

RF Test Report

For

Globe Electric Company Inc.

Test Standards:	Part 15C Subpart C §15.247 RSS 247 Issue 2
Product Description:	WiFi outdoor plug
Tested Model:	50029
Additional Model No.:	50151, 8080200
Brand Name:	N/A
FCC ID:	2AQUQGE50029
IC ID:	8290A-GE50029
Classification	(DTS) Digital Transmission System
Report No.:	EC1906008RF01
Tested Date:	2019-06-25 to 2019-08-13
Issued Date:	2019-08-13
Prepared By:	 Damon Zhang/ Engineer
Approved By:	 Bacon Wu / RF Manager

Hunan Ecloud Testing Technology Co., Ltd.
Building A1, Changsha E Center, No. 18 Xiangtai Avenue, Liuyang Economic and
Technological Development Zone, Hunan, P.R.C
Tel.: +86-731-89634887 Fax.: +86-731-89634887
www.hn-ecloud.com

Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Hunan Ecloud Testing Technology Co., Ltd., the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2019.08.13	Valid	Original Report

TABLE OF CONTENTS

1	TEST LABORATORY	5
1.1	Test facility	5
2	GENERAL DESCRIPTION.....	6
2.1	Applicant	6
2.2	Manufacturer	6
2.3	General Description Of EUT	6
2.4	Modification of EUT	7
2.5	Applicable Standards.....	7
3	TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....	8
3.1	Descriptions of Test Mode	8
3.2	Test Mode	8
3.3	Support Equipment.....	9
3.4	Test Setup.....	10
3.5	Measurement Results Explanation Example	12
4	TEST RESULT.....	13
4.1	6dB and 99% Bandwidth Measurement	13
4.2	Output Power Measurement	23
4.3	Power Spectral Density Measurement	35
4.4	Conducted Band Edges and Spurious Emission Measurement	42
4.5	Radiated Band Edges and Spurious Emission Measurement	65
4.6	AC Conducted Emission Measurement.....	118
4.7	Antenna Requirements	121
5	LIST OF MEASURING EQUIPMENT	122
6	UNCERTAINTY OF EVALUATION	123
 APPENDIX A. SETUP PHOTOGRAPHS		
 APPENDIX B. EUT EXTERNAL PHOTOGRAPHS		
 APPENDIX C. EUT INTERNAL PHOTOGRAPHS		

Summary Of Test Result

FCC Rule	IC Rule	Description	Limit	Result	Remark
15.247(a)(2)	RSS-247 5.2(a)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
-	RSS-Gen 6.7	99% Bandwidth	-	Pass	-
15.247(b)(3)	RSS-247 A5.4(d)	Peak Output Power	$\leq 30\text{dBm}$	Pass	-
15.247(e)	RSS-247 5.2(b)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
15.247(d)	RSS-247 5.5	Conducted Band Edges and Spurious Emission	$\leq 20\text{dBc}$	Pass	-
15.247(d)	RSS-247 5.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 2.65 dB at 159.98 MHz
15.207	RSS-GEN 8.8	AC Conducted Emission	15.207(a)	Pass	Under limit 20.32 dB at 0.419 MHz
15.203 & 15.247(b)	N/A	Antenna Requirement	N/A	Pass	-

1 Test Laboratory

1.1 Test facility

CNAS (accreditation number: L11138)

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1244 , Test Firm Registration Number: 793308)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

ISED(CAB identifier: CN0012, ISED# :24347)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the Wireless Device Testing Laboratories list of innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

A2LA (Certificate Code : 4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

2 General Description

2.1 Applicant

Globe Electric Company Inc.

150, ONEIDA, MONTREAL, QUEBEC, CANADA, H9R 1A8

2.2 Manufacturer

Globe Electric Company Inc.

150, ONEIDA, MONTREAL, QUEBEC, CANADA, H9R 1A8

2.3 General Description Of EUT

Product	WiFi outdoor plug
Model No.	50029
Additional No.	50151, 8080200
Difference Description	Only the model name is different.
FCC ID	2AQUQGE50029
IC ID	8290A-GE50029
Power Supply	125Vac 3.3Vdc
Modulation Technology	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Type	802.11b : DSSS 802.11g/n : OFDM
Operating Frequency	2412-2462MHz
Number Of Channel	11
Max. Output Power	802.11b : 14.63 dBm (0.0291 W) 802.11g : 14.23 dBm (0.0265 W) 802.11n HT20 : 14.05 dBm (0.0254 W)
Antenna Type	PCB Antenna with 3dBi gain
I/O Ports	Refer to user's manual
Cable Supplied	Refer to user's manual

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ ANSI C63.10-2013
- ♦ IC RSS-247 Issue 2
- ♦ IC RSS-Gen Issue 5
- ♦ KDB 558074 D01 15.247 Meas Guidance v05r02

Remark:

1. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

3 Test Configuration of Equipment Under Test

3.1 Descriptions of Test Mode

11 channels are provided for 802.11b, 802.11g and 802.11n(HT20):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2412 MHz	7	2442 MHz
2	2417 MHz	8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz	10	2457 MHz
5	2432 MHz	11	2462 MHz
6	2437 MHz		

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

Frequency Range(MHz)	Mode	Rate	Output Power(dBm)
2412~2462	802.11b	1M	14.63
2412~2462	802.11g	6M	14.23
2412~2462	802.11n HT20	MCS0	14.05

- a. 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.

3.2 Test Mode

3.2.1 Antenna Port Conducted Measurement

Summary table of Test Cases			
Test Item	Modulation		
	802.11 b	802.11 g	802.11n HT20
Conducted Test Cases	Mode 1: CH01	Mode 1: CH01	Mode 1: CH01
	Mode 2: CH06	Mode 2: CH06	Mode 2: CH06
	Mode 3: CH011	Mode 3: CH011	Mode 3: CH011

3.2.2 Radiated Emission Test (Below 1GHz)

Radiated	
Test Cases	WLAN Link + Charging

- Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type. Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.
2. Following channel(s) was (were) selected for the final test as listed above

3.2.3 Radiated Emission Test (Above 1GHz)

Test Item	Modulation		
	802.11 b	802.11 g	802.11n HT20
Radiated Test Cases	Mode 1: CH01	Mode 1: CH01	Mode 1: CH01
	Mode 2: CH06	Mode 2: CH06	Mode 2: CH06
	Mode 3: CH11	Mode 3: CH11	Mode 3: CH11

Note :

1. Following channel(s) was (were) selected for the final test as listed above.

3.2.4 Power Line Conducted Emission Test:

AC Conducted Emission	Mode 1 : WLAN Link + Power Supply+Lamp
--------------------------------------	--

3.3 Support Equipment

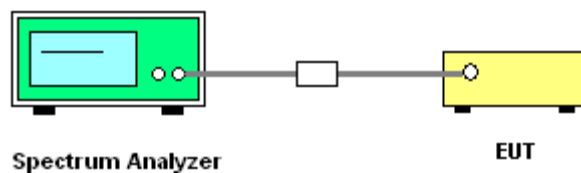
Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
3.	Lamp	N/A	1000W	N/A	N/A	N/A
4.	Notebook	Lenovo	E470C	FCC DoC	N/A	shielded cable DC O/P 1.8 m unshielded AC I/P cable1.2 m

3.4 Test Setup

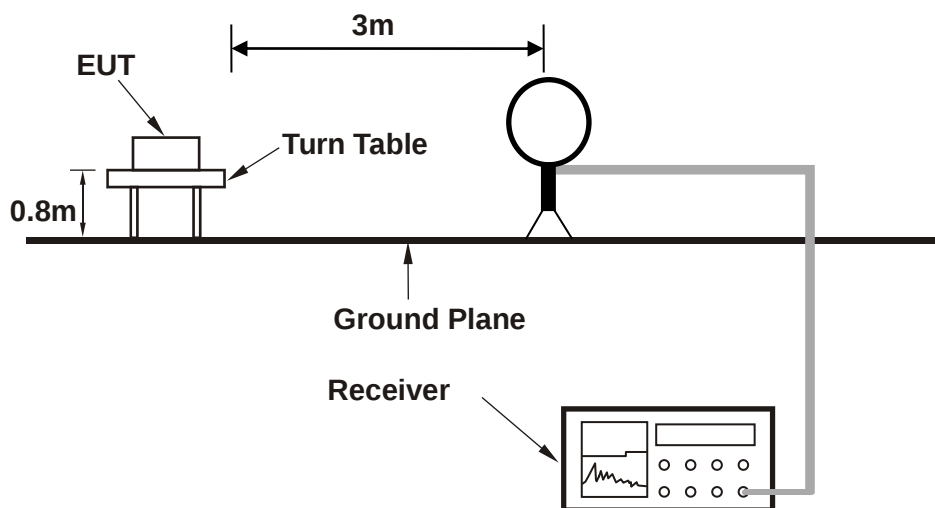
The EUT is continuously communicating to the Bluetooth tester during the tests.

EUT was set in the Hidden menu mode to enable BT communications.

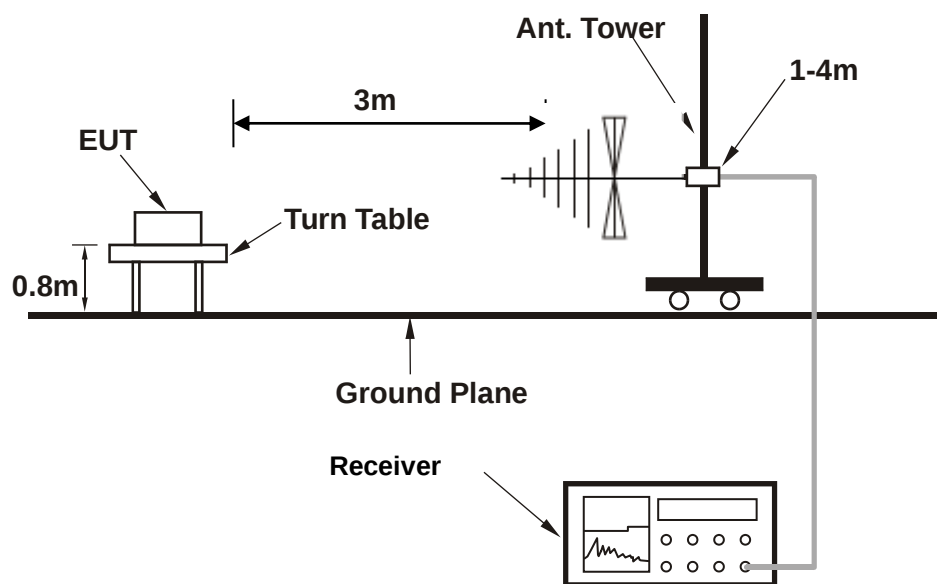
Setup diagram for Conducted Test



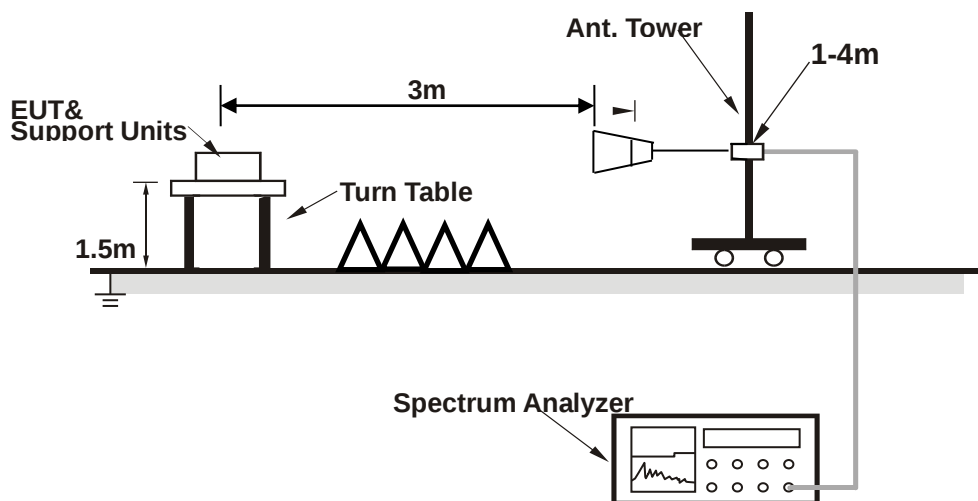
Setup diagram for Raidation(9KHz~30MHz) Test



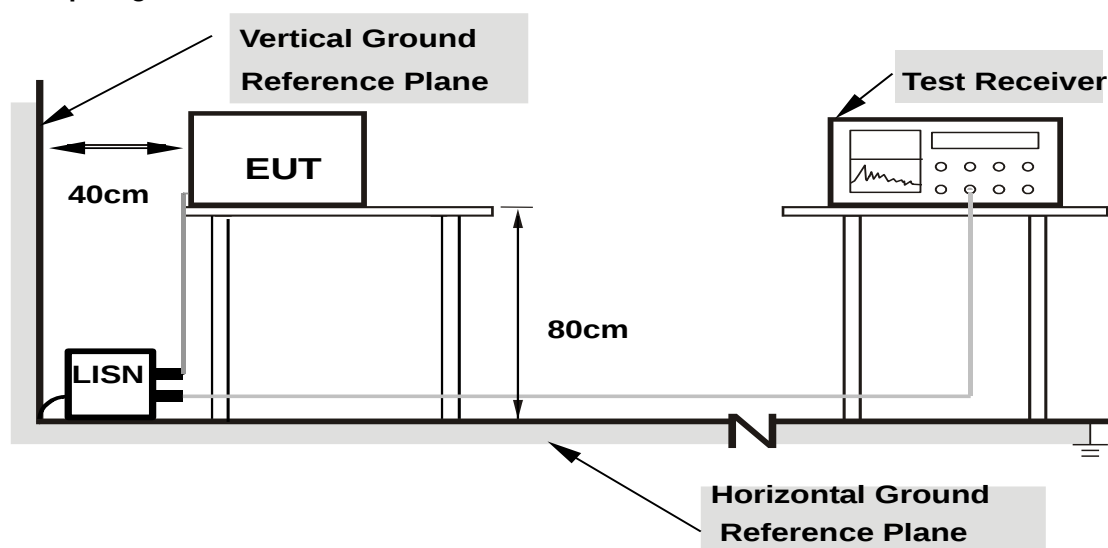
Setup diagram for Raidation(Below 1G) Test



Setup diagram for Raidation(Above1G) Test



Setup diagram for AC Conducted Emission Test



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 5 + 10 = 15 \text{ (dB)} \end{aligned}$$

4 Test Result

4.1 6dB and 99% Bandwidth Measurement

4.1.1 Limit of 6dB and 99% Bandwidth

FCC §15.247 (a) (2)

IC RSS-247 5.2(a)

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

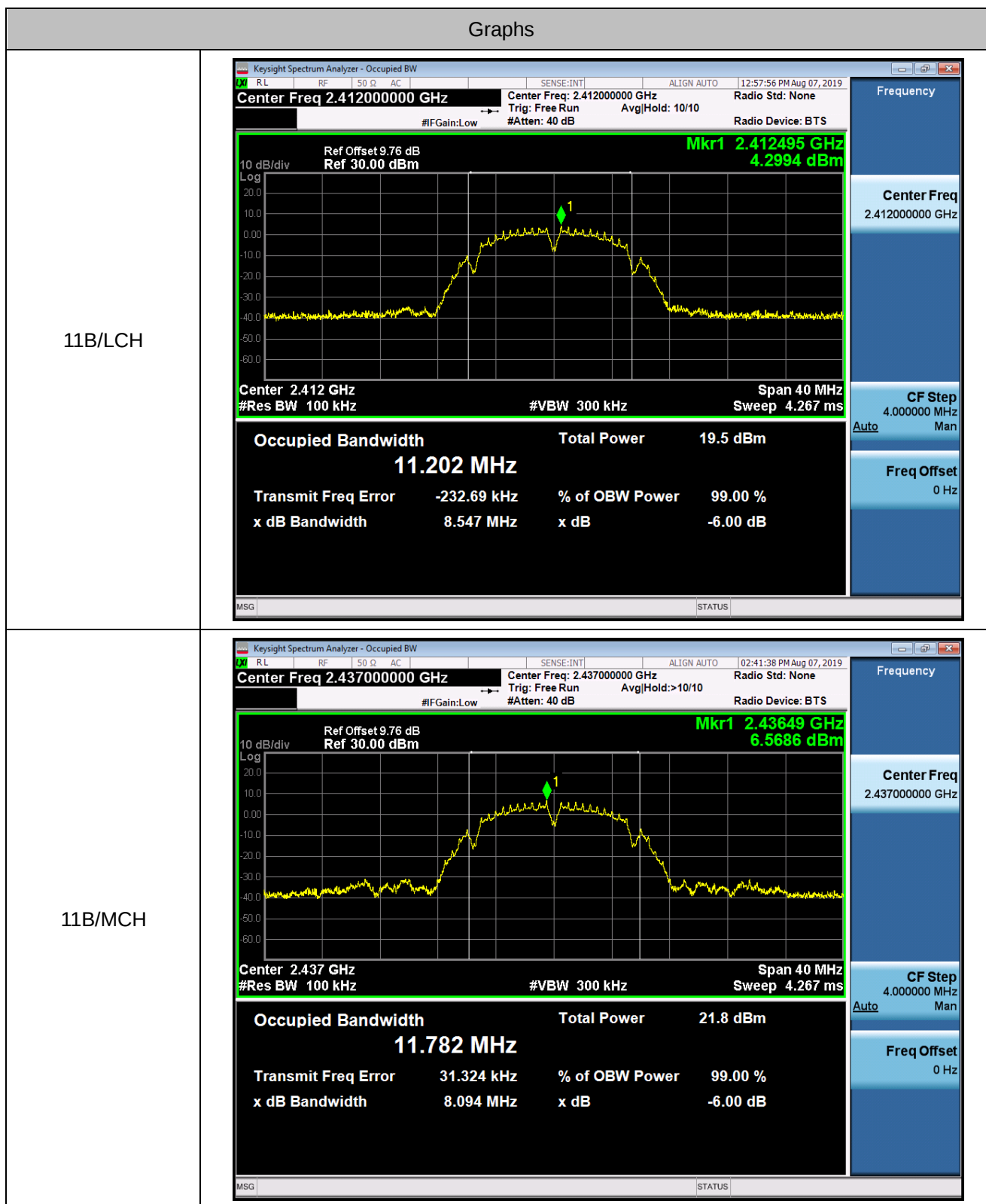
4.1.2 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v05r02.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Turn on the EUT and connect it to measurement instrument.
4. Set to the maximum power setting and enable Transmitting the EUT transmit continuously
5. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
6. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 100KHz and set the Video bandwidth (VBW) = 300KHz.

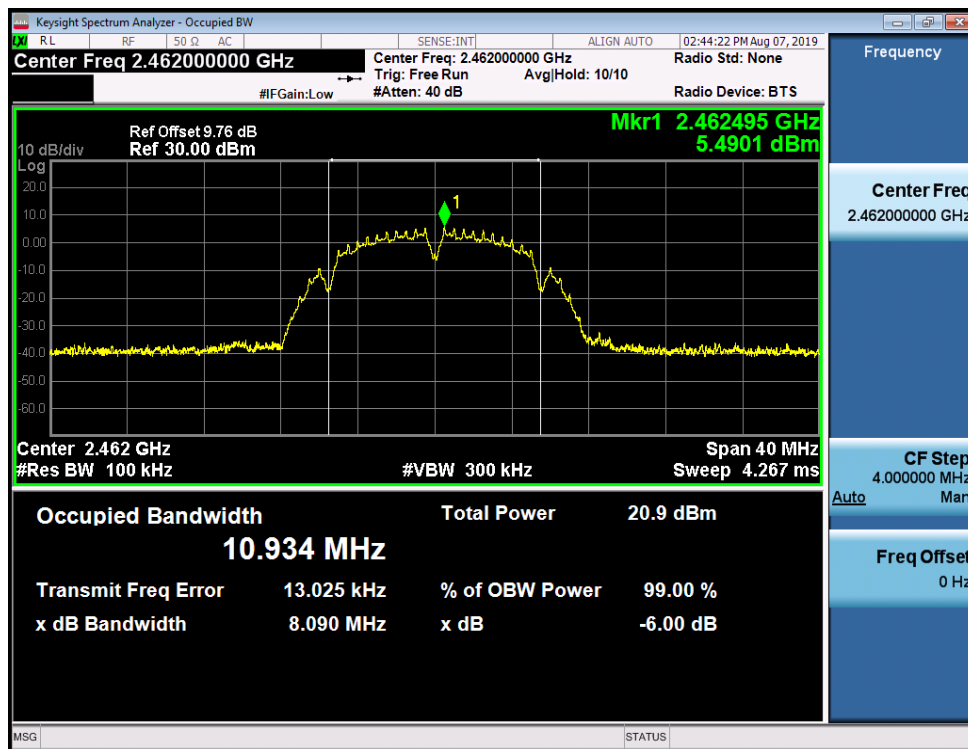
4.1.3 Test Result of 6dB and 99% Bandwidth

Test Mode :		2.4G WIFI	Temperature :	24~26°C	
Test Engineer :		Victorique Gao	Relative Humidity :	50~53%	
Mode	Channel	6dB Bandwidth [MHz]	99% OBW [MHz]	Verdict	
11B	LCH	8.547	11.794	PASS	
11B	MCH	8.094	11.915	PASS	
11B	HCH	8.090	11.643	PASS	
11G	LCH	16.06	16.958	PASS	
11G	MCH	16.28	16.957	PASS	
11G	HCH	16.31	16.905	PASS	
11N20	LCH	16.63	17.756	PASS	
11N20	MCH	16.56	17.734	PASS	
11N20	HCH	16.56	17.707	PASS	

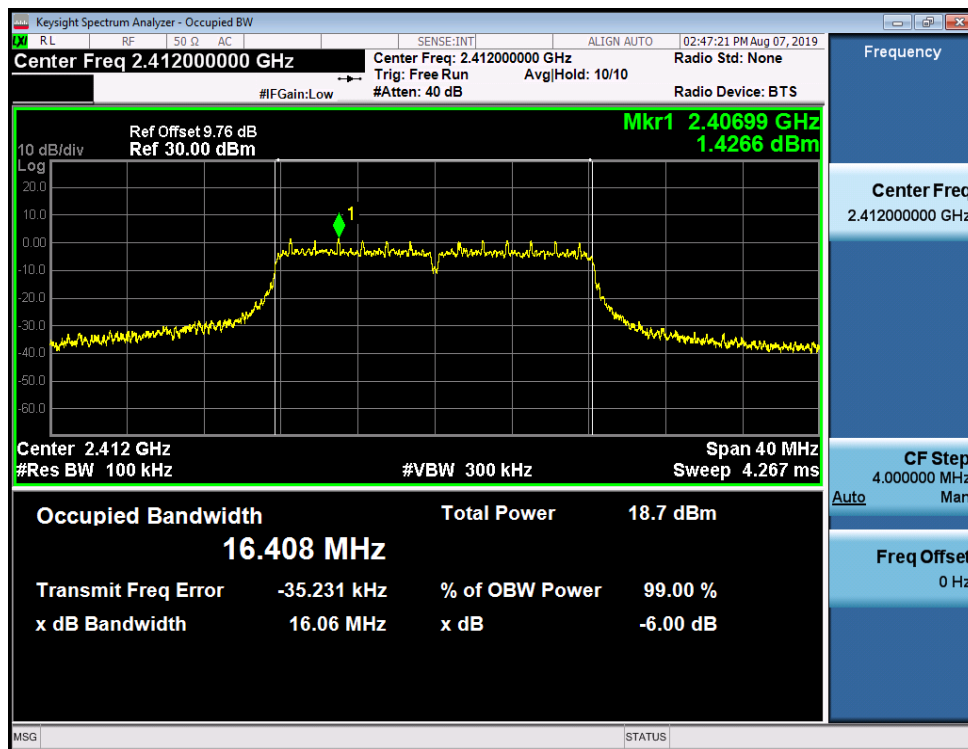
6dB bandwidth Plot



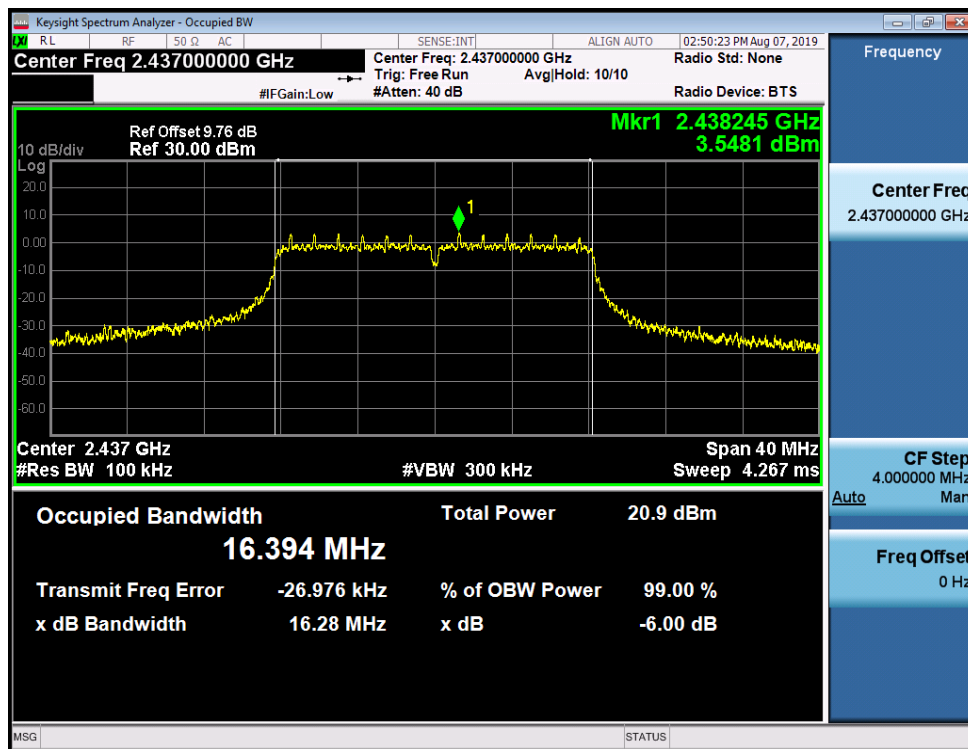
11B/HCH



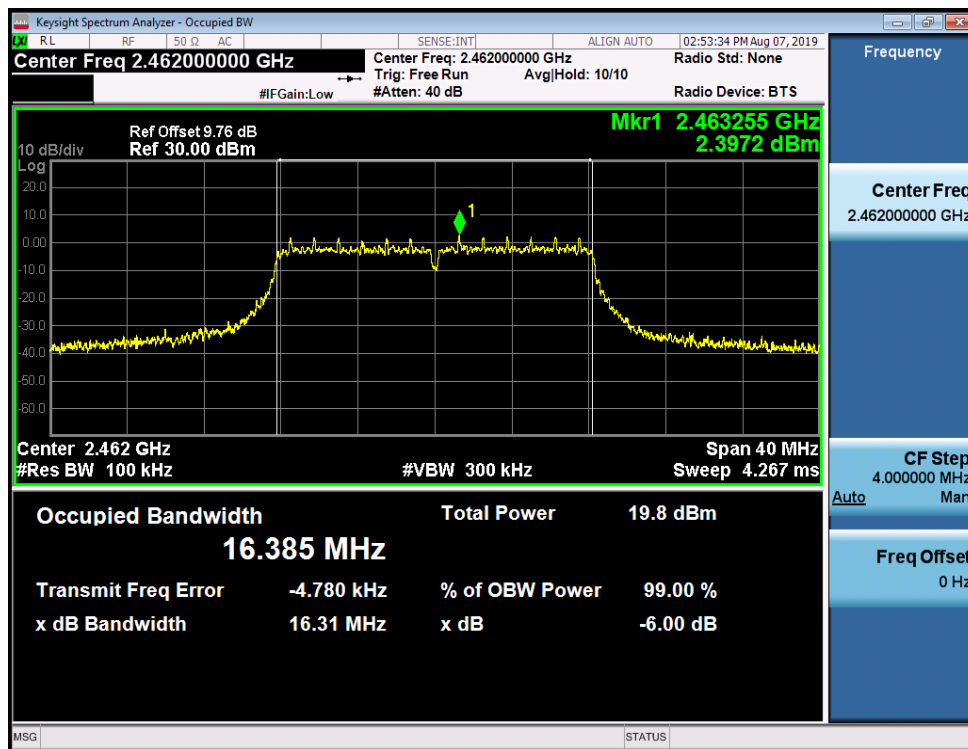
11G/LCH



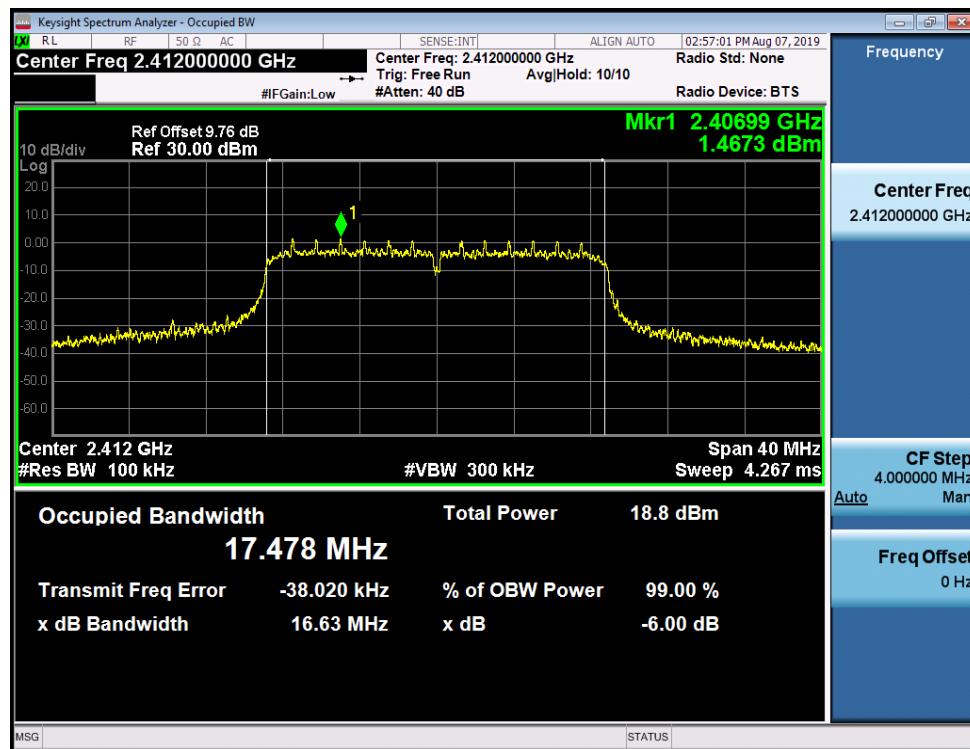
11G/MCH



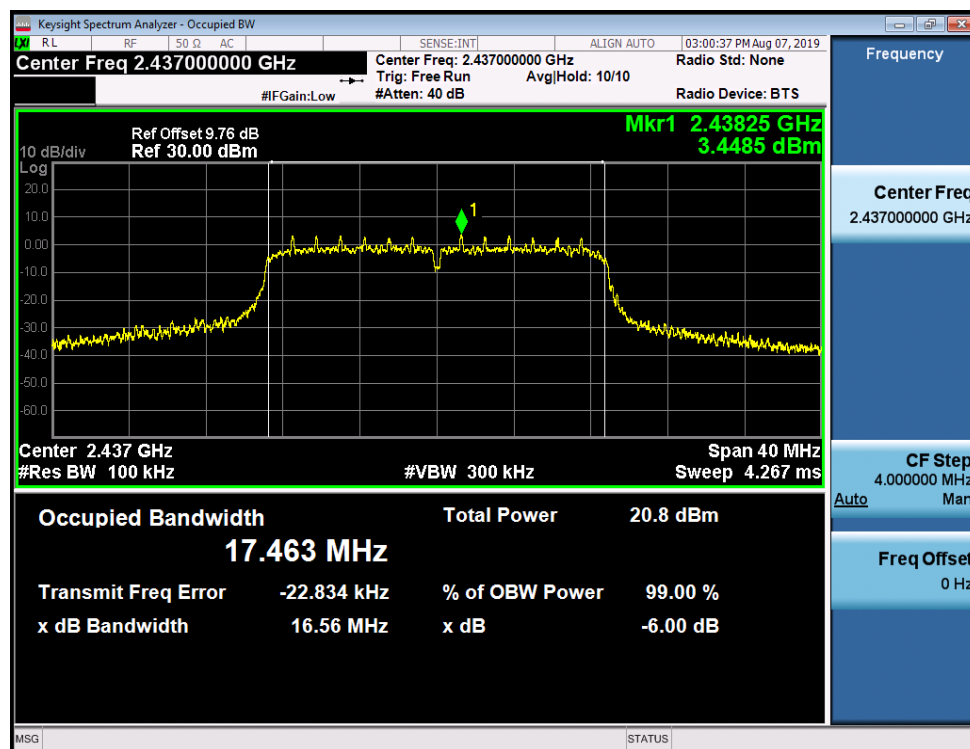
11G/HCH



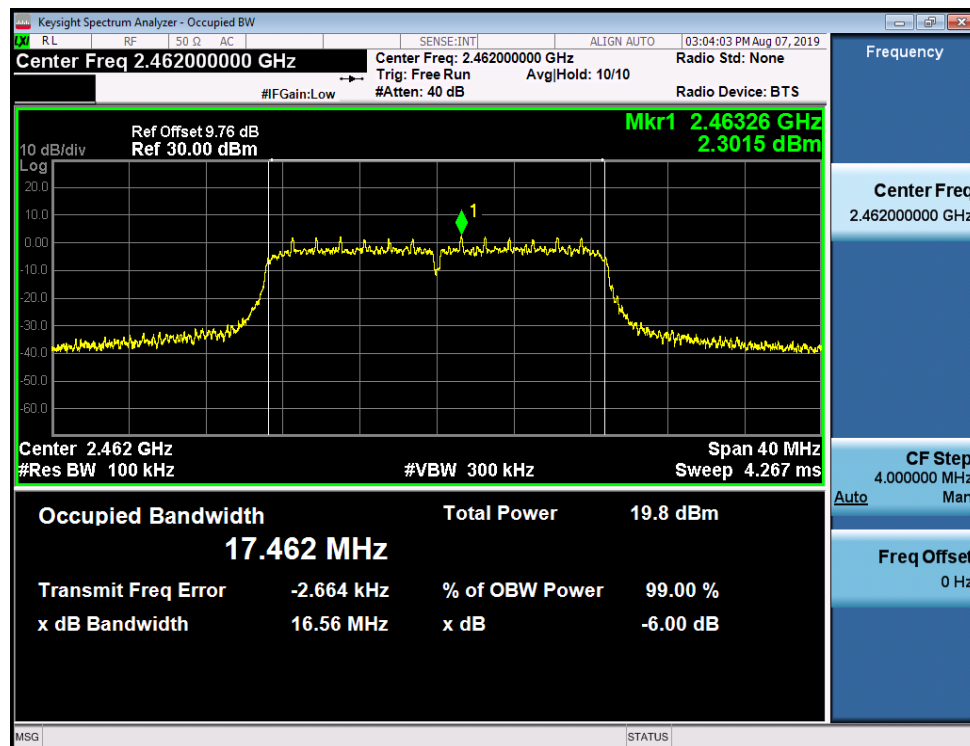
11N20/LCH



11N20/MCH



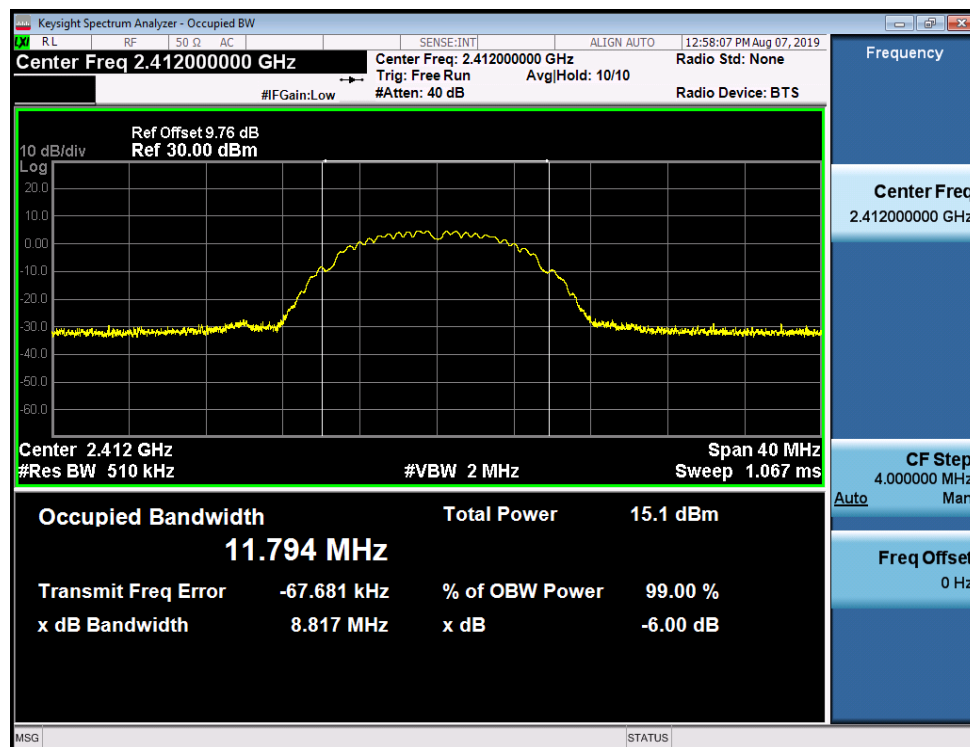
11N20/HCH



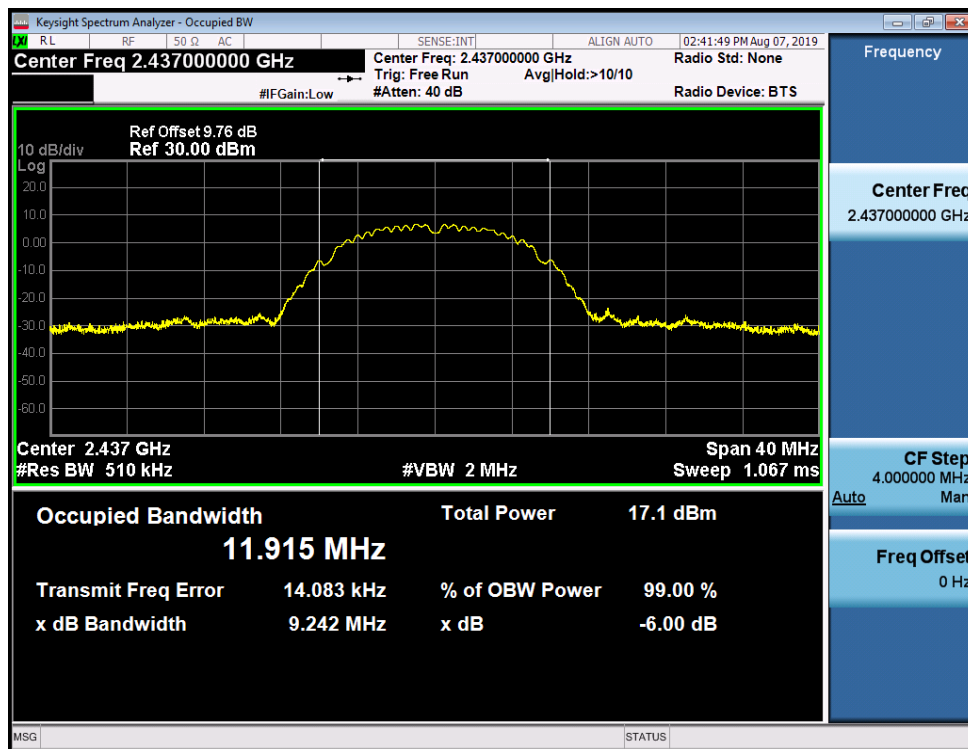
99% Bandwidth Plot

Graphs

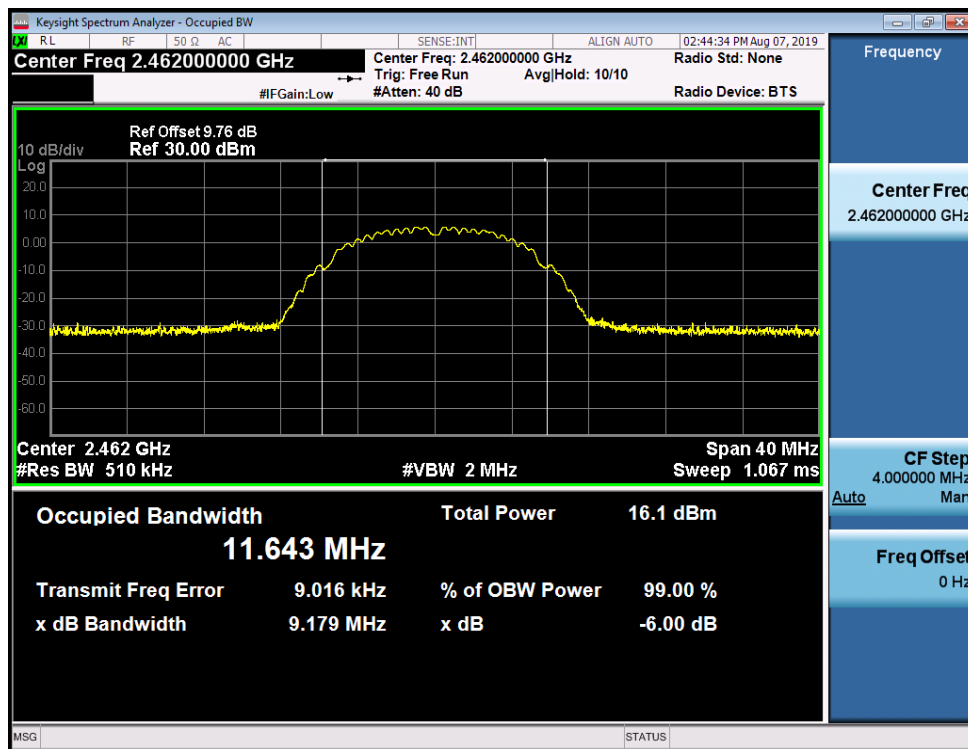
11B/LCH



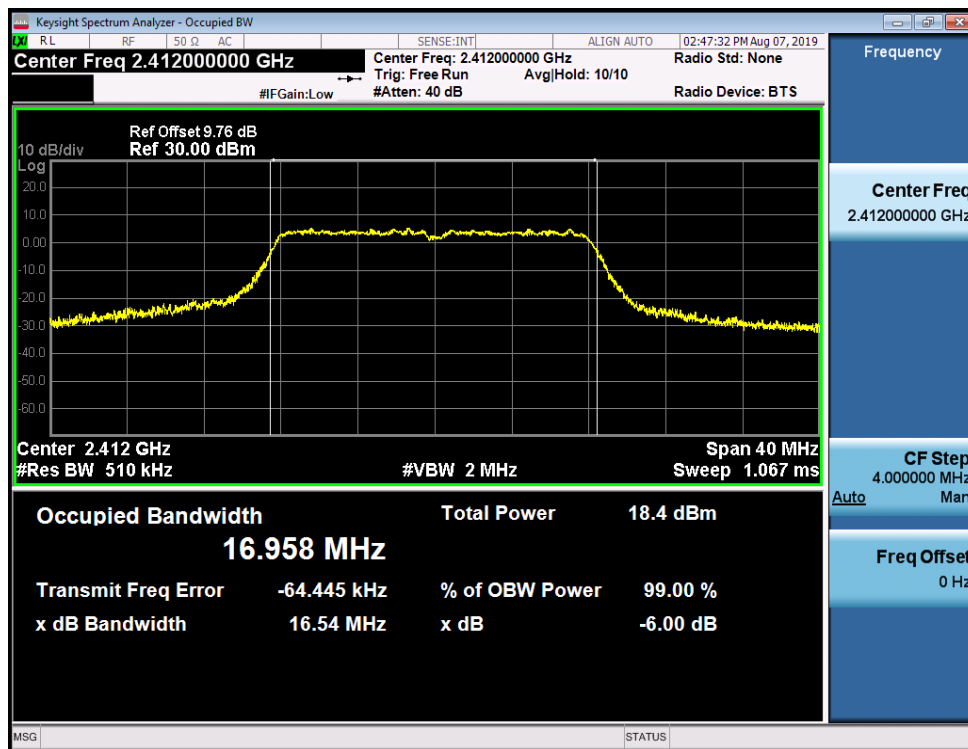
11B/MCH



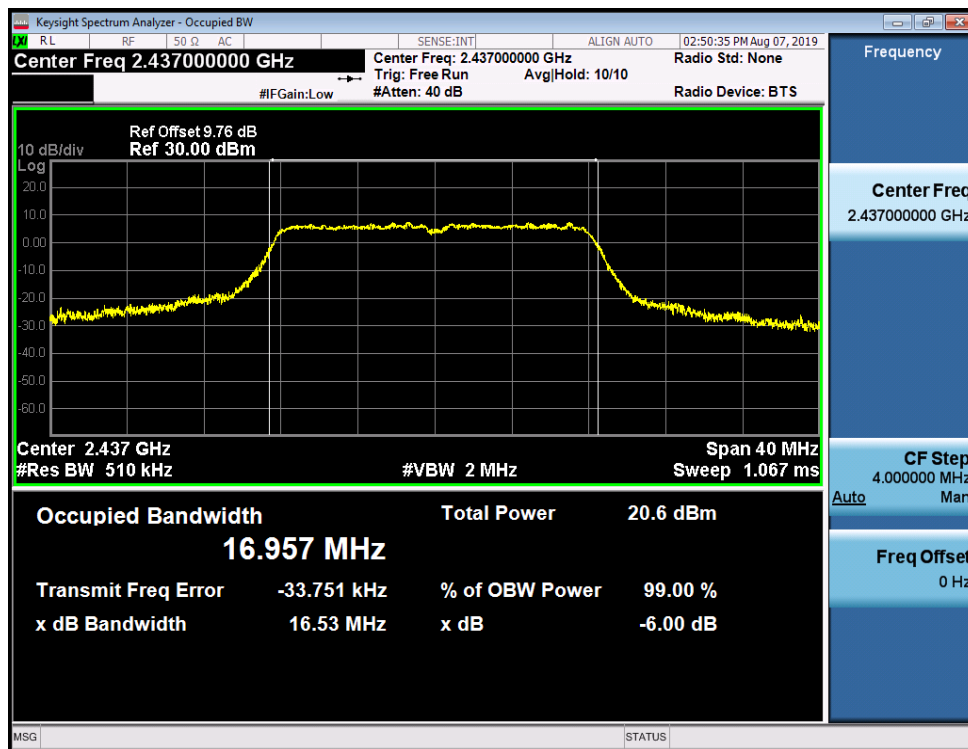
11B/HCH



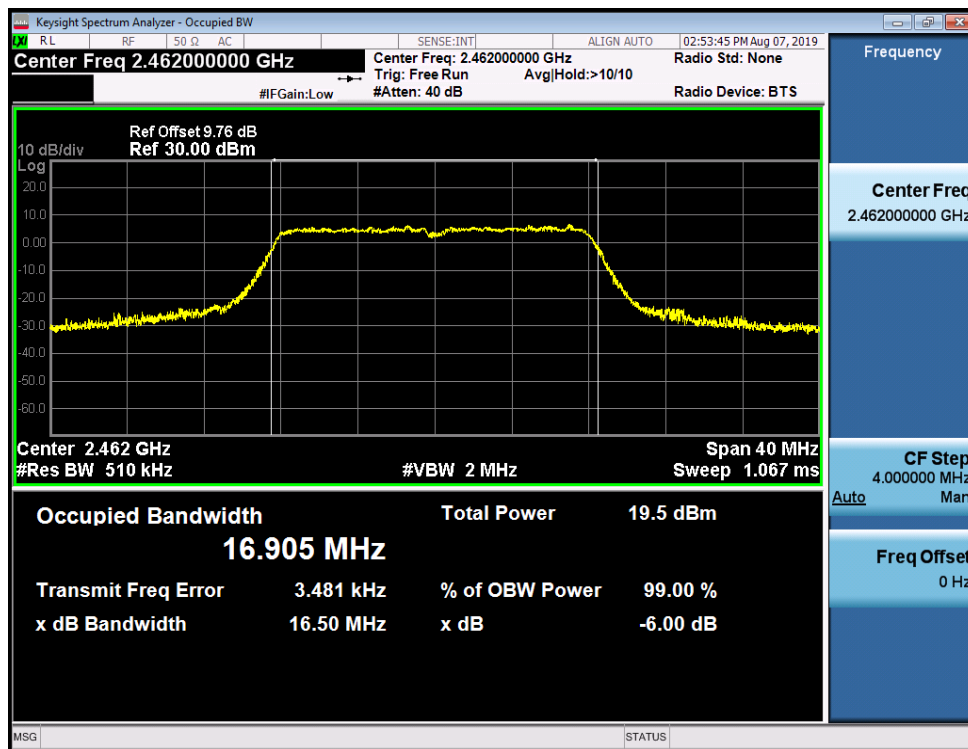
11G/LCH



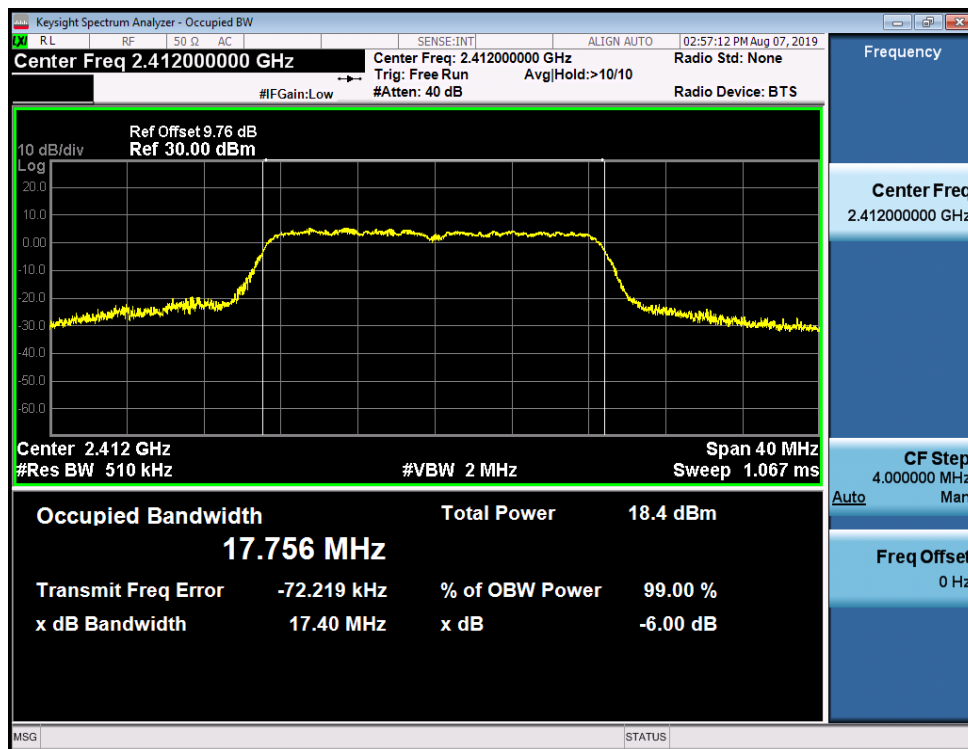
11G/MCH



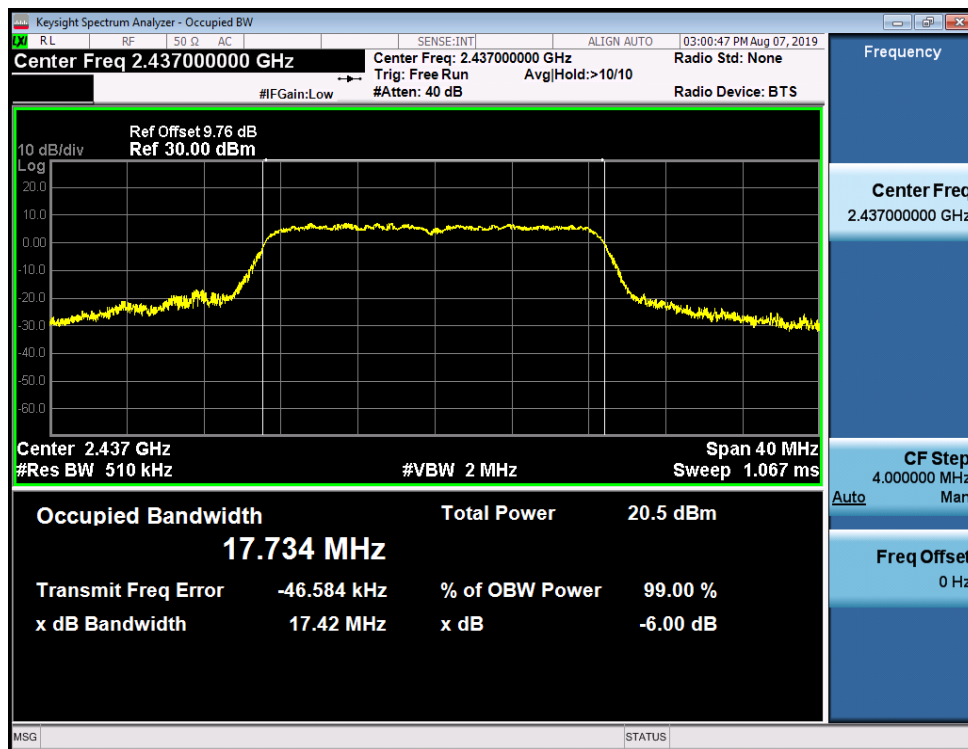
11G/HCH



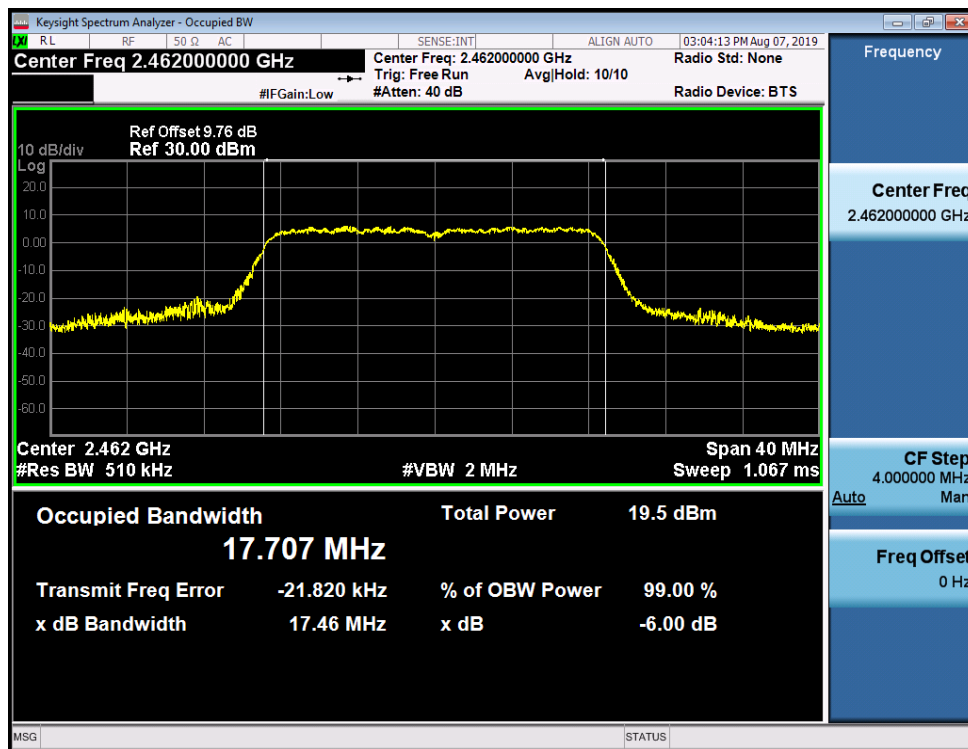
11N20/LCH



11N20/MCH



11N20/HCH



4.2 Output Power Measurement

4.2.1 Limit of Output Power

FCC §15.247 (b)(3)

IC RSS-247 A5.4(4)

For systems using digital modulation in the 2400-2483.5 MHz bands: 30dBm.

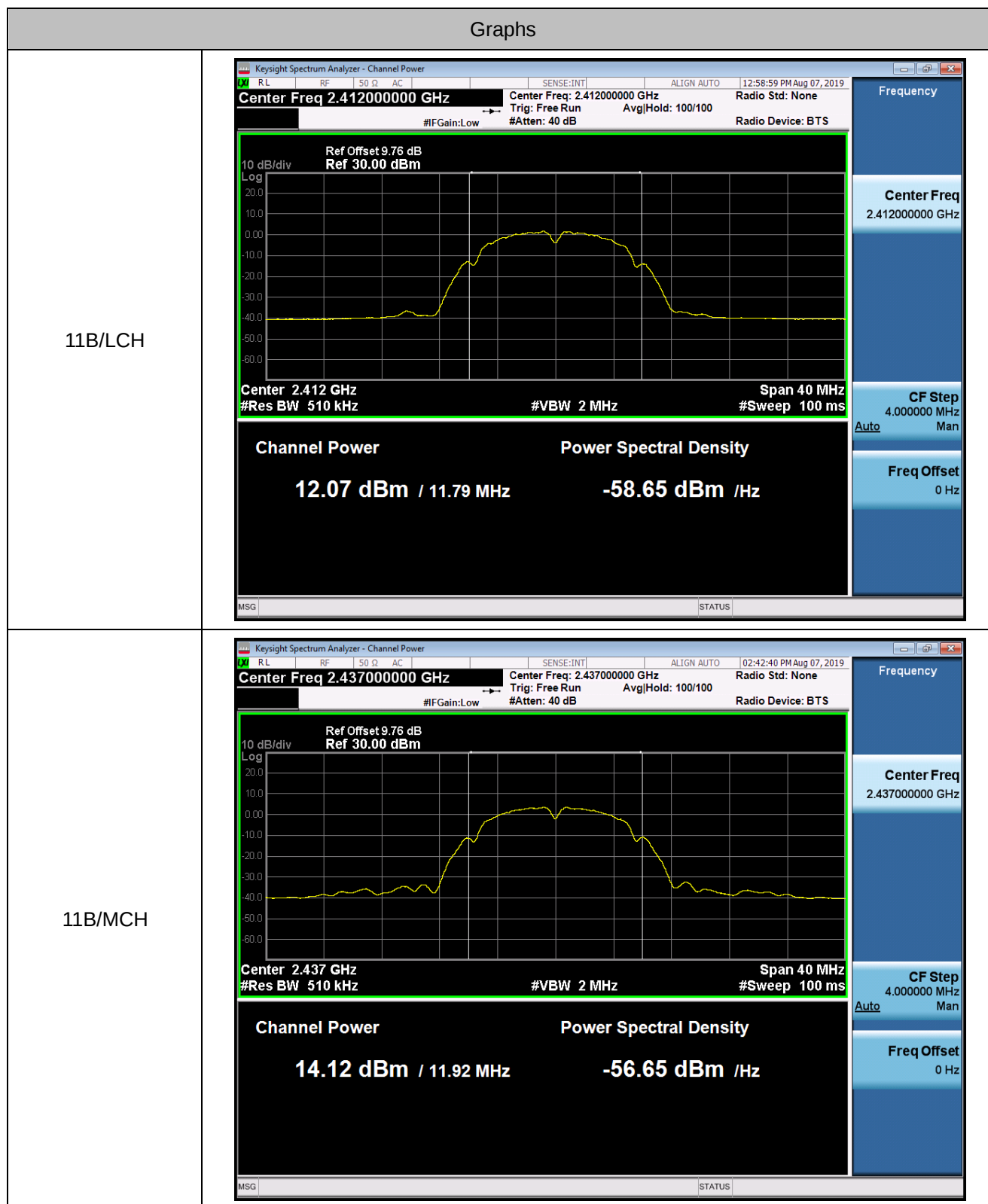
4.2.2 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 section 11.9.2.2.4 Measurement using a spectrum analyzer.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Turn on the EUT and connect it to spectrum analyzer.
4. Set to the maximum power setting and enable Transmitting the EUT transmit continuously
5. Measure the duty cycle, x , of the transmitter output signal as described in below:
 - a. Set the center frequency of the instrument to the center frequency of the transmission.
 - b. Set RBW to the largest available Transmitting value.
 - c. Set detector = peak
6. Set span to at least $1.5 \times \text{OBW}$. Set RBW=510KHz, VBW=2MHz, Number of points in sweep $\geq 2/3 \times$ span, Sweep time = auto. Detector = RMS
7. Allow the sweep to "free run". Trace average 100 traces in RMS mode
8. Compute power by integrating the spectrum across the OBW of the signal using the instrument's Channel power measurement function with band limits set equal to the OBW band edges.
9. Add $10 \log (1/x)$, where x is the duty cycle.

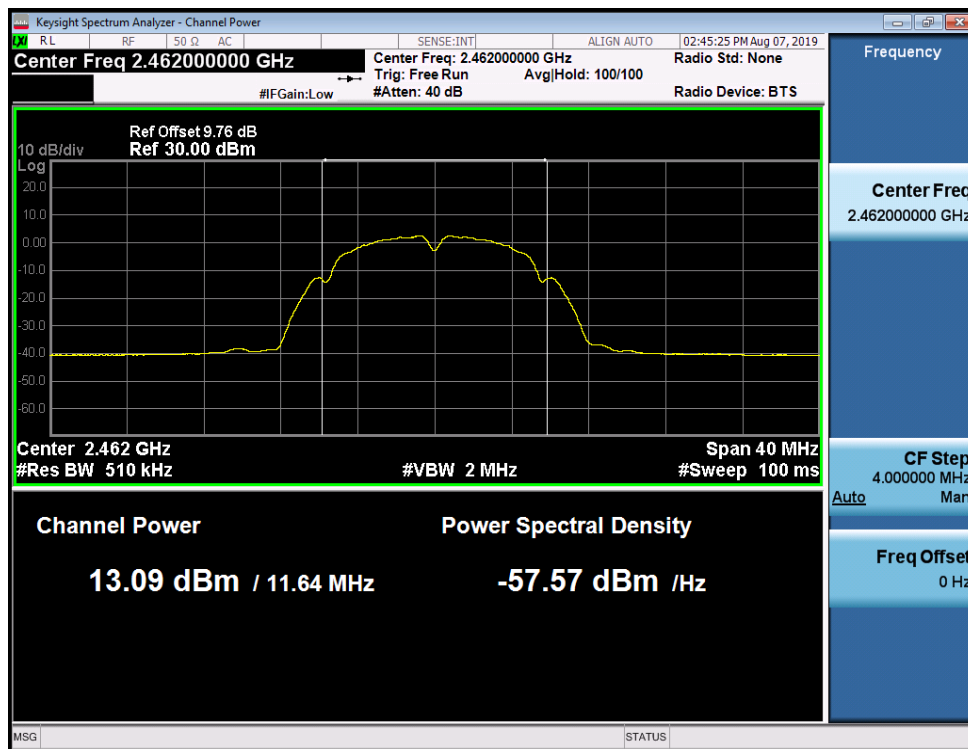
4.2.3 Test Result of Peak Output Power

Test Mode :		2.4G WIFI	Temperature :		24~26℃	
Test Engineer :		Victorique Gao	Relative Humidity :		50~53%	
Mode	Channel	Meas.Level [dBm]	DT	10 log (1/x)	AV.Power [dBm]	Verdict
11B	LCH	12.07	88.82 %	0.51	12.58	PASS
11B	MCH	14.12	88.97 %	0.51	14.63	PASS
11B	HCH	13.09	88.87 %	0.51	13.60	PASS
11G	LCH	11.45	86.58 %	0.63	12.08	PASS
11G	MCH	13.60	86.58 %	0.63	14.23	PASS
11G	HCH	12.55	86.31 %	0.64	13.19	PASS
11N20	LCH	11.32	85.95 %	0.67	11.98	PASS
11N20	MCH	13.38	85.62 %	0.67	14.05	PASS
11N20	HCH	12.40	85.67 %	0.67	13.07	PASS

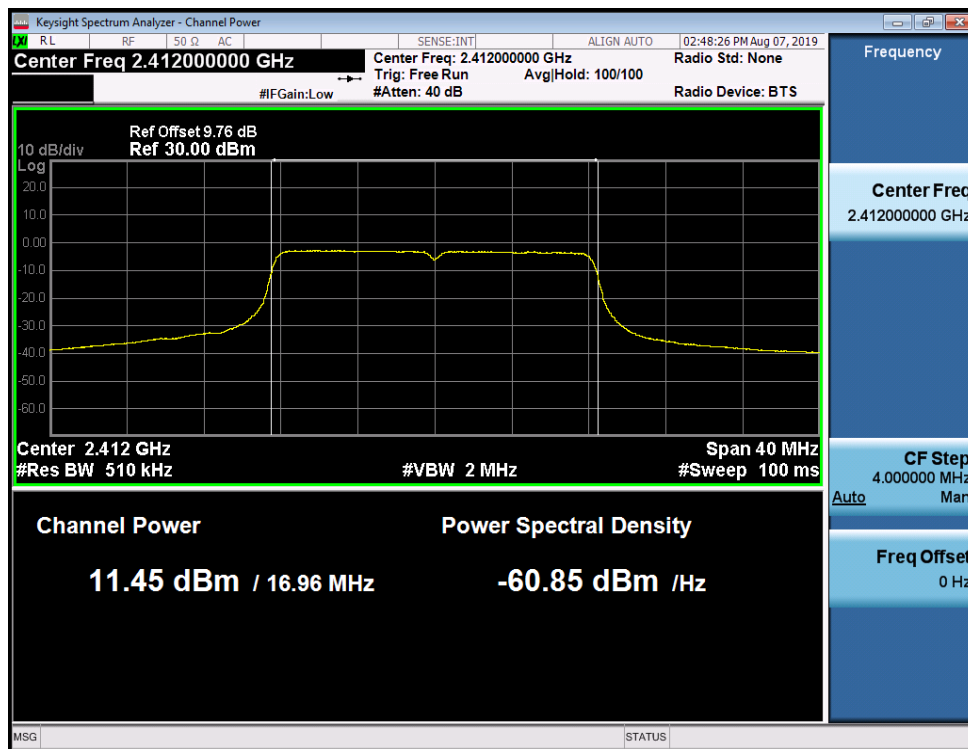
Meas.Level Plot



11B/HCH



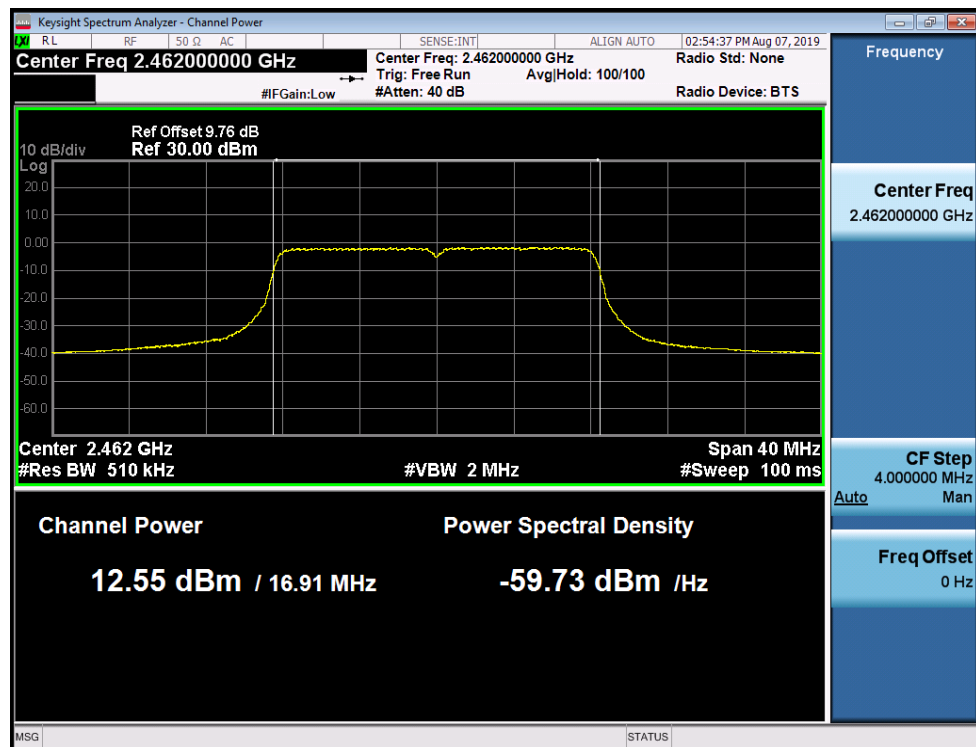
11G/LCH



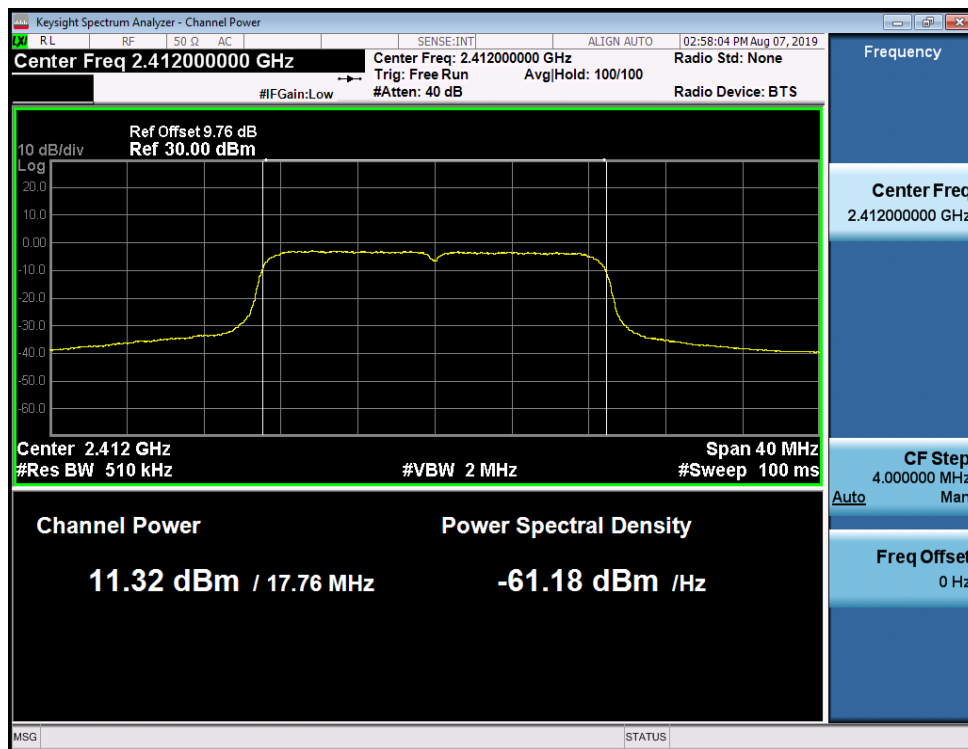
11G/MCH



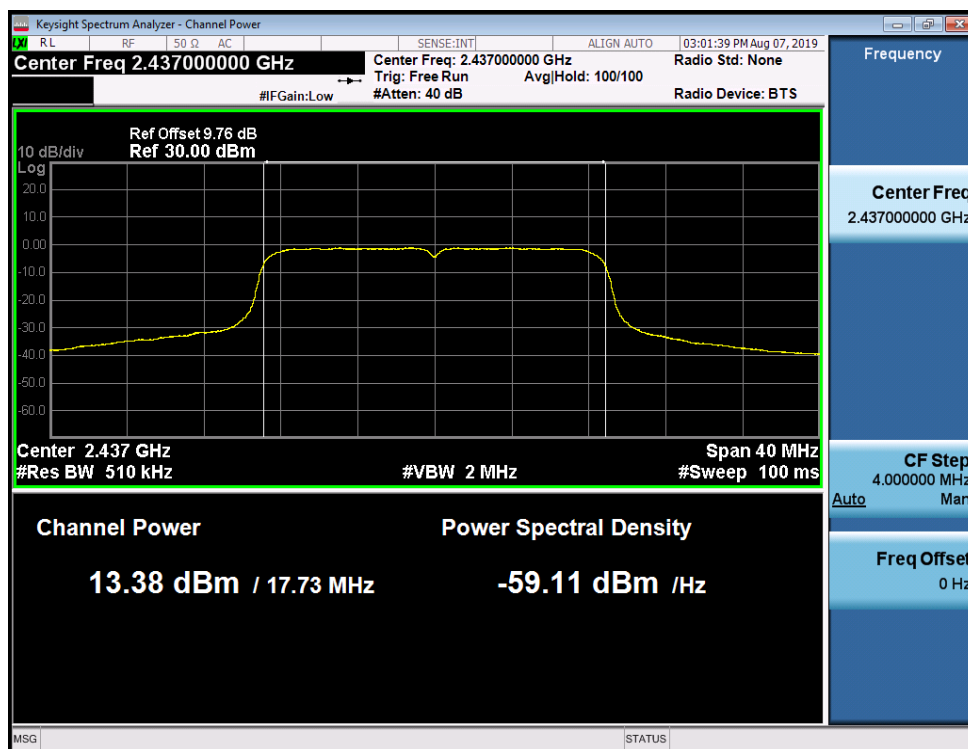
11G/HCH



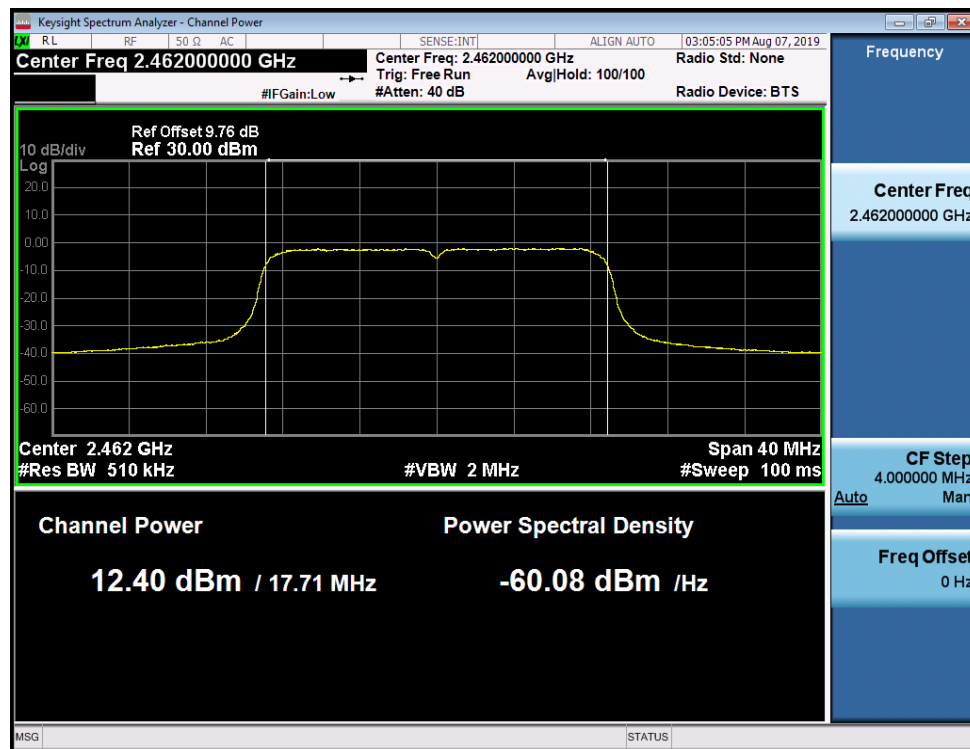
11N20/LCH



11N20/MCH



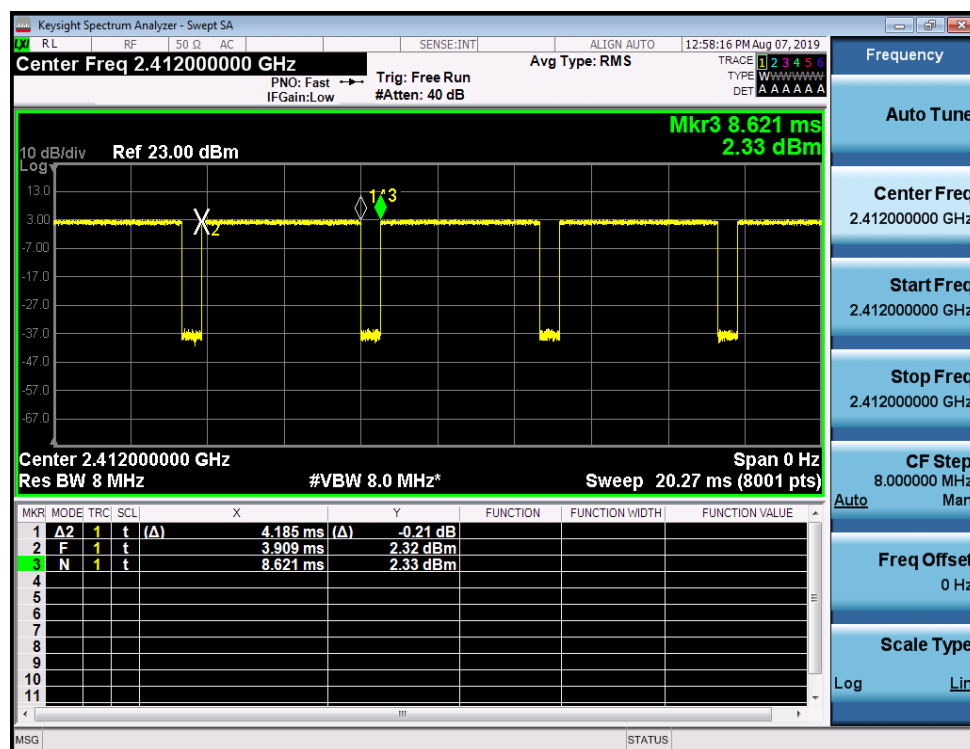
11N20/HCH



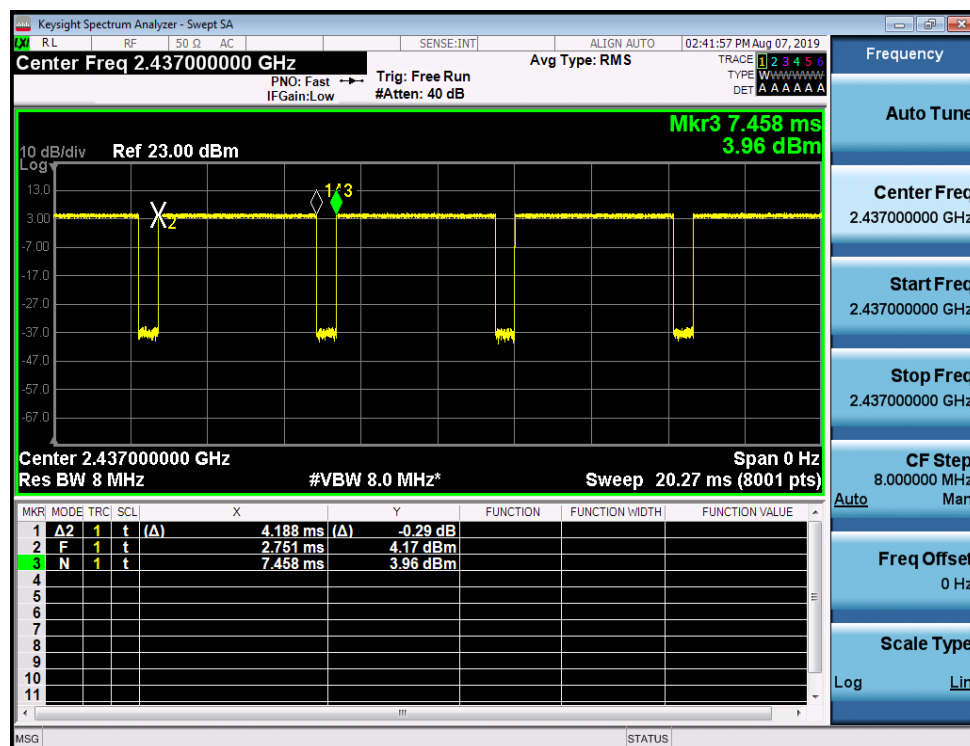
Duty cycle Plot

Graphs

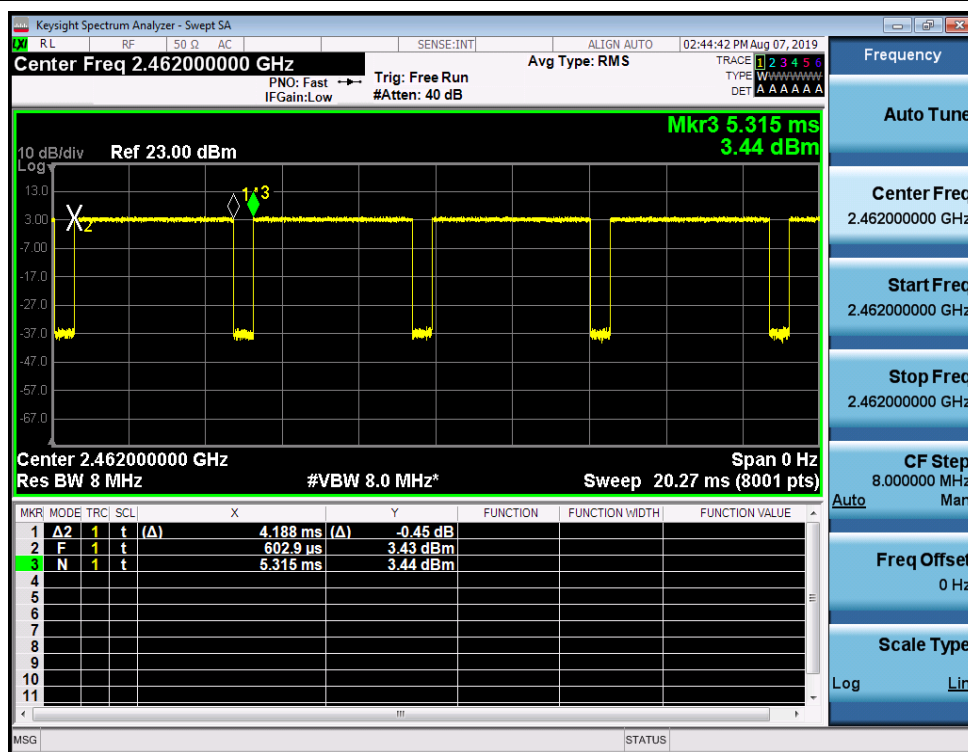
11B/LCH



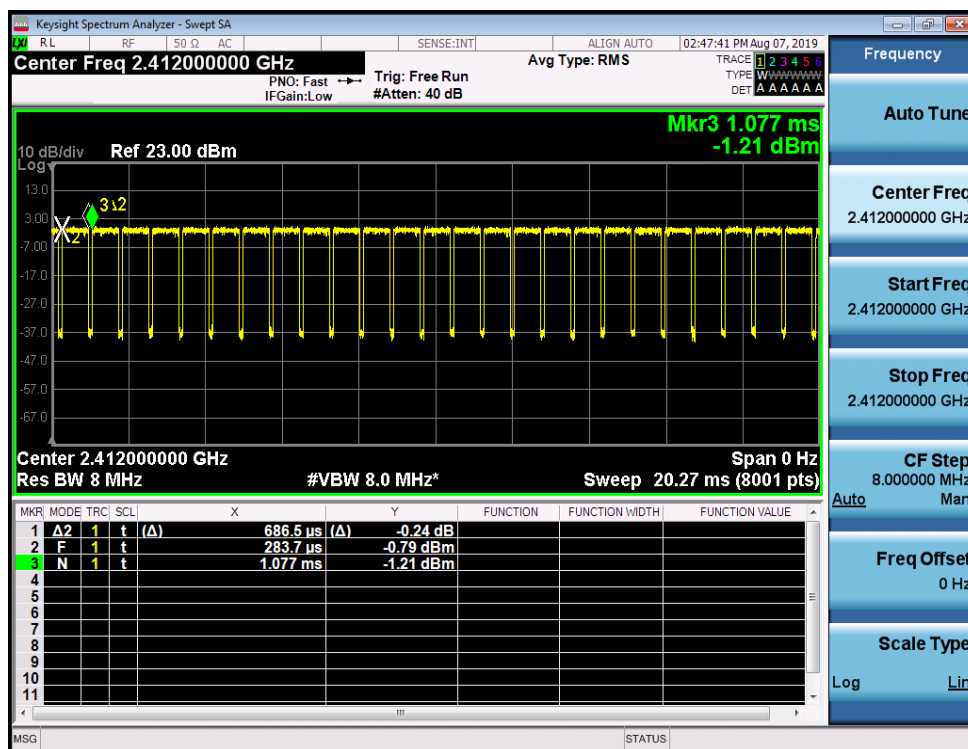
11B/MCH



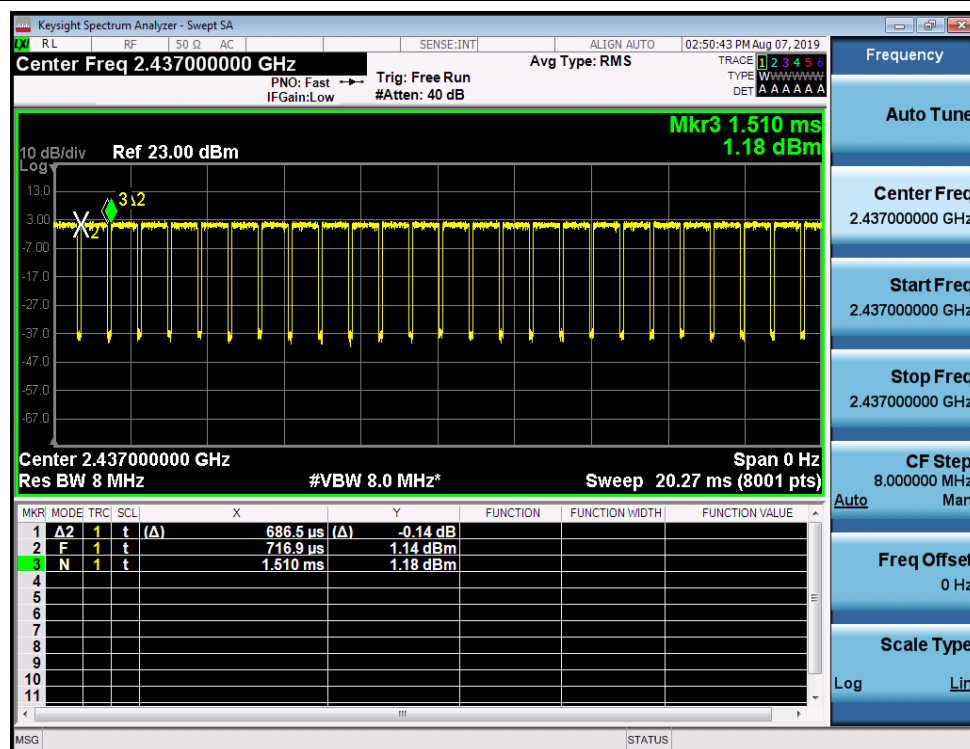
11B/HCH



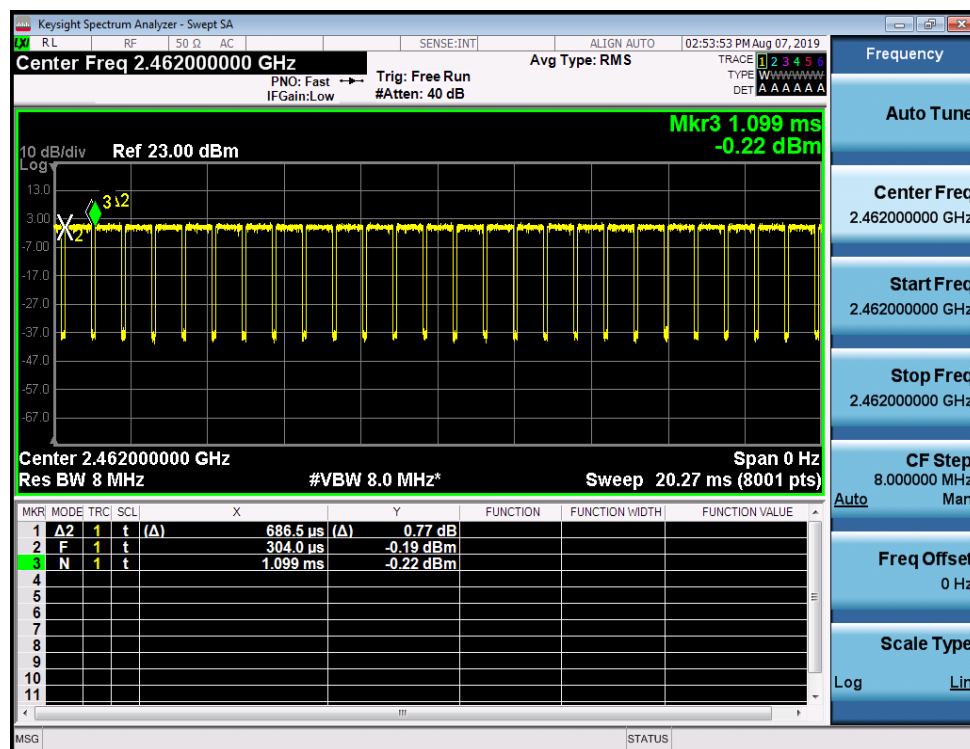
11G/LCH



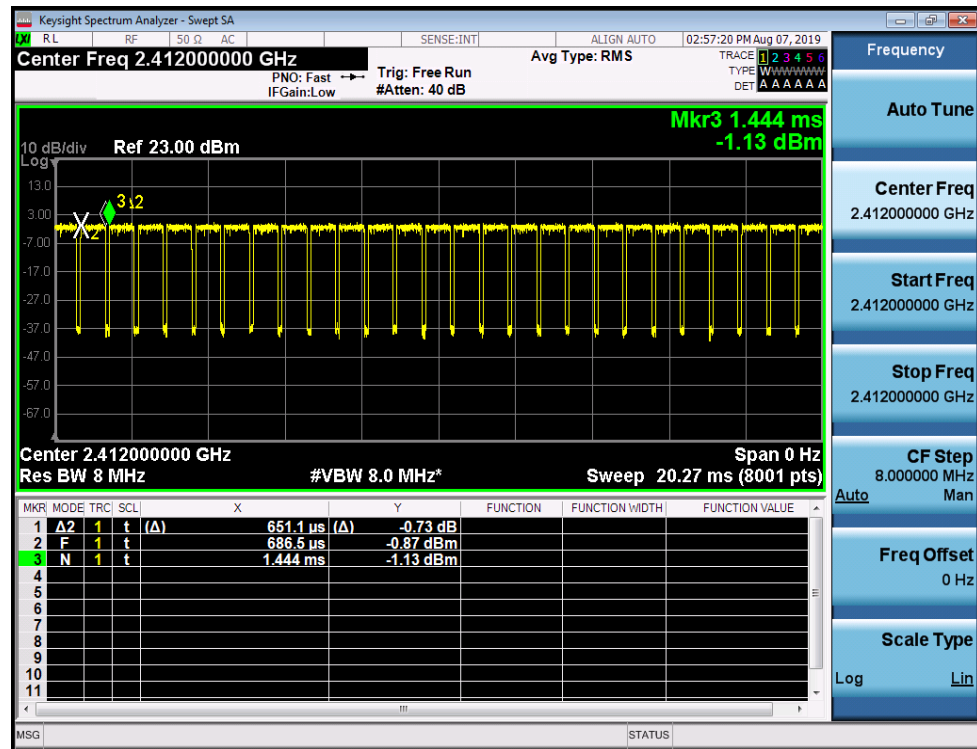
11G/MCH



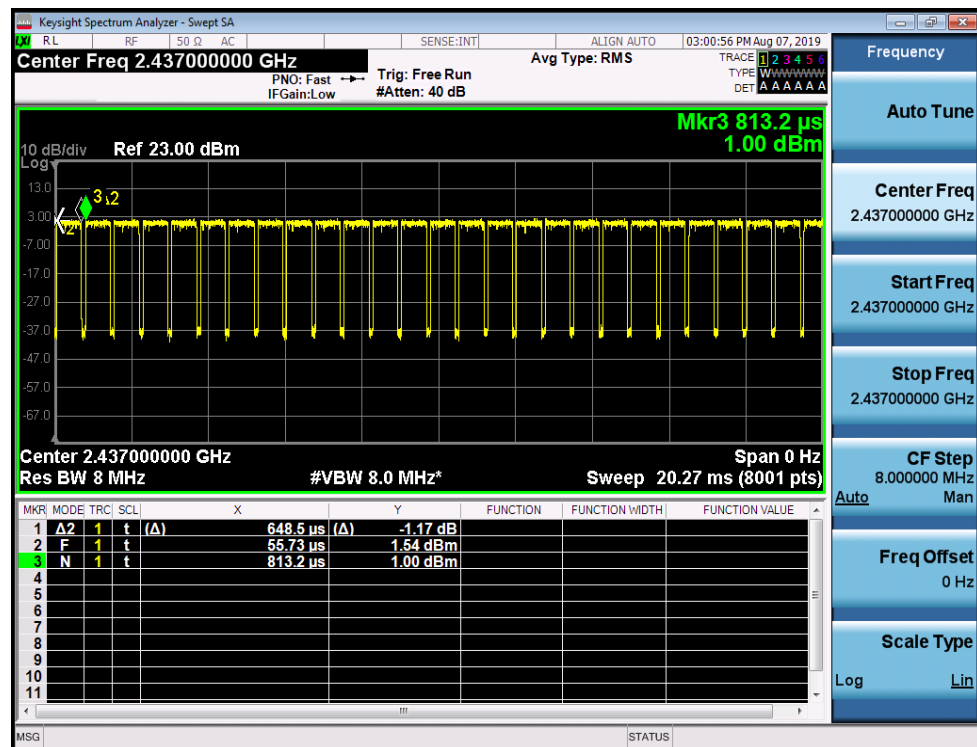
11G/HCH



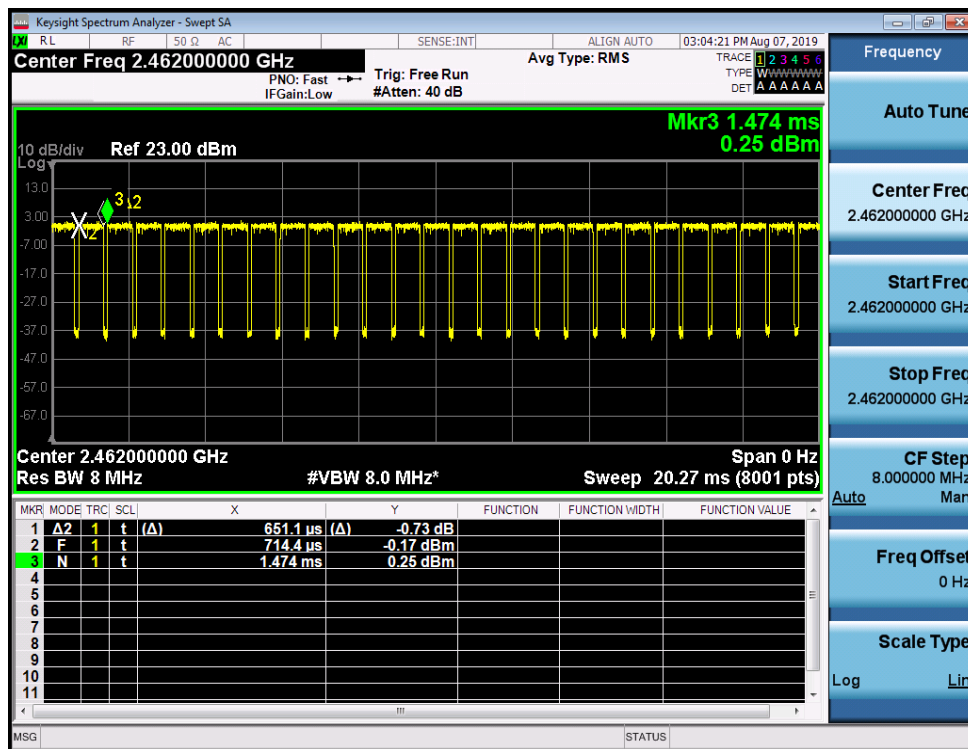
11N20/LCH



11N20/MCH



11N20/HCH



4.3 Power Spectral Density Measurement

4.3.1 Limits of Power Spectral Density

FCC§15.247(e)

IC RSS-247 5.2(2)

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

4.3.2 Test Procedure

1. The testing follows Measurement Procedure 8.4 DTS maximum power spectral density level in the fundamental emission of ANSI C63.10-2013 section 11.9.2.2.4
2. Turn on the EUT and connect it to measurement instrument.
3. Measure the duty cycle, x , of the transmitter output signal as described in below:
 - a. Set the center frequency of the instrument to the center frequency of the transmission.
 - b. Set RBW to the largest available Transmitting value.
 - c. Set detector = peak
4. Set span to at least $1.5 \times \text{OBW}$. Set RBW= 3 KHz, VBW=10 KHz, Number of points in sweep $\geq 2/3 \times$ span, Sweep time = auto.
5. Detector = power averaging (rms), Sweep time = auto couple, Trace mode = averaging (rms) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level.
6. Add $10 \log (1/x)$, where x is the duty cycle.
7. Measure and record the results in the test report.
8. The Measured power density (dBm)/ 100kHz is a reference level and used as 30dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

4.3.3 Test Result of Power Spectral Density

Test Mode :		2.4G WIFI	Temperature :	24~26℃	
Test Engineer :		Victorique Gao	Relative Humidity :	50~53%	
Mode	Channel	Meas.Level [dBm]	Av.PSD [dBm]	Verdict	
11B	LCH	-17.181	-16.671	PASS	
11B	MCH	-15.349	-14.839	PASS	
11B	HCH	-16.274	-15.764	PASS	
11G	LCH	-19.035	-18.405	PASS	
11G	MCH	-17.404	-16.774	PASS	
11G	HCH	-17.988	-17.348	PASS	
11N20	LCH	-18.567	-17.907	PASS	
11N20	MCH	-16.682	-16.012	PASS	
11N20	HCH	-17.741	-17.071	PASS	

Power Spectral Density Plot

Graphs

11B/LCH



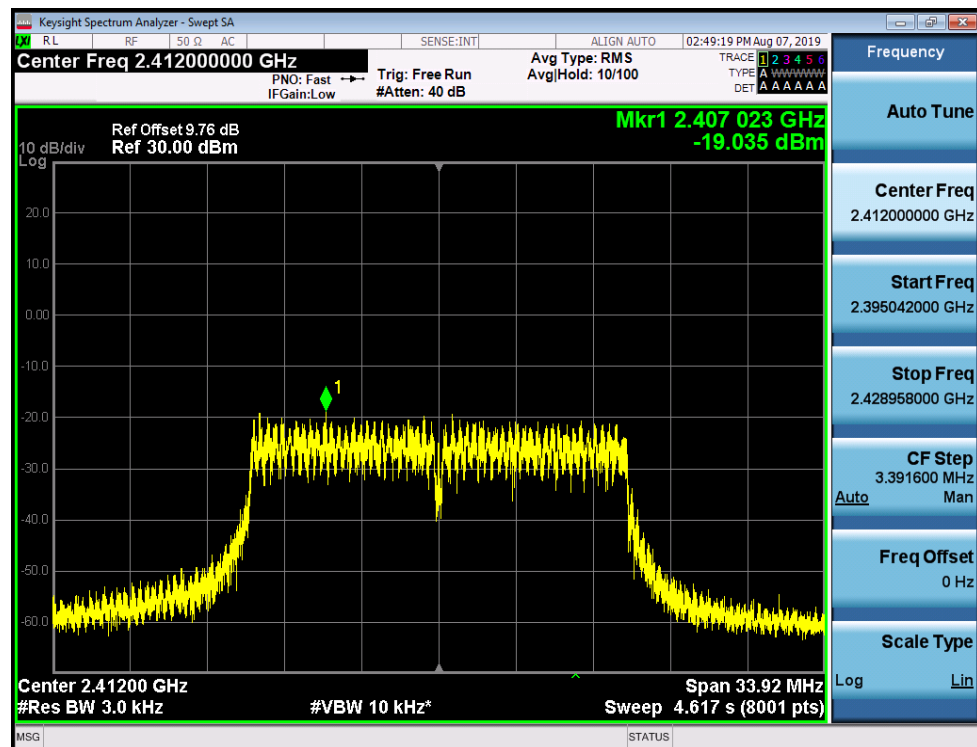
11B/MCH



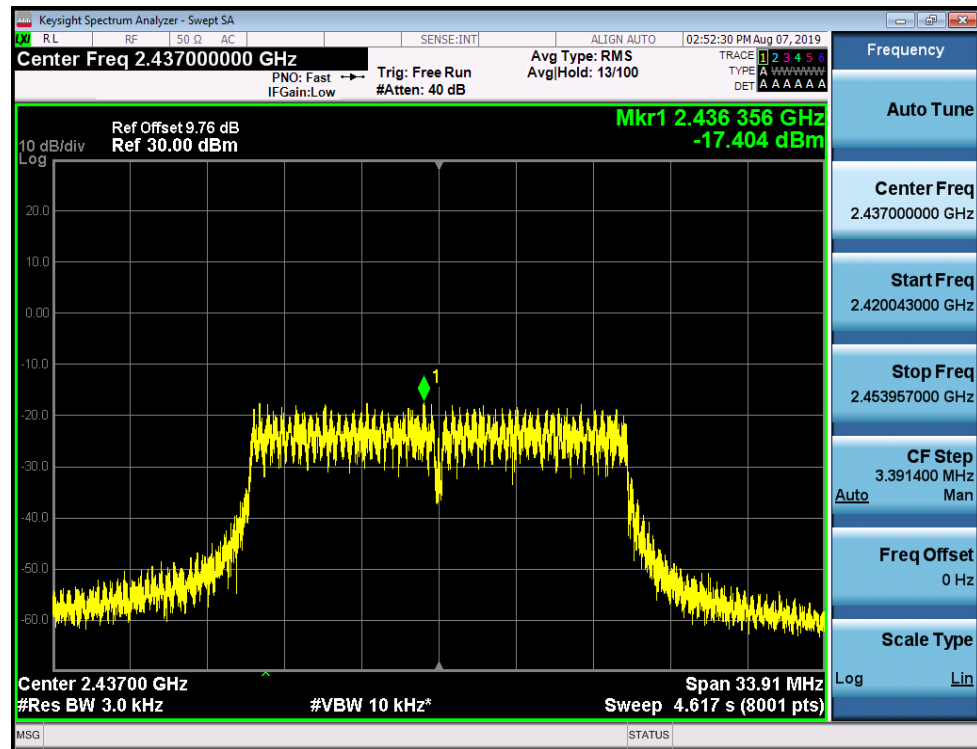
11B/HCH



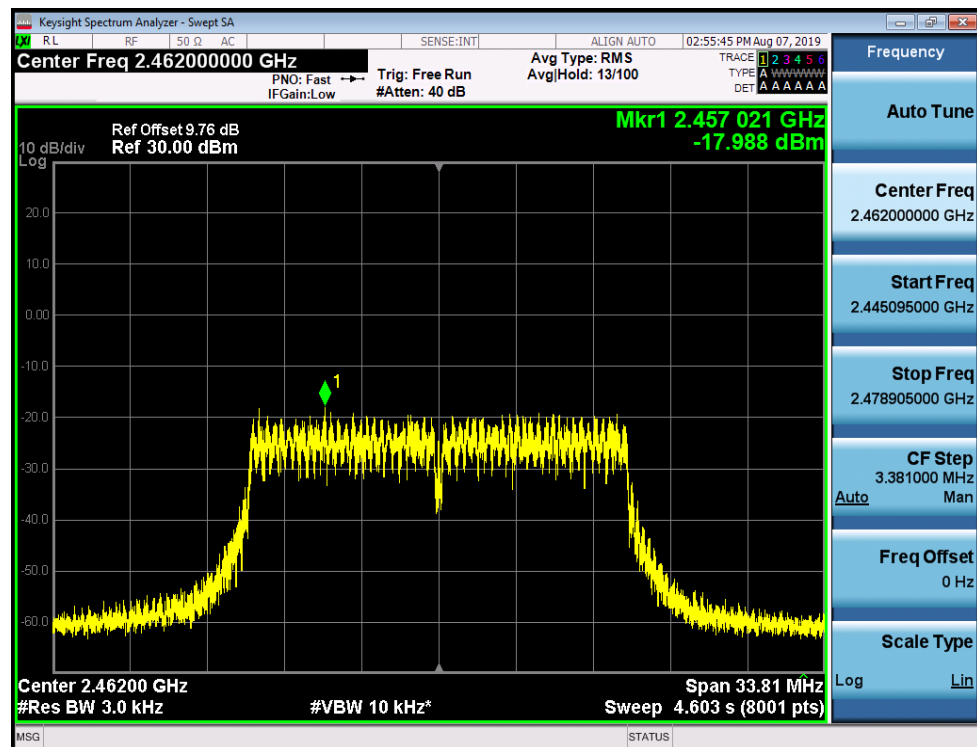
11G/LCH



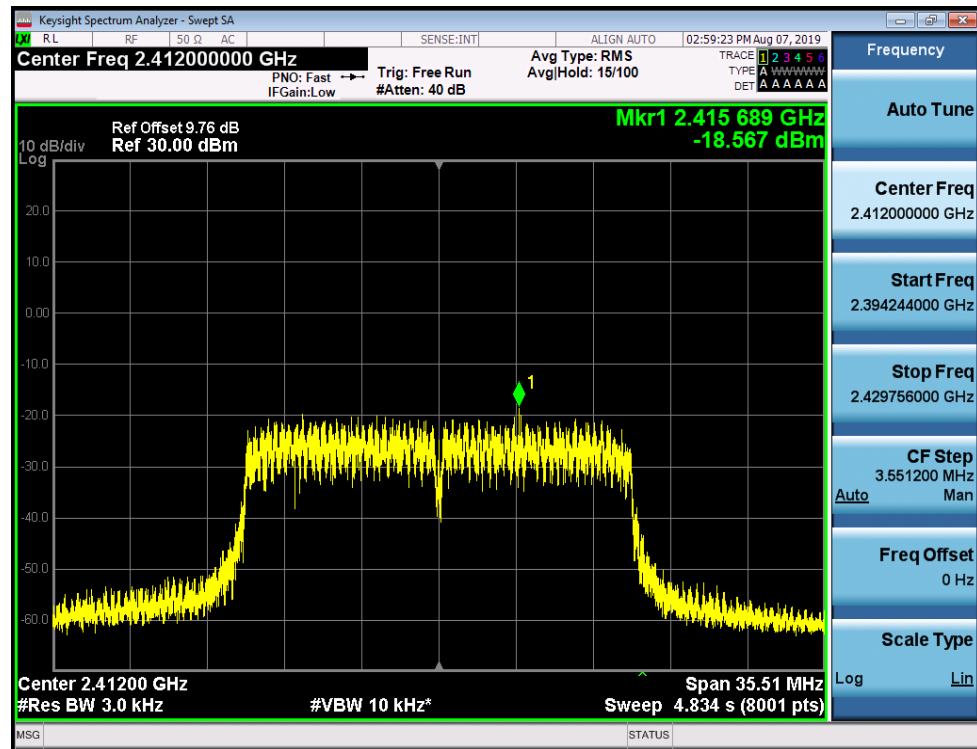
11G/MCH



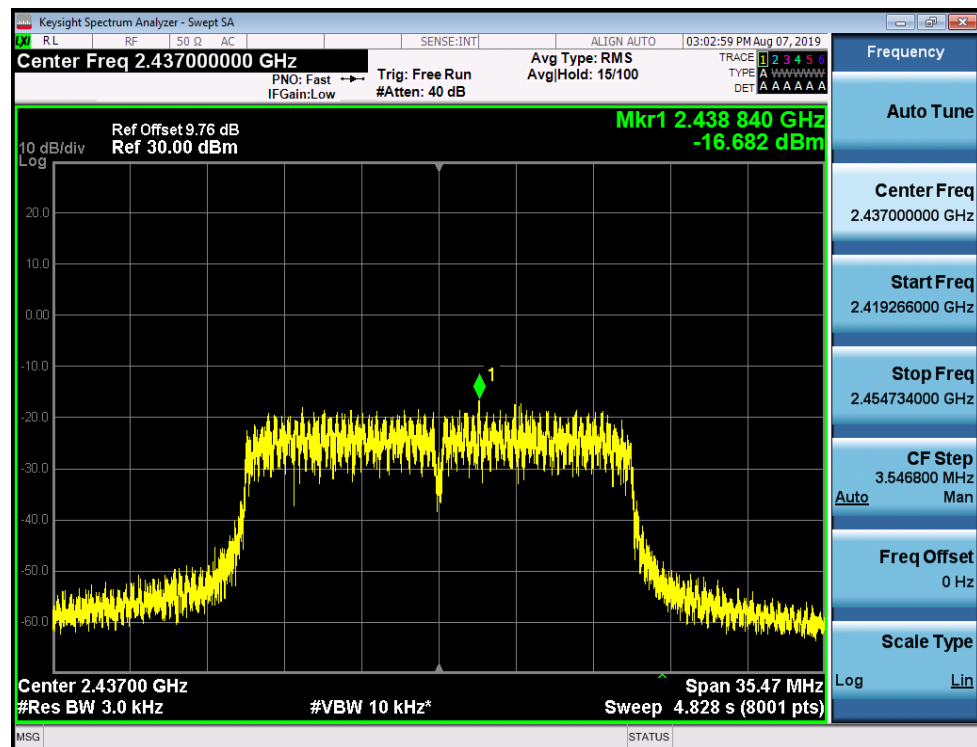
11G/HCH



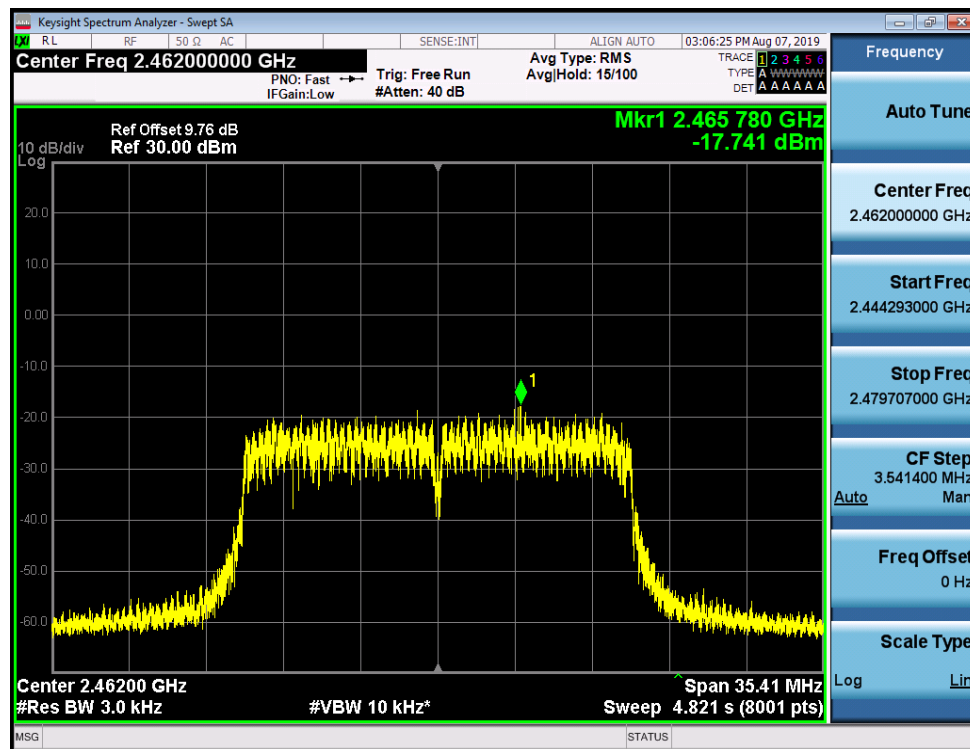
11N20/LCH



11N20/MCH



11N20/HCH



4.4 Conducted Band Edges and Spurious Emission Measurement

4.4.1 Limit of Conducted Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

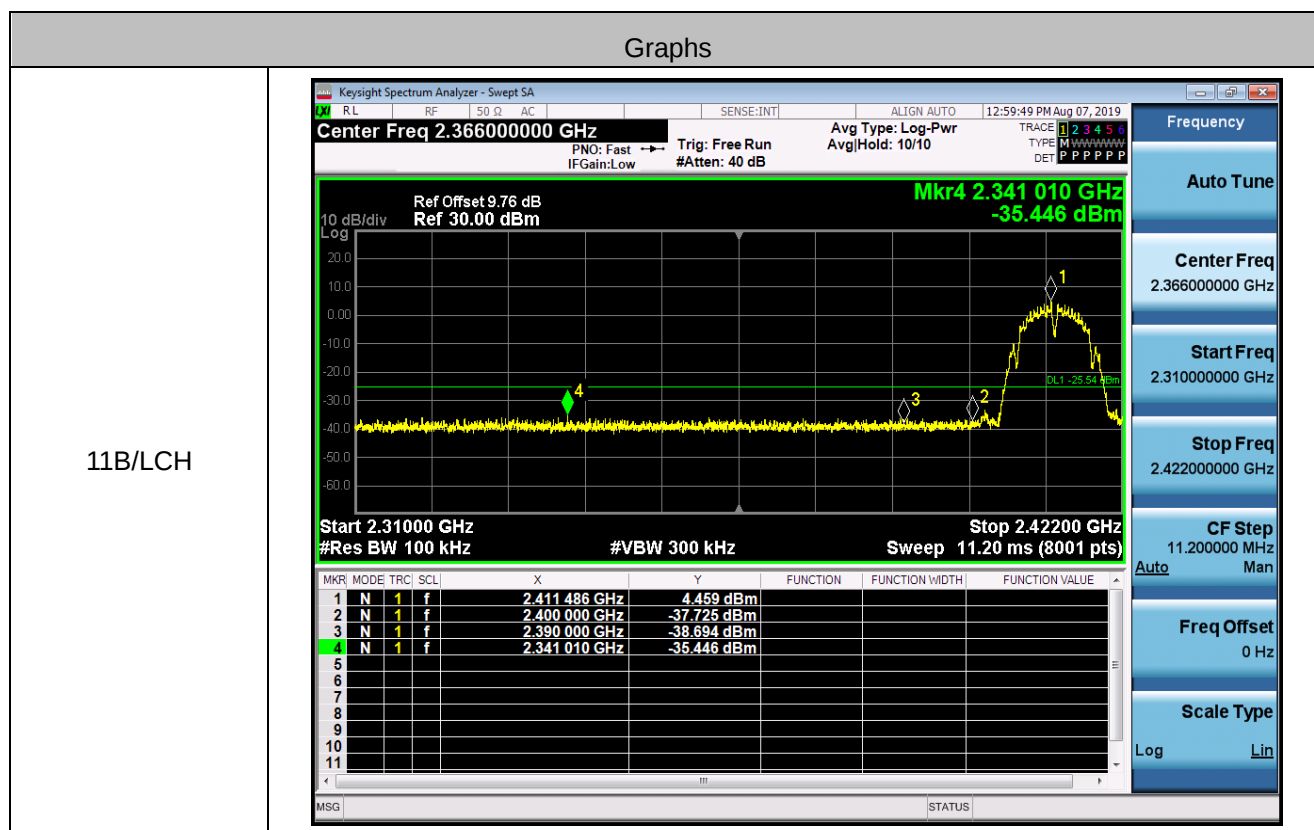
Maximum conducted (average) output power was used to determine compliance, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

4.4.2 Test Procedures

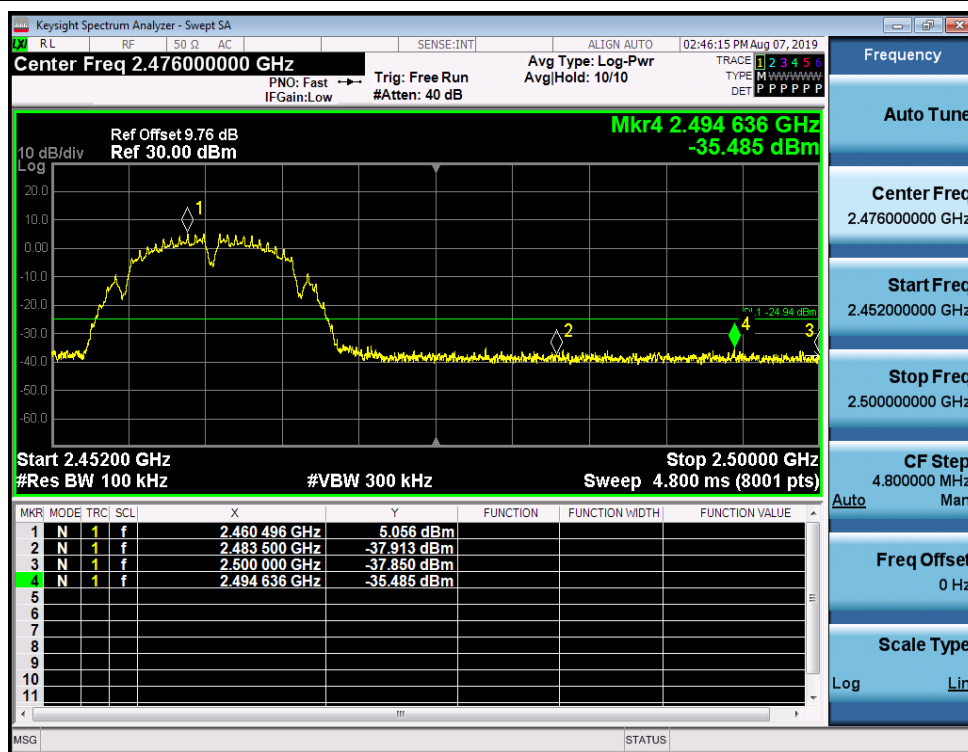
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

4.4.3 Test Result of Conducted Band Edges

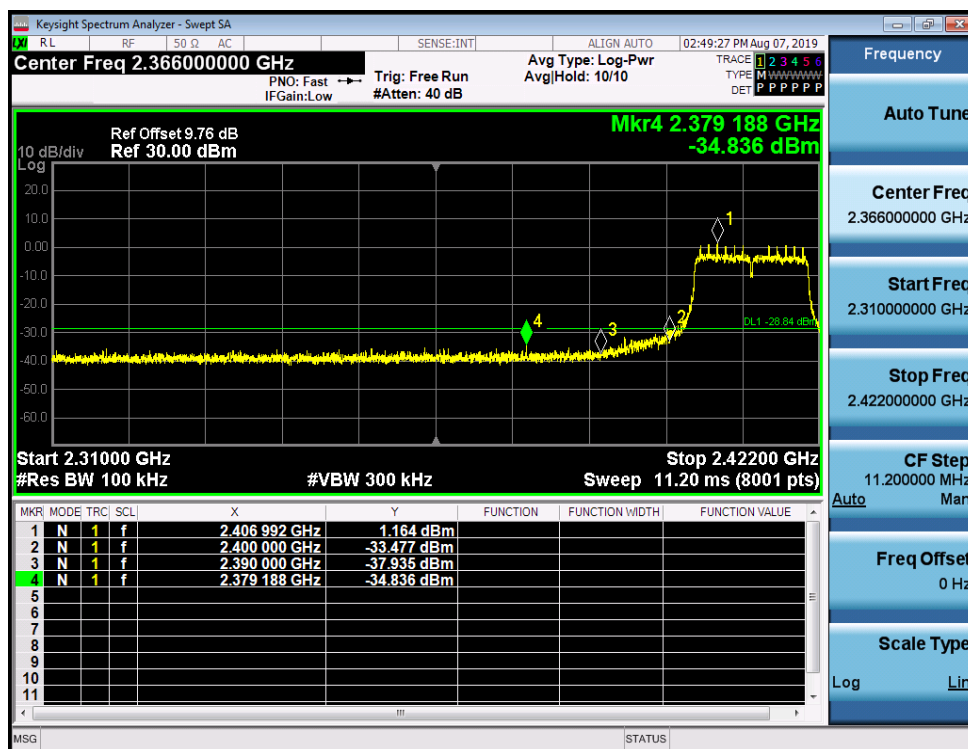
Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
11B	LCH	4.459	-35.446	-25.54	4.459
11B	HCH	5.056	-35.485	-24.94	5.056
11G	LCH	1.164	-33.477	-28.84	1.164
11G	HCH	1.908	-35.733	-28.09	1.908
11N20SISO	LCH	1.194	-32.285	-28.81	1.194
11N20SISO	HCH	2.166	-35.846	-27.83	2.166



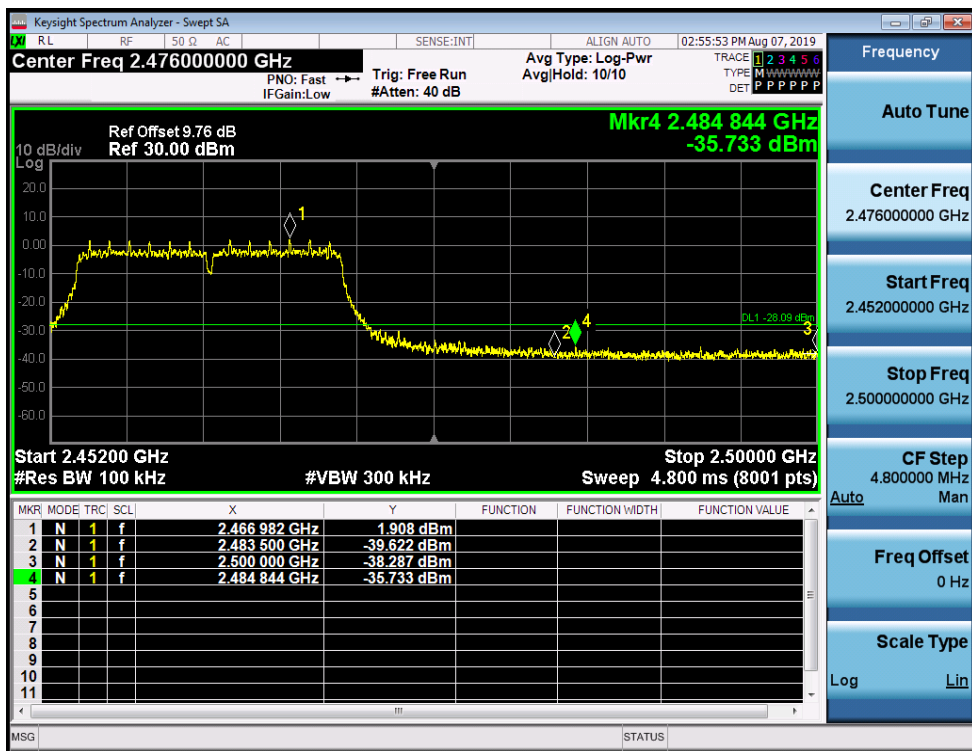
11B/HCH



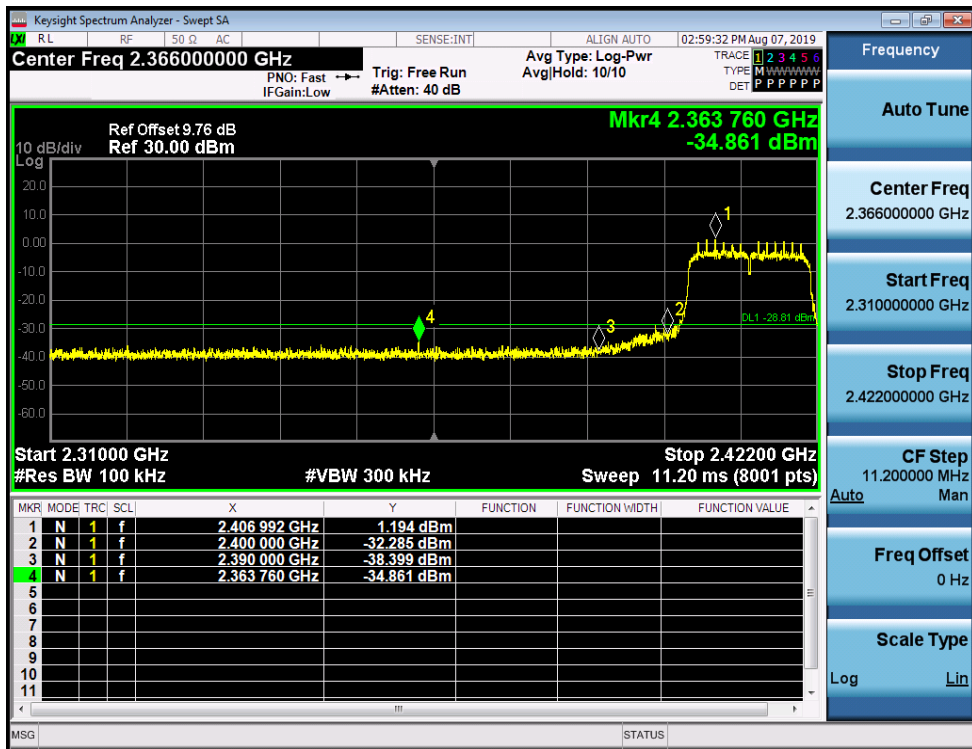
11G/LCH



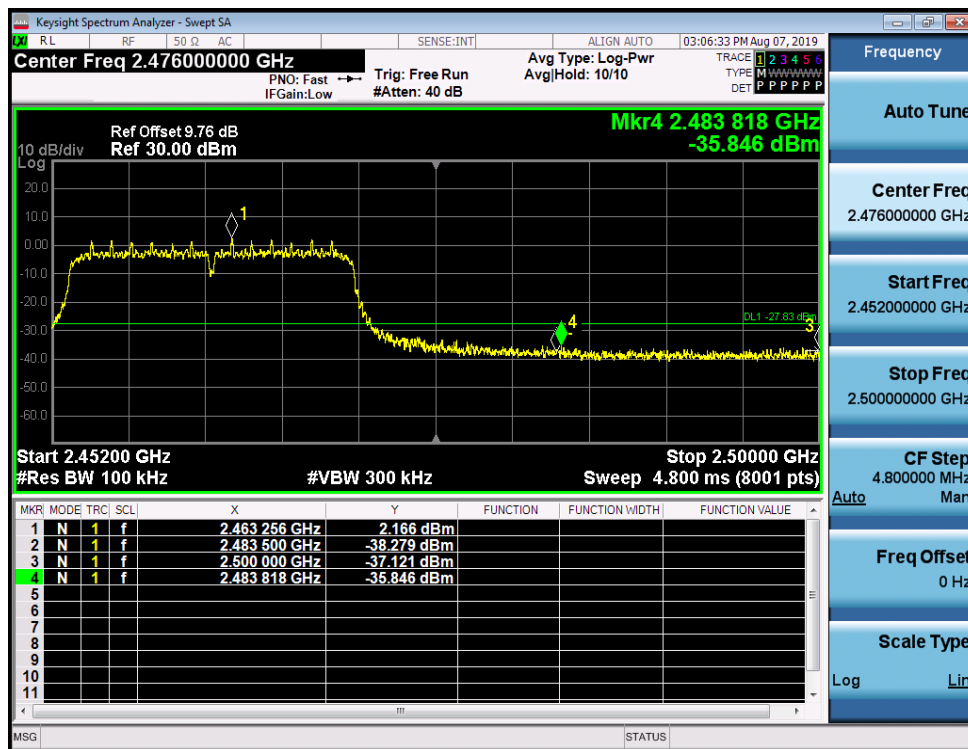
11G/HCH



11N20SISO/LCH

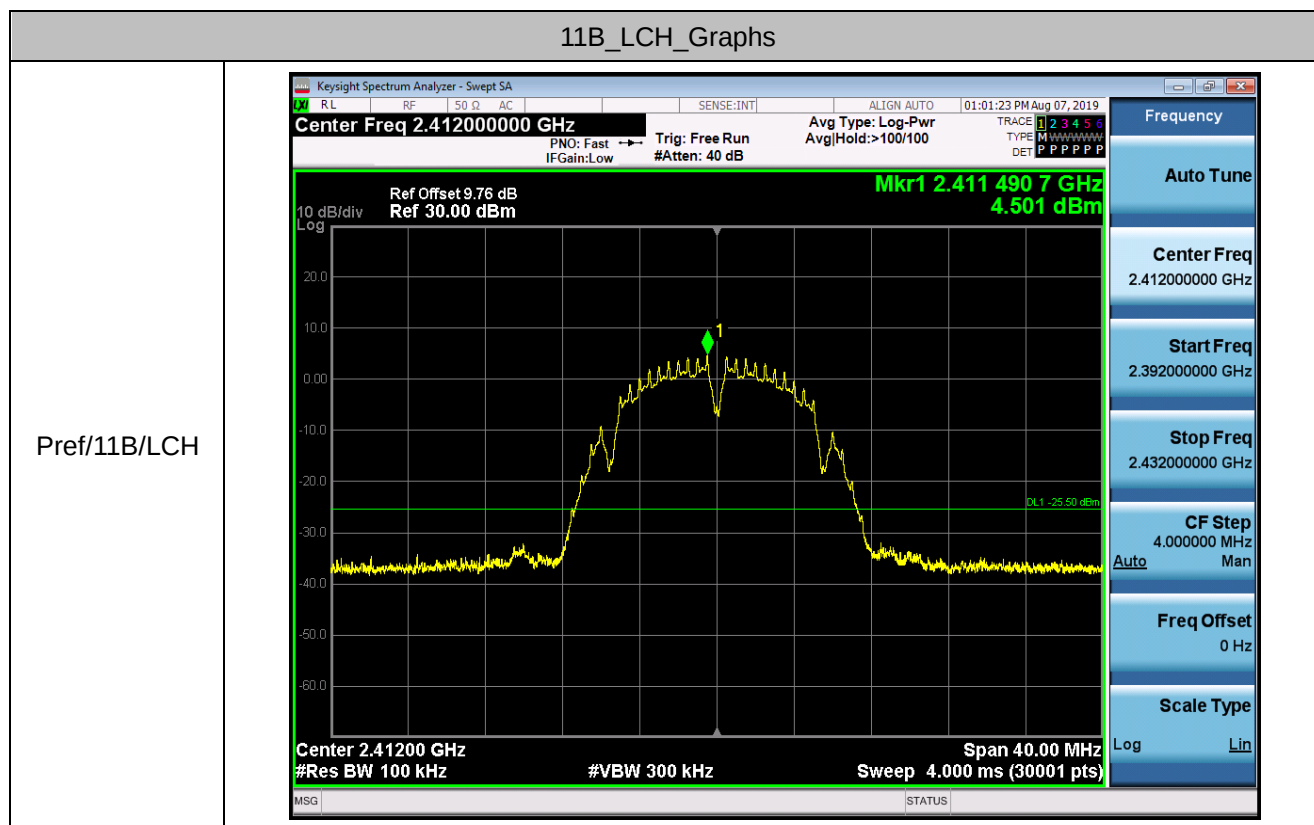


11N20SISO/HCH

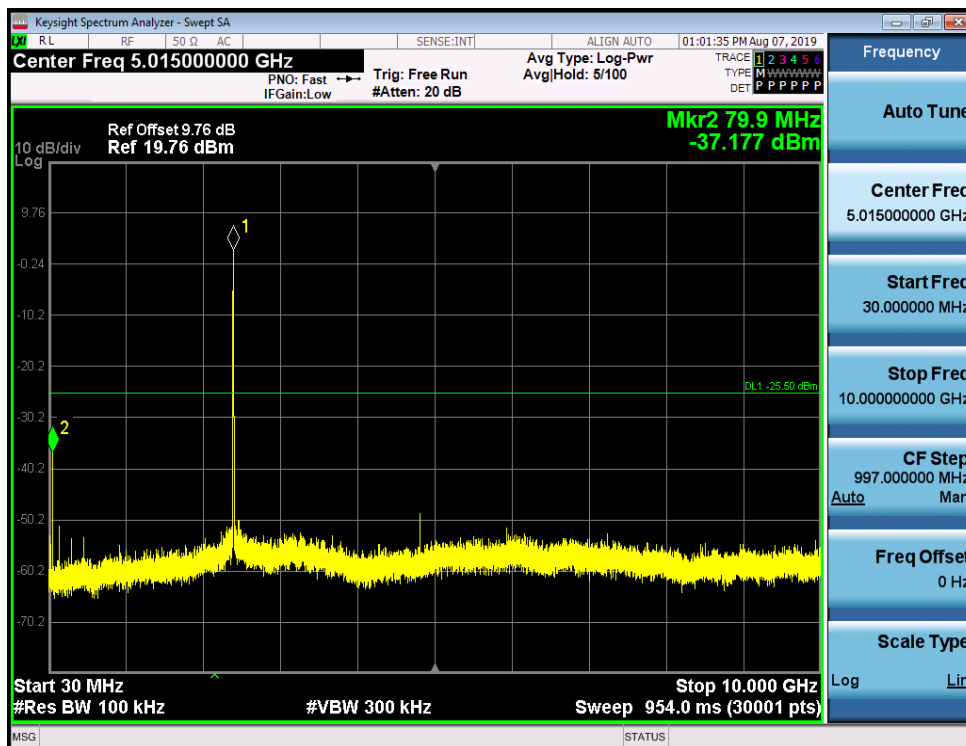


4.4.4 Test Result of Conducted Spurious Emission

Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
11B	LCH	4.501	<Limit	PASS
11B	MCH	6.326	<Limit	PASS
11B	HCH	5.376	<Limit	PASS
11G	LCH	1.178	<Limit	PASS
11G	MCH	2.943	<Limit	PASS
11G	HCH	2.049	<Limit	PASS
11N20SISO	LCH	1.083	<Limit	PASS
11N20SISO	MCH	3.296	<Limit	PASS
11N20SISO	HCH	1.894	<Limit	PASS

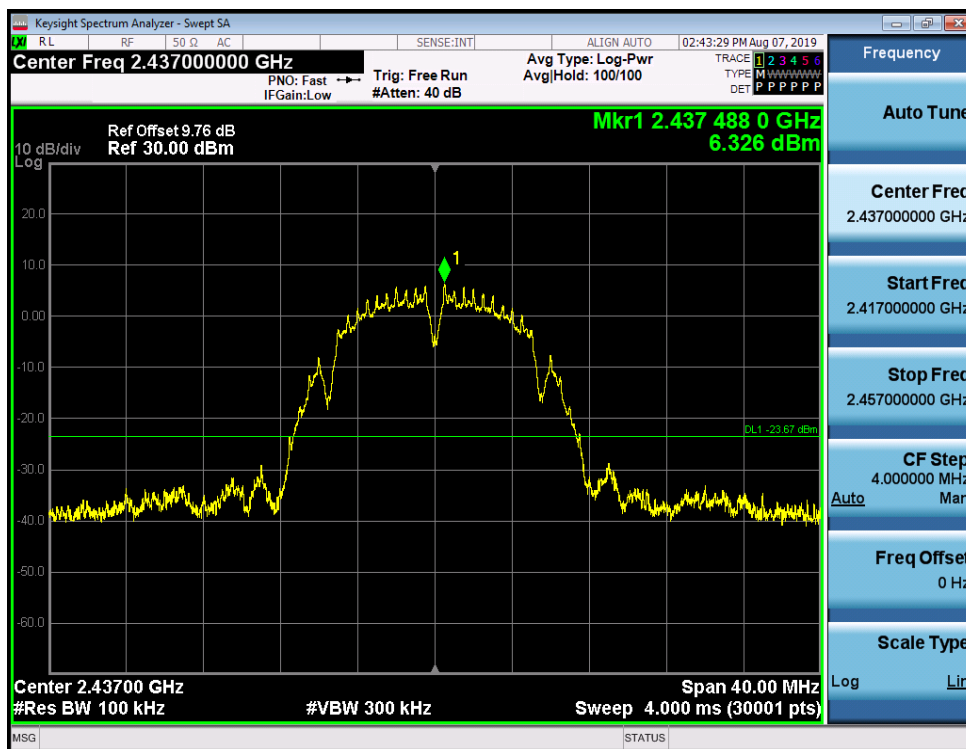


Puw/11B/LCH

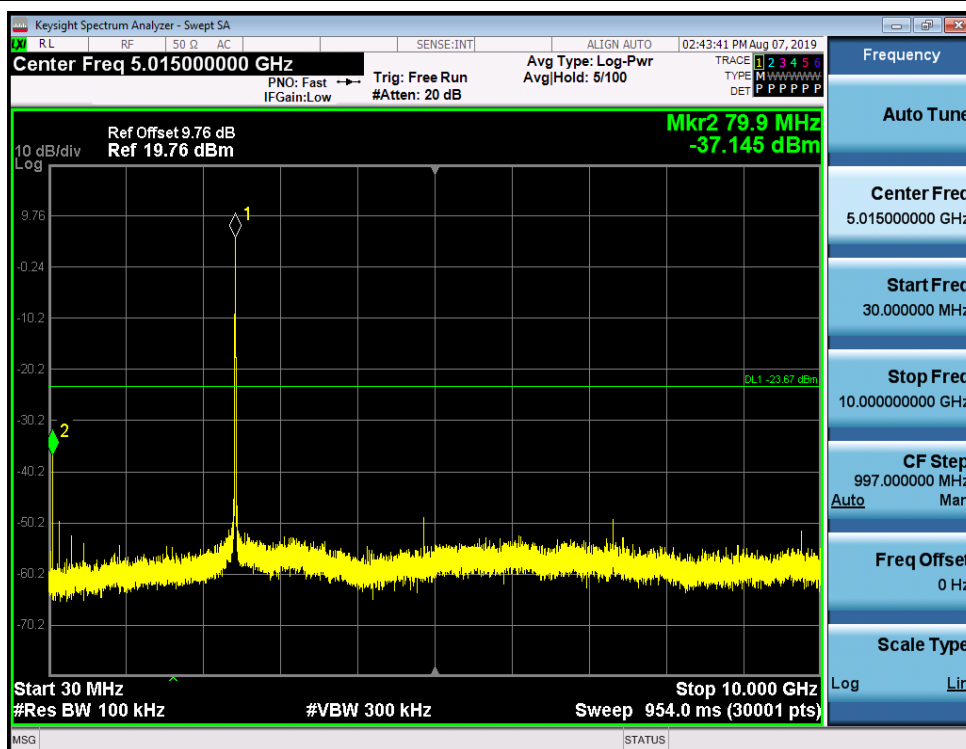


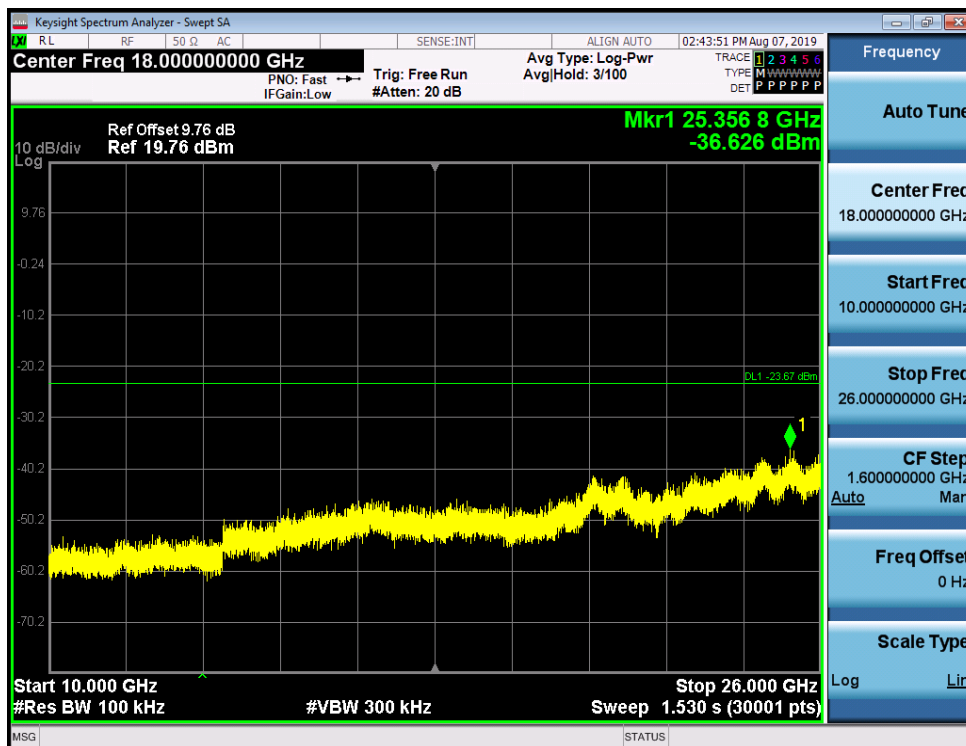
11B_MCH_Graphs

Pref/11B/MCH



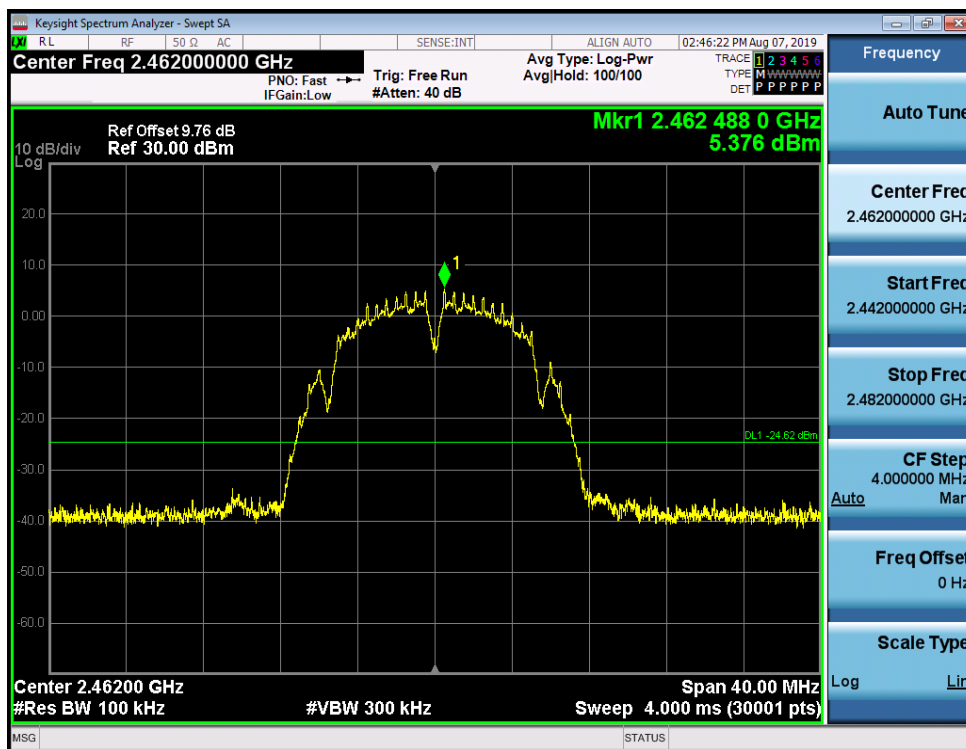
Puw/11B/MCH



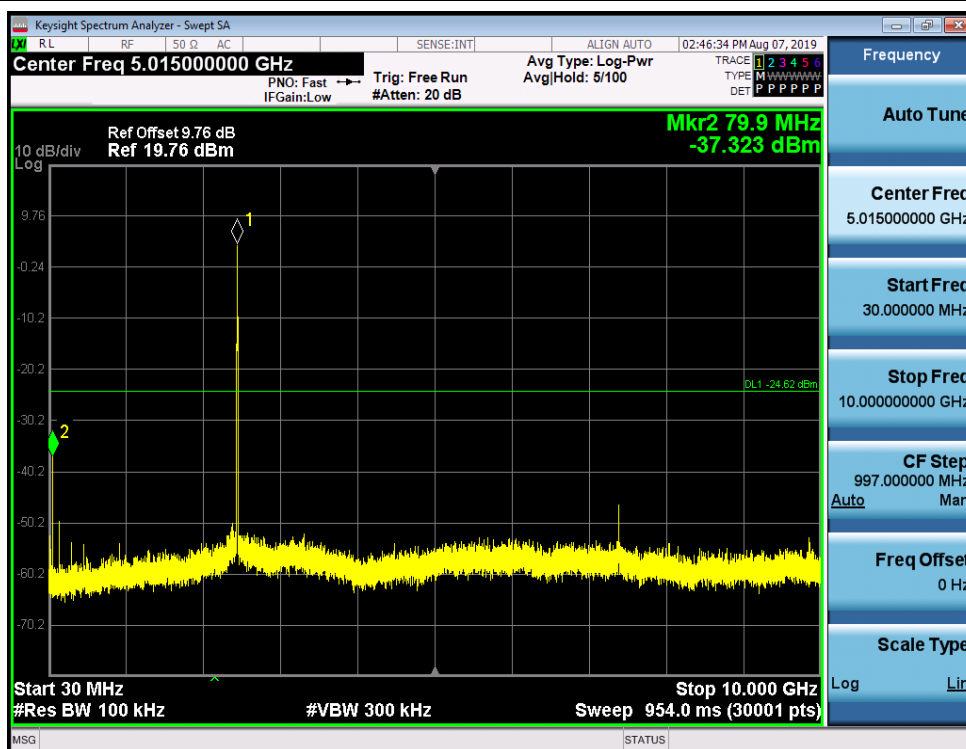


11B_HCH_Graphs

Pref/11B/HCH



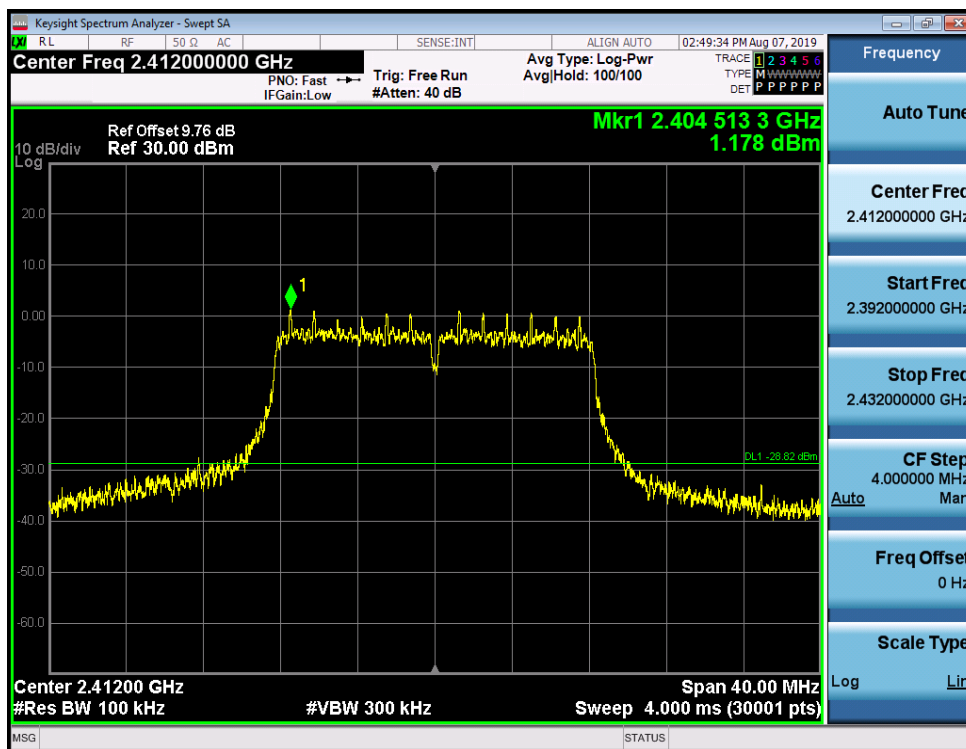
Puw/11B/HCH



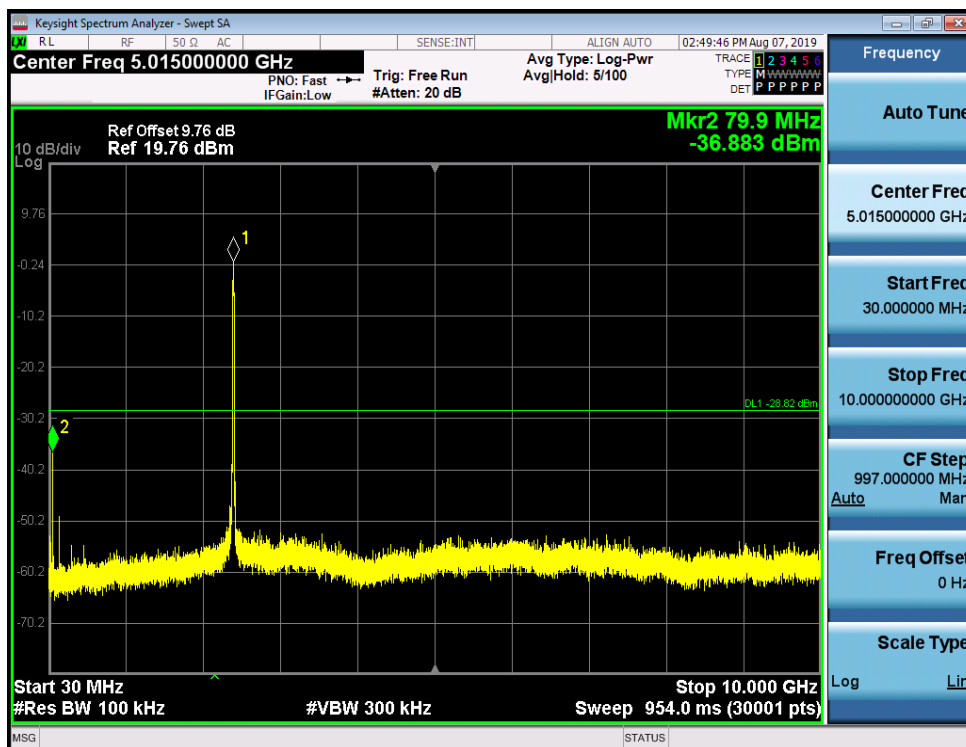


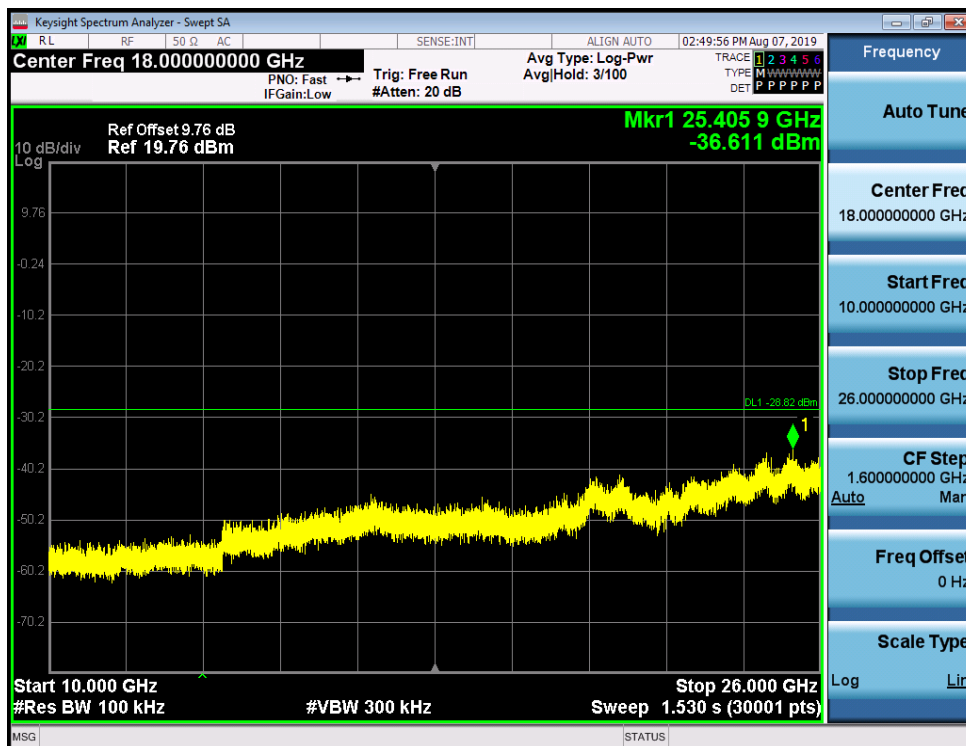
11G LCH Graphs

Pref/11G/LCH



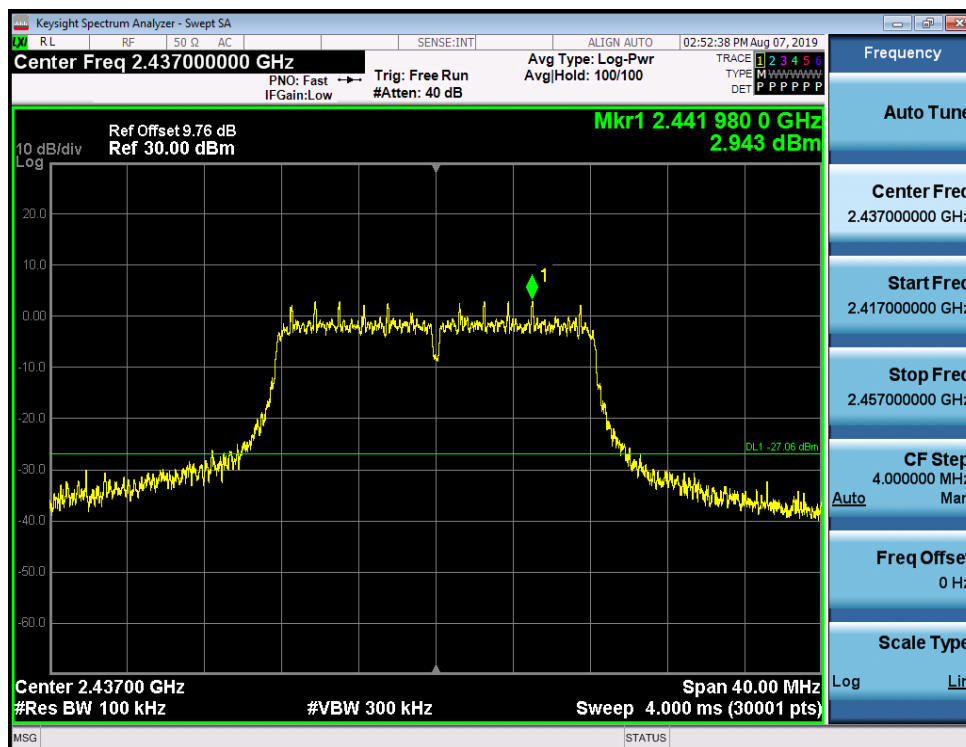
Puw/11G/LCH



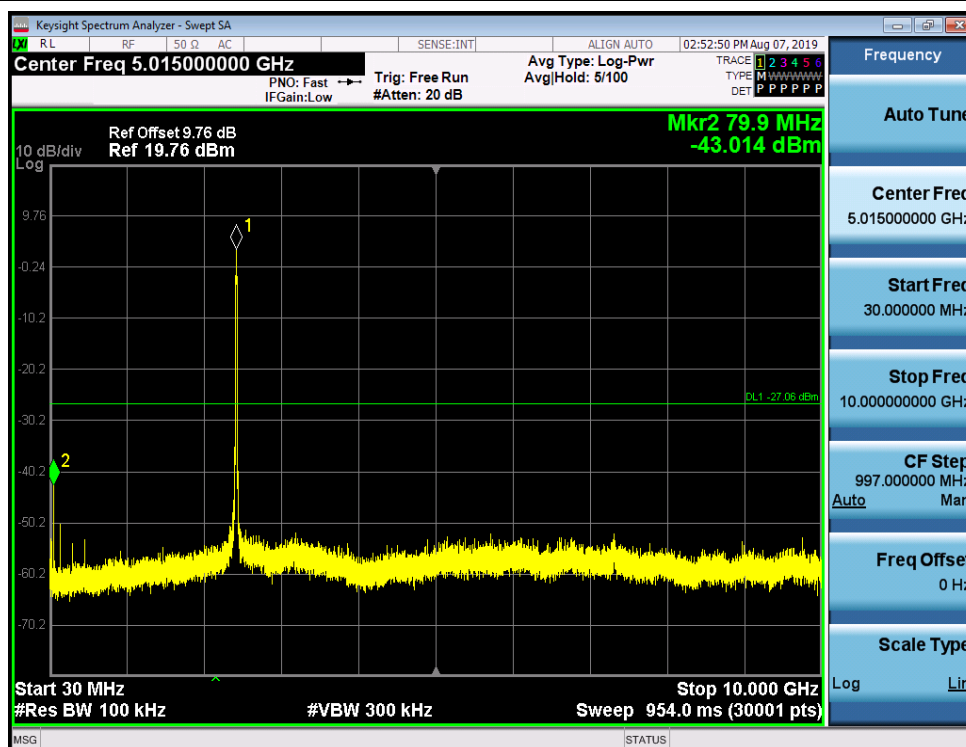


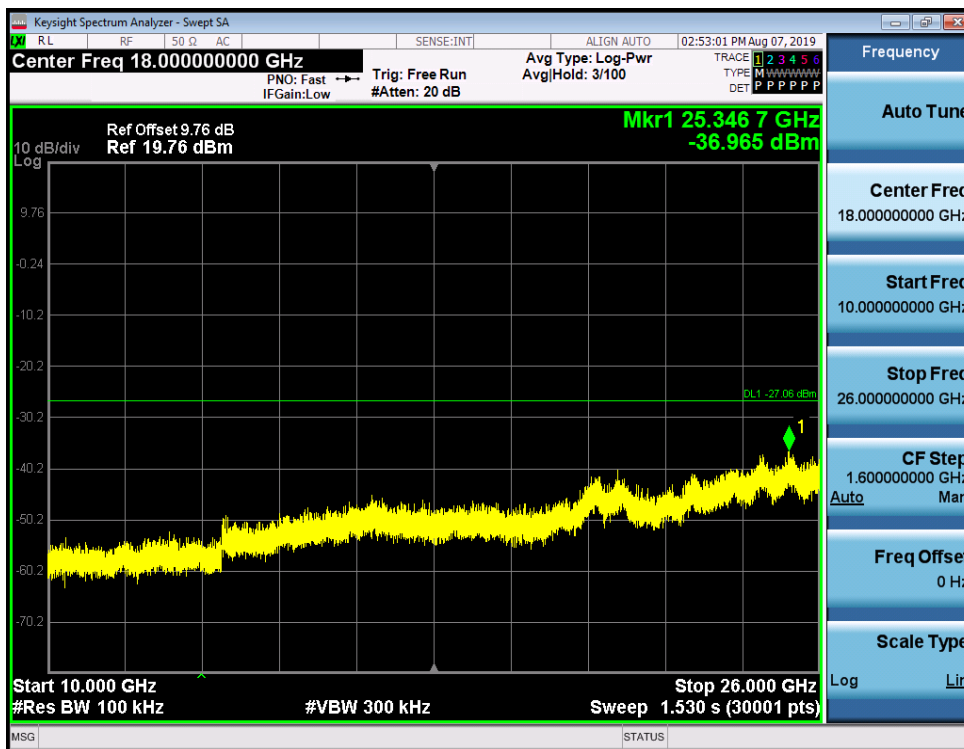
11G_MCH_Graphs

Pref/11G/MCH



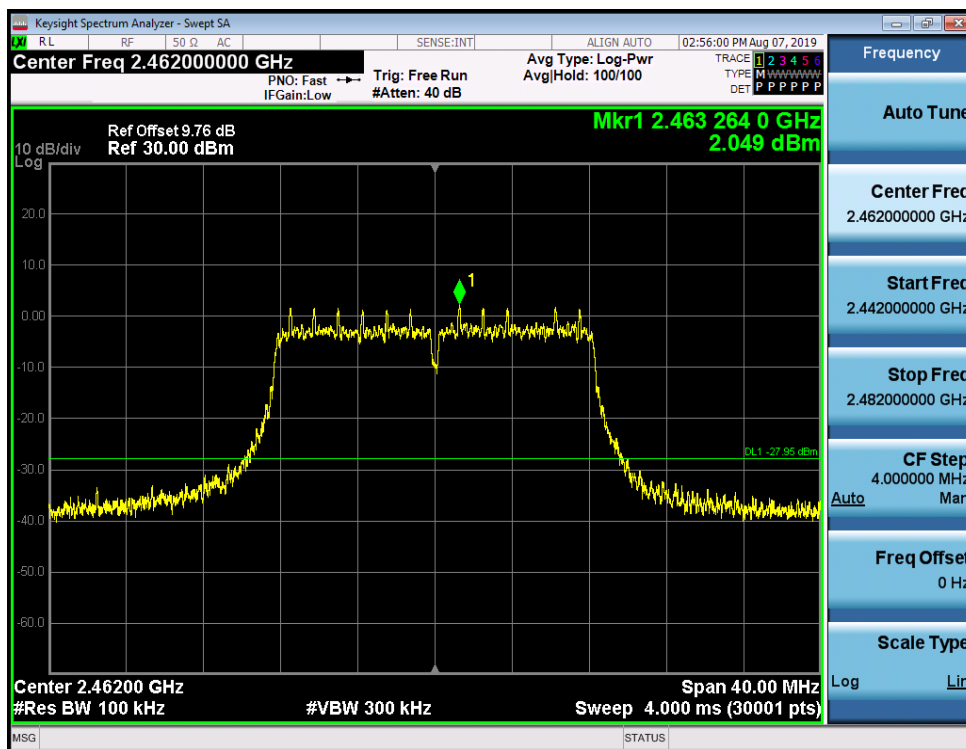
Puw/11G/MCH



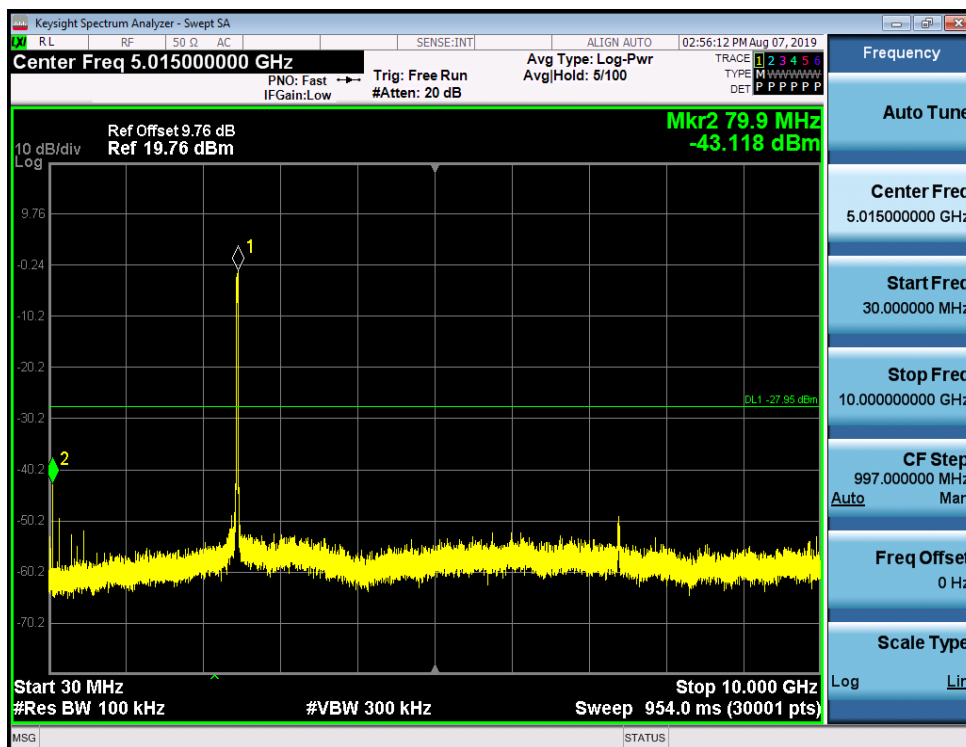


11G_HCH_Graphs

Pref/11G/HCH



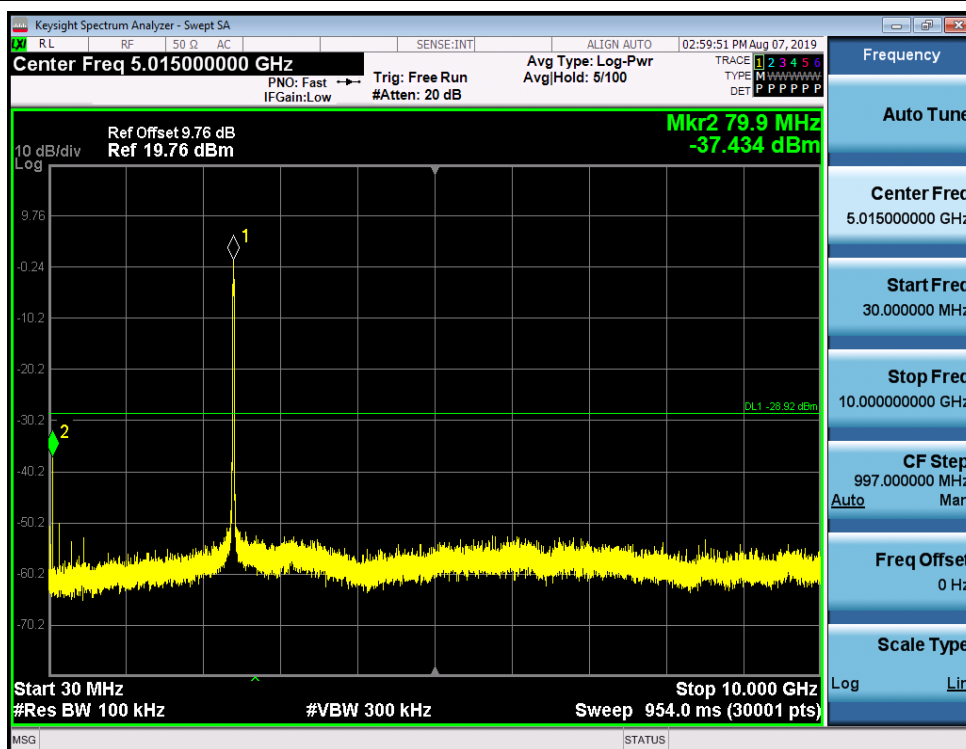
Puw/11G/HCH

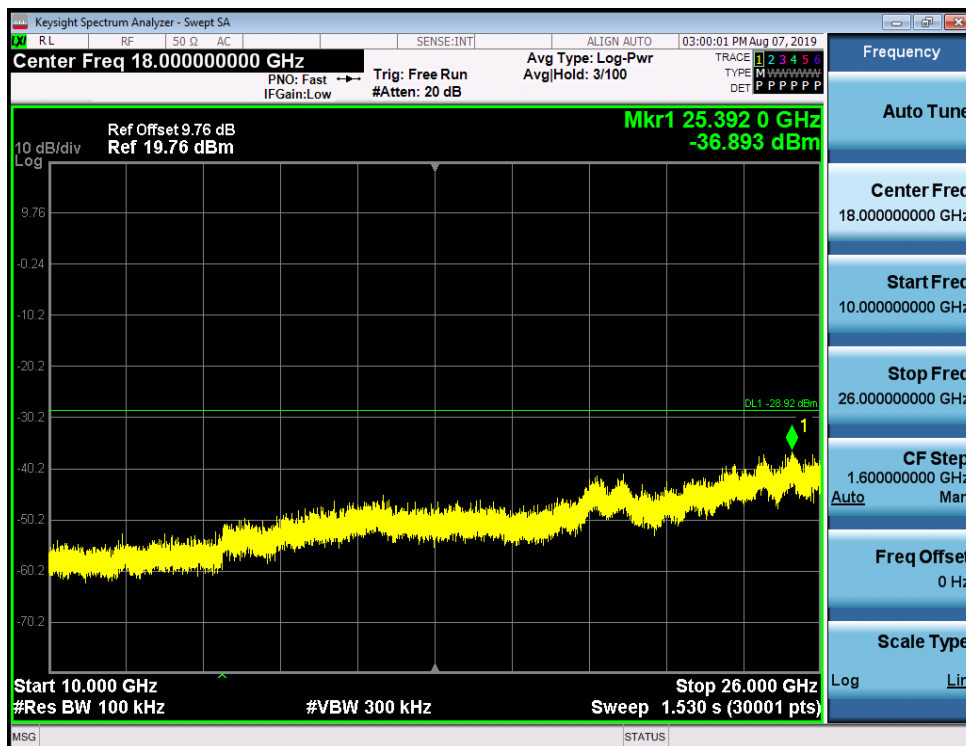




11N20_LCH_Graphs

Pref/11N20/LC
H

Puw/11N20/LC
H


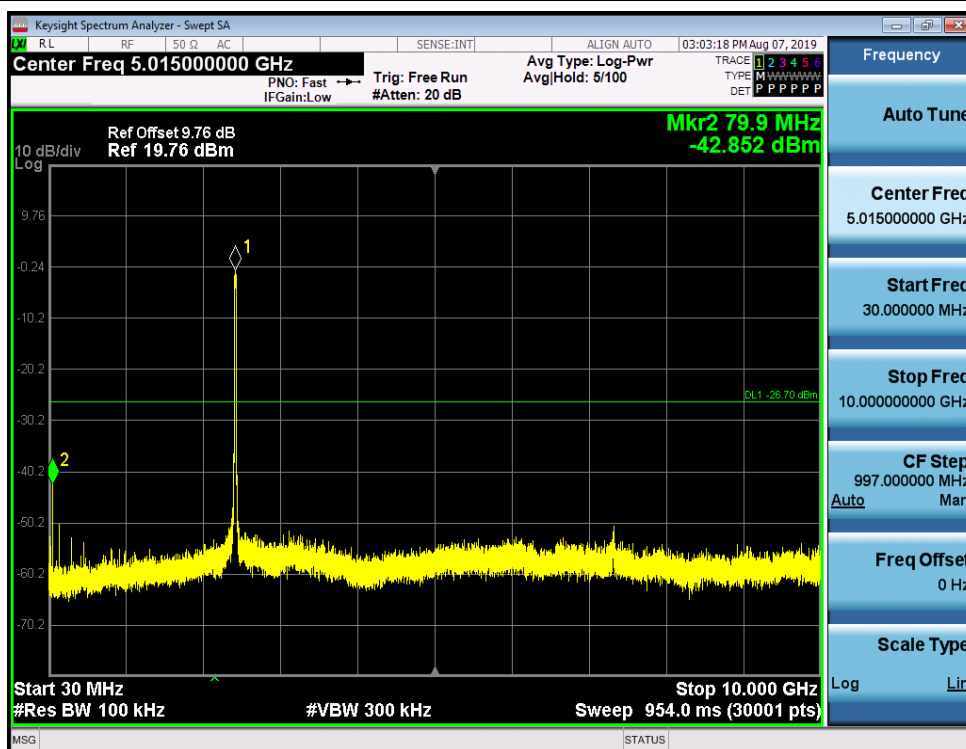


11N20_MCH_Graphs

Pref/11N20/MCH

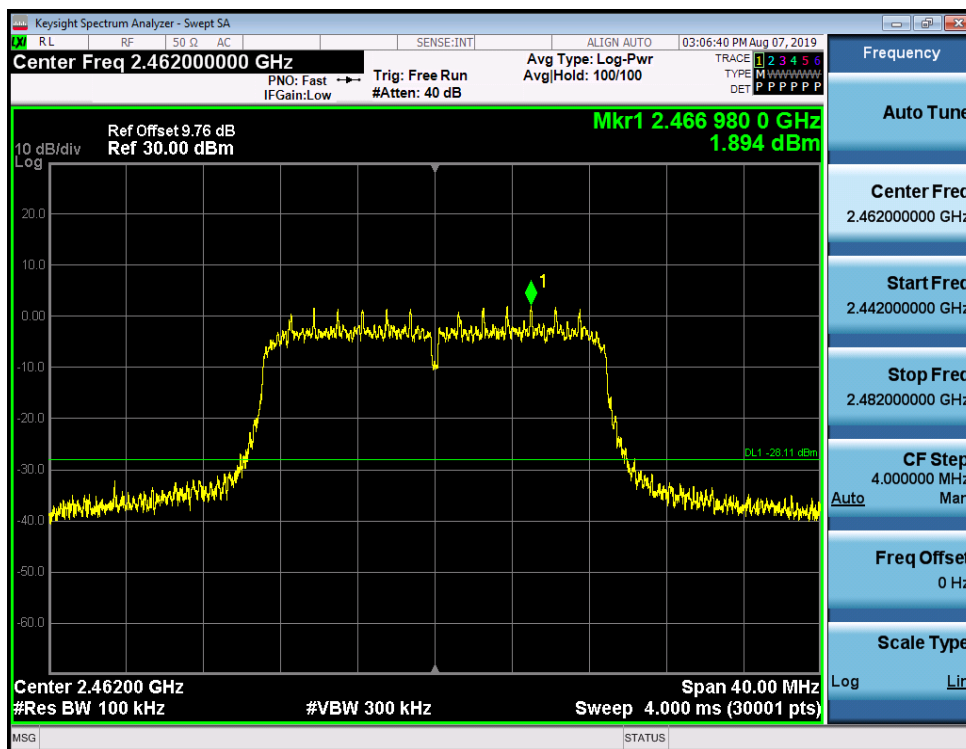
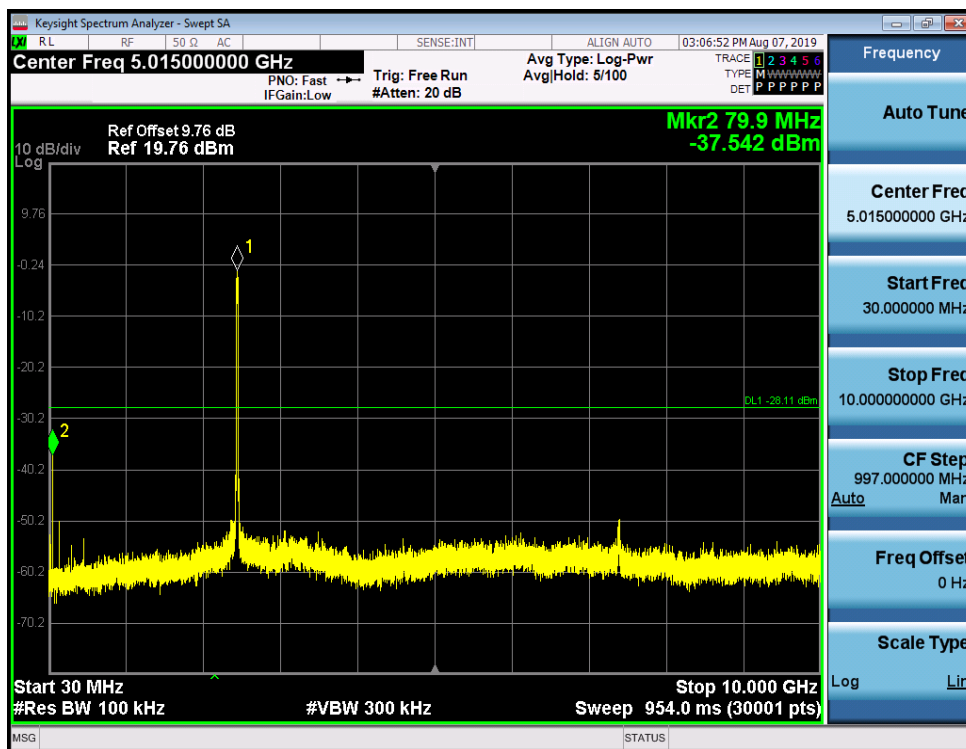


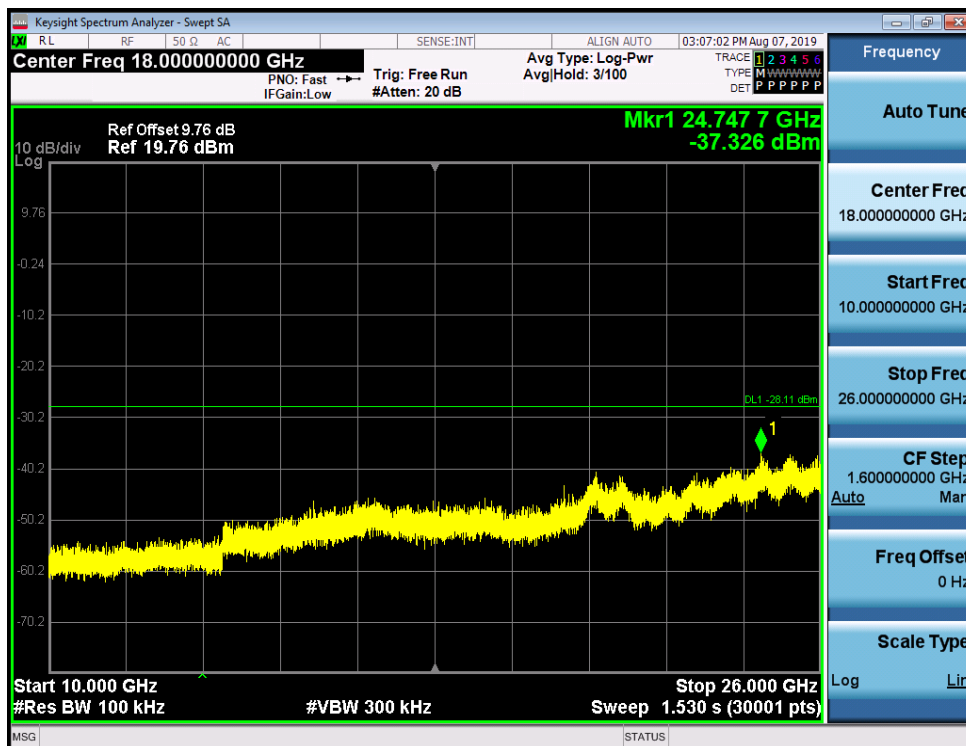
Puw/11N20/MCH





11N20_HCH_Graphs

Pref/11N20/HC
H

Puw/11N20/HC
H




4.5 Radiated Band Edges and Spurious Emission Measurement

4.5.1 Limit of Radiated Band Edges and Spurious Emission

FCC §15.247 (d)

IC RSS-247 5.5

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3