



**CLASS III PERMISSIVE CHANGE
TEST REPORT**

Report Number : 16U23351-E1V2

Applicant : CBF Networks, Inc., DBA Fastback Networks
2460 N. First Street, Suite 200
San Jose, CA 95131, USA

Model : IBR-1300-NA and IBR-1301-NA

FCC ID : 2AAEH-107

EUT Description : Intelligent Backhaul Radio, UNII 5.8GHz Band

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E

Date of Issue:
Monday, May 23, 2016

Prepared by:
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NVLAP®

NVLAP LAB CODE 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	5/13/2016	Initial Issue	---
V2	5/23/2016	Added 6 db BW data	Francisco de Anda

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: CBF NETWORKS, INC., DBA FASTBACK NETWORKS
2460 N. FIRST STREET, SUITE 200
SAN JOSE, CA 95131, USA

EUT DESCRIPTION: Intelligent Backhaul Radio, UNII 5.8GHz Band

MODEL: IBR-1300-NA and IBR-1301-NA

SERIAL NUMBER: Proto 1

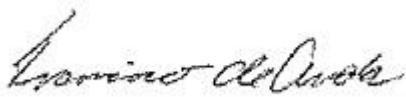
DATE TESTED: May 5th, 2016

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.

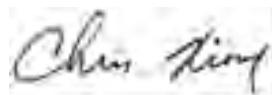
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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
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Prepared By:



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UL Verification Services Inc.

2. SUMMARY OF TESTING

2.1. FACILITIES AND ACCREDITATION

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

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A(IC: 2324B-1)	<input type="checkbox"/> Chamber D(IC: 2324B-4)
<input type="checkbox"/> Chamber B(IC: 2324B-2)	<input type="checkbox"/> Chamber E(IC: 2324B-5)
<input type="checkbox"/> Chamber C(IC: 2324B-3)	<input type="checkbox"/> Chamber F(IC: 2324B-6)
	<input type="checkbox"/> Chamber G(IC: 2324B-7)
	<input checked="" type="checkbox"/> Chamber H(IC: 2324B-8)

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>.

2.2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 789033 D02 v01r02, ANSI C63.10-2013, FCC KDB 662911 and FCC 06-96.

2.3. CALIBRATION AND UNCERTAINTY

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.

SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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%.

2.4. MEASUREMENT METHOD

26 dB Emission BW: KDB 789033 D02 v01r02, Section C.

Conducted Output Power: KDB 789033 D02 v01r02, Section E.2.b (Method SA-1).

Power Spectral Density: KDB 789033 D02 v01r02, Section F.

Unwanted emissions in restricted bands: KDB 789033 D02 v01r02, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01r02, Sections G.3, G.4, and G.5.

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 662911 D02 MIMO with Cross-Polarized Antenna v01

2.5. 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	ID Num	Cal Due
Spectrum Analyzer, 44 GHz	Keysight	N9030A	T907	01/06/17

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, June 24, 2015
Antenna Port Software	UL	UL RF	Ver 4.7, April 27, 2016

3. EQUIPMENT UNDER TEST

3.1. DESCRIPTION OF EUT

Fixed Point-to-Point radio in 5.8GHz unlicensed band with a proprietary communication management interface Intelligent Backhaul Radio.

The EUT uses 40, 20 and 10 MHz nominal bandwidths with QAM4, QAM16, QAM64, QAM256 modulation. The EUT can be powered by Power over Ethernet (PoE) or AC.

3.2. DESCRIPTION OF CLASS III PERMISSIVE CHANGE

The purpose of this C3PC is to upgrade the device described under section 3.1 of this report to the new rules per KDB 789033 D02 v01r02.

For UNII-1, UNII-2 and UNII-2C bands, we have reviewed the original test reports (15U21741-E1V3, UNII-1, 15U21741-E3V2, UNII-2A and 15U21741-E4V2, UNII-2C), including DFS tests under New UNII rules, and are hereby attesting that all the current technical requirements are still met and all applicable test procedures remain the same. Therefore, the original test reports are still applicable and no additional testing was performed.

3.3. MANUFACTURER'S DESCRIPTION OF MODEL DIFFERENCES

There are two power options available for the EUT;

The PoE powered model is identified as:

- Model: IBR-1300-NA
- FCC ID: 2AAEH-107

The AC mains powered model is identified as:

- Model: IBR-1301-NA
- FCC ID: 2AAEH-107

3.4. MAXIMUM OUTPUT POWER

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

5.8 GHz BAND

Bandwidth (MHz)	Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
4TX				
10	5735 - 5840	FDD	24.81	302.69
20	5740 - 5835	FDD	24.92	310.46
40	5750 - 5825	FDD	24.85	305.49

3.5. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a dipole array antenna with a maximum gain of 15 dBi

3.6. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 1.6.7.

The test utility software used during testing was Tera Term, version 4.76.

3.7. WORST-CASE CONFIGURATION AND MODE

Spurious emissions' testing was leveraged from previous reports as the frequencies are the same and the setting level at which they were tested are considered the same case.

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

10MHz bandwidth QAM 4

20MHz bandwidth QAM 4

40MHz bandwidth QAM 4

Data rate 38.4 Msamples/s for all bandwidths.

3.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Latitude E5420	CN-0H5TG2-75900-162-0089 A01	N/A
AC/DC Adapter	Dell	DAP130PE1-00	CN-0JU012-48661-14C-55WB-A04	N/A
POE	Tycon	TP-POE-HP-56G-FBN	155000210ARC00	N/A

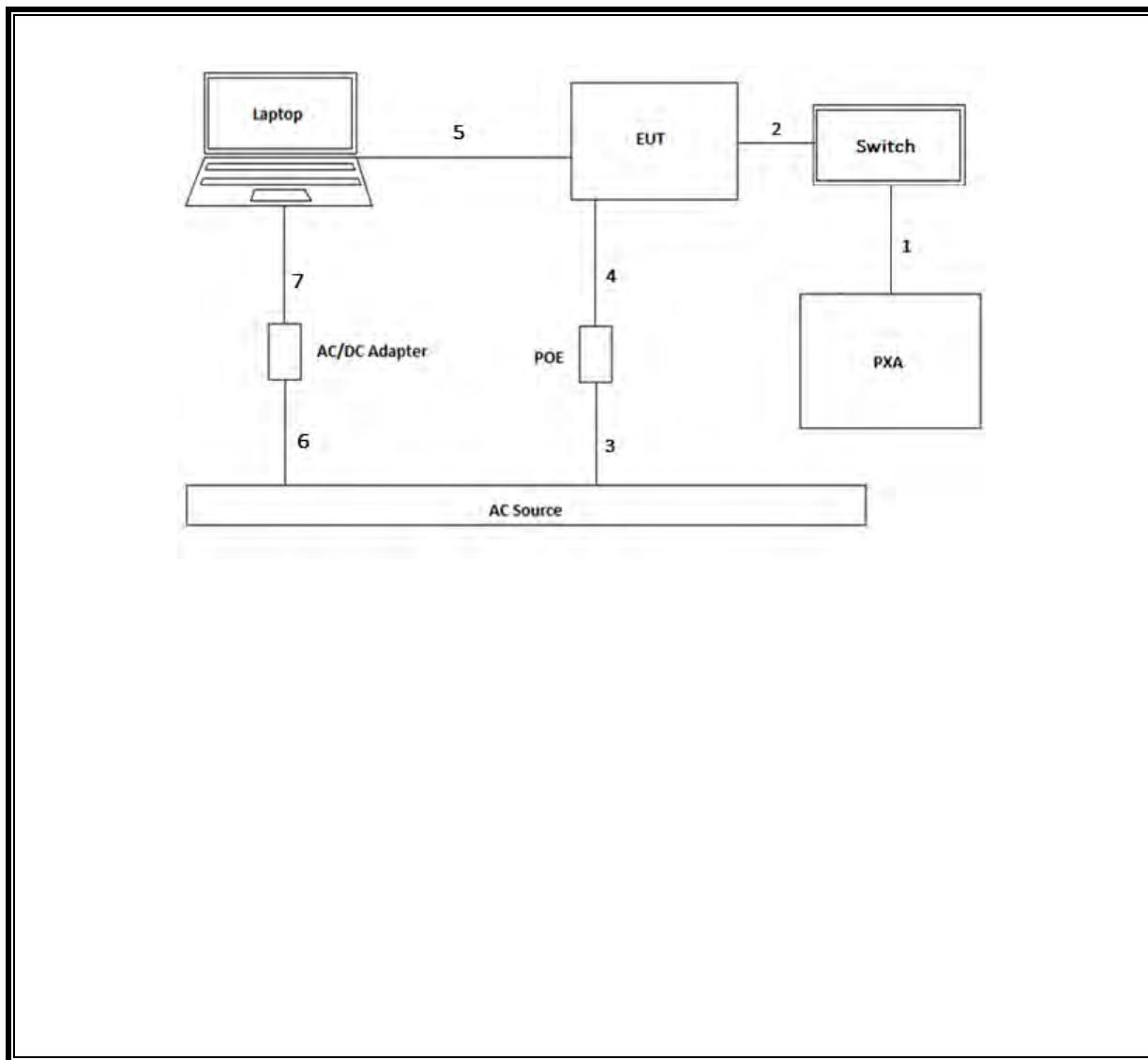
I/O CABLES

Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	RF Input	1	SMA	Shielded	1	To Analyzer
2	Antenna	4	SMA	Shielded	1	EUT to switch
3	AC	1	3 Prong	Un-Shielded	1	N/A
4	POE/LAN	1	RJ45	Shielded	1	N/A
5	USB/SERIAL	1	USB/10 pins	Shielded	1.5	USB to Laptop/Serial to EUT
6	AC	1	3-Prong	Un-Shielded	0.5	N/A
7	DC	1	Barrel	Un-Shielded	1.5	N/A

TEST SETUP

The EUT is a P-P outdoor radio used as a stand-alone device. Test software exercised the radio module. All tests were performed using the conducted methods.

SETUP DIAGRAM FOR CONDUCTED TESTS



4. ANTENNA PORT TEST RESULTS

4.1. 6 dB BANDWIDTH

6dB data below is leveraged from the original 5.8GHz test report. For reference see report number 15U21741-E2V3

4.1.1. 10MHz BW 4TX MODE IN THE 5.8 GHz BAND

LIMITS

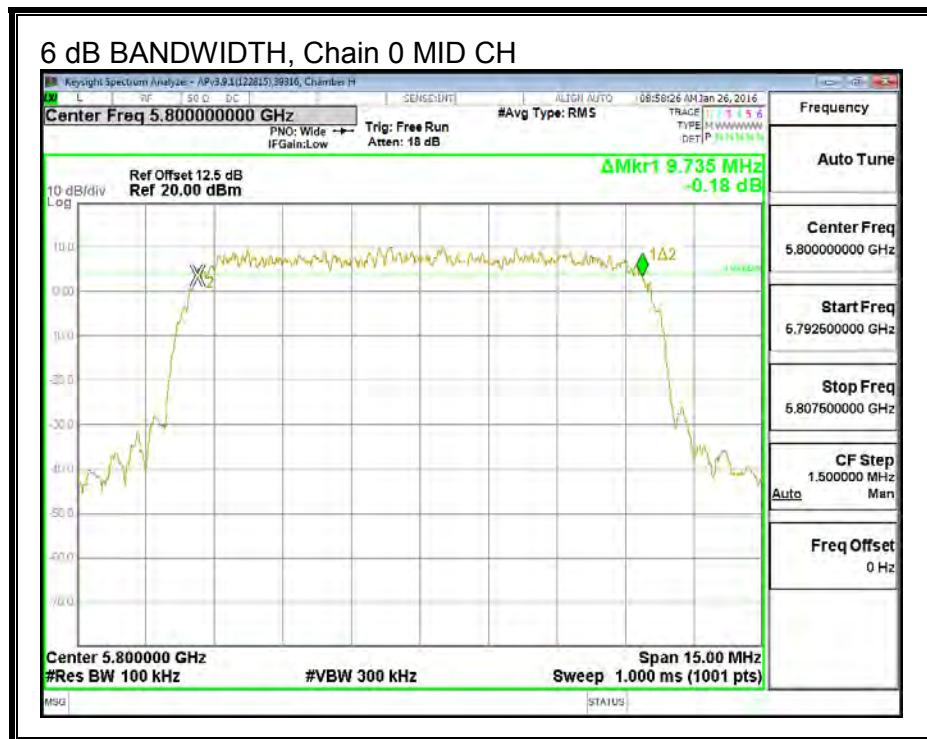
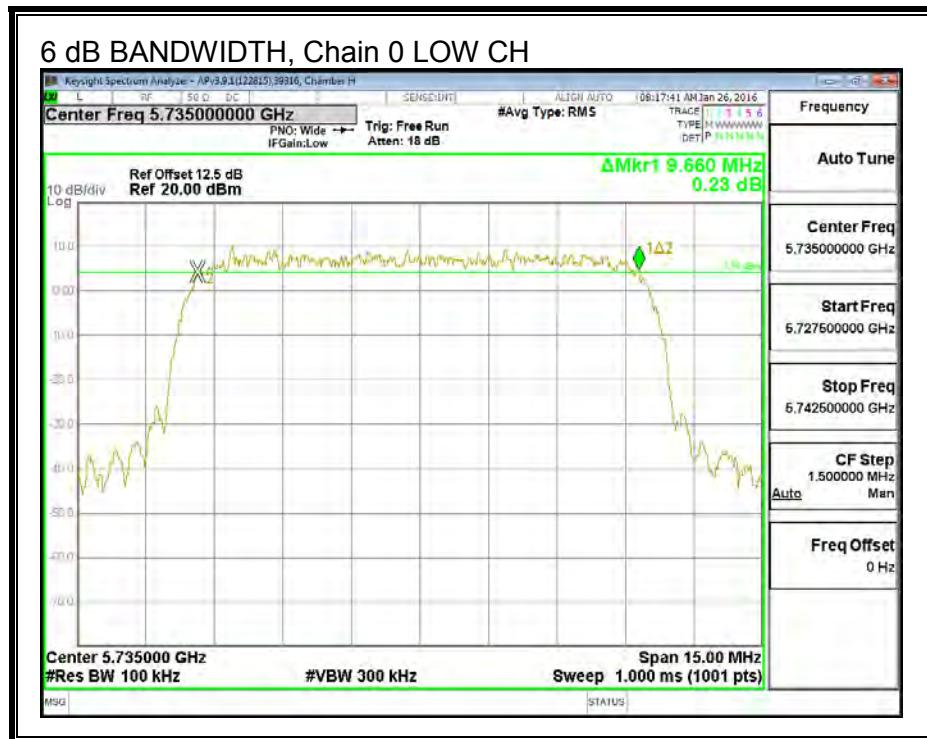
FCC §15.407 (e)

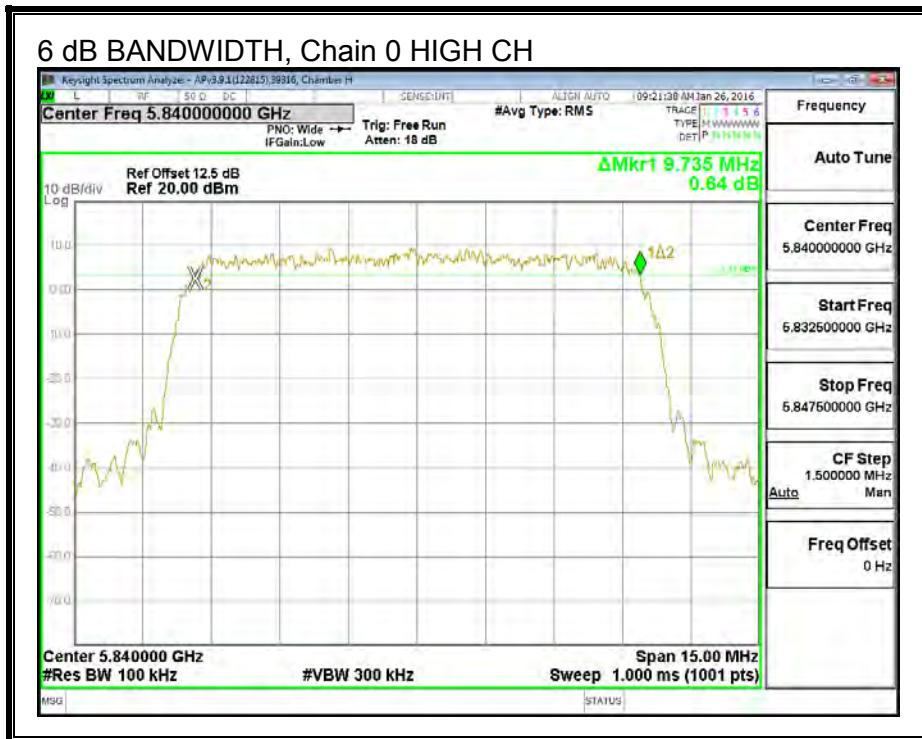
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

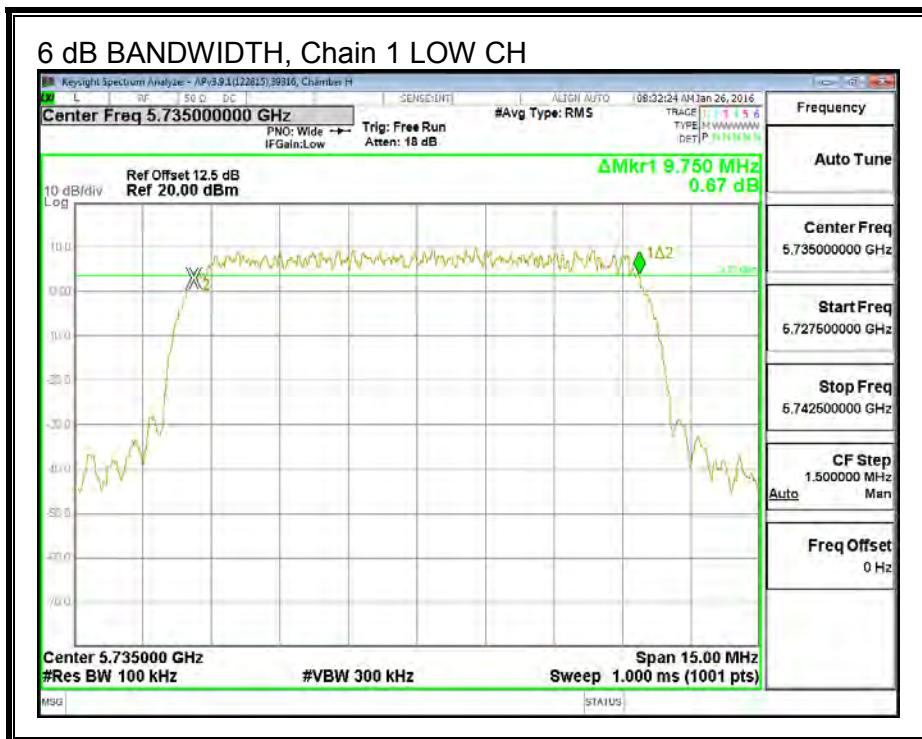
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	Minimum Limit (MHz)
Low	5735	9.660	9.750	9.600	9.540	0.5
Mid	5800	9.735	9.615	9.750	9.660	0.5
High	5840	9.735	9.540	9.585	9.570	0.5

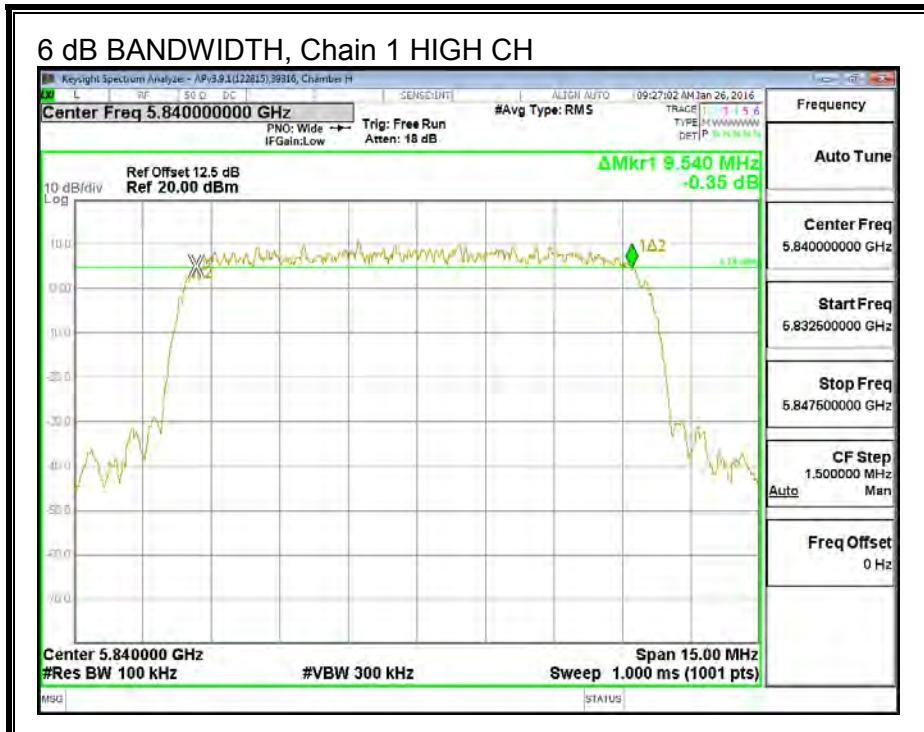
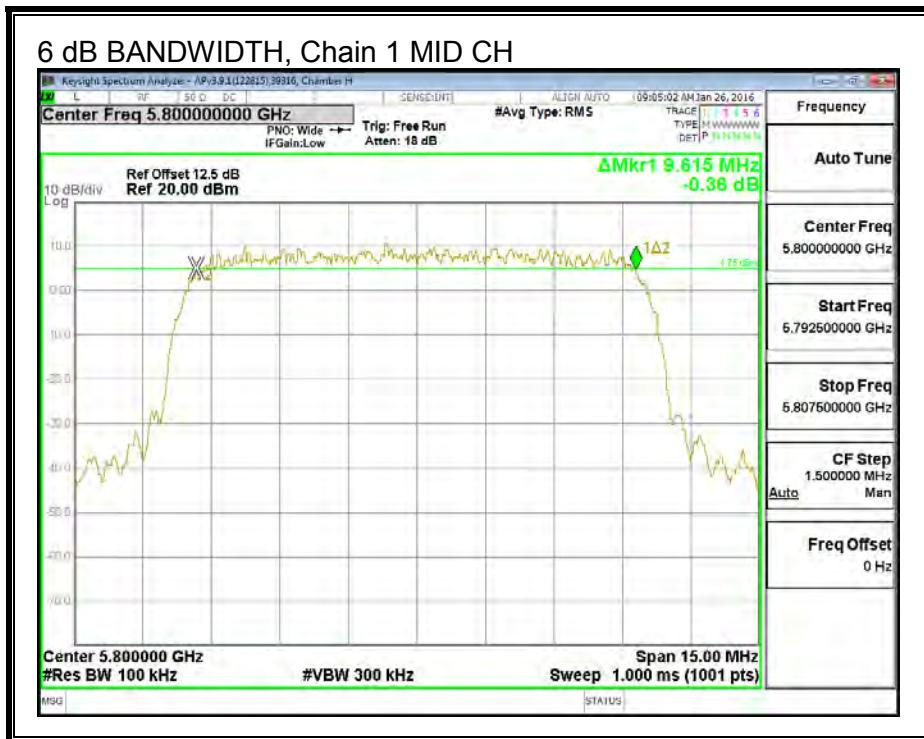
6 dB BANDWIDTH, Chain 0



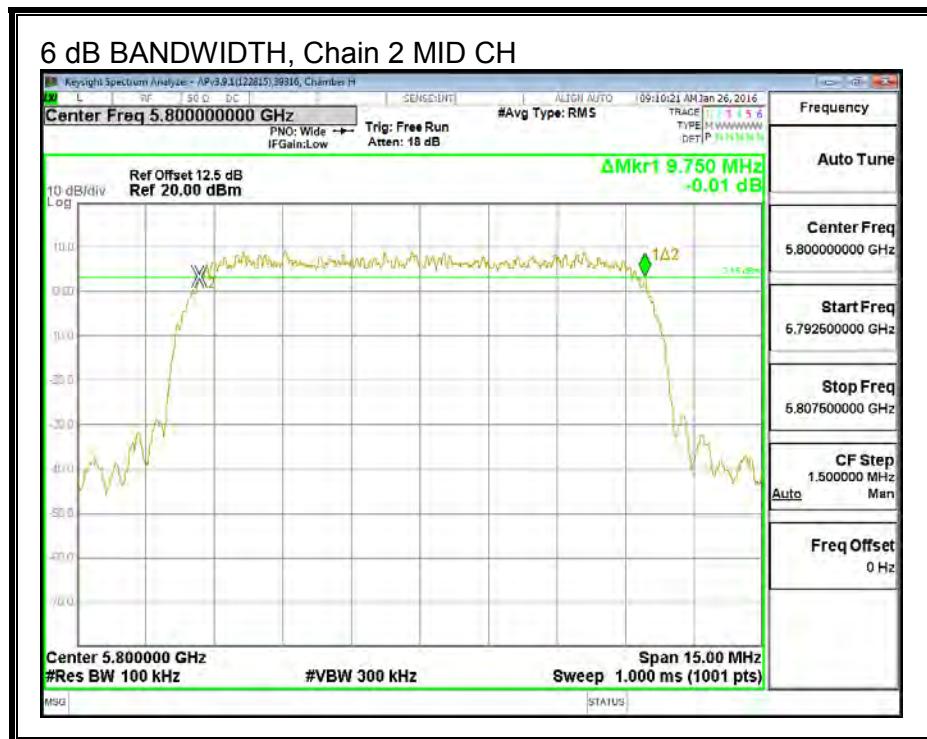
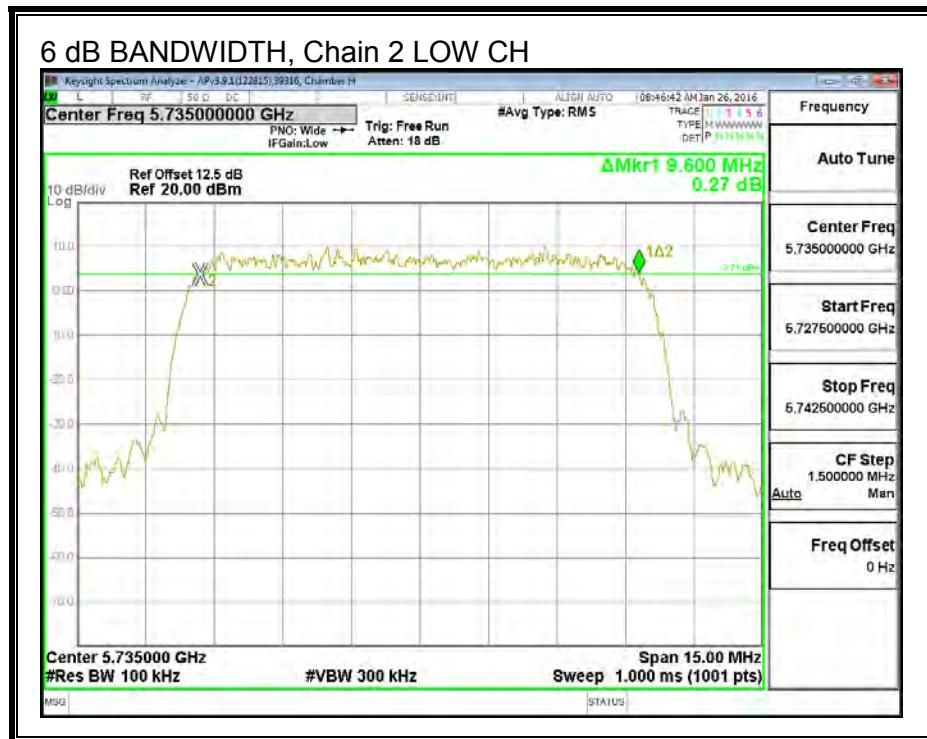


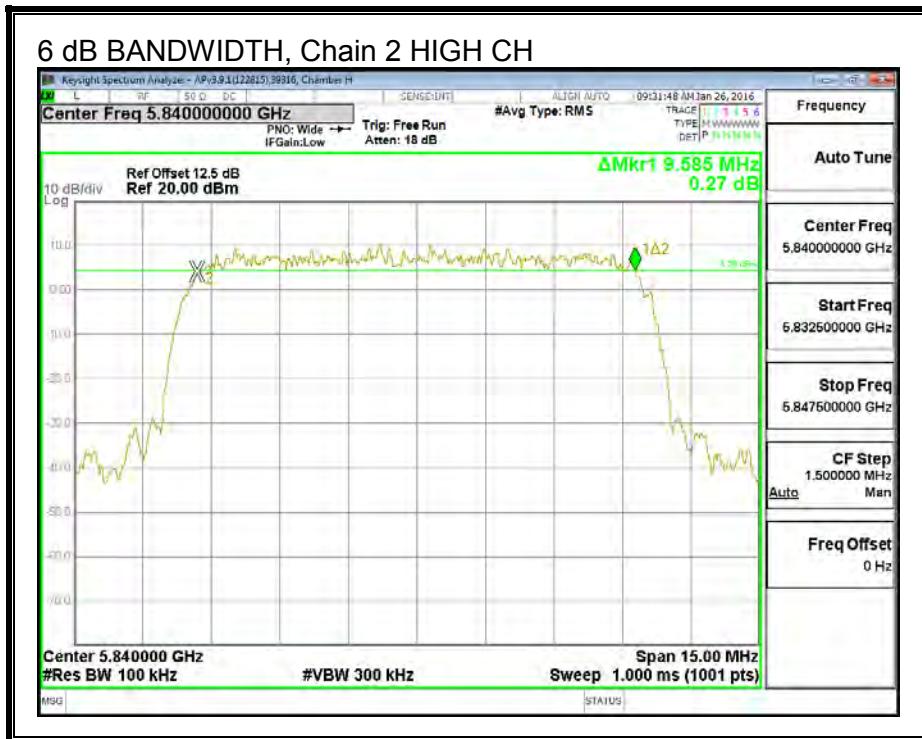
6 dB BANDWIDTH, Chain 1



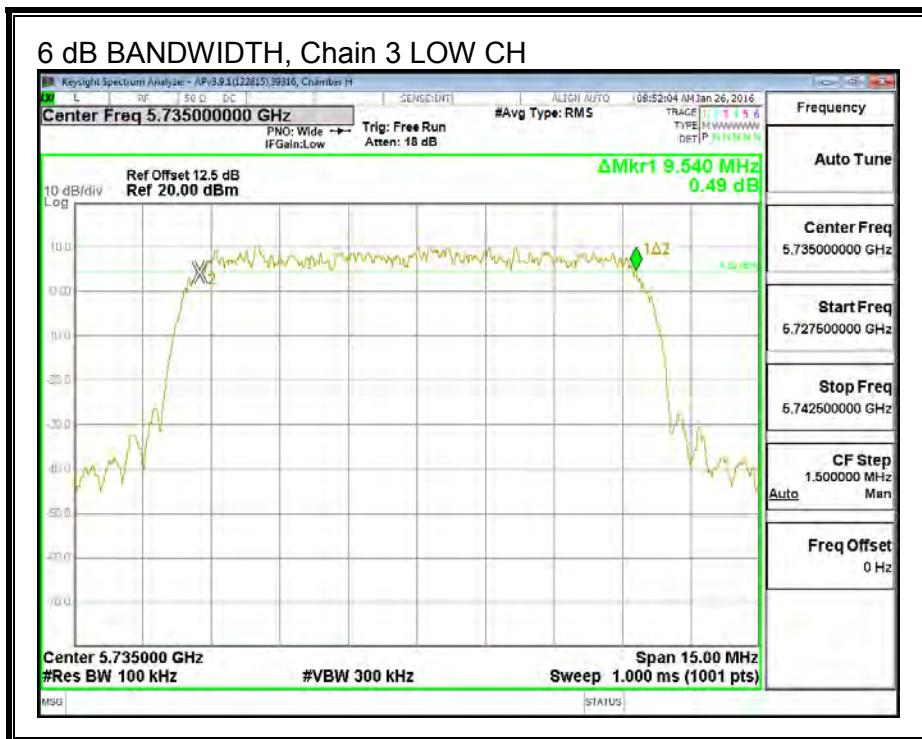


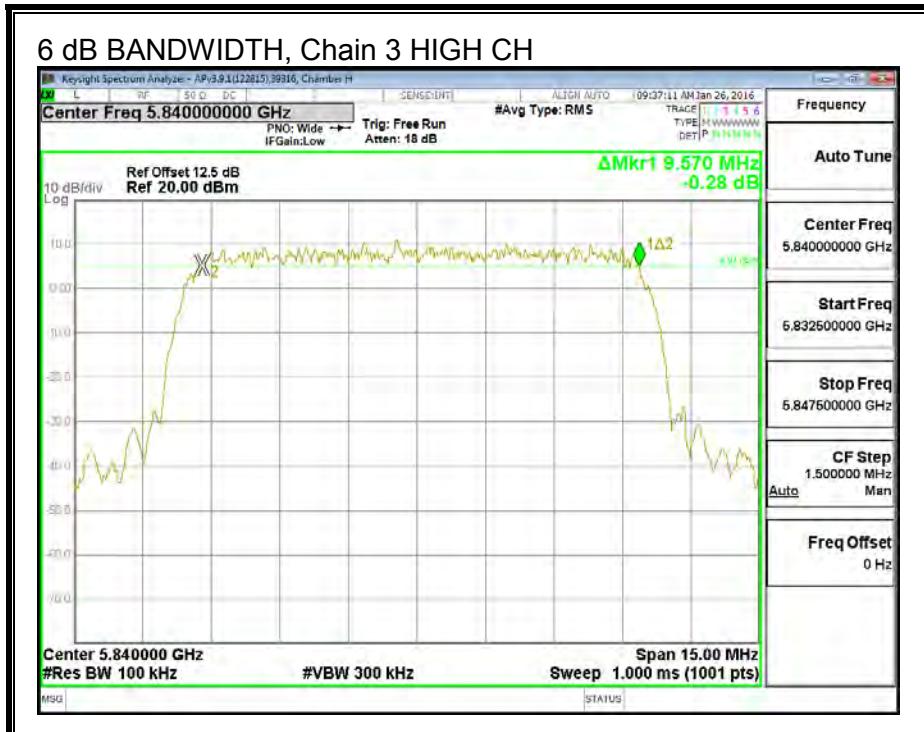
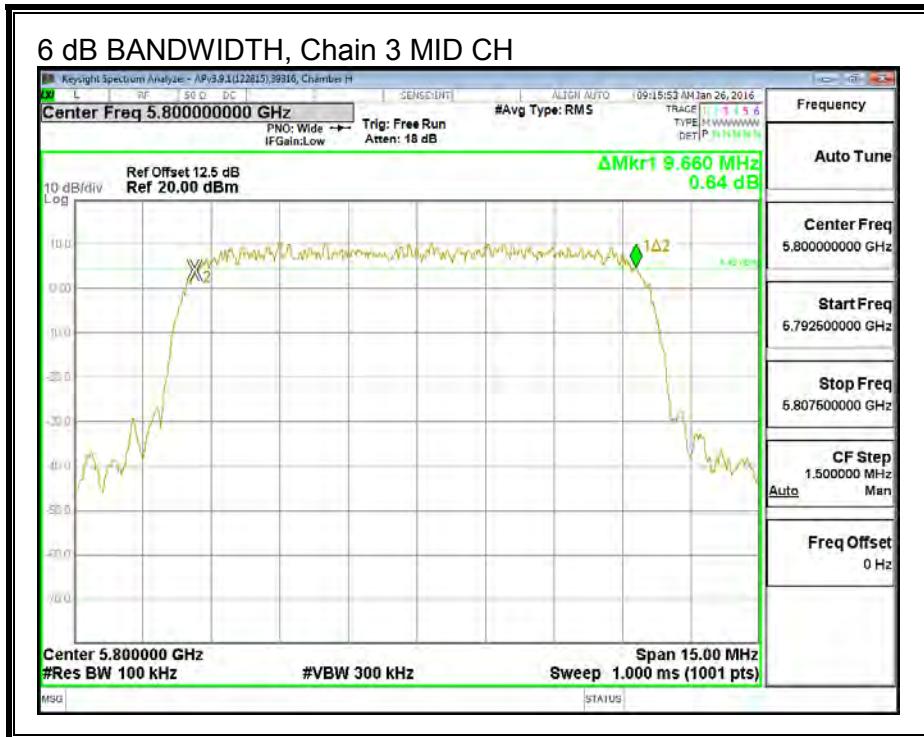
6 dB BANDWIDTH, Chain 2





6 dB BANDWIDTH, Chain 3





4.1.2. 20MHz BW 4TX MODE IN THE 5.8 GHz BAND

LIMITS

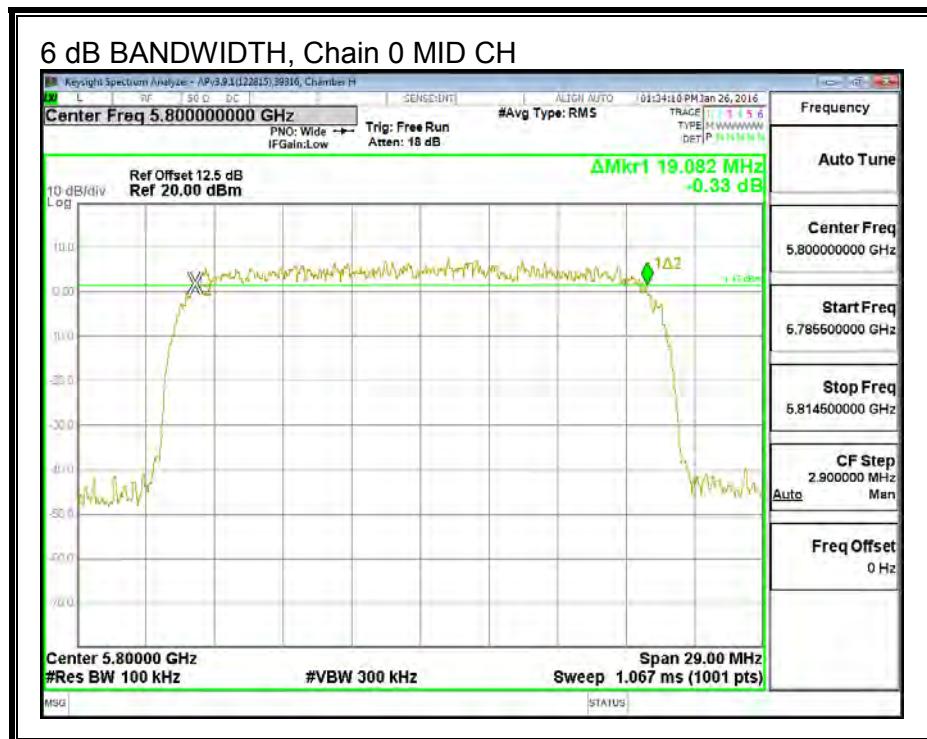
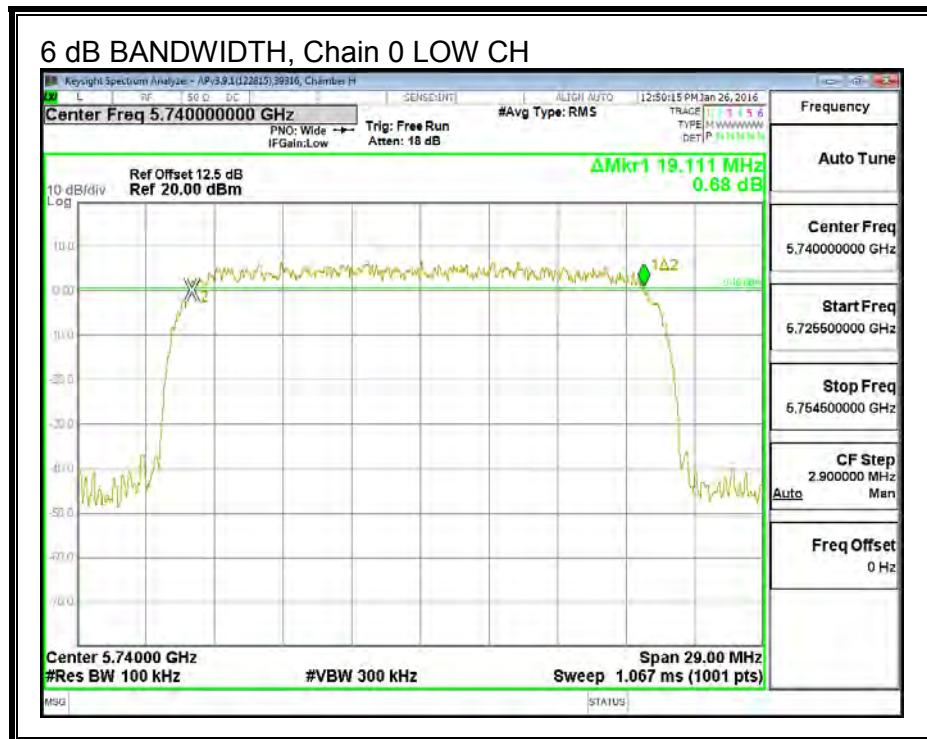
FCC §15.407 (e)

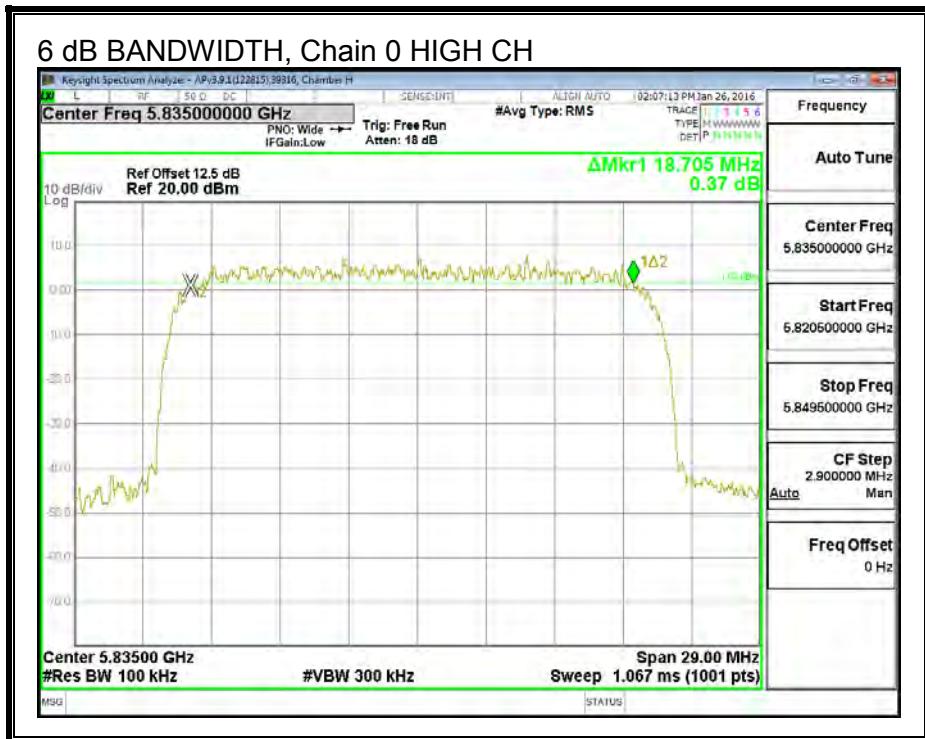
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

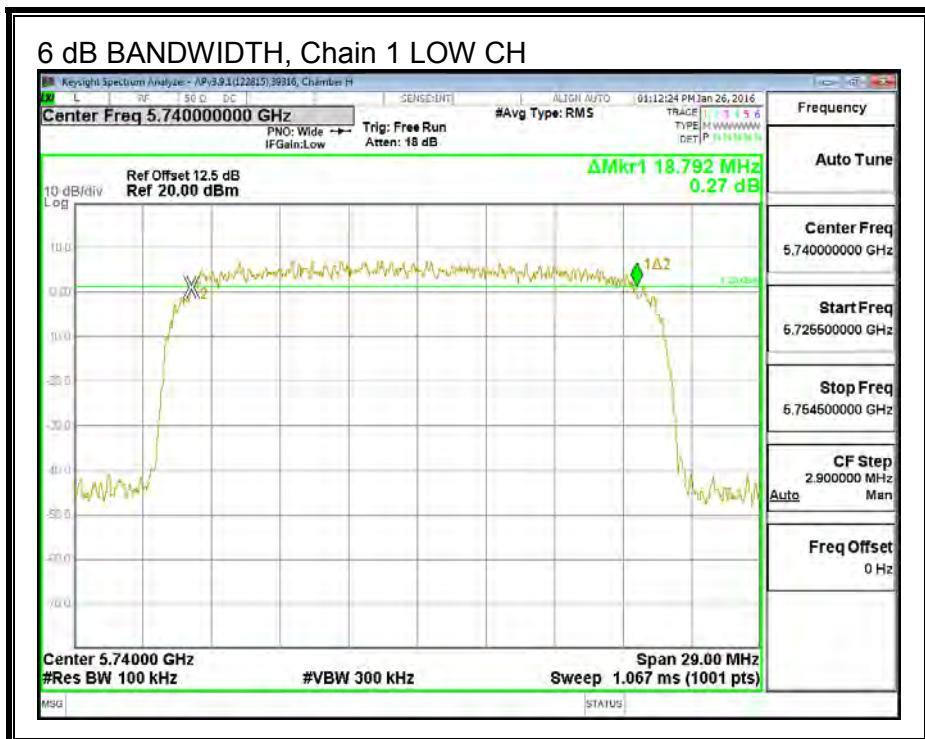
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	Minimum Limit (MHz)
Low	5740	19.111	18.792	19.285	18.879	0.5
Mid	5800	19.082	19.227	18.850	19.140	0.5
High	5835	18.705	18.648	18.821	19.024	0.5

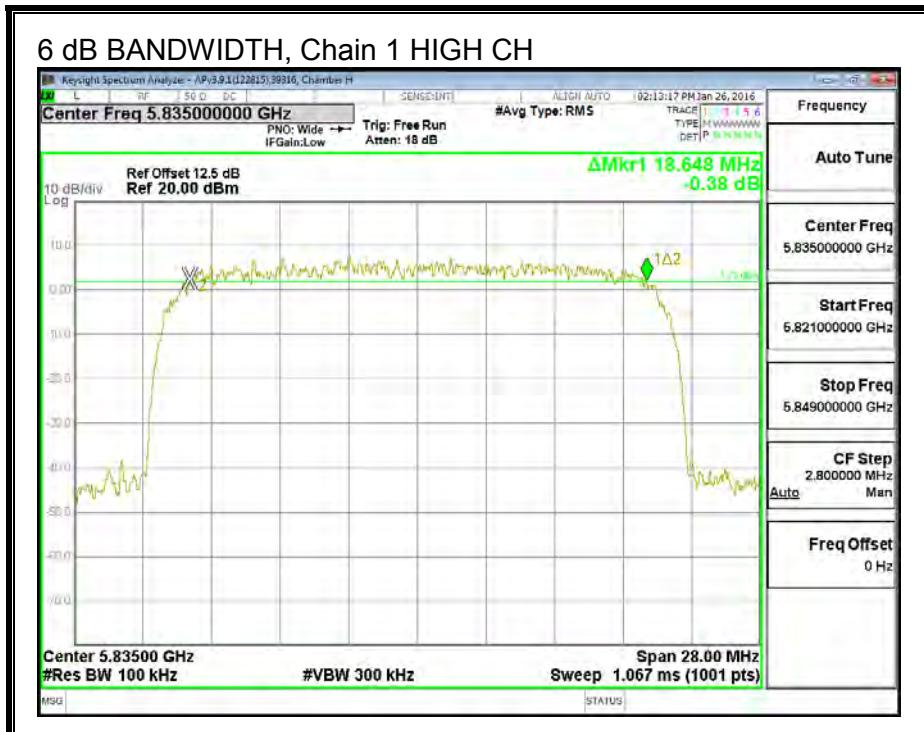
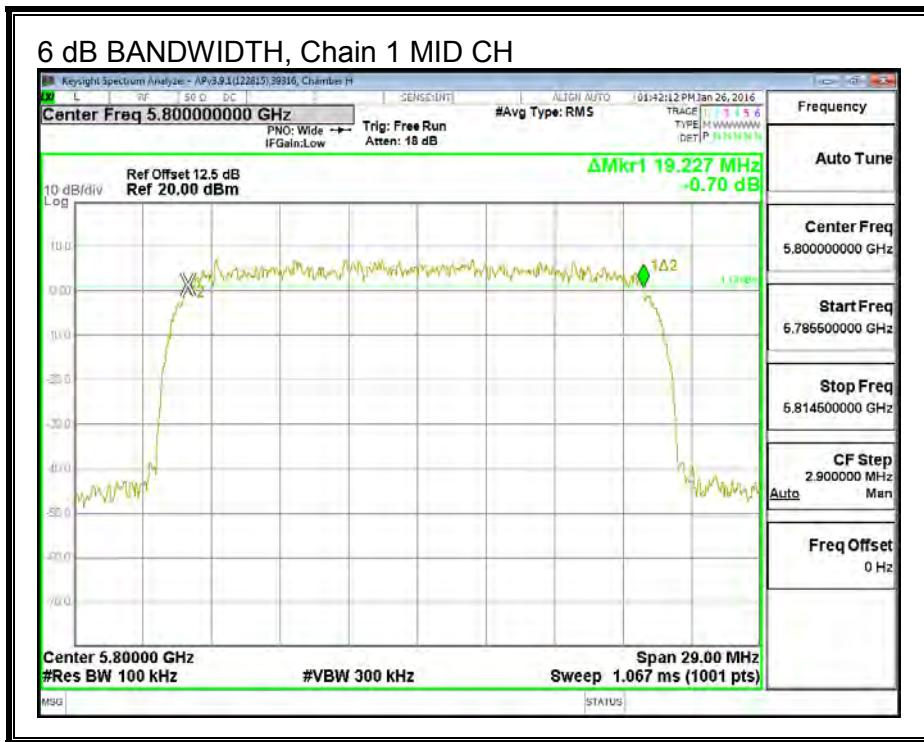
6 dB BANDWIDTH, Chain 0



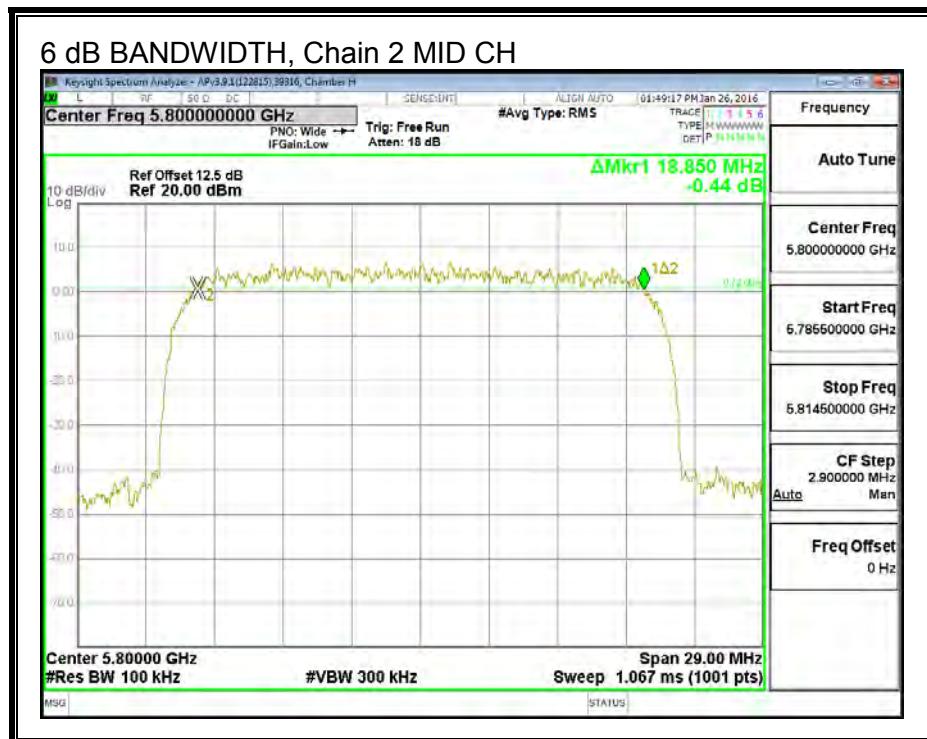
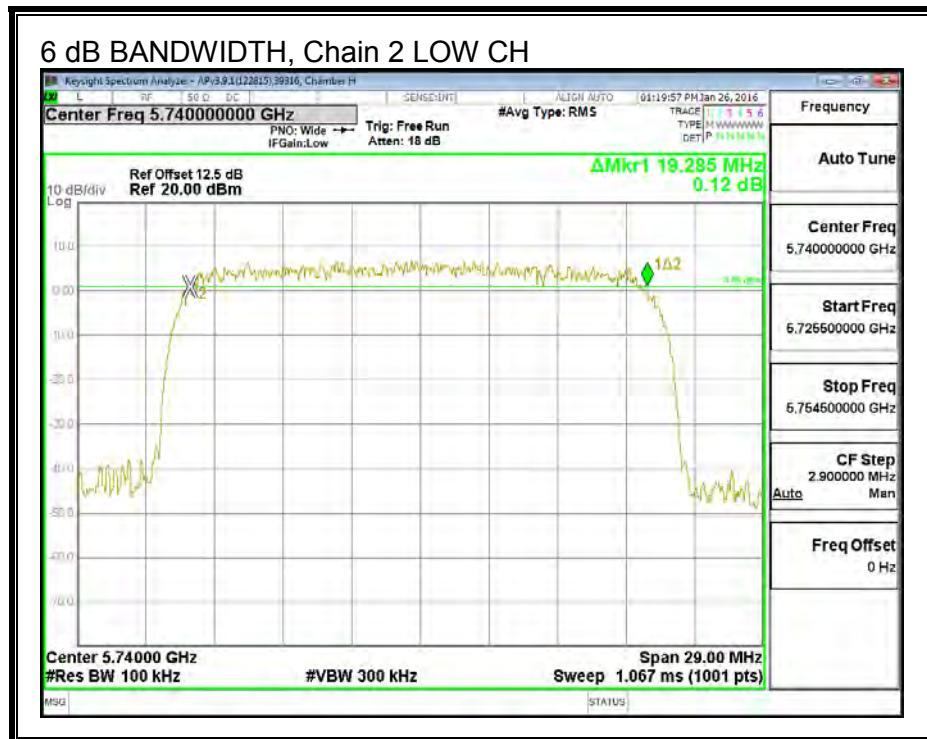


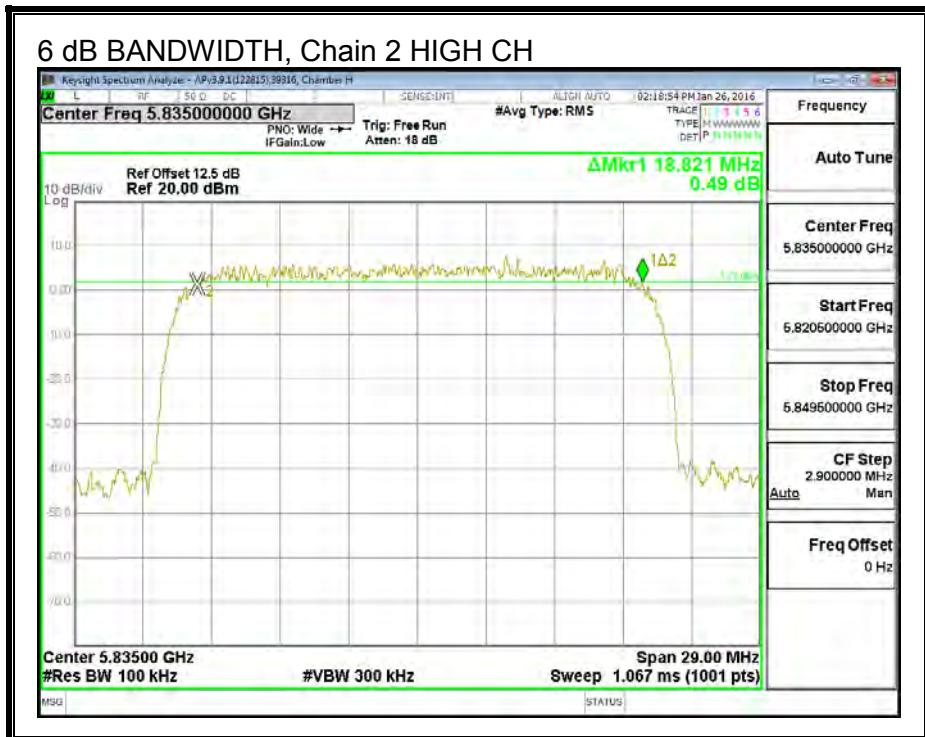
6 dB BANDWIDTH, Chain 1



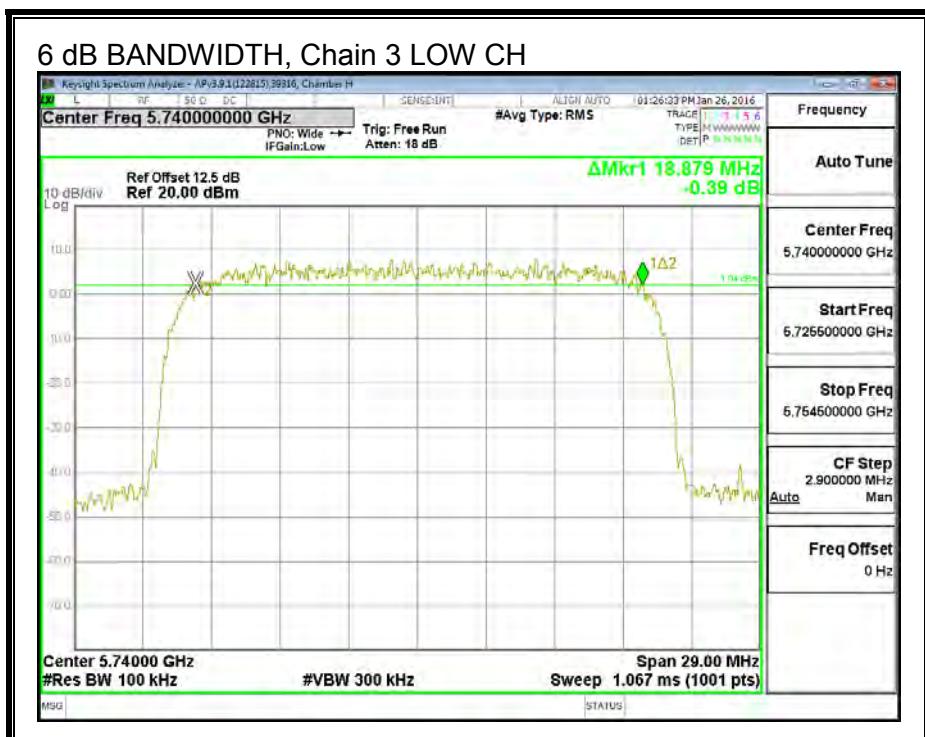


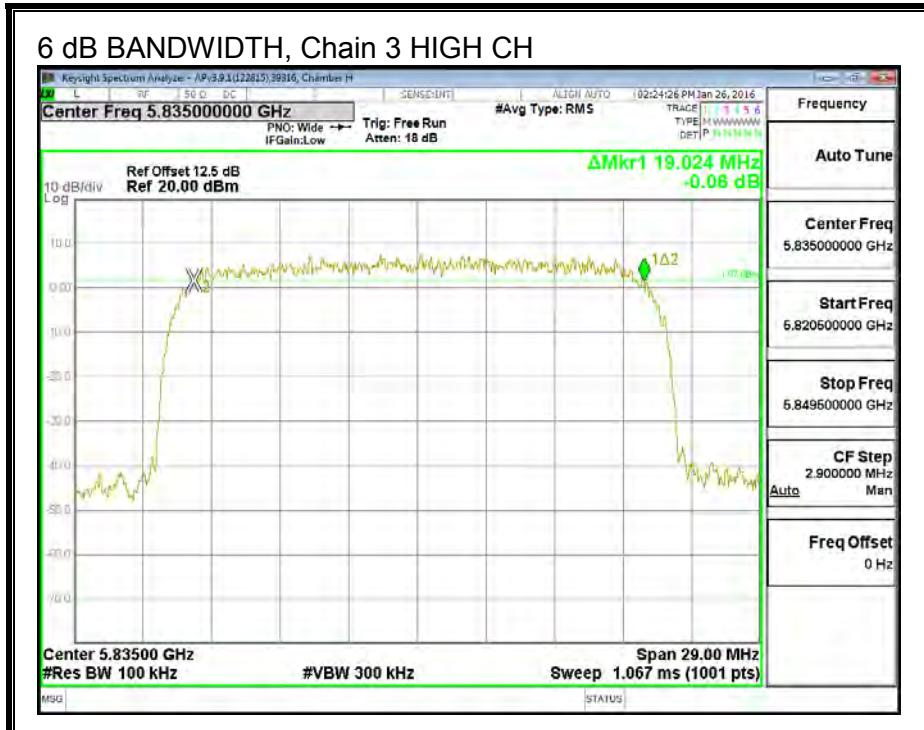
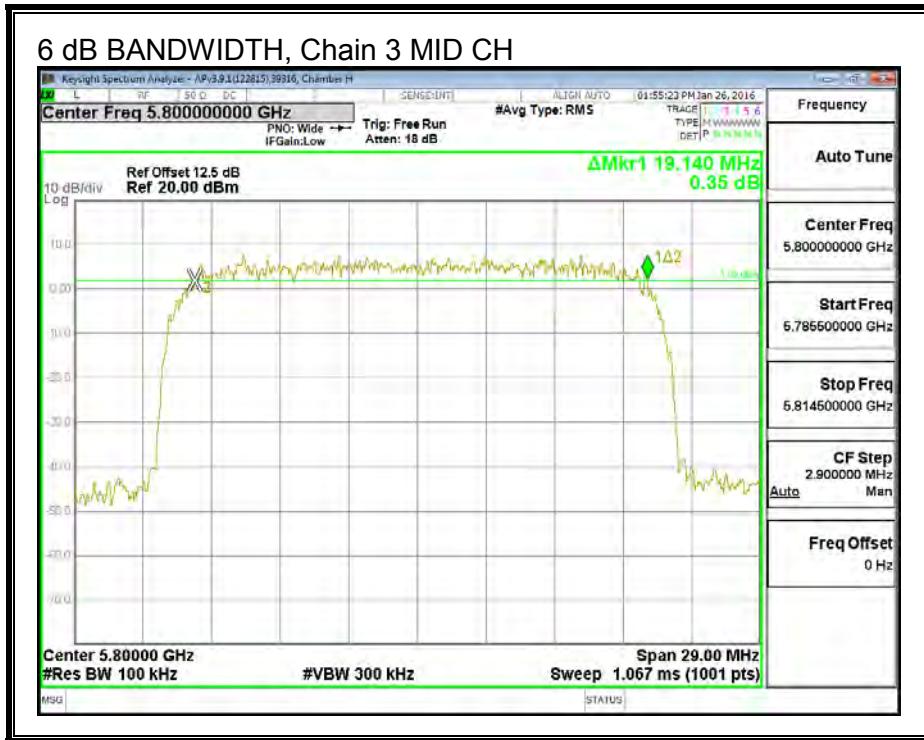
6 dB BANDWIDTH, Chain 2





6 dB BANDWIDTH, Chain 3





4.1.3. 40MHz BW 4TX MODE IN THE 5.8 GHz BAND

LIMITS

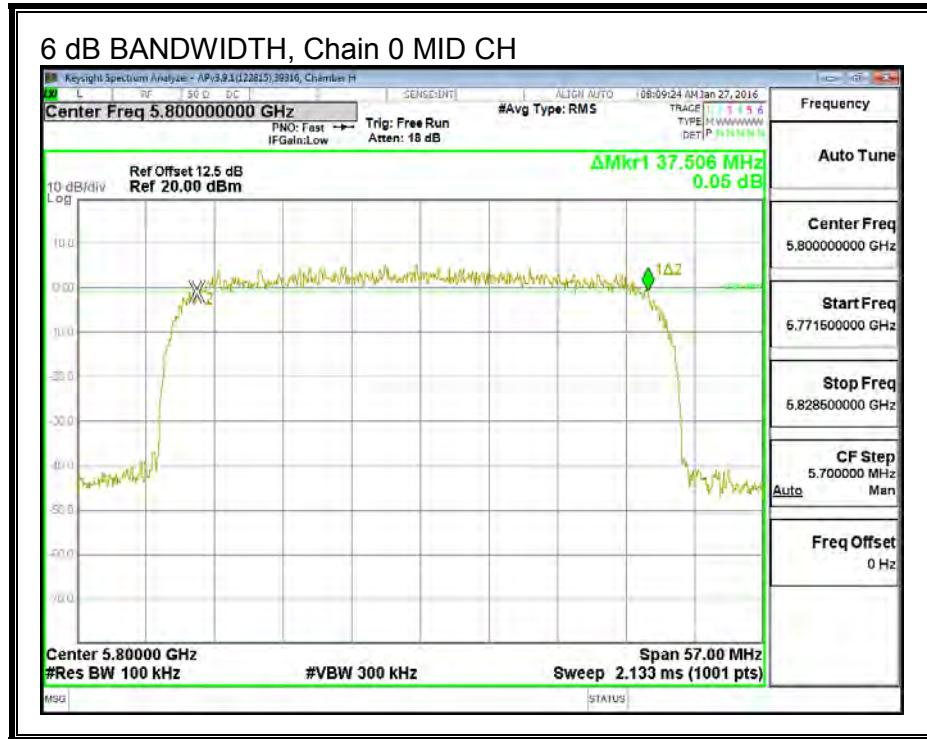
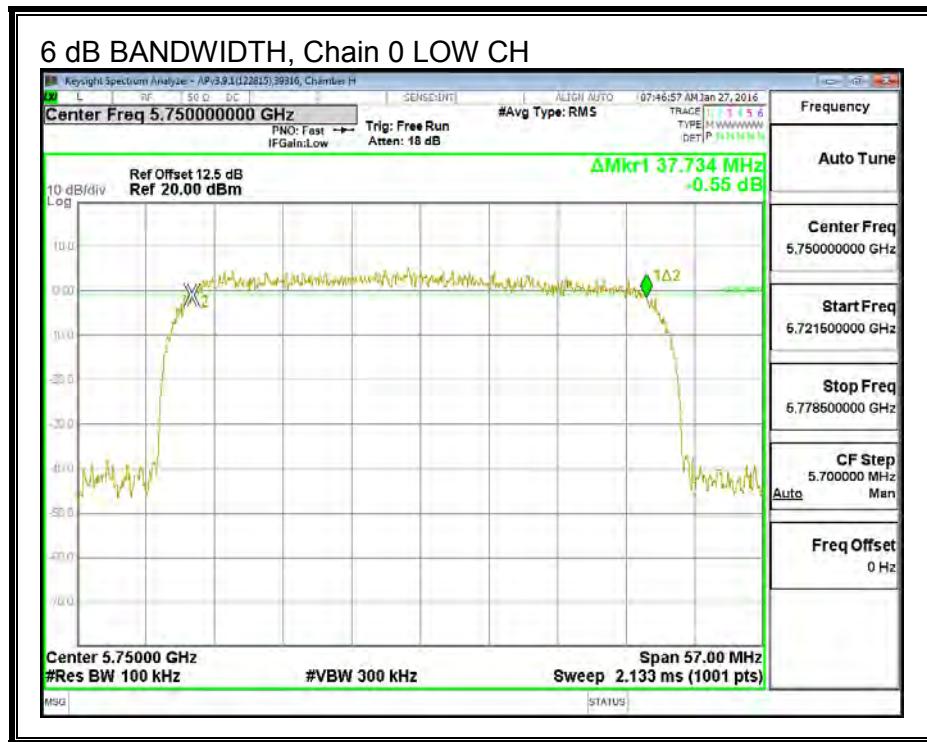
FCC §15.407 (e)

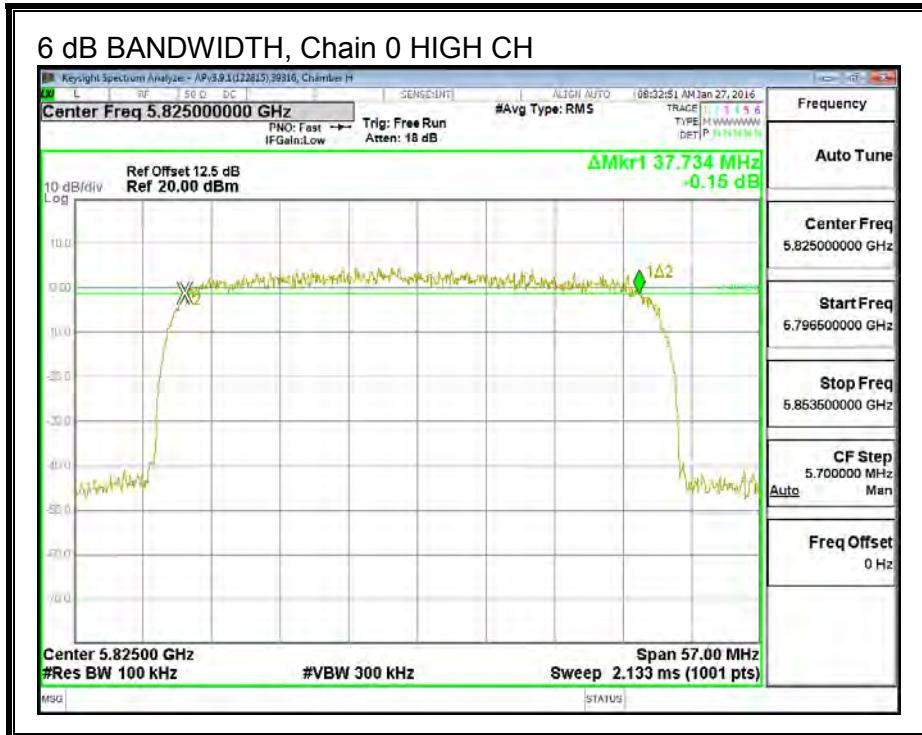
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

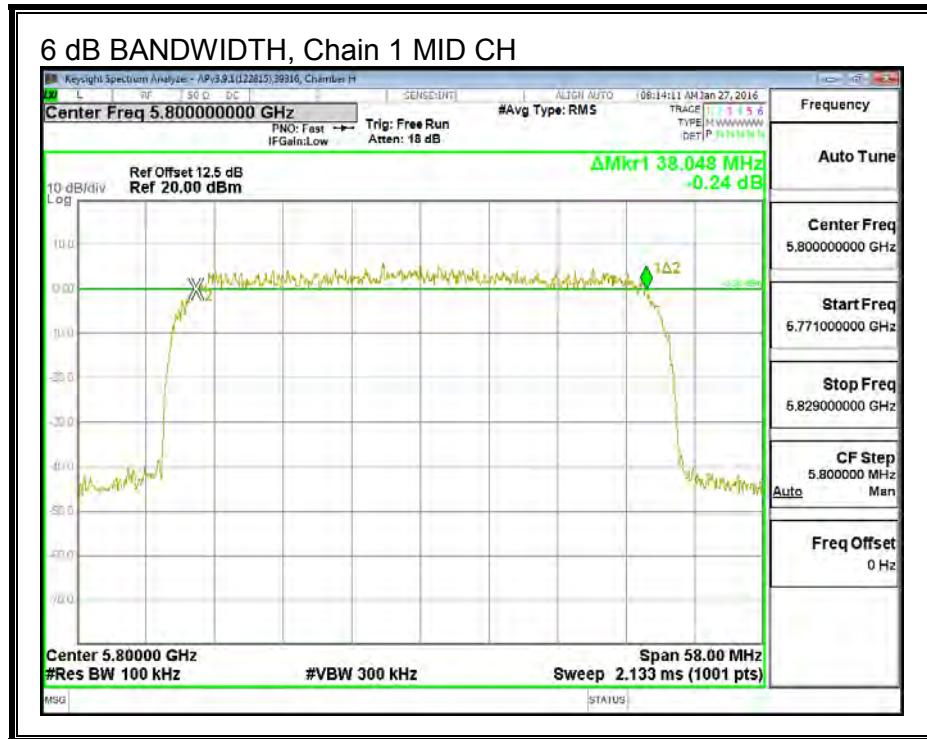
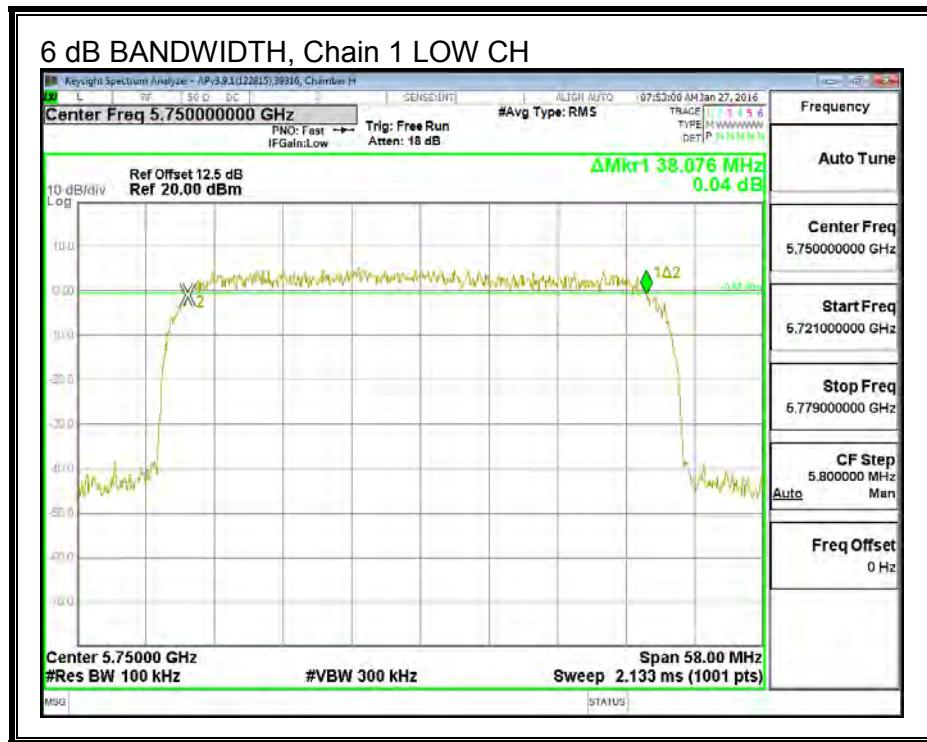
Channel	Frequency (MHz)	6 dB BW Chain 0 (MHz)	6 dB BW Chain 1 (MHz)	6 dB BW Chain 2 (MHz)	6 dB BW Chain 3 (MHz)	Minimum Limit (MHz)
Low	5750	37.734	38.076	38.338	37.734	0.5
Mid	5800	37.506	38.048	37.791	37.677	0.5
High	5825	37.734	38.396	38.570	37.962	0.5

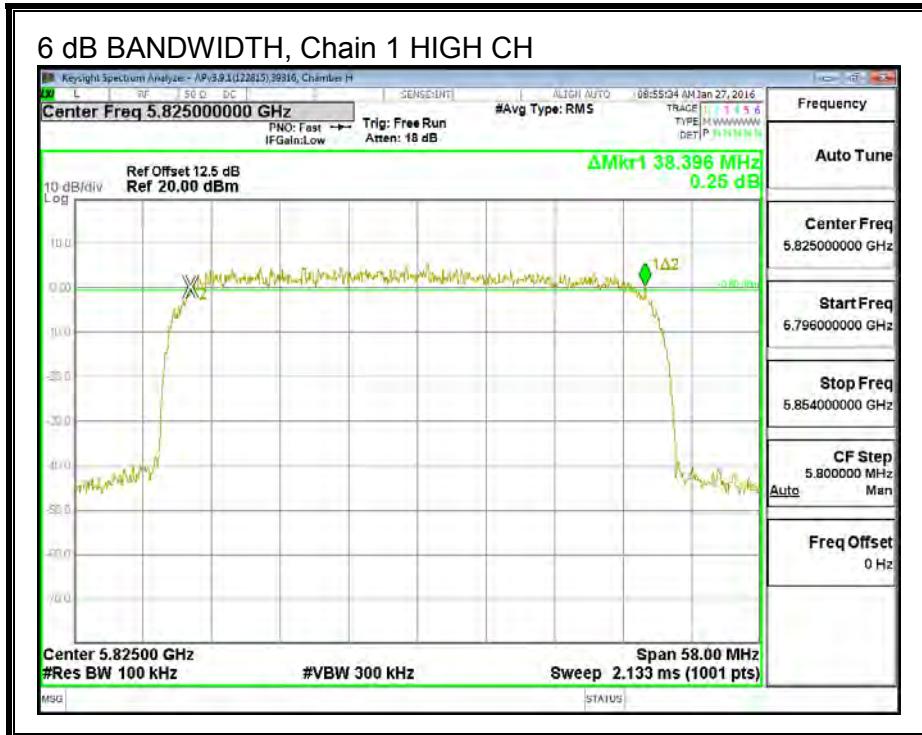
6 dB BANDWIDTH, Chain 0



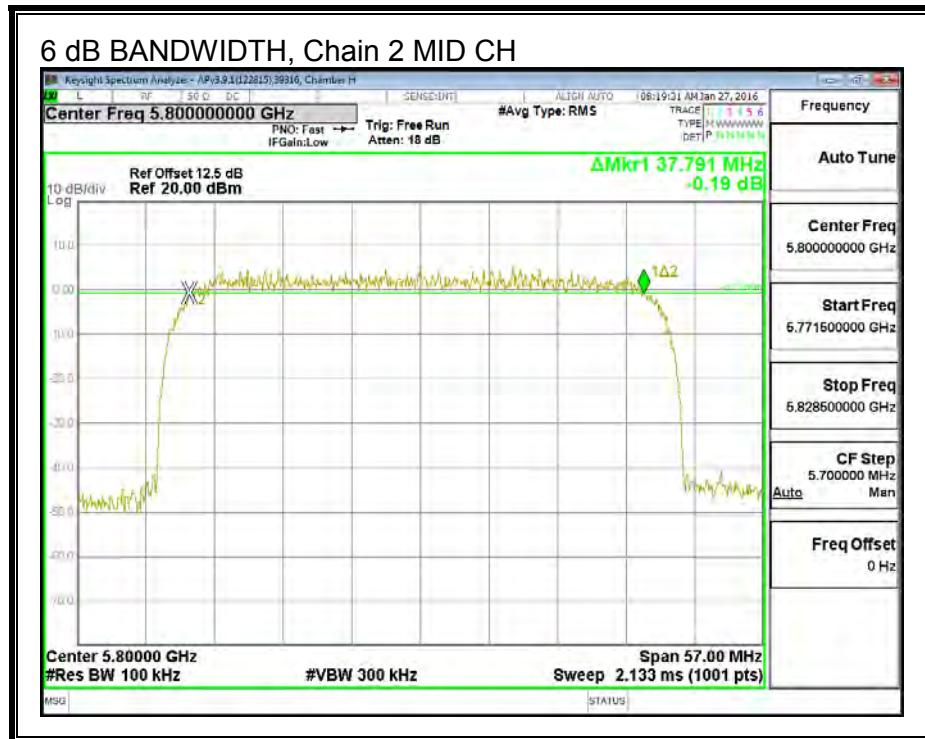
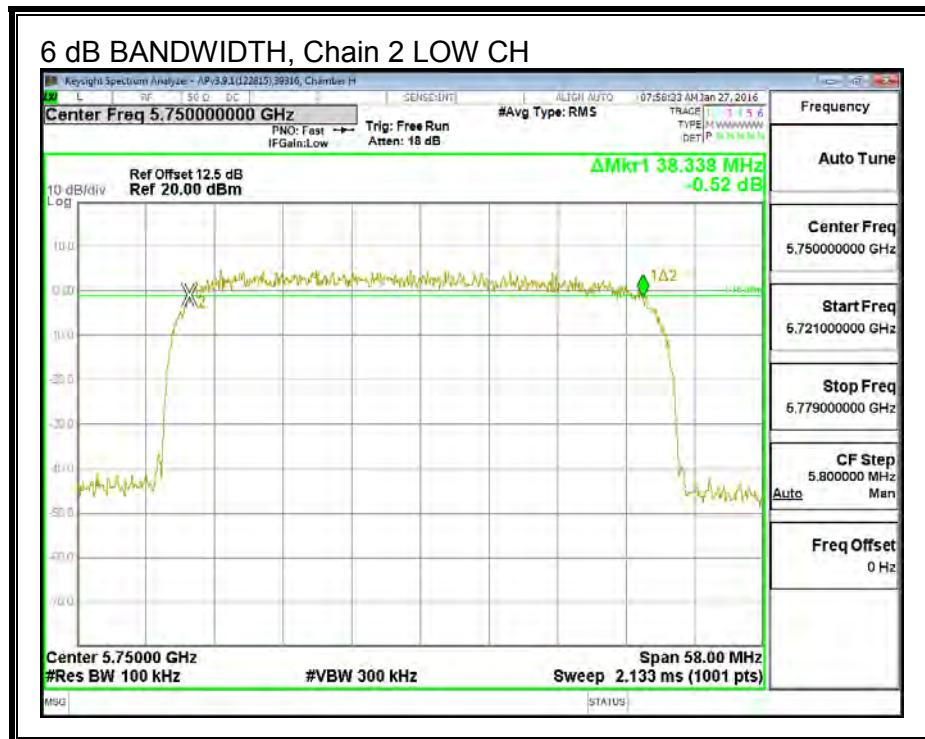


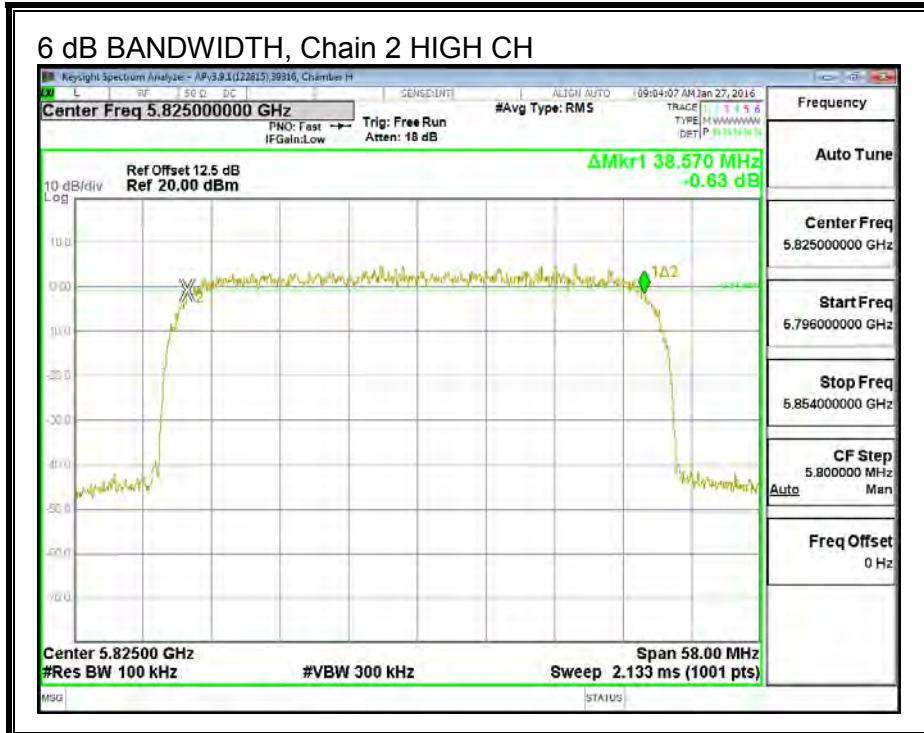
6 dB BANDWIDTH, Chain 1



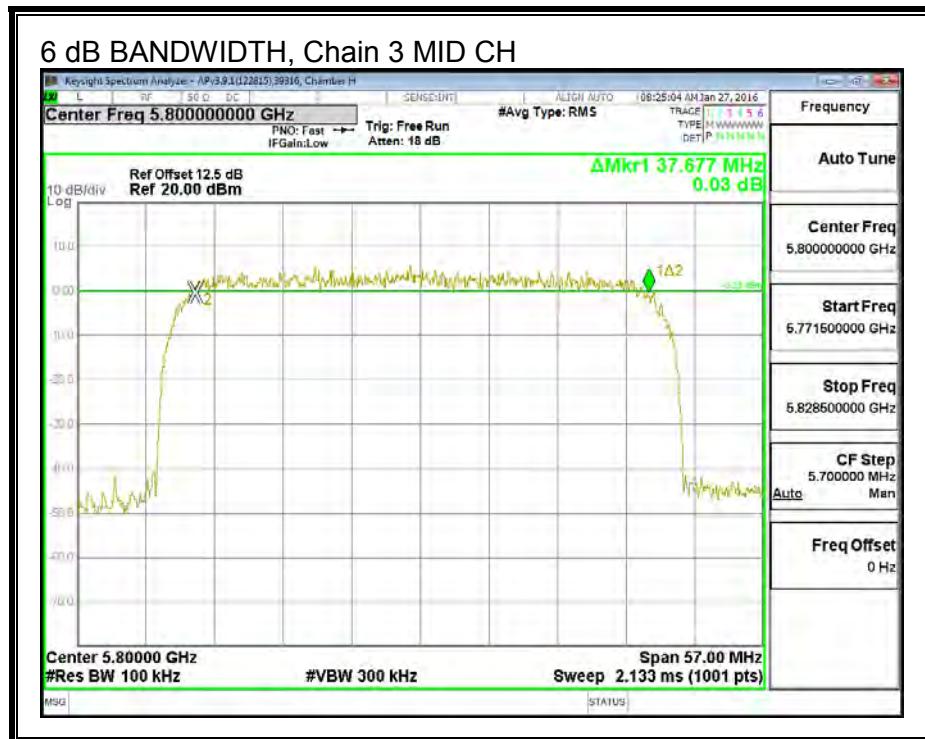
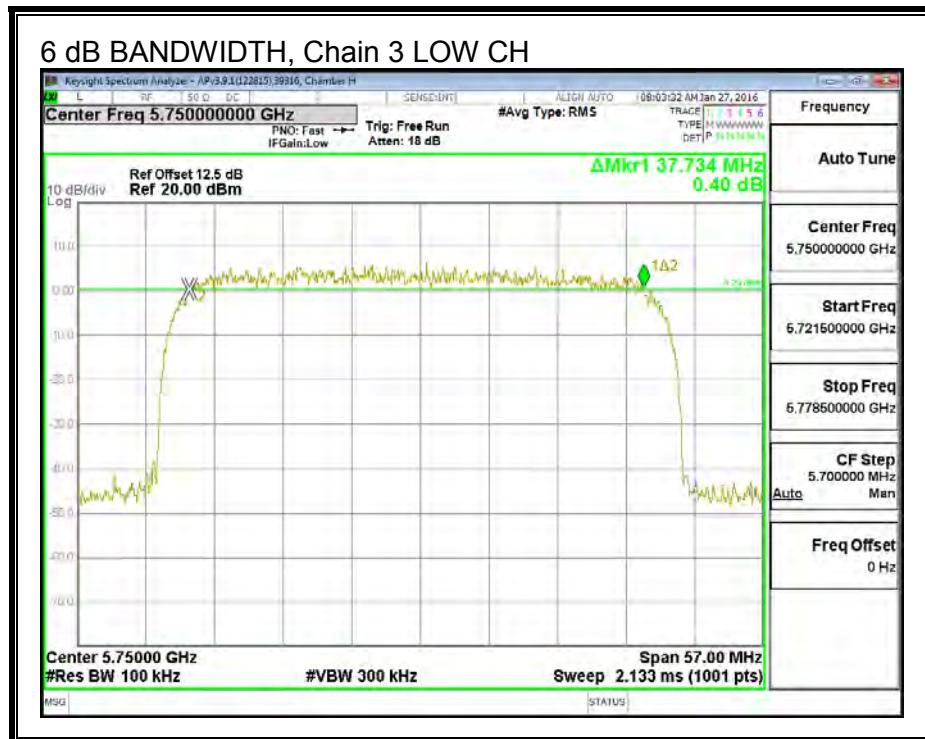


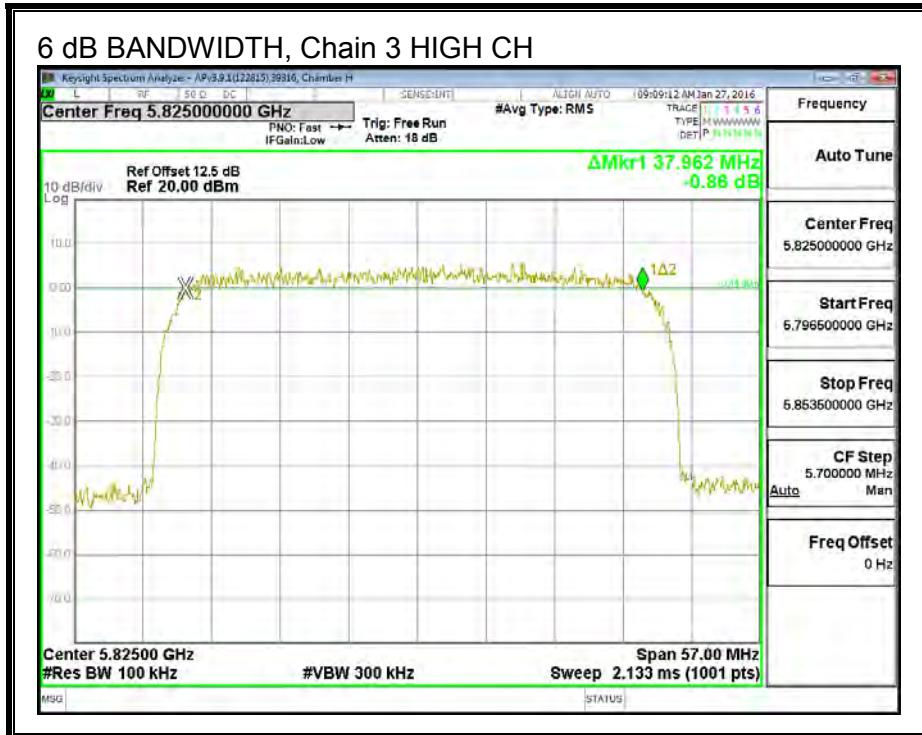
6 dB BANDWIDTH, Chain 2





6 dB BANDWIDTH, Chain 3





4.2. 26 dB BANDWIDTH

LIMITS

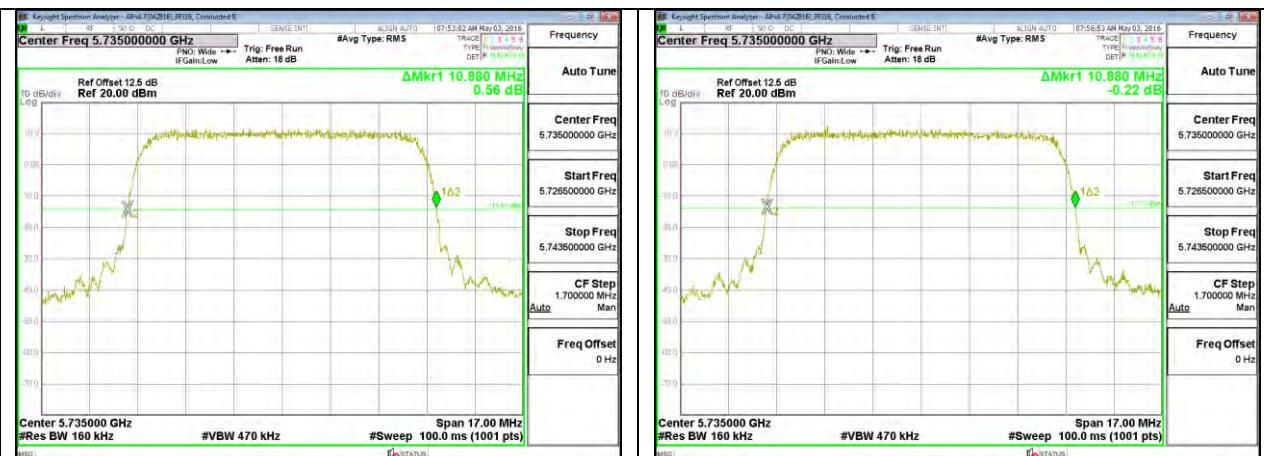
None; for reporting purposes only.

RESULTS

4.2.1. 10MHz BW 4Tx MODE IN THE 5.8 GHz BAND

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)	26 dB BW Chain 3 (MHz)
Low	5735	10.880	10.880	10.880	10.863
Mid	5800	10.897	10.897	10.880	10.880
High	5840	10.863	10.863	10.880	10.880

LOW CHANNEL 26dB BANDWIDTH



LOW CHANNEL CHAIN 0



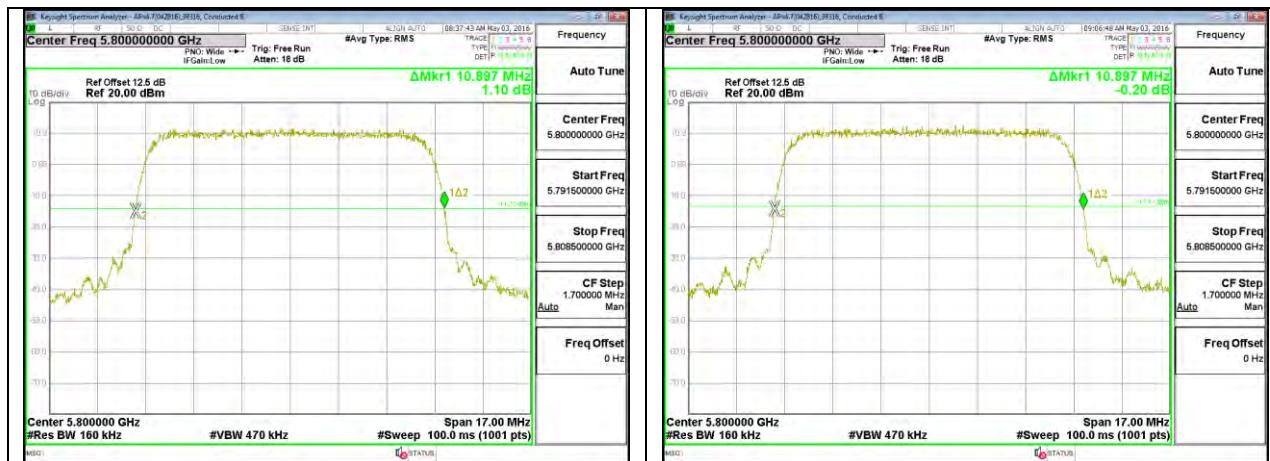
LOW CHANNEL CHAIN 1



LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 3

MID CHANNEL 26dB BANDWIDTH



MID CHANNEL CHAIN 0

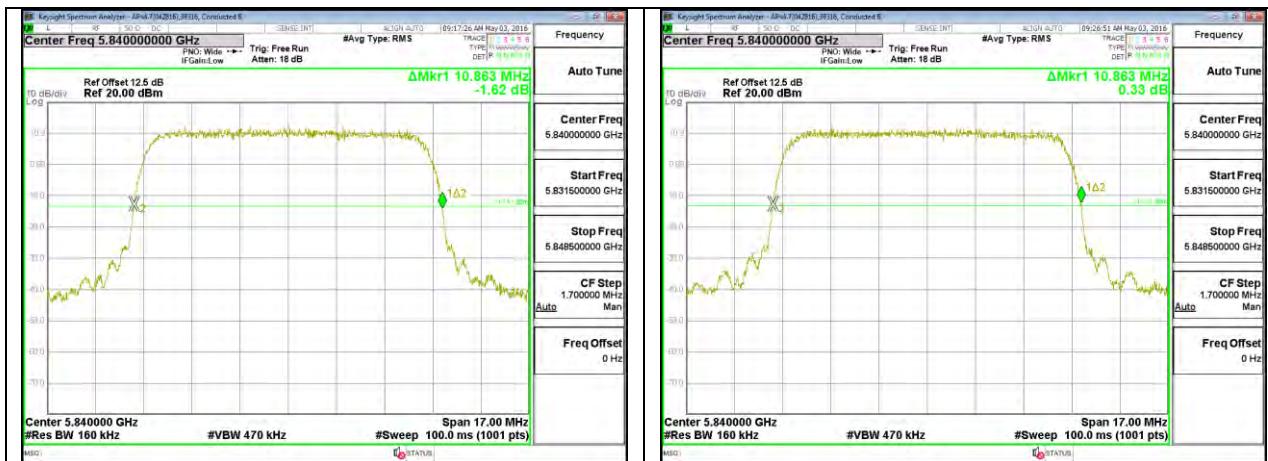


MID CHANNEL CHAIN 2

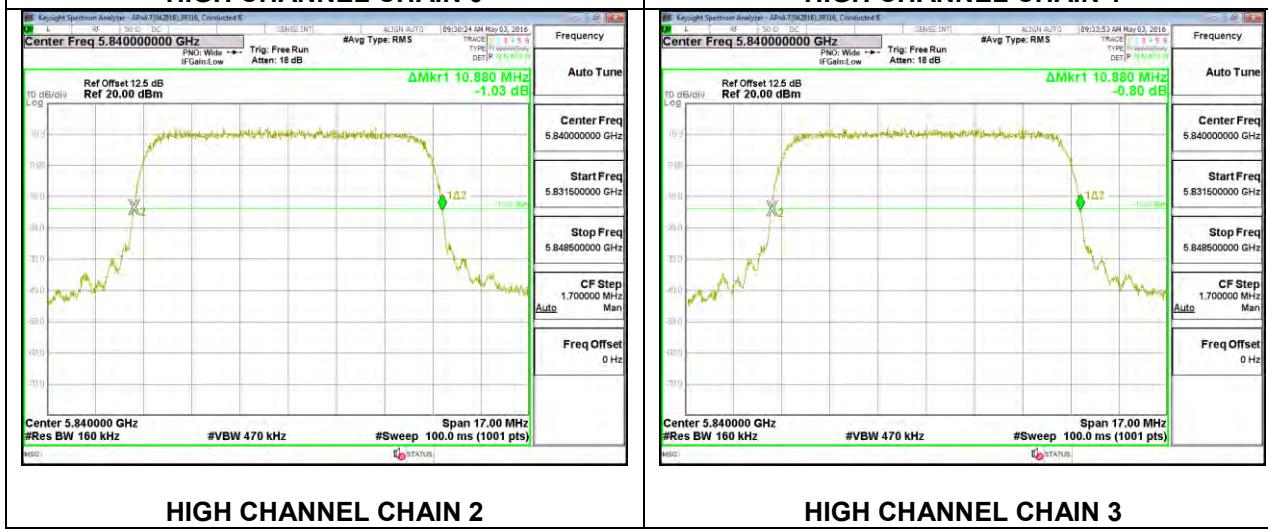
MID CHANNEL CHAIN 1

MID CHANNEL CHAIN 3

HIGH CHANNEL 26dB BANDWIDTH



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 2

HIGH CHANNEL CHAIN 1

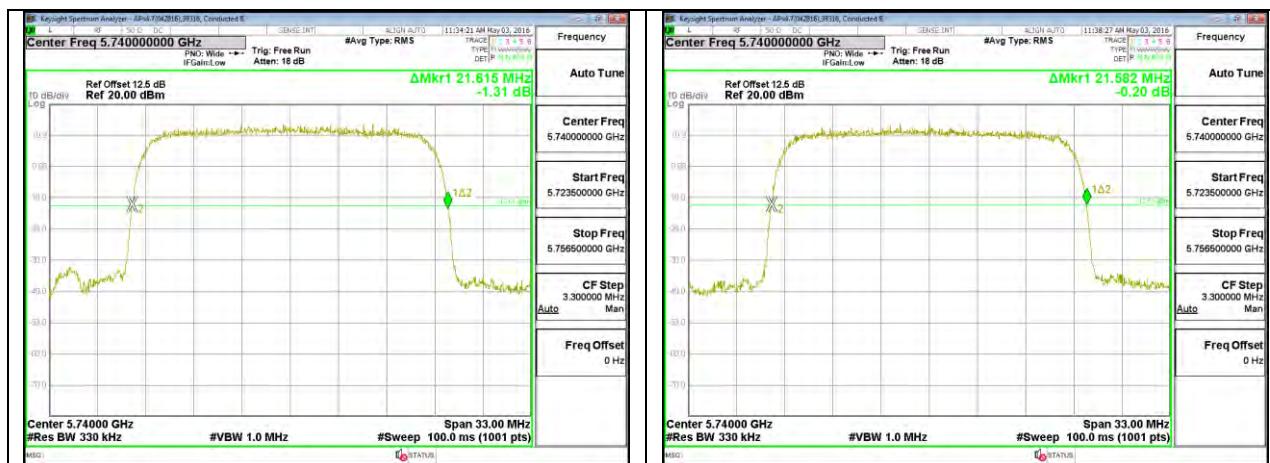


HIGH CHANNEL CHAIN 3

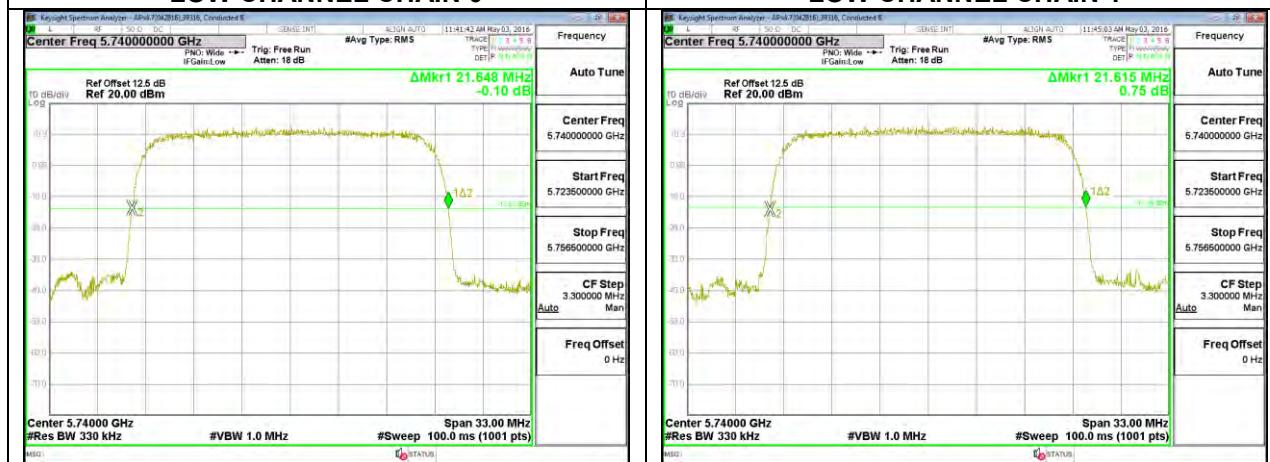
4.2.2. 20MHz BW 4Tx MODE IN THE 5.8 GHz BAND

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)	26 dB BW Chain 3 (MHz)
Low	5740	21.615	21.582	21.648	21.615
Mid	5800	21.615	21.615	21.615	21.582
High	5835	21.549	21.648	21.648	21.648

LOW CHANNEL 26dB BANDWIDTH



LOW CHANNEL CHAIN 0



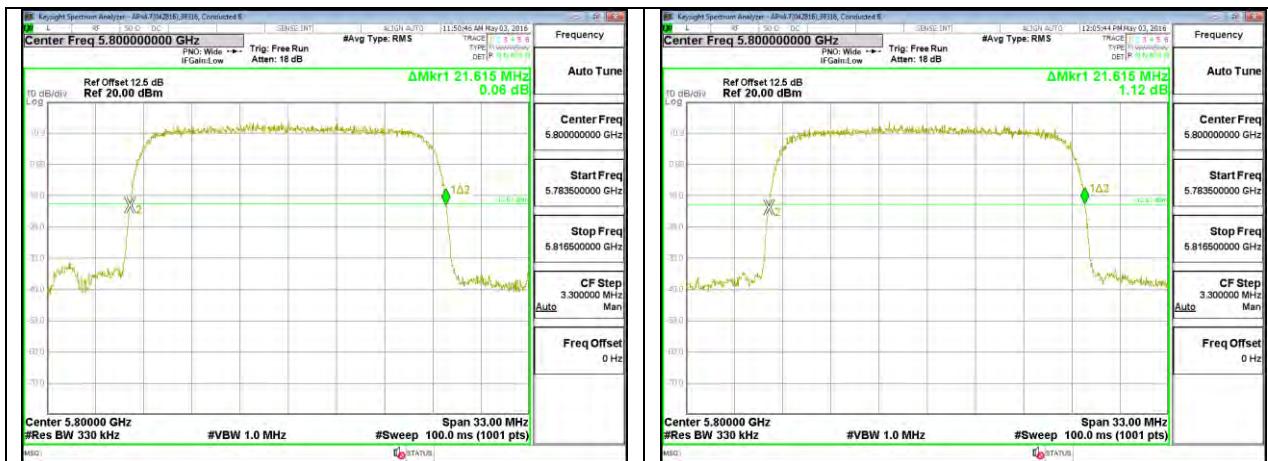
LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 1

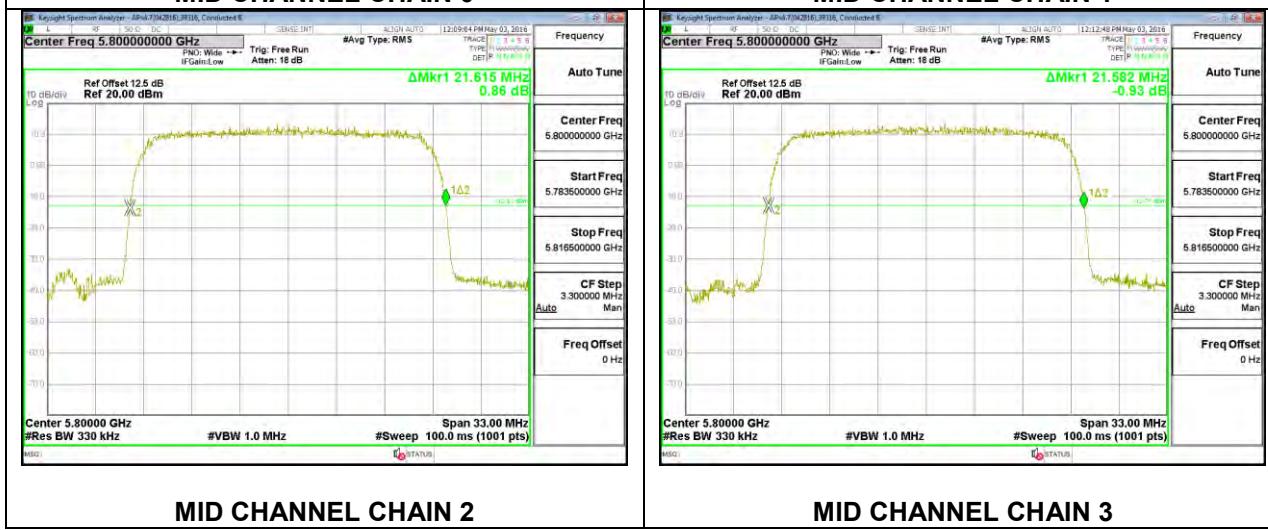


LOW CHANNEL CHAIN 3

MID CHANNEL 26dB BANDWIDTH



MID CHANNEL CHAIN 0

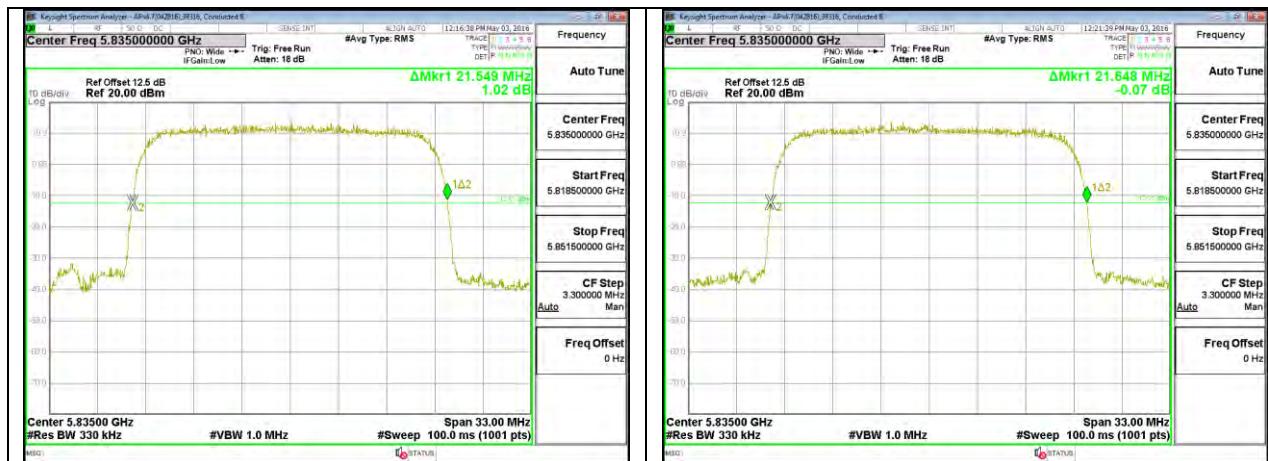


MID CHANNEL CHAIN 2

MID CHANNEL CHAIN 1

MID CHANNEL CHAIN 3

HIGH CHANNEL 26dB BANDWIDTH



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 2

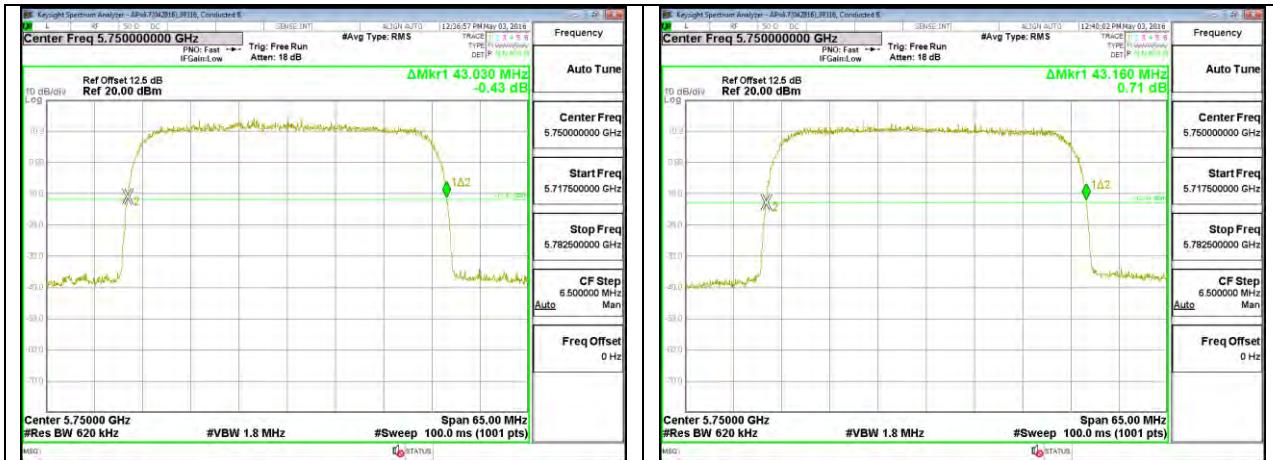
HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 3

4.2.3. 40MHz BW 4Tx MODE IN THE 5.8 GHz BAND

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)	26 dB BW Chain 3 (MHz)
Low	5750	43.030	43.160	43.160	43.290
Mid	5800	43.225	43.160	43.225	43.160
High	5825	43.225	43.160	43.225	43.095

LOW CHANNEL 26dB BANDWIDTH



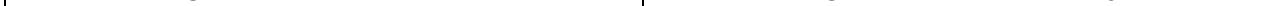
LOW CHANNEL CHAIN 0



LOW CHANNEL CHAIN 1

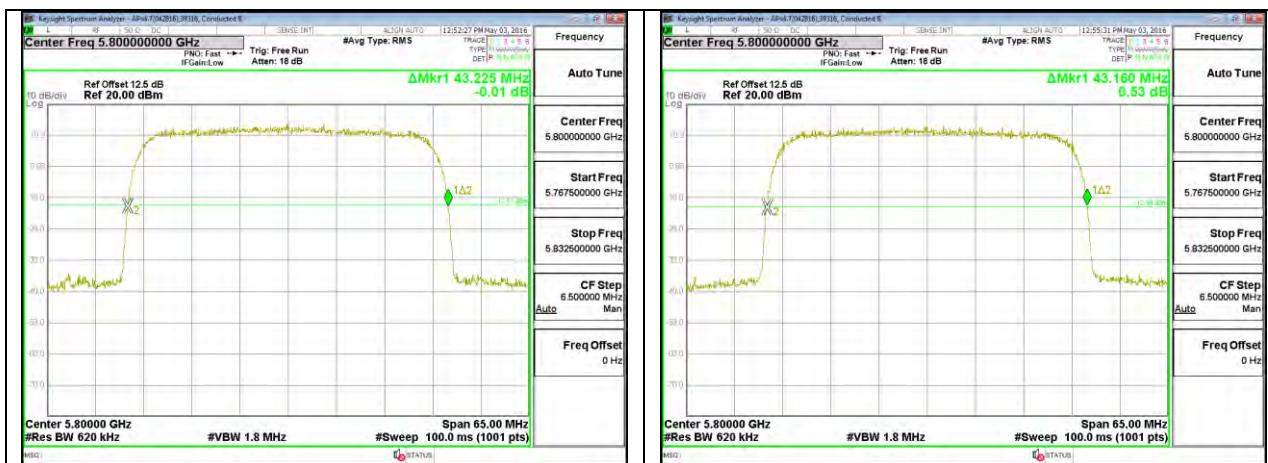


LOW CHANNEL CHAIN 2



LOW CHANNEL CHAIN 3

MID CHANNEL 26dB BANDWIDTH



MID CHANNEL CHAIN 0



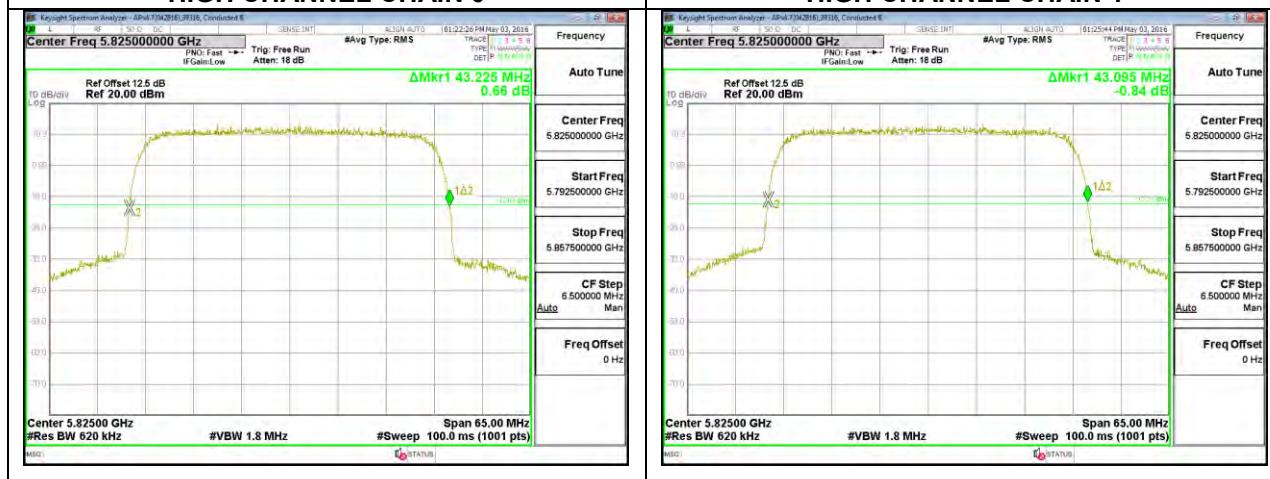
MID CHANNEL CHAIN 2

MID CHANNEL CHAIN 3

HIGH CHANNEL 26dB BANDWIDTH



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 2

HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 3

4.3. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (3)

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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

DIRECTIONAL ANTENNA GAIN

Two TX chains are correlated and two others are uncorrelated and the antenna gain is the same for each chain. The directional gain is:

Antenna Gain (dBi)	10 * Log (2 chains) (dB)	Correlated Chains Directional Gain (dBi)
15.00	3.01	18.01

RESULTS

4.3.1. 10MHz BW 4Tx MODE IN THE 5.8 GHz BAND

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5735	18.01	18.01	30.00	30.00
Mid	5800	18.01	18.01	30.00	30.00
High	5840	18.01	18.01	30.00	30.00

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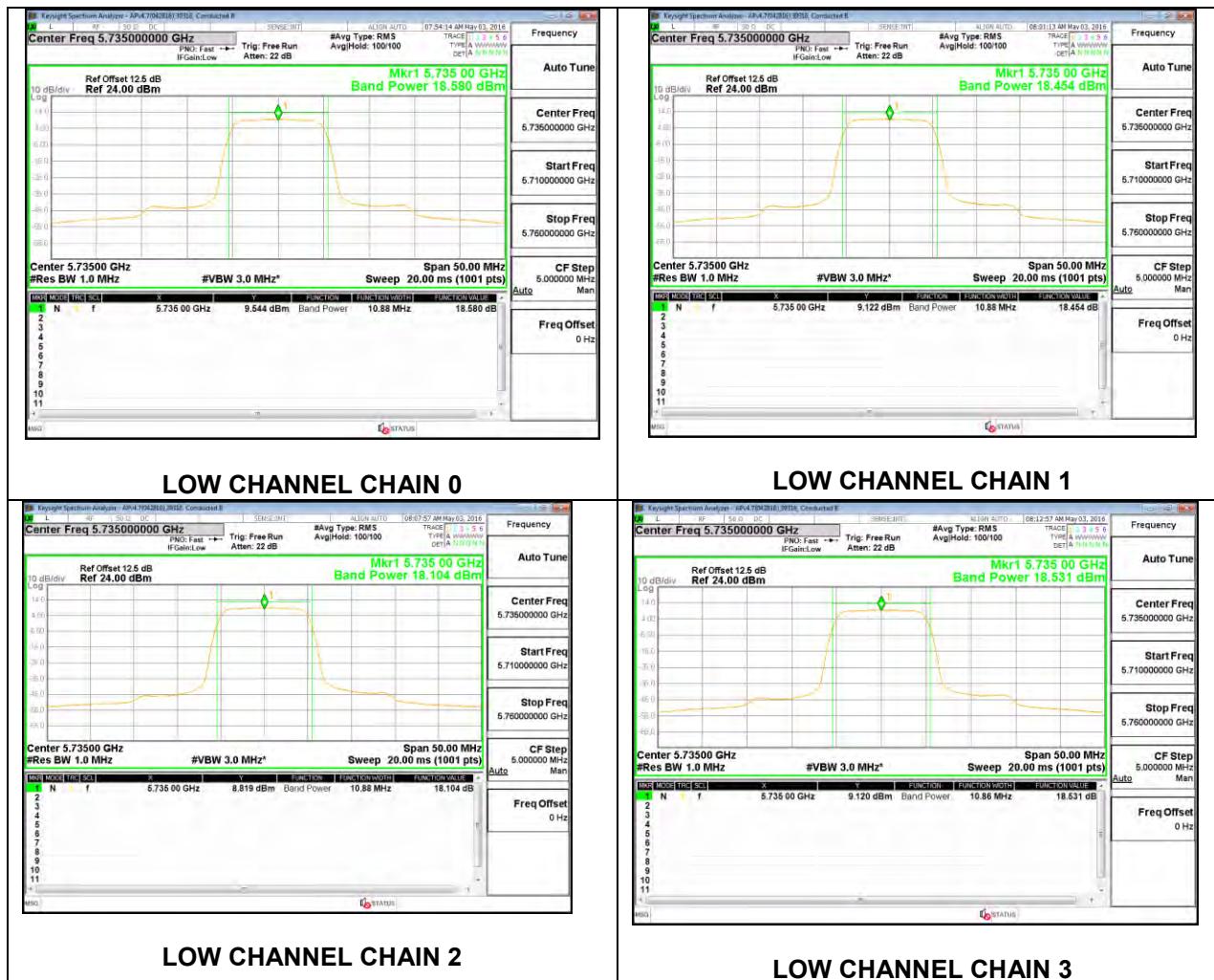
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5735	18.58	18.45	18.10	18.53	24.44	30.00	-5.56
Mid	5800	18.90	18.82	18.75	18.68	24.81	30.00	-5.19
High	5840	18.87	18.47	18.49	18.68	24.65	30.00	-5.35

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Chain 2 Meas PSD (dBm)	Chain 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5735	6.83	6.74	6.22	6.71	12.65	30.00	-17.35
Mid	5800	6.97	6.94	6.89	6.78	12.92	30.00	-17.08
High	5840	7.10	6.66	6.57	6.74	12.79	30.00	-17.21

LOW CHANNEL OUTPUT POWER



MID CHANNEL OUTPUT POWER



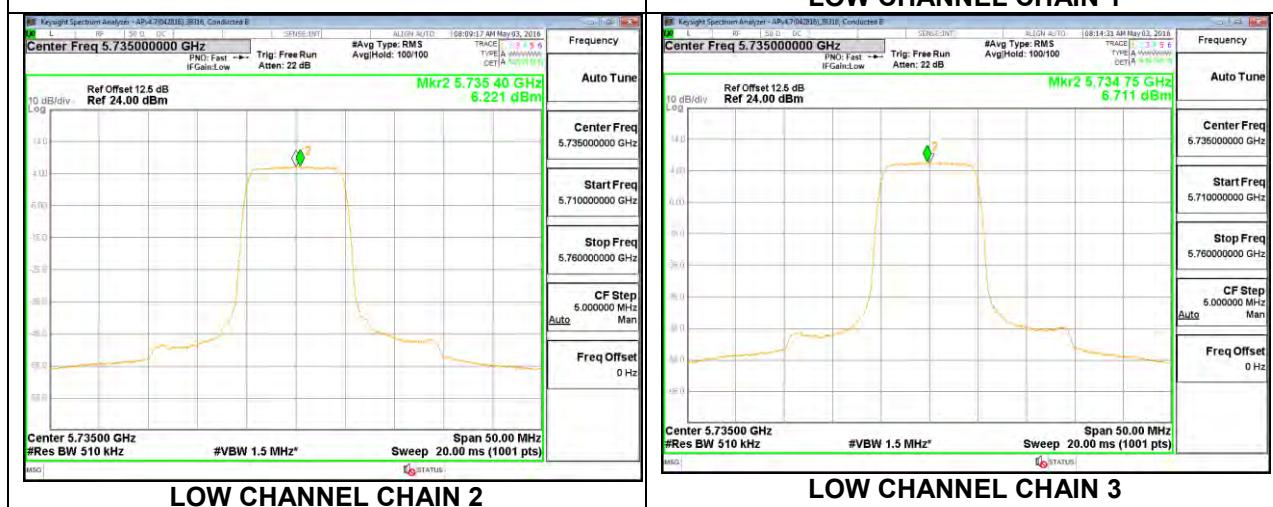
HIGH CHANNEL OUTPUT POWER



LOW CHANNEL PSD



LOW CHANNEL CHAIN 0

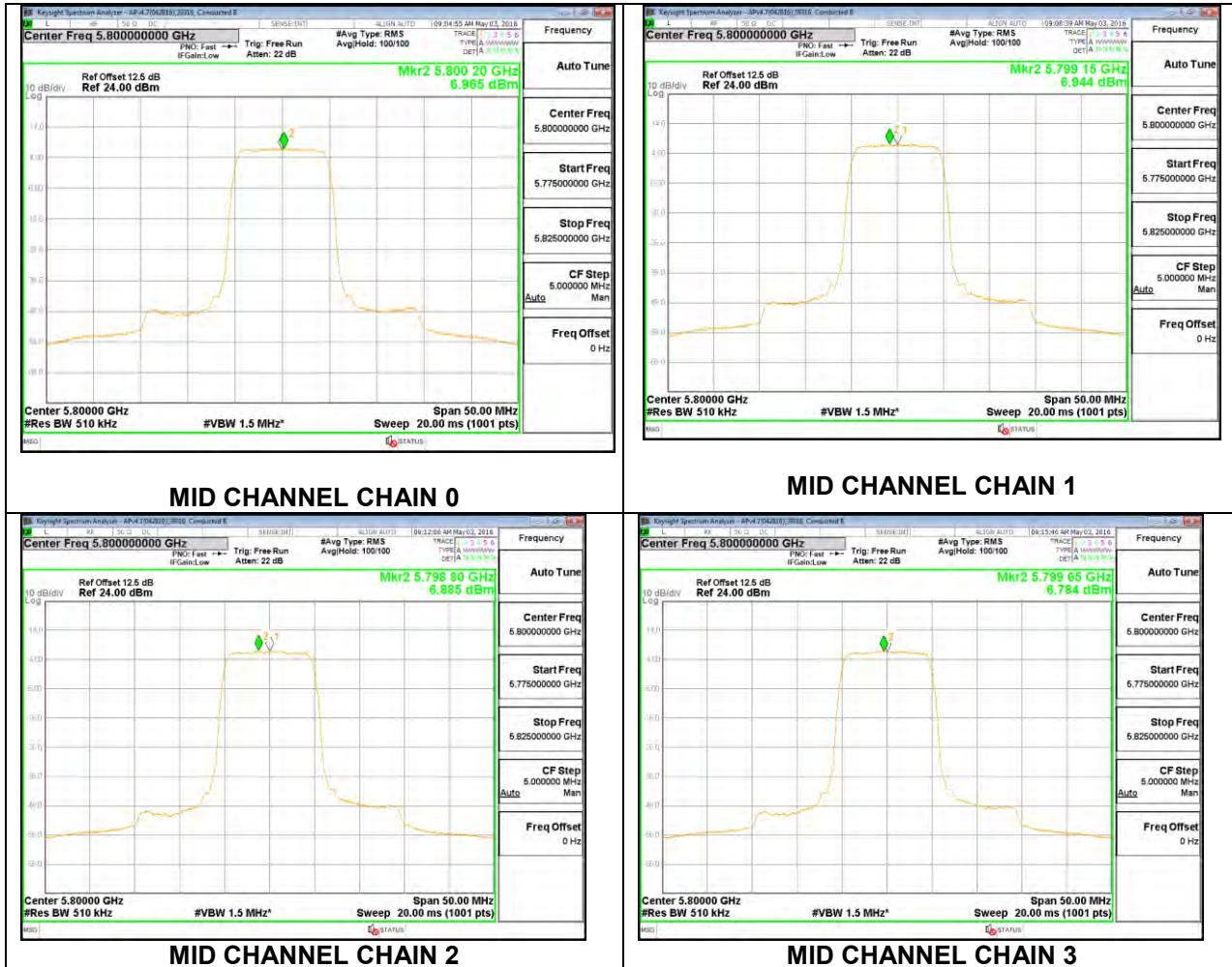


LOW CHANNEL CHAIN 2

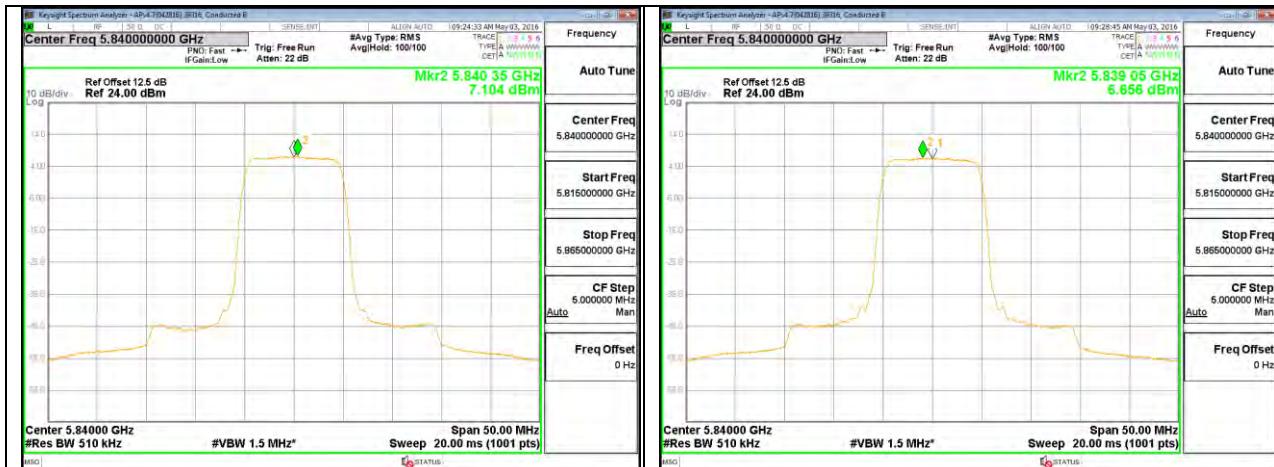
LOW CHANNEL CHAIN 1

LOW CHANNEL CHAIN 3

MID CHANNEL PSD



HIGH CHANNEL PSD



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 2

HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 3

4.3.2. 20MHz BW 4Tx MODE IN THE 5.8 GHz BAND

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5740	18.01	18.01	30.00	30.00
Mid	5800	18.01	18.01	30.00	30.00
High	5835	18.01	18.01	30.00	30.00

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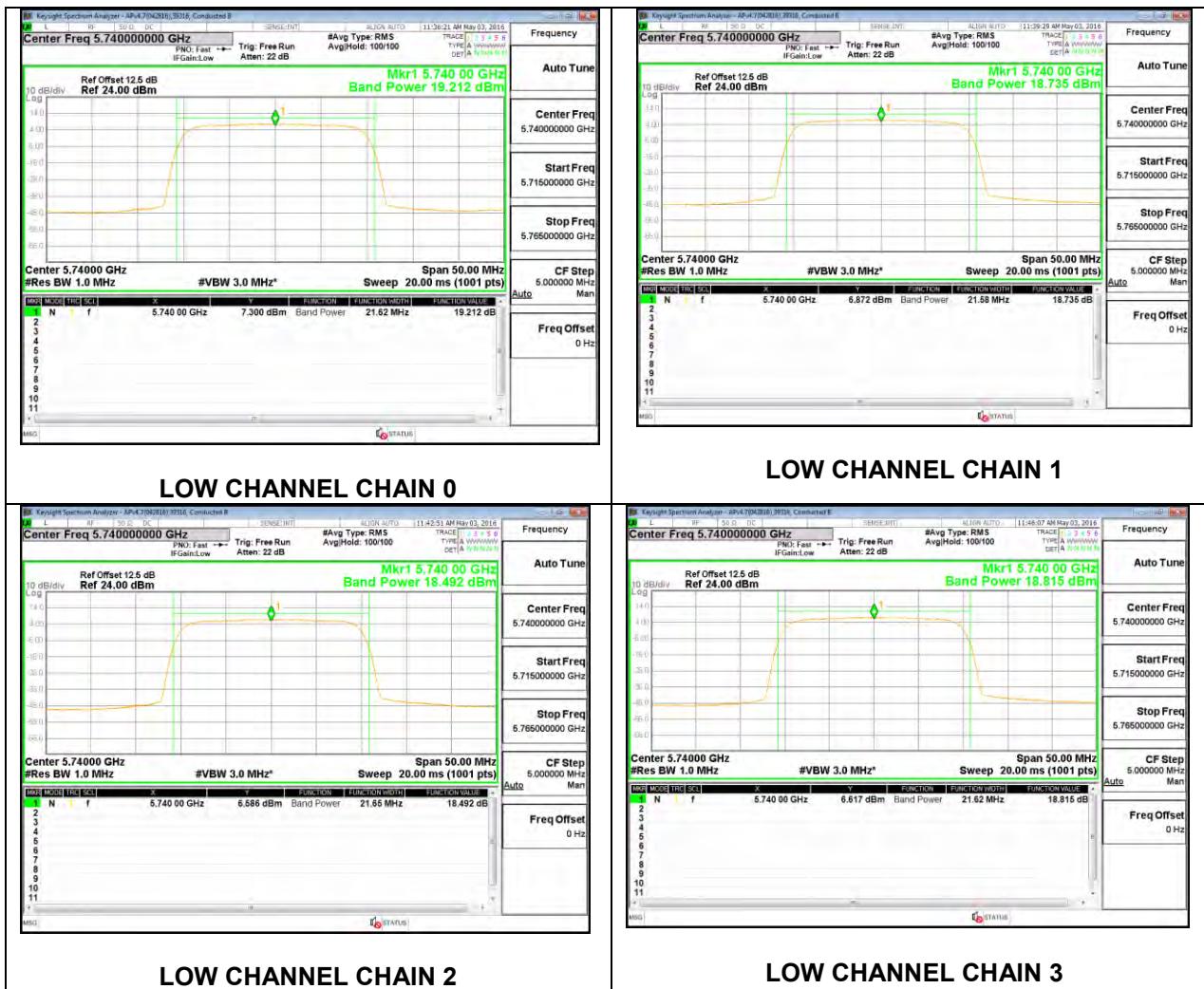
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5740	19.21	18.74	18.49	18.82	24.84	30.00	-5.16
Mid	5800	18.94	18.75	18.46	18.81	24.76	30.00	-5.24
High	5835	19.02	18.69	19.18	18.71	24.92	30.00	-5.08

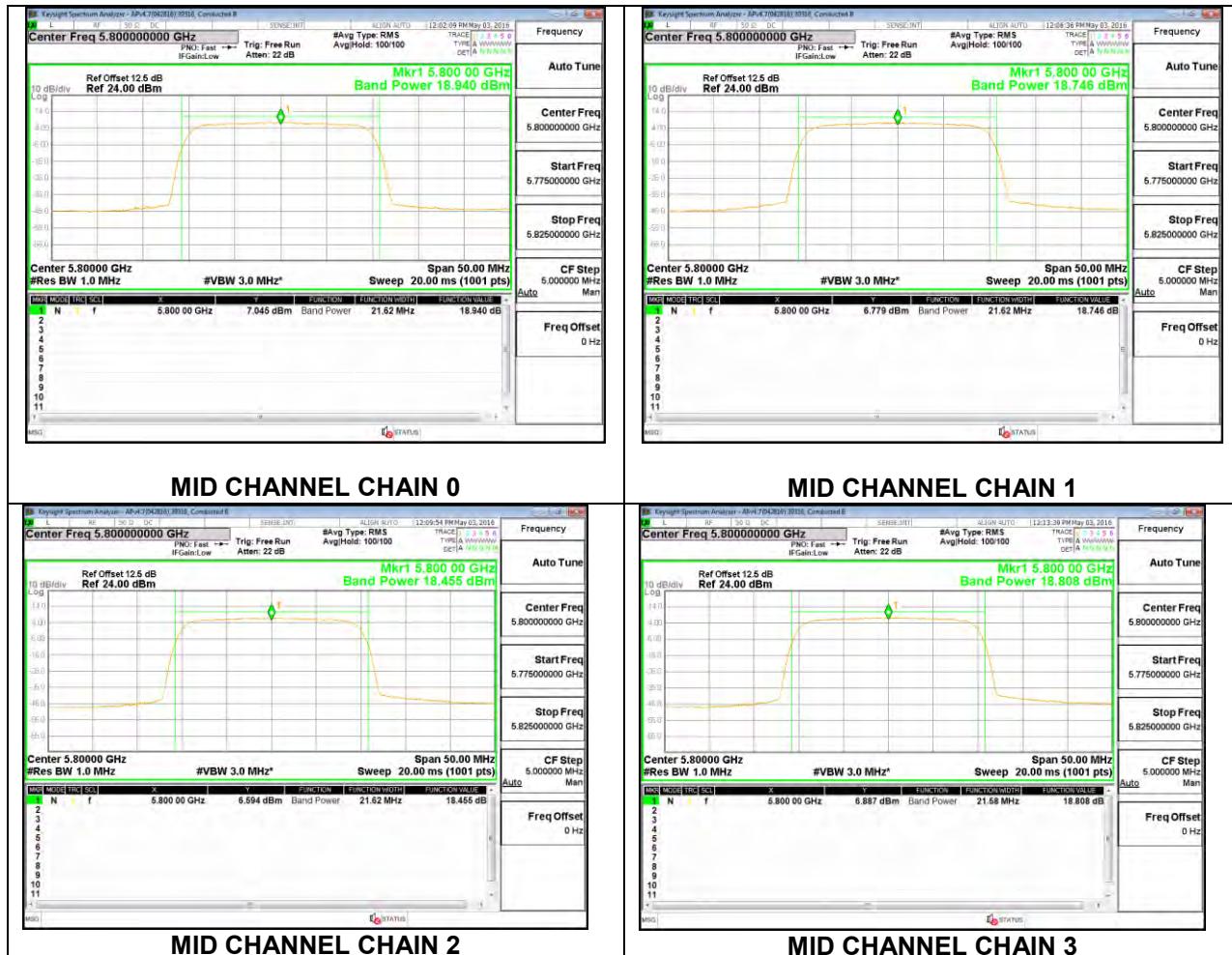
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Chain 2 Meas PSD (dBm)	Chain 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5740	4.75	4.14	3.95	4.25	10.30	30.00	-19.70
Mid	5800	4.39	4.28	3.91	4.32	10.25	30.00	-19.75
High	5835	4.52	4.18	4.47	4.10	10.34	30.00	-19.66

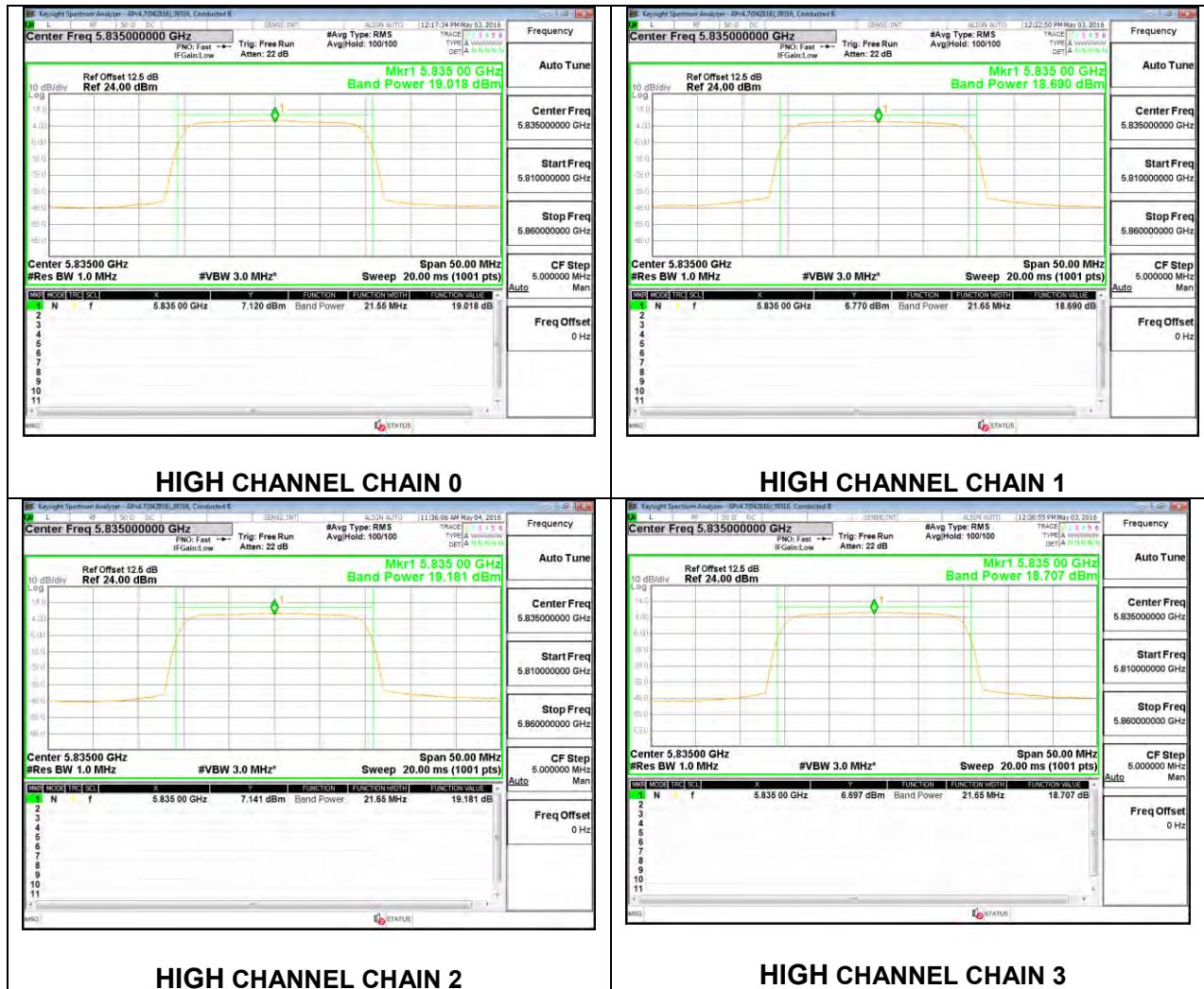
LOW CHANNEL OUTPUT POWER



MID CHANNEL OUTPUT POWER



HIGH CHANNEL OUTPUT POWER



LOW CHANNEL PSD



LOW CHANNEL CHAIN 0

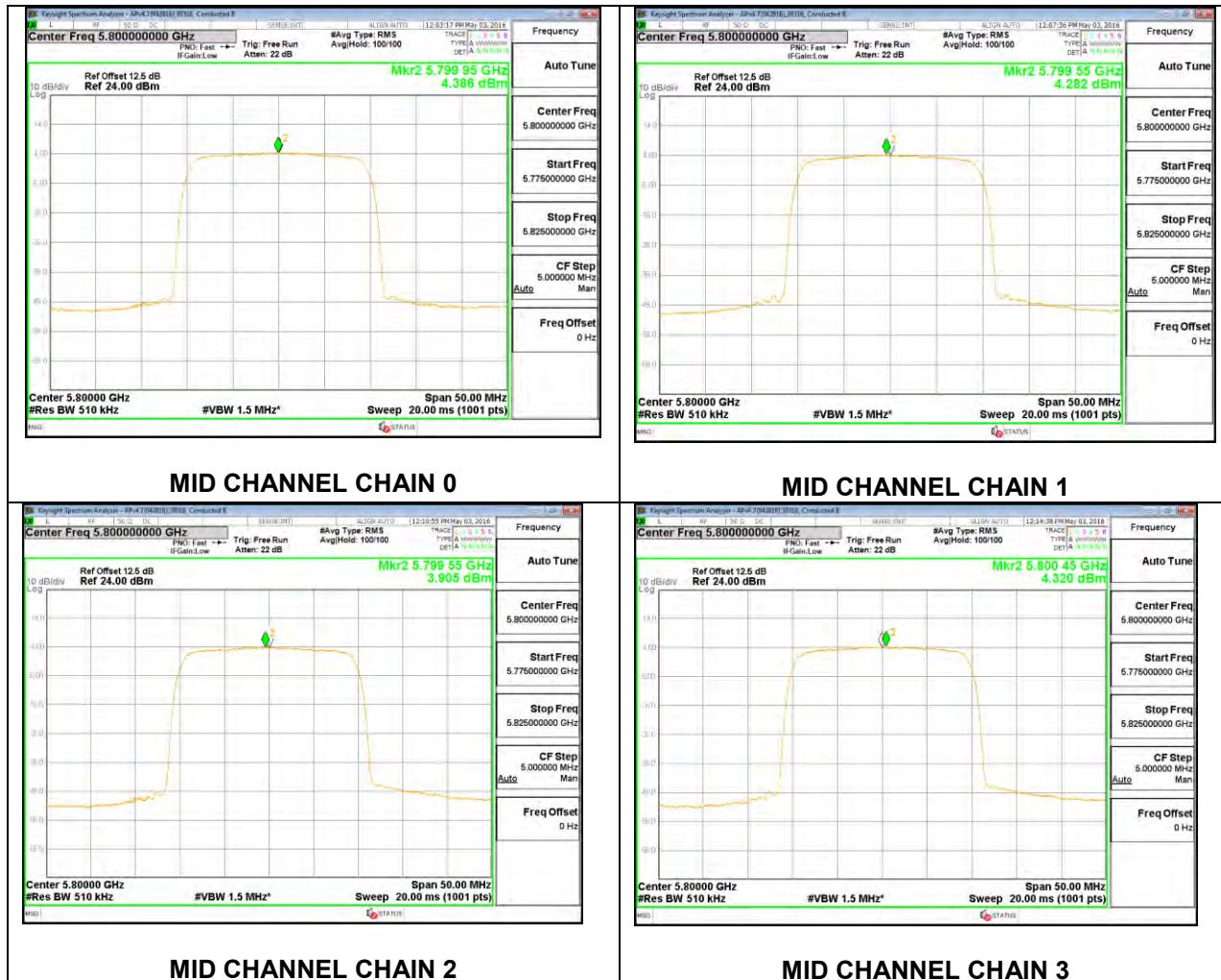


LOW CHANNEL CHAIN 1

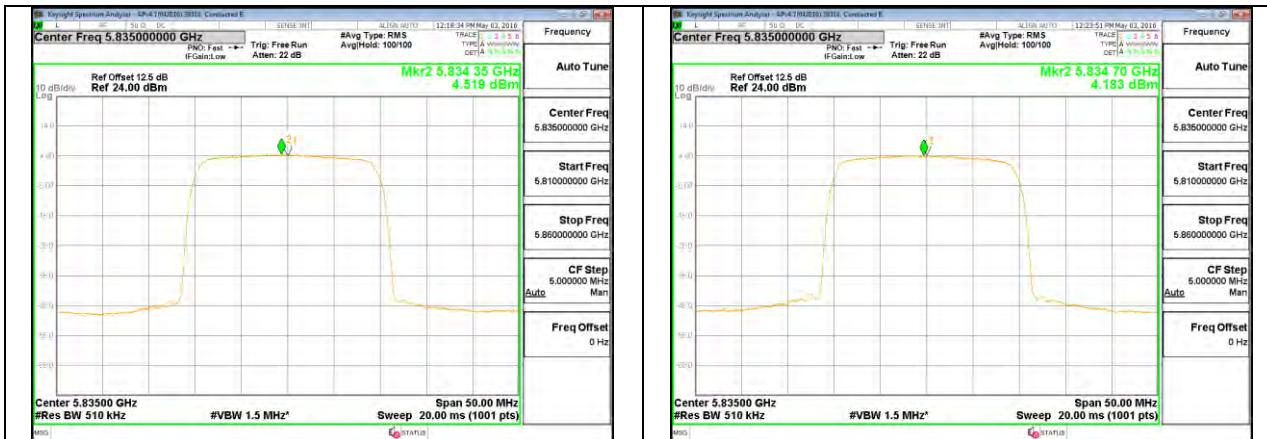
LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 3

MID CHANNEL PSD



HIGH CHANNEL PSD



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 3

4.3.3. 40MHz BW 4Tx MODE IN THE 5.8 GHz BAND

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5750	18.01	18.01	30.00	30.00
Mid	5800	18.01	18.01	30.00	30.00
High	5825	18.01	18.01	30.00	30.00

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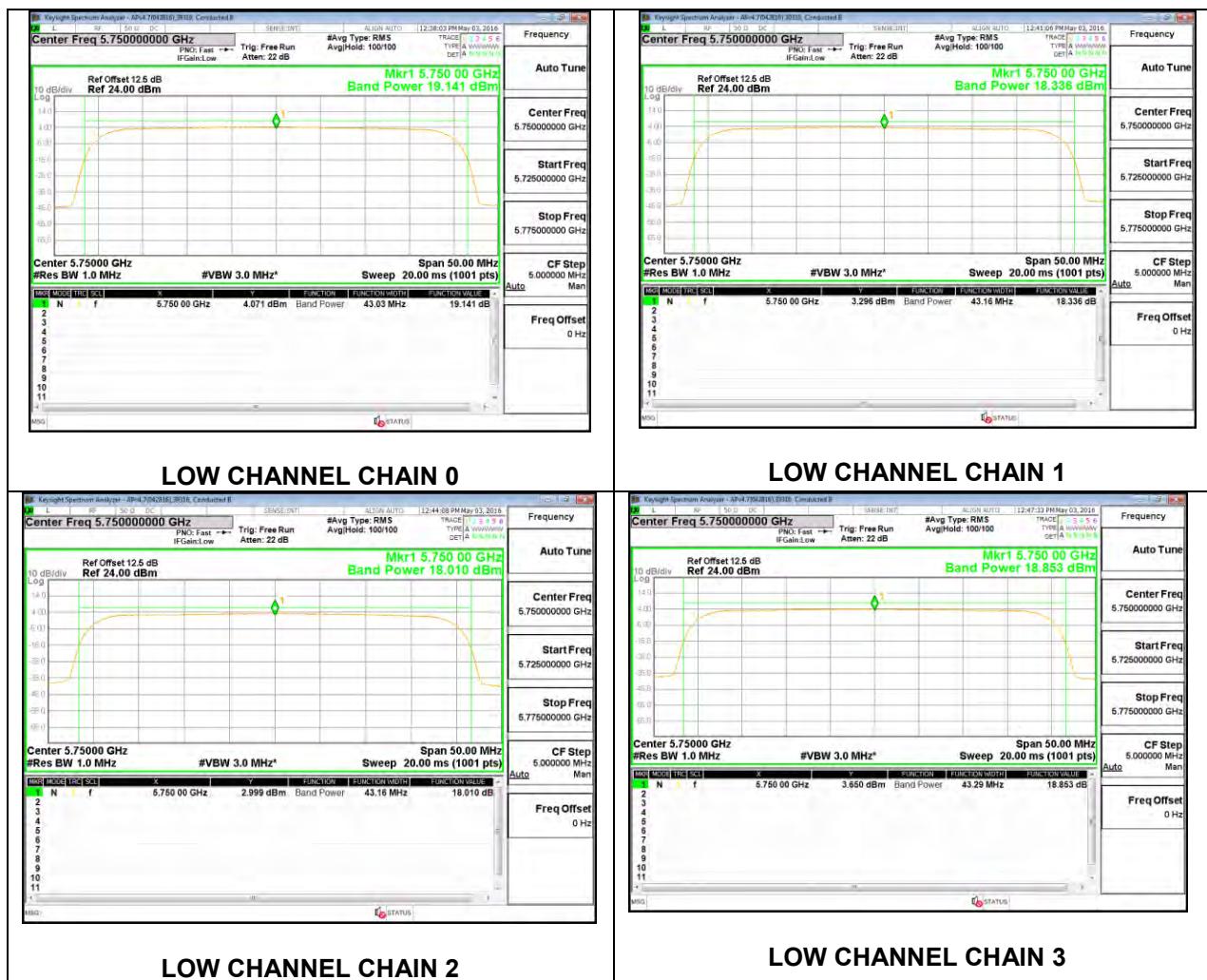
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5750	19.14	18.34	18.01	18.85	24.63	30.00	-5.37
Mid	5800	19.11	18.59	18.64	18.96	24.85	30.00	-5.15
High	5825	19.05	18.63	18.55	19.00	24.83	30.00	-5.17

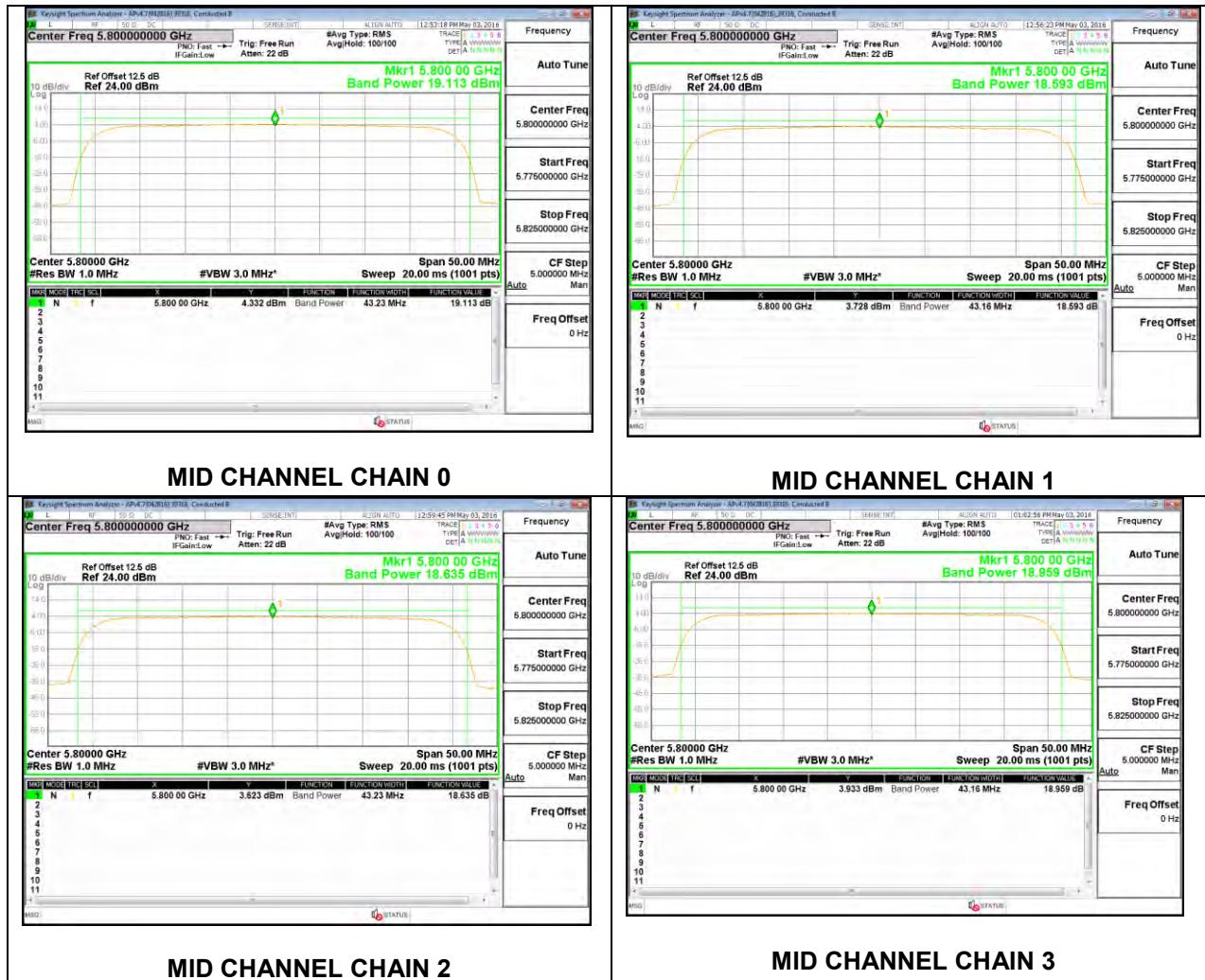
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Chain 1 Meas PSD (dBm)	Chain 2 Meas PSD (dBm)	Chain 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5750	1.57	0.72	0.38	1.27	7.03	30.00	-22.97
Mid	5800	1.84	1.22	0.96	1.36	7.38	30.00	-22.62
High	5825	1.52	1.24	1.01	1.32	7.30	30.00	-22.70

LOW CHANNEL OUTPUT POWER



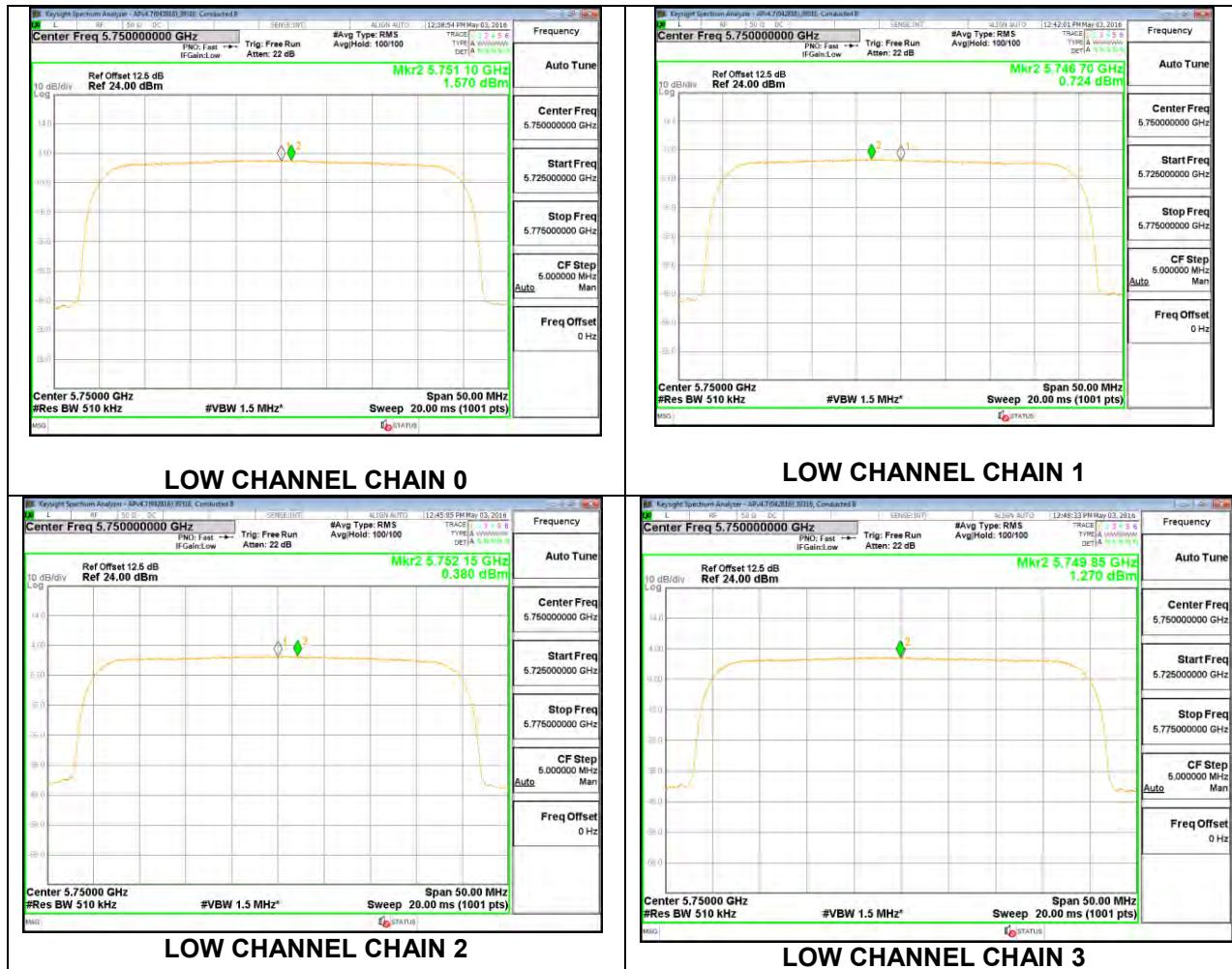
MID CHANNEL OUTPUT POWER



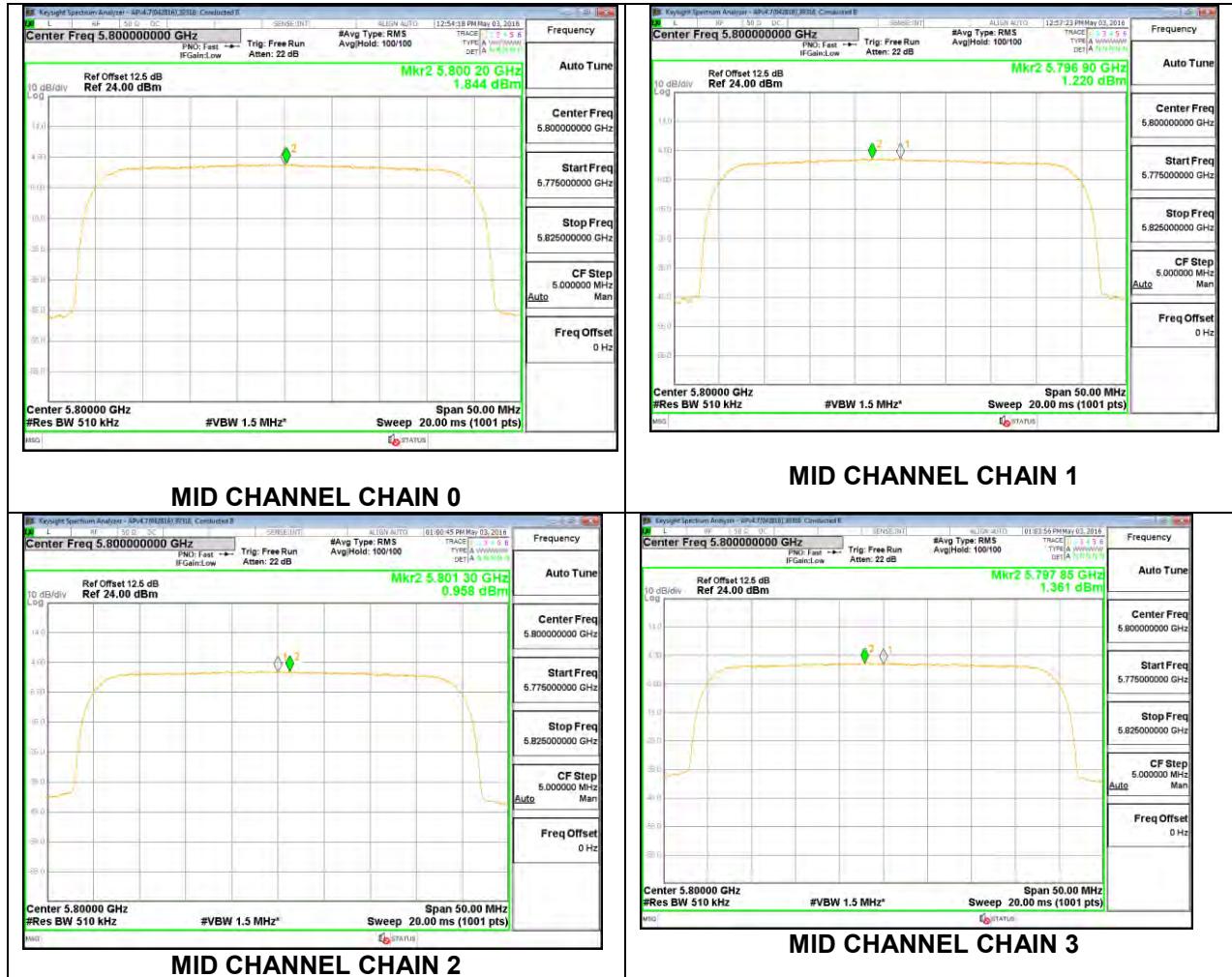
HIGH CHANNEL OUTPUT POWER



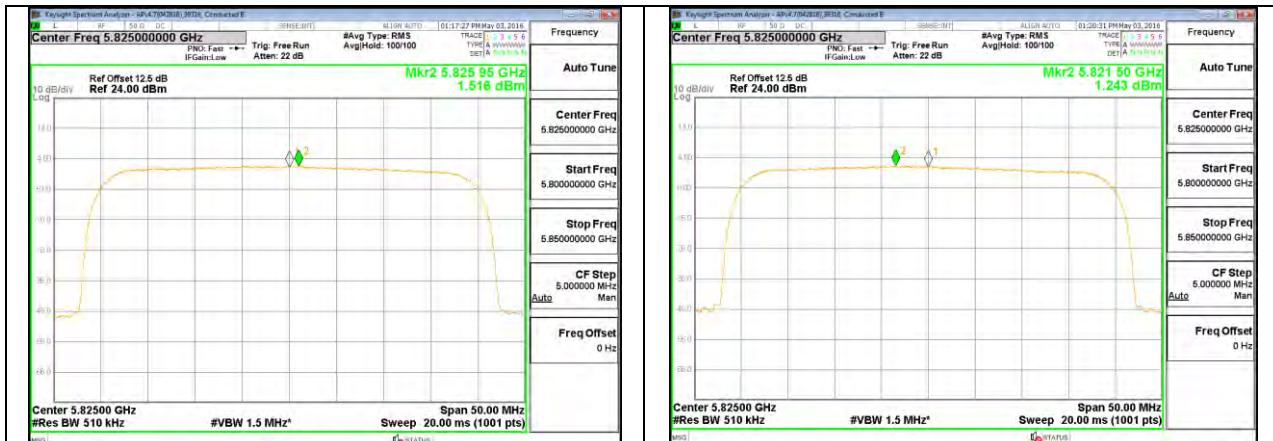
LOW CHANNEL PSD



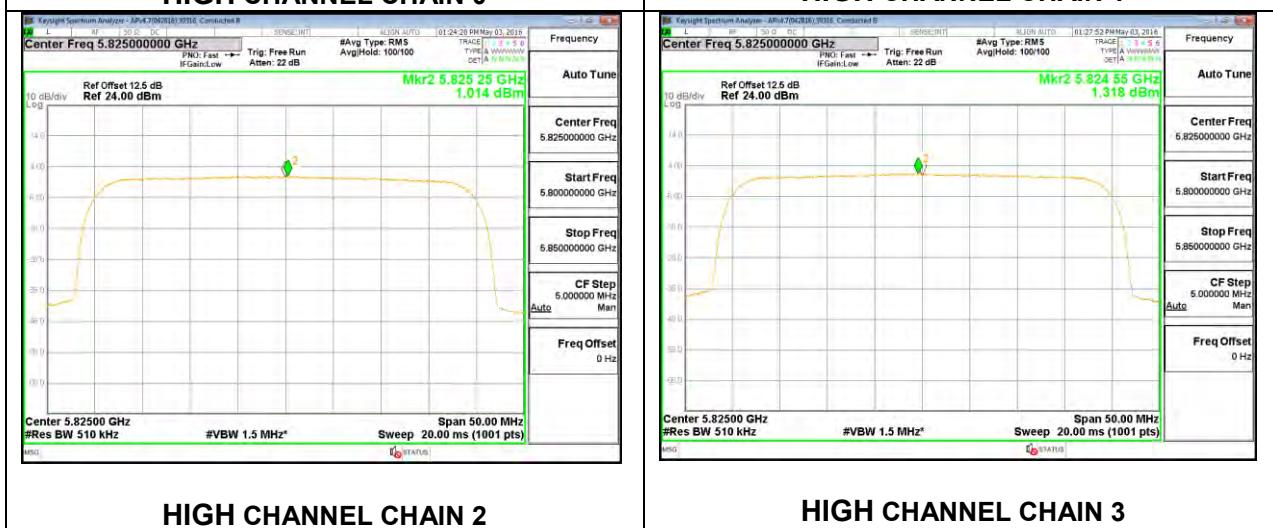
MID CHANNEL PSD



HIGH CHANNEL PSD



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 2

HIGH CHANNEL CHAIN 1

HIGH CHANNEL CHAIN 3

4.4. Out-of-band Emissions

LIMITS

FCC §15.205 and §15.209

PART 15, SUBPART E

Radiated LIMIT:

(1) For transmitters operating in the 5.725-5.85 GHz band: All emissions 75MHz from the bandedge shall not exceed an e.i.r.p. of -27dBm/MHz. For frequencies between 75 – 25MHz from the bandedge shall not exceed an e.i.r.p. linear limit of -27dBm/MHz to 10dBm/MHz. For frequencies between 25 – 5 MHz from the band edge shall not exceed an e.i.r.p. linear limit of 10dBm/MHz to 15.6dBm/MHz. For frequencies between 5MHz and the bandedge shall not exceed an e.i.r.p. linear limit of 15.6dBm/MHz to the band edge.

Procedure

KDB 789033 D02 General UNII Test Procedures New Rules v01, Section II, G5

Conducted measurements are being used to demonstrate compliance with the spurious limits in the restricted band. The plots include an offset to account for the EUT antenna gain and external attenuation between EUT antenna port and spectrum analyzer.

There are a total of four antenna chains; two horizontal antennas (chains 0 and 2) and two vertical antennas (chains 1 and 3). As two antennas chains (Horizontal Pol.) feed cross polarized with respect to two other antennas(Vertical Pol.), the two sets of chains are treated independently, and thus the emissions do not need to be summed for all four chains. However, there is a summation for the two horizontal antennas and two vertical chains separately.

The summation method is noted as below:

KDB 662911 D01 Multiple Transmitter Output v02r01

Section E(3)(a)(i) Measure and sum the spectra across the outputs as described in section E2)a). Note that the summation must be performed in linear power units, or the equivalent. For example, if measurement units are microvolts or microvolts/meter, the values shall be squared before summing, and then a square root shall be applied to the sum in order to achieve the equivalent of summing in power units.

RESULTS

4.4.1. 10MHz BW 4Tx MODE IN THE 5.8 GHz BAND

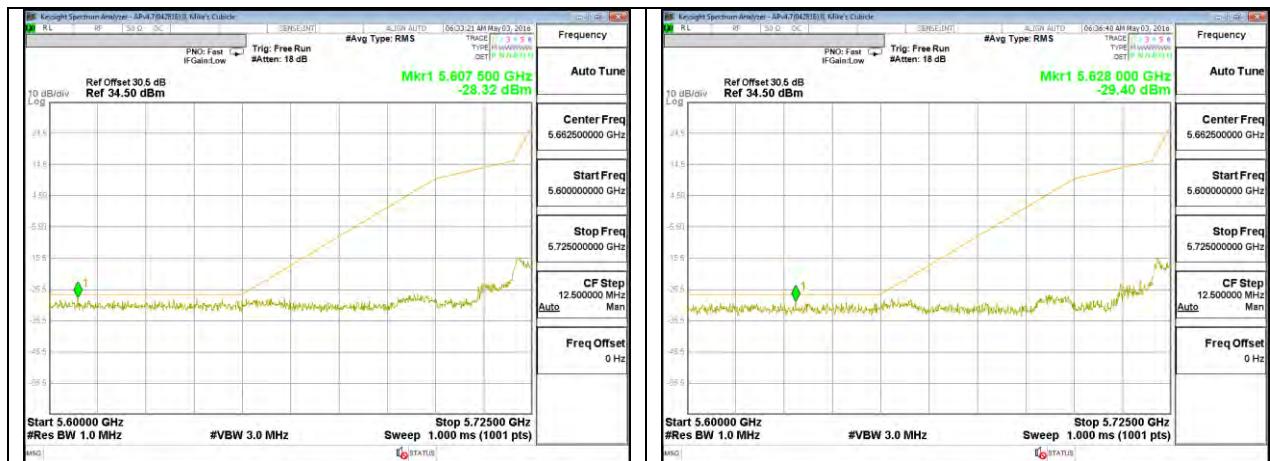
LOW CHANNEL BANDEDGE PEAK

Frequency Range (MHz)	BW (MHz)	Polarity	Power, Chain 0 (dBm)	Power, Chain 2 (dBm)	Corrected (dBm)	Limit	Margin
5735	10	Horizontal	-28.32	-31.63	-27.89	-27.00	-0.89
		Polarity	Power, Chain 1 (dBm)	Power, Chain 3 (dBm)	Corrected (dBm)	Limit	Margin
		Vertical	-29.40	-31.88	-28.80	-27.00	-1.80

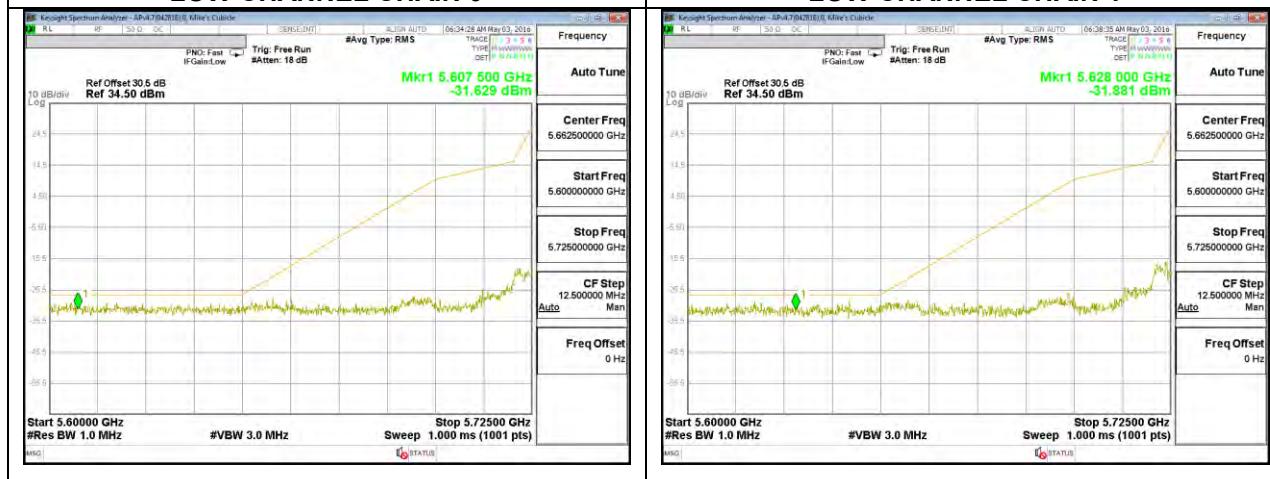
HIGH CHANNEL BANDEDGE PEAK

Frequency Range (MHz)	BW (MHz)	Polarity	Power, Chain 0 (dBm)	Power, Chain 2 (dBm)	Corrected (dBm)	Limit	Margin
5840	10	Horizontal	-32.04	-35.84	-31.69	-27.00	-4.69
		Polarity	Power, Chain 1 (dBm)	Power, Chain 3 (dBm)	Corrected (dBm)	Limit	Margin
		Vertical	-32.81	-35.72	-32.30	-27.00	-5.30

LOW CHANNEL BANDEDGE PEAK



LOW CHANNEL CHAIN 0

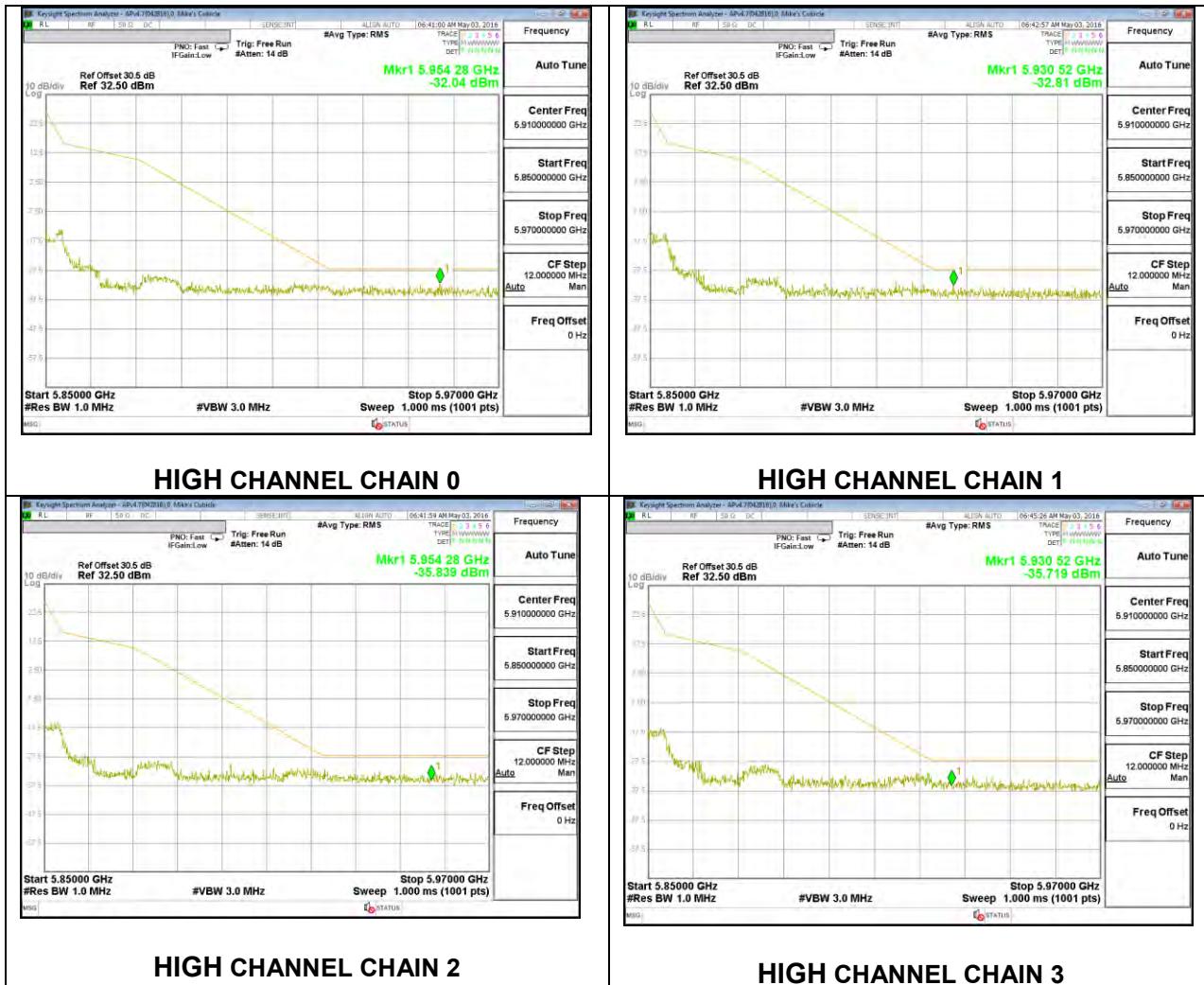


LOW CHANNEL CHAIN 2

LOW CHANNEL CHAIN 1

LOW CHANNEL CHAIN 3

HIGH CHANNEL BANDEDGE PEAK



4.4.2. 20MHz BW 4Tx MODE IN THE 5.8 GHz BAND

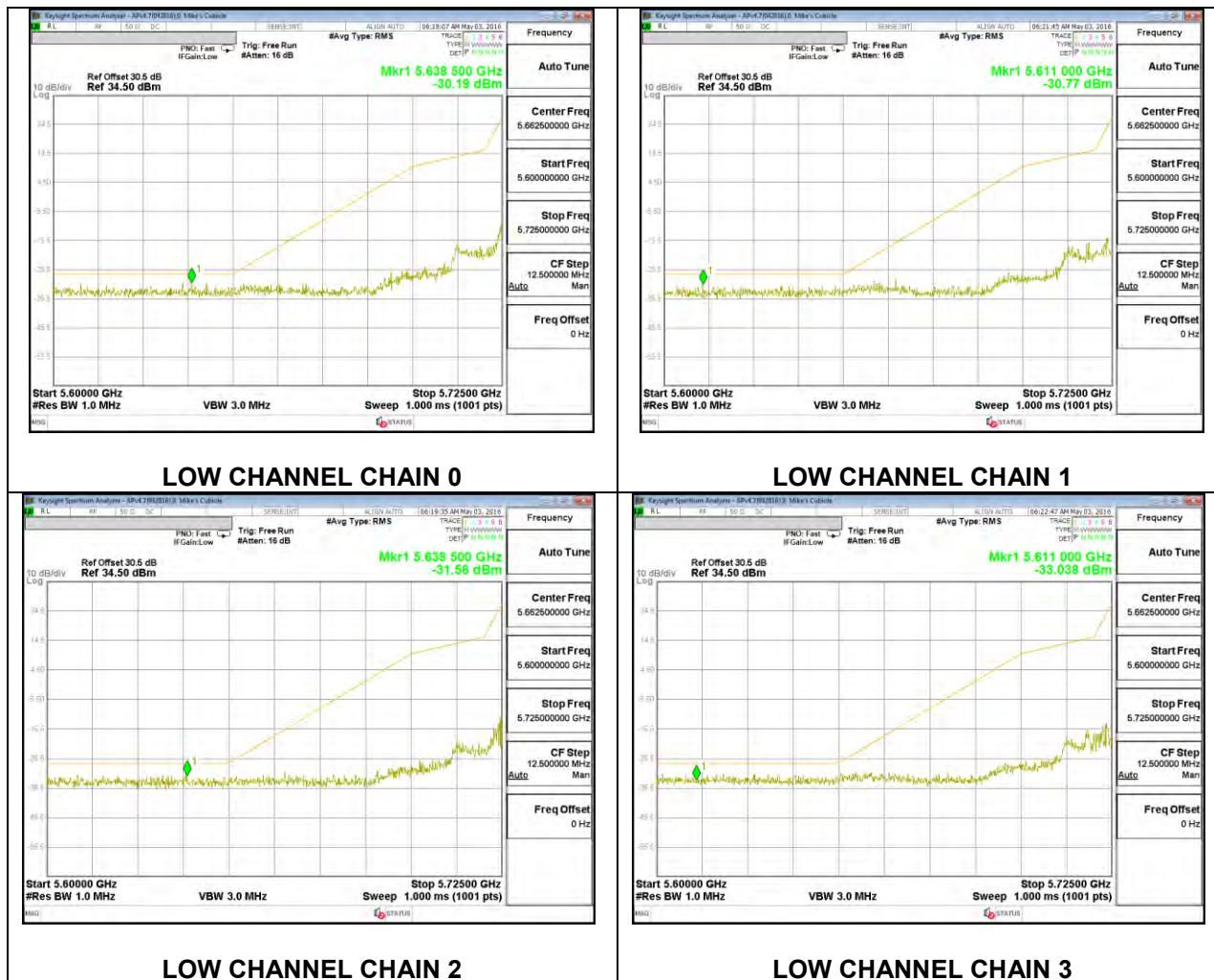
LOW CHANNEL BANDEDGE - PEAK

Frequency Range (MHz)	BW (MHz)	Polarity	Power, Chain 0 (dBm)	Power, Chain 2 (dBm)	Corrected (dBm)	Limit	Margin
5740	20	Horizontal	-30.19	-31.56	-29.26	-27.00	-2.26
		Polarity	Power, Chain 1 (dBm)	Power, Chain 3 (dBm)	Corrected (dBm)	Limit	Margin
		Vertical	-30.77	-33.04	-30.12	-27.00	-3.12

HIGH CHANNEL BANDEDGE- PEAK

Frequency Range (MHz)	BW (MHz)	Polarity	Power, Chain 0 (dBm)	Power, Chain 2 (dBm)	Corrected (dBm)	Limit	Margin
5835	20	Horizontal	-32.27	-32.62	-30.93	-27.00	-3.93
		Polarity	Power, Chain 1 (dBm)	Power, Chain 3 (dBm)	Corrected (dBm)	Limit	Margin
		Vertical	-32.00	-34.34	-31.36	-27.00	-4.36

LOW CHANNEL BANDEDGE PEAK



HIGH CHANNEL BANDEDGE PEAK



4.4.3. 40MHz BW 4Tx MODE IN THE 5.8 GHz BAND

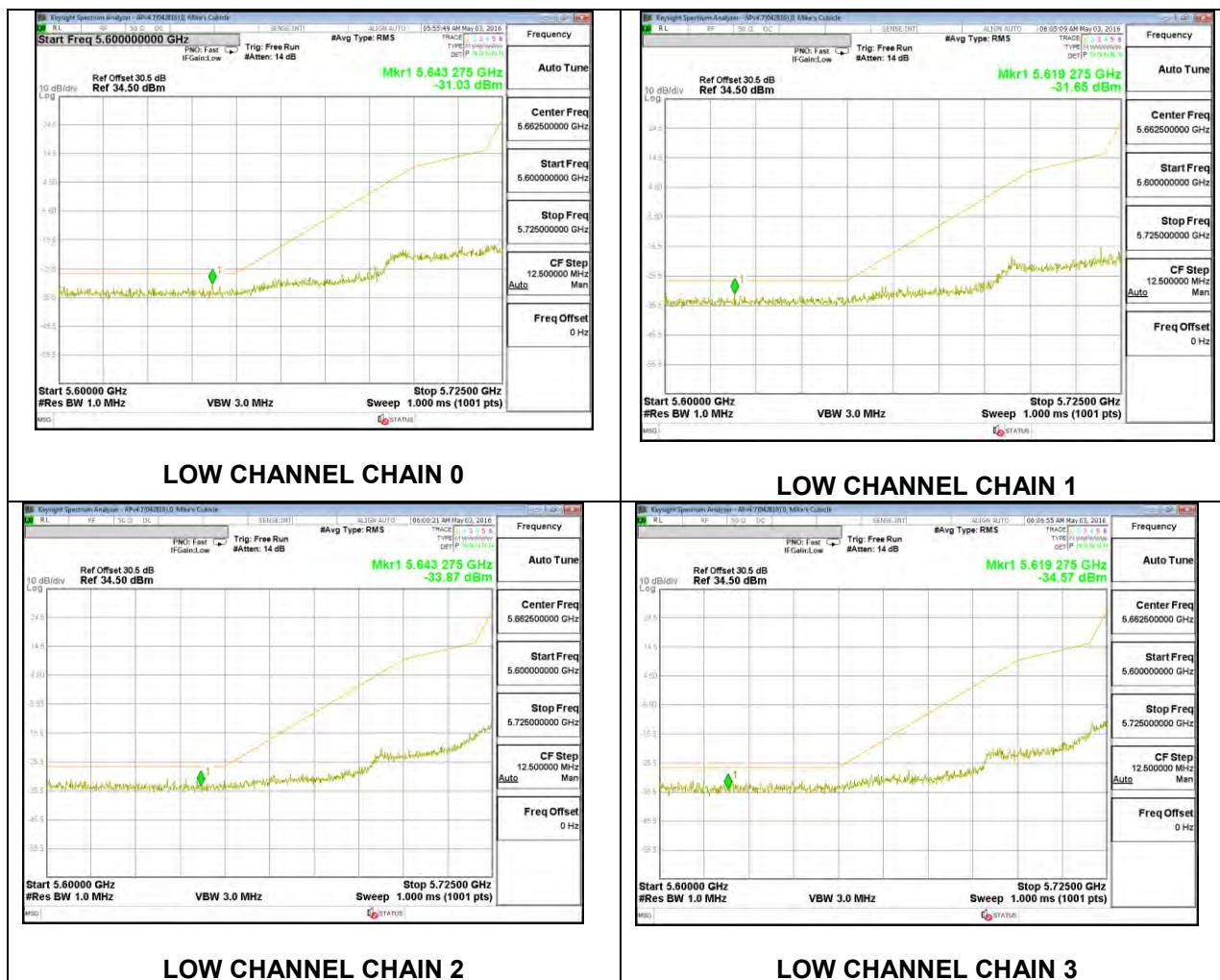
LOW CHANNEL BANDEDGE - PEAK

Frequency Range (MHz)	BW (MHz)	Polarity	Power, Chain 0 (dBm)	Power, Chain 2 (dBm)	Corrected (dBm)	Limit	Margin
5750	40	Horizontal	-31.03	-33.87	-30.51	-27.00	-3.51
		Polarity	Power, Chain 1 (dBm)	Power, Chain 3 (dBm)	Corrected (dBm)	Limit	Margin
		Vertical	-31.65	-34.57	-31.15	-27.00	-4.15

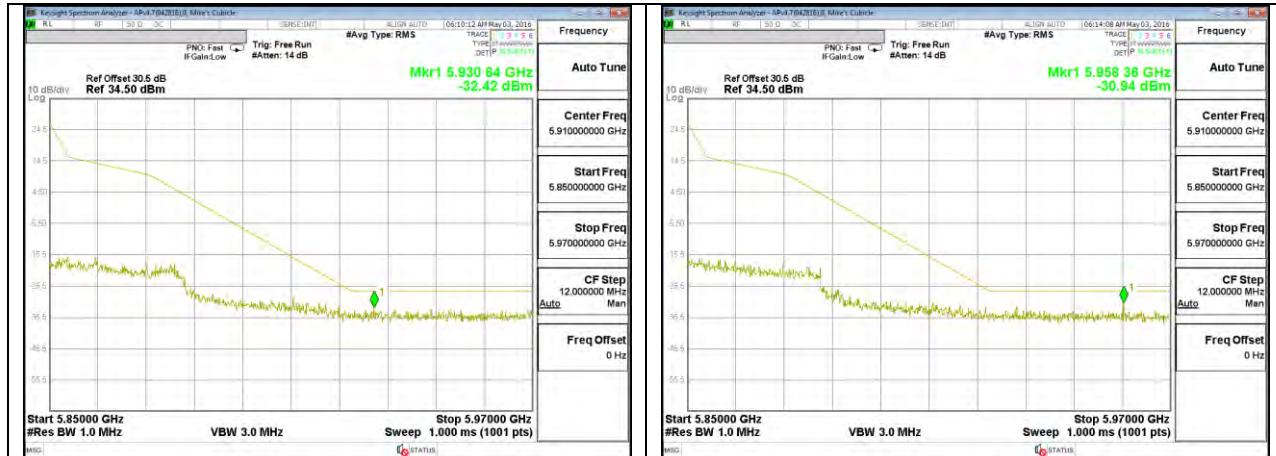
HIGH CHANNEL BANDEDGE - PEAK

Frequency Range (MHz)	BW (MHz)	Polarity	Power, Chain 0 (dBm)	Power, Chain 2 (dBm)	Corrected (dBm)	Limit	Margin
5825	40	Horizontal	-32.42	-35.21	-31.89	-27.00	-4.89
		Polarity	Power, Chain 1 (dBm)	Power, Chain 3 (dBm)	Corrected (dBm)	Limit	Margin
		Vertical	-30.94	-34.45	-30.55	-27.00	-3.55

LOW CHANNEL BANDEDGE PEAK



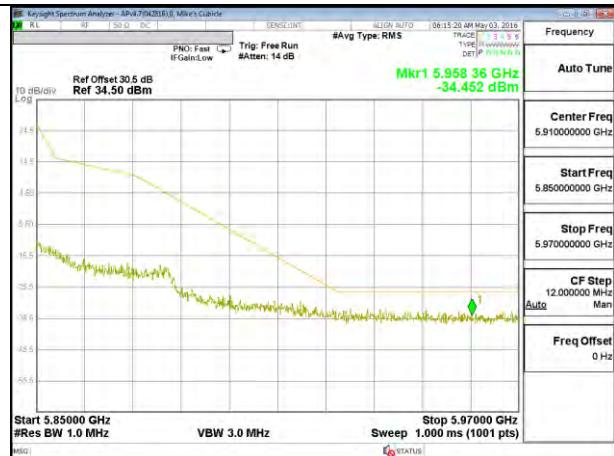
HIGH CHANNEL BANDEDGE PEAK



HIGH CHANNEL CHAIN 0



HIGH CHANNEL CHAIN 1



HIGH CHANNEL CHAIN 2



HIGH CHANNEL CHAIN 3

5. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

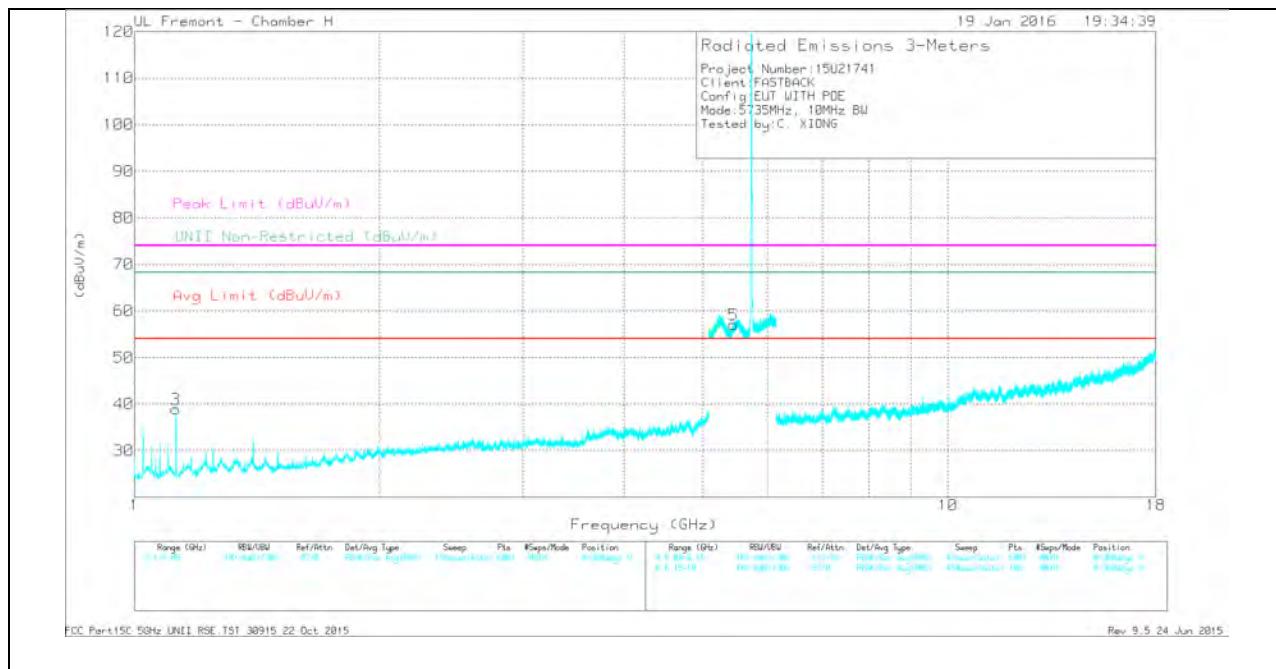
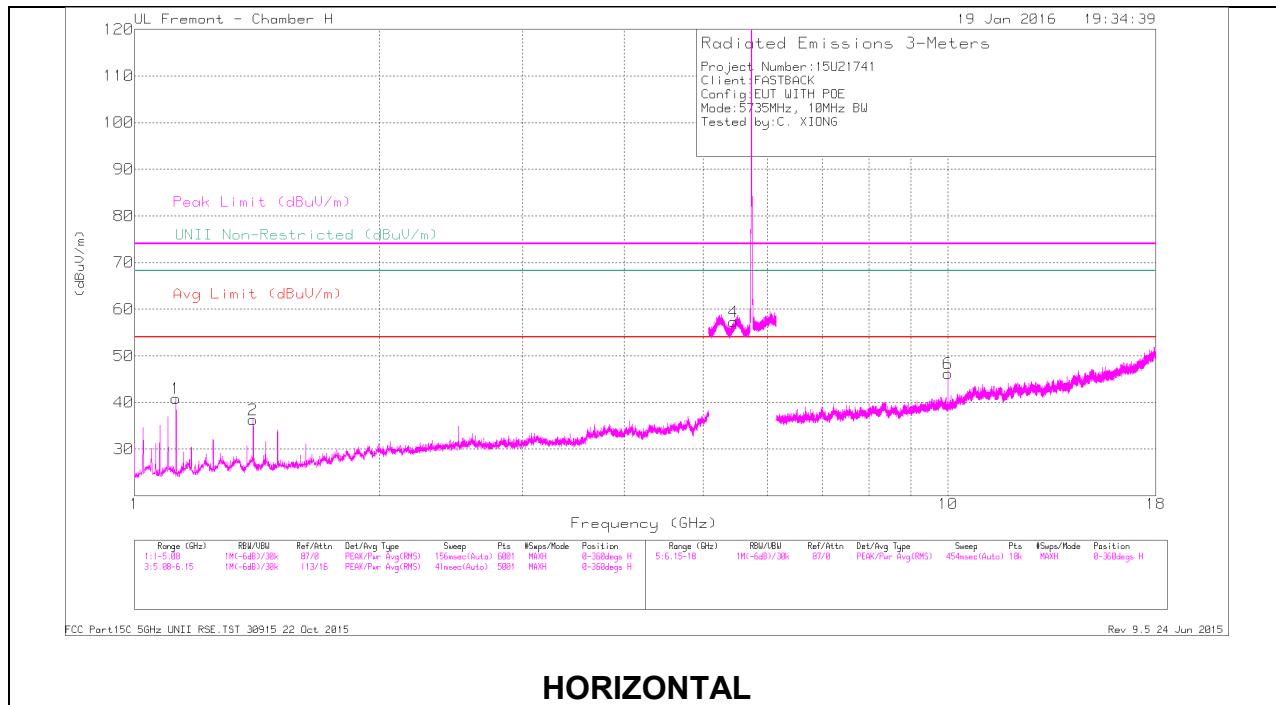
Radiated data below represents worst case scenario which is leveraged from the original 5.8GHz test report. Frequencies are the same but original data for power is slightly higher power. For reference see report number 15U21741-E2V3.

5.1. TRANSMITTER ABOVE 1 GHz

5.1.1. TX ABOVE 1 GHz 10MHz BW 4Tx MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



VERTICAL

LOW CHANNEL DATA

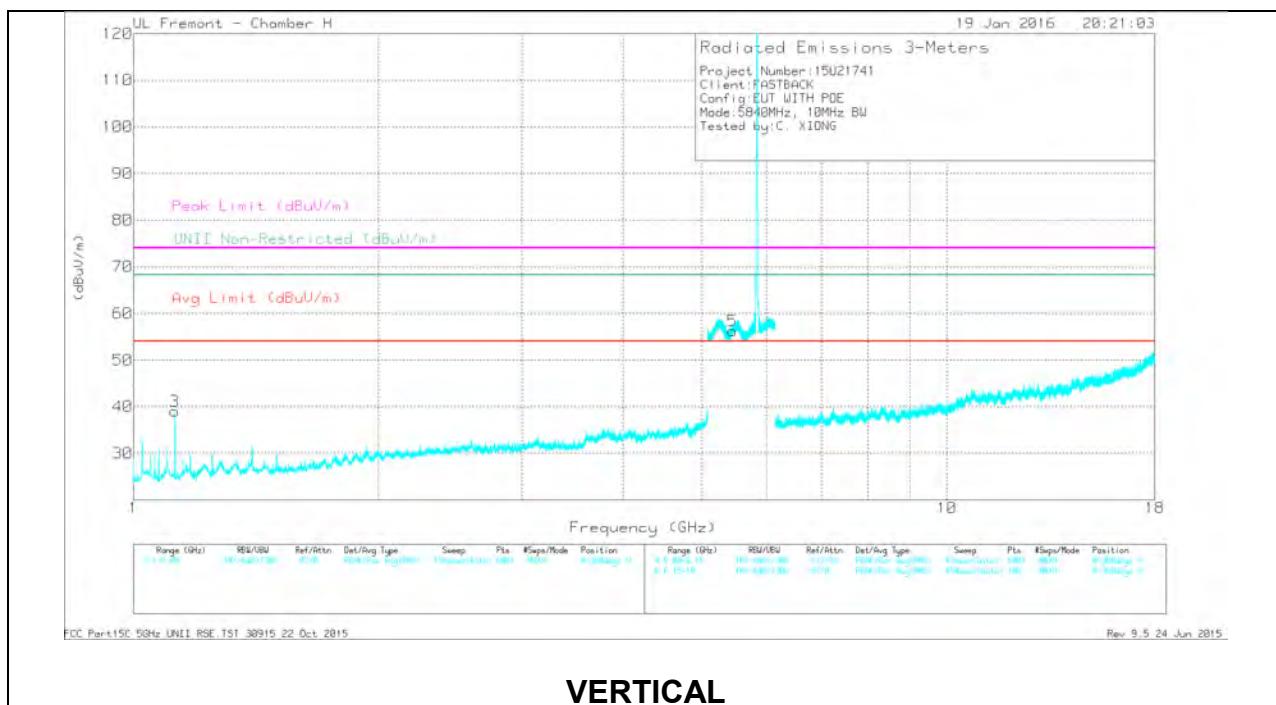
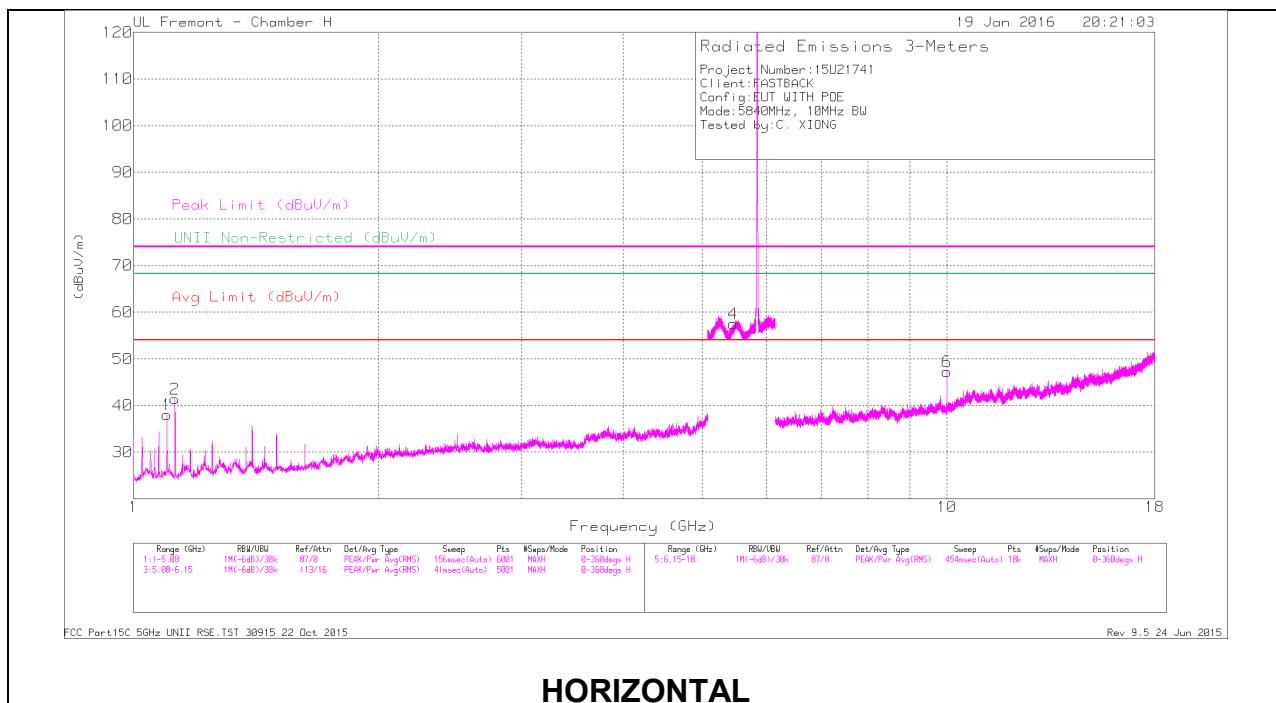
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNI Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.125	51.51	PK-U	27.4	-34.4	44.51	-	-	74	-29.49	-	-	32	138	H
	* 1.125	47.02	ADR	27.4	-34.4	40.02	54	-13.98	-	-	-	-	32	138	H
2	* 1.4	47.33	PK-U	28.5	-34	41.83	-	-	74	-32.17	-	-	92	103	H
	* 1.4	39.59	ADR	28.5	-34	34.09	54	-19.91	-	-	-	-	92	103	H
3	* 1.125	51.01	PK-U	27.4	-34.4	44.01	-	-	74	-29.99	-	-	57	212	V
	* 1.125	46.63	ADR	27.4	-34.4	39.63	54	-14.37	-	-	-	-	57	212	V
4	* 5.447	48.42	PK-U	35.4	-18.7	65.12	-	-	74	-8.88	-	-	173	200	H
	* 5.451	36.65	ADR	35.4	-18.7	53.35	54	-.65	-	-	-	-	173	200	H
5	* 5.448	48.82	PK-U	35.4	-18.7	65.52	-	-	74	-8.48	-	-	356	392	V
	* 5.448	36.61	ADR	35.4	-18.7	53.31	54	-.69	-	-	-	-	356	392	V
6	10	33.48	PK-U	36.9	-24.1	46.28	-	-	-	-	68.2	-21.92	143	231	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

HIGH CHANNEL RESULTS



HIGH CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	47.99	PK-U	27.1	-34.4	40.69	-	-	74	-33.31	-	-	26	102	H
	* 1.1	39.16	ADR	27.1	-34.4	31.86	54	-22.14	-	-	-	-	26	102	H
2	* 1.125	47.76	PK-U	27.4	-34.4	40.76	-	-	74	-33.24	-	-	106	105	H
	* 1.125	40.7	ADR	27.4	-34.4	33.7	54	-20.3	-	-	-	-	106	105	H
3	* 1.125	47.03	PK-U	27.4	-34.4	40.03	-	-	74	-33.97	-	-	51	222	V
	* 1.125	39.64	ADR	27.4	-34.4	32.64	54	-21.36	-	-	-	-	51	222	V
5	* 5.451	48.49	PK-U	35.4	-18.7	65.19	-	-	74	-8.81	-	-	205	106	V
	* 5.453	36.75	ADR	35.4	-18.7	53.45	54	-.55	-	-	-	-	205	106	V
4	5.461	40.9	PK-U	35.4	-18.7	57.6	-	-	-	-	68.2	-10.6	113	174	H
6	10	34.46	PK-U	36.9	-24.1	47.26	-	-	-	-	68.2	-20.94	147	227	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

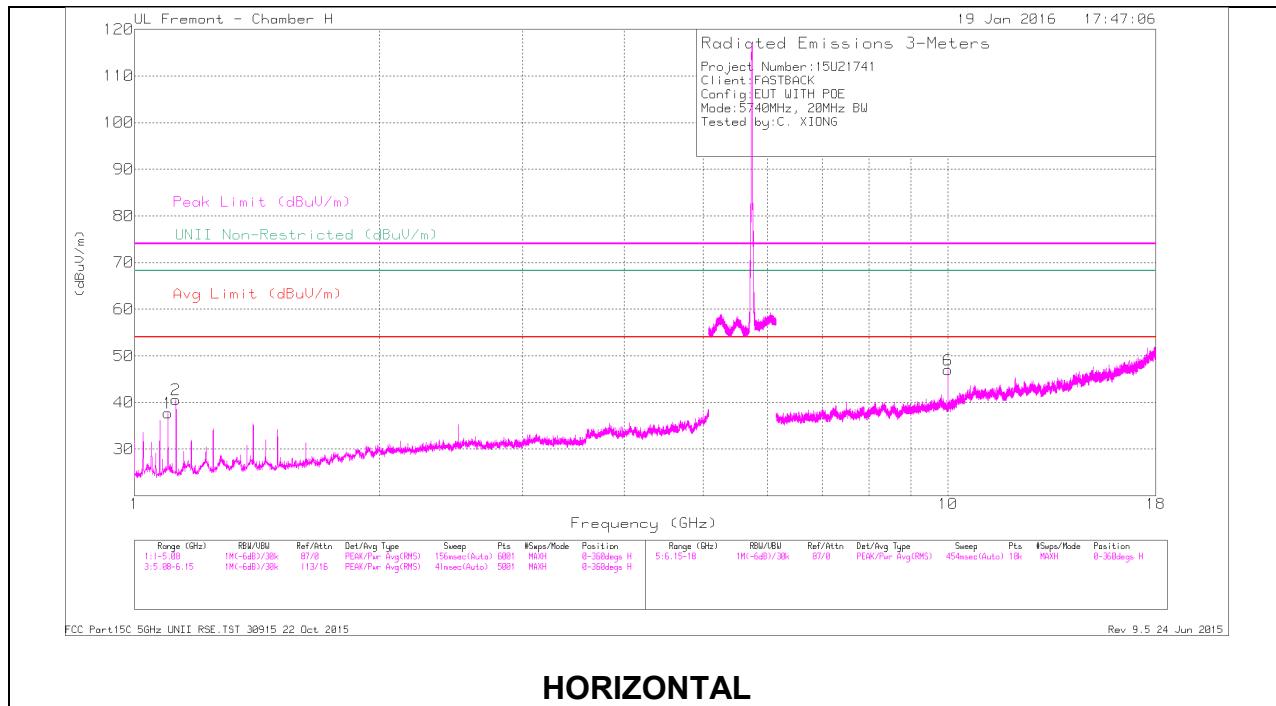
PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

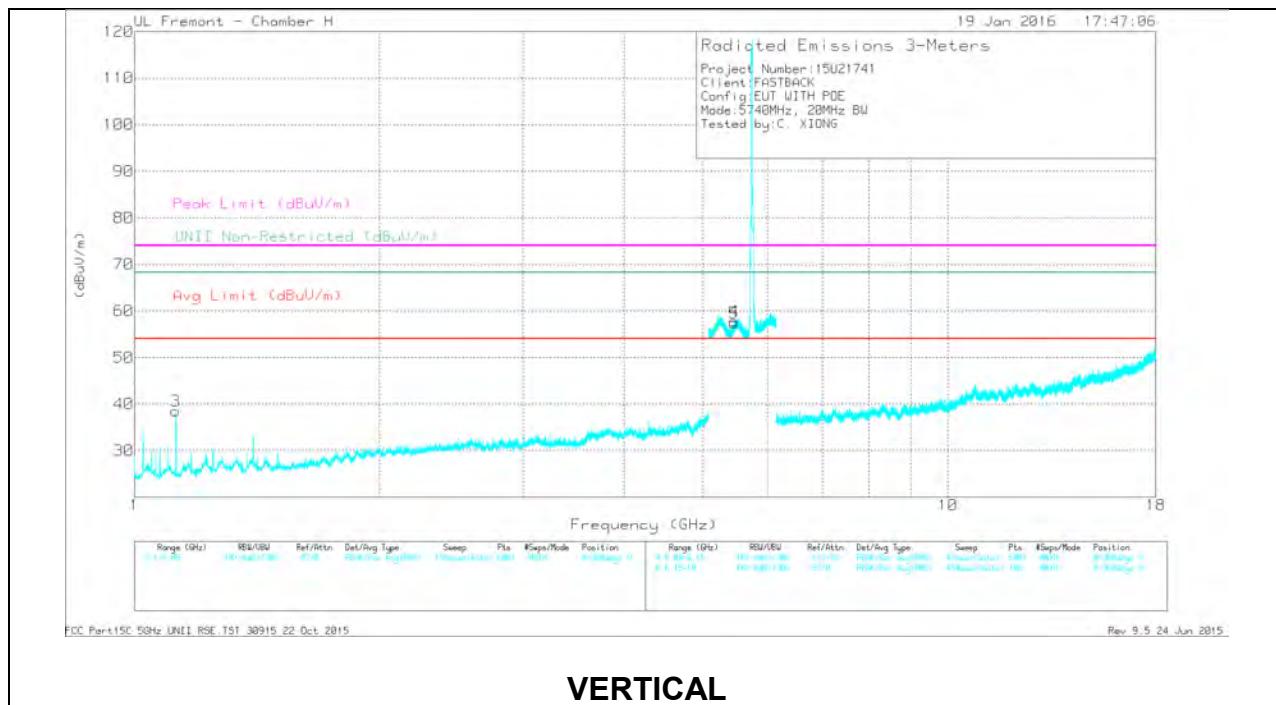
5.1.2. TX ABOVE 1 GHz 20MHz BW 4Tx MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

LOW CHANNEL DATA

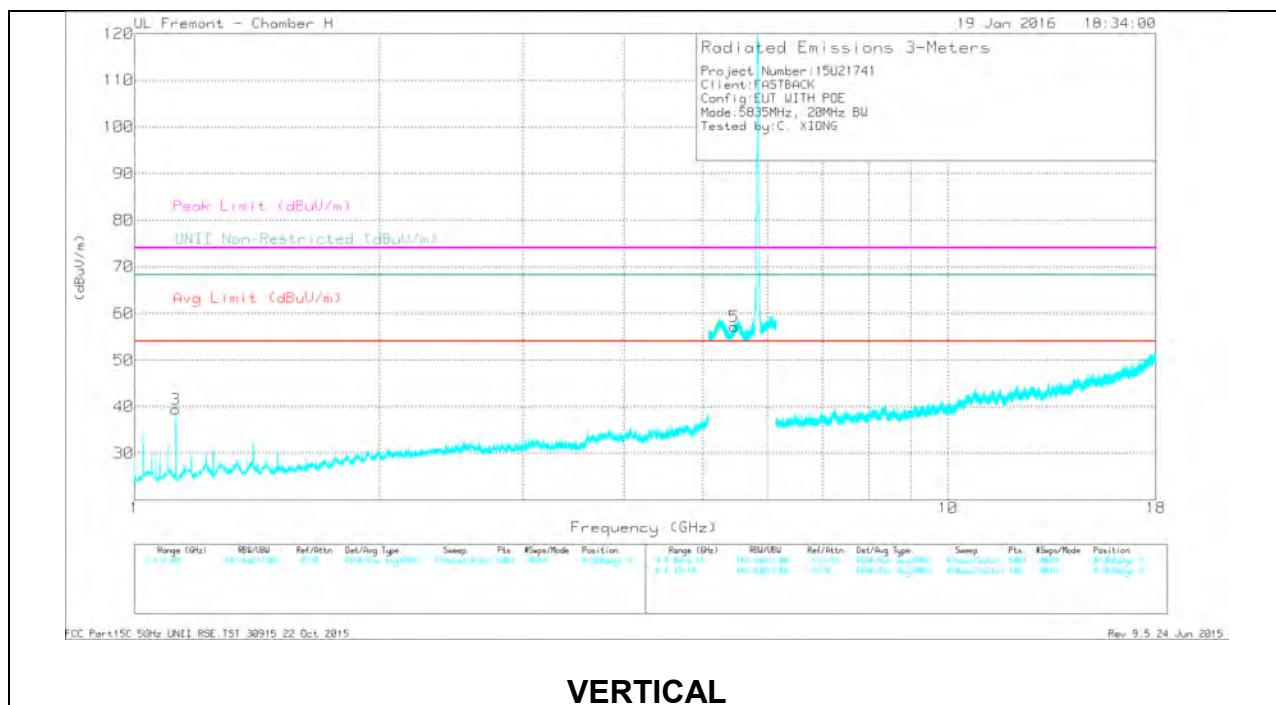
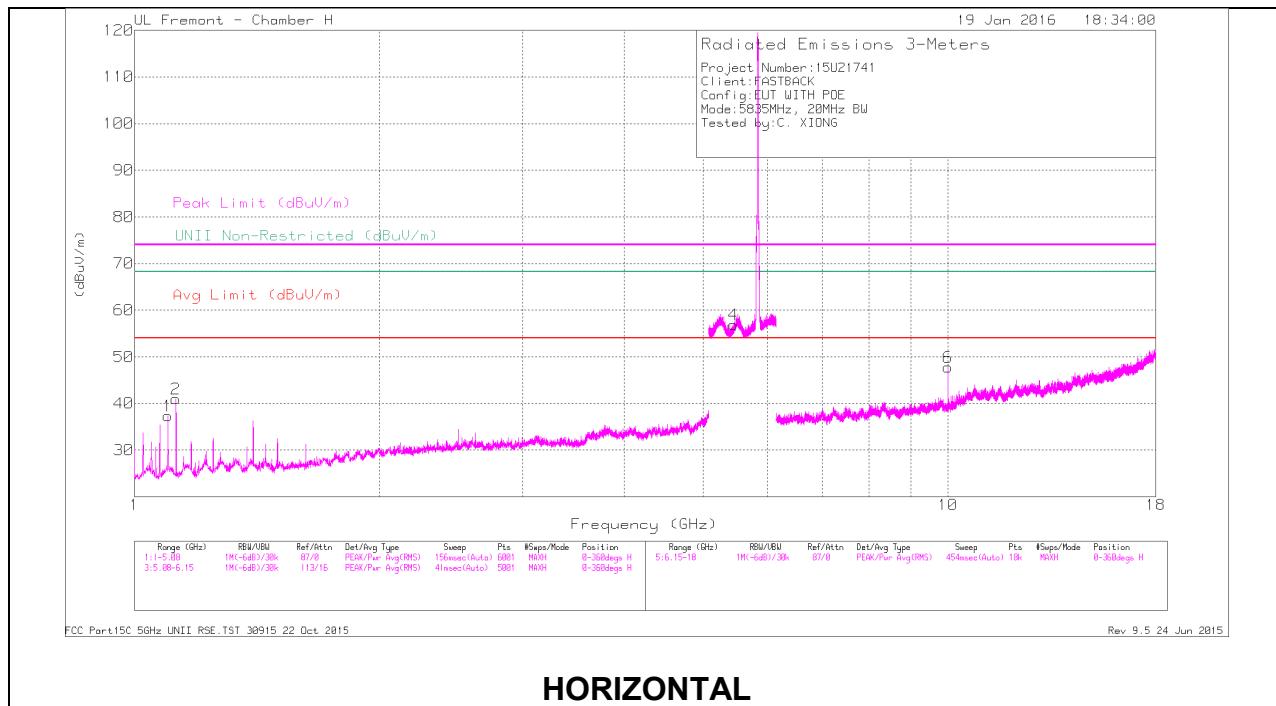
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	48.81	PK-U	27.1	-34.4	41.51	-	-	74	-32.49	-	-	26	101	H
	* 1.1	43.04	ADR	27.1	-34.4	35.74	54	-18.26	-	-	-	-	26	101	H
2	* 1.125	51.89	PK-U	27.4	-34.4	44.89	-	-	74	-29.11	-	-	37	138	H
	* 1.125	47.58	ADR	27.4	-34.4	40.58	54	-13.42	-	-	-	-	37	138	H
3	* 1.125	52.07	PK-U	27.4	-34.4	45.07	-	-	74	-28.93	-	-	56	218	V
	* 1.125	47.42	ADR	27.4	-34.4	40.42	54	-13.58	-	-	-	-	56	218	V
4	* 5.459	49.39	PK-U	35.4	-18.7	66.09	-	-	74	-7.91	-	-	355	127	V
	* 5.459	36.94	ADR	35.4	-18.7	53.64	54	-.36	-	-	-	-	355	127	V
5	* 5.457	48.78	PK-U	35.4	-18.7	65.48	-	-	74	-8.52	-	-	314	217	V
	* 5.457	36.85	ADR	35.4	-18.7	53.55	54	-.45	-	-	-	-	314	217	V
6	10	34.15	PK-U	36.9	-24.1	46.95	-	-	-	-	68.2	-21.25	144	229	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

HIGH CHANNEL RESULTS



HIGH CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	48.8	PK-U	27.1	-34.4	41.5	-	-	74	-32.5	-	-	27	100	H
	* 1.1	42.99	ADR	27.1	-34.4	35.69	54	-18.31	-	-	-	-	27	100	H
2	* 1.125	51.76	PK-U	27.4	-34.4	44.76	-	-	74	-29.24	-	-	33	141	H
	* 1.125	47.56	ADR	27.4	-34.4	40.56	54	-13.44	-	-	-	-	33	141	H
3	* 1.125	51.5	PK-U	27.4	-34.4	44.5	-	-	74	-29.5	-	-	54	216	V
	* 1.125	47.43	ADR	27.4	-34.4	40.43	54	-13.57	-	-	-	-	54	216	V
4	* 5.453	48.91	PK-U	35.4	-18.7	65.61	-	-	74	-8.39	-	-	54	216	H
	* 5.451	37.1	ADR	35.4	-18.7	53.8	54	-2	-	-	-	-	54	216	H
5	* 5.455	48.53	PK-U	35.4	-18.7	65.23	-	-	74	-8.77	-	-	33	307	V
	* 5.454	36.81	ADR	35.4	-18.7	53.51	54	-.49	-	-	-	-	33	307	V
6	10	34.98	PK-U	36.9	-24.1	47.78	-	-	-	-	68.2	-20.42	142	234	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

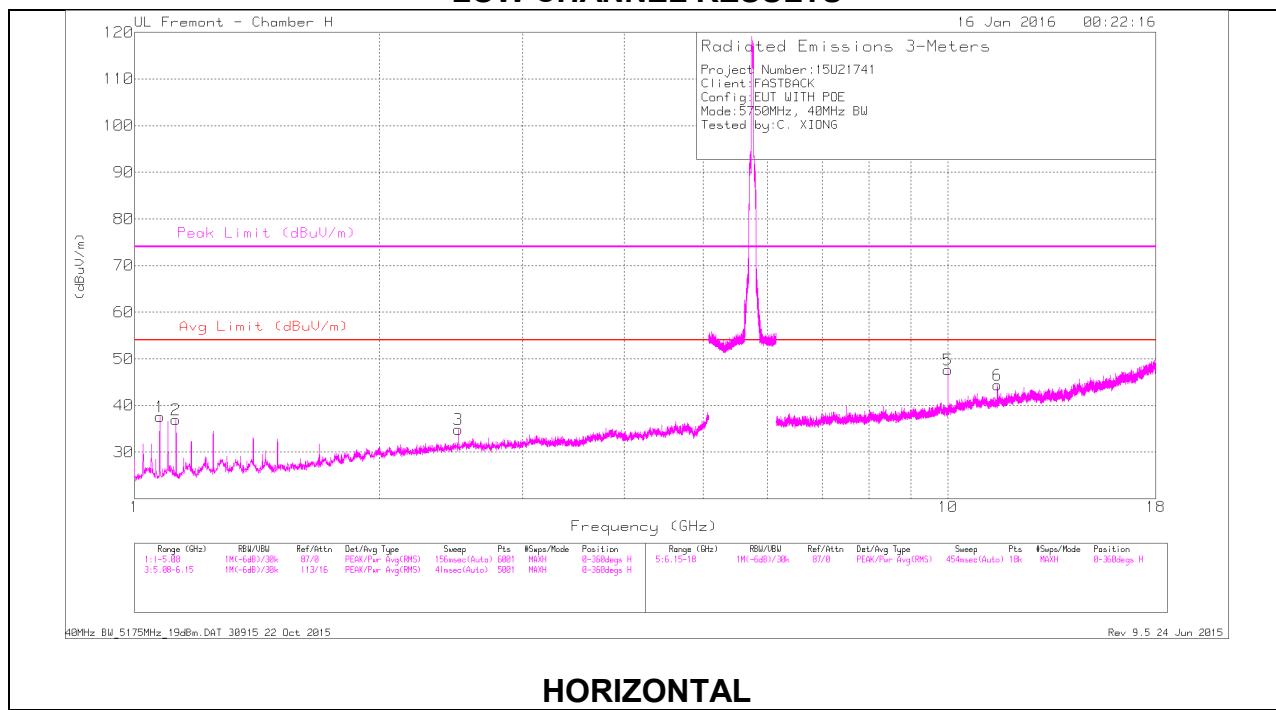
PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

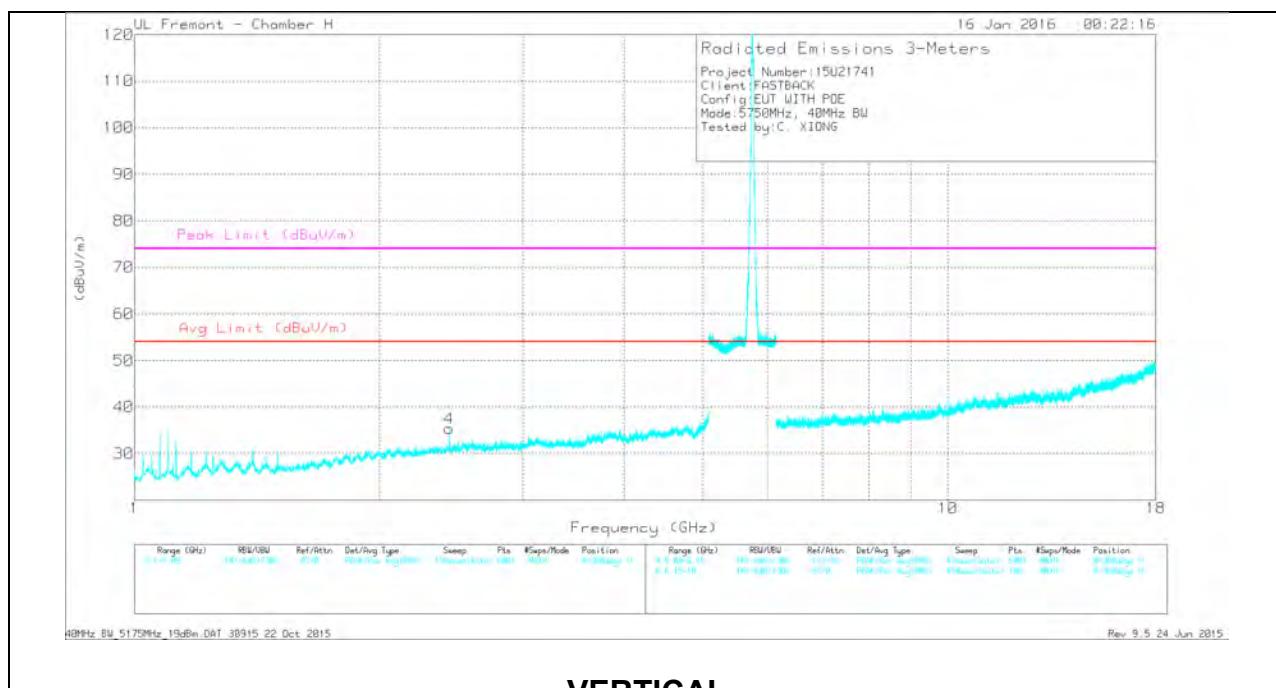
5.1.1. TX ABOVE 1 GHz 40MHz BW 4Tx MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

LOW CHANNEL DATA

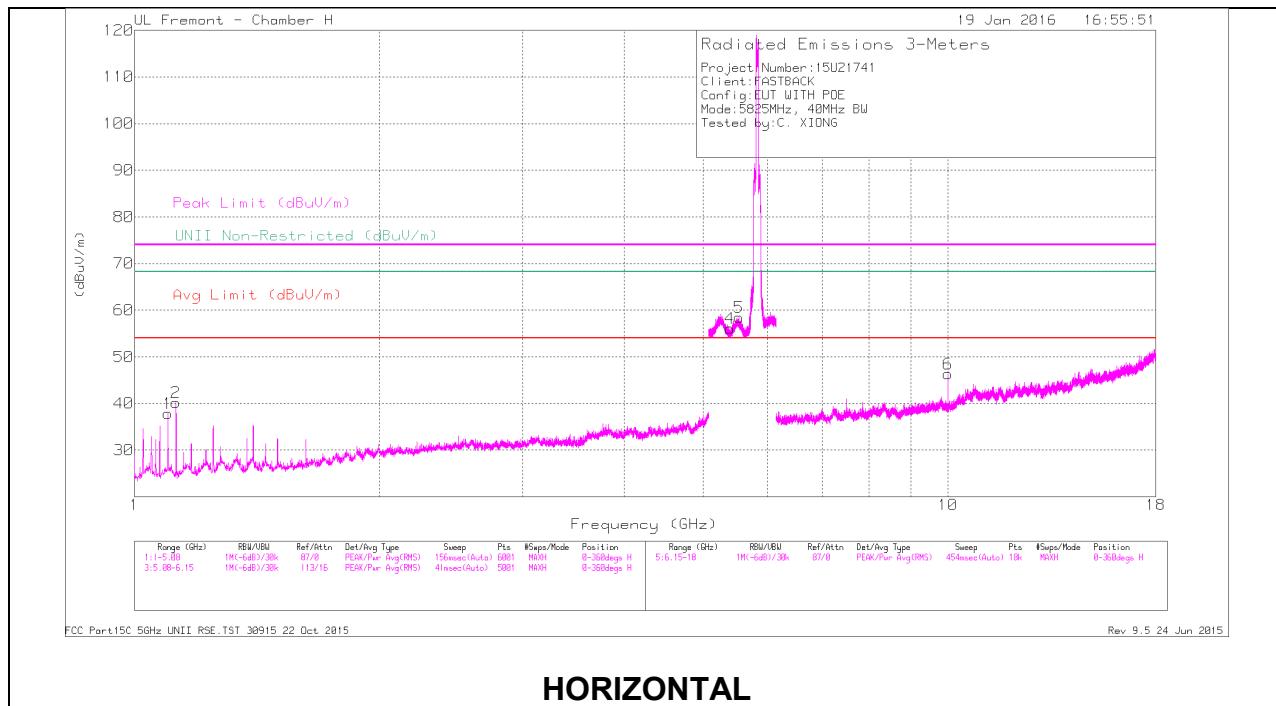
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.075	49.61	PK-U	27.1	-34.3	42.41	-	-	74	-31.59	-	-	95	100	H
	* 1.075	44.51	ADR	27.1	-34.3	37.31	54	-16.69	-	-	-	-	95	100	H
2	* 1.125	48.52	PK-U	27.4	-34.4	41.52	-	-	74	-32.48	-	-	101	223	H
	* 1.125	41.55	ADR	27.4	-34.4	34.55	54	-19.45	-	-	-	-	101	223	H
3	* 2.5	43.21	PK-U	32.5	-33.3	42.41	-	-	74	-31.59	-	-	34	113	H
	* 2.5	33.74	ADR	32.5	-33.3	32.94	54	-21.06	-	-	-	-	34	113	H
6	* 11.5	37.64	PK-U	38	-23.4	52.24	-	-	74	-21.76	-	-	33	194	H
	* 11.5	29.75	ADR	38	-23.4	44.35	54	-9.65	-	-	-	-	33	194	H
4	2.438	36.61	PK-U	32.2	-33.4	35.41	-	-	-	-	68.2	-32.79	78	184	V
5	10	34.82	PK-U	36.9	-24.1	47.62	-	-	-	-	68.2	-20.58	143	235	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

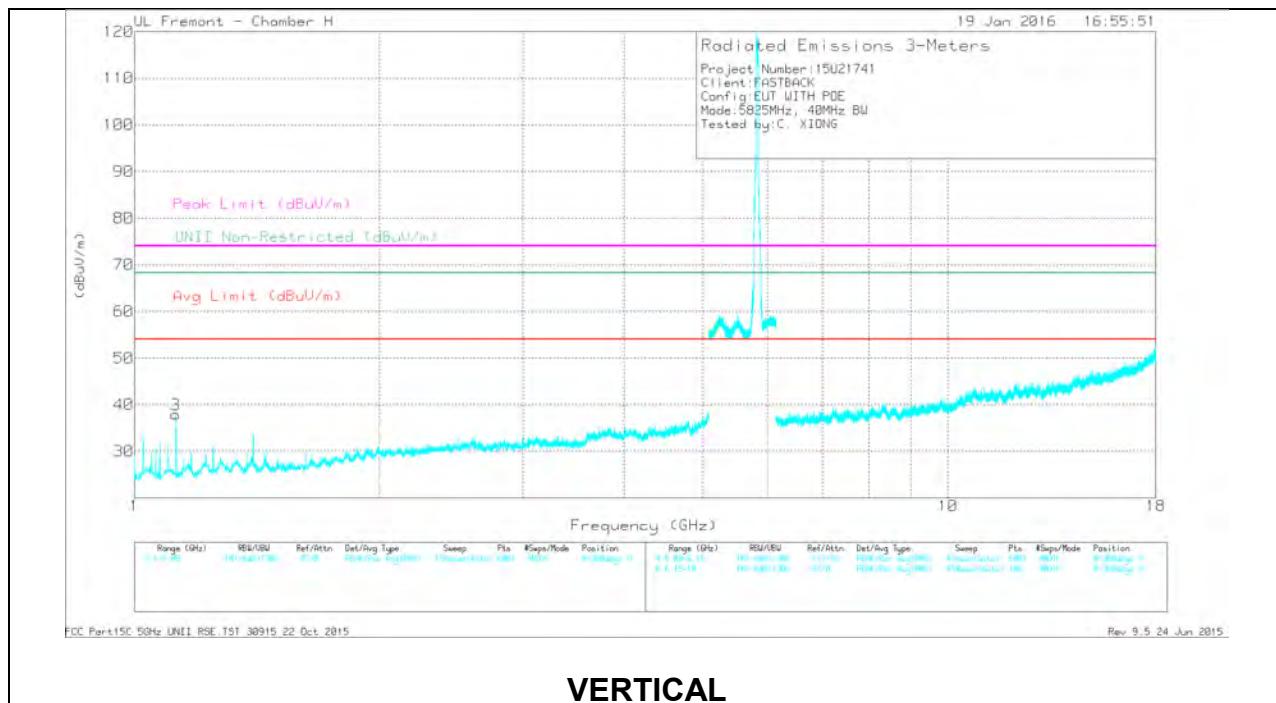
PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

HIGH CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Ft tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non-Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.1	48.91	PK-U	27.1	-34.4	41.61	-	-	74	-32.39	-	-	27	101	H
	* 1.1	43.08	ADR	27.1	-34.4	35.78	54	-18.22	-	-	-	-	27	101	H
2	* 1.125	52.33	PK-U	27.4	-34.4	45.33	-	-	74	-28.67	-	-	35	141	H
	* 1.125	47.87	ADR	27.4	-34.4	40.87	54	-13.13	-	-	-	-	35	141	H
3	* 1.125	51.63	PK-U	27.4	-34.4	44.63	-	-	74	-29.37	-	-	57	213	V
	* 1.125	47.13	ADR	27.4	-34.4	40.13	54	-13.87	-	-	-	-	57	213	V
4	* 5.393	47.78	PK-U	35.3	-18.6	64.48	-	-	74	-9.52	-	-	4	130	H
	* 5.392	35.69	ADR	35.3	-18.6	52.39	54	-1.61	-	-	-	-	4	130	H
5	5.531	41.84	PK-U	35.3	-18.7	58.44	-	-	-	-	68.2	-9.76	224	141	H
6	10	33.6	PK-U	36.9	-24.1	46.4	-	-	-	-	68.2	-21.8	141	233	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average