RF Test Report

For

Applicant Name:	**Sichuan AI-Link Technology Co.,Ltd.**
Address:	Anzhou,Industrial park,Mianyang,Sichuan,China
EUT Name:	WIFI &Bluetooth Module
Brand Name:	N/A
Model Number:	WF-M63B-USJ1
Series Model Number:	N/A

Issued By

Company Name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Report Number:	BTF240712R00703
Test Standards:	47 CFR Part 15.247
Test Conclusion:	Pass
FCC ID:	2AOKI-WFM63BUSJ1
Test Date:	2024-07-15 to 2024-08-21
Date of Issue:	2024-08-22
Prepared By:	Sunny Qin / Project Engineer
Date:	2024-08-22
Approved By:	Ryan GJ / EMC Manager
Date:	2024-08-22

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Revision History		
Version	Issue Date	Revisions Content
R_V0	2024-08-22	Original
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1 Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130
FCC Registration Number:	518915
Designation Number:	CN1330

1.3 Announcement

(1) The test report reference to the report template version v0.
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2 Product Information

2.1 Application Information

Company Name:	Sichuan AI-Link Technology Co.,Ltd.
Address:	Anzhou,Industrial park,Mianyang,Sichuan,China

2.2 Manufacturer Information

Company Name:	Sichuan AI-Link Technology Co.,Ltd.
Address:	Anzhou,Industrial park,Mianyang,Sichuan,China

2.3 Factory Information

Company Name:	Sichuan AI-Link Technology Co.,Ltd.
Address:	Anzhou,Industrial park,Mianyang,Sichuan,China

2.4 General Description of Equipment under Test (EUT)

EUT Name:	WIFI &Bluetooth Module
Test Model Number:	WF-M63B-USJ1
Series Model Number:	N/A
Description of Model name differentiation:	N/A
Hardware Version:	JU17.820
Software Version:	WinDriverV.0.0.2.5_FWv.67c4fb6a

2.5 Technical Information

Power Supply:	DC 3.3V
Power Adaptor:	N/A
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz; 802.11n(HT40): 2422MHz to 2452MHz
Number of Channels:	802.11b/g/n(HT20): 11 Channels; 802.11n(HT40): 7 Channels
Modulation Type:	802.11b: DSSS(CCK, DQPSK, DBPSK); 802.11g: OFDM(BPSK, QPSK, 16QAM, 64QAM); 802.11n(HT20 and HT40): OFDM (BPSK, QPSK, 16QAM, 64QAM)
Number of transmit chain:	2 (802.11b/g/n(HT20)/n(HT40) all used two antennas, but 802.11b/11g support SISO and 802.11n(HT20)/n(HT40)support MIMO.)
Antenna Type:	FPC antenna (The module is sold without an antenna, this antenna is only used as an accessory to assist eut testing)
Antenna Gain#:	5.16dBi
Directional gain:	Directional gain = G_{ANT} + 10 log(N_{ANT}) dBi=5.16+10 log(2)=8.17dBi
Note: #: The antenna gain provided by the applicant, and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.	
Bluetooth Version:	5.1

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3 Summary of Test Results

3.1 Test Standards

The tests were performed according to following standards:
47 CFR Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

3.2 Uncertainty of Test

Item	Measurement Uncertainty
Conducted Emission (150 kHz-30 MHz)	±2.64dB
Occupied Bandwidth	±69kHz
Transmitter Power, Conducted	±0.87dB
Power Spectral Density	±0.69dB
Conducted Spurious Emissions	±0.95dB
Radiated Spurious Emissions (above 1GHz)	1-6GHz: ±3.94dB 6-18GHz: ±4.16dB
Radiated Spurious Emissions (30M - 1GHz)	±4.12dB
The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3.3 Summary of Test Result

Item	Standard	Requirement	Result
Antenna requirement	47 CFR Part 15.247	47 CFR 15.203	Pass
Conducted Emission at AC power line	47 CFR Part 15.247	47 CFR 15.207(a)	Pass
Occupied Bandwidth	47 CFR Part 15.247	47 CFR 15.247(a)(2)	Pass
Maximum Conducted Output Power	47 CFR Part 15.247	47 CFR 15.247(b)(3)	Pass
Power Spectral Density	47 CFR Part 15.247	47 CFR 15.247(e)	Pass
Emissions in non-restricted frequency bands	47 CFR Part 15.247	47 CFR 15.247(d), 15.209, 15.205	Pass
Band edge emissions (Radiated)	47 CFR Part 15.247	47 CFR 15.247(d), 15.209, 15.205	Pass
Emissions in frequency bands (below 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d), 15.209, 15.205	Pass
Emissions in frequency bands (above 1GHz)	47 CFR Part 15.247	47 CFR 15.247(d), 15.209, 15.205	Pass

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4 Test Configuration

4.1 Test Equipment List

Conducted Emission at AC power line					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	00953	2023-11-16	2024-11-15
Coaxial Switcher	SCHWARZBECK	CX210	CX210	2023-11-16	2024-11-15
V-LISN	SCHWARZBECK	NSLK 8127	01073	2023-11-16	2024-11-15
LISN	AFJ	LS16/110VAC	16010020076	2023-11-16	2024-11-15
EMI Receiver	ROHDE&SCHWARZ	ESCI3	101422	2023-11-16	2024-11-15

Occupied Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in non-restricted frequency bands					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
RFTest software	/	V1.00	/	/	/
RF Control Unit	Techy	TR1029-1	/	2023-11-16	2024-11-15
RF Sensor Unit	Techy	TR1029-2	/	2023-11-16	2024-11-15
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2023-11-16	2024-11-15
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2023-11-16	2024-11-15
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2023-11-16	2024-11-15
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2023-11-16	2024-11-15

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Band edge emissions (Radiated) Emissions in frequency bands (below 1GHz) Emissions in frequency bands (above 1GHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023-11-16	2024-11-15
Preamplifier	SCHWARZBECK	BBV9744	00246	2023-11-16	2024-11-15
RE Cable	REBES Talent	UF1-SMASMAM-10m	21101566	2023-11-16	2024-11-15
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2023-11-16	2024-11-15
RE Cable	REBES Talent	UF1-SMASMAM-1m	21101568	2023-11-16	2024-11-15
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2023-11-16	2024-11-15
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2023-11-16	2024-11-15
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	2023-11-16	2024-11-15
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2023-11-13	2024-11-12
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2023-11-16	2024-11-15
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2023-11-16	2024-11-15
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	2023-11-16	2024-11-15
Broadband Preamplilifier	SCHWARZBECK	BBV9718D	00008	2023-11-16	2024-11-15
Horn Antenna	SCHWARZBECK	BBHA9120D	2597	2022-05-22	2024-05-21
EZ_EMC	Frad	FA-03A2 RE+	/	2023-11-16	2024-11-15
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	2023-11-16	2024-11-15
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2023-11-13	2024-11-12

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4.2 Test Auxiliary Equipment

Description	Manufacturer	Model	Serial No.	Length	Description
Notebook computer	ASUSTEK computer Inc	S4000U	/	/	/
FPC antenna	/	/	/	/	/
Computer	DELL	Vostro 5890	/	/	/
USB to TTL serial port board	/	/	/	/	/

4.3 Test Modes

No.	Test Modes	Description
TM1	802.11b mode	Keep the EUT in 802.11b transmitting mode.
TM2	802.11g mode	Keep the EUT in 802.11g transmitting mode.
TM3	802.11n(HT20) mode	Keep the EUT in 802.11n(HT20) transmitting mode.
TM4	802.11n(HT40) mode	Keep the EUT in 802.11n(HT40) transmitting mode.

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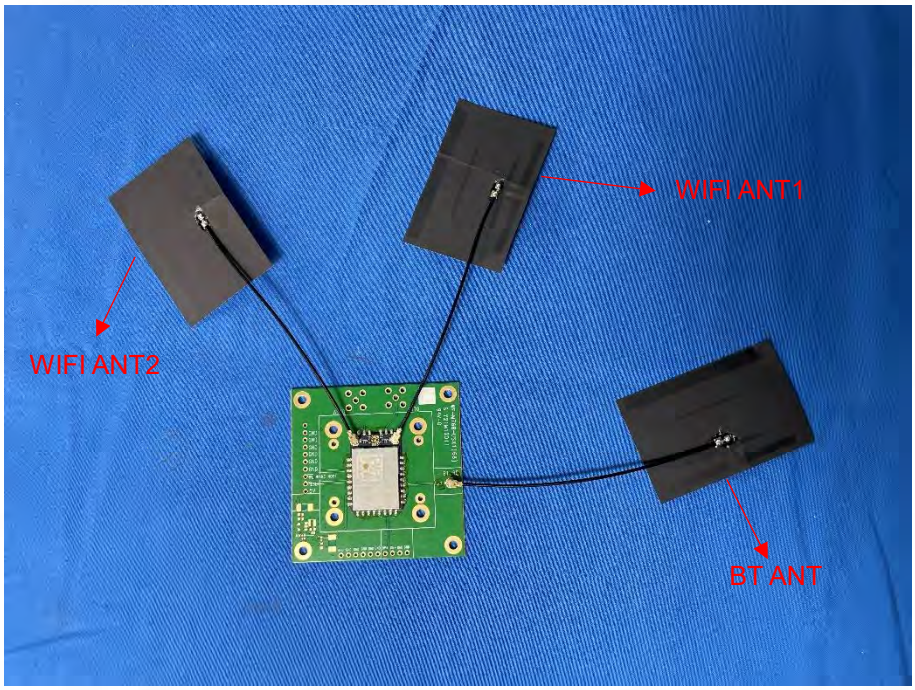
5 Evaluation Results (Evaluation)

5.1 Antenna requirement

Test Requirement:	Refer to 47 CFR Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

5.1.1 Conclusion:



6 Radio Spectrum Matter Test Results (RF)

6.1 Conducted Emission at AC power line

Test Requirement:	Refer to 47 CFR 15.207(a), Except as shown in paragraphs (b)and (c)of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).
Test Method:	ANSI C63.10-2020 section 6.2
Test Limit:	

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

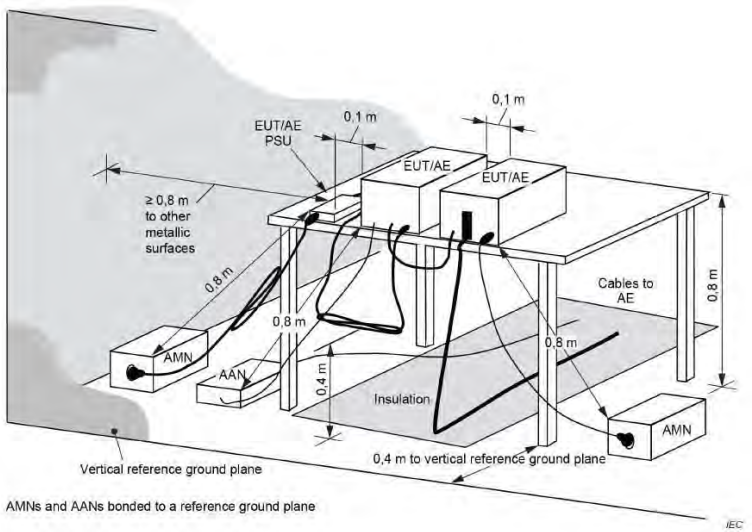
*Decreases with the logarithm of the frequency.

Procedure:	Refer to ANSI C63.10-2020 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices

6.1.1 E.U.T. Operation:

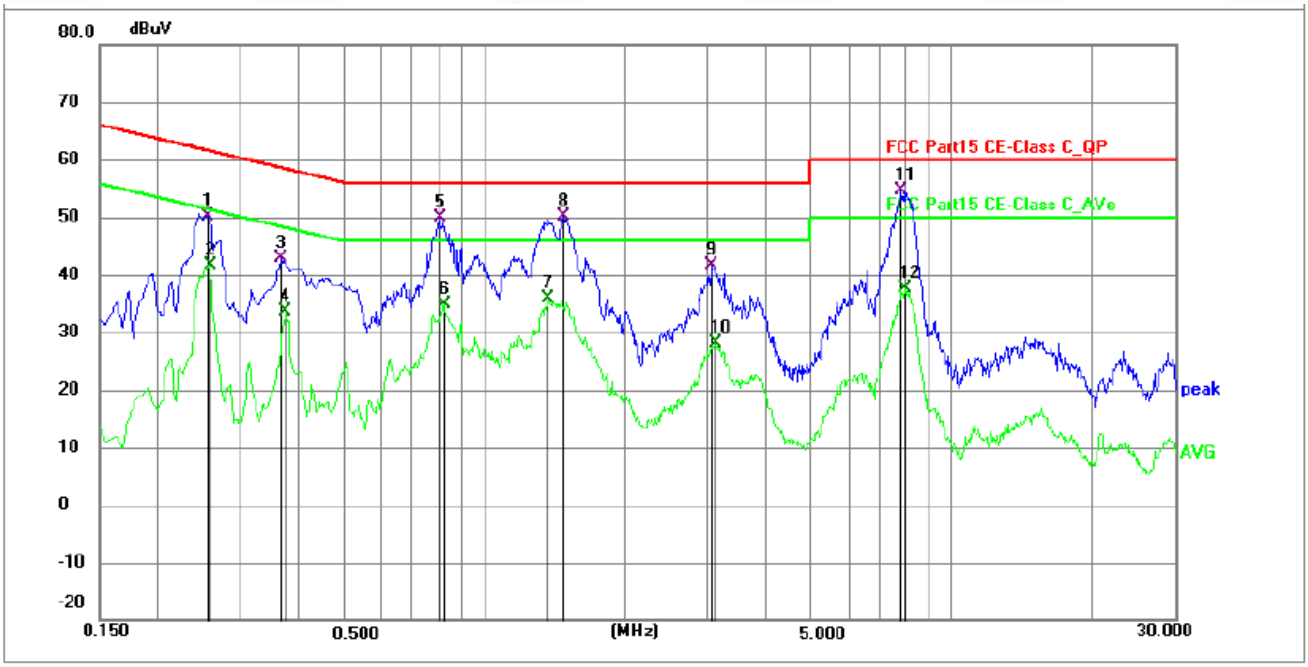
Operating Environment:	
Temperature:	25.7 °C
Humidity:	48.1 %
Atmospheric Pressure:	1010 mbar

6.1.2 Test Setup Diagram:



6.1.3 Test Data:

All modes of both antennas were tested, with antenna 2 having the worst data, and only the worst data showed in the report, the worst mode is 802.11g TX- 2412MHz.
Line: Line



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2560	39.68	10.56	50.24	61.56	-11.32	QP	P	
2	0.2580	31.09	10.56	41.65	51.50	-9.85	AVG	P	
3	0.3660	32.38	10.57	42.95	58.59	-15.64	QP	P	
4	0.3750	23.10	10.57	33.67	48.39	-14.72	AVG	P	
5	0.8024	39.10	10.69	49.79	56.00	-6.21	QP	P	
6	0.8205	24.07	10.69	34.76	46.00	-11.24	AVG	P	
7	1.3692	25.21	10.66	35.87	46.00	-10.13	AVG	P	
8	1.4730	39.57	10.66	50.23	56.00	-5.77	QP	P	
9	3.0660	30.90	10.67	41.57	56.00	-14.43	QP	P	
10	3.1110	17.50	10.67	28.17	46.00	-17.83	AVG	P	
11 *	7.8000	43.92	10.81	54.73	60.00	-5.27	QP	P	
12	7.9440	26.84	10.81	37.65	50.00	-12.35	AVG	P	

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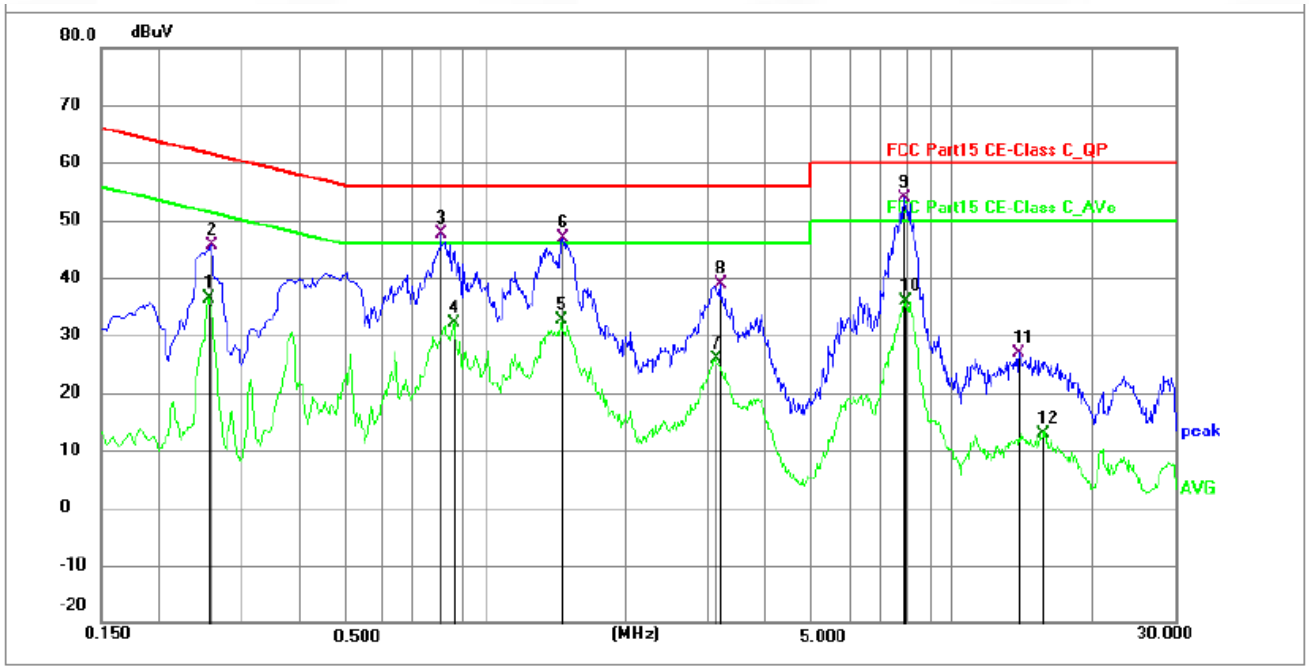
Line: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2535	25.83	10.56	36.39	51.64	-15.25	AVG	P	
2	0.2580	35.03	10.56	45.59	61.50	-15.91	QP	P	
3	0.8024	36.90	10.69	47.59	56.00	-8.41	QP	P	
4	0.8565	21.48	10.68	32.16	46.00	-13.84	AVG	P	
5	1.4550	21.91	10.66	32.57	46.00	-13.43	AVG	P	
6	1.4640	36.20	10.66	46.86	56.00	-9.14	QP	P	
7	3.1110	15.23	10.67	25.90	46.00	-20.10	AVG	P	
8	3.1740	28.14	10.66	38.80	56.00	-17.20	QP	P	
9 *	7.8765	43.00	10.81	53.81	60.00	-6.19	QP	P	
10	7.9305	25.03	10.81	35.84	50.00	-14.16	AVG	P	
11	13.8660	15.94	10.84	26.78	60.00	-33.22	QP	P	
12	15.7065	2.16	10.84	13.00	50.00	-37.00	AVG	P	

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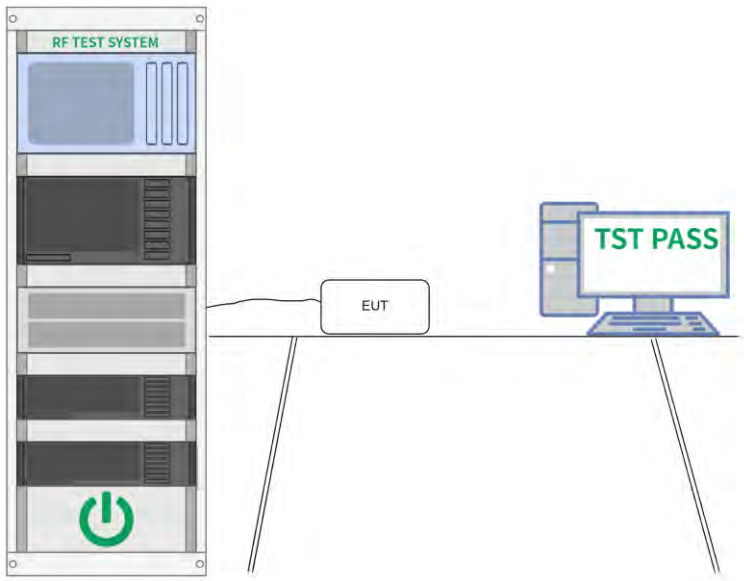
6.2 Occupied Bandwidth

Test Requirement:	47 CFR 15.247(a)(2)
Test Method:	ANSI C63.10-2020, section 11.8 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Procedure:	a) Set RBW = 100 kHz. b) Set the VBW >= [3 × RBW]. c) Detector = peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.2.1 E.U.T. Operation:

Operating Environment:	
Temperature:	24.3 °C
Humidity:	50 %
Atmospheric Pressure:	1010 mbar

6.2.2 Test Setup Diagram:



6.2.3 Test Data:

Please Refer to Appendix for Details.

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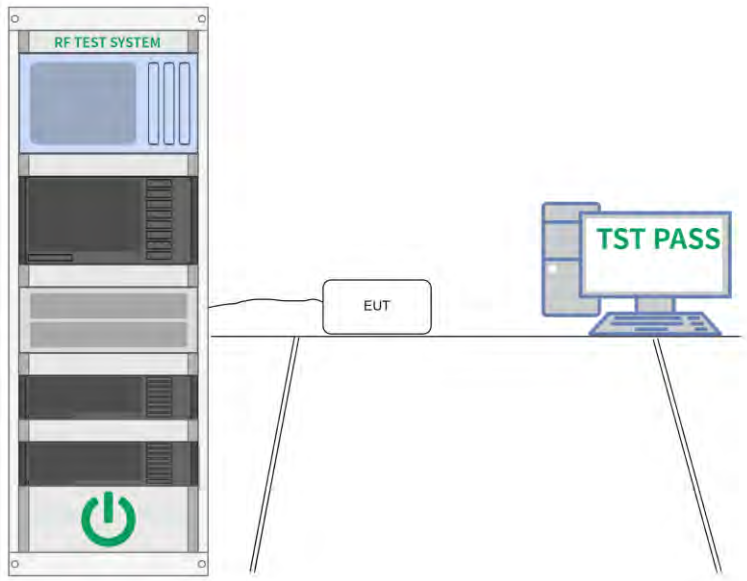
6.3 Maximum Conducted Output Power

Test Requirement:	47 CFR 15.247(b)(3)
Test Method:	ANSI C63.10-2020, section 11.9.1 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 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. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Procedure:	ANSI C63.10-2020, section 11.9.1 Maximum peak conducted output power

6.3.1 E.U.T. Operation:

Operating Environment:	
Temperature:	24.3 °C
Humidity:	50 %
Atmospheric Pressure:	1010 mbar

6.3.2 Test Setup Diagram:



6.3.3 Test Data:

Please Refer to Appendix for Details.

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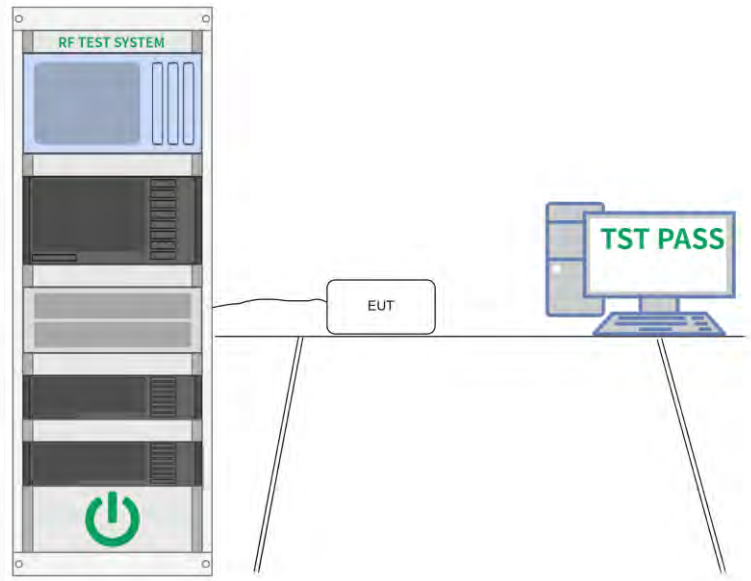
6.4 Power Spectral Density

Test Requirement:	47 CFR 15.247(e)
Test Method:	ANSI C63.10-2020, section 11.10 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Procedure:	ANSI C63.10-2020, section 11.10, Maximum power spectral density level in the fundamental emission

6.4.1 E.U.T. Operation:

Operating Environment:	
Temperature:	24.3 °C
Humidity:	50 %
Atmospheric Pressure:	1010 mbar

6.4.2 Test Setup Diagram:



6.4.3 Test Data:

Please Refer to Appendix for Details.

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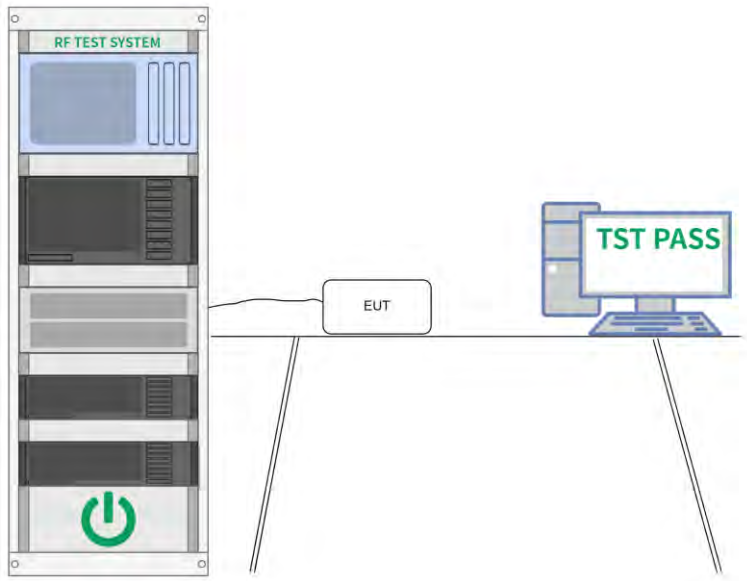
6.5 Emissions in non-restricted frequency bands

Test Requirement:	47 CFR 15.247(d), 15.209, 15.205
Test Method:	ANSI C63.10-2020 section 11.11 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	Refer to 47 CFR 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Procedure:	ANSI C63.10-2020 Section 11.11.1, Section 11.11.2, Section 11.11.3

6.5.1 E.U.T. Operation:

Operating Environment:	
Temperature:	24.3 °C
Humidity:	50 %
Atmospheric Pressure:	1010 mbar

6.5.2 Test Setup Diagram:



6.5.3 Test Data:

Please Refer to Appendix for Details.

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6.6 Band edge emissions (Radiated)

Test Requirement:	Refer to 47 CFR 15.247(d), 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 Method:	ANSI C63.10-2020 section 6.10 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	

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

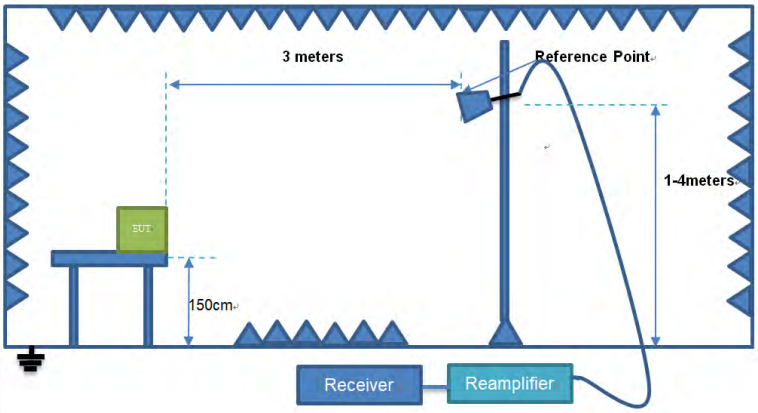
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
In the emission table above, the tighter limit applies at the band edges.
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Procedure:	ANSI C63.10-2020 section 6.10.5.2

6.6.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.7 °C
Humidity:	52.3 %
Atmospheric Pressure:	1010 mbar

6.6.2 Test Setup Diagram:



6.6.3 Test Data:

All modes of both antennas were tested, with antenna 2 having the worst data, and only the worst data showed in the report, the worst mode is 802.11n(HT40)

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Detector	Polarization
802.11n(HT40)-2422MHz TX mode							
2310.00	77.05	-30.59	46.46	74.00	-27.54	Peak	V
2310.00	68.37	-30.59	37.78	54.00	-16.22	AVG	V
2310.00	76.82	-30.59	46.23	74.00	-27.77	Peak	H
2310.00	68.21	-30.59	37.62	54.00	-16.38	AVG	H
2390.00	76.29	-30.49	45.80	74.00	-28.20	Peak	H
2390.00	67.86	-30.49	37.37	54.00	-16.63	AVG	H
2390.00	77.63	-30.49	47.14	74.00	-26.86	Peak	V
2390.00	66.52	-30.49	36.03	54.00	-17.97	AVG	V

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Detector	Polarization
802.11n(HT40)-2452MHz TX mode							
2483.50	75.19	-30.39	44.80	74.00	-29.20	Peak	V
2483.50	64.89	-30.39	34.50	54.00	-19.50	AVG	V
2483.50	78.55	-30.39	48.16	74.00	-25.84	Peak	H
2483.50	67.29	-30.39	36.90	54.00	-17.10	AVG	H
2500.00	76.36	-30.37	45.99	74.00	-28.01	Peak	H
2500.00	68.12	-30.37	37.75	54.00	-16.25	AVG	H
2500.00	75.42	-30.37	45.05	74.00	-28.95	Peak	V
2500.00	64.60	-30.37	34.23	54.00	-19.77	AVG	V

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6.7 Emissions in frequency bands (below 1GHz)

Test Requirement:	Refer to 47 CFR 15.247(d), 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 Method:	ANSI C63.10-2020 section 6.6.4 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	

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

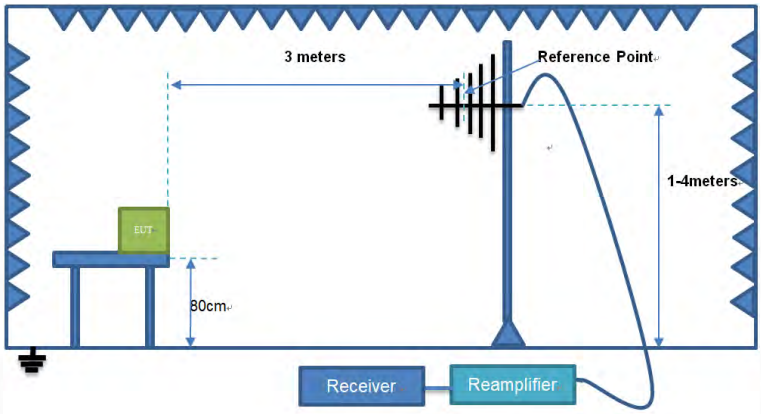
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
In the emission table above, the tighter limit applies at the band edges.
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Procedure:	ANSI C63.10-2020 section 6.6.4

6.7.1 E.U.T. Operation:

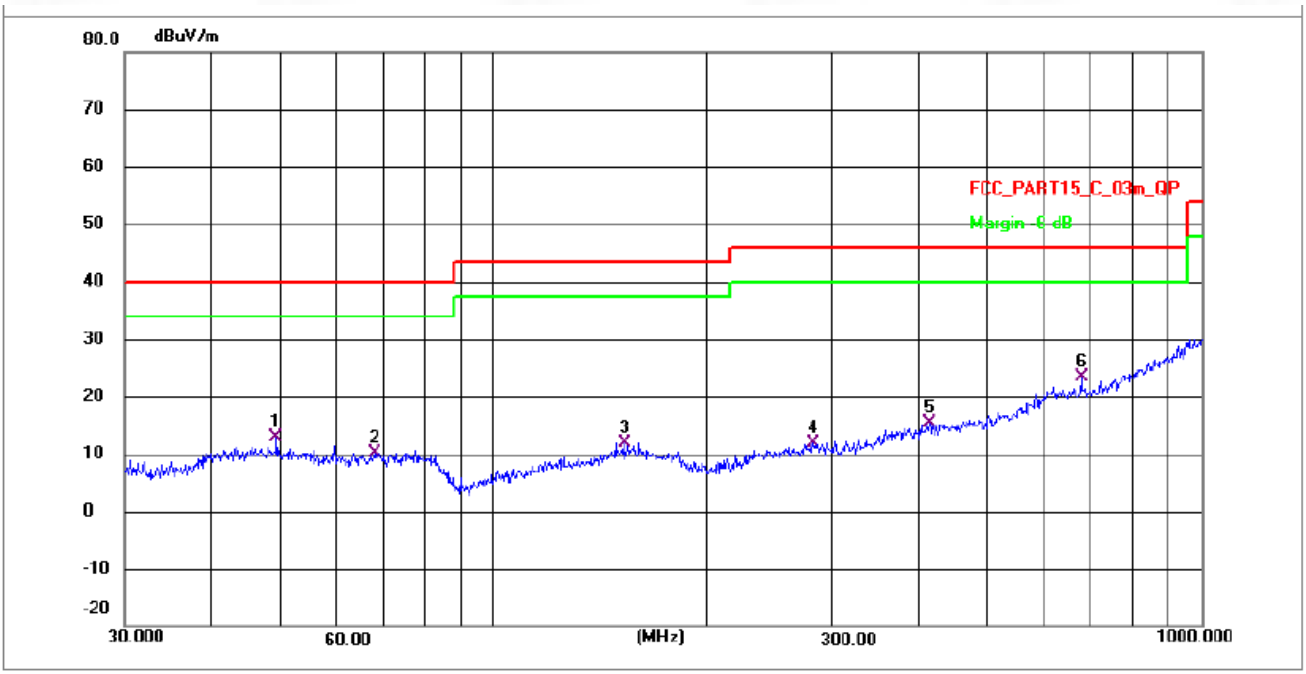
Operating Environment:	
Temperature:	22.7 °C
Humidity:	52.3 %
Atmospheric Pressure:	1010 mbar

6.7.2 Test Setup Diagram:



6.7.3 Test Data:

All modes of both antennas were tested, with antenna 2 having the worst data, and only the worst data showed in the report, the worst mode is 802.11g TX- 2462MHz.
Polarization: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	49.3594	36.09	-23.24	12.85	40.00	-27.15	QP	P
2	67.9129	33.12	-22.96	10.16	40.00	-29.84	QP	P
3	152.6641	33.98	-21.98	12.00	43.50	-31.50	QP	P
4	281.9946	32.61	-20.78	11.83	46.00	-34.17	QP	P
5	413.2706	35.12	-19.72	15.40	46.00	-30.60	QP	P
6 *	676.3929	41.15	-17.78	23.37	46.00	-22.63	QP	P

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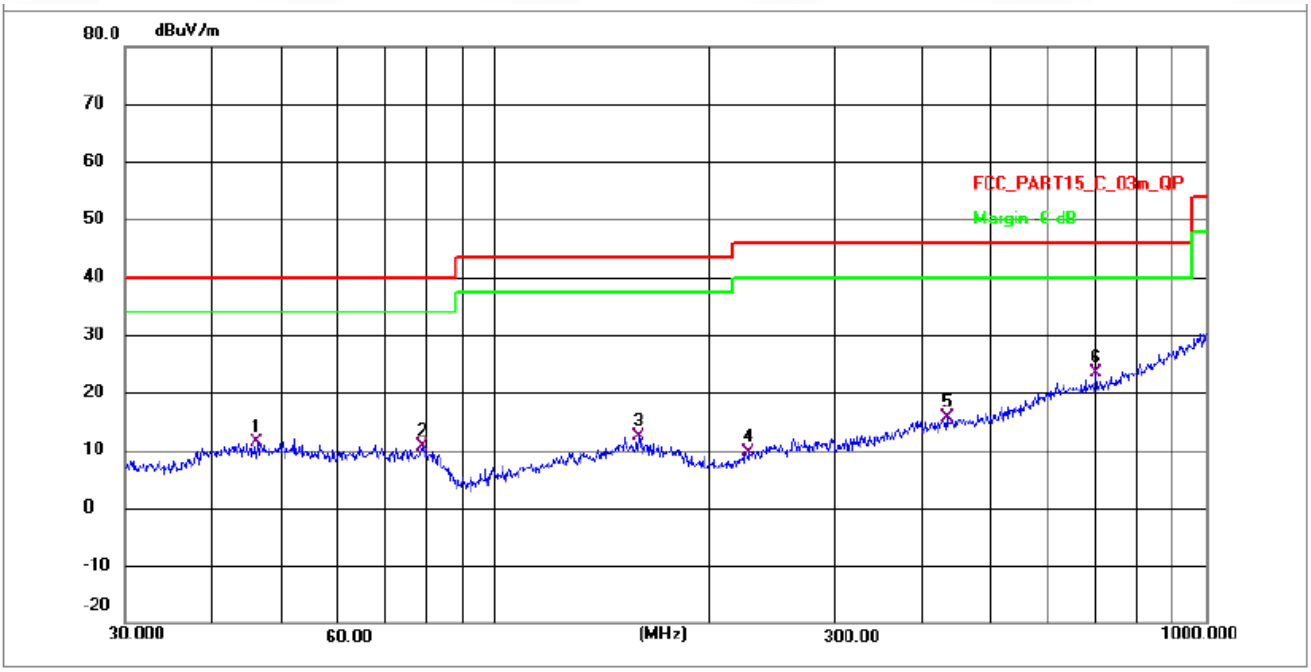
Polarization: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F
1	46.1779	34.59	-23.29	11.30	40.00	-28.70	QP	P
2	78.9652	33.42	-22.79	10.63	40.00	-29.37	QP	P
3	158.9462	34.28	-21.93	12.35	43.50	-31.15	QP	P
4	227.6906	30.88	-21.26	9.62	46.00	-36.38	QP	P
5	431.0316	35.10	-19.57	15.53	46.00	-30.47	QP	P
6 *	699.3046	41.09	-17.61	23.48	46.00	-22.52	QP	P

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6.8 Emissions in frequency bands (above 1GHz)

Test Requirement:	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 Method:	ANSI C63.10-2020 section 6.6.4 KDB 558074 D01 15.247 Meas Guidance v05r02
Test Limit:	

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

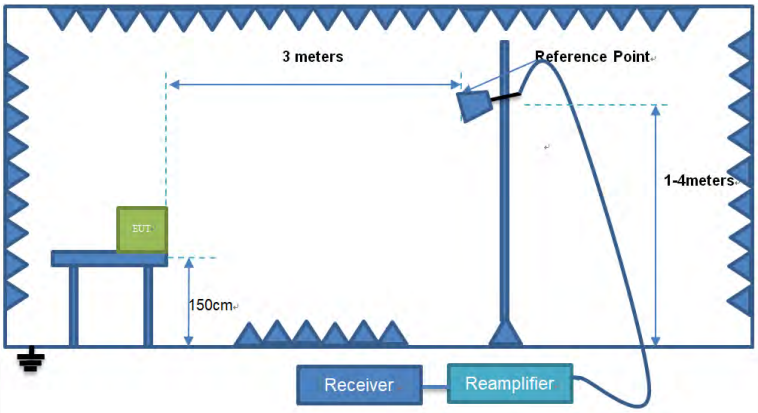
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
In the emission table above, the tighter limit applies at the band edges.
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Procedure:	ANSI C63.10-2020 section 6.6.4

6.8.1 E.U.T. Operation:

Operating Environment:	
Temperature:	22.7 °C
Humidity:	52.3 %
Atmospheric Pressure:	1010 mbar

6.8.2 Test Setup Diagram:



6.8.3 Test Data:

All modes of both antennas were tested, with antenna 2 having the worst data, and only the worst data showed in the report, the worst mode is 802.11g.

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Detector	Polarization
802.11g - 2412MHz TX mode							
4824.00	69.54	-27.87	41.67	74.00	-32.33	Peak	V
4824.00	59.31	-27.87	31.44	54.00	-22.56	AVG	V
7236.00	68.48	-24.86	43.62	74.00	-30.38	Peak	V
7236.00	57.83	-24.86	32.97	54.00	-21.03	AVG	V
9648.00	68.21	-23.52	44.69	74.00	-29.31	Peak	V
9648.00	58.03	-23.52	34.51	54.00	-19.49	AVG	V
4824.00	71.50	-27.87	43.63	74.00	-30.37	Peak	H
4824.00	60.39	-27.87	32.52	54.00	-21.48	AVG	H
7236.00	69.66	-24.86	44.80	74.00	-29.20	Peak	H
7236.00	59.76	-24.86	34.90	54.00	-19.10	AVG	H
9648.00	69.85	-23.52	46.33	74.00	-27.67	Peak	H
9648.00	59.10	-23.52	35.58	54.00	-18.42	AVG	H

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Detector	Polarization
802.11g - 2437MHz TX mode							
4874.00	70.39	-27.73	42.66	74.00	-31.34	Peak	V
4874.00	60.24	-27.73	32.51	54.00	-21.49	AVG	V
7311.00	68.47	-24.84	43.63	74.00	-30.37	Peak	V
7311.00	58.98	-24.84	34.14	54.00	-19.86	AVG	V
9748.00	67.48	-23.74	43.74	74.00	-30.26	Peak	V
9748.00	57.89	-23.74	34.15	54.00	-19.85	AVG	V
4874.00	71.45	-27.73	43.72	74.00	-30.28	Peak	H
4874.00	61.26	-27.73	33.53	54.00	-20.47	AVG	H
7311.00	69.01	-24.84	44.17	74.00	-29.83	Peak	H
7311.00	59.11	-24.84	34.27	54.00	-19.73	AVG	H
9748.00	68.71	-23.74	44.97	74.00	-29.03	Peak	H
9748.00	58.26	-23.74	34.52	54.00	-19.48	AVG	H

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Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Detector	Polarization
802.11g - 2462MHz TX mode							
4924.00	70.98	-27.59	43.39	74.00	-30.61	Peak	V
4924.00	59.86	-27.59	32.27	54.00	-21.73	AVG	V
7236.00	69.33	-24.81	44.52	74.00	-29.48	Peak	V
7236.00	58.38	-24.81	33.57	54.00	-20.43	AVG	V
9848.00	67.86	-23.95	43.91	74.00	-30.09	Peak	V
9848.00	57.18	-23.95	33.23	54.00	-20.77	AVG	V
4924.00	71.53	-27.59	43.94	74.00	-30.06	Peak	H
4924.00	61.62	-27.59	34.03	54.00	-19.97	AVG	H
7236.00	70.47	-24.81	45.66	74.00	-28.34	Peak	H
7236.00	60.15	-24.81	35.34	54.00	-18.66	AVG	H
9848.00	68.30	-23.95	44.35	74.00	-29.65	Peak	H
9848.00	58.08	-23.95	34.13	54.00	-19.87	AVG	H

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7 Test Setup Photos

Conducted Emission at AC power line

Band edge emissions (Radiated) Emissions in frequency bands (above 1GHz)

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Emissions in frequency bands (below 1GHz)

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Appendix

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1. Duty Cycle

1.1 Test Result

1.1.1 Ant1

Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
802.11b	SISO	2412	8.400	8.438	99.55	0.02	0.15
		2437	8.400	8.437	99.56	0.02	0.15
		2462	8.400	8.437	99.56	0.02	0.15
802.11g	SISO	2412	1.393	1.436	97.01	0.13	0.13
		2437	1.395	1.436	97.14	0.13	0.00
		2462	1.393	1.437	96.94	0.14	0.12
802.11n (HT20)	SISO	2412	1.290	1.333	96.77	0.14	0.13
		2437	1.290	1.334	96.70	0.15	0.13
		2462	1.290	1.334	96.70	0.15	0.13
802.11n (HT40)	SISO	2422	0.638	0.681	93.69	0.28	0.36
		2437	0.638	0.680	93.82	0.28	0.13
		2452	0.638	0.681	93.69	0.28	0.12

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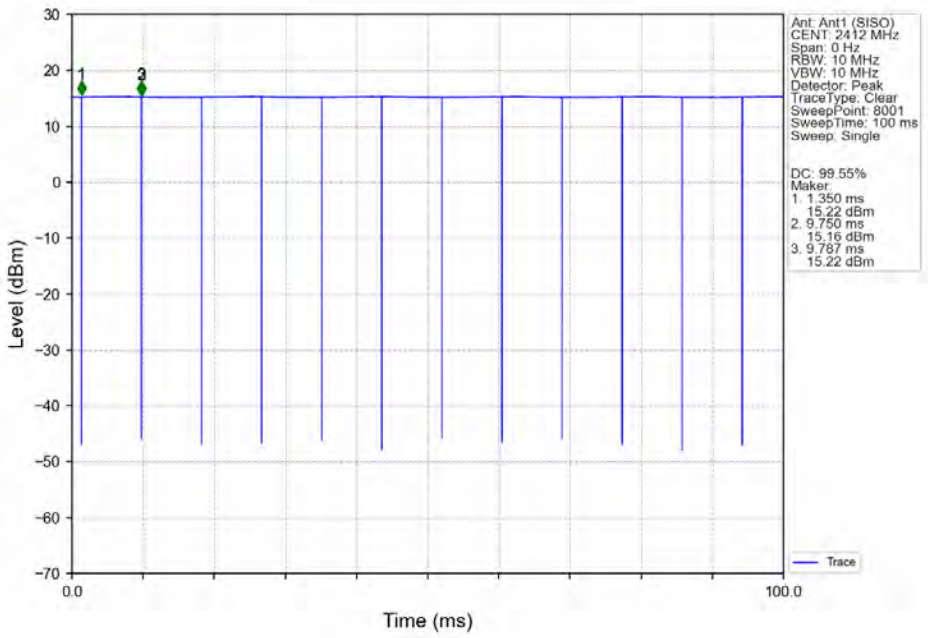
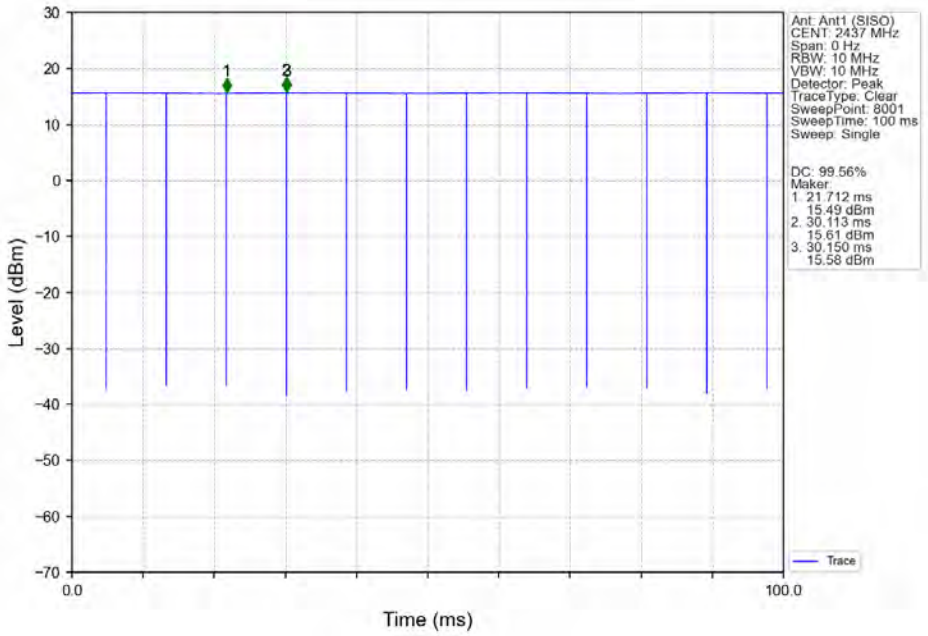
1.2 Test Graph

1.2.1 Ant1

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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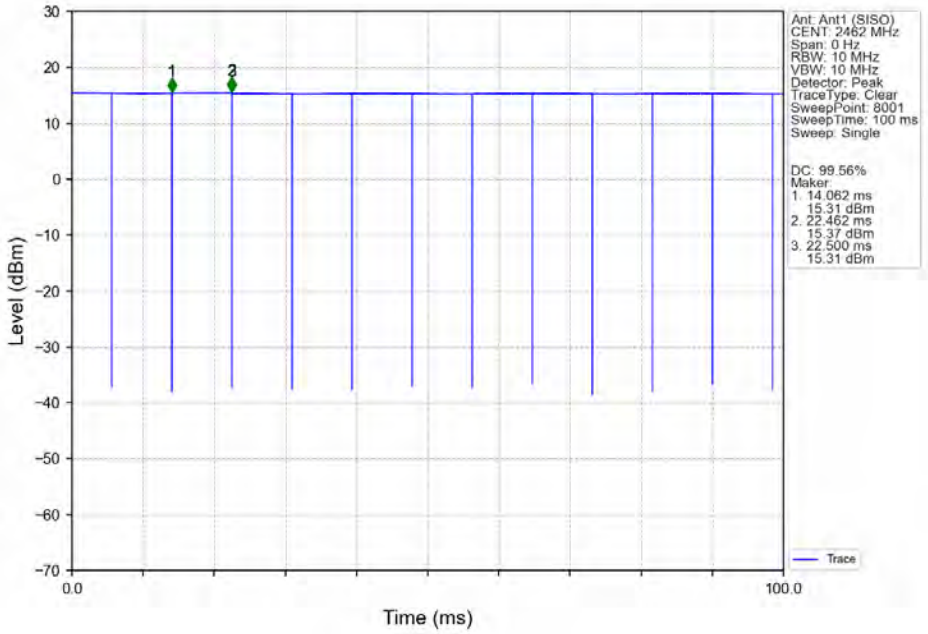
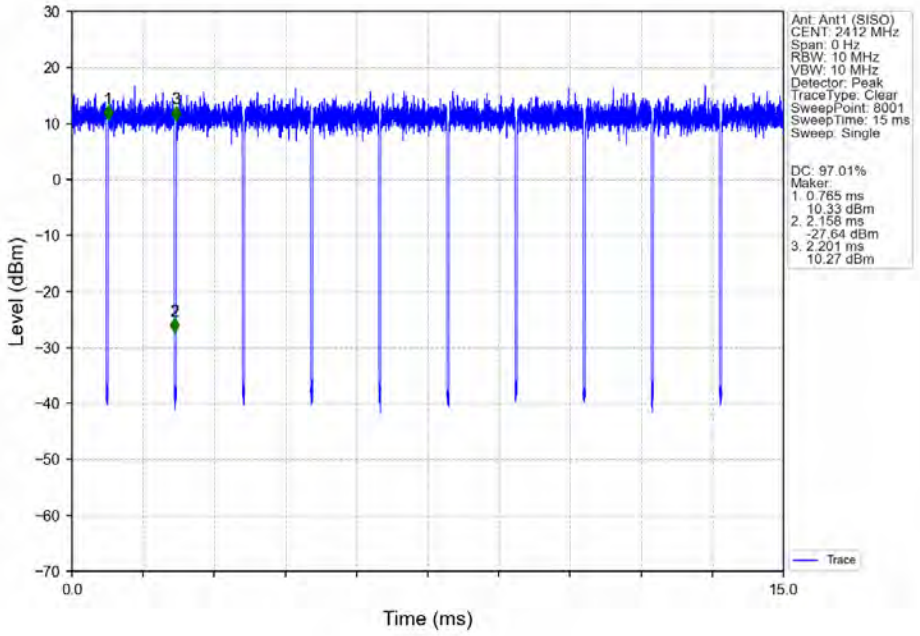
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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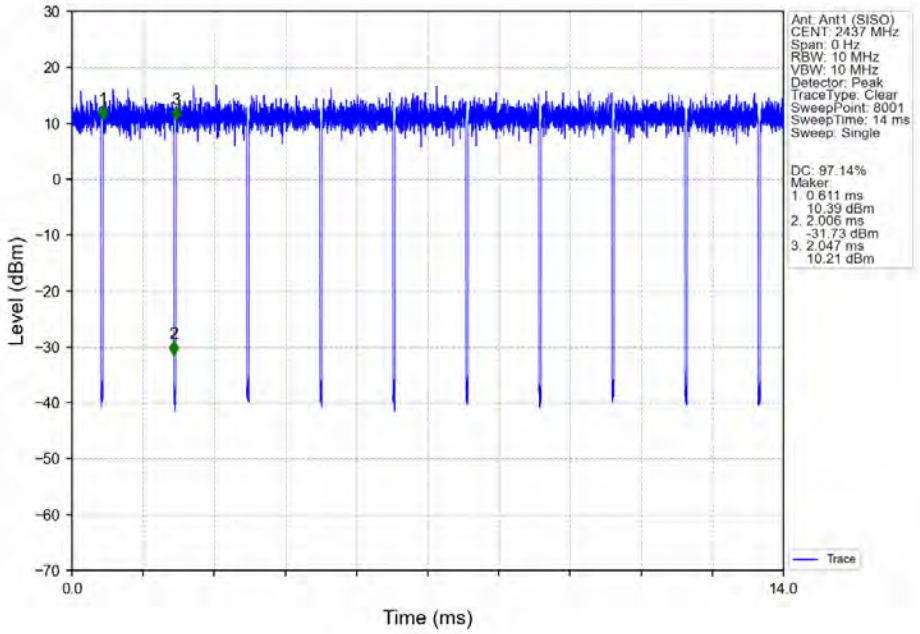
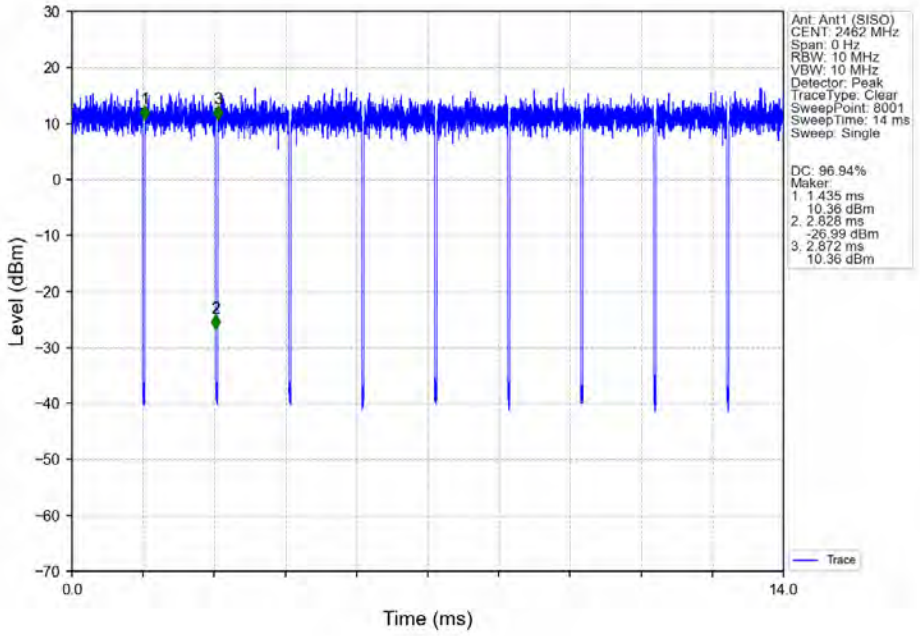
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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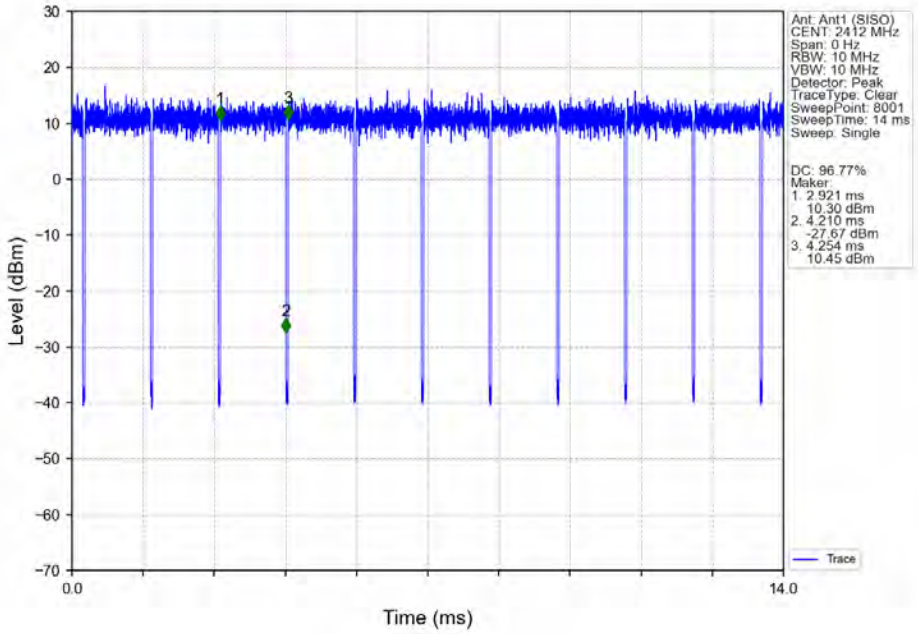
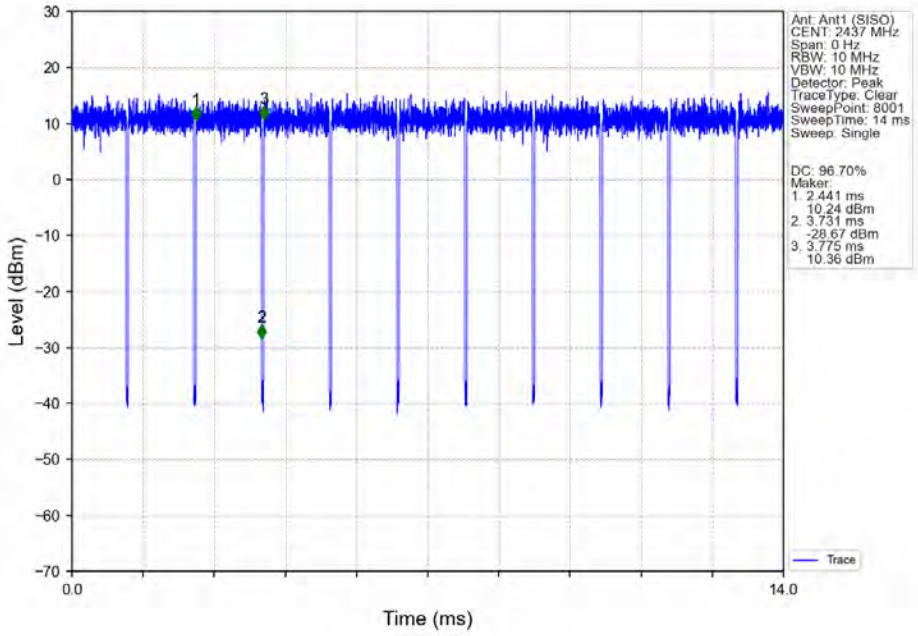
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant1 (SISO)_NTNV



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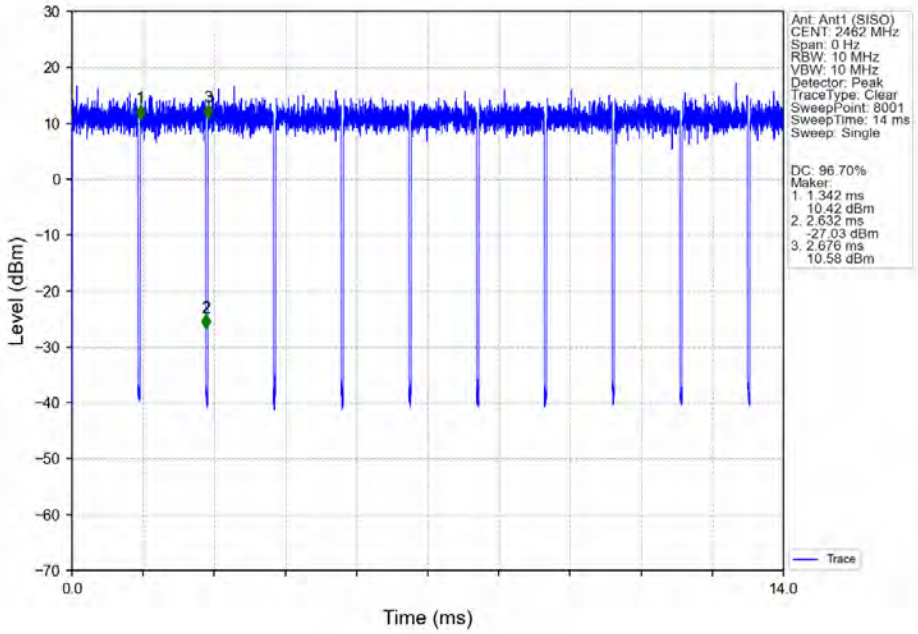
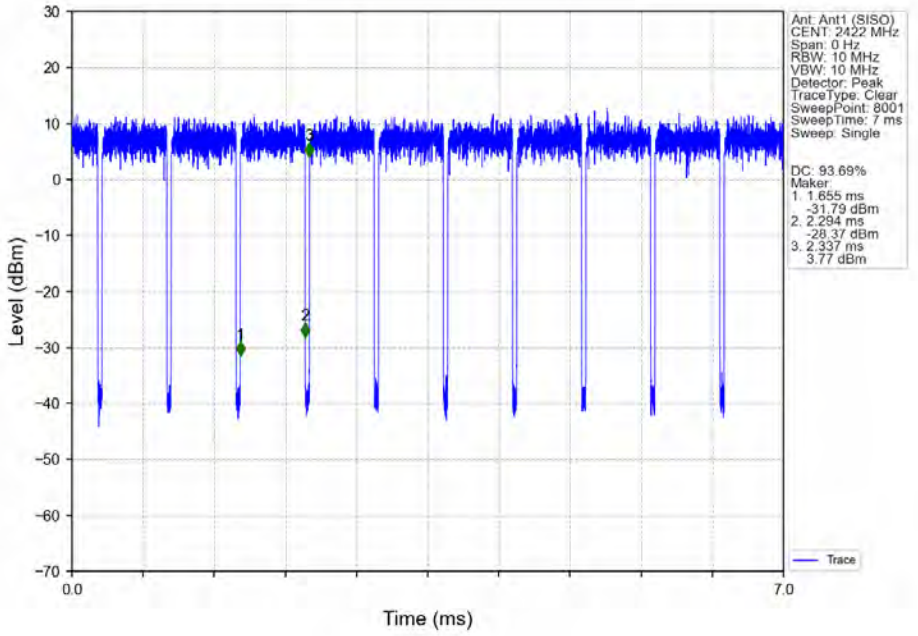
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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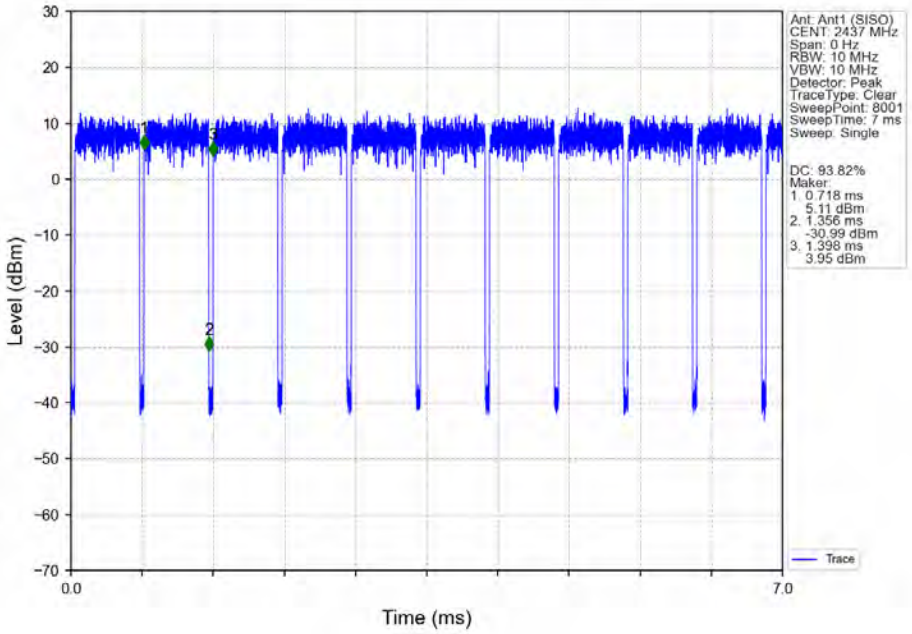
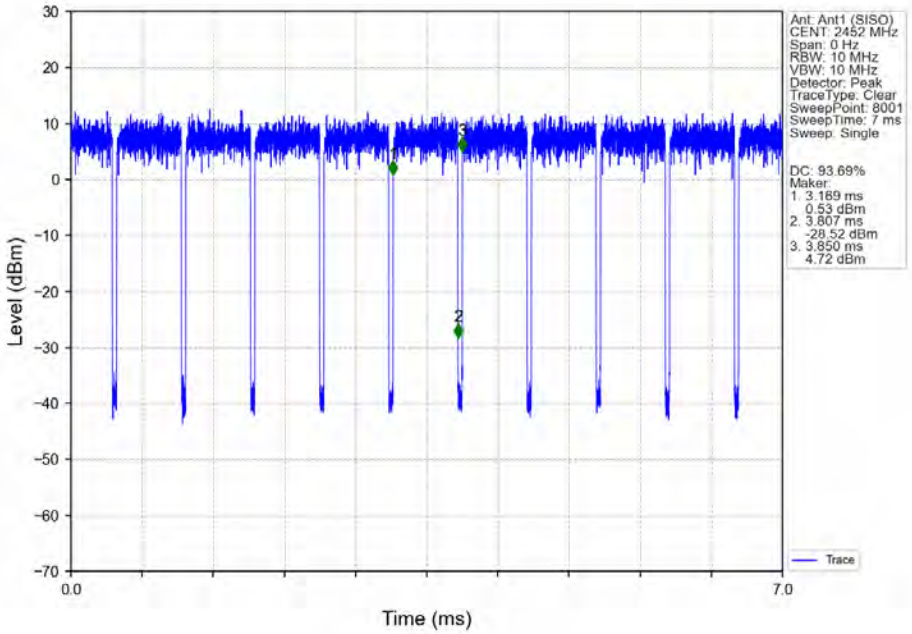
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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2. Bandwidth

2.1 Test Result

2.1.1 OBW

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
802.11b	SISO	2412	1	13.358	/	Pass
		2437	1	13.328	/	Pass
		2462	1	13.320	/	Pass
802.11g	SISO	2412	1	17.336	/	Pass
		2437	1	17.324	/	Pass
		2462	1	17.365	/	Pass
802.11n (HT20)	SISO	2412	1	18.148	/	Pass
		2437	1	18.080	/	Pass
		2462	1	18.147	/	Pass
802.11n (HT40)	SISO	2422	1	36.490	/	Pass
		2437	1	36.349	/	Pass
		2452	1	36.602	/	Pass

2.1.2 6dB BW

Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
802.11b	SISO	2412	1	9.185	>=0.5	Pass
		2437	1	9.180	>=0.5	Pass
		2462	1	9.178	>=0.5	Pass
802.11g	SISO	2412	1	15.957	>=0.5	Pass
		2437	1	15.960	>=0.5	Pass
		2462	1	16.003	>=0.5	Pass
802.11n (HT20)	SISO	2412	1	17.498	>=0.5	Pass
		2437	1	16.762	>=0.5	Pass
		2462	1	17.281	>=0.5	Pass
802.11n (HT40)	SISO	2422	1	35.682	>=0.5	Pass
		2437	1	35.146	>=0.5	Pass
		2452	1	35.375	>=0.5	Pass

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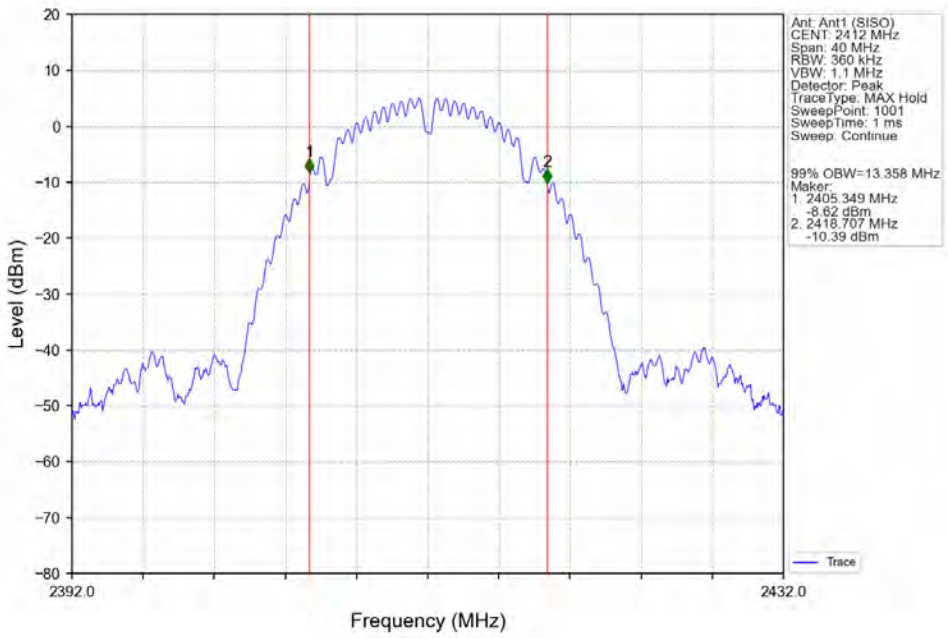
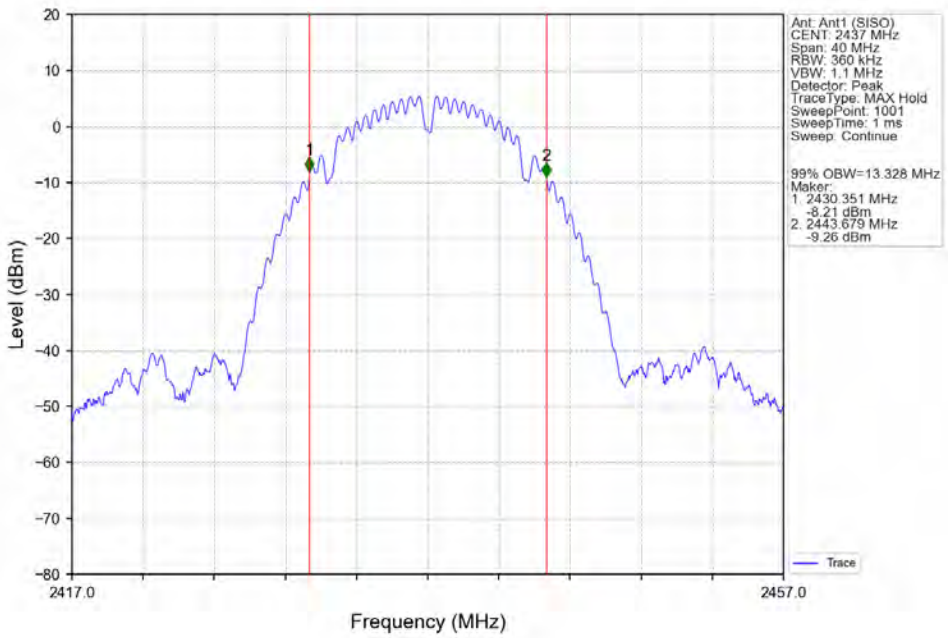
2.2 Test Graph

2.2.1 OBW

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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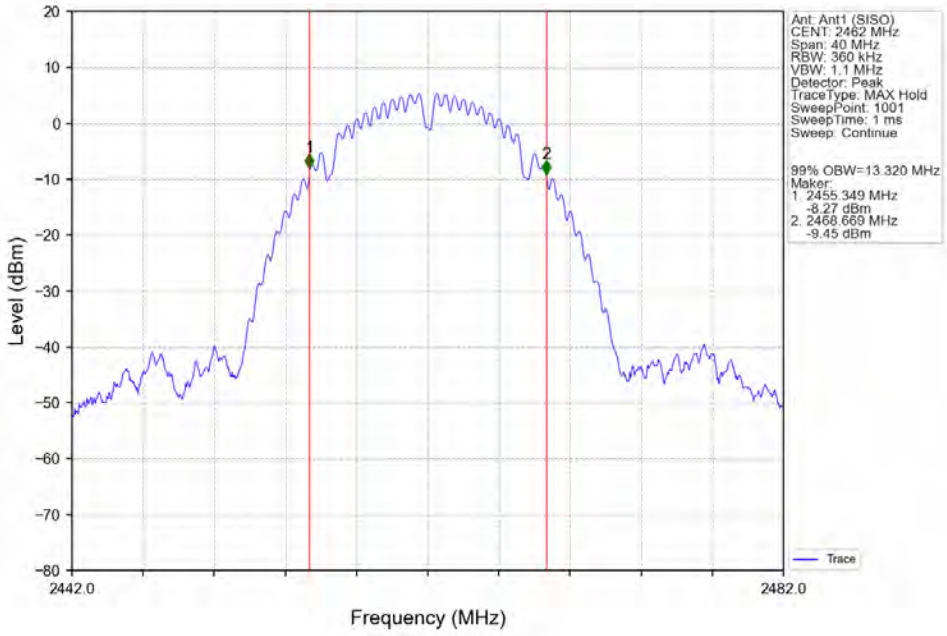
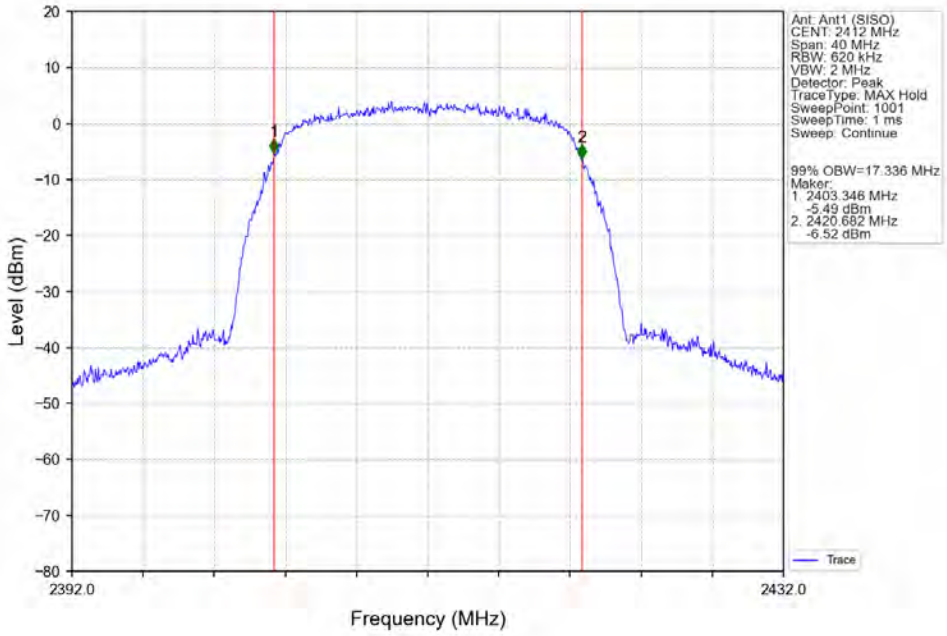
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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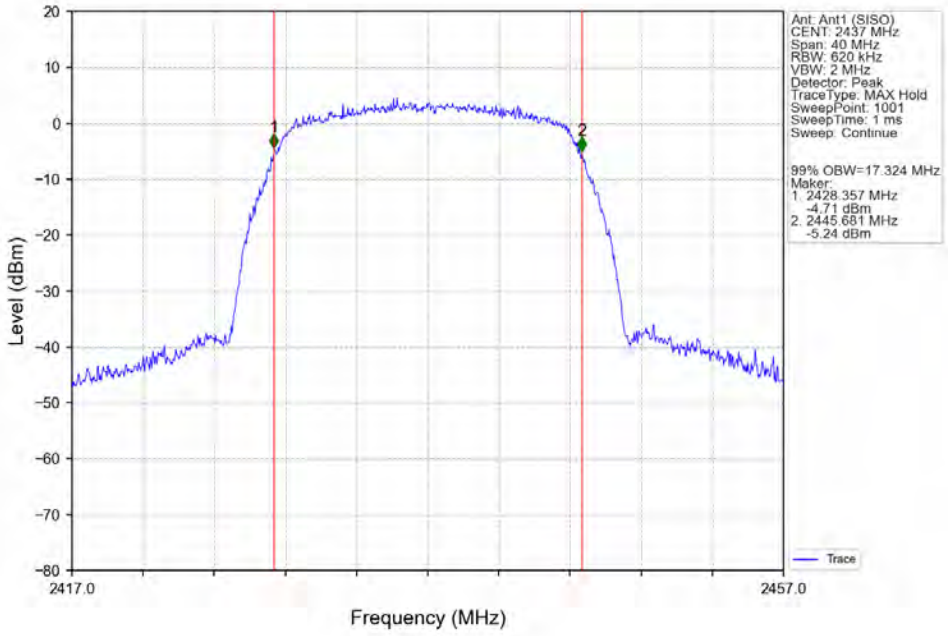
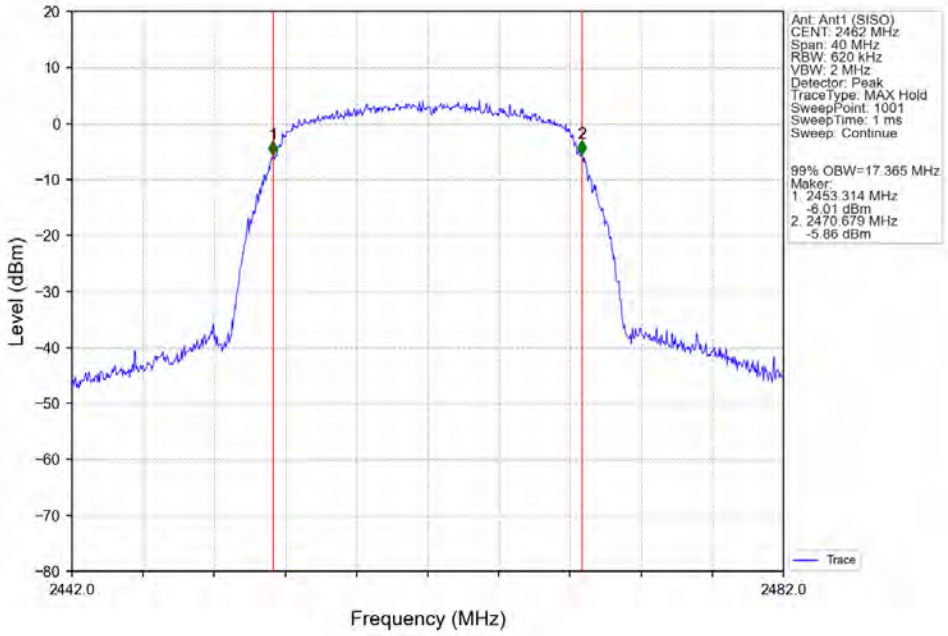
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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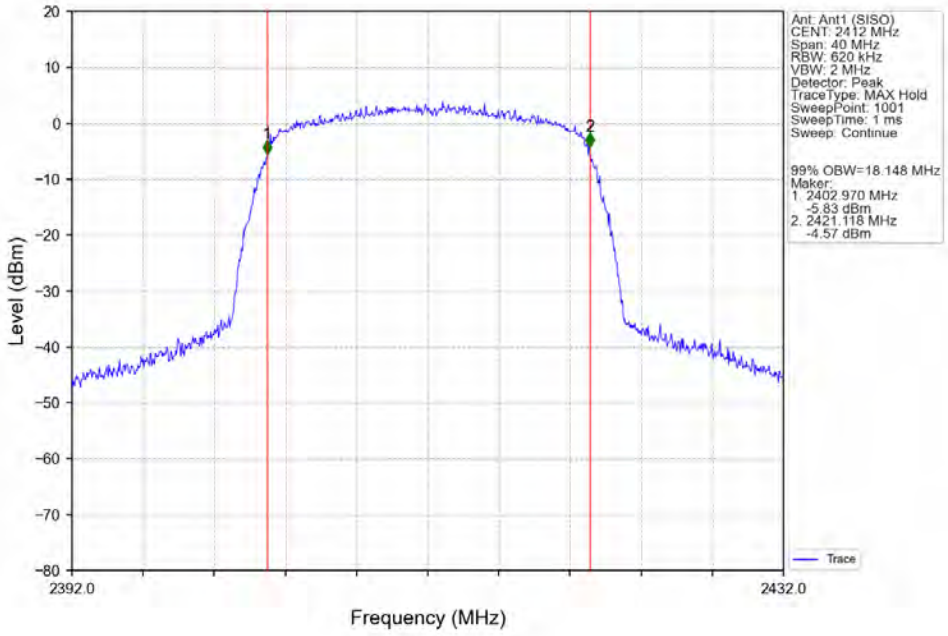
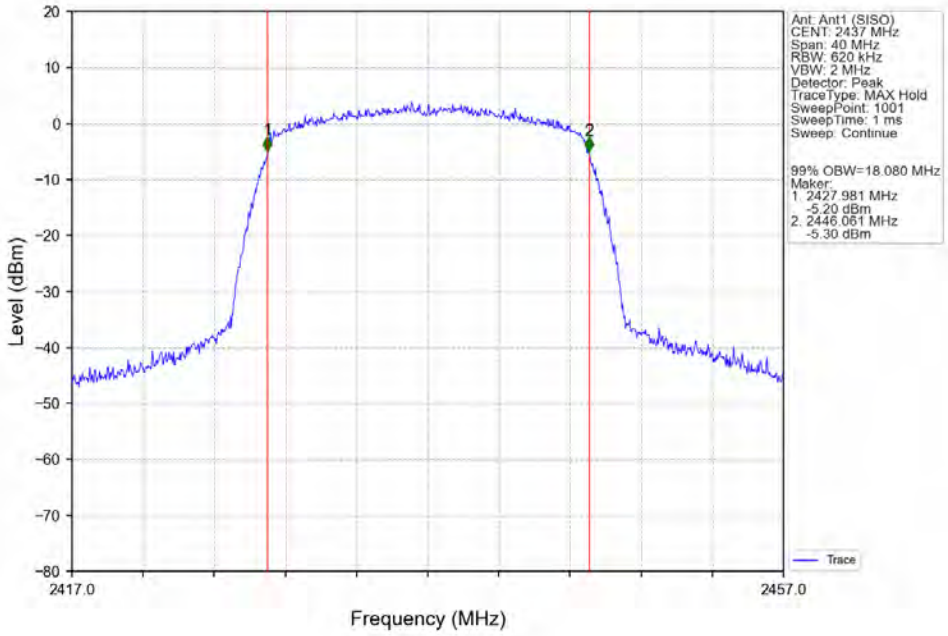
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant1 (SISO)_NTNV



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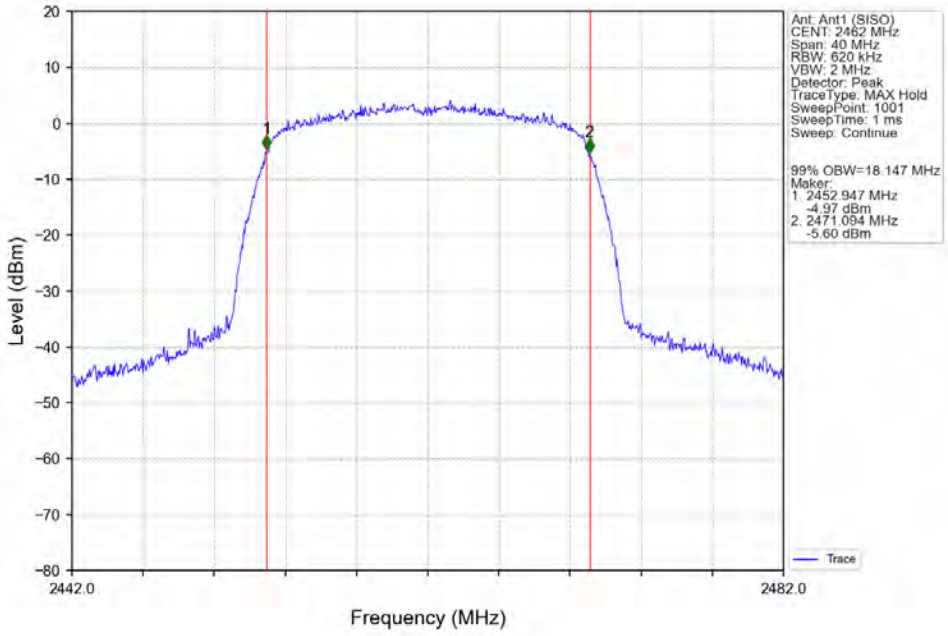
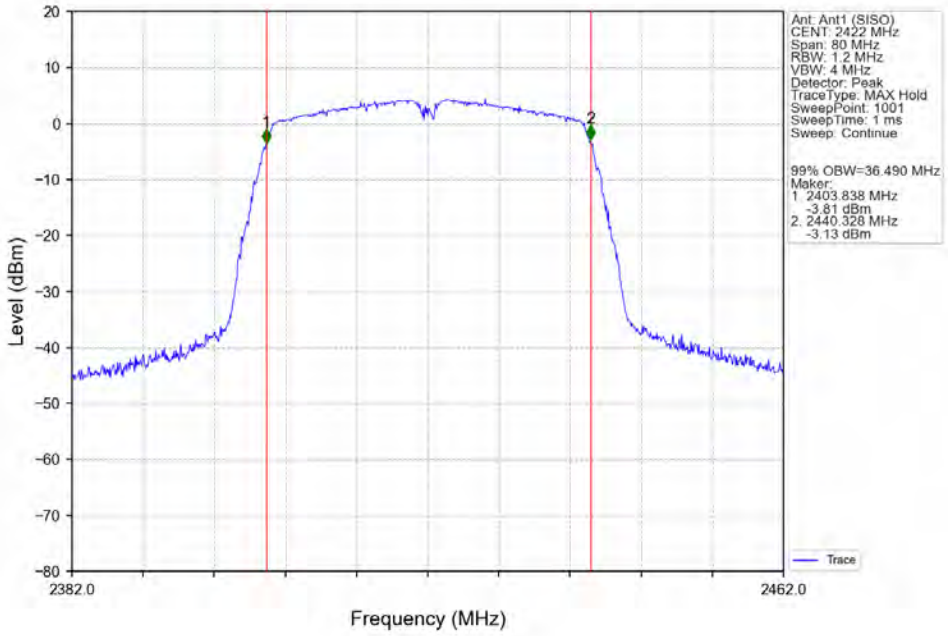
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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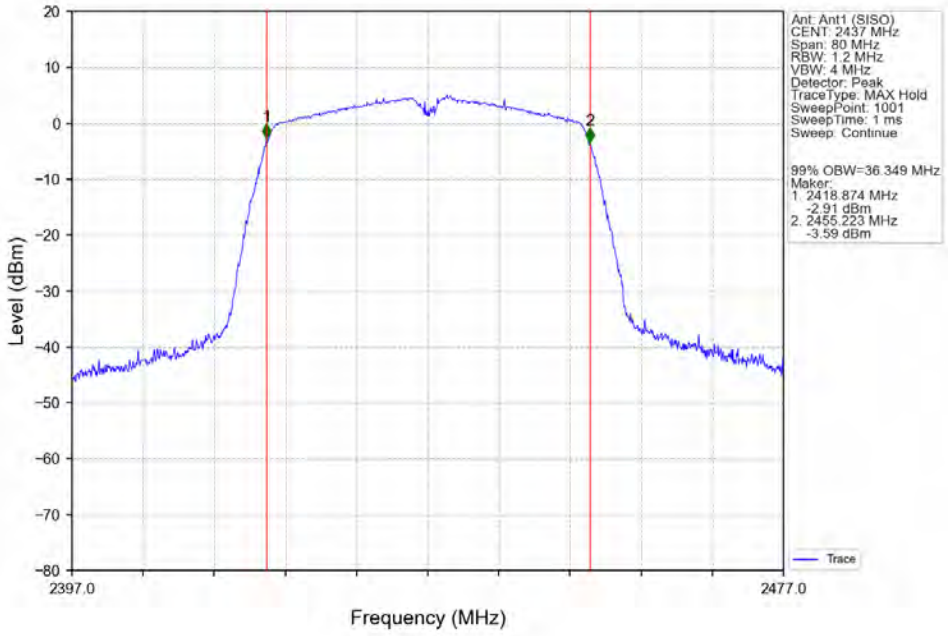
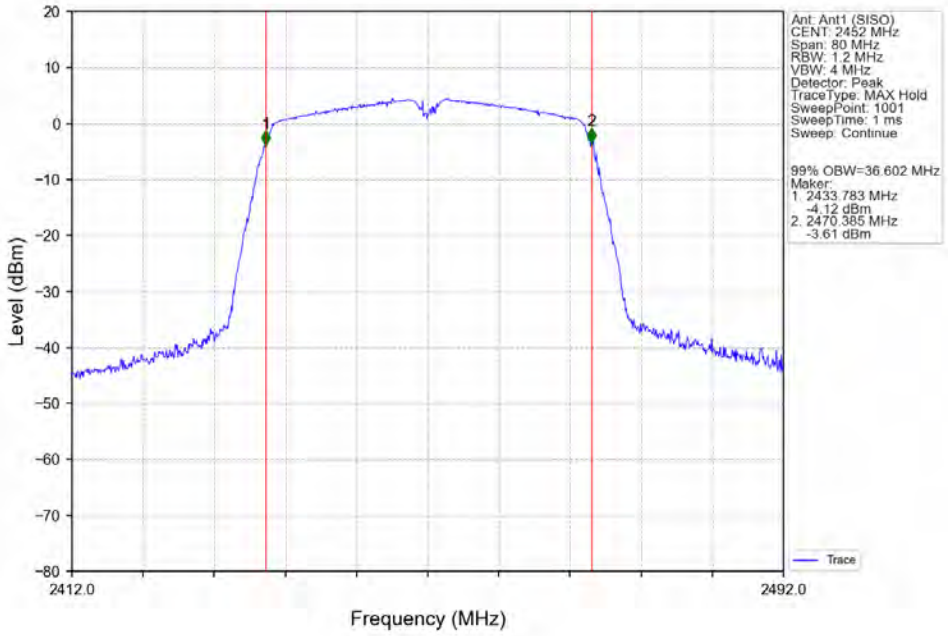
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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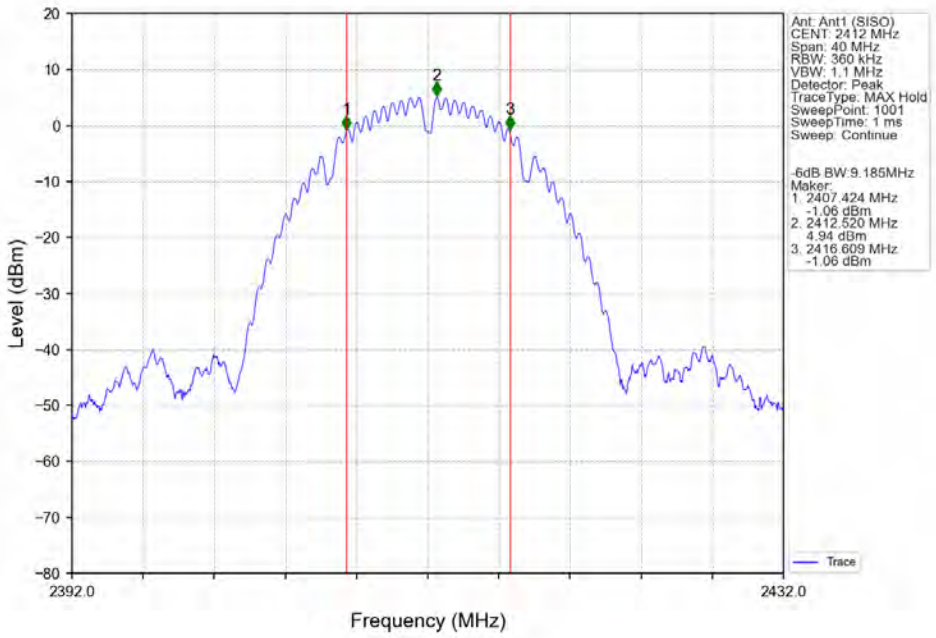
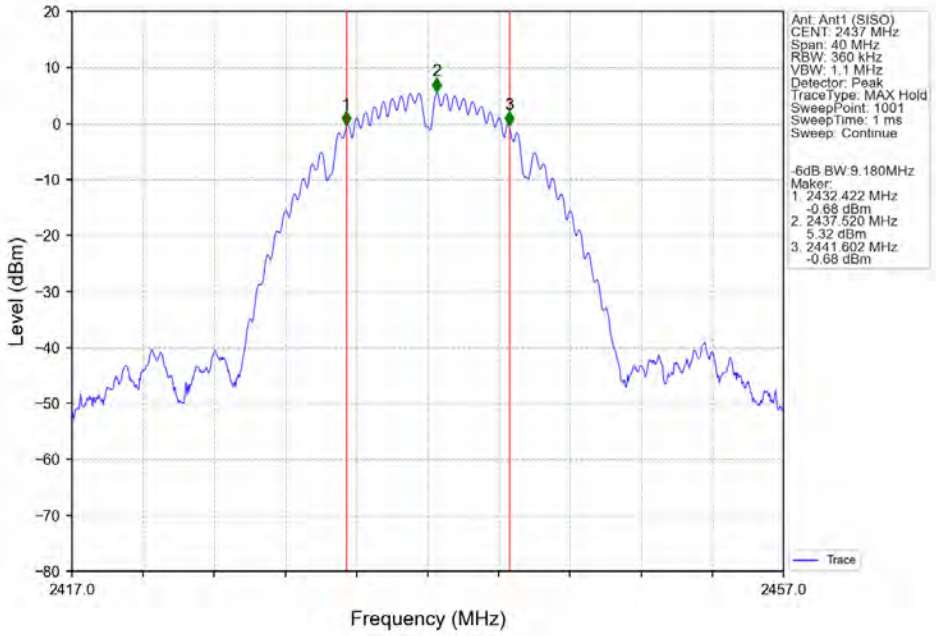
2.2.2 6dB BW

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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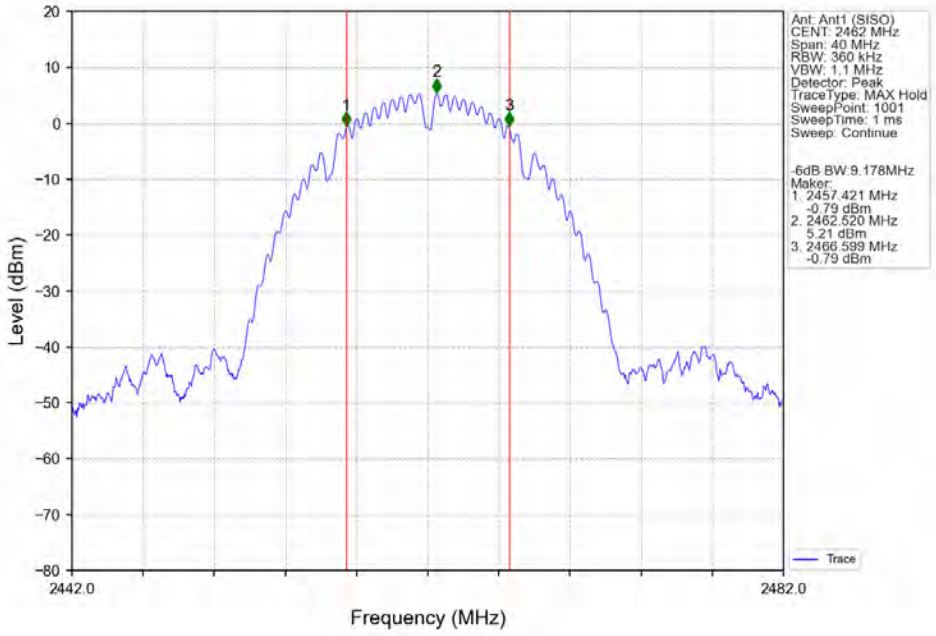
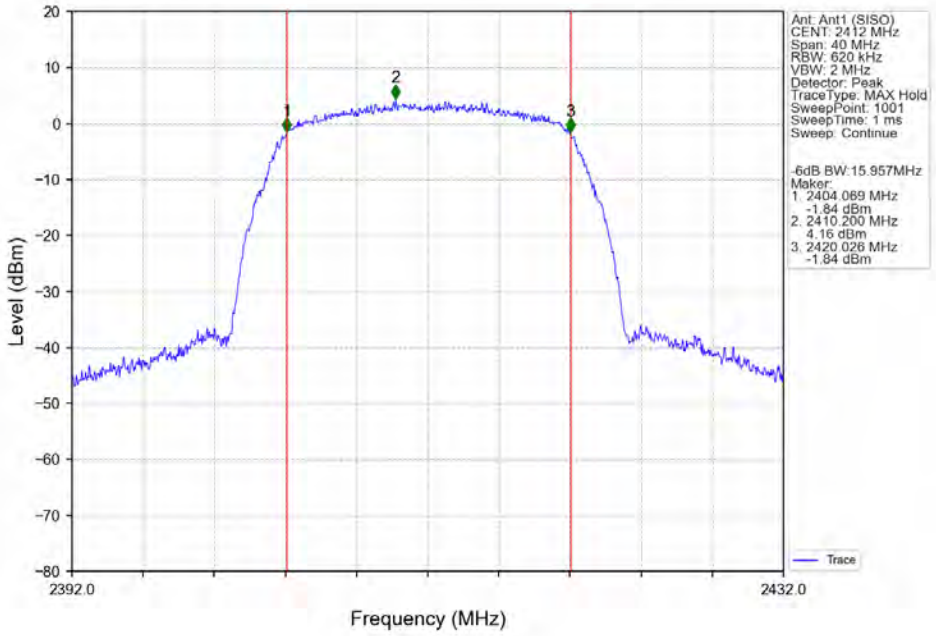
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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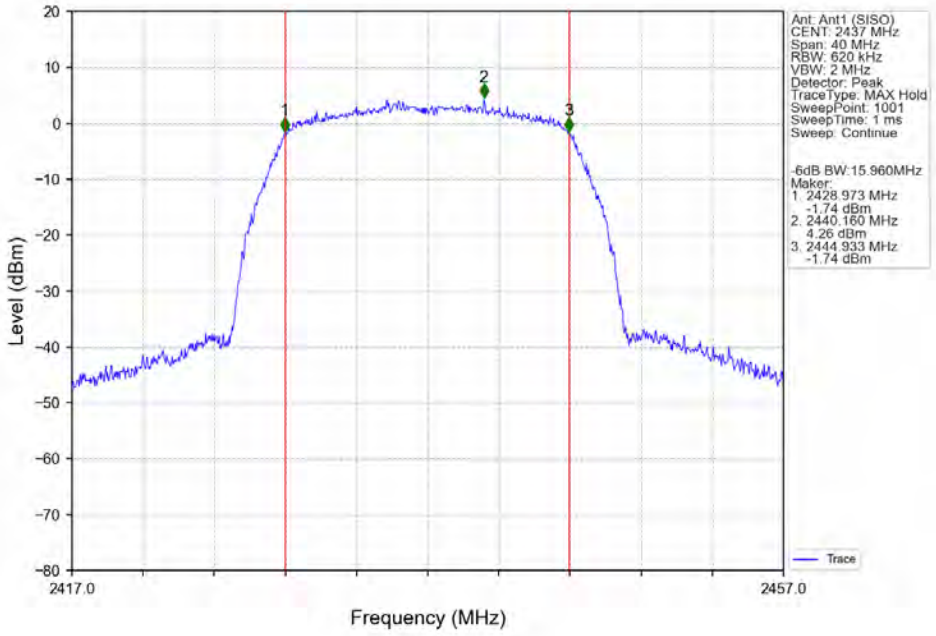
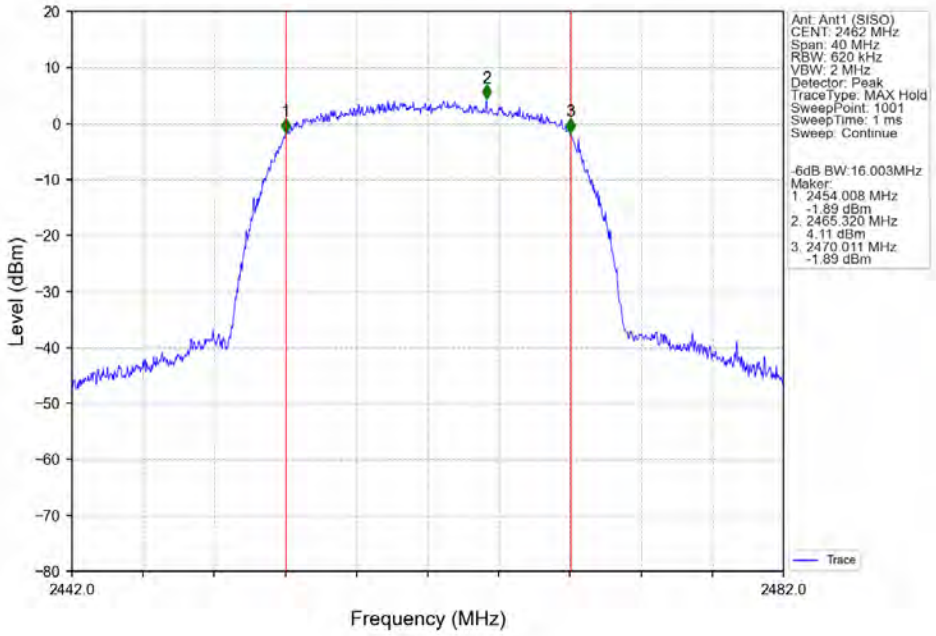
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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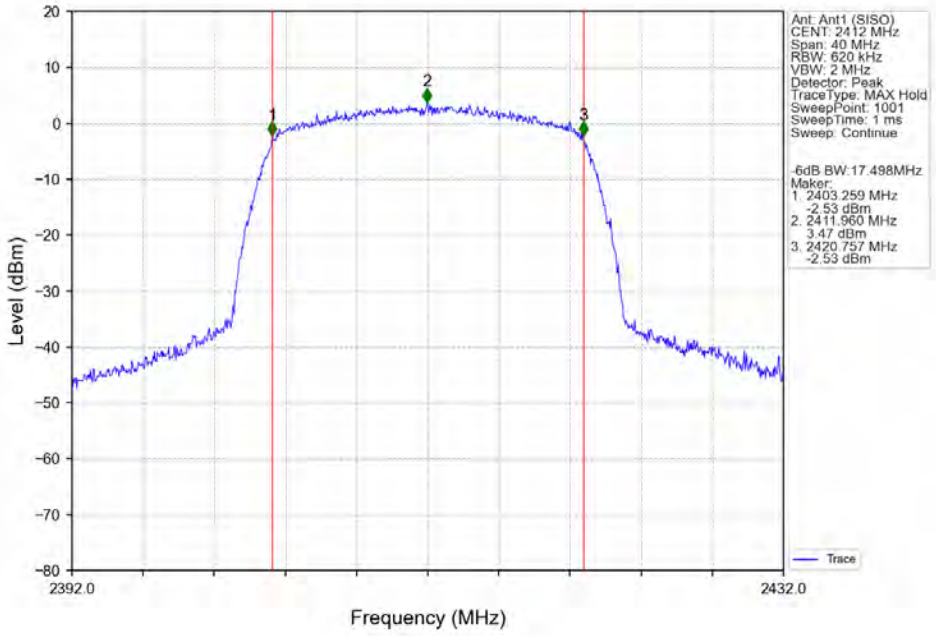
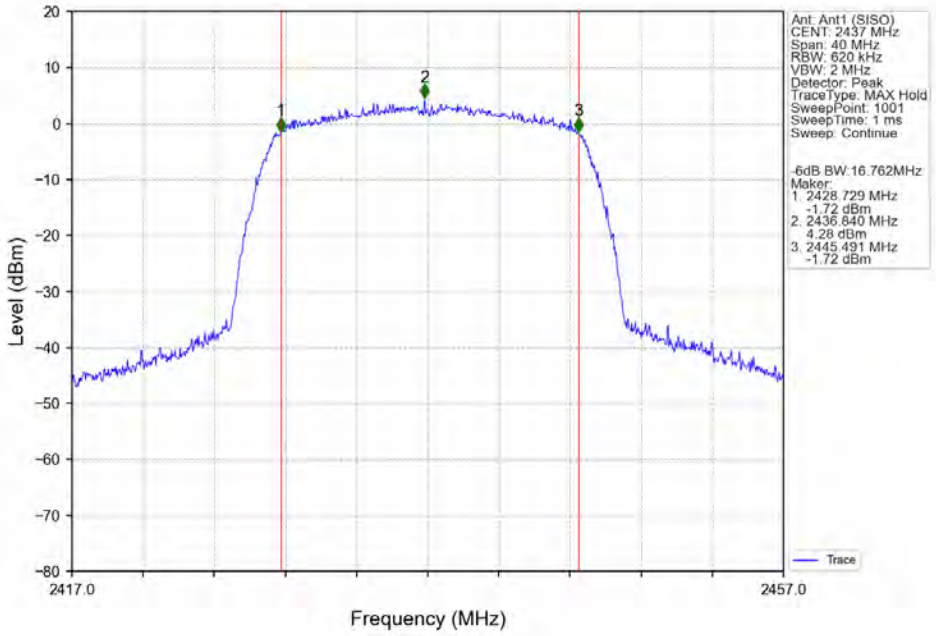
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant1 (SISO)_NTNV



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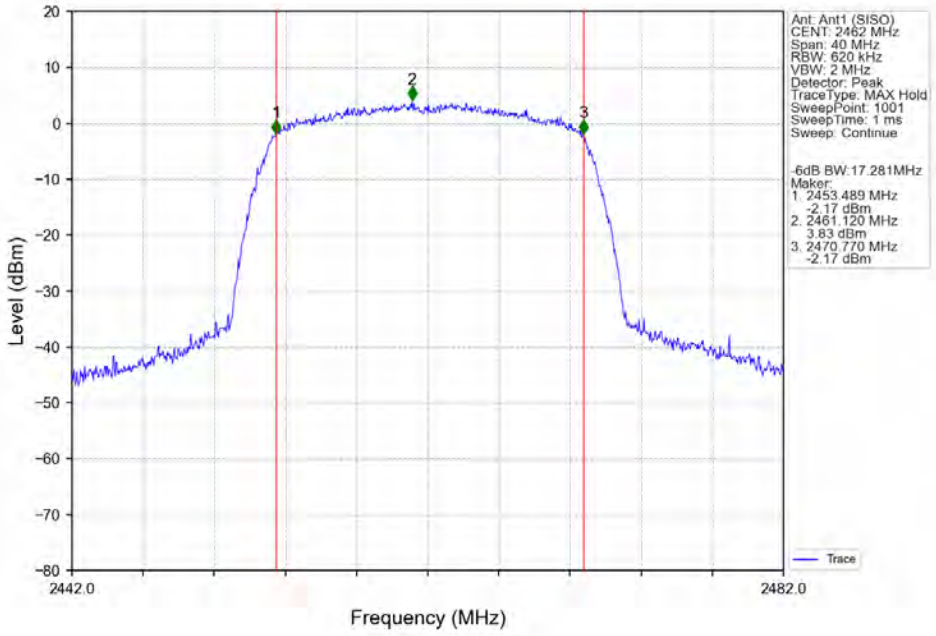
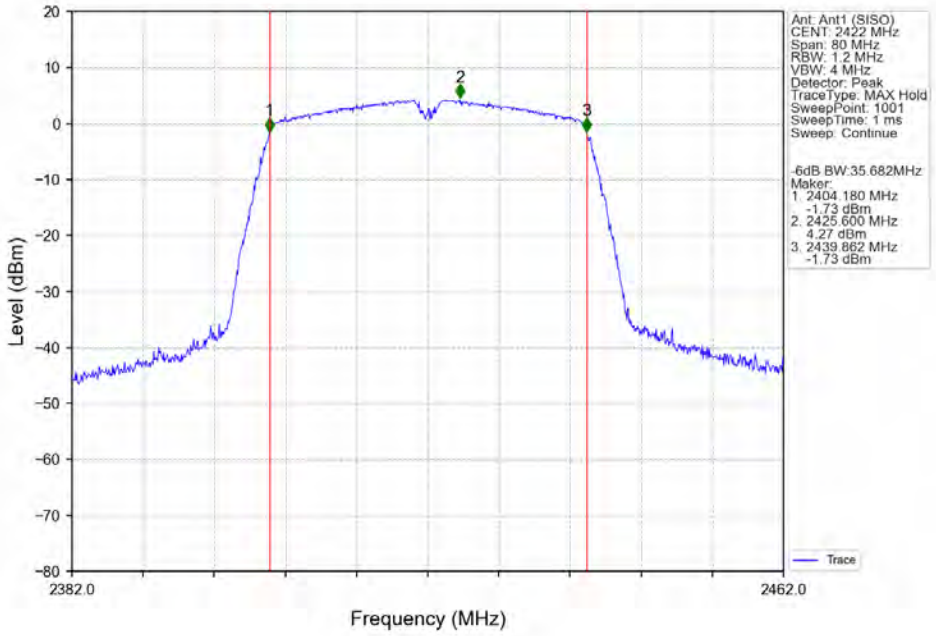
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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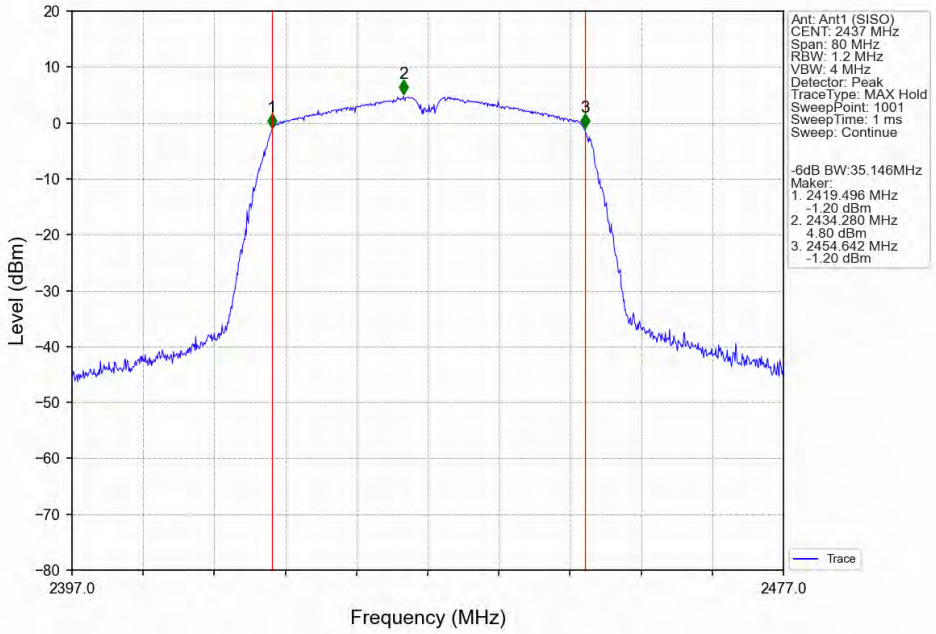
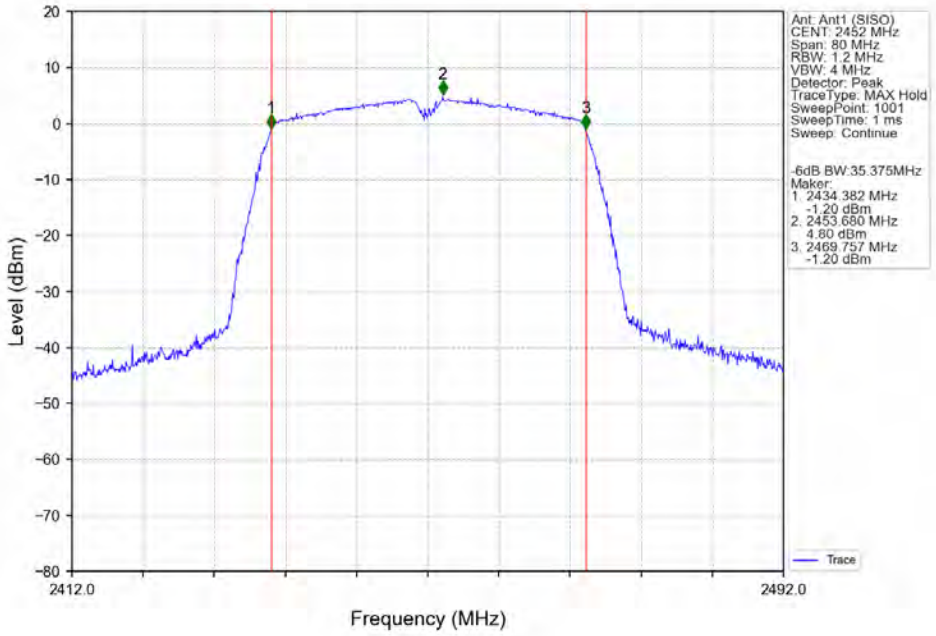
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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3. Maximum Conducted Output Power

3.1 Test Result

3.1.1 Power

Test Channel	Frequency (MHz)	Average Output Power (ANT 1)		Average Output Power (ANT 2)		Average Output Power (ANT Total)		Limit (dBm)	
		dBm	mW	dBm	mW	dBm	mW	dBm	mW
802.11b mode									
CH1	2412	14.88	30.76	15.59	36.22	N/A	N/A	30	1000
CH6	2437	15.28	33.73	15.71	37.24	N/A	N/A		
CH11	2462	15.29	33.81	15.77	37.76	N/A	N/A		
802.11g mode									
CH1	2412	15.72	37.33	15.94	39.26	N/A	N/A	30	1000
CH6	2437	15.79	37.93	16.07	40.46	N/A	N/A		
CH11	2462	15.85	38.46	16.21	41.78	N/A	N/A		
802.11n (HT20)									
CH1	2412	15.60	36.31	15.83	38.28	18.73	74.59	30	1000
CH6	2437	15.83	38.28	15.90	38.90	18.88	77.19		
CH11	2462	15.82	38.19	16.12	40.93	18.98	79.12		
802.11n (HT40)									
CH3	2422	15.75	37.58	16.15	41.21	18.96	78.79	30	1000
CH6	2437	15.99	39.72	16.06	40.36	19.04	80.08		
CH9	2452	15.97	39.54	16.19	41.59	19.09	81.13		

Note: Total Power=ANT 1+ANT 2

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4. Maximum Power Spectral Density

4.1 Test Result

4.1.1 PSD

Test Channel	Frequency (MHz)	Power density (ANT 1)	Power density (ANT 2)	Power density (ANT Total)	Limit (dBm)
		dBm/MHz	dBm/MHz	dBm/MHz	dBm/MHz
802.11b mode					
CH1	2412	-10.12	-10.16	N/A	<=8
CH6	2437	-9.35	-8.79	N/A	
CH11	2462	-10.44	-8.38	N/A	
802.11g mode					
CH1	2412	-17.35	-15.68	N/A	<=8
CH6	2437	-16.40	-16.87	N/A	
CH11	2462	-17.15	-15.47	N/A	
802.11n (HT20) mode					
CH1	2412	-16.06	-16.22	-13.13	<=5.83
CH6	2437	-17.73	-16.86	-14.26	
CH11	2462	-17.44	-15.37	-13.27	
802.11n (HT40) mode					
CH3	2422	-19.40	-18.77	-16.06	<=5.83
CH6	2437	-17.97	-19.21	-15.54	
CH9	2452	-19.77	-19.66	-16.70	

Note1: Total Power density =ANT 1+ANT 2
Note2: Directional gain = G_{ANT} + 10 log(N_{ANT}) dBi=5.16+3.01=8.17dBi>6dBi
Note3: FCC limit=8-(5.16 + 10 log(2)-6)=5.83

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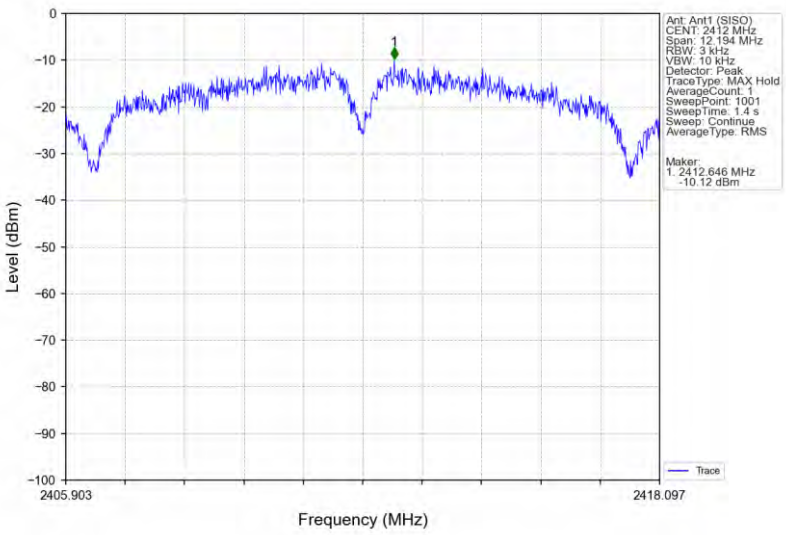
4.2 Test Graph

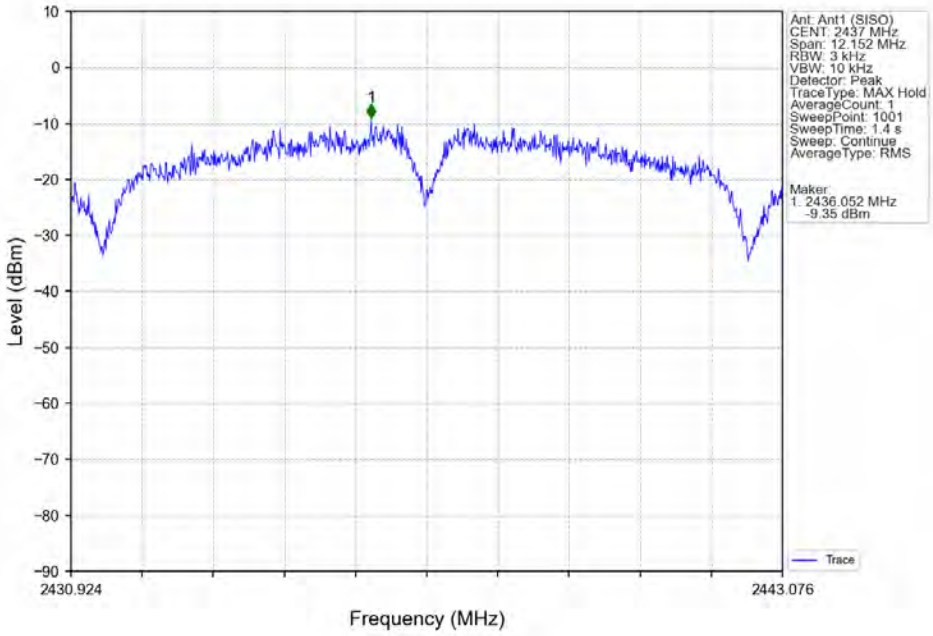
4.2.1 PSD

ANT 1

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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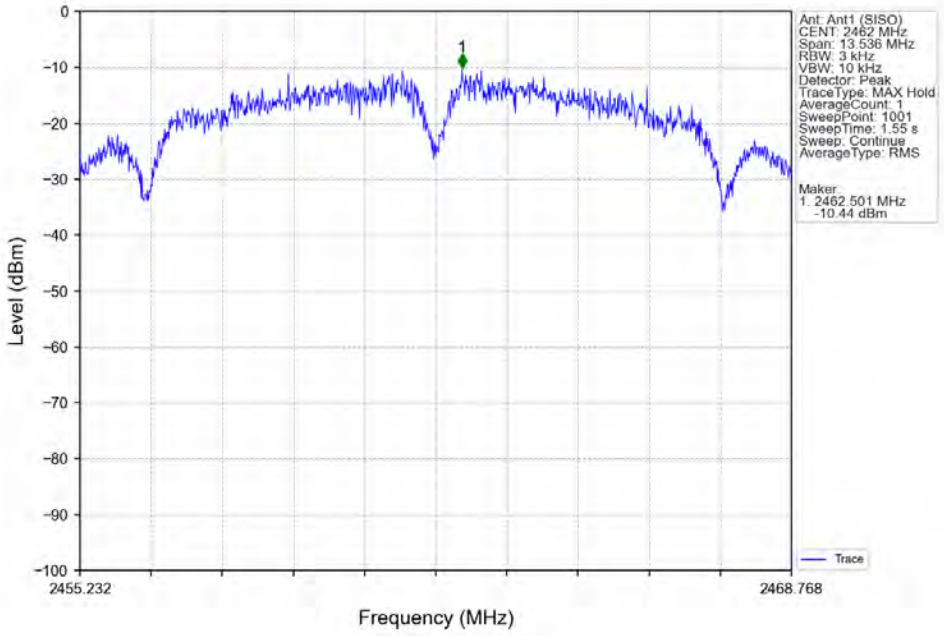
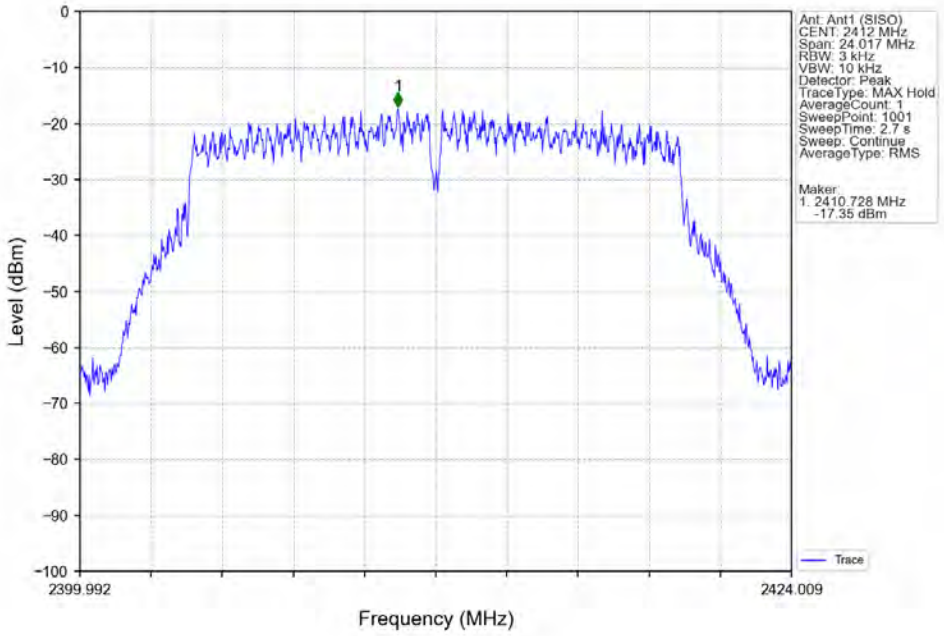
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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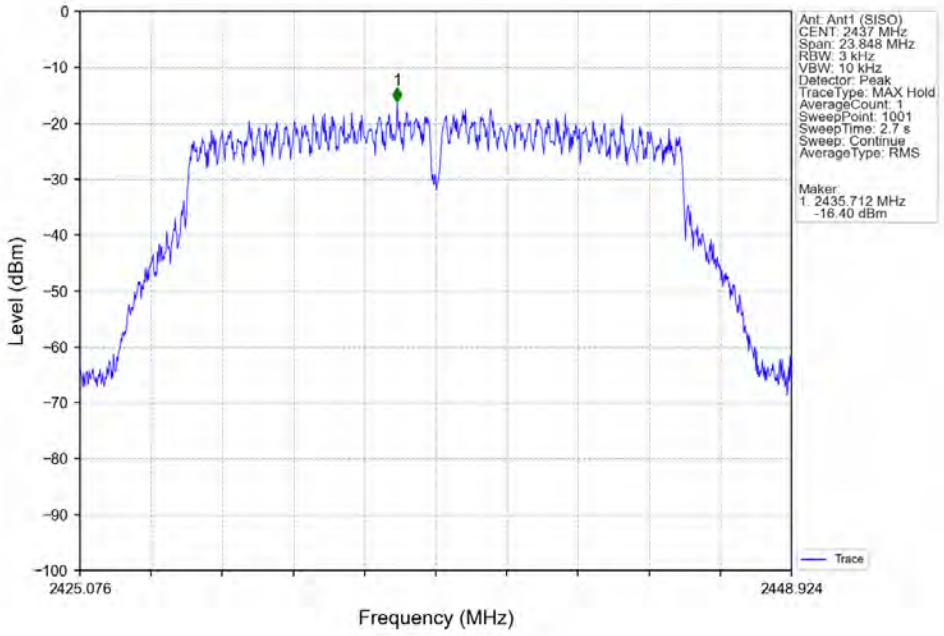
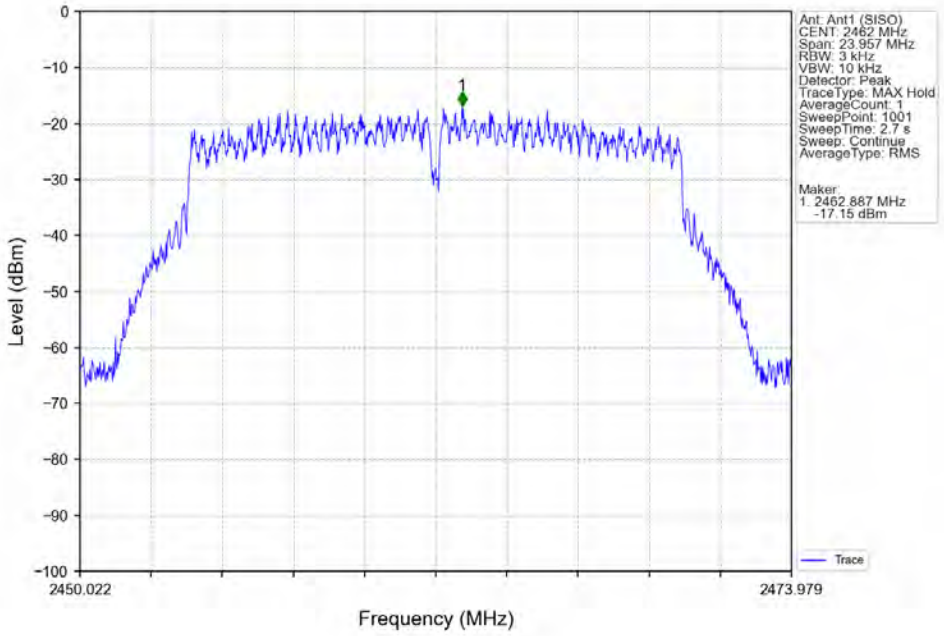
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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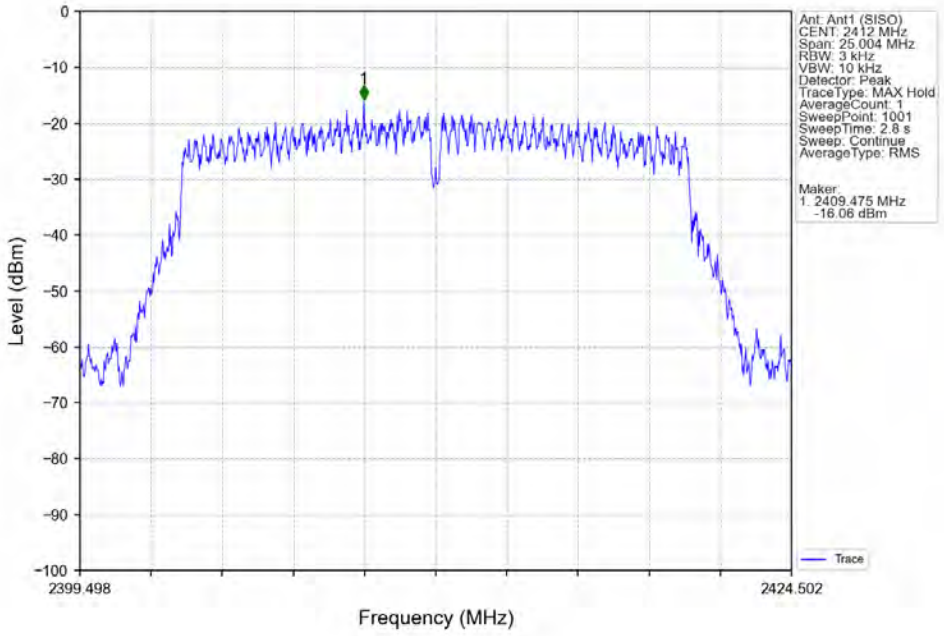
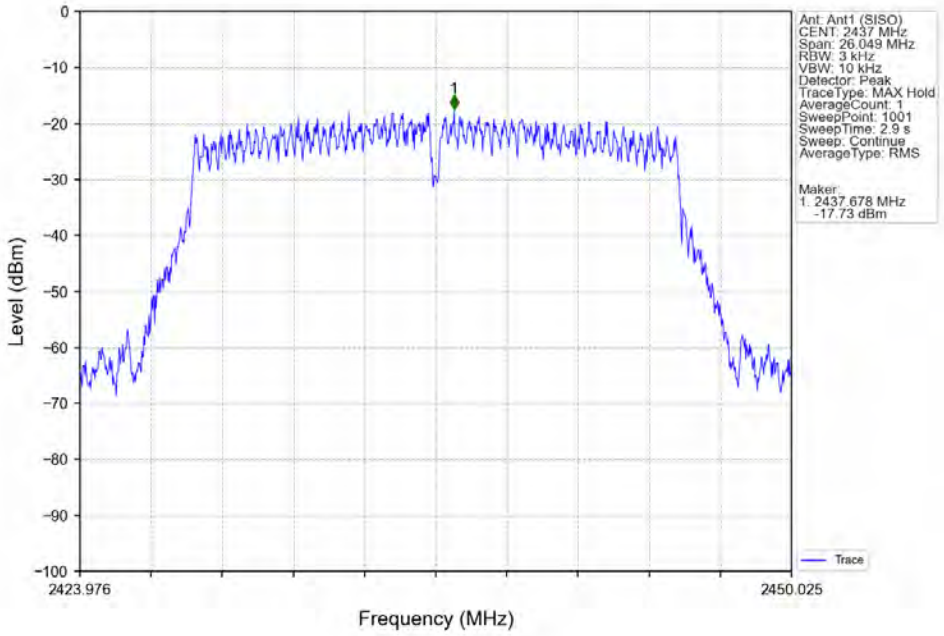
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant1 (SISO)_NTNV



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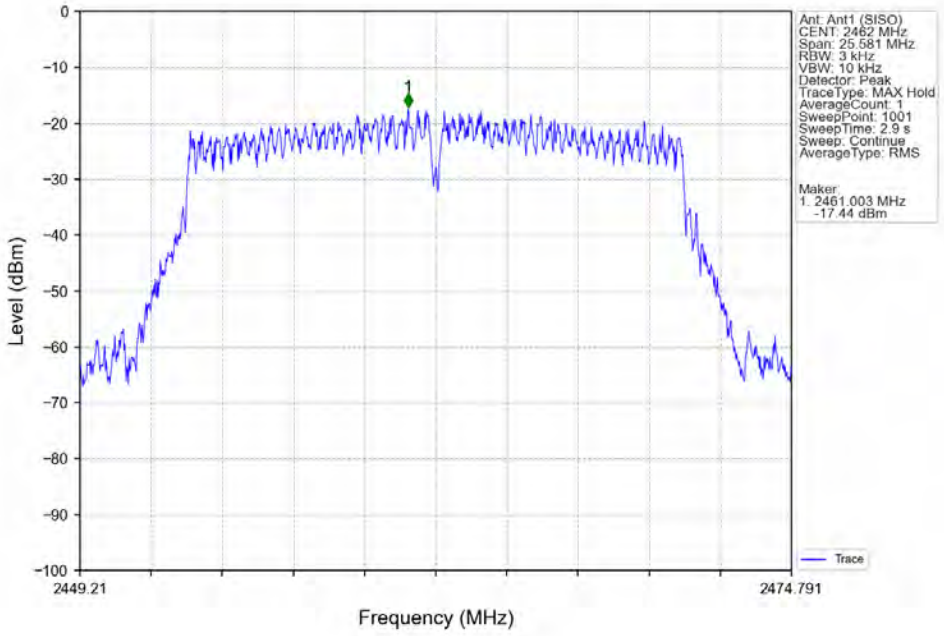
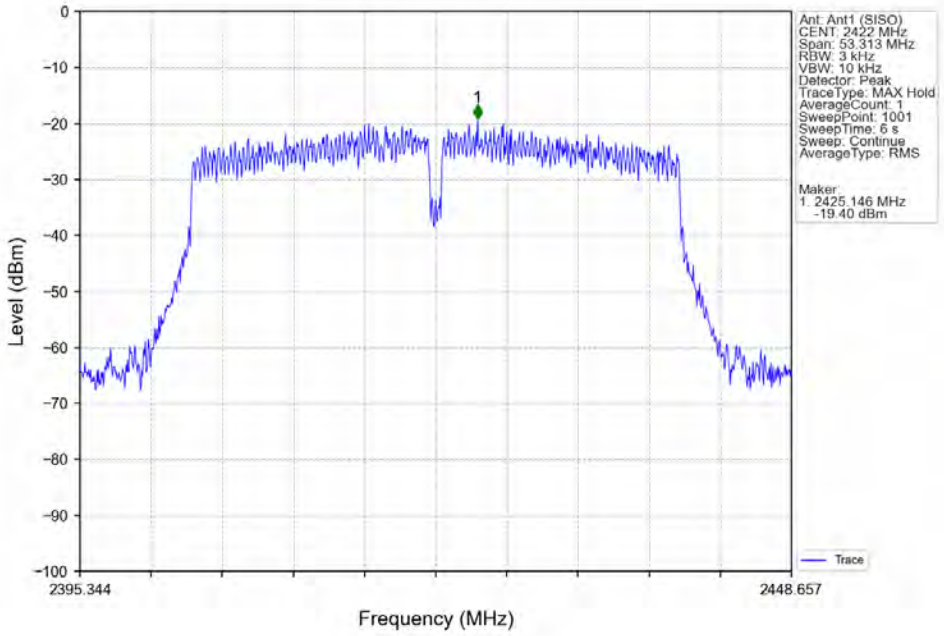
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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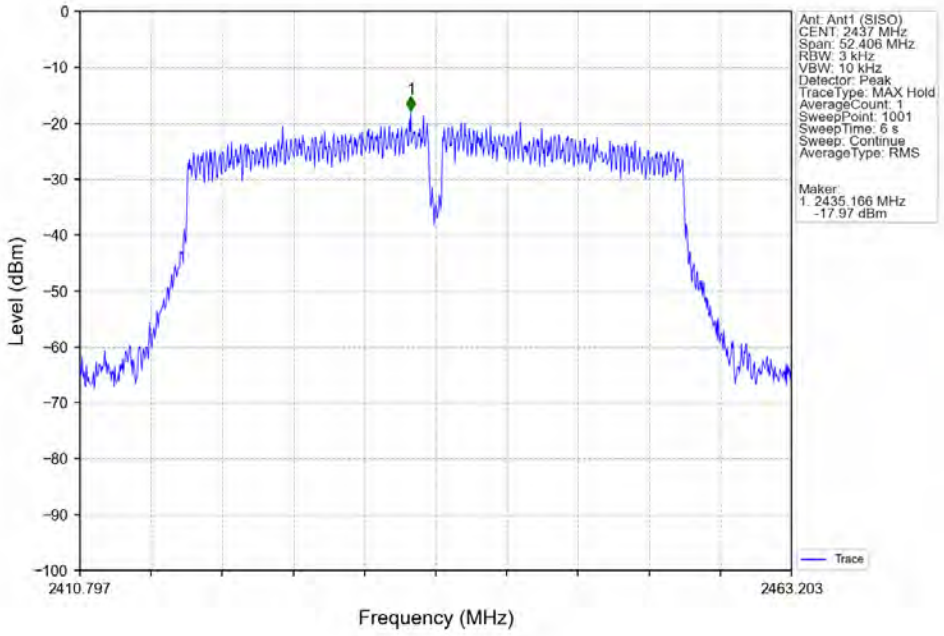
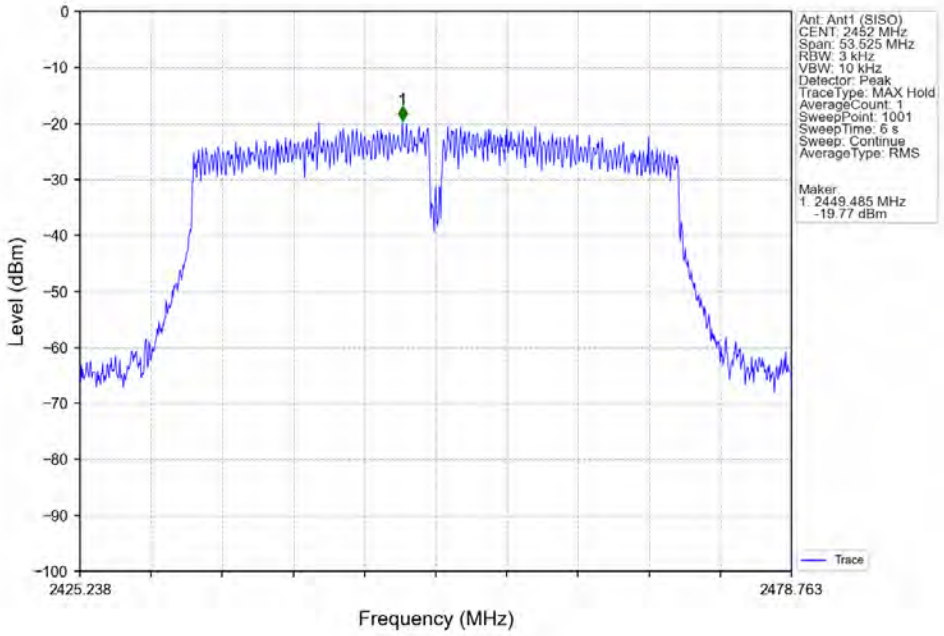
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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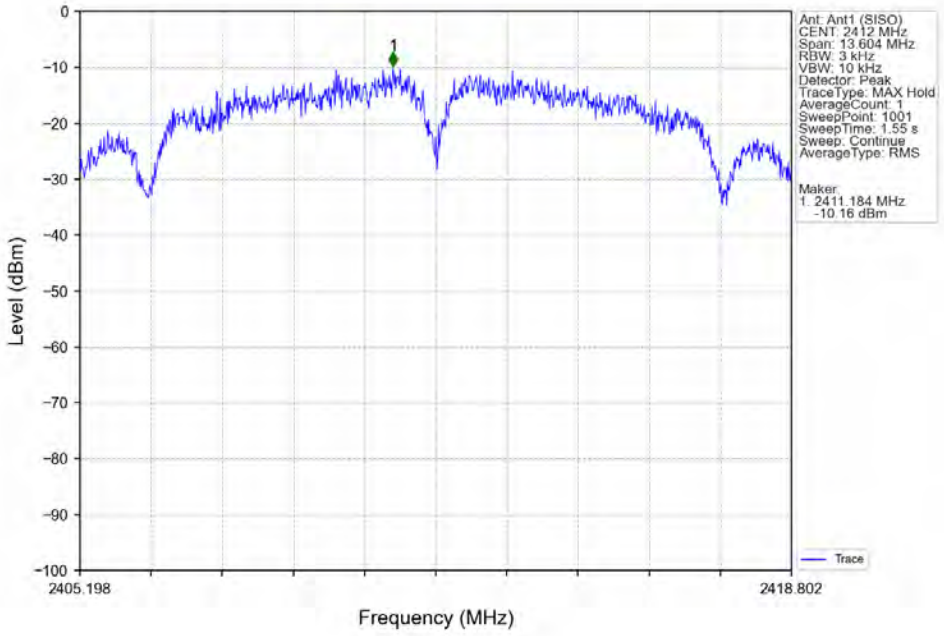
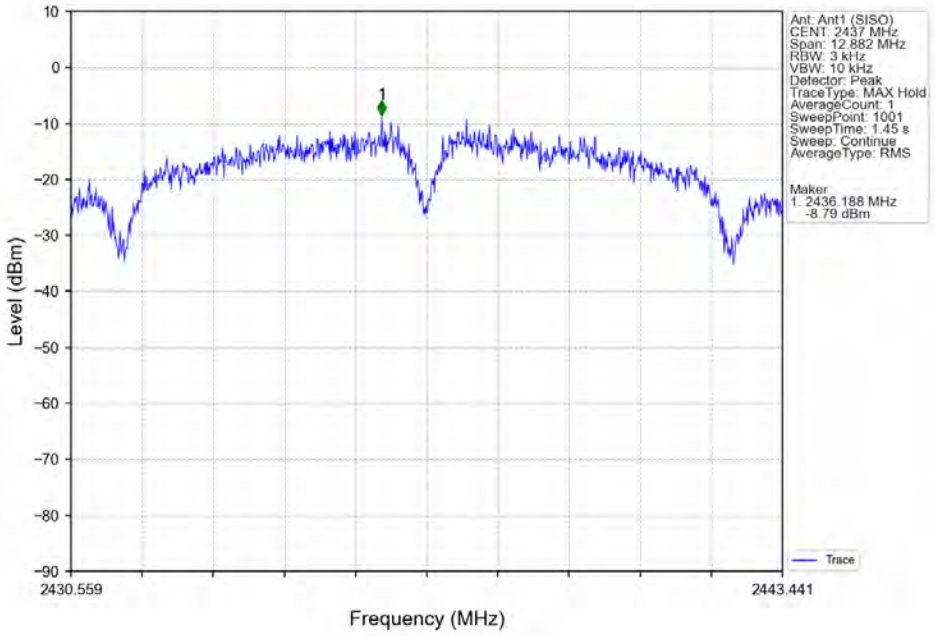
ANT2

802.11b_LCH_2412MHz_Ant2 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant2 (SISO)_NTNV



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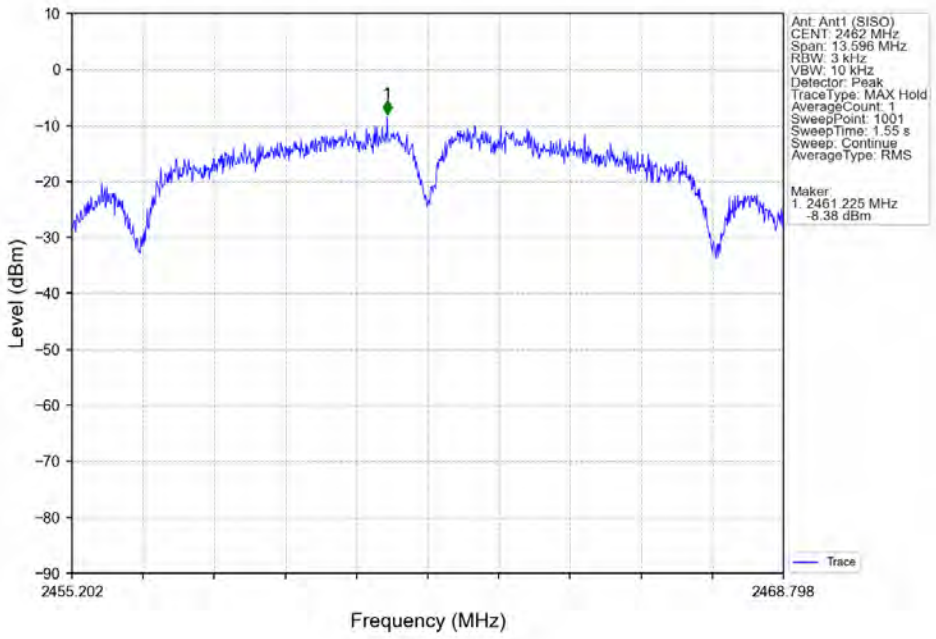
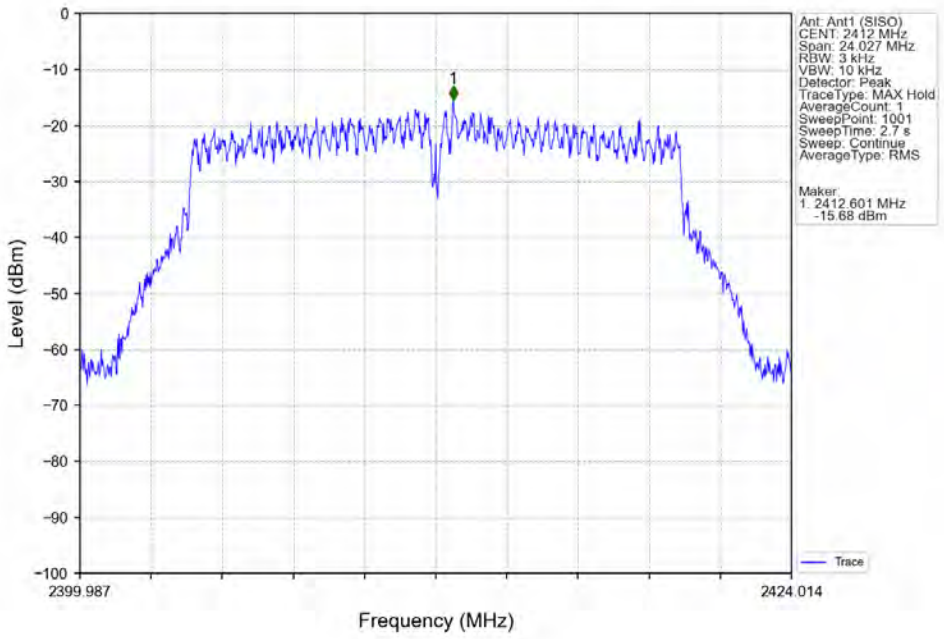
802.11b_HCH_2462MHz_Ant2 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant2 (SISO)_NTNV



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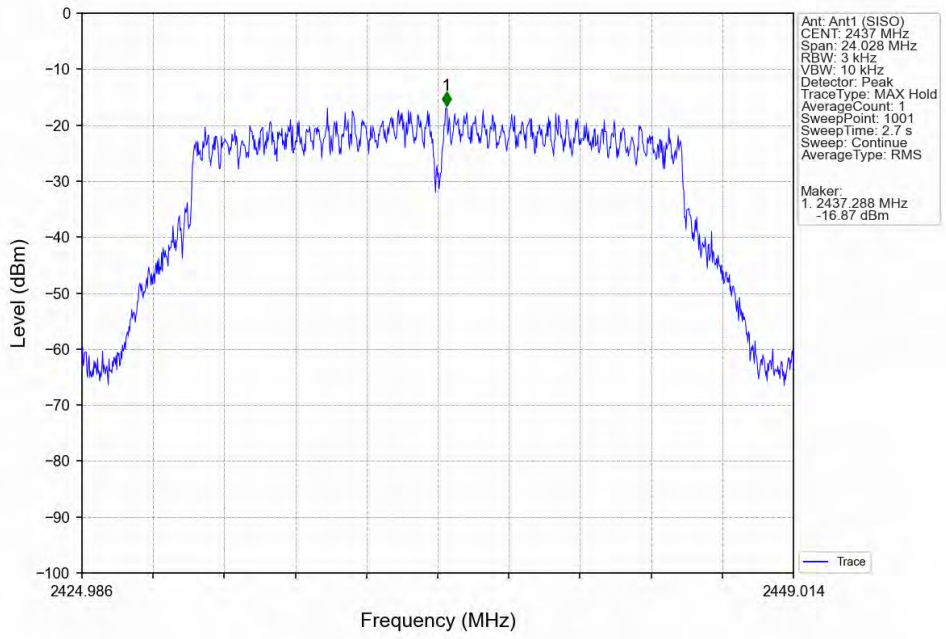
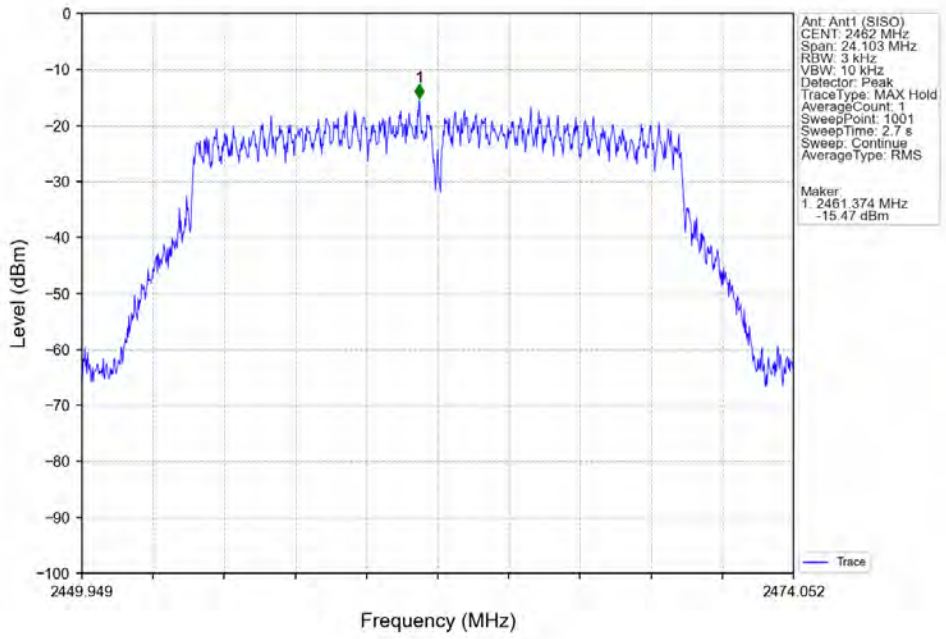
802.11g_MCH_2437MHz_Ant2 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant2 (SISO)_NTNV



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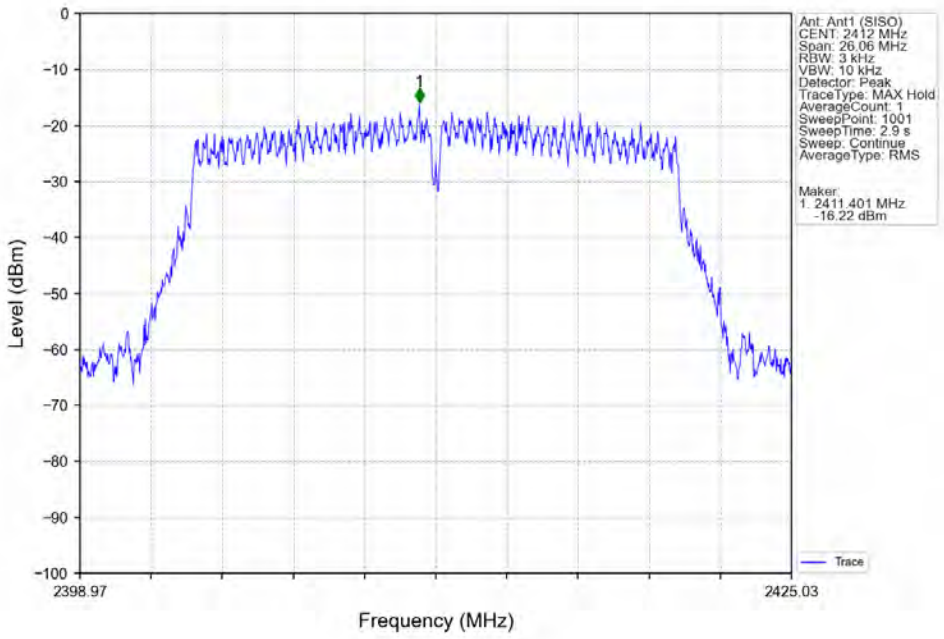
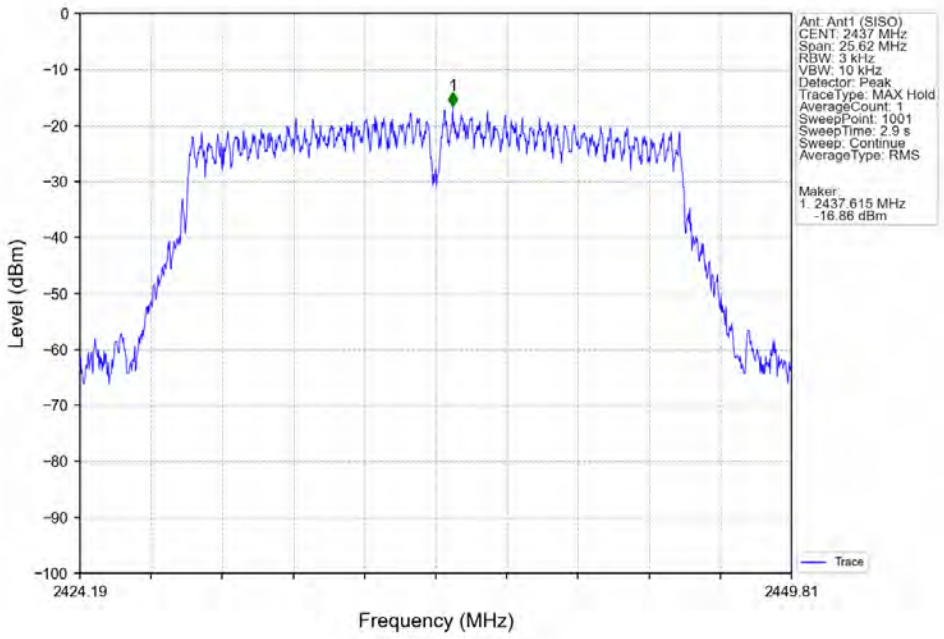
802.11n(HT20)_LCH_2412MHz_Ant2 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant2 (SISO)_NTNV



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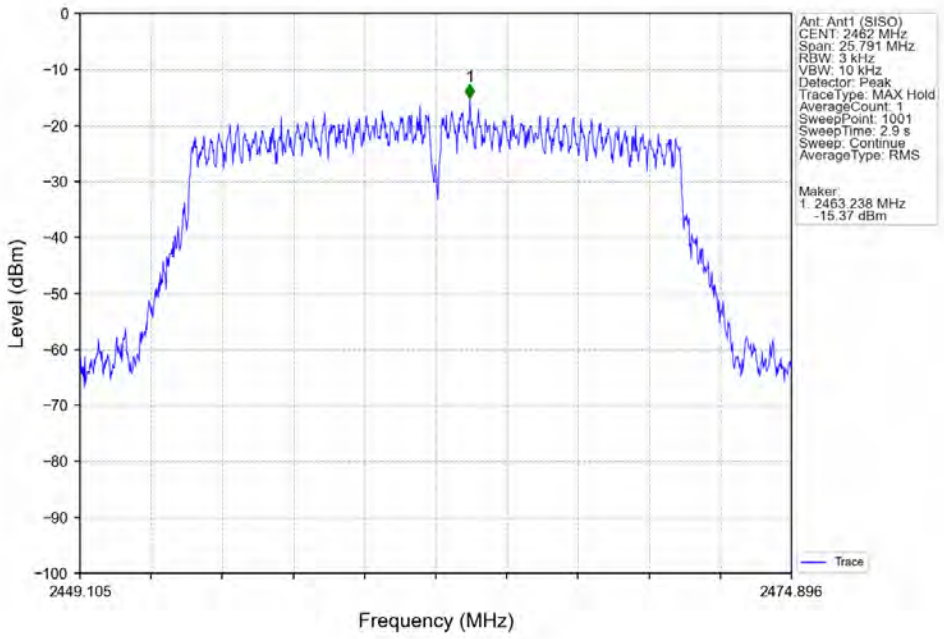
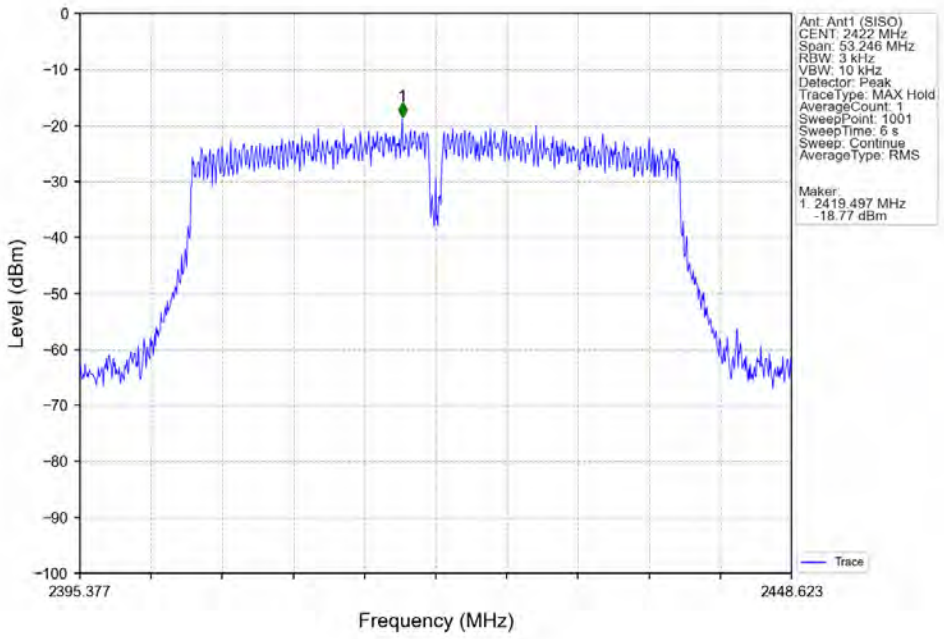
802.11n(HT20)_HCH_2462MHz_Ant2 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant2 (SISO)_NTNV



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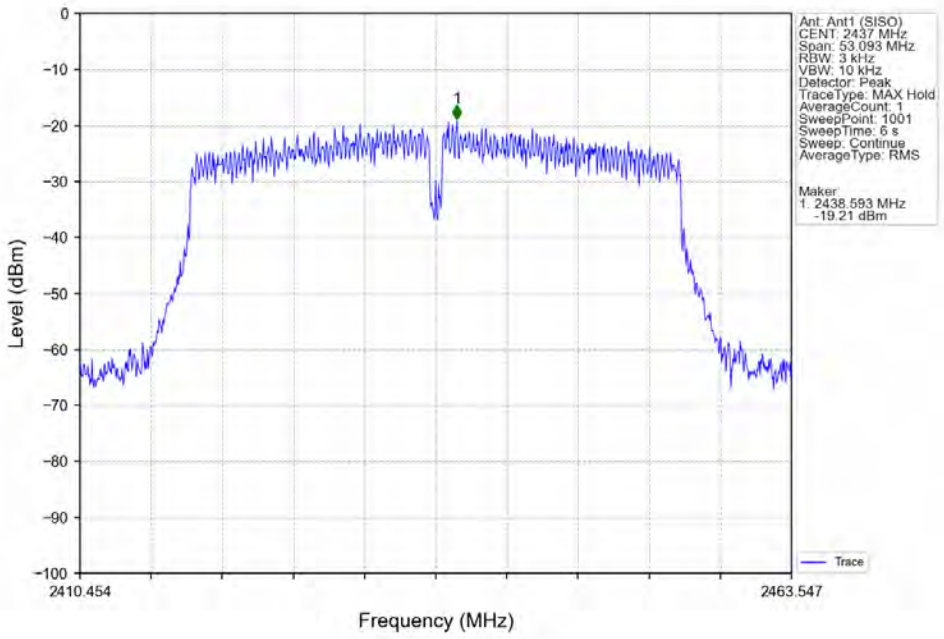
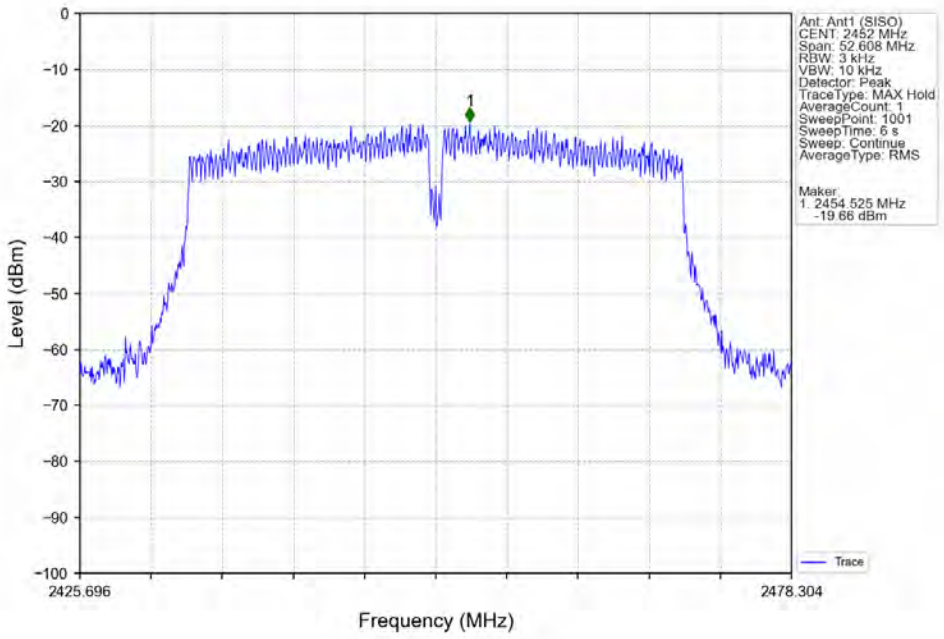
802.11n(HT40)_MCH_2437MHz_Ant2 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant2 (SISO)_NTNV



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5. Unwanted Emissions In Non-restricted Frequency Bands

Note: All modes of both antennas were tested, with antenna 2 having the worst data, and only the worst data showed in the report

5.1 Test Result

5.1.1 Ref

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
802.11b	SISO	2412	2	4.84
		2437	2	4.90
		2462	2	5.13
802.11g	SISO	2412	2	-2.49
		2437	2	-2.45
		2462	2	-1.76
802.11n (HT20)	SISO	2412	2	-2.53
		2437	2	-1.87
		2462	2	-1.88
802.11n (HT40)	SISO	2422	2	-4.64
		2437	2	-4.36
		2452	2	-4.62
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2020, the channel contains the maximum PSD level was used to establish the reference level.				

5.1.2 CSE

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
802.11b	SISO	2412	2	5.13	-24.87	Pass
		2437	2	5.13	-24.87	Pass
		2462	2	5.13	-24.87	Pass
802.11g	SISO	2412	2	-1.76	-31.76	Pass
		2437	2	-1.76	-31.76	Pass
		2462	2	-1.76	-31.76	Pass
802.11n (HT20)	SISO	2412	2	-1.87	-31.87	Pass
		2437	2	-1.87	-31.87	Pass
		2462	2	-1.87	-31.87	Pass
802.11n (HT40)	SISO	2422	2	-4.36	-34.36	Pass
		2437	2	-4.36	-34.36	Pass
		2452	2	-4.36	-34.36	Pass
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2020, the channel contains the maximum PSD level was used to establish the reference level.						

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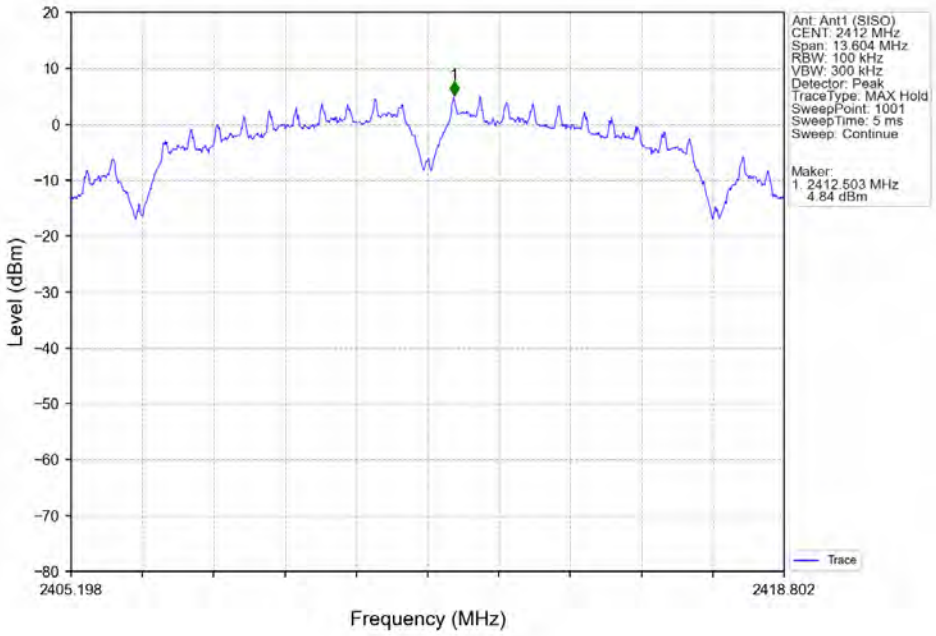
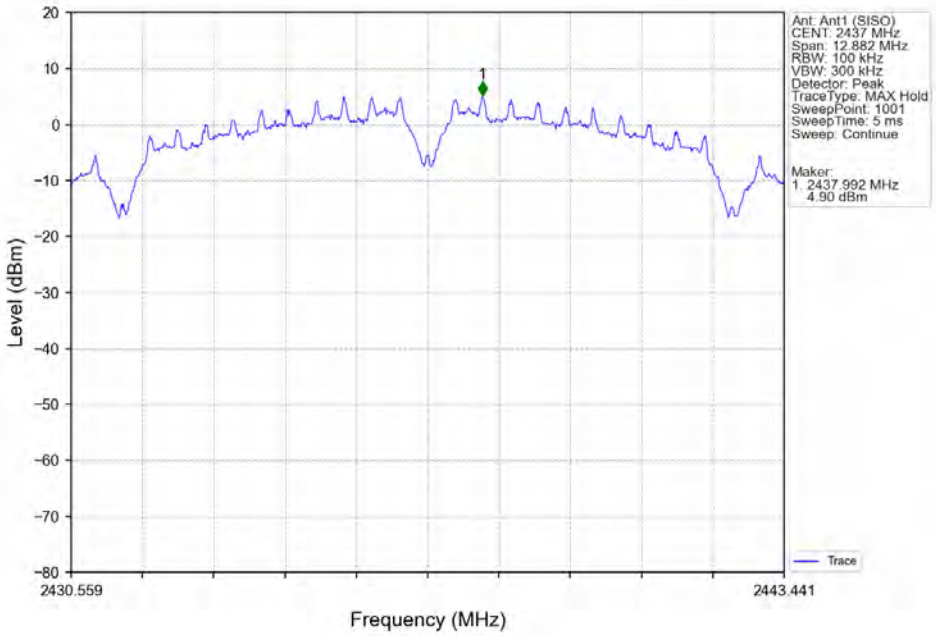
5.2 Test Graph

802.11b_LCH_2412MHz_Ant2 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant2 (SISO)_NTNV



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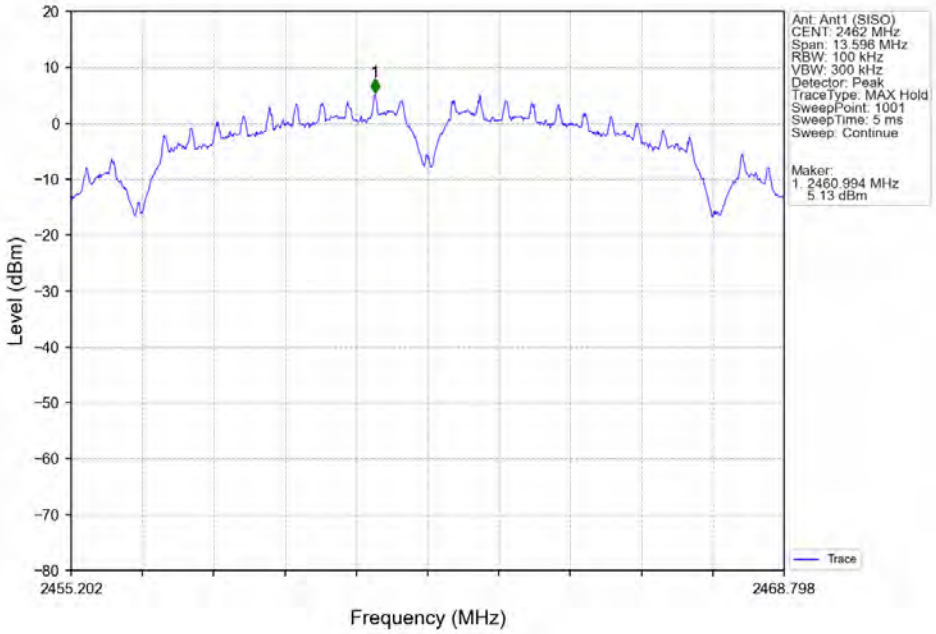
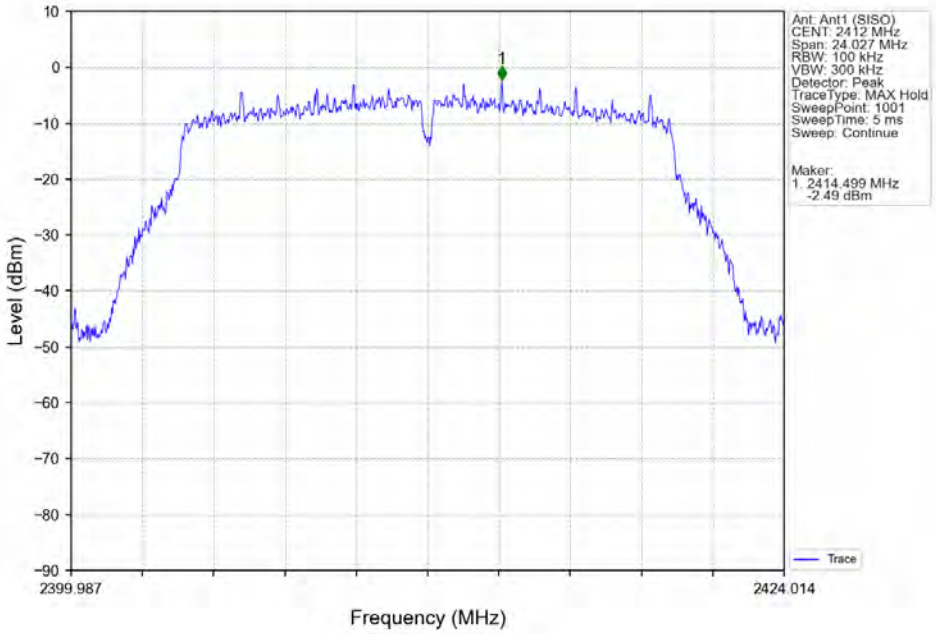
802.11b_HCH_2462MHz_Ant2 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant2 (SISO)_NTNV



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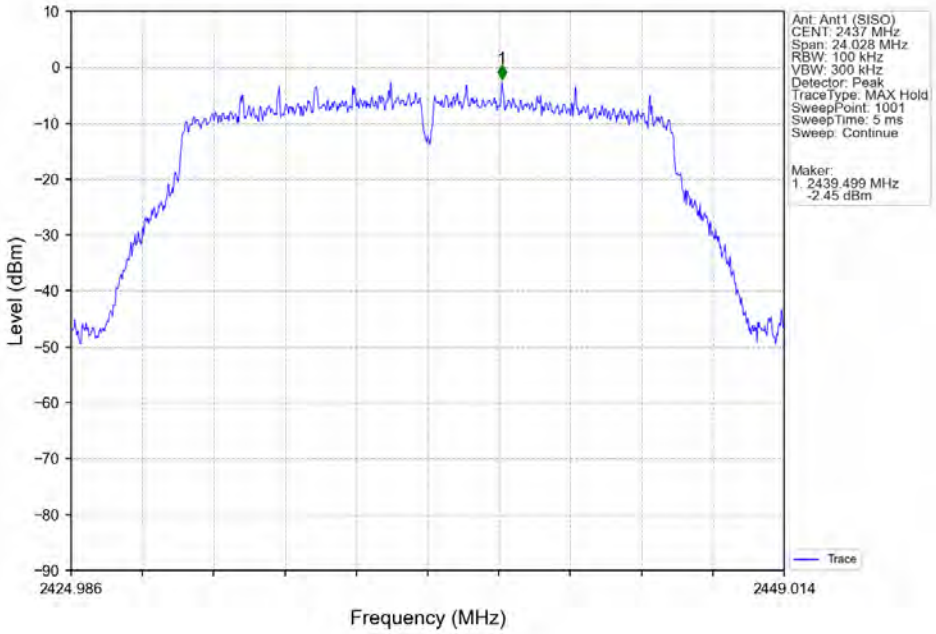
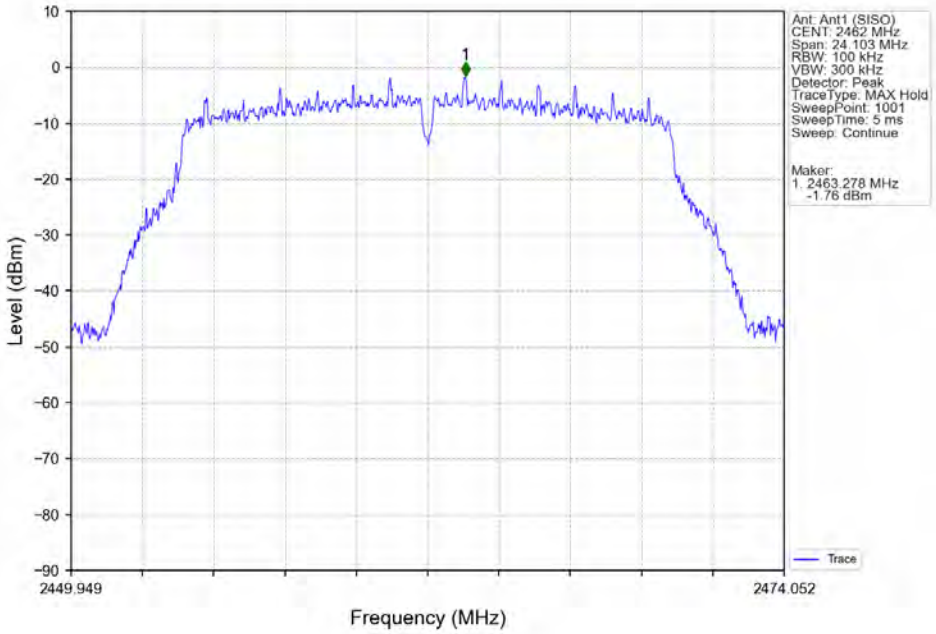
802.11g_MCH_2437MHz_Ant2 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant2 (SISO)_NTNV



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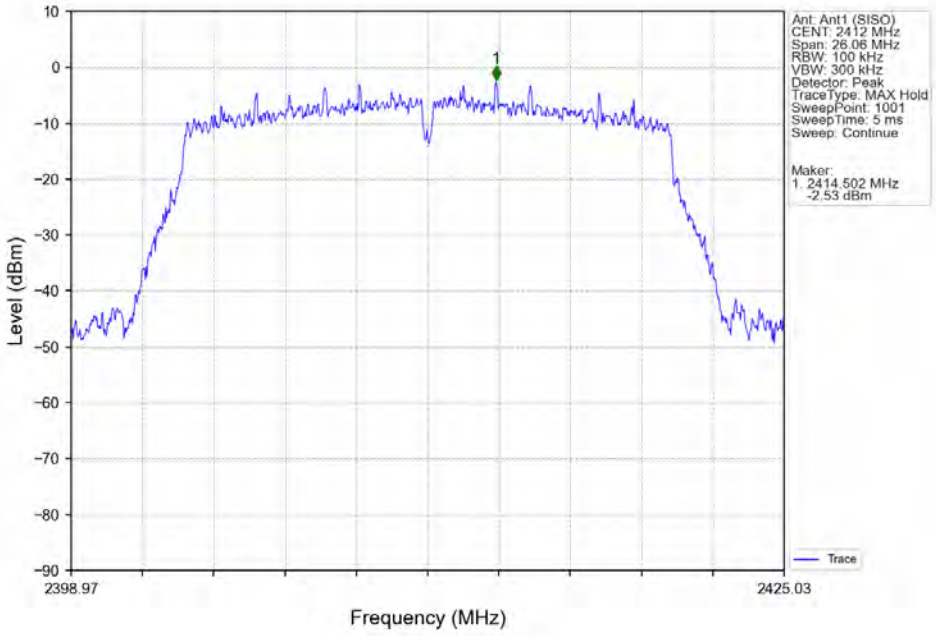
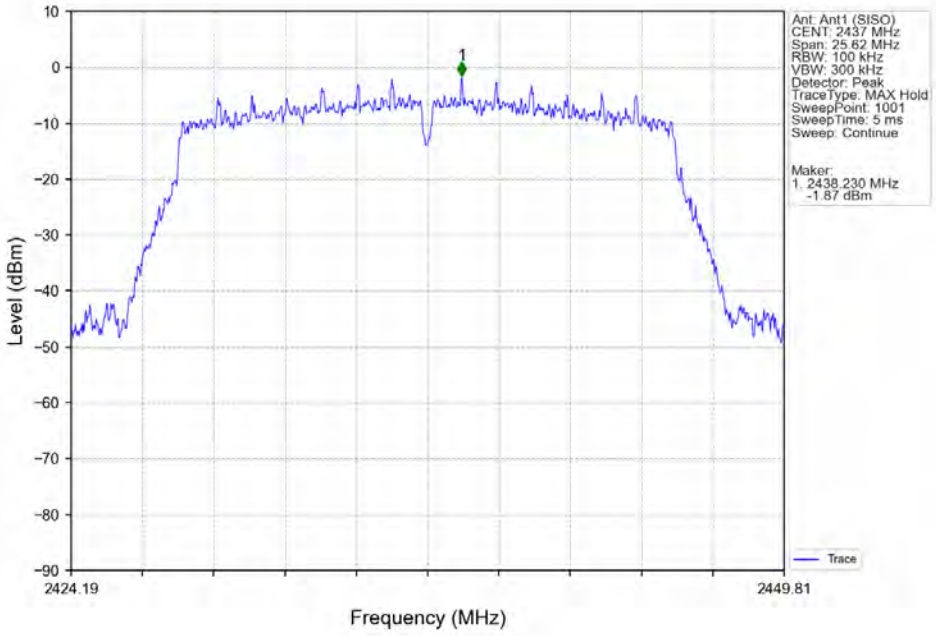
802.11n(HT20)_LCH_2412MHz_Ant2 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant2 (SISO)_NTNV



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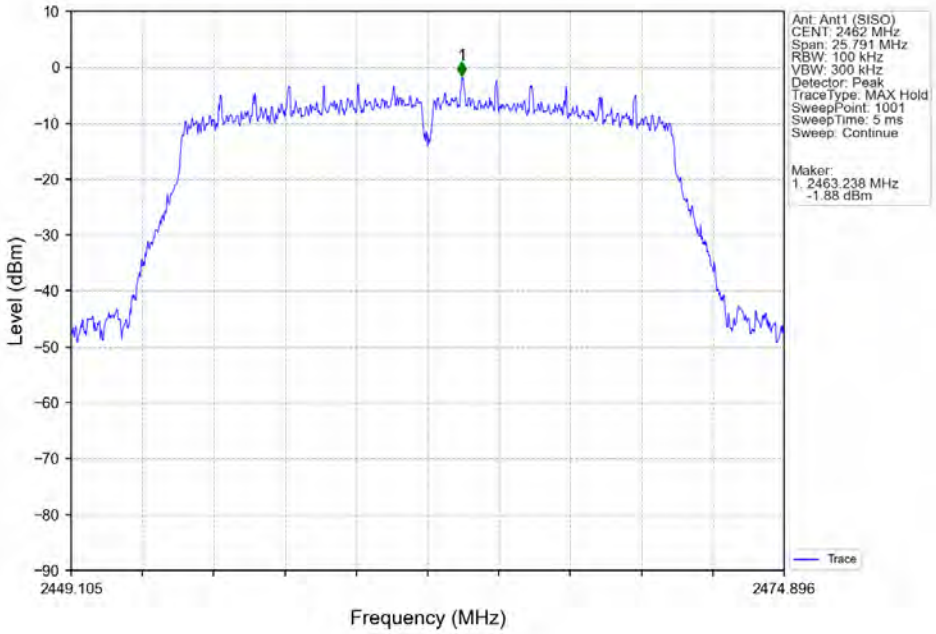
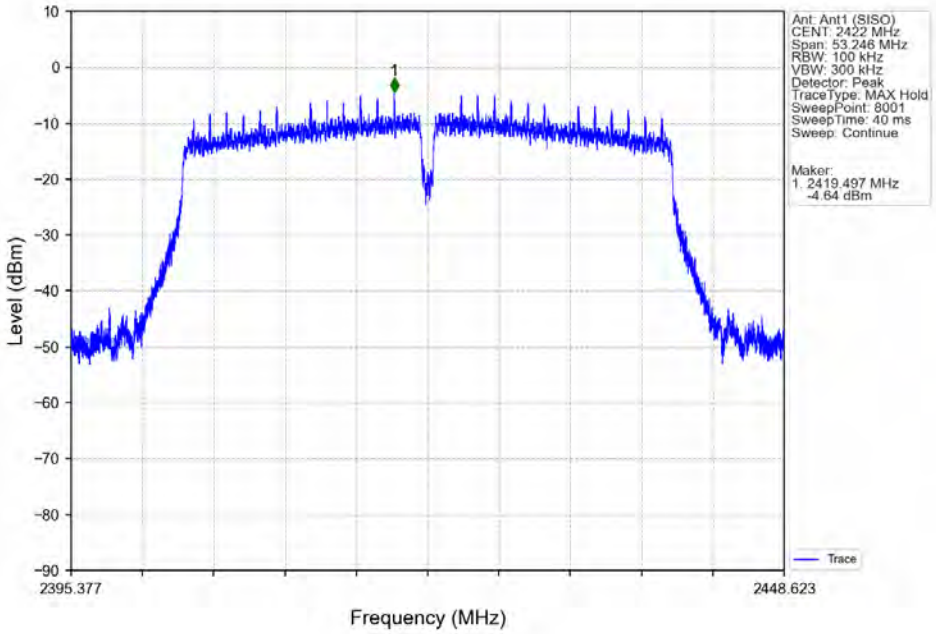
802.11n(HT20)_HCH_2462MHz_Ant2 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant2 (SISO)_NTNV



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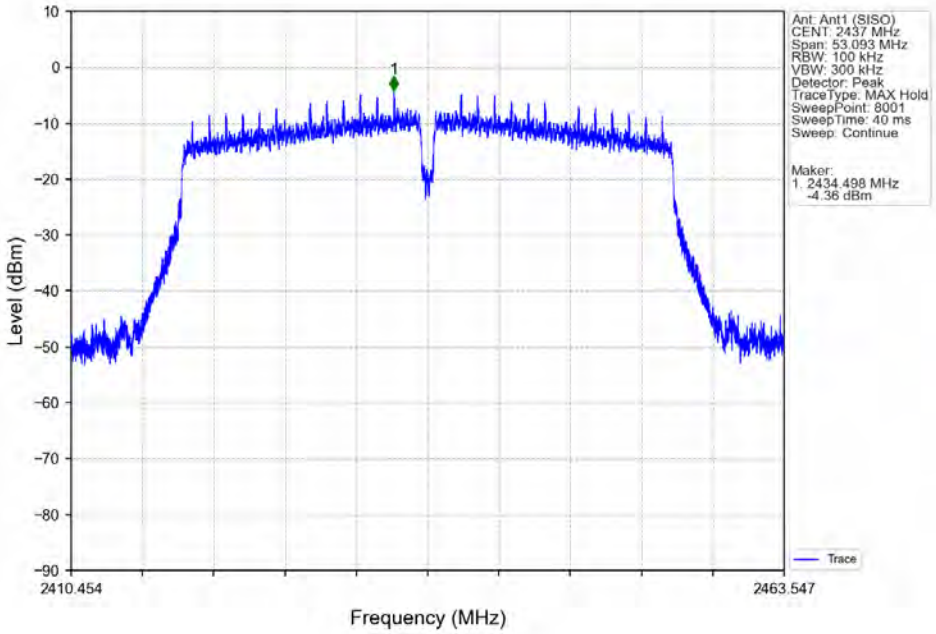
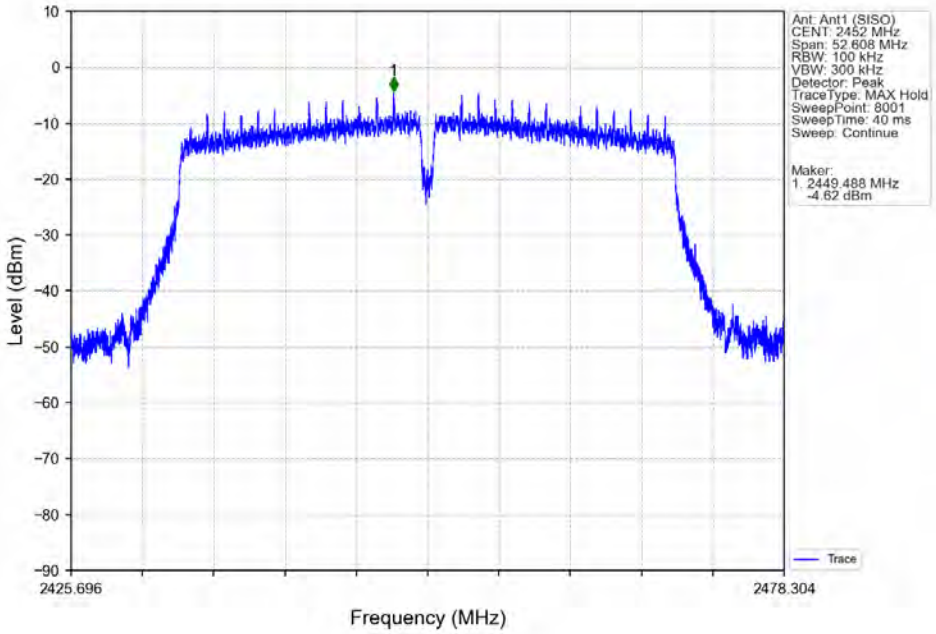
802.11n(HT40)_MCH_2437MHz_Ant2 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant2 (SISO)_NTNV



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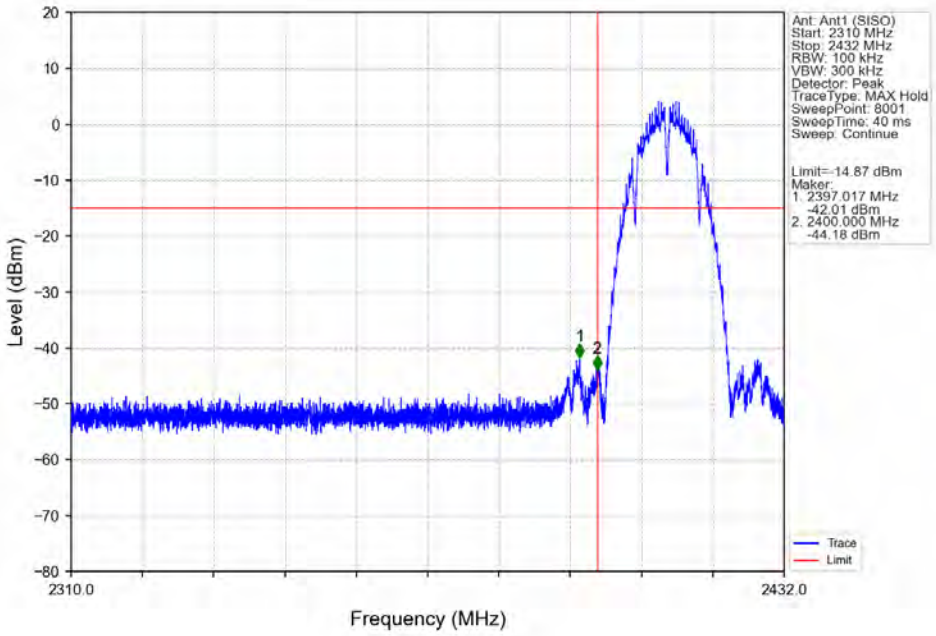
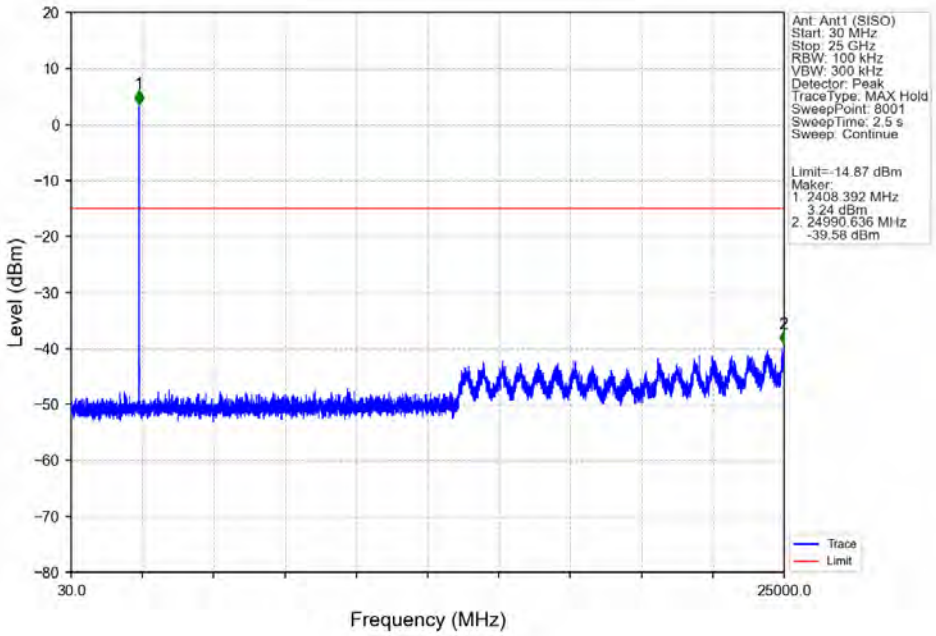
5.2.2 CSE

802.11b_LCH_2412MHz_Ant2 (SISO)_NTNV



802.11b_LCH_2412MHz_Ant2 (SISO)_NTNV



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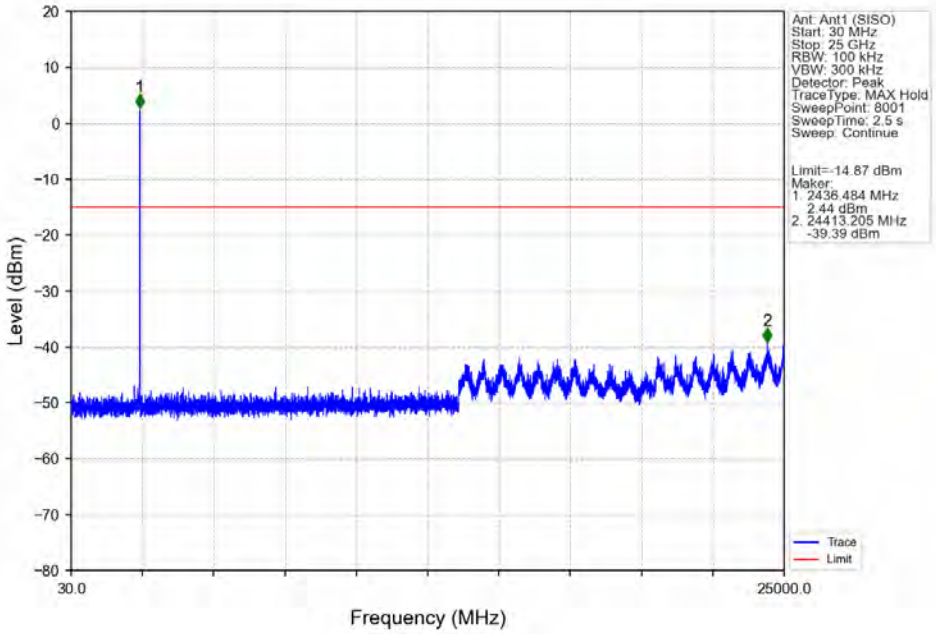
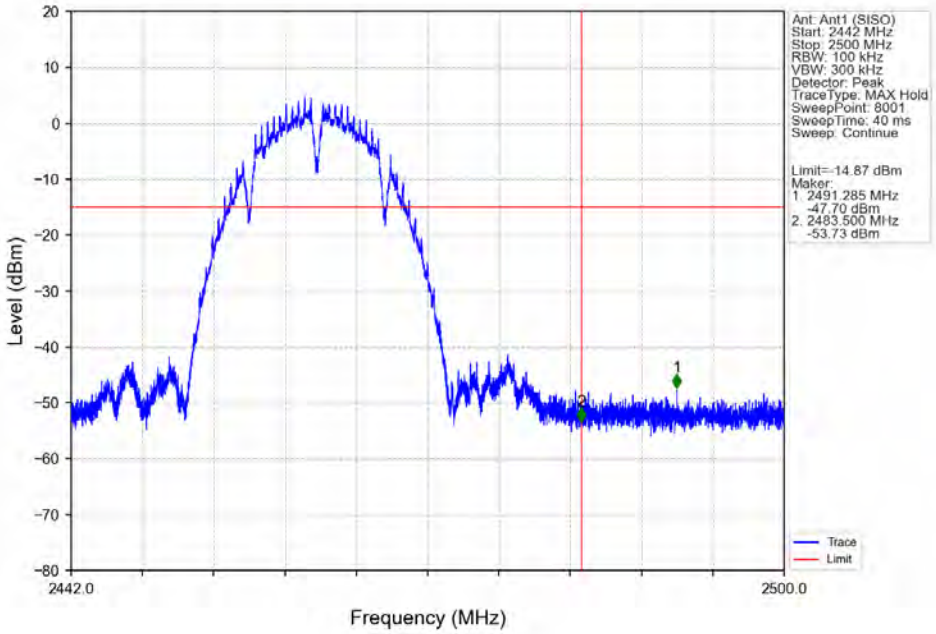
802.11b_MCH_2437MHz_Ant2 (SISO)_NTNV



802.11b_HCH_2462MHz_Ant2 (SISO)_NTNV



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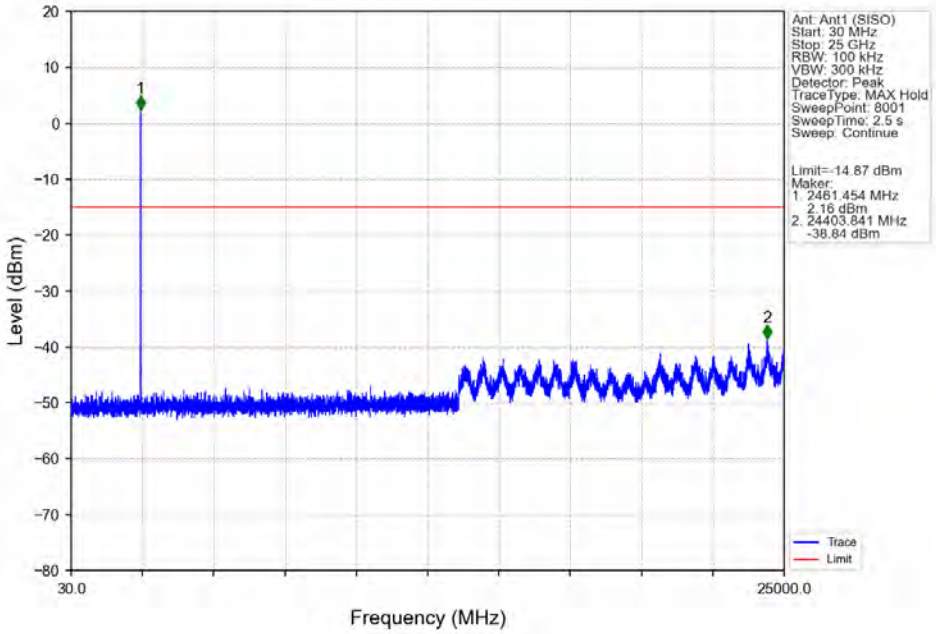
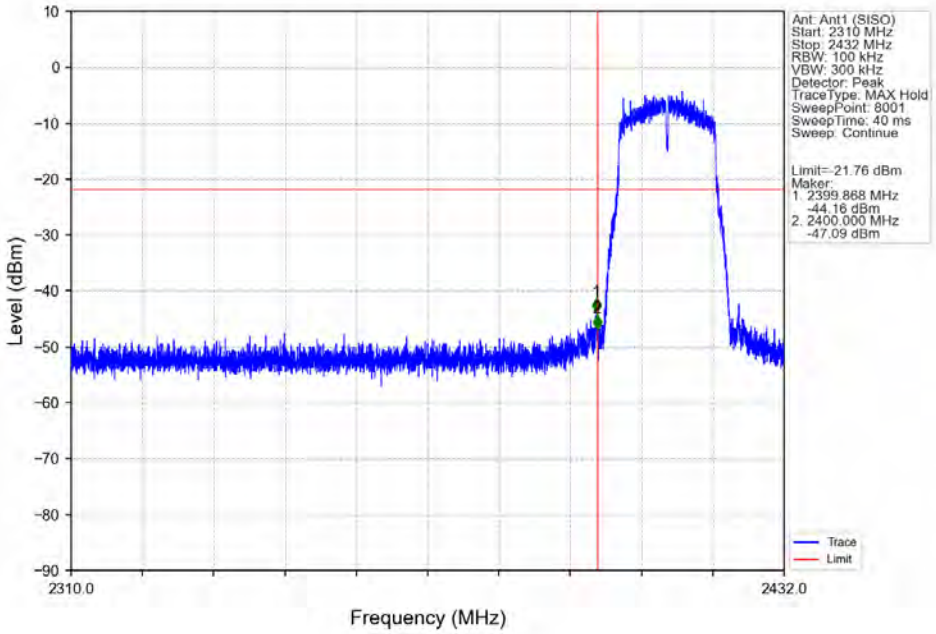
802.11b_HCH_2462MHz_Ant2 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant2 (SISO)_NTNV



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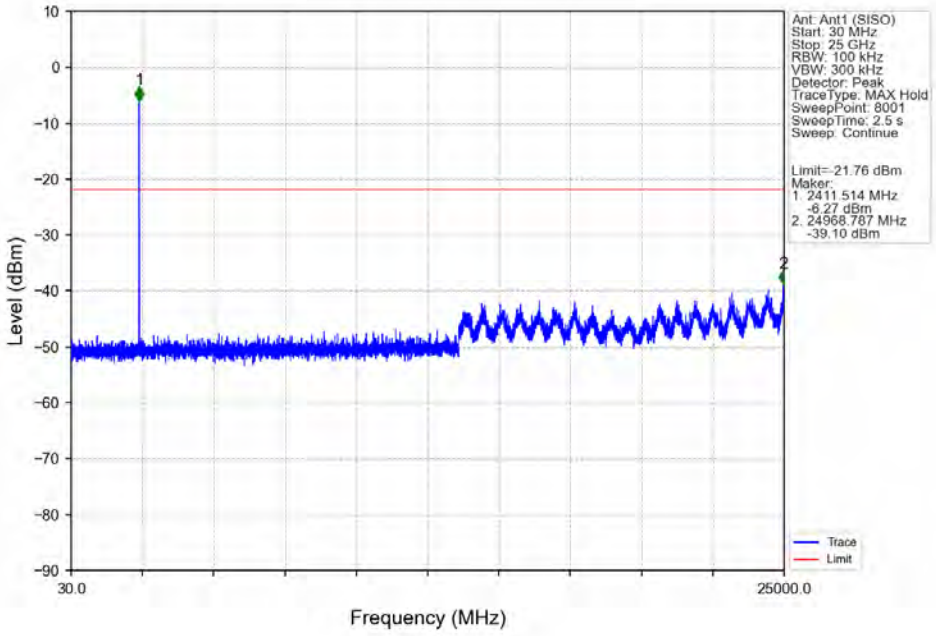
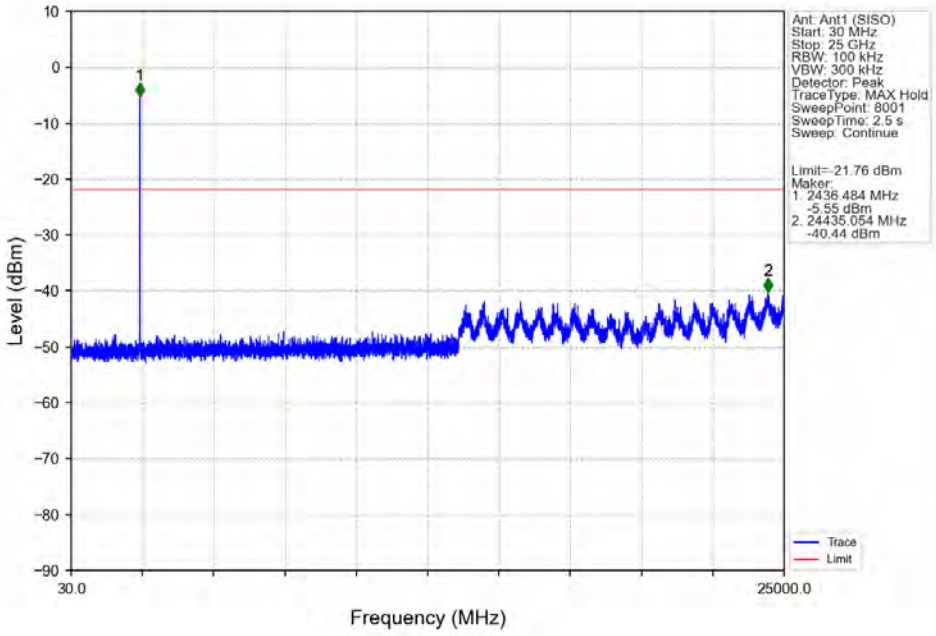
802.11g_LCH_2412MHz_Ant2 (SISO)_NTNV



802.11g_MCH_2437MHz_Ant2 (SISO)_NTNV



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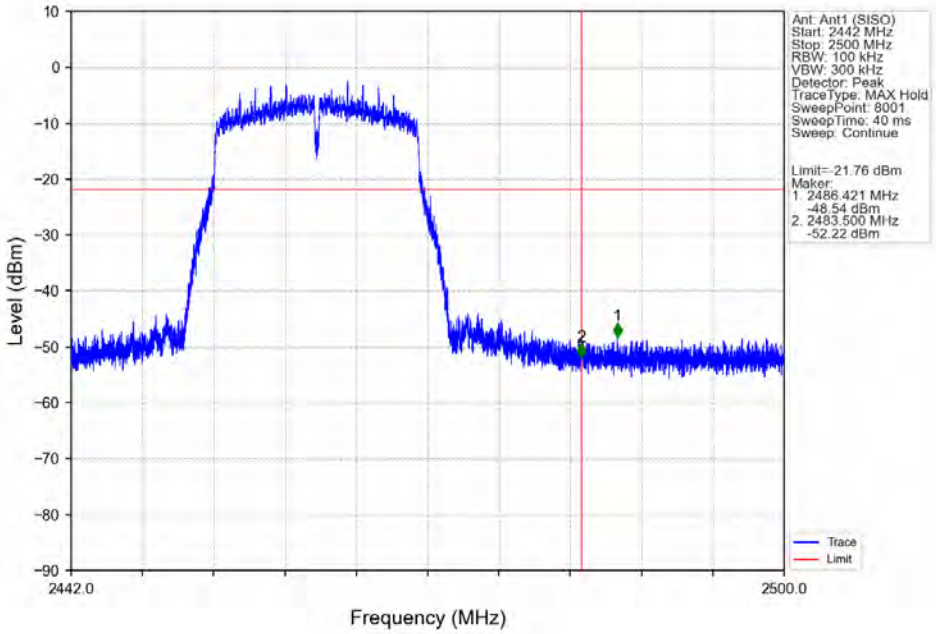
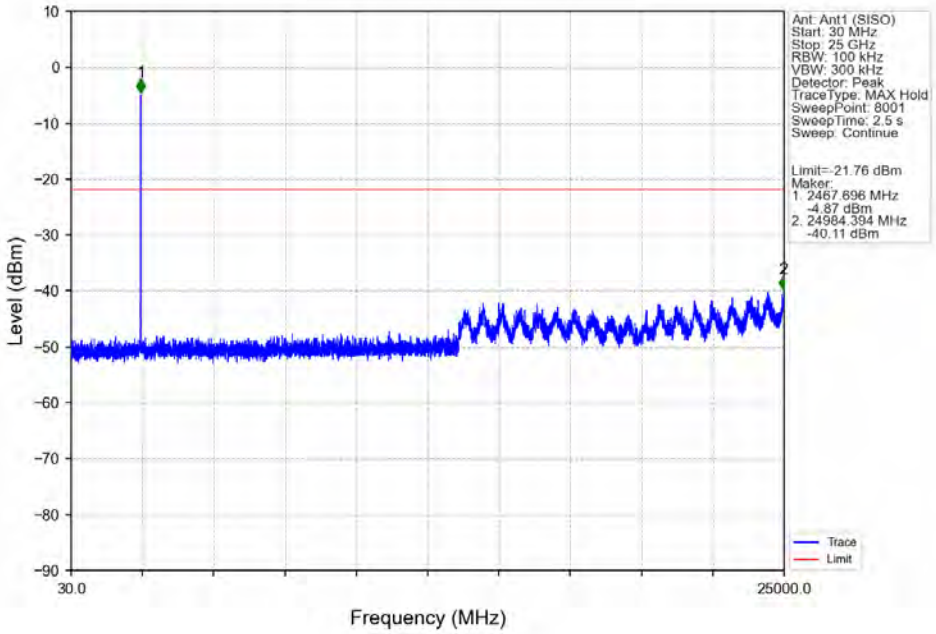
802.11g_HCH_2462MHz_Ant2 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant2 (SISO)_NTNV



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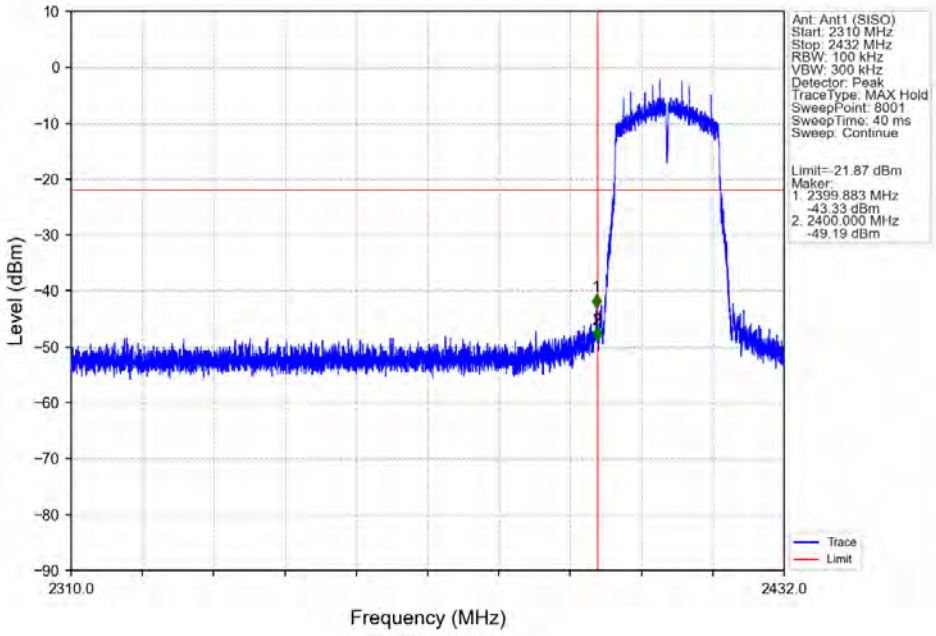
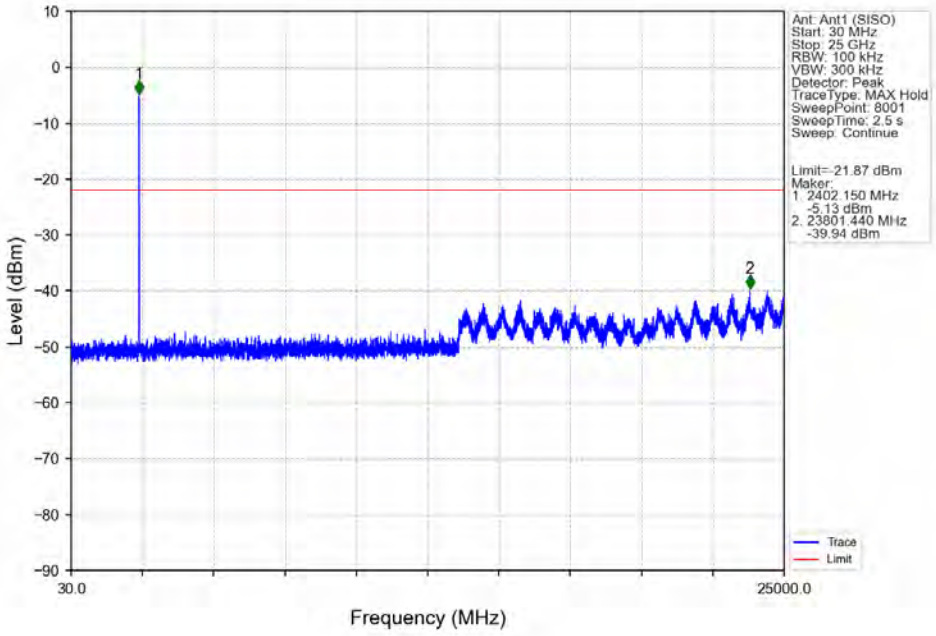
802.11n(HT20)_LCH_2412MHz_Ant2 (SISO)_NTNV



802.11n(HT20)_LCH_2412MHz_Ant2 (SISO)_NTNV



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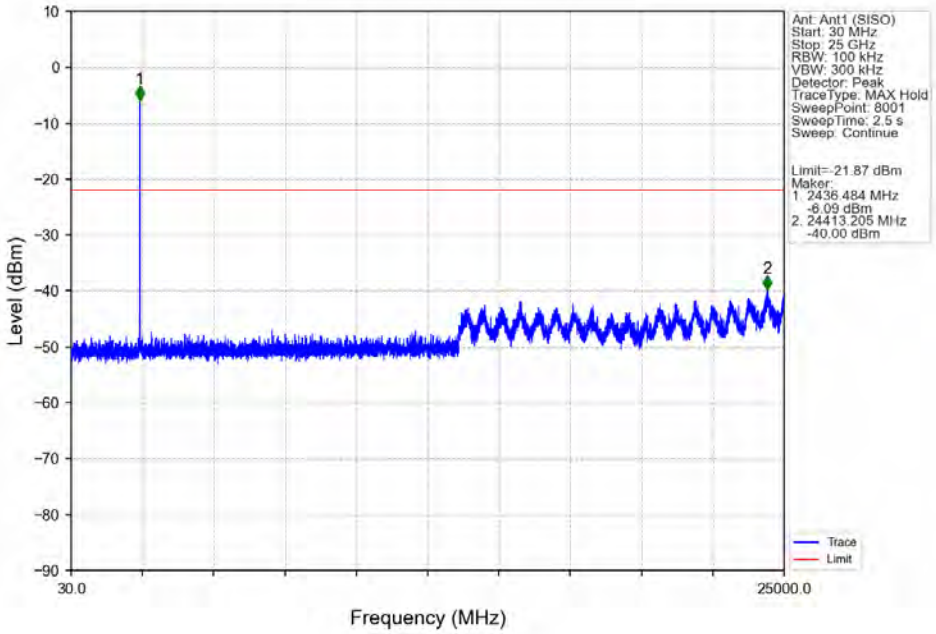
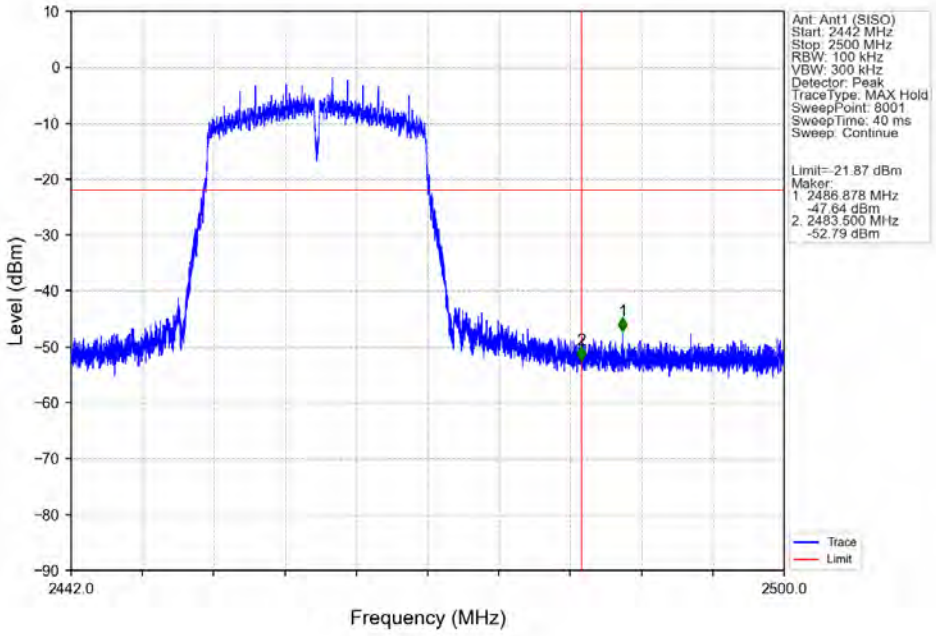
802.11n(HT20)_MCH_2437MHz_Ant2 (SISO)_NTNV



802.11n(HT20)_HCH_2462MHz_Ant2 (SISO)_NTNV



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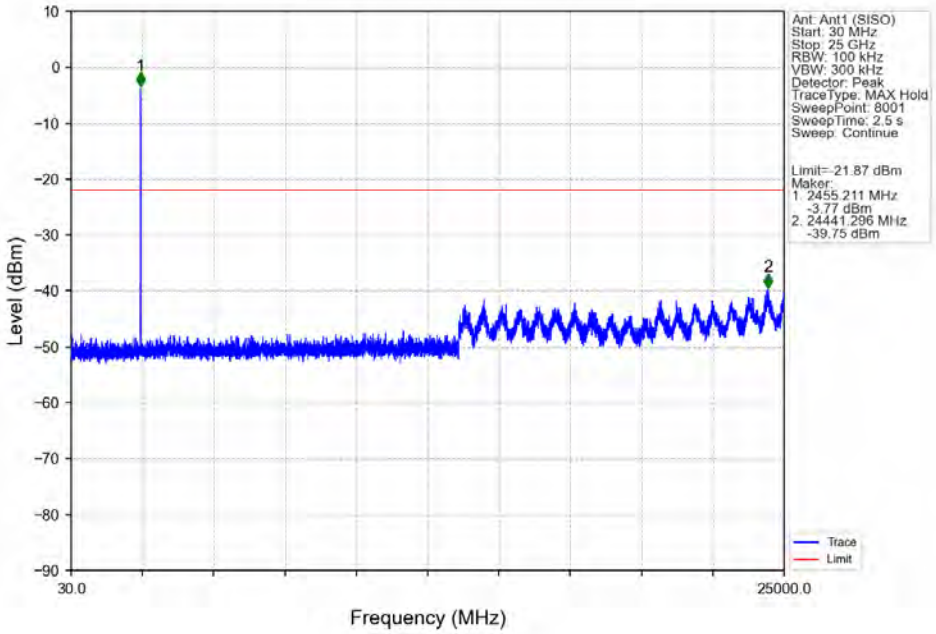
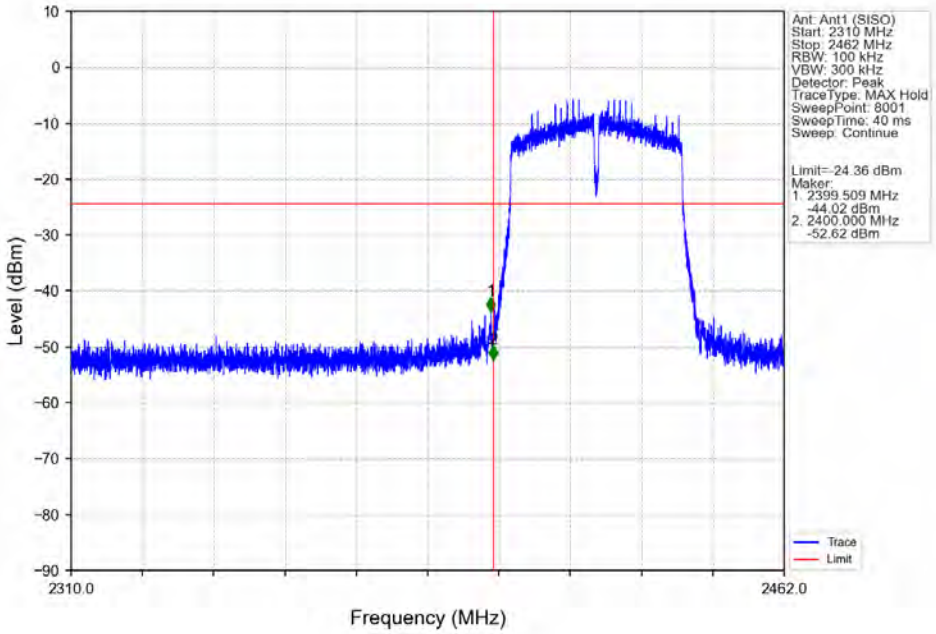
802.11n(HT20)_HCH_2462MHz_Ant2 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant2 (SISO)_NTNV



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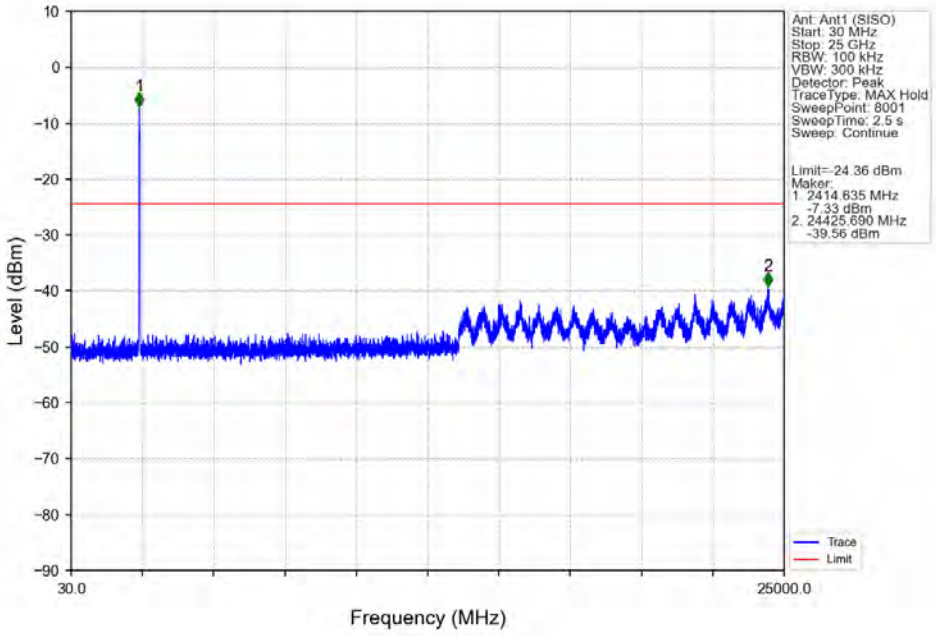
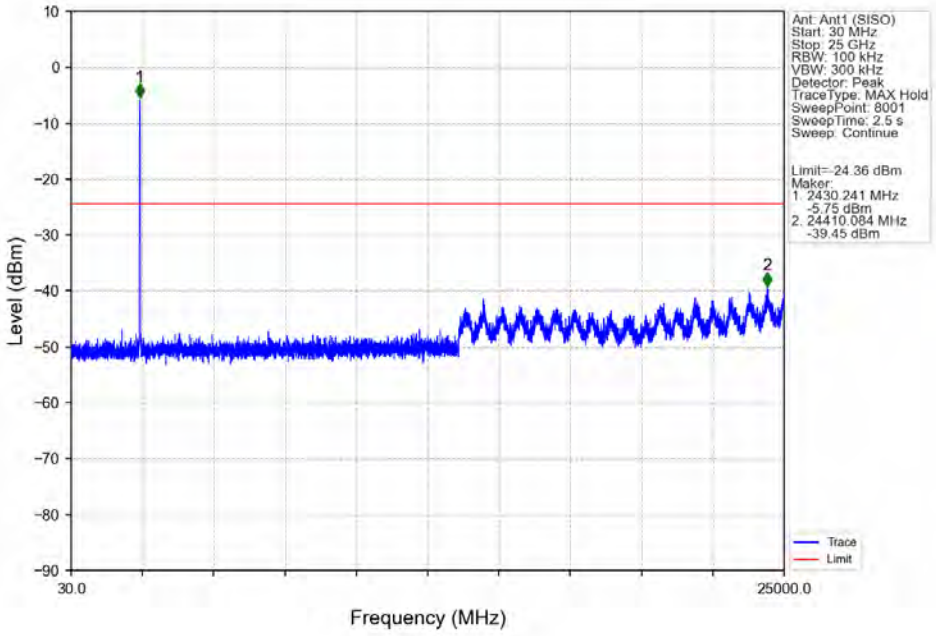
802.11n(HT40)_LCH_2422MHz_Ant2 (SISO)_NTNV



802.11n(HT40)_MCH_2437MHz_Ant2 (SISO)_NTNV



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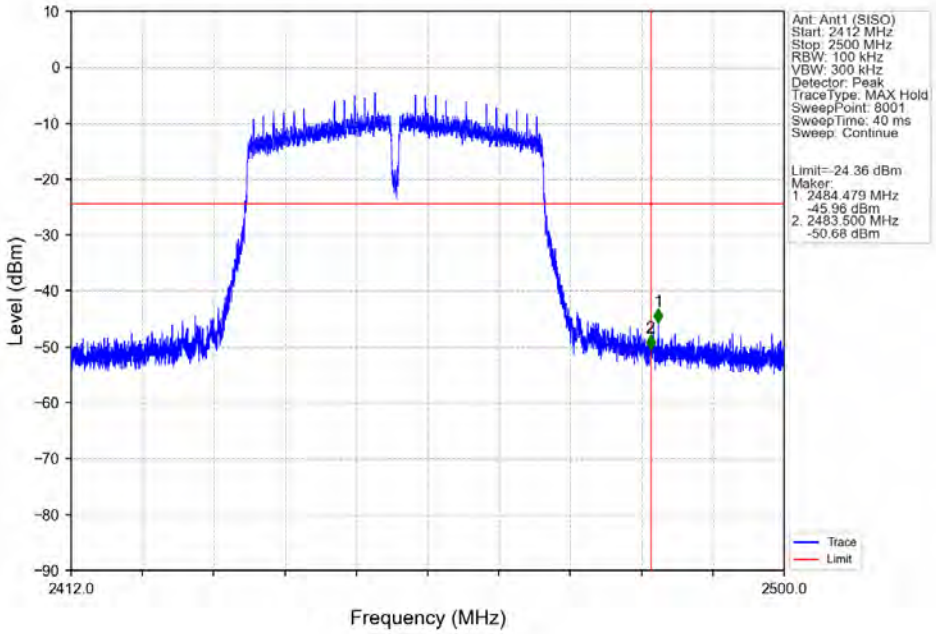
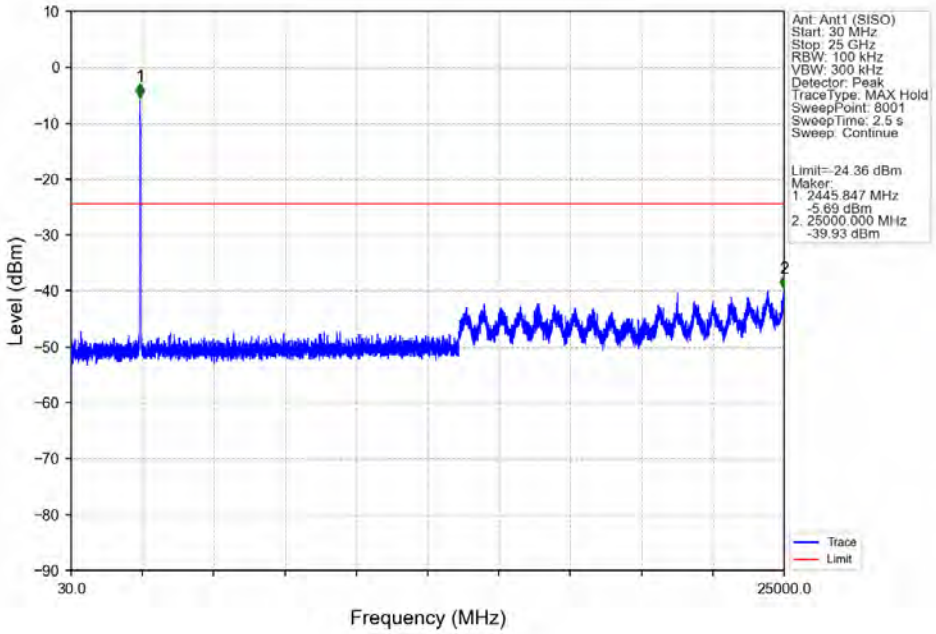
802.11n(HT40)_HCH_2452MHz_Ant2 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant2 (SISO)_NTNV



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6. Form731

6.1 Test Result

6.1.1 Form731

Lower Freq (MHz)	High Freq (MHz)	MAX Power (W)	MAX Power (dBm)
2412	2462	0.0791	18.98
2422	2452	0.0811	19.09

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