FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10: 2013

TEST REPORT

For

Wireless N300 Router

Model: DIR-615

Data Applies To: DIR-612

Brand: D-Link

Issued for

D-Link Corporation

14420 Myford Road Suite 100, Irvine, California 92606, United States

Issued by

Compliance Certification Services Inc.

Tainan Lab.

No.8, Jiucengling, Xinhua Dist.,
Tainan City, Taiwan

Issued Date: January 14, 2022

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REVISION HISTORY

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	December 14, 2021	Initial Issue	ALL	Gina Lin
01	December 24, 2021	See the following note rev.01	ALL	Gina Lin
02	January 10, 2022	See the following note rev.02	ALL	Gina Lin
03	January 14, 2022	See the following note rev.03	ALL	Gina Lin

Note:

- *Rev.01 Issue Date: December 24, 2021*
  Update supported equipment, all tables of test data and description of test modes.
- *Rev.02 Issue Date: January 10, 2022*
  Update test data of 6dB bandwidth, output power, PPSD, conducted spurious emission and setup photo.
- *Rev.03 Issue Date: January 14, 2022*
  Revised PPSD limit.

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1. TEST REPORT CERTIFICATION

Applicant	:	**D-Link Corporation** 14420 Myford Road Suite 100, Irvine, California 92606, United States
Manufacturer	:	**Amigo Technology Inc.** No. 82, Gongye 2nd Rd., Annan Dist., Tainan City 709, Taiwan
Equipment Under Test	:	Wireless N300 Router
Model	:	DIR-615
Data Applies To	:	DIR-612
Brand	:	D-Link
Date of Test	:	July 30, 2021 ~ August 25, 2021

APPLICABLE STANDARD	
STANDARD	**TEST RESULT**
FCC Part 15 Subpart C AND ANSI C63.10: 2013	No non-compliance noted

FCC Standard Section	Report Section	Test Item	Result
15.247(a)	8.1	6dB BANDWIDTH	Pass
15.247(b)	8.2	MAXIMUM PEAK OUTPUT POWER	Pass
-	8.3	DUTY CYCLE	-
15.247(e)	8.4	POWER SPECTRAL DENSITY	Pass
15.247(d)	8.5	CONDUCTED SPURIOUS EMISSION	Pass
15.205(a)	8.6	RADIATED EMISSIONS	Pass
15.207(a)	8.7	POWERLINE CONDUCTED EMISSIONS	Pass
15.203	9	ANTENNA REQUIREMENT	Unique coupling antenna

Statements of Conformity
Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Approved by:

Eric Huang
Section Manager

2. EUT DESCRIPTION

Product Name	Wireless N300 Router
Model	DIR-615
Data Applies To	DIR-612
Brand	D-Link
Received Date	July 29, 2021
Frequency Range	IEEE 802.11b/g, 802.11n HT20 (DTS Band):2412MHz~2462MHz IEEE 802.11n HT40 (DTS Band):2422MHz~2452MHz
Transmit Power	IEEE 802.11b Mode: 13.14dBm (20.606mW) IEEE 802.11g Mode: 22.80dBm (190.546mW) IEEE 802.11n HT20 Mode: 22.58dBm (181.134mW) IEEE 802.11n HT40 Mode: 21.54dBm (142.561mW)
Channel Spacing	IEEE 802.11b/g, 802.11n HT20/HT40: 5MHz
Channel Number	IEEE 802.11b/g, 802.11n HT20:11 Channels IEEE 802.11n HT40 :7 Channels
Transmit Data Rate	IEEE 802.11b : 11, 5.5, 2, 1 Mbps IEEE 802.11g : 54, 48 ,36, 24, 18, 12, 9, 6 Mbps IEEE 802.11n HT20 : 65, 58.5, 52, 39, 26, 19.5, 13, 6.5 Mbps IEEE 802.11n HT40 : 135, 121.5, 108, 81, 54, 40.5, 27, 13.5 Mbps
Type of Modulation	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20/HT40: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Type	Two antenna **(2TX2RX)** **Antenna 1:** Type: RF Antenna Assembly Connector: i-pex Model: RF21C06560A Manufacturer: RenFeng Electronic technology Co., LTD. Gain: 5dBi Length: 150mm **Antenna 2:** Type: RF Antenna Assembly Connector: i-pex Model: RF21C06561A Manufacturer: RenFeng Electronic technology Co., LTD. Gain: 5dBi Length: 45mm **MIMO / Directional Gain (For IEEE 802.11 n):** 8.01 dBi
Power Rating	AC 100V-240V, 65W, 50/60Hz
Software Version	1.00
Firmware Version	1.00
Temperature Range	0°C ~ +40°C
Reported Date	September 28, 2021

Power Adapter :

Manufacturer	Model No.	Power Input	Power Output
SHENZHEN YOUNGHOPE ELECTRONICS TECHNOLOGY CO., LTD.	YHSW-050100UA	AC 100-240V, 0.25A, 50-60Hz	DC 5V, 1000mA

REMARK:

1. The sample (**DIR-615**) selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **KA2IR615Z1** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the User's manual of the EUT.
4. The listed model(s) (**DIR-612**) are all the same of the original model (**DIR-615**) design, except for different models name and is just for the marketing purpose.

3. DESCRIPTION OF TEST MODES

The EUT is a Wireless N300 Router. It has two transmitter chains and two receive chains (2x2 configurations).

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

The RF chipset is manufactured by Realtek.

The antenna peak gain 5.0dBi (highest gain) were chosen for full testing.

IEEE 802.11 b ,802.11g ,802.11n HT20 mode (DTS Band)

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2412
Middle	2437
High	2462

IEEE 802.11b mode: 1Mbps long data rate (worst case) were chosen for full testing.

IEEE 802.11g mode: 6Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT20 mode: 6.5Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT40 mode (DTS Band)

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2422
Middle	2437
High	2452

IEEE 802.11n HT40 mode: 13Mbps data rate (worst case) were chosen for full testing.

The worst-case data rates are determined according to the description above, based on the investigations by measuring the PSD, peak power and average power across all the data rates, bandwidths, modulations and spatial stream modes.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 and FCC CFR 47 15.207, 15.209 and 15.247.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW1109).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada (TW1109)
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsrf.com

6. CALIBRATION AND UNCERTAINTY

6.1 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.

6.2 MEASUREMENT UNCERTAINTY

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

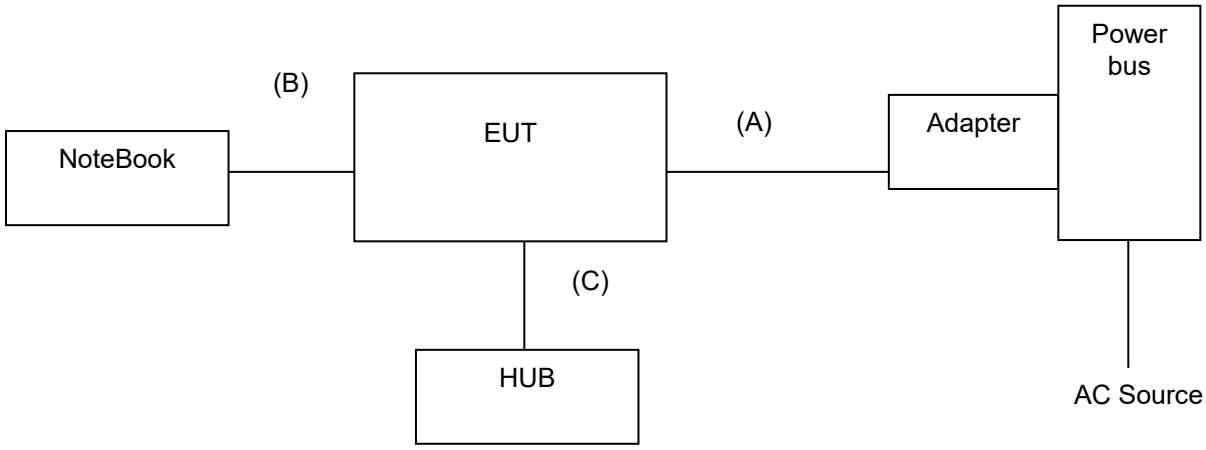
PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz Test Site : OATS-6	±3.3456dB
Radiated Emission, 200 to 1000 MHz Test Site : OATS-6	±2.6828dB
Radiated Emission, 1 to 8 GHz	± 2.6485dB
Radiated Emission, 8 to 18 GHz	± 2.6852dB
Radiated Emission, 18 to 26.5 GHz	± 2.6485dB
Radiated Emission, 26 to 40 GHz	± 3.0295dB
Power Line Conducted Emission	±1.91dB
Band Width	136.49kHz
Peak Output Power MU	±1.904dB
Band Edge MU	±0.302dBuV
Channel Separation MU	361.69Hz
Duty Cycle MU	0.064ms
Frequency Stability MU	0.223kHz

Uncertainty figures are valid to a confidence level of 95%, K=2

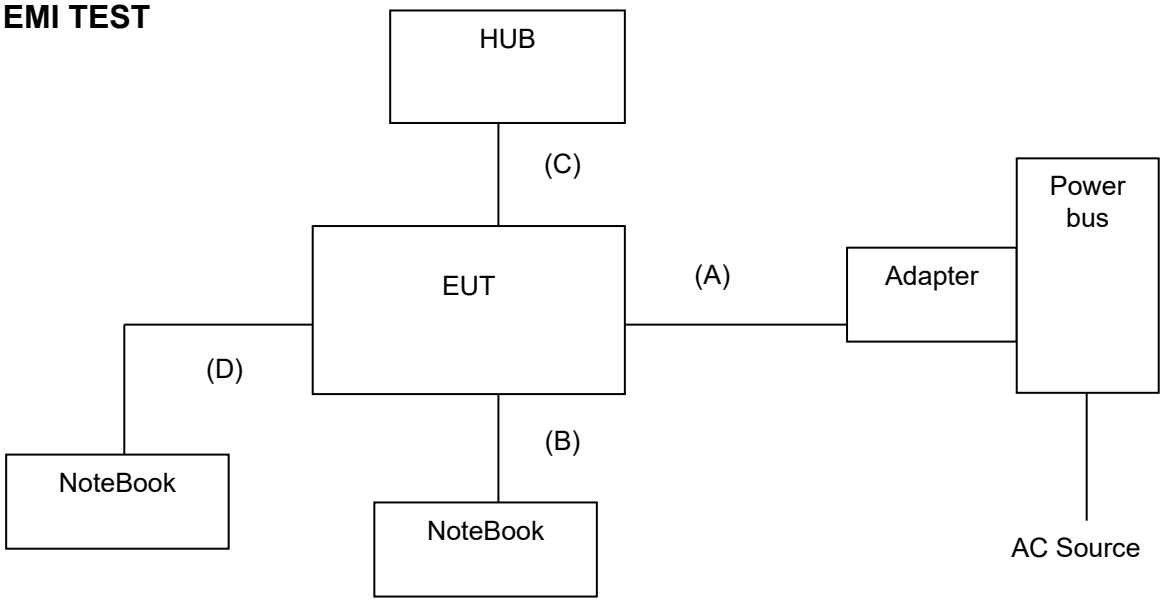
7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

FOR RF TEST



FOR EMI TEST



7.2 SUPPORT EQUIPMENT

RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Notebook	Acer	AS 3830TG	PPD-QCWB335	Unshd, 1.8m
2	HUB	BARRICADE	SMC7008BR	Doc	N/A

No.	Signal cable description	
A	DC Power	Unshielded, 1.0m, 1 pcs.
B	RJ-45	Unshielded, 1.0m, 1 pcs.
C	RJ-45	Unshielded, 3.0m, 4 pcs.

EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	HUB	BARRICADE	SMC7008BR	Doc	N/A
2	Notebook	TOSHIBA	PORTEGE R30-A	Doc	Unshd, 1.8m

No.	Signal cable description	
A	DC Power	Unshielded, 1.2m, 1 pcs.
B	RJ-45	Unshielded, 10.0m, 1 pcs.
C	RJ-45	Unshielded, 3.0m, 3 pcs.
D	RJ-45	Unshielded, 10.0m, 1 pcs.

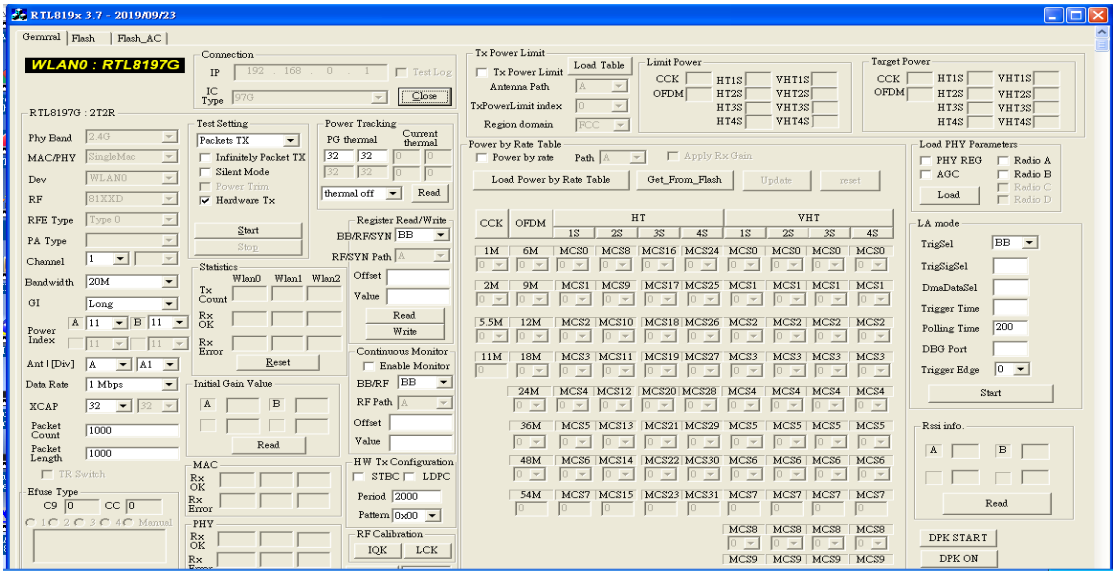
REMARK:

1. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.
2. Grounding was established in accordance with the manufacturer’s requirements and conditions for the intended use.

7.3 EUT OPERATING CONDITION

RF Setup

1. Set up all computers like the setup diagram.
2. The Test Program “MP_TEST” software was used for testing.



TX Mode:

⇒ **IC TYPE : 92F**

⇒ **Test Setting : Continous TX**

⇒ **Tx Mode: CCK、OFDM、HT MixMode** (Bandwidth: 20、40)

⇒ **Tx Data Rate: 1Mbps long** (IEEE 802.11b mode ,Chain AB TX)

6Mbps (IEEE 802.11g mode ,Chain AB TX)

MCS7 (IEEE 802.11n HT20 mode ,Chain AB TX)

MCS7 (IEEE 802.11n HT40 mode, Chain AB TX**)**

Power control mode

Target Power: IEEE 802.11b Channel Low (2412MHz) = 18 **(Chain AB)**
IEEE 802.11b Channel Middle (2437MHz) = 19 **(Chain AB)**
IEEE 802.11b Channel High (2462MHz) = 19 **(Chain AB)**

Target Power: IEEE 802.11g Channel Low (2412MHz) = 31 **(Chain AB)**
IEEE 802.11g Channel Middle (2437MHz) = 28 **(Chain AB)**
IEEE 802.11g Channel High (2462MHz) = 25 **(Chain AB)**

Target Power: IEEE 802.11n HT20 Channel Low (2412MHz) = 27 **(Chain AB)**
IEEE 802.11n HT20 Channel Middle (2437MHz) = 25 **(Chain AB)**
IEEE 802.11n HT20 Channel High (2462MHz) = 23 **(Chain AB)**

Target Power: IEEE 802.11n HT40 Channel Low (2422MHz) = 24 **(Chain AB)**
IEEE 802.11n HT40 Channel Middle (2437MHz) = 23 **(Chain AB)**

IEEE 802.11n HT40 Channel High (2452MHz) = 21 **(Chain AB)**

⇒ Start

RX Mode：

⇒Test Setting : Packets RX

⇒ Start

3. All of the function are under run.
4. Start test.

8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6dB BANDWIDTH

LIMIT

§ 15.247(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2023
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2023
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/29/2021	01/28/2022
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP

TEST PROCEDURE

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

TEST RESULTS

No non-compliance noted.

Model Name	DIR-615	Test By	Peter Chu
Temp & Humidity	26.4℃, 60%	Test Date	2021/07/30

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	6dB Bandwidth ChainA (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	10.13	500	PASS
Middle	2437	10.13	500	PASS
High	2462	10.12	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	6dB Bandwidth ChainA (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	16.58	500	PASS
Middle	2437	16.59	500	PASS
High	2462	16.58	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	6dB Bandwidth ChainA (MHz)	6dB Bandwidth ChainB (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	17.81	17.80	500	PASS
Middle	2437	17.80	17.80	500	PASS
High	2462	17.80	17.80	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

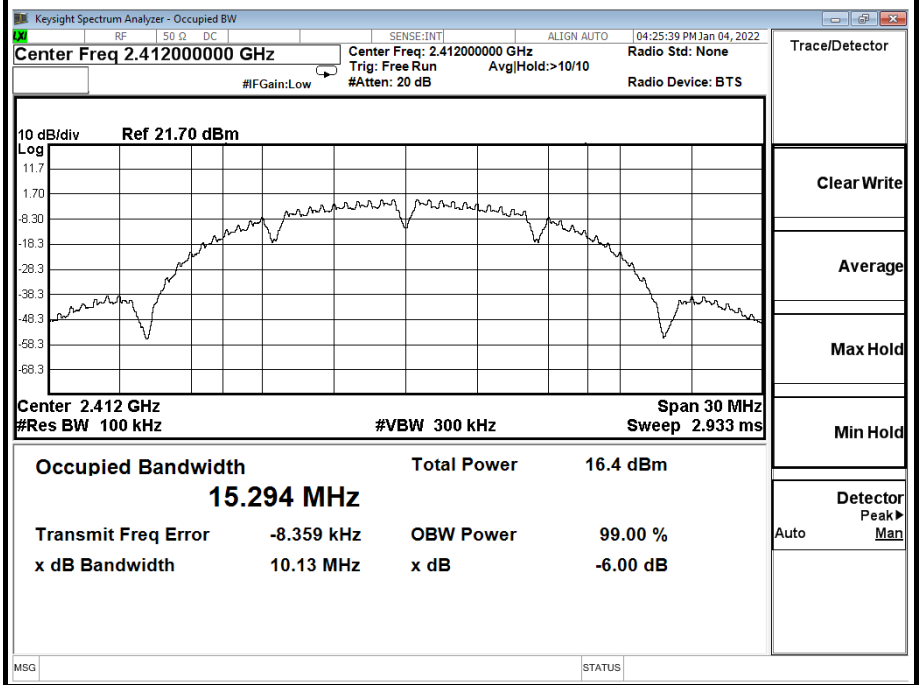
IEEE 802.11n HT40 mode

Channel	Channel Frequency (MHz)	6dB Bandwidth ChainA (MHz)	6dB Bandwidth ChainB (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2422	36.41	36.40	500	PASS
Middle	2437	36.40	36.41	500	PASS
High	2452	36.40	36.41	500	PASS

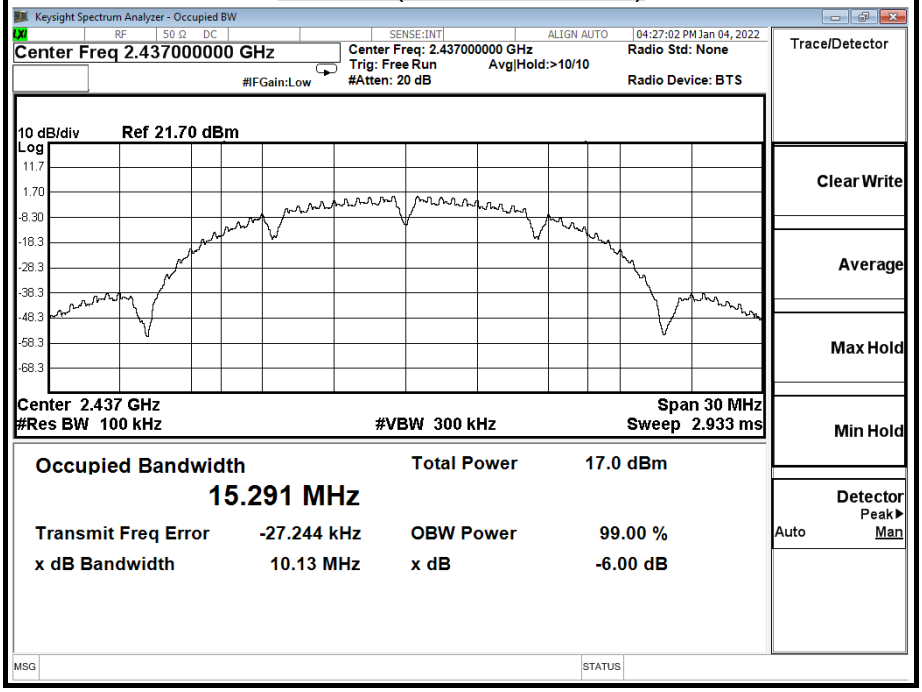
NOTE : 1. At finial test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

6dB BANDWIDTH (802.11b MODE)

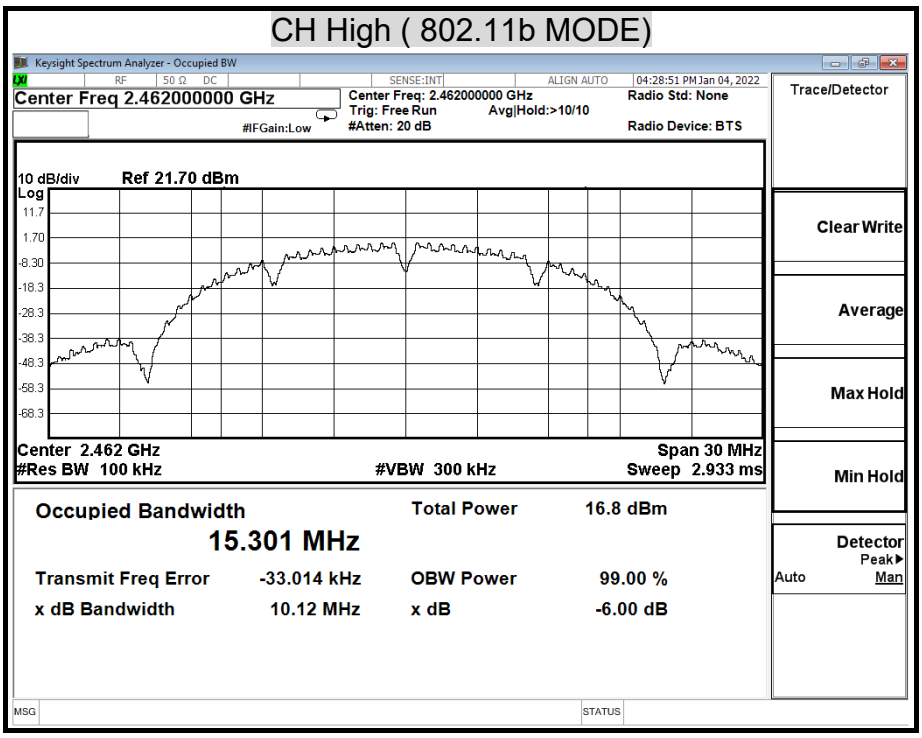
CH Low (802.11b MODE)



CH Mid (802.11b MODE)

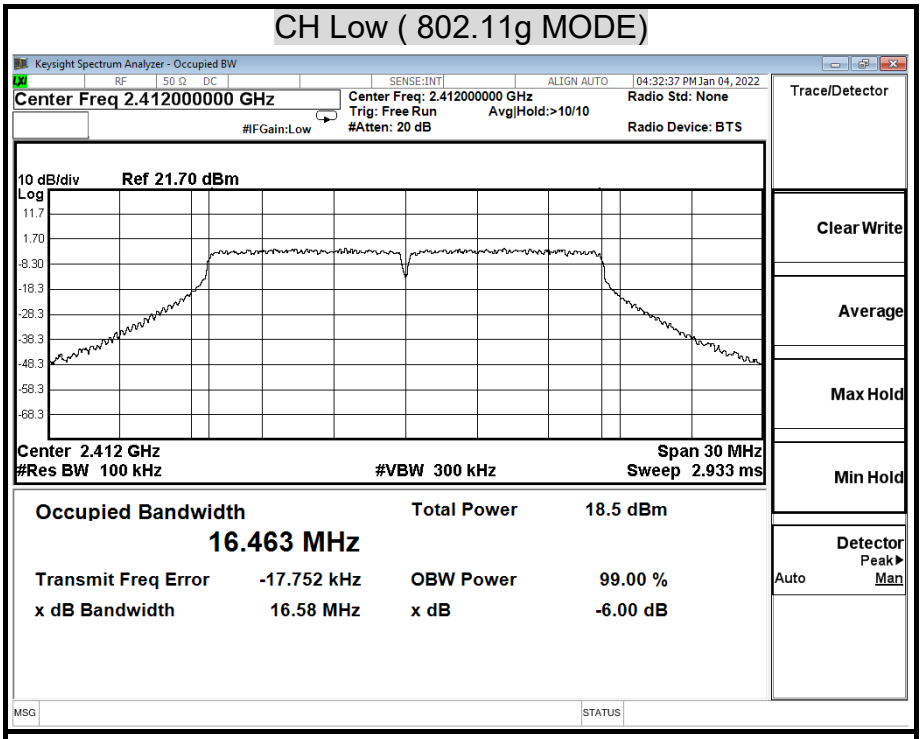


CH High (802.11b MODE)

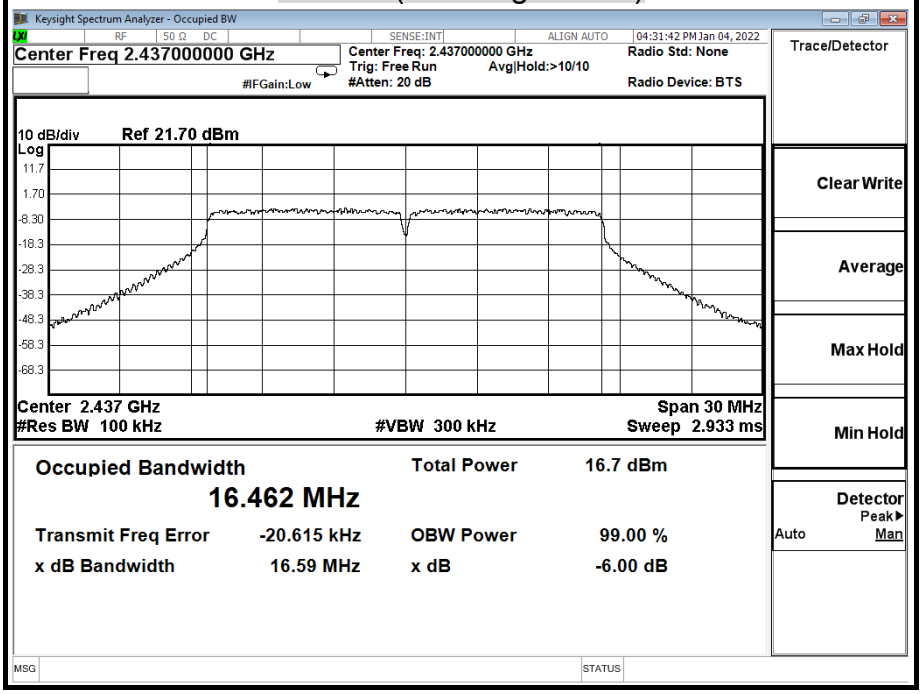


6dB BANDWIDTH (802.11g MODE)

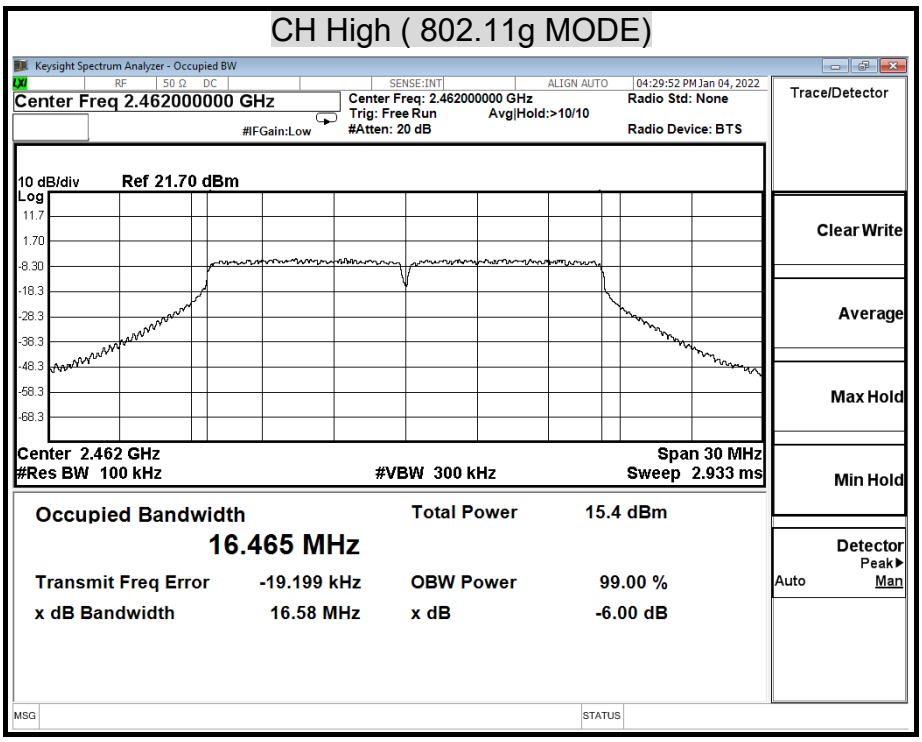
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

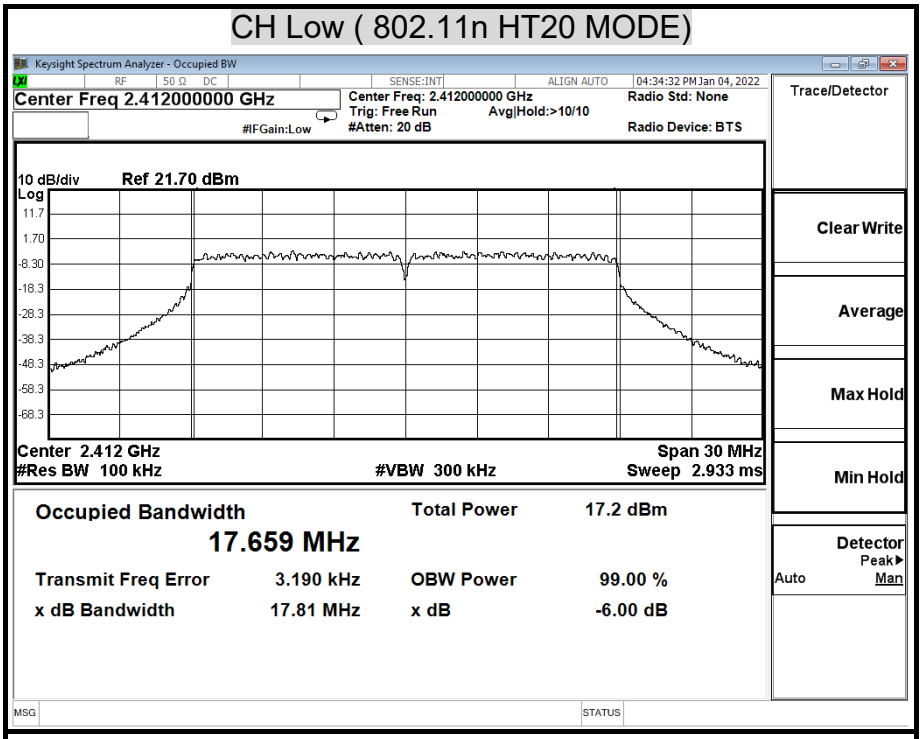


CH High (802.11g MODE)

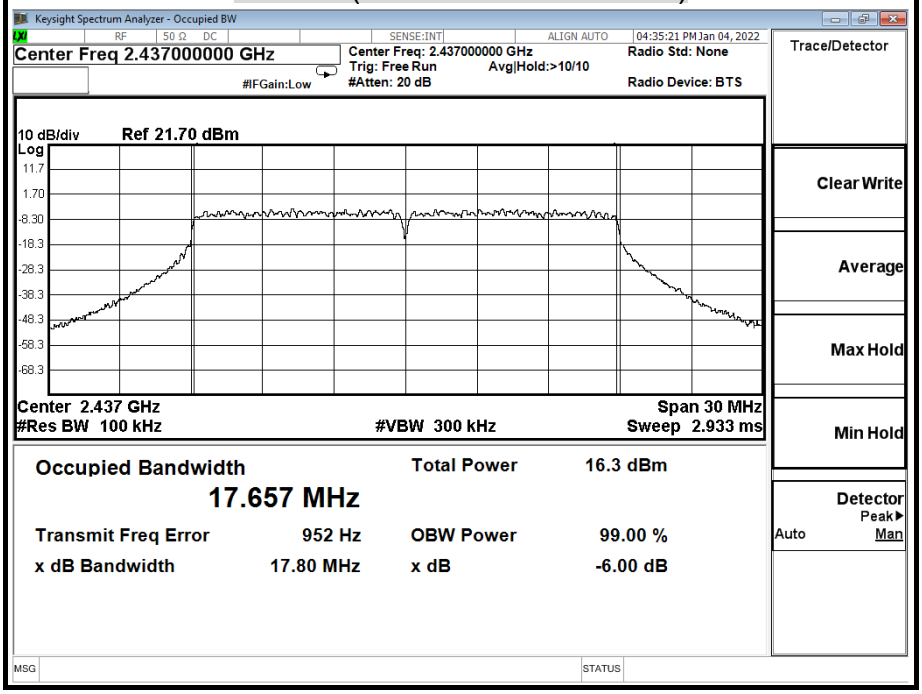


6dB BANDWIDTH (802.11n HT20 MODE) ChainA

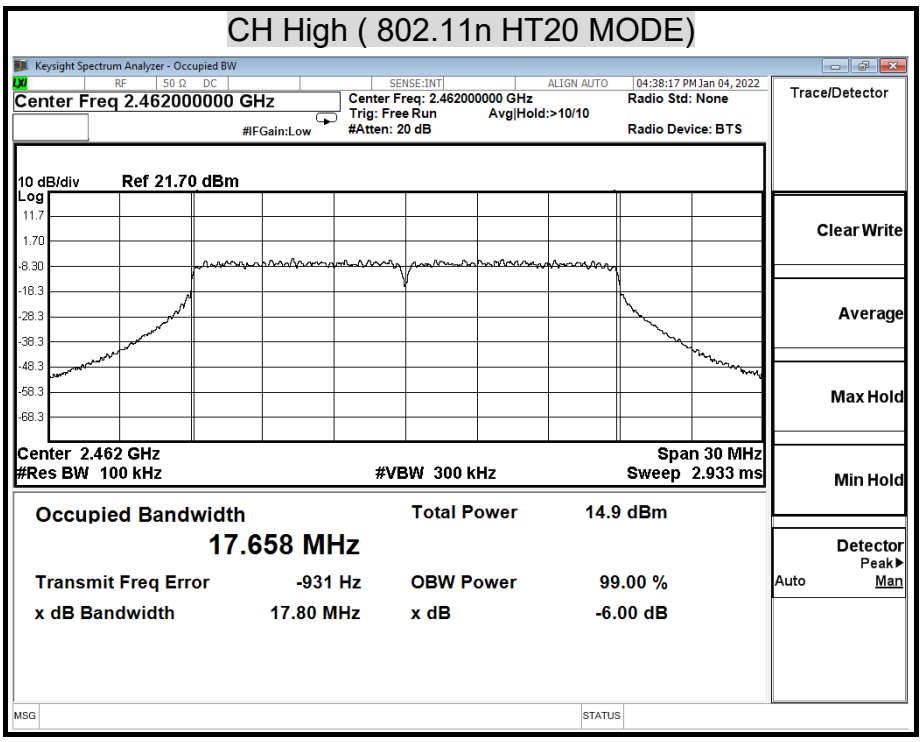
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

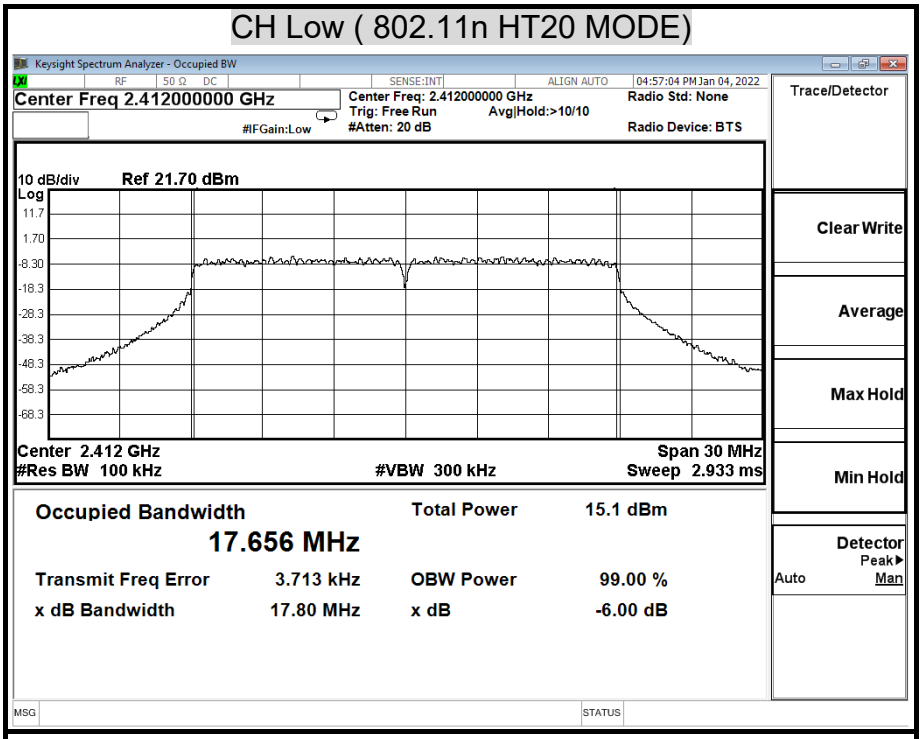


CH High (802.11n HT20 MODE)

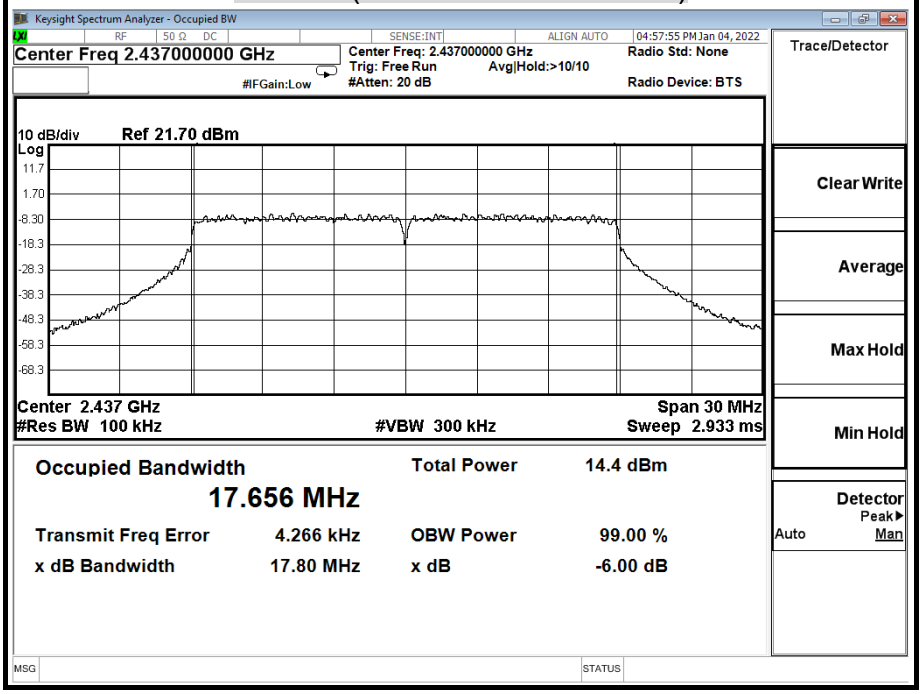


6dB BANDWIDTH (802.11n HT20 MODE) ChainB

CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)



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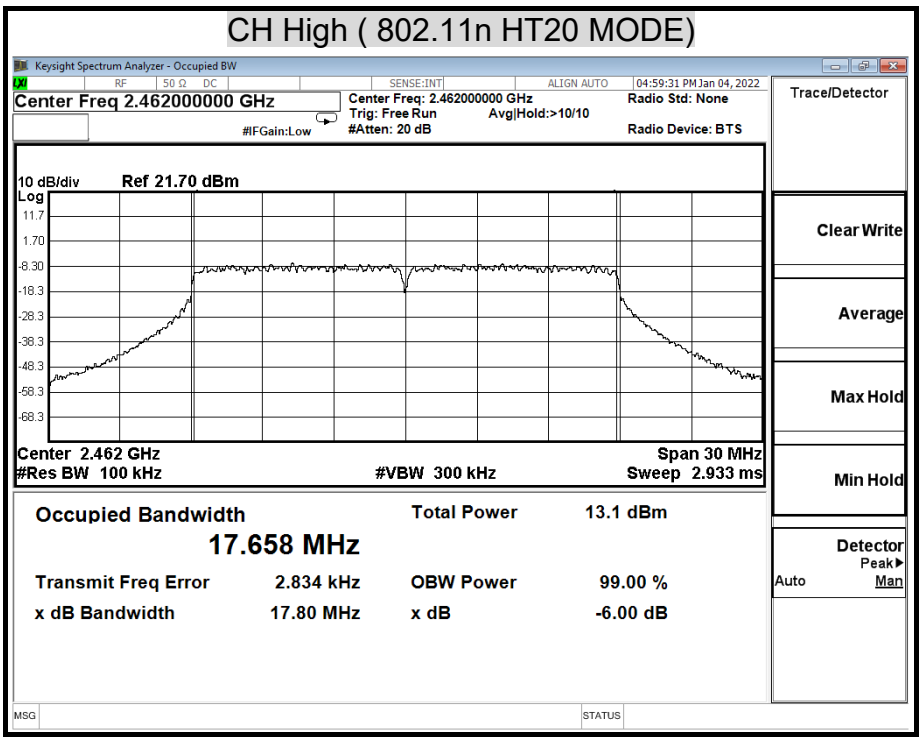
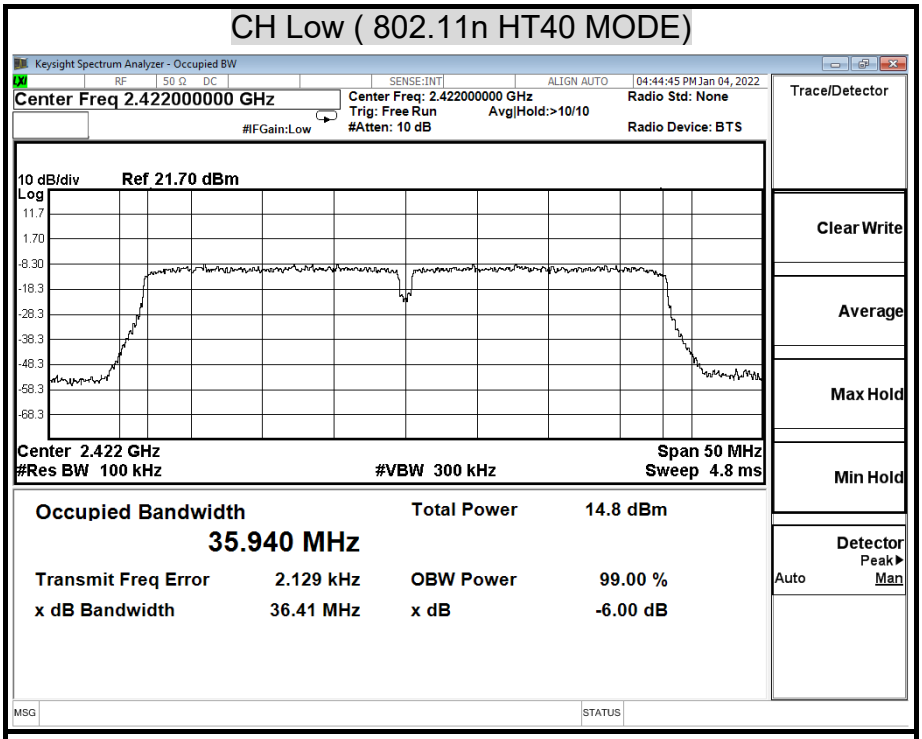
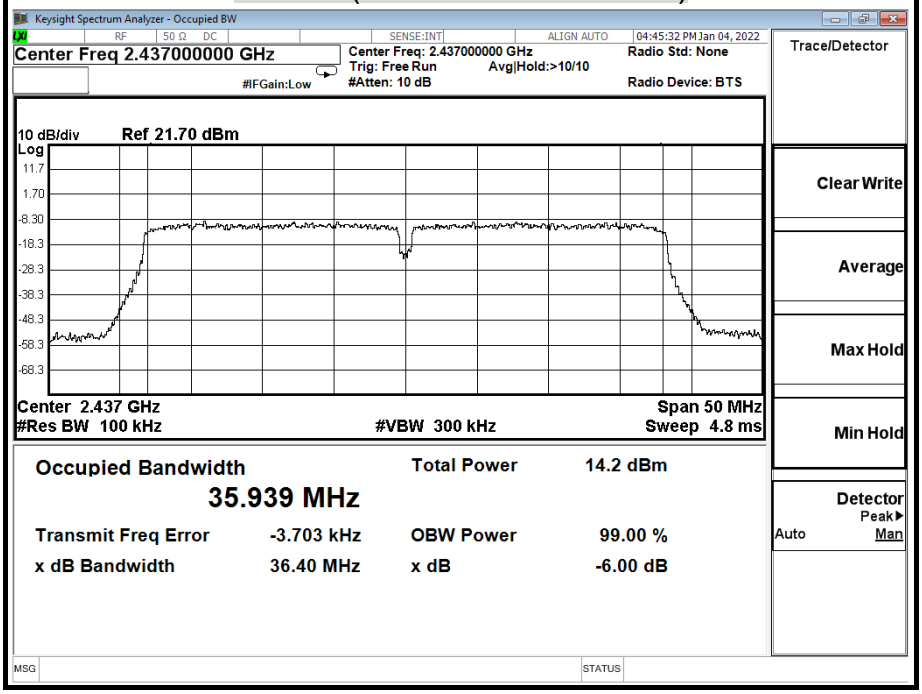


6dB BANDWIDTH (802.11n HT40 MODE) ChainA

CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)



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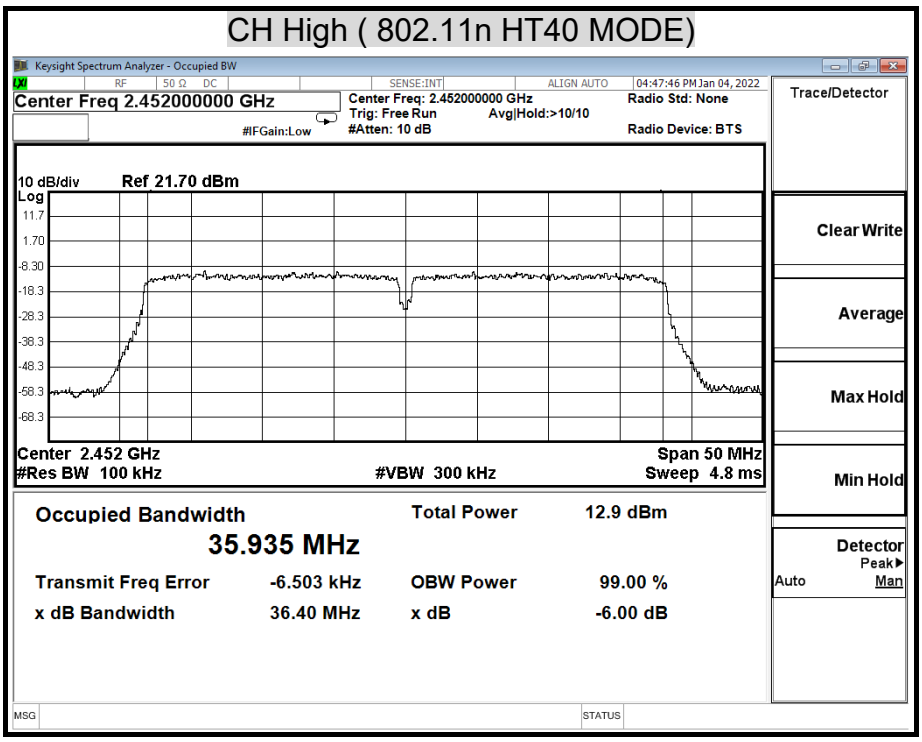
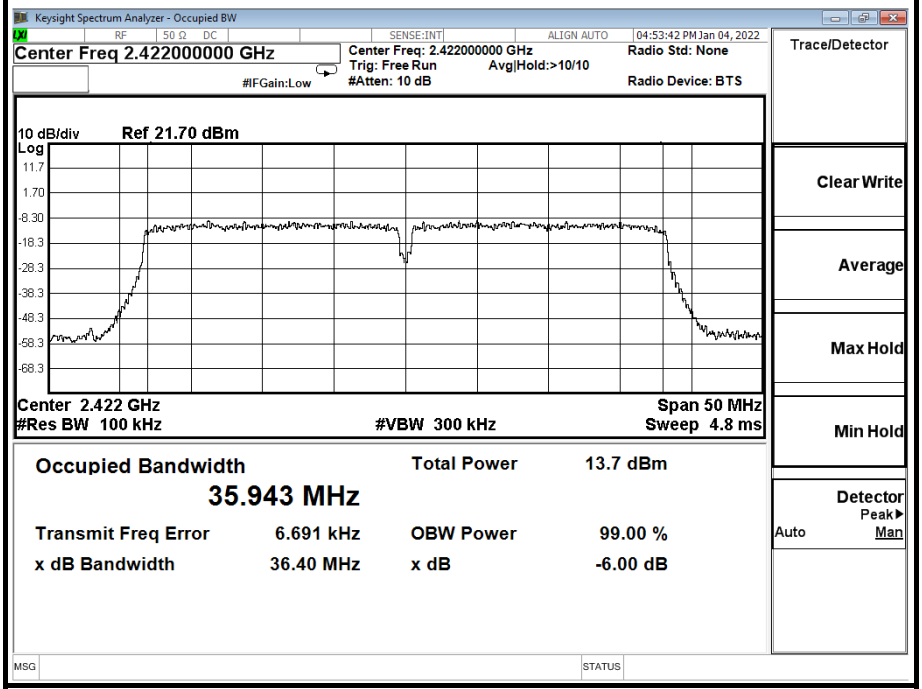
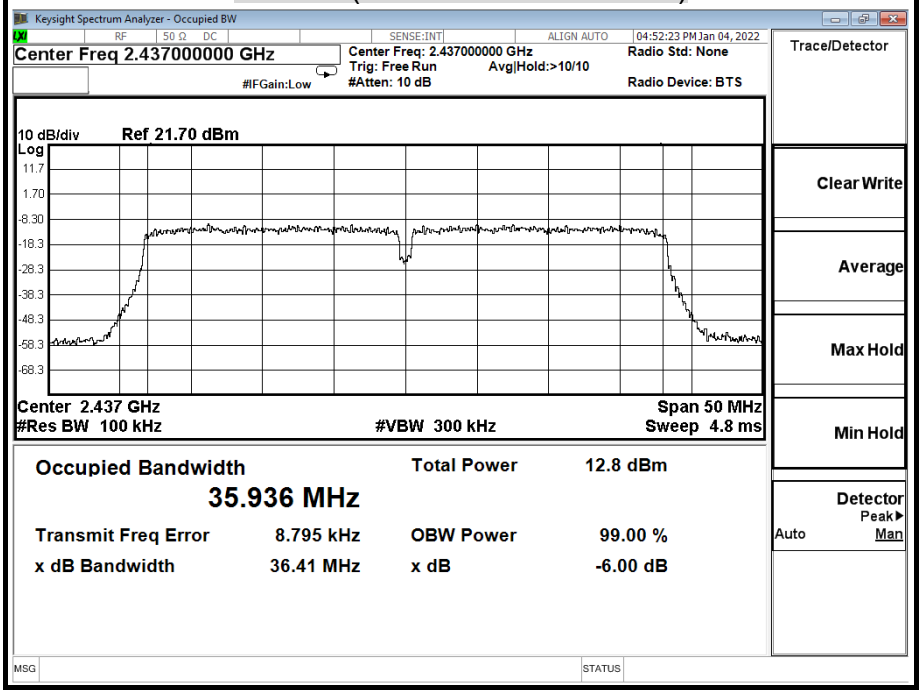


6dB BANDWIDTH (802.11n HT40 MODE) ChainB

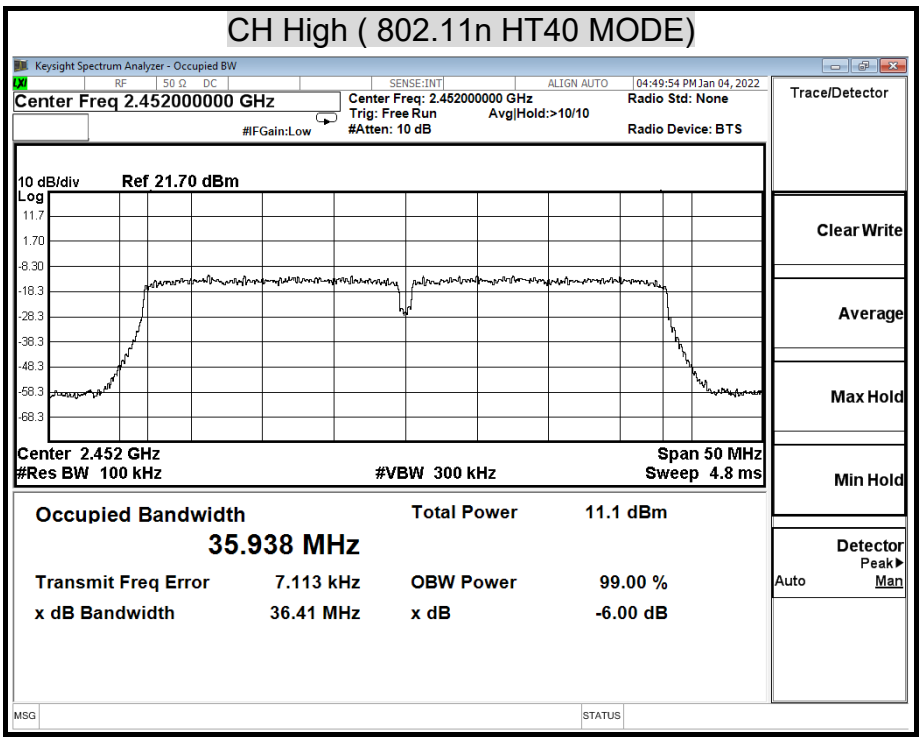
CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)



CH High (802.11n HT40 MODE)



8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

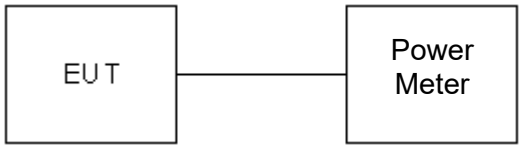
§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2023
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2023
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/29/2021	01/28/2022
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 662911 D01 and KDB 558074 D01 v05r02 8.3.1.

11.9.1.2(ANSI C63.10) Measurement Procedure PK2:

1. Set the RBW = 1 MHz.
2. Set the VBW ≥ 3 RBW
3. Set the span ≥ 1.5 x DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function,
9. Sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

TEST RESULTS

No non-compliance noted

Model Name	DIR-615	Test By	Peter Chu
Temp & Humidity	26.4℃, 60%	Test Date	2021/07/30

IEEE 802.11b mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total		Limit (dBm)	Result
				ChainA	ChainB	(dBm)	(W)		
Low	2412	1	18	12.53	-	12.53	0.0179	30.00	PASS
Middle	2437	1	19	13.14	-	13.14	0.0206		PASS
High	2462	1	19	13.09	-	13.09	0.0204		PASS

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total		Limit (dBm)	Result
				ChainA	ChainB	(dBm)	(W)		
Low	2412	1	18	-	10.82	10.82	0.0121	30.00	PASS
Middle	2437	1	19	-	11.66	11.66	0.0147		PASS
High	2462	1	19	-	11.63	11.63	0.0146		PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total		Limit (dBm)	Result
				ChainA	ChainB	(dBm)	(W)		
Low	2412	6	31	22.80	-	22.80	0.1905	30.00	PASS
Middle	2437	6	28	21.26	-	21.26	0.1337		PASS
High	2462	6	25	19.87	-	19.87	0.0971		PASS

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total		Limit (dBm)	Result
				ChainA	ChainB	(dBm)	(W)		
Low	2412	6	31	-	21.32	21.32	0.1355	30.00	PASS
Middle	2437	6	28	-	20.18	20.18	0.1042		PASS
High	2462	6	25	-	18.40	18.40	0.0692		PASS

NOTE : 1.At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total		Limit (dBm)	Result
				ChainA	ChainB	(dBm)	(W)		
Low	2412	MCS8	27	20.18	18.86	22.58	0.1811	27.99	PASS
Middle	2437	MCS8	25	19.49	18.06	21.84	0.1529		PASS
High	2462	MCS8	23	18.34	16.82	20.66	0.1163		PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT40 mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total		Limit (dBm)	Result
				ChainA	ChainB	(dBm)	(W)		
Low	2422	MCS8	24	19.18	17.76	21.54	0.1425	27.99	PASS
Middle	2437	MCS8	23	18.58	16.92	20.84	0.1213		PASS
High	2452	MCS8	21	17.13	15.34	19.34	0.0858		PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

Average Power Data

IEEE 802.11b mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total	
				ChainA	ChainB	(dBm)	(W)
Low	2412	1	18	9.92	-	9.92	0.0098
Middle	2437	1	19	10.60	-	10.60	0.0115
High	2462	1	19	10.54	-	10.54	0.0113

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total	
				ChainA	ChainB	(dBm)	(W)
Low	2412	1	18	-	8.26	8.26	0.0067
Middle	2437	1	19	-	8.37	8.37	0.0069
High	2462	1	19	-	8.26	8.26	0.0067

IEEE 802.11g mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total	
				ChainA	ChainB	(dBm)	(W)
Low	2412	6	31	12.92	-	12.92	0.0196
Middle	2437	6	28	11.22	-	11.22	0.0132
High	2462	6	25	9.72	-	9.72	0.0094

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total	
				ChainA	ChainB	(dBm)	(W)
Low	2412	6	31	-	10.37	10.37	0.0109
Middle	2437	6	28	-	9.12	9.12	0.0082
High	2462	6	25	-	7.53	7.53	0.0057

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total	
				ChainA	ChainB	(dBm)	(W)
Low	2412	MCS8	27	10.14	8.14	12.26	0.0168
Middle	2437	MCS8	25	9.35	7.35	11.47	0.0140
High	2462	MCS8	23	8.15	6.05	10.24	0.0106

IEEE 802.11n HT40 mode

Channel	Frequency (MHz)	Data Rate	Power Set	Output Power (dBm)		Output Power Total	
				ChainA	ChainB	(dBm)	(W)
Low	2422	MCS8	24	9.08	7.35	11.31	0.0135
Middle	2437	MCS8	23	8.32	6.57	10.54	0.0113
High	2452	MCS8	21	6.86	5.26	9.14	0.0082

8.3 DUTY CYCLE

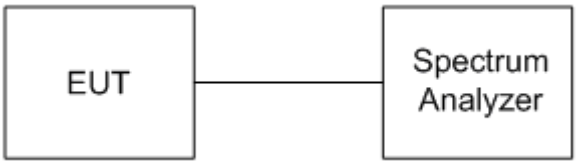
LIMIT

Nil (No dedicated limit specified in the Rules)

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2023
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2023
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/29/2021	01/28/2022
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

TEST RESULTS

No non-compliance noted.

TEST DATA

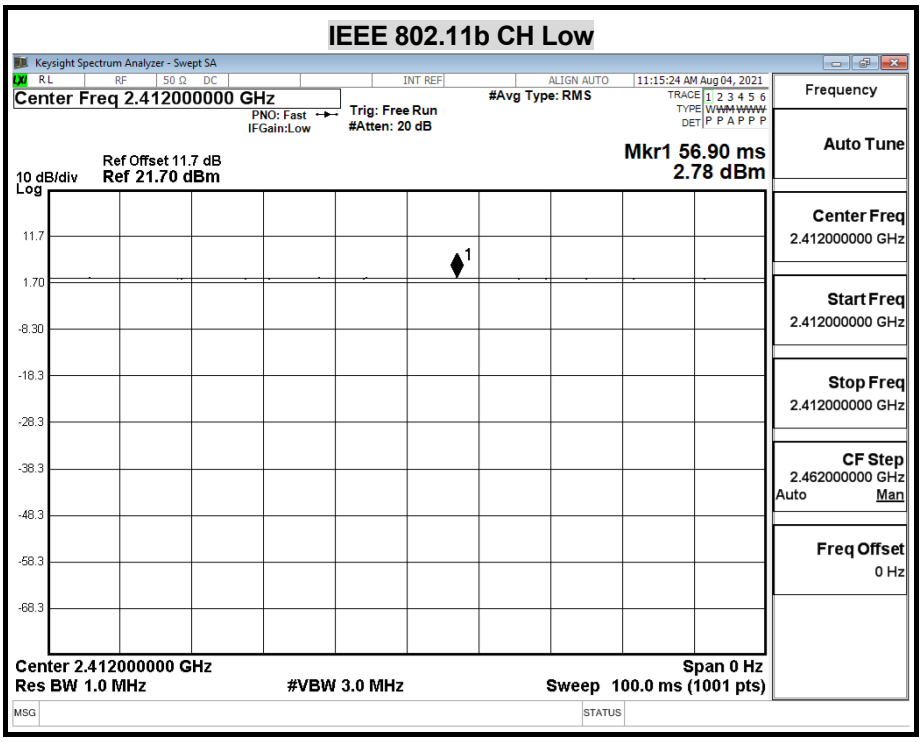
Model Name	DIR-615	Test By	Peter Chu
Temp & Humidity	26.4℃, 60%	Test Date	2021/07/30

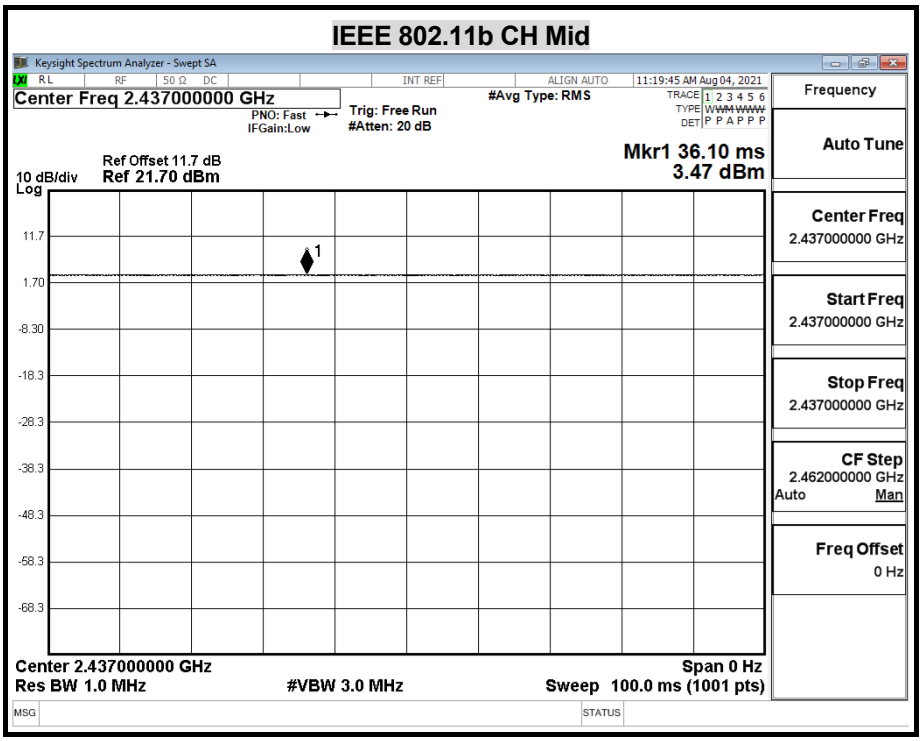
	us	Times	Ton	Total Ton time(ms)
Ton1	100000.000	1	100000	
Ton2		0	0	
Ton3			0	100
Tp				100

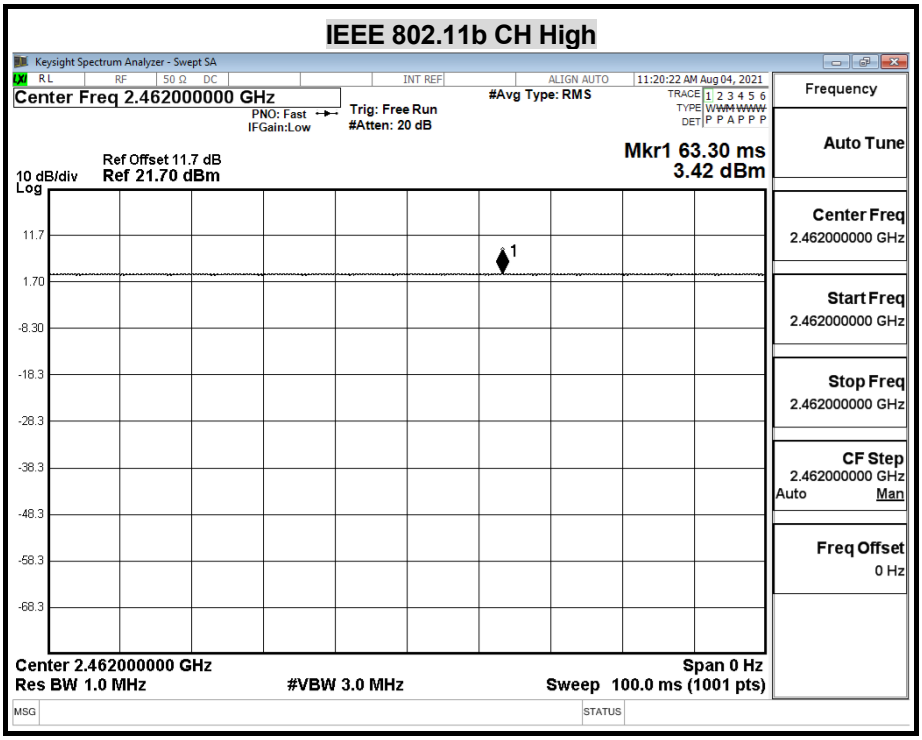
Ton	100
Tp(Ton+Toff)	100
Duty Cycle	1
10 * log (1/x) =	0

TEST PLOT

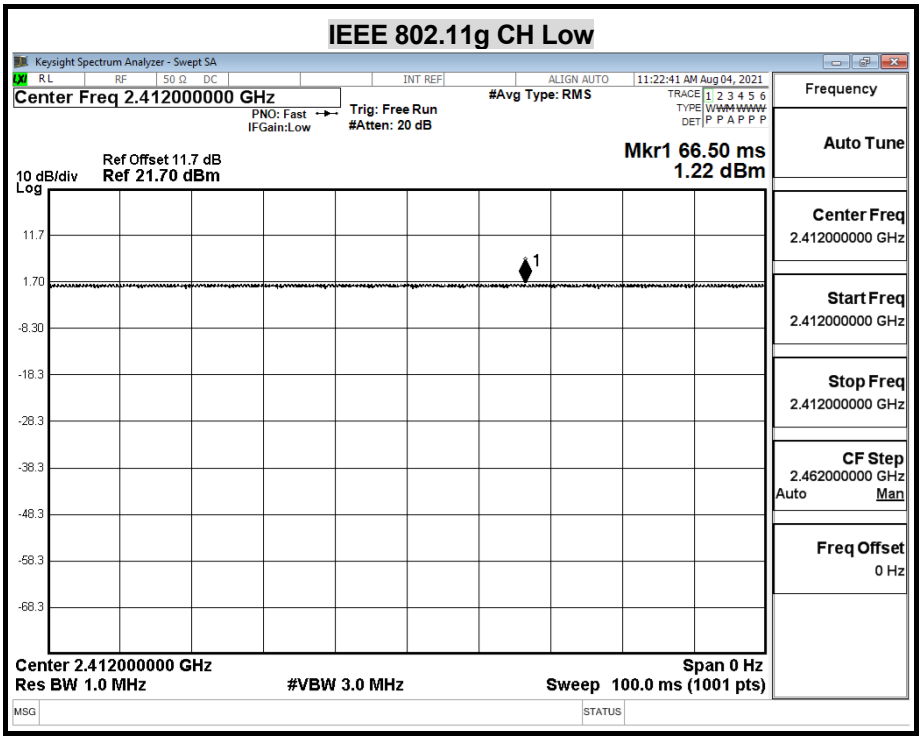
Plot



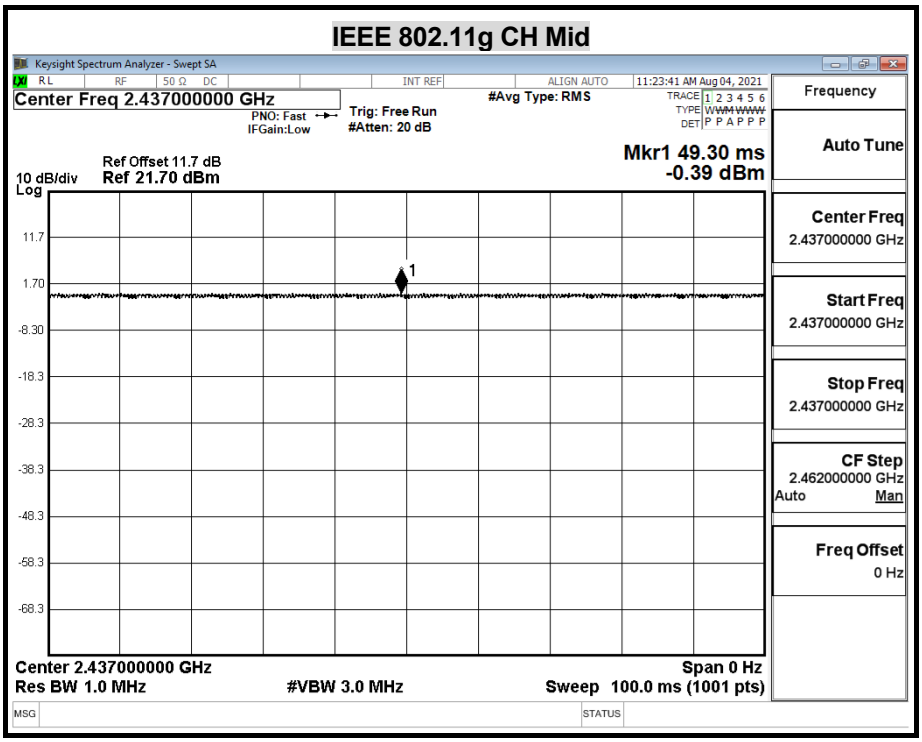


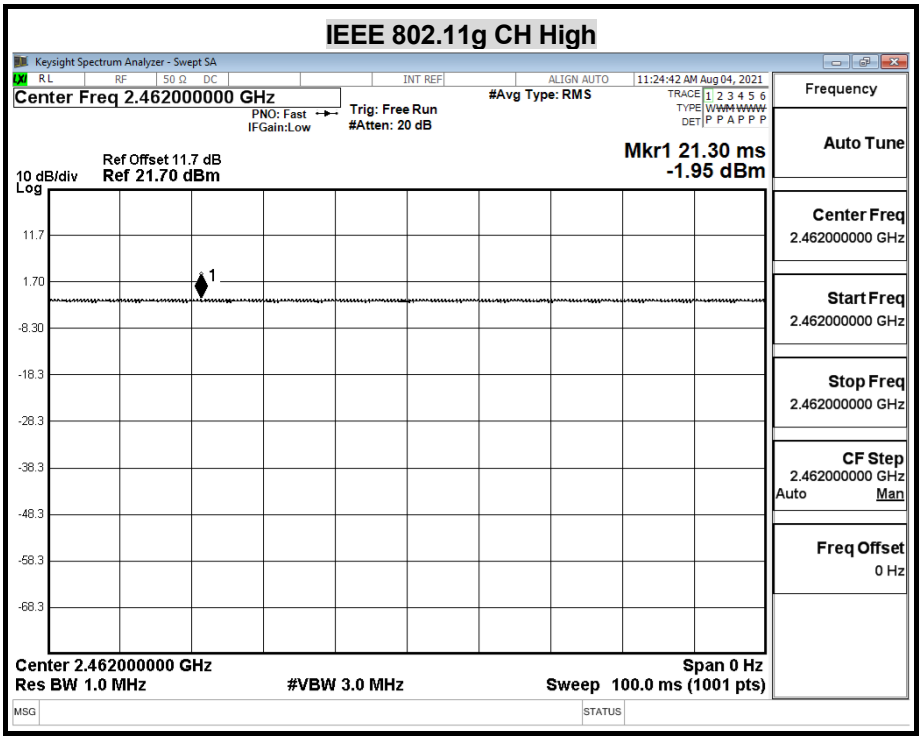


IEEE 802.11g CH Low

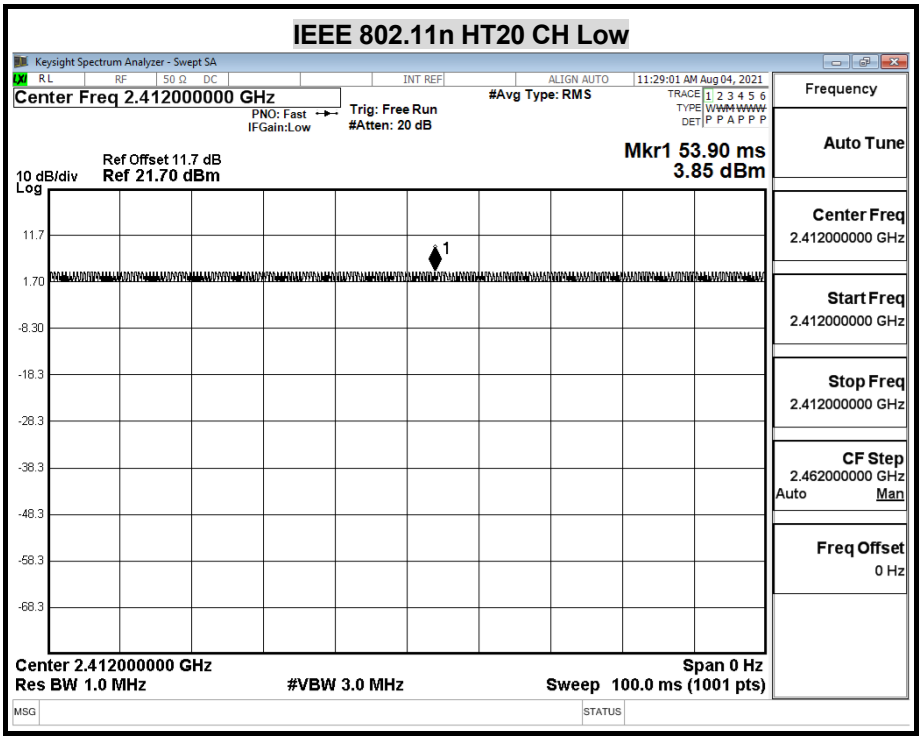


IEEE 802.11g CH Mid

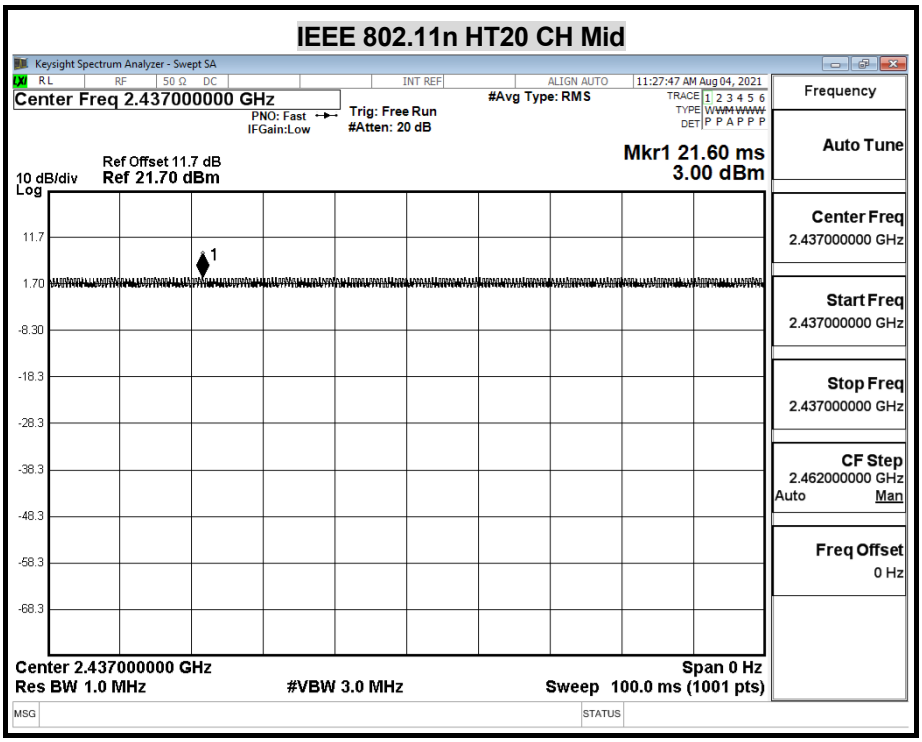


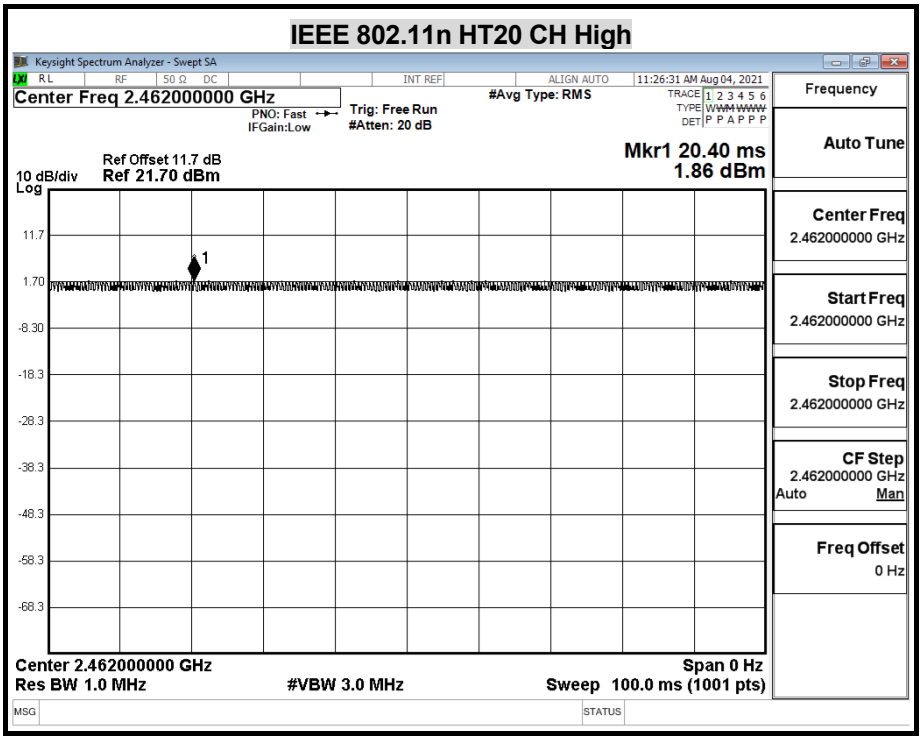


IEEE 802.11n HT20 CH Low

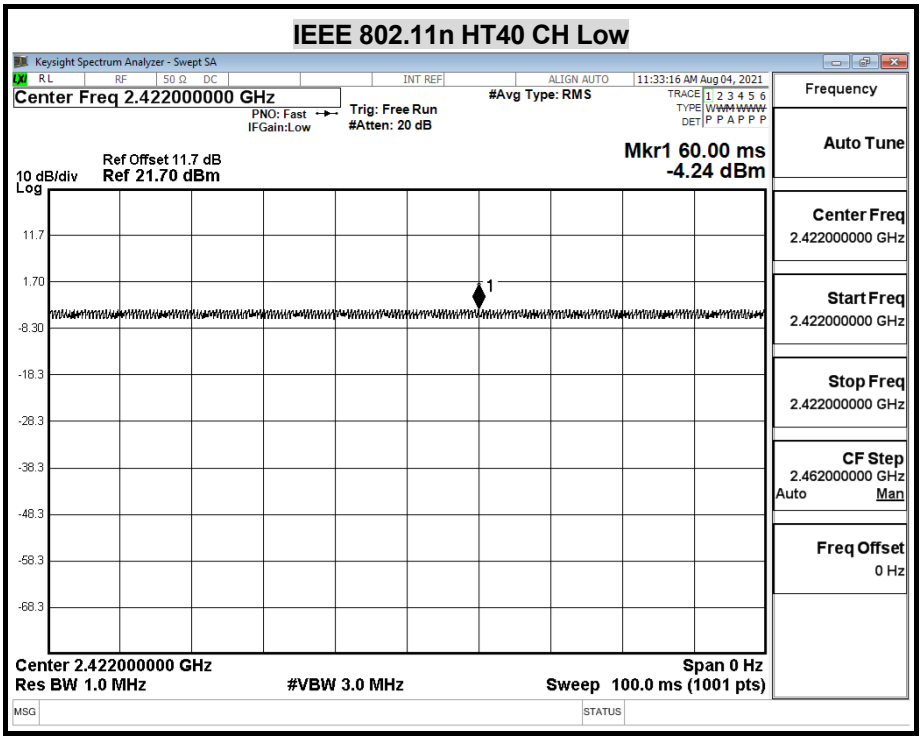


IEEE 802.11n HT20 CH Mid

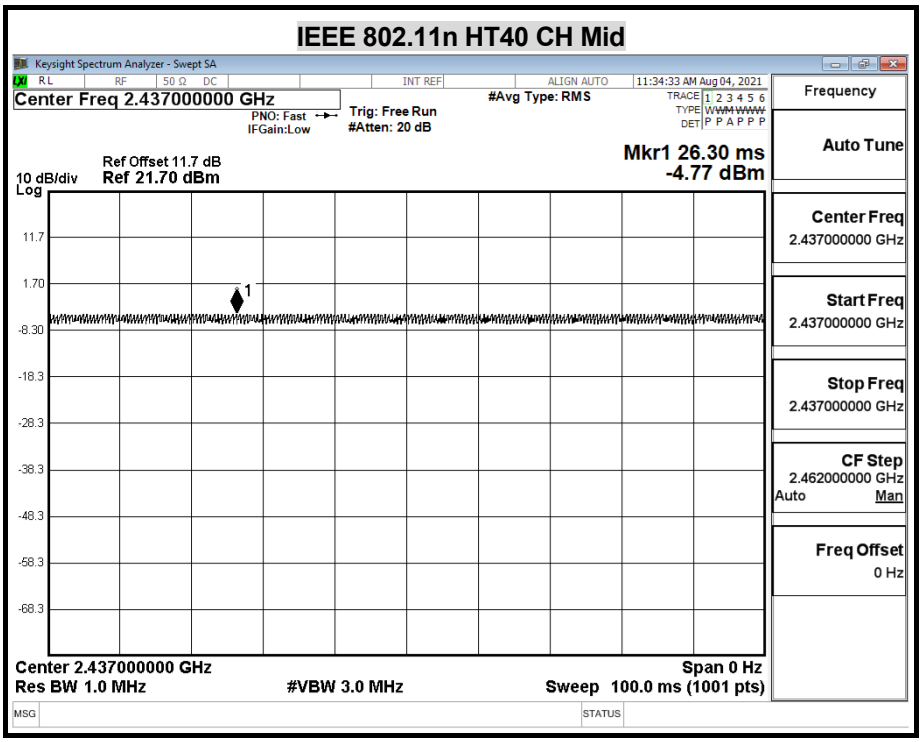


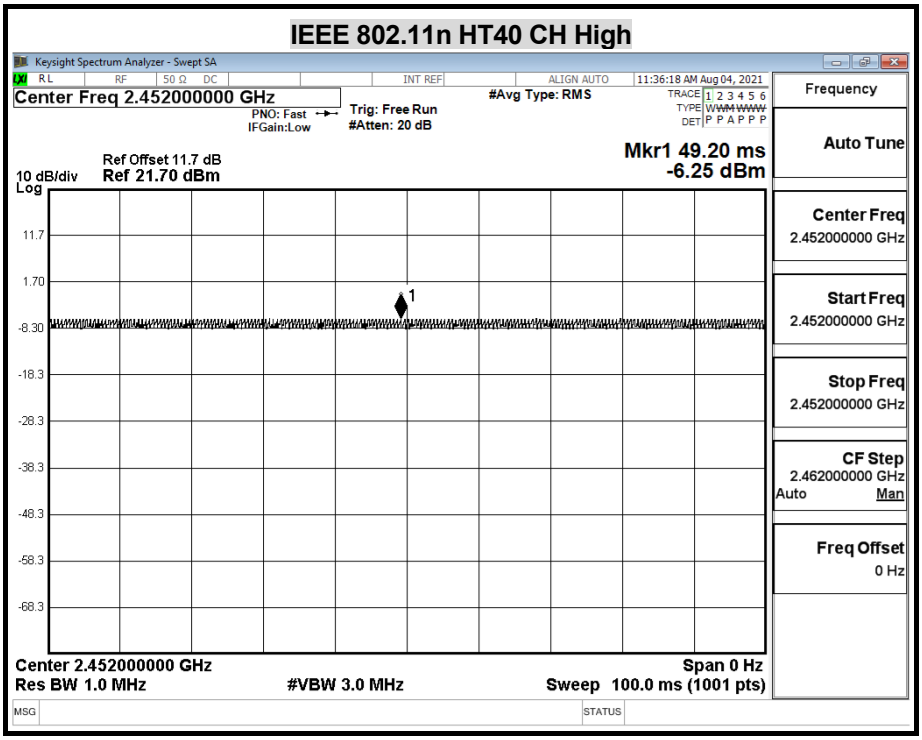


IEEE 802.11n HT40 CH Low



IEEE 802.11n HT40 CH Mid





8.4 POWER SPECTRAL DENSITY

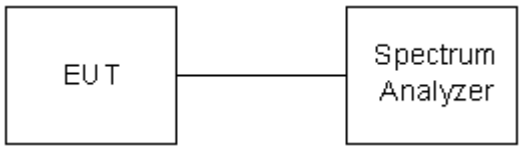
LIMIT

§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2023
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2023
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/29/2021	01/28/2022
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 662911 D01 and KDB 558074 D01 v05r02 8.4.

11.10.2 (ANSI C63.10) Measurement Procedure PKPSD:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST RESULTS

Model Name	DIR-615	Test By	Peter Chu
Temp & Humidity	26.4℃, 60%	Test Date	2021/07/30

IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD/3kHz ChainA (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-20.86	8.00	-28.86	PASS
Middle	2437	-20.33	8.00	-28.33	PASS
High	2462	-20.45	8.00	-28.45	PASS

NOTE : 1. At finial test to get the worst-case emission at 1long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD/3kHz ChainA (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-16.69	8.00	-24.69	PASS
Middle	2437	-18.36	8.00	-26.36	PASS
High	2462	-19.80	8.00	-27.80	PASS

NOTE : 1. At finial test to get the worst-case emission at 6Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	PPSD/3kHz ChainA (dBm)	PPSD/3kHz ChainB (dBm)	PPSD/3kHz Total (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-16.99	-19.06	-14.89	8.00	-22.89	PASS
Middle	2437	-17.80	-19.51	-15.56	8.00	-23.56	PASS
High	2462	-19.18	-20.66	-16.84	8.00	-24.84	PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

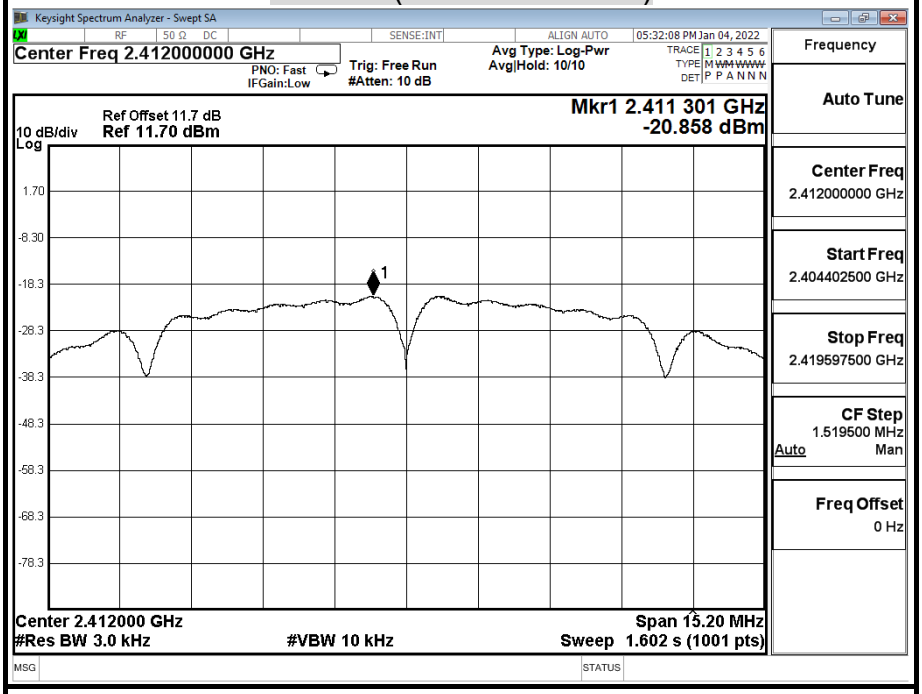
IEEE 802.11n HT40 mode

Channel	Frequency (MHz)	PPSD/3kHz ChainA (dBm)	PPSD/3kHz ChainB (dBm)	PPSD/3kHz Total (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2422	-20.02	-23.72	-18.47	8.00	-26.47	PASS
Middle	2437	-20.98	-24.60	-19.41	8.00	-27.41	PASS
High	2452	-22.24	-25.96	-20.70	8.00	-28.70	PASS

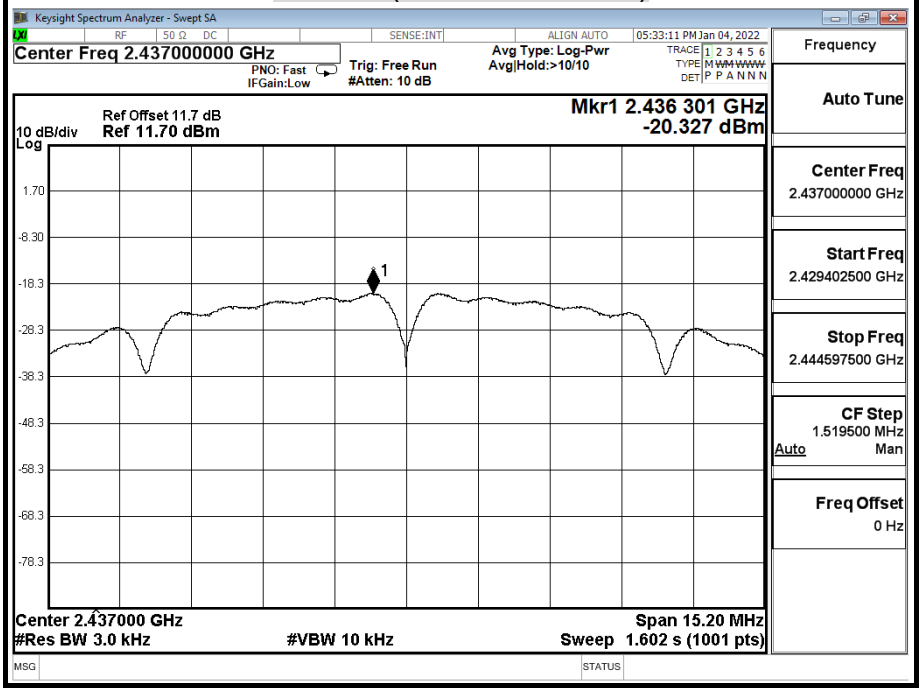
NOTE : 1. At finial test to get the worst-case emission at 13Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

POWER SPECTRAL DENSITY (IEEE 802.11b MODE)

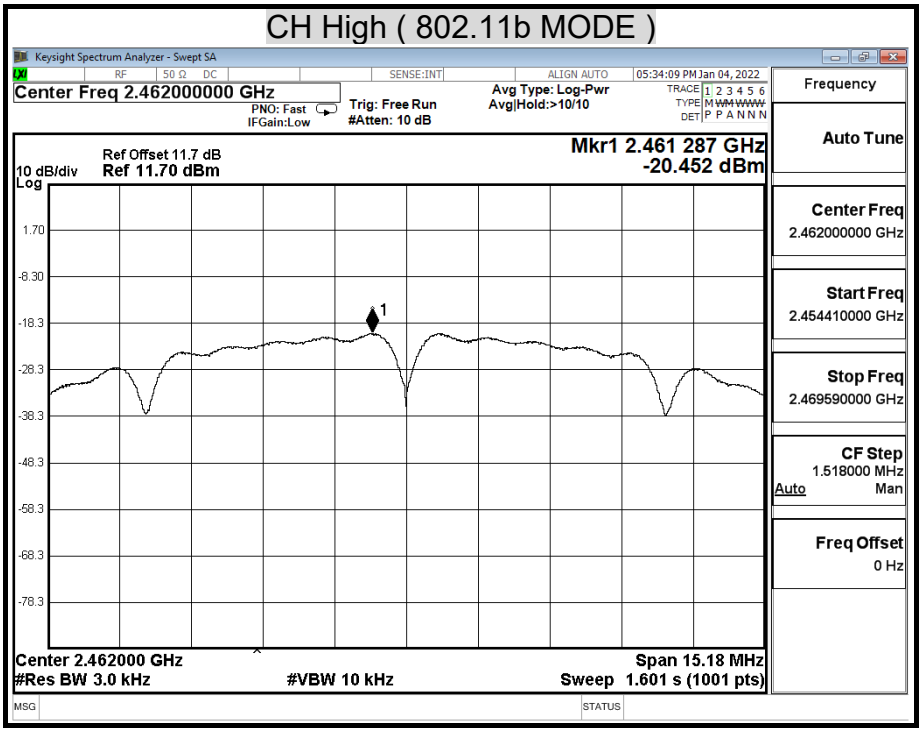
CH Low (802.11b MODE)



CH Mid (802.11b MODE)

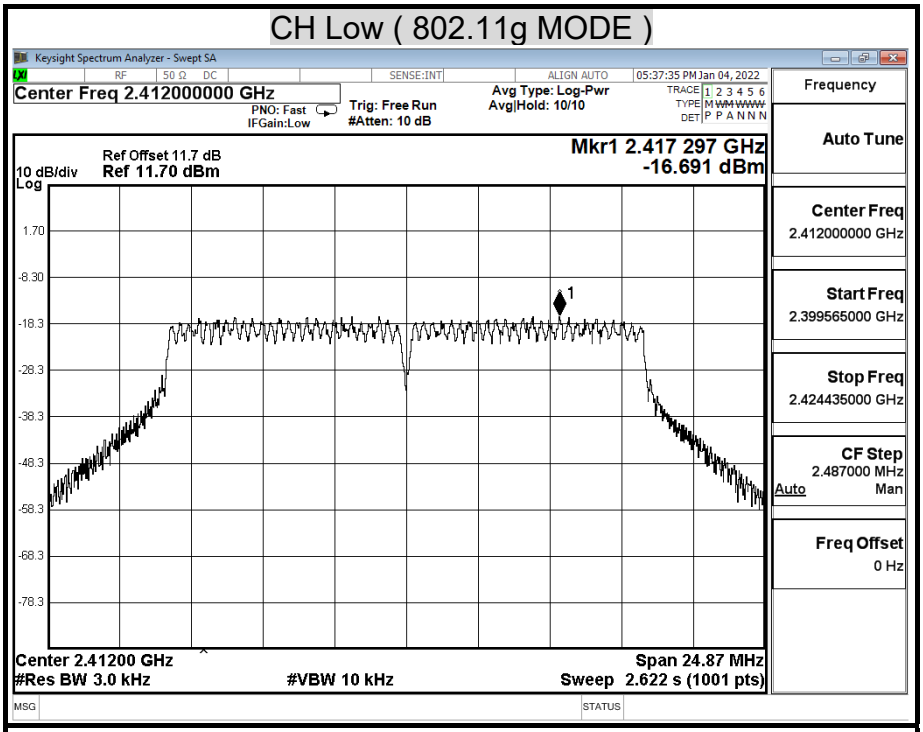


CH High (802.11b MODE)

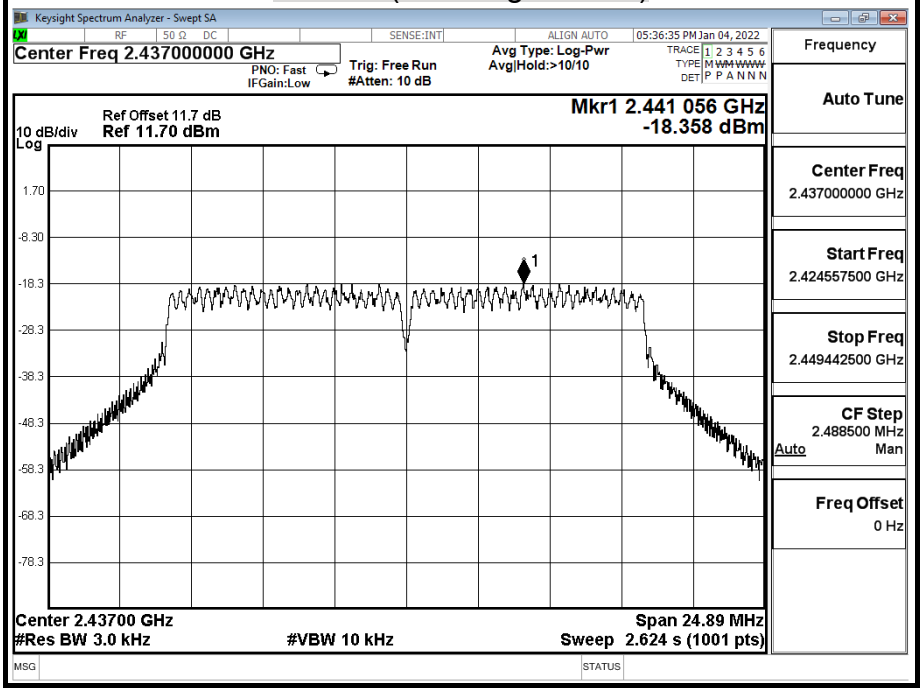


POWER SPECTRAL DENSITY (IEEE 802.11g MODE)

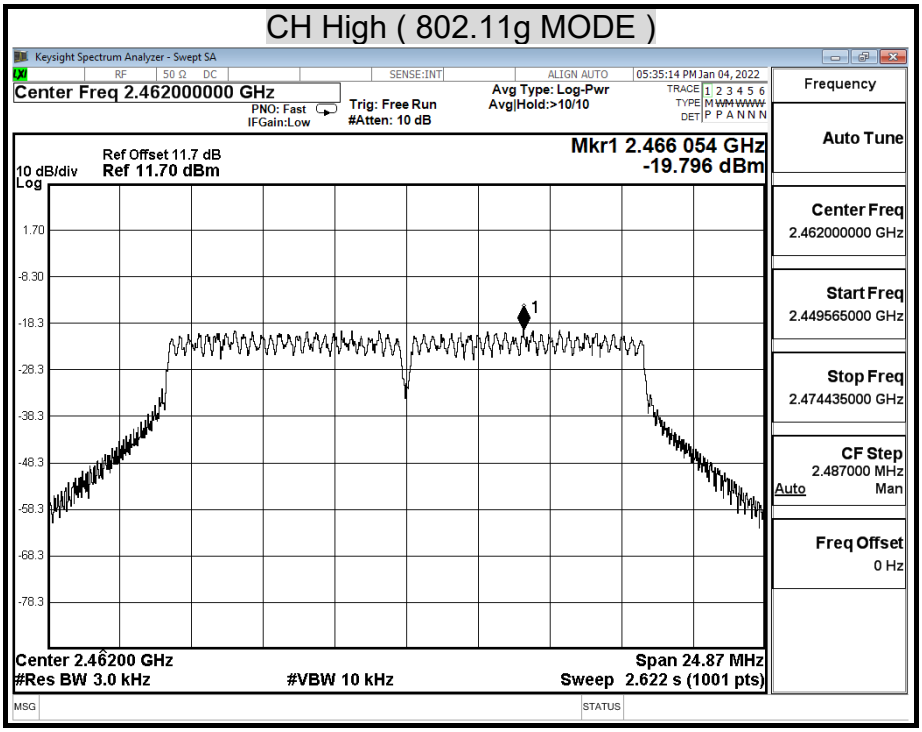
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

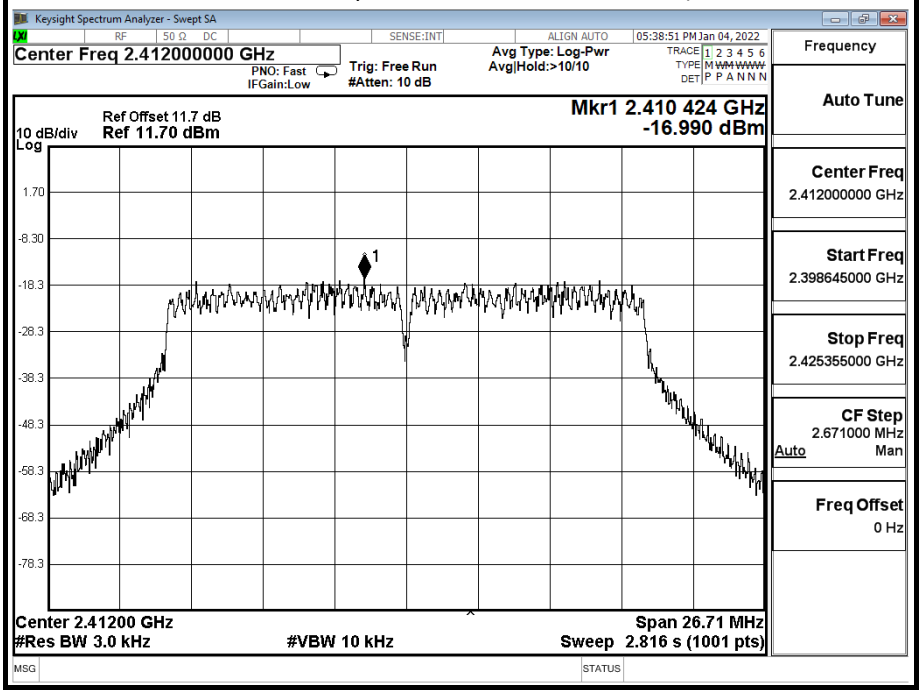


CH High (802.11g MODE)

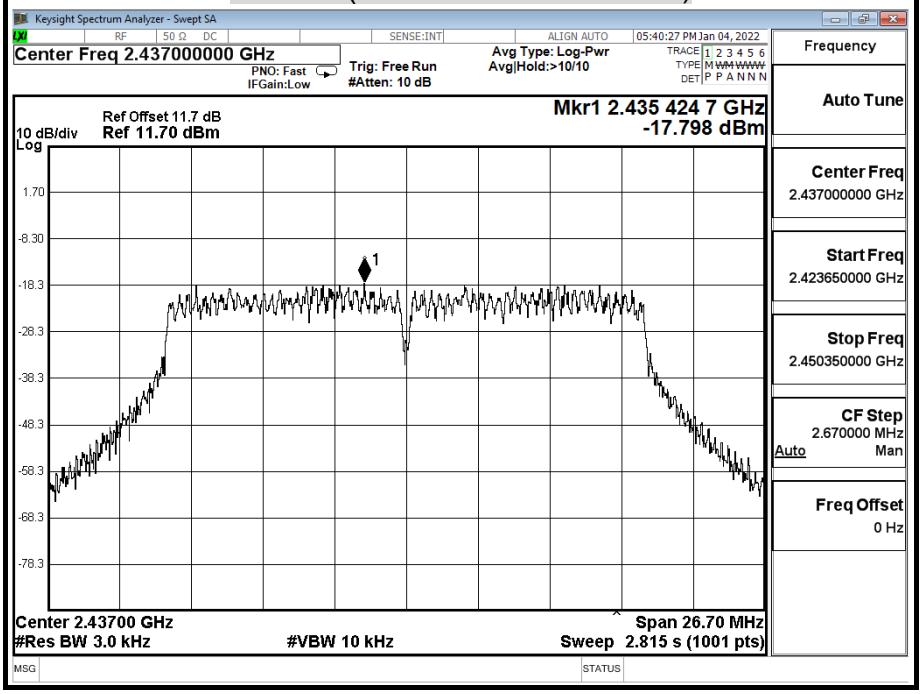


POWER SPECTRAL DENSITY (802.11n HT20 MODE) ChainA

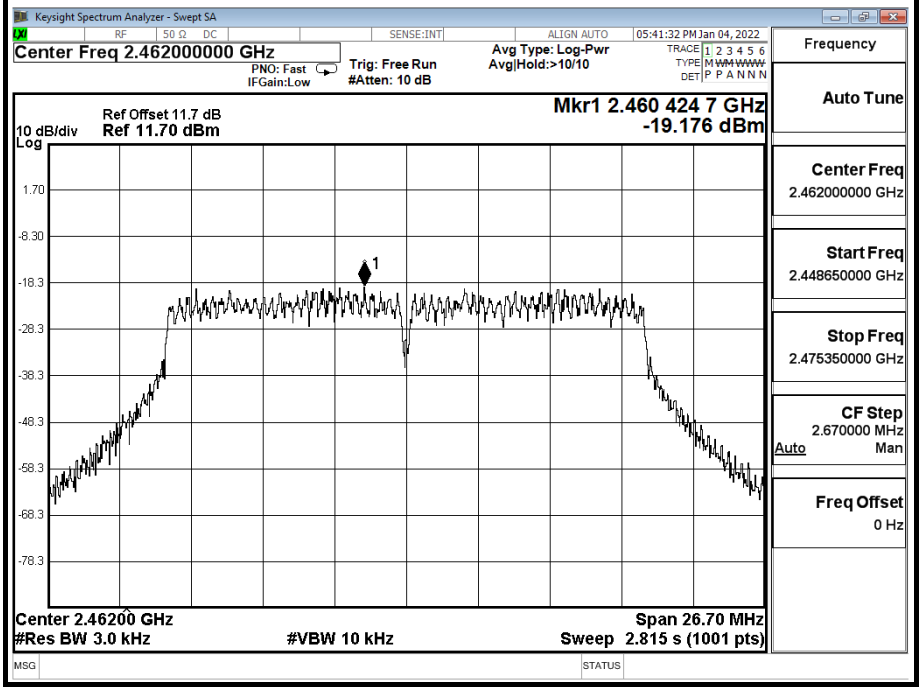
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

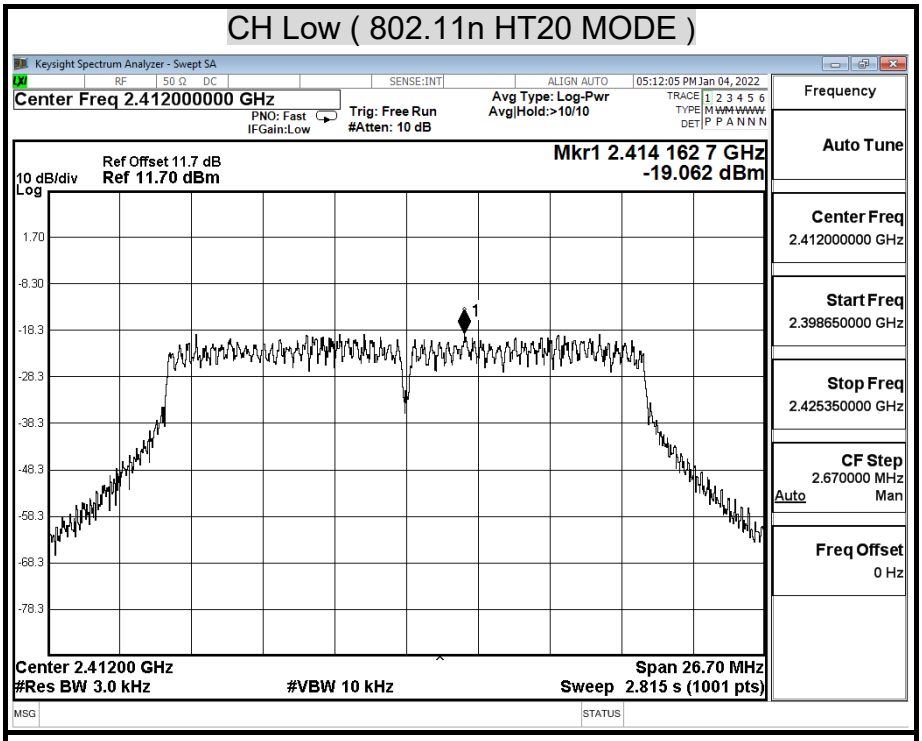


CH High (802.11n HT20 MODE)

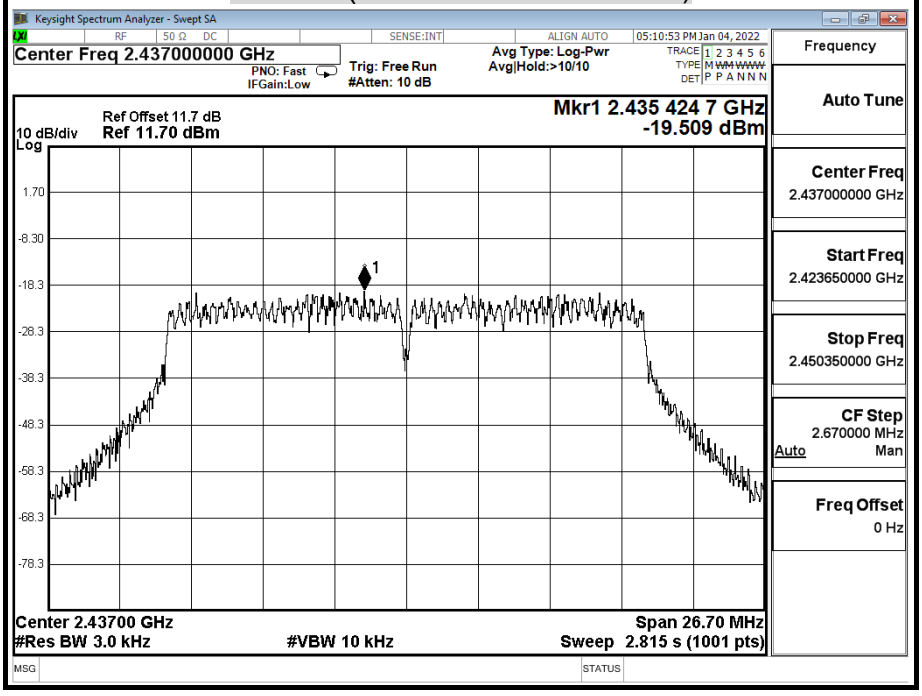


POWER SPECTRAL DENSITY (802.11n HT20 MODE) ChainB

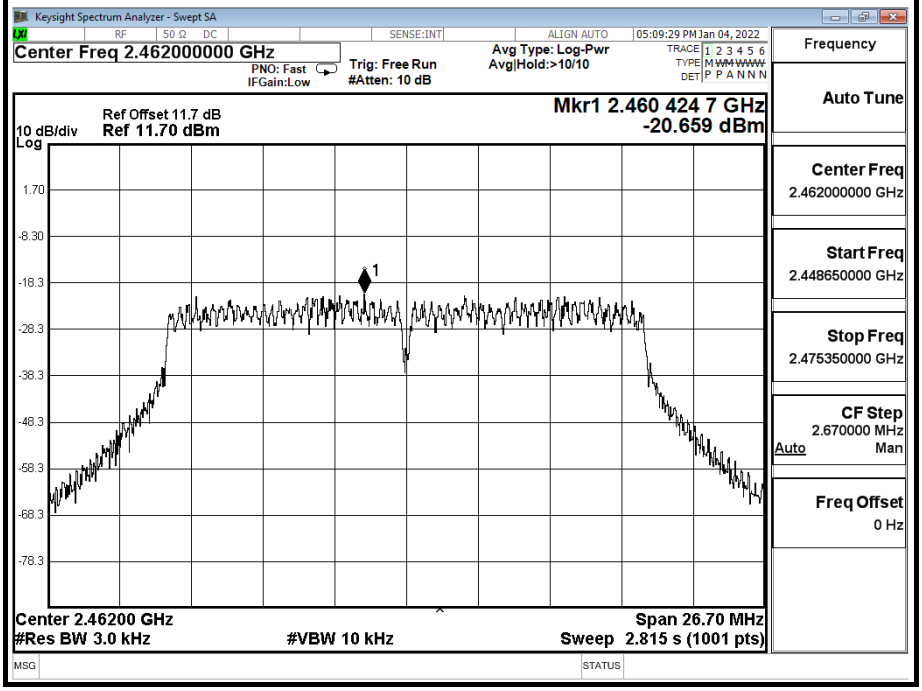
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

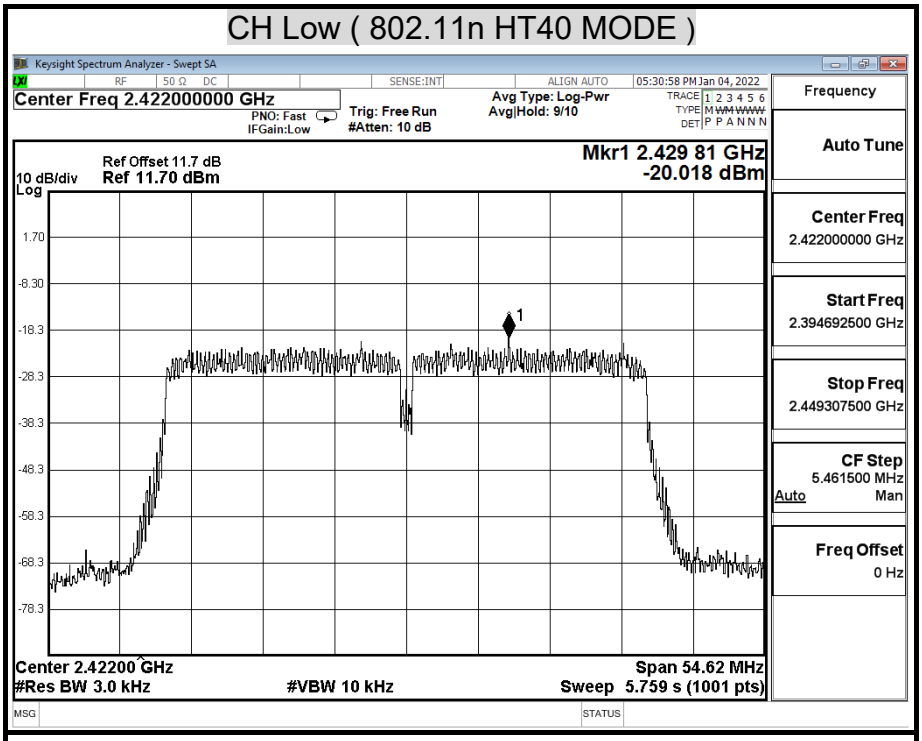


CH High (802.11n HT20 MODE)

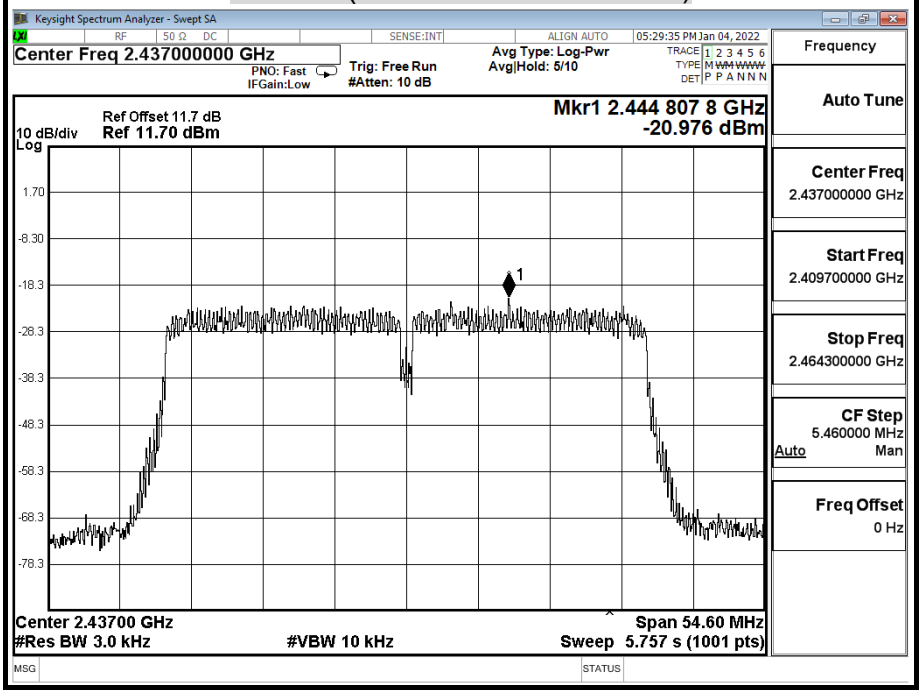


POWER SPECTRAL DENSITY (IEEE 802.11n HT40 MODE) ChainA

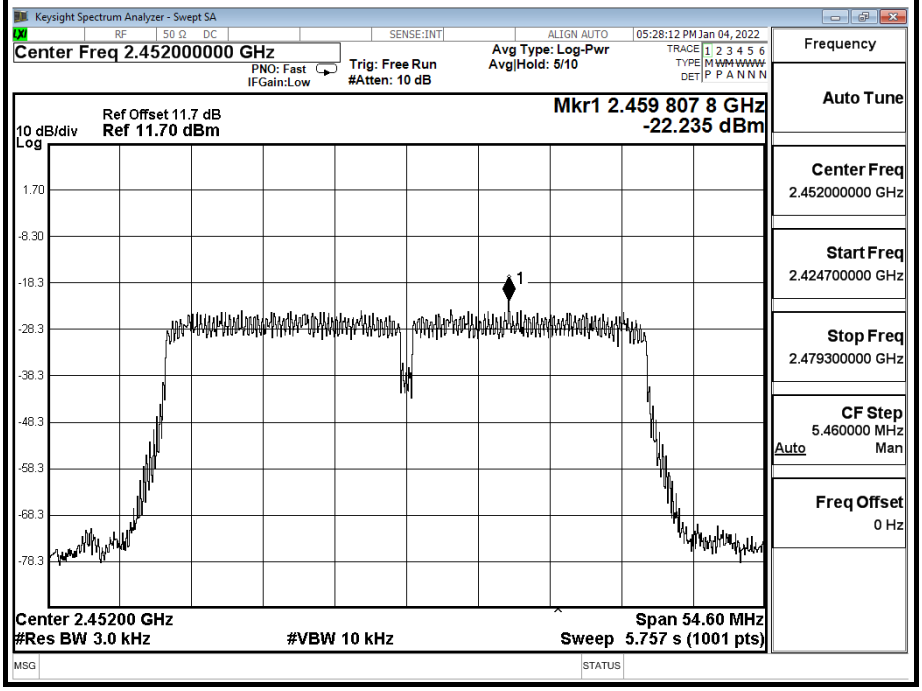
CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)

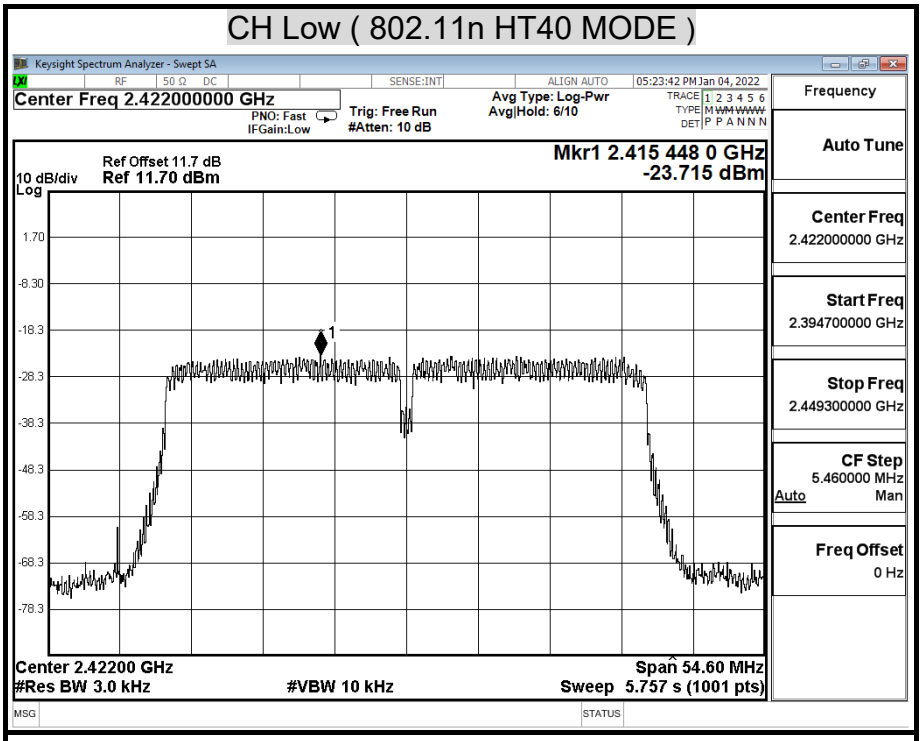


CH High (802.11n HT40 MODE)

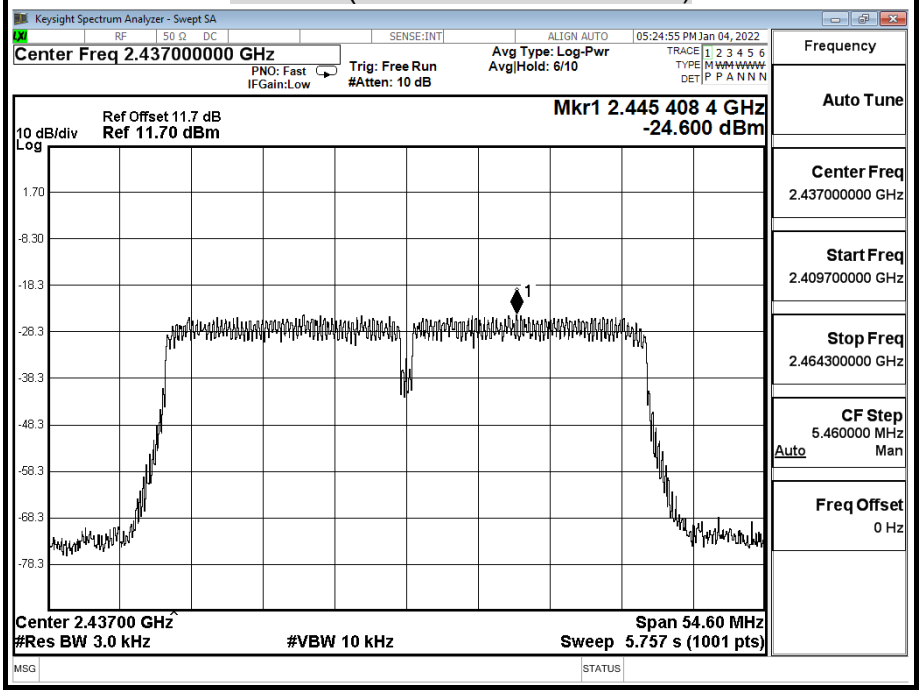


POWER SPECTRAL DENSITY (IEEE 802.11n HT40 MODE) ChainB

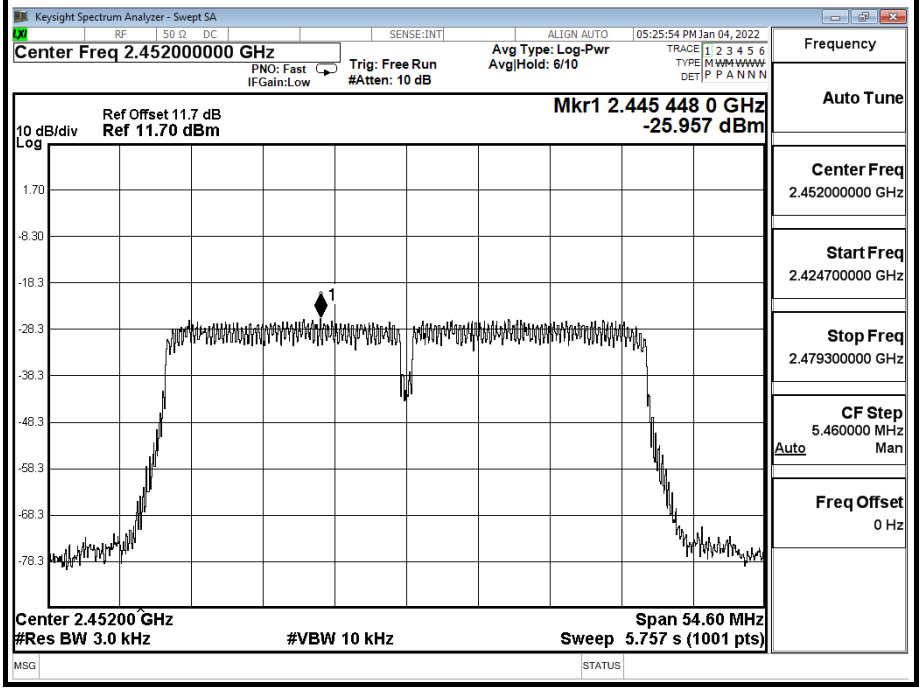
CH Low (802.11n HT40 MODE)



CH Mid (802.11n HT40 MODE)



CH High (802.11n HT40 MODE)



8.5 CONDUCTED SPURIOUS EMISSION

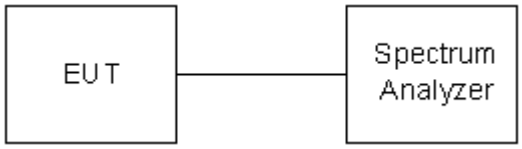
LIMITS

§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 and that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	07/22/2021	07/21/2022
Power Meter	Anritsu	ML2487A	6K00003888	05/18/2021	05/17/2023
Power Sensor	Anritsu	MA2491A	033265	05/18/2021	05/17/2023
SMA Cable + 10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/29/2021	01/28/2022
Software	Excel(ccs-o6-2020 v1.1)				

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

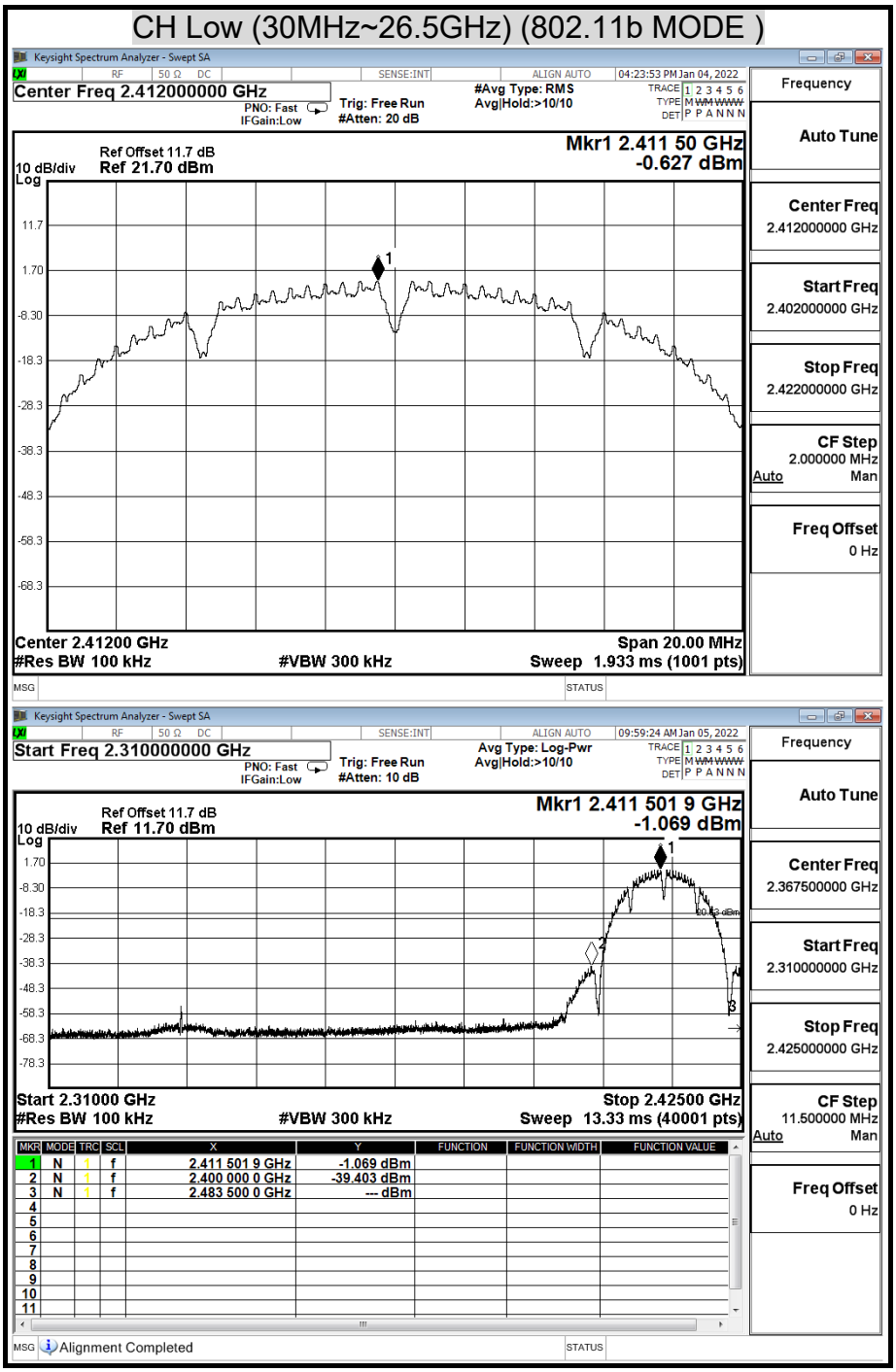
TEST RESULTS

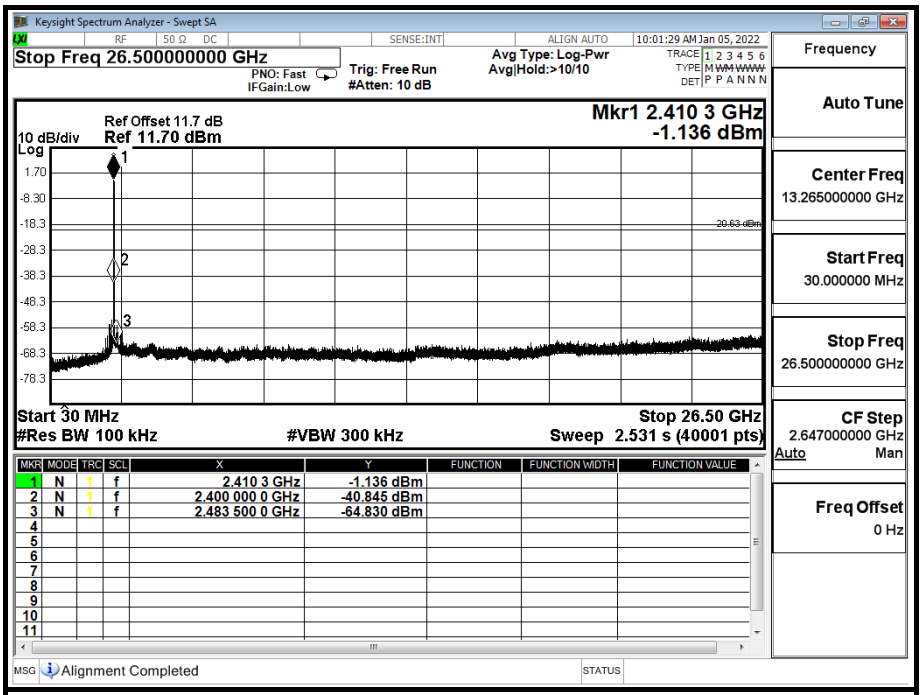
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

Model Name	DIR-615	Test By	Peter Chu
Temp & Humidity	26.4℃, 60%	Test Date	2021/07/30

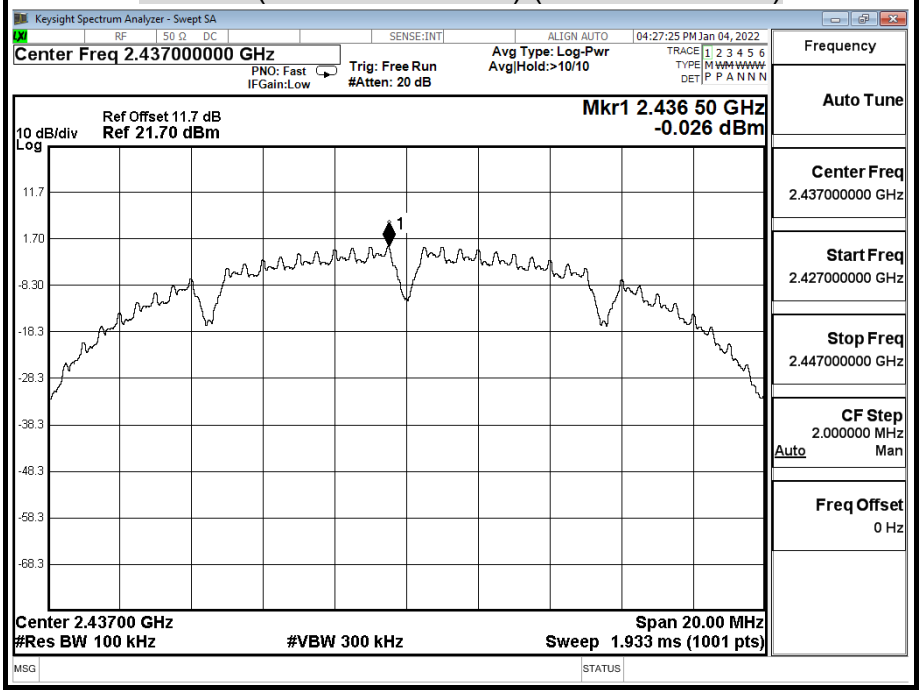
(IEEE 802.11b MODE)

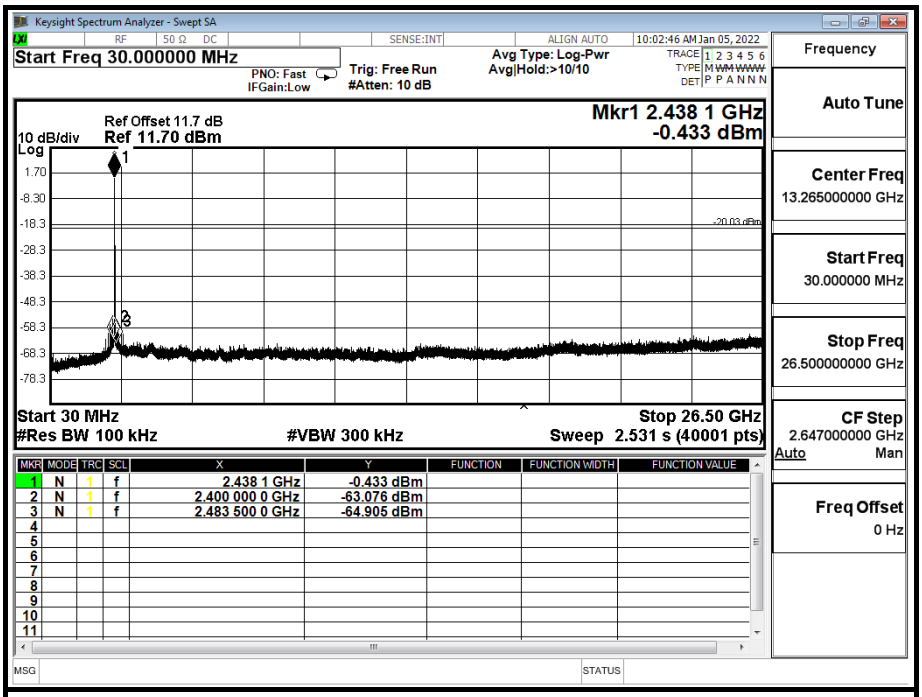
CH Low (30MHz~26.5GHz) (802.11b MODE)



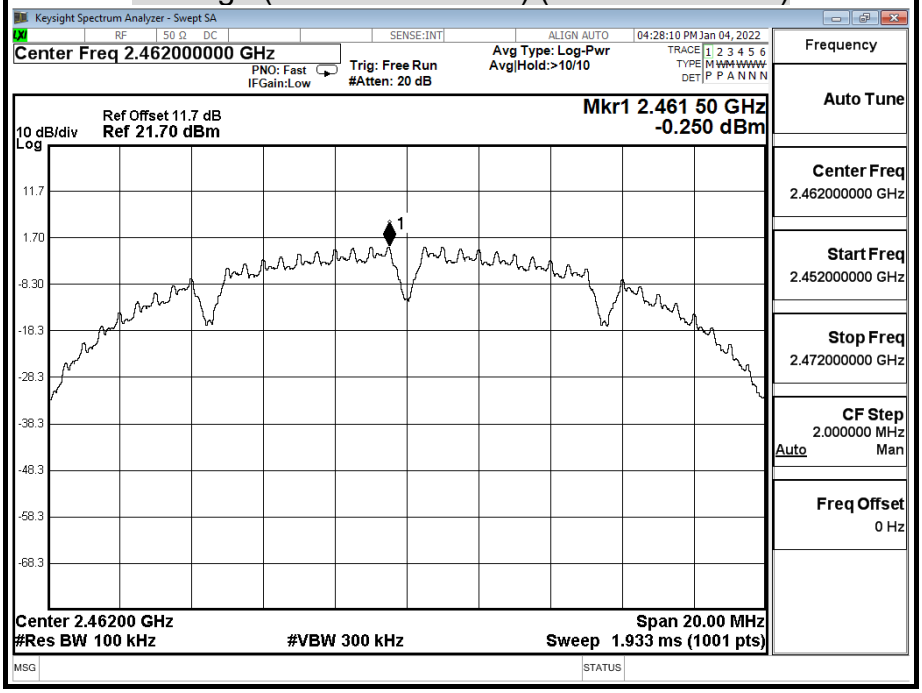


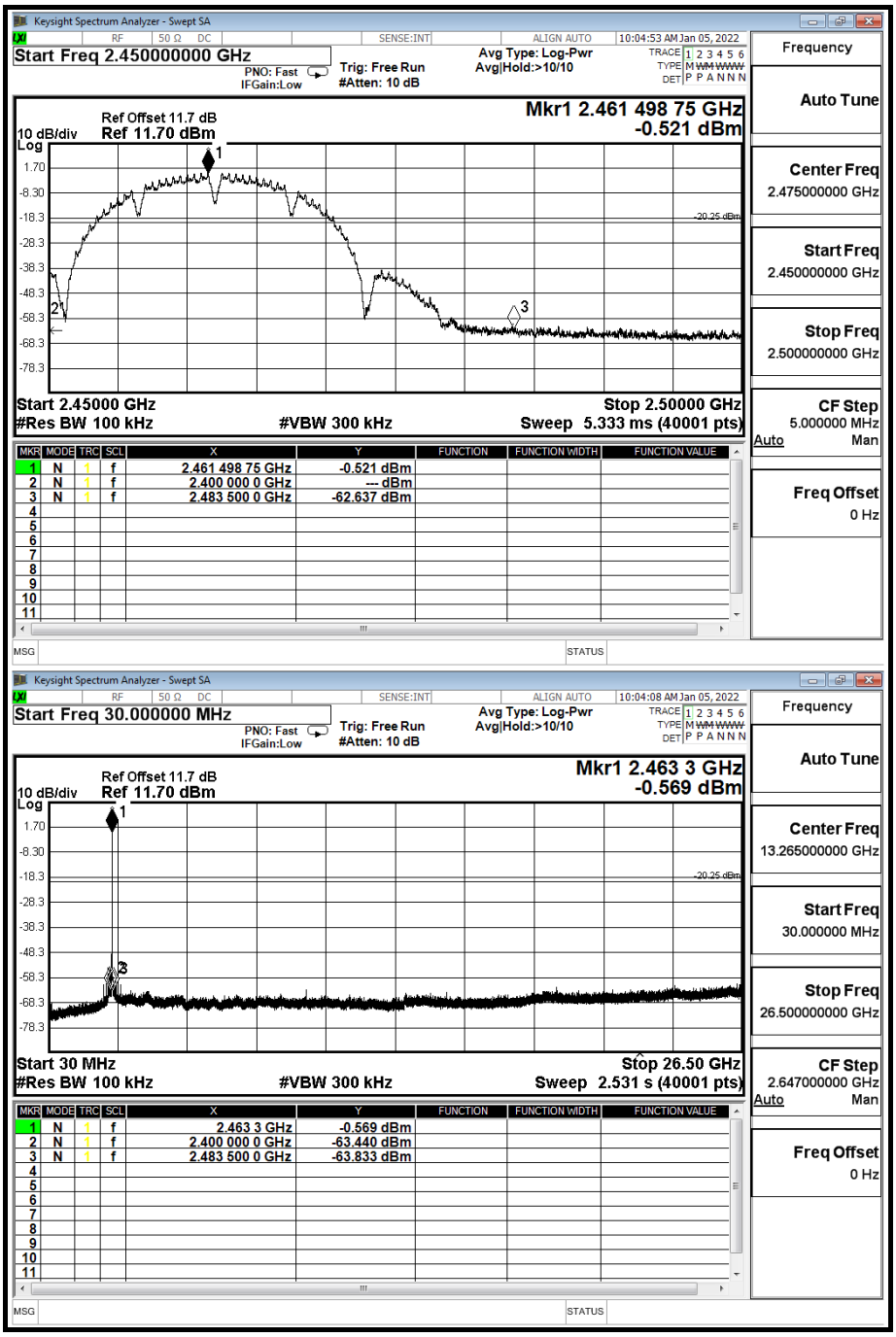
CH Mid (30MHz~26.5GHz) (802.11b MODE)





CH High (30MHz~26.5GHz) (802.11b MODE)

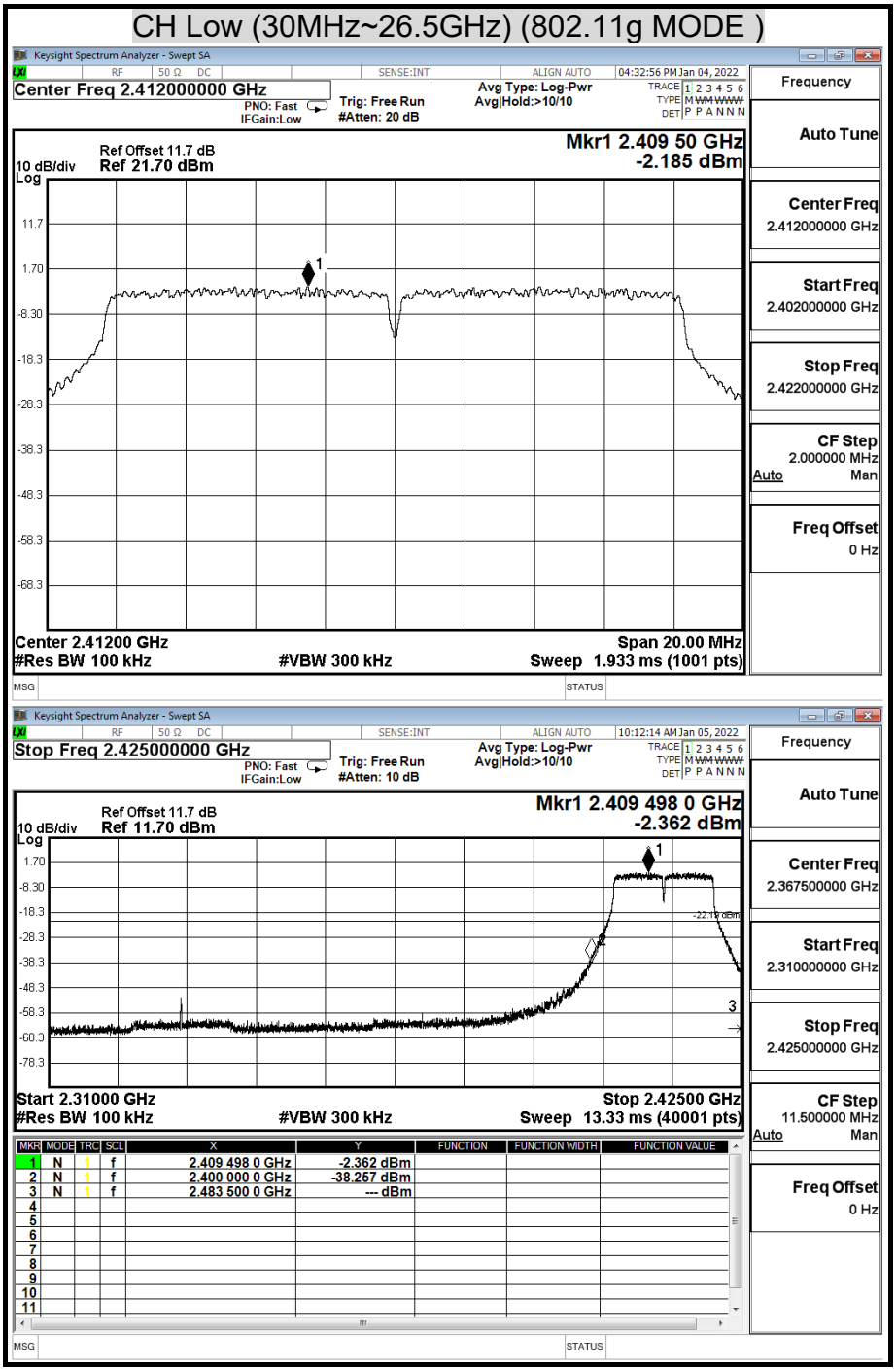


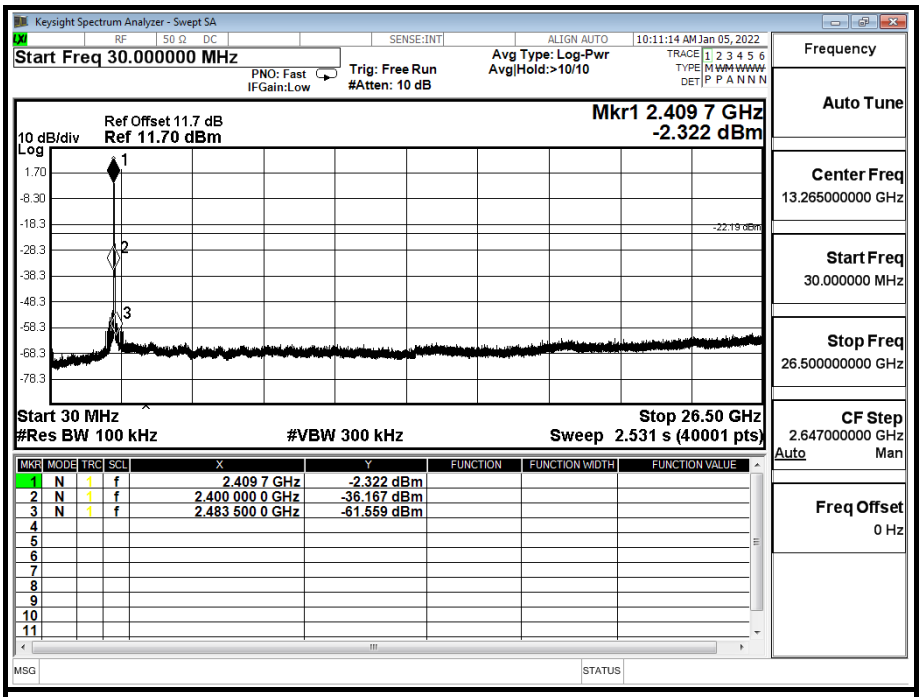


OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

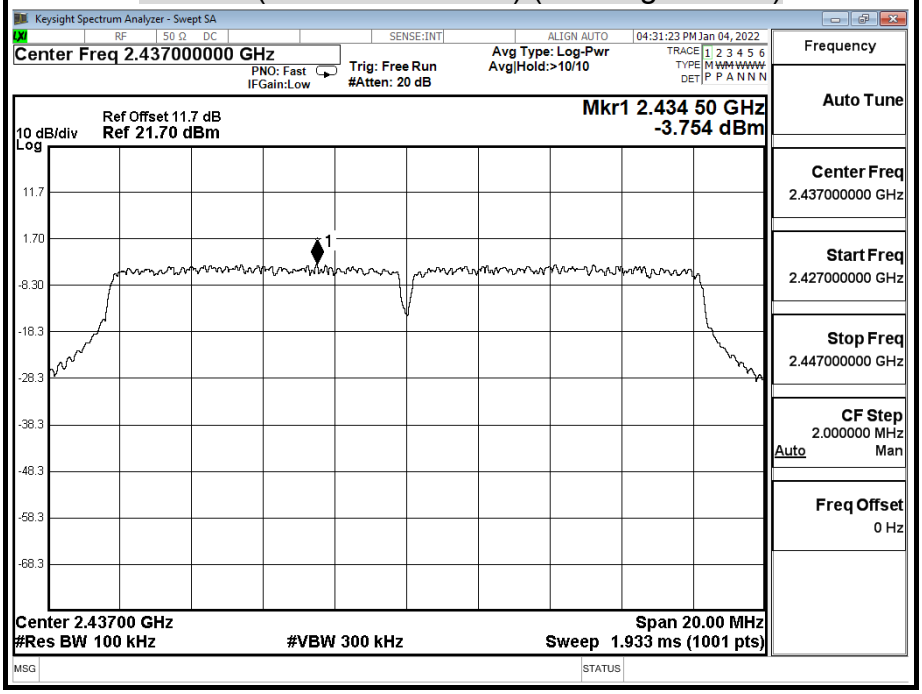
(802.11g MODE)

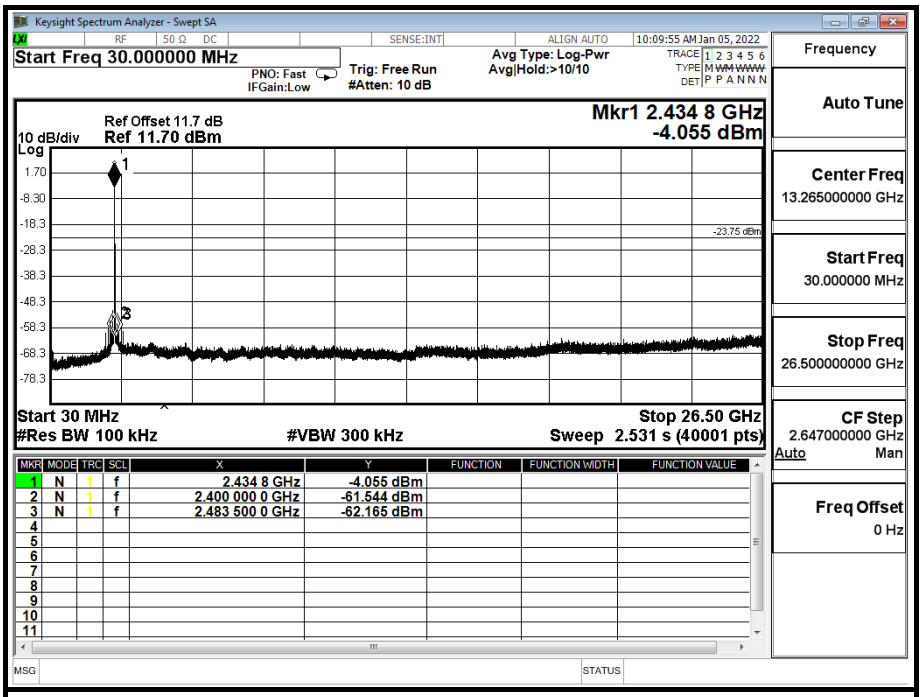
CH Low (30MHz~26.5GHz) (802.11g MODE)





CH Mid (30MHz~26.5GHz) (802.11g MODE)





CH High (30MHz~26.5GHz) (802.11g MODE)