FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

INTELLIGENT BACKHAUL RADIO, DTS 5.8GHz Band

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

FCC ID: 2AAEH-107

REPORT NUMBER: 15U21741-E2V3

ISSUE DATE: February 11, 2016

Prepared for
CBF NETWORKS, INC., DBA FASTBACK NETWORKS
2460 N. FIRST STREET, SUITE 200
SAN JOSE, CA 95131, USA

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2/8/16	Initial Issue	F. de Anda
V2	2/9/16	Update- section 9.1	F. de Anda
V3	2/11/16	Update- section 7	F. 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

MODELS: IBR-1300-NA and IBR-1301-NA

SERIAL NUMBER: Proto 1

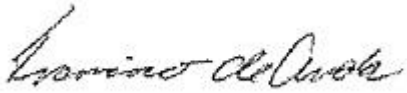
DATE TESTED: January 15, 2016 – February 2, 2016

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

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services 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.

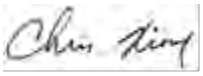
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section.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

Tested By:



CHRIS XIONG
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013.

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. 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

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 QPSK, QAM16, QAM64, QAM256 modulation. The EUT can be powered by Power over Ethernet (PoE) or AC.

5.2. 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

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

5.8 GHz BAND

Bandwidth (MHz)	Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz Band, 4TX				
10	5735 - 5840	FDD	25.68	369.83
20	5740 - 5835	FDD	25.75	375.84
40	5750 - 5825	FDD	25.90	389.05

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

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

5.5. 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.

5.6. 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.

All radiated testing was performed with the EUT in normal use orientation.

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.

5.7. 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	157000258ARC00	N/A

I/O CABLES

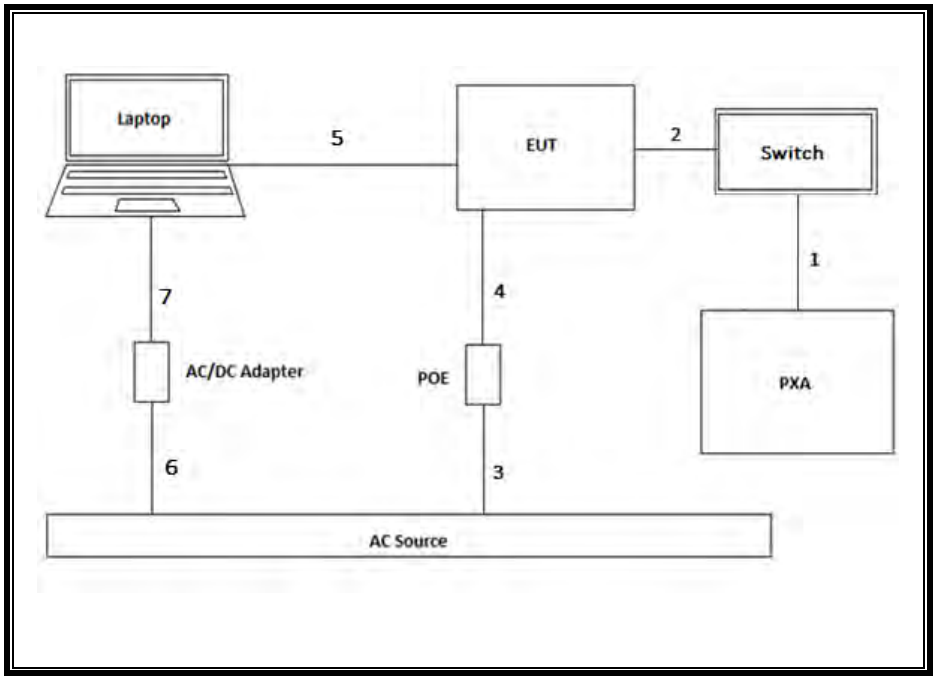
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	RF Input	1	SMA	Shielded	1	To Analyzer
2	Antenna	4	SMA	Shielded	1	EUT to switch
3	AC	1	3 Prong	Un-Shielded	1	N/A
4	POE/LAN	1	RJ45	Shielded	20	N/A
5	USB/SERIAL	1	USB/10 pins	Shielded	1.5	USB to Laptop/Serial to EUT
6	AC	1	3-Prong	Un-Shielded	0.5	N/A
7	DC	1	Barrel	Un-Shielded	1.5	N/A
8	AC	1	Barrel	Un-Shielded	1.5	To EUT

TEST SETUP

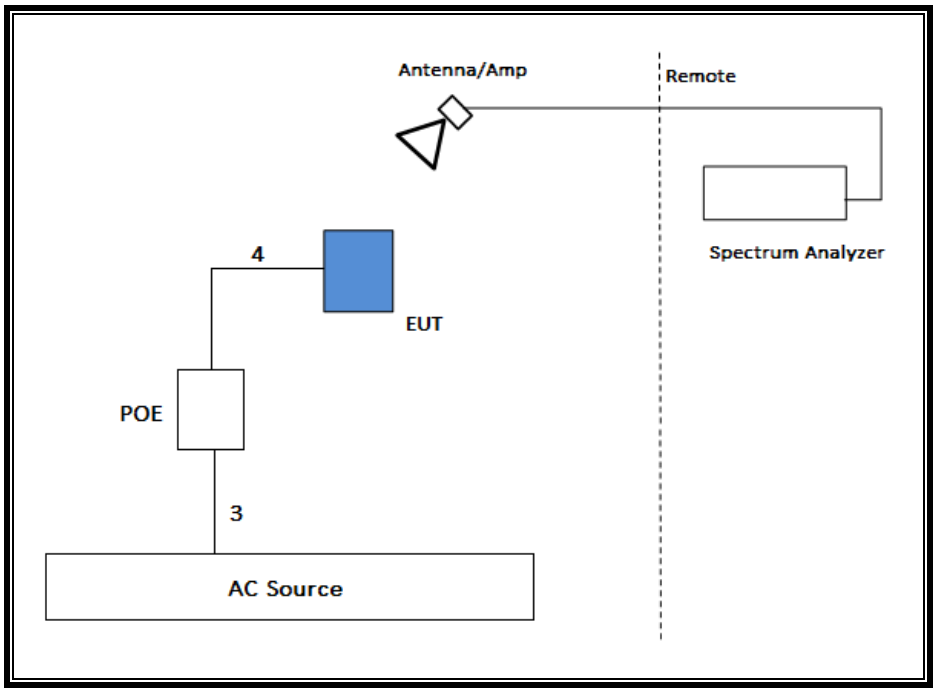
The EUT is a P-P outdoor radio used as a stand-alone device. Test software exercised the radio module.

SETUP DIAGRAM FOR TESTS

CONDUCTED

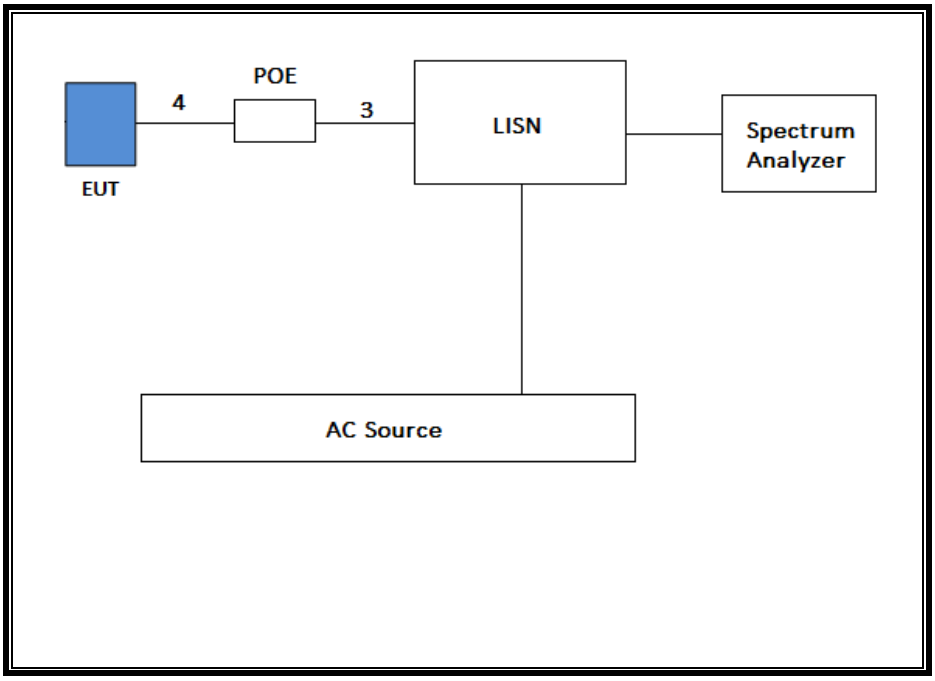


RADIATED

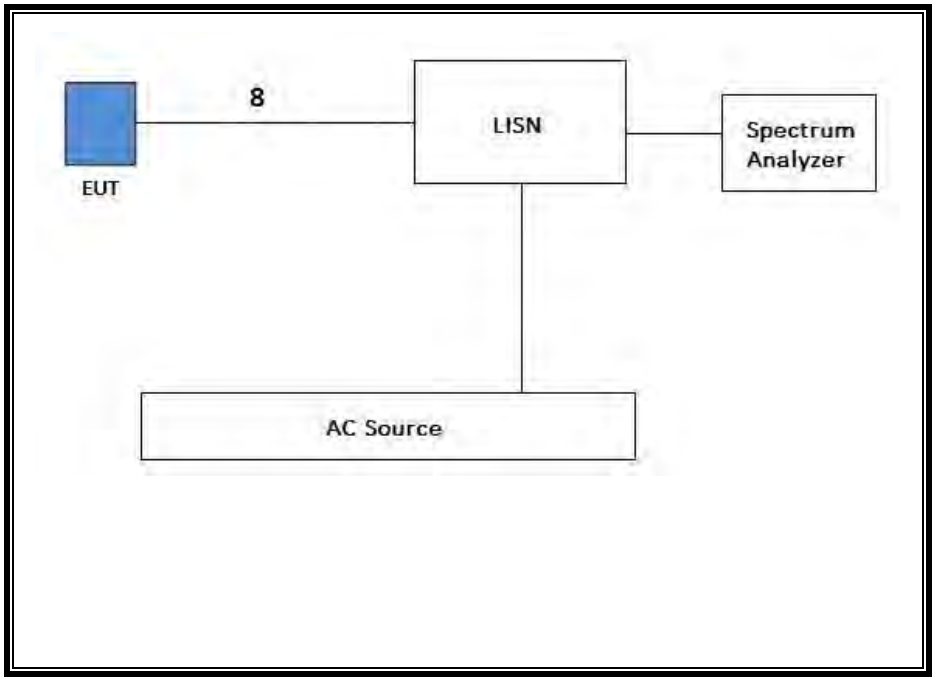


AC LINE CONDUCTED

Model IBR-1300-NA (PoE Option)



Model IBR-1301-NA (AC Option)



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 Due**
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
Conducted Software	UL	UL EMC	Ver 3.9.1, December 28, 2015	
Spectrum Analyzer 9kHz - 26.5GHz	Keysight	N9030A	PRE0123763	12/09/16
Antenna, Horn 1-18GHz	ETS Lindgren	3117	863	04/10/16
Antenna, Broadband Hybrid, 30MHz - 2000MHz	Sunol Science	JB3	900	04/10/16
Amplifier, 1-18GHz	Miteq	ASF42-00101800-25-S-42	495	10/22/16
Amplifier, 10KHz-1GHz, 32dB	Sonoma	310N	835	06/06/16
Amplifier, 1-8GHz, 35dB	Miteq	AMF-4D-01000800-30-29P	782	10/22/16
Spectrum Analyzer, 40GHz	Hewlett-Packard	8564E	106	08/14/16
Antenna, Horn 18-26GHz	ARA	MWH-1826	447	05/12/16
Antenna, Horn 40GHz	ARA	MWH-2640/B	90	07/28/16
Amplifier, 1-26GHz	Keysight	8449B	404	06/29/16
Amplifier, 26-40GHz	Miteq	NSP4000-SP2	88	04/07/16
EMI Test Receiver, 10Hz-7GHz	Rohde & Schwarz	ESR7	1436	12/19/16
LISN, Conducted Emissions CISPR-16	Fischer	FCC-LISN-50/250-25-2-01-CISPR16	1310	09/16/16
Switch, SP6T Coaxial Switch	Keysight	87106C	836	06/26/16

7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r04, Section 8.1.

99% BW: ANSI C63.10-2013, Section 6.9.3.

Output Power: KDB 558074 D01 v03r04, Section 9.2.2.3.

Power Spectral Density: KDB 558074 D01 v03r04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r04, Section 12.1.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r04, Section 12.2.

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 662911 D02 MIMO with Cross-Polarized Antennas v01

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

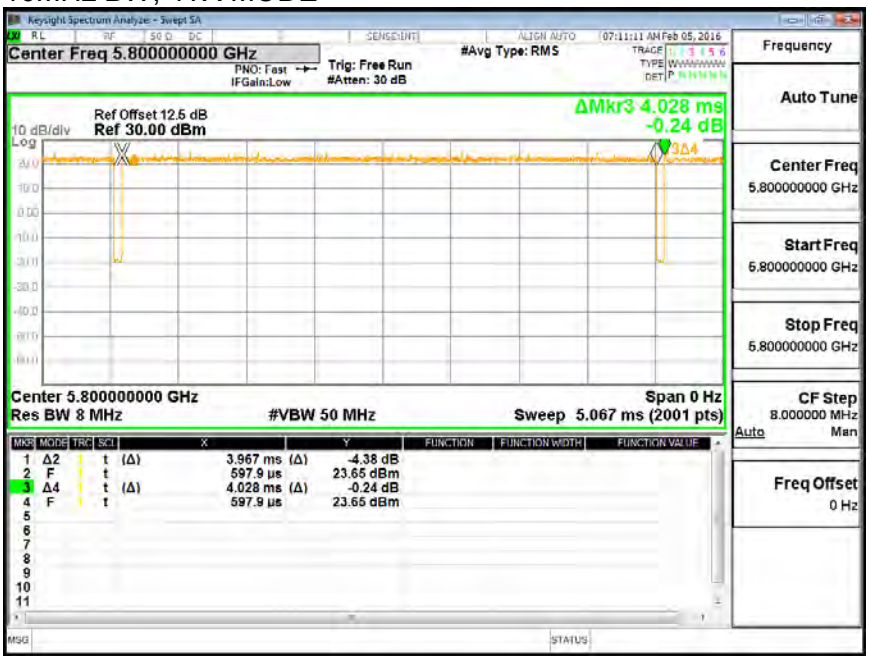
KDB 789033 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

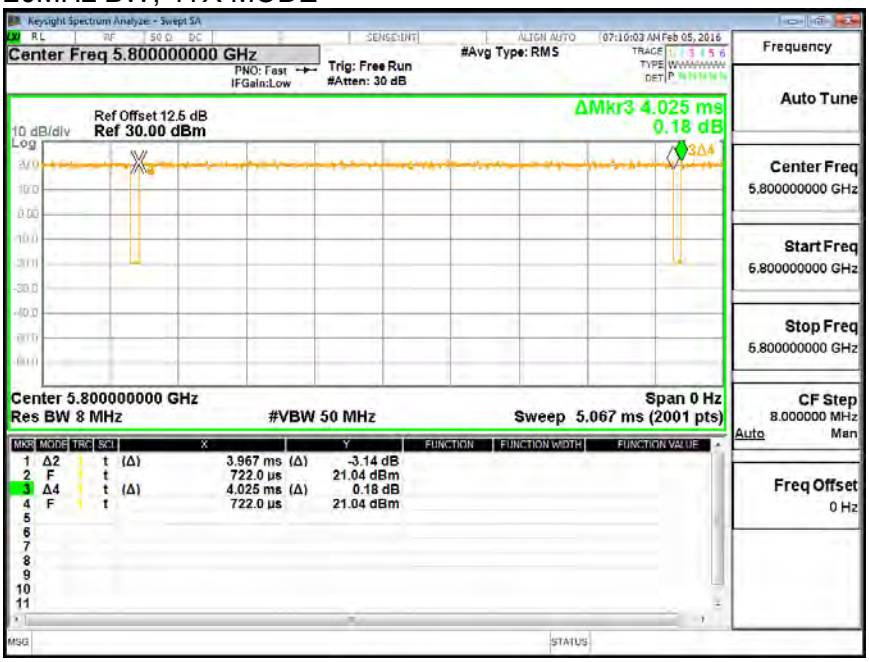
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
10MHz BW, 4TX	3.967	4.028	0.985	98.49%	0.00	0.010
20MHz BW, 4TX	3.967	4.025	0.986	98.56%	0.00	0.010
40MHz BW, 4TX	3.967	4.028	0.985	98.49%	0.00	0.010

DUTY CYCLE PLOTS

10MHz BW, 4TX MODE



20MHz BW, 4TX MODE



40MHz BW, 4TX MODE

8.2. 10MHz BW 4TX MODE IN THE 5.8 GHz BAND

8.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

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

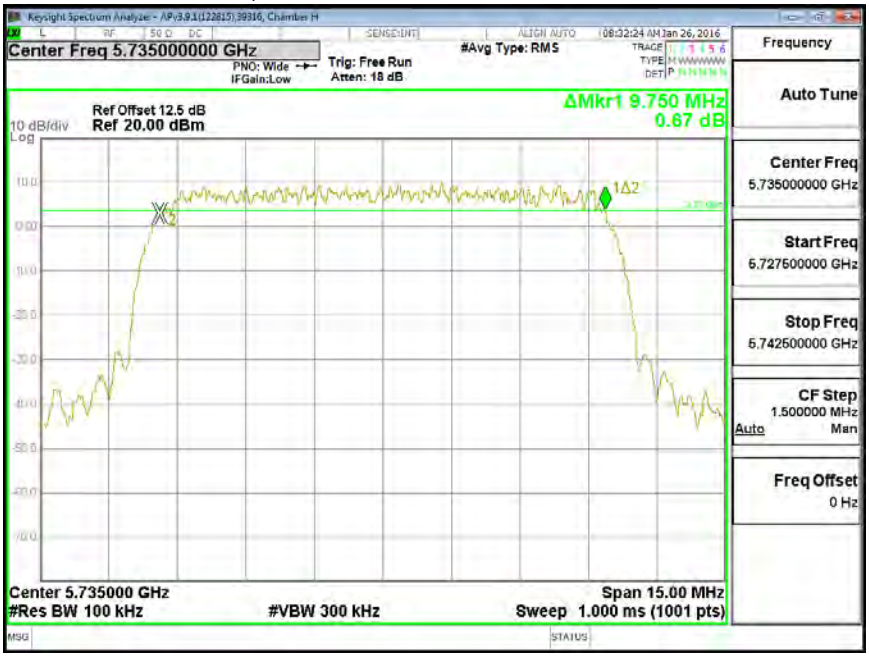
6 dB BANDWIDTH, Chain 0 LOW CH

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



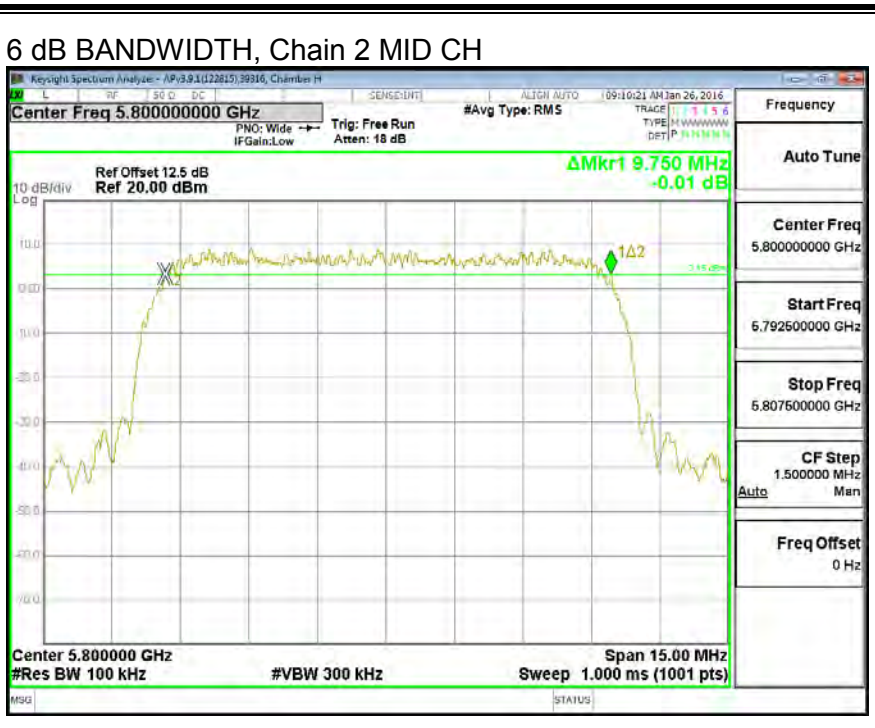
6 dB BANDWIDTH, Chain 1 MID CH

6 dB BANDWIDTH, Chain 1 HIGH CH

6 dB BANDWIDTH, Chain 2

6 dB BANDWIDTH, Chain 2 LOW CH

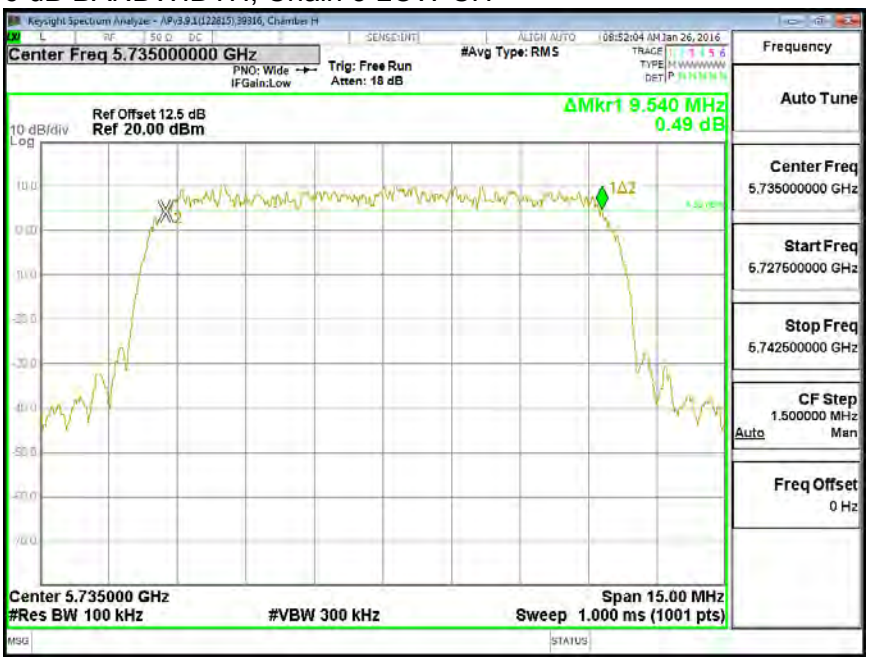
6 dB BANDWIDTH, Chain 2 MID CH



6 dB BANDWIDTH, Chain 2 HIGH CH

6 dB BANDWIDTH, Chain 3

6 dB BANDWIDTH, Chain 3 LOW CH



6 dB BANDWIDTH, Chain 3 MID CH

6 dB BANDWIDTH, Chain 3 HIGH CH

8.2.2. 99% BANDWIDTH

LIMITS

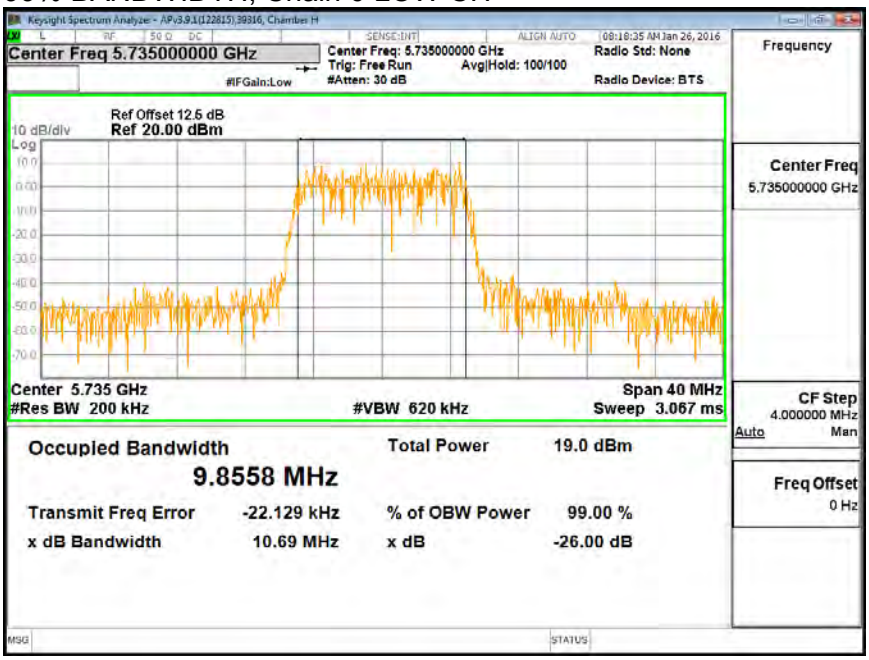
None; for reporting purposes only.

RESULTS

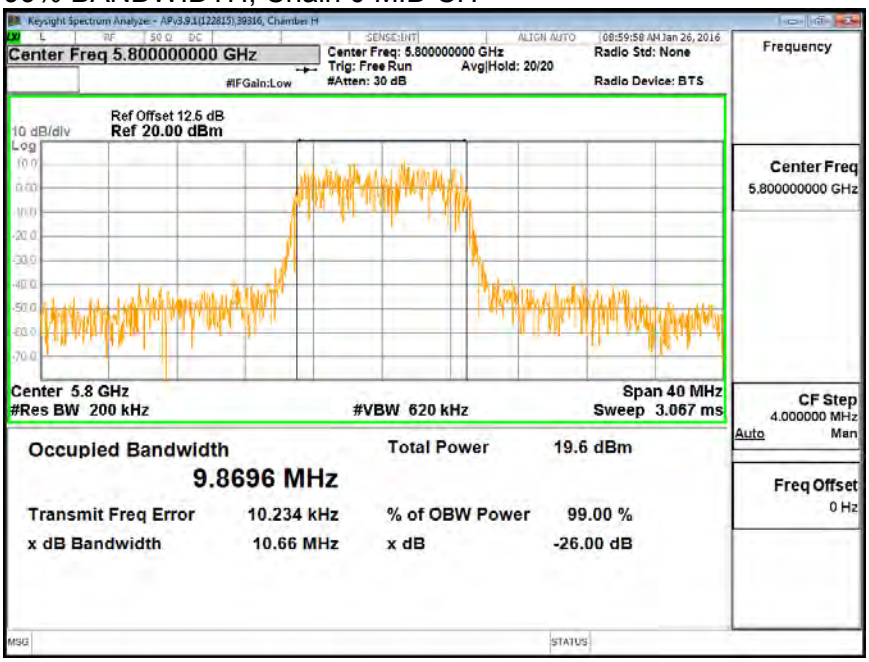
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)	99% BW Chain 3 (MHz)
Low	5735	9.8558	9.8923	10.0290	9.7410
Mid	5800	9.8696	9.8092	9.8120	10.0010
High	5840	9.8103	9.8239	9.9620	9.8496

99% BANDWIDTH, Chain 0

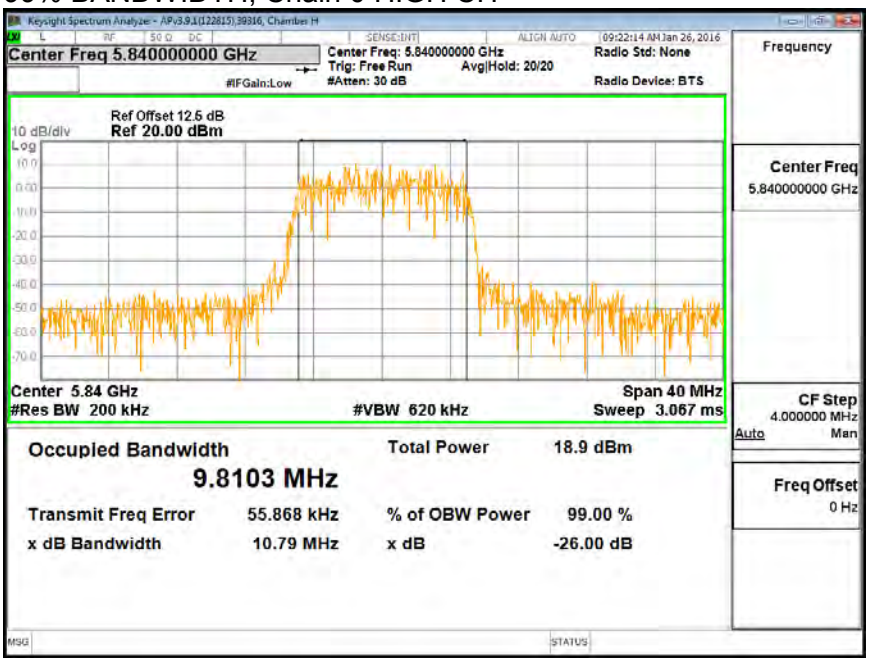
99% BANDWIDTH, Chain 0 LOW CH



99% BANDWIDTH, Chain 0 MID CH

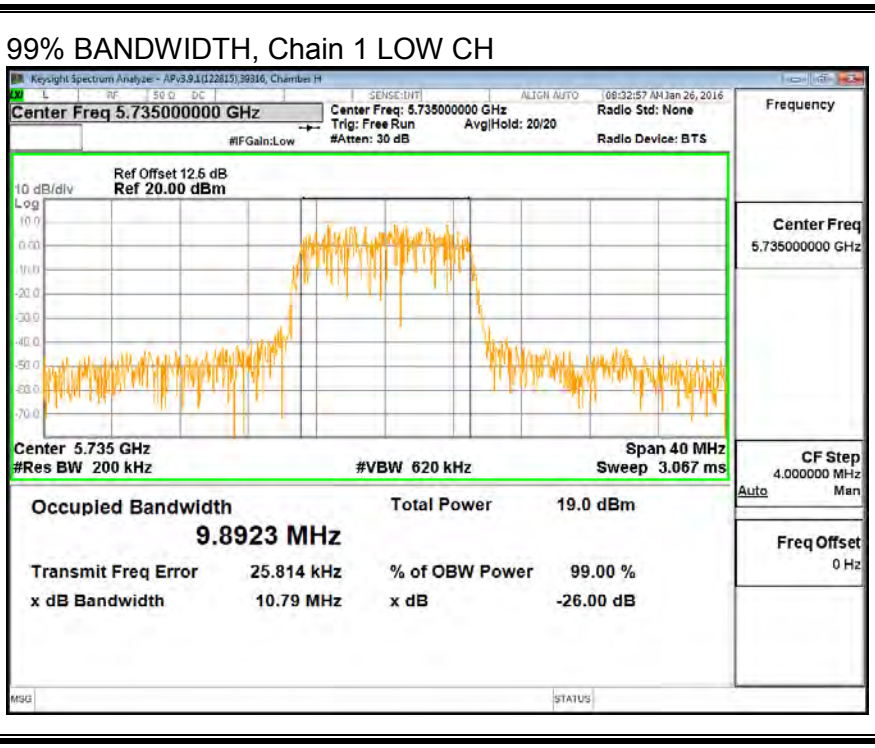


99% BANDWIDTH, Chain 0 HIGH CH

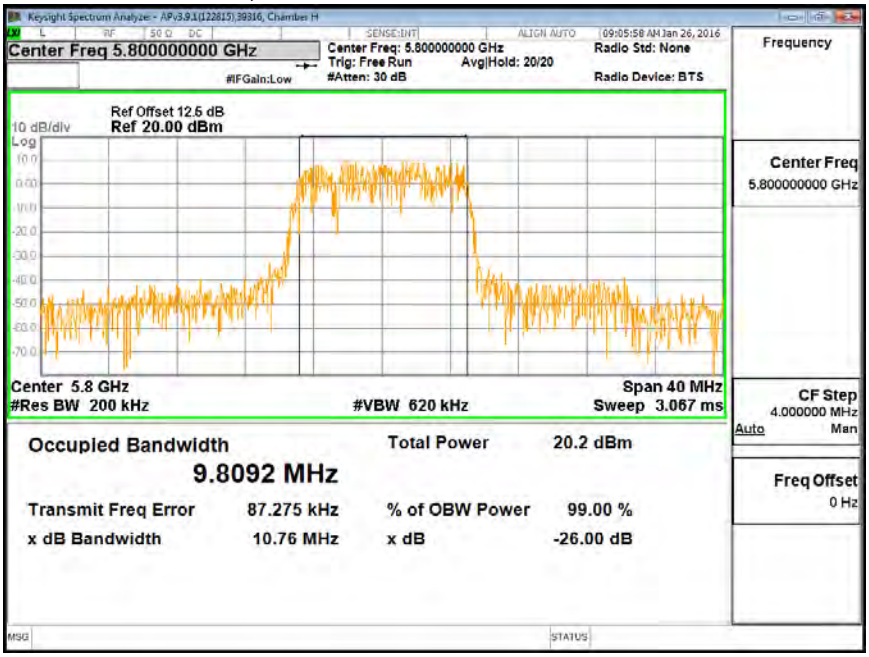


99% BANDWIDTH, Chain 1

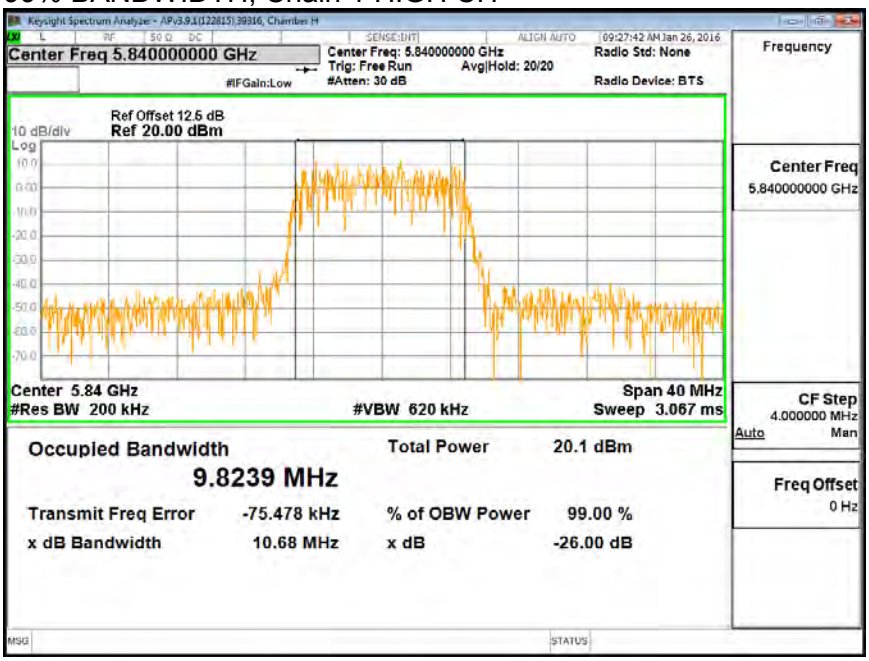
99% BANDWIDTH, Chain 1 LOW CH



99% BANDWIDTH, Chain 1 MID CH

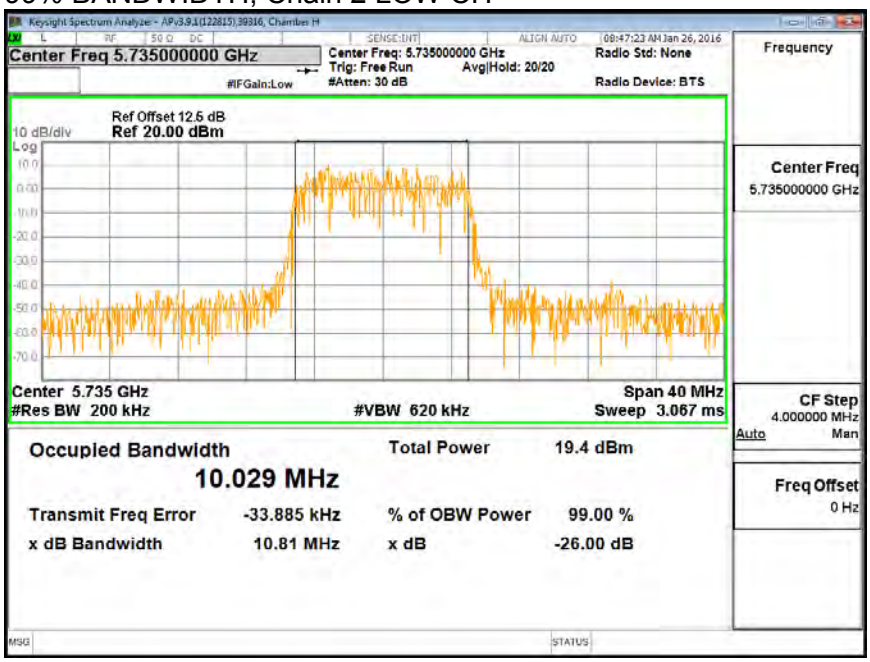


99% BANDWIDTH, Chain 1 HIGH CH

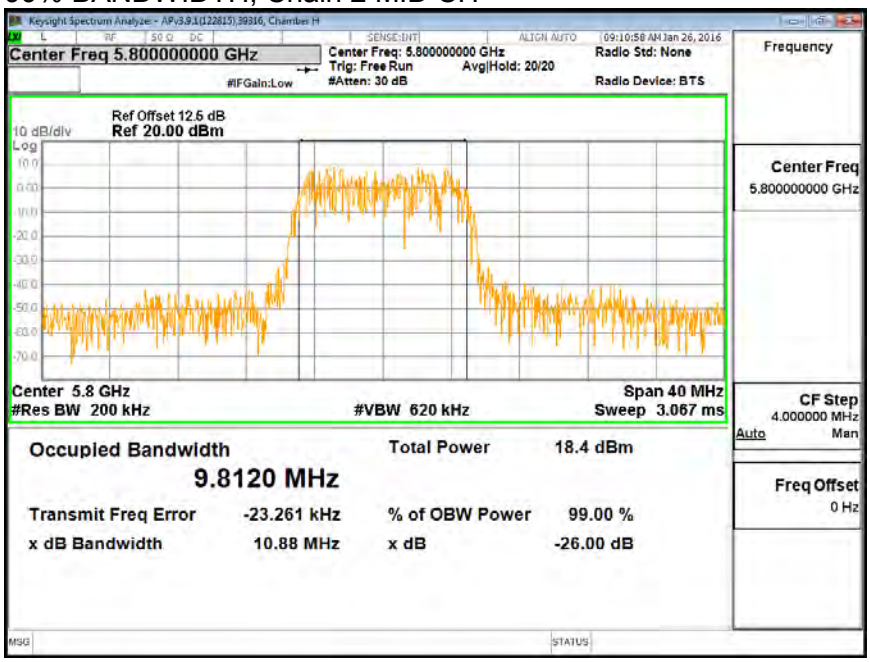


99% BANDWIDTH, Chain 2

99% BANDWIDTH, Chain 2 LOW CH



99% BANDWIDTH, Chain 2 MID CH

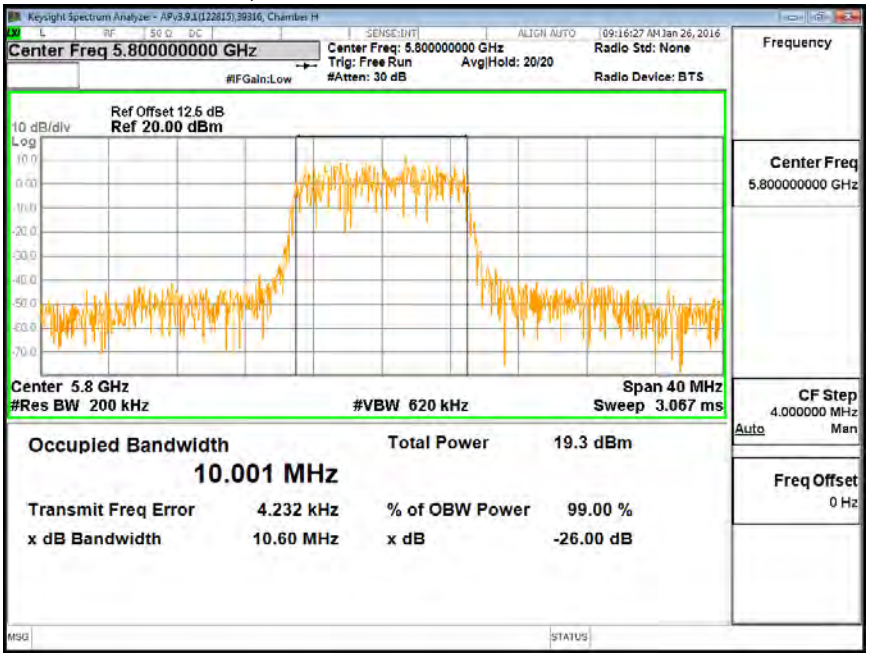


99% BANDWIDTH, Chain 2 HIGH CH

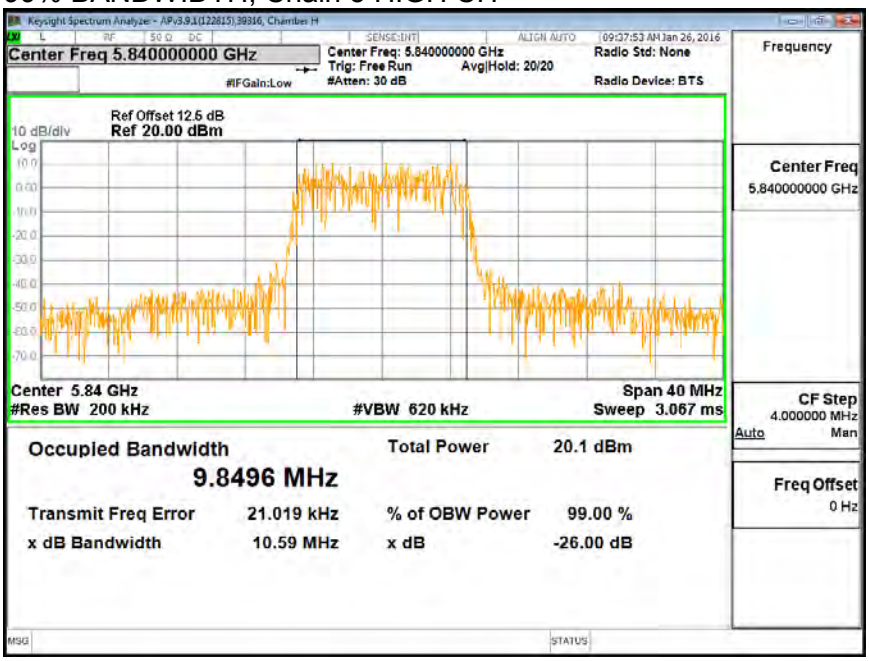
99% BANDWIDTH, Chain 3

99% BANDWIDTH, Chain 3 LOW CH

99% BANDWIDTH, Chain 3 MID CH



99% BANDWIDTH, Chain 3 HIGH CH



8.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3), (c)(1)(ii)

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

(c) Operation with directional antenna gains greater than 6 dBi.
(1) Fixed point-to-point operation:
(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

DIRECTIONAL ANTENNA GAIN

There are a total of four antennas; two horizontal antennas (chains 0 and 2) and two vertical antennas (chains 1 and 3). Horizontal antennas are cross polarized with respect to vertical antennas

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

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5735	18.01	30.00	30	36	30.00
Mid	5800	18.01	30.00	30	36	30.00
High	5840	18.01	30.00	30	36	30.00

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

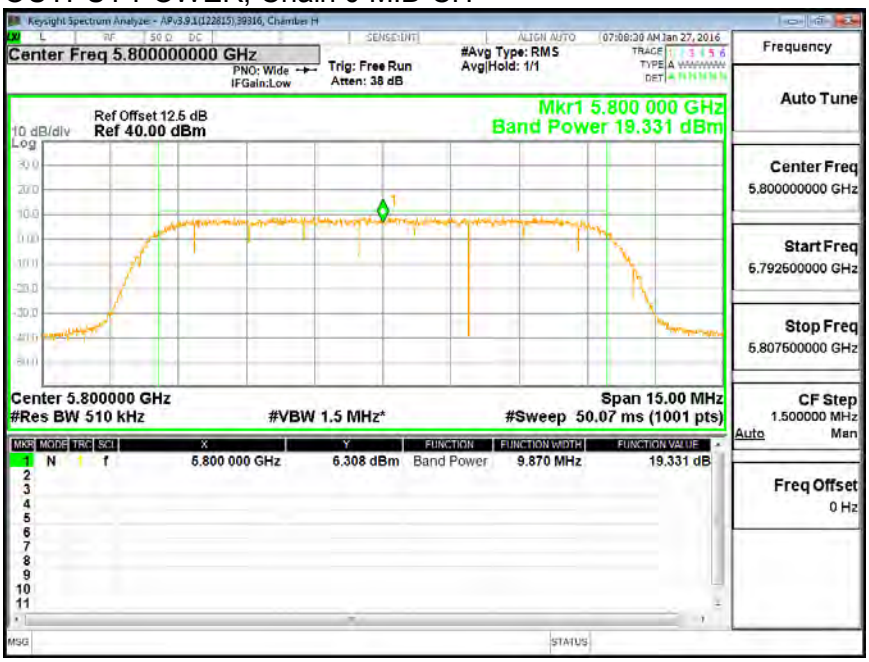
Results

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)	Margin (dB)
Low	5735	19.11	19.72	19.40	20.21	25.65	30.00	-4.35
Mid	5800	19.33	20.13	19.22	19.90	25.68	30.00	-4.32
High	5840	19.03	19.43	19.36	19.93	25.47	30.00	-4.53

OUTPUT POWER, Chain 0

OUTPUT POWER, Chain 0 LOW CH

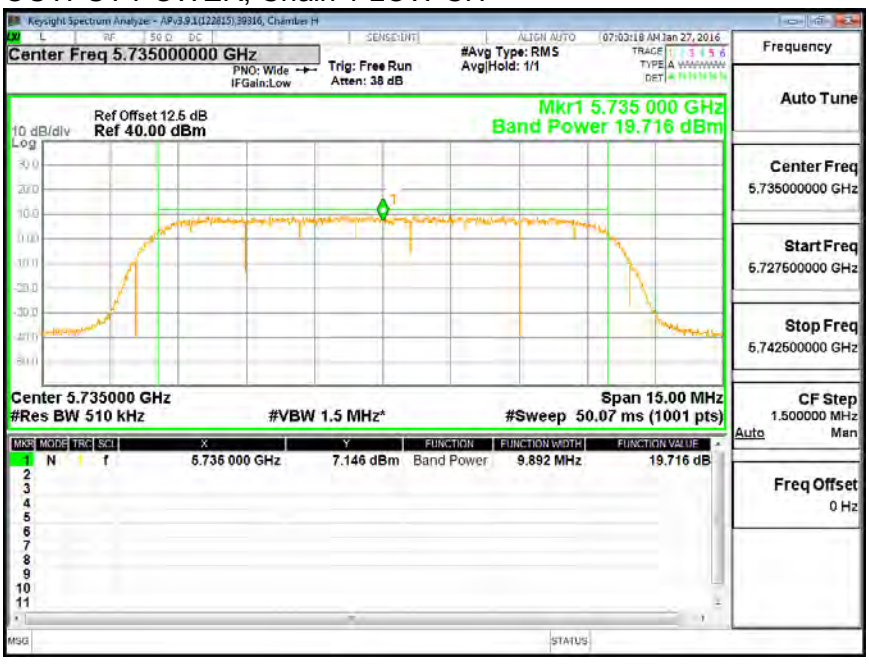
OUTPUT POWER, Chain 0 MID CH



OUTPUT POWER, Chain 0 HIGH CH

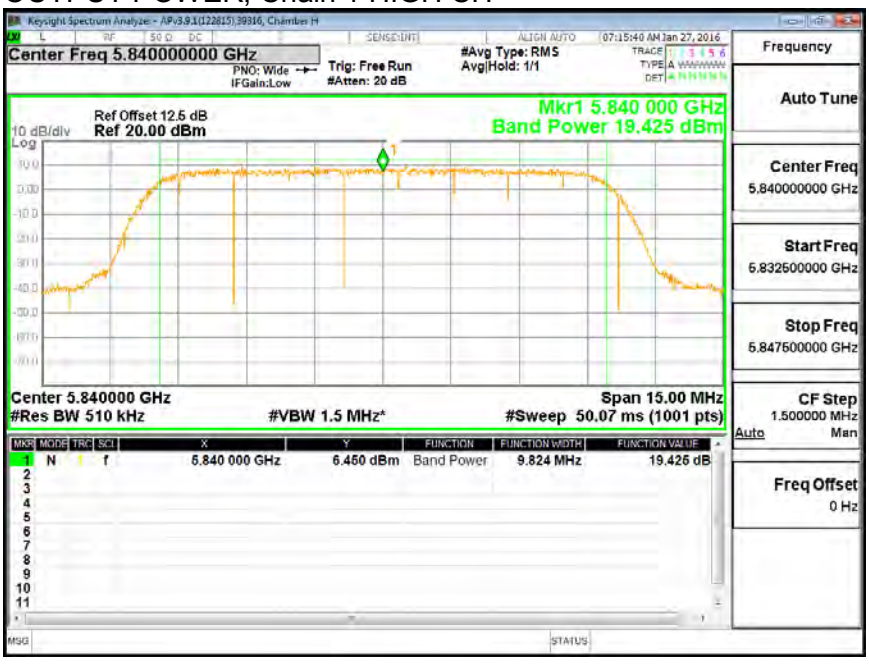
OUTPUT POWER, Chain 1

OUTPUT POWER, Chain 1 LOW CH



OUTPUT POWER, Chain 1 MID CH

OUTPUT POWER, Chain 1 HIGH CH

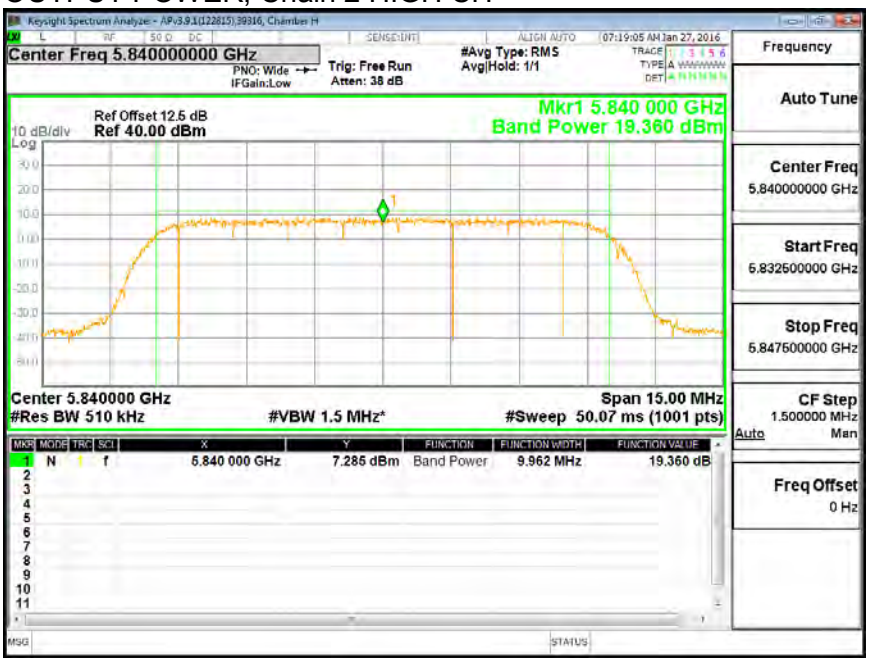


OUTPUT POWER, Chain 2

OUTPUT POWER, Chain 2 LOW CH

OUTPUT POWER, Chain 2 MID CH

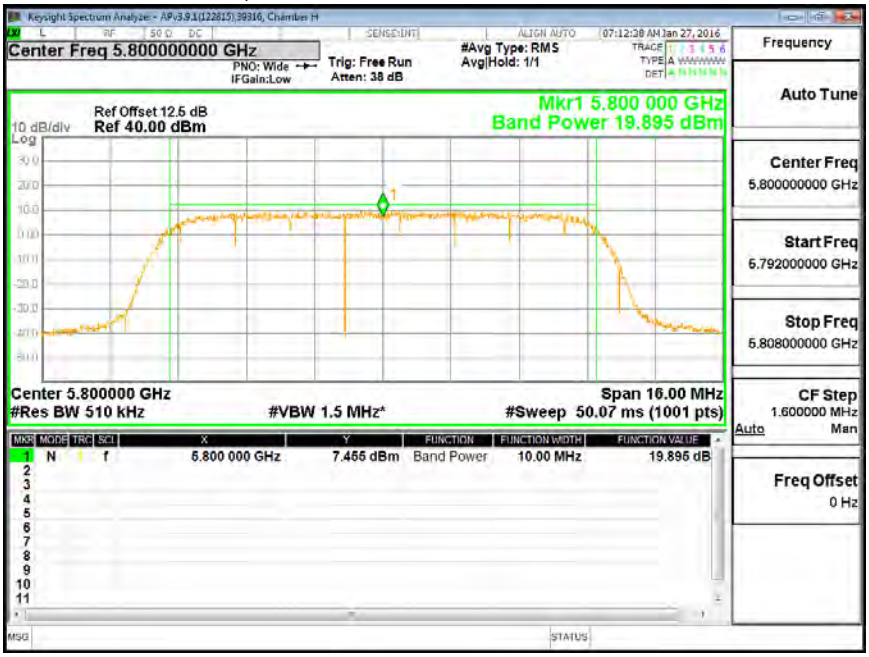
OUTPUT POWER, Chain 2 HIGH CH



OUTPUT POWER, Chain 3

OUTPUT POWER, Chain 3 LOW CH

OUTPUT POWER, Chain 3 MID CH



OUTPUT POWER, Chain 3 HIGH CH

8.2.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

For digitally modulated systems, the power spectral density conducted form the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

RESULTS

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

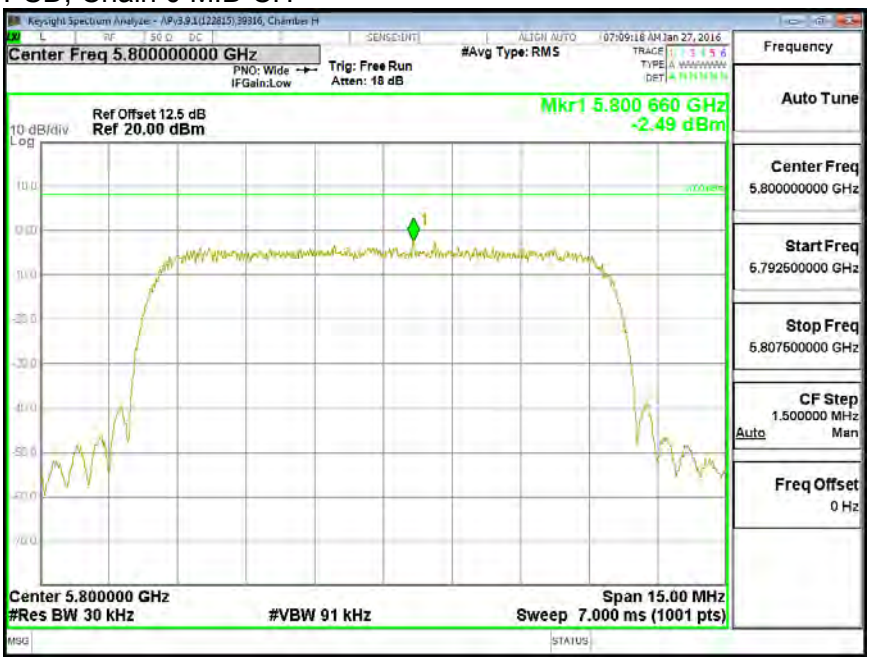
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Chain 3 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5735	-3.79	-2.95	-3.33	-2.70	2.85	8.0	-5.2
Mid	5800	-2.49	-2.49	-3.92	-2.85	3.12	8.0	-4.9
High	5840	-3.61	-3.59	-3.03	-2.73	2.80	8.0	-5.2

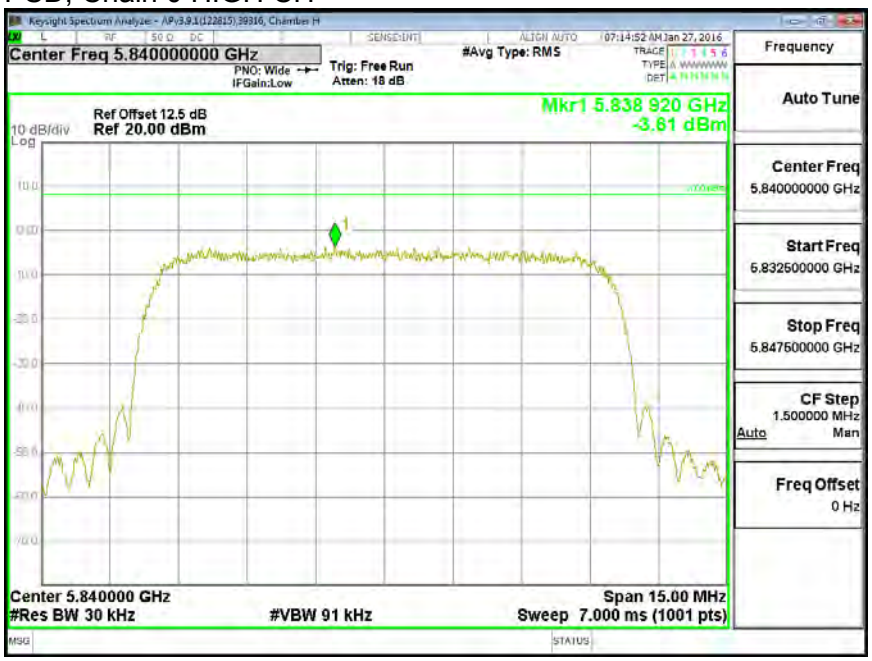
PSD, Chain 0

PSD, Chain 0 LOW CH

PSD, Chain 0 MID CH



PSD, Chain 0 HIGH CH



PSD, Chain 1

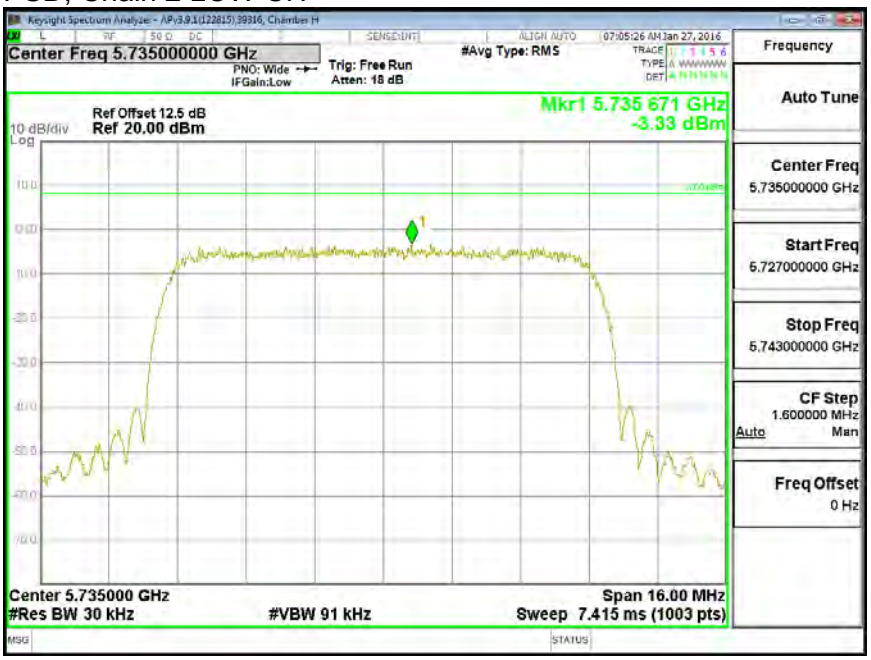
PSD, Chain 1 LOW CH

PSD, Chain 1 MID CH

PSD, Chain 1 HIGH CH

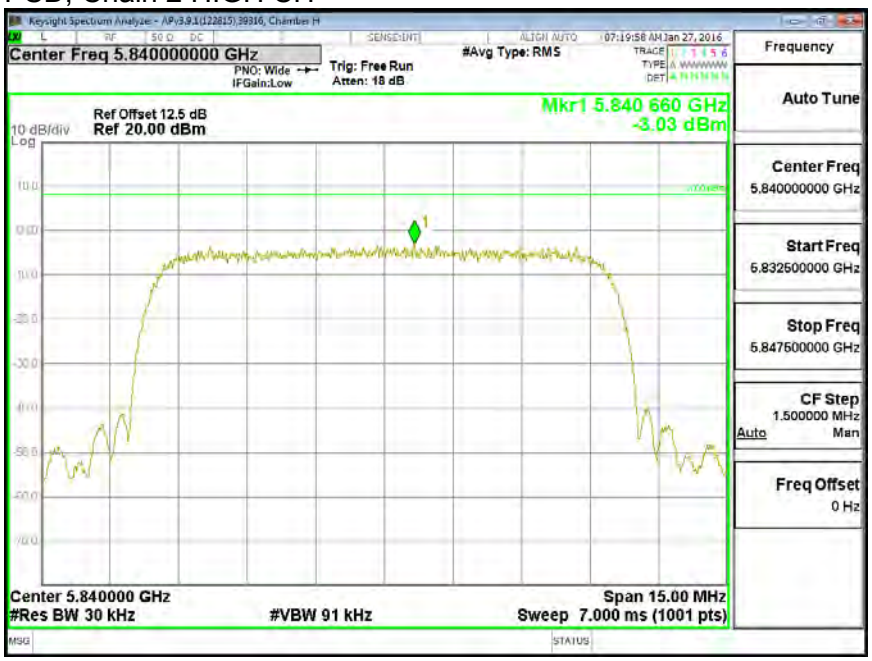
PSD, Chain 2

PSD, Chain 2 LOW CH



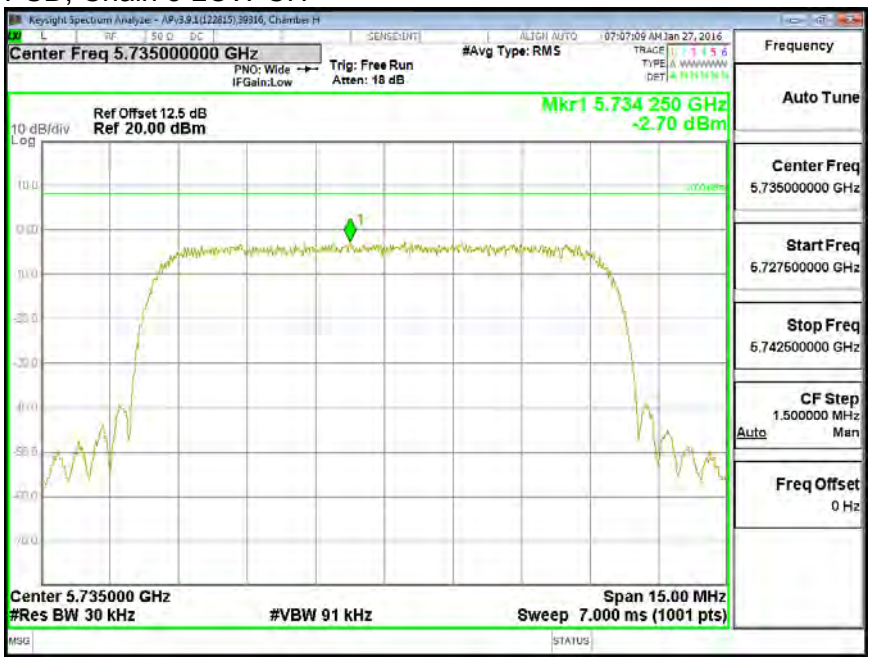
PSD, Chain 2 MID CH

PSD, Chain 2 HIGH CH

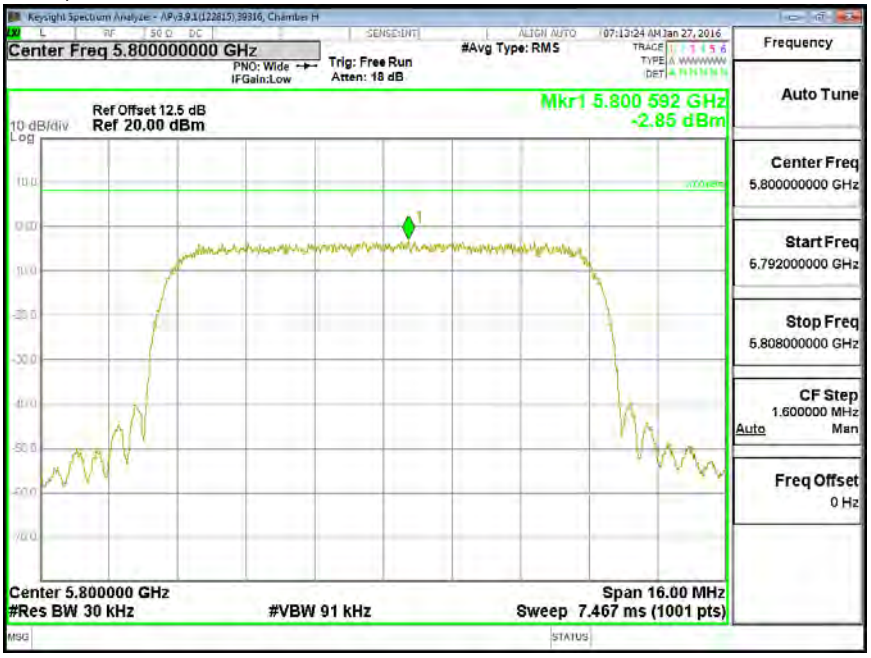


PSD, Chain 3

PSD, Chain 3 LOW CH



PSD, Chain 3 MID CH



PSD, Chain 3 HIGH CH

8.2.5. OUT-OF-BAND EMISSIONS

LIMITS

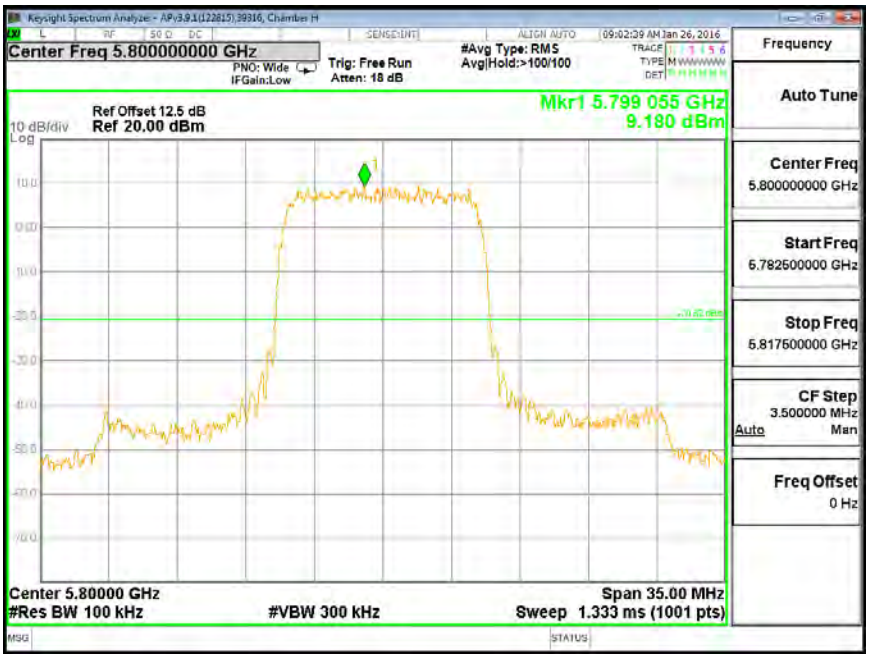
FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS

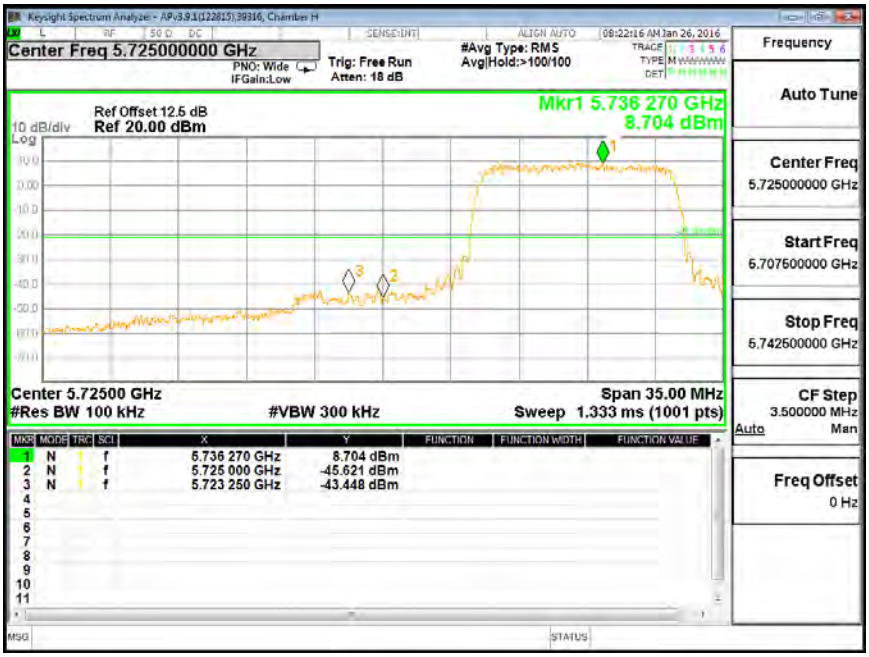
IN-BAND REFERENCE LEVEL, Chain 0

REFERENCE LEVEL Chain 0 MID CH



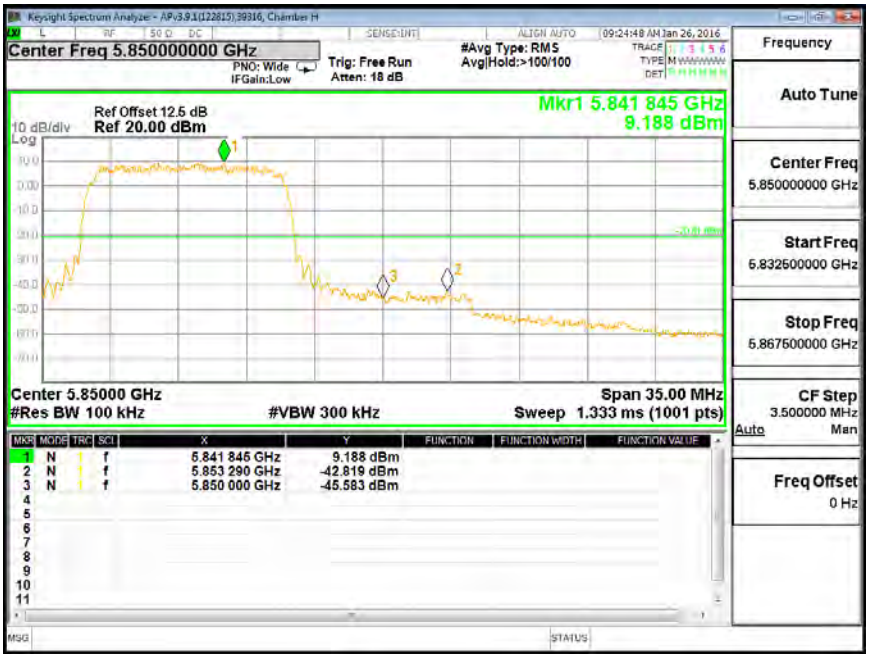
LOW CHANNEL BANDEDGE, Chain 0

AUTHORIZED BAND EDGE Chain 0 LOW CH



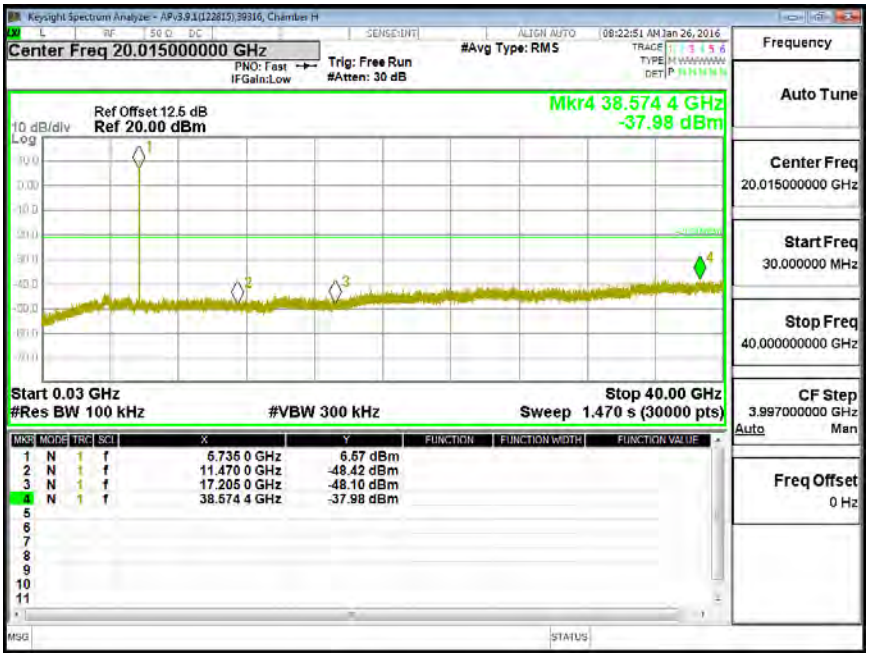
HIGH CHANNEL BANDEDGE, Chain 0

AUTHORIZED BAND EDGE Chain 0 HIGH CH

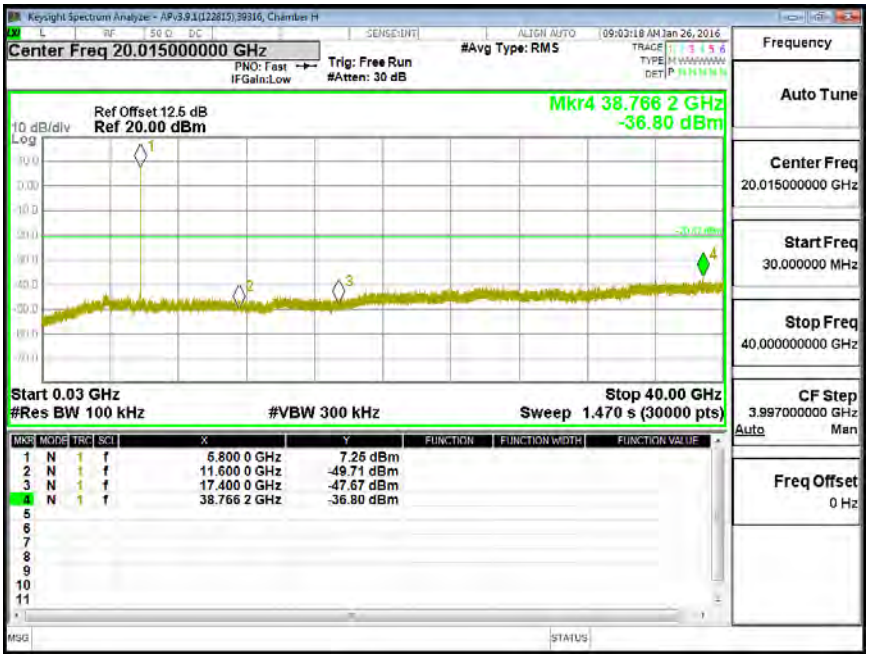


OUT-OF-BAND EMISSIONS, Chain 0

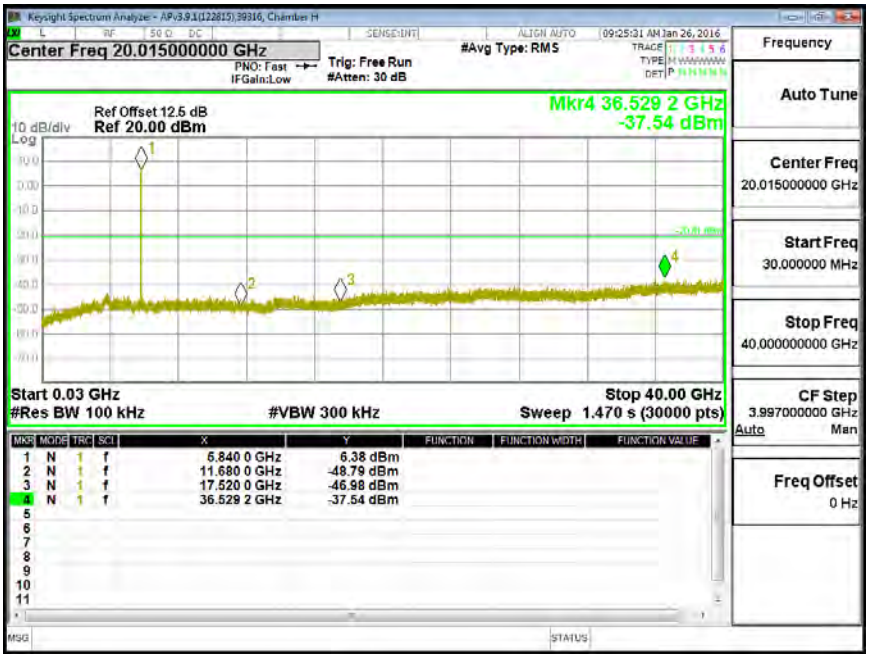
OUT OF BAND Chain 0 LOW CH



OUT OF BAND Chain 0 MID CH

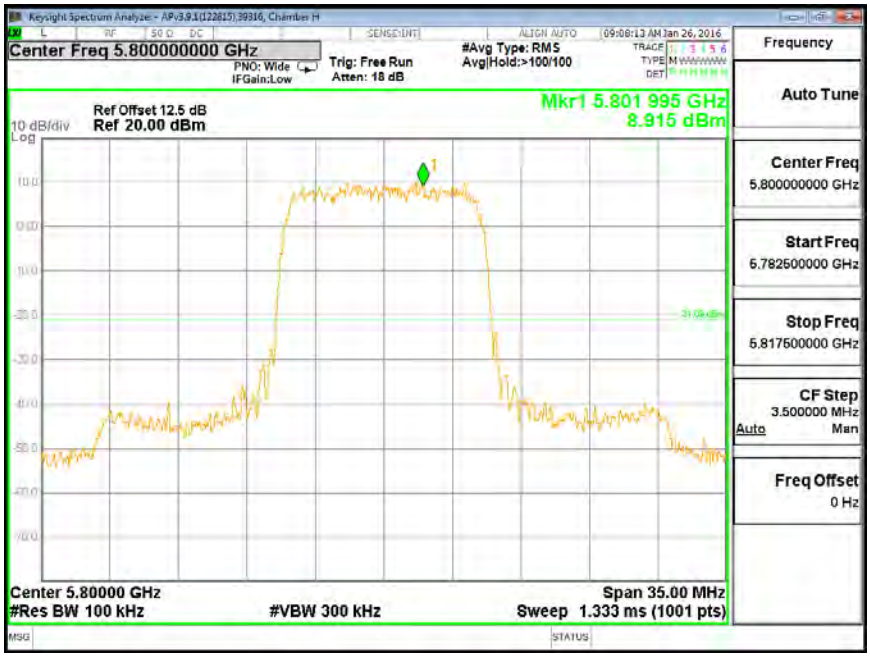


OUT OF BAND Chain 0 HIGH CH



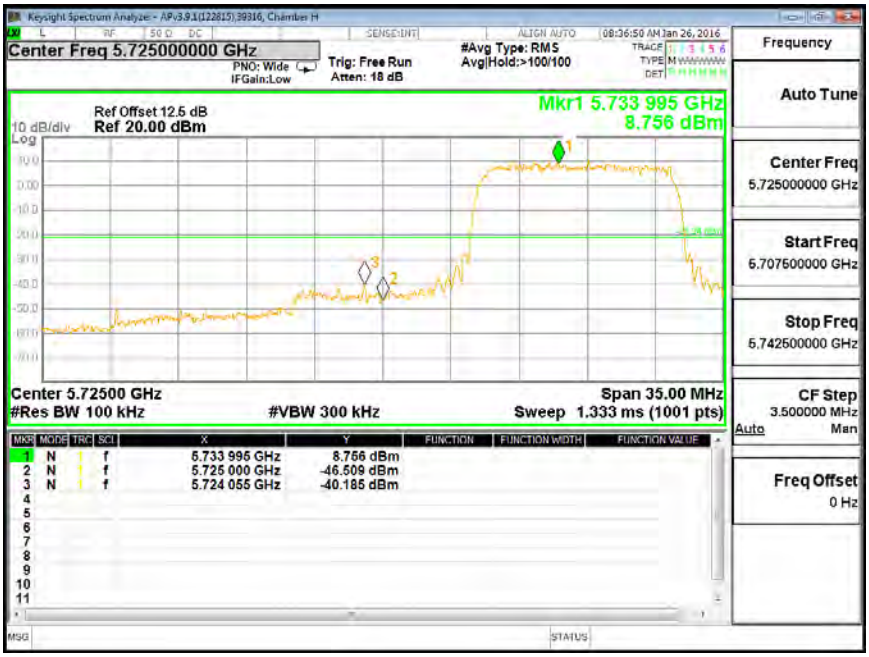
IN-BAND REFERENCE LEVEL, Chain 1

REFERENCE LEVEL Chain 1 MID CH



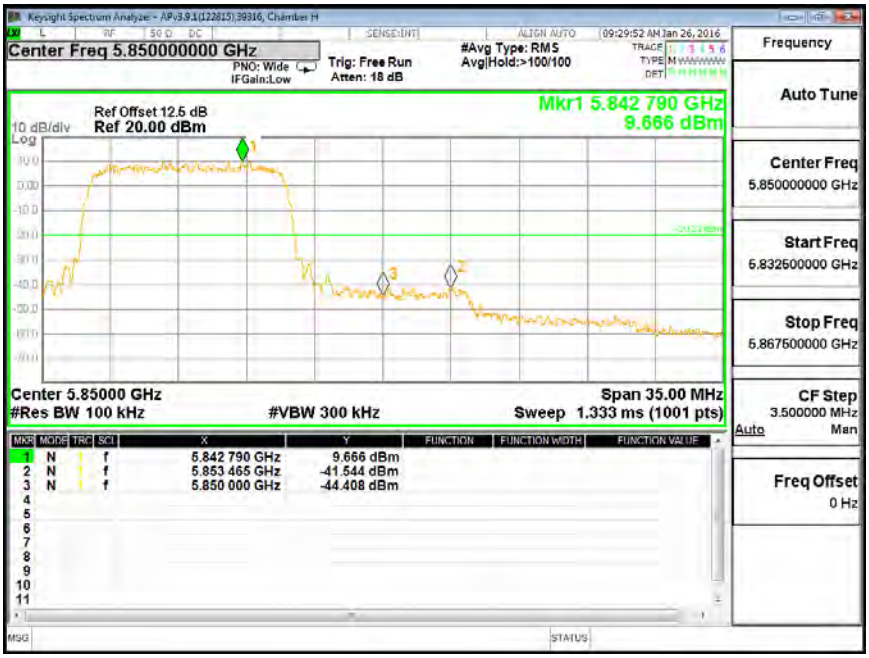
LOW CHANNEL BANDEDGE, Chain 1

AUTHORIZED BAND EDGE Chain 1 LOW CH



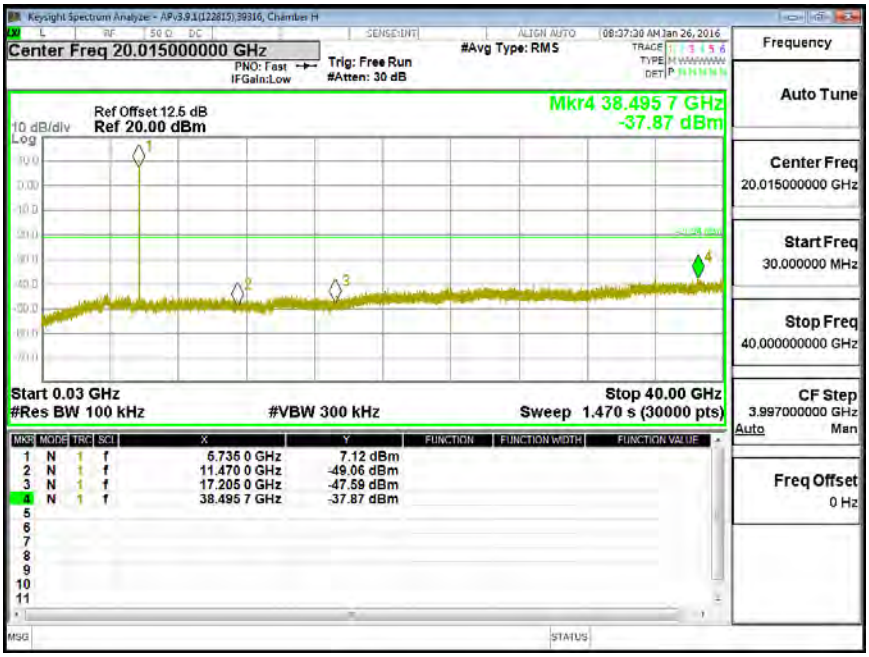
HIGH CHANNEL BANDEDGE, Chain 1

AUTHORIZED BAND EDGE Chain 1 HIGH CH

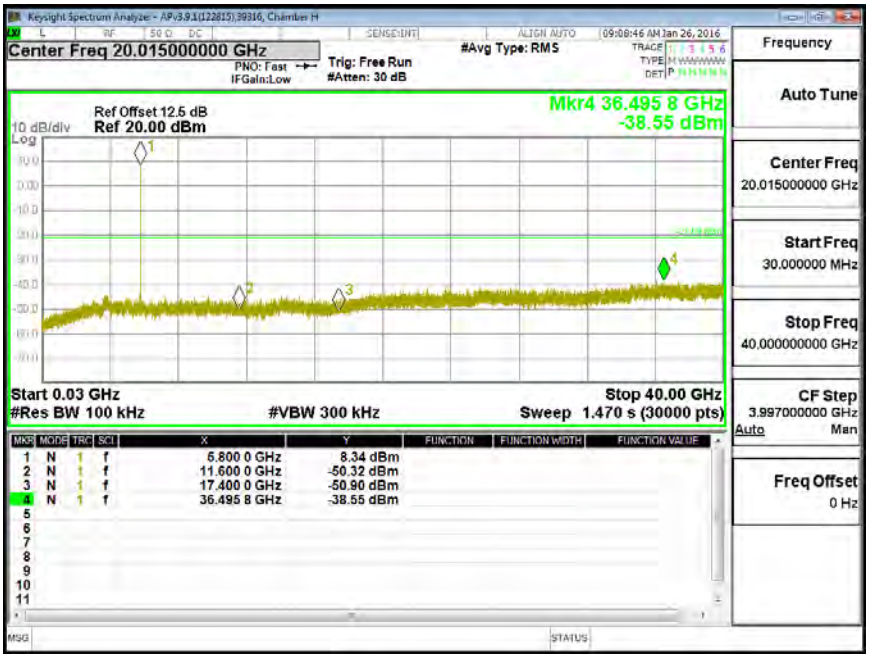


OUT-OF-BAND EMISSIONS, Chain 1

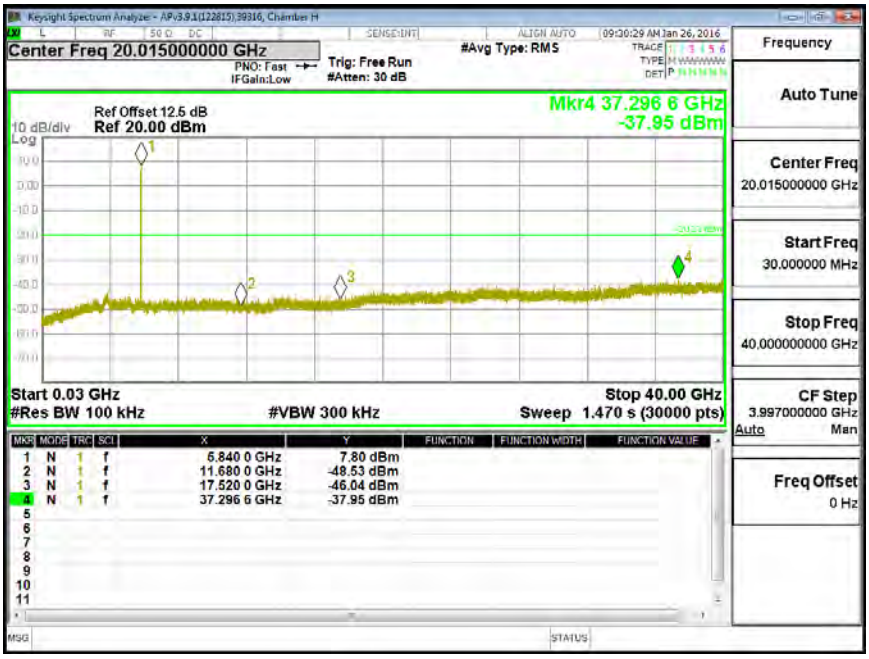
OUT OF BAND Chain 1 LOW CH



OUT OF BAND Chain 1 MID CH

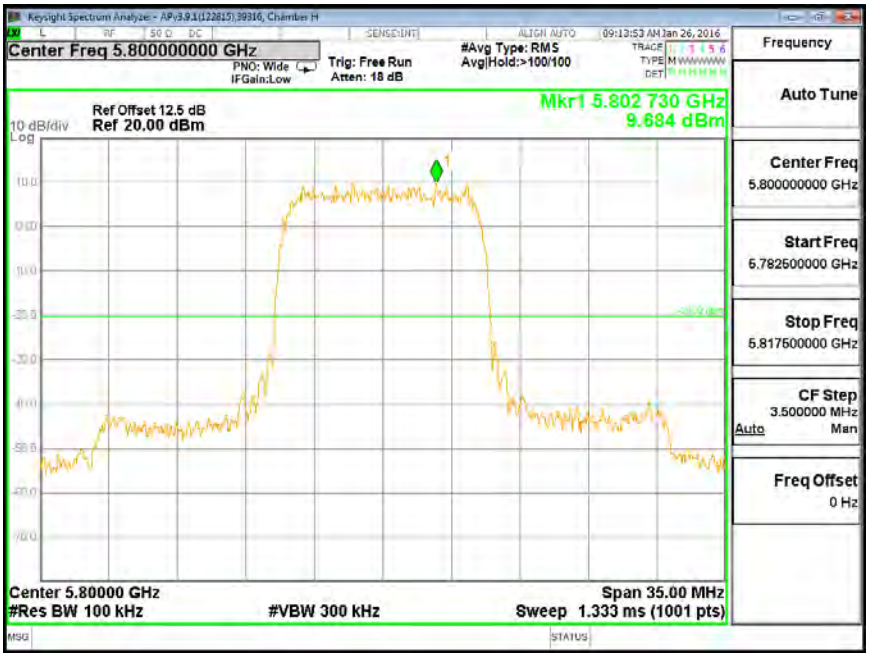


OUT OF BAND Chain 1 HIGH CH



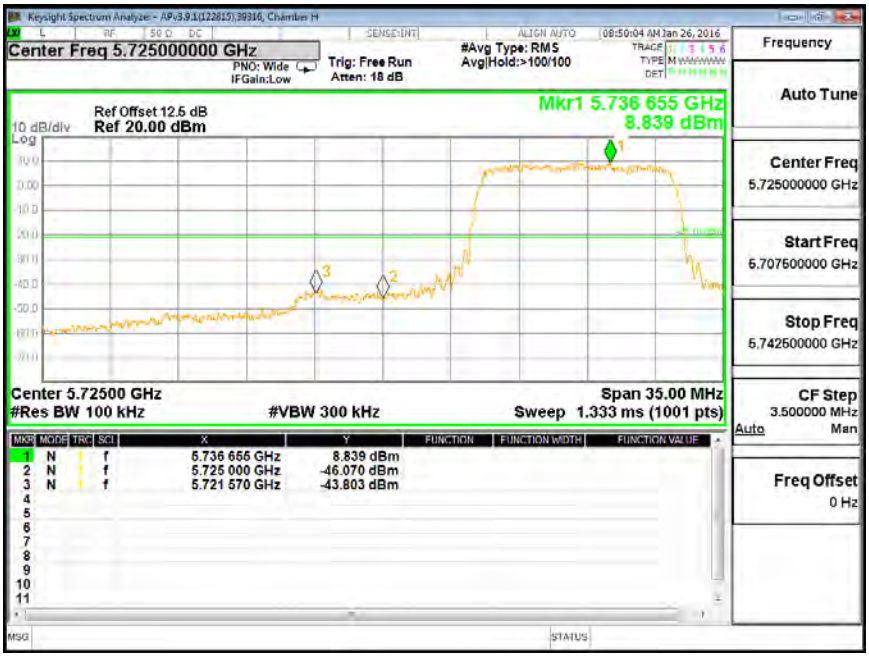
IN-BAND REFERENCE LEVEL, Chain 2

REFERENCE LEVEL Chain 2 MID CH



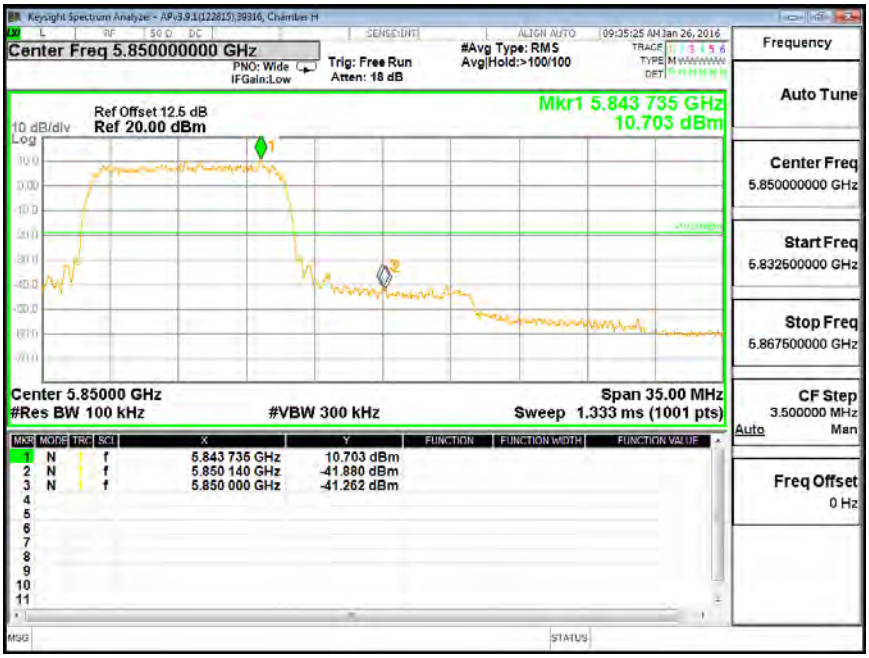
LOW CHANNEL BANDEDGE, Chain 2

AUTHORIZED BAND EDGE Chain 2 LOW CH



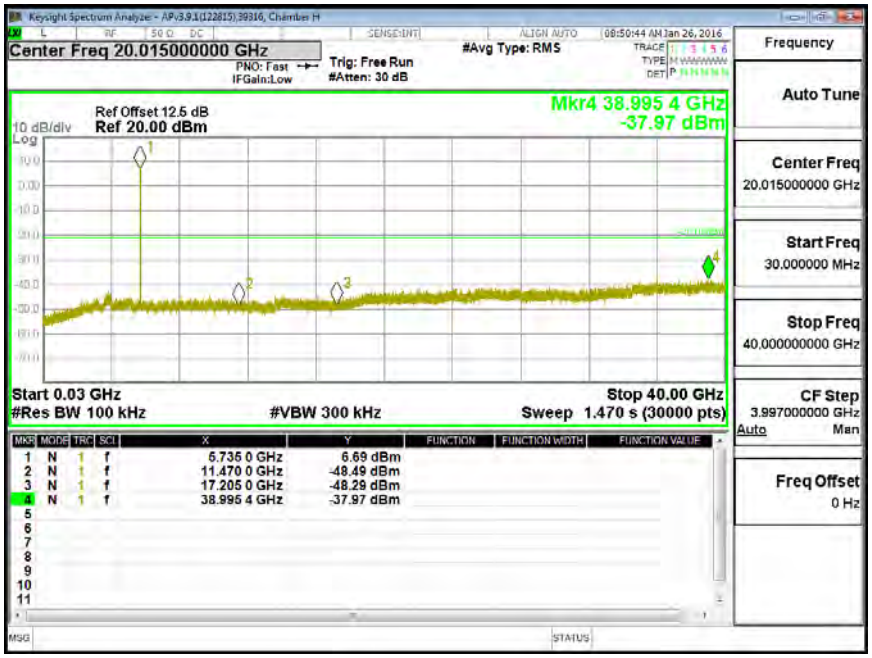
HIGH CHANNEL BANDEDGE, Chain 2

AUTHORIZED BAND EDGE Chain 2 HIGH CH

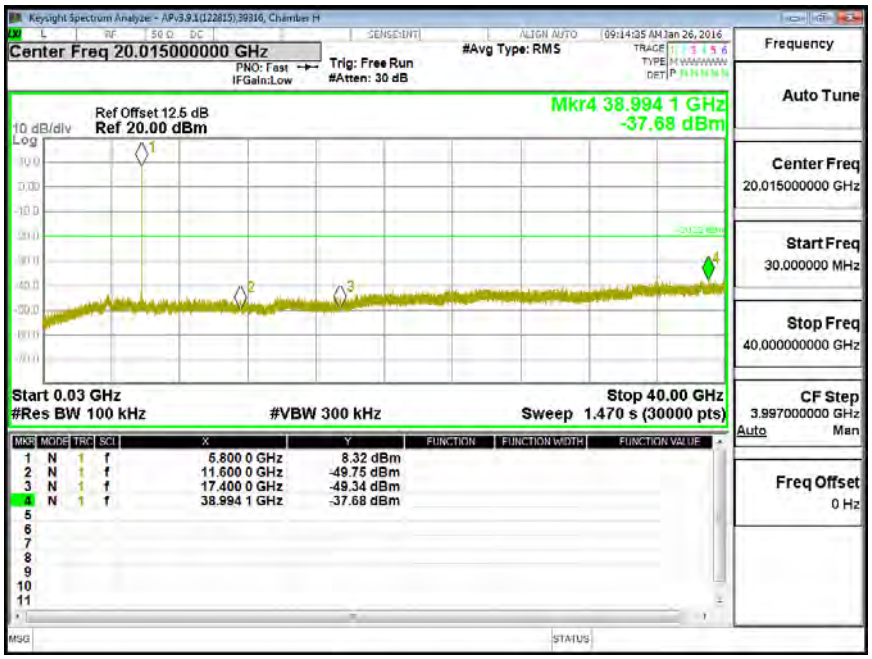


OUT-OF-BAND EMISSIONS, Chain 2

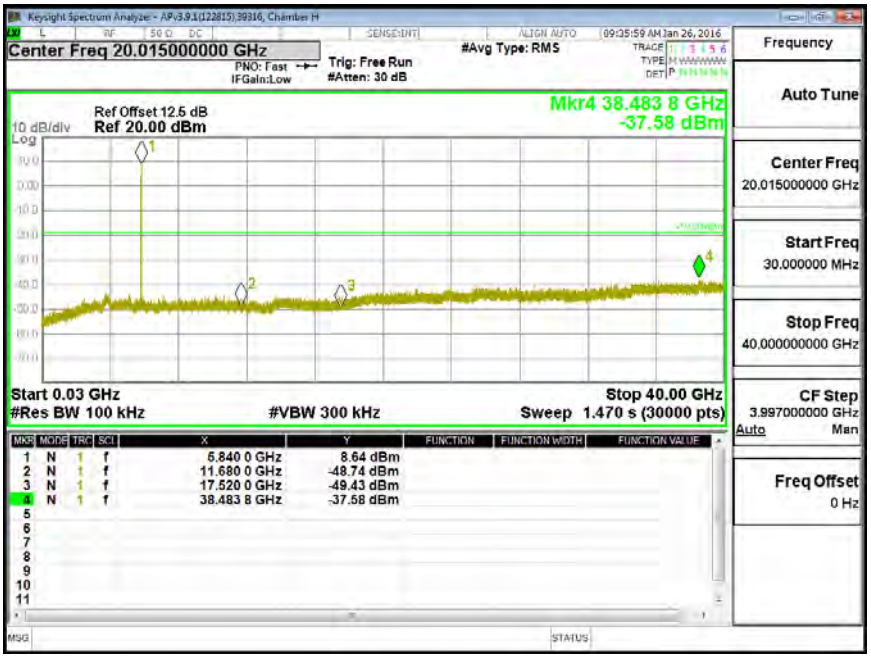
OUT OF BAND Chain 2 LOW CH



OUT OF BAND Chain 2 MID CH

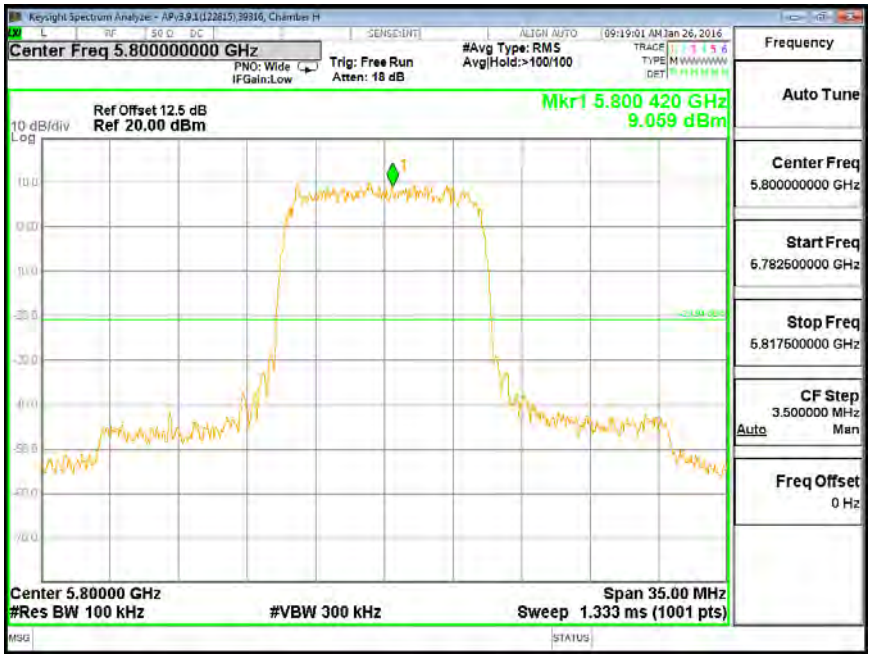


OUT OF BAND Chain 2 HIGH CH



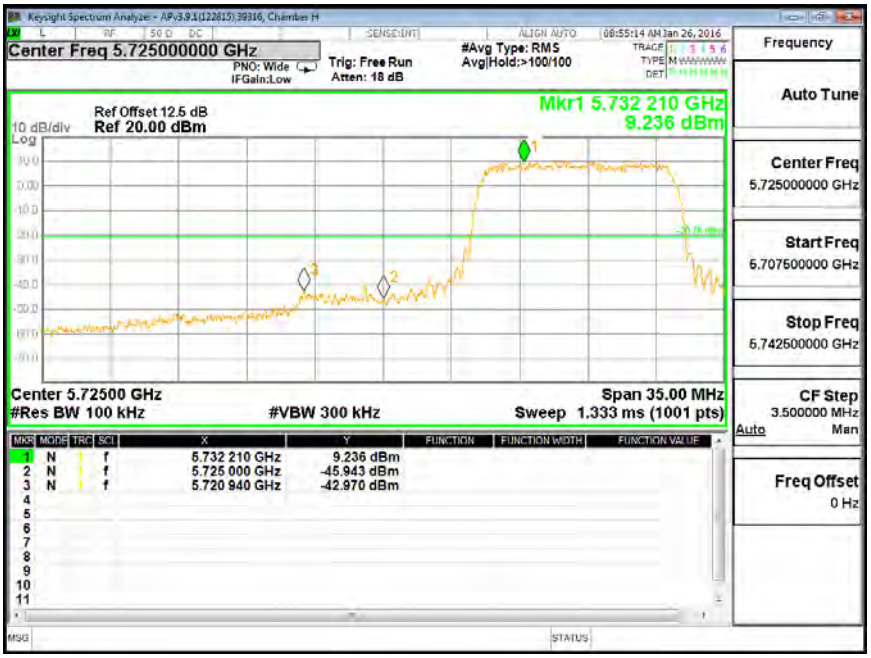
IN-BAND REFERENCE LEVEL, Chain 3

REFERENCE LEVEL Chain 3 MID CH



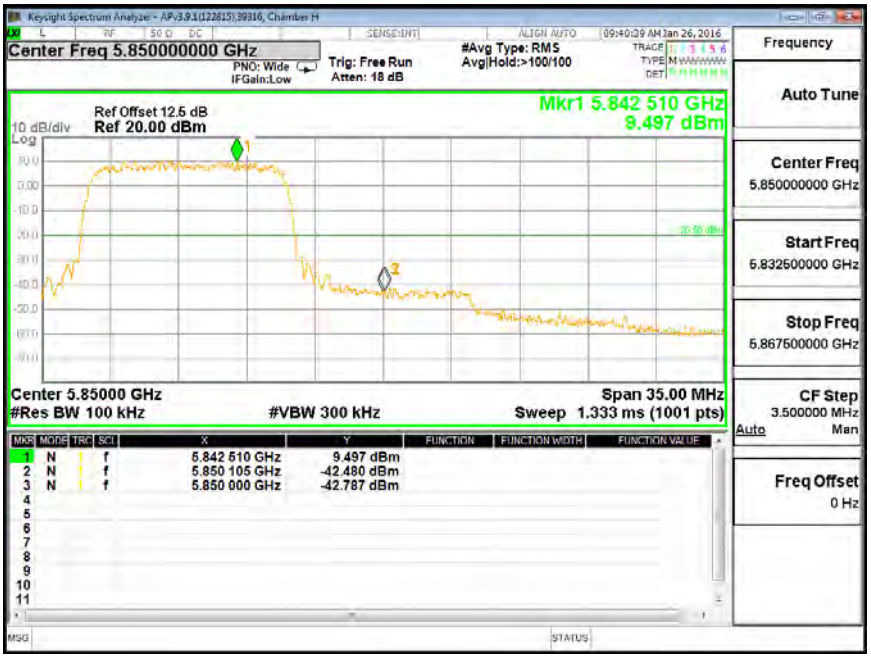
LOW CHANNEL BANDEDGE, Chain 3

AUTHORIZED BAND EDGE Chain 3 LOW CH



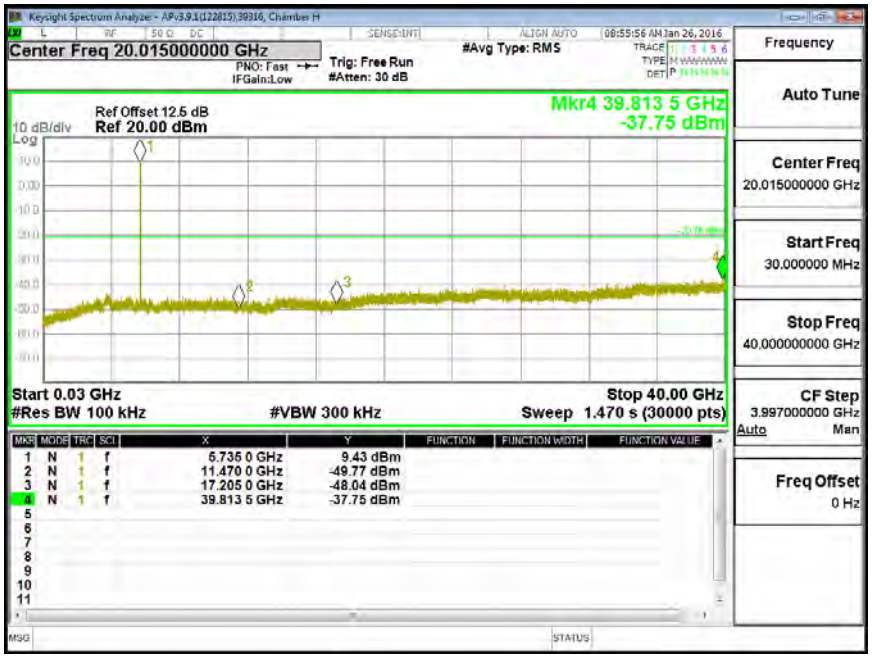
HIGH CHANNEL BANDEDGE, Chain 3

AUTHORIZED BAND EDGE Chain 3 HIGH CH

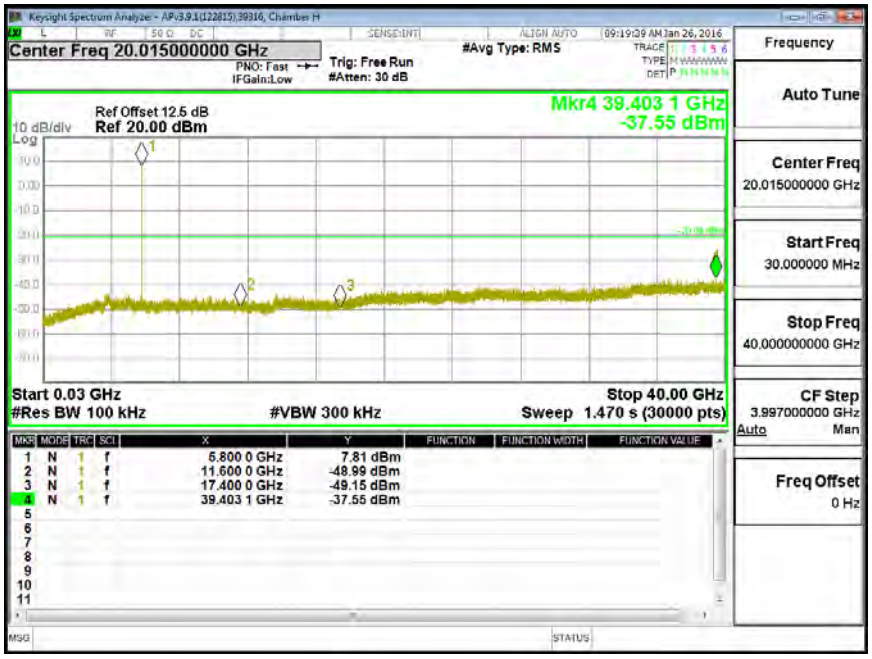


OUT-OF-BAND EMISSIONS, Chain 3

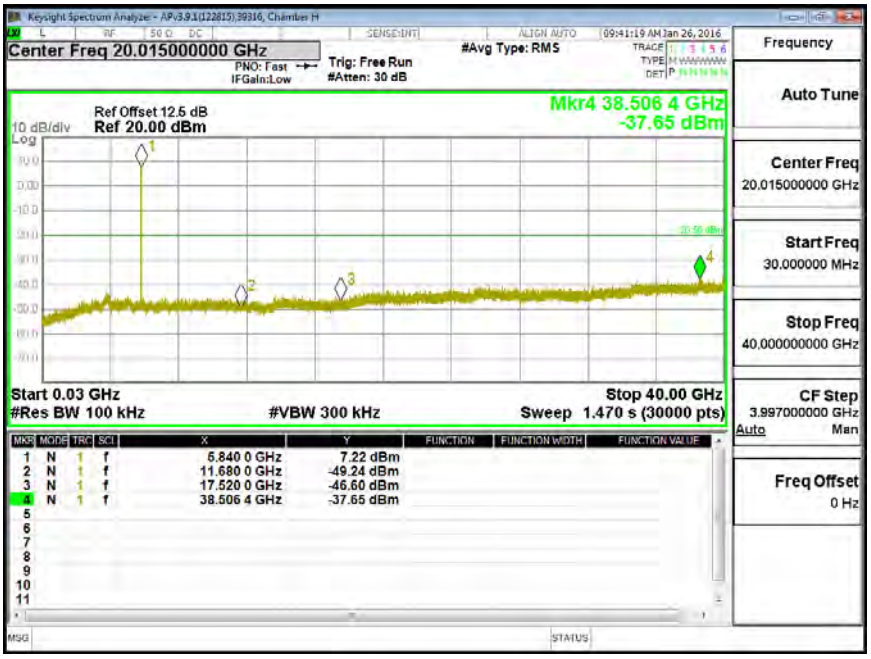
OUT OF BAND Chain 3 LOW CH



OUT OF BAND Chain 3 MID CH



OUT OF BAND Chain 3 HIGH CH



8.3. 20MHz BW 4TX MODE IN THE 5.8 GHz BAND

8.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

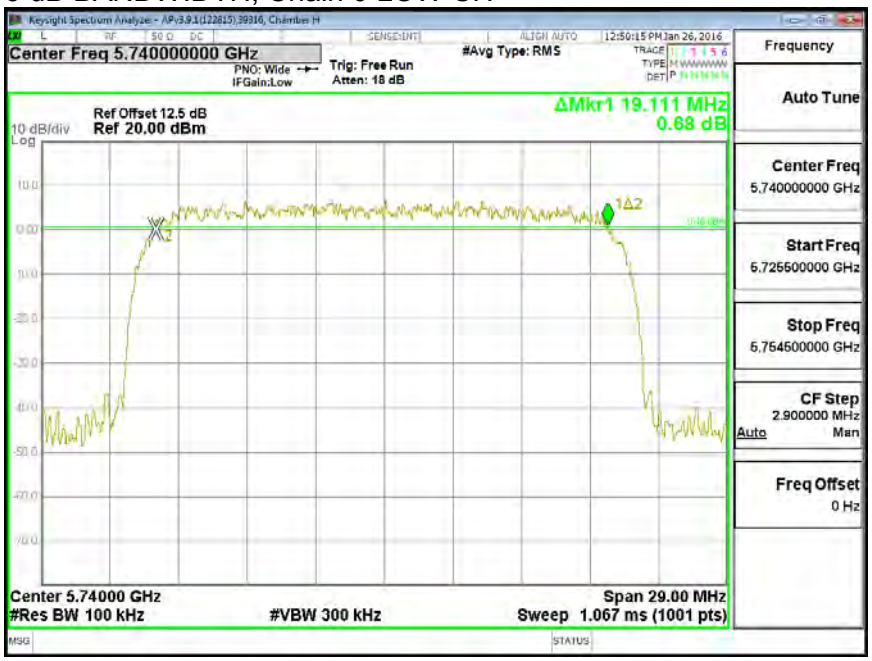
The minimum 6 dB bandwidth shall be at least 500 kHz.

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 0 LOW CH



6 dB BANDWIDTH, Chain 0 MID CH

6 dB BANDWIDTH, Chain 0 HIGH CH

6 dB BANDWIDTH, Chain 1

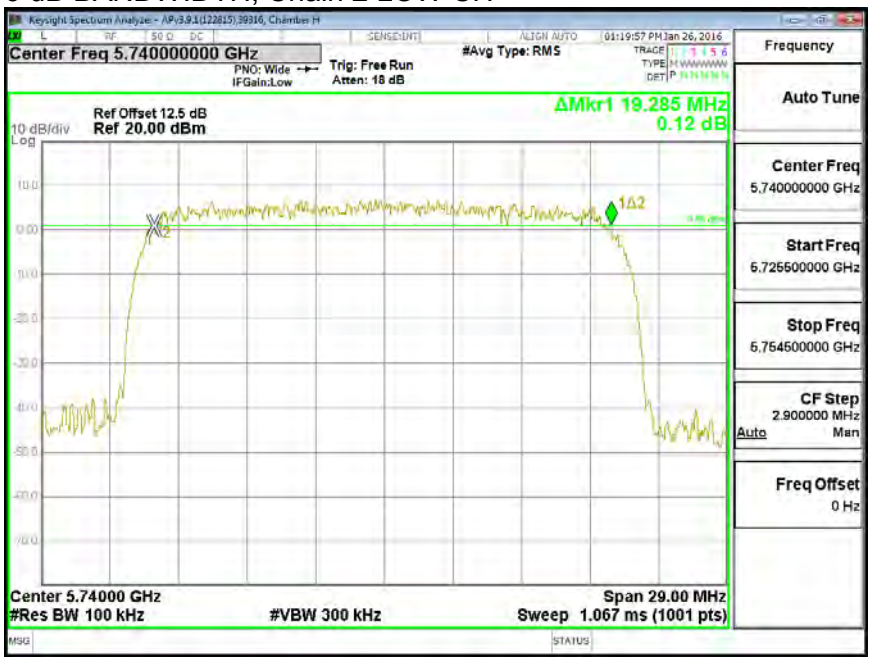
6 dB BANDWIDTH, Chain 1 LOW CH

6 dB BANDWIDTH, Chain 1 MID CH

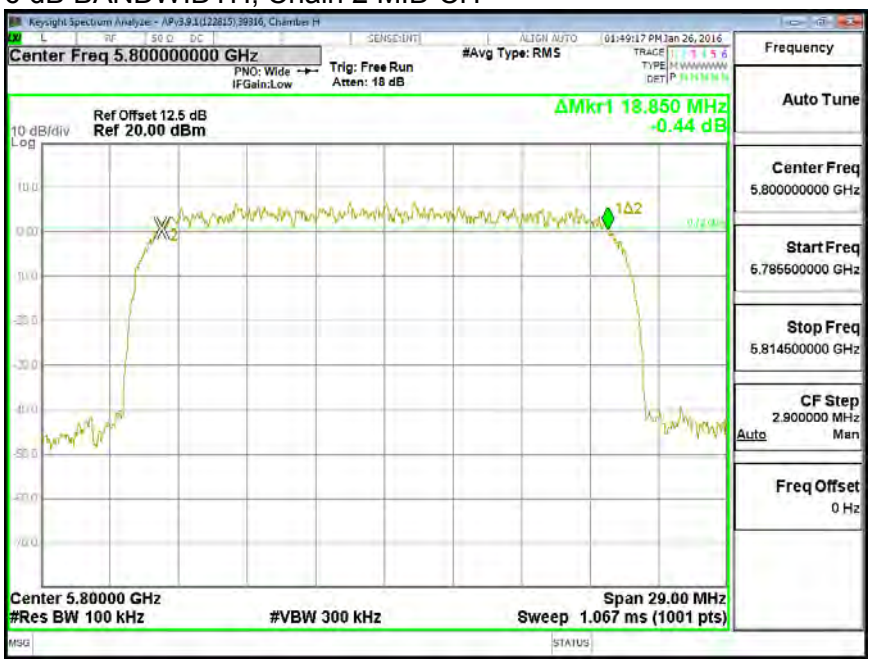
6 dB BANDWIDTH, Chain 1 HIGH CH

6 dB BANDWIDTH, Chain 2

6 dB BANDWIDTH, Chain 2 LOW CH



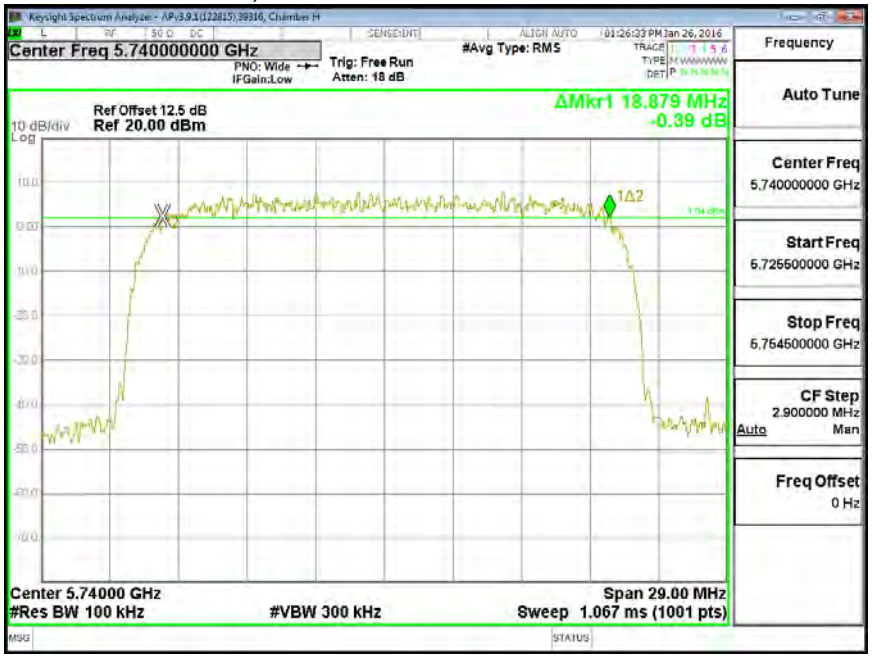
6 dB BANDWIDTH, Chain 2 MID CH



6 dB BANDWIDTH, Chain 2 HIGH CH

6 dB BANDWIDTH, Chain 3

6 dB BANDWIDTH, Chain 3 LOW CH



6 dB BANDWIDTH, Chain 3 MID CH

6 dB BANDWIDTH, Chain 3 HIGH CH

8.3.2. 99% BANDWIDTH

LIMITS

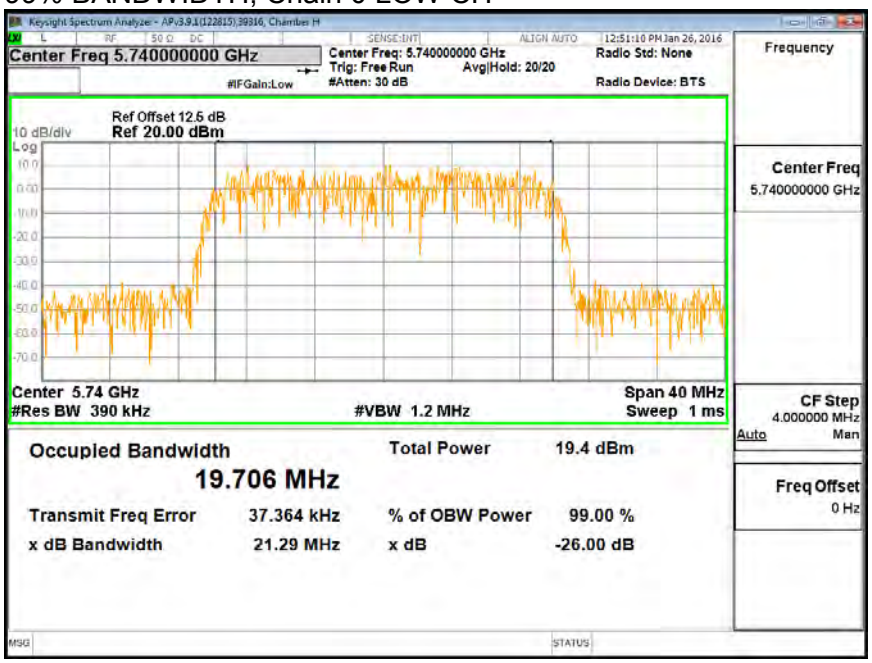
None; for reporting purposes only.

RESULTS

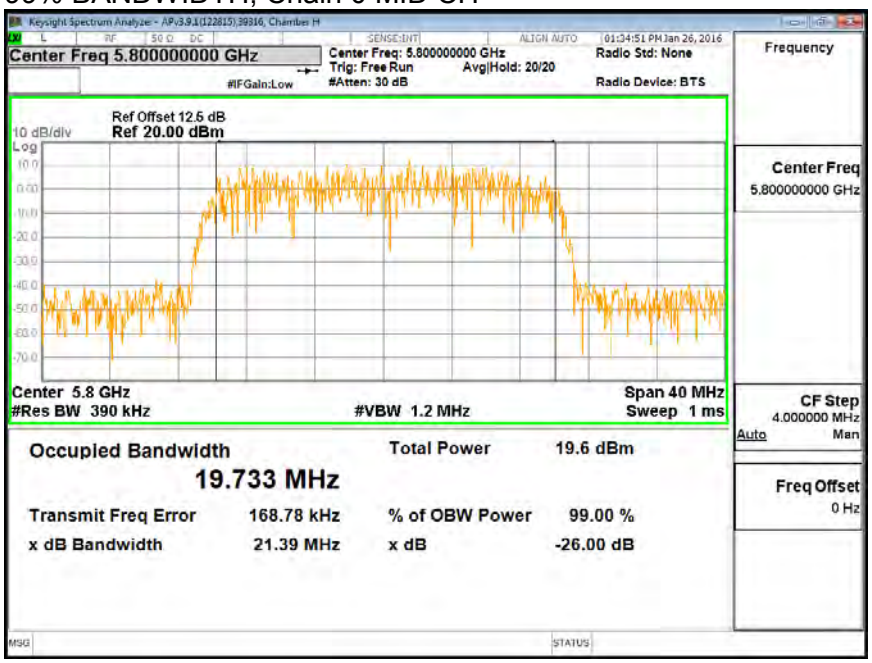
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)	99% BW Chain 3 (MHz)
Low	5740	19.706	19.686	19.392	19.760
Mid	5800	19.733	19.778	19.569	19.655
High	5835	19.341	19.686	19.875	19.777

99% BANDWIDTH, Chain 0

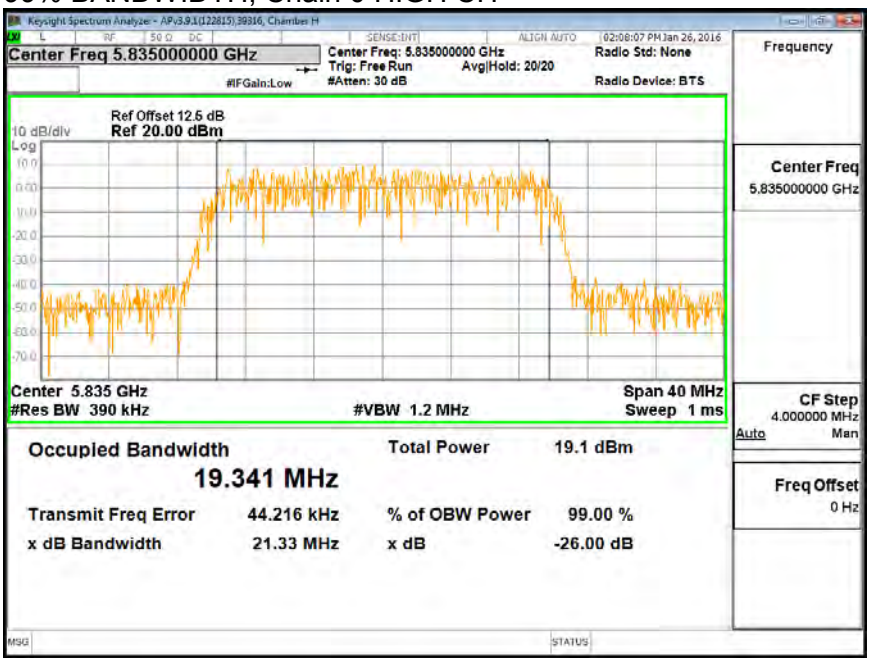
99% BANDWIDTH, Chain 0 LOW CH



99% BANDWIDTH, Chain 0 MID CH

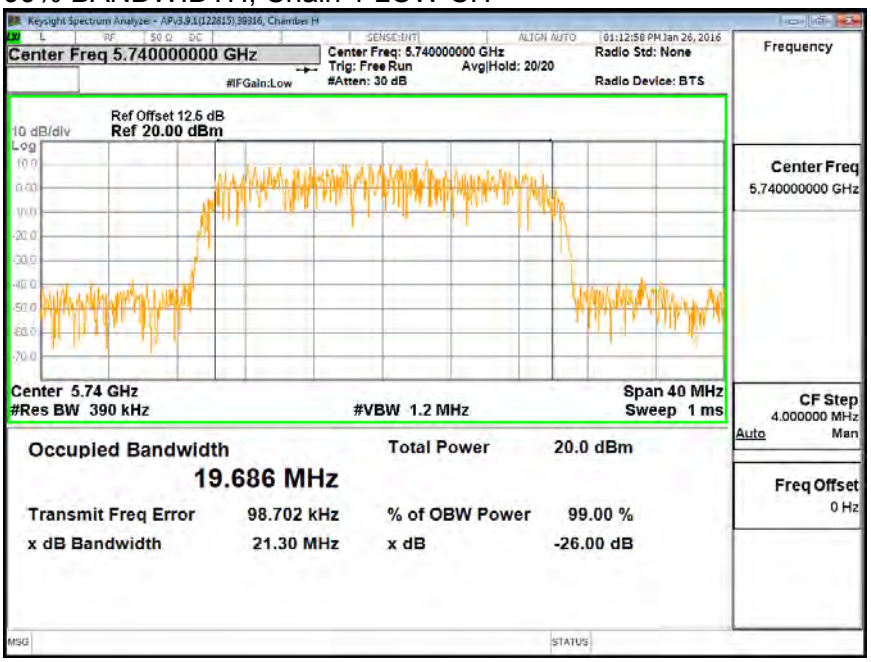


99% BANDWIDTH, Chain 0 HIGH CH

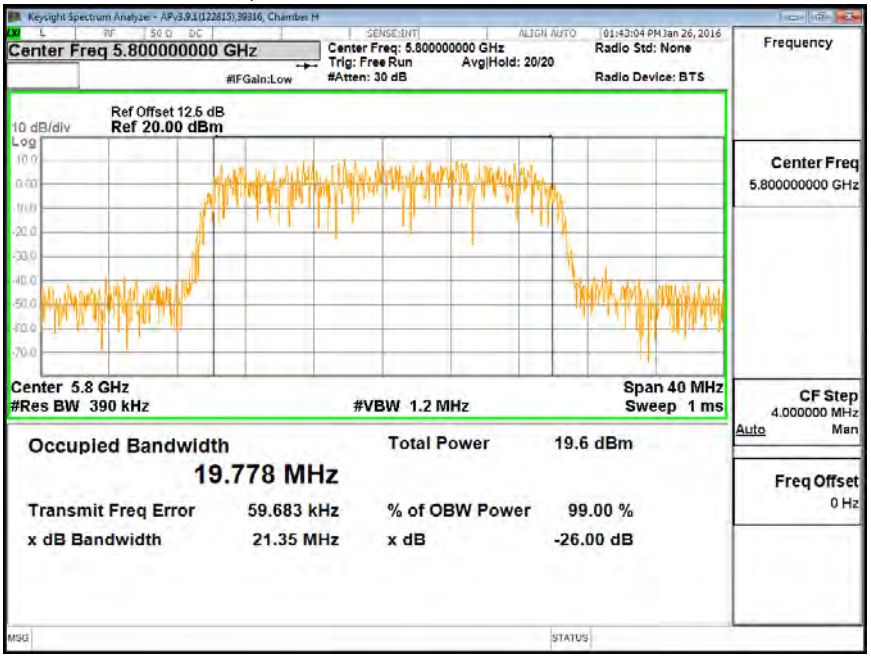


99% BANDWIDTH, Chain 1

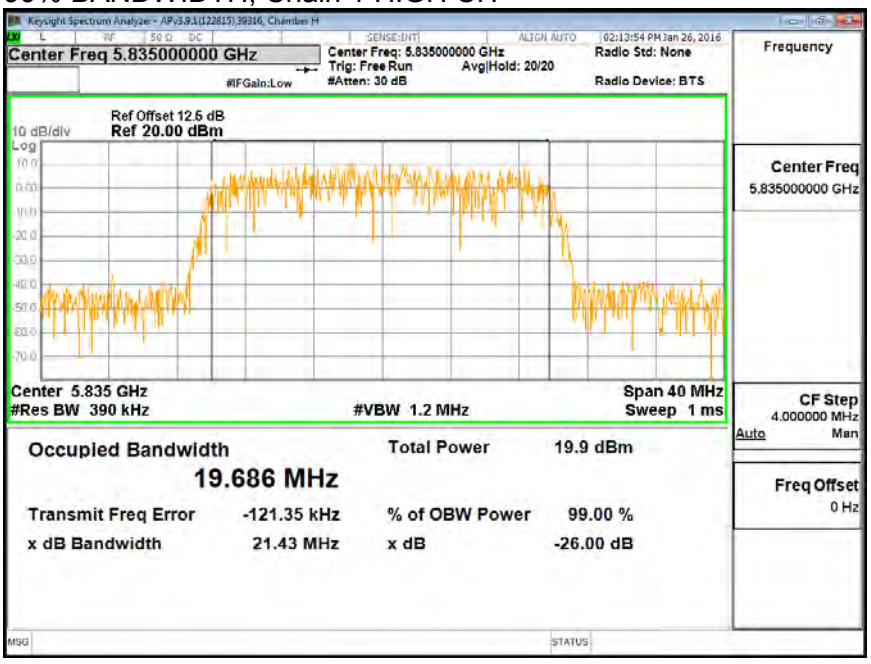
99% BANDWIDTH, Chain 1 LOW CH



99% BANDWIDTH, Chain 1 MID CH

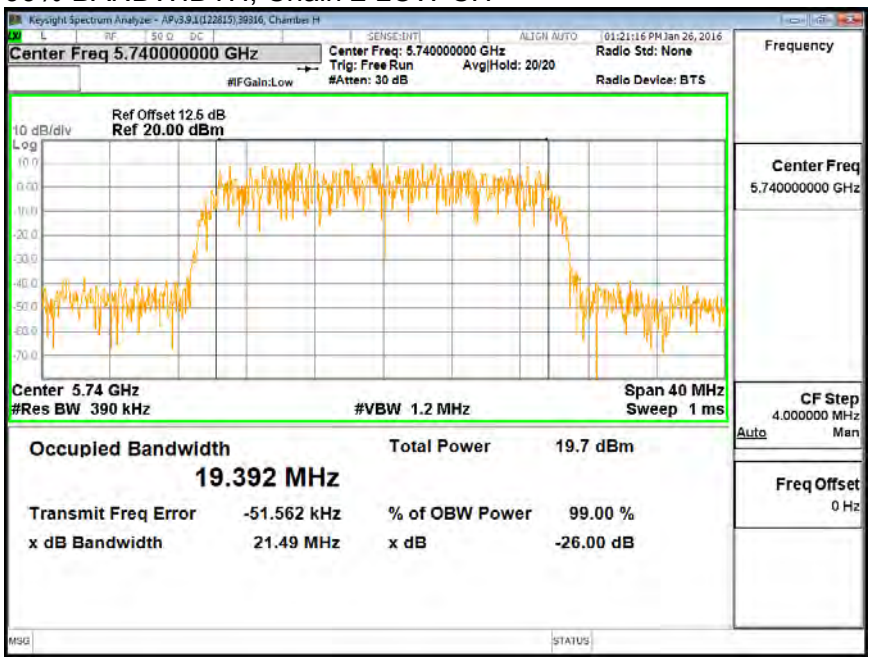


99% BANDWIDTH, Chain 1 HIGH CH

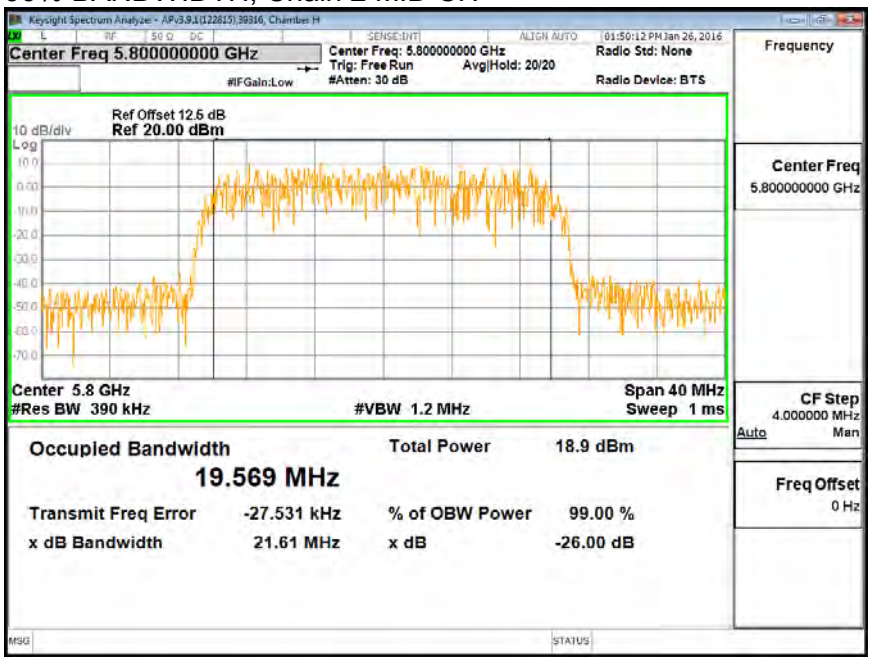


99% BANDWIDTH, Chain 2

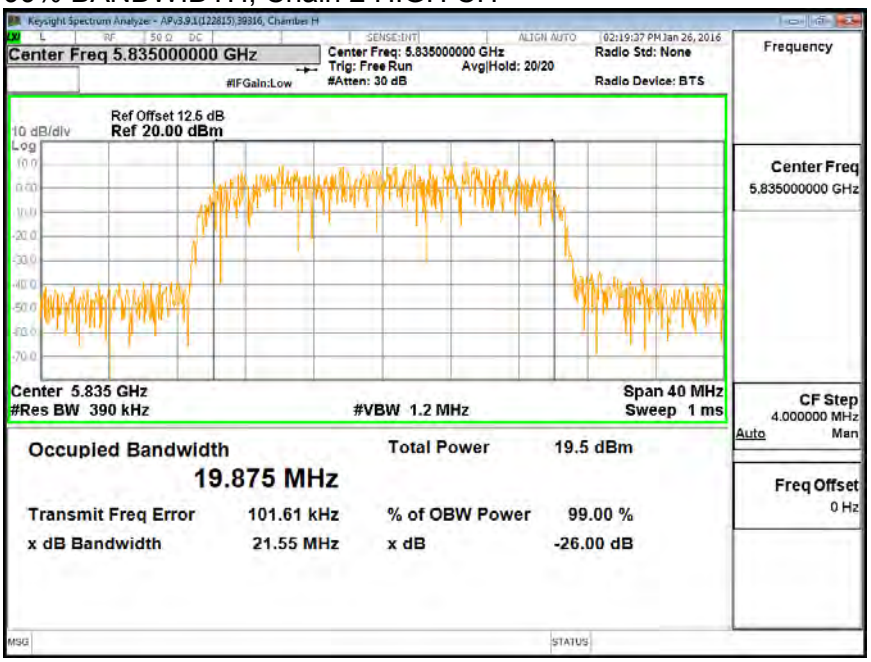
99% BANDWIDTH, Chain 2 LOW CH



99% BANDWIDTH, Chain 2 MID CH

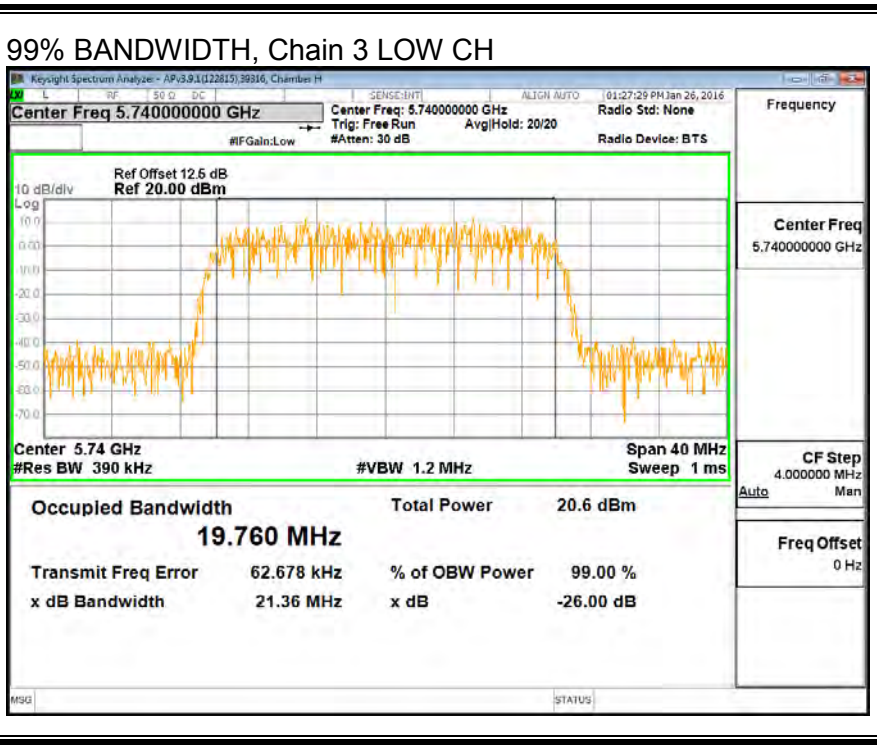


99% BANDWIDTH, Chain 2 HIGH CH

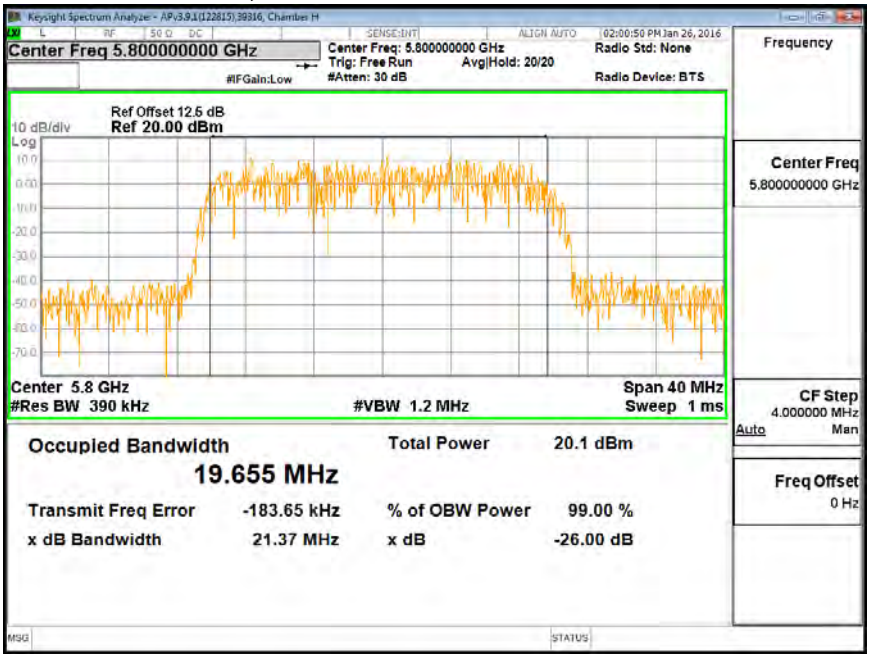


99% BANDWIDTH, Chain 3

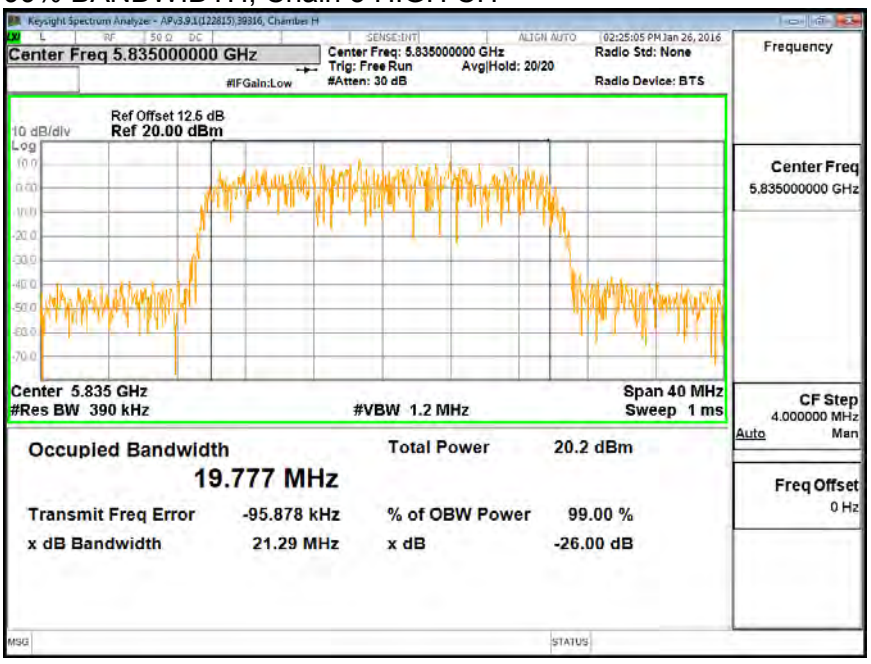
99% BANDWIDTH, Chain 3 LOW CH



99% BANDWIDTH, Chain 3 MID CH



99% BANDWIDTH, Chain 3 HIGH CH



8.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3), (c)(1)(ii)

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

(c) Operation with directional antenna gains greater than 6 dBi.
(1) Fixed point-to-point operation:
(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

DIRECTIONAL ANTENNA GAIN

There are a total of four antennas; two horizontal antennas (chains 0 and 2) and two vertical antennas (chains 1 and 3). Horizontal antennas are cross polarized with respect to vertical antennas

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

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	5740	18.01	30.00	30	36	30.00
Mid	5800	18.01	30.00	30	36	30.00
High	5835	18.01	30.00	30	36	30.00

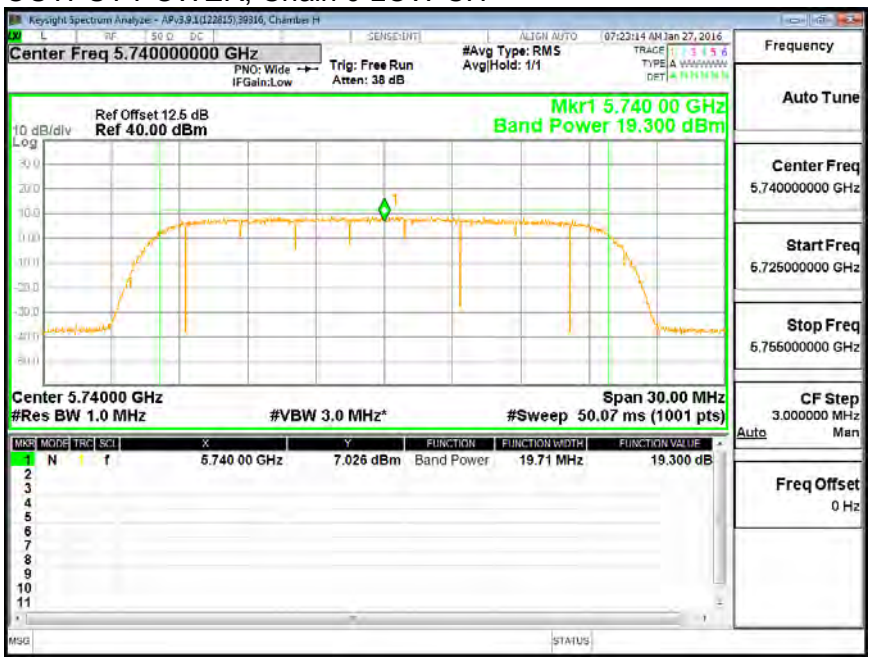
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power

Results

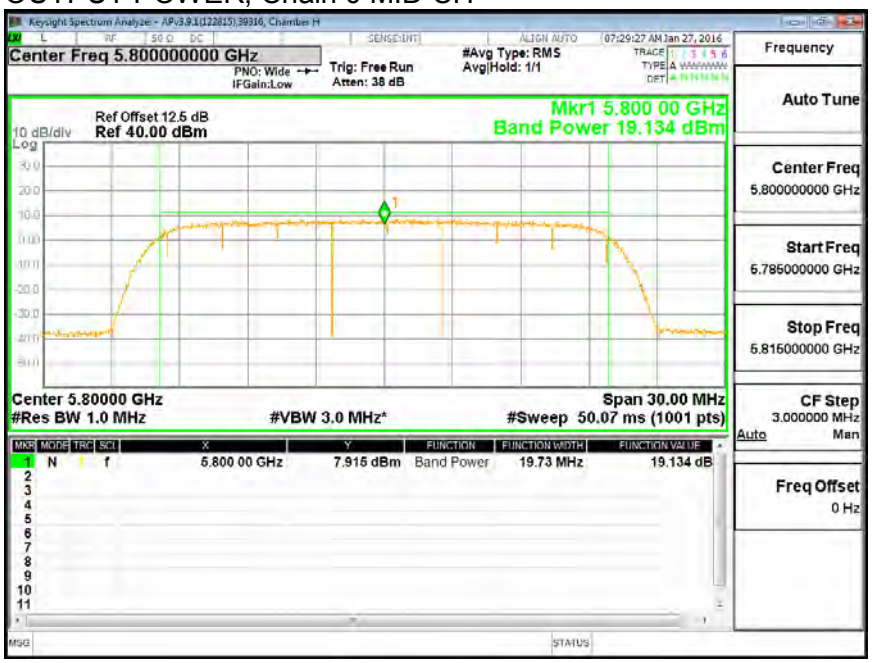
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Chain 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	5740	19.30	19.76	19.20	20.17	25.64	30.00	-4.36
Mid	5800	19.13	19.79	19.02	19.55	25.40	30.00	-4.60
High	5835	19.42	19.82	19.44	20.20	25.75	30.00	-4.25

OUTPUT POWER, Chain 0

OUTPUT POWER, Chain 0 LOW CH



OUTPUT POWER, Chain 0 MID CH

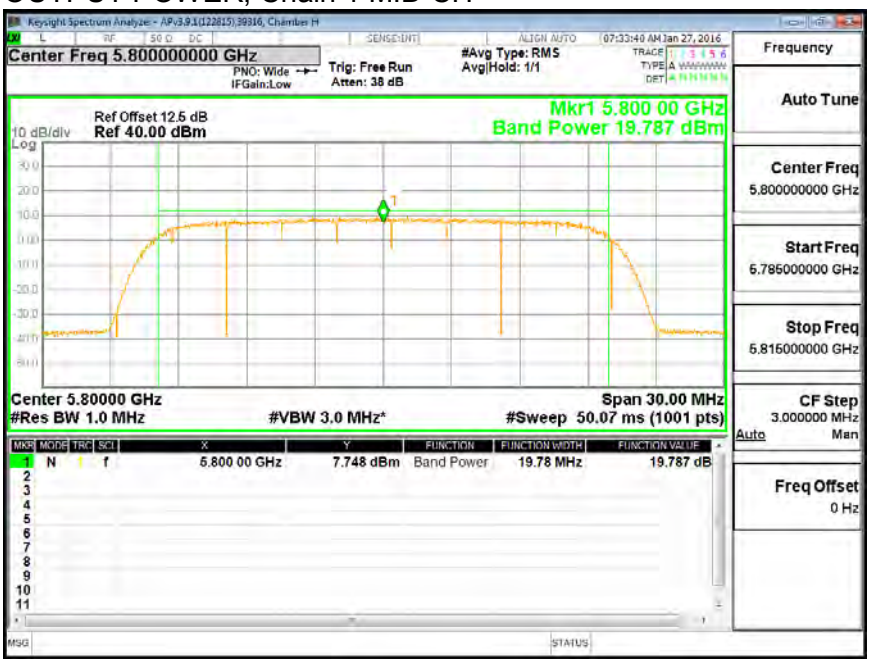


OUTPUT POWER, Chain 0 HIGH CH

OUTPUT POWER, Chain 1

OUTPUT POWER, Chain 1 LOW CH

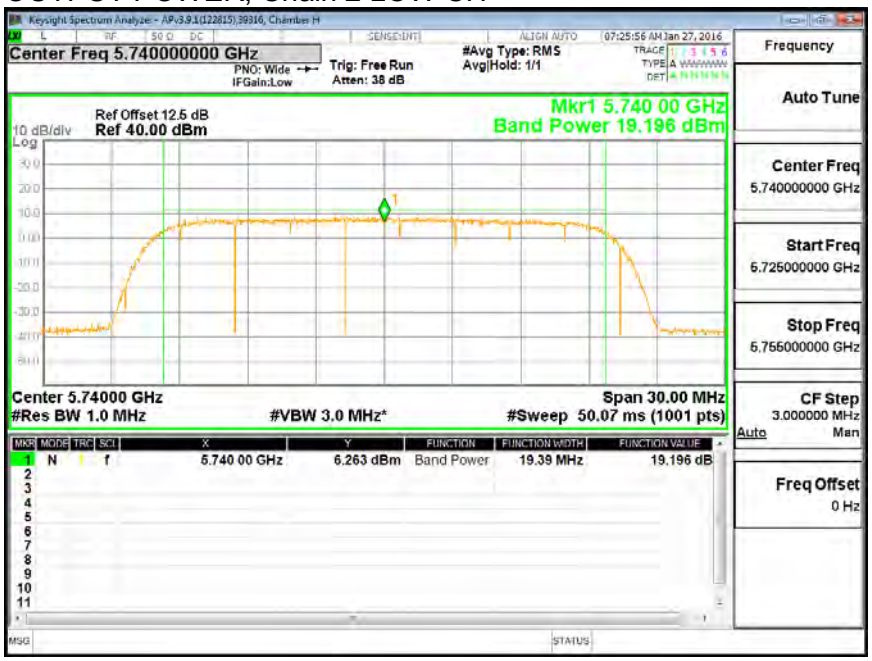
OUTPUT POWER, Chain 1 MID CH



OUTPUT POWER, Chain 1 HIGH CH

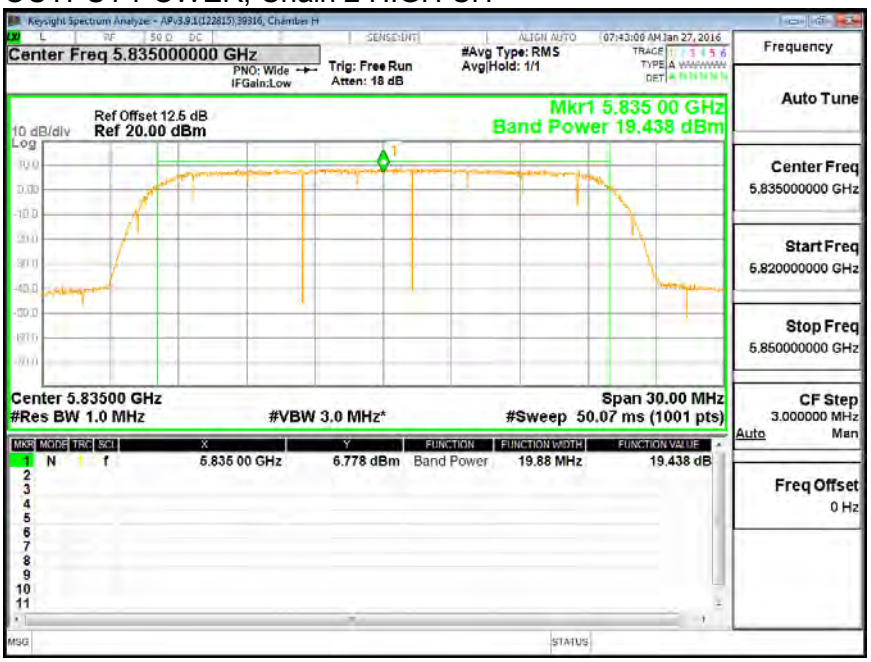
OUTPUT POWER, Chain 2

OUTPUT POWER, Chain 2 LOW CH



OUTPUT POWER, Chain 2 MID CH

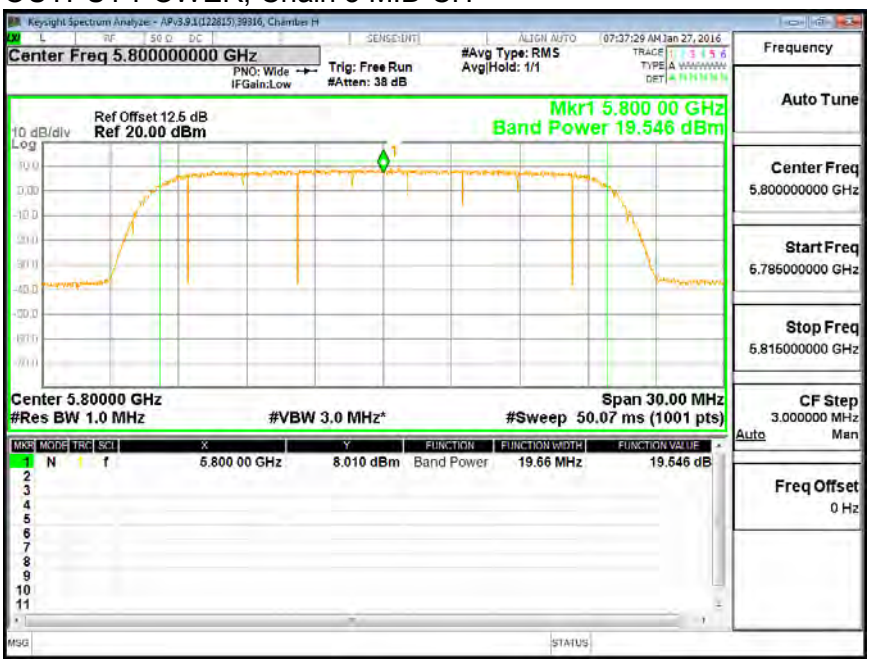
OUTPUT POWER, Chain 2 HIGH CH



OUTPUT POWER, Chain 3

OUTPUT POWER, Chain 3 LOW CH

OUTPUT POWER, Chain 3 MID CH



OUTPUT POWER, Chain 3 HIGH CH

8.3.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

For digitally modulated systems, the power spectral density conducted form the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

RESULTS

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

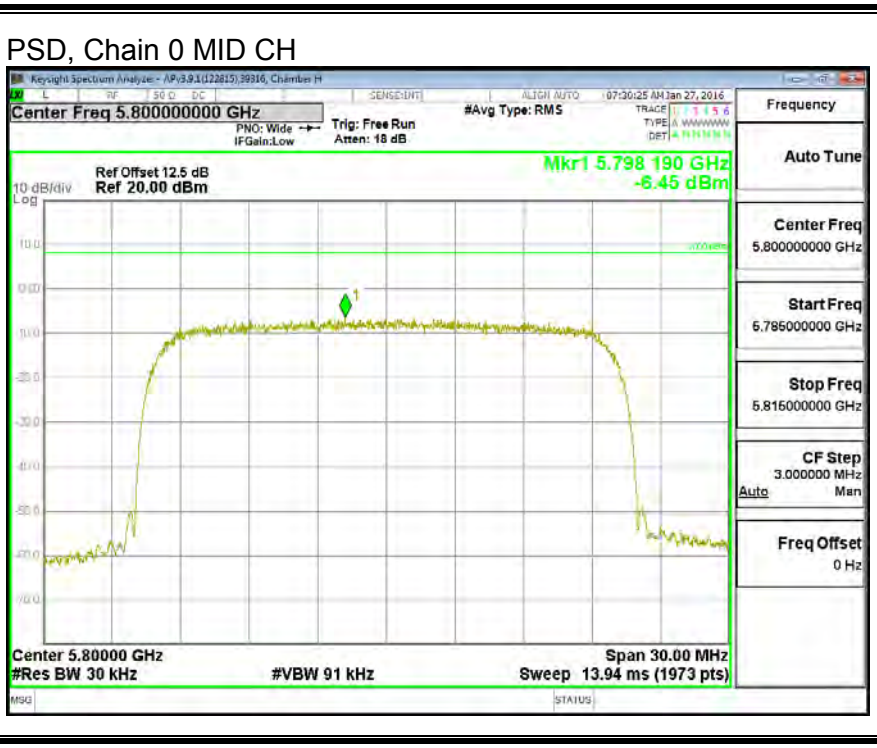
PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Chain 1 Meas (dBm)	Chain 2 Meas (dBm)	Chain 3 Meas (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5740	-6.44	-5.78	-6.37	-5.44	0.03	8.0	-8.0
Mid	5800	-6.45	-5.48	-6.88	-5.98	-0.15	8.0	-8.1
High	5835	-5.51	-5.76	-6.33	-5.27	0.32	8.0	-7.7

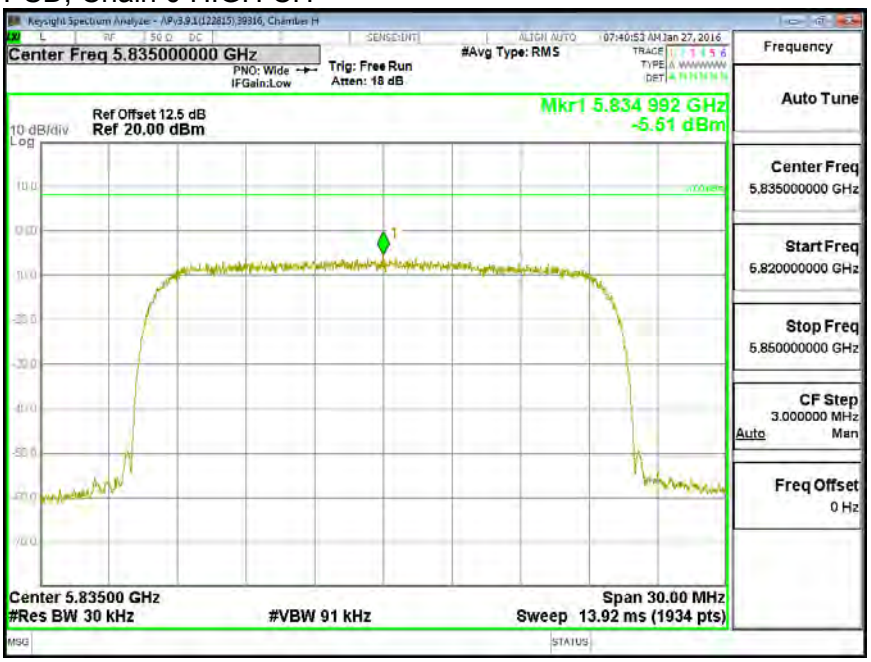
PSD, Chain 0

PSD, Chain 0 LOW CH

PSD, Chain 0 MID CH

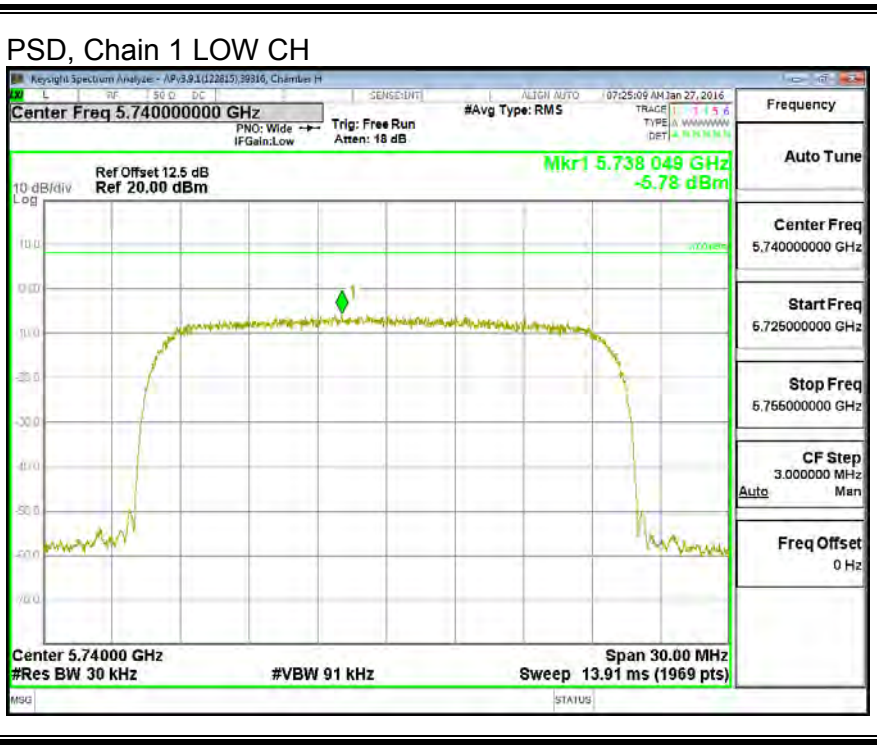


PSD, Chain 0 HIGH CH



PSD, Chain 1

PSD, Chain 1 LOW CH



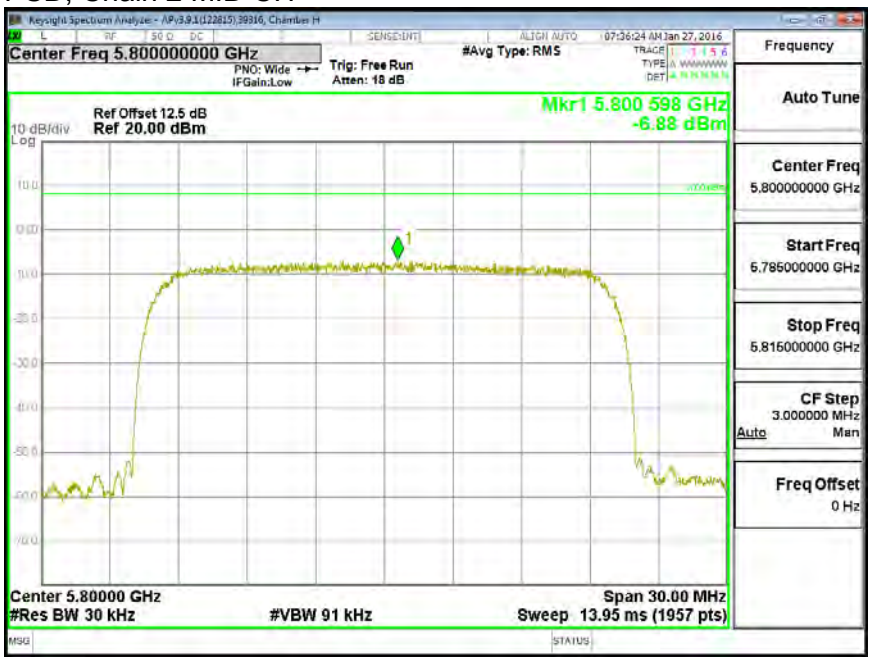
PSD, Chain 1 MID CH

PSD, Chain 1 HIGH CH

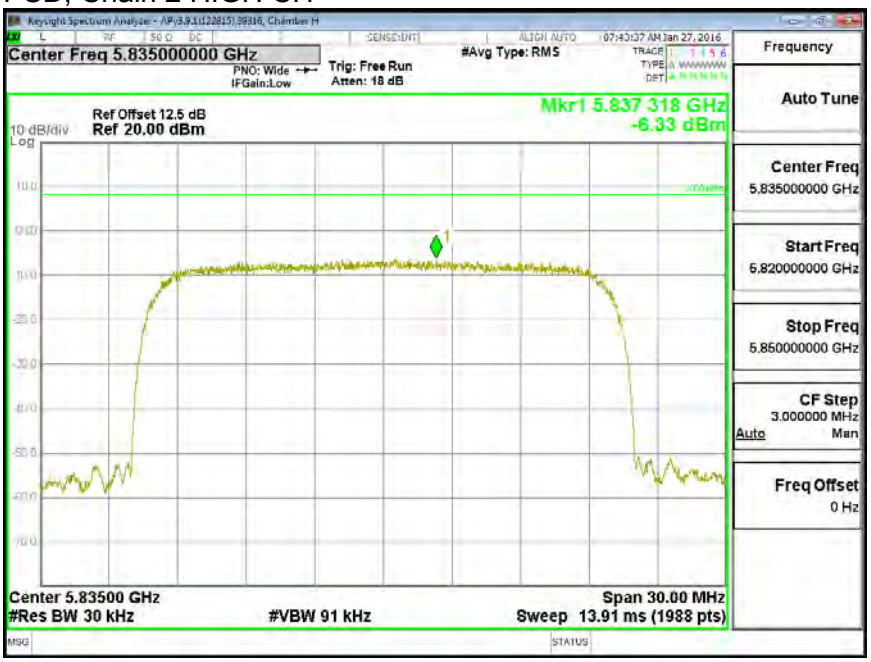
PSD, Chain 2

PSD, Chain 2 LOW CH

PSD, Chain 2 MID CH

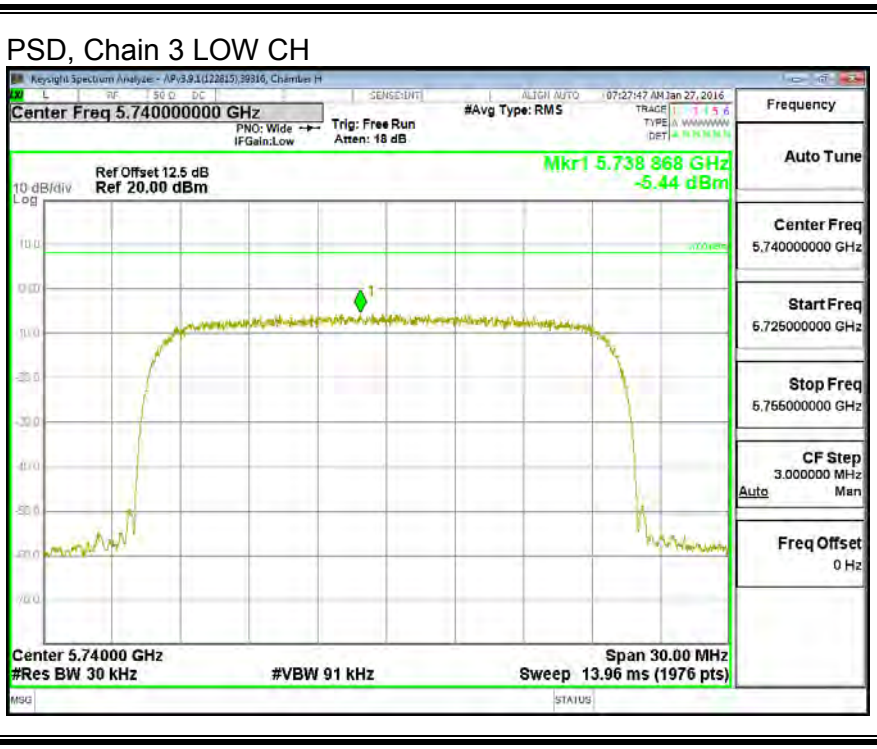


PSD, Chain 2 HIGH CH



PSD, Chain 3

PSD, Chain 3 LOW CH



PSD, Chain 3 MID CH

PSD, Chain 3 HIGH CH

8.3.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

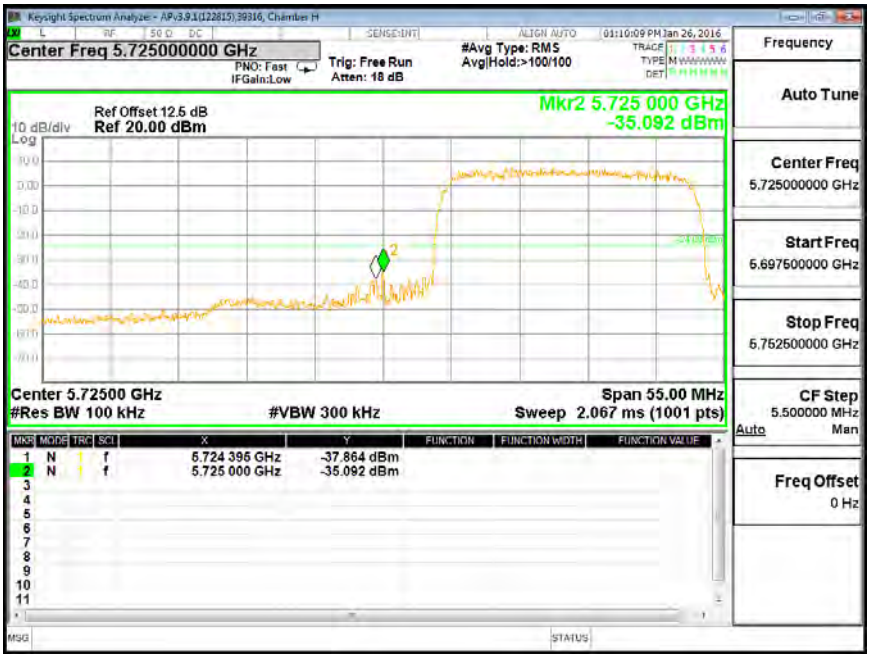
RESULTS

IN-BAND REFERENCE LEVEL, Chain 0

REFERENCE LEVEL Chain 0 MID CH

LOW CHANNEL BANDEDGE, Chain 0

AUTHORIZED BAND EDGE Chain 0 LOW CH

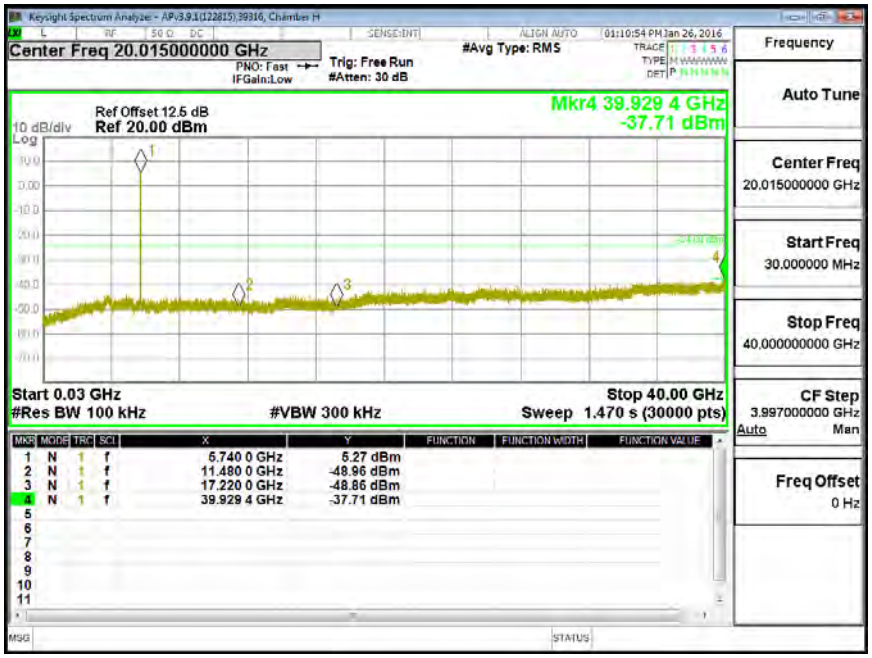


HIGH CHANNEL BANDEDGE, Chain 0

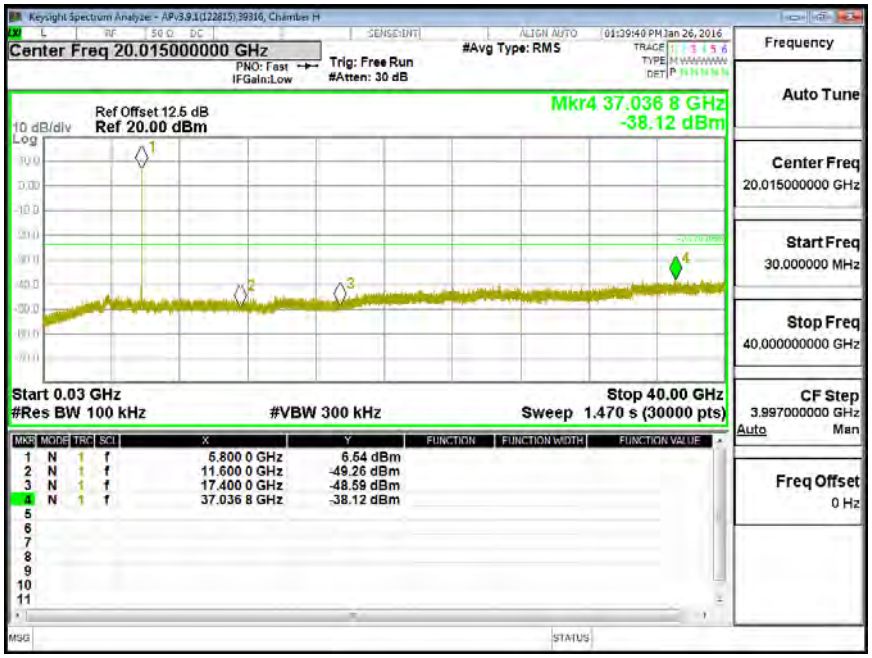
AUTHORIZED BAND EDGE Chain 0 HIGH CH

OUT-OF-BAND EMISSIONS, Chain 0

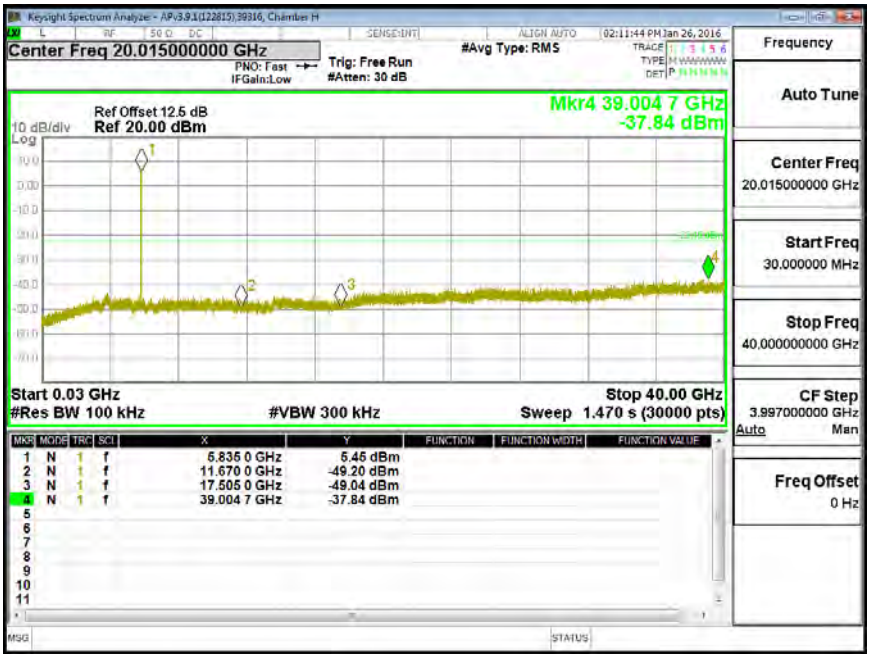
OUT OF BAND Chain 0 LOW CH



OUT OF BAND Chain 0 MID CH

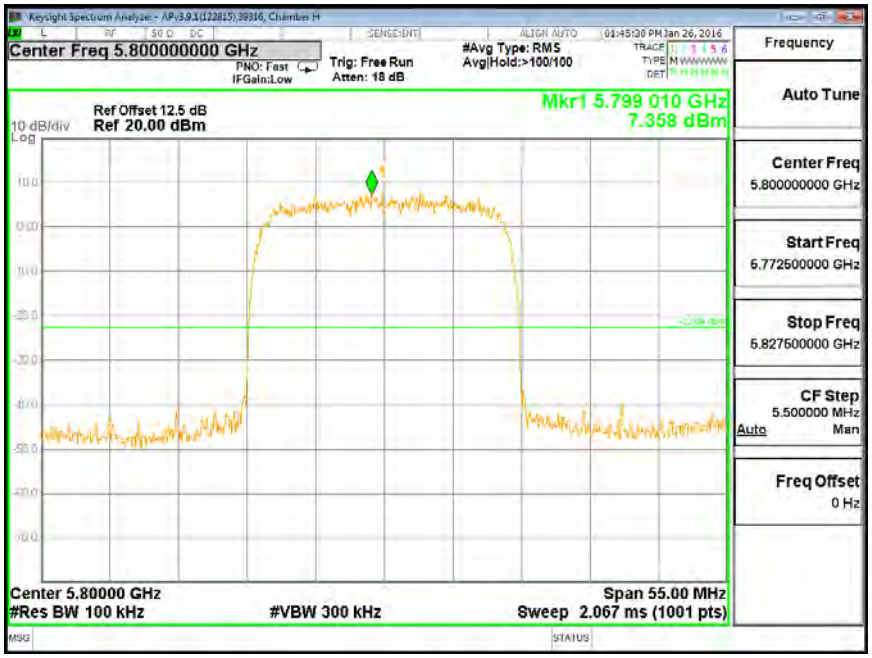


OUT OF BAND Chain 0 HIGH CH



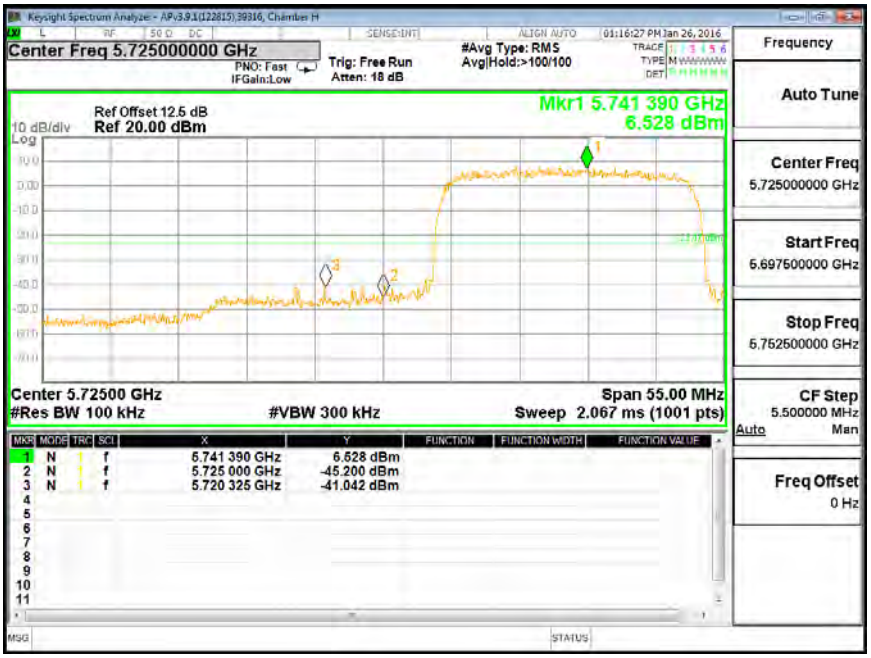
IN-BAND REFERENCE LEVEL, Chain 1

REFERENCE LEVEL Chain 1 MID CH



LOW CHANNEL BANDEDGE, Chain 1

AUTHORIZED BAND EDGE Chain 1 LOW CH

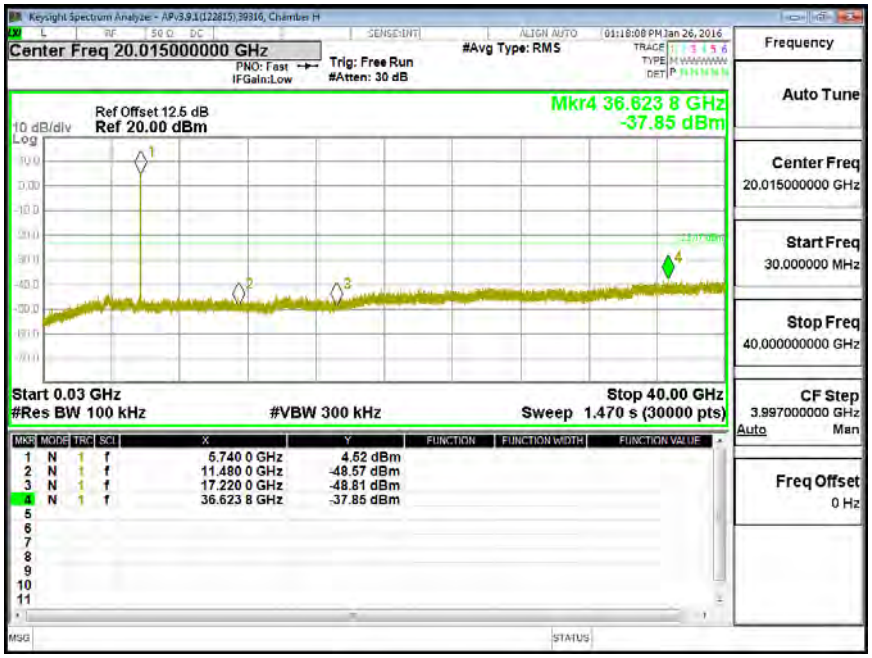


HIGH CHANNEL BANDEDGE, Chain 1

AUTHORIZED BAND EDGE Chain 1 HIGH CH

OUT-OF-BAND EMISSIONS, Chain 1

OUT OF BAND Chain 1 LOW CH



OUT OF BAND Chain 1 MID CH