FCC 47 CFR PART 15 SUBPART E

CERTIFICATION TEST REPORT

FOR

PORTABLE COMPUTING DEVICE

MODEL NUMBER: 1657

FCC: C3K1657

REPORT NUMBER: 14U19730-2, REVISION A

ISSUE DATE: MAY 4, 2015

Prepared for
MICROSOFT CORPORATION
ONE MICROSOFT WAY
REDMOND, WA 98052, U.S.A.

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/19/15	Initial Issue	F. de Anda
A	04/16/15	Remove setup photos, addressed typo in Section 9.9.2 to show 16.557 instead of 6.557	J. Gomez

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: PORTABLE COMPUTING DEVICE

MODEL: 1657

SERIAL NUMBER: 00010154252, 000044645252

DATE TESTED: MARCH 8, 2015 – MARCH 18, 2015

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

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

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

Approved & Released For
UL Verification Services Inc. By:

FRANCISCO DE ANDA
PROJECT LEAD
UL VERIFICATION SERVICES INC.

Tested By:

JOEY GOMEZ
EMC ENGINEER
UL VERIFICATION SERVICES INC.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, 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
	☐ Chamber G
	☒ Chamber H

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a handheld computing device with 802.11 2x2, a/b/g/n/ac WLAN radios.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode 2TX	Output Power (dBm)	Output Power (mW)
5.2GHz band			
5180 - 5240	802.11a	9.45	8.81
5180 - 5240	802.11n HT20	9.14	8.20
5190 - 5230	802.11n HT40	9.52	8.95
5210	802.11ac VHT80	8.94	7.83
5.3GHz band			
5260 - 5320	802.11a	9.49	8.89
5260 - 5320	802.11n HT20	9.35	8.61
5270 - 5310	802.11n HT40	9.45	8.81
5290	802.11ac VHT80	9.50	8.91
5.6GHz band			
5500 - 5700	802.11a	9.47	8.85
5500 - 5700	802.11n HT20	9.58	9.08
5510 - 5670	802.11n HT40	9.79	9.53
5530 - 5610	802.11ac VHT80	9.73	9.40
5.8GHz band			
5745 - 5825	802.11a	10.31	10.74
5745 - 5825	802.11n HT20	11.11	12.91
5755 - 5795	802.11n HT40	10.48	11.17
5775	802.11ac VHT80	9.46	8.83

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integrated antenna with maximum gains as follows:

Frequency Band (GHz)	Antenna Gain (dBi)	
	Chain 0	Chain 1
5.15 to 5.25 GHz	3.5	3.1
5.25 to 5.35 GHz	3.4	2.9
5.47 to 5.725 GHz	2.4	3.3
5.725 to 5.85 GHz	1.8	3.5

5.4. SOFTWARE

The test software used during testing was WIFI Tool v2.3.2

5.5. WORST-CASE CONFIGURATION AND MODE

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

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z, it was determined that Y orientation was worst-case orientation for 2.4GHz band and Z orientation was worst-case orientation for 5GHz band; therefore, all final radiated testing was performed with the EUT in Y (Landscape) orientation for 2.4GHz band and Z (Portrait) orientation for 5.GHz band.

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

802 11a mode: 6 Mbps
802.11n HT20mode: MCS0
802.11n HT40 mode: MCS0
802.11ac mode: MCS0

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	E545	MP-06P906	DoC
Laptop AC/DC adapter	Lenovo	ADLX65NCT2A	11S36200229 3ZZ7004954LO	DoC
Ethernet to USB Adapter	Linksys	MUSB300M	CU906M718557	N/A
EUT AC/DC adapter	Microsoft	1623	2068010	DoC

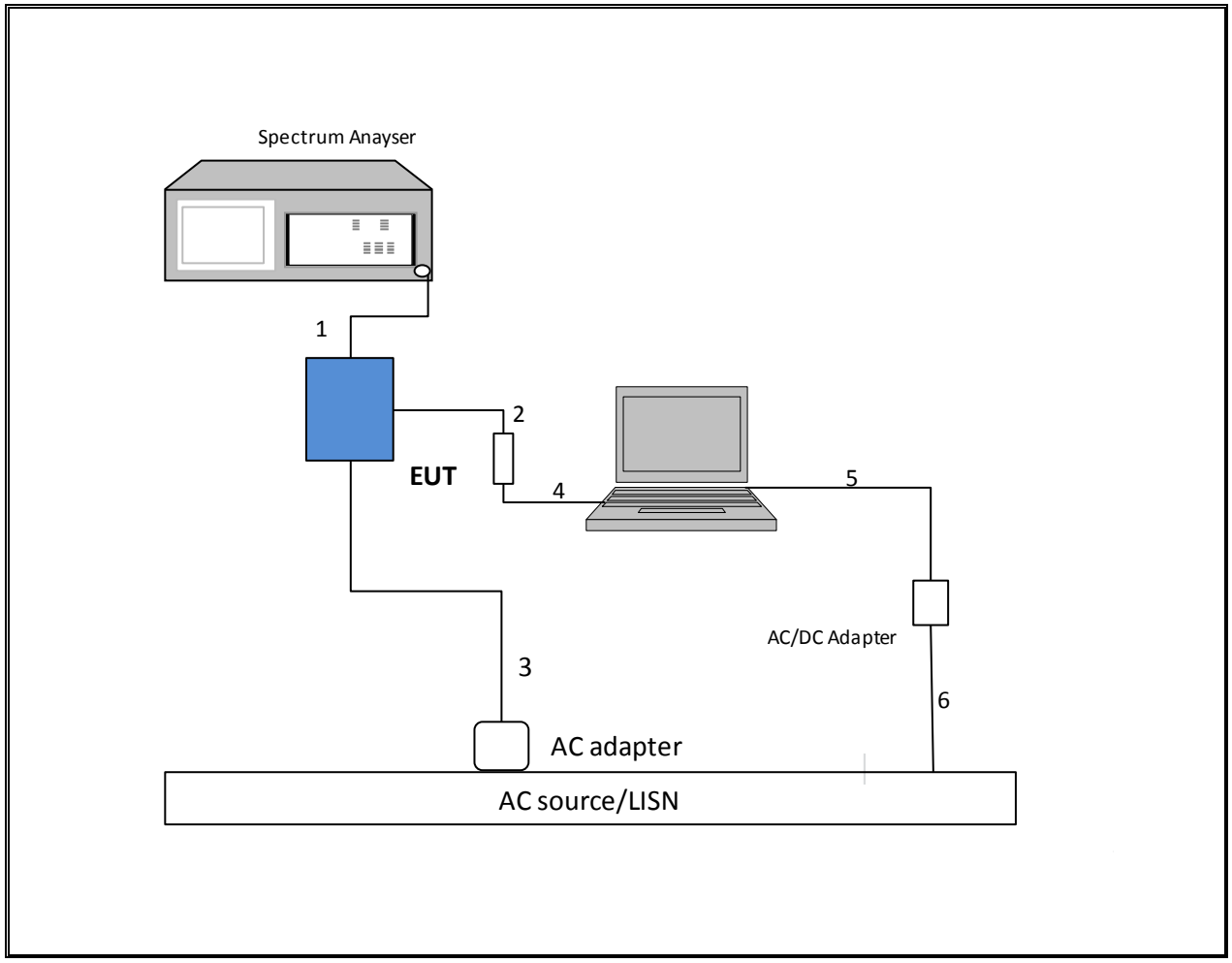
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.3	To spectrum Analyzer
2	USB	1	USB	Shielded	0.2	To EUT
3	DC	1	DC	Un-shielded	0.8	N/A
4	Ether cable	1	RJ45- USB	Shielded	1	To laptop
5	DC	1	DC	Un-shielded	0.8	N/A
6	AC	1	2-Prong	Un-shielded	1.5	N/A

TEST SETUP- CONDUCTED PORT

The EUT was tested connected to a host Laptop via RJ45/USB cable and spectrum analyzer to antenna port. Test software exercised the EUT.

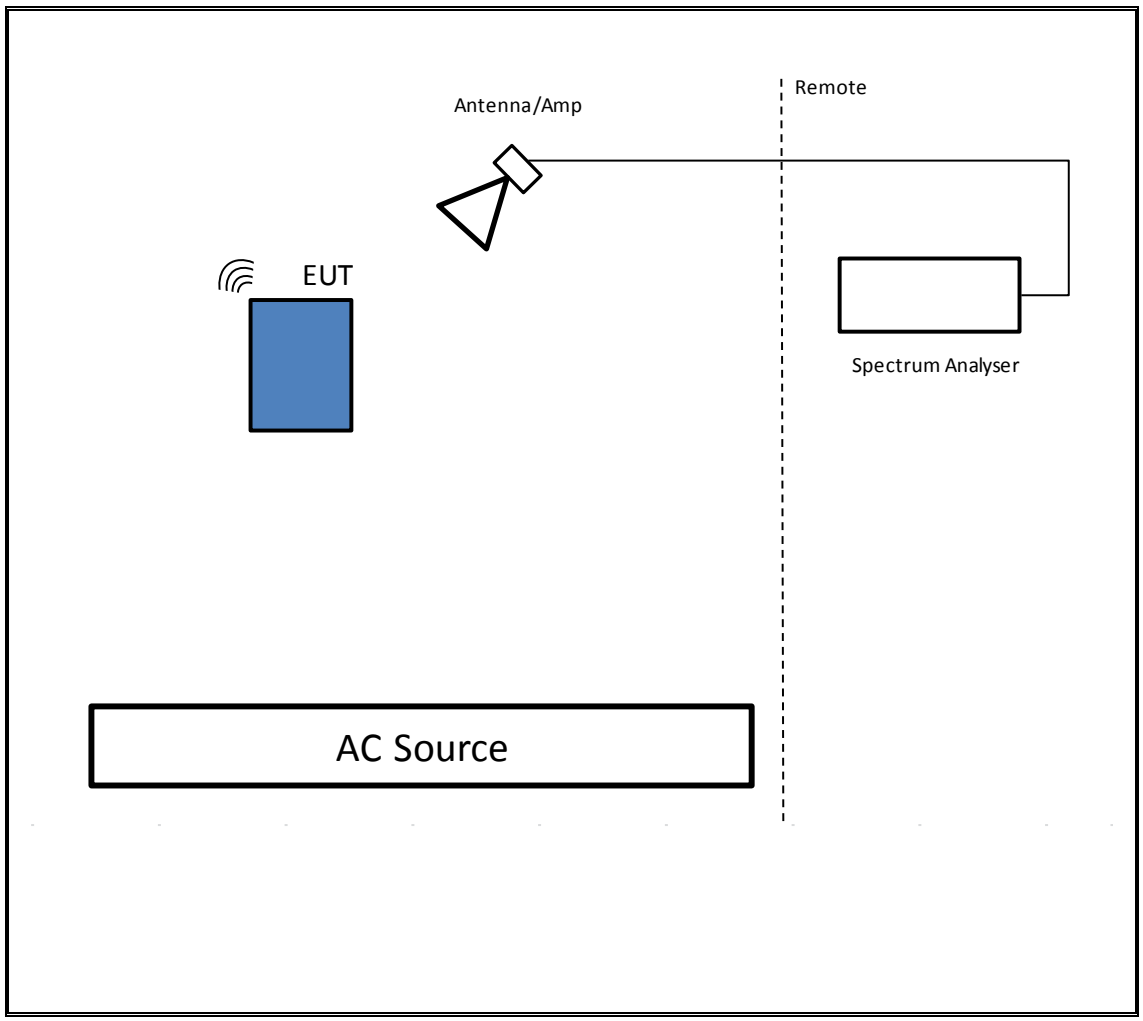
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

The EUT was tested battery powered. Test software exercised the EUT.

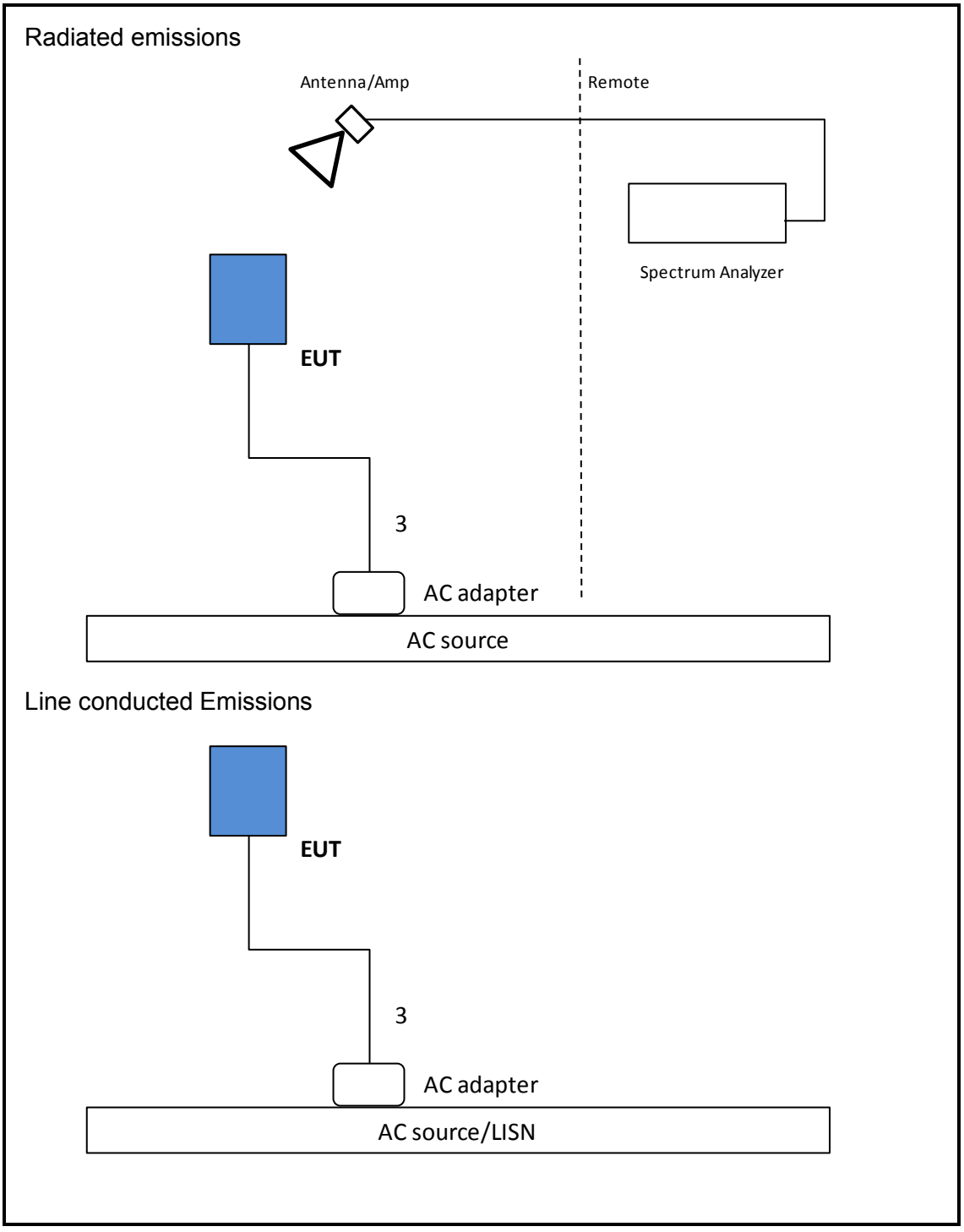
SETUP DIAGRAM



TEST SETUP -BELOW 1GHZ & AC LINE CONDUCTED TESTS

The EUT was tested with AC Adapter. Test software exercised the EUT.

SETUP DIAGRAM



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**	**T No.**	**Cal Date**	**Cal Due**
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014		
Horn Antenna 1-18 GHz	ETS Lindgren	3117	863	04/14/14	04/14/15
Hybrid Antenna 30 - 2000MHz	Sunol Sciences	JB3	900	05/14/14	05/14/15
3GHz HPF	Micro-Tronics	HPM17543	897	05/13/14	05/13/15
5GHz LPF	Micro-Tronics	LPS17541	422	01/26/15	01/26/16
6GHz HPF	Micro-Tronics	HPS17542	423	01/26/15	01/26/16
Amplifier 1-18GHz	Miteq	AFS42-00101800-25-S-42	495	06/05/14	06/05/15
Amplifier 10kHz - 1GHz	Sonoma	310N	835	06/05/14	06/05/15
Spectrum Analyzer PXA 3Hz - 44GHz	Agilent	N9030A	906	05/07/14	05/07/15
Horn Antenna 18-26GHz	ARA	MWH-1826	89	12/17/14	12/17/15
Horn Antenna 26-40GHz	ARA	MWH-2640/B	90	07/15/14	07/15/15
Amplifier 1-26.5GHz	Agilent	8449B	404	03/25/14	03/25/15
Amplifier 26-40GHz	Miteq	NSP4000-SP2	88	09/03/14	09/03/15
Spectrum Analyzer 40GHz	Agilent	8564E	106	08/06/14	08/06/15
EMI Test Receiver, 9KHz to 7GHz	Rohde & Schwarz	ESCI 7	284	09/16/14	09/16/15

7. MEASUREMENT METHODS

26 dB Emission BW: KDB 789033 D02 v01r, Section C.

99% Occupied BW: KDB 789033 D02 v01, Section D.

Conducted Output Power: KDB 789033 D02 v01, Section E.2.b (Method SA-1).
Conducted Output Power: KDB 789033 D02 v01, Section E.2.d (Method SA-2).

Power Spectral Density: KDB 789033 D02 v01, Section F.

Unwanted emissions in restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01, Sections G.3, G.4, and G.5.

8. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

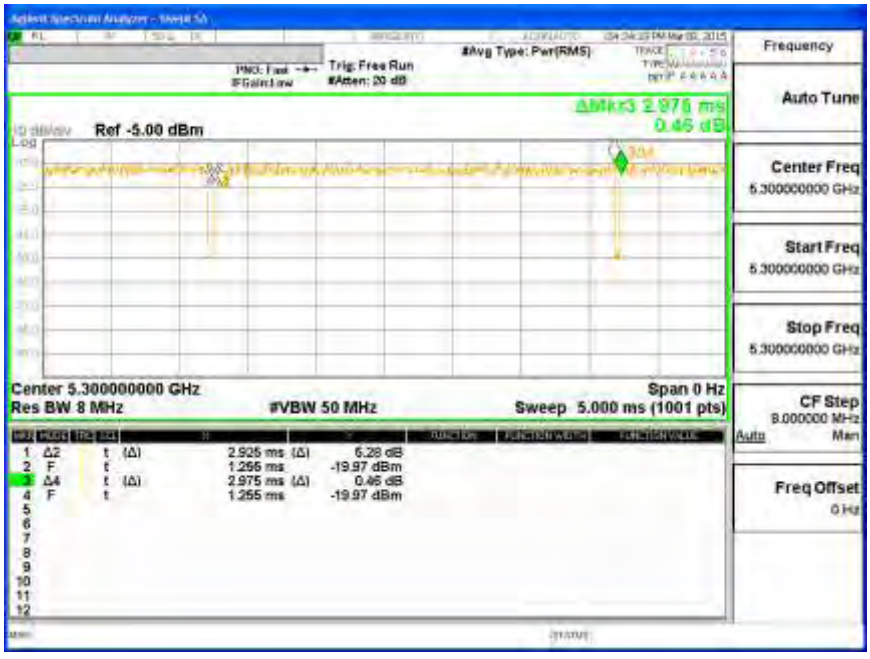
8.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11a 2TX	3.145	3.190	0.986	98.59%	0.00	0.010
802.11n HT20 2TX	2.925	2.975	0.983	98.32%	0.00	0.010
802.11n HT40 2TX	1.428	1.470	0.971	97.14%	0.13	0.700
802.11ac VHT80 2TX	0.684	0.726	0.942	94.21%	0.26	1.462

8.2. DUTY CYCLE PLOTS

DUTY CYCLE 802.11a 2TX MODE

DUTY CYCLE 802.11n HT20 2TX MODE



DUTY CYCLE 802.11n HT40 2TX MODE

DUTY CYCLE 802.11ac VHT80 2TX MODE

9. ANTENNA PORT TEST RESULTS

9.1. 802.11a MODE IN THE 5.2 GHz BAND

9.1.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5180	19.448	19.656
Mid	5200	19.474	19.578
High	5240	19.526	19.682

26 dB BANDWIDTH, Chain 0

BANDWIDTH Chain 0 LOW CH

BANDWIDTH Chain 0 MID CH

BANDWIDTH Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

BANDWIDTH Chain 1 LOW CH

BANDWIDTH Chain 1 MID CH

BANDWIDTH Chain 1 HIGH CH

9.1.2. 99% BANDWIDTH

LIMITS

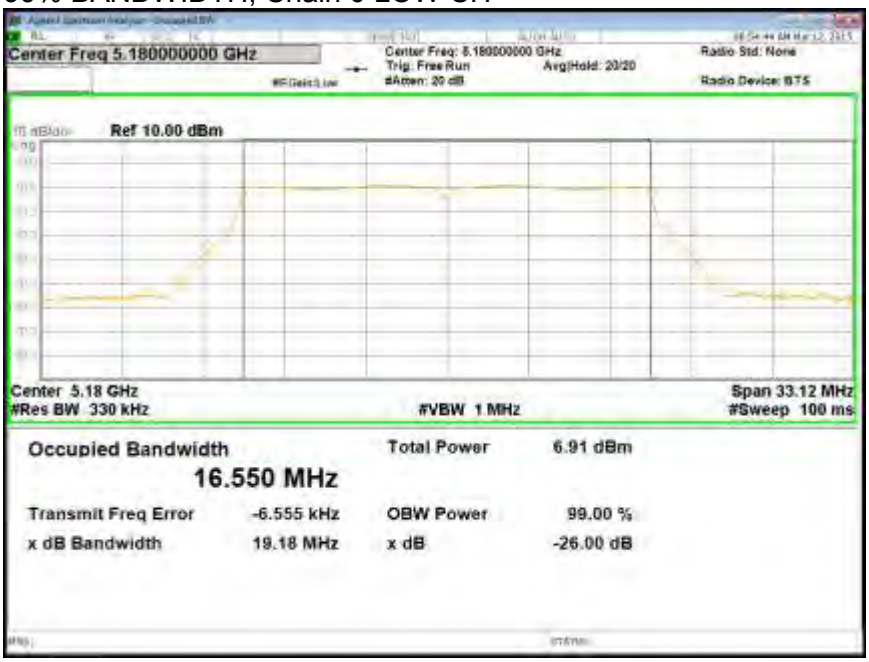
None; for reporting purposes only.

RESULTS

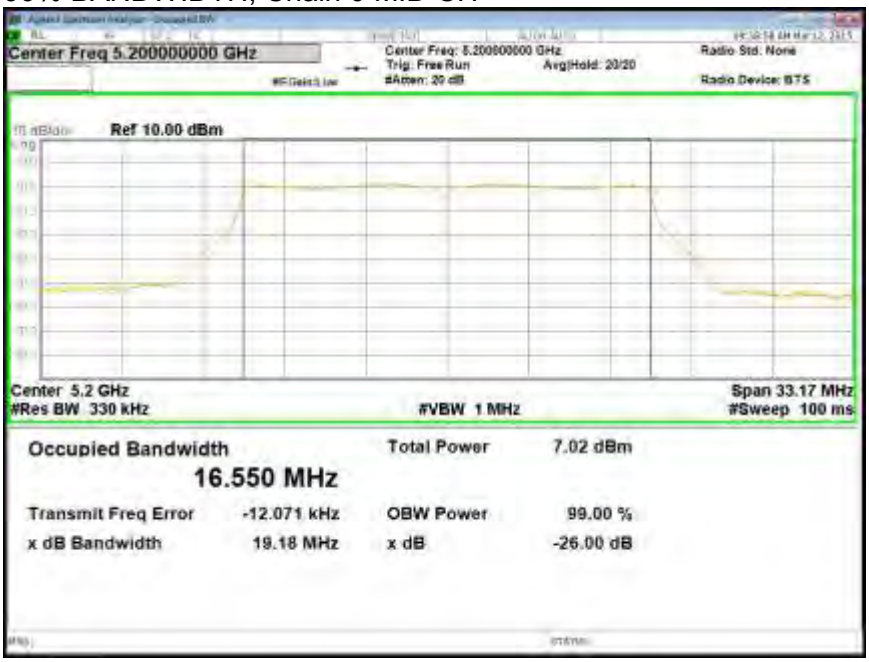
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5180	16.550	16.548
Mid	5200	16.550	16.549
High	5240	16.545	16.545

99% BANDWIDTH, Chain 0

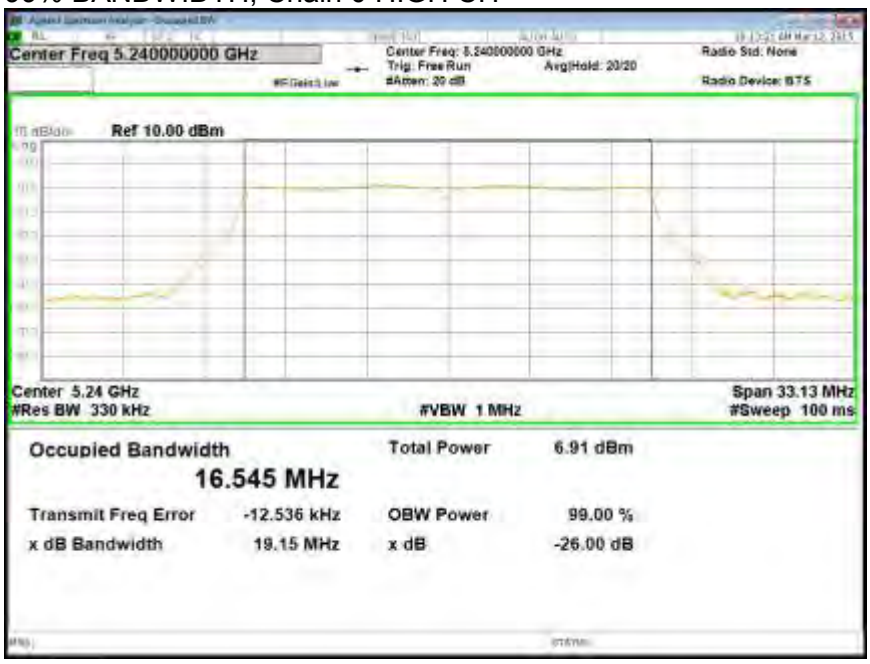
99% BANDWIDTH, Chain 0 LOW CH



99% BANDWIDTH, Chain 0 MID CH

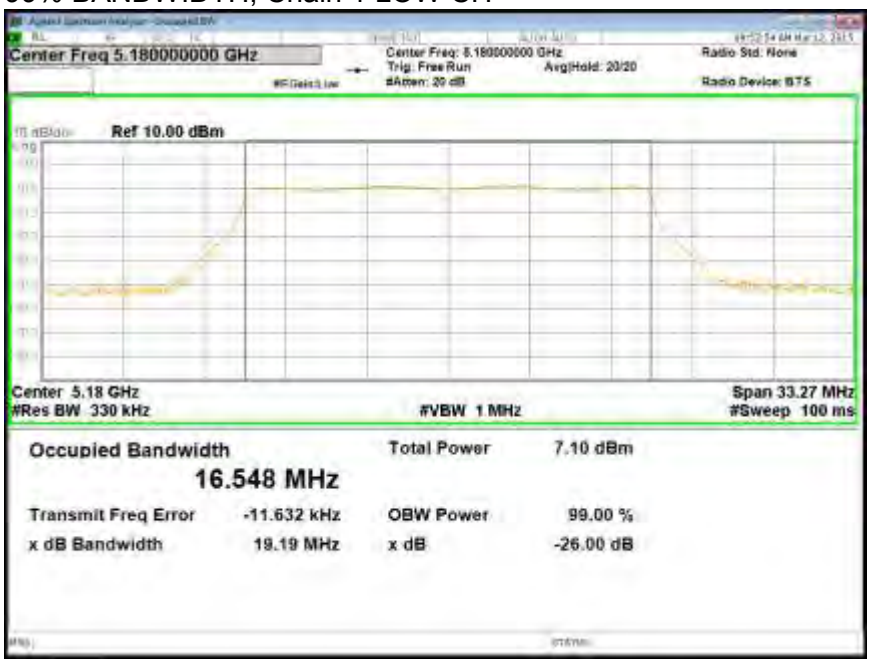


99% BANDWIDTH, Chain 0 HIGH CH

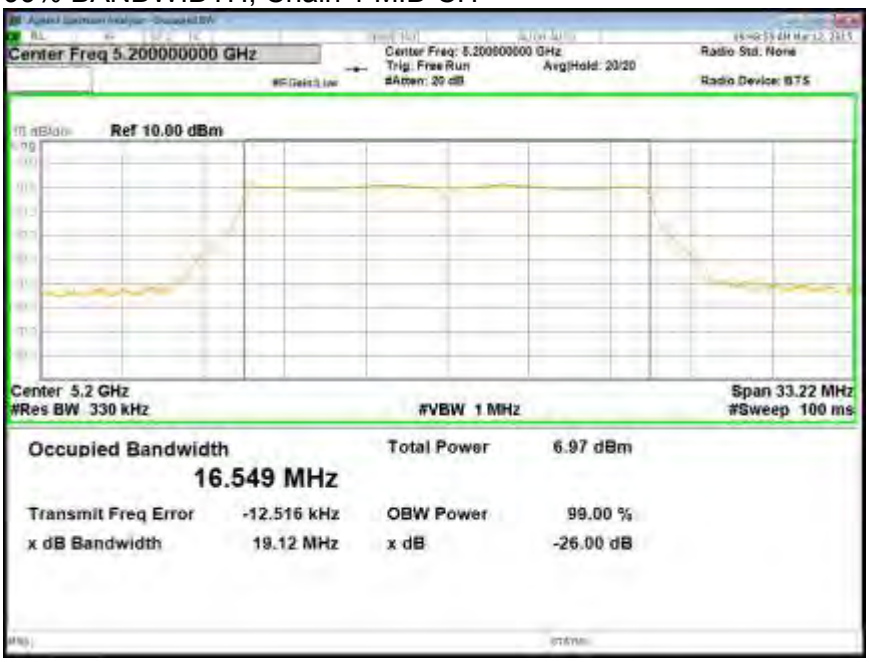


99% BANDWIDTH, Chain 1

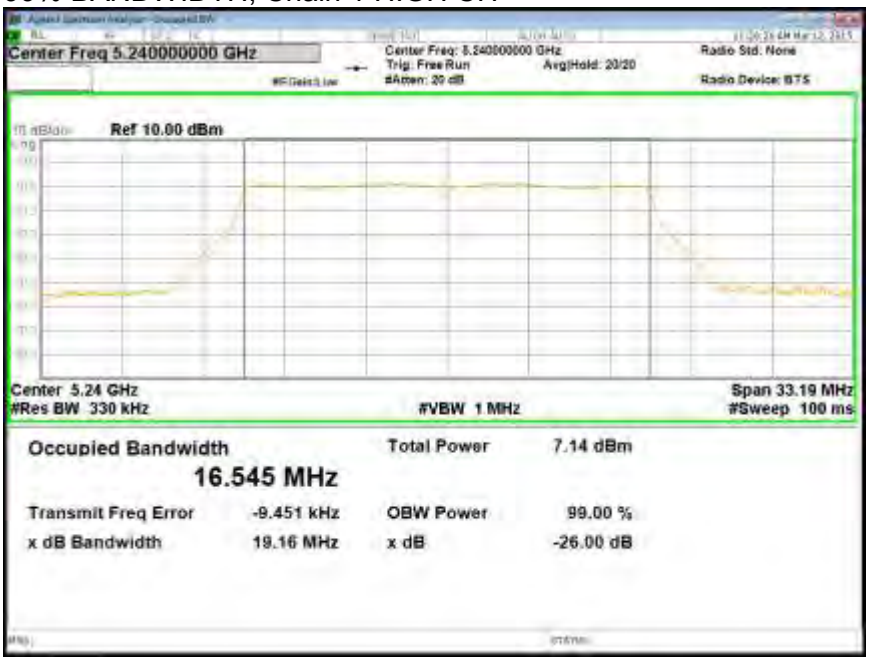
99% BANDWIDTH, Chain 1 LOW CH



99% BANDWIDTH, Chain 1 MID CH



99% BANDWIDTH, Chain 1 HIGH CH



9.1.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.5	3.1	3.30

RESULTS

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5180	3.30	3.30	24.00	11.00
Mid	5200	3.30	3.30	24.00	11.00
High	5240	3.30	3.30	24.00	11.00

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

Output Power Results

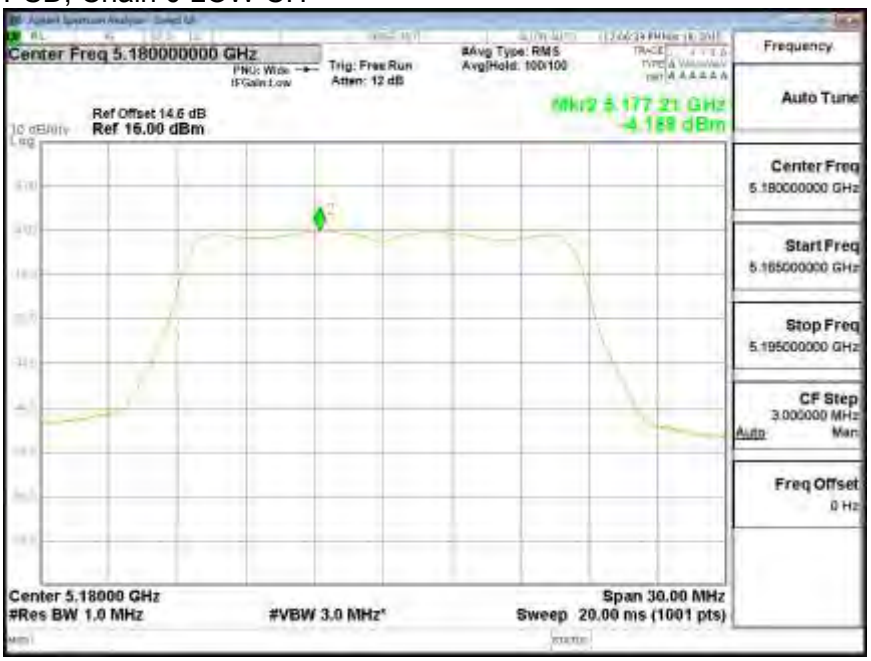
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	6.48	6.35	9.43	24.00	-14.57
Mid	5200	6.58	6.30	9.45	24.00	-14.55
High	5240	6.20	6.13	9.18	24.00	-14.82

PSD Results

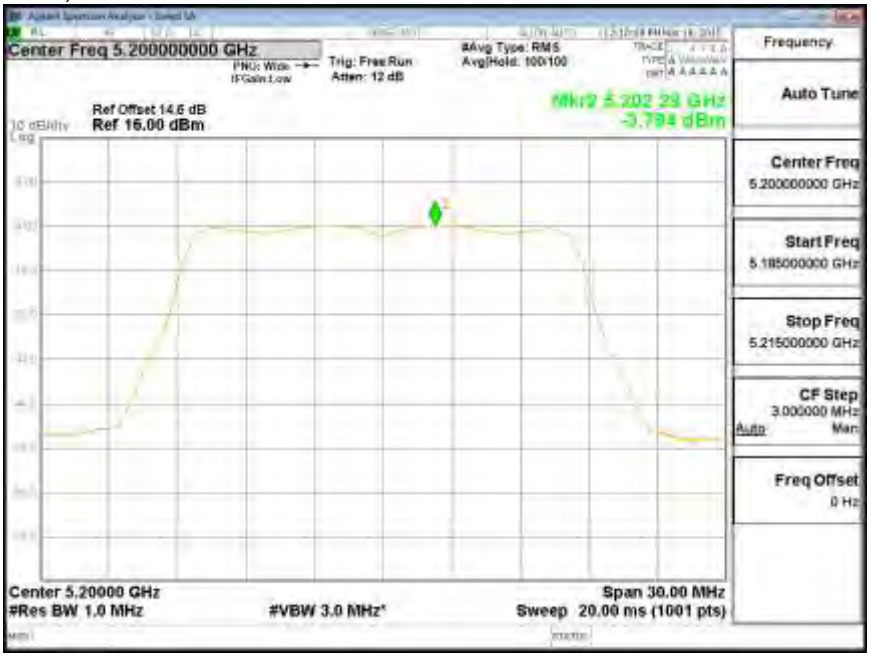
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	-4.188	-4.021	-1.09	11.00	-12.09
Mid	5200	-3.794	-4.044	-0.91	11.00	-11.91
High	5240	-3.532	-3.972	-0.74	11.00	-11.74

PSD, Chain 0

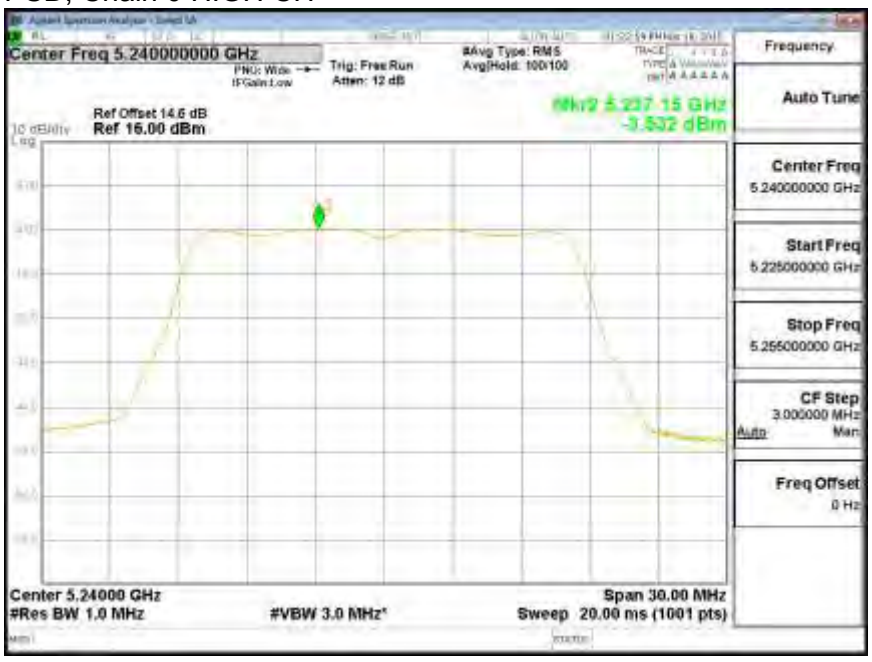
PSD, Chain 0 LOW CH



PSD, Chain 0 MID CH

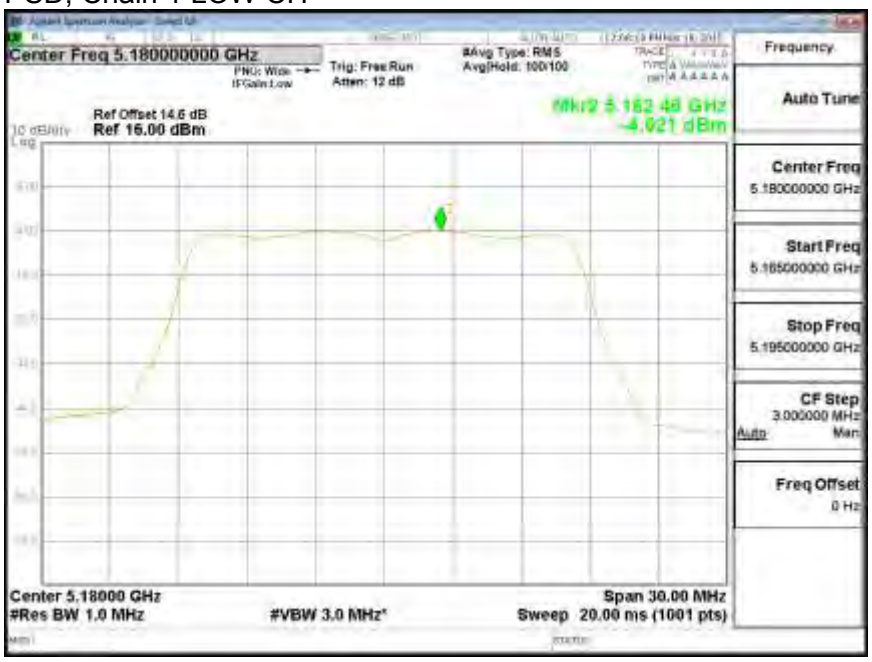


PSD, Chain 0 HIGH CH

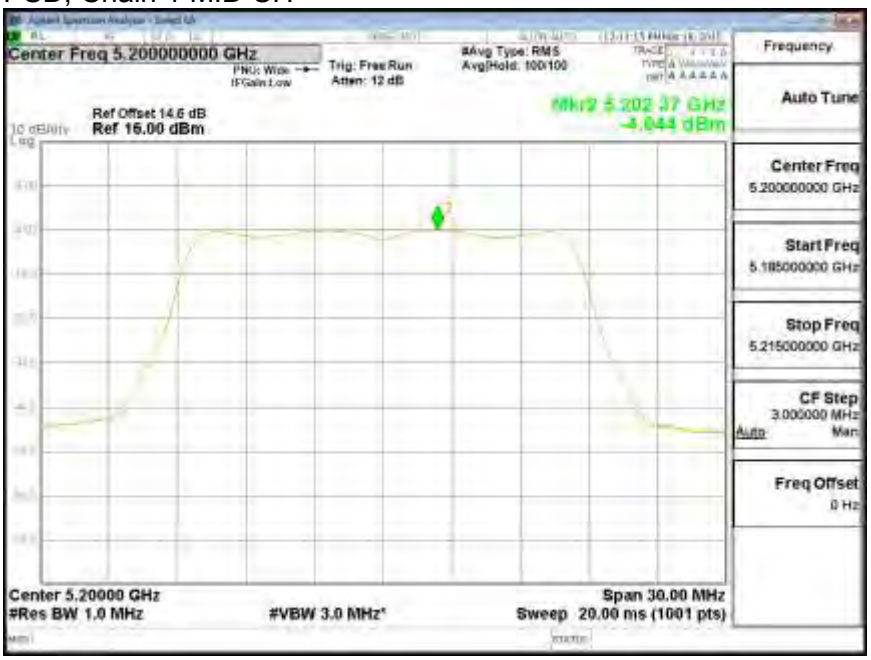


PSD, Chain 1

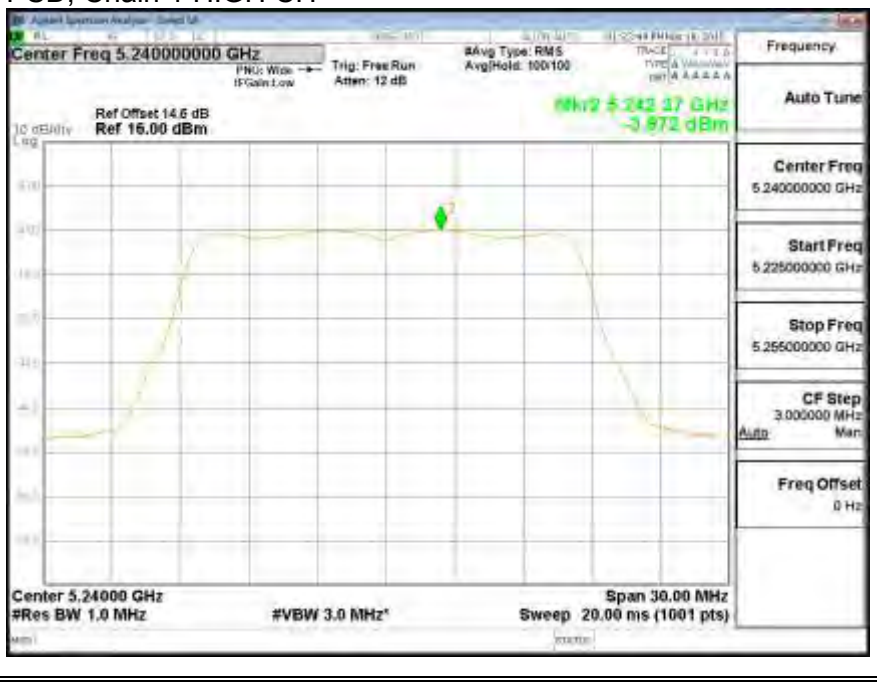
PSD, Chain 1 LOW CH



PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9.2. 802.11n HT20 MODE IN THE 5.2 GHz BAND

9.2.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5180	19.916	20.020
Mid	5200	19.864	20.046
High	5240	19.890	19.994

26 dB BANDWIDTH, Chain 0

BANDWIDTH Chain 0 LOW CH

BANDWIDTH Chain 0 MID CH

BANDWIDTH Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

BANDWIDTH Chain 1 LOW CH

BANDWIDTH Chain 1 MID CH

BANDWIDTH Chain 1 HIGH CH

9.2.2. 99% BANDWIDTH

LIMITS

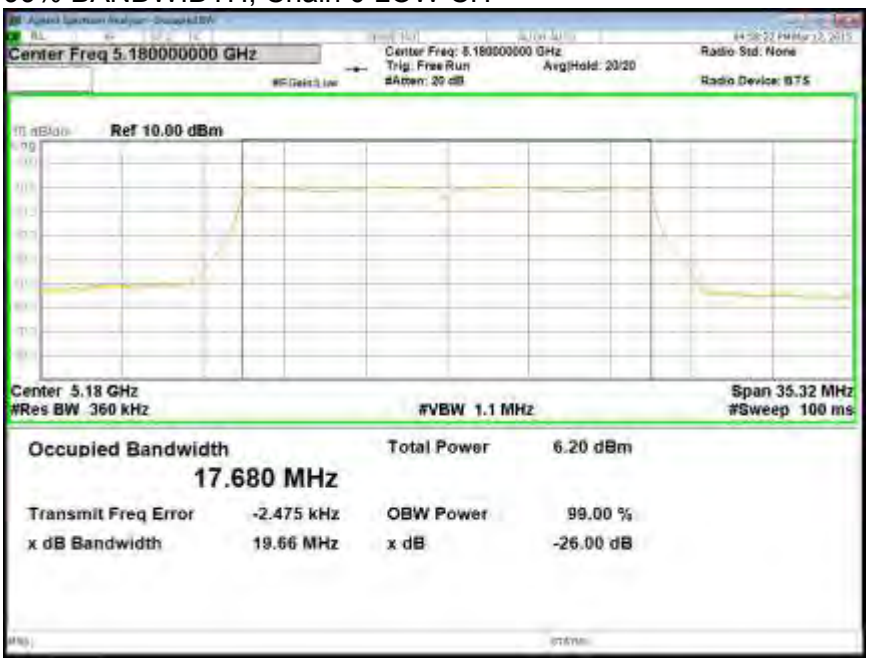
None; for reporting purposes only.

RESULTS

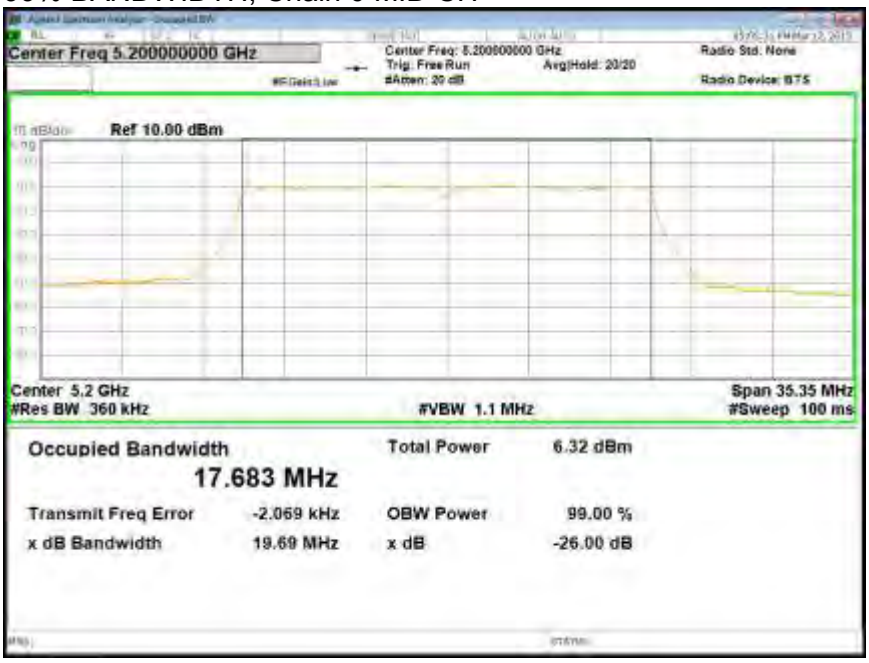
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5180	17.680	17.690
Mid	5200	17.683	17.690
High	5240	17.681	17.693

99% BANDWIDTH, Chain 0

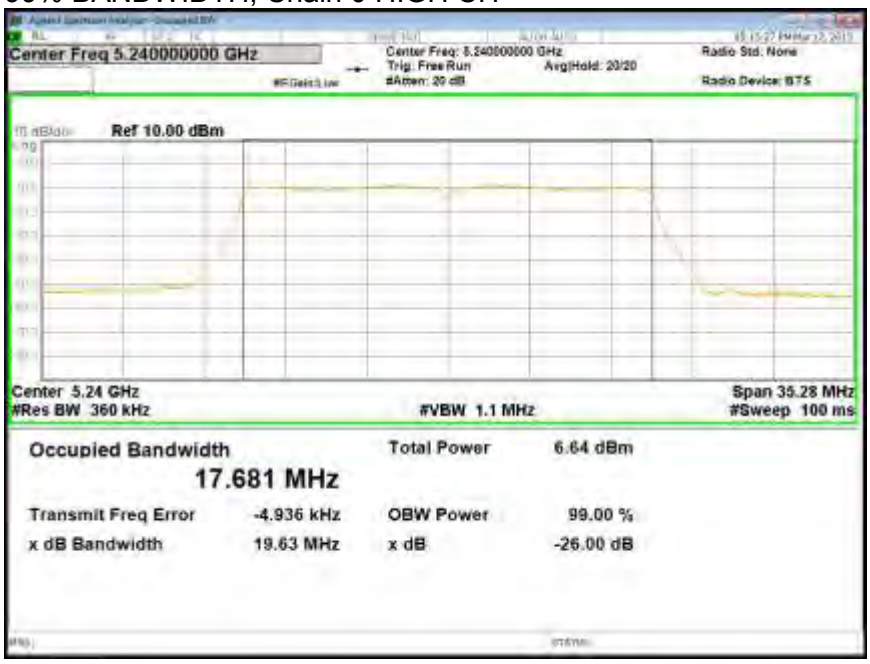
99% BANDWIDTH, Chain 0 LOW CH



99% BANDWIDTH, Chain 0 MID CH



99% BANDWIDTH, Chain 0 HIGH CH



99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH

99% BANDWIDTH, Chain 1 MID CH

99% BANDWIDTH, Chain 1 HIGH CH

9.2.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.5	3.1	3.30

RESULTS

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5180	3.30	3.30	24.00	11.00
Mid	5200	3.30	3.30	24.00	11.00
High	5240	3.30	3.30	24.00	11.00

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

Output Power Results

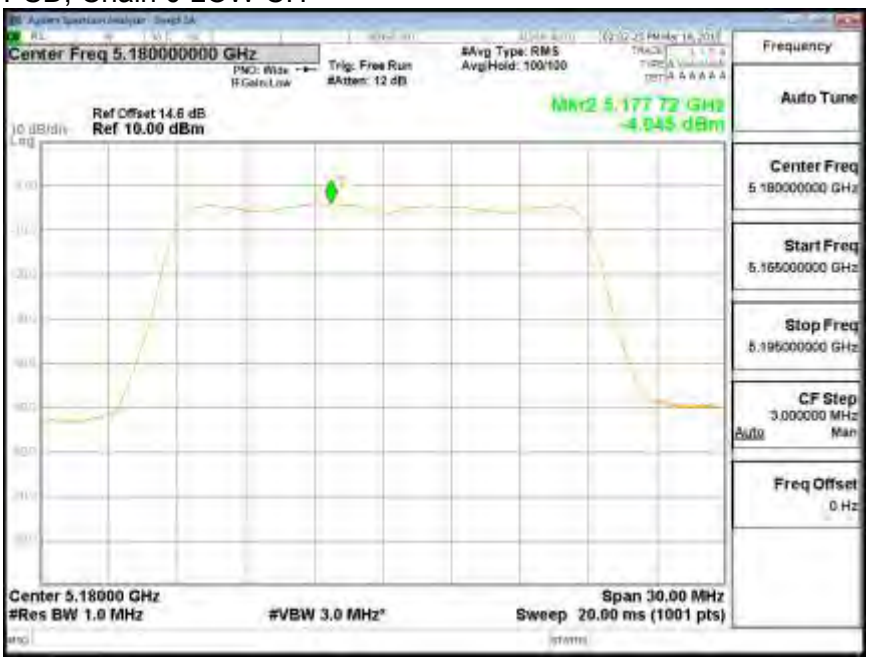
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	6.22	5.90	9.07	24.00	-14.93
Mid	5200	6.45	5.79	9.14	24.00	-14.86
High	5240	6.16	5.91	9.05	24.00	-14.95

PSD Results

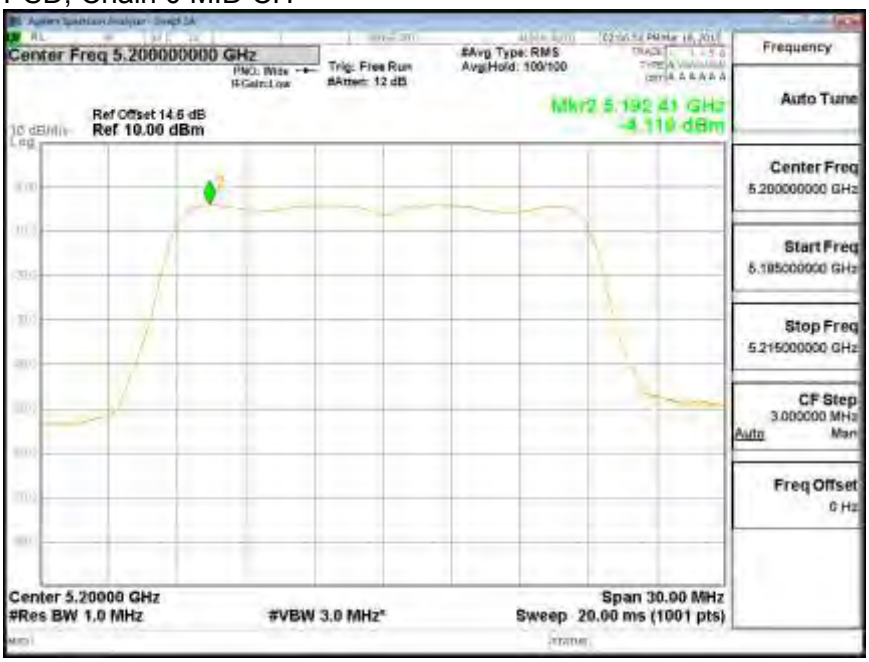
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	-4.045	-3.741	-0.88	11.00	-11.88
Mid	5200	-4.110	-4.067	-1.08	11.00	-12.08
High	5240	-3.850	-3.988	-0.91	11.00	-11.91

PSD, Chain 0

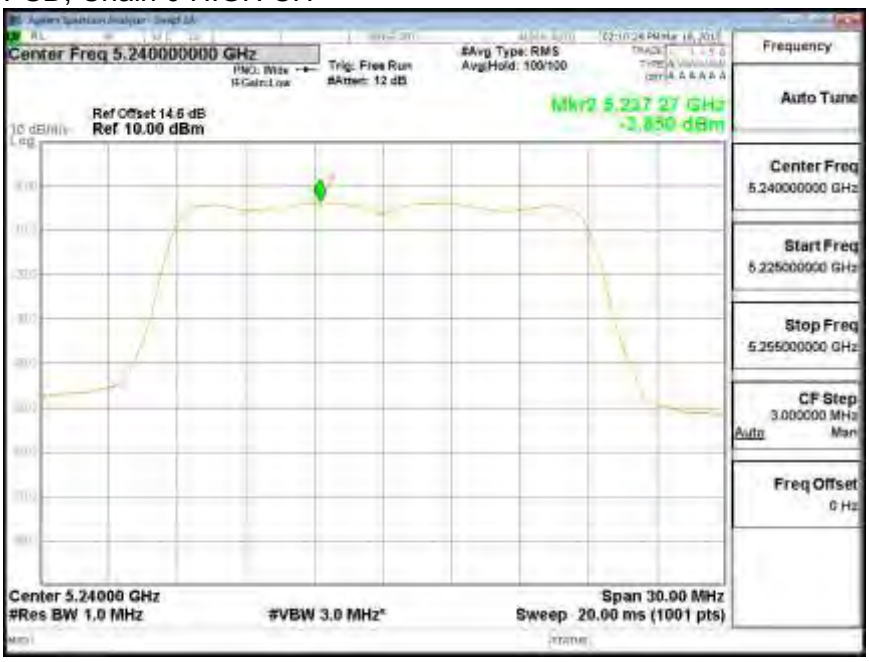
PSD, Chain 0 LOW CH



PSD, Chain 0 MID CH



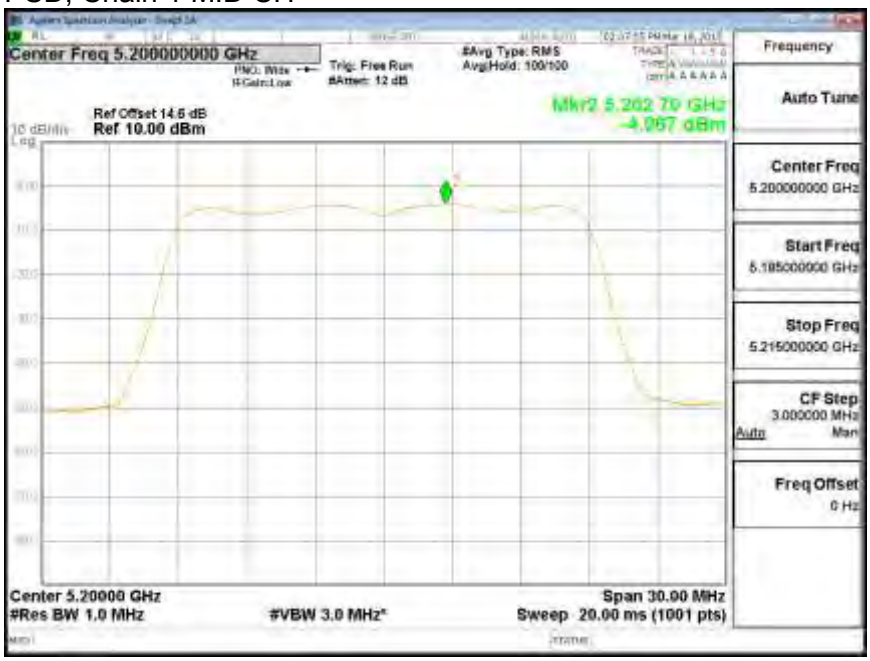
PSD, Chain 0 HIGH CH



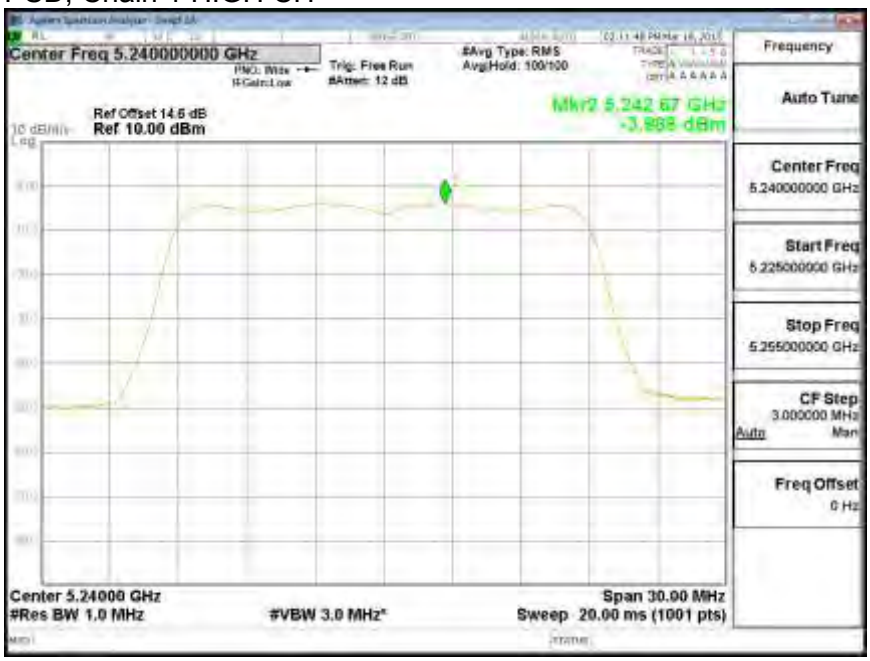
PSD, Chain 1

PSD, Chain 1 LOW CH

PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9.3. 802.11n HT40 MODE IN THE 5.2 GHz BAND

9.3.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5190	39.663	40.482
High	5230	39.604	40.365

26 dB BANDWIDTH, Chain 0

26 dB BANDWIDTH, Chain 0 LOW CH

26 dB BANDWIDTH, Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

26 dB BANDWIDTH, Chain 1 LOW CH

26 dB BANDWIDTH, Chain 1 HIGH CH

9.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5190	36.208	36.206
High	5230	36.198	36.219

99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH

99% BANDWIDTH, Chain 0 HIGH CH

99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH

99% BANDWIDTH, Chain 1 HIGH CH

9.3.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.5	3.1	3.30

RESULTS

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5190	3.30	3.30	24.00	11.00
High	5230	3.30	3.30	24.00	11.00

Duty Cycle CF (dB)	0.13	Included in Calculations of Corr'd Power & PSD

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	6.510	6.250	9.52	24.00	-14.48
High	5230	6.540	6.220	9.52	24.00	-14.48

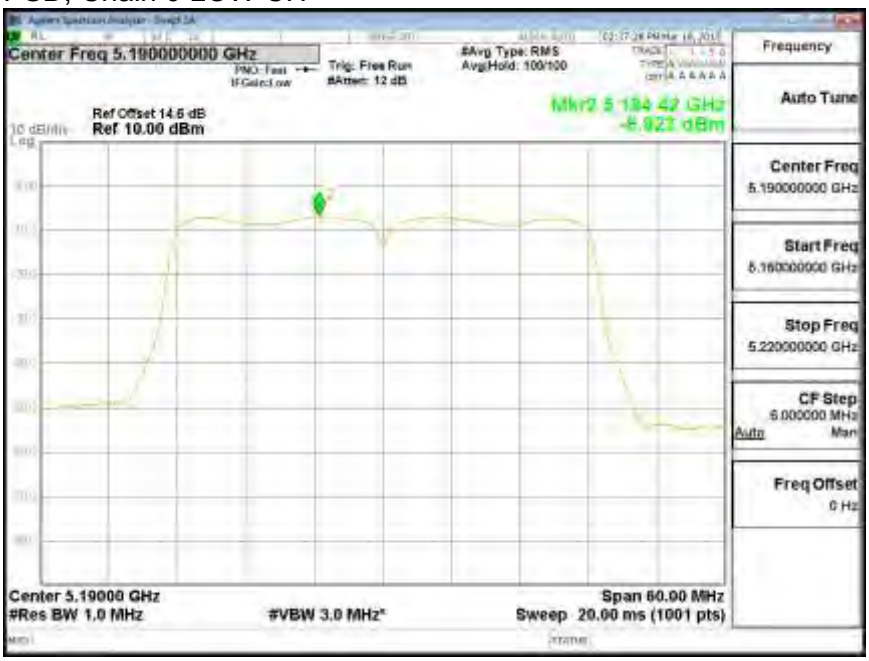
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5190	-6.923	-7.040	-3.84	11.00	-14.84
High	5230	-7.196	-7.578	-4.24	11.00	-15.24

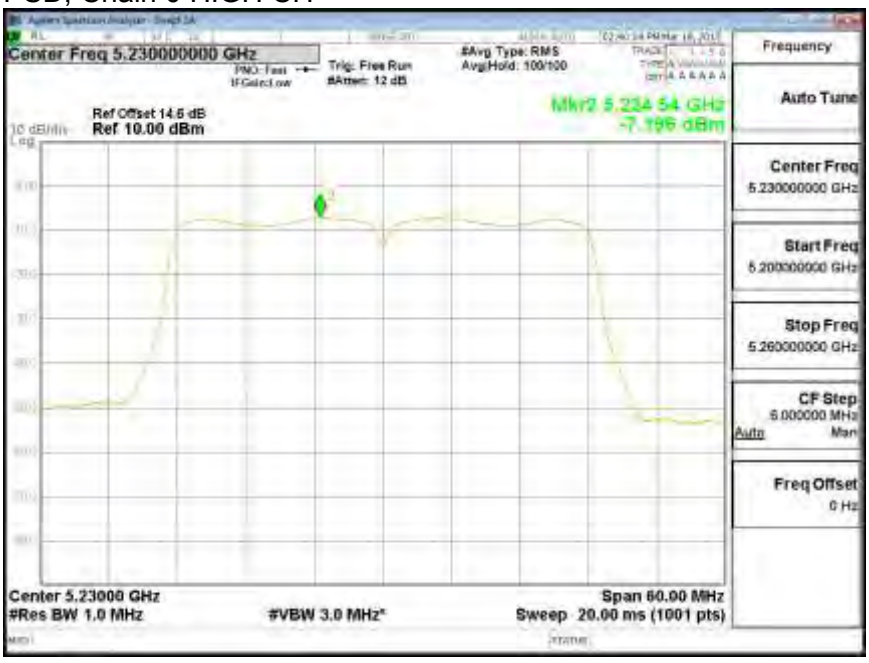
-

PSD, Chain 0

PSD, Chain 0 LOW CH

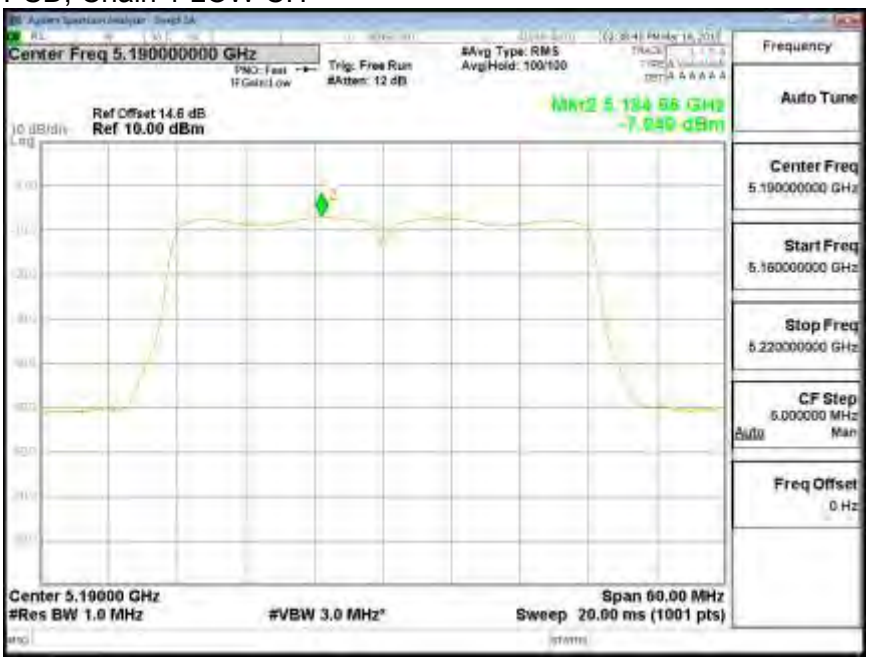


PSD, Chain 0 HIGH CH

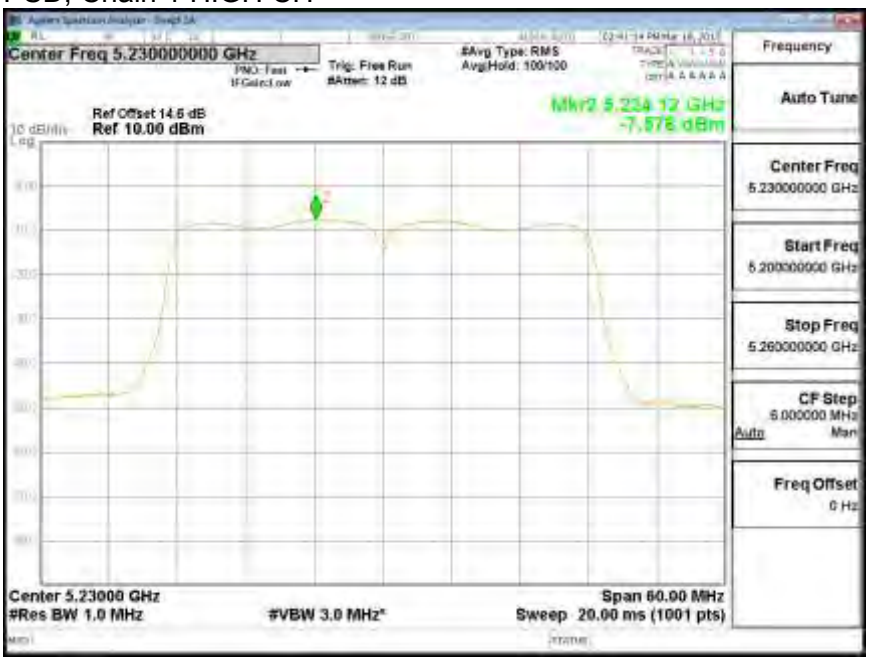


PSD, Chain 1

PSD, Chain 1 LOW CH



PSD, Chain 1 HIGH CH



9.4. 802.11ac VHT80MHz MODE IN THE 5.2 GHz BAND

9.4.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Mid	5210	81.61	82.13

26 dB BANDWIDTH, Chain 0

26 dB BANDWIDTH, Chain 0 MID CH

26 dB BANDWIDTH, Chain 1

26 dB BANDWIDTH, Chain 1 MID CH

9.4.2. 99% BANDWIDTH

LIMITS

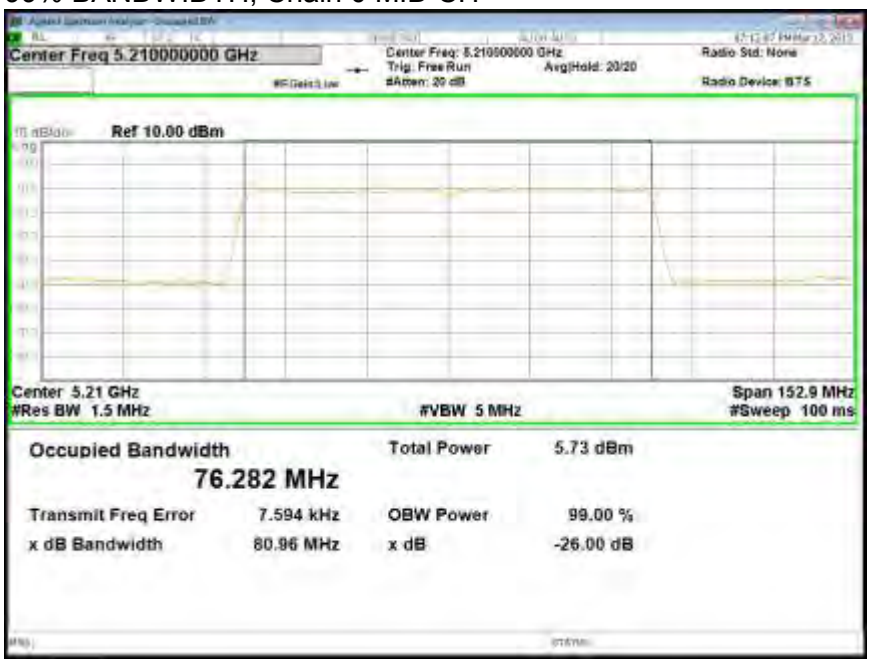
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Mid	5210	76.282	76.287

99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 MID CH



99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 MID CH

9.4.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.5	3.1	3.30

RESULTS

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Mid	5210	3.30	3.30	24.00	11.00

Duty Cycle CF (dB)	0.26	Included in Calculations of Corr'd Power & PSD

Output Power Results

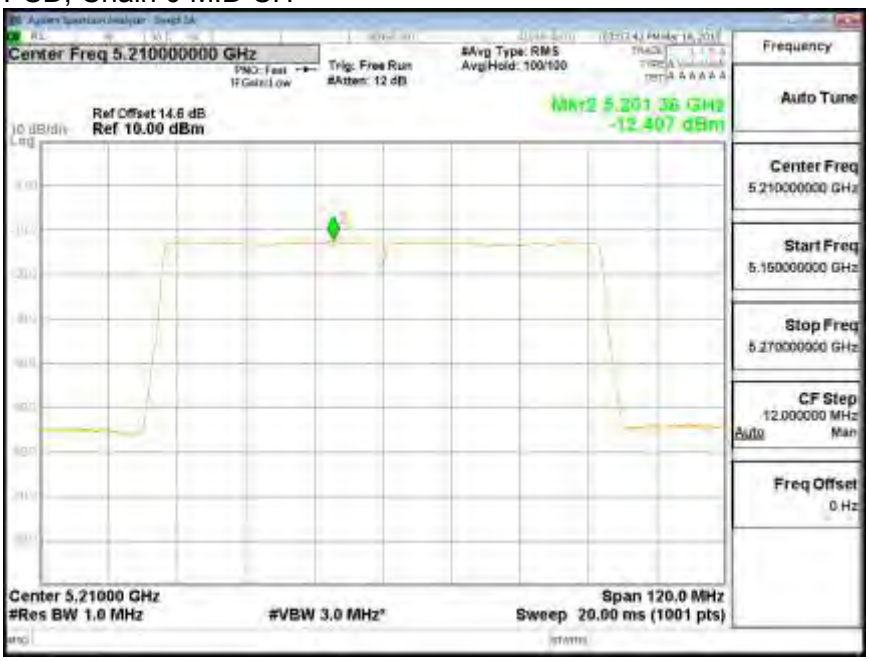
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Mid	5210	5.81	5.52	8.94	24.00	-15.06

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Mid	5210	-12.407	-12.039	-8.95	11.00	-19.95

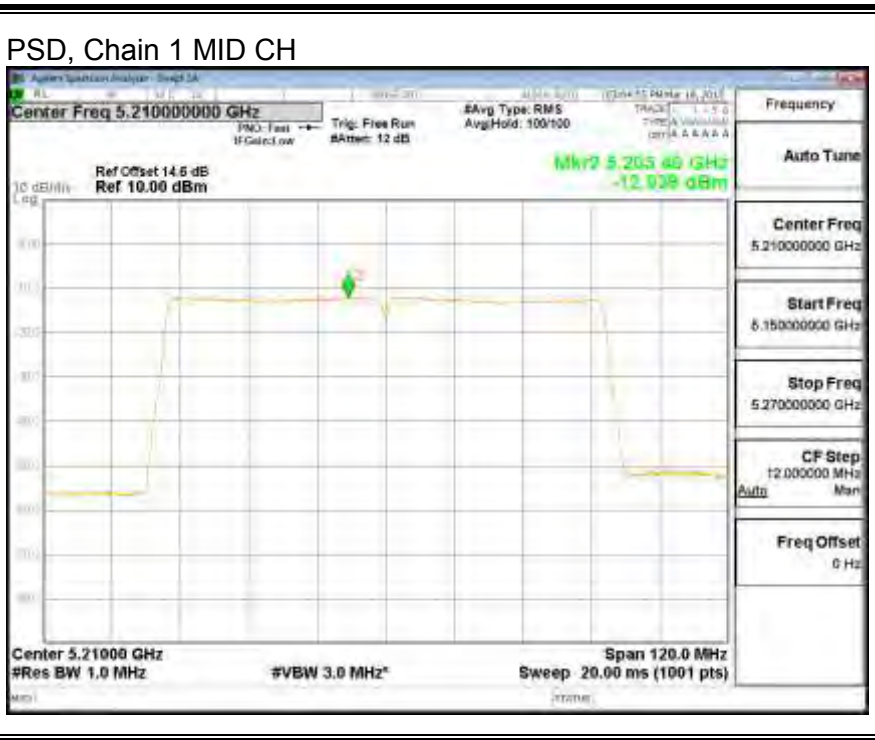
PSD, Chain 0

PSD, Chain 0 MID CH



PSD, Chain 1

PSD, Chain 1 MID CH



9.5. 802.11a MODE IN THE 5.3 GHz BAND

9.5.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5260	19.500	19.604
Mid	5300	19.474	19.630
High	5320	19.474	19.578

26 dB BANDWIDTH, Chain 0

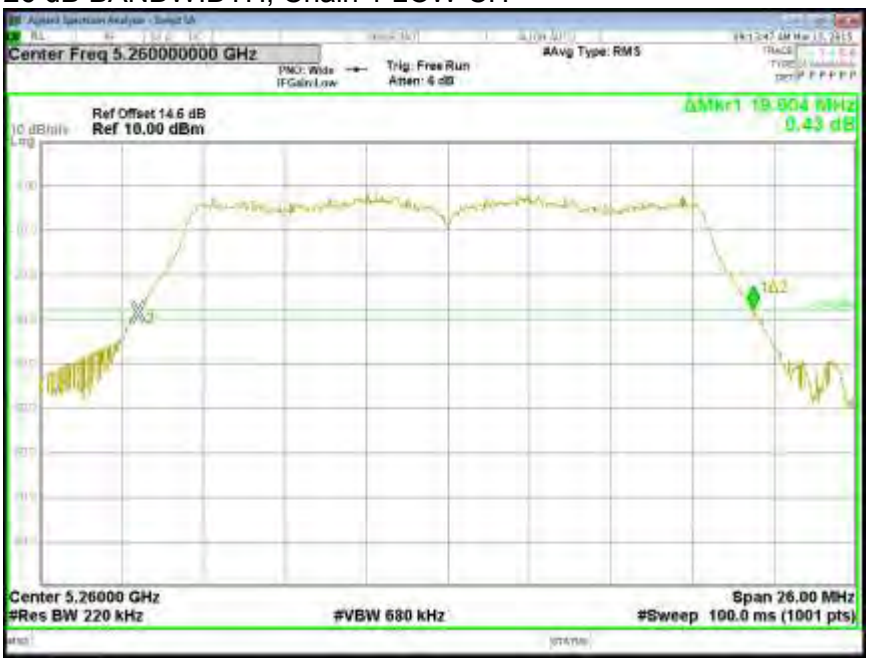
26 dB BANDWIDTH, Chain 0 LOW CH

26 dB BANDWIDTH, Chain 0 MID CH

26 dB BANDWIDTH, Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

26 dB BANDWIDTH, Chain 1 LOW CH



26 dB BANDWIDTH, Chain 1 MID CH

26 dB BANDWIDTH, Chain 1 HIGH CH

9.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

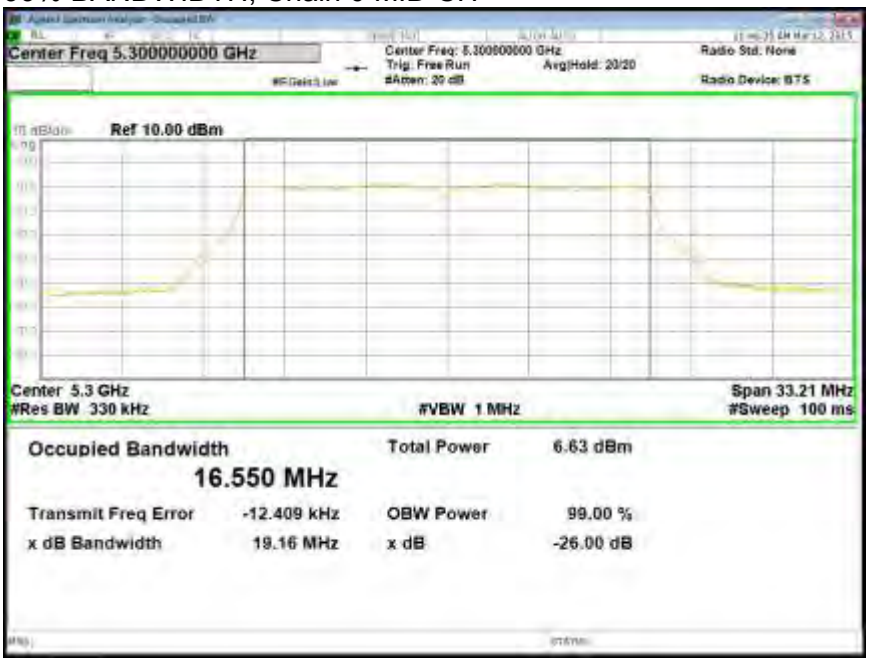
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5260	16.556	16.556
Mid	5300	16.550	16.551
High	5320	16.551	16.555

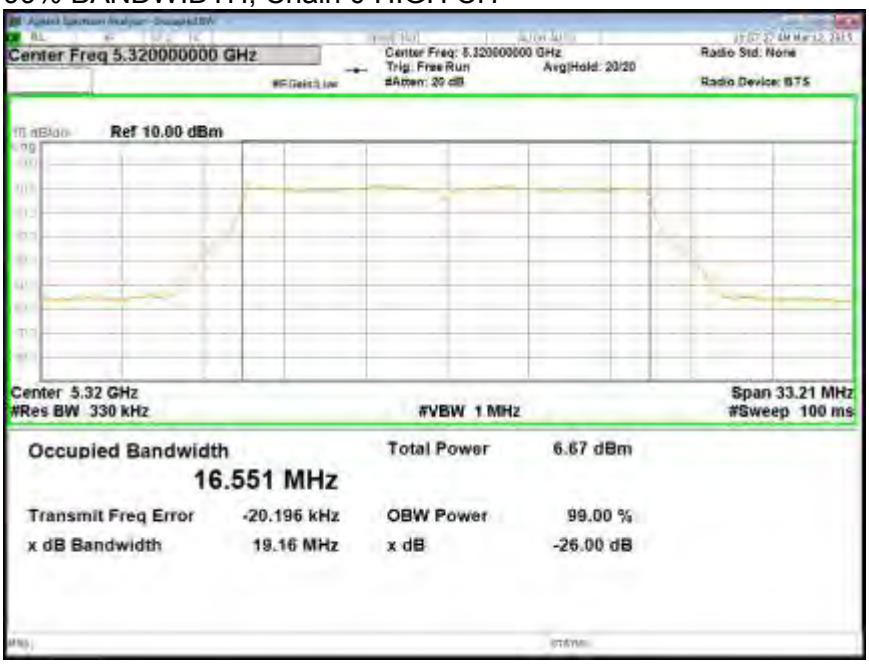
99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH

99% BANDWIDTH, Chain 0 MID CH

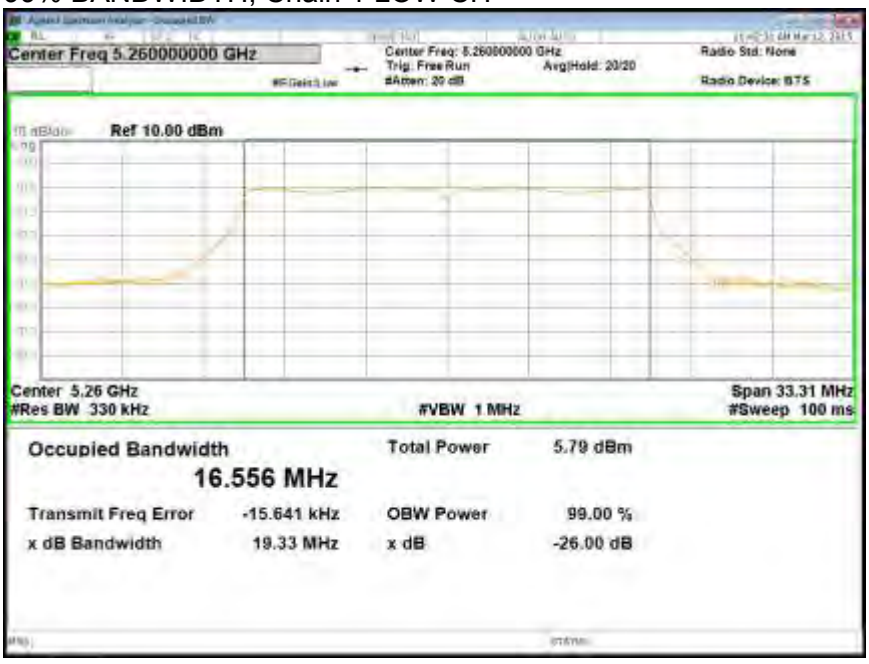


99% BANDWIDTH, Chain 0 HIGH CH

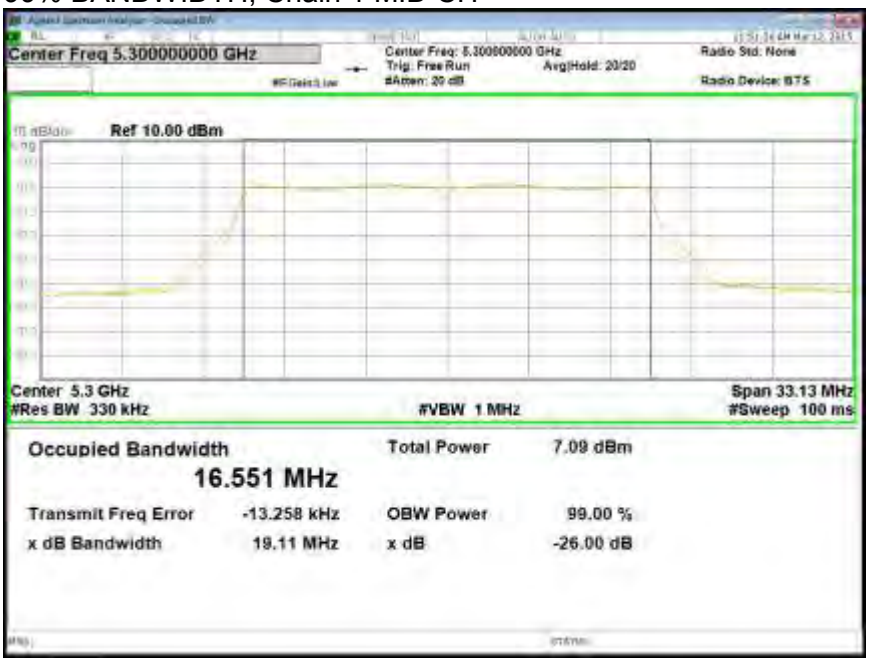


99% BANDWIDTH, Chain 1

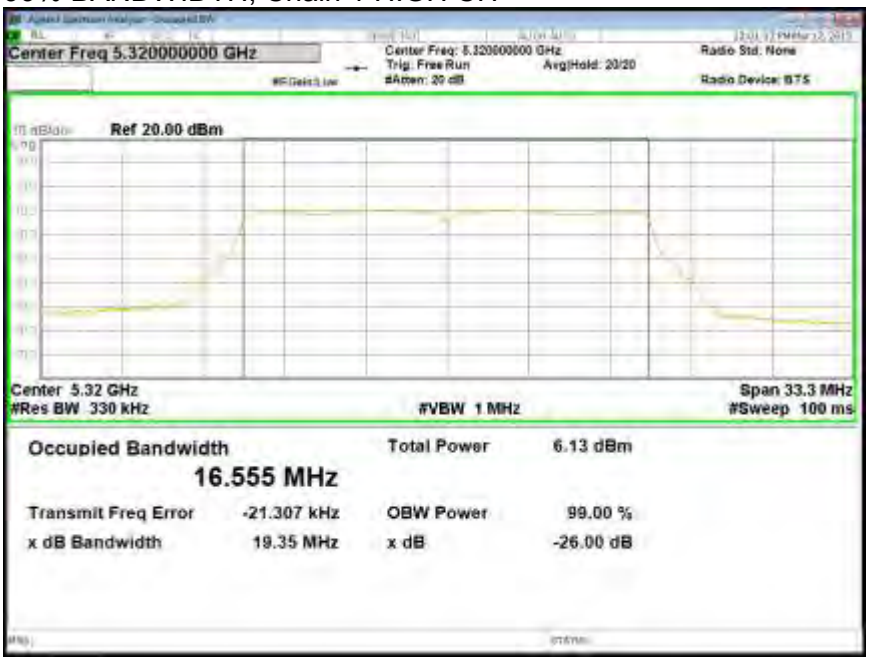
99% BANDWIDTH, Chain 1 LOW CH



99% BANDWIDTH, Chain 1 MID CH



99% BANDWIDTH, Chain 1 HIGH CH



9.5.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.4	2.9	3.16

RESULTS

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5260	19.500	3.16	3.16	23.90	11.00
Mid	5300	19.474	3.16	3.16	23.89	11.00
High	5320	19.474	3.16	3.16	23.89	11.00

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

Output Power Results

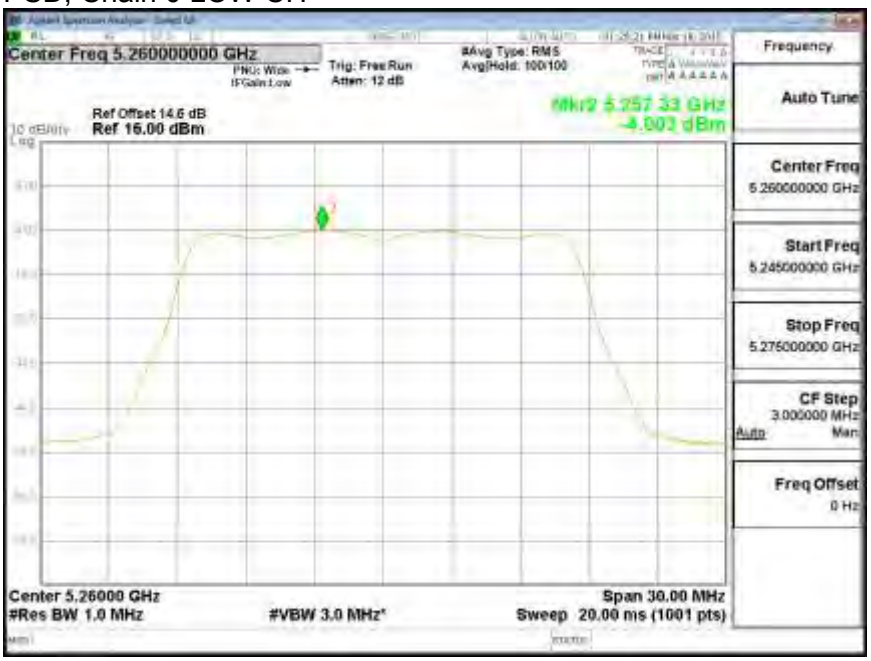
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	6.29	6.24	9.28	23.90	-14.62
Mid	5300	6.00	6.05	9.04	23.89	-14.86
High	5320	6.48	6.47	9.49	23.89	-14.41

PSD Results

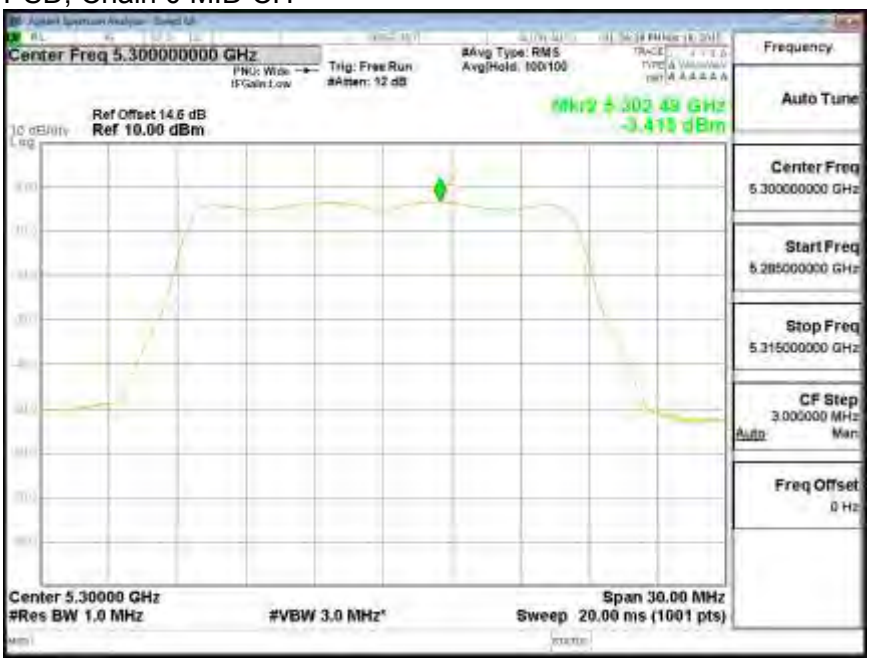
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5260	-4.003	-3.681	-0.83	11.00	-11.83
Mid	5300	-3.415	-3.623	-0.51	11.00	-11.51
High	5320	-3.772	-3.465	-0.61	11.00	-11.61

PSD, Chain 0

PSD, Chain 0 LOW CH



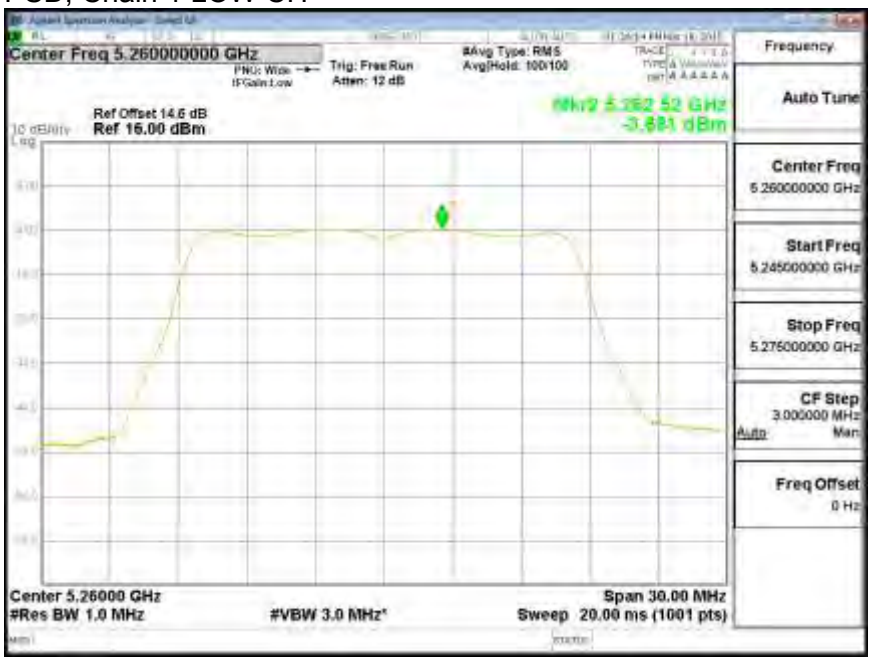
PSD, Chain 0 MID CH



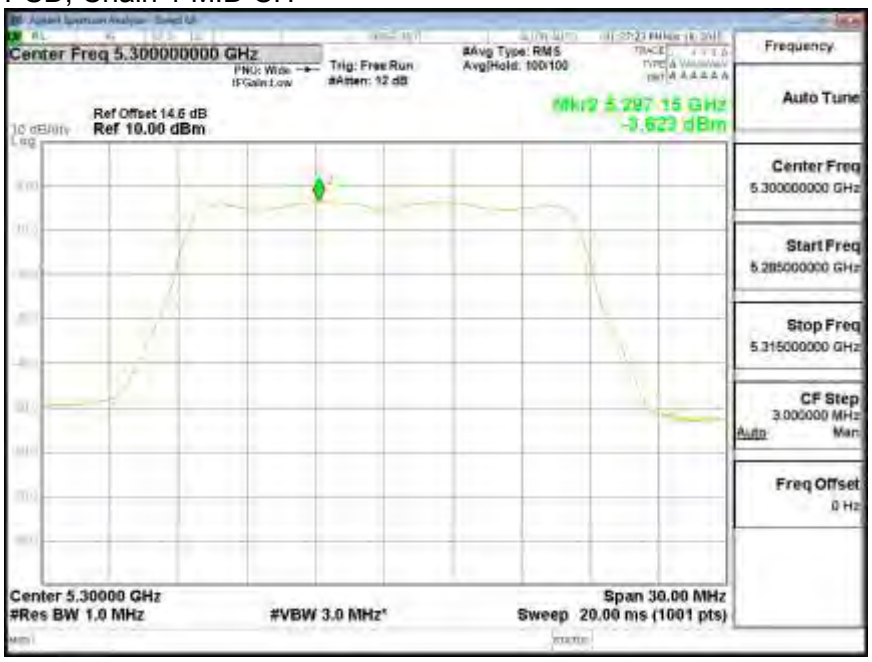
PSD, Chain 0 HIGH CH

PSD, Chain 1

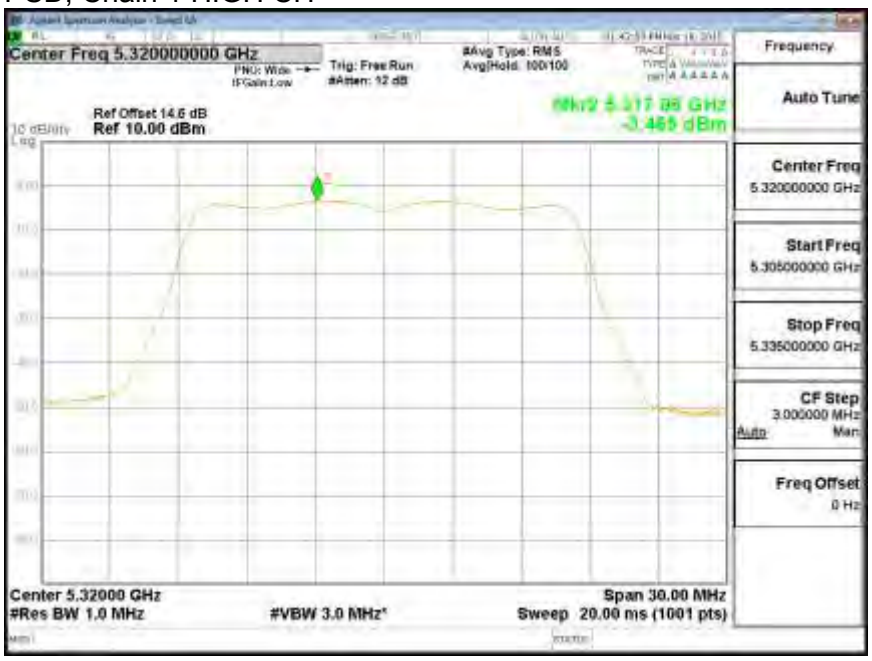
PSD, Chain 1 LOW CH



PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9.6. 802.11n HT20 MODE IN THE 5.3 GHz BAND

9.6.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

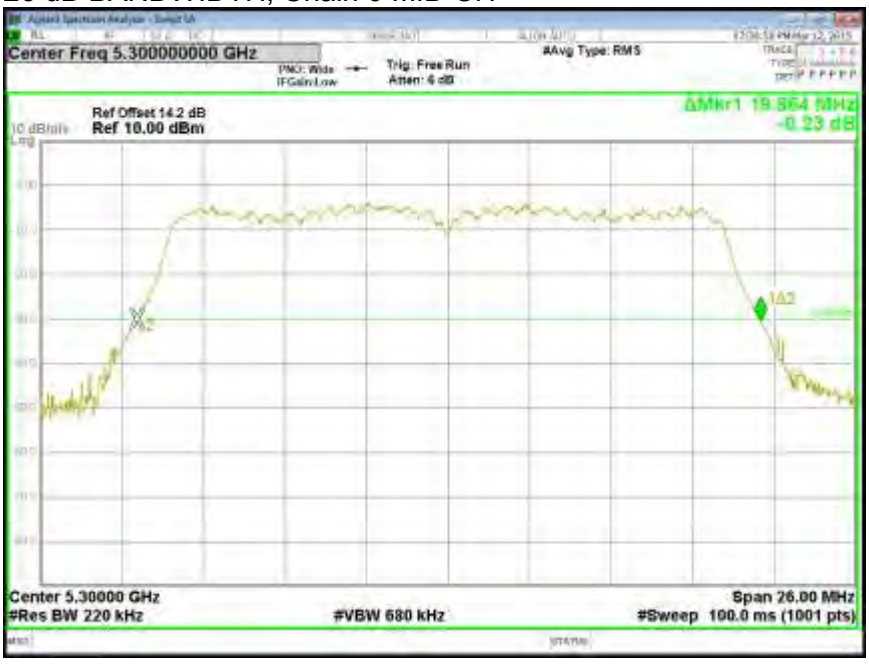
RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5260	19.92	20.12
Mid	5300	19.86	19.94
High	5320	19.84	20.02

26 dB BANDWIDTH, Chain 0

26 dB BANDWIDTH, Chain 0 LOW CH

26 dB BANDWIDTH, Chain 0 MID CH



26 dB BANDWIDTH, Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

26 dB BANDWIDTH, Chain 1 LOW CH

26 dB BANDWIDTH, Chain 1 MID CH

26 dB BANDWIDTH, Chain 1 HIGH CH

9.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

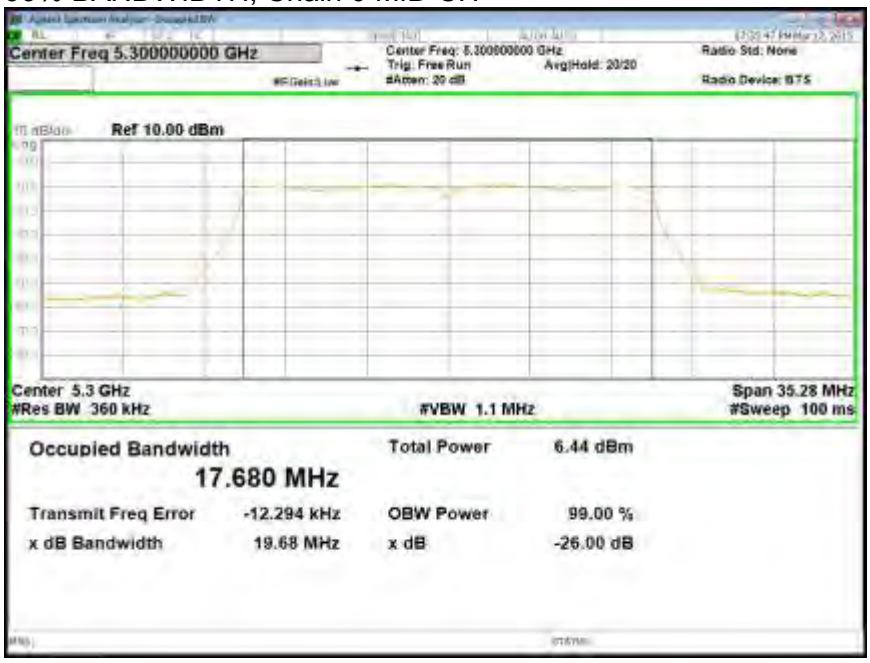
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5260	17.682	17.689
Mid	5300	17.680	17.697
High	5320	17.681	17.693

99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH

99% BANDWIDTH, Chain 0 MID CH



99% BANDWIDTH, Chain 0 HIGH CH

99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH

99% BANDWIDTH, Chain 1 MID CH

99% BANDWIDTH, Chain 1 HIGH CH

9.6.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.4	2.9	3.16

RESULTS

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5260	19.92	3.16	3.16	23.99	11.00
Mid	5300	19.86	3.16	3.16	23.98	11.00
High	5320	19.84	3.16	3.16	23.98	11.00

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

Output Power Results

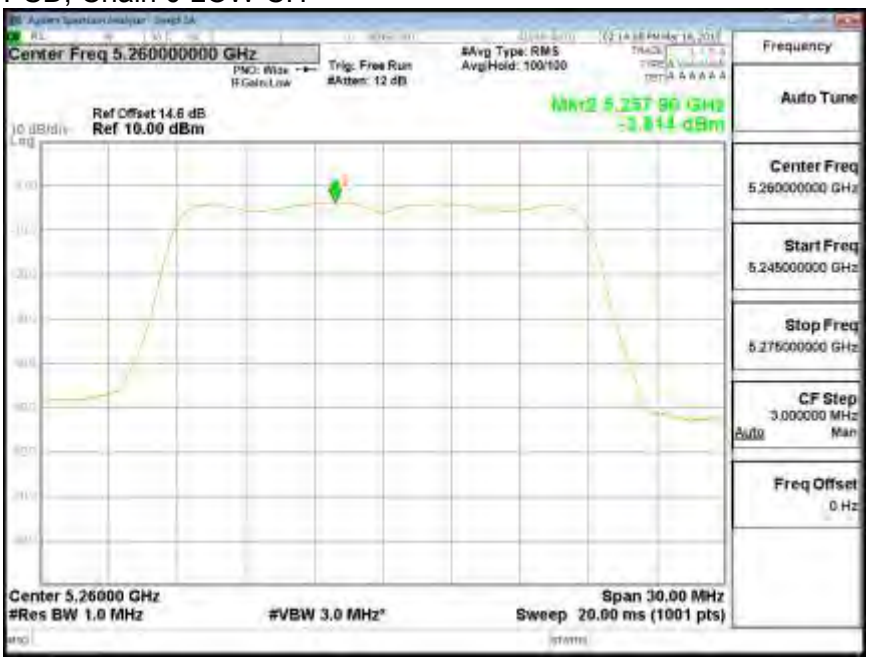
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5260	6.43	6.24	9.35	23.99	-14.65
Mid	5300	6.47	6.05	9.28	23.98	-14.70
High	5320	6.16	6.47	9.33	23.98	-14.65

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5260	-3.814	-3.961	-0.88	11.00	-11.88
Mid	5300	-4.204	-3.952	-1.07	11.00	-12.07
High	5320	-3.977	-4.042	-1.00	11.00	-12.00

PSD, Chain 0

PSD, Chain 0 LOW CH



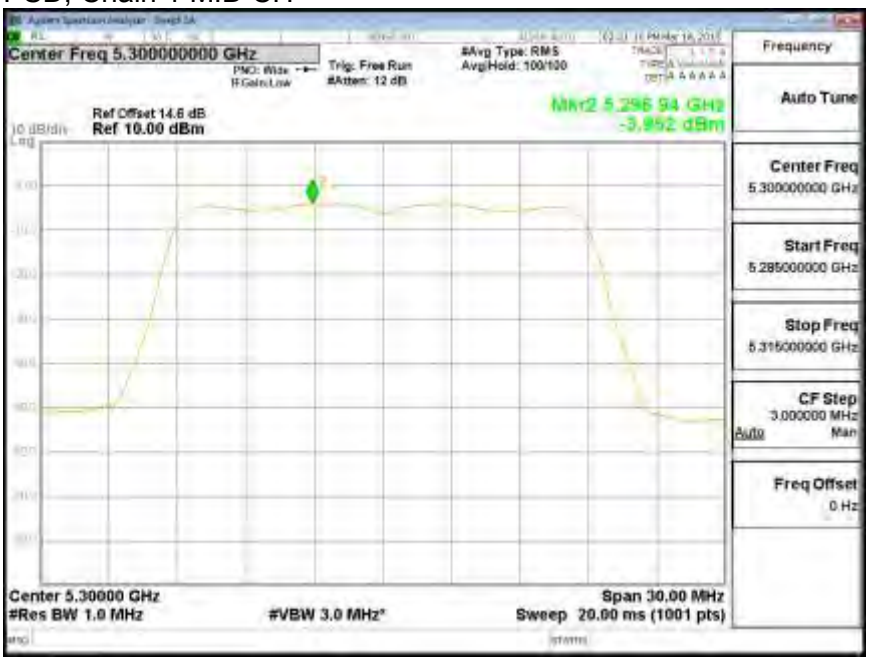
PSD, Chain 0 MID CH

PSD, Chain 0 HIGH CH

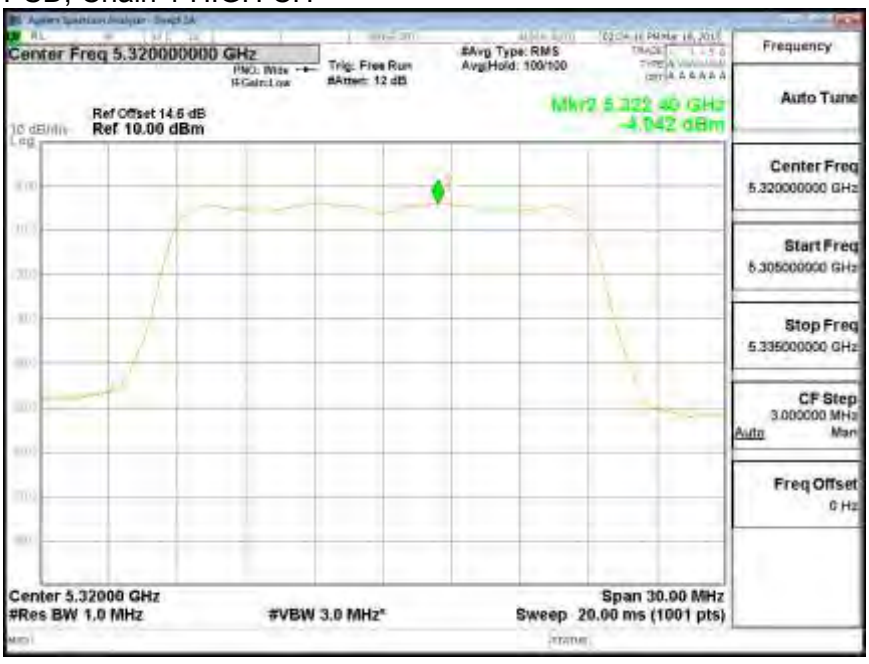
PSD, Chain 1

PSD, Chain 1 LOW CH

PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9.7. 802.11n HT40 MODE IN THE 5.3 GHz BAND

9.7.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5270	39.72	40.37
High	5310	39.84	40.37

26 dB BANDWIDTH, Chain 0

26 dB BANDWIDTH, Chain 0 LOW CH

26 dB BANDWIDTH, Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

26 dB BANDWIDTH, Chain 1 LOW CH

26 dB BANDWIDTH, Chain 1 HIGH CH

9.7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5270	36.194	36.191
High	5310	36.191	36.212

99% BANDWIDTH, Chain 0

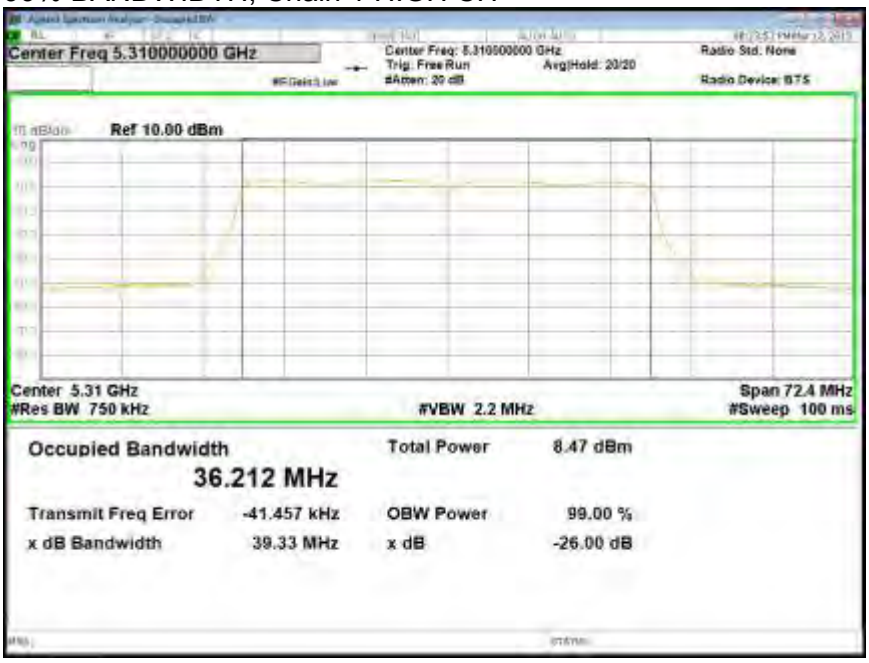
99% BANDWIDTH, Chain 0 LOW CH

99% BANDWIDTH, Chain 0 HIGH CH

99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH

99% BANDWIDTH, Chain 1 HIGH CH



9.7.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.4	2.9	3.16

RESULTS

Bandwidth, Antenna Gain and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5270	39.90	3.16	3.16	24.00	11.00
High	5310	39.90	3.16	3.16	24.00	11.00

Duty Cycle CF (dB)	0.13	Included in Calculations of Corr'd Power & PSD

Output Power Results

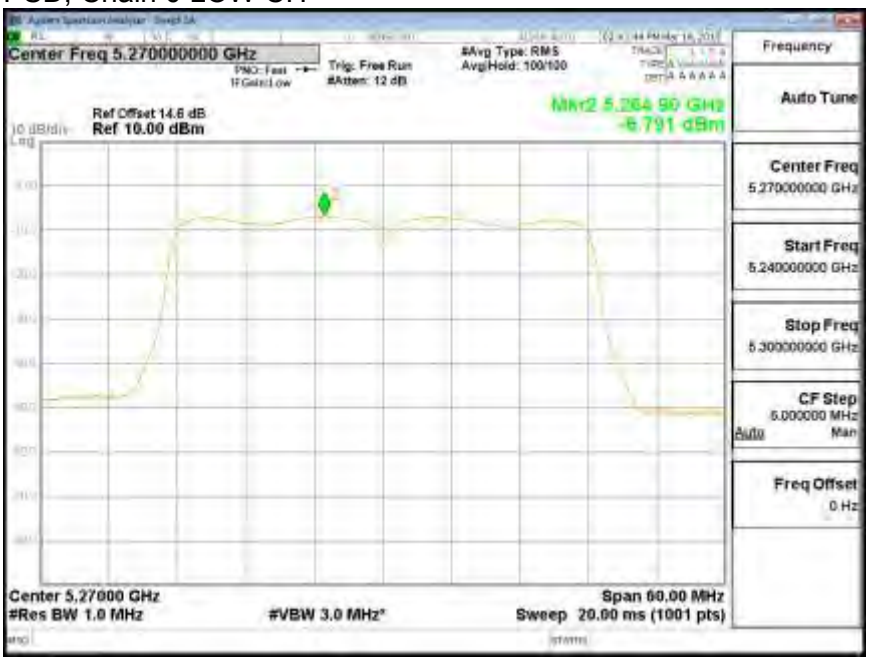
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5270	6.550	5.920	9.39	24.00	-14.61
High	5310	6.470	6.150	9.45	24.00	-14.55

PSD Results

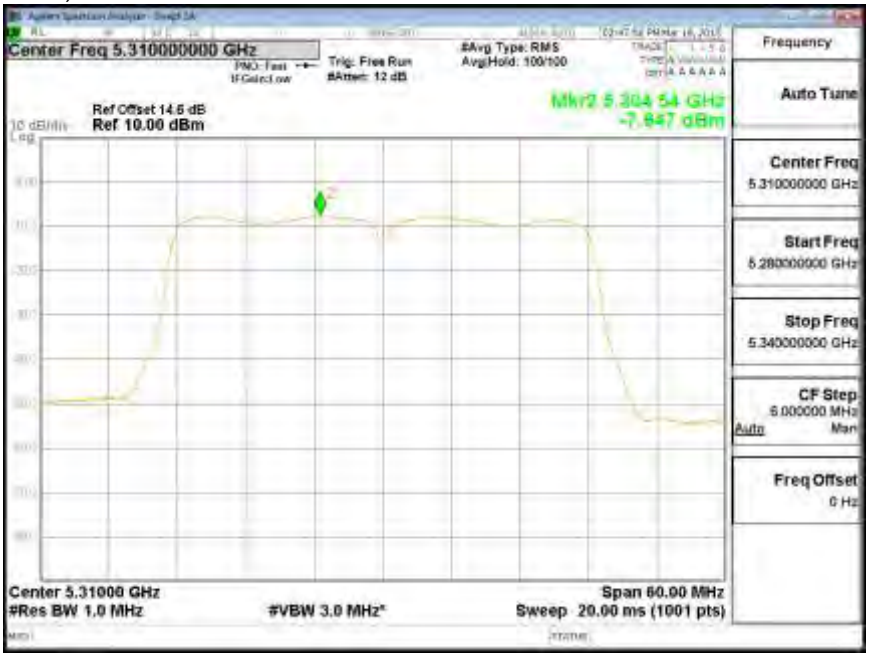
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5270	-6.791	-7.079	-3.79	11.00	-14.79
High	5310	-7.647	-7.476	-4.42	11.00	-15.42

PSD, Chain 0

PSD, Chain 0 LOW CH

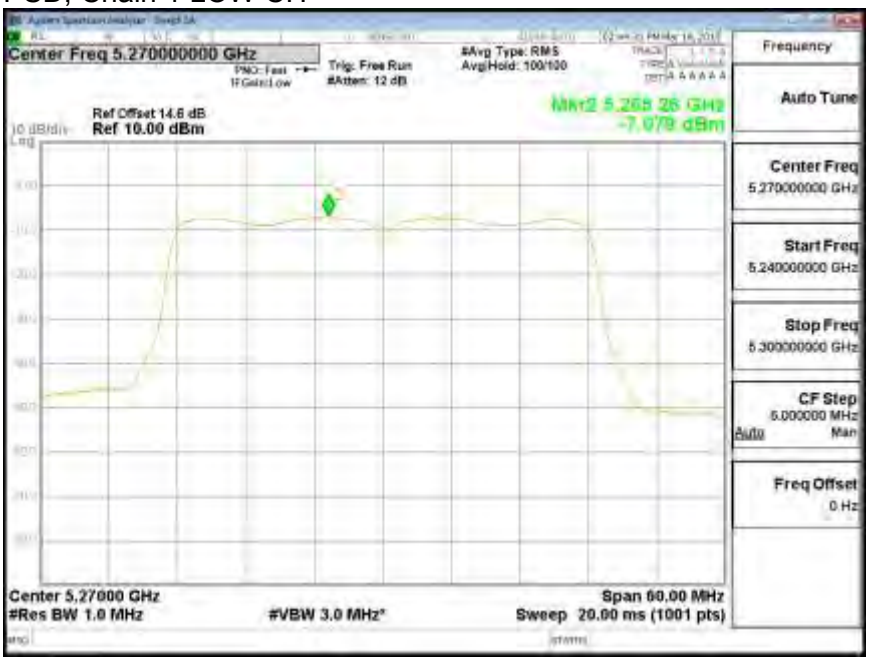


PSD, Chain 0 HIGH CH

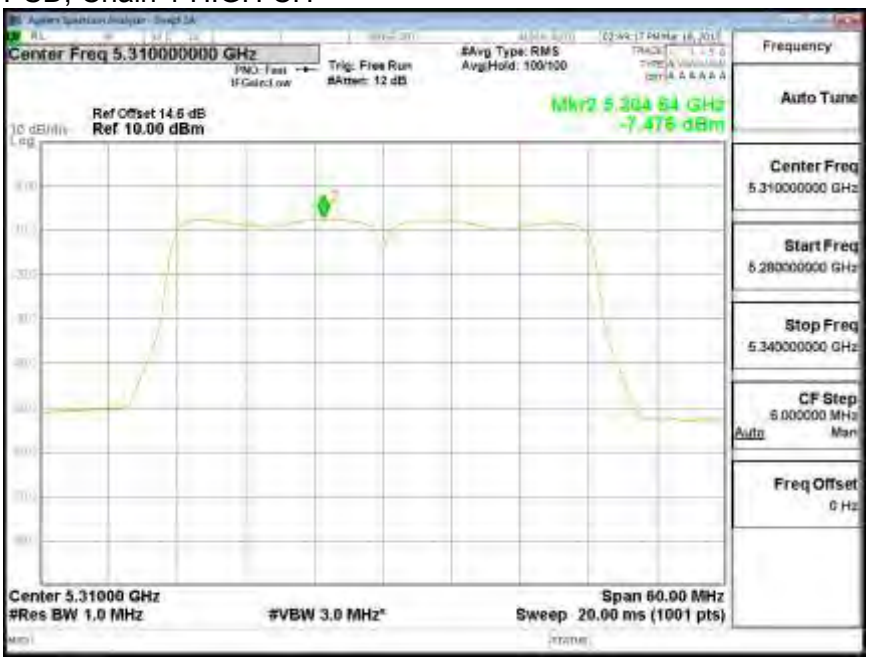


PSD, Chain 1

PSD, Chain 1 LOW CH



PSD, Chain 1 HIGH CH



9.8. 802.11ac VHT80 MODE IN THE 5.3 GHz BAND

9.8.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Mid	5290	82.00	82.00

26 dB BANDWIDTH, Chain 0

26 dB BANDWIDTH, Chain 0 MID CH

26 dB BANDWIDTH, Chain 1

26 dB BANDWIDTH, Chain 1 MID CH

9.8.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Mid	5290	76.199	76.292

99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 MID CH

99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 MID CH

9.8.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.25–5.35 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
3.4	2.9	3.16

RESULTS

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Mid	5290	82.00	3.16	3.16	24.00	11.00

Duty Cycle CF (dB)	0.26	Included in Calculations of Corr'd Power & PSD

Output Power Results

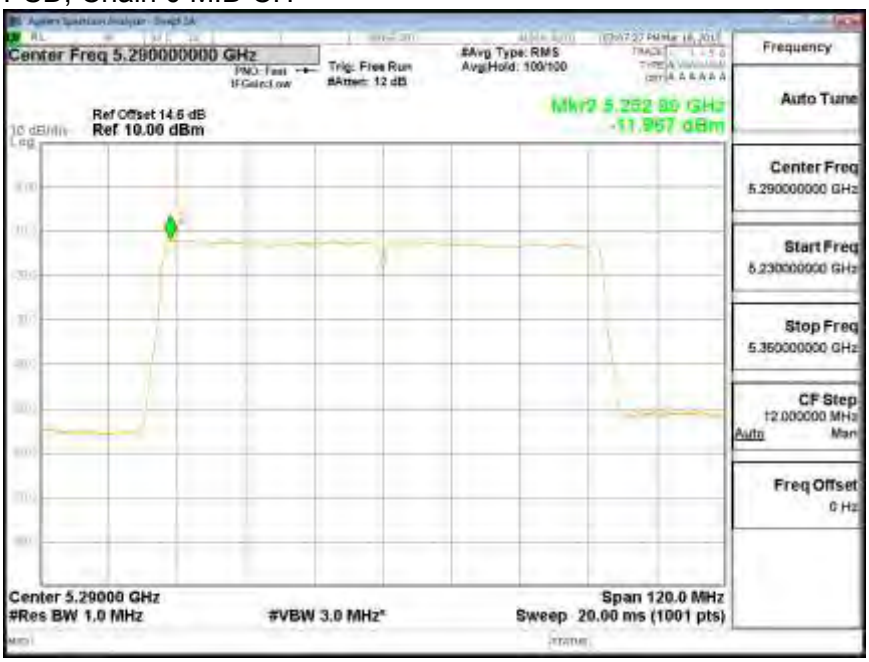
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Mid	5290	6.38	6.07	9.50	24.00	-14.50

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Mid	5290	-11.967	-12.139	-8.78	11.00	-19.78

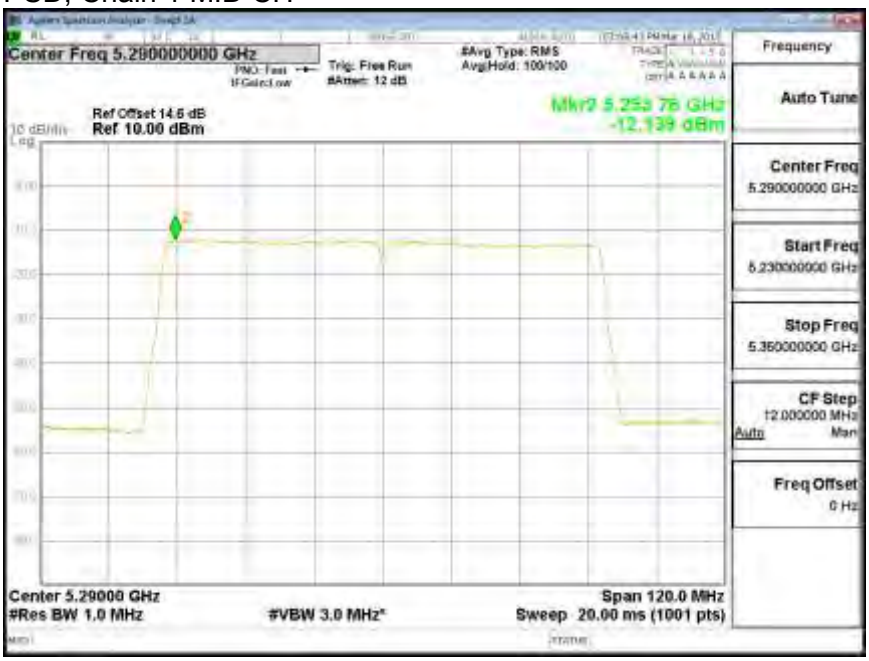
PSD, Chain 0

PSD, Chain 0 MID CH



PSD, Chain 1

PSD, Chain 1 MID CH



9.9. 802.11a MODE IN THE 5.6 GHz BAND

9.9.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5500	19.500	19.656
Mid	5580	19.630	19.682
High	5700	19.552	19.604

26 dB BANDWIDTH, Chain 0

BANDWIDTH Chain 0 LOW CH

BANDWIDTH Chain 0 MID CH

BANDWIDTH Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

BANDWIDTH Chain 1 LOW CH

BANDWIDTH Chain 1 MID CH

BANDWIDTH Chain 1 HIGH CH

9.9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

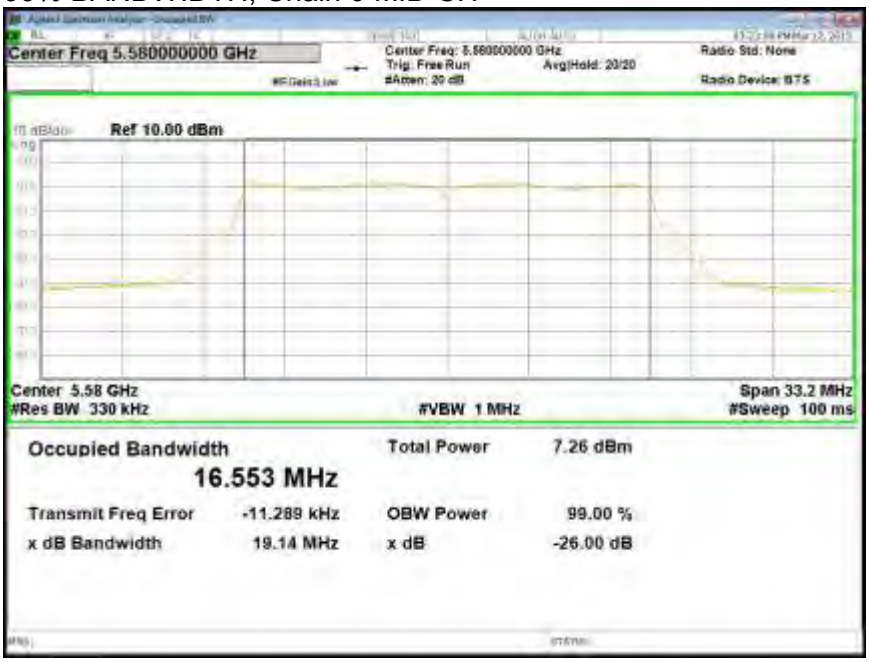
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5500	16.548	16.557
Mid	5580	16.553	16.558
High	5700	16.551	16.554

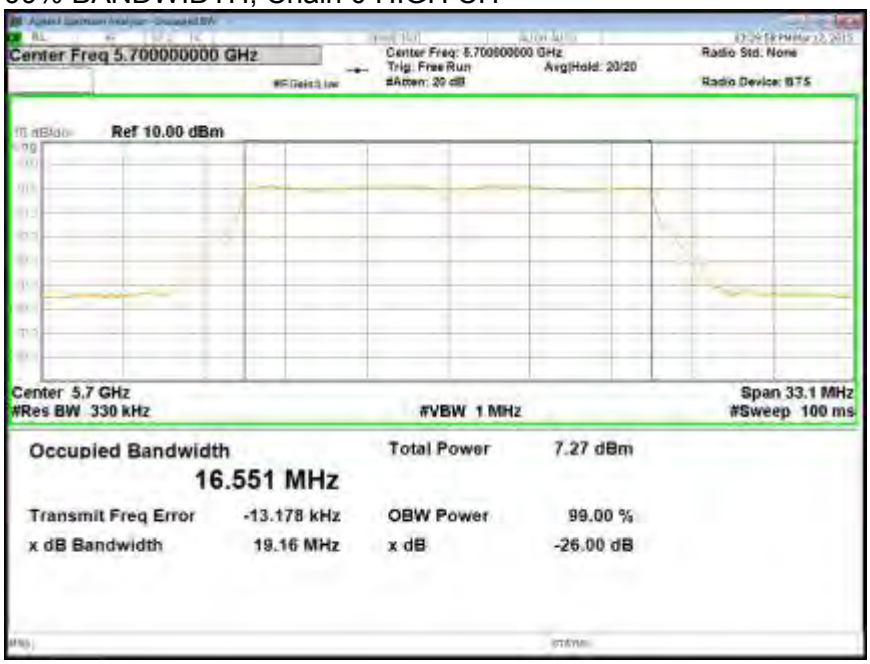
99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH

99% BANDWIDTH, Chain 0 MID CH

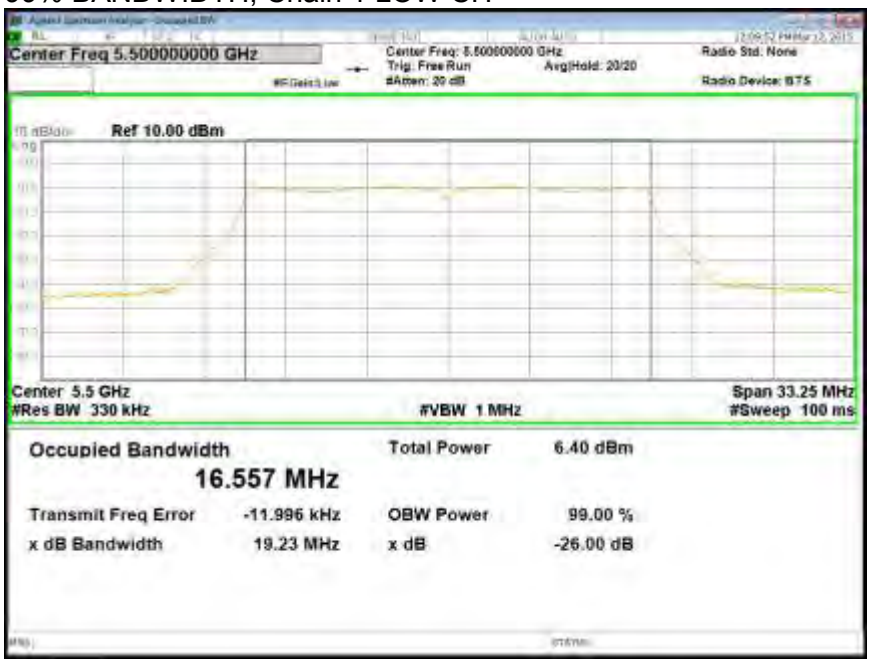


99% BANDWIDTH, Chain 0 HIGH CH

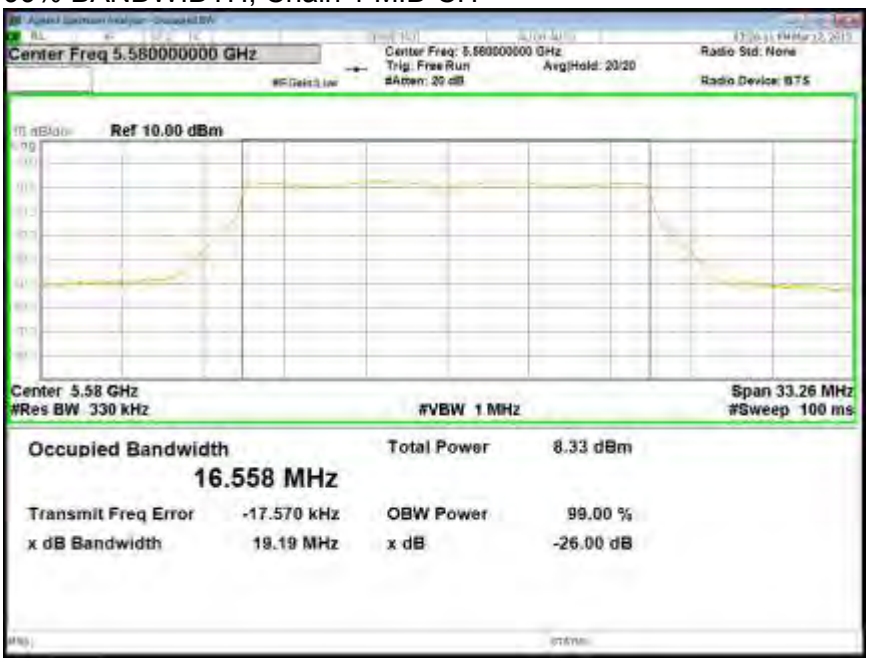


99% BANDWIDTH, Chain 1

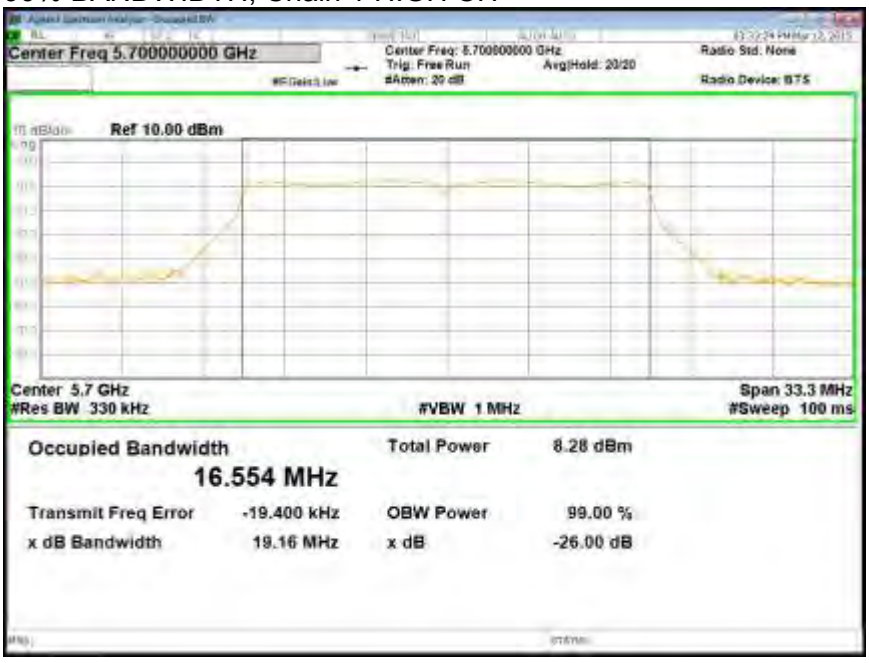
99% BANDWIDTH, Chain 1 LOW CH



99% BANDWIDTH, Chain 1 MID CH



99% BANDWIDTH, Chain 1 HIGH CH



9.9.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.4	3.3	2.87

RESULTS

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5500	19.500	2.87	2.87	23.90	11.00
Mid	5600	19.630	2.87	2.87	23.93	11.00
High	5700	19.552	2.87	2.87	23.91	11.00

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

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	6.34	6.54	9.45	23.90	-14.45
Mid	5580	6.51	6.39	9.46	23.93	-14.47
High	5700	6.54	6.38	9.47	23.91	-14.44

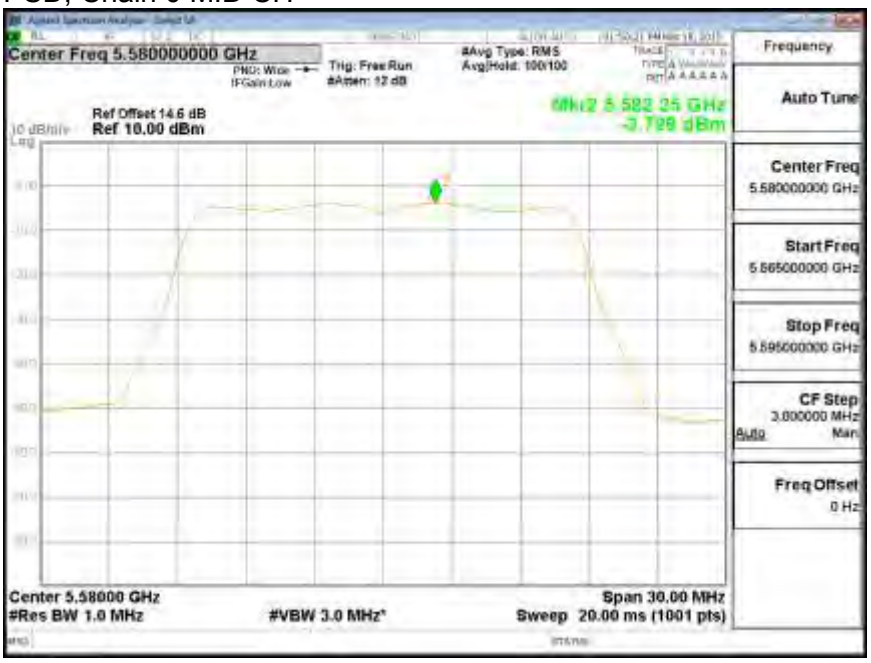
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5500	-3.908	-3.762	-0.82	11.00	-11.82
Mid	5580	-3.799	-3.418	-0.59	11.00	-11.59
High	5700	-3.587	-4.011	-0.78	11.00	-11.78

PSD, Chain 0

PSD, Chain 0 LOW CH

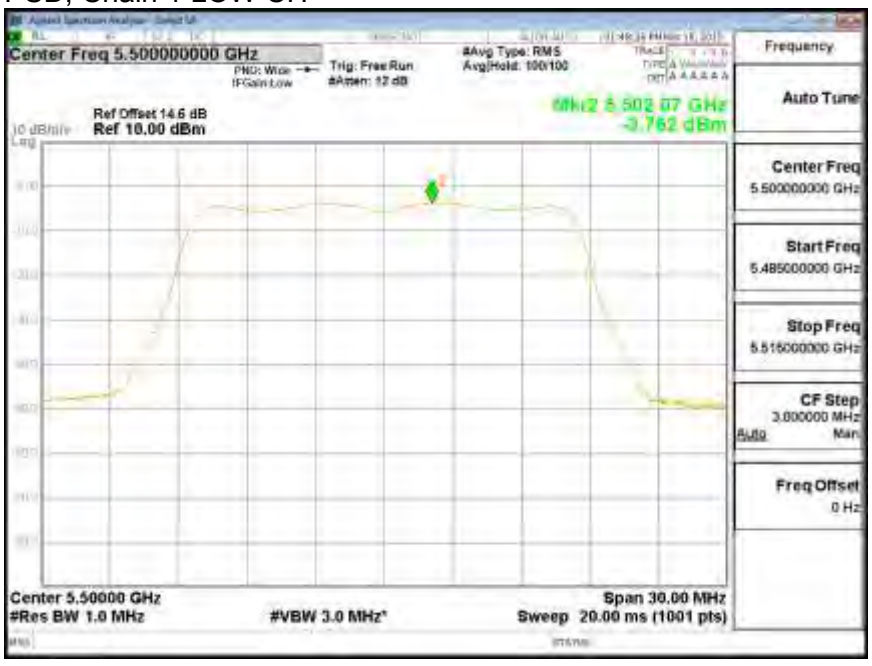
PSD, Chain 0 MID CH



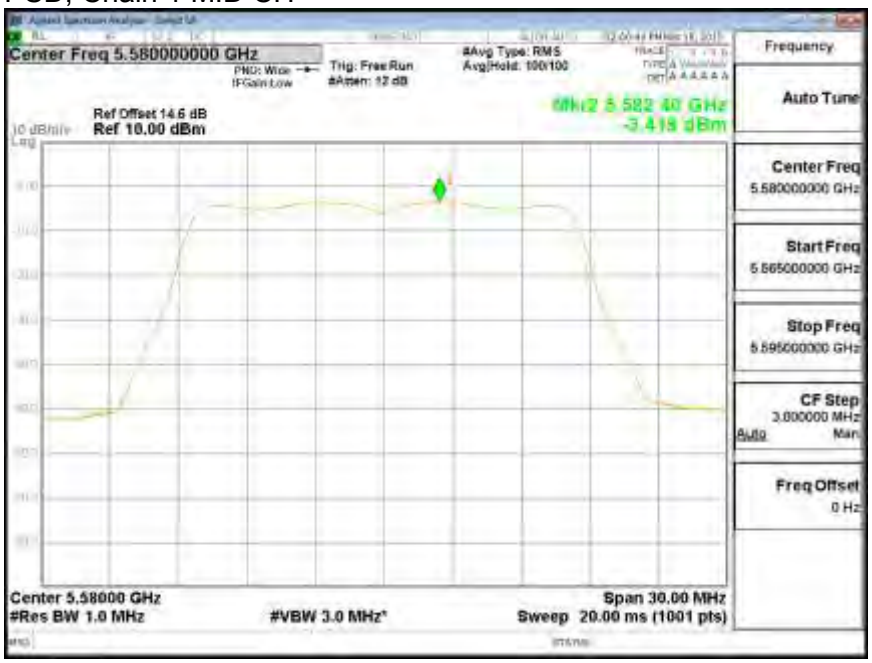
PSD, Chain 0 HIGH CH

PSD, Chain 1

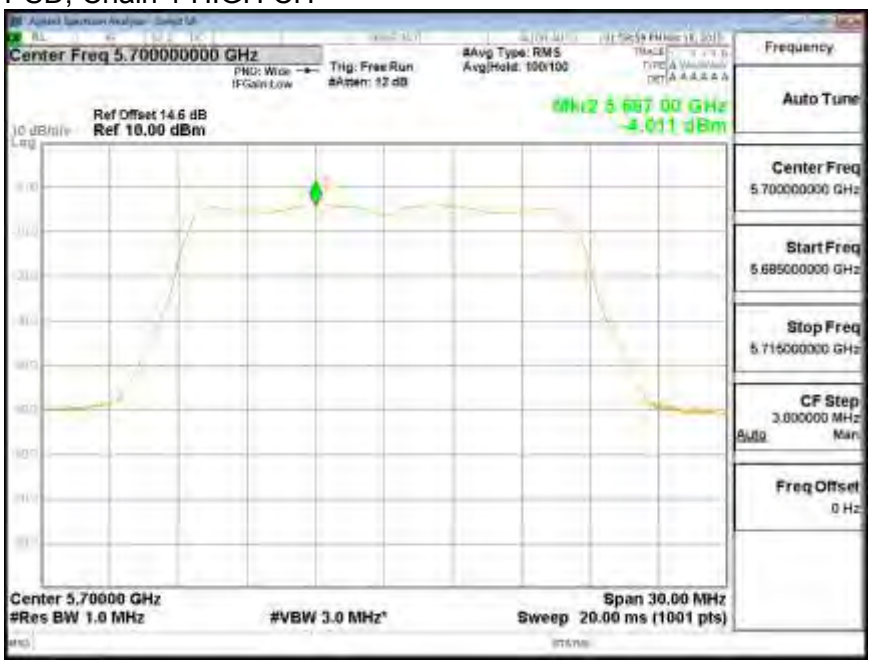
PSD, Chain 1 LOW CH



PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9.10. 802.11n HT20 MODE IN THE 5.6 GHz BAND

9.10.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

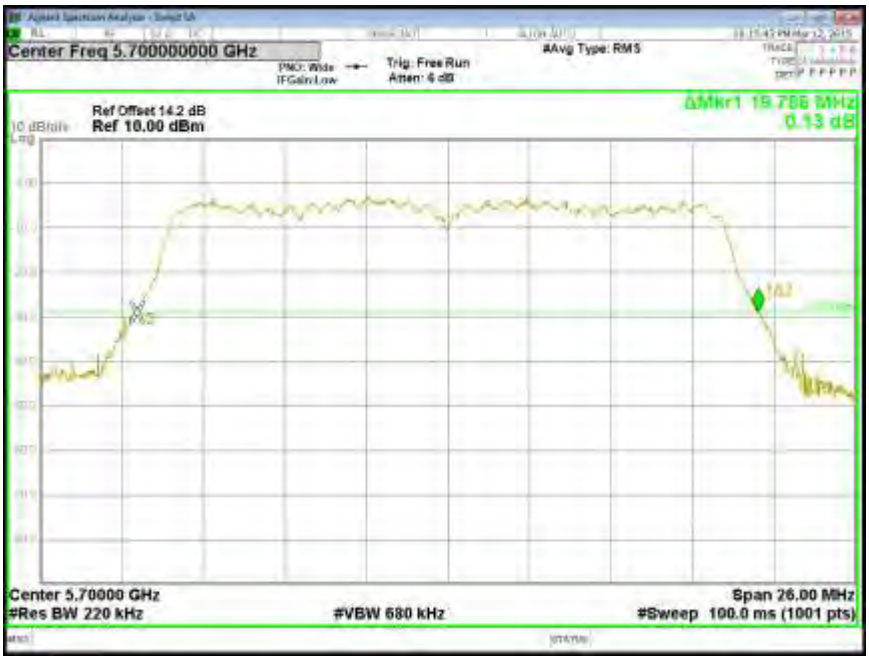
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5500	19.864	19.942
Mid	5580	19.838	20.020
High	5700	19.786	20.176

26 dB BANDWIDTH, Chain 0

BANDWIDTH Chain 0 LOW CH

BANDWIDTH Chain 0 MID CH

BANDWIDTH Chain 0 HIGH CH



26 dB BANDWIDTH, Chain 1

BANDWIDTH Chain 1 LOW CH

BANDWIDTH Chain 1 MID CH

BANDWIDTH Chain 1 HIGH CH

9.10.2. 99% BANDWIDTH

LIMITS

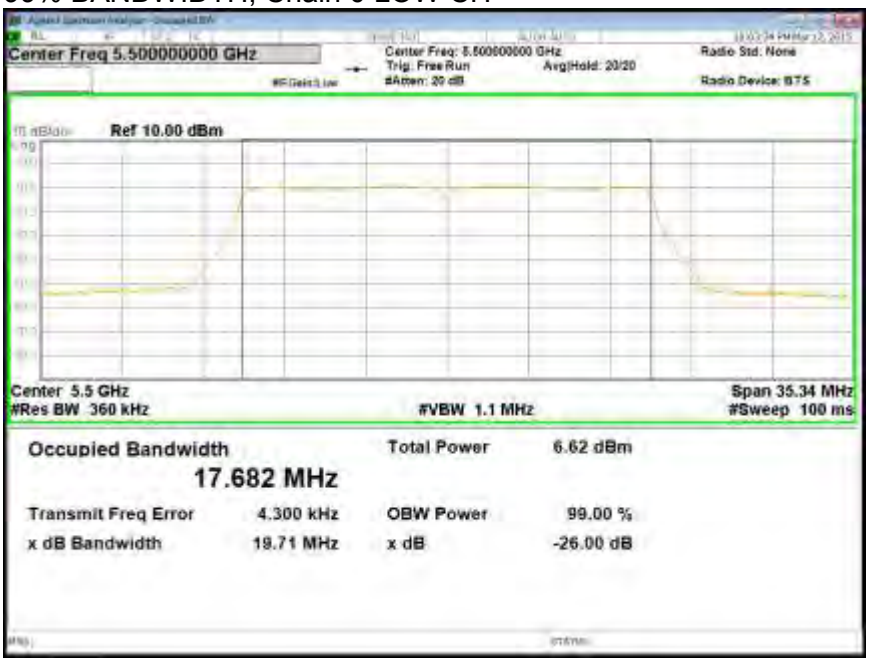
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5500	17.682	17.692
Mid	5580	17.683	17.691
High	5700	17.681	17.687

99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH



99% BANDWIDTH, Chain 0 MID CH

99% BANDWIDTH, Chain 0 HIGH CH

99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH

99% BANDWIDTH, Chain 1 MID CH

99% BANDWIDTH, Chain 1 HIGH CH

9.10.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.4	3.3	2.87

RESULTS

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5500	19.83	2.87	2.87	23.97	11.00
Mid	5580	19.74	2.87	2.87	23.95	11.00
High	5700	19.83	2.87	2.87	23.97	11.00

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

Output Power Results

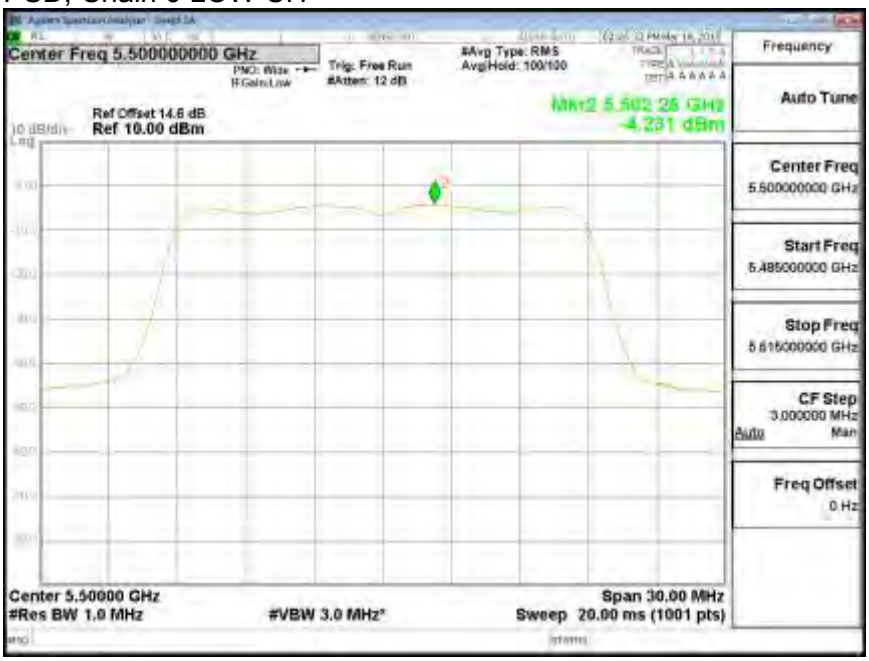
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5500	6.51	6.11	9.32	23.97	-14.65
Mid	5580	6.62	6.51	9.58	23.95	-14.38
High	5700	6.43	6.08	9.27	23.97	-14.70

PSD Results

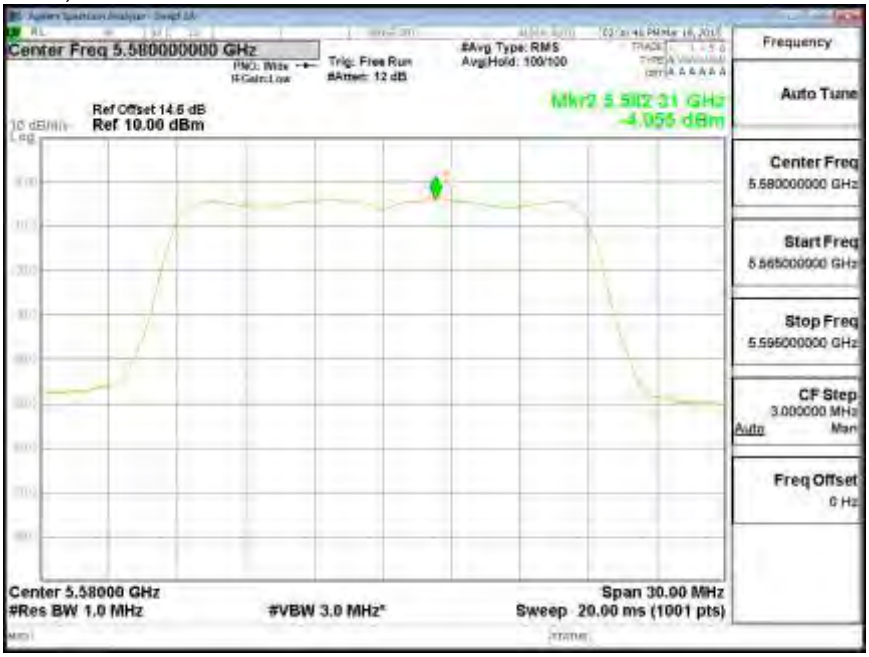
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5500	-4.231	-4.129	-1.17	11.00	-12.17
Mid	5580	-4.055	-4.078	-1.06	11.00	-12.06
High	5700	-4.370	-4.614	-1.48	11.00	-12.48

PSD, Chain 0

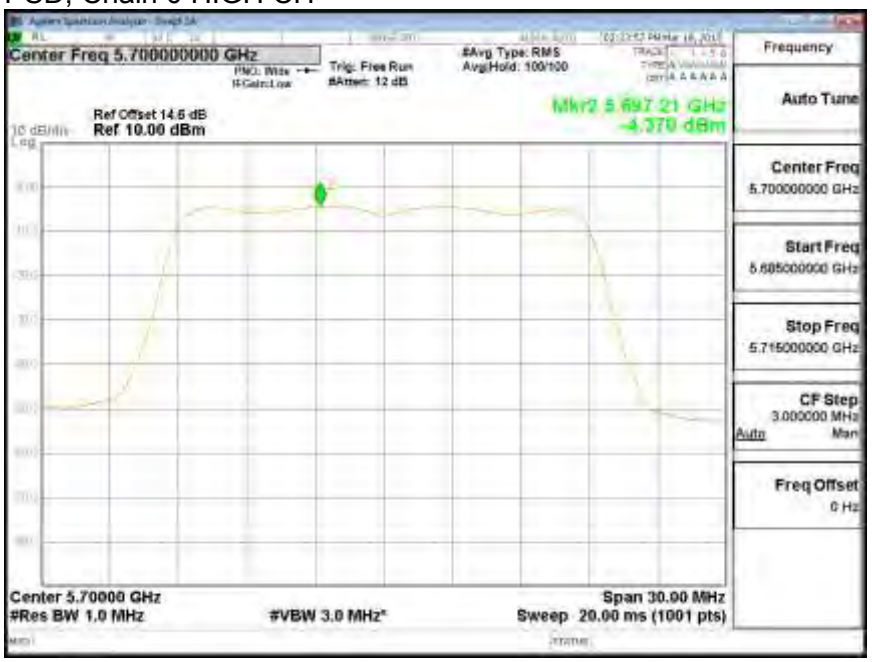
PSD, Chain 0 LOW CH



PSD, Chain 0 MID CH

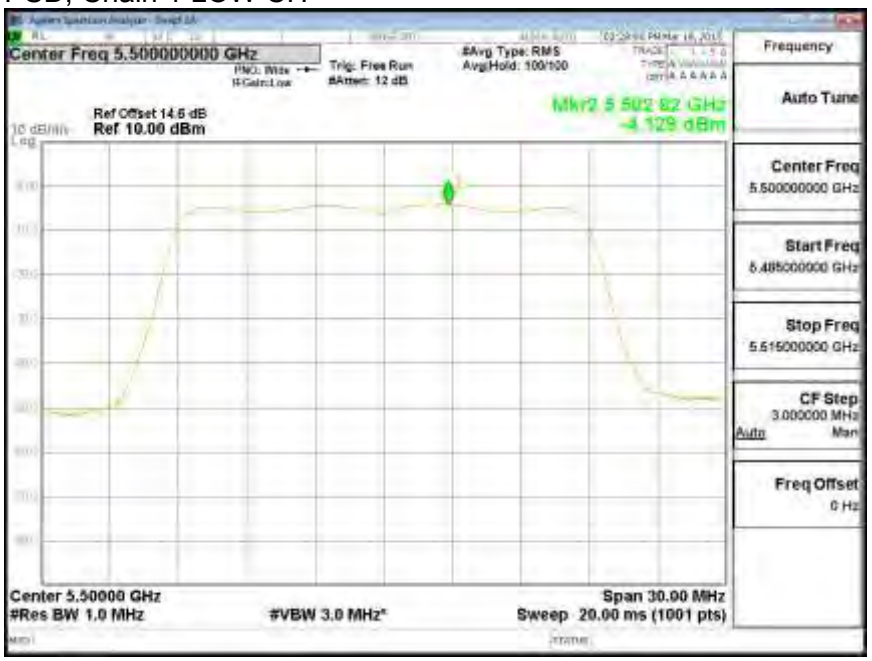


PSD, Chain 0 HIGH CH

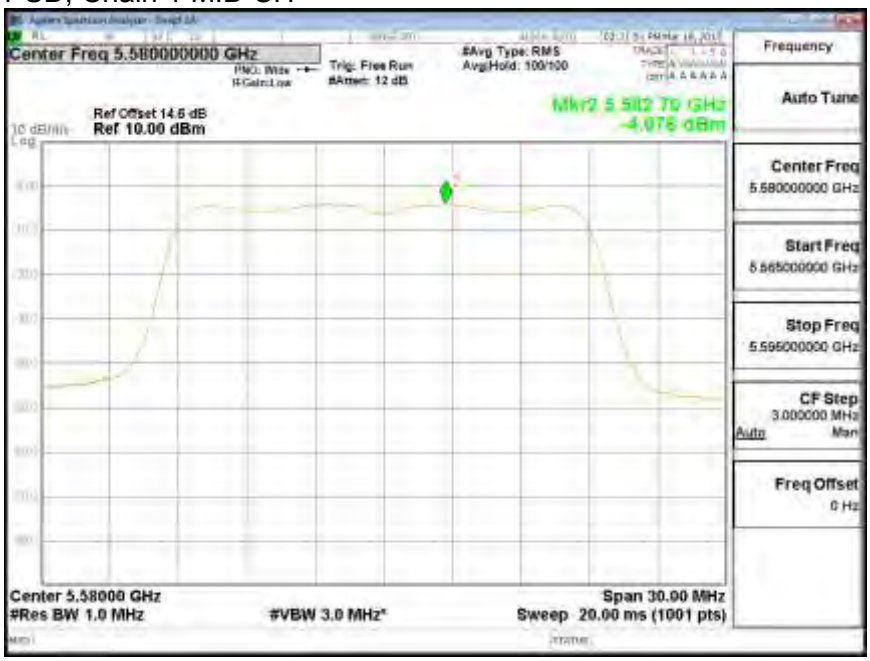


PSD, Chain 1

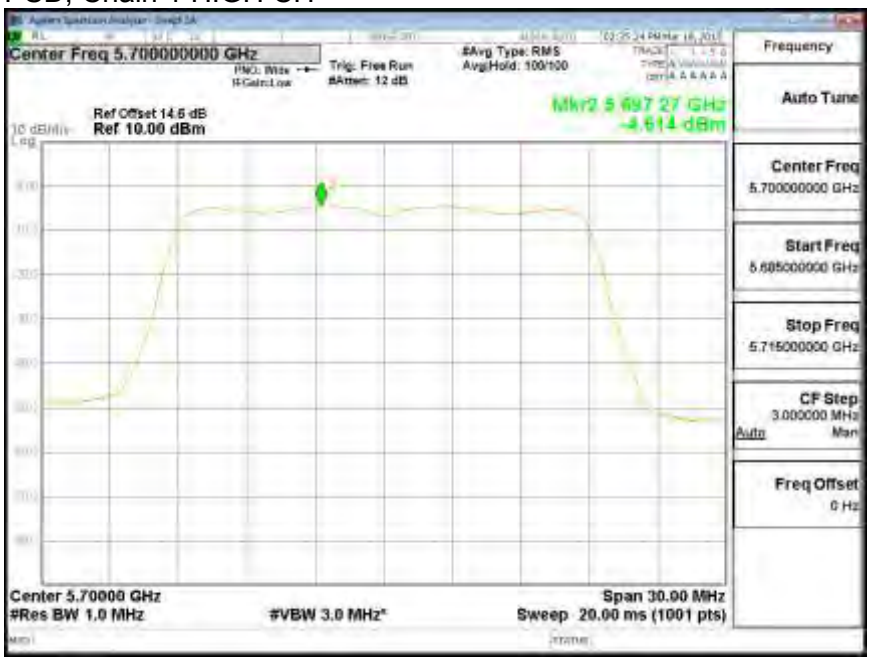
PSD, Chain 1 LOW CH



PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9.11. 802.11n HT40 MODE IN THE 5.6 GHz BAND

9.11.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5510	39.721	40.482
Mid	5550	39.897	40.365
High	5670	39.663	40.248

26 dB BANDWIDTH, Chain 0

BANDWIDTH Chain 0 LOW CH

BANDWIDTH Chain 0 MID CH

BANDWIDTH Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

BANDWIDTH Chain 1 LOW CH

BANDWIDTH Chain 1 MID CH

BANDWIDTH Chain 1 HIGH CH

9.11.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

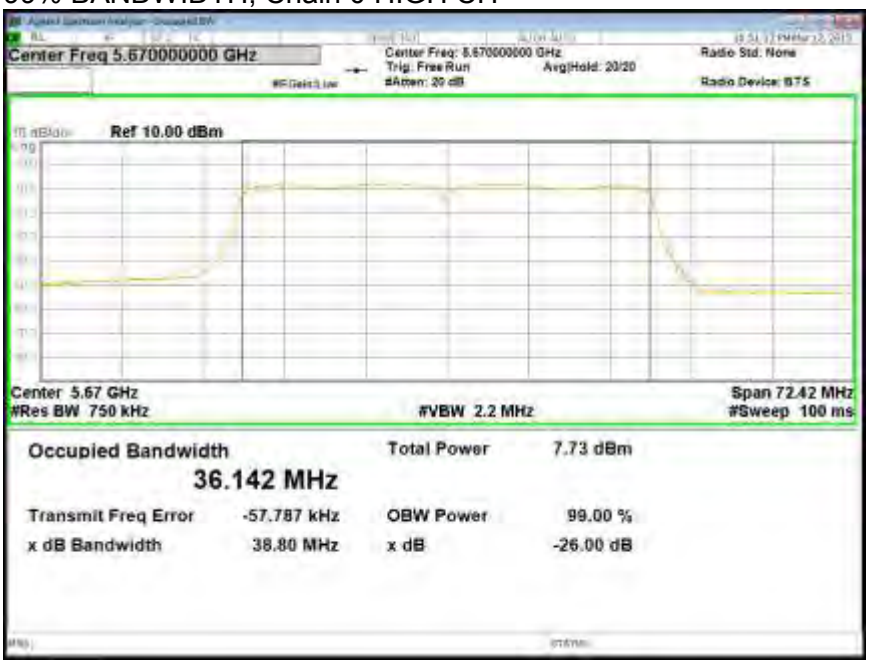
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5510	36.194	36.185
Mid	5590	36.221	36.200
High	5670	36.142	36.190

99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH

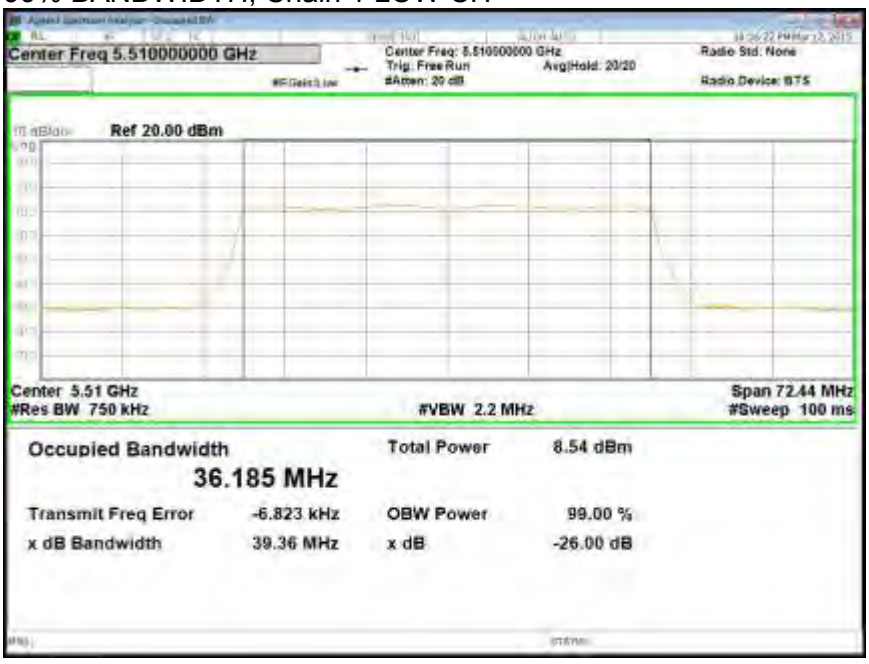
99% BANDWIDTH, Chain 0 MID CH

99% BANDWIDTH, Chain 0 HIGH CH



99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH



99% BANDWIDTH, Chain 1 MID CH

99% BANDWIDTH, Chain 1 HIGH CH

9.11.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.4	3.3	2.87

RESULTS

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5510	39.721	2.87	2.87	24.00	11.00
Mid	5590	39.897	2.87	2.87	24.00	11.00
High	5670	39.663	2.87	2.87	24.00	11.00

Duty Cycle CF (dB)	0.13	Included in Calculations of Corr'd Power & PSD

Output Power Results

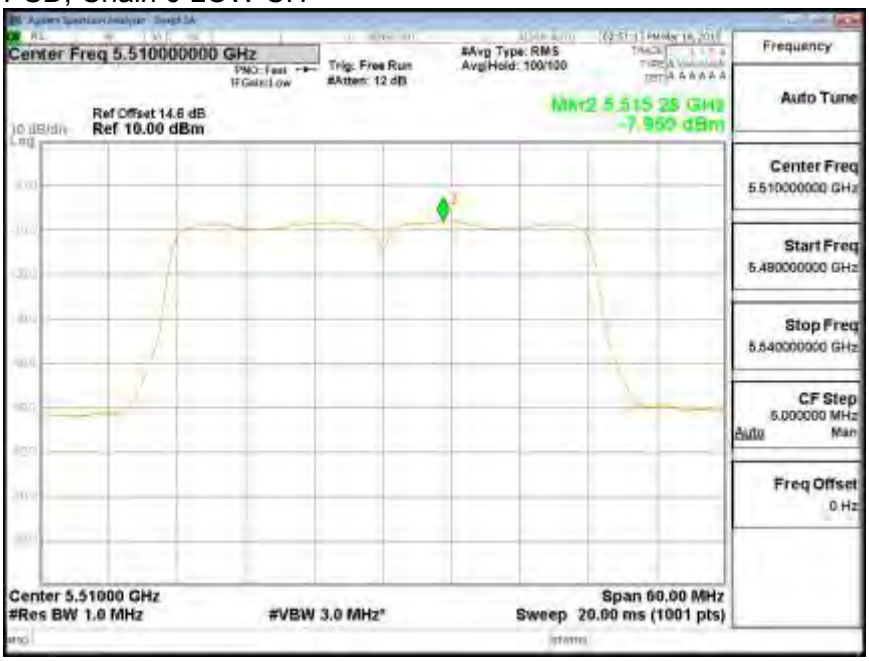
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5510	6.39	6.38	9.53	24.00	-14.47
Mid	5590	6.71	6.59	9.79	24.00	-14.21
High	5670	6.62	6.42	9.66	24.00	-14.34

PSD Results

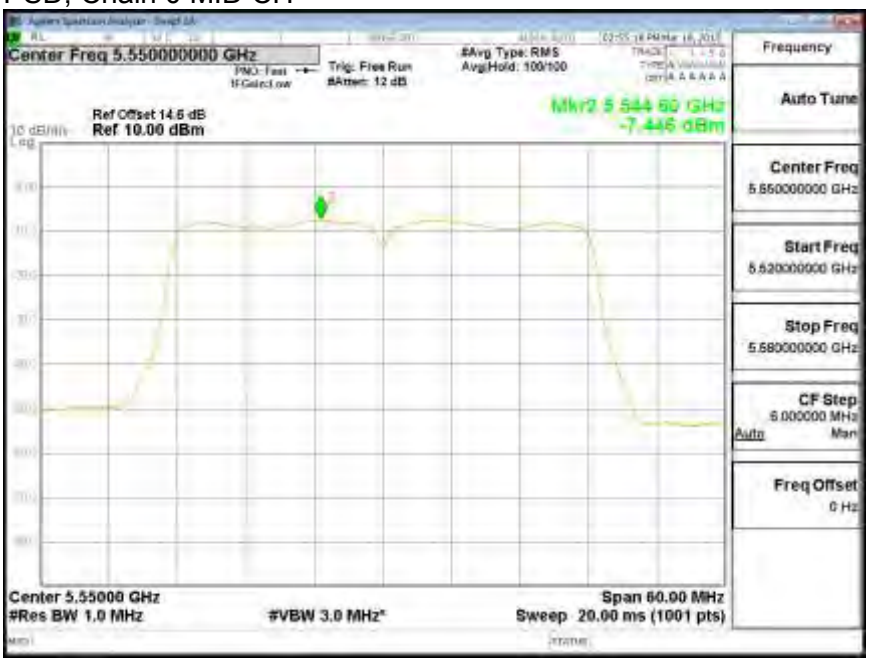
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5510	-7.950	-7.298	-4.47	11.00	-15.47
Mid	5590	-7.446	-7.590	-4.38	11.00	-15.38
High	5670	-7.788	-7.822	-4.66	11.00	-15.66

PSD, Chain 0

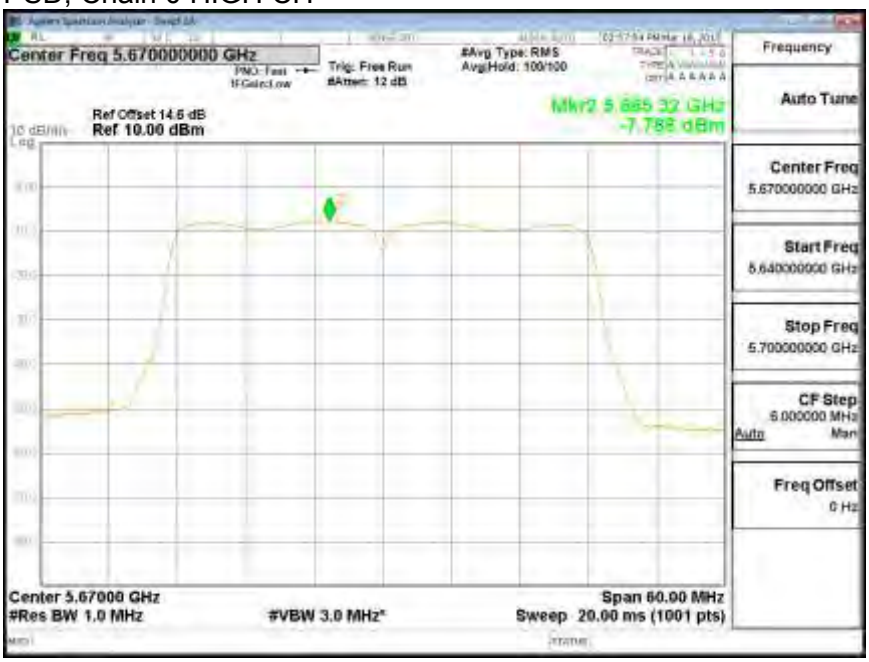
PSD, Chain 0 LOW CH



PSD, Chain 0 MID CH

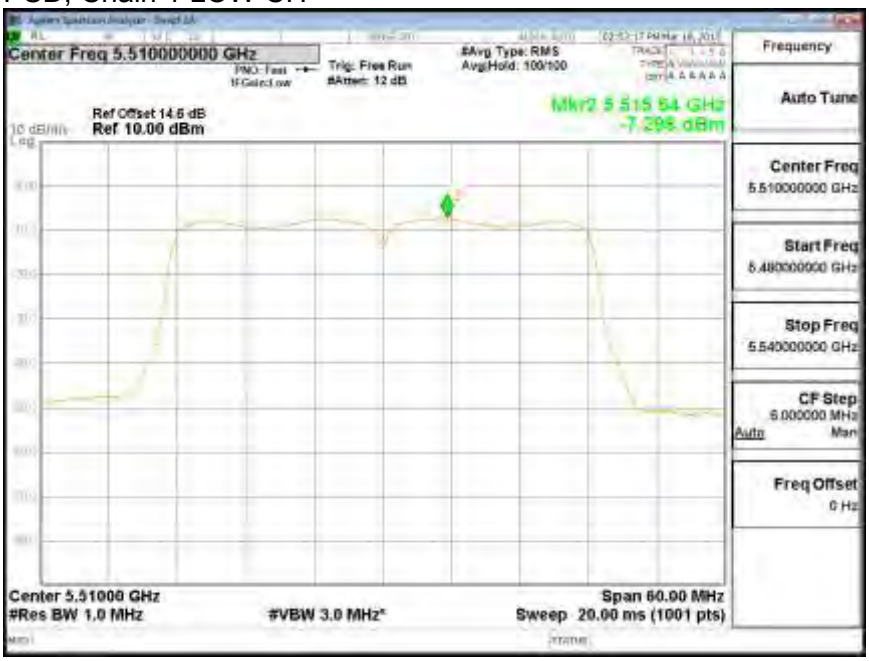


PSD, Chain 0 HIGH CH

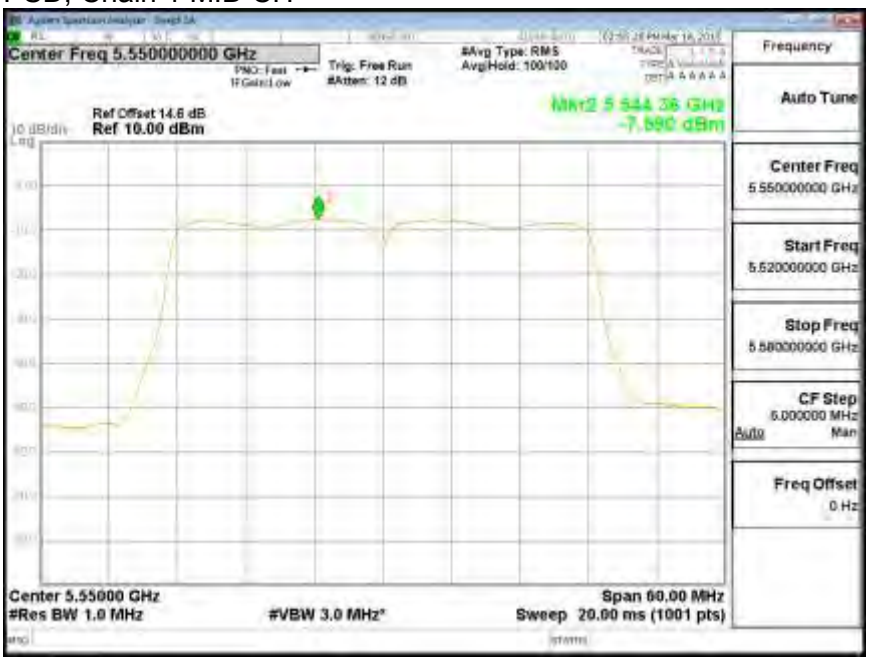


PSD, Chain 1

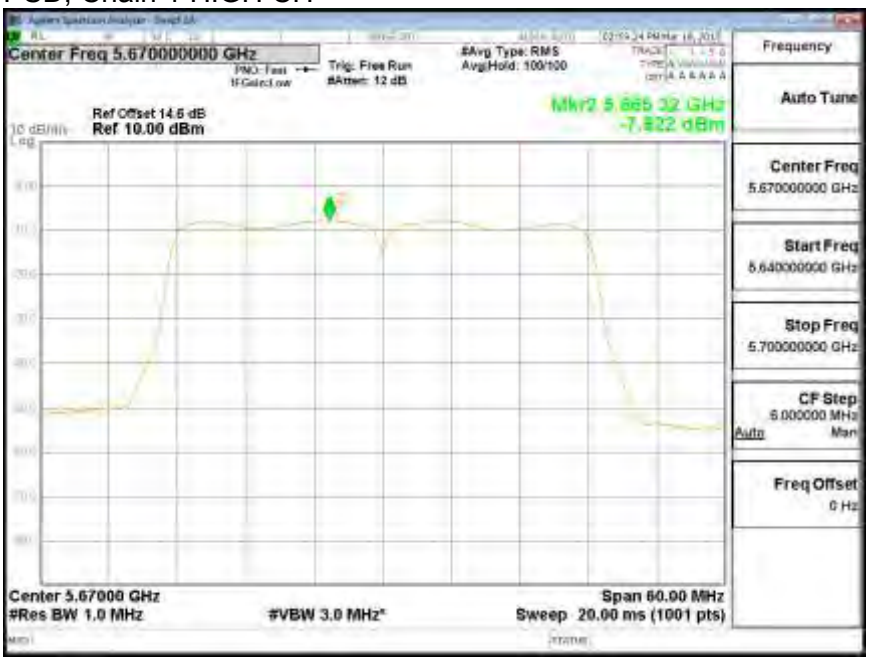
PSD, Chain 1 LOW CH



PSD, Chain 1 MID CH



PSD, Chain 1 HIGH CH



9.12. 802.11ac VHT80 MODE IN THE 5.6 GHz BAND

9.12.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5530	81.610	82.530
Mid	5610	82.530	82.400

26 dB BANDWIDTH, Chain 0

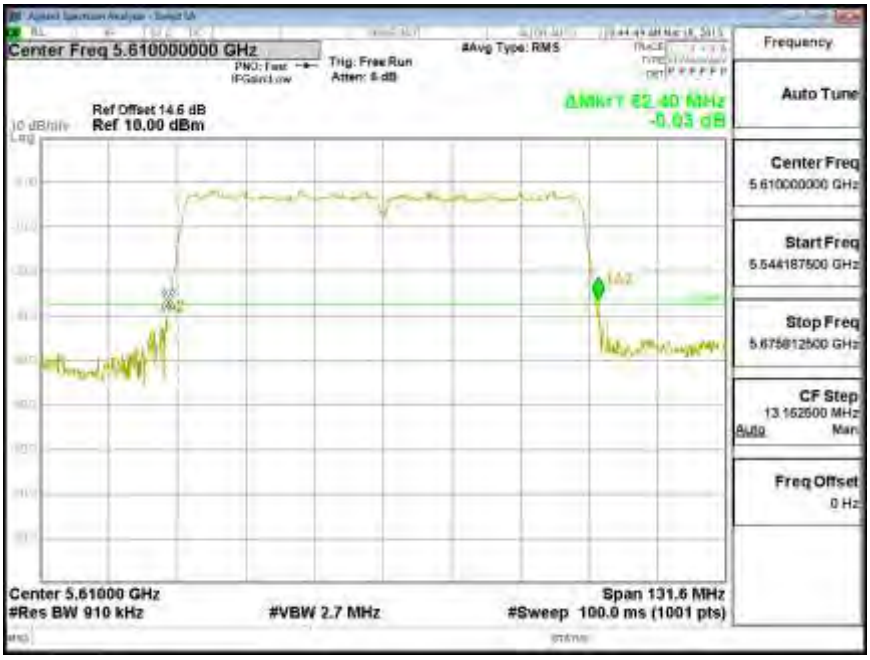
BANDWIDTH Chain 0 LOW CH

BANDWIDTH Chain 0 MID CH

26 dB BANDWIDTH, Chain 1

BANDWIDTH Chain 1 LOW CH

BANDWIDTH Chain 1 MID CH



9.12.2. 99% BANDWIDTH

LIMITS

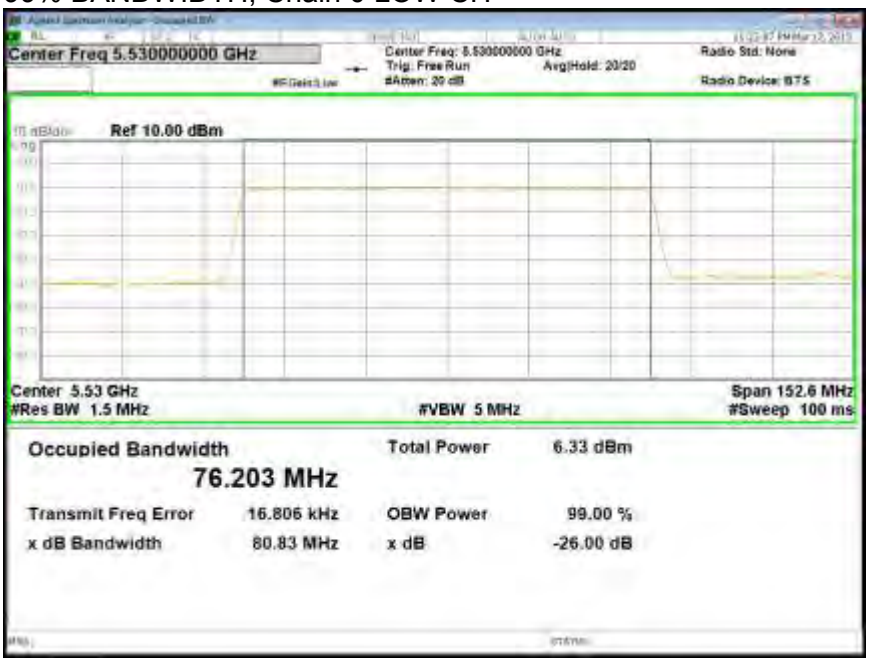
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5530	76.203	76.224
Mid	5610	76.253	76.341

99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH



99% BANDWIDTH, Chain 0 MID CH

99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH

99% BANDWIDTH, Chain 1 MID CH

9.12.3. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (2)

For the band 5.47–5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.4	3.3	2.87

RESULTS

Bandwidth, Antenna Gain, and Limits

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5530	81.530	2.87	2.87	24.00	11.00
Mid	5610	82.40	2.87	2.87	24.00	11.00

Duty Cycle CF (dB)	0.26	Included in Calculations of Corr'd Power & PSD

Output Power Results

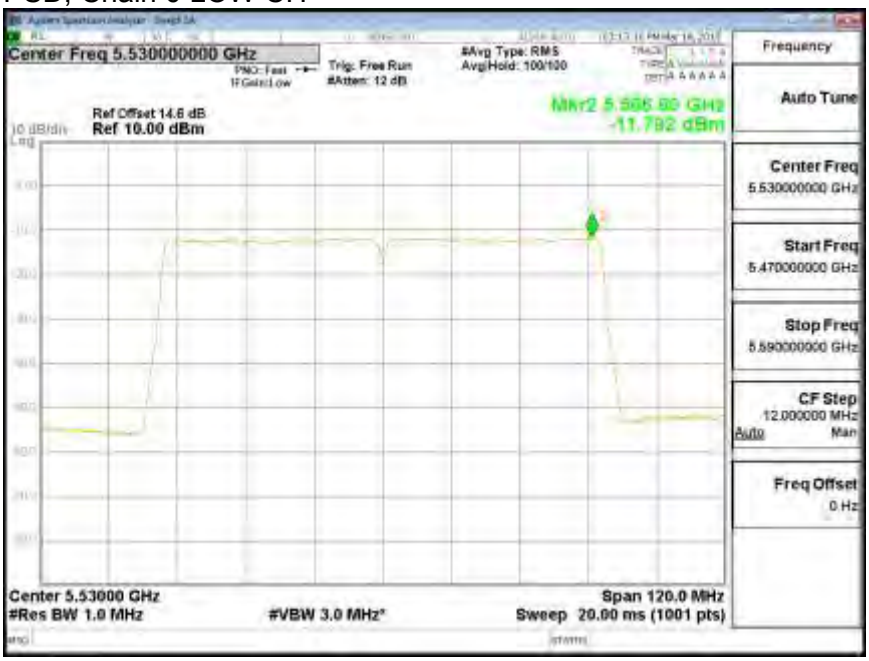
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5530	6.56	6.36	9.73	24.00	-14.27
Mid	5610	6.51	6.38	9.72	24.00	-14.28

PSD Results

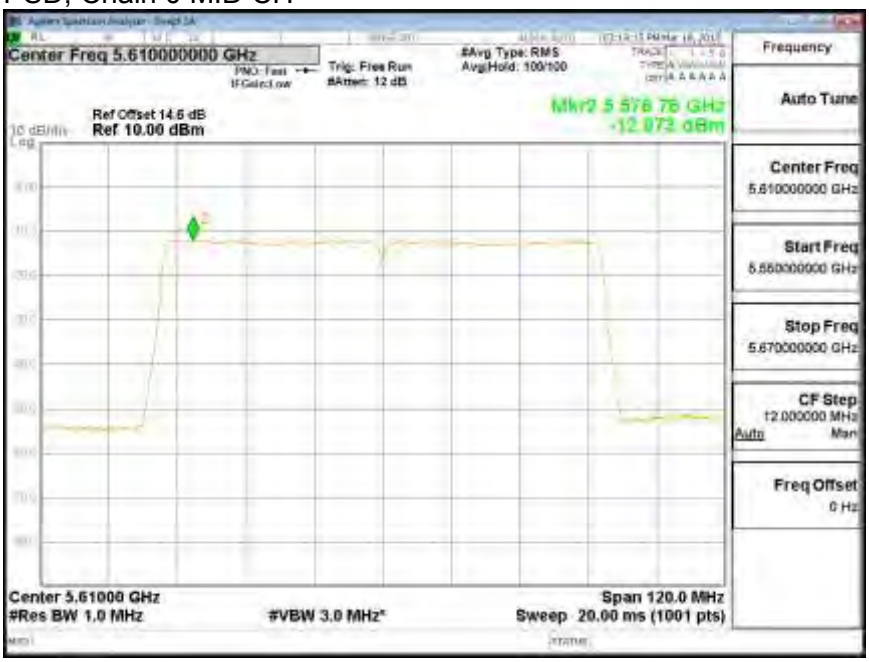
Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5530	-11.782	-12.086	-8.66	11.00	-19.66
Mid	5610	-12.073	-12.132	-8.83	11.00	-19.83

PSD, Chain 0

PSD, Chain 0 LOW CH

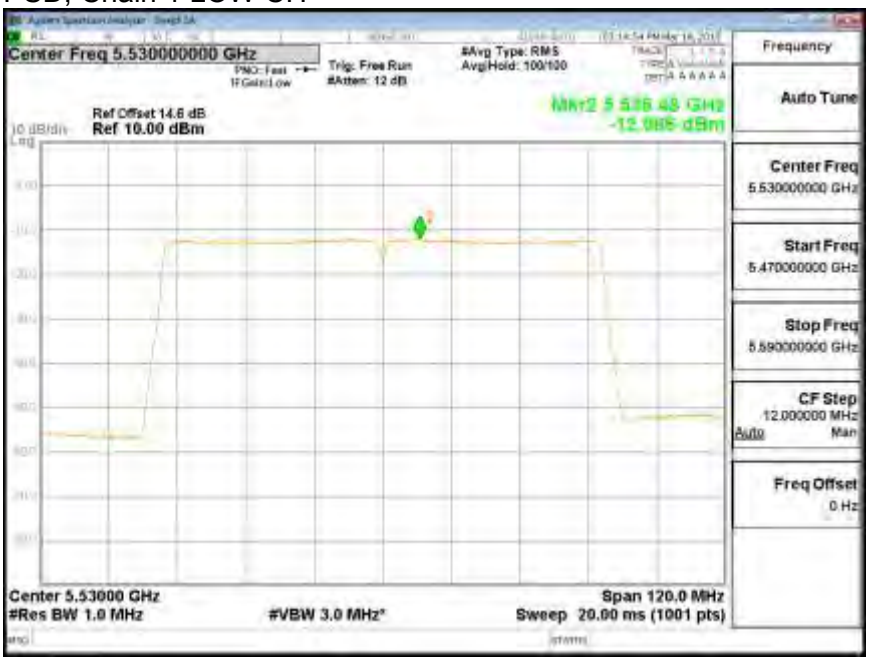


PSD, Chain 0 MID CH

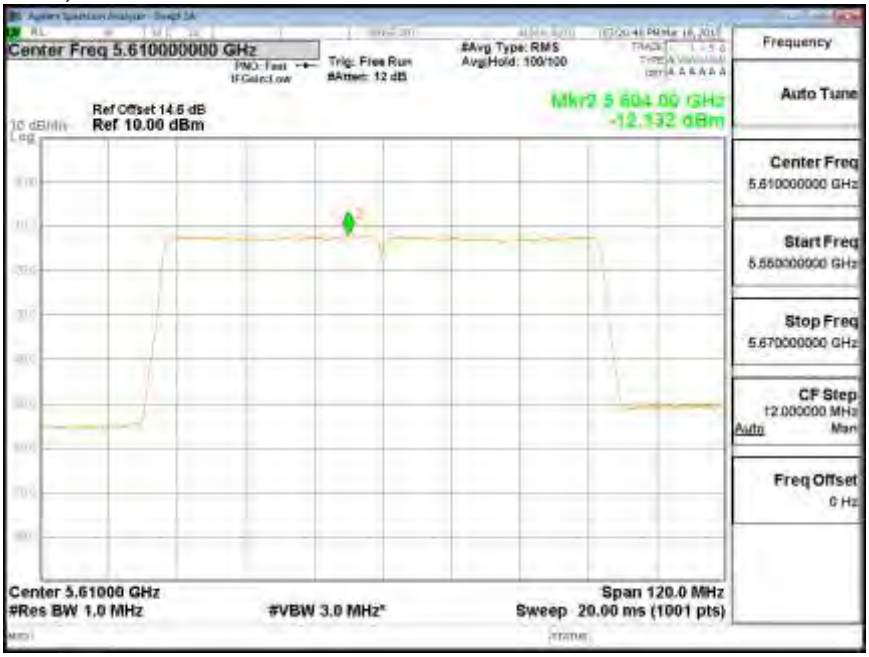


PSD, Chain 1

PSD, Chain 1 LOW CH



PSD, Chain 1 MID CH



9.13. 802.11a MODE IN THE 5.8 GHz BAND

9.13.1. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)

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

RESULTS

Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	Minimum Limit (MHz)
Low	5745	16.481	16.383	0.5
Mid	5785	16.360	16.533	0.5
High	5825	16.384	16.384	0.5

6 dB BANDWIDTH, Chain 0

6 dB BANDWIDTH Chain 0 LOW CH

6 dB BANDWIDTH Chain 0 MID CH

6 dB BANDWIDTH Chain 0 HIGH CH

6 dB BANDWIDTH, Chain 1

6 dB BANDWIDTH Chain 1 LOW CH

6 dB BANDWIDTH Chain 1 MID CH

6 dB BANDWIDTH Chain 1 HIGH CH

9.13.2. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)
Low	5745	19.500	19.656
Mid	5785	19.682	19.630
High	5825	19.500	19.630

26 dB BANDWIDTH, Chain 0

BANDWIDTH Chain 0 LOW CH

BANDWIDTH Chain 0 MID CH

BANDWIDTH Chain 0 HIGH CH

26 dB BANDWIDTH, Chain 1

BANDWIDTH Chain 1 LOW CH

BANDWIDTH Chain 1 MID CH

BANDWIDTH Chain 1 HIGH CH

9.13.3. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

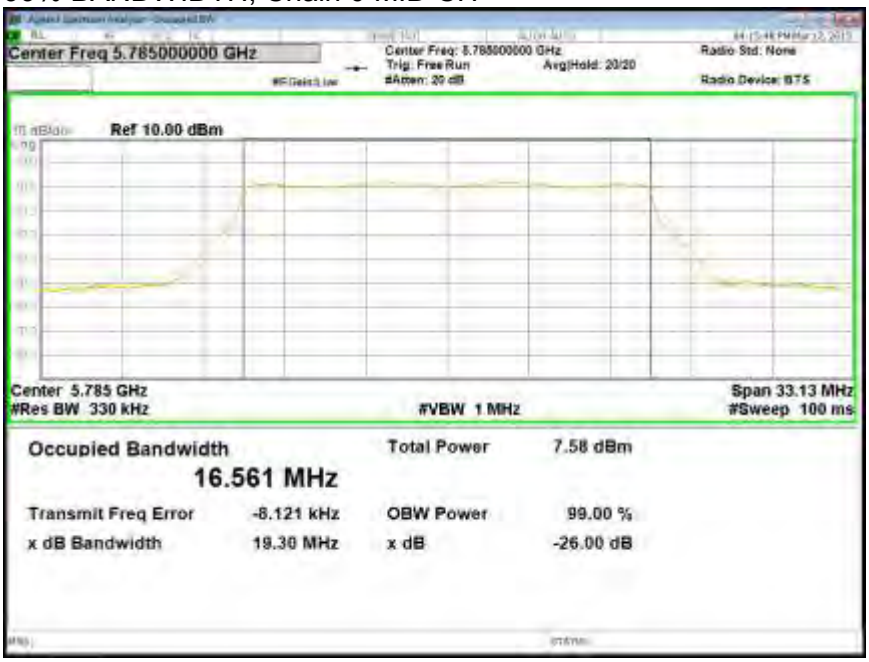
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)
Low	5745	16.552	16.556
Mid	5785	16.561	16.556
High	5825	16.554	16.559

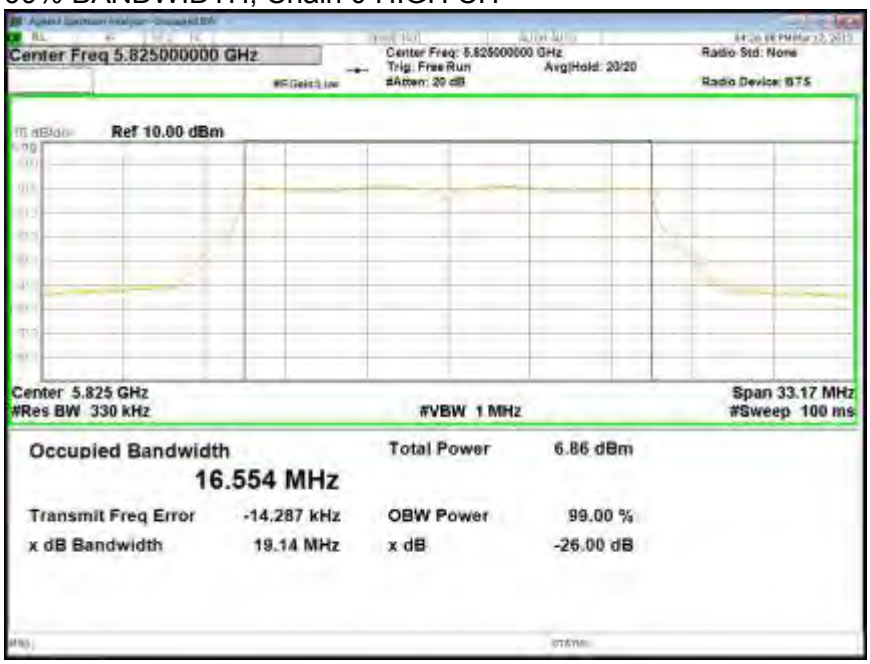
99% BANDWIDTH, Chain 0

99% BANDWIDTH, Chain 0 LOW CH

99% BANDWIDTH, Chain 0 MID CH

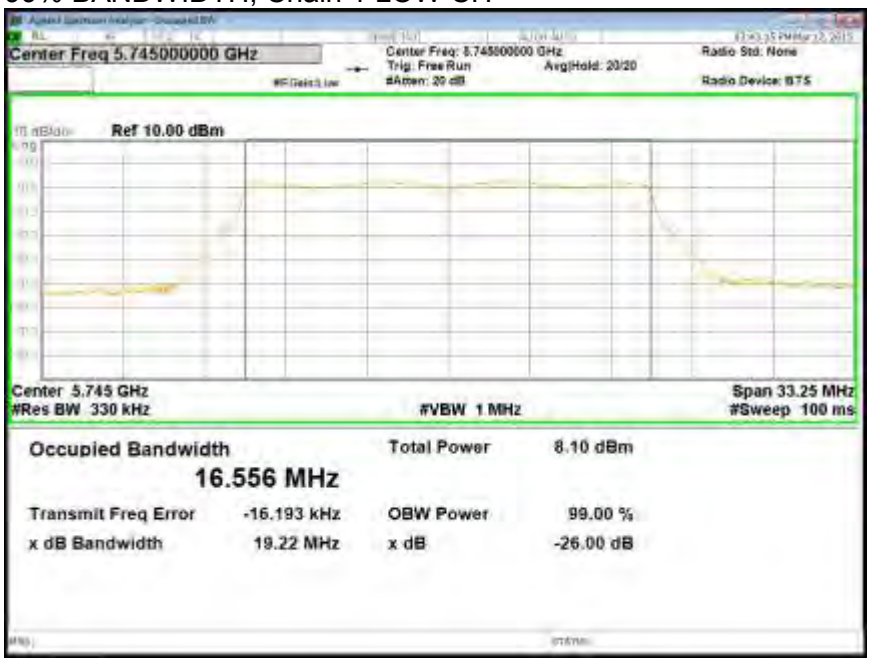


99% BANDWIDTH, Chain 0 HIGH CH

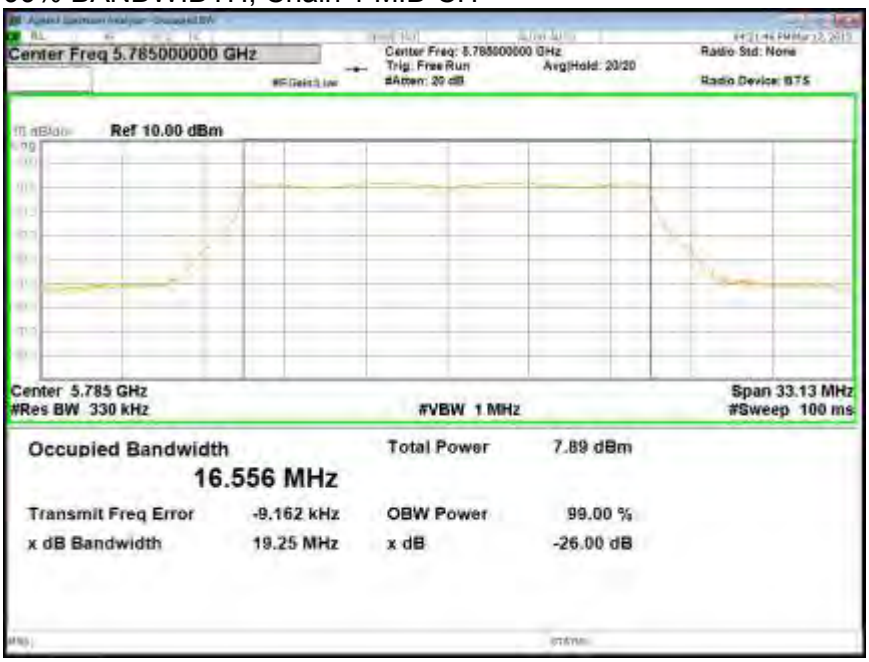


99% BANDWIDTH, Chain 1

99% BANDWIDTH, Chain 1 LOW CH



99% BANDWIDTH, Chain 1 MID CH



99% BANDWIDTH, Chain 1 HIGH CH

9.13.4. OUTPUT POWER

LIMITS

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
1.8	3.5	2.73

RESULTS

Antenna Gain and Limit

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Power Limit (dBm)
Low	5745	2.73	30.00
Mid	5785	2.73	30.00
High	5825	2.73	30.00

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

Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5745	7.56	6.89	10.25	30.00	-19.75
Mid	5785	7.64	6.94	10.31	30.00	-19.69
High	5825	7.35	6.86	10.12	30.00	-19.88

9.13.5. MAXIMUM POWER SPECTRAL DENSITY (PSD)

Limits

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

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

Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
1.8	3.5	2.73

RESULTS

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	PSD Limit (dBm)
Low	5745	2.73	30.00
Mid	5785	2.73	30.00
High	5825	2.73	30.00

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

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5745	-7.452	-6.680	-4.04	30.00	-34.04
Mid	5785	-8.104	-6.565	-4.26	30.00	-34.26
High	5825	-7.660	-6.189	-3.85	30.00	-33.85

PSD, Chain 0

PSD, Chain 0 LOW CH

PSD, Chain 0 MID CH

PSD, Chain 0 HIGH CH

PSD, Chain 1

PSD, Chain 1 LOW CH