CERTIFICATION TEST REPORT

Report Number : 11882202-E1V2

Applicant	:	MICROSOFT CORP ONE MICROSOFT WAY REDMOND, WA 98052, U.S.A.
Model	:	1832
FCC ID	:	C3K1832
IC	:	3048A-1832
EUT Description	:	PORTABLE COMPUTING DEVICE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS - 247 ISSUE 2

Date Of Issue:
September 28, 2017

Prepared by:
UL Verification Services Inc.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	09/05/17	Initial Release	---
V2	09/28/17	- Replaced Chain 0 with Chain A and Replaced Chain 1 with Chain B	C. Susa

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: PORTABLE COMPUTING DEVICE

MODEL: 1832

SERIAL NUMBER: Radiated: 012813672657
Conducted: 009698372657

DATE TESTED: AUGUST 11 – SEPTEMBER 6, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 2	Pass
INDUSTRY CANADA RSS-GEN Issue 4	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
WiSE Program Manager
UL VERIFICATION SERVICES INC.

Prepared By:

ERIC YU
WiSE LAB 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, KDB 558074 D01 v4, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 2.

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(IC: 2324B-1)	☐ Chamber D(IC: 22541-1)
☒ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 22541-2)
☒ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 22541-3)
	☐ Chamber G(IC: 22541-4)
	☐ Chamber H(IC: 22541-5)

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.
Chambers A through C are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under Industry Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

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
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a portable computing device with 802.11 2x2, a/b/g/n/ac WLAN, Bluetooth, Bluetooth LE.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11b 2TX	19.91	97.95
2412 - 2472	802.11g 2TX	26.11	408.32
2412 - 2472	802.11n HT20 2TX CDD	25.19	330.37

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11b 2TX	16.63	46.03
2412 - 2472	802.11g 2TX	16.40	43.65
2412 - 2472	802.11n HT20 2TX	16.09	40.64

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)	
	Chain A	Chain B
2.4	2.58	3.26

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 14.2.201.159

The test utility software used during testing was Wifi tool v2.7.5

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated bandedge, harmonics, and spurious emissions from 1 GHz to 18GHz were performed. The EUT was set to transmit at the Low/Middle/High channels.

Radiated emission below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT was set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in four orientations X/Y/Z and display tilted at 45degrees, it was determined that Y orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in Y orientation.

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

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20mode: MCS0

For MIMO modes, the 2TX emission testing was considered as a worst case scenario and was performed at power levels, per transmit chain, greater than or equal to the maximum power in any 1TX mode.

5.6. DESCRIPTION OF TEST SETUP

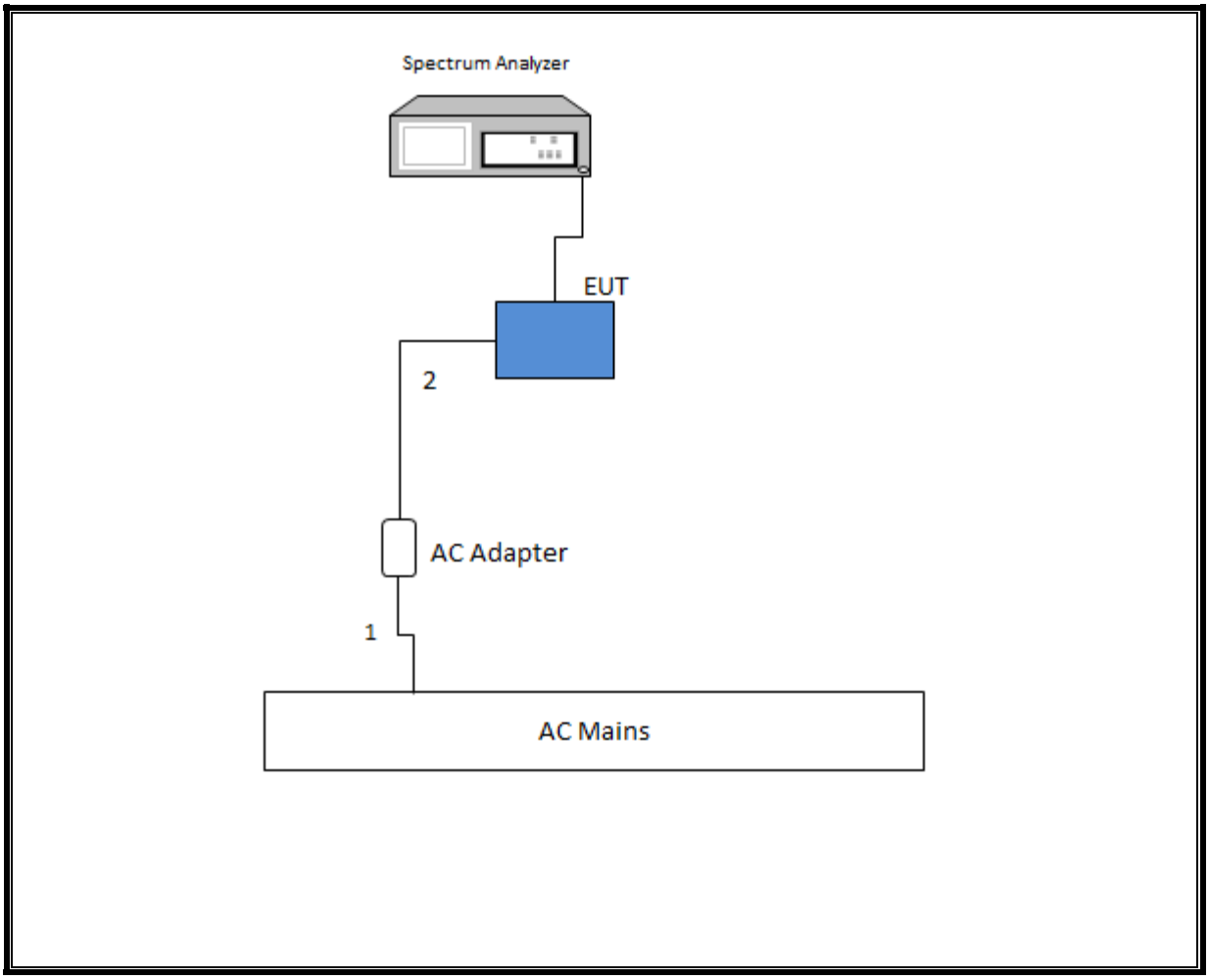
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC	1	Proprietary	Un-Shielded	1.75	
2	USB	1	USB	Un-Shielded	0.17	

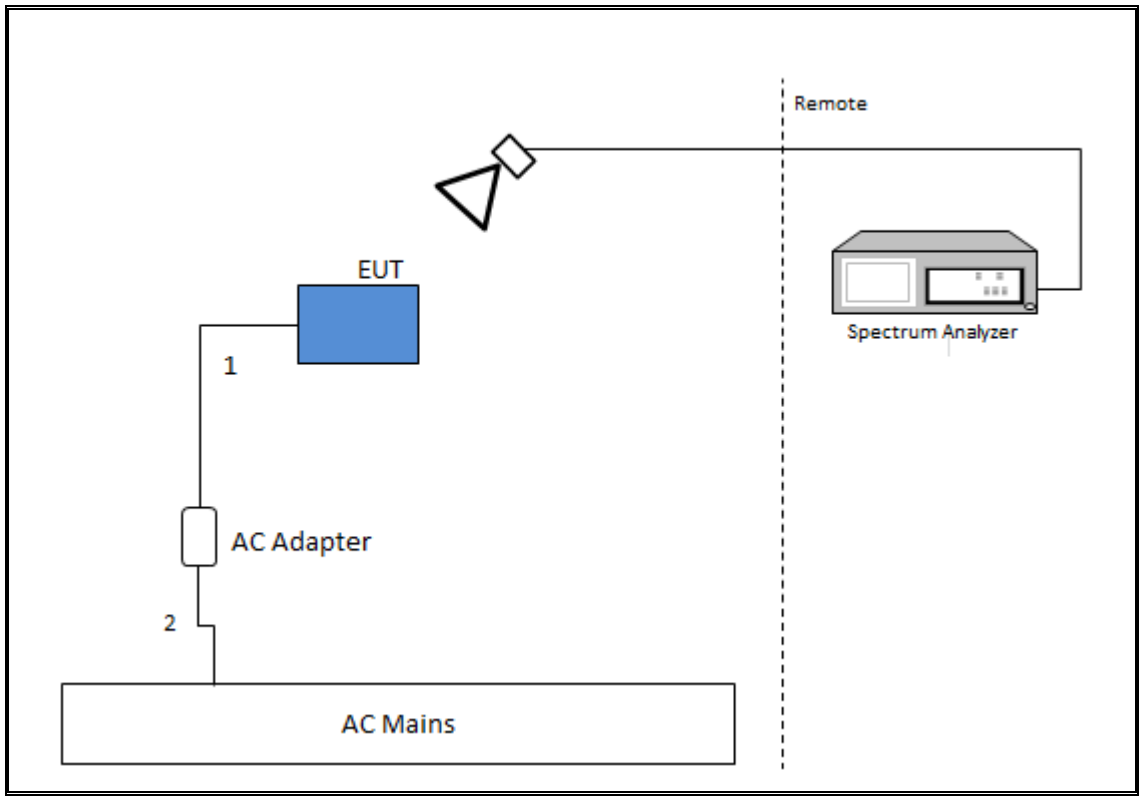
TEST SETUP

Test software is installed on the EUT and exercises the radio. During all tests the EUT is connected to the AC adapter.

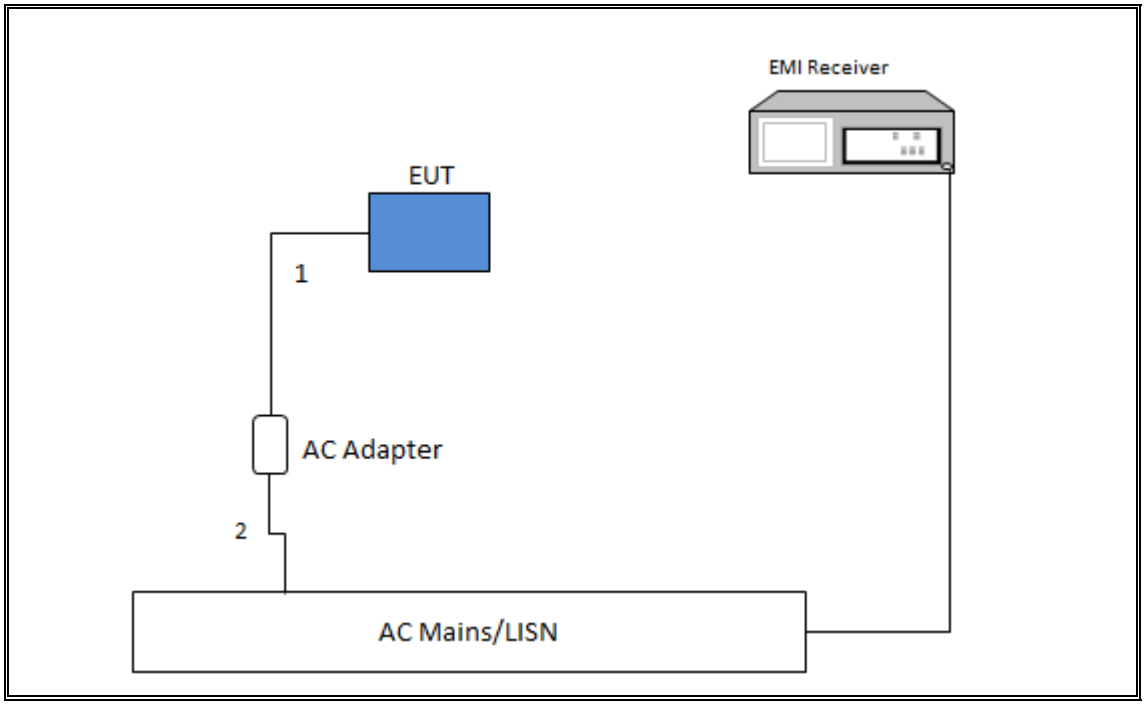
SETUP DIAGRAM FOR ANTENNA PORT CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



SETUP DIAGRAM FOR AC LINE CONDUCTED TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Spectrum Analyzer	Keysight	N9030A	T1210	07/17/18
Spectrum Analyzer	Keysight	N9030A	T1466	04/11/18
Antenna, Biconolog, 30-1GHz	Sunol Sciences	JB1	T130	09/23/17
RF Preamplifier, 10kHz – 1GHz	Sonoma	310N	T300	11/10/17
Antenna, Horn, 1-18GHz	ETS Lindgren	3117	T862	06/09/18
RF Preamplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	T1165	06/24/18
RF Preamplifier, 1-8GHz	Miteq	AMF-4D-01000800-30-29P	T1573	06/24/18
Low Pass Filter, 5GHz	Micro-Tronics	LPS17541	T481	06/24/18
High Pass Filter, 6GHz	Micro-Tronics	HPS17542	T484	06/24/18
Spectrum Analyzer	Keysight	N9030A	T907	01/23/18
RF Preamplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	T493	02/15/18
RF Preamplifier, 1-8GHz	Miteq	AMF-4D-01000800-30-29P	T1156	02/15/18
Antenna, Horn, 1-18GHz	ETS Lindgren	3117	T863	06/09/18
Low Pass Filter, 5GHz	Micro-Tronics	LPS17541	T482	02/15/18
High Pass Filter, 6GHz	Micro-Tronics	HPS17542	T483	02/15/18
Antenna, Horn, 18-26GHz	ARA	MWH-1826/B	T449	06/12/18
RF Preamplifier, 1-26GHz	Agilent	8499B	T404	07/23/18
Antenna, Horn, 26-40GHz	ARA	MWH-2640	T90	08/25/18
RF Preamplifier, 26-40GHz	Miteq	NSP4000-SP2	T88	04/29/18
Spectrum Analyzer	Keysight	N9030A	T1454	12/15/17
EMI Receiver	Rohde & Schwarz	ESR	T1436	01/06/18
LISN	Fischer Custom Communications	FCC-LSN-50/250-25-2-01	T1310	06/15/18

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	9.5, 12/01/16
Antenna Port Software	UL	UL RF	7.1, 8/6/17
Conducted Emissions Software	UL	UL EMC	9.5, 5/26/15

7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.

6 dB BW: KDB 558074 D01 v04, Section 8.1.

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

Output Power: KDB 558074 D01 v04, Section 9.2.3.2.

Power Spectral Density: KDB 558074 D01 v04, Section 10.3.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.1 (b).

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

8. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	Occupied Band width (6dB)	>500KHz	Conducted	Pass
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-30dBc		Pass
15.247 (b) (3)	TX conducted output power	<30dBm		Pass
15.247 (e)	PSD	<8dBm/3kHz		Pass
15.207 (a)	AC Power Line conducted emissions	Section 10		Pass
15.205, 15.209, 15.247(d)	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass
		< 74dBuV/m		

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

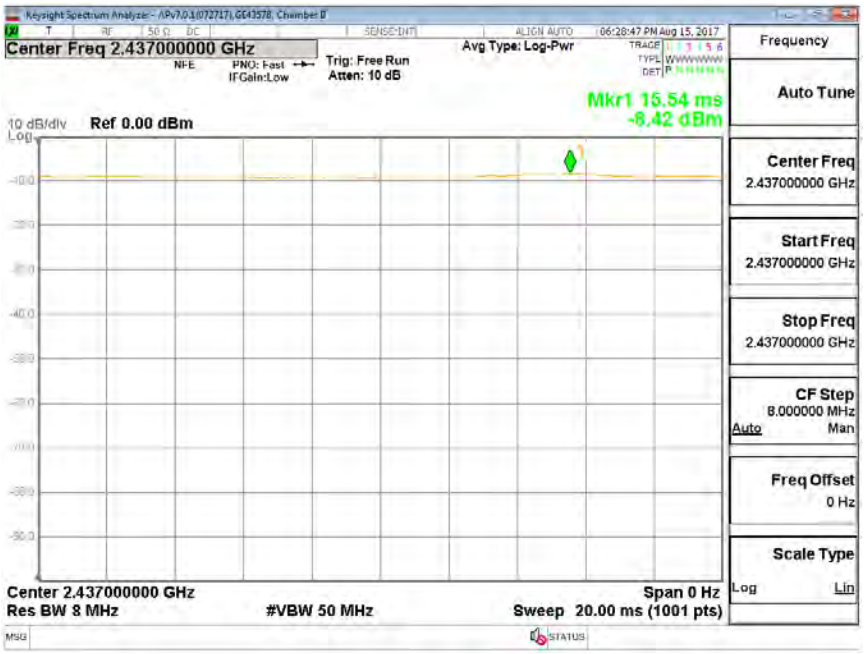
KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)
802.11b	20.00	20.00	1.000	100.00%	0.00	0.01
802.11g	3.14	3.18	0.989	98.90%	0.00	0.01
802.11n HT20 CDD	9.89	9.94	0.995	99.50%	0.00	0.01

DUTY CYCLE PLOTS

DUTY CYCLE 802.11b MODE



DUTY CYCLE 802.11g MODE

DUTY CYCLE 802.11n HT20 CDD MODE

9.2. 11b 2TX MIMO MODE IN THE 2.4GHz BAND

9.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

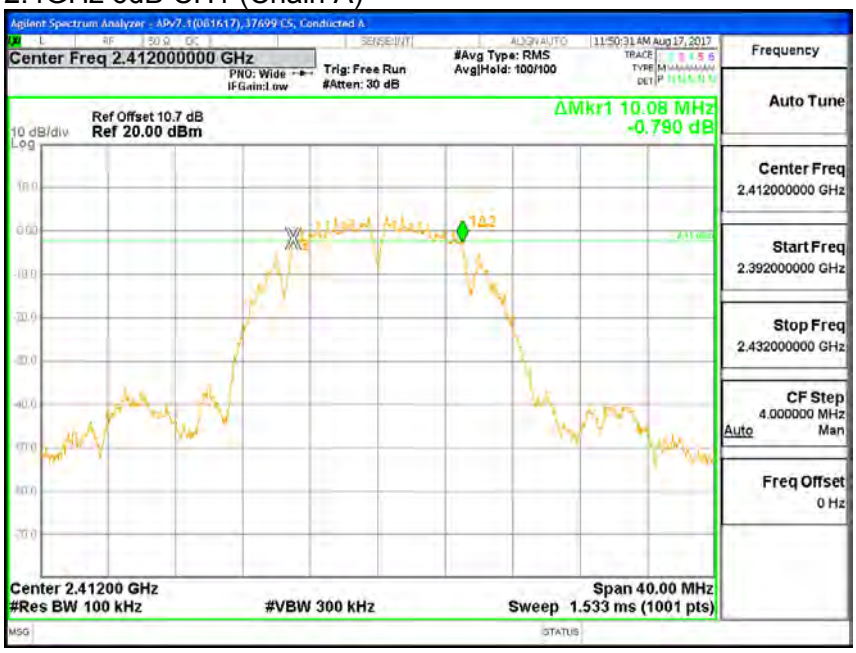
IC RSS-247 (5.2) (a)

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

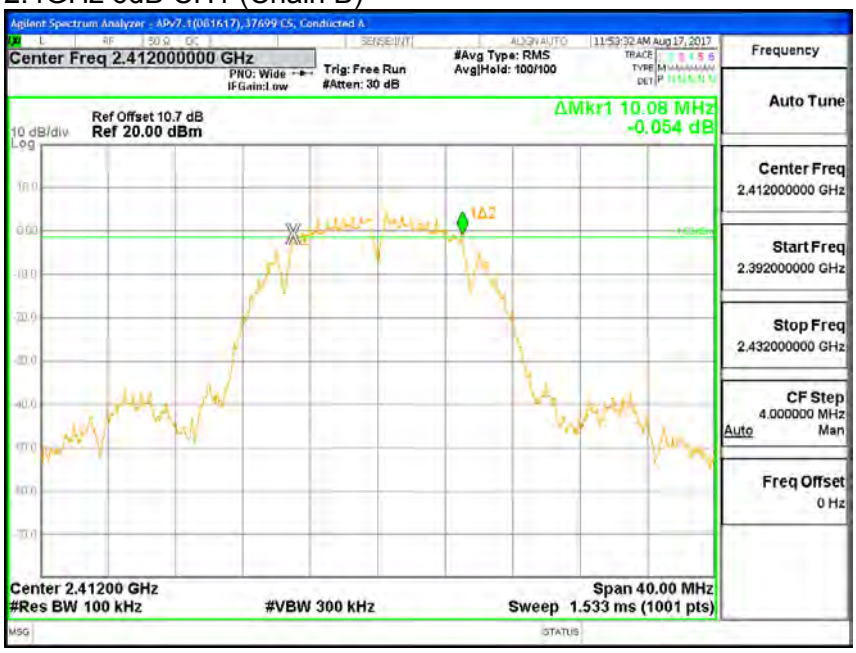
RESULTS

Channel	Frequency (MHz)	6 dB BW Chain A (MHz)	6 dB BW Chain B (MHz)	Minimum Limit (MHz)
CH1	2412	10.08	10.08	0.5
CH6	2437	10.08	9.84	0.5
CH11	2462	9.60	10.08	0.5
CH12	2467	10.08	10.04	0.5
CH13	2472	9.64	10.08	0.5

2.4GHz 6dB CH1 (Chain A)



2.4GHz 6dB CH1 (Chain B)



2.4GHz 6dB CH6 (Chain A)

2.4GHz 6dB CH6 (Chain B)

2.4GHz 6dB CH11 (Chain A)

2.4GHz 6dB CH11 (Chain B)

2.4GHz 6dB CH12 (Chain A)

2.4GHz 6dB CH12 (Chain B)

2.4GHz 6dB CH13 (Chain A)

2.4GHz 6dB CH13 (Chain B)

9.2.2. 99% BANDWIDTH

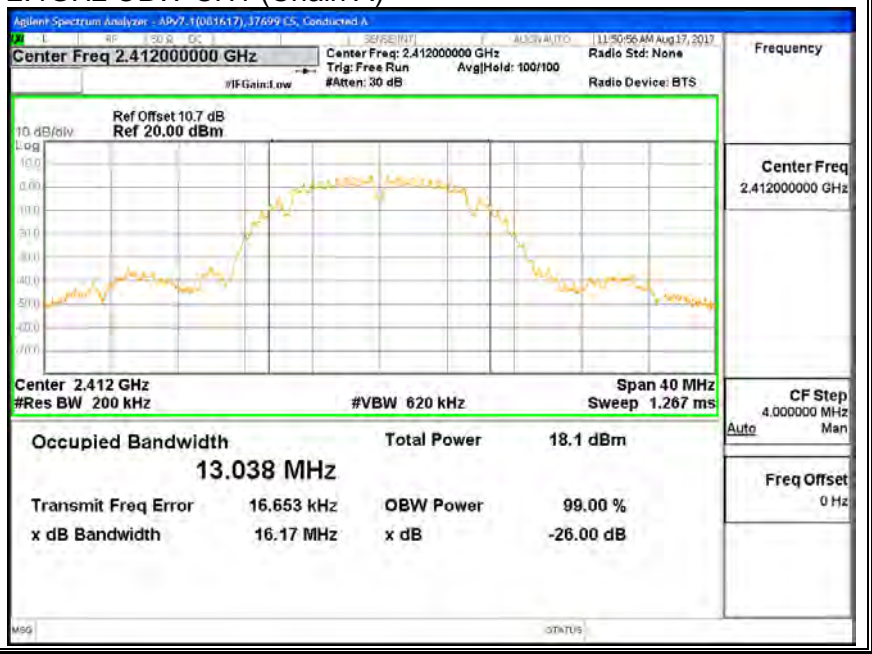
LIMITS

None; for reporting purposes only.

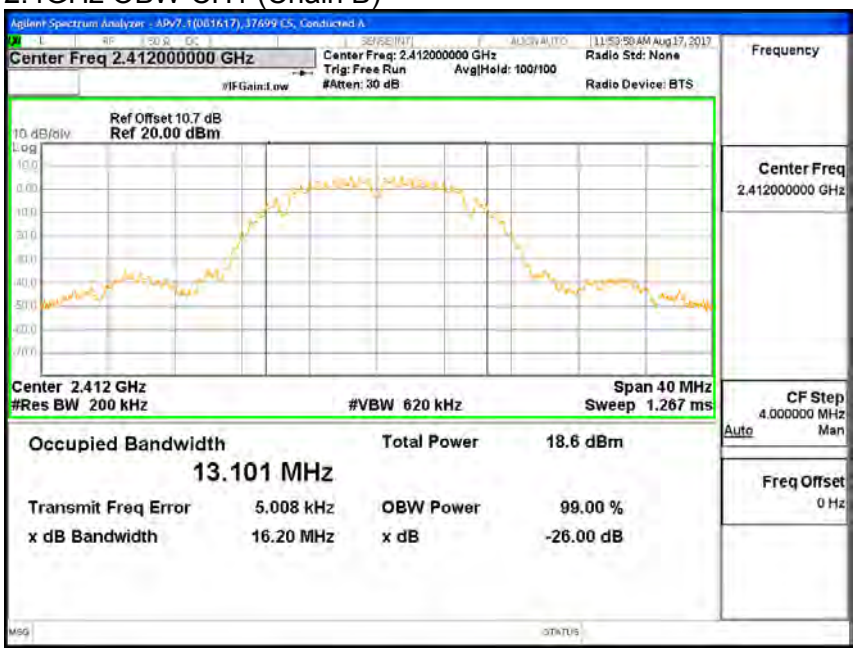
RESULTS

Channel	Frequency (MHz)	99% Bandwidth Chain A (MHz)	99% Bandwidth Chain B (MHz)
CH1	2412	13.038	13.101
CH6	2437	13.039	13.068
CH11	2462	13.055	13.108
CH12	2467	13.141	13.186
CH13	2472	13.136	13.192

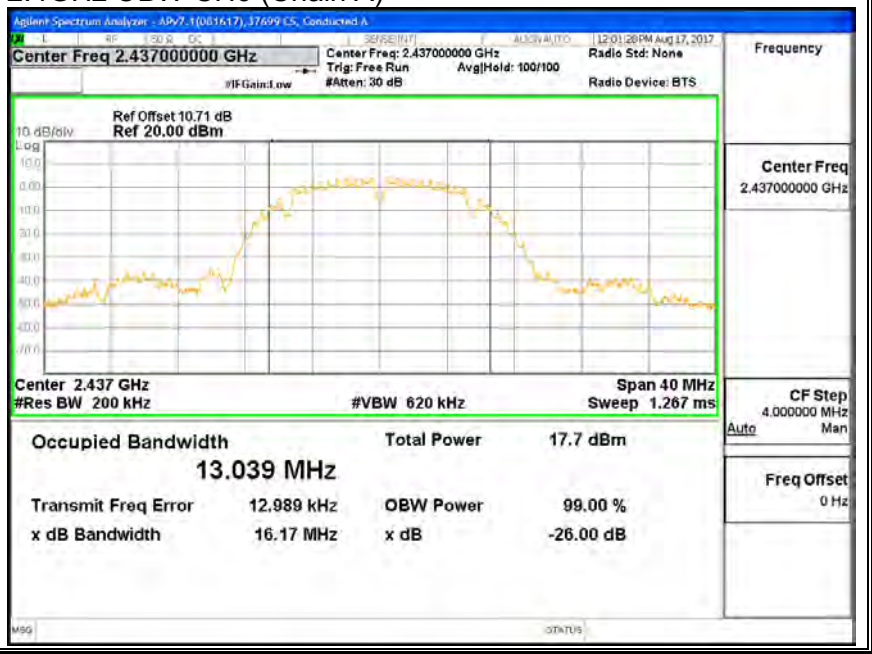
2.4GHz OBW CH1 (Chain A)



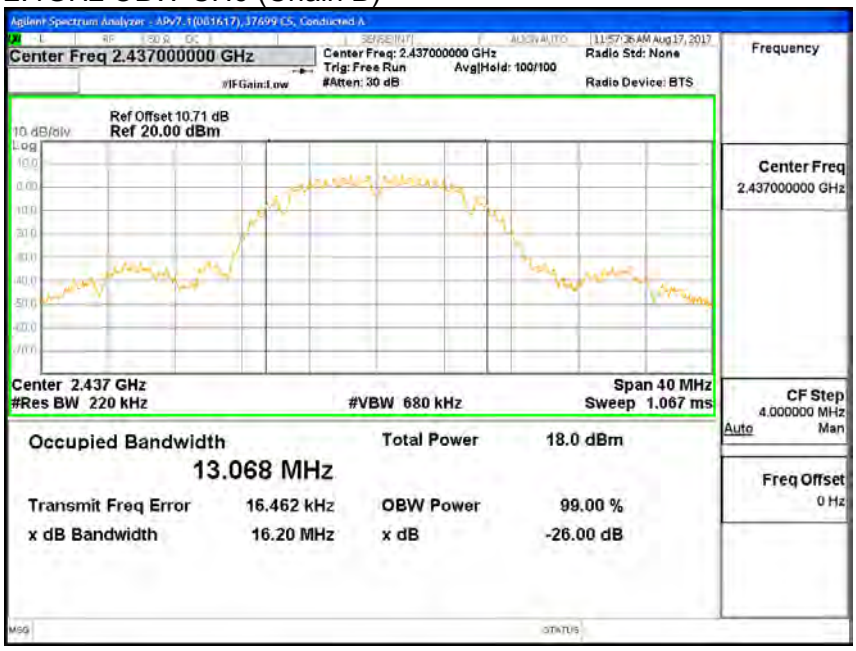
2.4GHz OBW CH1 (Chain B)



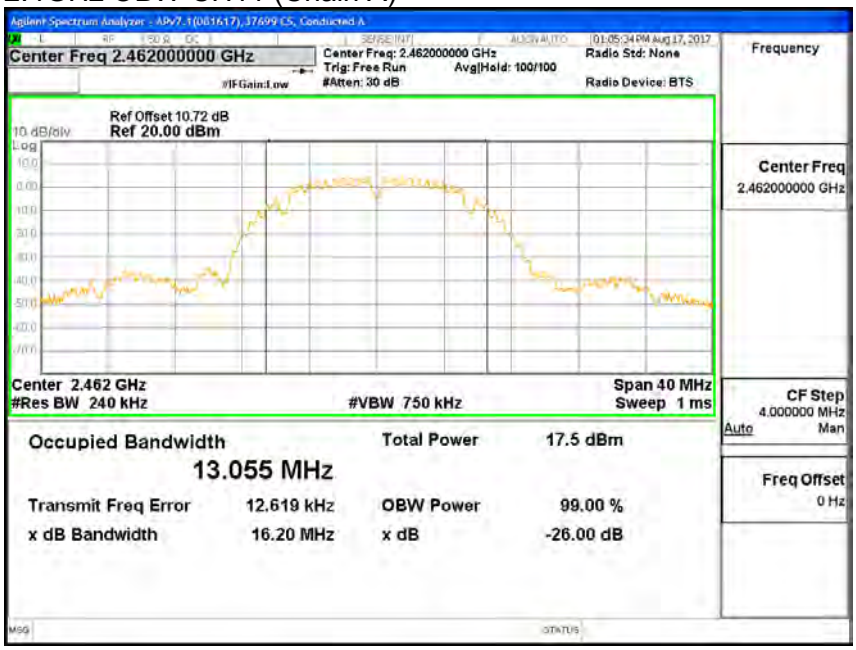
2.4GHz OBW CH6 (Chain A)



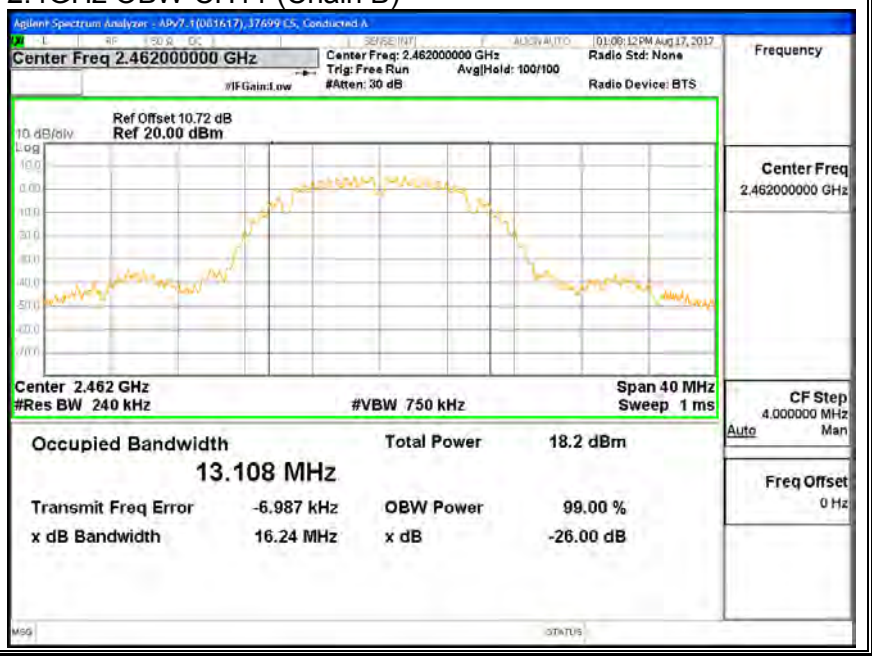
2.4GHz OBW CH6 (Chain B)



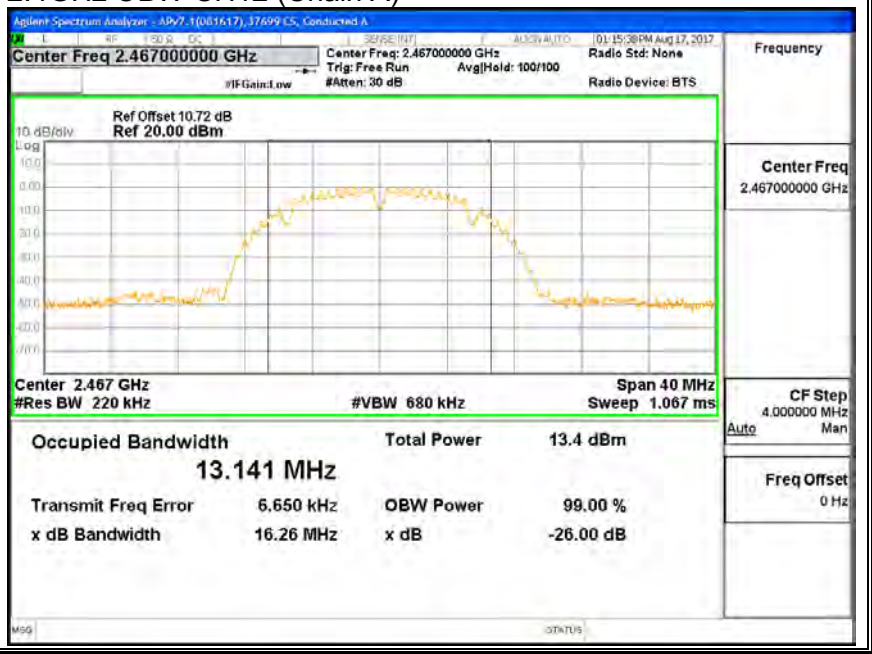
2.4GHz OBW CH11 (Chain A)



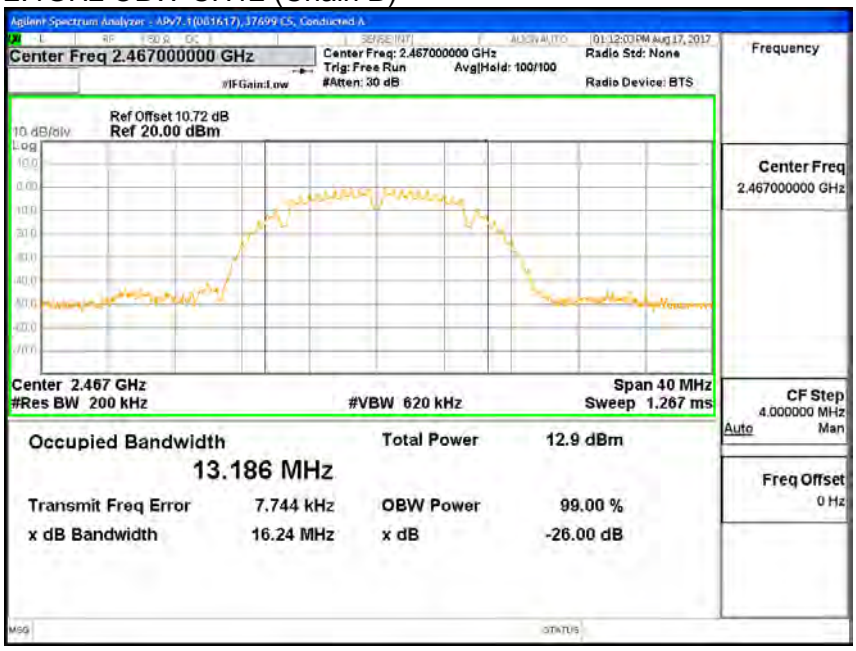
2.4GHz OBW CH11 (Chain B)



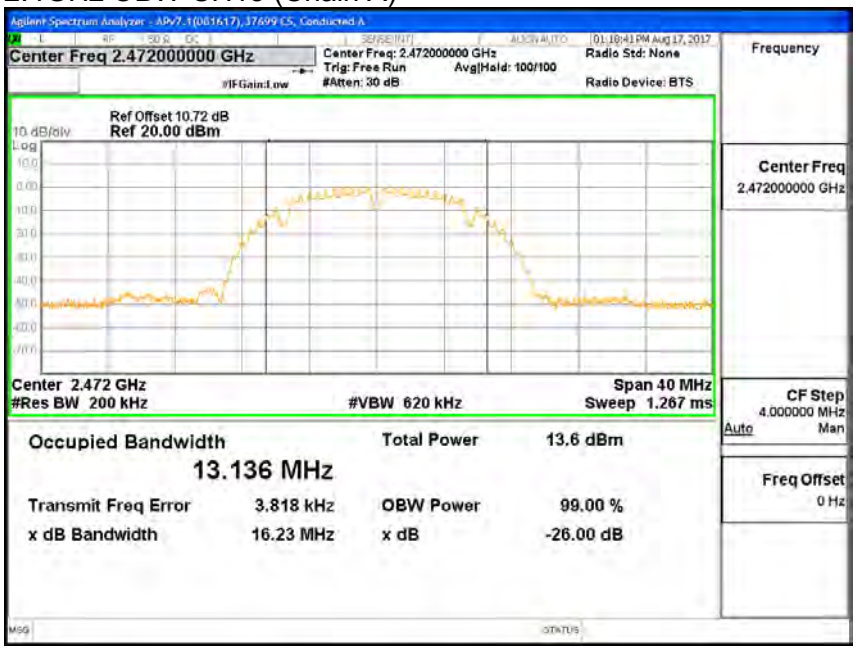
2.4GHz OBW CH12 (Chain A)



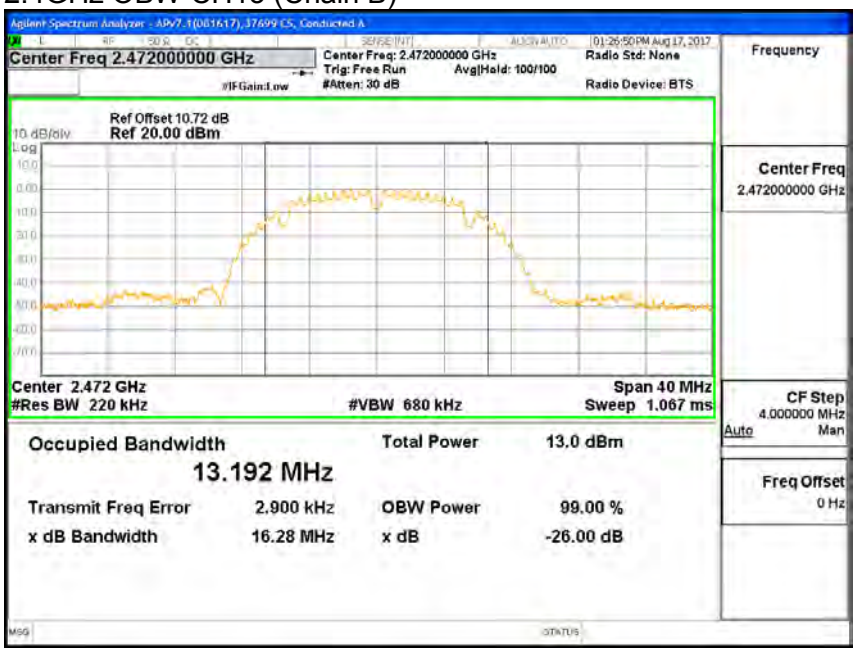
2.4GHz OBW CH12 (Chain B)



2.4GHz OBW CH13 (Chain A)



2.4GHz OBW CH13 (Chain B)



9.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 10.7 dB cable) was entered as an offset in the power meter to allow for a gated reading of power.

RESULTS

ID:	37699	Date:	08/11/17

Channel	Frequency (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Total Power (dBm)
Low	2412	13.15	13.14	16.16
Mid	2437	13.33	13.41	16.38
High_11	2462	13.37	13.85	16.63
High_12	2467	9.12	8.52	11.84
High_13	2472	9.13	8.75	11.95

9.2.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

IC RSS-247 (5.4) (d)

For systems using digital modulation in the 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

KDB 558074 D01 v04 Section 9.2.3.2

DIRECTIONAL ANTENNA GAIN

Tx chains are uncorrelated due to the device supporting CDD in all MIMO modes. The directional gain is:

Chain A Antenna Gain (dBi)	Chain B Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.58	3.26	2.93

RESULTS

ID:	37699	Date:	08/11/17

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
CH1	2412	2.93	30.00	30	36	30.00
CH6	2437	2.93	30.00	30	36	30.00
CH11	2462	2.93	30.00	30	36	30.00
CH12	2467	2.93	30.00	30	36	30.00
CH13	2472	2.93	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain A Meas Power (dBm)	Chain B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
CH1	2412	16.41	14.47	18.56	30.00	-11.44
CH6	2437	16.62	16.76	19.70	30.00	-10.30
CH11	2462	16.56	17.21	19.91	30.00	-10.09
CH12	2467	12.59	11.66	15.16	30.00	-14.84
CH13	2472	12.32	12.03	15.19	30.00	-14.81

9.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-247 (5.2) (b)

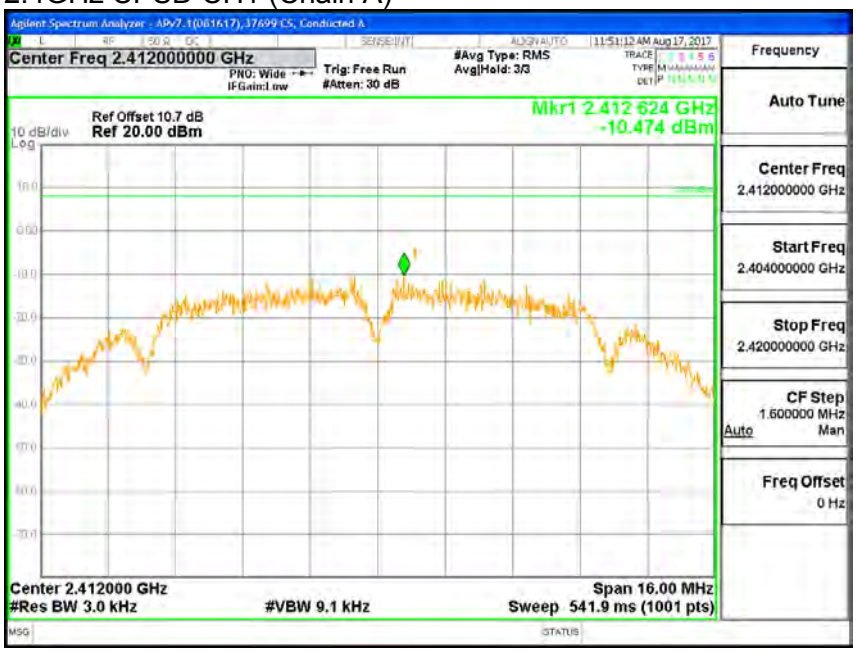
For digitally modulated systems, the power spectral density conducted form the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

RESULTS

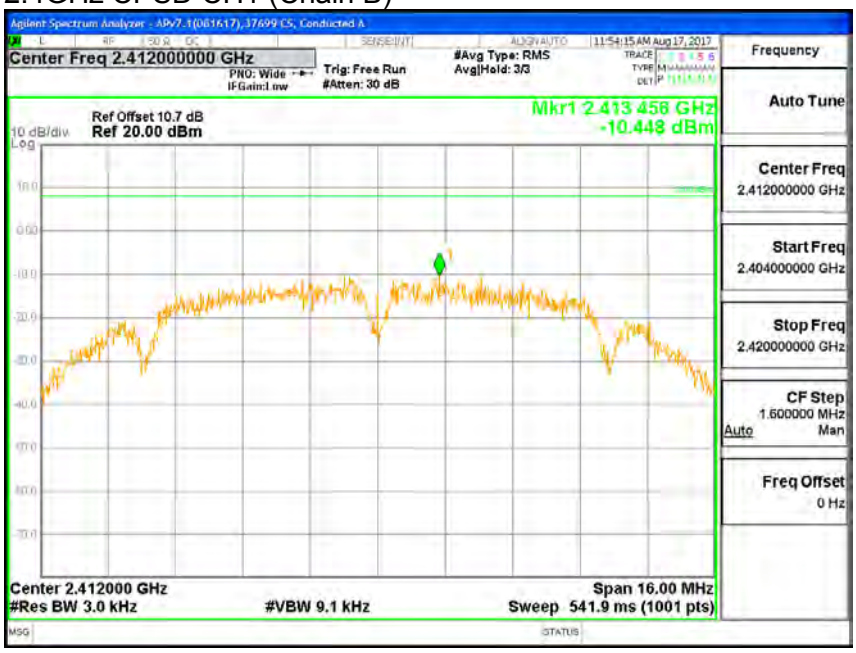
PSD Results

Channel	Frequency (MHz)	Chain A Meas (dBm/3kHz)	Chain B Meas (dBm/3kHz)	Total Corr'd PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
CH1	2412	-10.47	-10.45	-7.45	8.0	-15.5
CH6	2437	-12.21	-11.10	-8.61	8.0	-16.6
CH11	2462	-11.49	-10.77	-8.10	8.0	-16.1
CH12	2467	-14.85	-16.04	-12.39	8.0	-20.4
CH13	2472	-14.50	-16.16	-12.24	8.0	-20.2

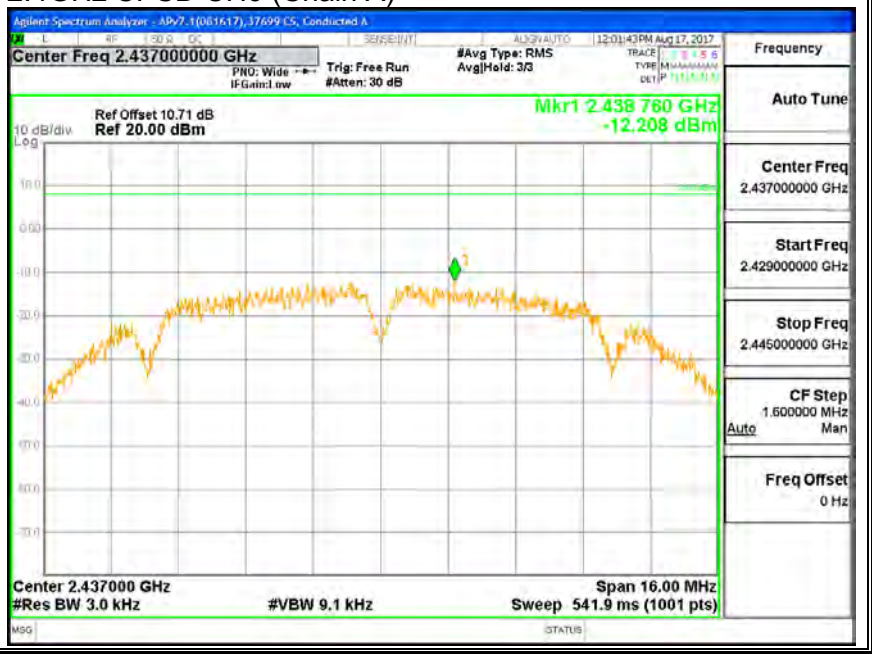
2.4GHz CPSD CH1 (Chain A)



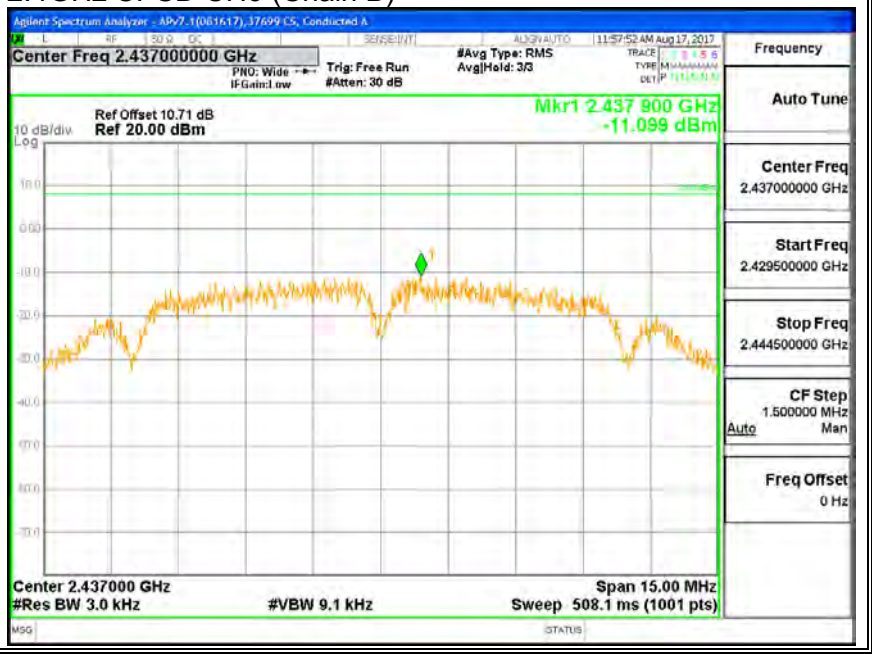
2.4GHz CPSD CH1 (Chain B)



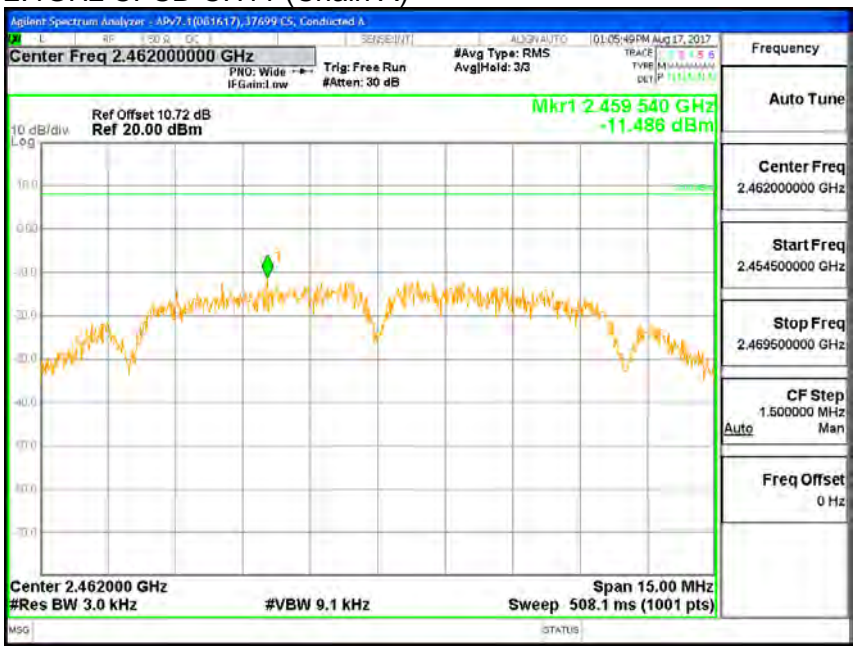
2.4GHz CPSD CH6 (Chain A)



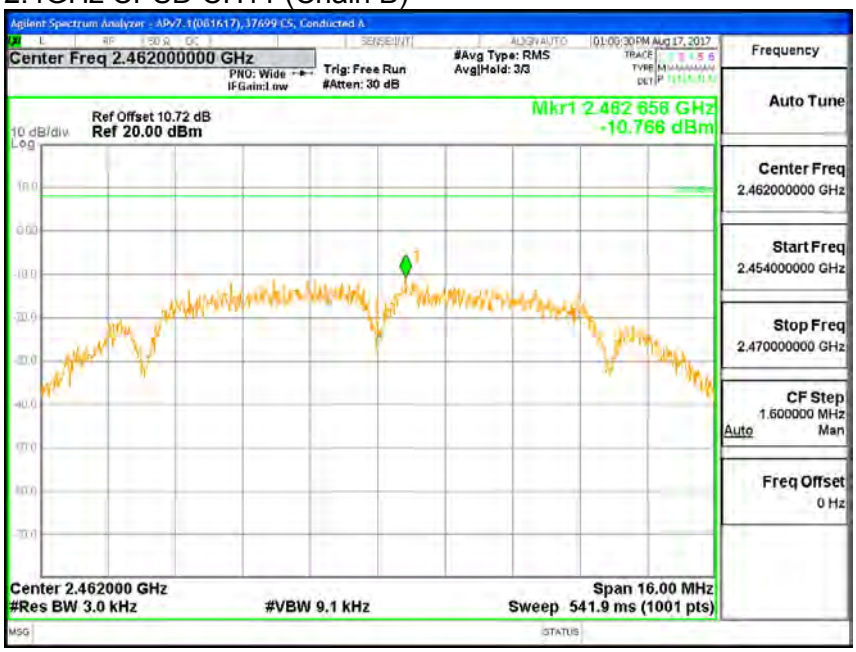
2.4GHz CPSD CH6 (Chain B)



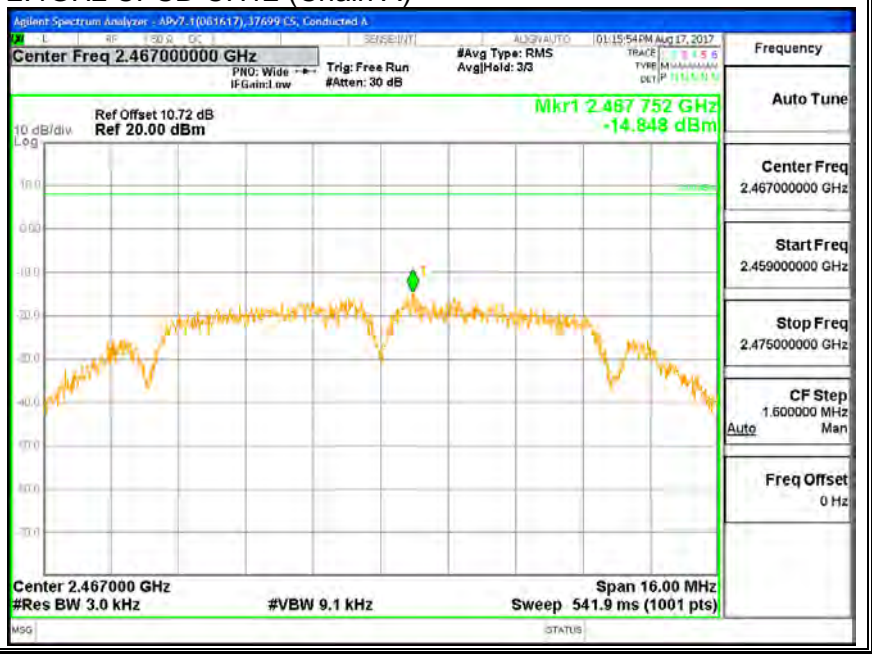
2.4GHz CPSD CH11 (Chain A)



2.4GHz CPSD CH11 (Chain B)

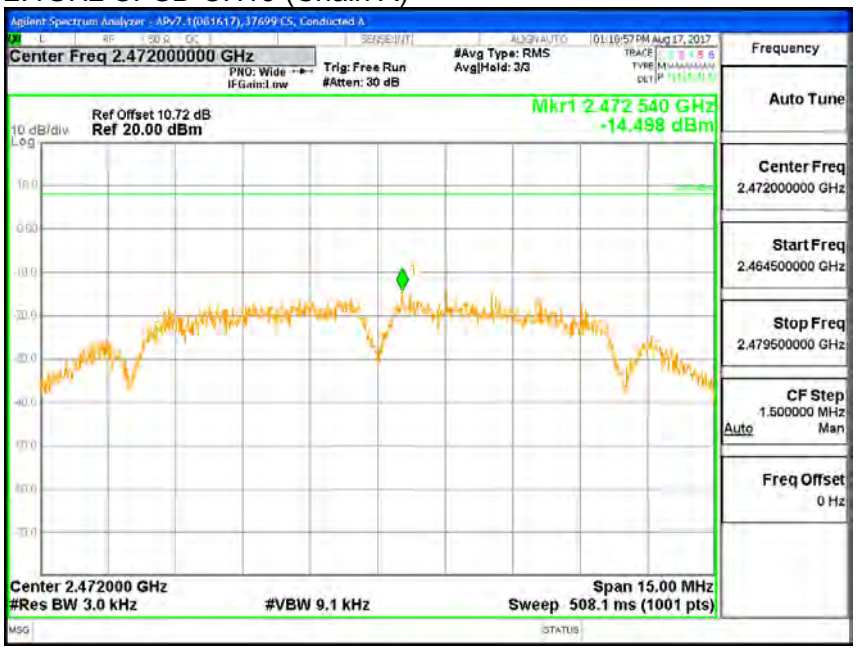


2.4GHz CPSD CH12 (Chain A)



2.4GHz CPSD CH12 (Chain B)

2.4GHz CPSD CH13 (Chain A)



2.4GHz CPSD CH13 (Chain B)

9.2.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

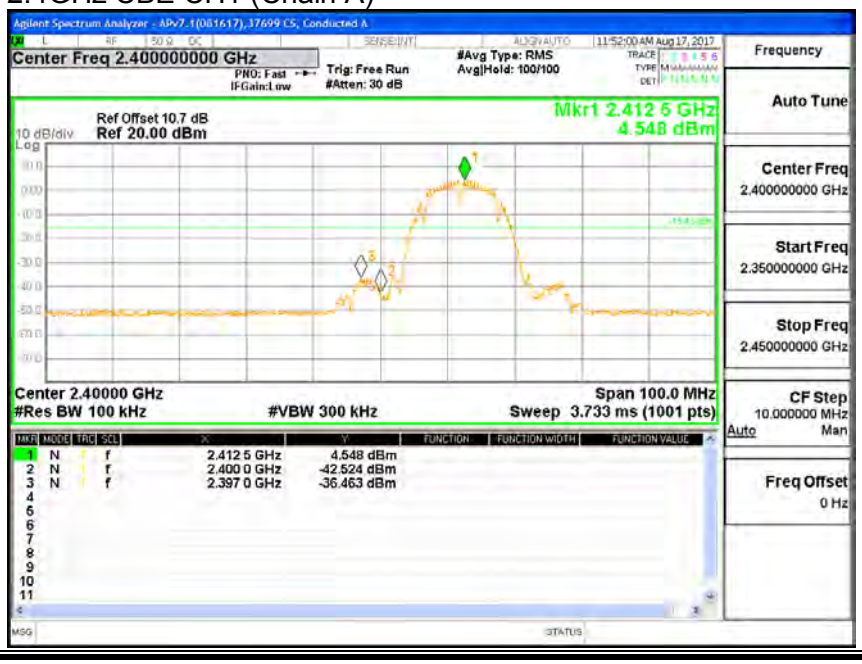
FCC §15.247 (d)

IC RSS-247 5.5

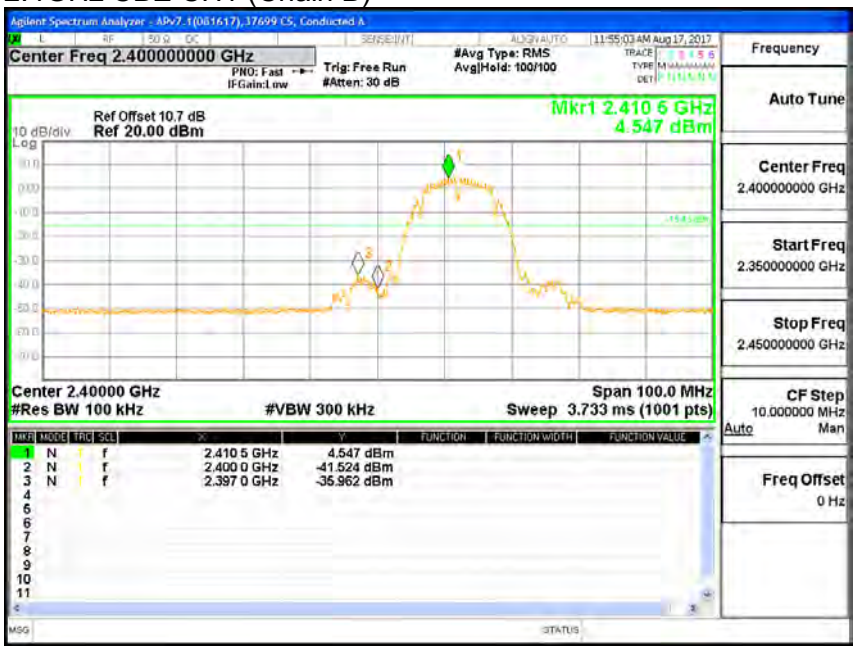
Output power was measured based on the use of Peak measurement, therefore the required attenuation is 20 dB.

RESULTS

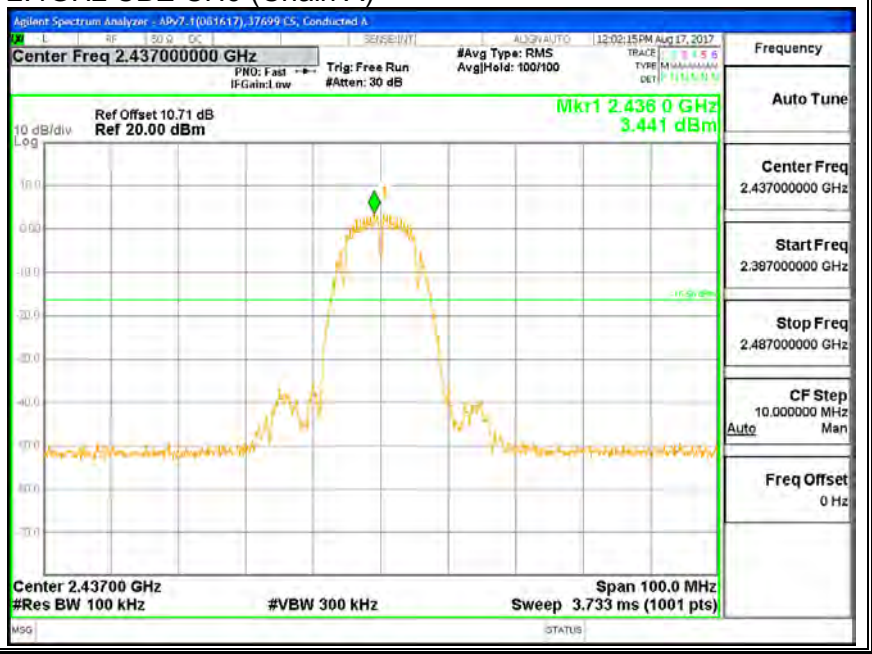
2.4GHz CBE CH1 (Chain A)



2.4GHz CBE CH1 (Chain B)



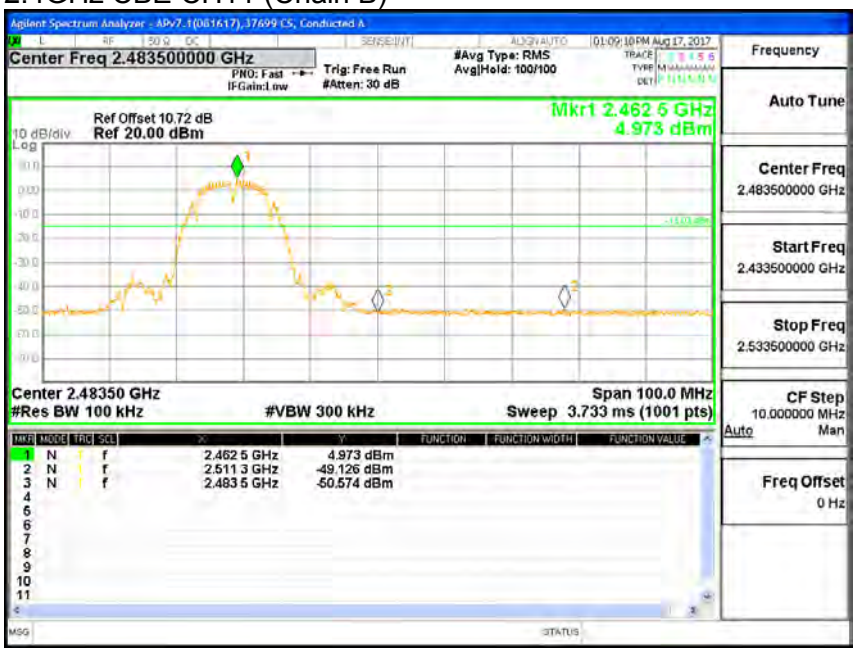
2.4GHz CBE CH6 (Chain A)



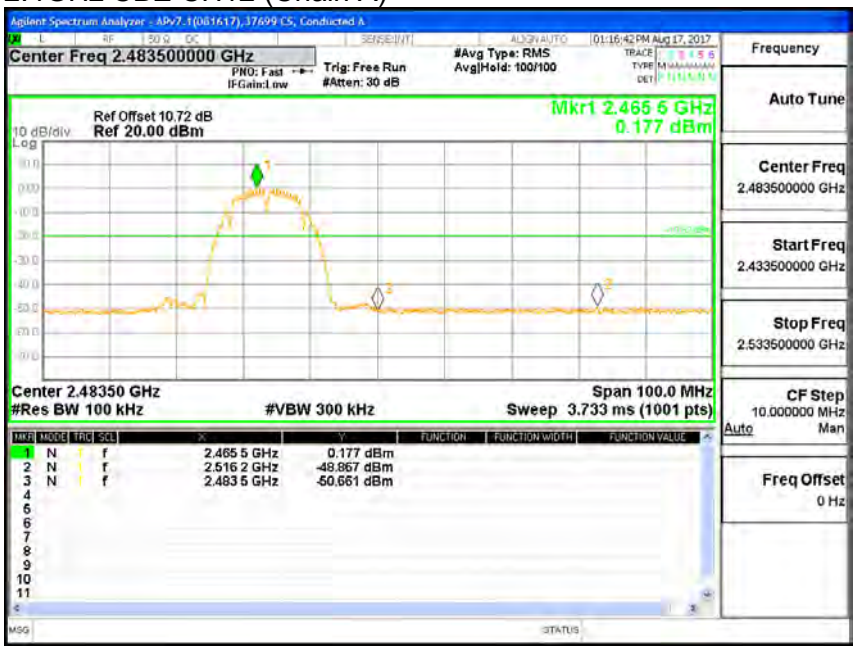
2.4GHz CBE CH6 (Chain B)

2.4GHz CBE CH11 (Chain A)

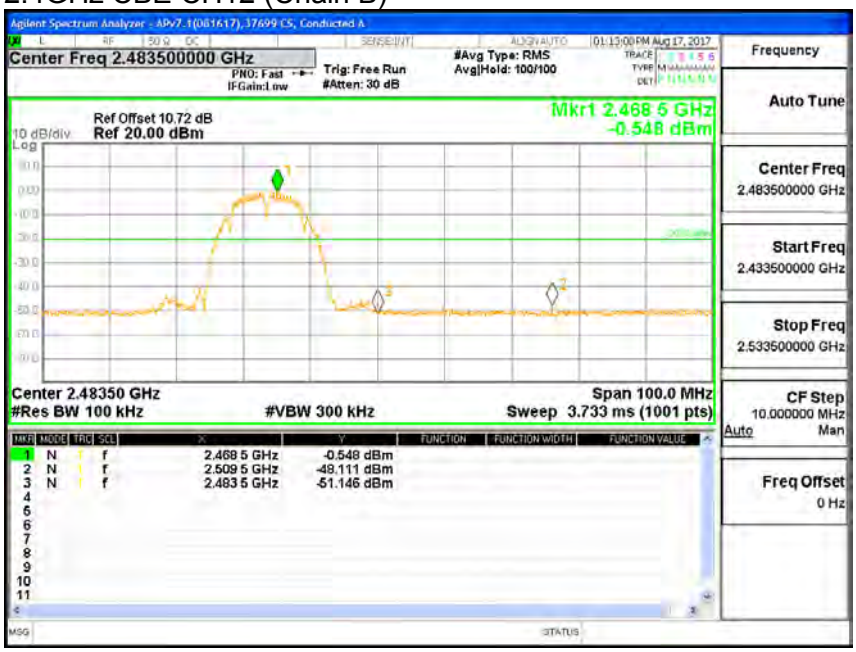
2.4GHz CBE CH11 (Chain B)



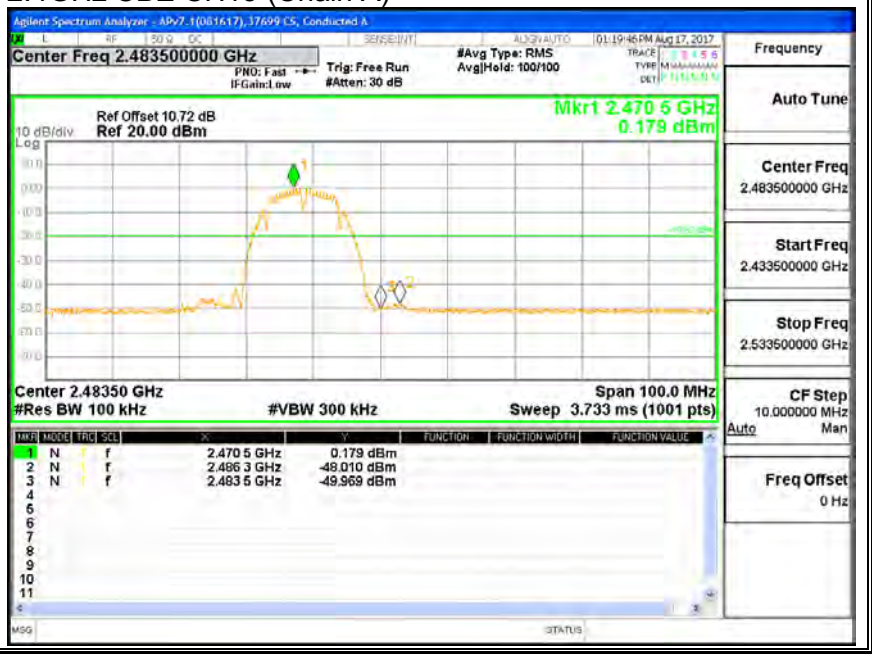
2.4GHz CBE CH12 (Chain A)



2.4GHz CBE CH12 (Chain B)

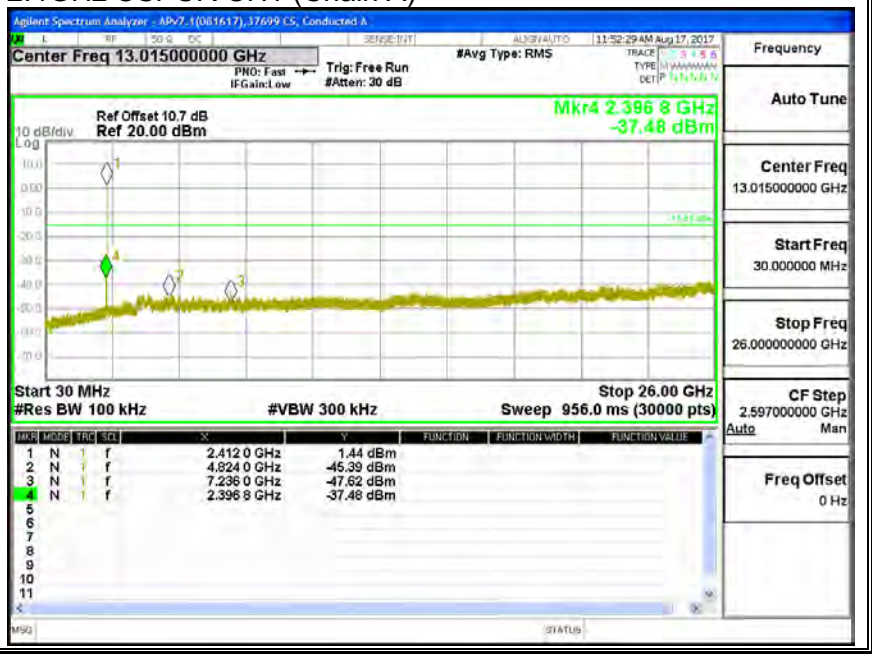


2.4GHz CBE CH13 (Chain A)

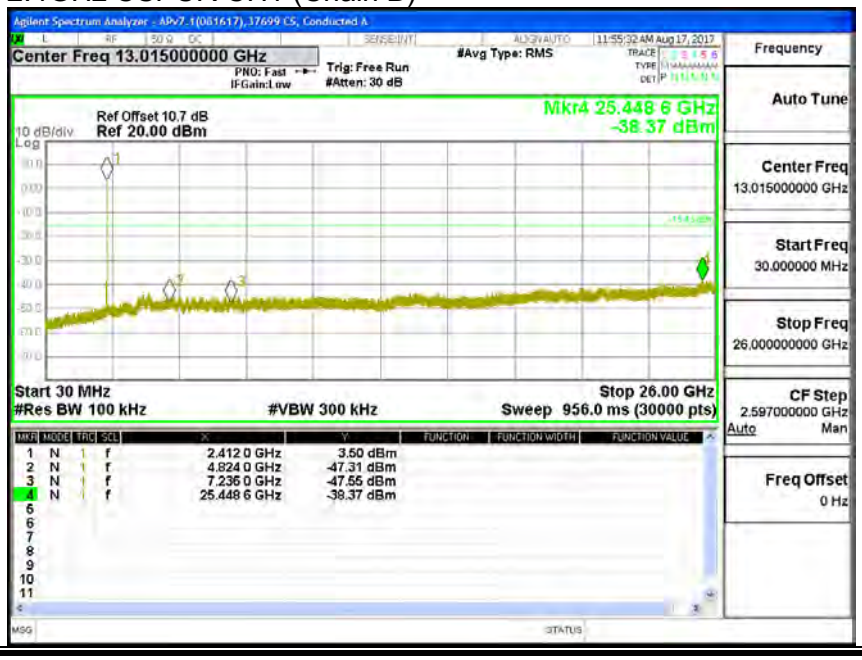


2.4GHz CBE CH13 (Chain B)

2.4GHz CSPUR CH1 (Chain A)



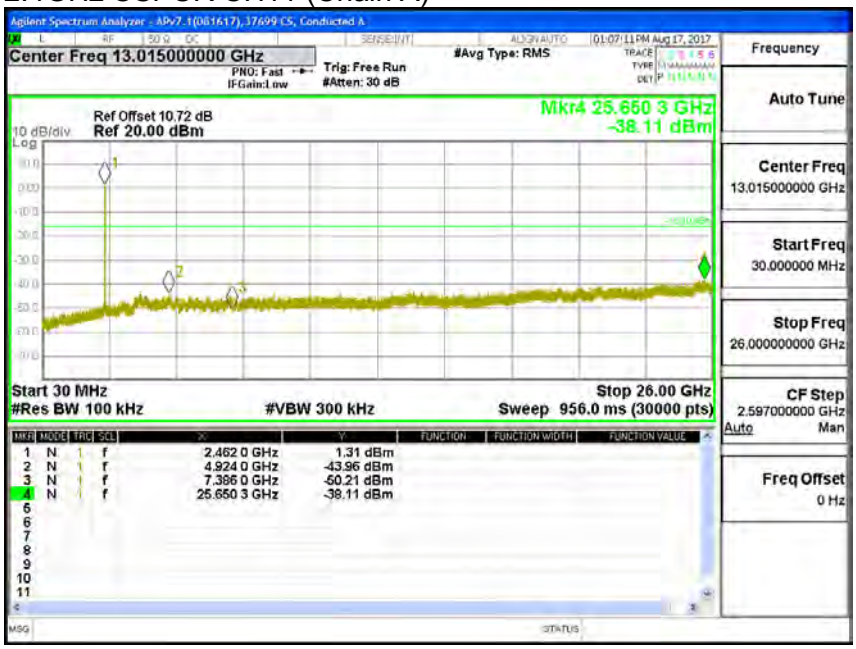
2.4GHz CSPUR CH1 (Chain B)



2.4GHz CSPUR CH6 (Chain A)

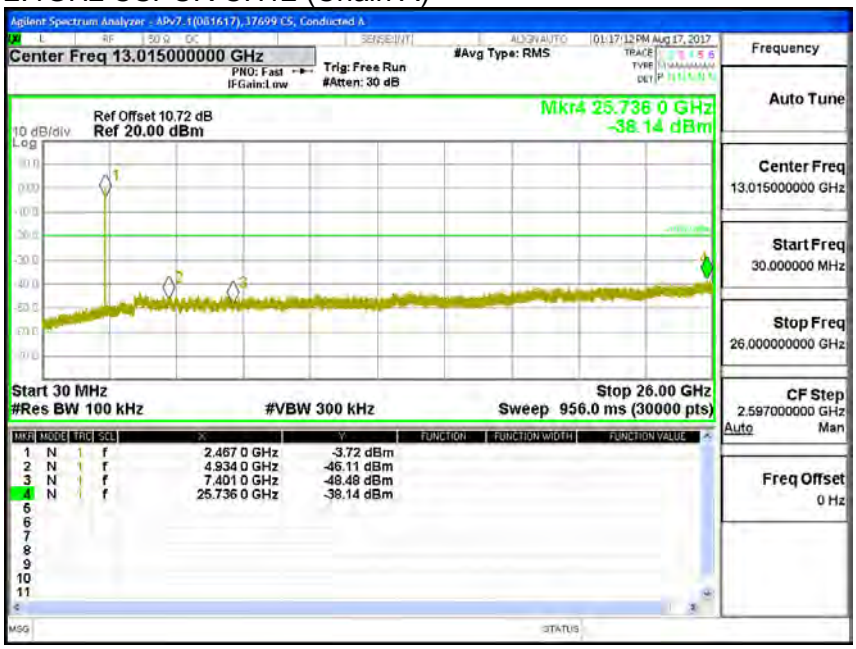
2.4GHz CSPUR CH6 (Chain B)

2.4GHz CSPUR CH11 (Chain A)

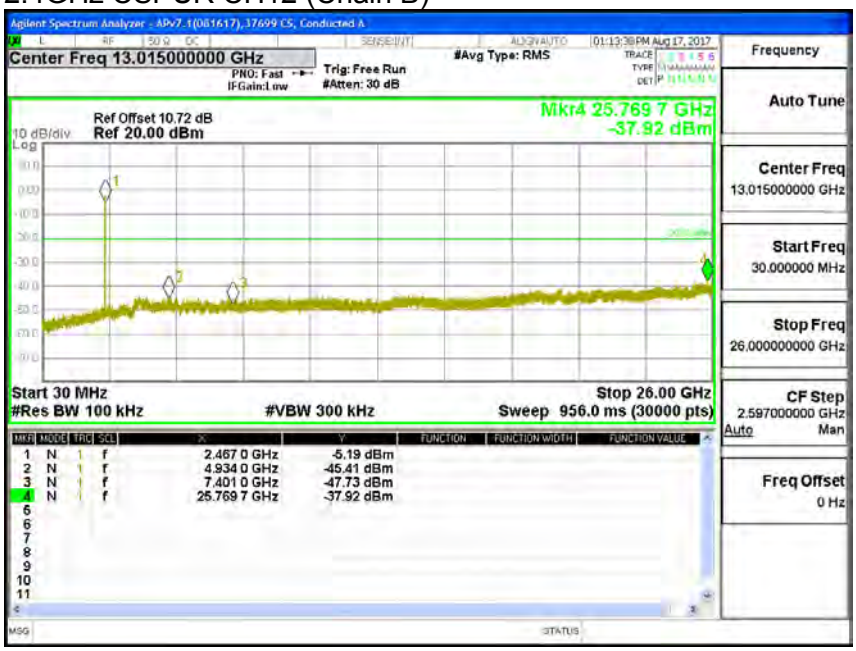


2.4GHz CSPUR CH11 (Chain B)

2.4GHz CSPUR CH12 (Chain A)

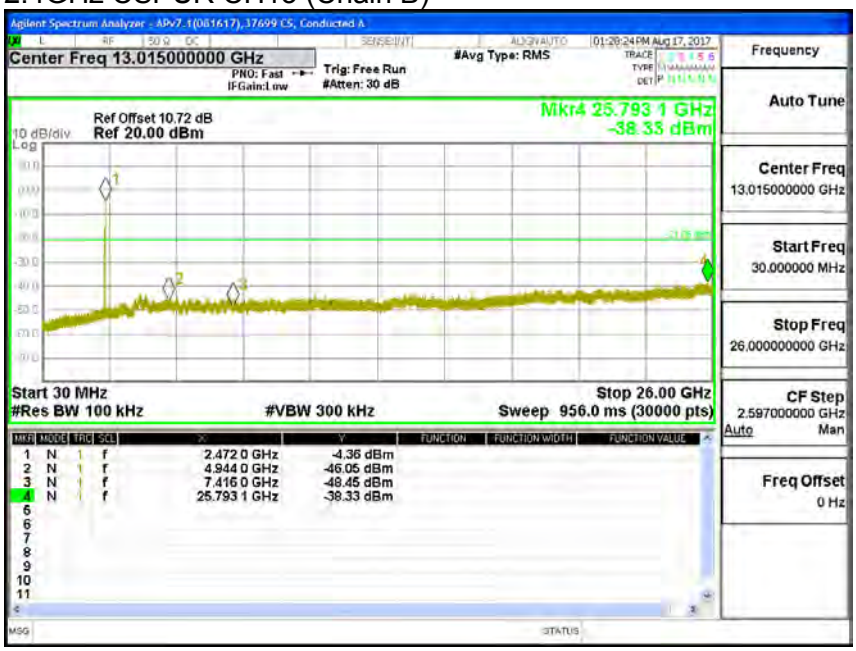


2.4GHz CSPUR CH12 (Chain B)



2.4GHz CSPUR CH13 (Chain A)

2.4GHz CSPUR CH13 (Chain B)



9.3. 11g 2TX CDD MIMO MODE IN THE 2.4GHz BAND

9.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-247 (5.2) (a)

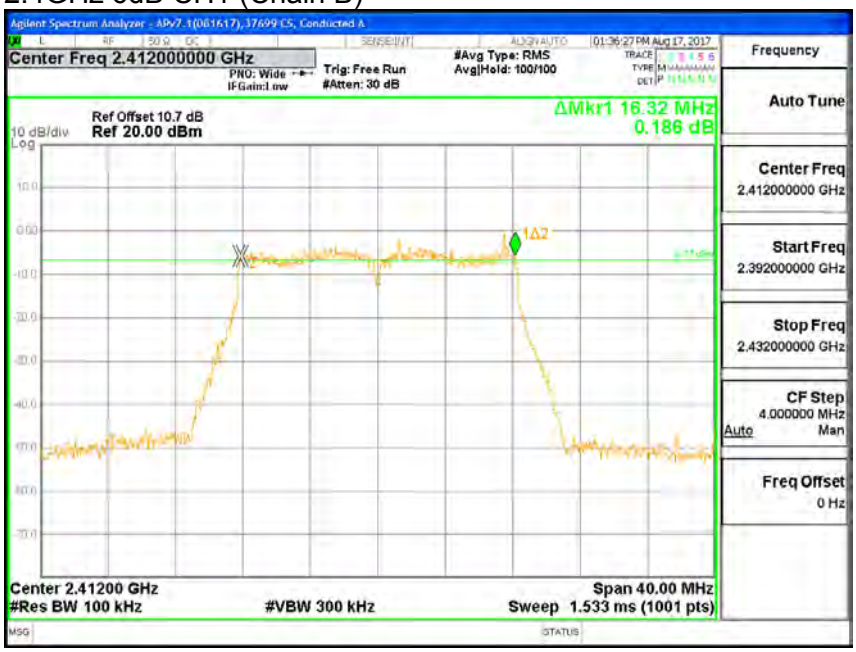
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

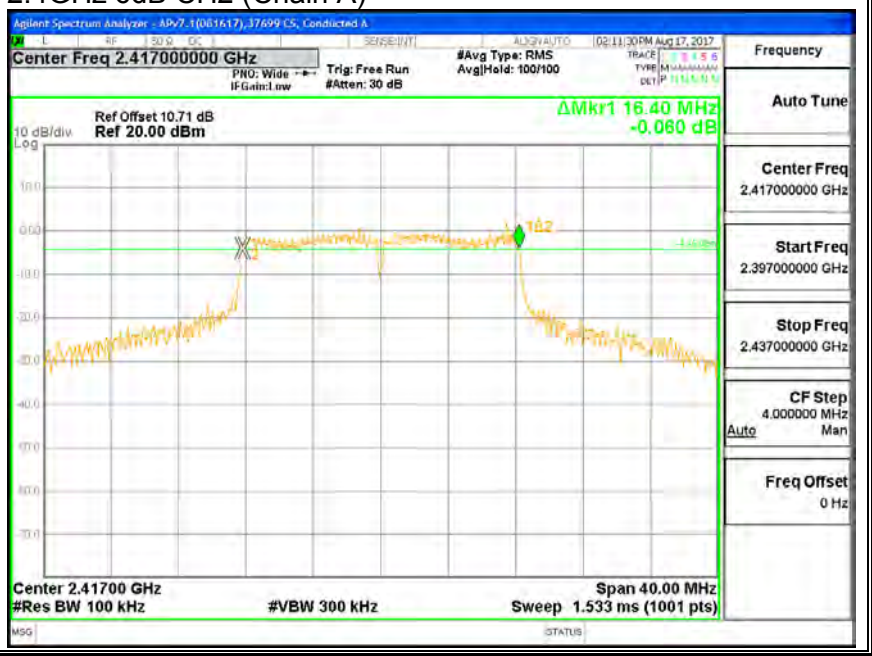
Channel	Frequency	6 dB BW Chain A (MHz)	6 dB BW Chain B (MHz)	Minimum Limit (MHz)
CH1	2412	16.48	16.32	0.5
CH2	2417	16.40	16.40	0.5
CH6	2437	16.32	16.40	0.5
CH11	2462	16.40	16.40	0.5
CH12	2467	16.40	16.40	0.5
CH13	2472	16.36	16.40	0.5

2.4GHz 6dB CH1 (Chain A)

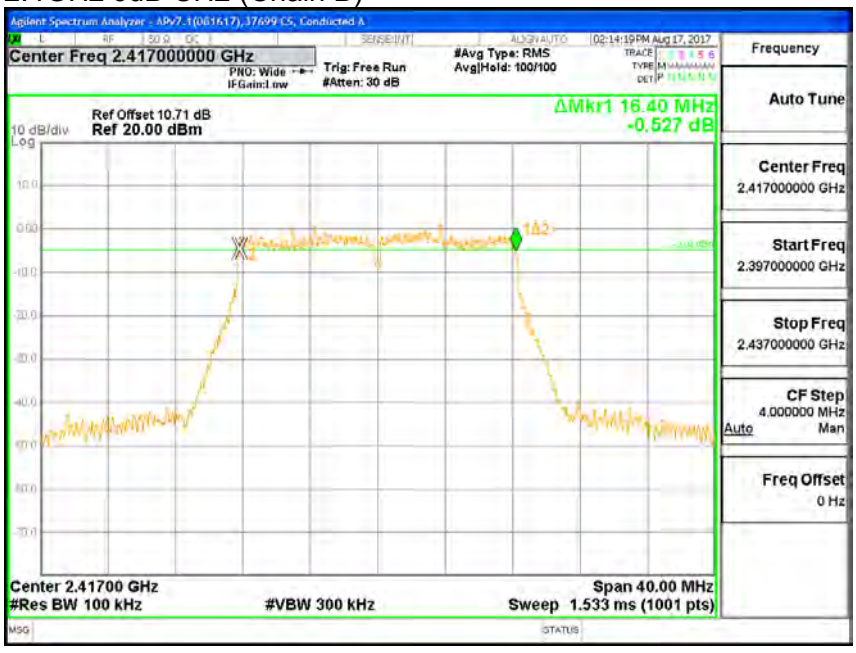
2.4GHz 6dB CH1 (Chain B)



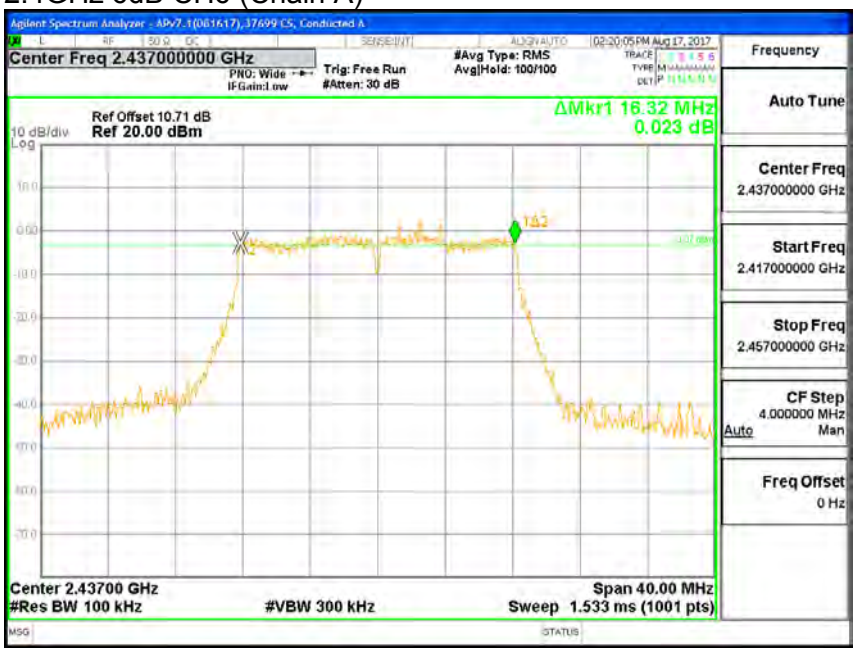
2.4GHz 6dB CH2 (Chain A)



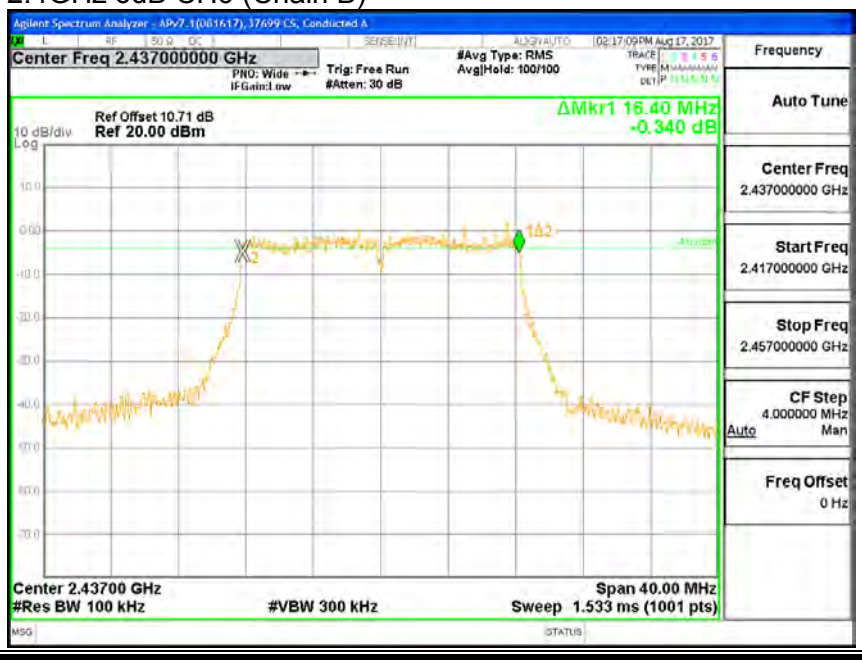
2.4GHz 6dB CH2 (Chain B)



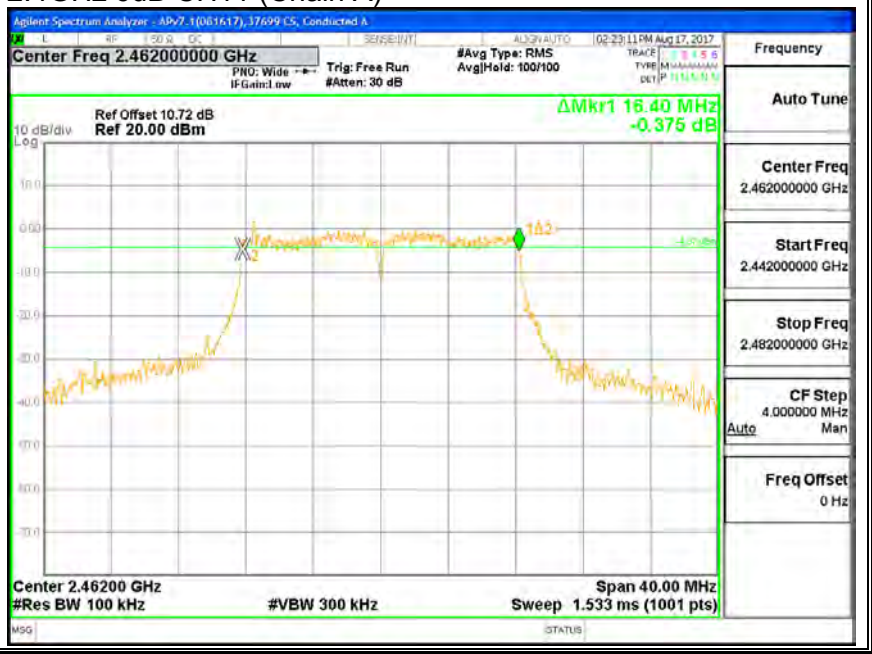
2.4GHz 6dB CH6 (Chain A)



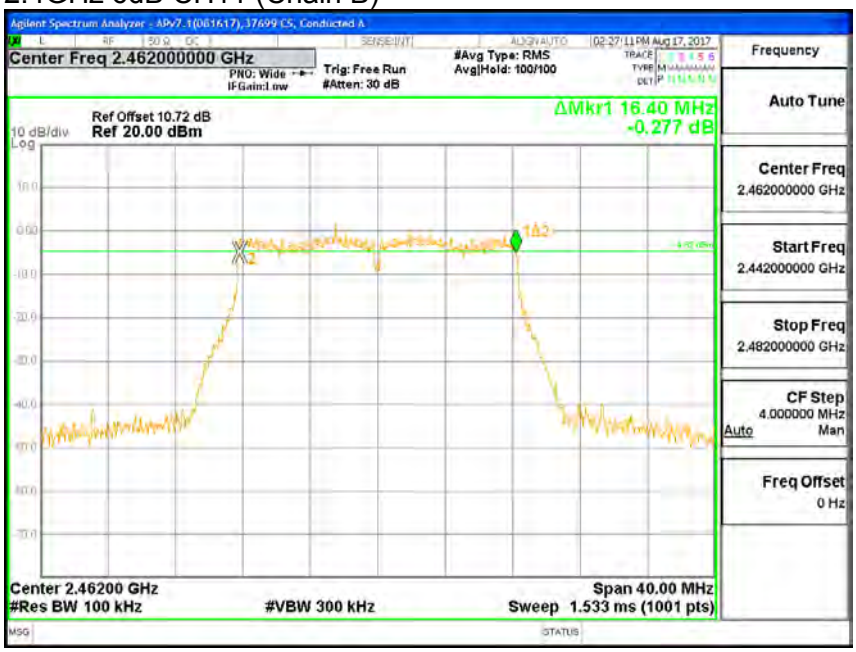
2.4GHz 6dB CH6 (Chain B)



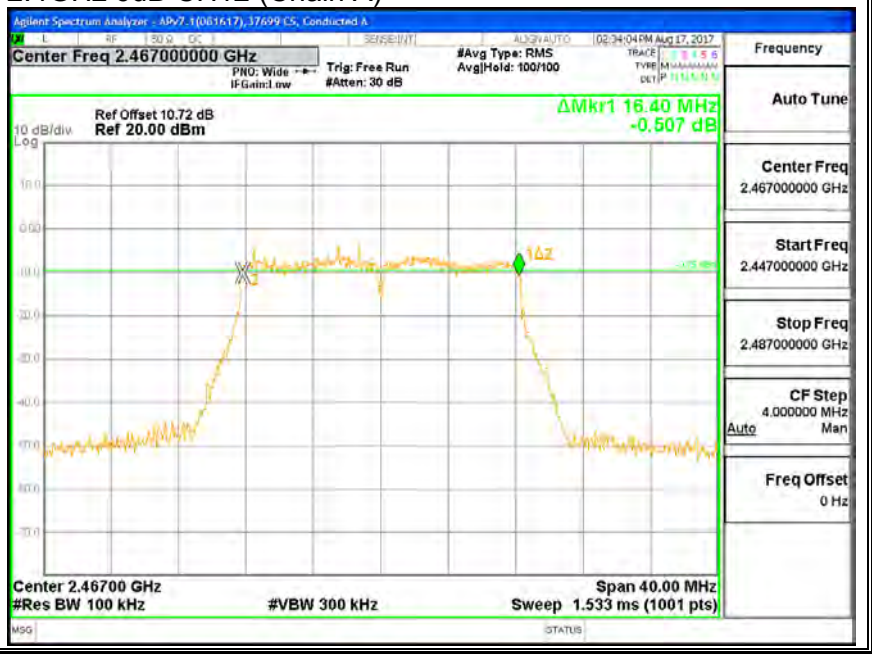
2.4GHz 6dB CH11 (Chain A)



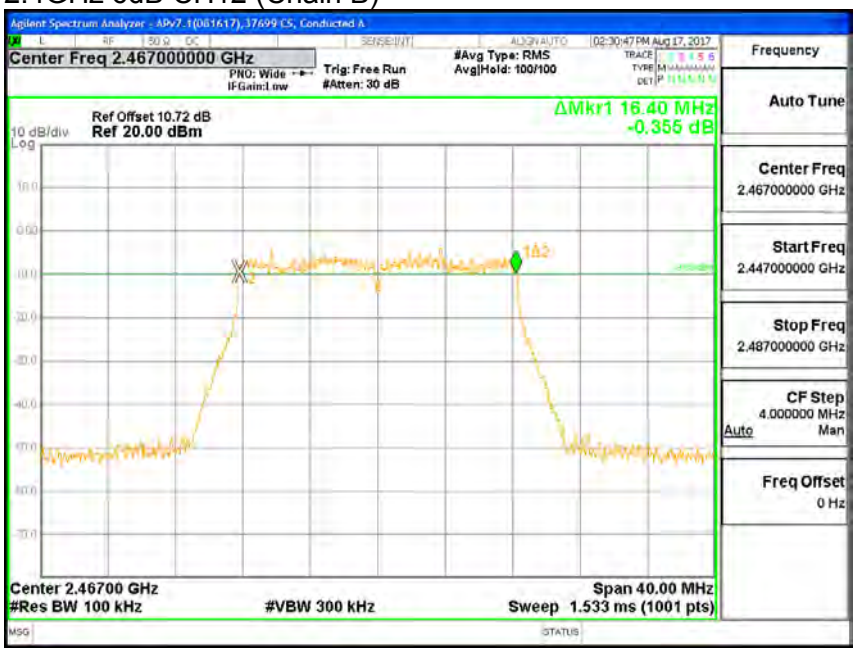
2.4GHz 6dB CH11 (Chain B)



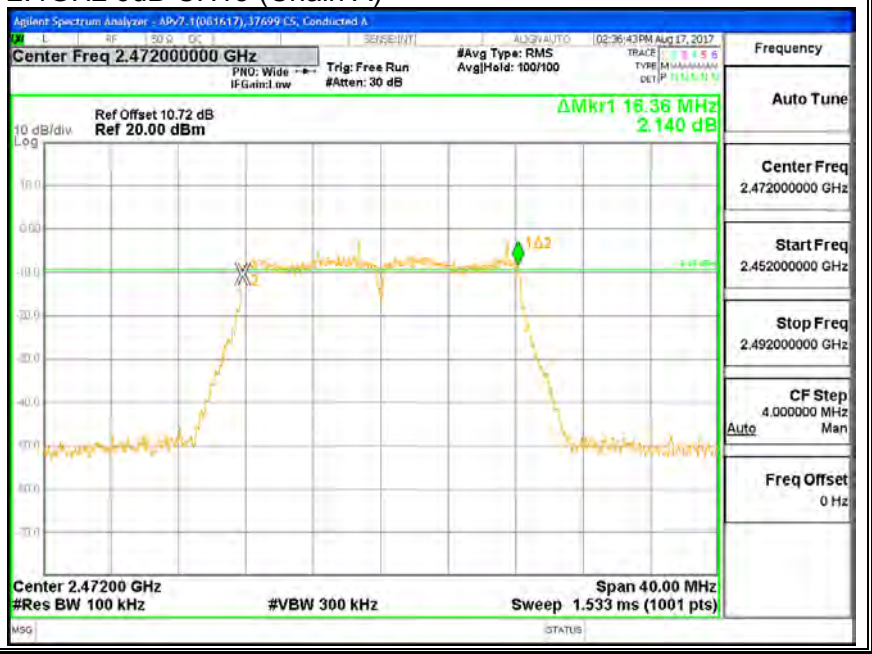
2.4GHz 6dB CH12 (Chain A)



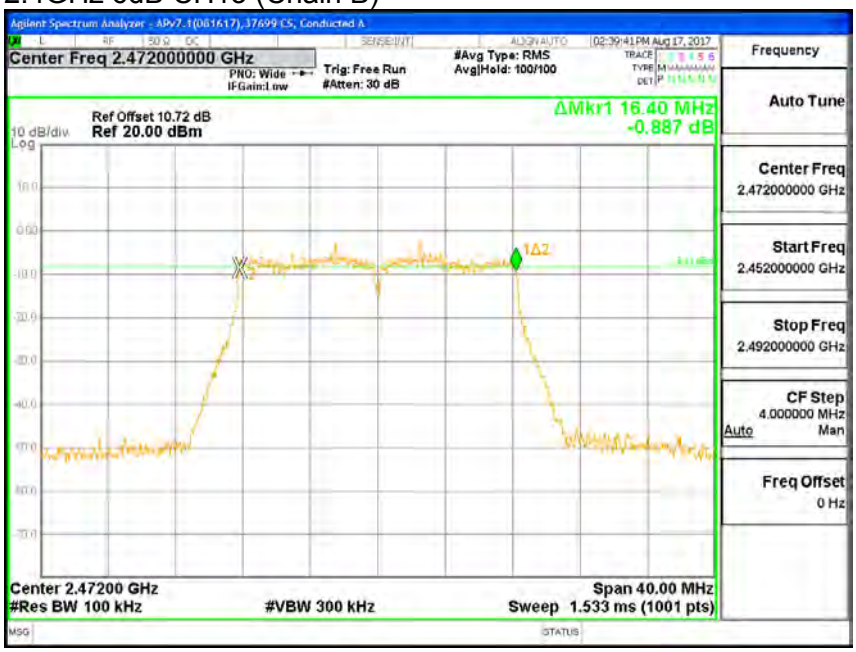
2.4GHz 6dB CH12 (Chain B)



2.4GHz 6dB CH13 (Chain A)



2.4GHz 6dB CH13 (Chain B)



9.3.2. 99% BANDWIDTH

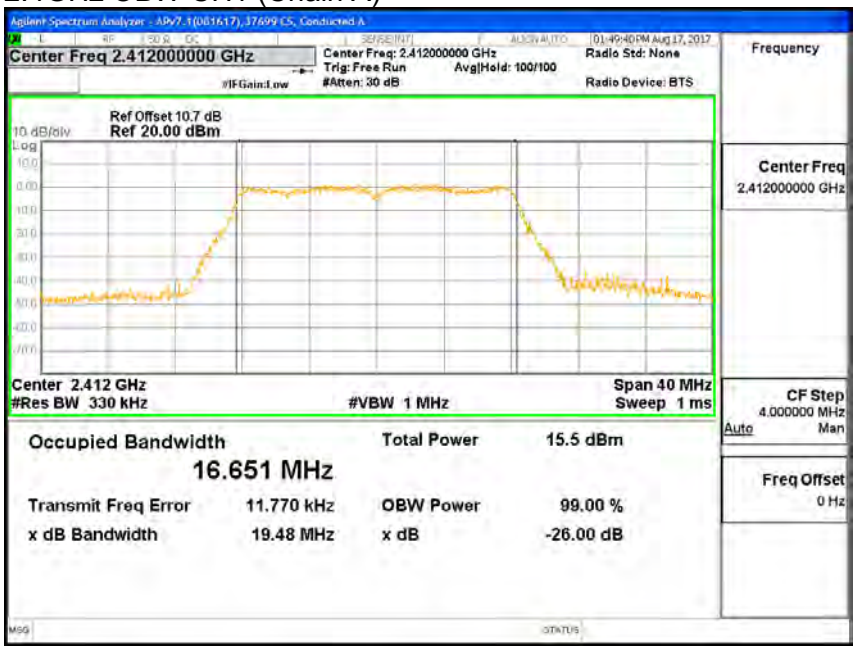
LIMITS

None; for reporting purposes only.

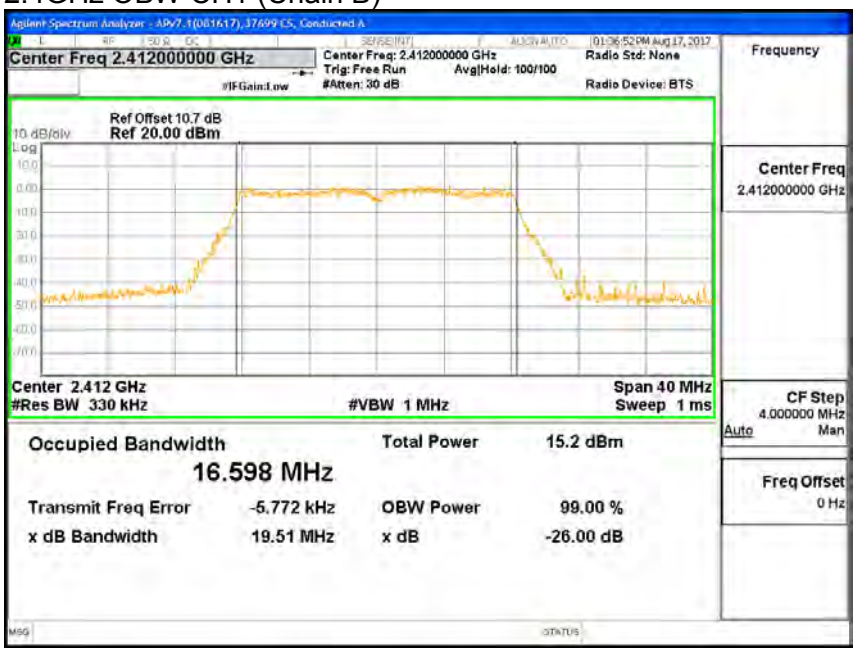
RESULTS

Channel	Frequency (MHz)	99% Bandwidth Chain A (MHz)	99% Bandwidth Chain B (MHz)
CH1	2412	16.651	16.598
CH2	2417	17.683	16.617
CH6	2437	16.694	16.598
CH11	2462	16.728	16.610
CH12	2467	16.672	16.595
CH13	2472	16.678	16.600

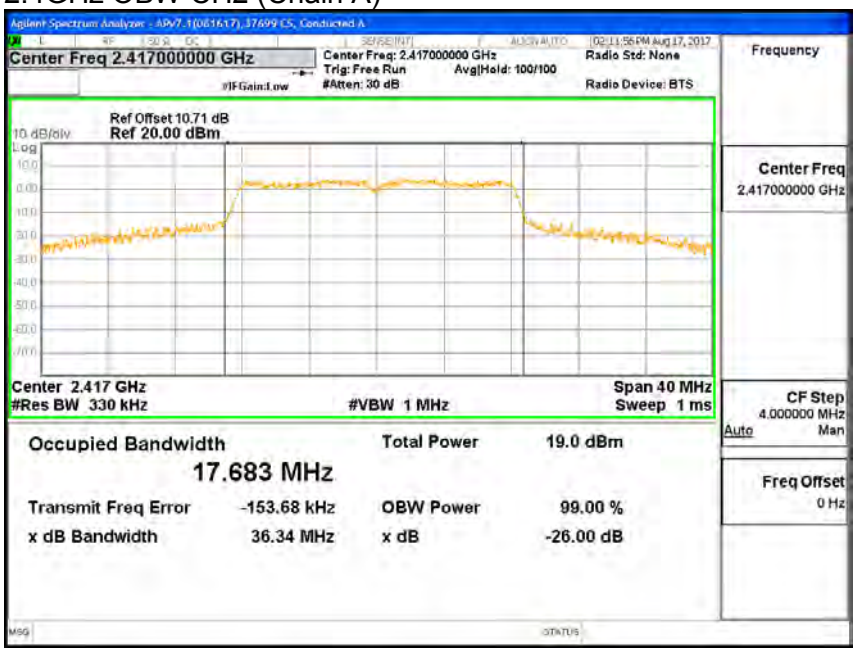
2.4GHz OBW CH1 (Chain A)



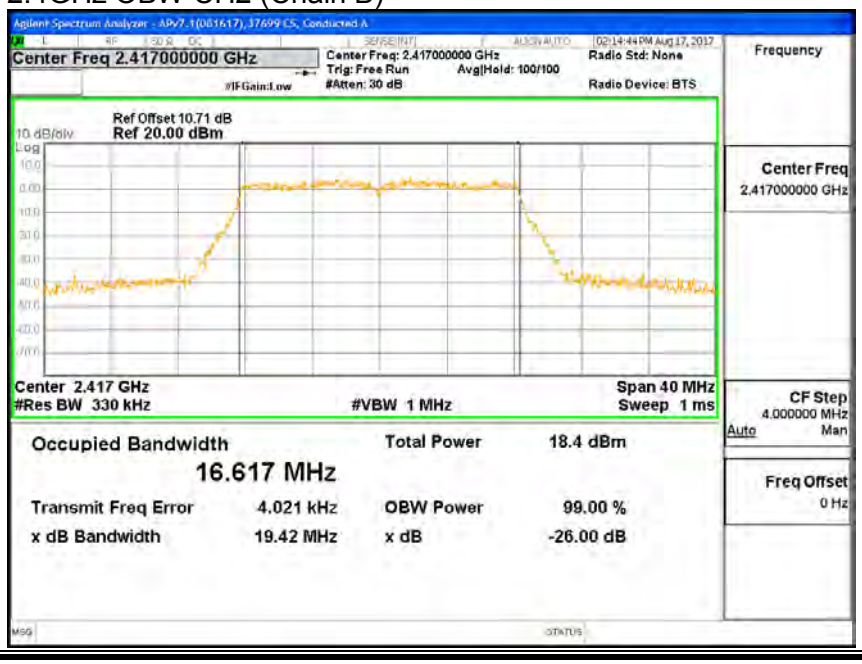
2.4GHz OBW CH1 (Chain B)



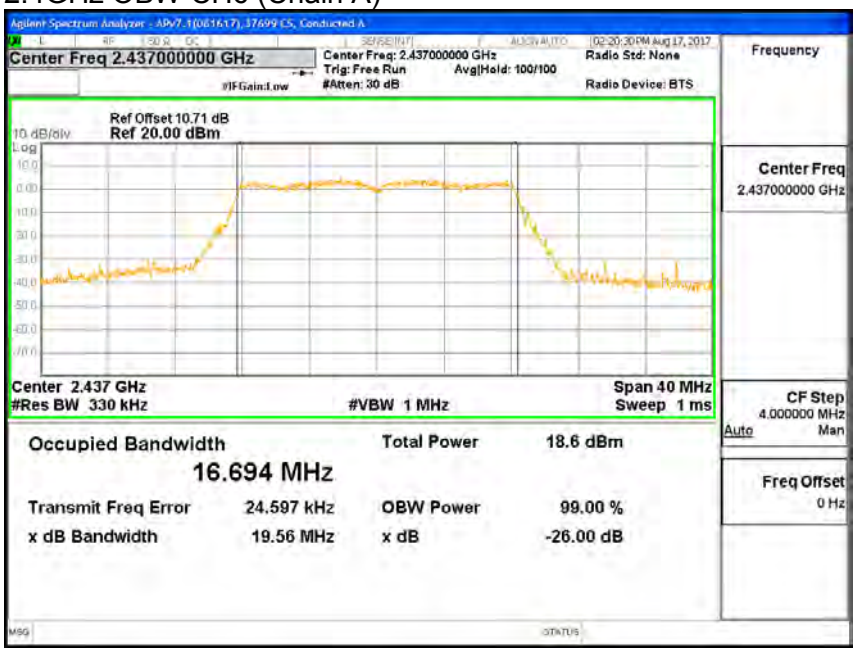
2.4GHz OBW CH2 (Chain A)



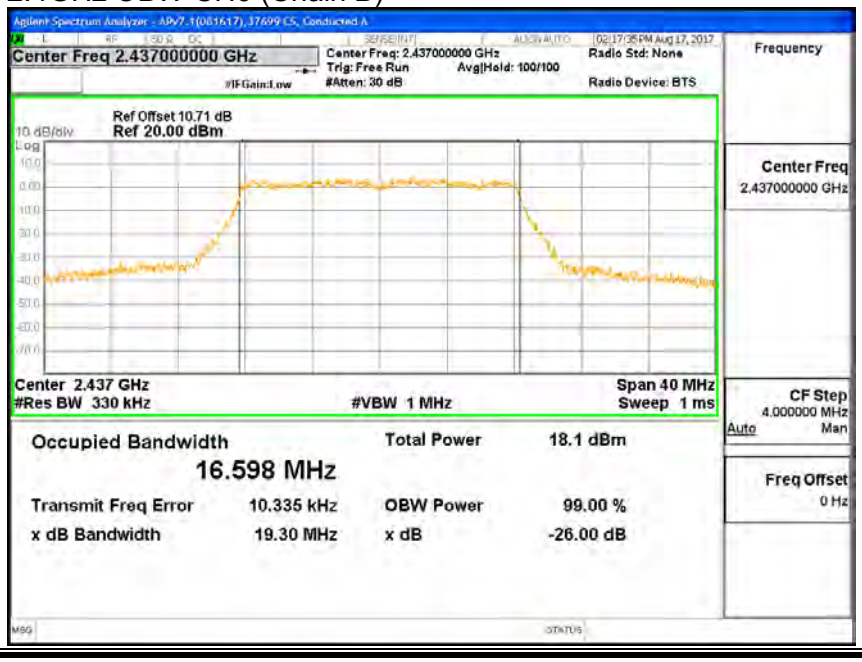
2.4GHz OBW CH2 (Chain B)



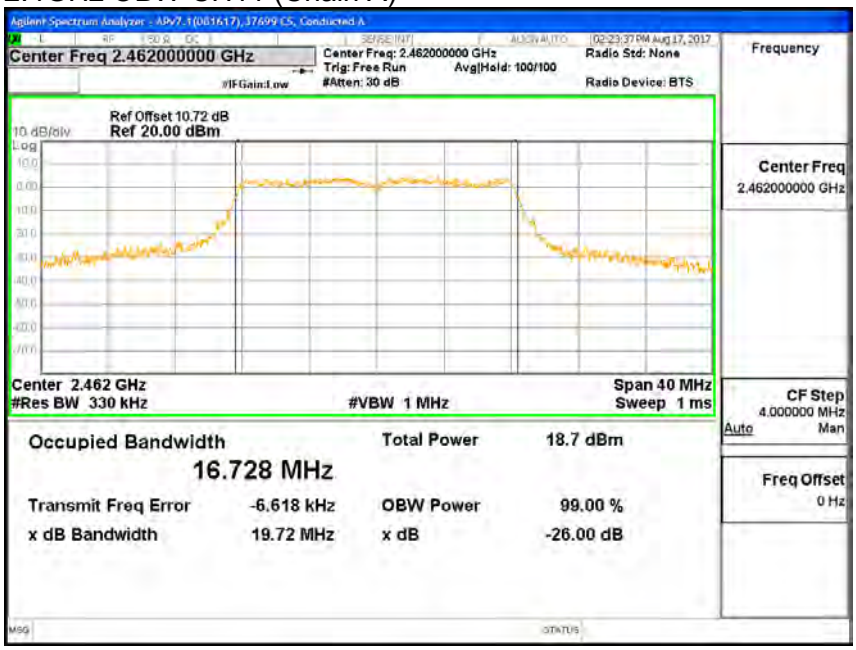
2.4GHz OBW CH6 (Chain A)



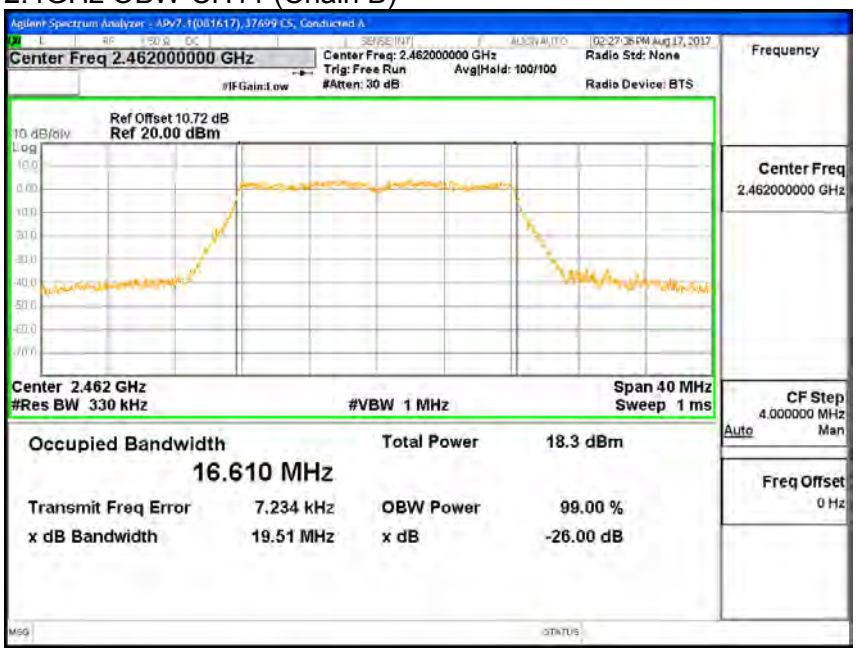
2.4GHz OBW CH6 (Chain B)



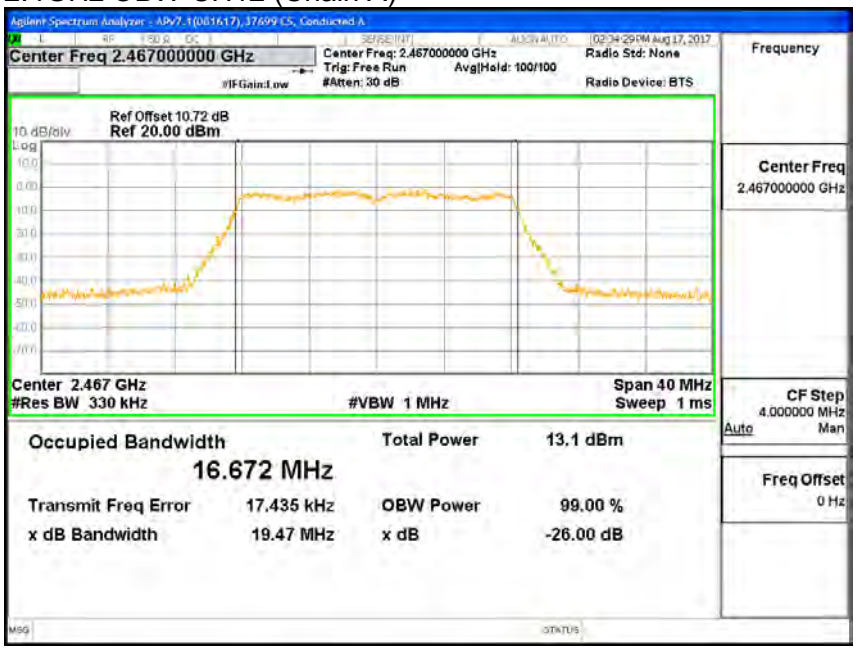
2.4GHz OBW CH11 (Chain A)



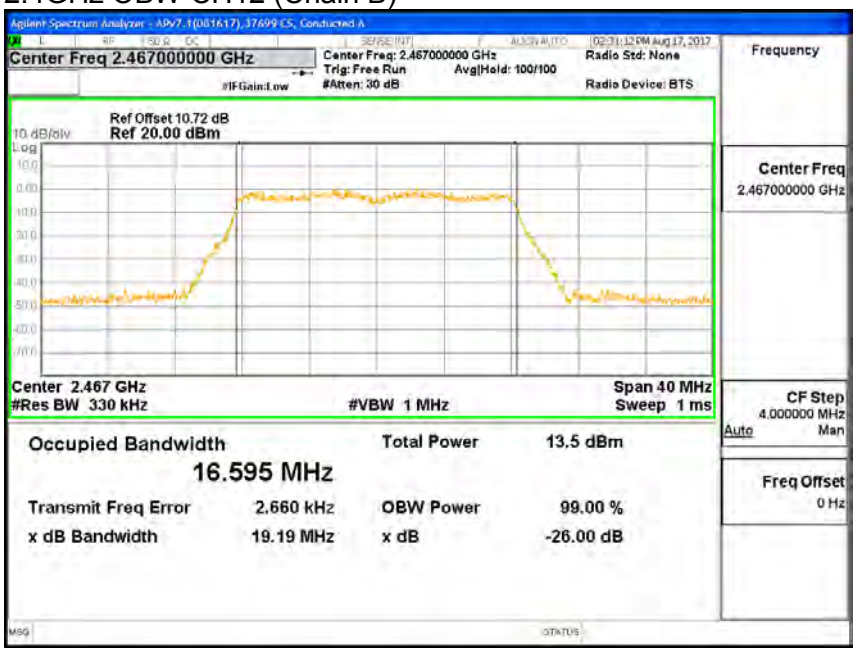
2.4GHz OBW CH11 (Chain B)



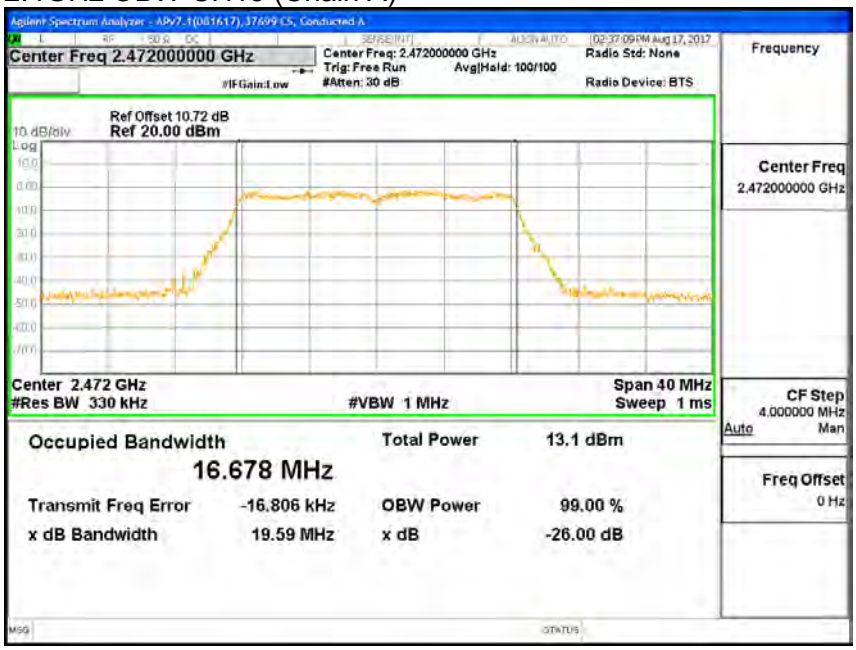
2.4GHz OBW CH12 (Chain A)



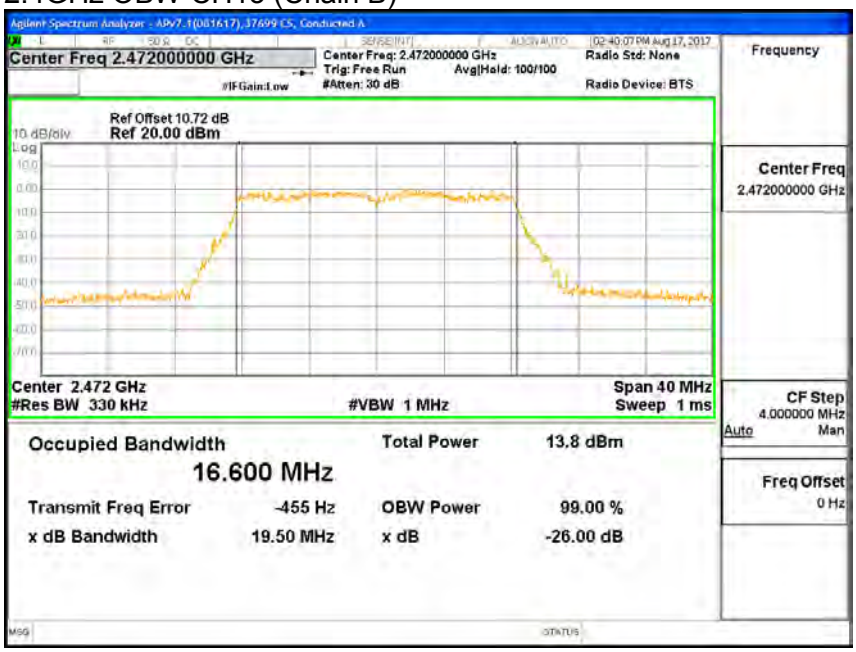
2.4GHz OBW CH12 (Chain B)



2.4GHz OBW CH13 (Chain A)



2.4GHz OBW CH13 (Chain B)



9.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 10.7 dB cable) was entered as an offset in the power meter to allow for a gated reading of power.

RESULTS

ID:	37699	Date:	08/11/17

Channel	Frequency (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Total Power (dBm)
Low_1	2412	9.77	10.29	13.05
Low_2	2417	13.57	13.21	16.40
Mid	2437	13.34	13.01	16.19
High_11	2462	12.46	12.07	15.28
High_12	2467	7.75	8.04	10.91
High_13	2472	7.81	8.21	11.02

9.3.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

IC RSS-247 (5.4) (d)

For systems using digital modulation in the 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

KDB 558074 D01 v04Section 9.2.3.2

DIRECTIONAL ANTENNA GAIN

Tx chains are uncorrelated due to the device supporting CDD in all MIMO modes. The directional gain is:

Chain A Antenna Gain (dBi)	Chain B Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
2.58	3.26	2.93

RESULTS

ID:	37699	Date:	08/11/17

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
CH1	2412	2.93	30.00	30	36	30.00
CH2	2417	2.93	30.00	30	36	30.00
CH6	2437	2.93	30.00	30	36	30.00
CH11	2462	2.93	30.00	30	36	30.00
CH12	2467	2.93	30.00	30	36	30.00
CH13	2472	2.93	30.00	30	36	30.00

Results

Channel	Frequency (MHz)	Chain A Meas Power (dBm)	Chain B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
CH1	2412	18.21	18.57	21.40	30.00	-8.60
CH2	2417	23.37	22.82	26.11	30.00	-3.89
CH6	2437	22.98	22.52	25.77	30.00	-4.23
CH11	2462	20.87	20.11	23.52	30.00	-6.48
CH12	2467	16.39	17.78	20.15	30.00	-9.85
CH13	2472	16.25	16.97	19.64	30.00	-10.36

9.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-247 (5.2) (b)

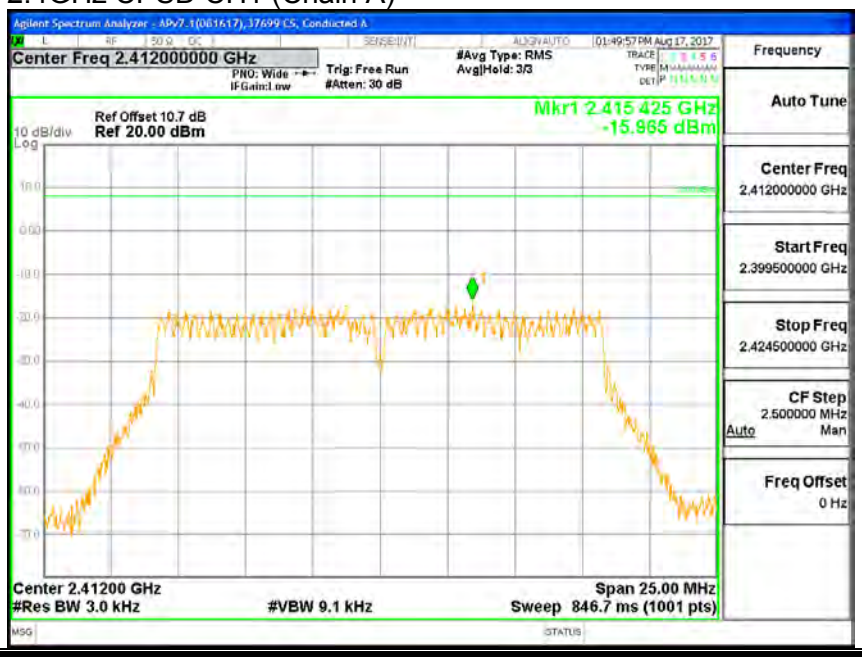
For digitally modulated systems, the power spectral density conducted form the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmissions.

RESULTS

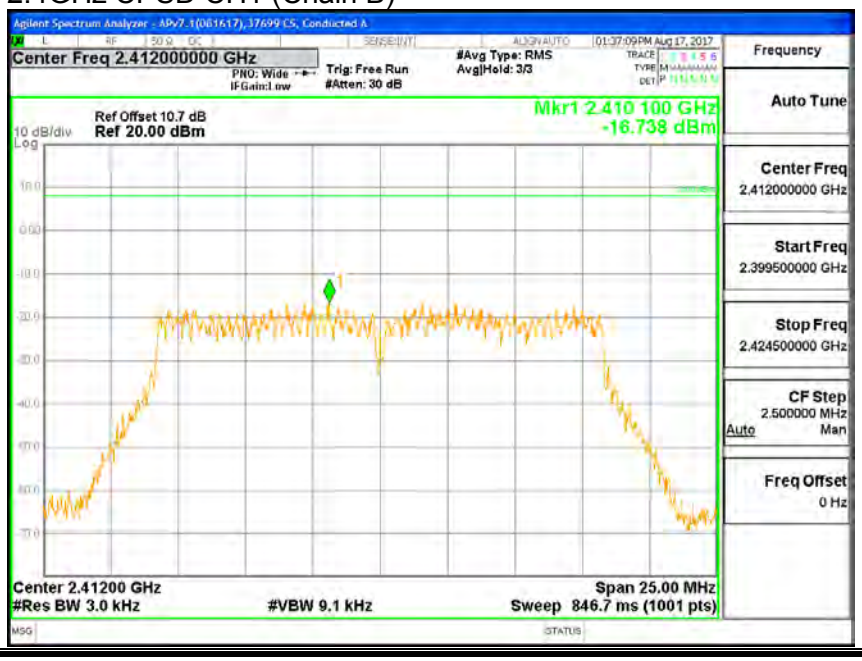
PSD Results

Channel	Frequency (MHz)	Chain A Meas (dBm/3kHz)	Chain B Meas (dBm/3kHz)	Total Corr'd PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
CH1	2412	-15.97	-16.74	-13.32	8.0	-21.3
CH2	2417	-13.48	-13.11	-10.28	8.0	-18.3
CH6	2437	-13.03	-13.91	-10.44	8.0	-18.4
CH11	2462	-13.78	-12.86	-10.28	8.0	-18.3
CH12	2467	-19.35	-17.98	-15.60	8.0	-23.6
CH13	2472	-18.43	-17.57	-14.97	8.0	-23.0

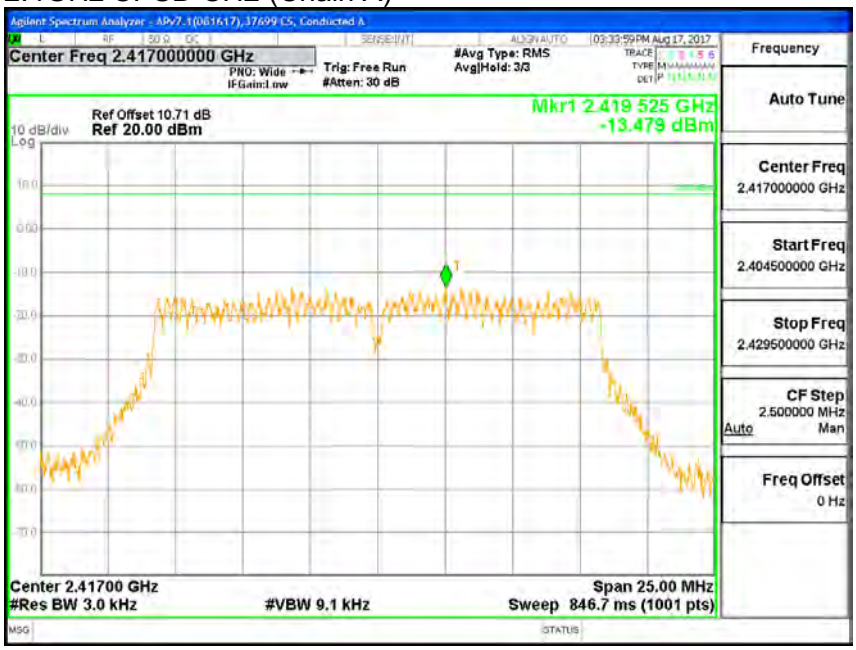
2.4GHz CPSD CH1 (Chain A)



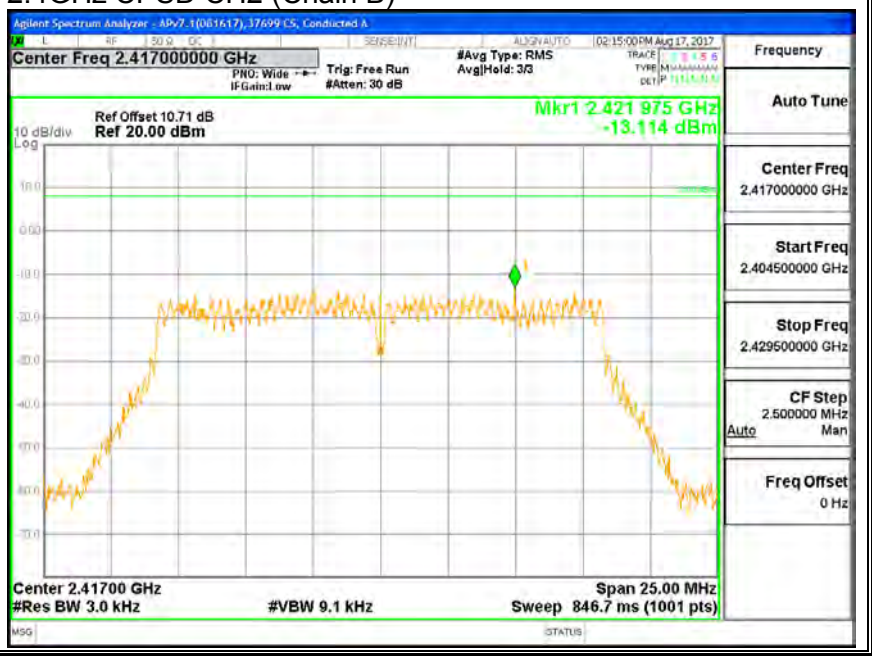
2.4GHz CPSD CH1 (Chain B)



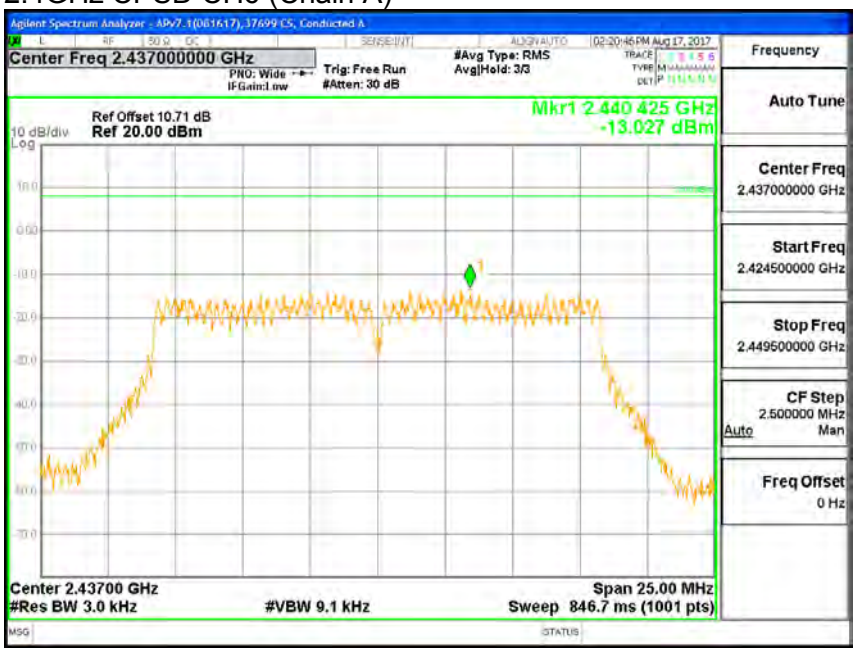
2.4GHz CPSD CH2 (Chain A)



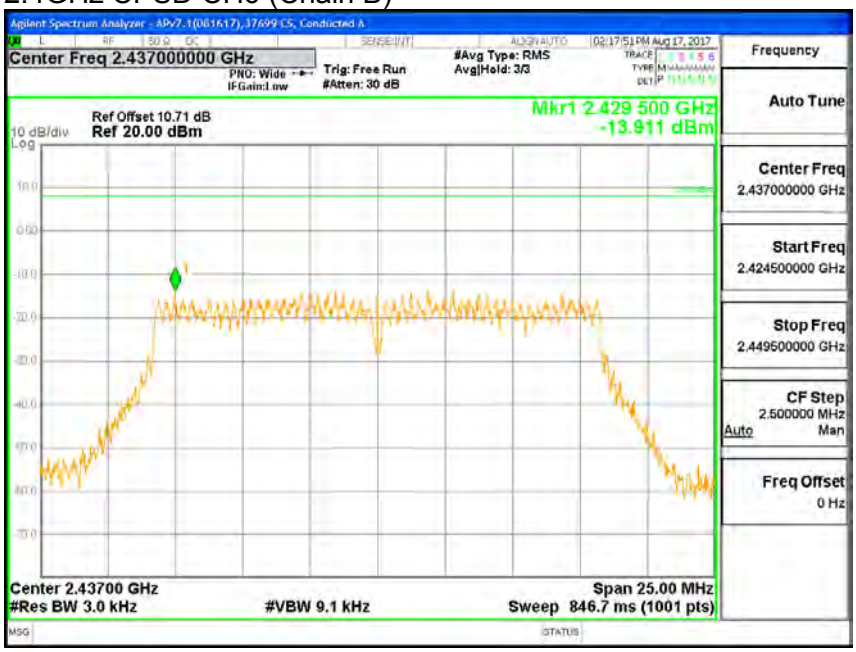
2.4GHz CPSD CH2 (Chain B)



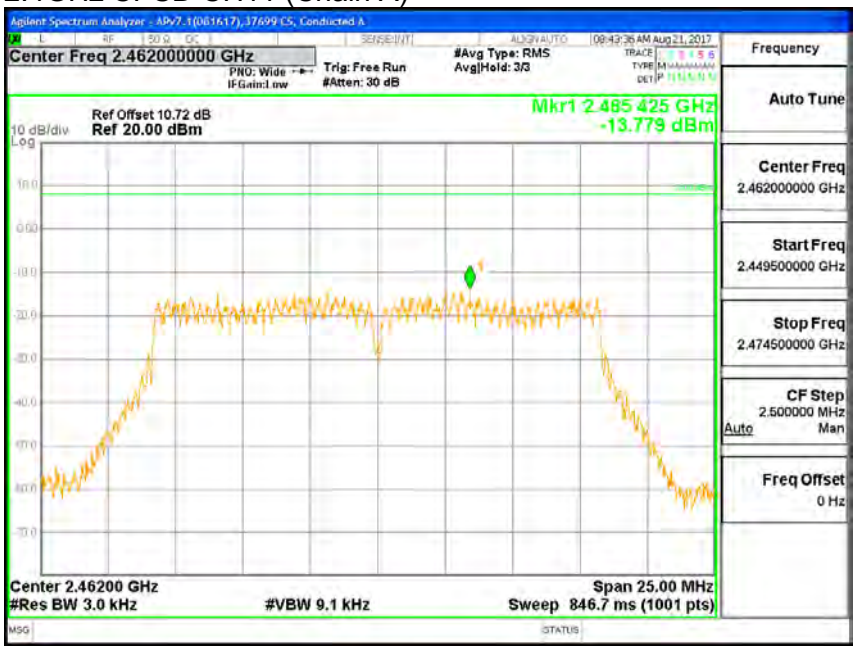
2.4GHz CPSD CH6 (Chain A)



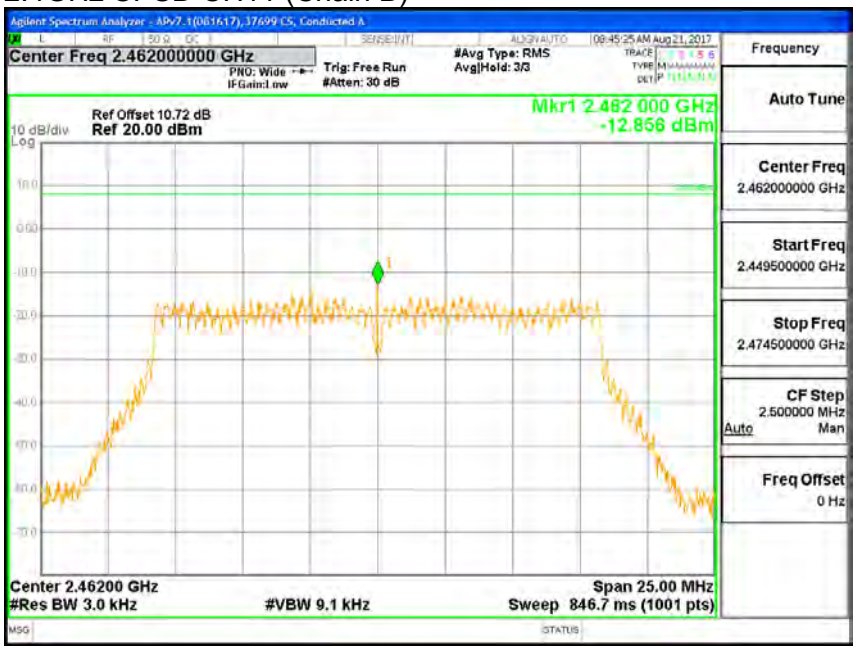
2.4GHz CPSD CH6 (Chain B)



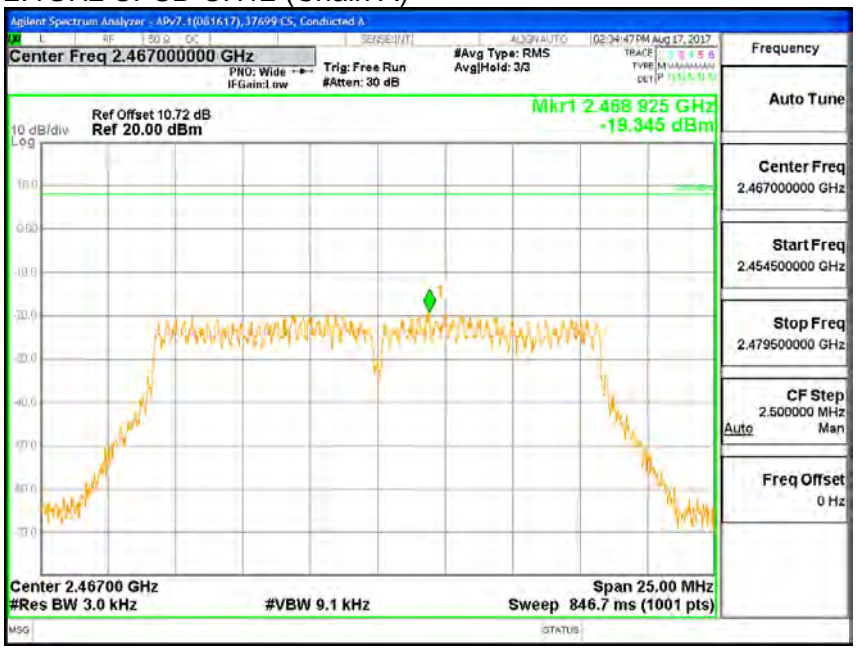
2.4GHz CPSD CH11 (Chain A)



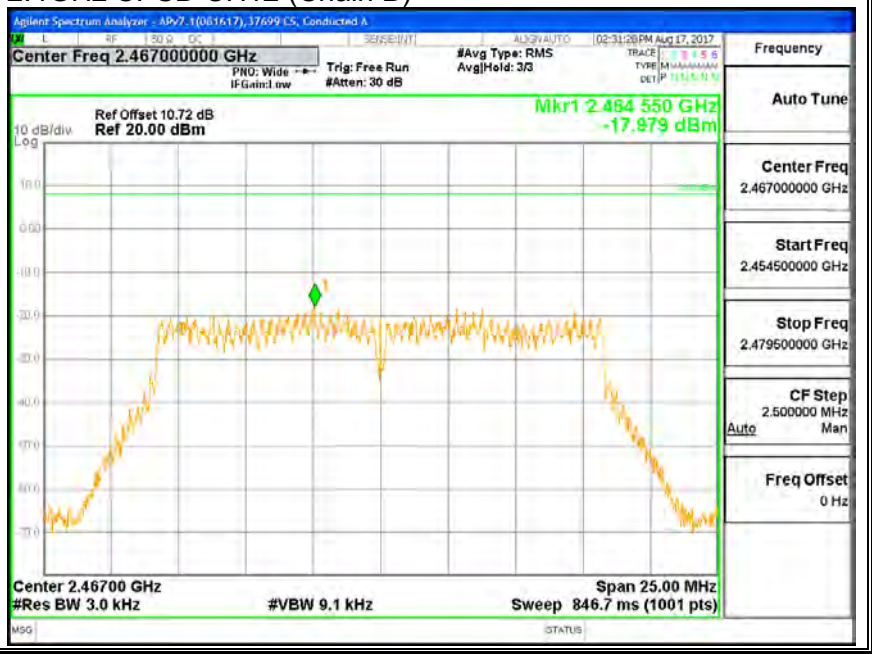
2.4GHz CPSD CH11 (Chain B)



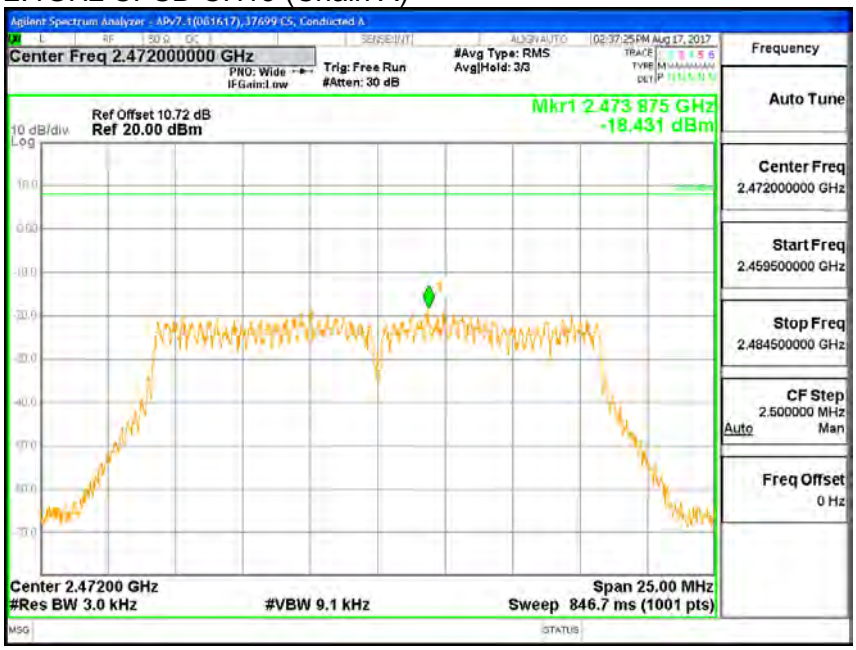
2.4GHz CPSD CH12 (Chain A)



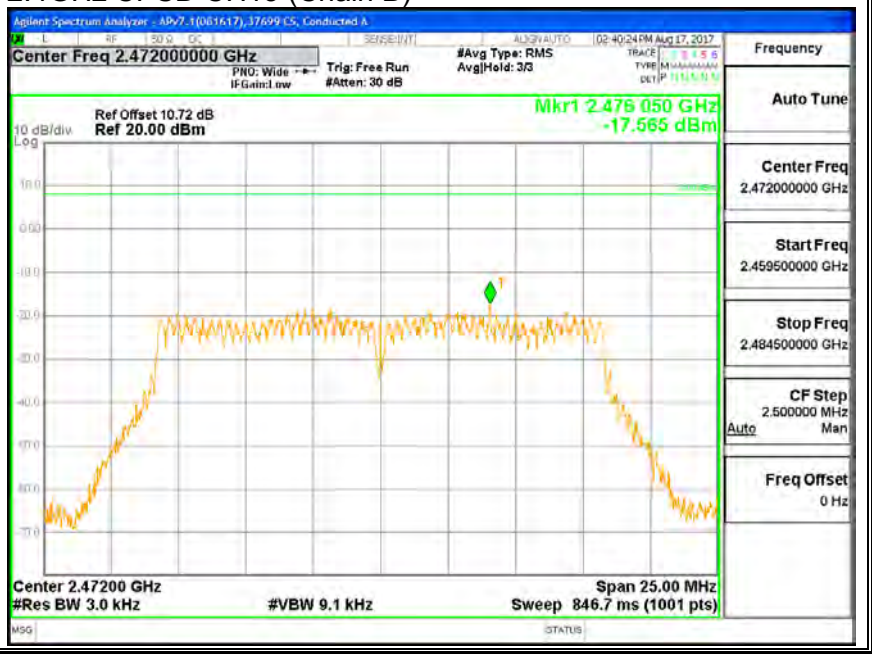
2.4GHz CPSD CH12 (Chain B)



2.4GHz CPSD CH13 (Chain A)



2.4GHz CPSD CH13 (Chain B)



9.3.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

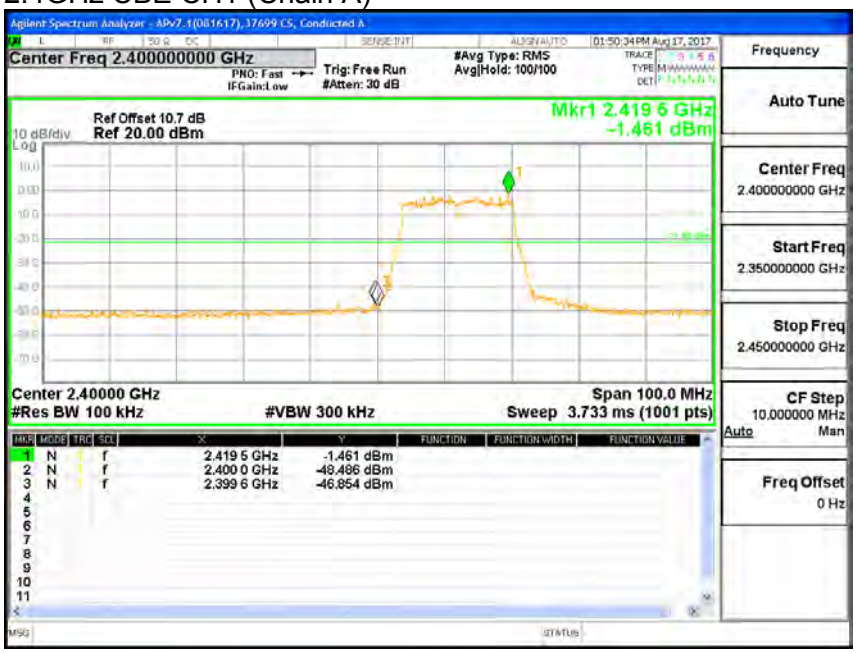
FCC §15.247 (d)

IC RSS-247 5.5

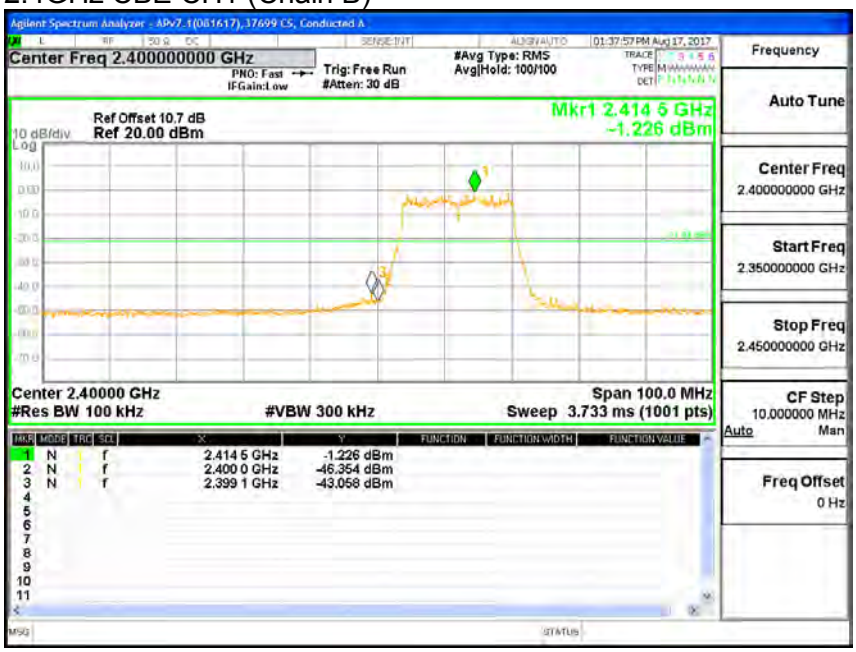
Output power was measured based on the use of peak measurement, therefore the required attenuation is 20 dB.

RESULTS

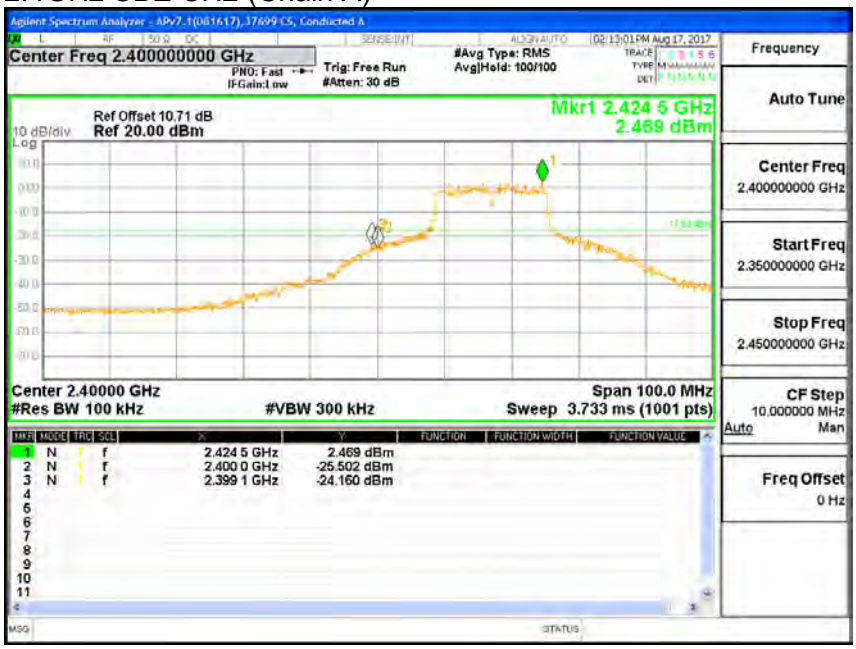
2.4GHz CBE CH1 (Chain A)



2.4GHz CBE CH1 (Chain B)

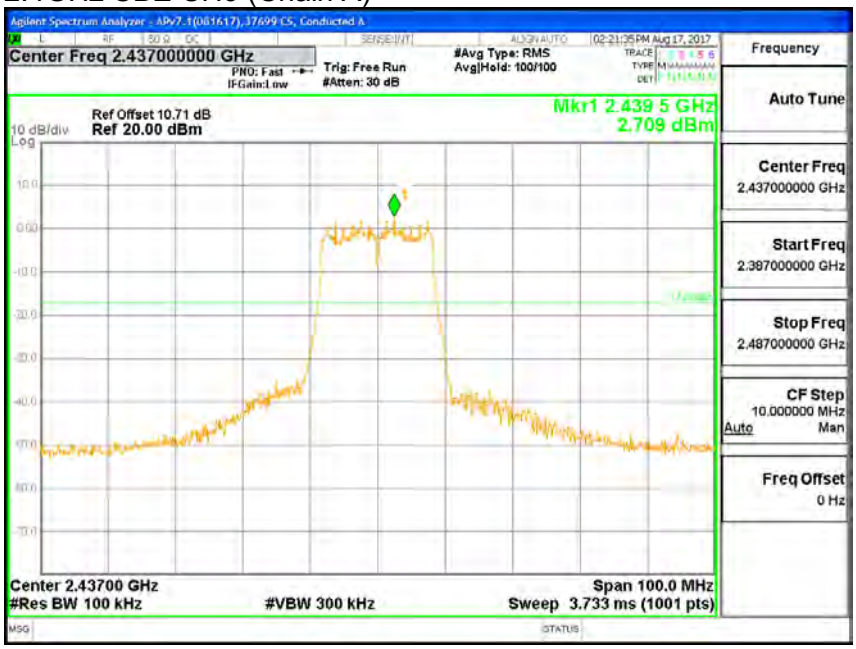


2.4GHz CBE CH2 (Chain A)

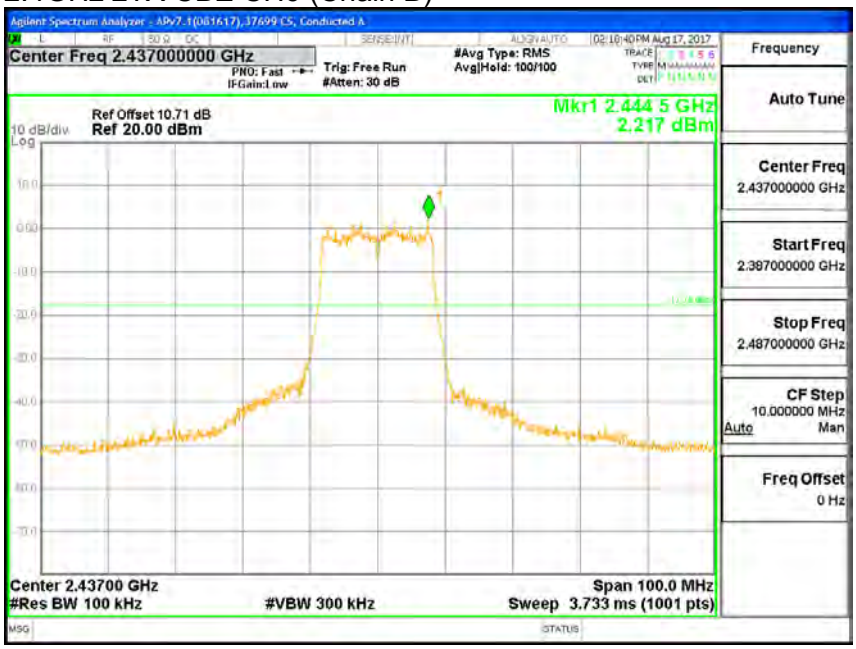


2.4GHz CBE CH2 (Chain B)

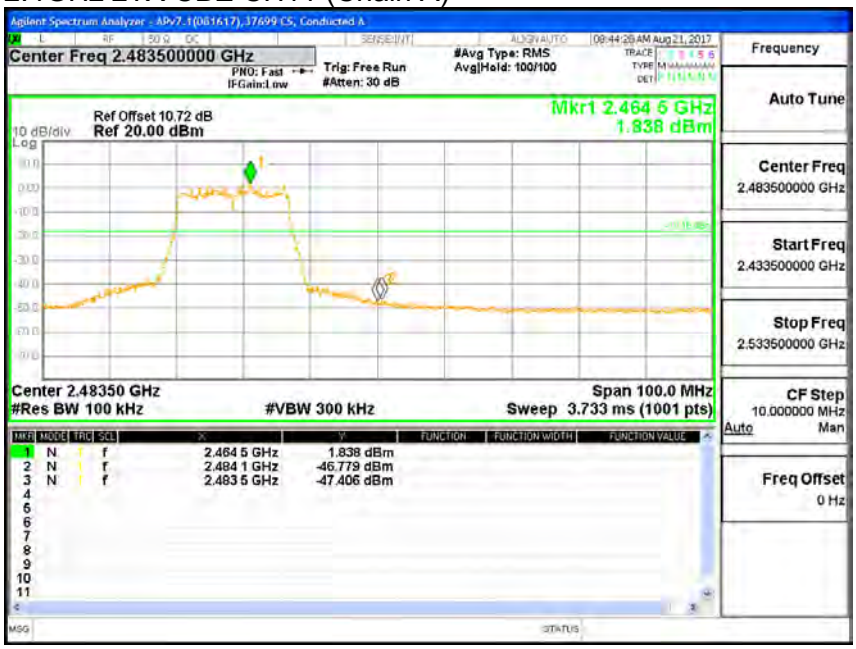
2.4GHz CBE CH6 (Chain A)



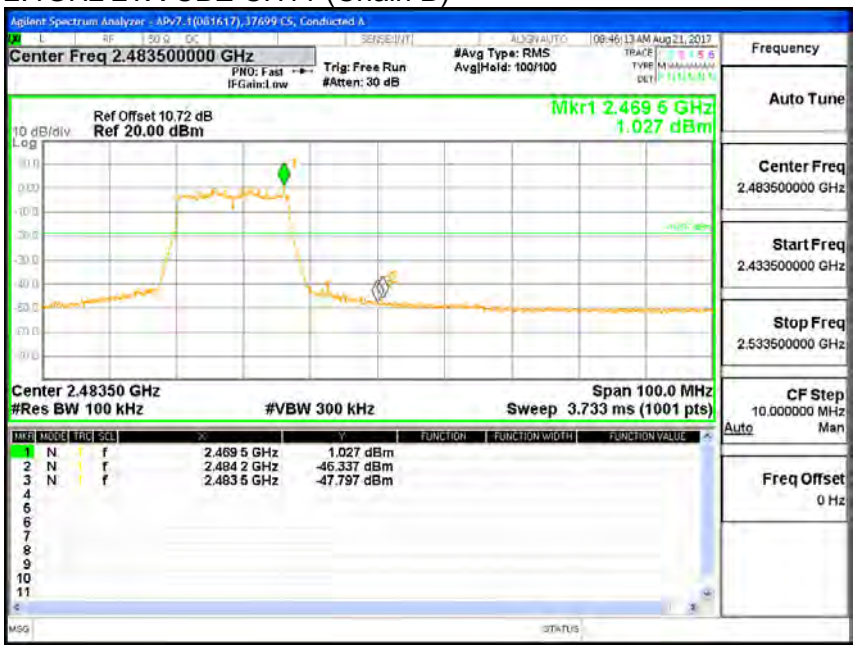
2.4GHz 2TX CBE CH6 (Chain B)



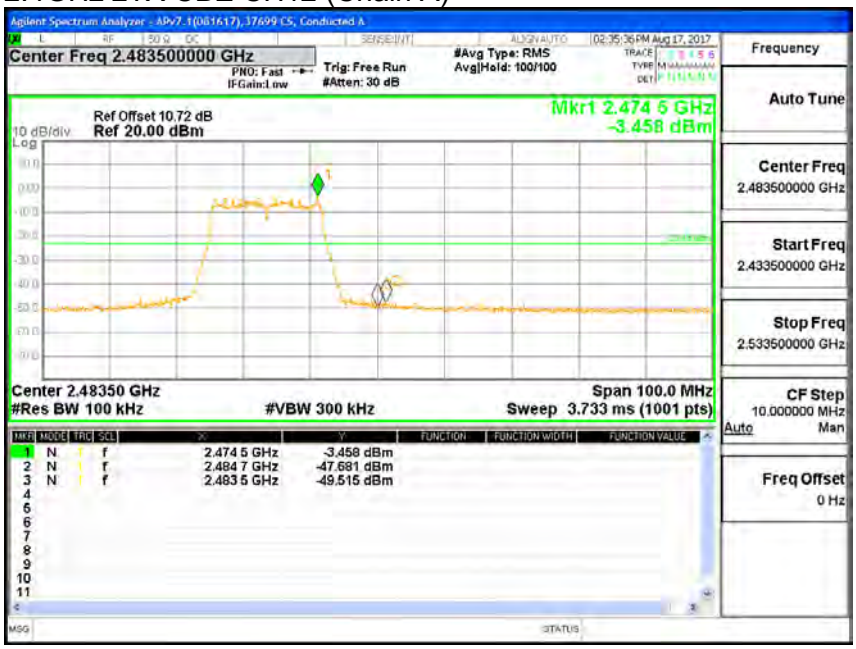
2.4GHz 2TX CBE CH11 (Chain A)



2.4GHz 2TX CBE CH11 (Chain B)



2.4GHz 2TX CBE CH12 (Chain A)



2.4GHz 2TX CBE CH12 (Chain B)

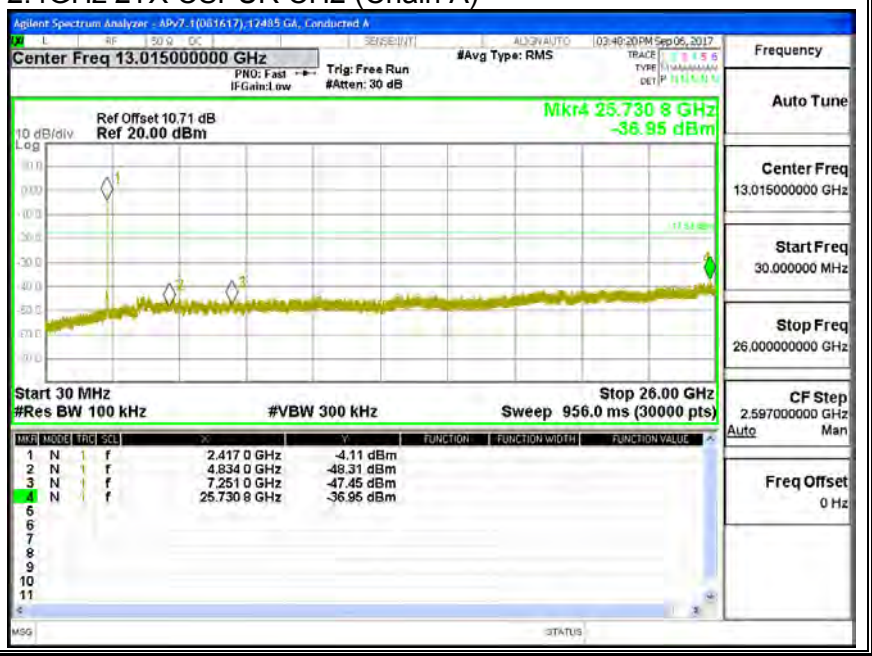
2.4GHz 2TX CBE CH13 (Chain A)

2.4GHz 2TX CBE CH13 (Chain B)

2.4GHz 2TX CSPUR CH1 (Chain A)

2.4GHz 2TX CSPUR CH1 (Chain B)

2.4GHz 2TX CSPUR CH2 (Chain A)

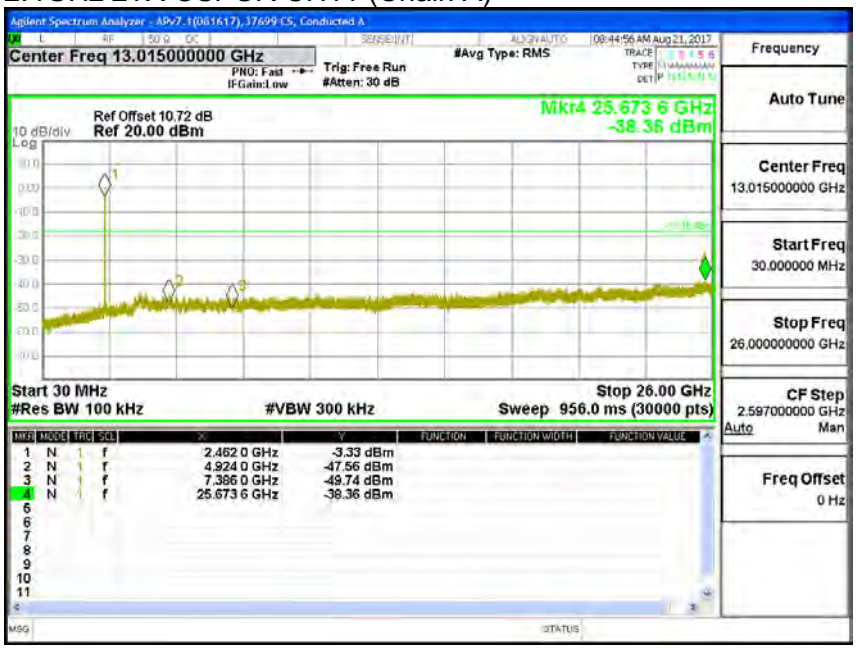


2.4GHz 2TX CSPUR CH2 (Chain B)

2.4GHz 2TX CSPUR CH6 (Chain A)

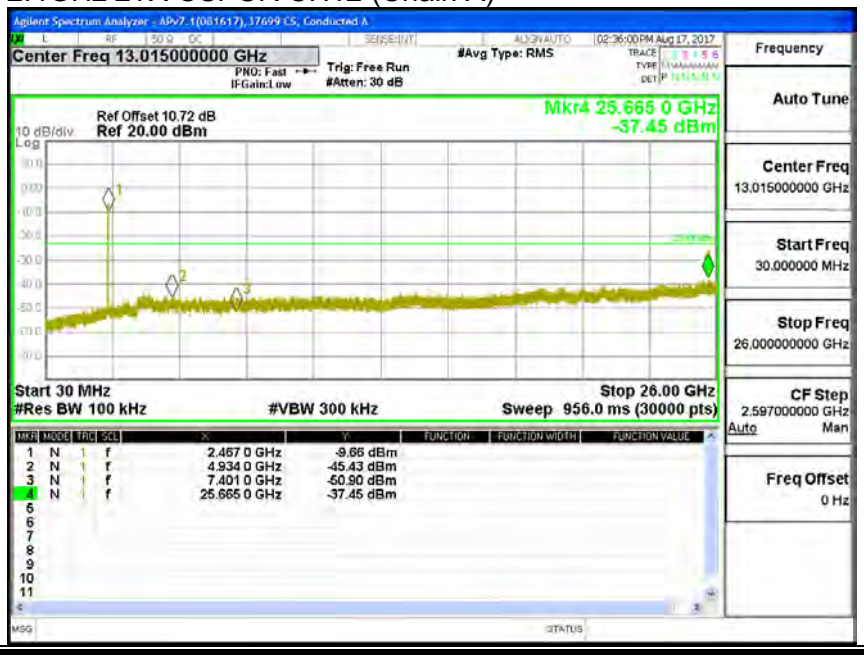
2.4GHz 2TX CSPUR CH6 (Chain B)

2.4GHz 2TX CSPUR CH11 (Chain A)

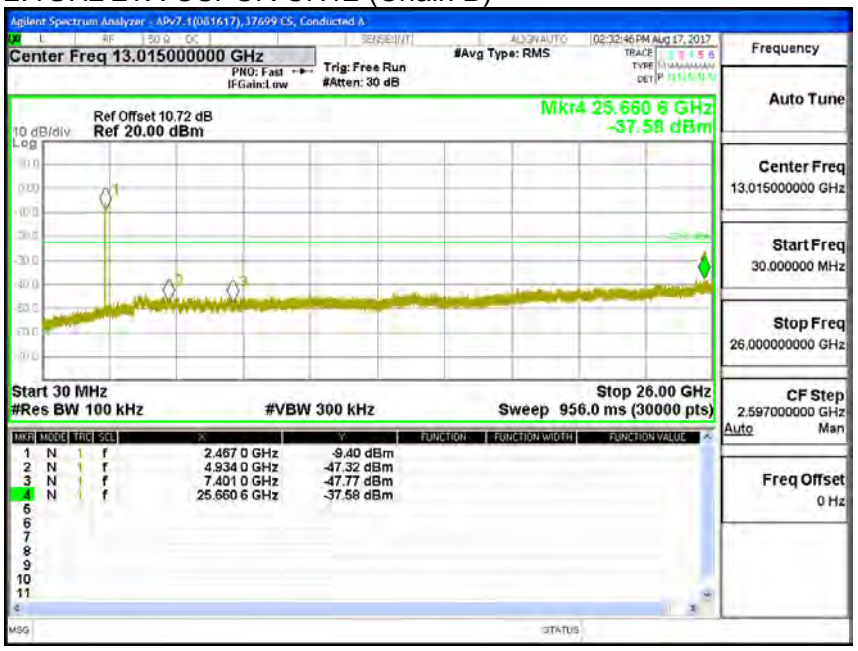


2.4GHz 2TX CSPUR CH11 (Chain B)

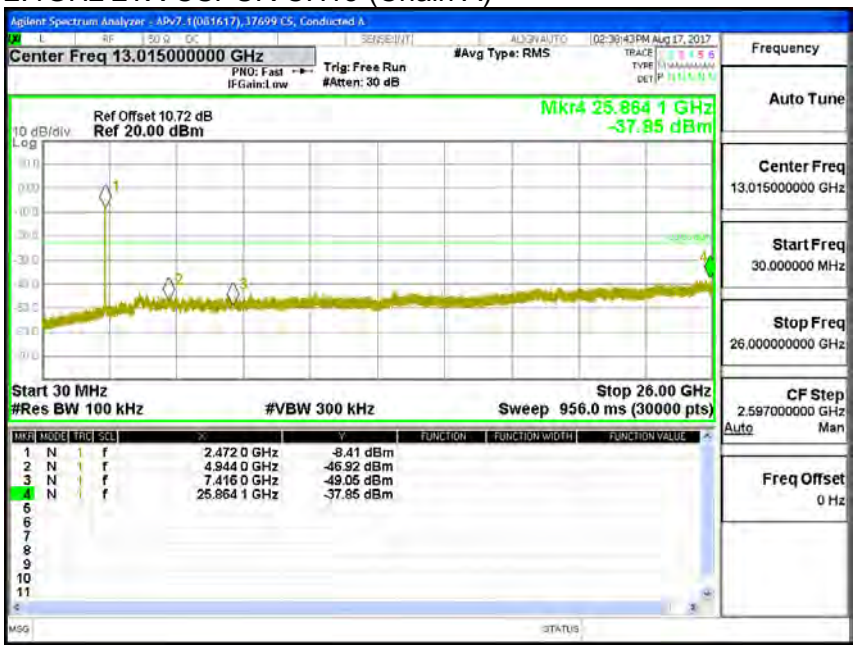
2.4GHz 2TX CSPUR CH12 (Chain A)



2.4GHz 2TX CSPUR CH12 (Chain B)



2.4GHz 2TX CSPUR CH13 (Chain A)



2.4GHz 2TX CSPUR CH13 (Chain B)

9.4. 11n HT20 2TX CDD MIMO MODE IN THE 2.4GHz BAND

9.4.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

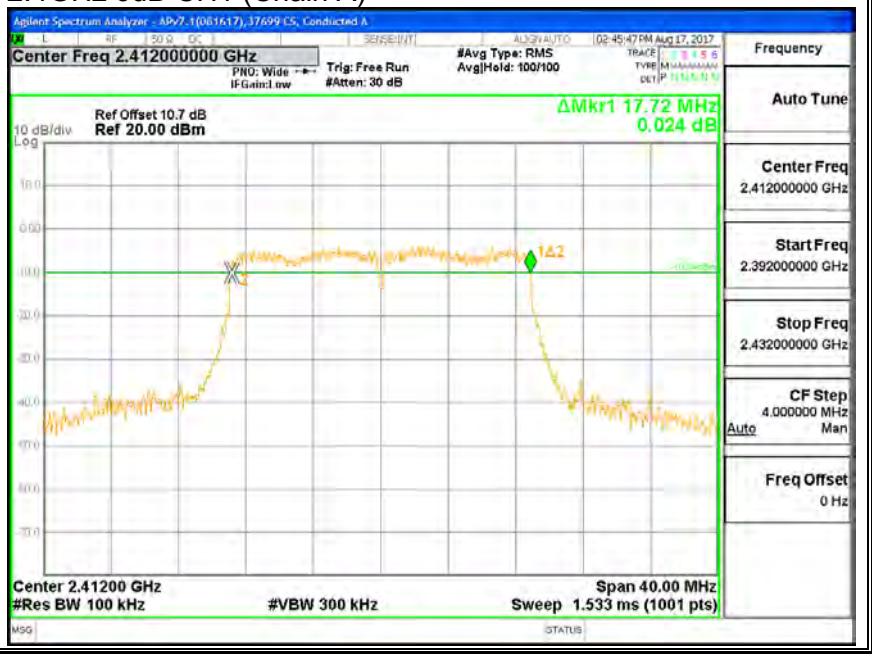
IC RSS-247 (5.2) (a)

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

RESULTS

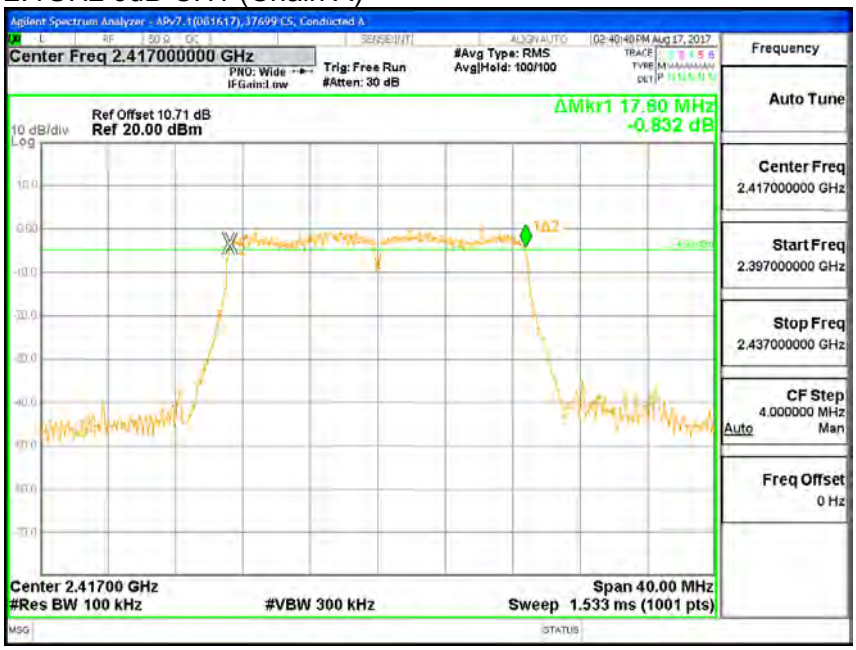
Channel	Frequency	6 dB BW Chain A (MHz)	6 dB BW Chain B (MHz)	Minimum Limit (MHz)
CH1	2412	17.72	17.60	0.5
CH2	2417	17.60	17.68	0.5
CH6	2437	17.68	17.68	0.5
CH11	2462	17.72	17.68	0.5
CH12	2467	17.72	17.60	0.5
CH13	2472	17.68	17.68	0.5

2.4GHz 6dB CH1 (Chain A)

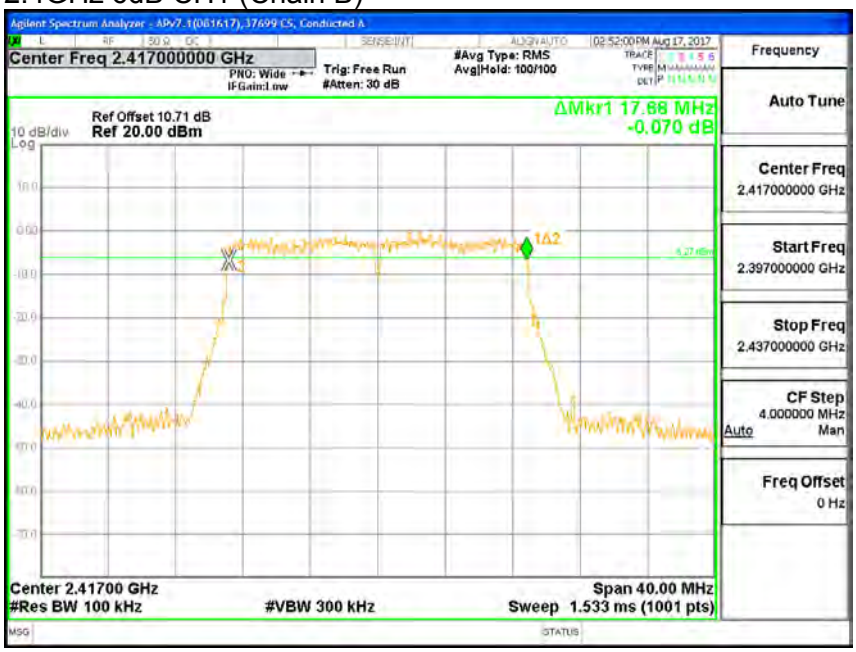


2.4GHz 6dB CH1 (Chain B)

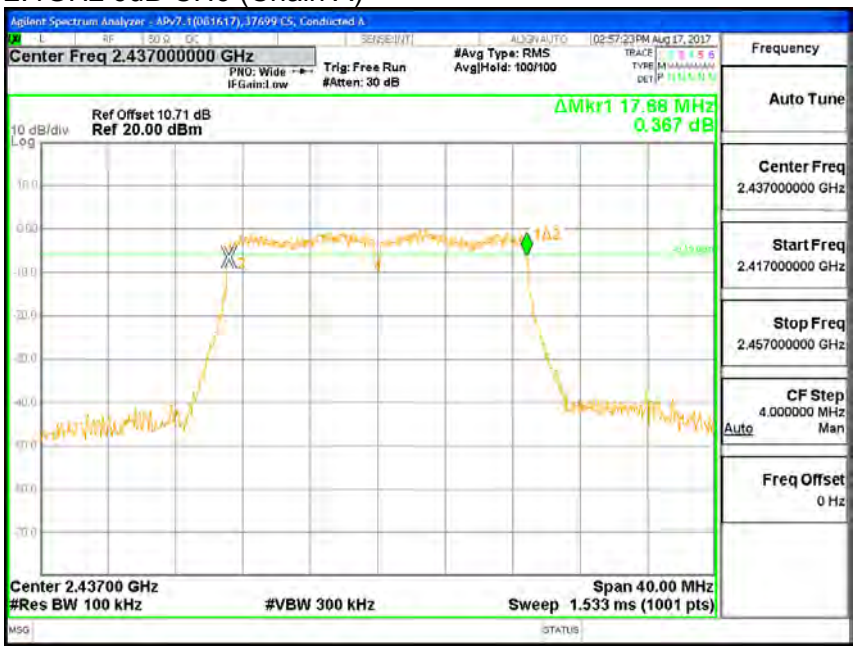
2.4GHz 6dB CH1 (Chain A)



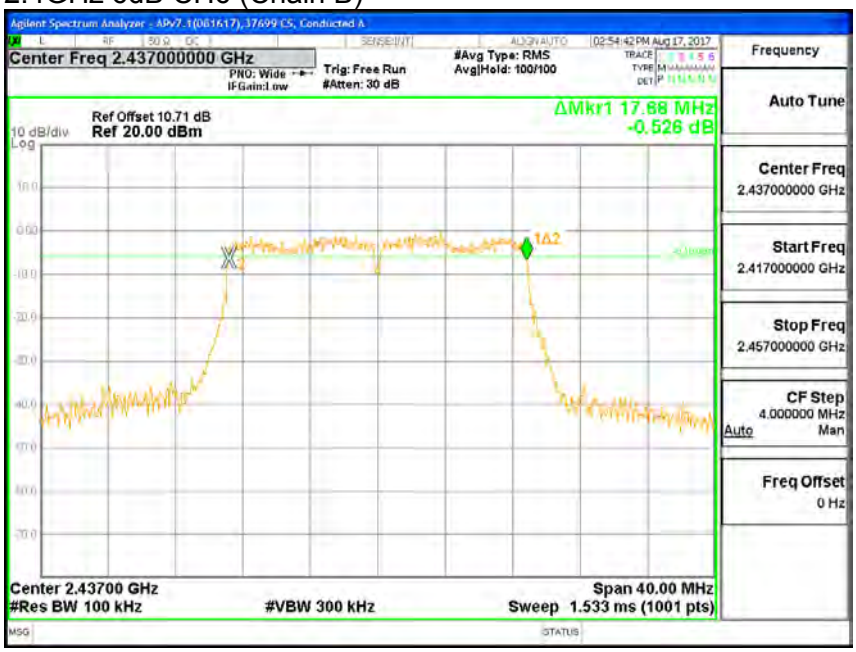
2.4GHz 6dB CH1 (Chain B)



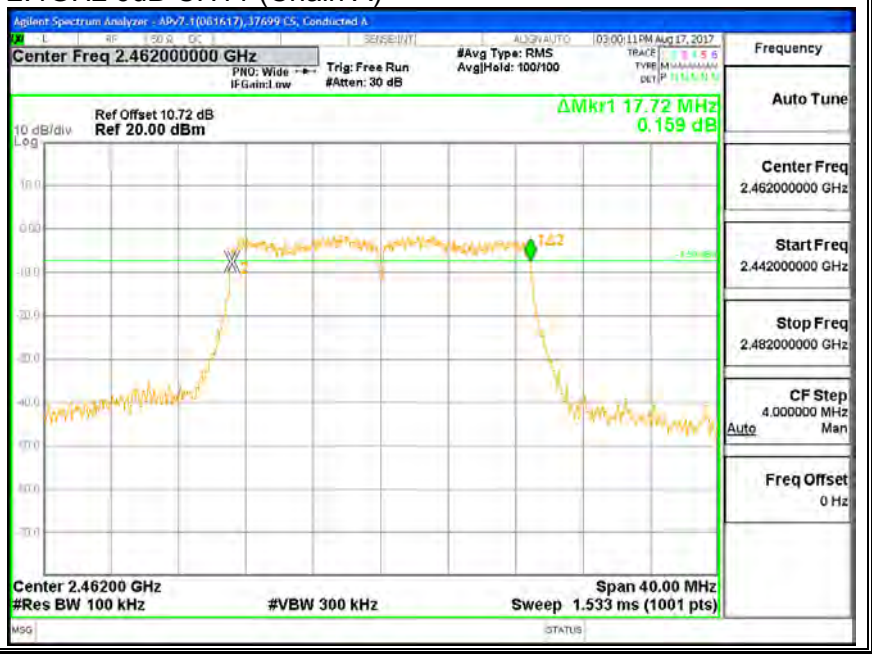
2.4GHz 6dB CH6 (Chain A)



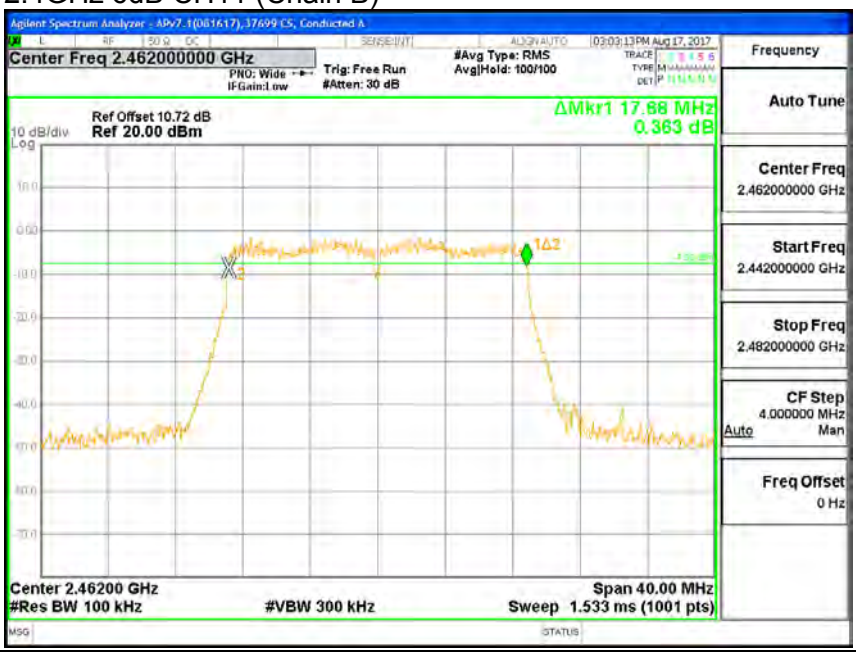
2.4GHz 6dB CH6 (Chain B)



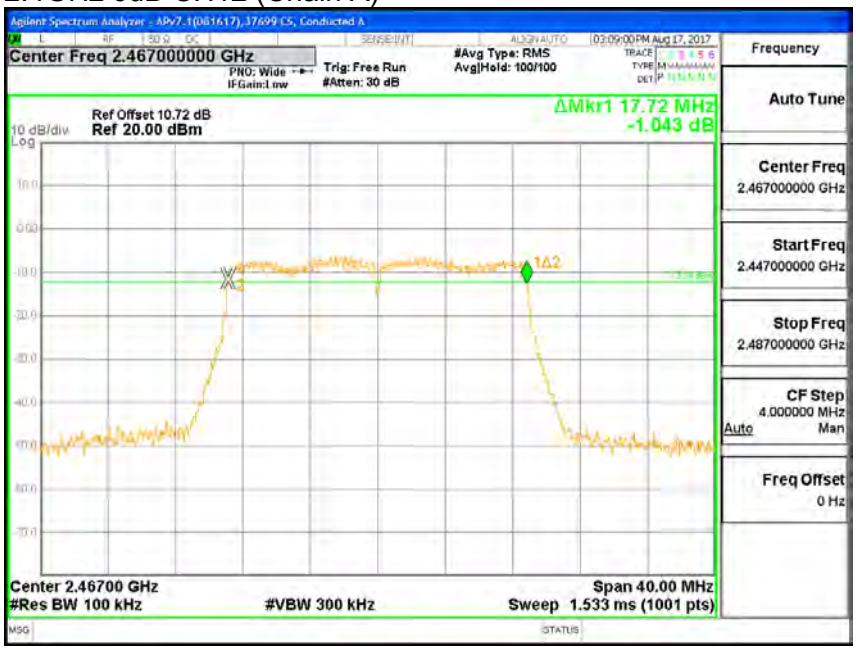
2.4GHz 6dB CH11 (Chain A)



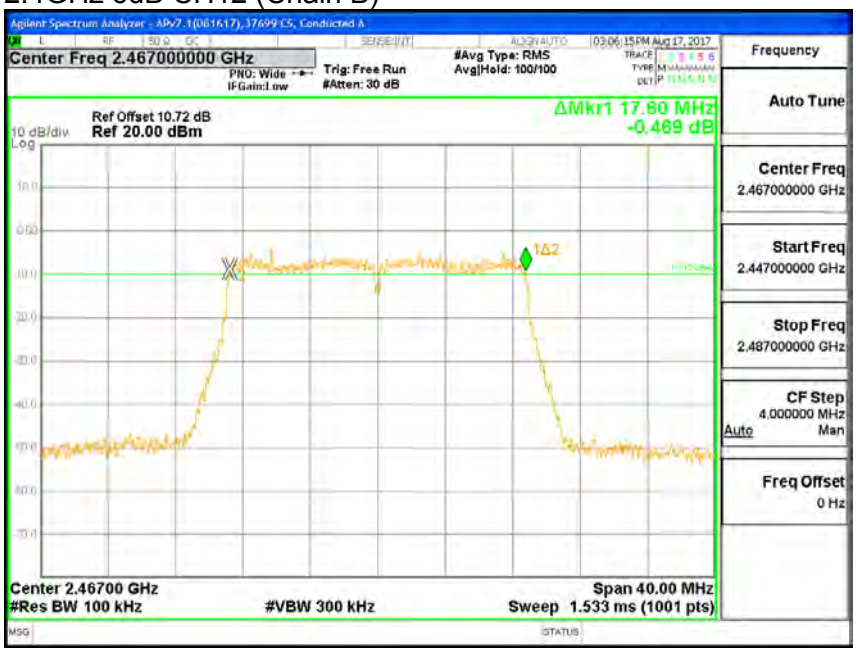
2.4GHz 6dB CH11 (Chain B)



2.4GHz 6dB CH12 (Chain A)



2.4GHz 6dB CH12 (Chain B)



2.4GHz 6dB CH13 (Chain A)

2.4GHz 6dB CH13 (Chain B)

9.4.2. 99% BANDWIDTH

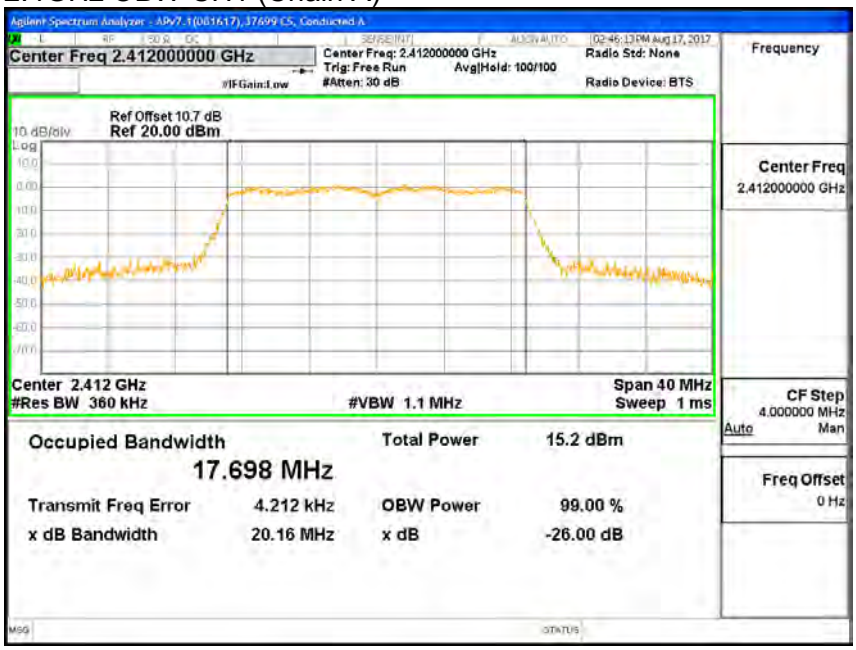
LIMITS

None; for reporting purposes only.

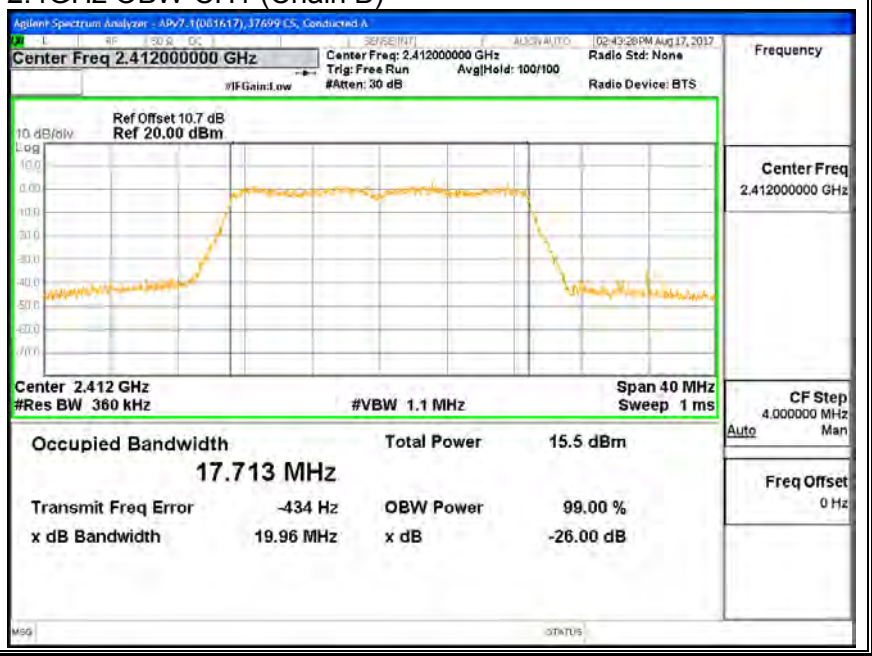
RESULTS

Channel	Frequency (MHz)	99% Bandwidth Chain A (MHz)	99% Bandwidth Chain B (MHz)
CH1	2412	17.698	17.713
CH2	2417	17.686	17.706
CH6	2437	17.670	17.733
CH11	2462	17.686	17.671
CH12	2467	17.681	17.692
CH13	2472	17.708	17.699

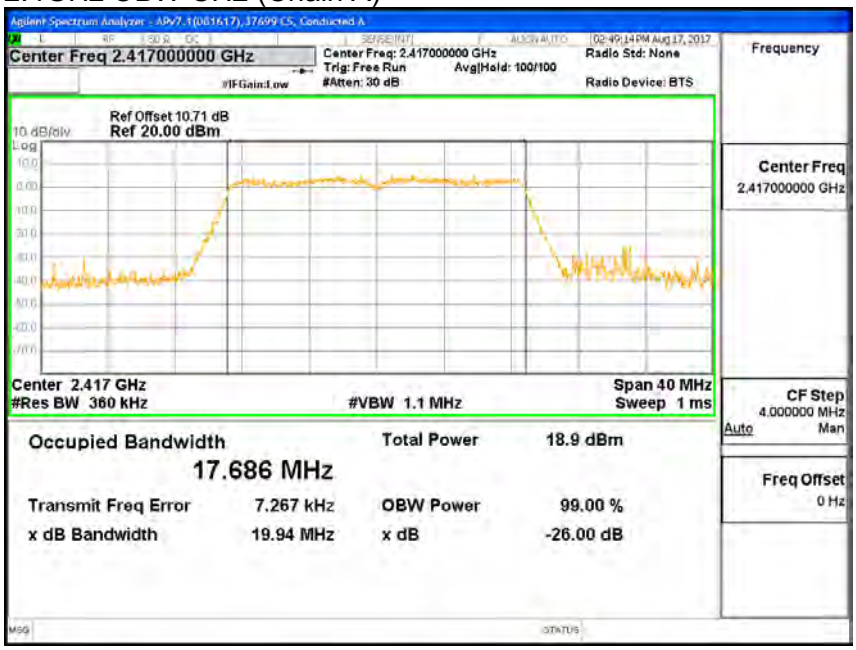
2.4GHz OBW CH1 (Chain A)



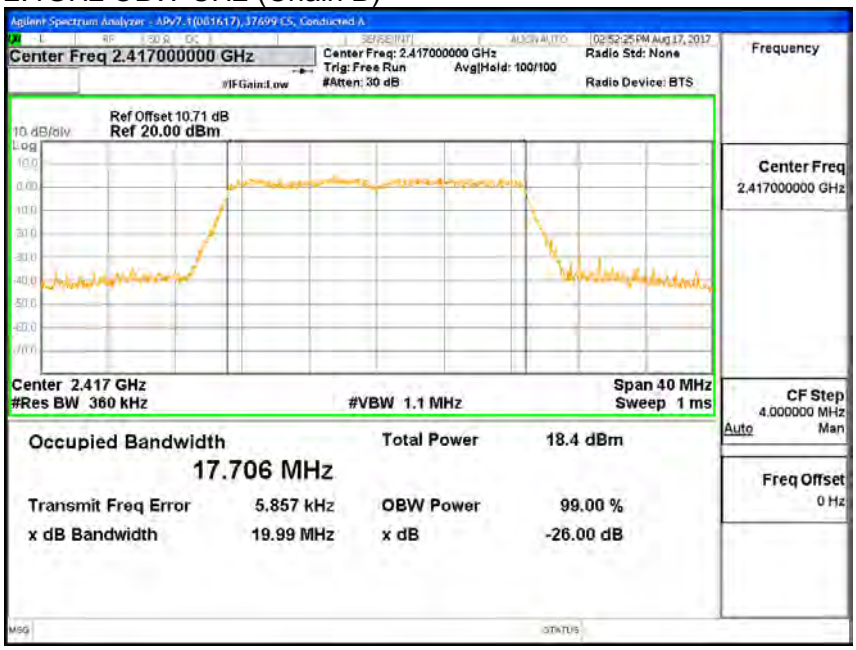
2.4GHz OBW CH1 (Chain B)



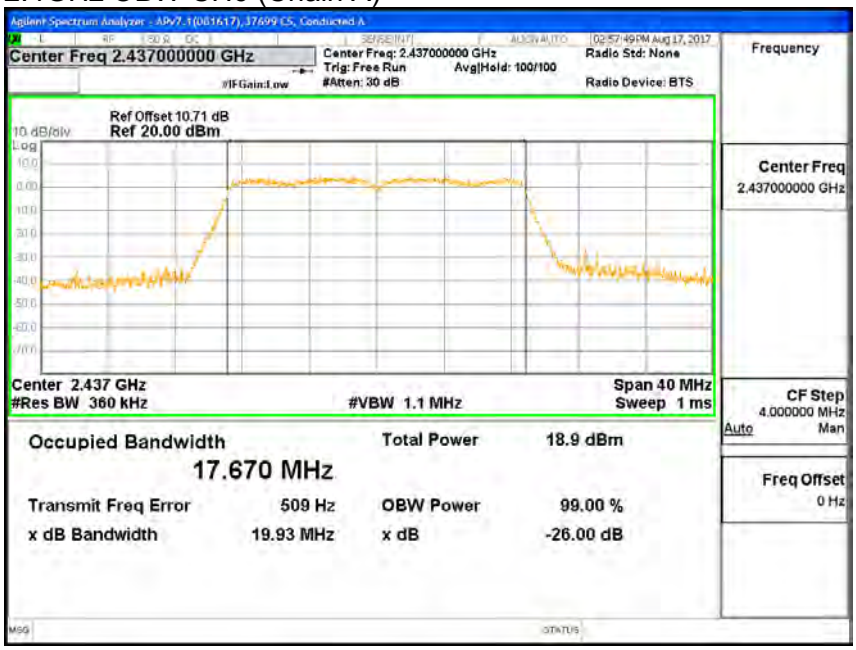
2.4GHz OBW CH2 (Chain A)



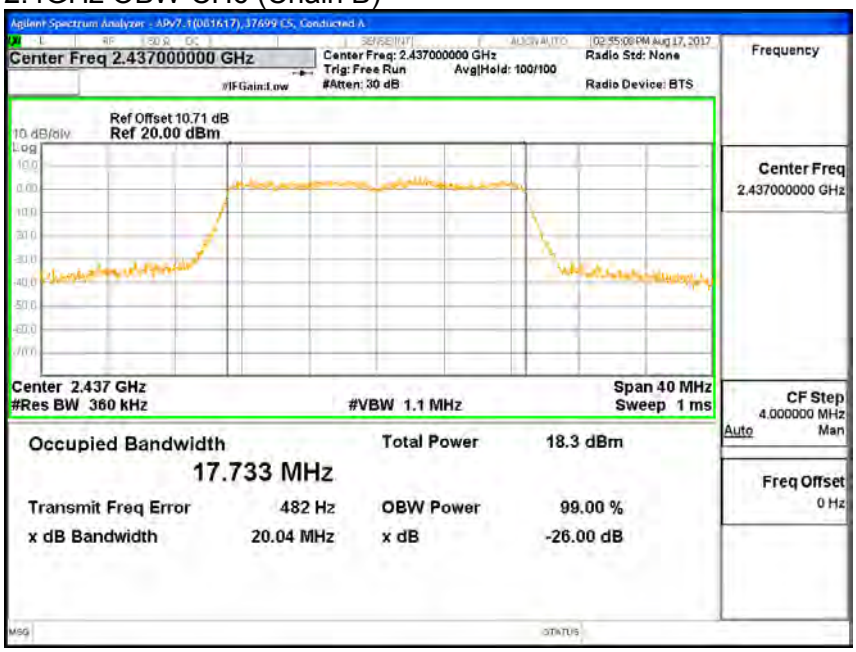
2.4GHz OBW CH2 (Chain B)



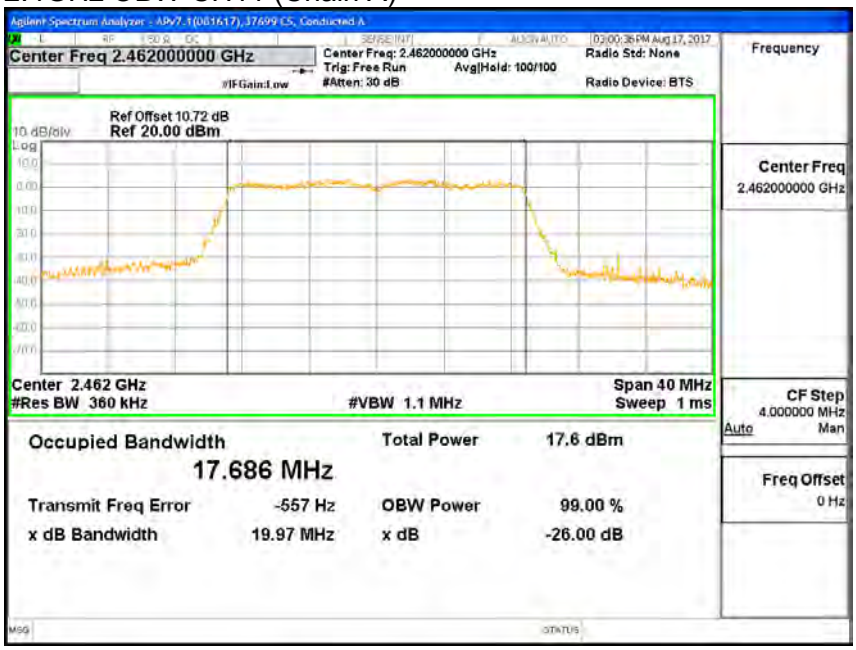
2.4GHz OBW CH6 (Chain A)



2.4GHz OBW CH6 (Chain B)



2.4GHz OBW CH11 (Chain A)



2.4GHz OBW CH11 (Chain B)