FCC/ISED - TEST REPORT

Report Number	:	**68.710.24.0030.01**	Date of Issue:	2024-04-10
Model/HVIN	:	**T10 SE**		
Product Type	:	Robotic vacuum cleaner		
Applicant	:	Shenzhen Topband Co.,Ltd		
Address	:	Topband Industrial Park, LiYuan Industrial Zone, ShiYan Town, Bao'An District, 518108 Shenzhen, PEOPLE'S REPUBLIC OF CHINA		
Manufacturer	:	Shenzhen Topband Co.,Ltd		
Address	:	Topband Industrial Park, LiYuan Industrial Zone, ShiYan Town, Bao'An District, 518108 Shenzhen, PEOPLE'S REPUBLIC OF CHINA		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**69**		

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Guankou Erlu, Nantou, Nanshan District, Shenzhen, Guangdong, China
Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299
FCC Registration No.:	514049
FCC Designation Number:	CN5009
ISED CAB identifier:	CN0077
IC Registration No.:	10320A

3 Description of the Equipment Under Test

Product:	Robotic vacuum cleaner
Model no.:	T10 SE
Product Marketing Name (PMN):	Robotic vacuum cleaner
Hardware Version Identification No. (HVIN):	T10 SE
FCC ID:	2ADDW-T10SE
IC:	23804-T10SE
Options and accessories:	Power supply Manufacturer: SHENZHEN KEYU POWER SUPPLY TECHNOLOGY CO., LTD Model: KA1201A-200600US Input: 100-240VAC, 50/60Hz, 0.4A Max. Output: 20VDC, 600mA
Ratings:	20VDC, 0.6A
RF Transmission Frequency:	2412MHz - 2462MHz for 2.4GHz Wi-Fi
No. of Operated Channel:	11 for 2.4GHz Wi-Fi
Modulation:	802.11b: BPSK, QPSK, CCK 802.11g: BPSK, QPSK, 16-QAM, 64-QAM 802.11n: BPSK, QPSK, 16-QAM, 64-QAM
Antenna Type:	Integrated FPC antenna
Antenna Gain:	3.2 dBi for 2.4GHz Wi-Fi
Description of the EUT:	The EUT is a Robotic vacuum cleaner supports Wi-Fi and BT functions: 2412MHz - 2462MHz for 2.4GHz Wi-Fi; 2402MHz - 2480MHz for BLE (1Mbps); 2402MHz - 2480MHz for BT BR/EDR.
Remark:	This report is only for 2.4GHz Wi-Fi.

NOTE 1: The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2023 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 April 2018 + Amendment 1 March 2019 + Amendment 2 February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 3 August 2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2013.

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C/ RSS-247 Issue 3/RSS-Gen Issue 5						
Test Condition		Test Site	Test Result			Test Environment
			Pass	Fail	N/A	
§15.207 & RSS-GEN 8.8	Conducted emission AC power port	N/A	☐	☐	☒	--
§15.247 (b) (3) & RSS-247 5.4(d)	Conducted peak output power	Site 1	☒	☐	☐	T: 23.2℃ H: 51.5%
RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	Site 1	☒	☐	☐	T: 23.2℃ H: 51.5%
§15.247(a)(2) & RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	Site 1	☒	☐	☐	T: 23.2℃ H: 51.5%
§15.247(e) & RSS-247 5.2(b)	Power spectral density	Site 1	☒	☐	☐	T: 23.2℃ H: 51.5%
§15.247(d) & RSS-247 5.5	Spurious RF conducted emissions	Site 1	☒	☐	☐	T: 23.2℃ H: 51.5%
§15.247(d) & RSS-247 5.5	Band edge	Site 1	☒	☐	☐	T: 23.2℃ H: 51.5%
§15.247(d) & §15.209 & §15.205 & RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	Site 1	☒	☐	☐	T: 24.7℃ H: 49.3%
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 2	☒	☐	☐	--

Note 1: N/A=Not Applicable.
Note 2: The EUT uses an Integrated FPC antenna, which gains are 3.2dBi for 2.4GHz WIFI. In accordance with §15.203 and RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.
Note 3: T: Temperature, H: Humidity.

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6 General Remarks

This submittal(s) (test report) is intended for FCC ID: 2ADDW-T10SE, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C rules.

This submittal(s) (test report) is intended for IC: 23804-T10SE, complies with RSS-247 and RSS-Gen.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date:	2024-02-18
Testing Start Date:	2024-02-22
Testing End Date:	2024-02-27

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch –

Reviewed by:	Prepared by:	Tested by:
Jessie He	Myron Yu	Carry Cai
Project Manager	Project Engineer	Test Engineer

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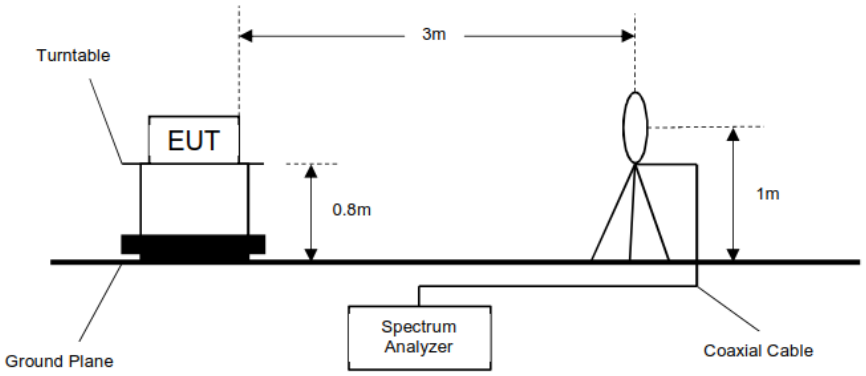
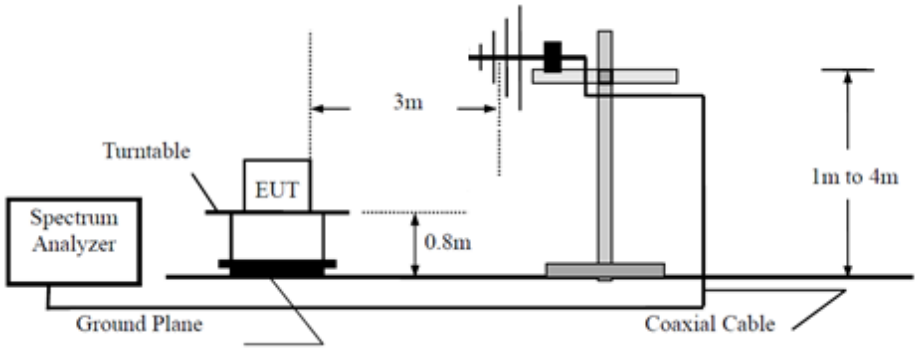
7 Test Setups

7.1 Radiated test setups

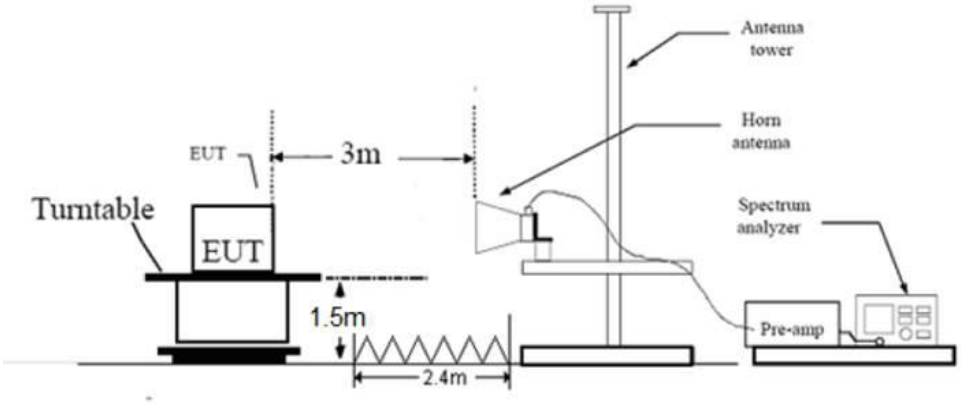
9kHz - 30MHz



Below 1GHz



Above 1GHz



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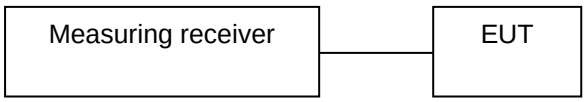
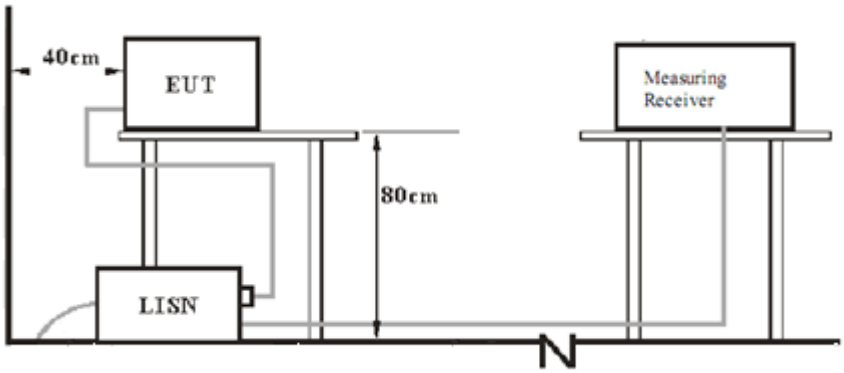
7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MODEL NO.	MANUFACTURER	S/N
Laptop	X220	ThinkPad	EMC-158

Test Software Information:

Test Software Version	adb	
Mode	Setting TX Power	Data Rate
802.11b	Default parameters	11b 1 Mbps
802.11g	Default parameters	11g 6 Mbps
802.11n HT20	Default parameters	MCS0 6.5 Mbps
802.11n HT20	Default parameters	MCS0 13.5 Mbps

The system was configured to channel 1, 6, and 11 for 802.11b/802.11g/802.11n-HT20:

Test mode	Channel	Frequency(MHz)
TX	1	2412
TX	6	2437
TX	11	2462

The system was configured to channel 3, 6, and 9 for 802.11n-HT40:

Test mode	Channel	Frequency(MHz)
TX	3	2422
TX	6	2437
TX	9	2452

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Remark: “*” Decreasing linearly with logarithm of the frequency

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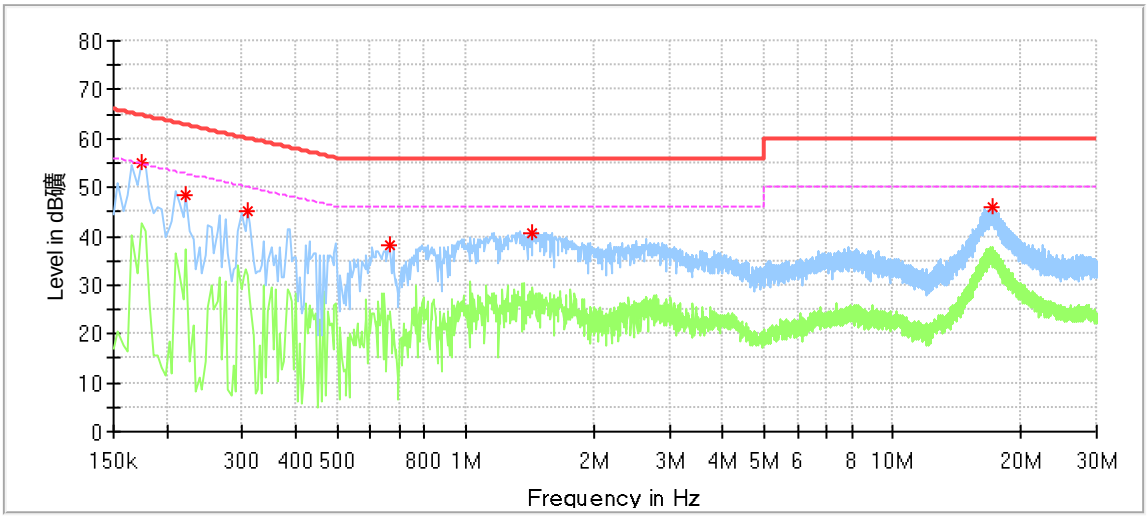
Conducted Emission

Product Type	:	Robotic vacuum cleaner
M/N	:	T10 SE
Operating Condition	:	Charging + WIFI communication mode
Test Specification	:	L
Comment	:	AC 120V/60Hz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.174000	55.00	---	64.77	9.76	L1	9.54
0.222000	48.38	---	62.74	14.36	L1	9.55
0.310000	45.27	---	59.97	14.70	L1	9.57
0.662000	38.32	---	56.00	17.68	L1	9.60
1.426000	40.73	---	56.00	15.27	L1	9.61
17.134000	46.12	---	60.00	13.88	L1	10.00

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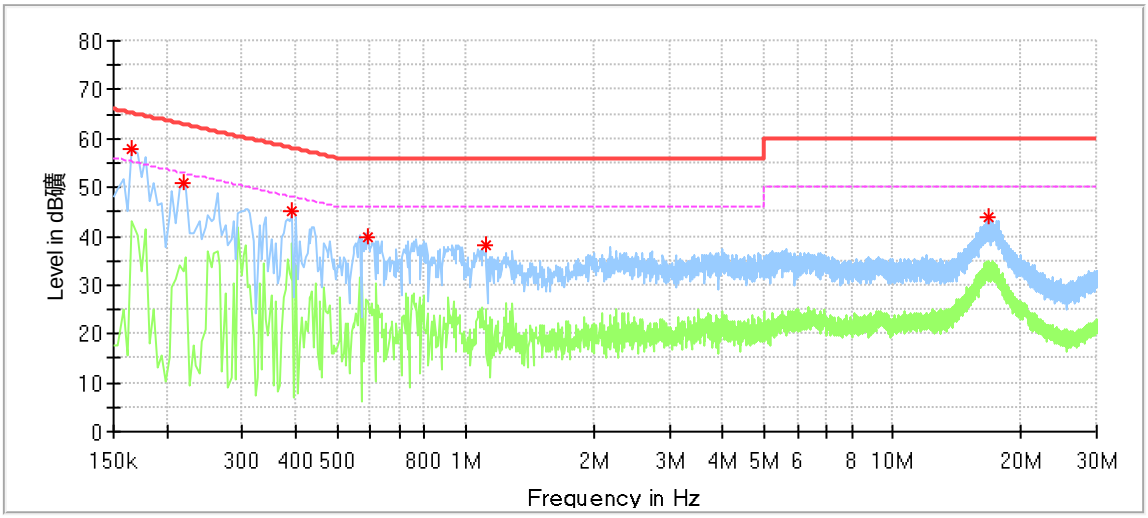
Conducted Emission

Product Type	:	Robotic vacuum cleaner
M/N	:	T10 SE
Operating Condition	:	Charging + WIFI communication mode
Test Specification	:	N
Comment	:	AC 120V/60Hz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.166000	57.91	---	65.16	7.25	N	9.57
0.218000	51.02	---	62.90	11.87	N	9.58
0.394000	45.19	---	57.98	12.79	N	9.61
0.590000	39.65	---	56.00	16.35	N	9.63
1.118000	37.96	---	56.00	18.04	N	9.63
16.682000	43.95	---	60.00	16.05	N	9.98

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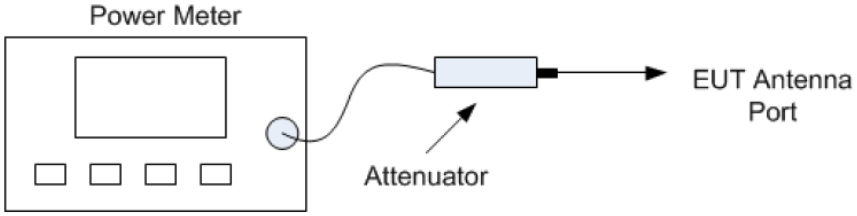
9.2 Conducted Output Power & EIRP

Test Method

1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

4) Measure the peak power of the transmitter. This measurement is a peak over both the ON and OFF periods of the transmitter.



Power meter conducted test setup

Limit

According to §15.247 (b) (3) & RSS-247 5.4(d), conducted output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

According to & RSS-247 5.4(d), EIRP limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36

Test Results

Mode	Frequency (MHz)	Gain (dBi)	Measured Power (dBm)	EIRP (dBm)	Conducted output power limit (dBm)	EIRP Limit (dBm)	Verdict
802.11b	2412	3.2	15.00	18.20	<=30	<=36	Pass
	2437	3.2	15.40	18.60	<=30	<=36	Pass
	2462	3.2	15.39	18.59	<=30	<=36	Pass
802.11g	2412	3.2	14.73	17.93	<=30	<=36	Pass
	2437	3.2	15.35	18.55	<=30	<=36	Pass
	2462	3.2	15.53	18.73	<=30	<=36	Pass
802.11n (HT20)	2412	3.2	13.89	17.09	<=30	<=36	Pass
	2437	3.2	14.37	17.57	<=30	<=36	Pass
	2462	3.2	14.57	17.77	<=30	<=36	Pass
802.11n (HT40)	2422	3.2	13.81	17.01	<=30	<=36	Pass
	2437	3.2	13.98	17.18	<=30	<=36	Pass
	2452	3.2	14.20	17.40	<=30	<=36	Pass
Note1: E.I.R.P = Measured Power + Antenna Gain							

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9.3 6 dB and 99% Bandwidth

Test Method for 6 dB Bandwidth

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:
   RBW=100KHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Use the automatic bandwidth measurement capability of an instrument, use the X dB bandwidth mode with X set to 6 dB.
5. Allow the trace to stabilize, record the 6 dB Bandwidth value.

Test Method for 99 % Bandwidth

1. Connect EUT test port to spectrum analyzer.
   Use the following spectrum analyzer settings:
   RBW=1% to 5% of the actual occupied, VBW≥3RBW, Sweep = auto,
   Detector function = peak, Trace = max hold
2. Use the occupied bandwidth measurement capability of test receiver.
3. Allow the trace to stabilize, record the occupied bandwidth value.

Limit

6dB bandwidth Limit [kHz]	99% bandwidth Limit [kHz]
≥500	--

Test result

6dB bandwidth

Mode	Frequency (MHz)	6dB Bandwidth (MHz)		Verdict
		Result	Limit	
802.11b	2412	9.165	>=0.5	Pass
	2437	9.753	>=0.5	Pass
	2462	9.623	>=0.5	Pass
802.11g	2412	16.426	>=0.5	Pass
	2437	16.447	>=0.5	Pass
	2462	16.445	>=0.5	Pass
802.11n (HT20)	2412	17.058	>=0.5	Pass
	2437	17.644	>=0.5	Pass
	2462	17.672	>=0.5	Pass
802.11n (HT40)	2422	35.244	>=0.5	Pass
	2437	35.210	>=0.5	Pass
	2452	35.420	>=0.5	Pass

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99% bandwidth

Mode	Frequency (MHz)	99% Occupied Bandwidth (MHz)		Verdict
		Result	Limit	
802.11b	2412	14.623	/	Pass
	2437	14.609	/	Pass
	2462	14.615	/	Pass
802.11g	2412	17.105	/	Pass
	2437	17.232	/	Pass
	2462	17.282	/	Pass
802.11n (HT20)	2412	18.138	/	Pass
	2437	18.074	/	Pass
	2462	18.316	/	Pass
802.11n (HT40)	2412	36.135	/	Pass
	2437	36.332	/	Pass
	2462	36.277	/	Pass

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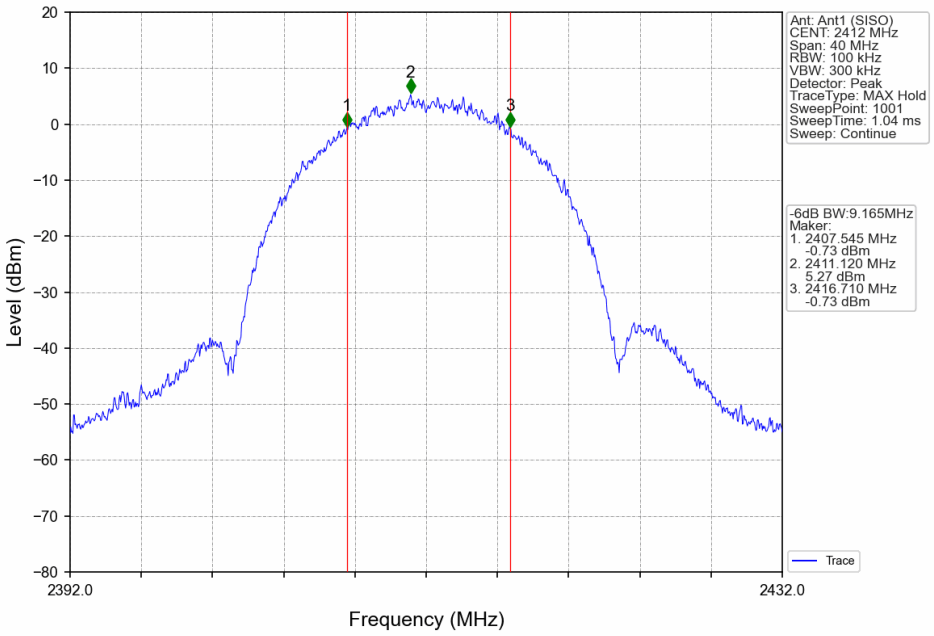
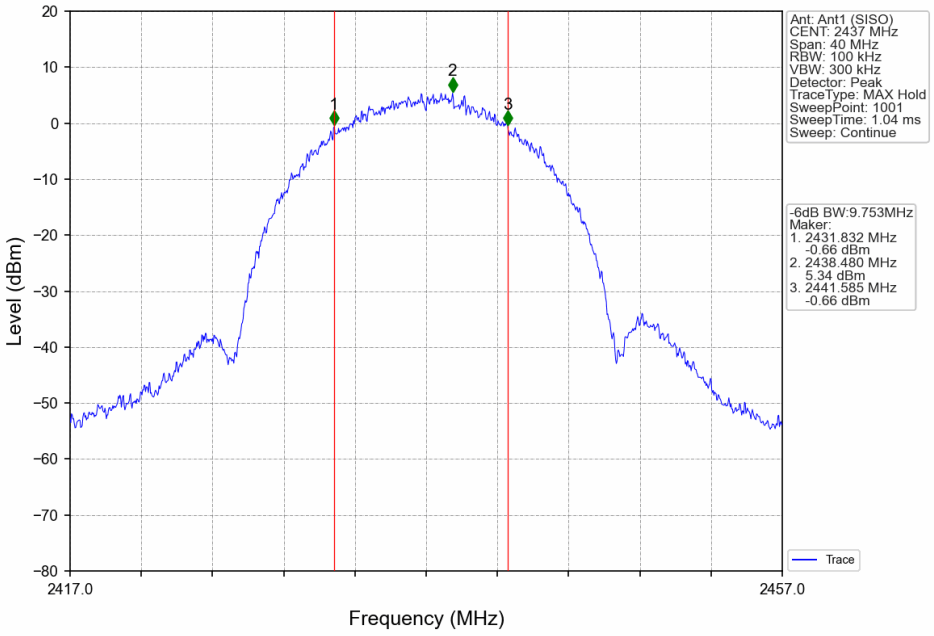
Test Graphs

6dB bandwidth

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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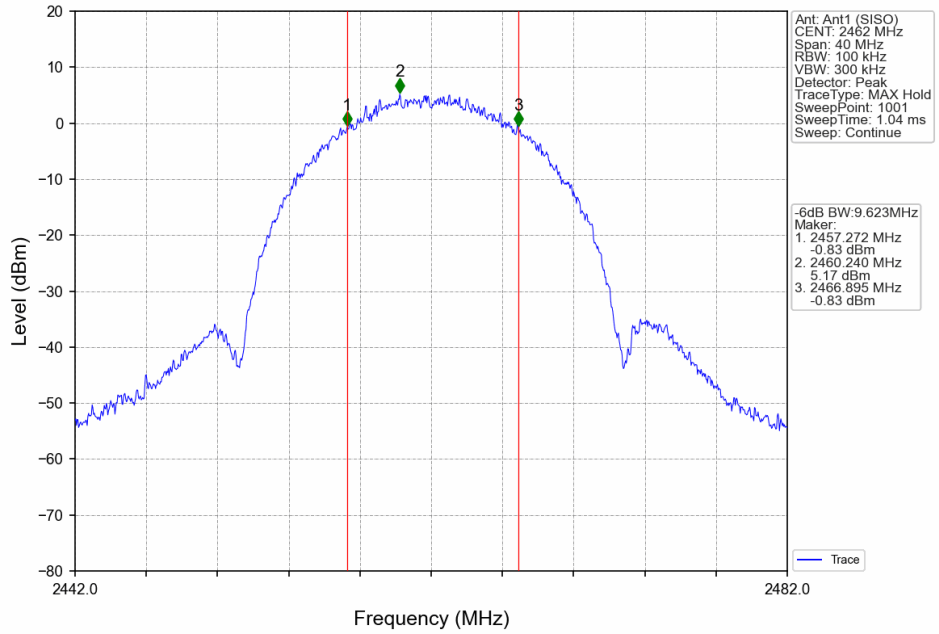
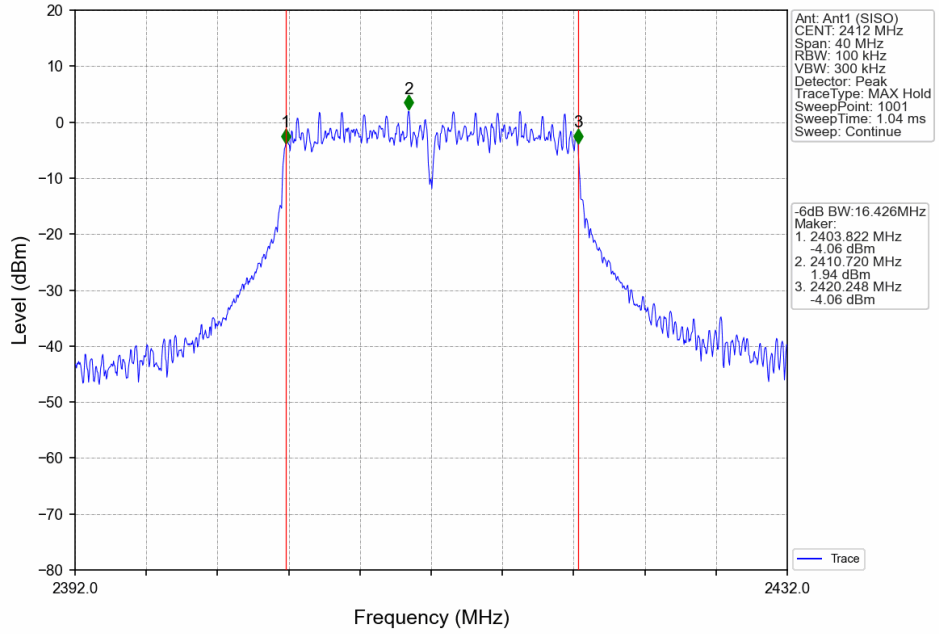
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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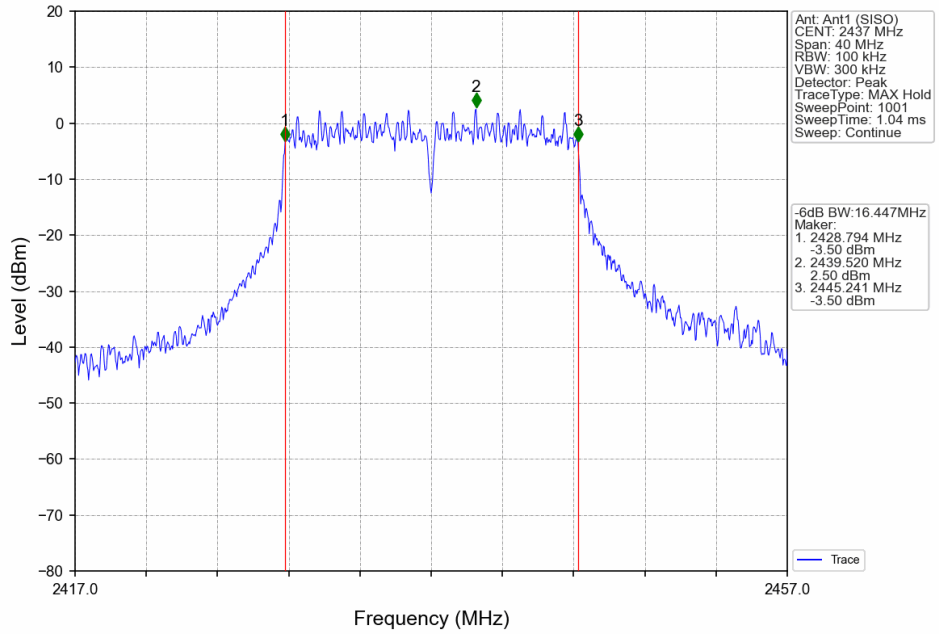
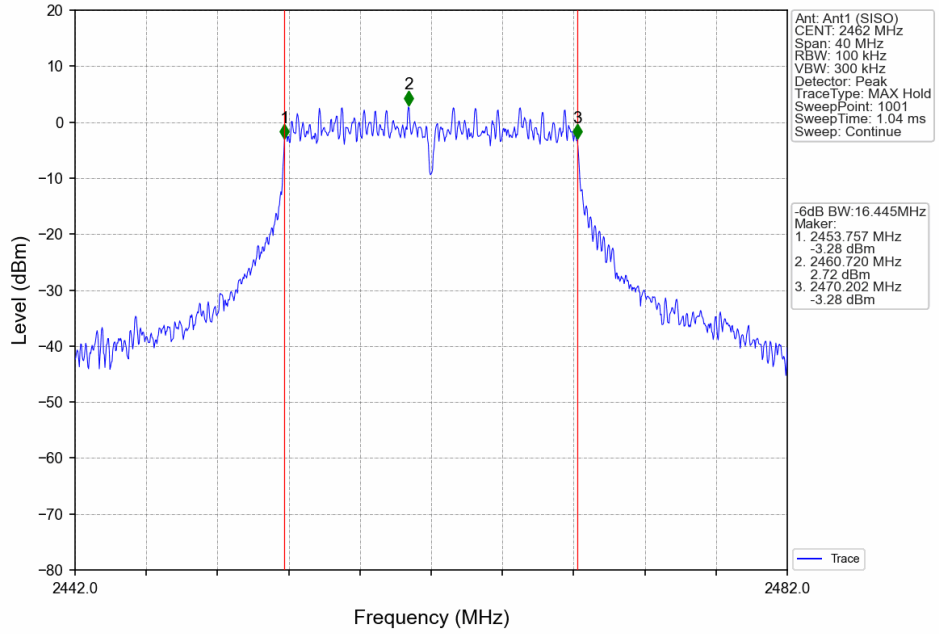
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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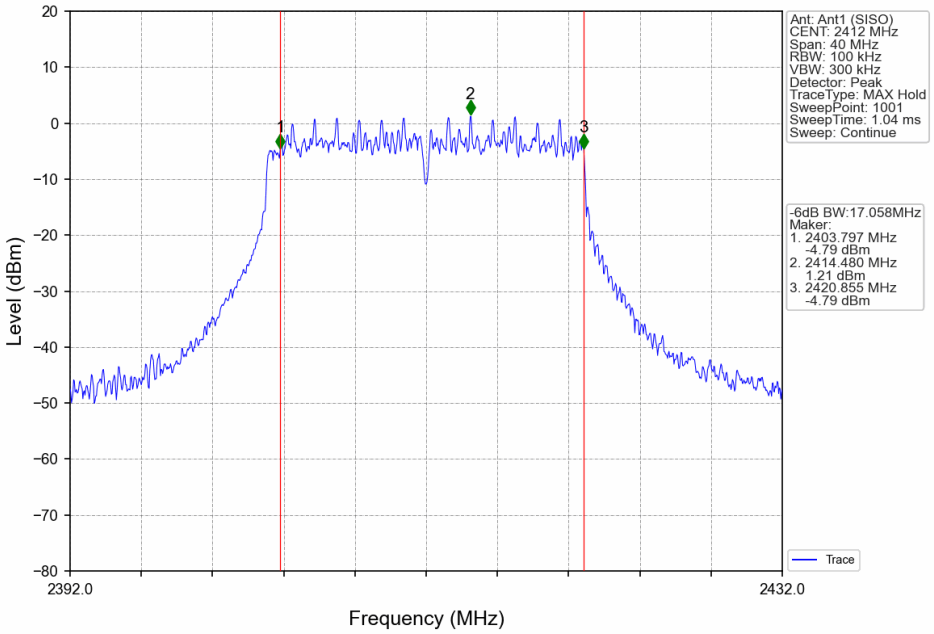
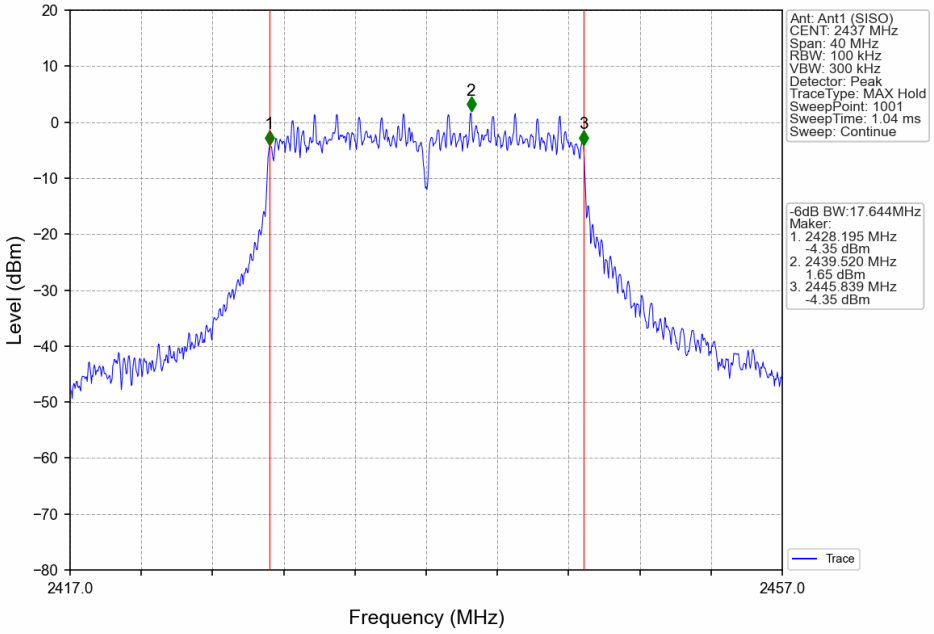
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant1 (SISO)_NTNV



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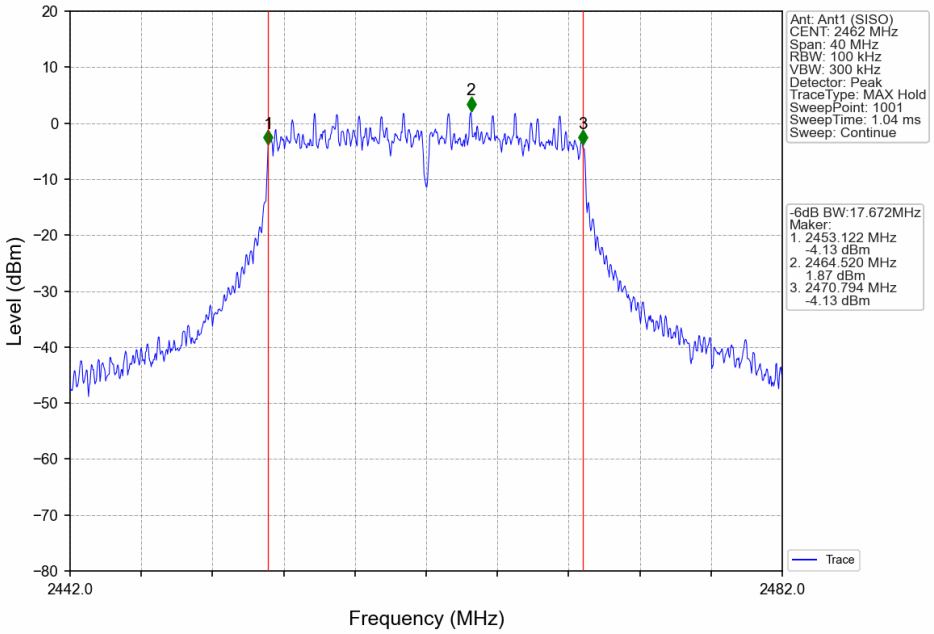
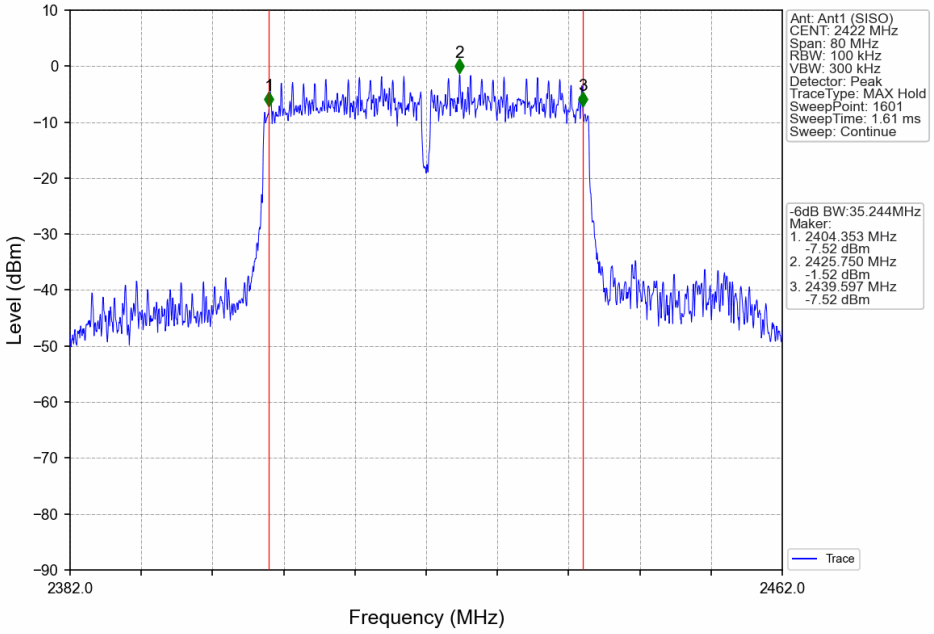
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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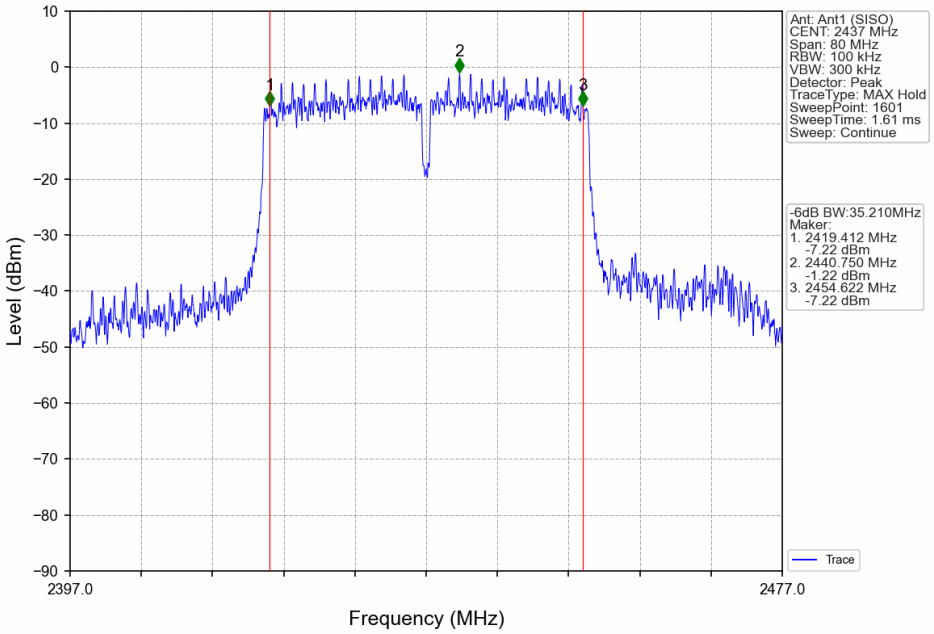
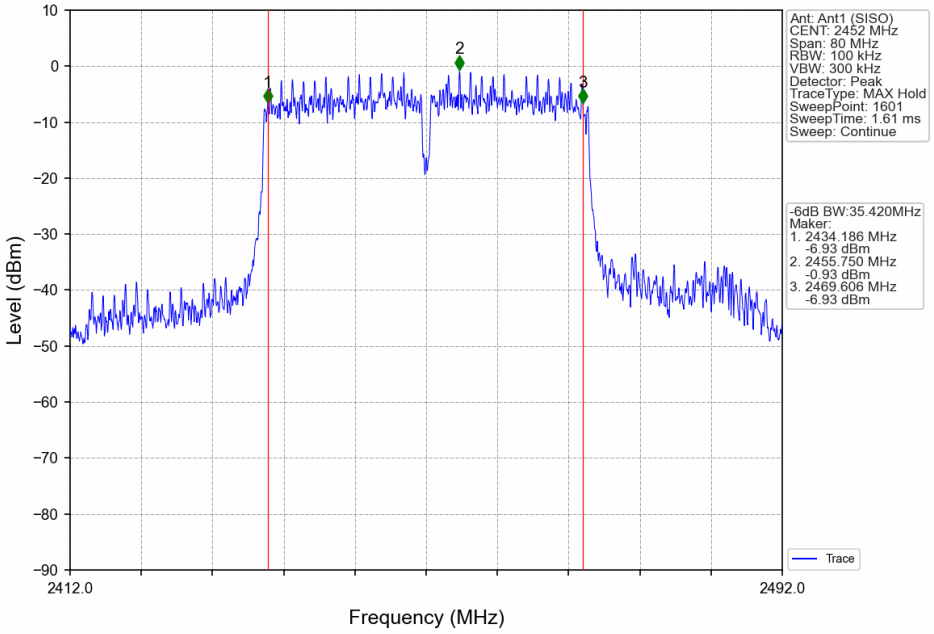
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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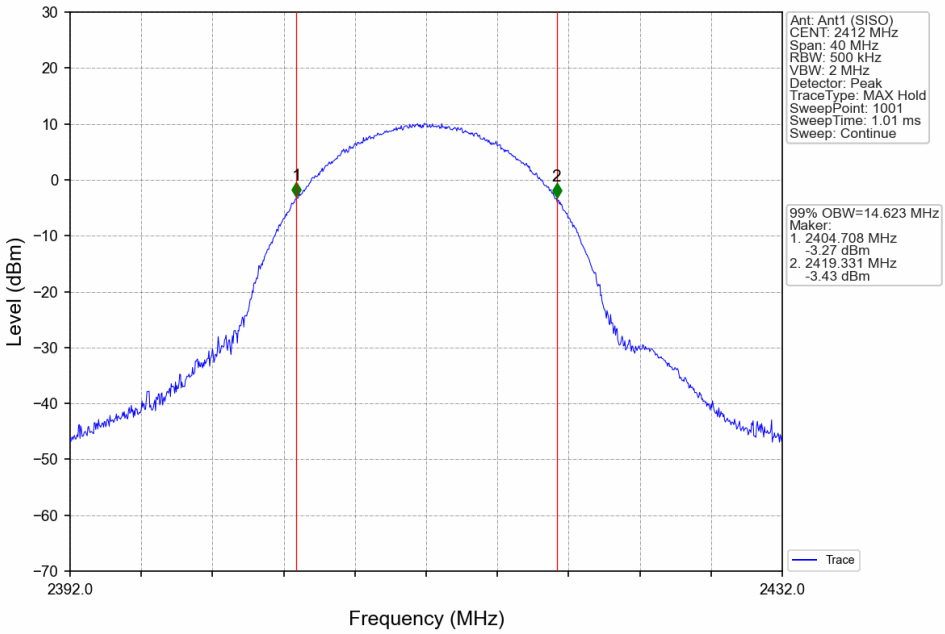
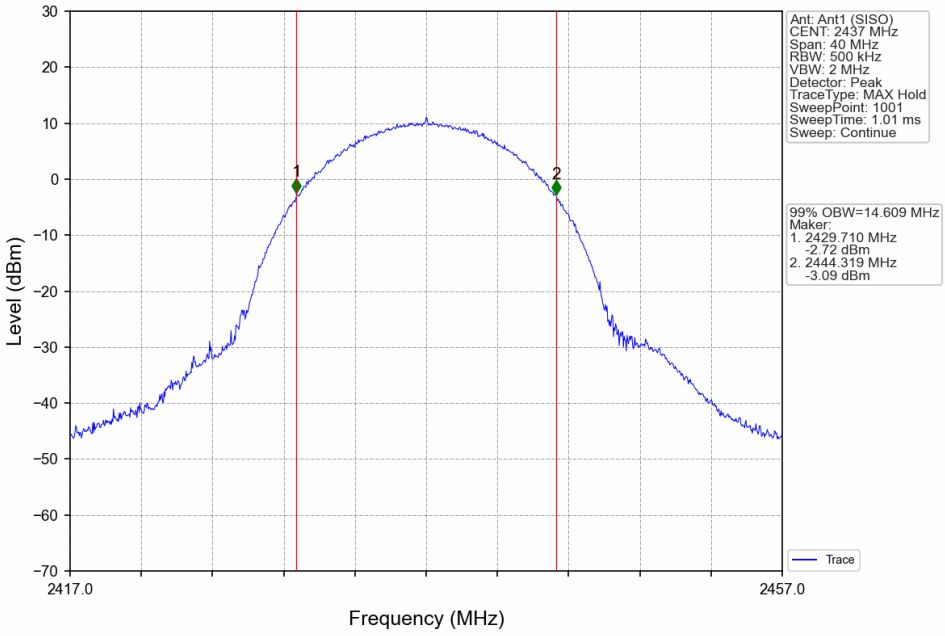
99% bandwidth

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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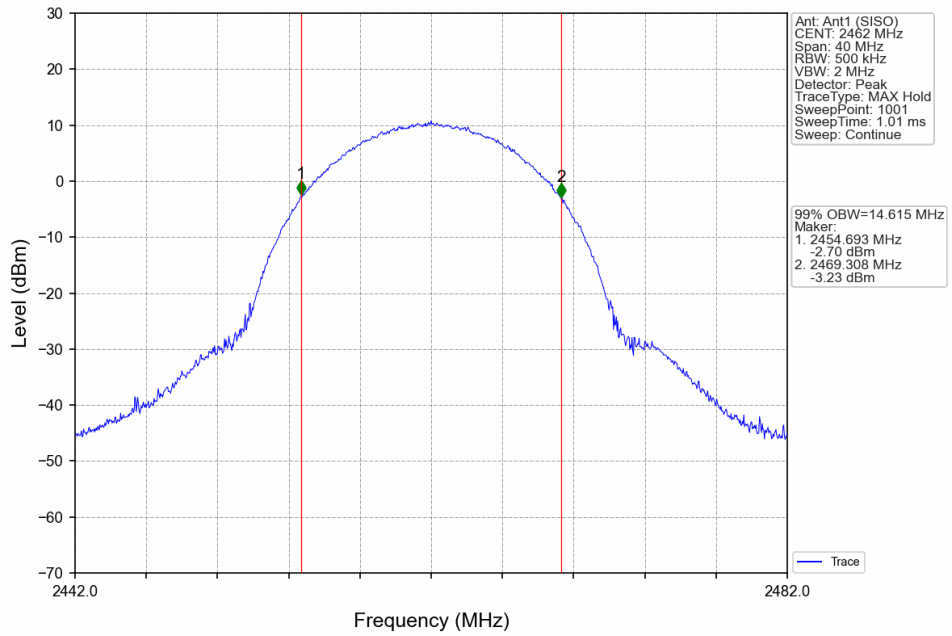
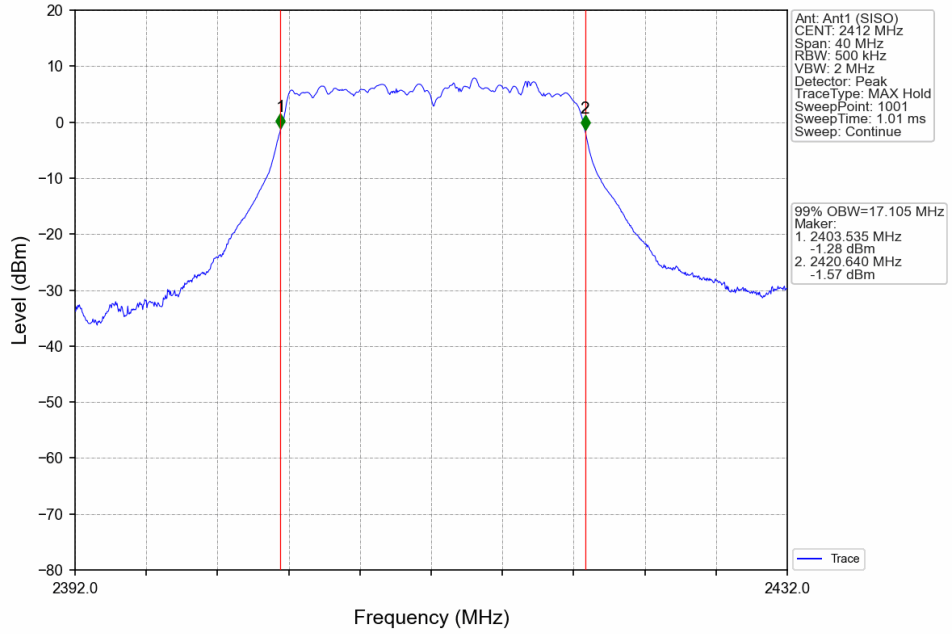
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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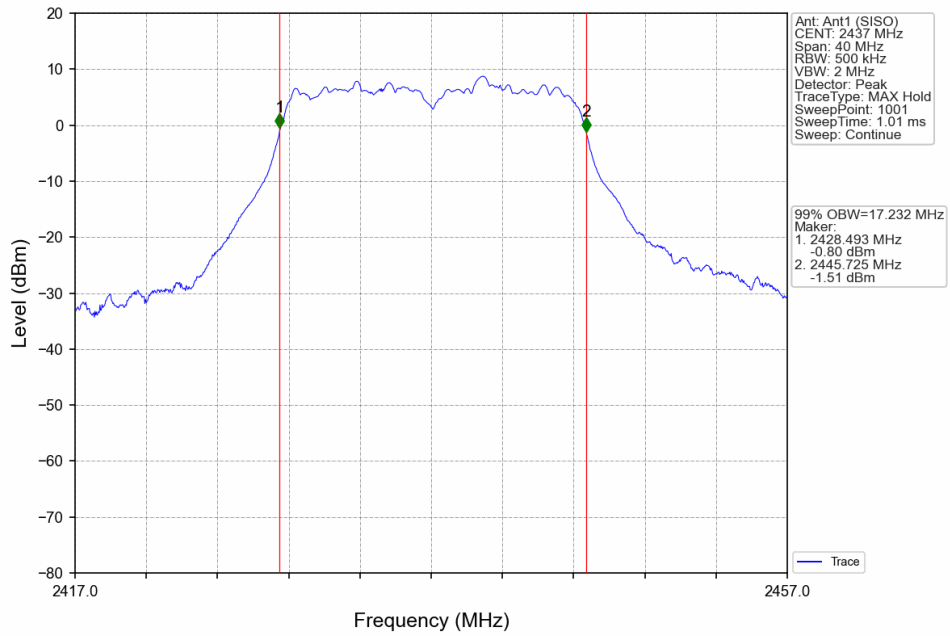
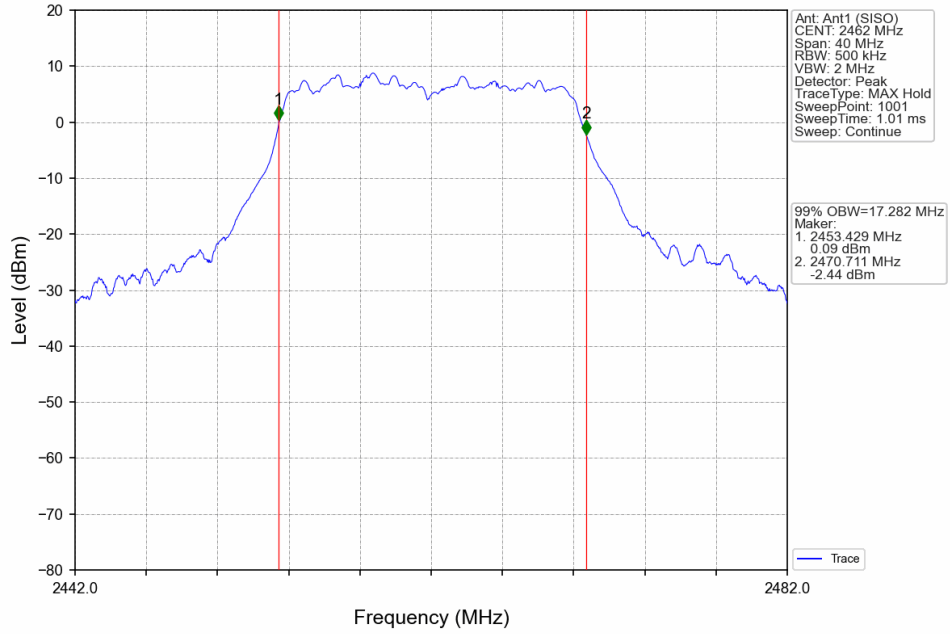
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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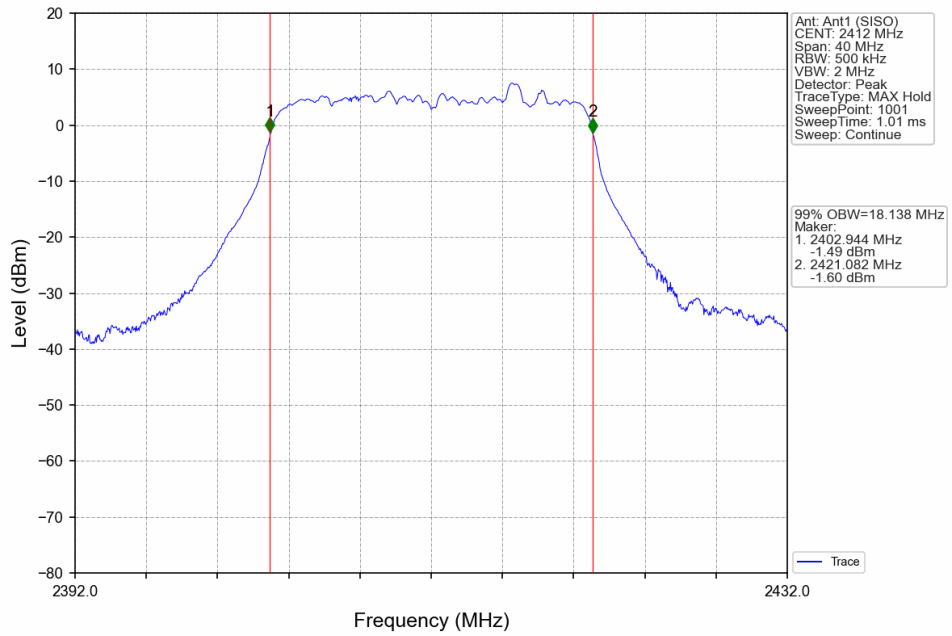
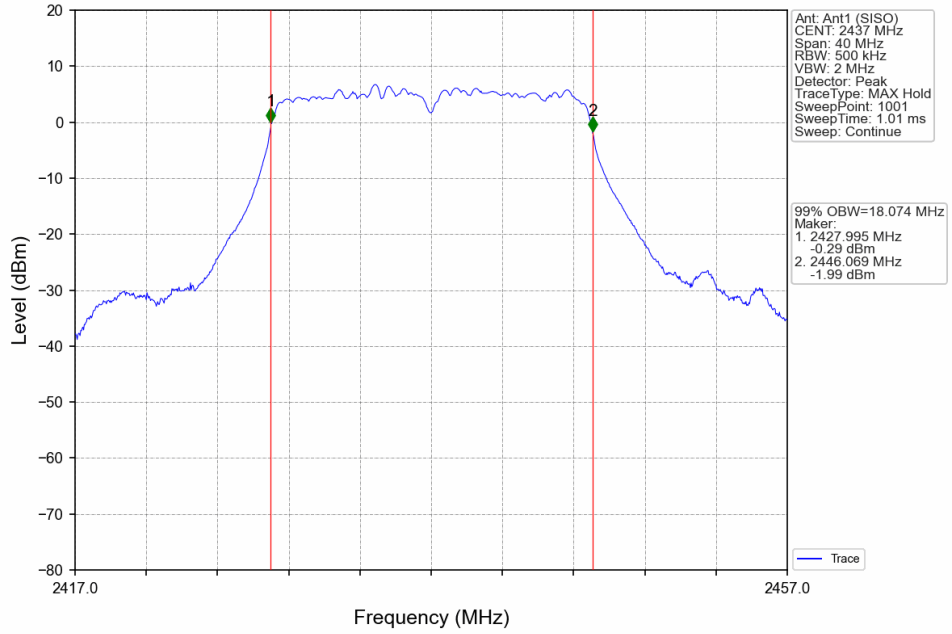
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant1 (SISO)_NTNV



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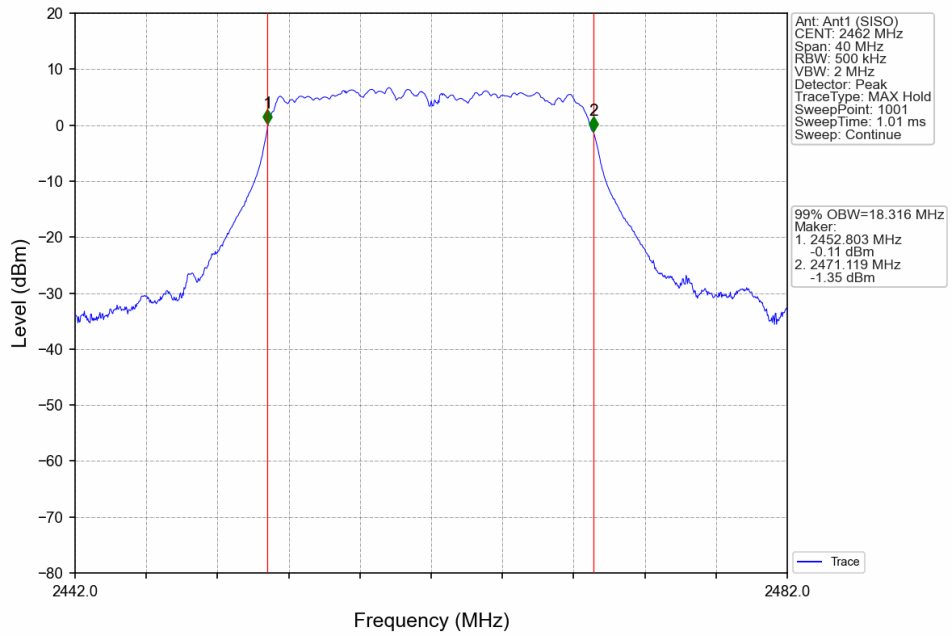
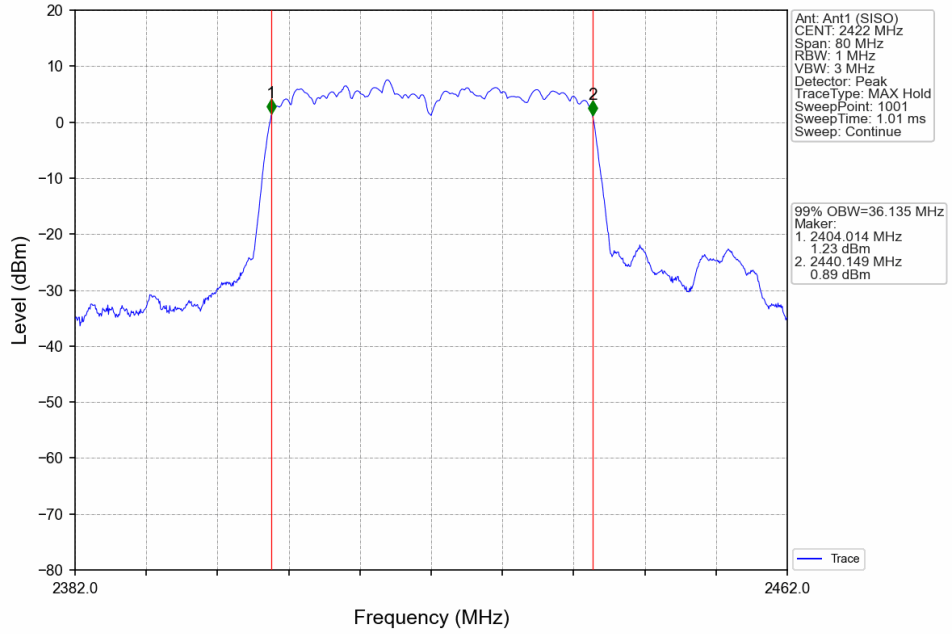
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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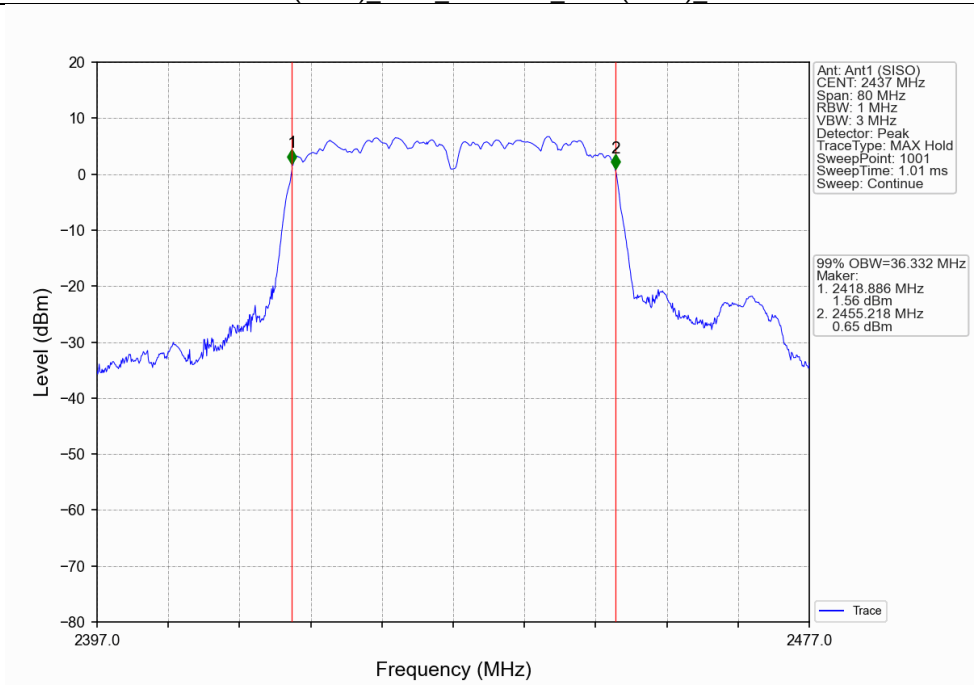
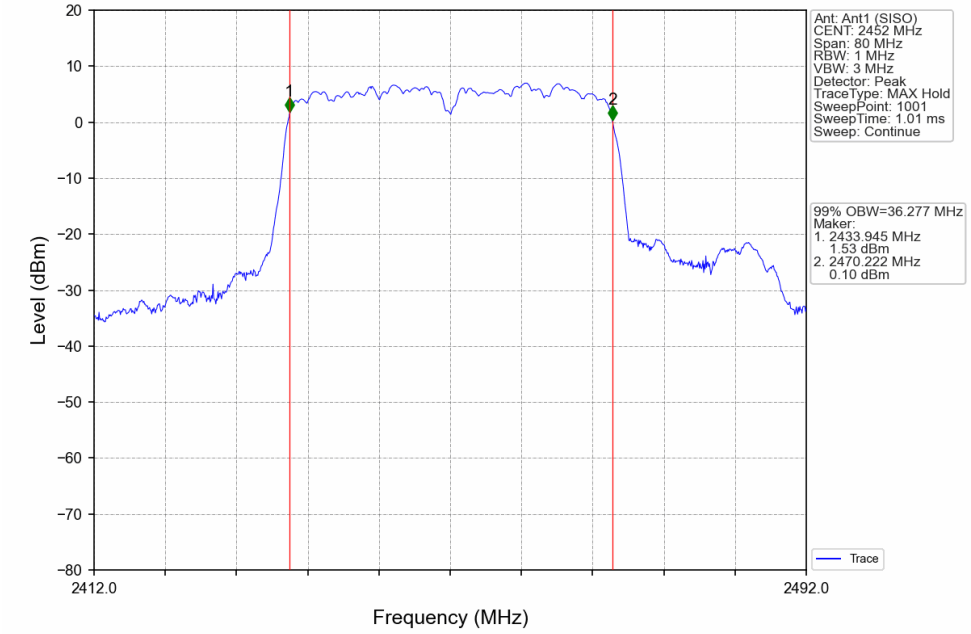
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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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

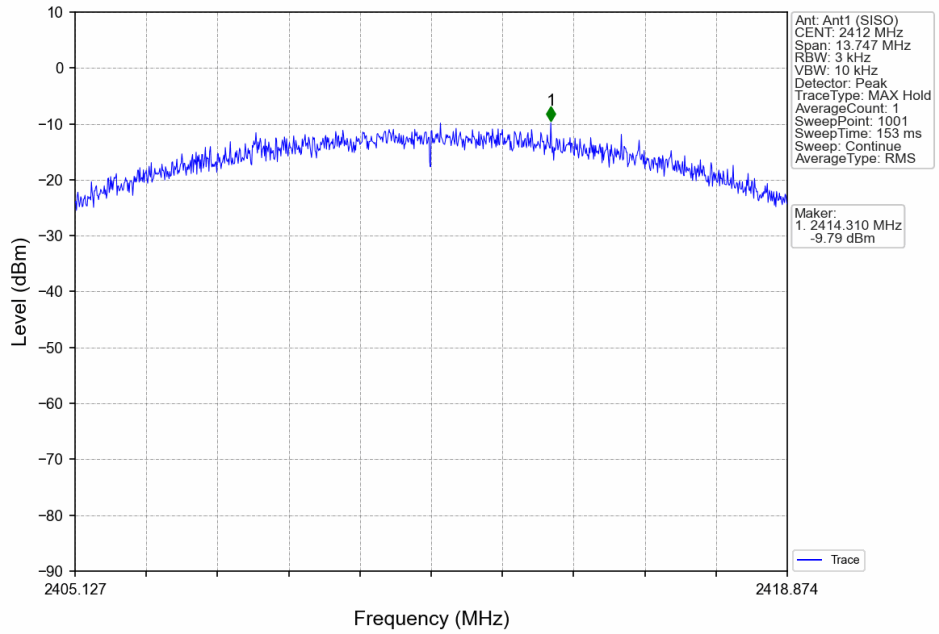
Limit [dBm/3kHz]
≤ 8

Test Results

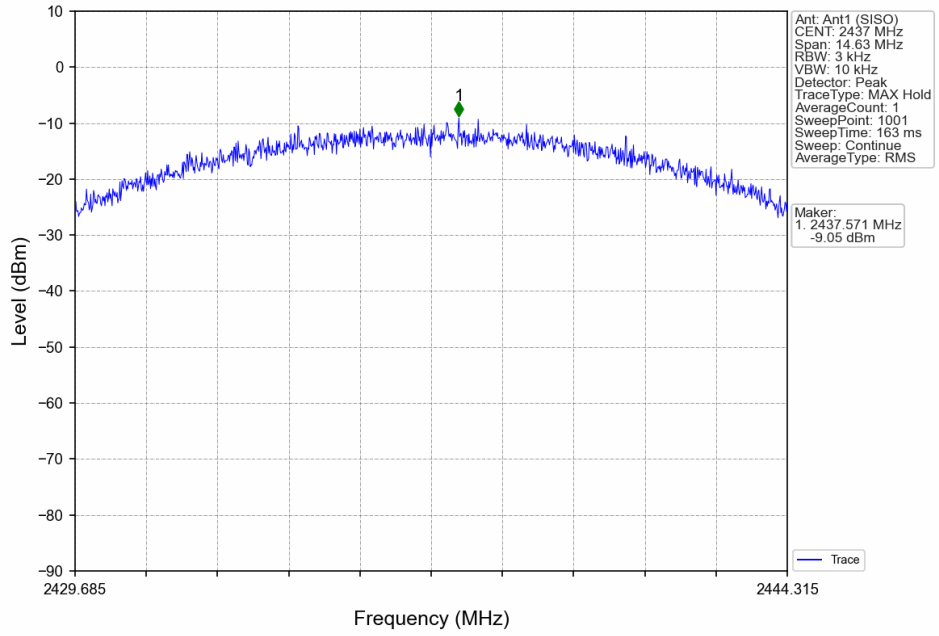
Mode	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
		Result	Limit	
802.11b	2412	-9.79	<=8	Pass
	2437	-9.05	<=8	Pass
	2462	-9.35	<=8	Pass
802.11g	2412	-12.38	<=8	Pass
	2437	-11.73	<=8	Pass
	2462	-12.16	<=8	Pass
802.11n (HT20)	2412	-13.47	<=8	Pass
	2437	-13.09	<=8	Pass
	2462	-13.60	<=8	Pass
802.11n (HT20)	2422	-16.67	<=8	Pass
	2437	-14.95	<=8	Pass
	2452	-13.48	<=8	Pass

Test Graphs

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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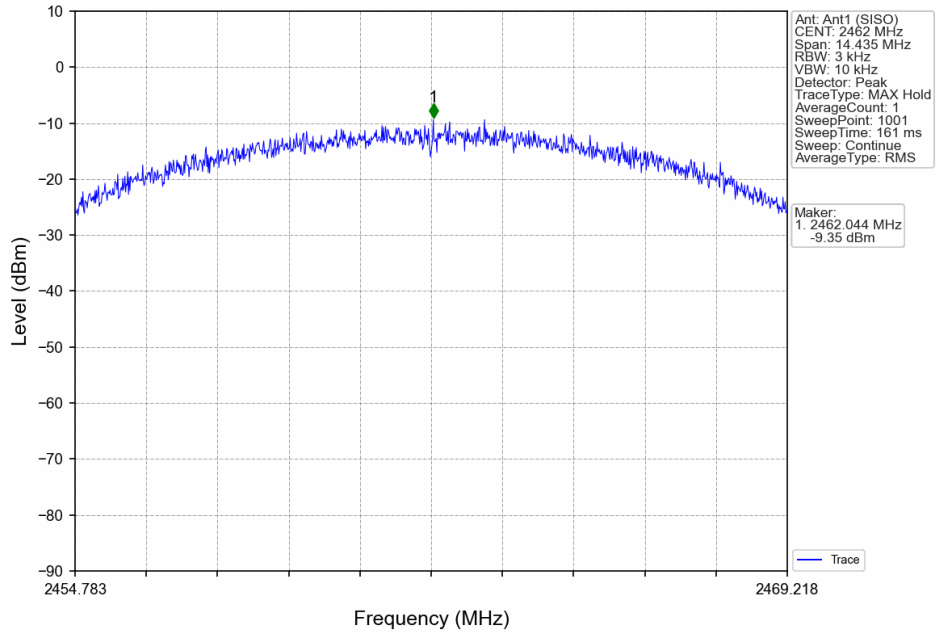
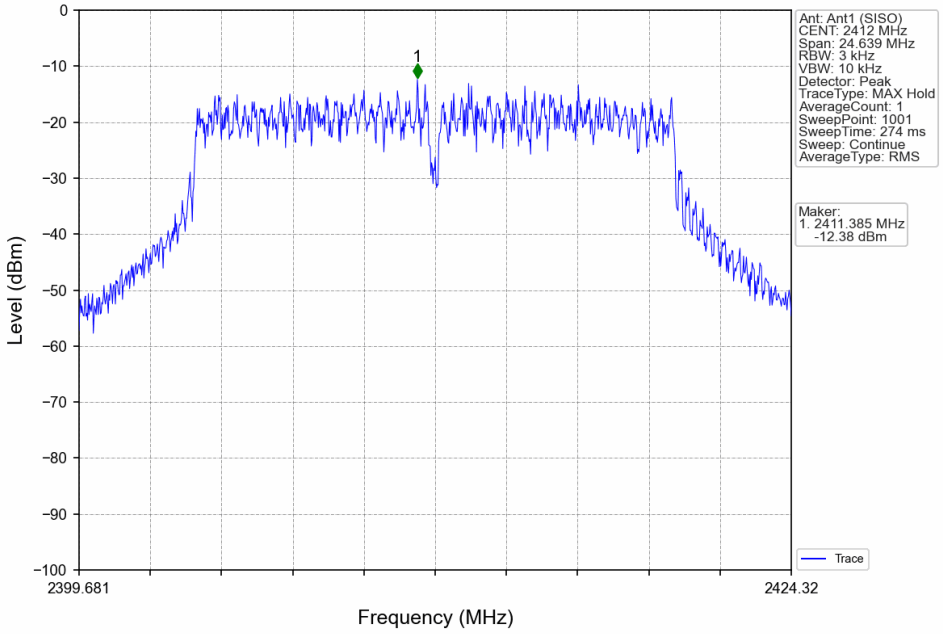
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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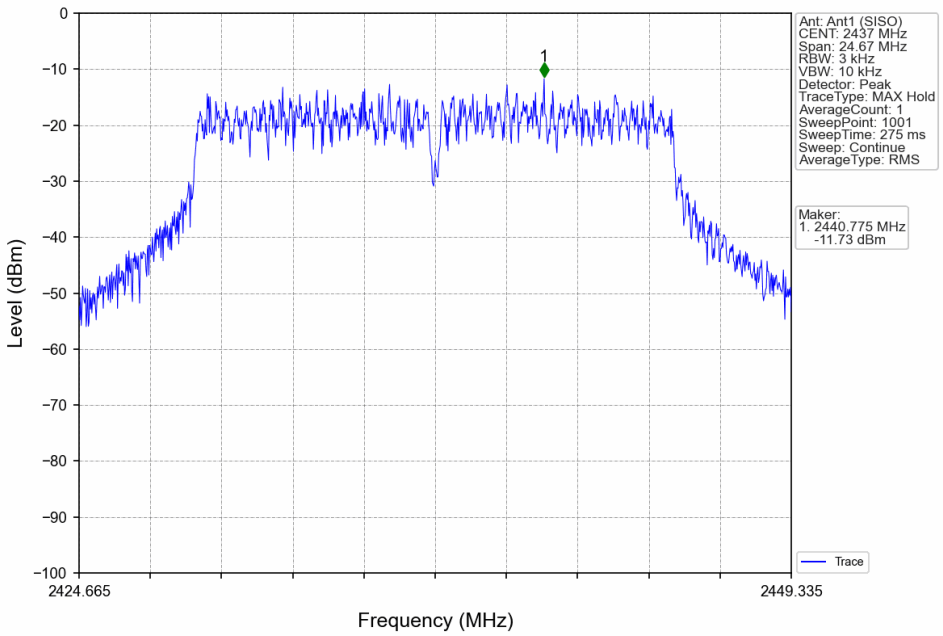
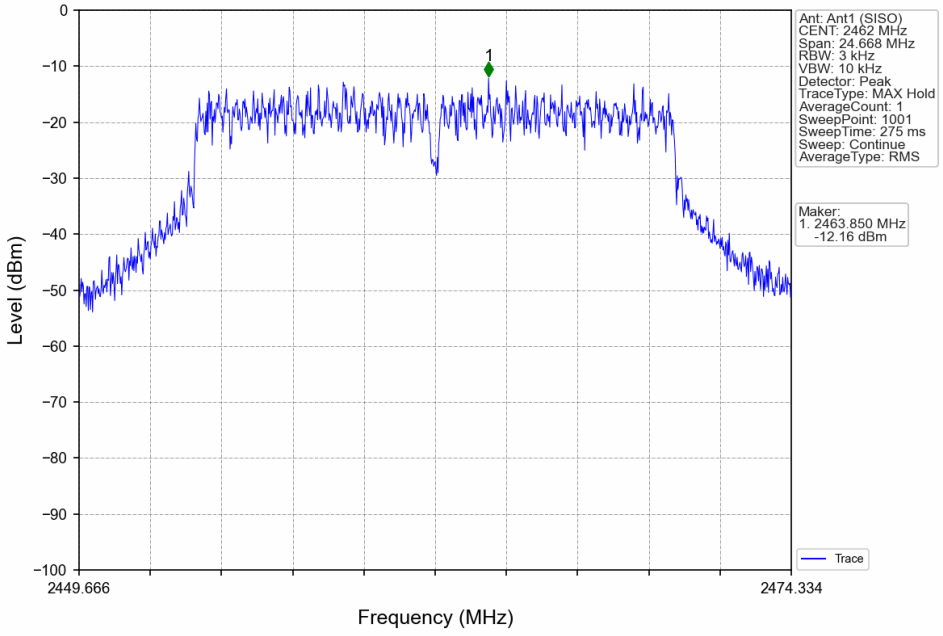
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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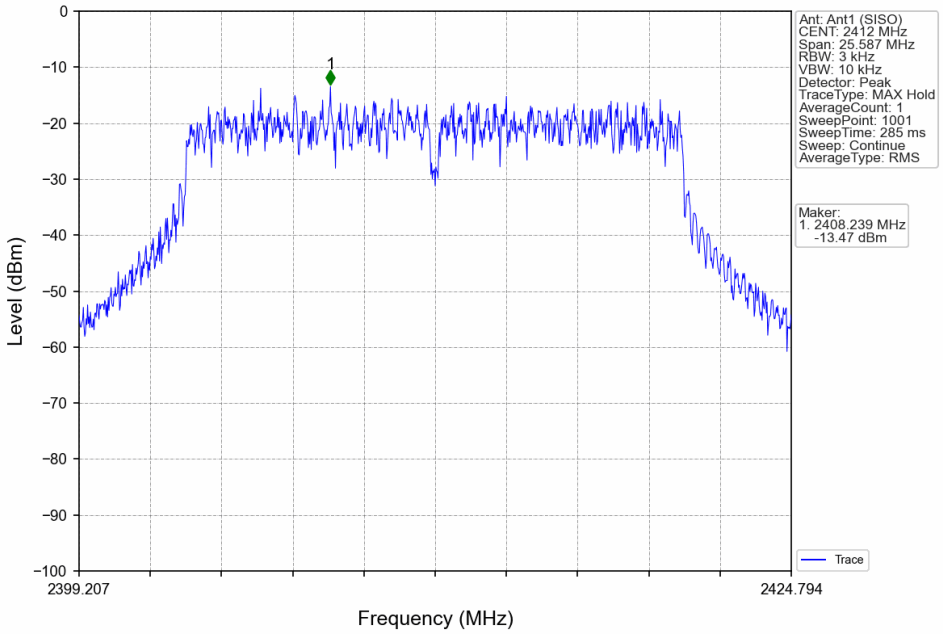
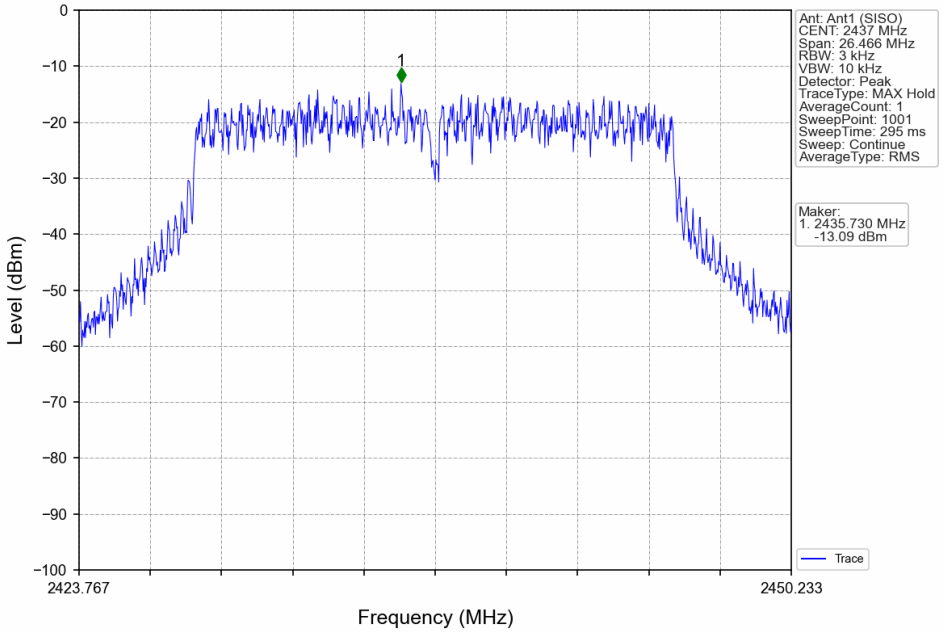
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11n(HT20)_MCH_2437MHz_Ant1 (SISO)_NTNV



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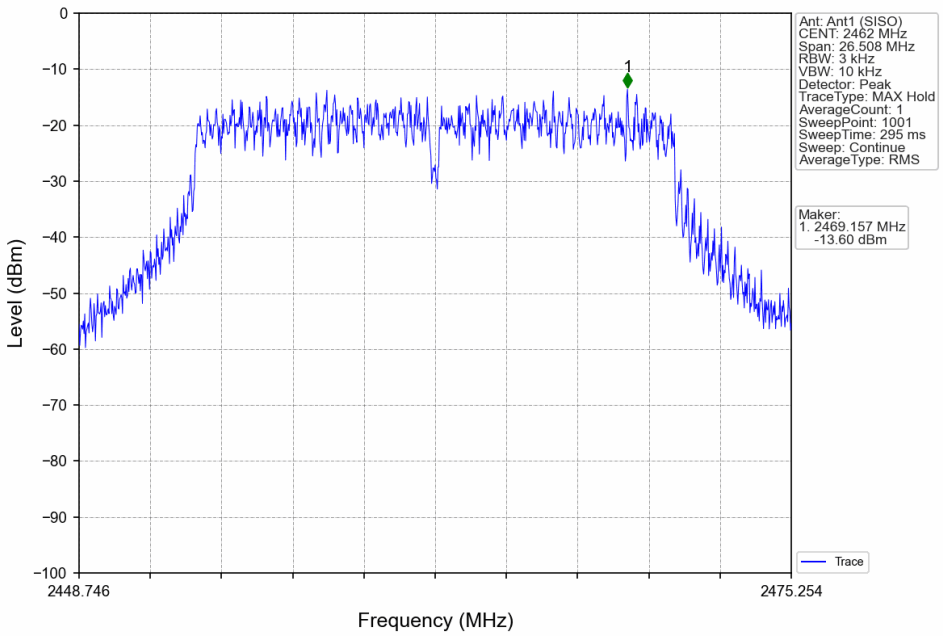
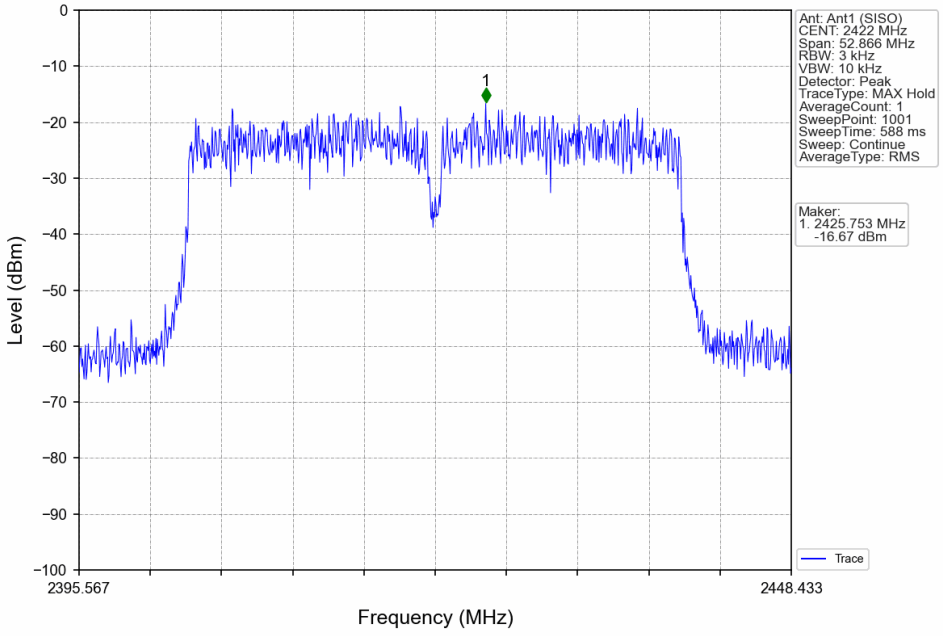
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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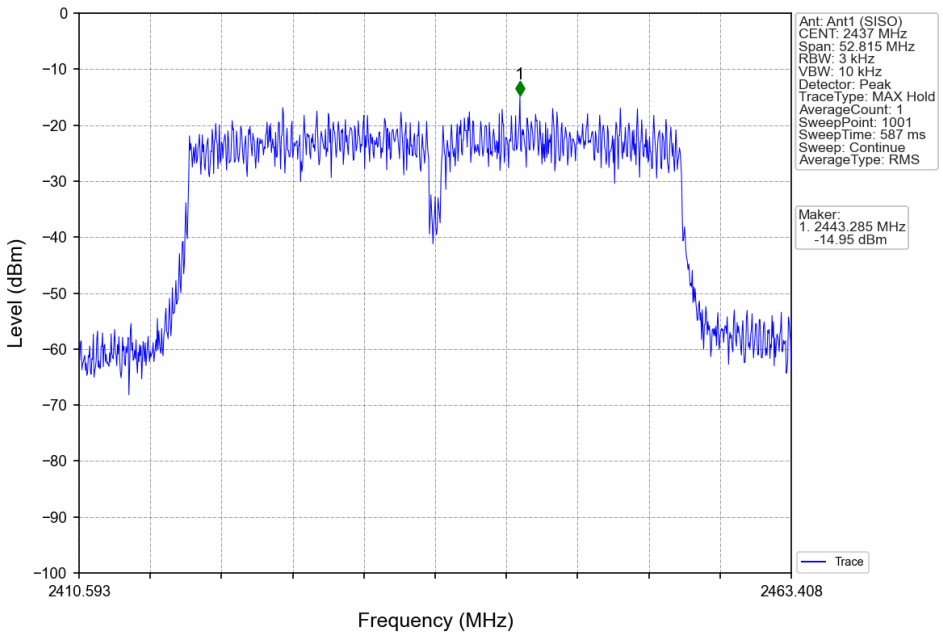
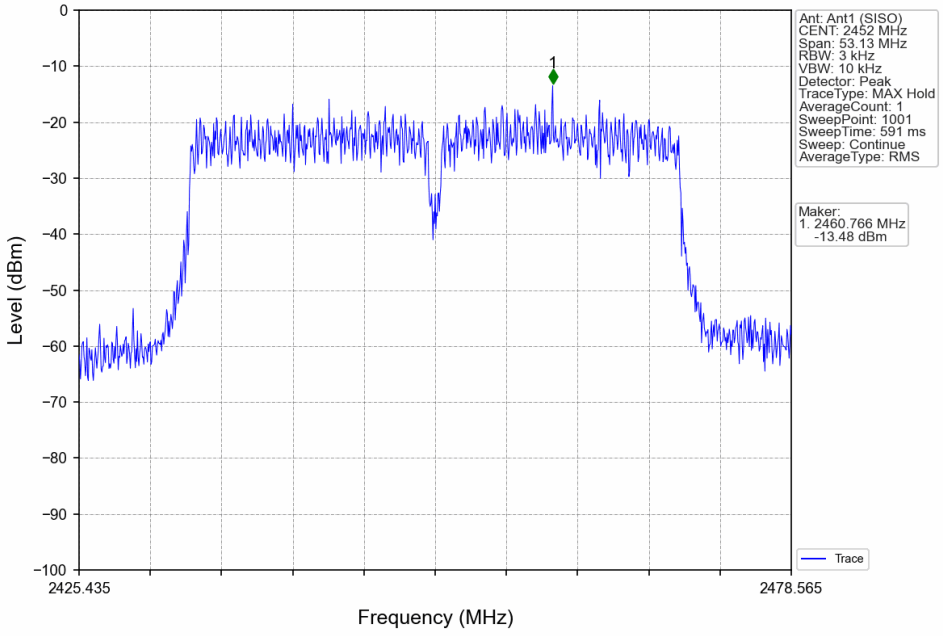
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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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

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

Test Result

Mode	Frequency (MHz)	Level of Reference (dBm)	Limit (dBm)	Verdict
802.11b	2412	5.37	-14.63	Pass
	2437	6.21	-13.79	Pass
	2462	5.18	-14.82	Pass
802.11g	2412	2.04	-17.96	Pass
	2437	2.49	-17.51	Pass
	2462	2.64	-17.36	Pass
802.11n (HT20)	2412	1.20	-18.80	Pass
	2437	1.63	-18.37	Pass
	2462	1.89	-18.11	Pass
802.11n (HT40)	2422	-1.53	-21.53	Pass
	2437	-1.21	-21.21	Pass
	2452	-0.96	-20.96	Pass
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.				

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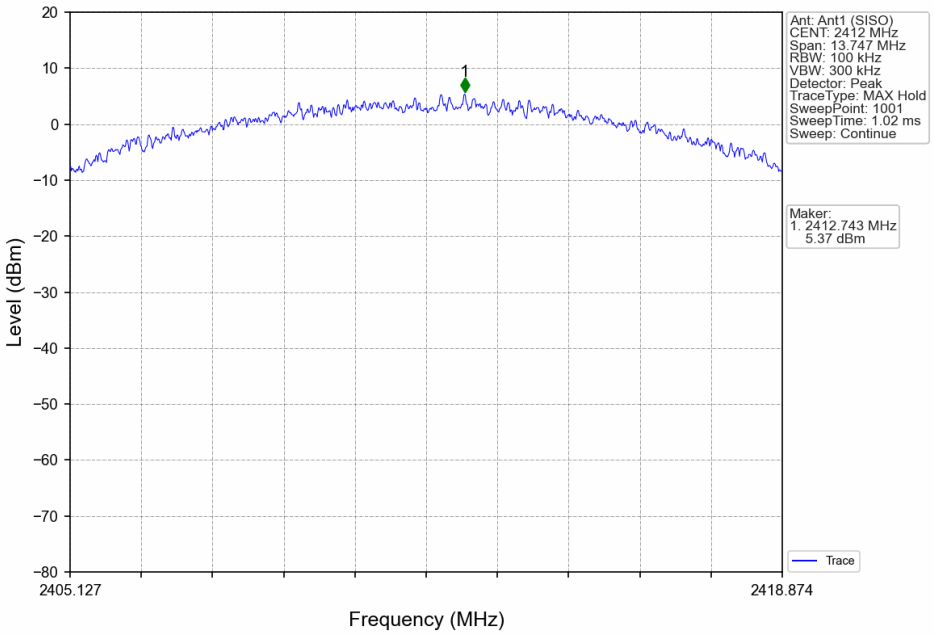
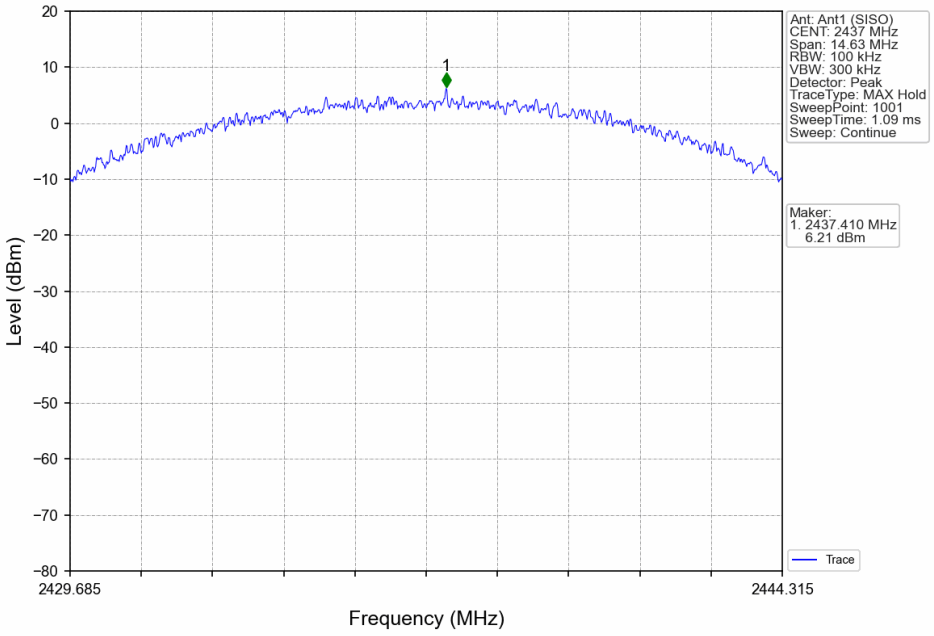
Test Graphs Reference Level

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_MCH_2437MHz_Ant1 (SISO)_NTNV



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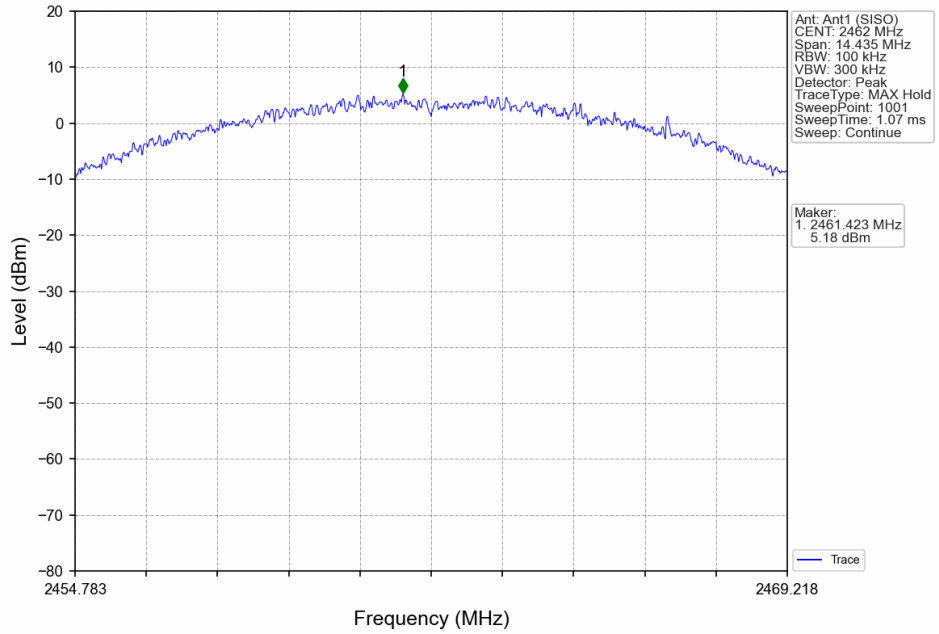
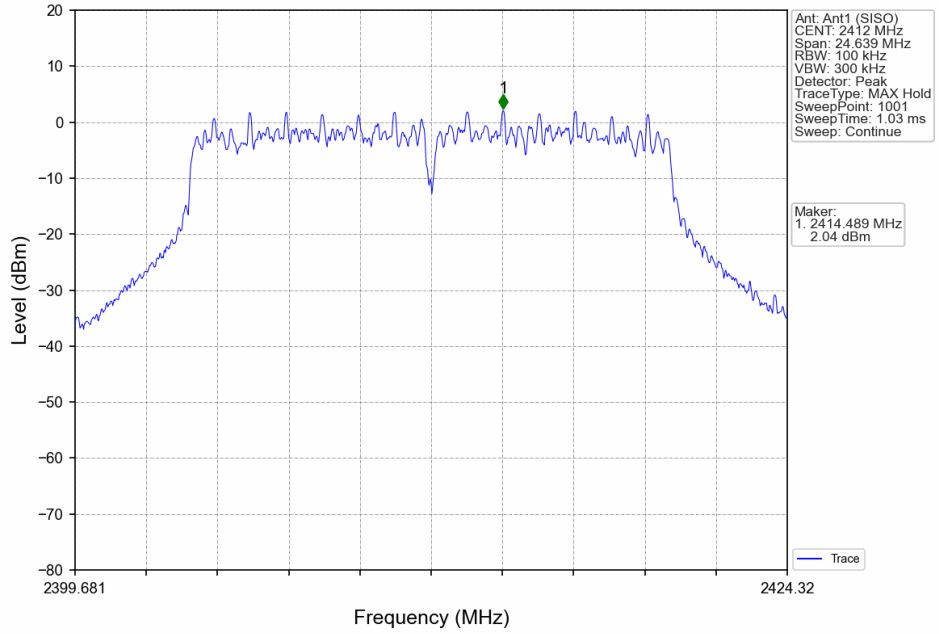
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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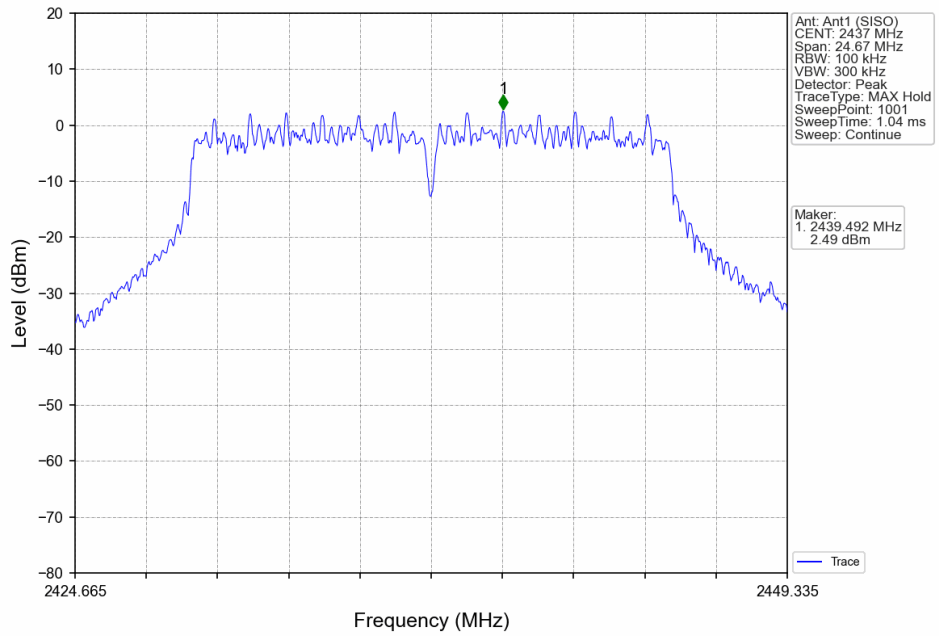
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



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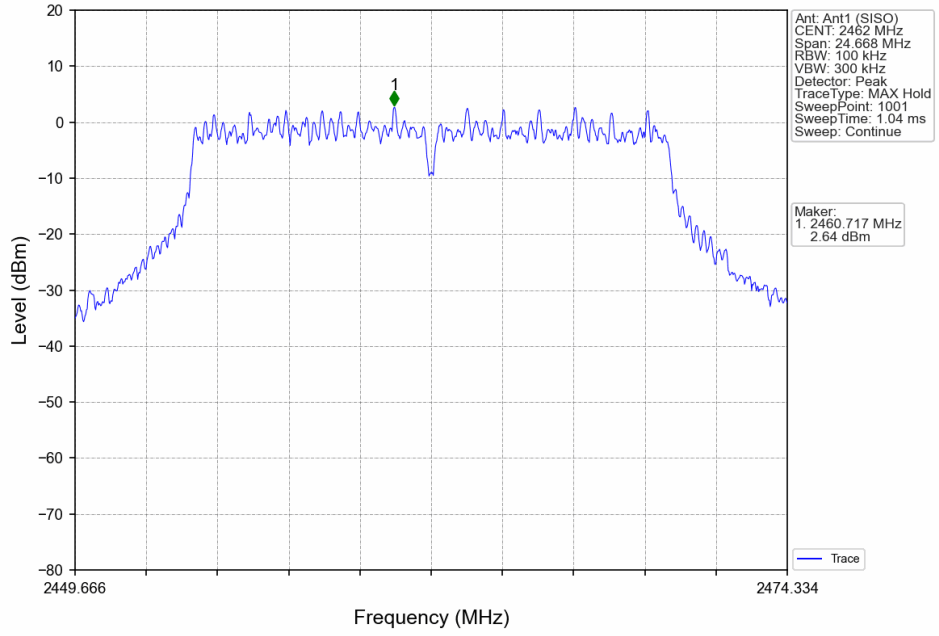

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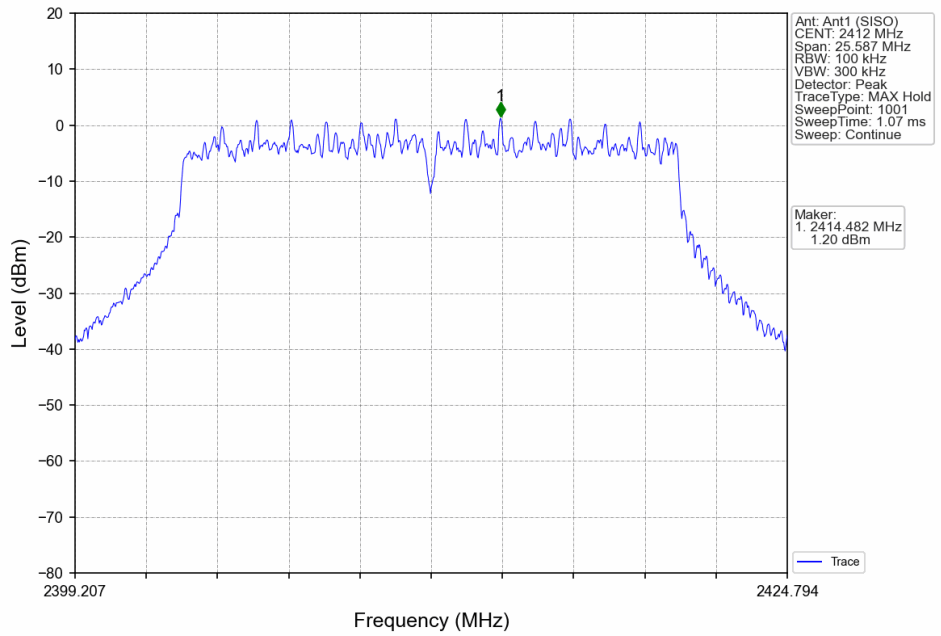
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



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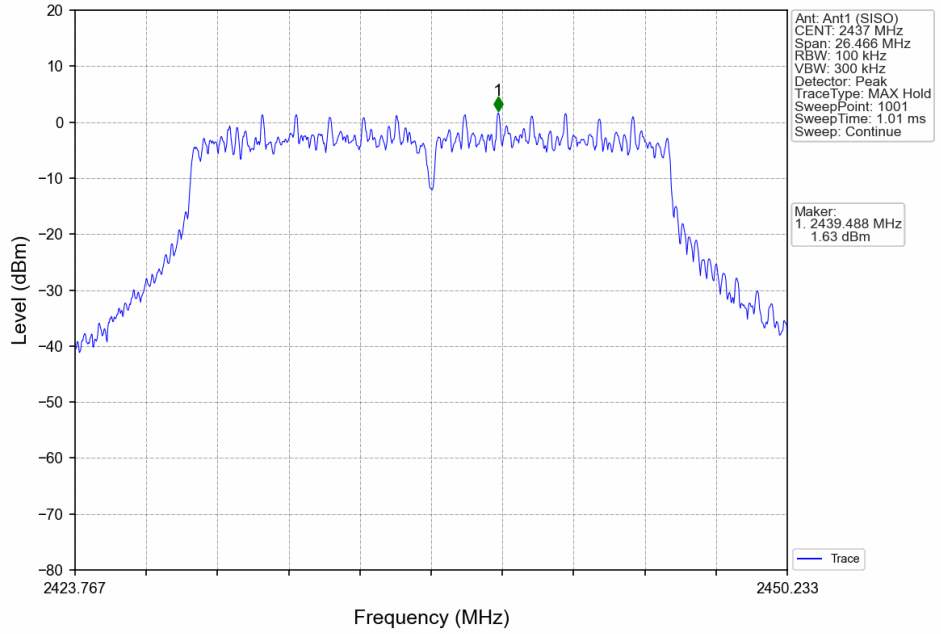

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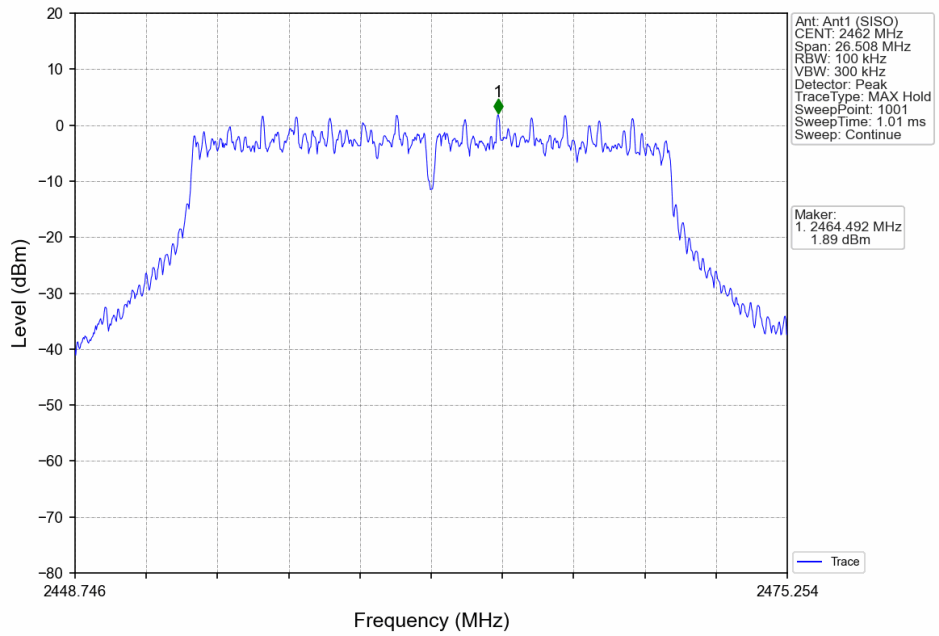
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



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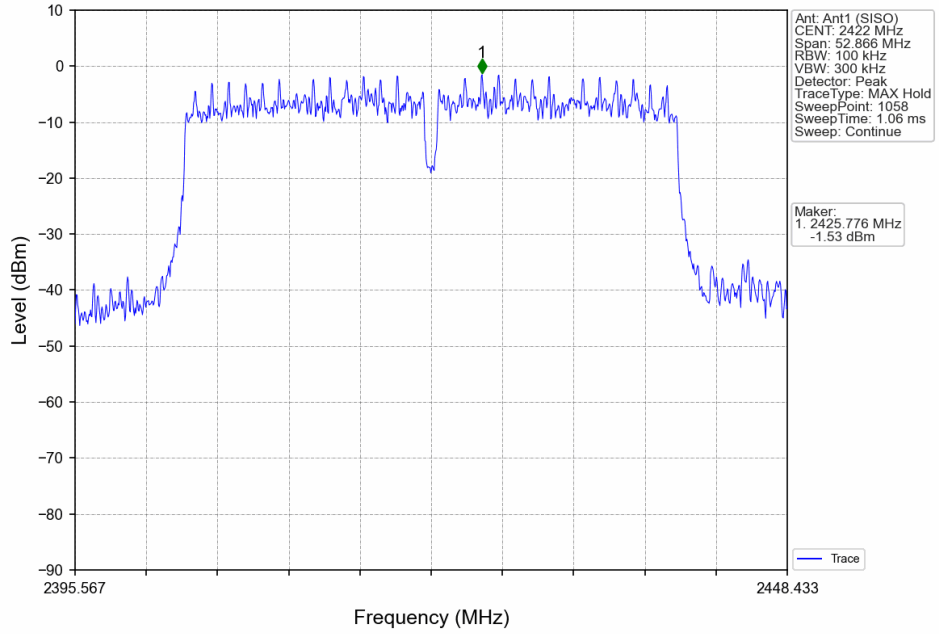

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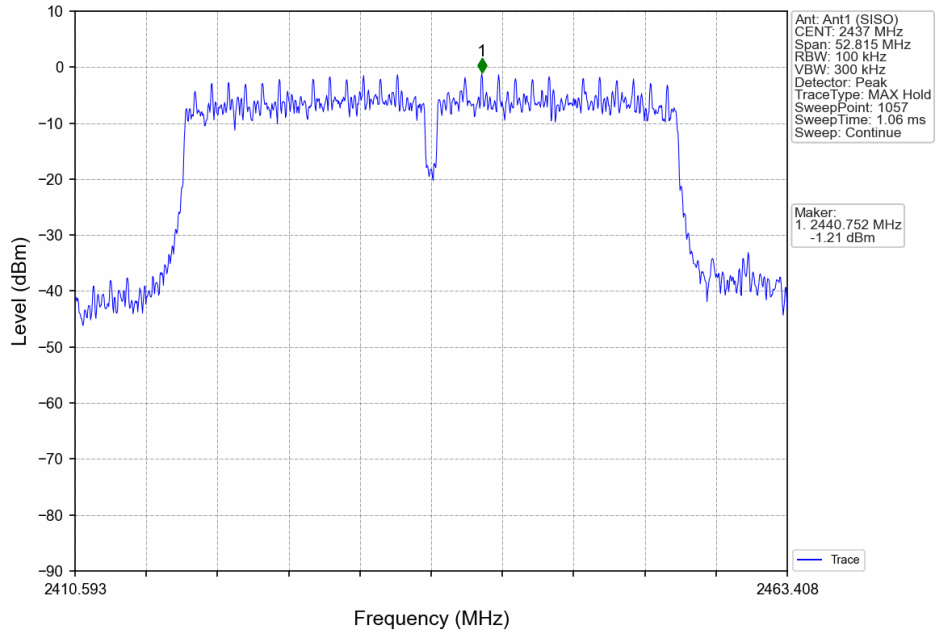
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



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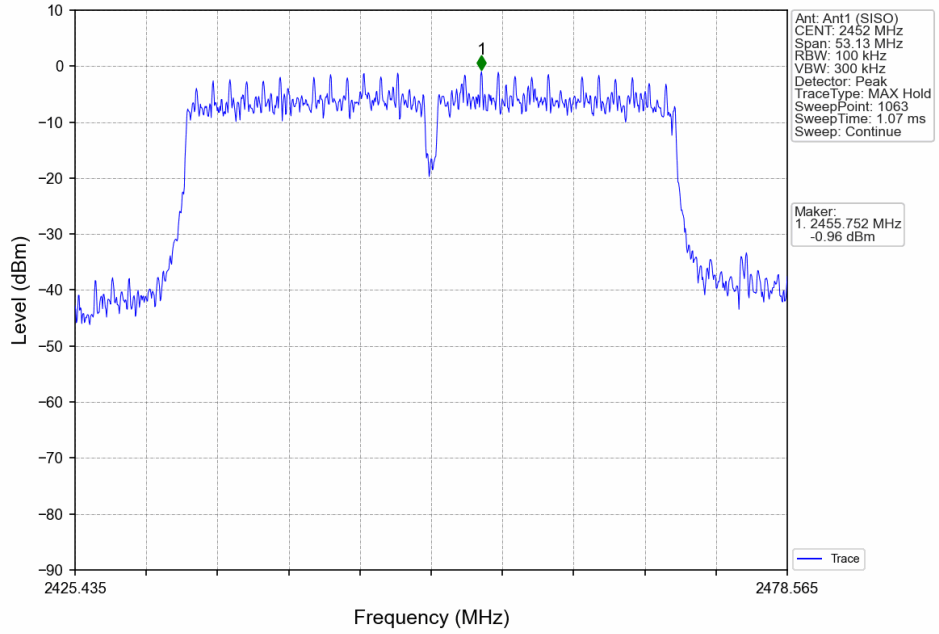

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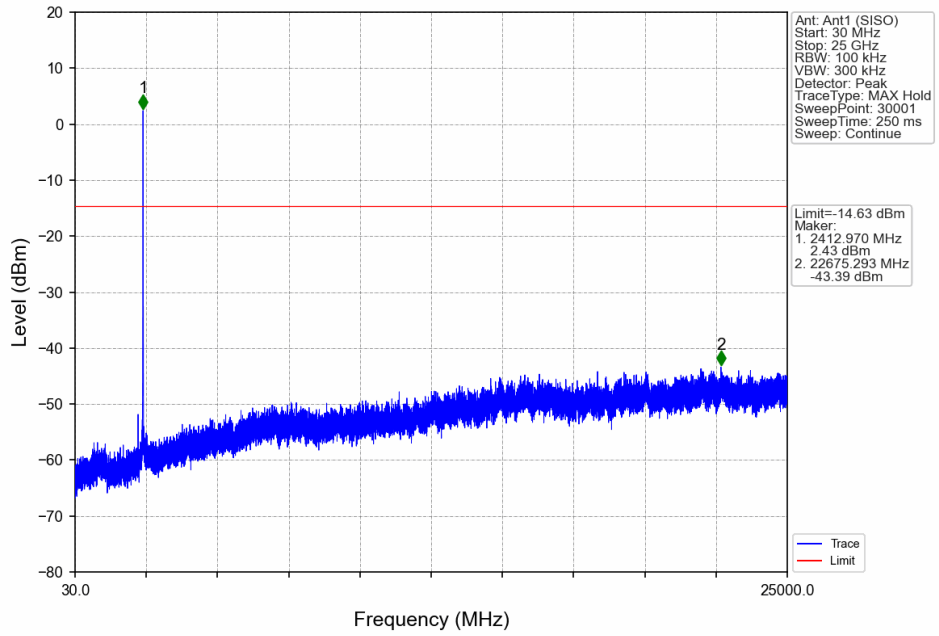
Test Graphs Conducted Spurious Emissions

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



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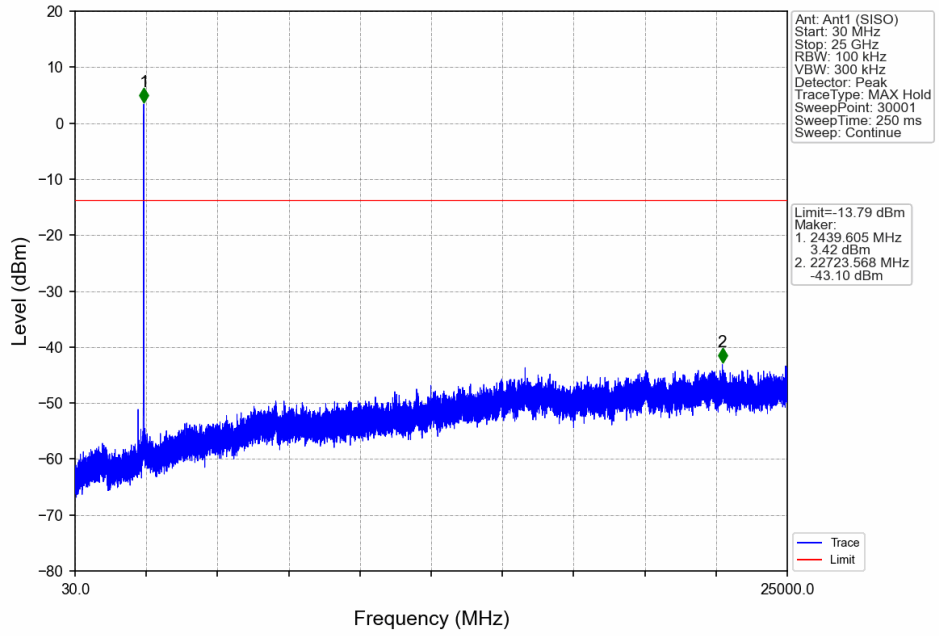

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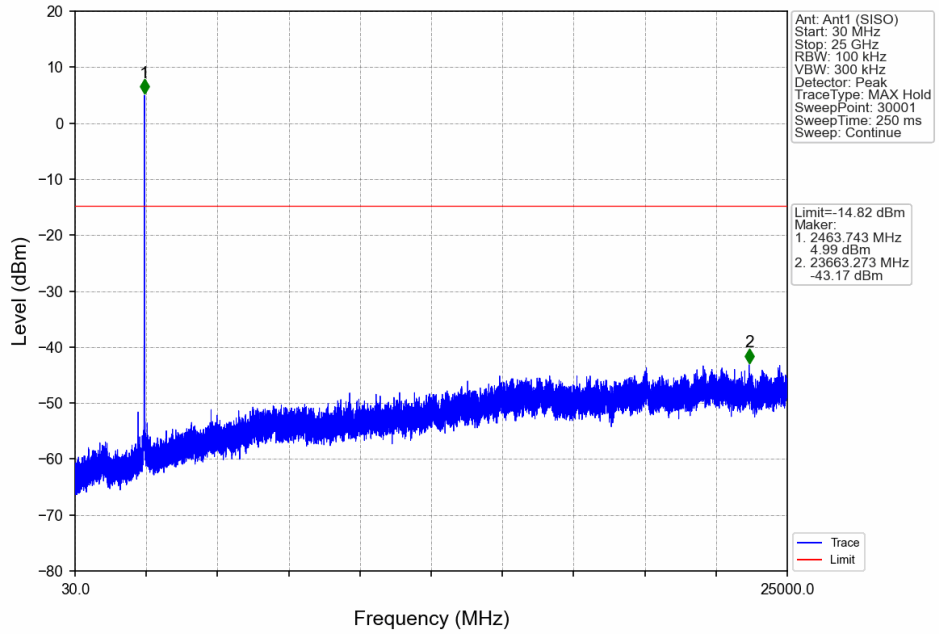
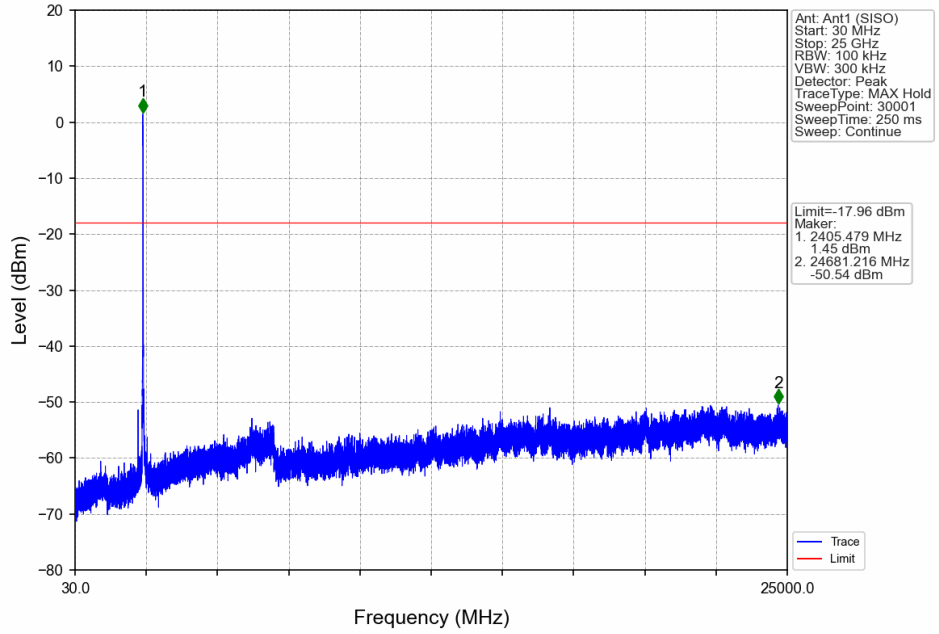
802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



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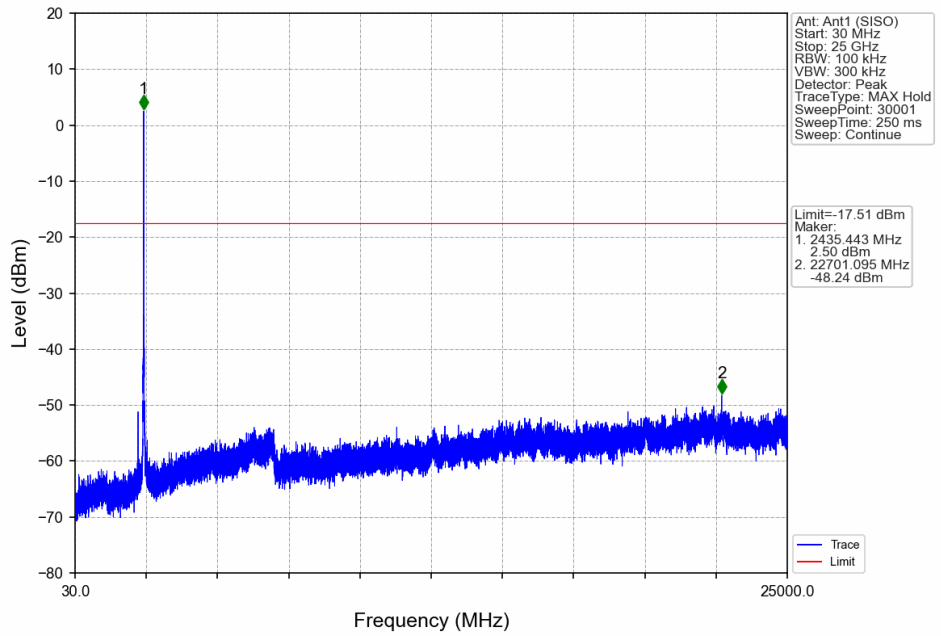
802.11g_MCH_2437MHz_Ant1 (SISO)_NTNV



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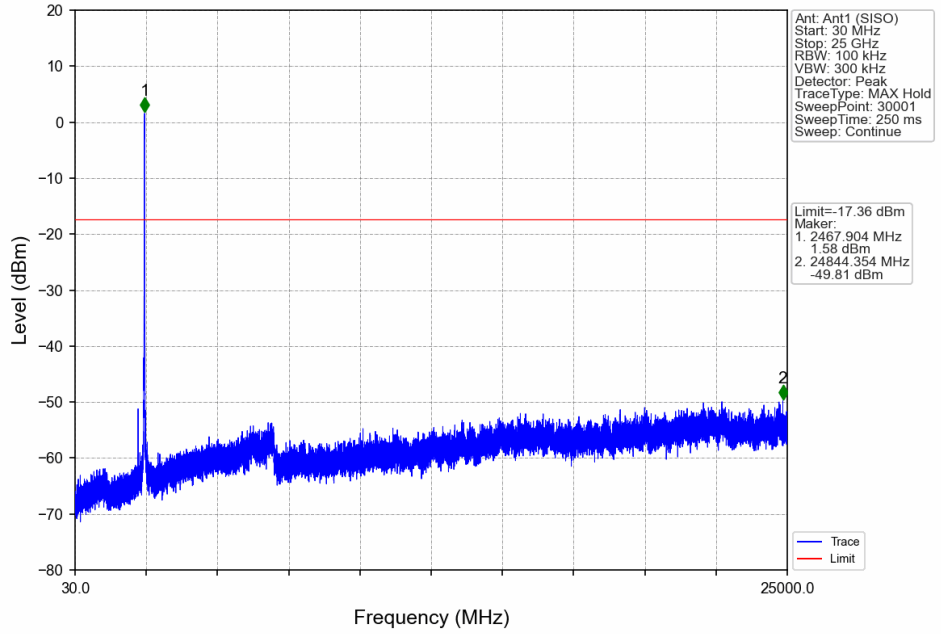

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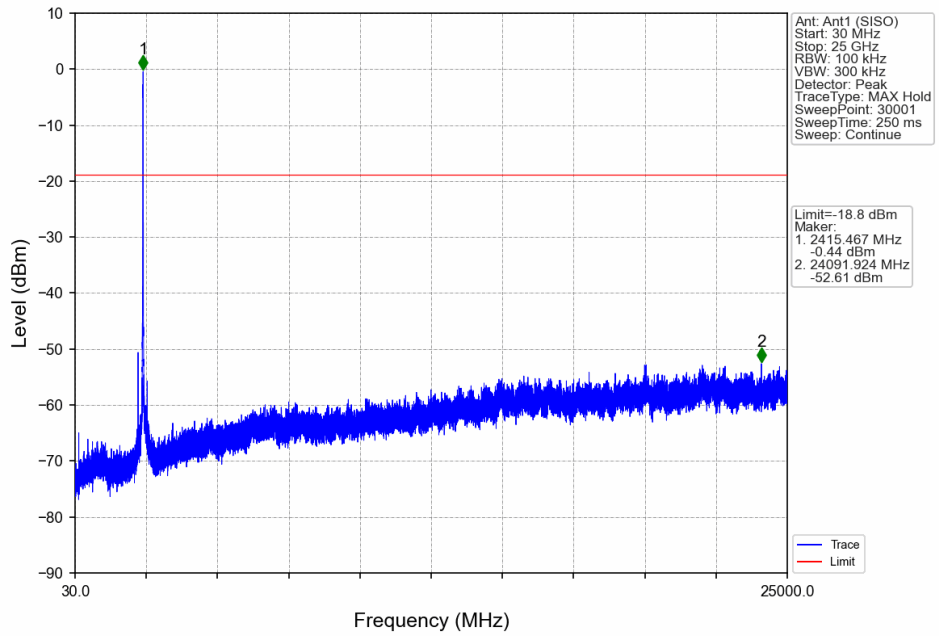
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



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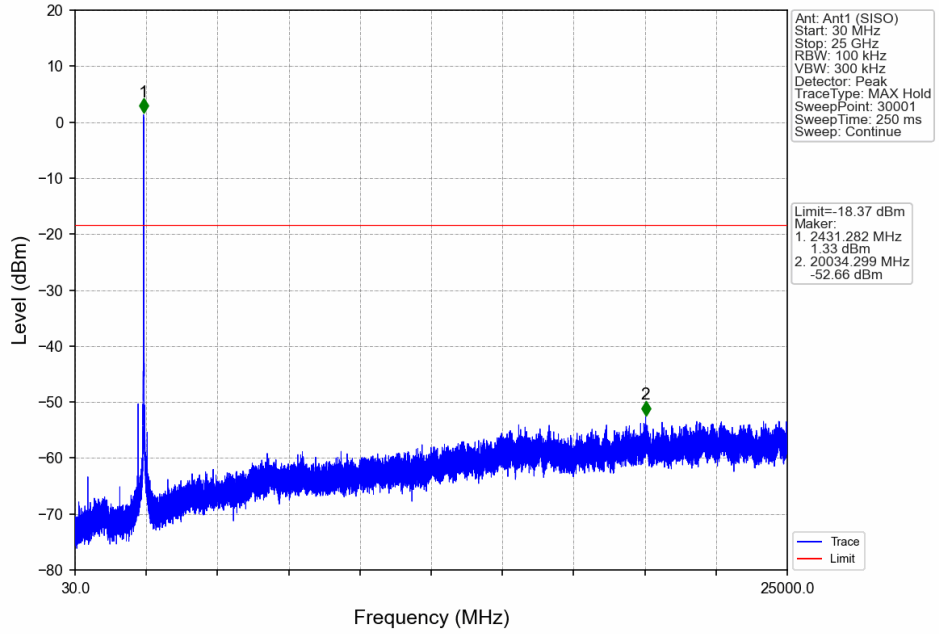

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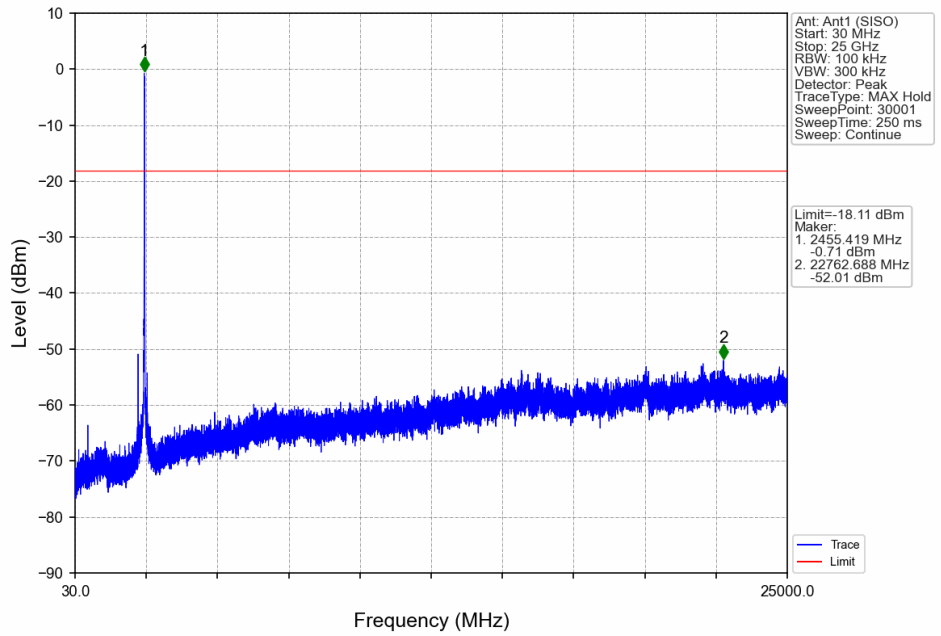
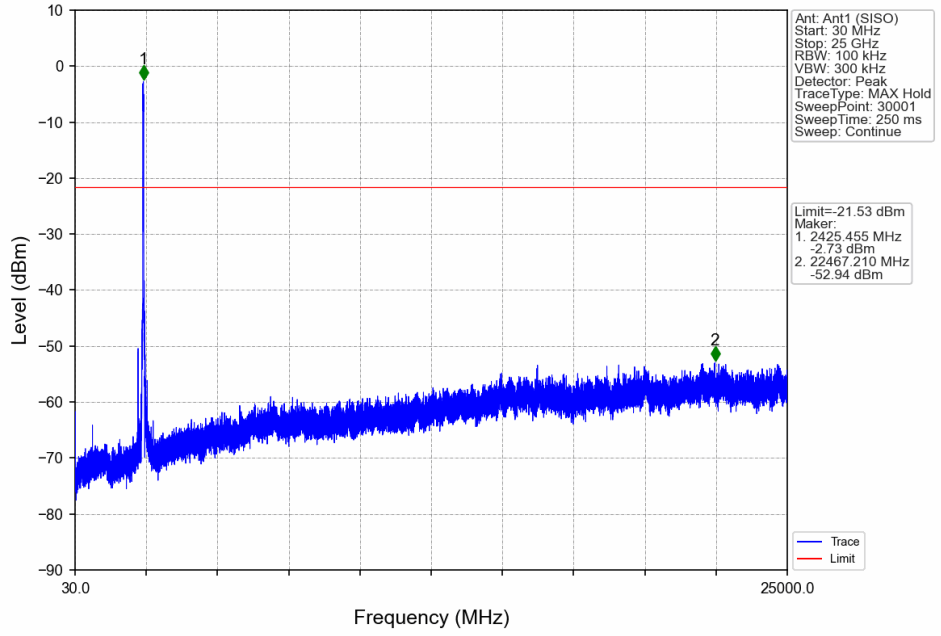
802.11n(HT20)_HCH_2462MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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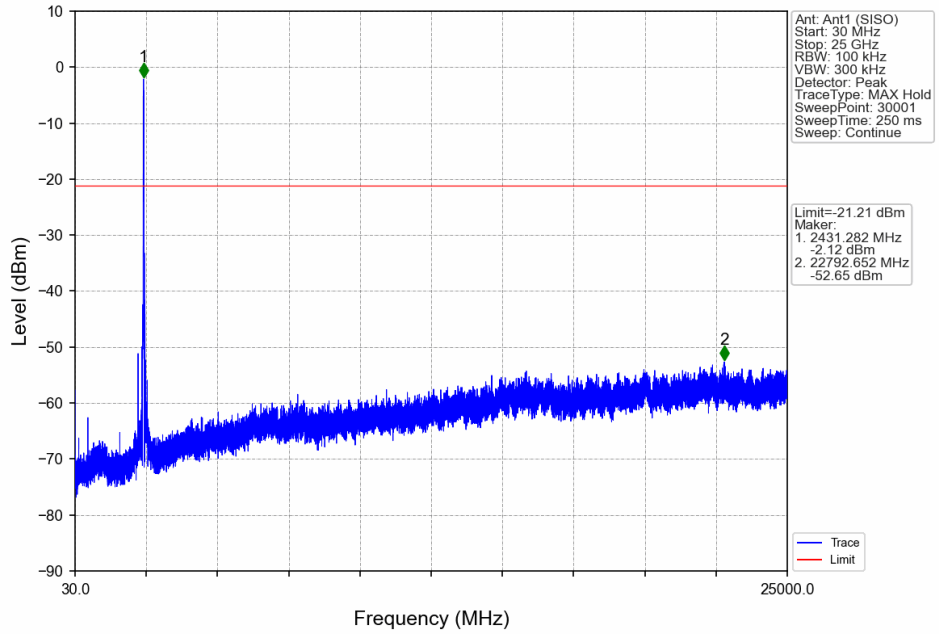
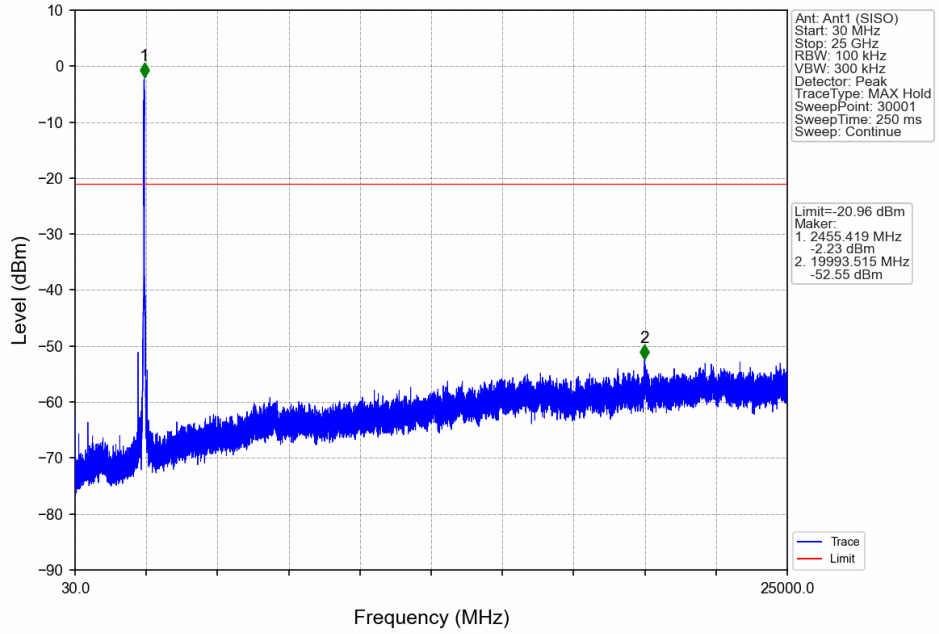
802.11n(HT40)_MCH_2437MHz_Ant1 (SISO)_NTNV



802.11n(HT40)_HCH_2452MHz_Ant1 (SISO)_NTNV



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9.6 Band edge testing

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
   RBW = 100 kHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that 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 § 15.247(b)(3) and RSS-247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB.

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

Test result

Mode	Frequency (MHz)	Level of Reference (dBm)	Limit (dBm)	Verdict
802.11b	2412	5.37	-14.63	Pass
	2462	5.18	-14.82	Pass
802.11g	2412	2.04	-17.96	Pass
	2462	2.64	-17.36	Pass
802.11n (HT20)	2412	1.20	-18.80	Pass
	2462	1.89	-18.11	Pass
802.11n (HT40)	2422	-1.53	-21.53	Pass
	2452	-0.96	-20.96	Pass

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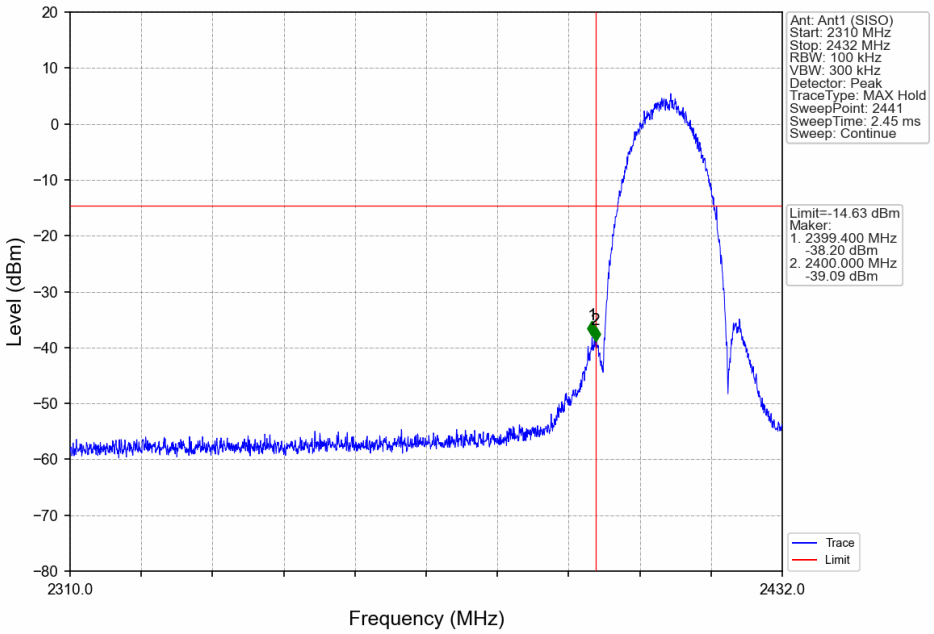
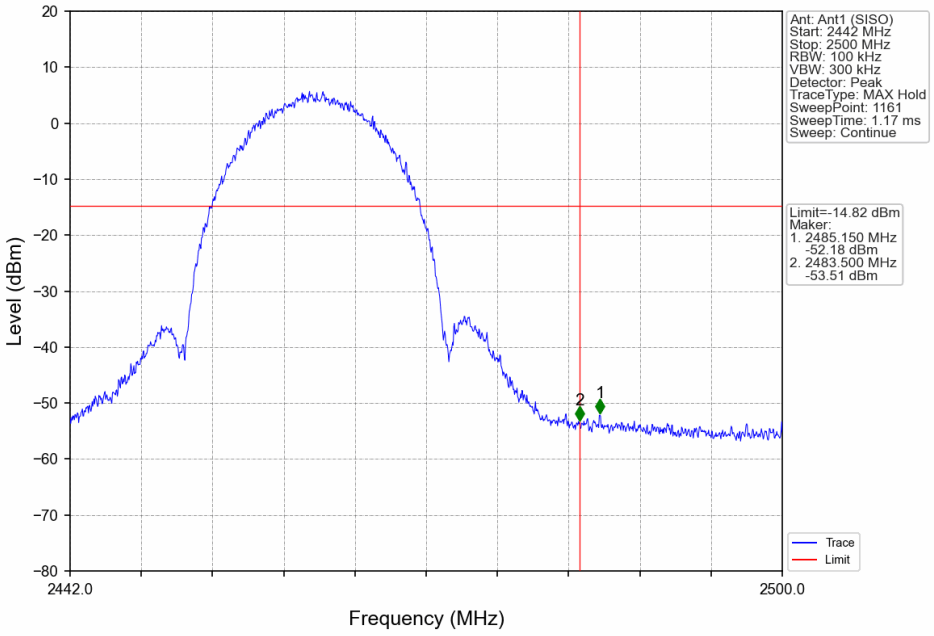
Test Graphs

802.11b_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11b_HCH_2462MHz_Ant1 (SISO)_NTNV



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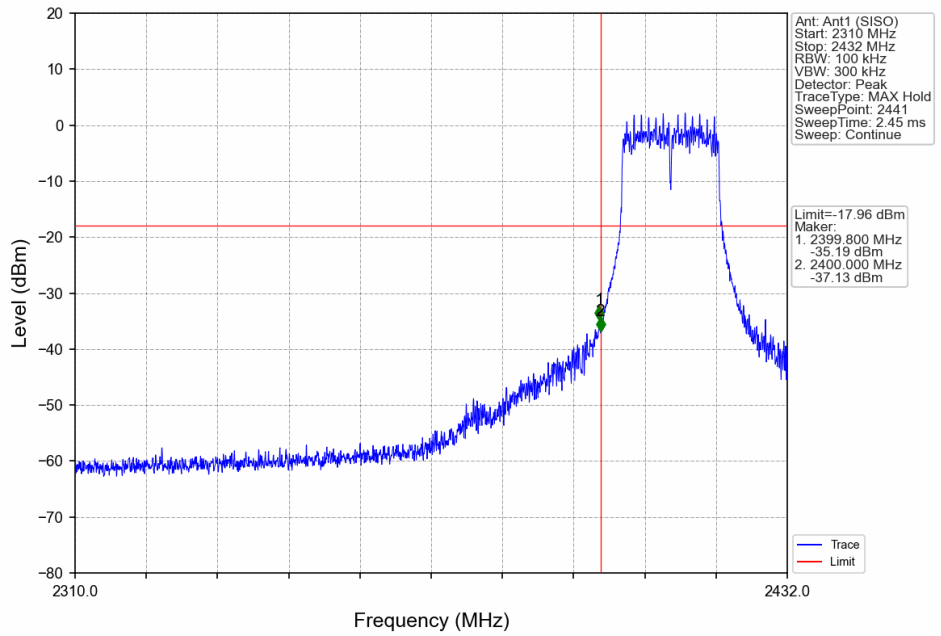
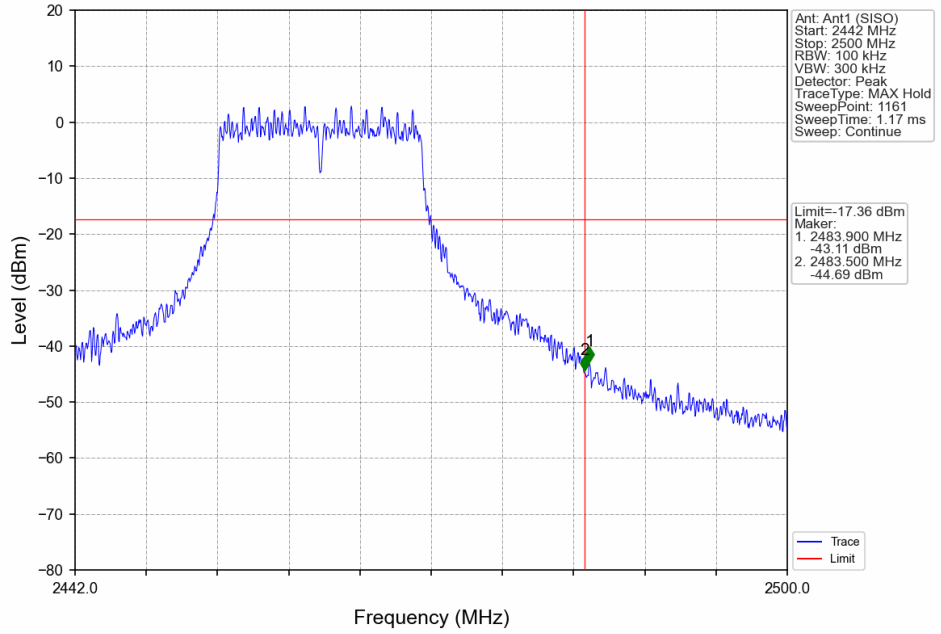
802.11g_LCH_2412MHz_Ant1 (SISO)_NTNV



802.11g_HCH_2462MHz_Ant1 (SISO)_NTNV



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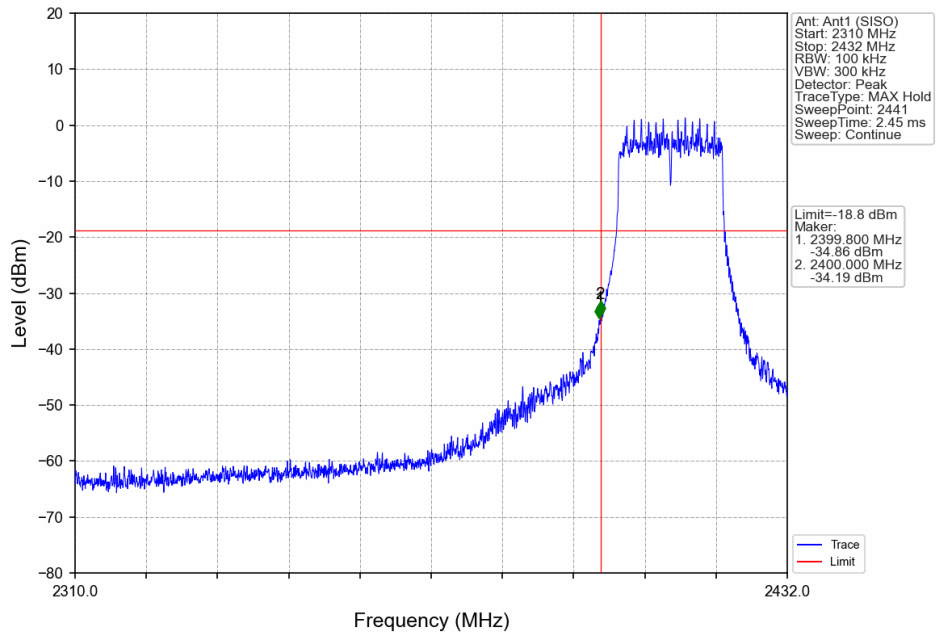
802.11n(HT20)_LCH_2412MHz_Ant1 (SISO)_NTNV



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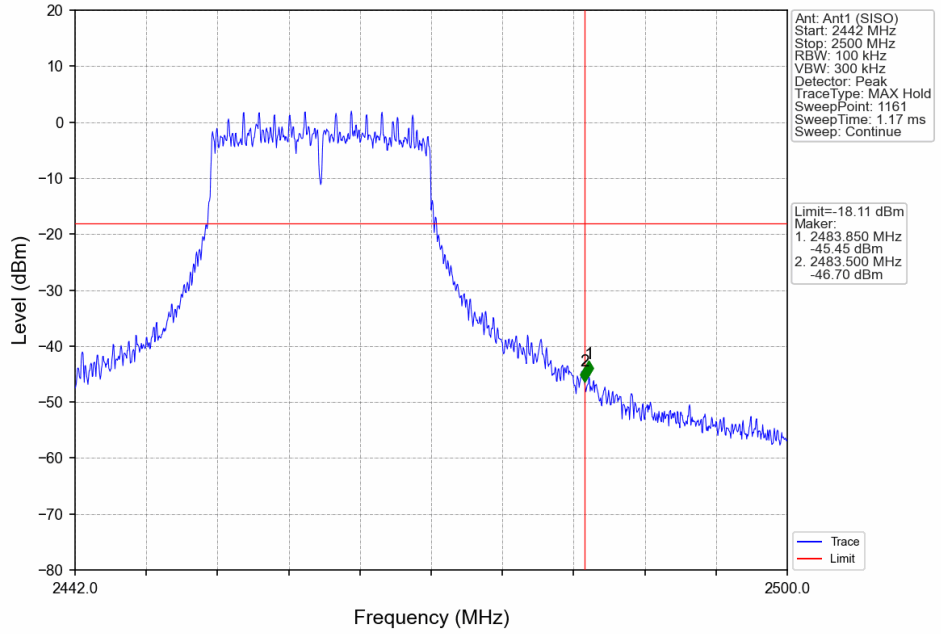

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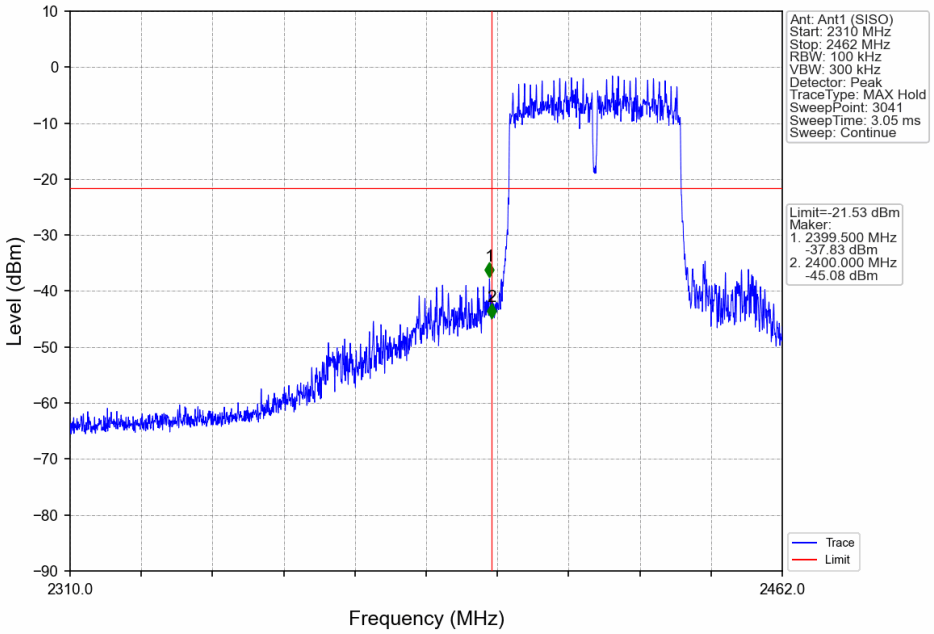
802.11n(HT40)_LCH_2422MHz_Ant1 (SISO)_NTNV



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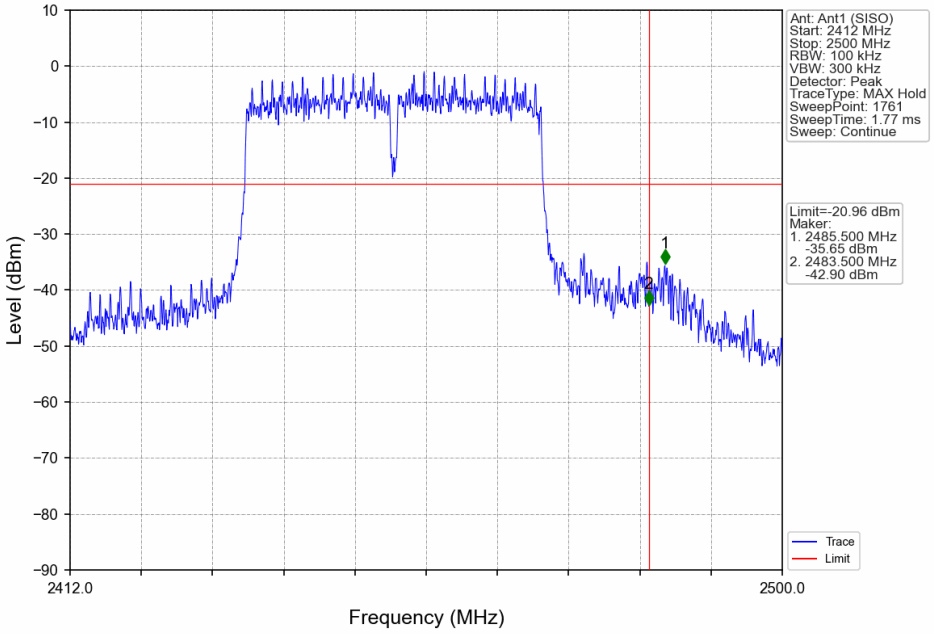

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9.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10:

1) Procedure for Unwanted Emissions Measurements Below 1000 MHz
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz to 120KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

2) For Peak unwanted emissions Above 1GHz:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

3) Procedures for average unwanted emissions measurements above 1000 MHz
a) RBW = 1MHz.
b) VBW \ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

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2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission(AV) at frequency above 1GHz.

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that 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 § 15.247(b)(3) and RSS 247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in § 15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in§ 15.205(a) and RSS-Gen scetion8.9, must also comply with the radiated emission limits specified in § 15.209(a) and RSS-Gen section 8.10.

Frequency MHz	Field Strength μV/m	Field Strength dBμV/m	Detector	Measurement distance meters
0.009-0.490	2400/F(kHz)	48.5-13.8	AV	300
0.490-1.705	24000/F(kHz)	33.8-23.0	QP	30
1.705-30	30	29.5	QP	30
30-88	100	40	QP	3
88-216	150	43.5	QP	3
216-960	200	46	QP	3
960-1000	500	54	QP	3
Above 1000	500	54	AV	3
Above 1000	5000	74	PK	3

Note 1: Limit 3m(dBμV/m)=Limit 300m(dBμV/m)+40Log(300m/3m) (Below 30MHz)
Note 2: Limit 3m(dBμV/m)=Limit 30m(dBμV/m)+40Log(30m/3m) (Below 30MHz)

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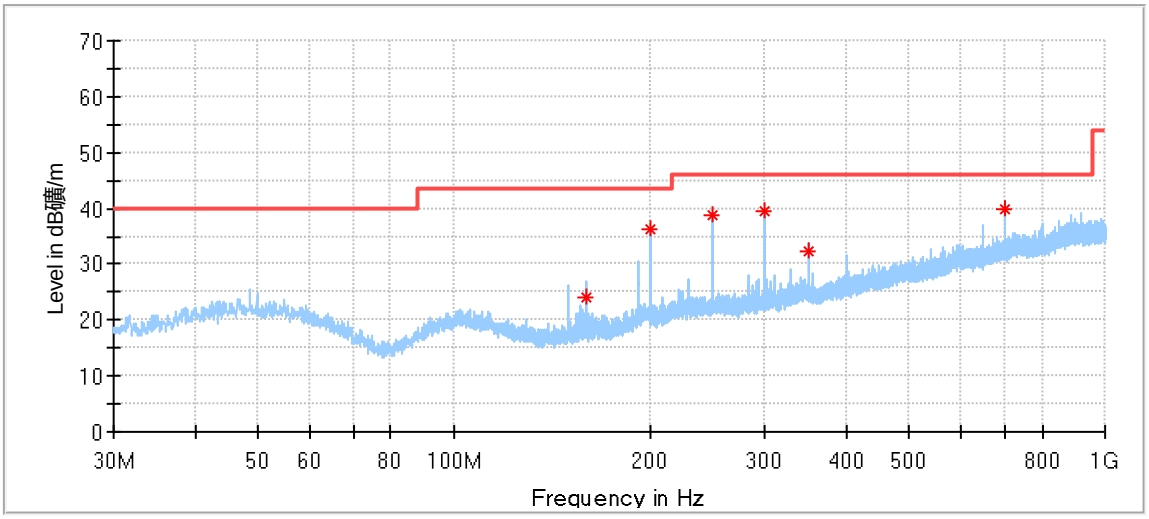
Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Only the worst case (802.11-HT40) test result is listed in the report.

Transmitting spurious emission test result as below:

Emission below 1GHz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
159.656667	23.92	43.50	19.58	100.0	H	225.0	13.12
199.965556	36.41	43.50	7.09	100.0	H	264.0	15.78
250.028333*	38.81	46.00	7.19	100.0	H	152.0	17.79
299.983333	39.39	46.00	6.61	100.0	H	89.0	18.48
350.046111	32.35	46.00	13.65	100.0	H	348.0	20.13
700.000556	39.95	46.00	6.05	100.0	H	89.0	26.31

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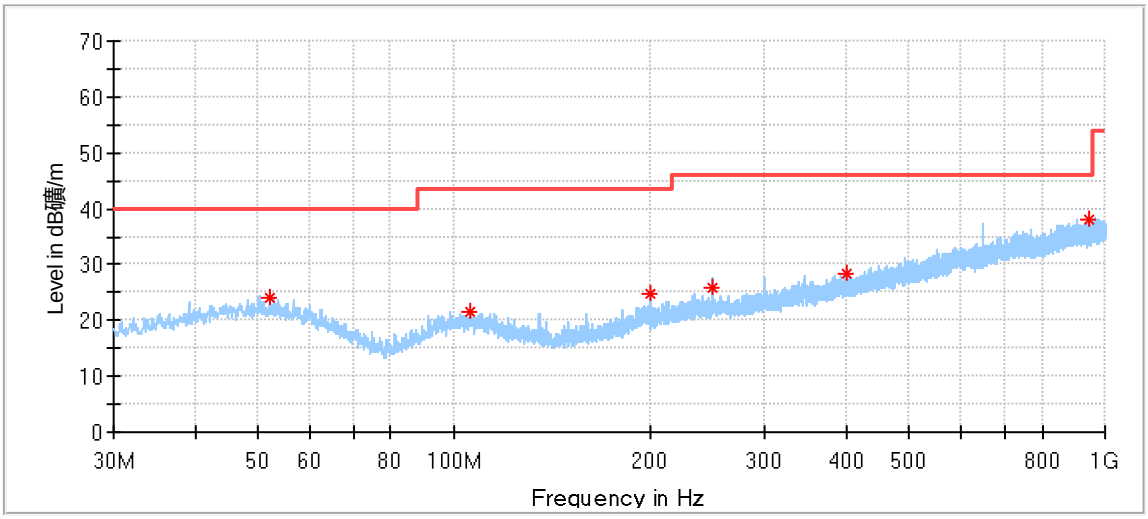

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
52.256111	24.19	40.00	15.81	100.0	V	204.0	18.20
106.198889	21.60	43.50	21.90	100.0	V	318.0	15.97
200.019444	24.59	43.50	18.91	100.0	V	286.0	15.78
249.920556*	25.72	46.00	20.28	100.0	V	64.0	17.78
399.947222*	28.21	46.00	17.79	100.0	V	271.0	21.20
944.440556	38.16	46.00	7.84	100.0	V	235.0	29.35

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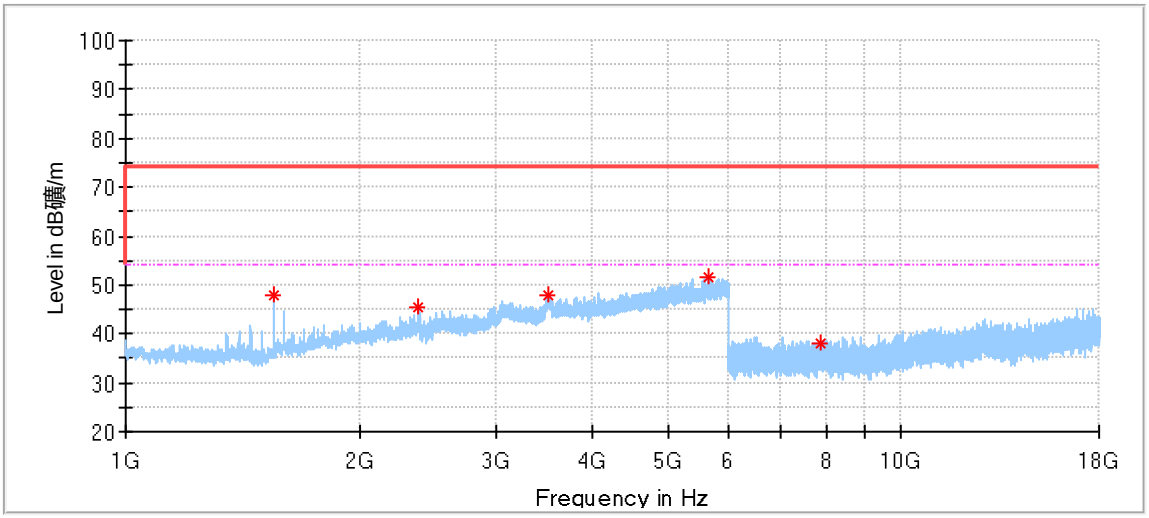
Emission above 1GHz

Transmitting mode 802.11(HT40)_2422MHz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1549.500000*	47.80	74.00	26.20	150.0	H	171.0	-7.69
2388.000000*	45.64	74.00	28.36	150.0	H	103.0	-2.46
3504.000000	48.03	74.00	25.97	150.0	H	321.0	4.29
5634.000000	51.49	74.00	22.51	150.0	H	116.0	7.19
7872.000000	38.23	74.00	35.77	150.0	H	354.0	7.25

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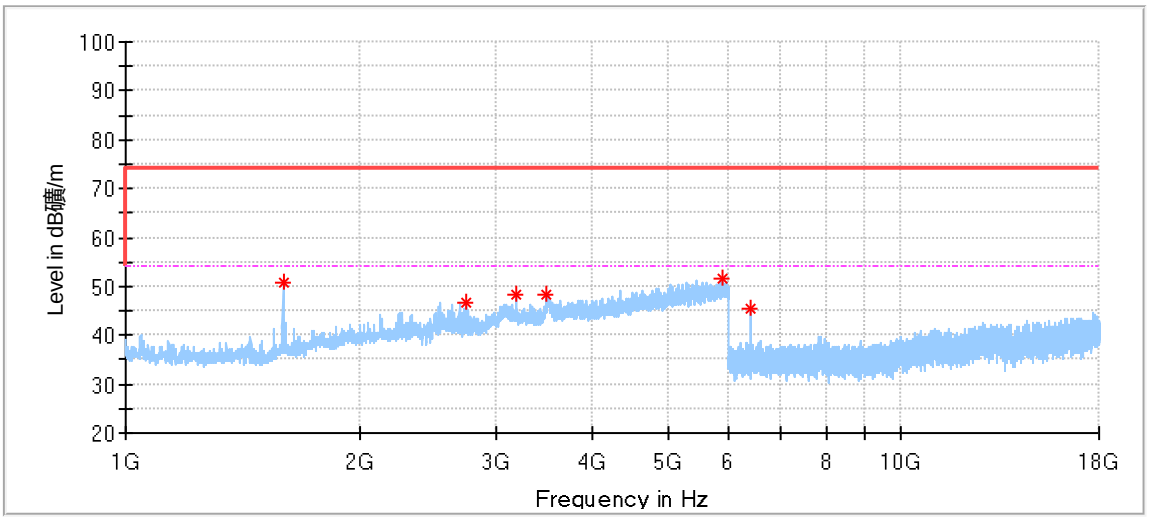

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1597.500000*	50.89	74.00	23.11	150.0	V	347.0	-6.88
2744.500000*	46.74	74.00	27.26	150.0	V	72.0	-1.74
3189.000000	48.15	74.00	25.85	150.0	V	356.0	0.64
3494.500000	48.28	74.00	25.72	150.0	V	86.0	4.06
5887.500000	51.47	74.00	22.53	150.0	V	308.0	8.04
6380.000000	45.30	74.00	28.70	150.0	V	61.0	5.99

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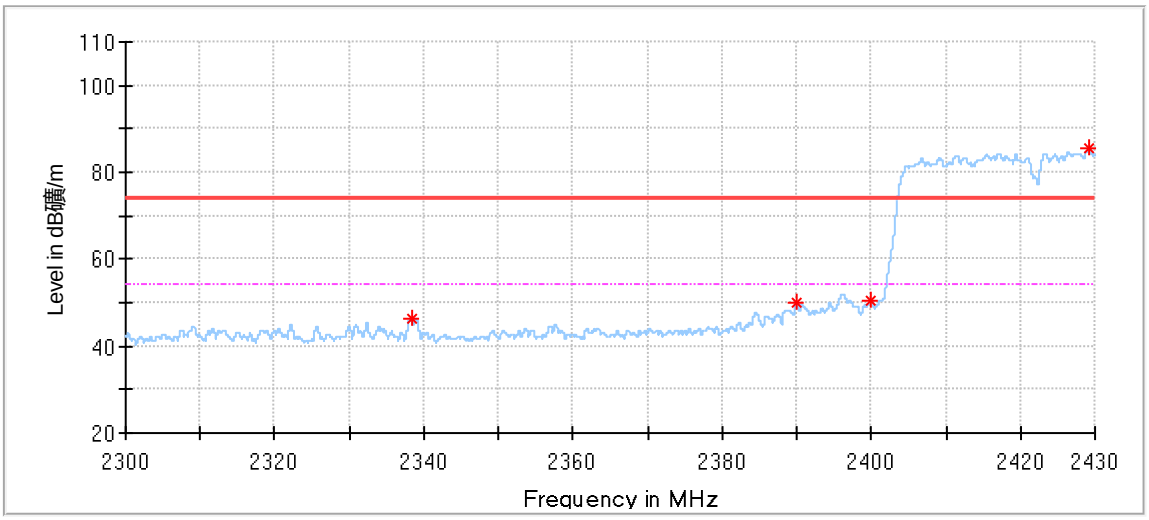

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2338.298000*	46.31	74.00	27.69	150.0	H	120.0	-3.47
2390.103000	49.94	74.00	24.06	150.0	H	239.0	-2.88
2400.048000	50.29	74.00	23.71	150.0	H	120.0	-2.91
2429.220000	85.53	74.00	-11.53	150.0	H	132.0	-2.71

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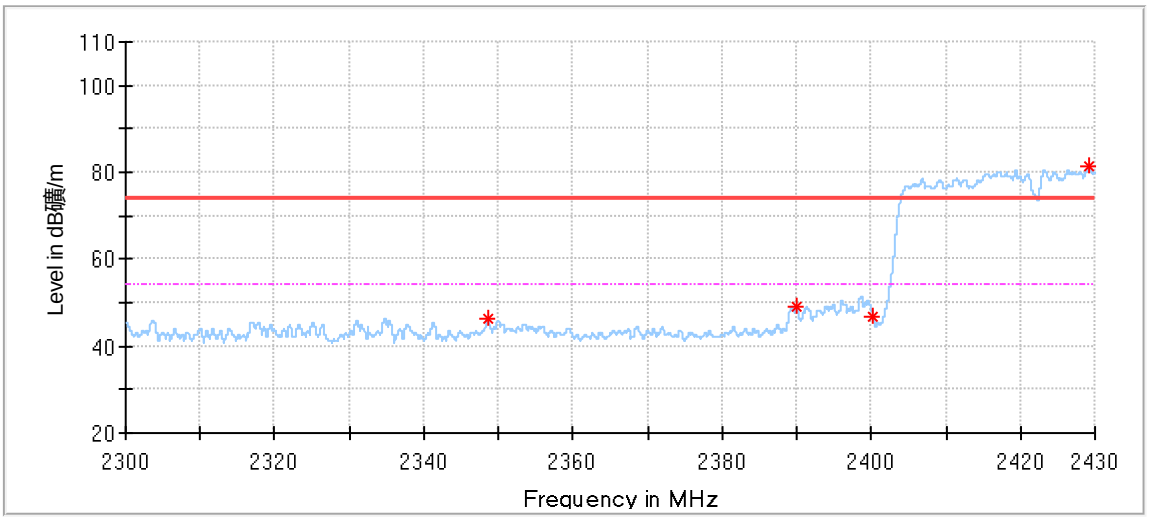

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2348.490000*	46.16	74.00	27.84	150.0	V	309.0	-3.37
2389.999000*	48.88	74.00	25.12	150.0	V	35.0	-2.88
2400.256000	46.72	74.00	27.28	150.0	V	0.0	-2.91
2429.246000	81.20	74.00	-7.20	150.0	V	231.0	-2.71

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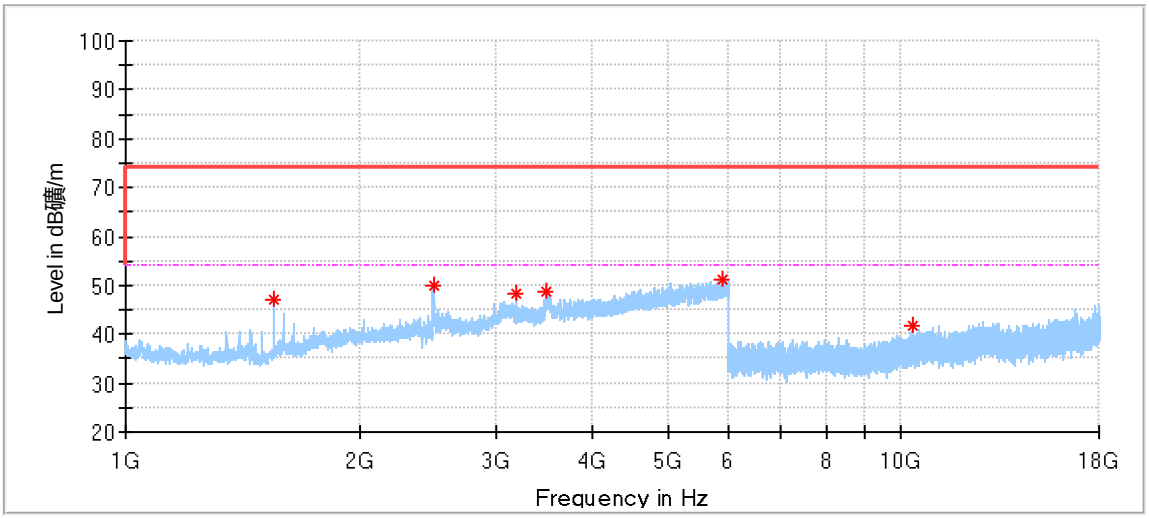
Transmitting mode 802.11(HT40)_2437MHz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1549.500000*	47.12	74.00	26.88	150.0	H	171.0	-7.69
2492.000000*	49.84	74.00	24.16	150.0	H	144.0	-1.84
3186.000000	48.19	74.00	25.81	150.0	H	34.0	0.66
3496.000000	48.89	74.00	25.11	150.0	H	239.0	4.18
5882.500000	51.35	74.00	22.65	150.0	H	308.0	8.04
10331.500000	41.56	74.00	32.44	150.0	H	352.0	9.95

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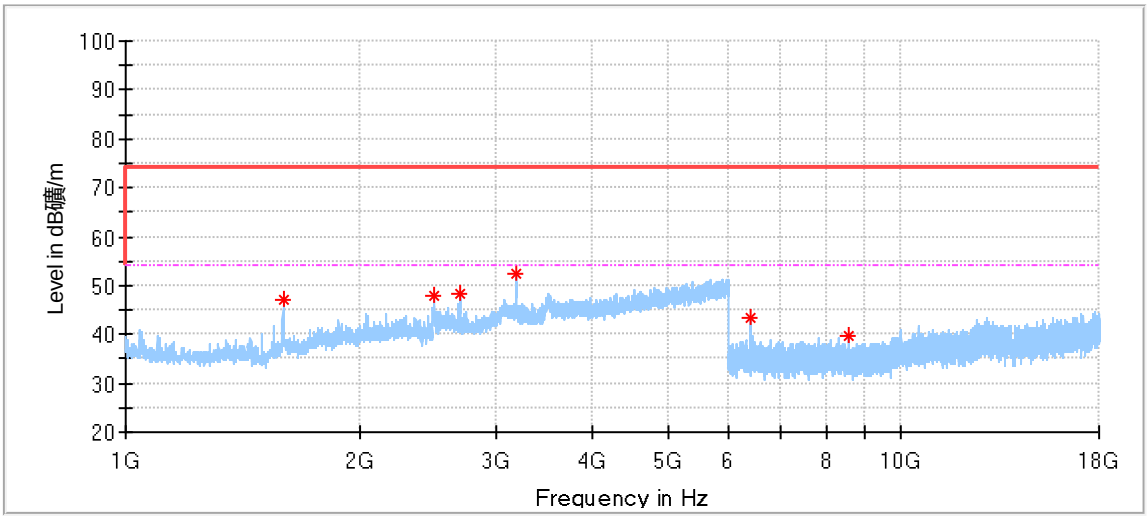

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1598.000000*	47.27	74.00	26.73	150.0	V	335.0	-6.87
2500.500000	48.06	74.00	25.94	150.0	V	226.0	-1.85
2699.000000*	48.23	74.00	25.77	150.0	V	75.0	-1.79
3188.500000	52.33	74.00	21.67	150.0	V	308.0	0.64
6394.000000	43.42	74.00	30.58	150.0	V	223.0	6.01
8555.500000	39.51	74.00	34.49	150.0	V	30.0	7.51

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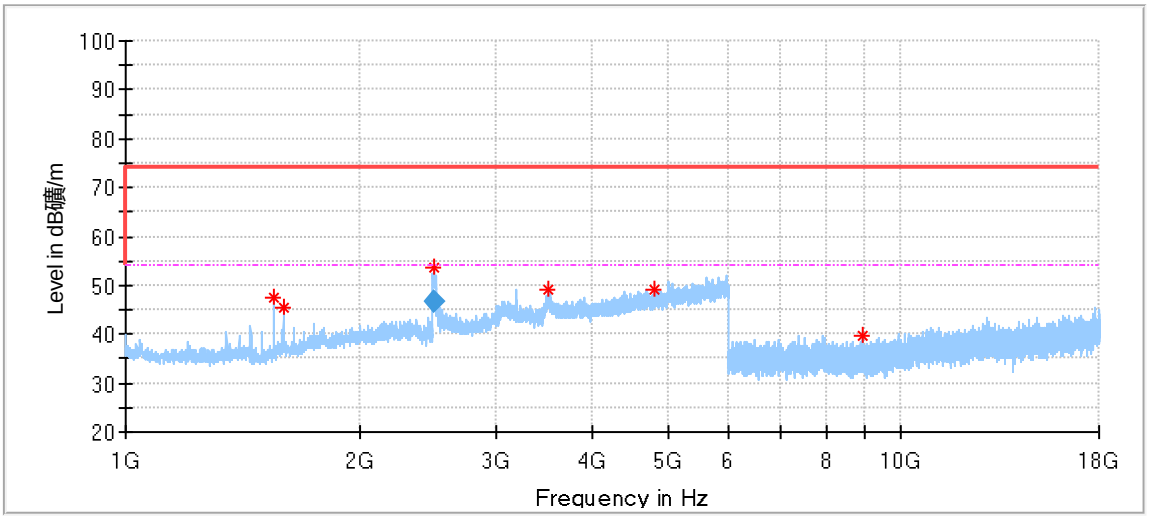
Transmitting mode 802.11(HT40)_2452MHz



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1549.500000*	47.52	74.00	26.48	150.0	H	168.0	-7.69
1599.500000*	45.59	74.00	28.41	150.0	H	168.0	-6.84
2496.500000*	53.56	74.00	20.44	150.0	H	294.0	-1.85
3503.500000	49.15	74.00	24.85	150.0	H	263.0	4.31
4802.500000*	49.06	74.00	24.94	150.0	H	321.0	4.93
8901.000000	39.69	74.00	34.31	150.0	H	4.0	7.88

Final_Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2496.500000*	46.69	54.00	7.31	150.0	H	294.0	-1.85

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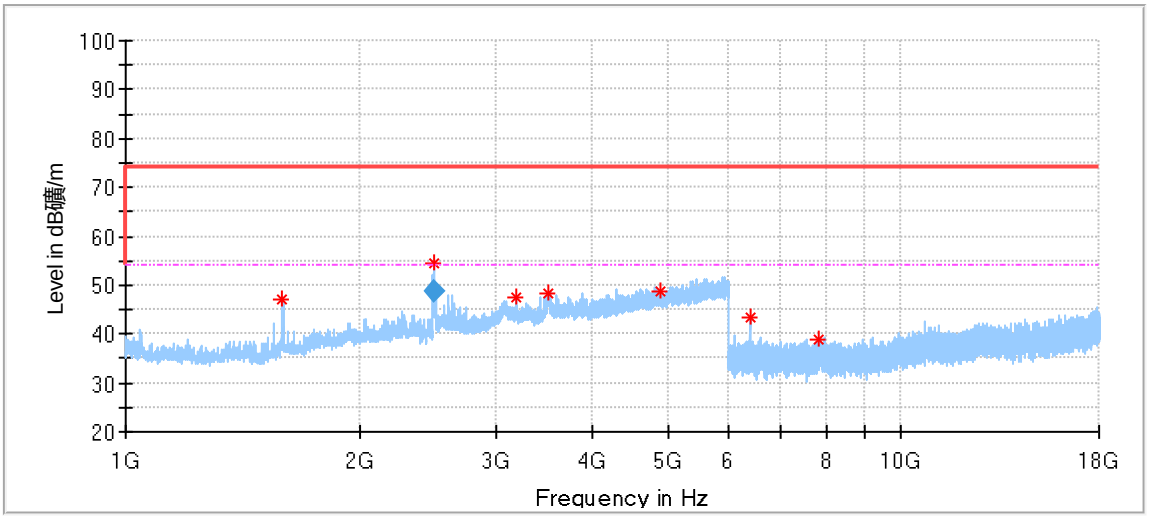

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1593.500000*	46.88	74.00	27.12	150.0	V	306.0	-6.94
2495.000000*	54.29	74.00	19.71	150.0	V	224.0	-1.84
3197.000000	47.38	74.00	26.62	150.0	V	306.0	0.59
3502.500000	48.44	74.00	25.56	150.0	V	224.0	4.36
4906.000000*	48.87	74.00	25.13	150.0	V	306.0	5.06
6376.500000	43.30	74.00	30.70	150.0	V	58.0	5.98
7840.500000	38.95	74.00	35.05	150.0	V	221.0	7.25

Final_Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2495.000000*	48.69	54.00	5.31	150.0	V	224.0	-1.84

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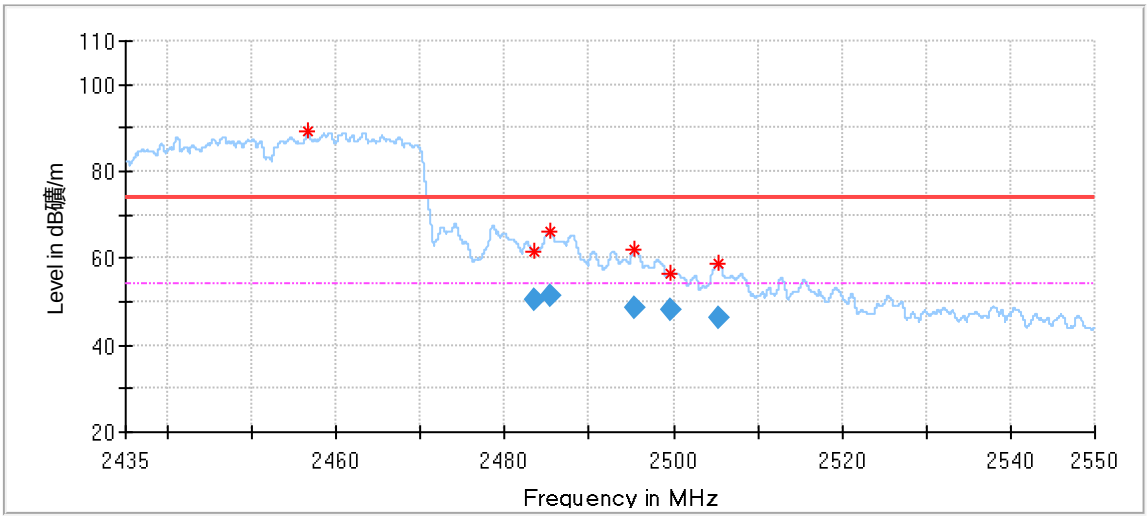

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2456.620000	89.03	74.00	-15.03	150.0	H	82.0	-2.47
2483.553000*	61.63	74.00	12.37	150.0	H	123.0	-2.38
2485.416000*	66.01	74.00	7.99	150.0	H	123.0	-2.38
2495.329000*	61.87	74.00	12.13	150.0	H	123.0	-2.36
2499.687500*	56.54	74.00	17.46	150.0	H	123.0	-2.35
2505.265000	58.58	74.00	15.42	150.0	H	123.0	-2.33

Final_Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.553000*	50.24	54.00	3.76	150.0	H	123.0	-2.38
2485.416000*	51.21	54.00	2.79	150.0	H	123.0	-2.38
2495.329000*	48.64	54.00	5.36	150.0	H	123.0	-2.36
2499.687500*	47.96	54.00	6.04	150.0	H	123.0	-2.35
2505.265000	46.33	54.00	7.67	150.0	H	123.0	-2.33

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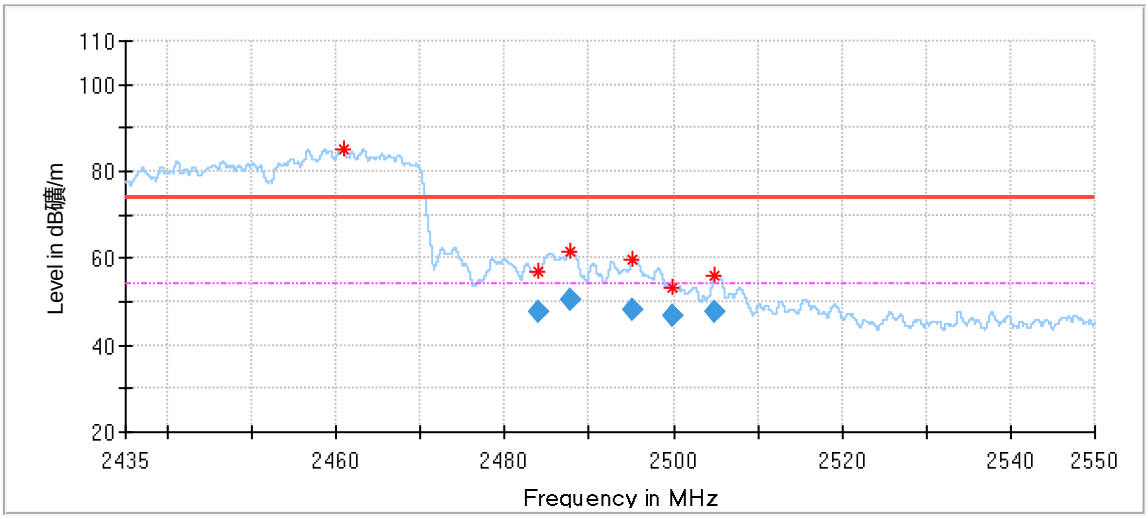

Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2460.875000	85.23	74.00	-11.23	150.0	V	234.0	-2.45
2483.978500*	57.15	74.00	16.85	150.0	V	234.0	-2.38
2487.681500*	61.66	74.00	12.34	150.0	V	221.0	-2.37
2495.122000*	59.63	74.00	14.37	150.0	V	221.0	-2.36
2499.975000*	53.31	74.00	20.69	150.0	V	234.0	-2.35
2504.897000	55.82	74.00	18.18	150.0	V	221.0	-2.33

Final_Result

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.978500*	47.55	54.00	6.45	150.0	V	234.0	-2.38
2487.681500*	50.29	54.00	3.71	150.0	V	221.0	-2.37
2495.122000*	48.33	54.00	5.67	150.0	V	221.0	-2.36
2499.975000*	46.58	54.00	7.42	150.0	V	234.0	-2.35
2504.897000	47.79	54.00	6.21	150.0	V	221.0	-2.33

Remark:
(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of § 15.205 and RSS-Gen section 8.10.
(2) Data of measurement within frequency ranges 9kHz-30MHz and 18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report,
(3) Level= Reading Level + Correction Factor
(4) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

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10 Test Equipment List

Conducted Emission Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-19-002	102590	1	2024-5-19
LISN	Rohde & Schwarz	ENV216	68-4-87-19-001	102472	1	2024-5-20
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2024-5-19
Test software	Rohde & Schwarz	EMC32	68-4-90-19-005-A01	Version 10.35.02	N/A	N/A
Shielding Room	TDK	CSR #2	68-4-90-19-005	----	3	2025-10-15

Radiated Emission Test, SAC-3 #1

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 7	68-4-74-19-001	102176	1	2024-5-20
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2024-8-7
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2024-5-19
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-001	15542	1	2024-5-19
3m Semi-anechoic chamber	TDK	SAC-3 #1	68-4-90-14-001	----	3	2024-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-14-001-A10	Version10.35.02	N/A	N/A

Radiated Emission Test, SAC-3 #2

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2024-5-20
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	1	2024-3-5
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2024-4-26
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2024-5-19
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2024-5-19
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2024-7-11
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2024-8-1
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2024-5-19
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2024-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A	N/A

RF Conducted Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2024-5-19
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.6.77.0518	N/A	N/A

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission in new shielding room (68-4-90-19-005) 150kHz-30MHz (for test using AMN ENV216)	3.33dB
Uncertainty for Radiated Emission in 3m chamber (68-4-90-14-001) 9kHz-30MHz	4.70dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 30MHz-1000MHz	Horizontal: 4.59dB; Vertical: 4.75dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 1000MHz-18000MHz	Horizontal: 5.08dB; Vertical: 5.09dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) above 18000MHz	Horizontal: 3.14dB; Vertical: 3.12dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10^{-8} or 1%

Measurement Uncertainty Decision Rule:
Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, clause 4.4.3 and 4.5.1.

--- END OF REPORT---

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