9.4 Power Spectral Density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

Limit

According to §15.247(e) & RSS-247 5.2(b), Power Spectral Density limit as below:

Limit [dBm/3kHz]

≤8

For MT7663BSN Module:

Mode	ANT	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			Result	Limit	
802.11b	B	2412	4.60	<=8	Pass
	B	2437	4.84	<=8	Pass
	B	2462	5.11	<=8	Pass
802.11g	B	2412	-9.78	<=8	Pass
	B	2437	-9.32	<=8	Pass
	B	2462	-9.87	<=8	Pass
802.11b	A	2412	4.70	<=8	Pass
	A	2437	5.18	<=8	Pass
	A	2462	5.21	<=8	Pass
802.11g	A	2412	-9.68	<=8	Pass
	A	2437	-8.77	<=8	Pass
	A	2462	-9.08	<=8	Pass
802.11n (HT20)	B	2412	-13.62	<=8	Pass
	A	2412	-11.77	<=8	Pass
	SUM	2412	-9.59	<=8	Pass
	B	2437	-13.97	<=8	Pass
	A	2437	-12.74	<=8	Pass
	SUM	2437	-10.30	<=8	Pass
	B	2462	-12.26	<=8	Pass
	A	2462	-10.67	<=8	Pass
	SUM	2462	-8.38	<=8	Pass
802.11n (HT40)	B	2422	-16.50	<=8	Pass
	A	2422	-16.94	<=8	Pass
	SUM	2422	-13.70	<=8	Pass
	B	2437	-17.58	<=8	Pass
	A	2437	-15.86	<=8	Pass
	SUM	2437	-13.63	<=8	Pass
	B	2452	-16.92	<=8	Pass
	A	2452	-16.56	<=8	Pass
	SUM	2452	-13.73	<=8	Pass

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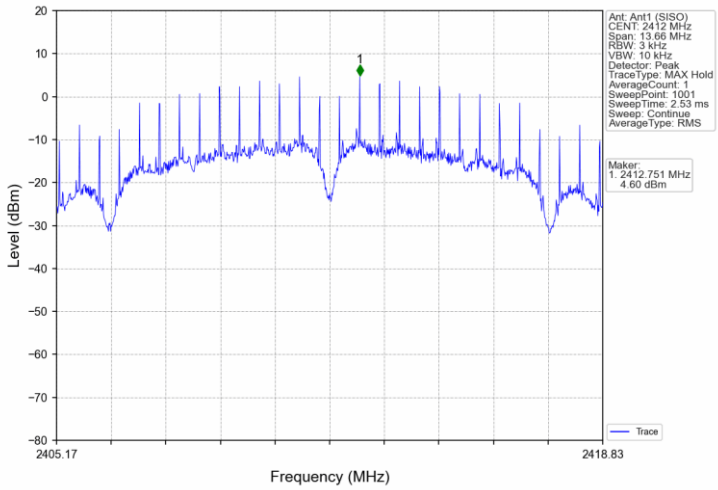
For ESP32-S3-WROOM-1U Module:

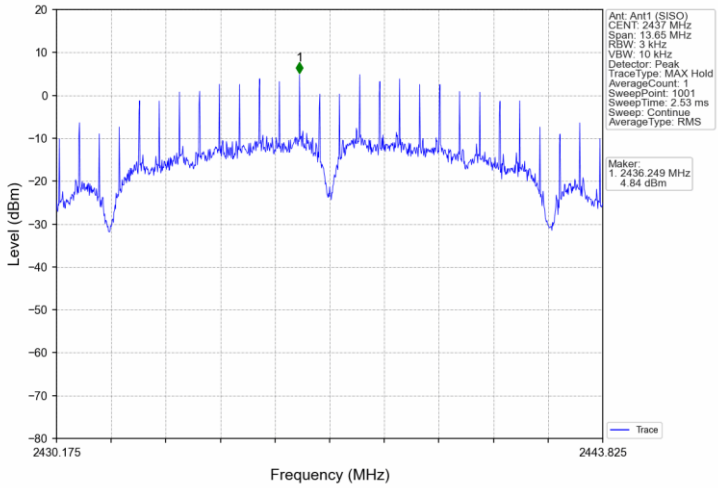
Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			Result	Limit	
802.11b	SISO	2412	-3.40	<=8	Pass
		2437	-3.61	<=8	Pass
		2462	-2.13	<=8	Pass
802.11g	SISO	2412	-9.00	<=8	Pass
		2437	-8.80	<=8	Pass
		2462	-7.48	<=8	Pass
802.11n (HT20)	SISO	2412	-8.86	<=8	Pass
		2437	-8.64	<=8	Pass
		2462	-7.50	<=8	Pass
802.11n (HT40)	SISO	2422	-12.34	<=8	Pass
		2437	-11.57	<=8	Pass
		2452	-11.49	<=8	Pass

For MT7663BSN Module:

802.11b_LCH_2412MHz_ANT_B (SISO)_NTNV



802.11b_MCH_2437MHz_ANT_B (SISO)_NTNV



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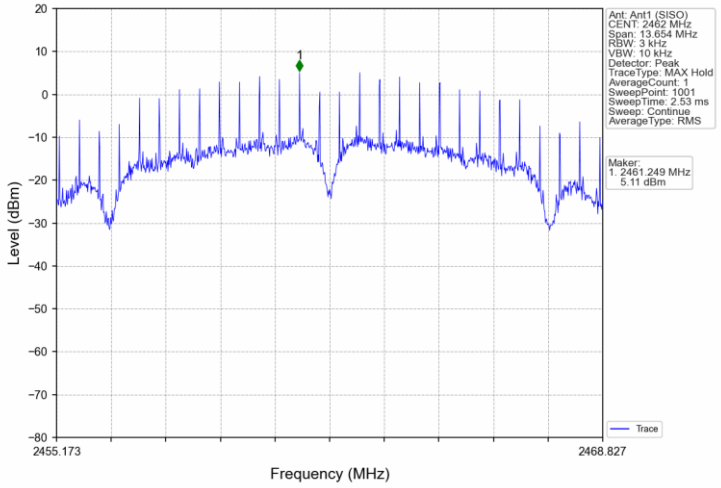
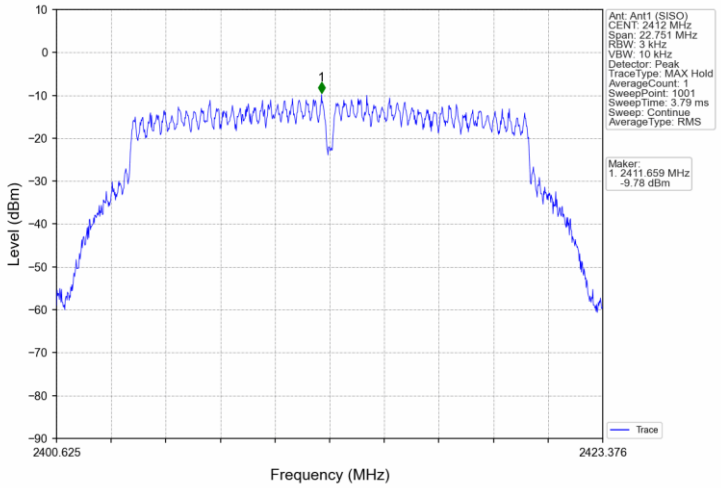
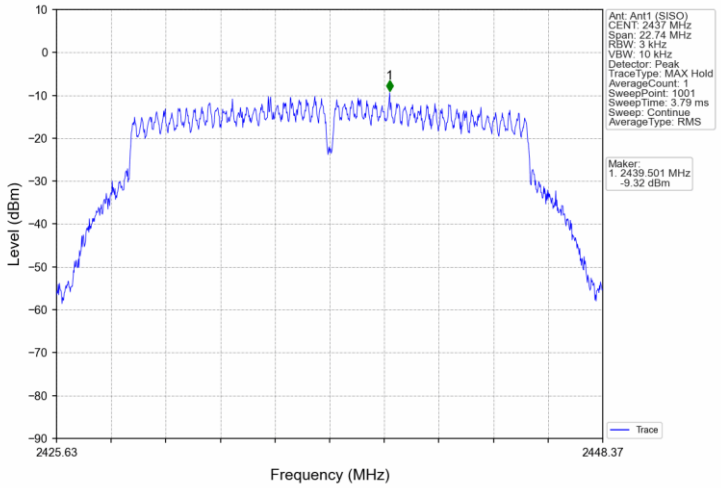
802.11b_HCH_2462MHz_ANT_B (SISO)_NTNV



802.11g_LCH_2412MHz_ANT_B (SISO)_NTNV



802.11g_MCH_2437MHz_ANT_B (SISO)_NTNV



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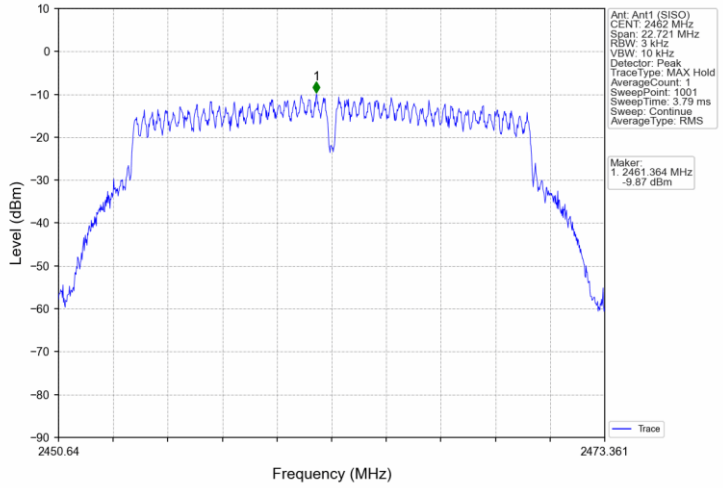
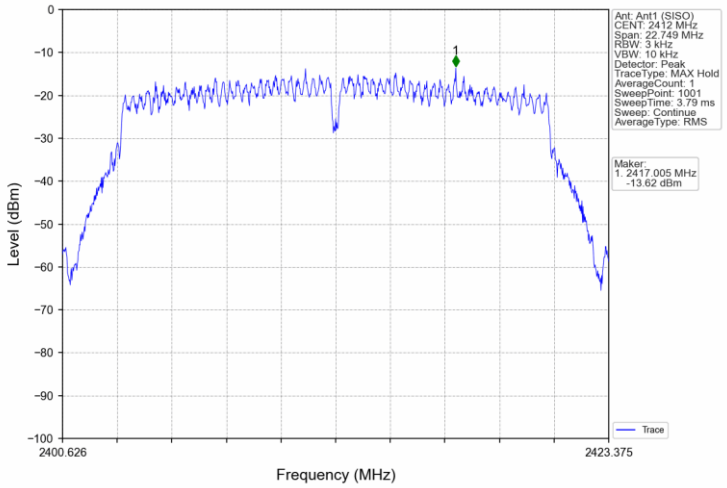
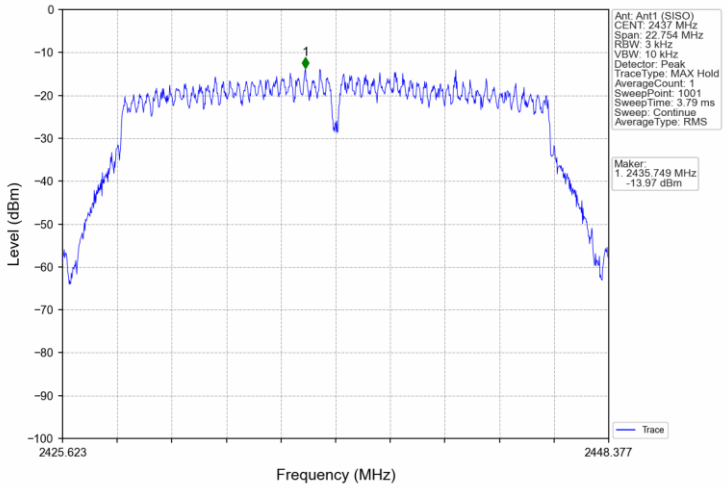
802.11g_HCH_2462MHz_ANT_B (SISO)_NTNV



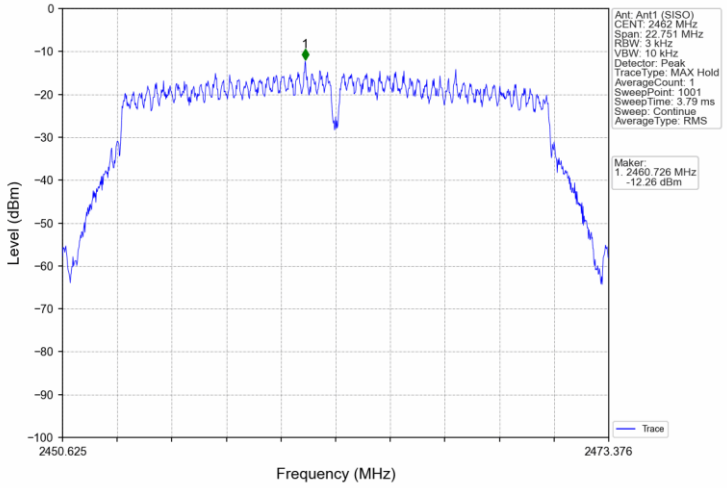
802.11n(HT20)_LCH_2412MHz_ANT_B (MIMO)_NTNV



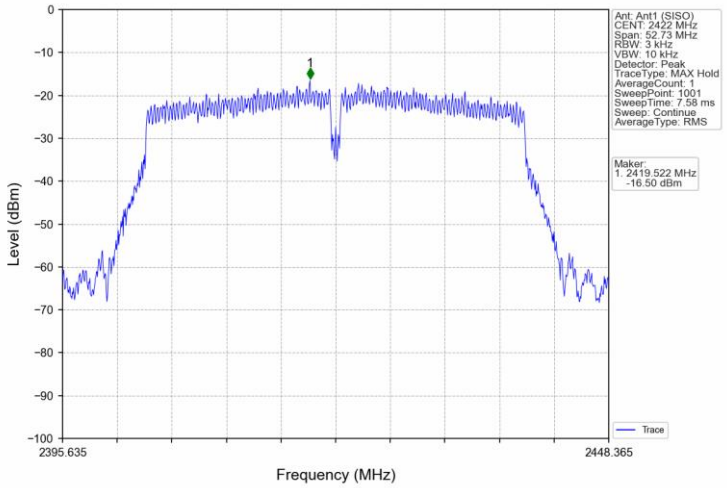
802.11n(HT20)_MCH_2437MHz_ANT_B (MIMO)_NTNV



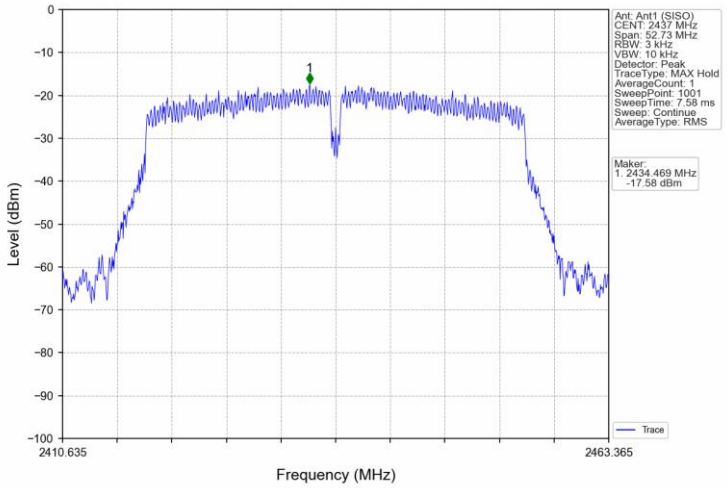
802.11n(HT20)_HCH_2462MHz_ANT_B (MIMO)_NTNV



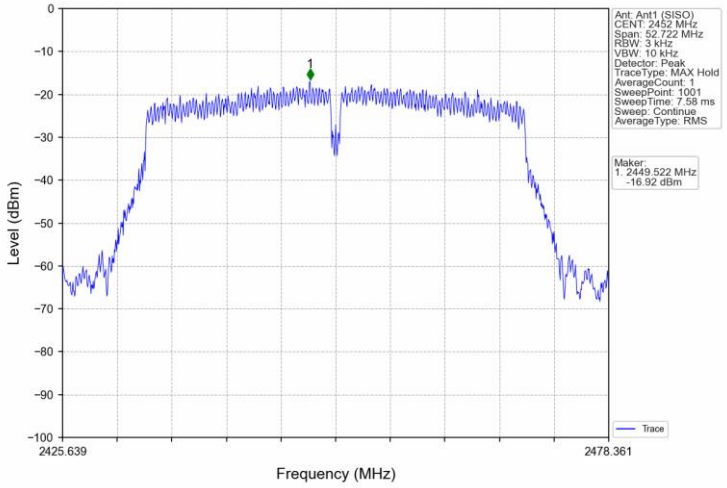
802.11n(HT40)_LCH_2422MHz_ANT_B (MIMO)_NTNV



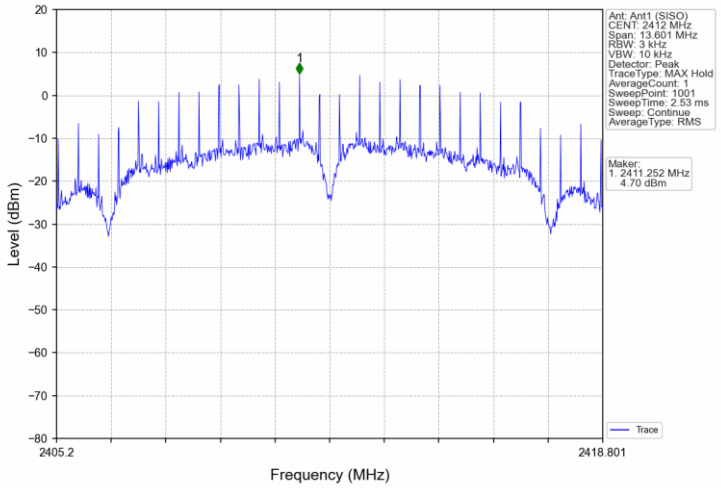
802.11n(HT40)_MCH_2437MHz_ANT_B (MIMO)_NTNV



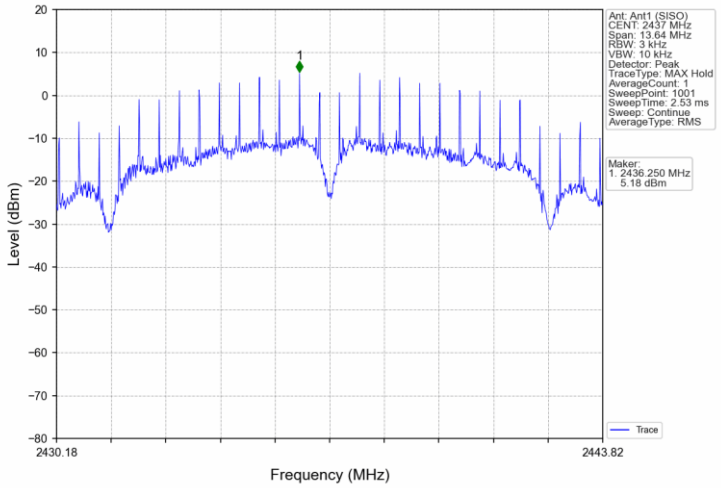
802.11n(HT40)_HCH_2452MHz_ANT_B (MIMO)_NTNV



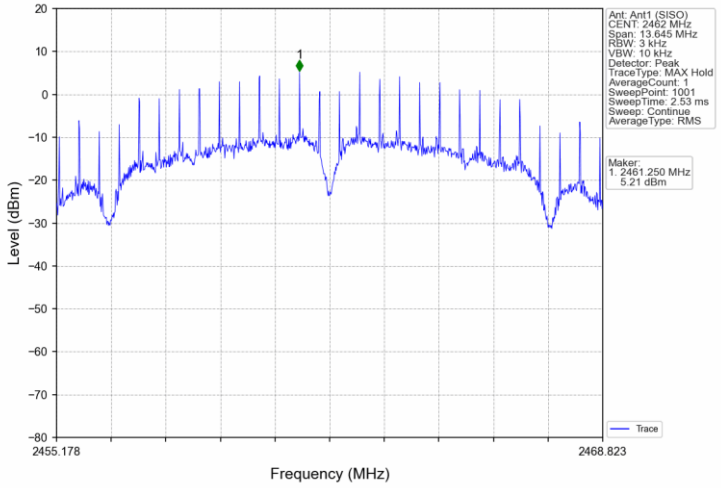
802.11b_LCH_2412MHz_ANT_A (SISO)_NTNV



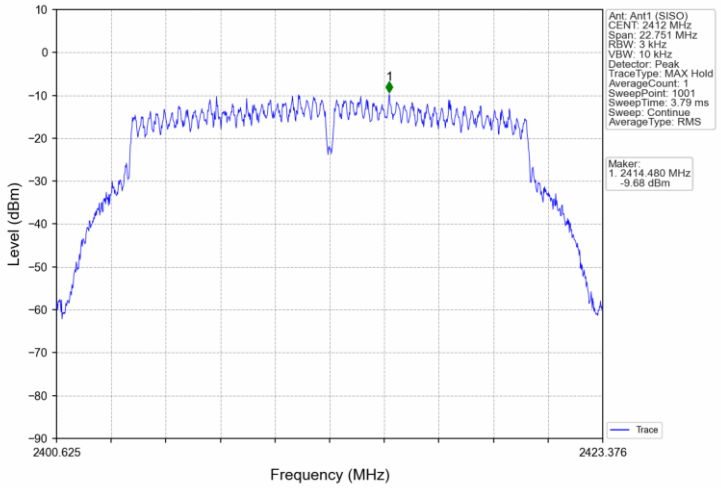
802.11b_MCH_2437MHz_ANT_A (SISO)_NTNV



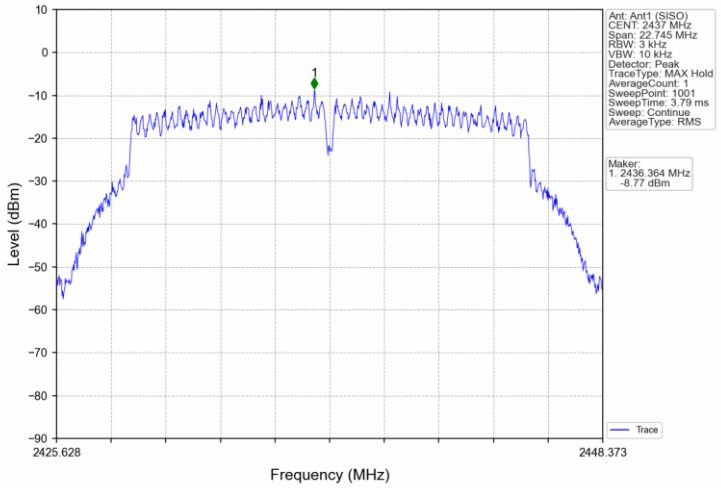
802.11b_HCH_2462MHz_ANT_A (SISO)_NTNV



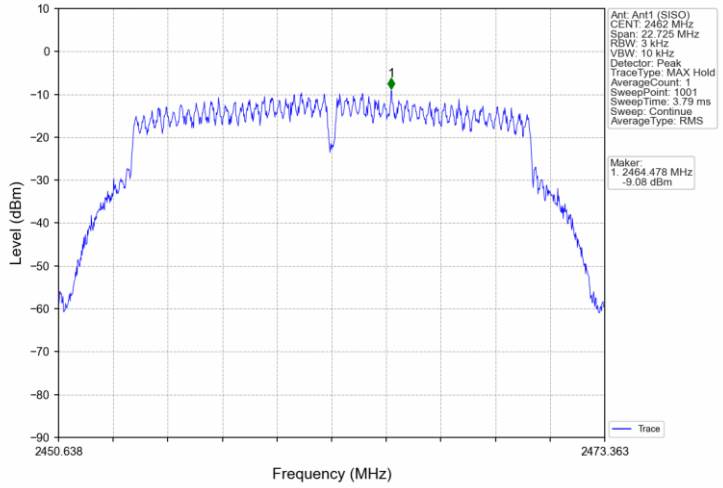
802.11g_LCH_2412MHz_ANT_A (SISO)_NTNV



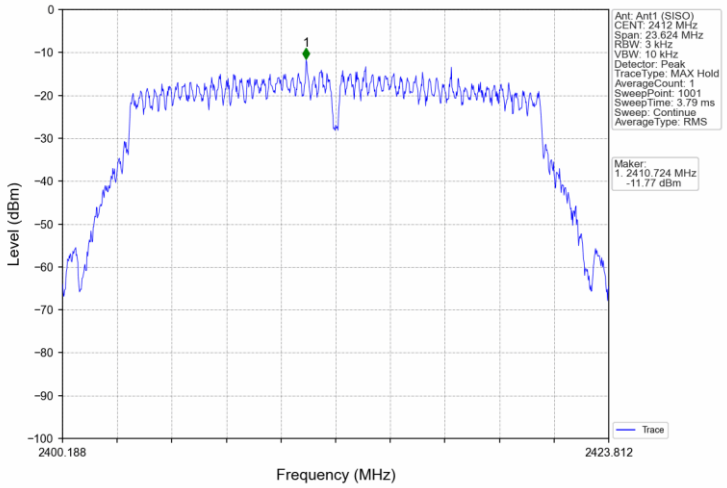
802.11g_MCH_2437MHz_ANT_A (SISO)_NTNV



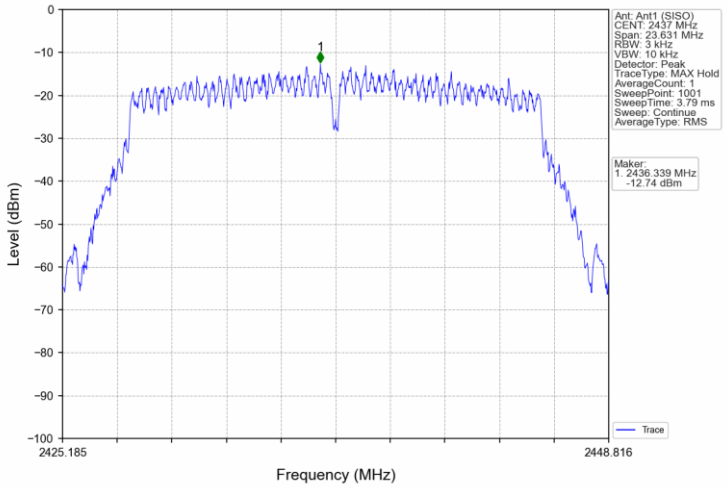
802.11g_HCH_2462MHz_ANT_A (SISO)_NTNV



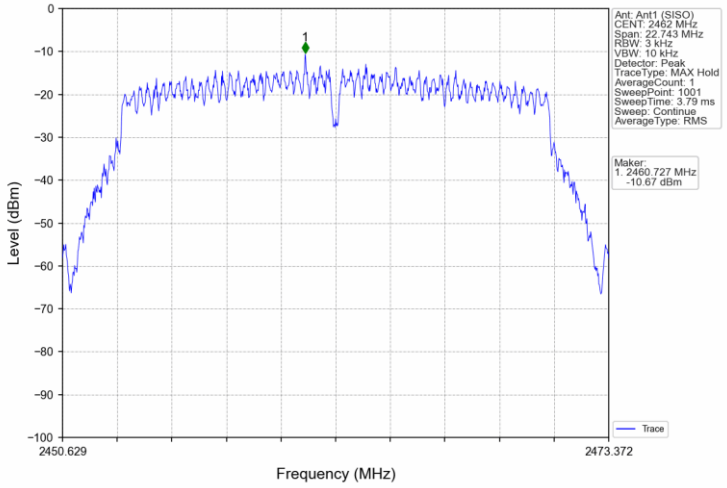
802.11n(HT20)_LCH_2412MHz_ANT_A (MIMO)_NTNV



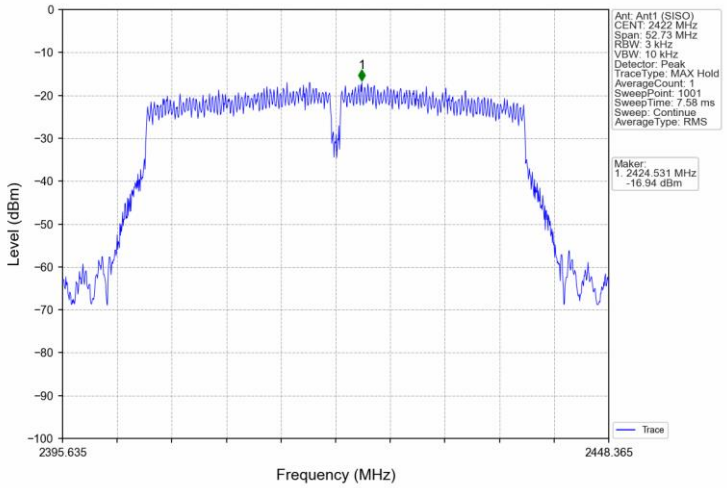
802.11n(HT20)_MCH_2437MHz_ANT_A (MIMO)_NTNV



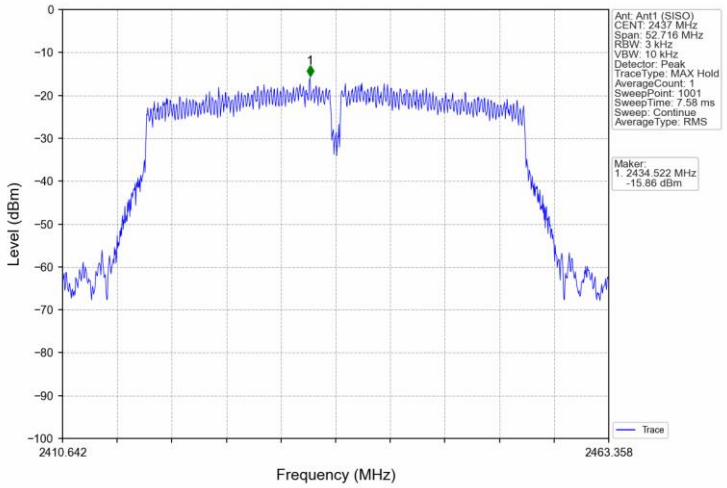
802.11n(HT20)_HCH_2462MHz_ANT_A (MIMO)_NTNV



802.11n(HT40)_LCH_2422MHz_ANT_A (MIMO)_NTNV



802.11n(HT40)_MCH_2437MHz_ANT_A (MIMO)_NTNV



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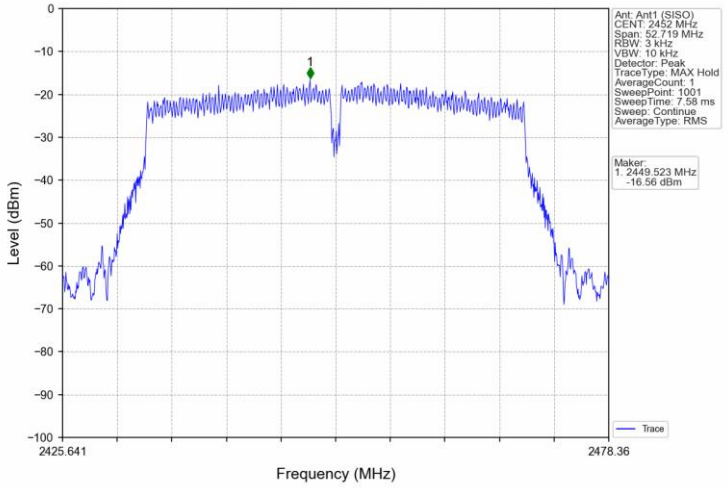
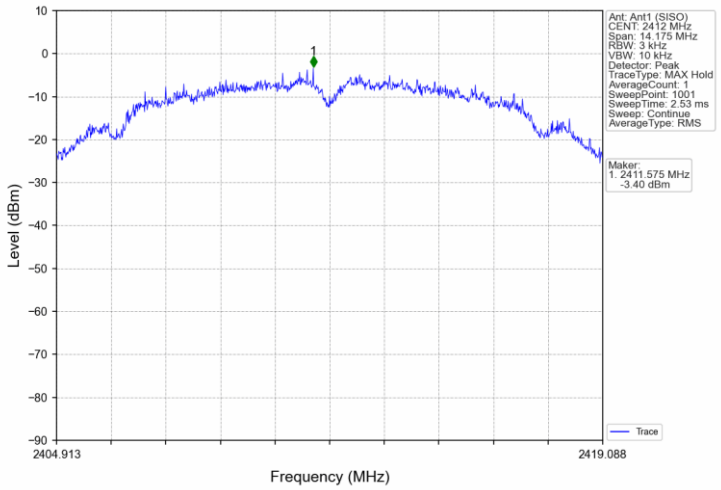
802.11n(HT40)_HCH_2452MHz_ANT_A (MIMO)_NTNV

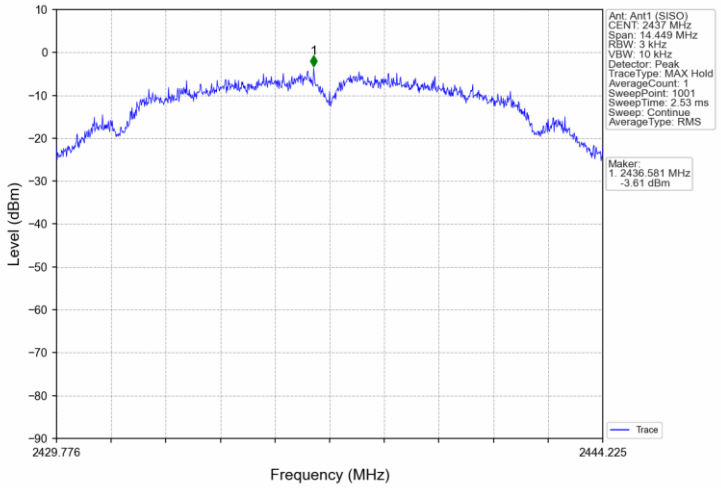


For ESP32-S3-WROOM-1U Module:

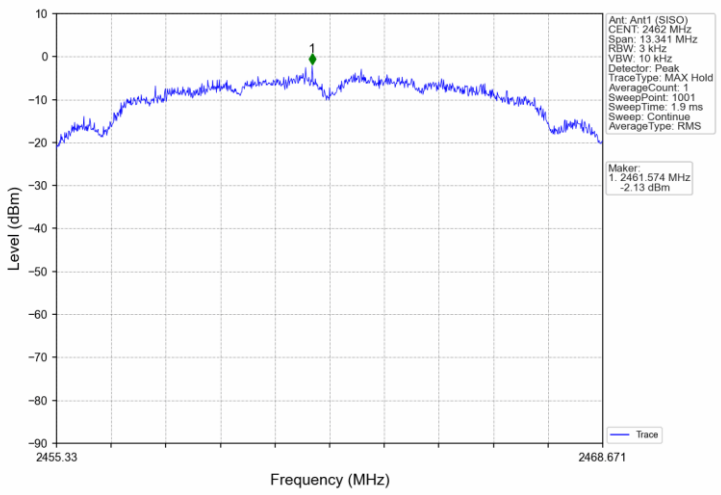
802.11b_LCH_2412MHz_ANT_C (SISO)_NTNV



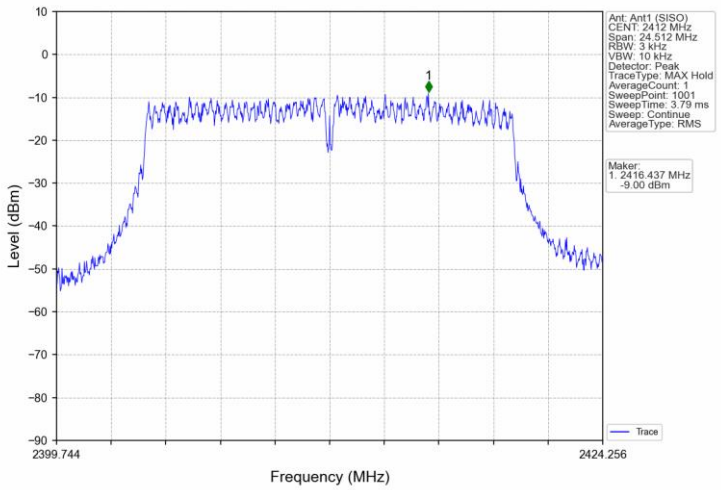
802.11b_MCH_2437MHz_ANT_C (SISO)_NTNV



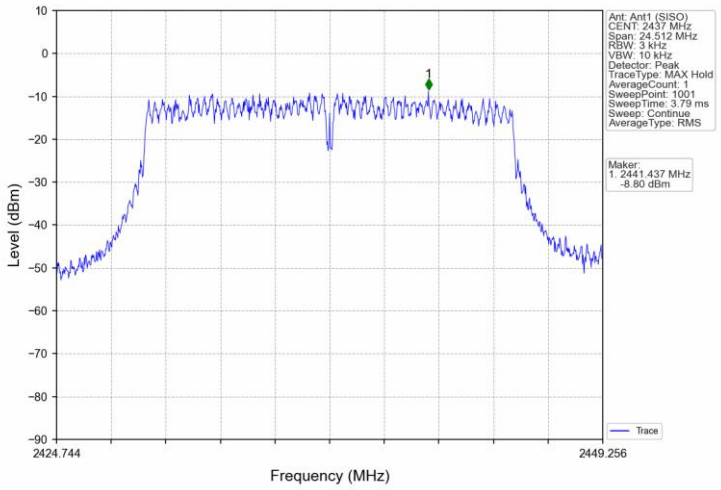
802.11b_HCH_2462MHz_ANT_C (SISO)_NTNV



802.11g_LCH_2412MHz_ANT_C (SISO)_NTNV



802.11g_MCH_2437MHz_ANT_C (SISO)_NTNV



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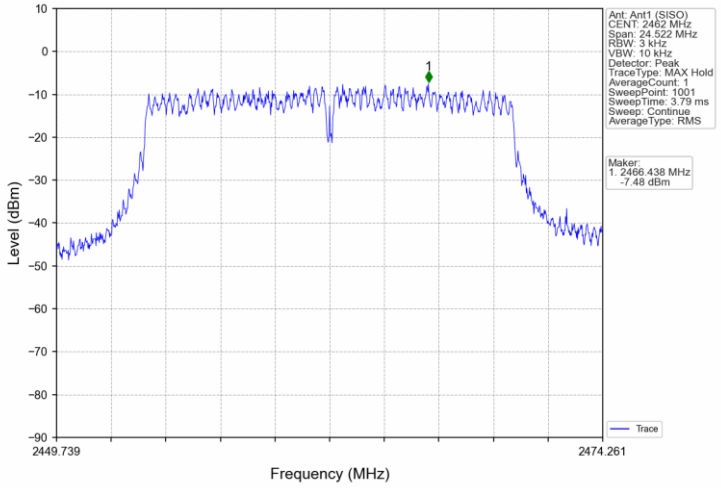
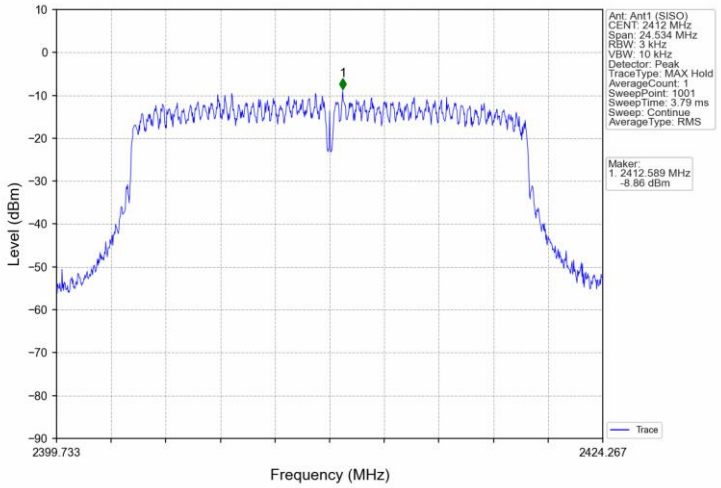
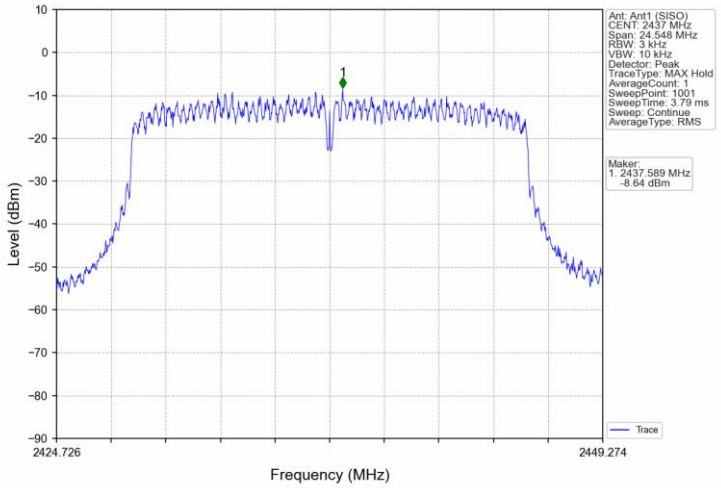
802.11g_HCH_2462MHz_ANT_C (SISO)_NTNV



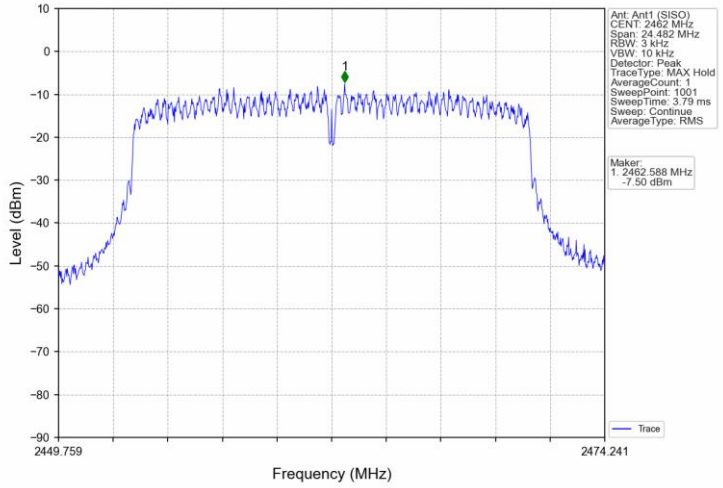
802.11n(HT20)_LCH_2412MHz_ANT_C (SISO)_NTNV



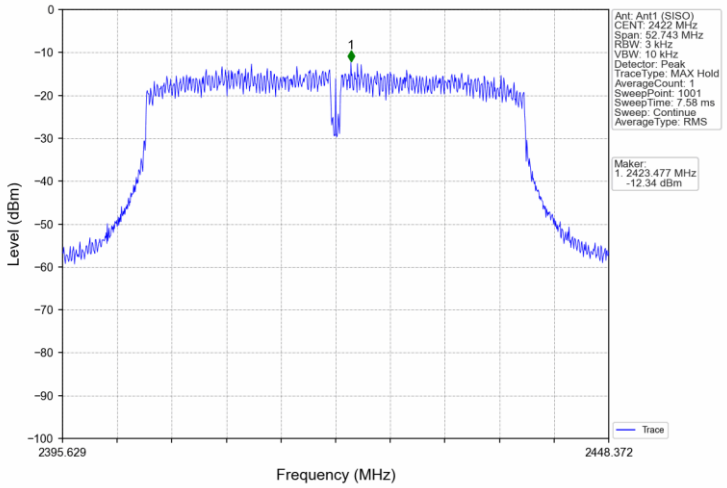
802.11n(HT20)_MCH_2437MHz_ANT_C (SISO)_NTNV



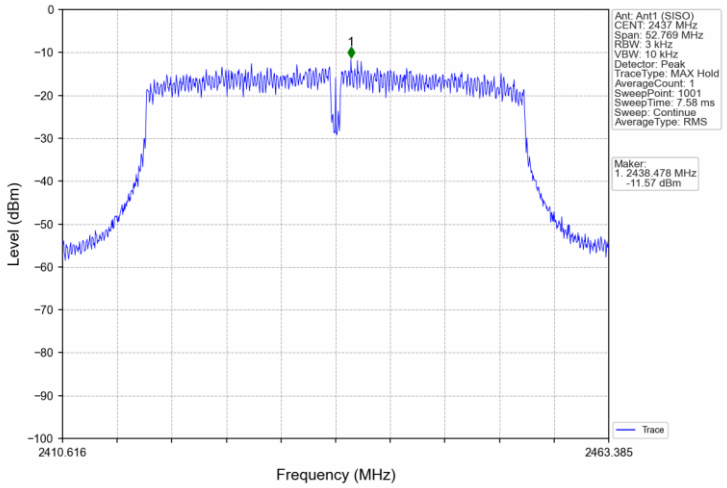
802.11n(HT20)_HCH_2462MHz_ANT_C (SISO)_NTNV



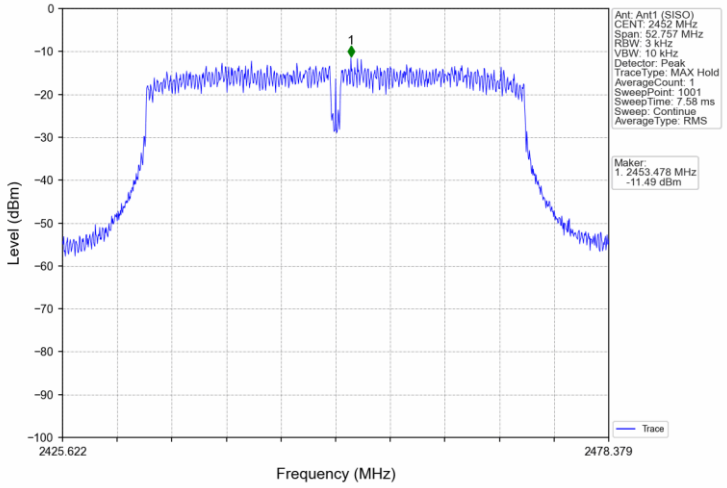
802.11n(HT40)_LCH_2422MHz_ANT_C (SISO)_NTNV



802.11n(HT40)_MCH_2437MHz_ANT_C (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_ANT_C (SISO)_NTNV



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9.5 Spurious RF Conducted Emissions

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

Limit

According to §15.247(d) & RSS-247 5.5, Spurious RF Conducted Emissions limit as below:

Frequency Range MHz	Limit (dBc)
30-25000	-20

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Spurious RF conducted emissions

For MT7663BSN Module:

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
802.11b	SISO	2412	B	5.51
		2437	B	5.73
		2462	B	6.03
802.11g	SISO	2412	B	3.48
		2437	B	4.93
		2462	B	5.10
802.11n (HT20)	MIMO	2412	B	-0.44
		2437	B	-0.36
		2462	B	0.97
802.11n (HT40)	MIMO	2422	B	-2.00
		2437	B	-1.44
		2452	B	-1.24
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.				

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
802.11b	SISO	2412	B	6.03	<=-13.97	Pass
		2437	B	6.03	<=-13.97	Pass
		2462	B	6.03	<=-13.97	Pass
802.11g	SISO	2412	B	5.10	<=-14.90	Pass
		2437	B	5.10	<=-14.90	Pass
		2462	B	5.10	<=-14.90	Pass
802.11n (HT20)	MIMO	2412	B	0.97	<=-19.03	Pass
		2437	B	0.97	<=-19.03	Pass
		2462	B	0.97	<=-19.03	Pass
802.11n (HT40)	MIMO	2422	B	-1.24	<=-21.24	Pass
		2437	B	-1.24	<=-21.24	Pass
		2452	B	-1.24	<=-21.24	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.						

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
802.11b	SISO	2412	A	5.63
		2437	A	6.27
		2462	A	6.11
802.11g	SISO	2412	A	5.24
		2437	A	5.03
		2462	A	5.51
802.11n (HT20)	MIMO	2412	A	1.04
		2437	A	1.01
		2462	A	1.24
802.11n (HT40)	MIMO	2422	A	-1.40
		2437	A	-0.91
		2452	A	-1.44
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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Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
802.11b	SISO	2412	A	6.27	<=-13.73	Pass
		2437	A	6.27	<=-13.73	Pass
		2462	A	6.27	<=-13.73	Pass
802.11g	SISO	2412	A	5.51	<=-14.49	Pass
		2437	A	5.51	<=-14.49	Pass
		2462	A	5.51	<=-14.49	Pass
802.11n (HT20)	MIMO	2412	A	1.24	<=-18.76	Pass
		2437	A	1.24	<=-18.76	Pass
		2462	A	1.24	<=-18.76	Pass
802.11n (HT40)	MIMO	2422	A	-0.91	<=-20.91	Pass
		2437	A	-0.91	<=-20.91	Pass
		2452	A	-0.91	<=-20.91	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.						

For ESP32-S3-WROOM-1U Module:

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
802.11b	SISO	2412	C	-7.62
		2437	C	-8.62
		2462	C	-8.96
802.11g	SISO	2412	C	-11.77
		2437	C	-12.58
		2462	C	-13.75
802.11n (HT20)	SISO	2412	C	-13.27
		2437	C	-13.46
		2462	C	-14.07
802.11n (HT40)	SISO	2422	C	-15.77
		2437	C	-16.21
		2452	C	-17.54
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.				

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
802.11b	SISO	2412	C	-7.62	<=-27.62	Pass
		2437	C	-7.62	<=-27.62	Pass
		2462	C	-7.62	<=-27.62	Pass
802.11g	SISO	2412	C	-11.77	<=-31.77	Pass
		2437	C	-11.77	<=-31.77	Pass
		2462	C	-11.77	<=-31.77	Pass
802.11n (HT20)	SISO	2412	C	-13.27	<=-33.27	Pass
		2437	C	-13.27	<=-33.27	Pass
		2462	C	-13.27	<=-33.27	Pass
802.11n (HT40)	SISO	2422	C	-15.77	<=-35.77	Pass
		2437	C	-15.77	<=-35.77	Pass
		2452	C	-15.77	<=-35.77	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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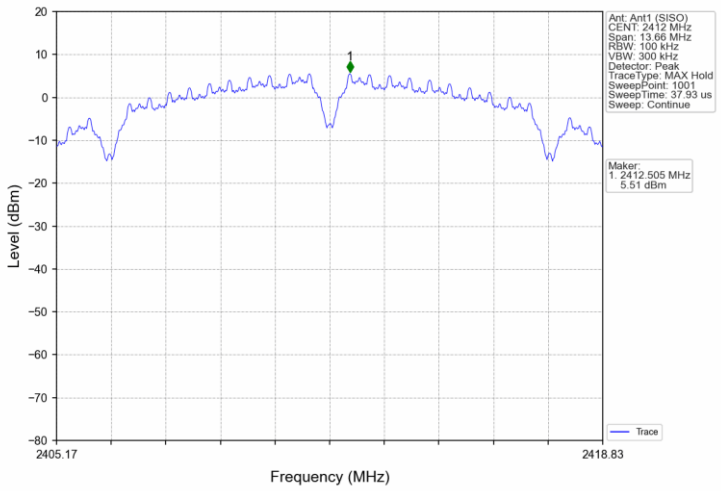
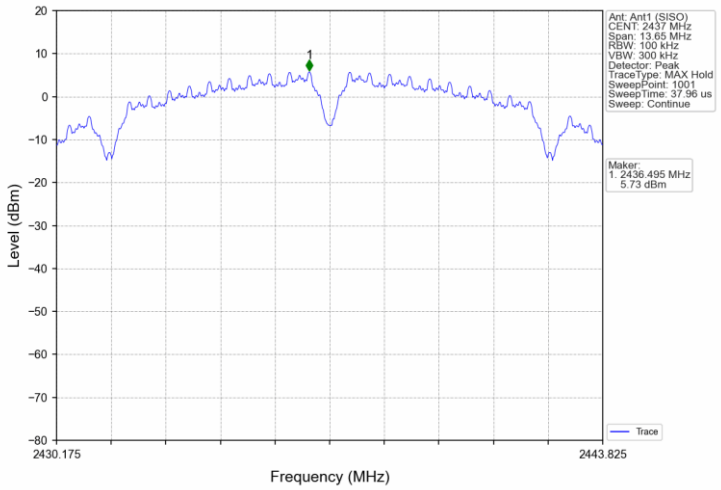
For MT7663BSN Module:

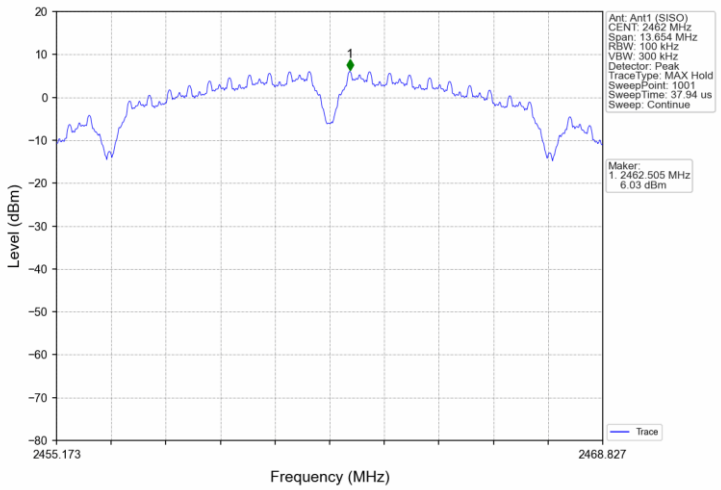
802.11b_LCH_2412MHz_ANT_B (SISO)_NTNV



802.11b_MCH_2437MHz_ANT_B (SISO)_NTNV



802.11b_HCH_2462MHz_ANT_B (SISO)_NTNV



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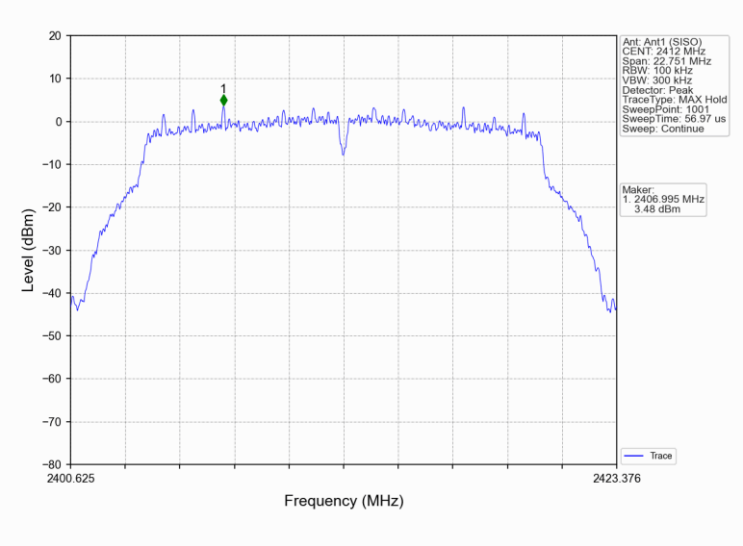
802.11g_LCH_2412MHz_ANT_B (SISO)_NTNV



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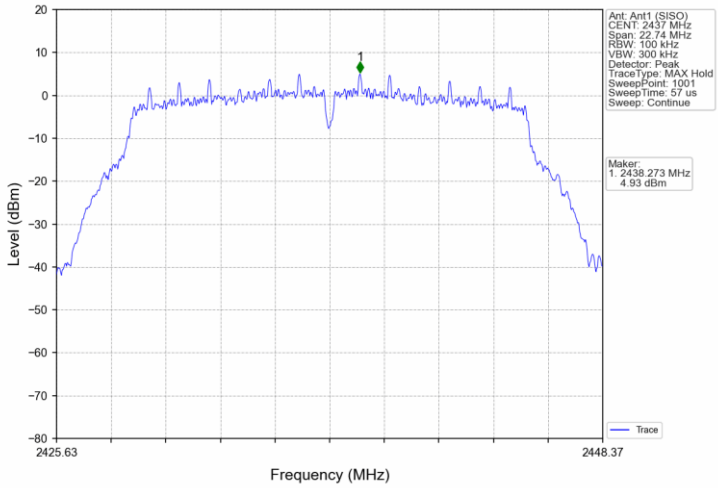
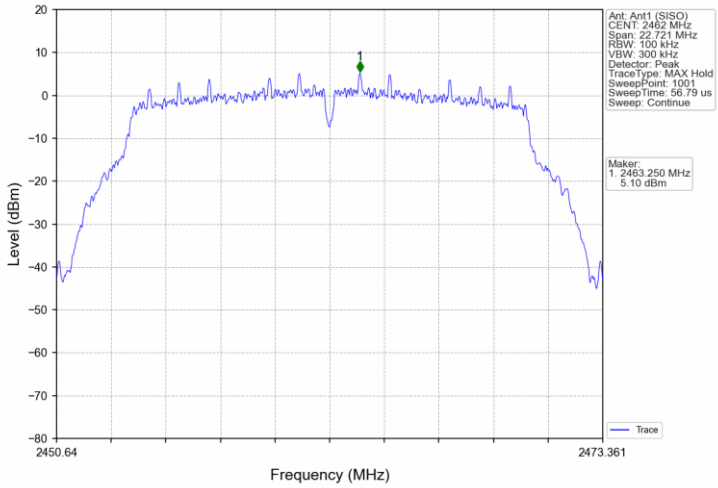


802.11g_HCH_2462MHz_ANT_B (SISO)_NTNV



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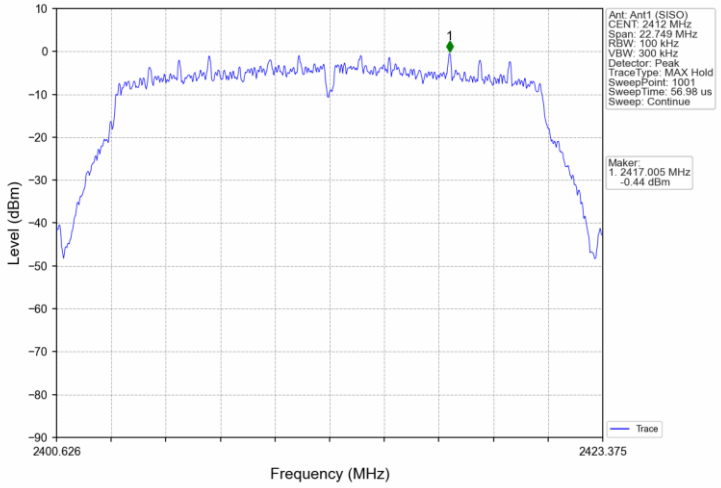
802.11n(HT20)_LCH_2412MHz_ANT_B (MIMO)_NTNV



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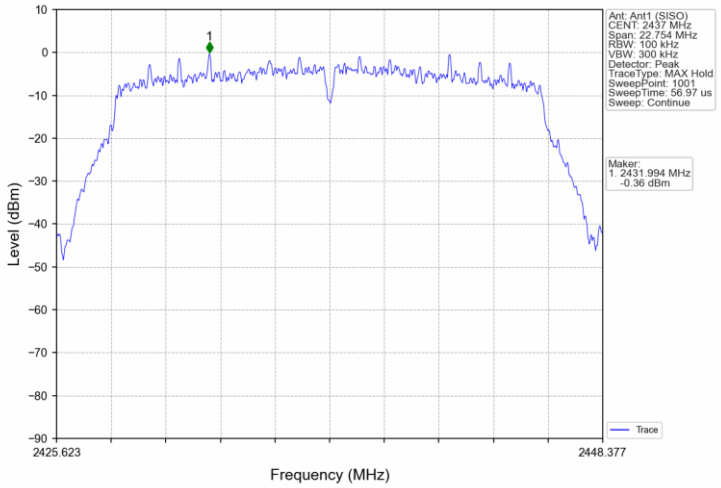
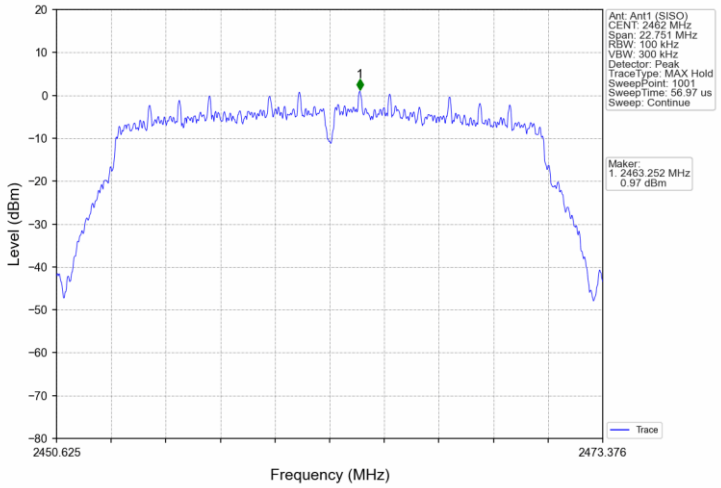


802.11n(HT20)_HCH_2462MHz_ANT_B (MIMO)_NTNV



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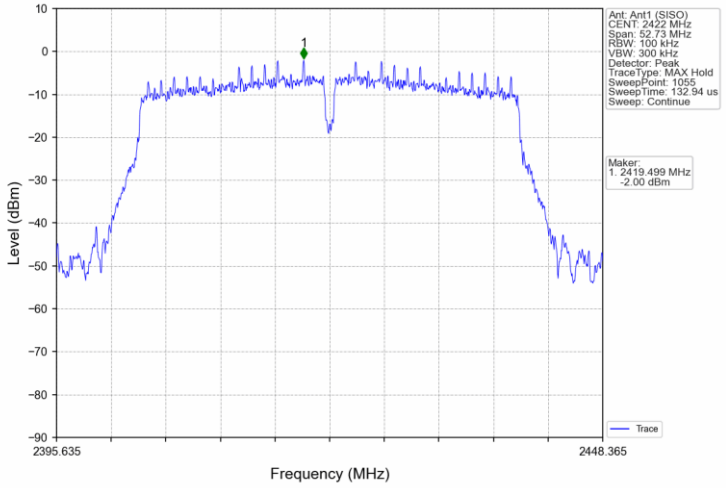
802.11n(HT40)_LCH_2422MHz_ANT_B (MIMO)_NTNV



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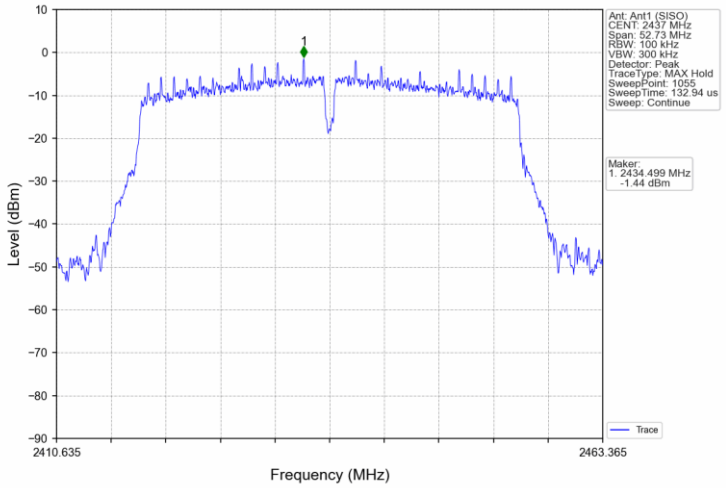
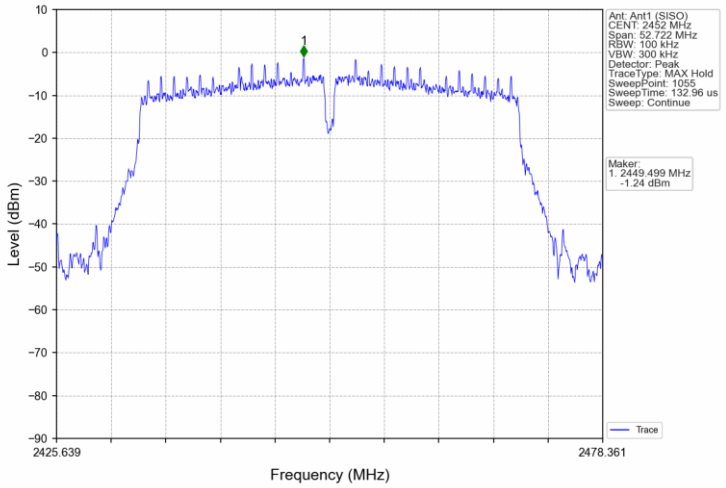
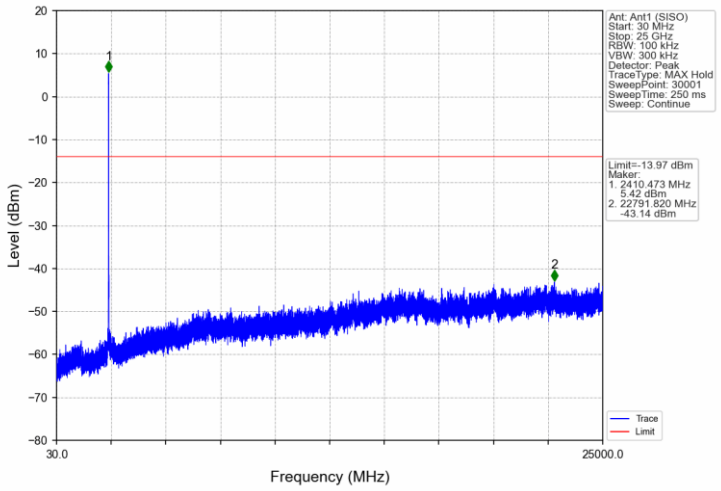


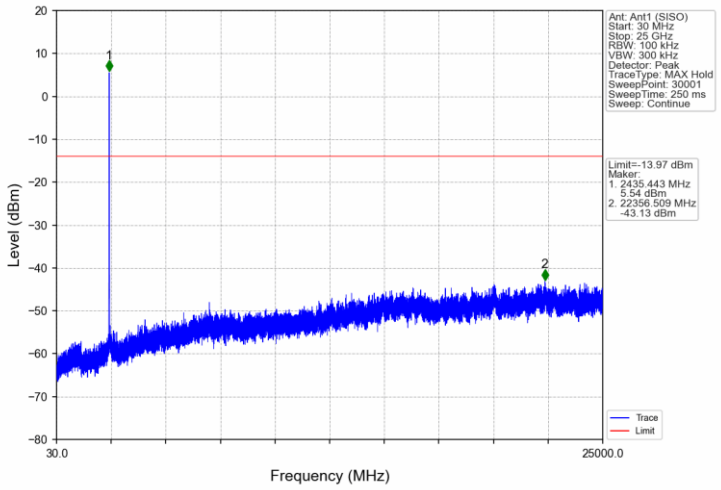
802.11n(HT40)_HCH_2452MHz_ANT_B (MIMO)_NTNV



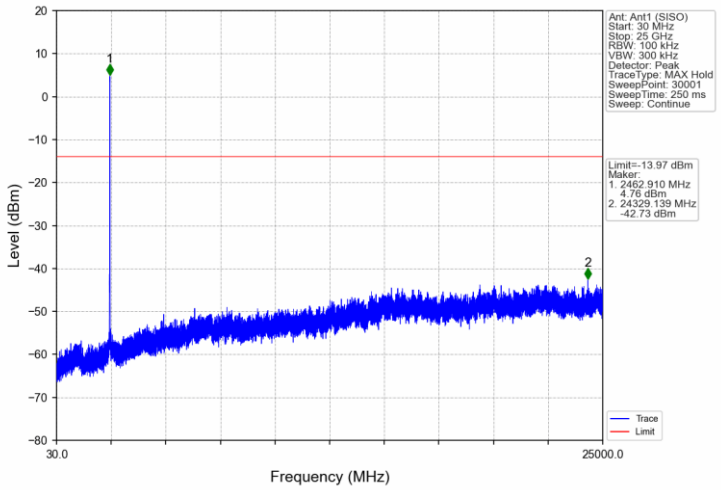
802.11b_LCH_2412MHz_ANT_B (SISO)_NTNV



802.11b_MCH_2437MHz_ANT_B (SISO)_NTNV



802.11b_HCH_2462MHz_ANT_B (SISO)_NTNV



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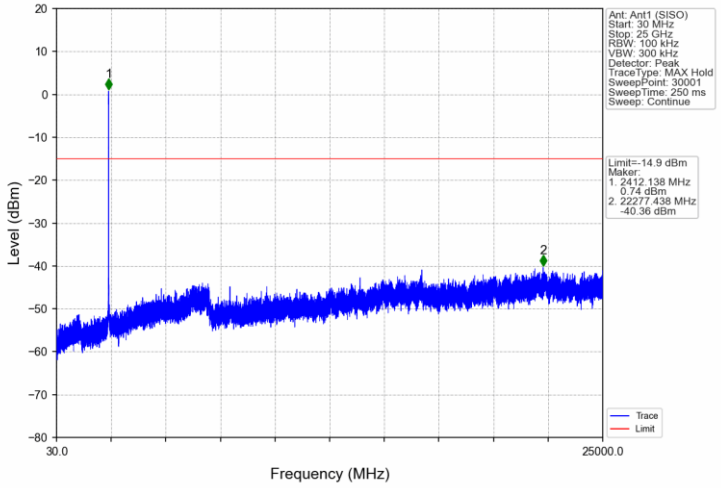
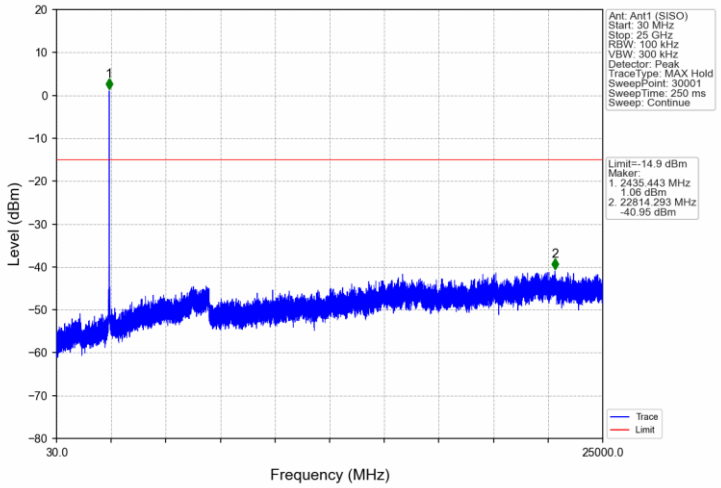
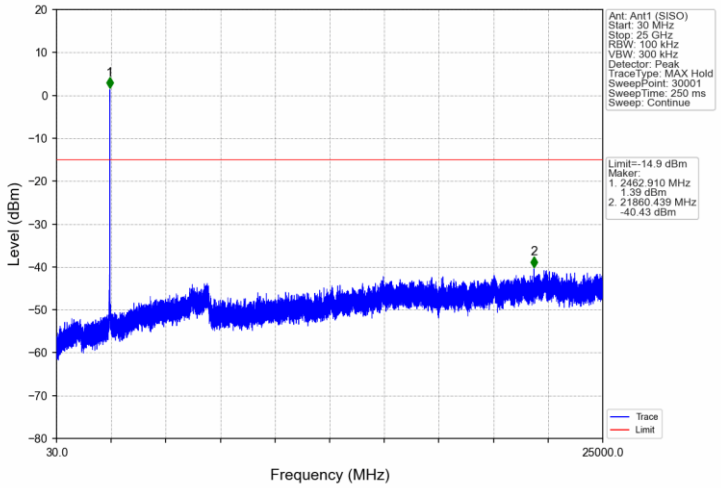
802.11g_LCH_2412MHz_ANT_B (SISO)_NTNV



802.11g_MCH_2437MHz_ANT_B (SISO)_NTNV



802.11g_HCH_2462MHz_ANT_B (SISO)_NTNV



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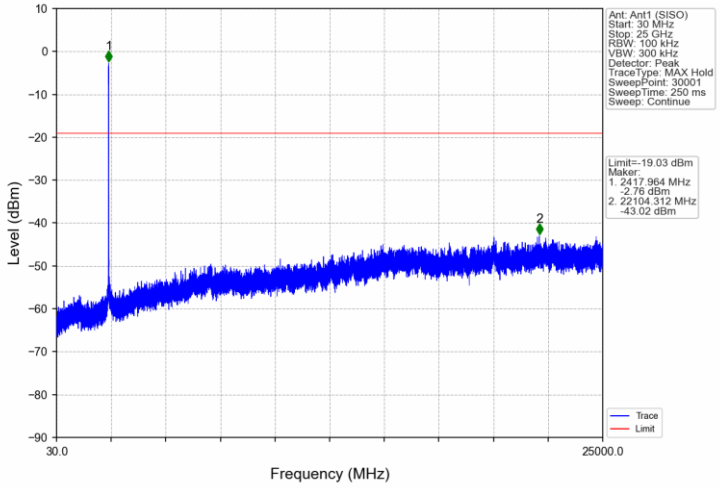
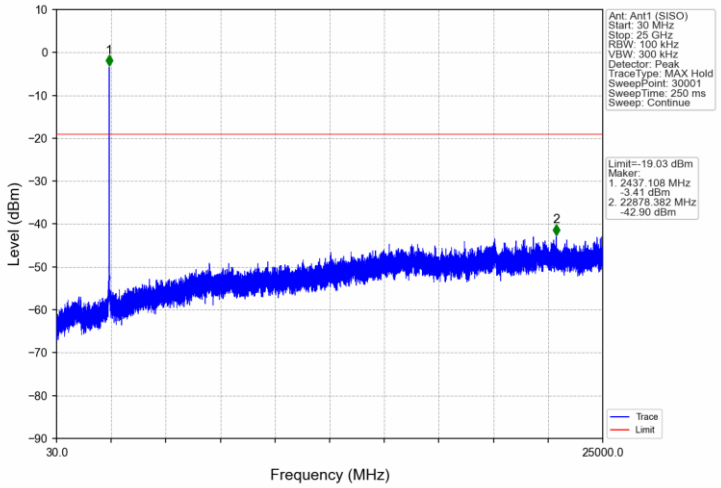
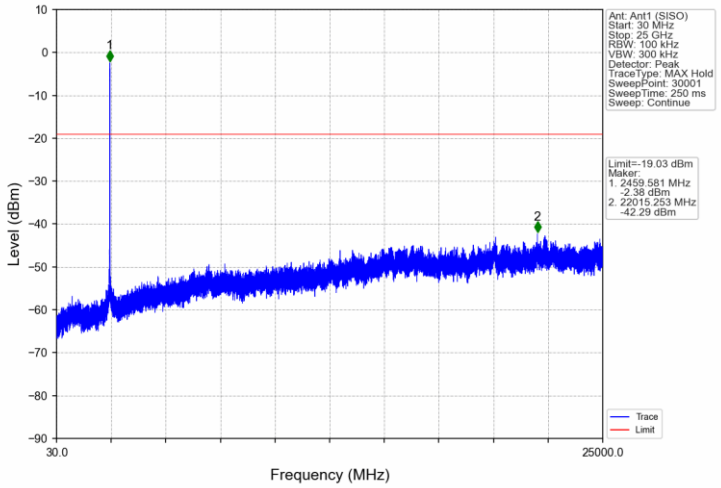
802.11n(HT20)_LCH_2412MHz_ANT_B (MIMO)_NTNV



802.11n(HT20)_MCH_2437MHz_ANT_B (MIMO)_NTNV



802.11n(HT20)_HCH_2462MHz_ANT_B (MIMO)_NTNV



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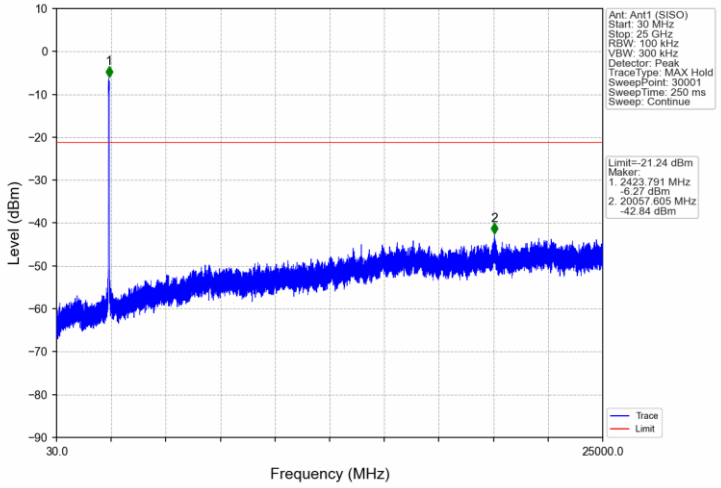
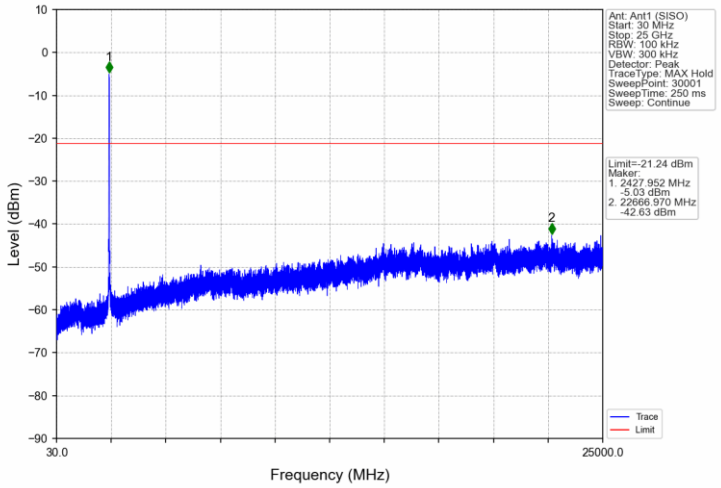
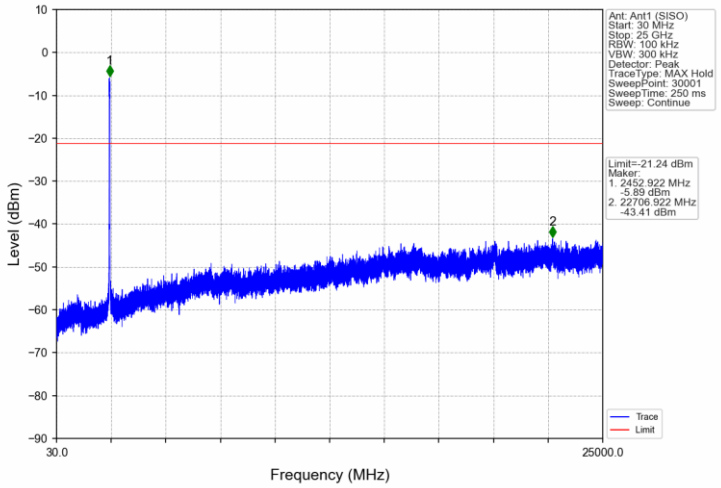
802.11n(HT40)_LCH_2422MHz_ANT_B (MIMO)_NTNV



802.11n(HT40)_MCH_2437MHz_ANT_B (MIMO)_NTNV



802.11n(HT40)_HCH_2452MHz_ANT_B (MIMO)_NTNV



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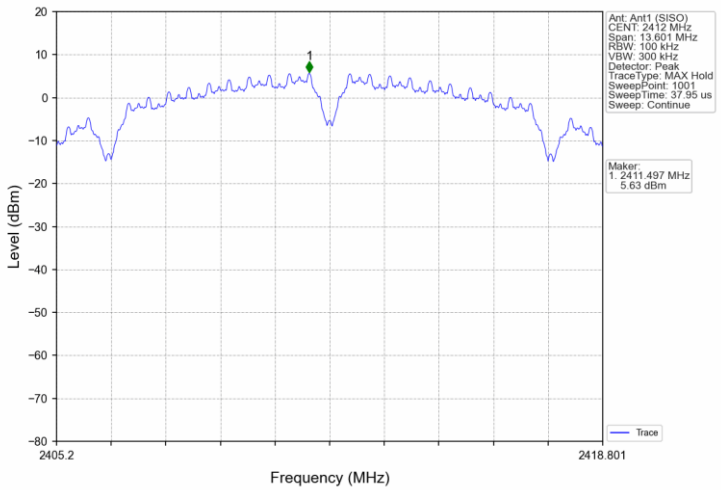
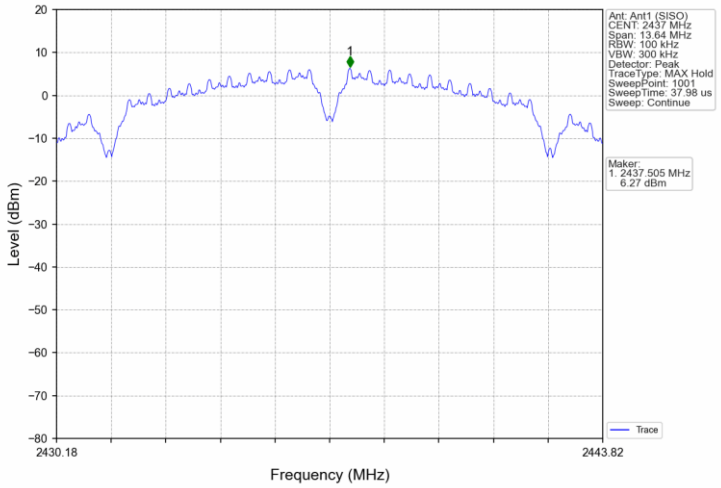
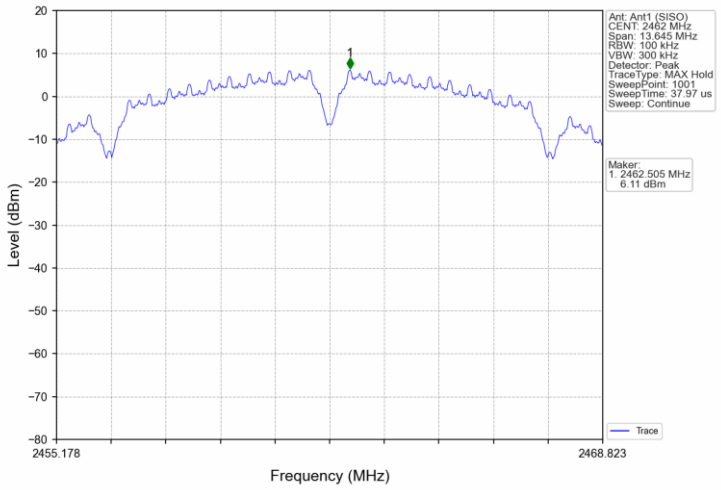
802.11b_LCH_2412MHz_ANT_A (SISO)_NTNV



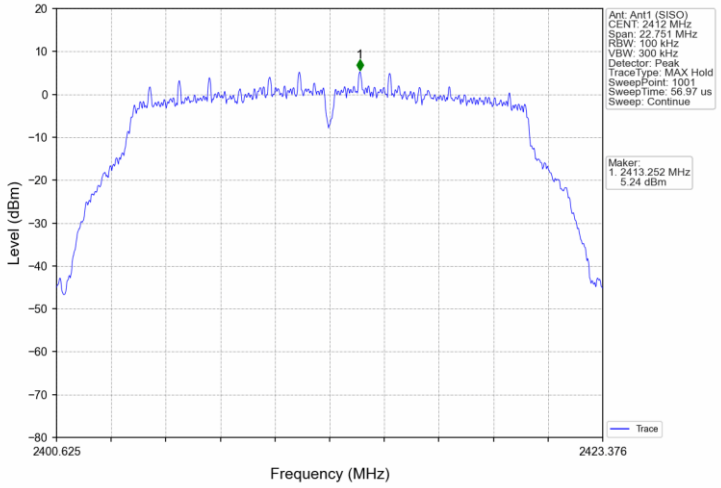
802.11b_MCH_2437MHz_ANT_A (SISO)_NTNV



802.11b_HCH_2462MHz_ANT_A (SISO)_NTNV



802.11g_LCH_2412MHz_ANT_A (SISO)_NTNV



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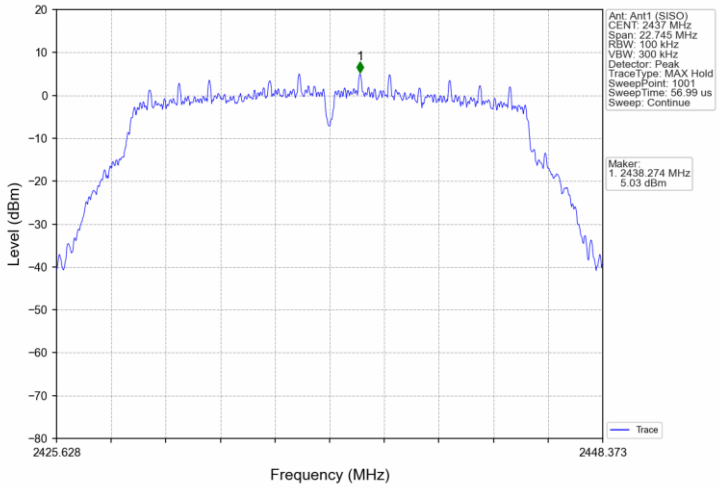
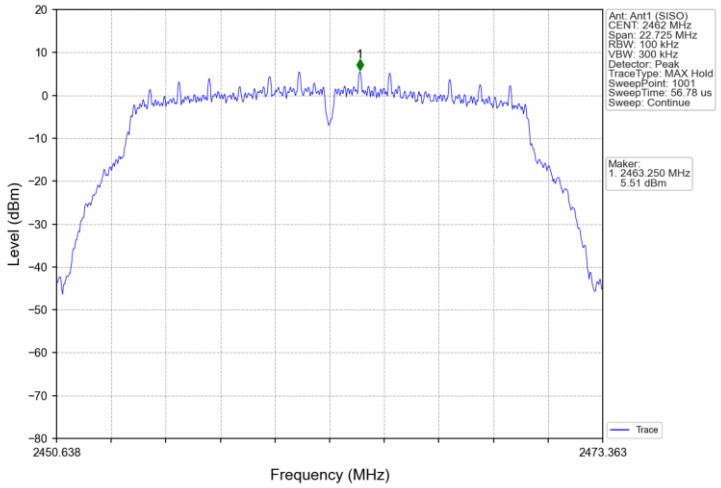
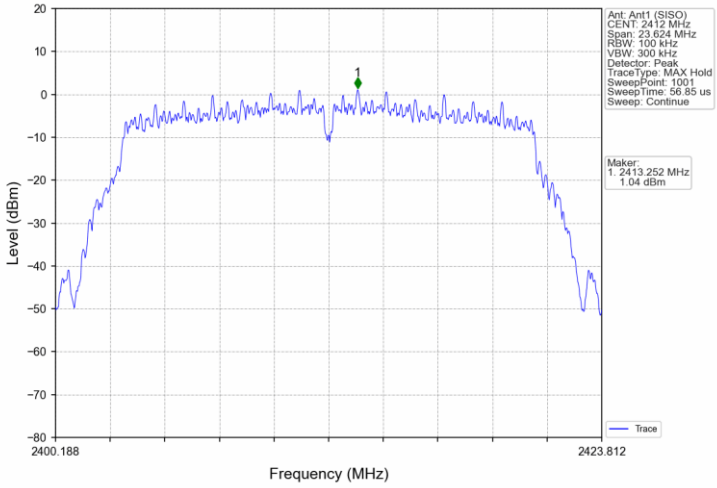


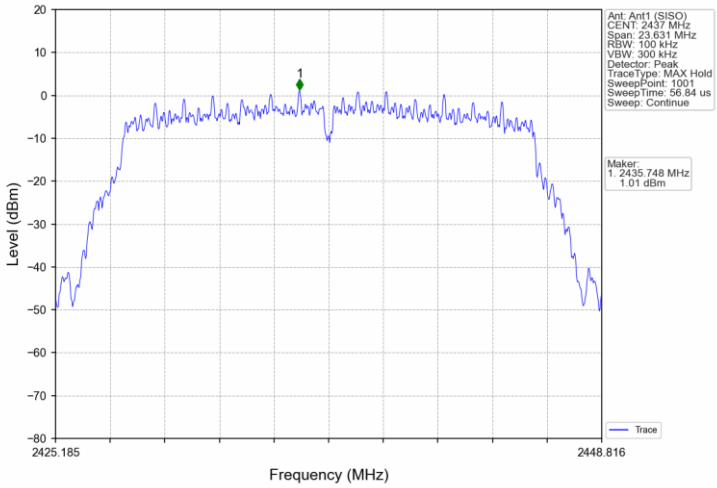
802.11g_HCH_2462MHz_ANT_A (SISO)_NTNV



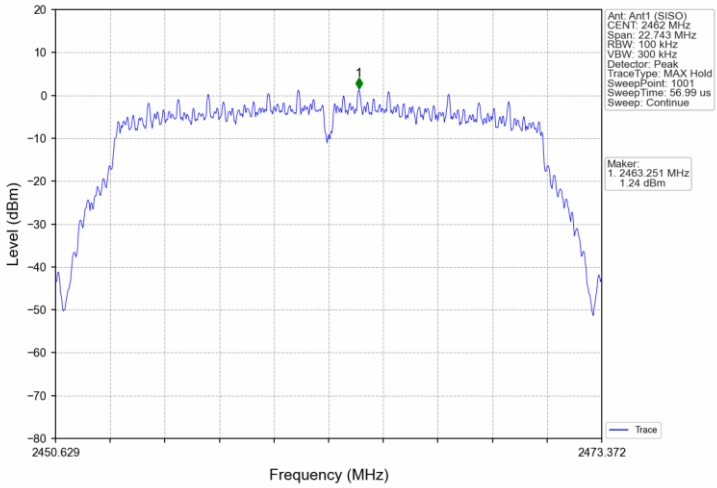
802.11n(HT20)_LCH_2412MHz_ANT_A (MIMO)_NTNV



802.11n(HT20)_MCH_2437MHz_ANT_A (MIMO)_NTNV



802.11n(HT20)_HCH_2462MHz_ANT_A (MIMO)_NTNV



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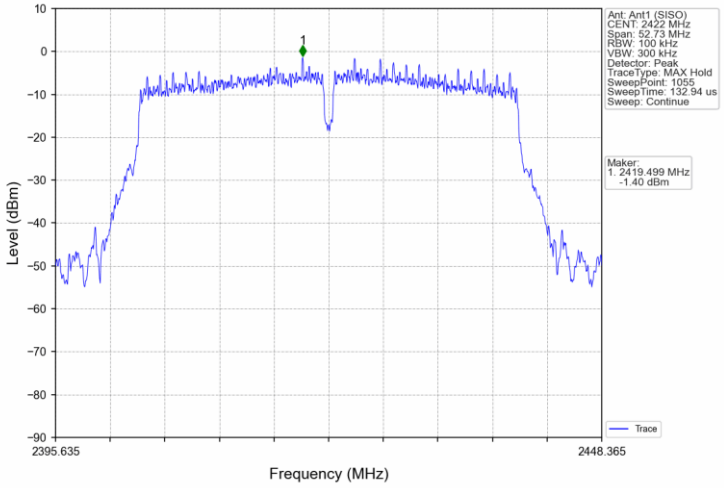
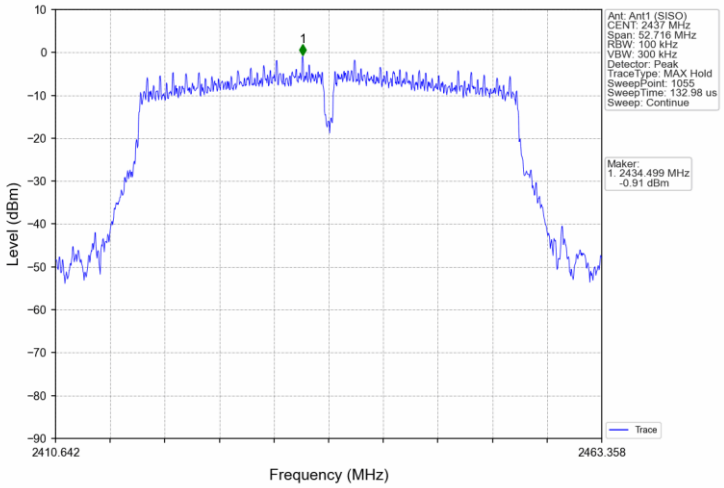
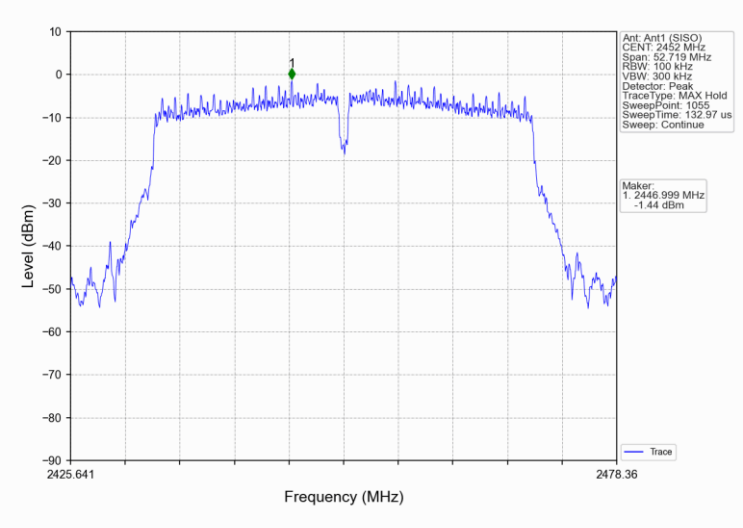
802.11n(HT40)_LCH_2422MHz_ANT_A (MIMO)_NTNV



802.11n(HT40)_MCH_2437MHz_ANT_A (MIMO)_NTNV



802.11n(HT40)_HCH_2452MHz_ANT_A (MIMO)_NTNV



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