

FCC - TEST REPORT

Report Number : **7095021029129-00** Date of Issue: Jan.12,2022Model : AXY3LProduct Type : Wi-Fi and Bluetooth ModuleApplicant : Hangzhou Tuya Information Technology Co.,LtdAddress : Room701,Building3,More Center,No.87 GuDun
Road, Hangzhou, Zhejiang ChinaManufacturer : Hangzhou Tuya Information Technology Co.,LtdAddress : Room701,Building3,More Center,No.87 GuDun
Road, Hangzhou, Zhejiang ChinaTest Result : ☒ **Positive** ☐ **Negative**Total pages including
Appendices : 63

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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. Shanghai Branch
No.16 Lane, 1951 Du Hui Road,
Shanghai 201108,
P.R. China

Test Firm FCC
Registration
Number: 820234

Designation
number: CN1183

IC Company
Number: 25988

CAB identifier: CN0101

Telephone: +86 21 6141 0123
Fax: +86 21 6140 8600

3 Description of the Equipment under Test

Product: Wi-Fi and Bluetooth Module

Model no.: AXY3L

FCC ID: 2ANDL-AXY3L

Options and accessories: NA

Rating: 3V-3.6V DC

RF Transmission Frequency: For 802.11b/g/n(HT20)/ax(HE20): 2412~2462 MHz (Wi-Fi)
For 802.11n(HT40): 2422~2452 MHz (Wi-Fi)
For 802.15.1:2402~2480 MHz (BLE 5.1)

No. of Operated Channel: 2.4GHz WIFI: 11 for 802.11b/g/n(HT20)/ax(HE20)
7 for 802.11n(HT40)
2.4GHz BLE: 40

Modulation: Direct Sequence Spread Spectrum (DSSS) for 802.11b
Orthogonal Frequency Division Multiplexing (OFDM) for
802.11g/n; Orthogonal Frequency Division Multiple Access
(OFDMA) for 802.11ax; 2.4GHz BLE: GFSK

Channel list:

802.11b/g/n(HT20)/ax(HE20)					802.11n(HT40)		
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
1	2412	7	2442	3	2422	8	2447MHz
2	2417	8	2447	4	2427	9	2452MHz
3	2422	9	2452	5	2432		
4	2427	10	2457	6	2437		
5	2432	11	2462	7	2442		
6	2437						

Bluetooth Low Energy							
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480



China

Antenna Type: onboard PCB antenna

Antenna Gain: 2.7dBi

Description of the EUT: The Equipment Under Test (EUT) is a Wi-Fi and Bluetooth module which support 2.4GHz Wi-Fi and BLE 5.1(support 1Mbps and 2Mbps data rate). We tested it and listed the worst data in this report.

Test sample no.: SHA-625549-2

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.



4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

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

5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	13-15	Site 1	☒	☐	☐
§15.247 (b) (1)	Conducted peak output power	16	Site 1	☒	☐	☐
§15.247(a)(1)	20dB bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Dwell Time	---	---	☐	☐	☒
§15.247(a)(2)	6dB bandwidth	17-22	Site 1	☒	☐	☐
§15.247(e)	Power spectral density	23-28	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	29-44	Site 1	☒	☐	☐
§15.247(d)	Band edge	45-50	Site 1	☒	☐	☐
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	51-59	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses an onboard PCB antenna, which gain is 2.7dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANDL-AXY3L, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

This report is only for the 2.4GHz Wi-Fi test report, for the 2.4GHz BLE test report please refer to 7095021029134-00.

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: December 21, 2021

Testing Start Date: December 24, 2021

Testing End Date: December 31, 2021

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

Reviewed by:

Prepared by:

Tested by:

Hui Tong



Jiaxi Xu

Wang Yiquan

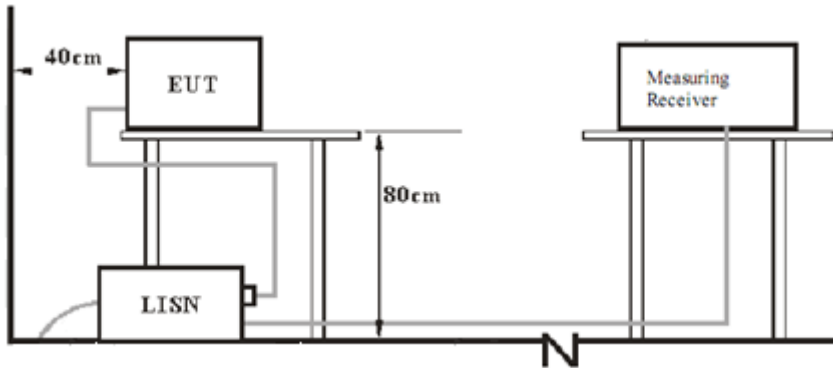
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Project Engineer

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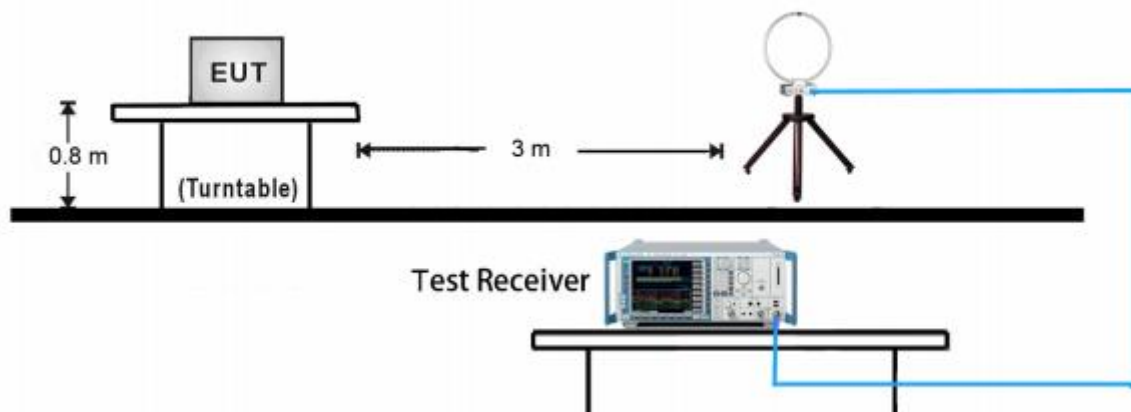
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

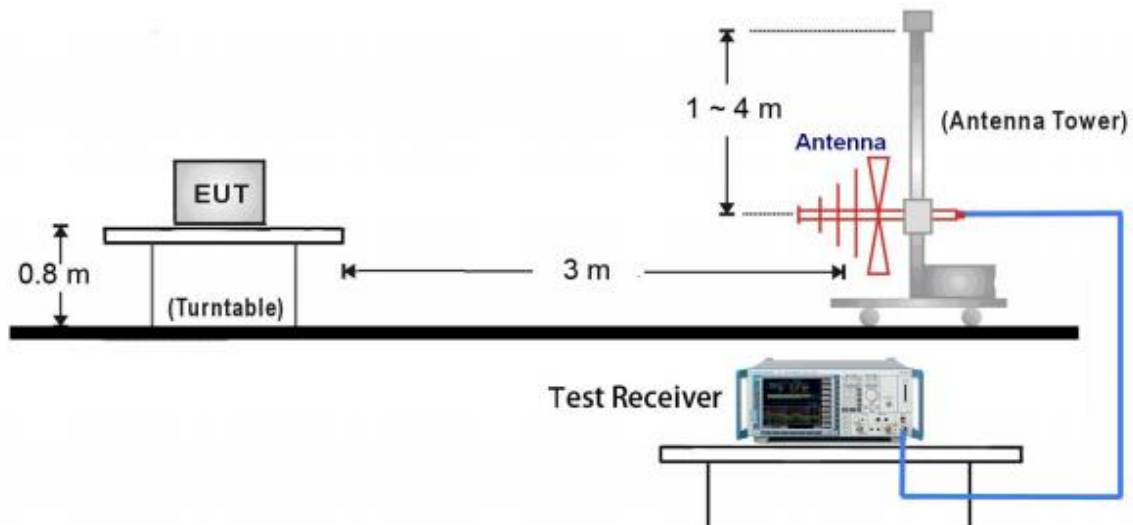


7.2 Radiated test setups

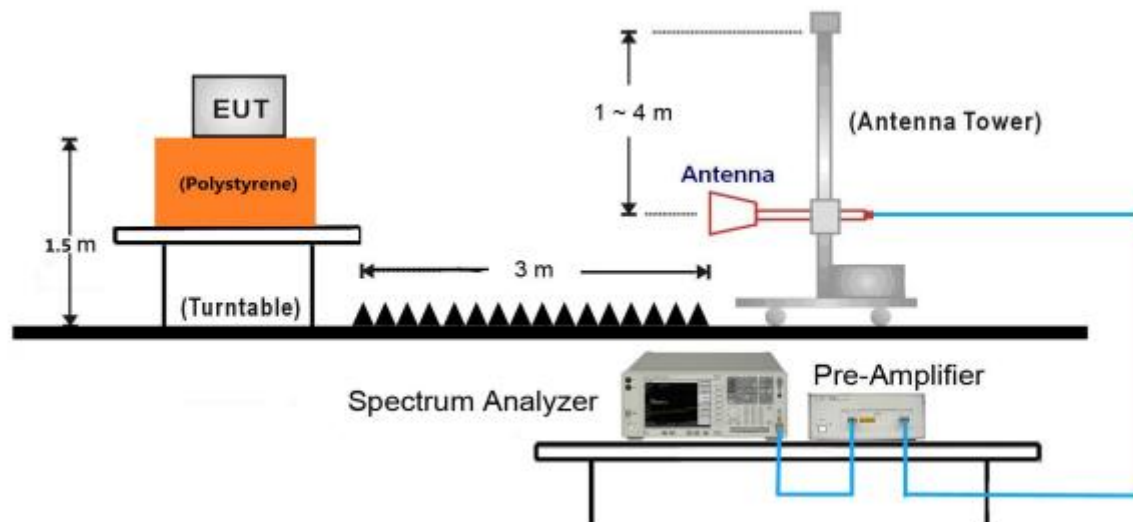
9kHz ~ 30MHz Test Setup:



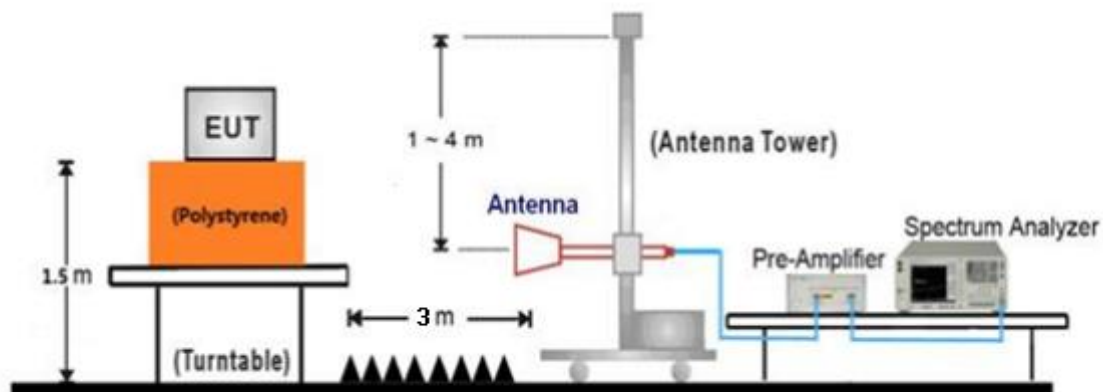
30MHz ~ 1GHz Test Setup:



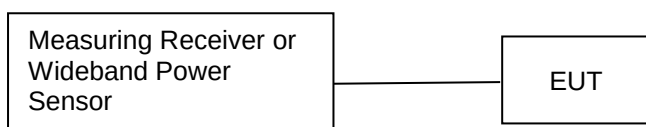
1GHz ~ 18GHz Test Setup:



18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups





8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenovo	E470	PF-OU5TS7 17/09

Test software: RDTool V1.0.19

The system was configured to channel 1(2412MHz), 6(2437MHz), and 11(2462MHz) for 802.11 b/g/n(HT20)/ax(HE20) test and channel 3(2422MHz), 6(2437MHz), 9(2452MHz) for 802.11n (HT40).

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

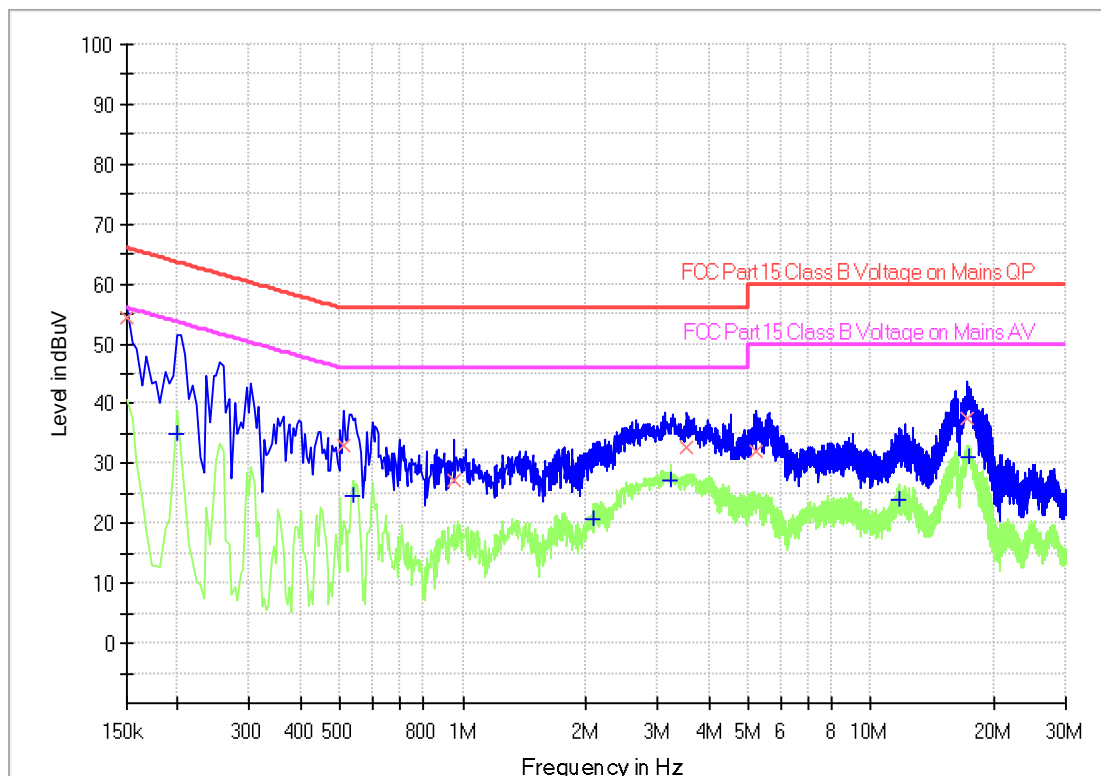
Limit

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

Decreasing linearly with logarithm of the frequency

Conducted Emission

Product Type : Wi-Fi and Bluetooth module
 M/N : AXY3L3L
 Operating Condition : Mode 1: Tx_2437MHz for 802.11n20
 Test Specification : L-line
 Comment : AC 120V/60Hz for notebook (the EUT powered by notebook)

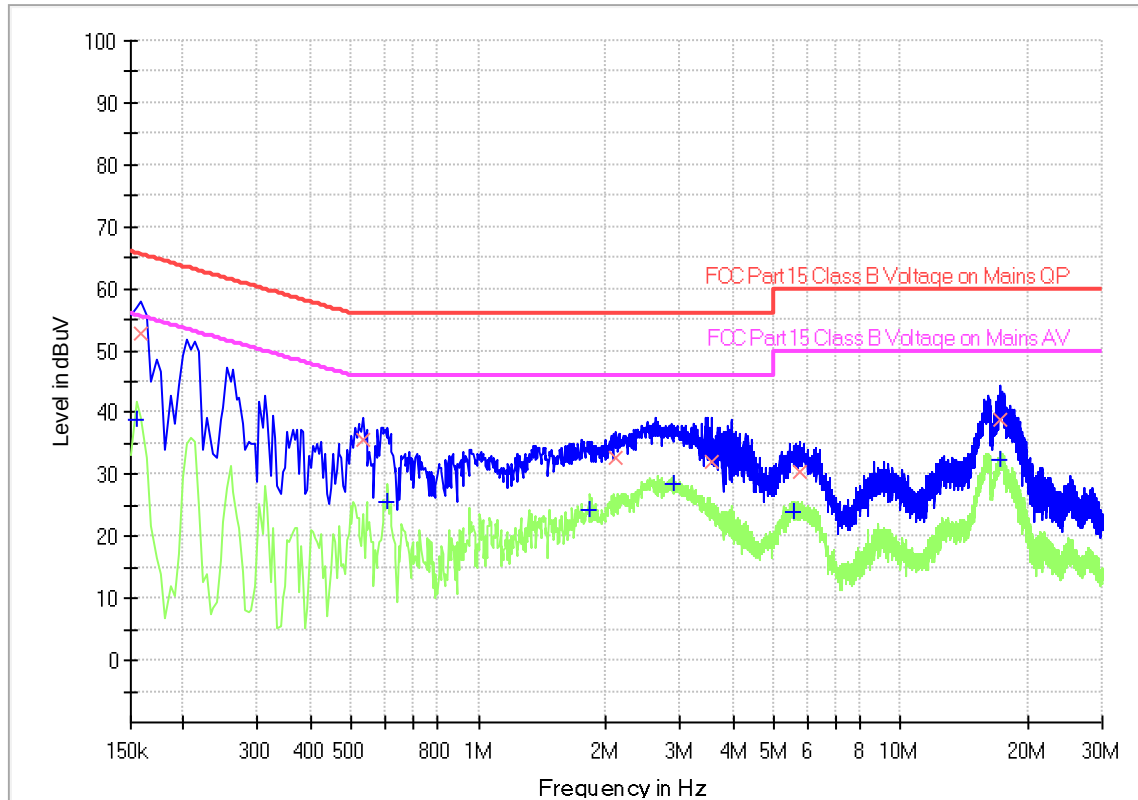


Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	54.47	---	66.00	11.53	1000.0	9.000	L1	19.5
0.199500	---	34.90	53.63	18.73	1000.0	9.000	L1	19.5
0.510000	33.02	---	56.00	22.98	1000.0	9.000	L1	19.5
0.537000	---	24.50	46.00	21.50	1000.0	9.000	L1	19.5
0.951000	27.29	---	56.00	28.71	1000.0	9.000	L1	19.5
2.085000	---	20.65	46.00	25.35	1000.0	9.000	L1	19.5
3.232500	---	27.29	46.00	18.71	1000.0	9.000	L1	19.6
3.543000	32.64	---	56.00	23.36	1000.0	9.000	L1	19.6
5.248500	31.91	---	60.00	28.09	1000.0	9.000	L1	19.6
11.665500	---	24.13	50.00	25.87	1000.0	9.000	L1	19.7
17.124000	37.48	---	60.00	22.52	1000.0	9.000	L1	19.8
17.466000	---	31.05	50.00	18.95	1000.0	9.000	L1	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
 Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

Product Type : Wi-Fi and Bluetooth module
 M/N : AXY3L
 Operating Condition : Mode 1: Tx_2437MHz for 802.11n20
 Test Specification : N-line
 Comment : AC 120V/60Hz for notebook (the EUT powered by notebook)



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154500	---	38.82	55.75	16.93	1000.0	9.000	N	19.5
0.159000	52.81	---	65.52	12.71	1000.0	9.000	N	19.5
0.532500	35.71	---	56.00	20.29	1000.0	9.000	N	19.5
0.609000	---	25.62	46.00	20.38	1000.0	9.000	N	19.5
1.837500	---	24.35	46.00	21.65	1000.0	9.000	N	19.5
2.121000	32.62	---	56.00	23.38	1000.0	9.000	N	19.5
2.895000	---	28.59	46.00	17.41	1000.0	9.000	N	19.5
3.561000	32.11	---	56.00	23.89	1000.0	9.000	N	19.5
5.559000	---	24.13	50.00	25.87	1000.0	9.000	N	19.6
5.757000	30.43	---	60.00	29.57	1000.0	9.000	N	19.6
17.200500	38.70	---	60.00	21.30	1000.0	9.000	N	19.8
17.232000	---	32.41	50.00	17.59	1000.0	9.000	N	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
 Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
RBW > the 6dB bandwidth of the emission being measured, VBW $\geq$ 3RBW, Span $\geq$ 3RBW
Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Use a power meter to measure the conducted peak output power.

Limits

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

Test result

802.11b

Frequency (MHz)	Conducted Peak Output Power(dBm)	Result
Low channel 2412MHz	18.06	Pass
Middle channel 2437MHz	18.48	Pass
High channel 2462MHz	18.15	Pass

802.11g

Frequency (MHz)	Conducted Peak Output Power(dBm)	Result
Low channel 2412MHz	23.82	Pass
Middle channel 2437MHz	23.93	Pass
High channel 2462MHz	23.72	Pass

802.11n(HT20)

Frequency (MHz)	Conducted Peak Output Power(dBm)	Result
Low channel 2412MHz	24.68	Pass
Middle channel 2437MHz	24.77	Pass
High channel 2462MHz	24.61	Pass

802.11n(HT40)

Frequency (MHz)	Conducted Peak Output Power(dBm)	Result
Low channel 2422MHz	22.50	Pass
Middle channel 2437MHz	22.60	Pass
High channel 2452MHz	22.57	Pass

802.11ax(HE20)

Frequency (MHz)	Conducted Peak Output Power(dBm)	Result
Low channel 2412MHz	23.24	Pass
Middle channel 2437MHz	23.33	Pass
High channel 2462MHz	23.19	Pass

9.3 6dB bandwidth

Test Method

1. Use the following spectrum analyzer settings:
RBW=100K, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be $\geq$ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

Limit

Limit [kHz]

 ≥ 500

Test result

802.11b

Frequency MHz	6dB bandwidth MHz	Result
Top channel 2412MHz	10.032	Pass
Middle channel 2437MHz	10.016	Pass
Bottom channel 2462MHz	10.025	Pass

802.11g

Frequency MHz	6dB bandwidth MHz	Result
Top channel 2412MHz	5.327	Pass
Middle channel 2437MHz	5.420	Pass
Bottom channel 2462MHz	10.052	Pass

802.11n(HT20)

Frequency MHz	6dB bandwidth MHz	Result
Top channel 2412MHz	6.327	Pass
Middle channel 2437MHz	8.141	Pass
Bottom channel 2462MHz	5.833	Pass

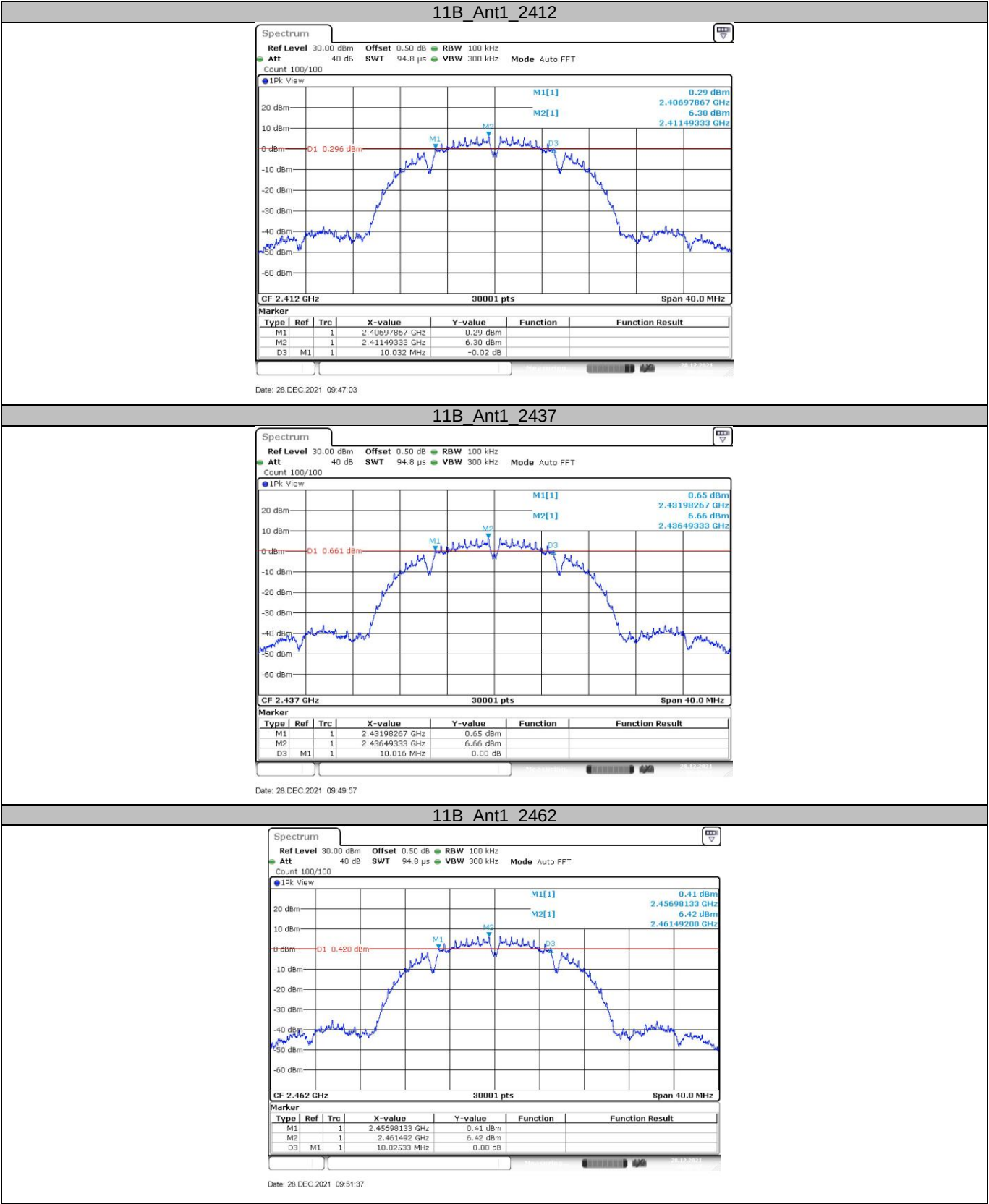
802.11n(HT40)

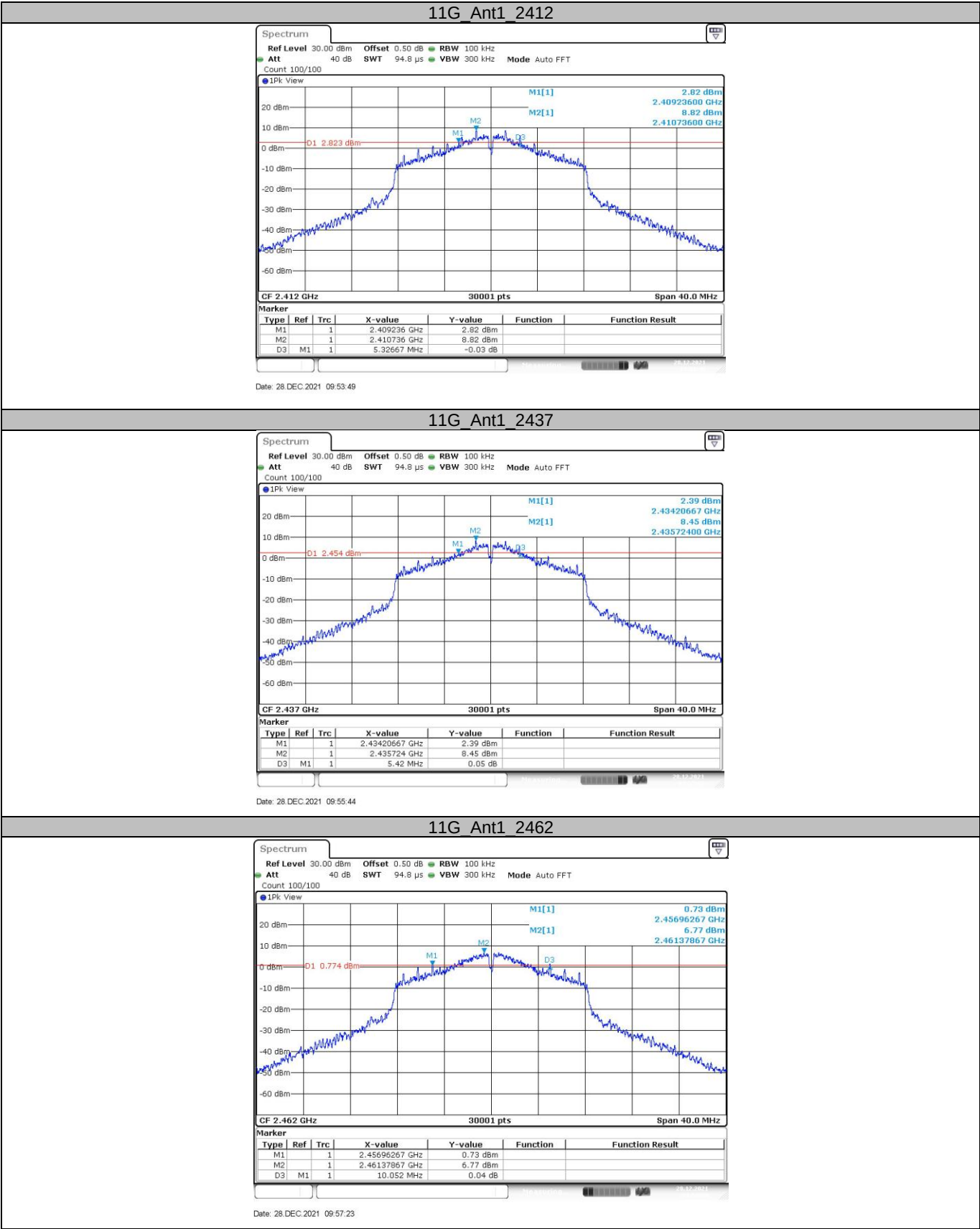
Frequency MHz	6dB bandwidth MHz	Result
Low channel 2422MHz	10.094	Pass
Middle channel 2437MHz	9.400	Pass
High channel 2452MHz	11.019	Pass

802.11ax(HE20)

Frequency MHz	6dB bandwidth MHz	Result
Low channel 2412MHz	6.596	Pass
Middle channel 2437MHz	5.123	Pass
High channel 2462MHz	5.680	Pass

6 dB Bandwidth

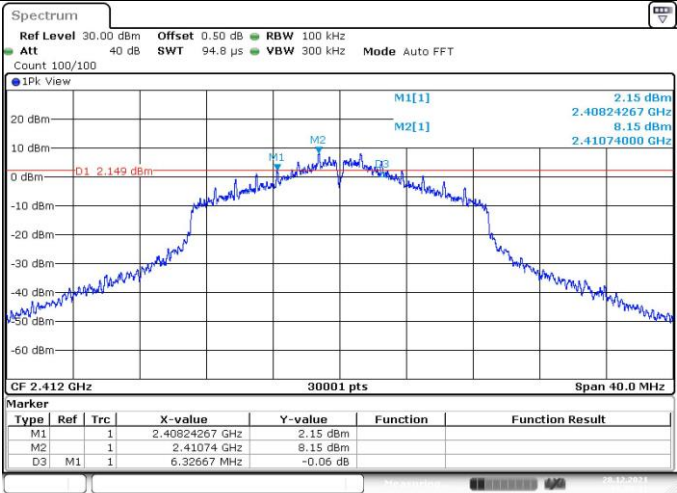






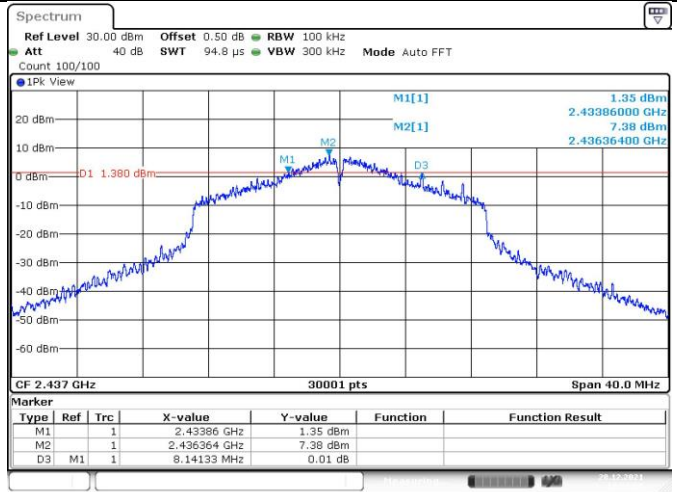
China

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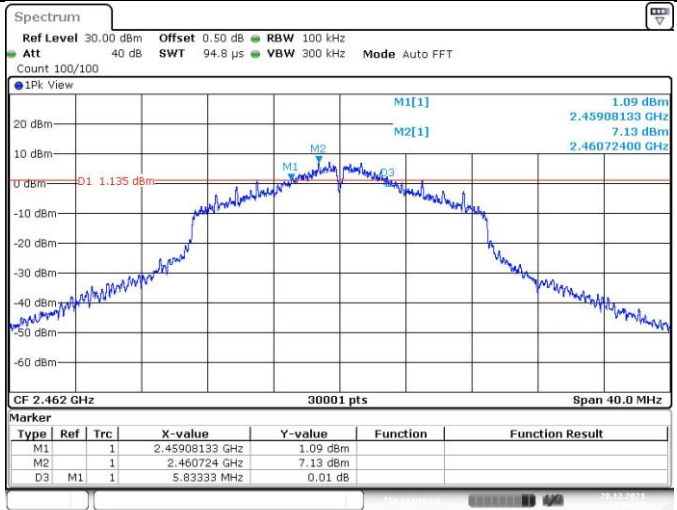
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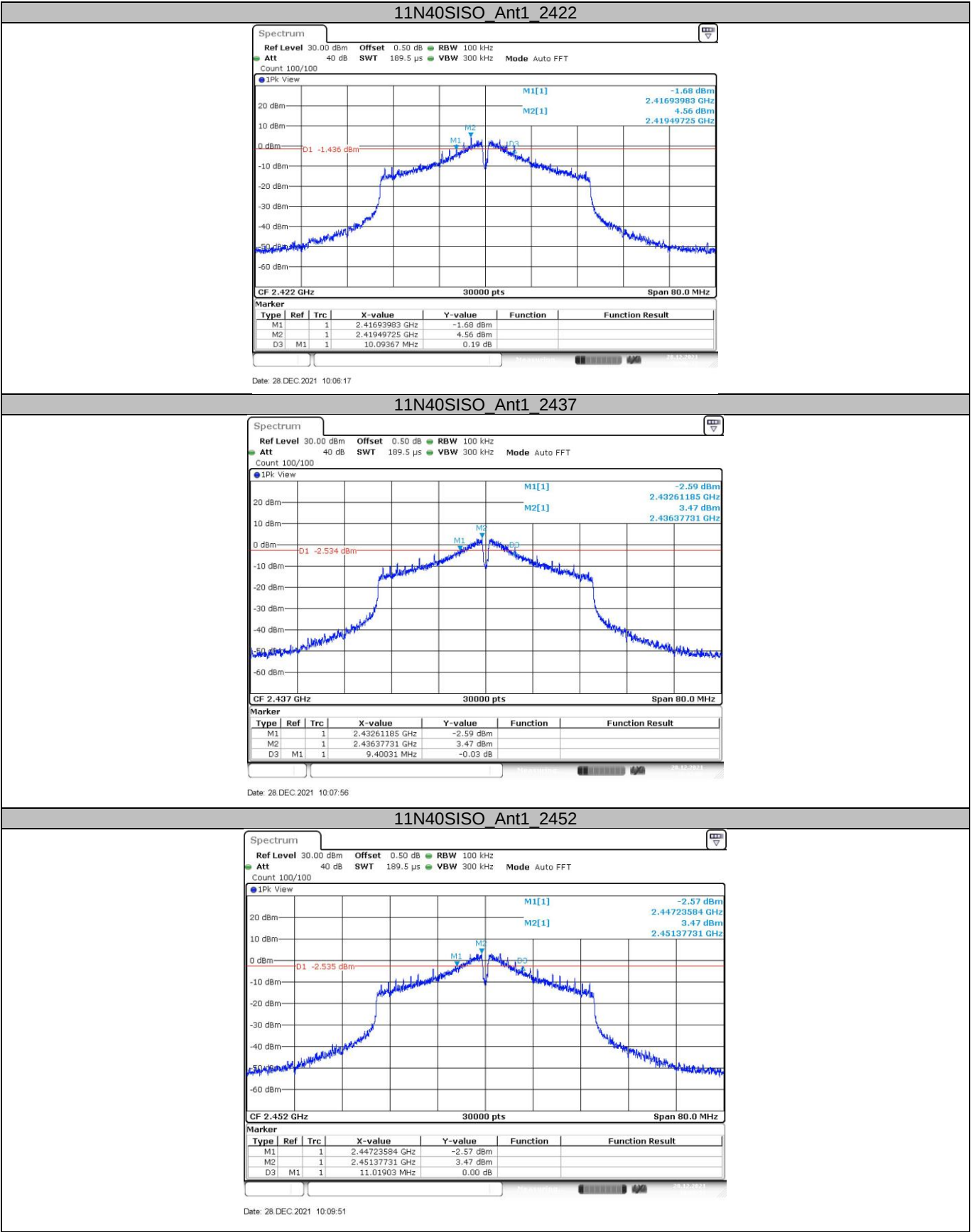
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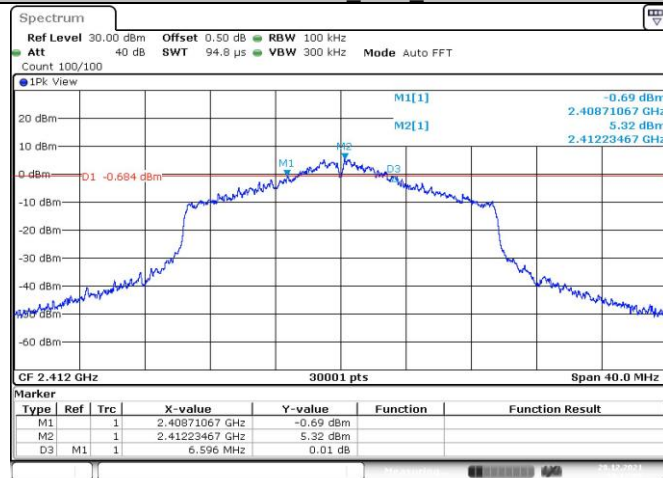
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China

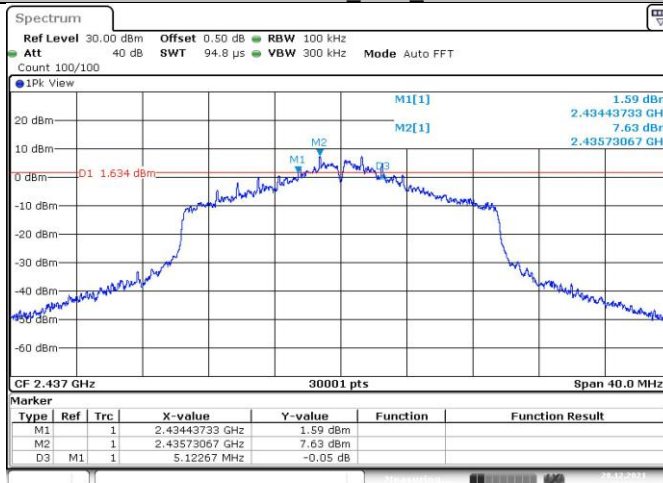


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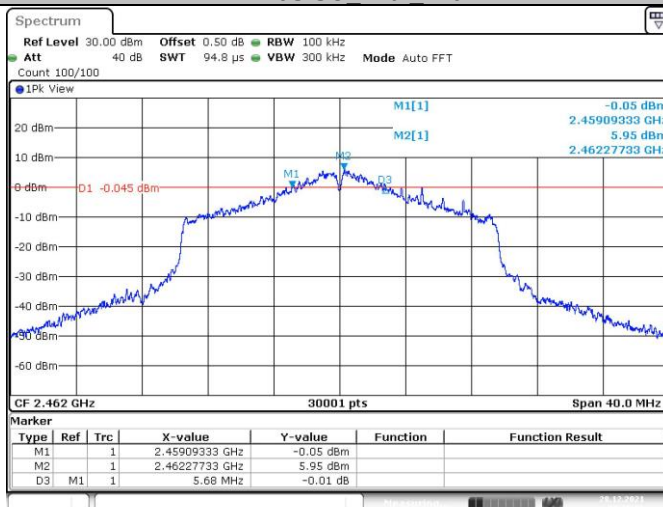
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11AX20SISO Ant1_2437



Date: 28 DEC 2021 10:13:46

11AX20SISO Ant1_2462



Date: 28 DEC 2021 10:15:29

9.4 Power spectral density

Test Method

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

1. 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.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3KHz]

≤8

Test result

802.11b

Frequency (MHz)	Power spectral density(dBm/3KHz)	Result
Low channel 2412MHz	-9.85	Pass
Middle channel 2437MHz	-9.39	Pass
High channel 2462MHz	-9.57	Pass

802.11g

Frequency (MHz)	Power spectral density(dBm/3KHz)	Result
Low channel 2412MHz	-5.06	Pass
Middle channel 2437MHz	-5.13	Pass
High channel 2462MHz	-6.12	Pass

802.11 n(HT20)

Frequency (MHz)	Power spectral density(dBm/3KHz)	Result
Low channel 2412MHz	-4.41	Pass
Middle channel 2437MHz	-5.07	Pass
High channel 2462MHz	-4.25	Pass

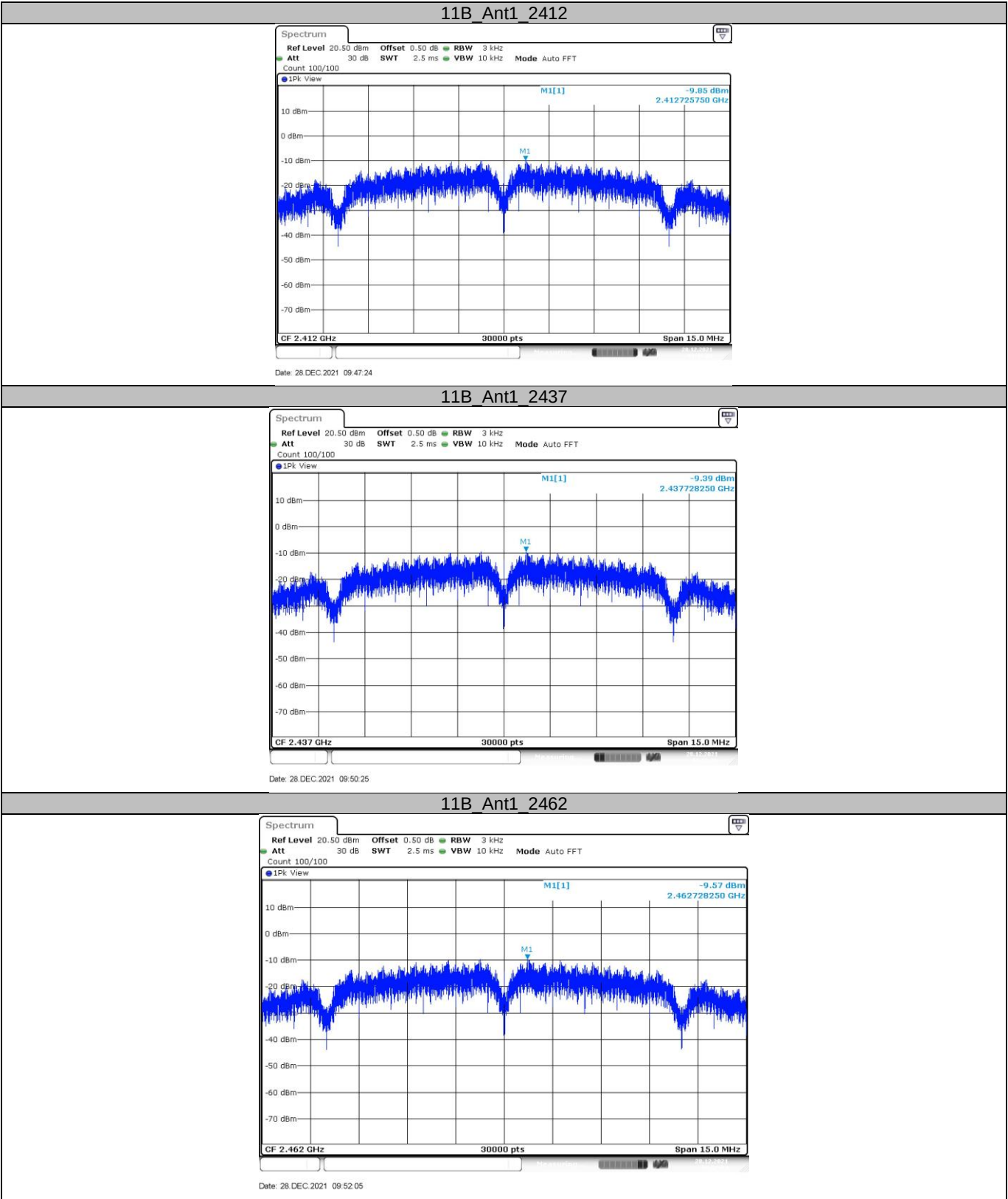
802.11 n(HT40)

Frequency (MHz)	Power spectral density(dBm/3KHz)	Result
Low channel 2422MHz	-10.76	Pass
Middle channel 2437MHz	-10.37	Pass
High channel 2452MHz	-10.48	Pass

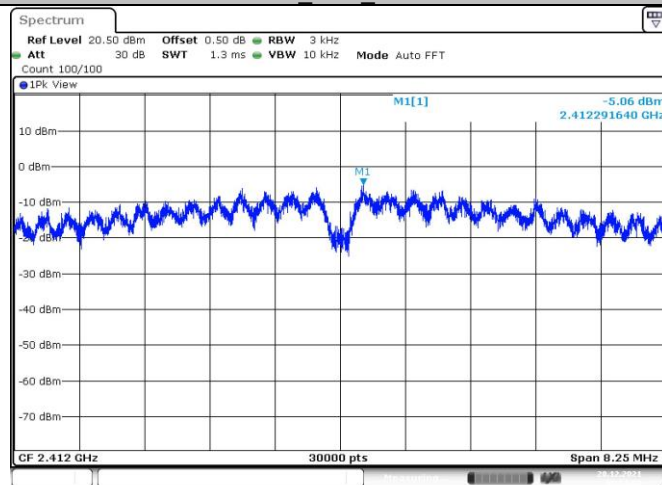
802.11 ax(HE20)

Frequency (MHz)	Power spectral density(dBm/3KHz)	Result
Low channel 2412MHz	-7.75	Pass
Middle channel 2437MHz	-7.98	Pass
High channel 2462MHz	-7.13	Pass

Power spectral density

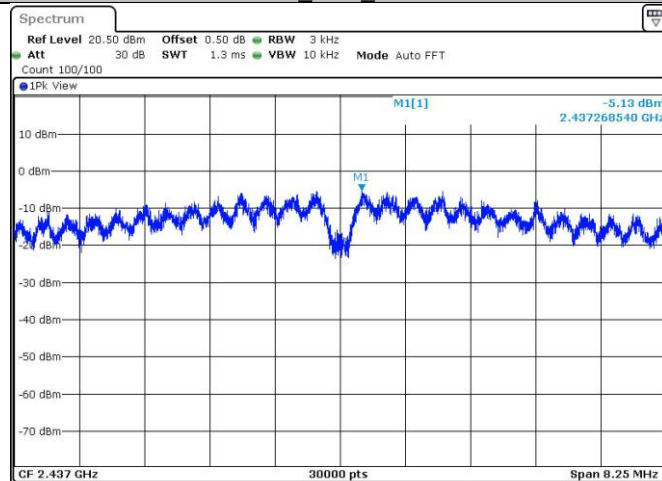


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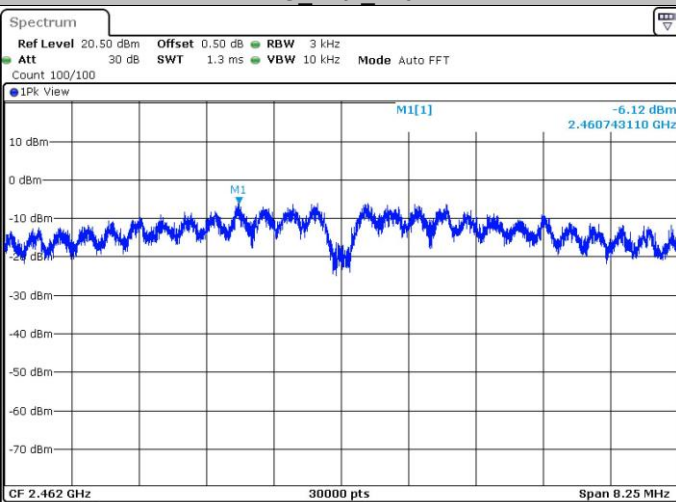
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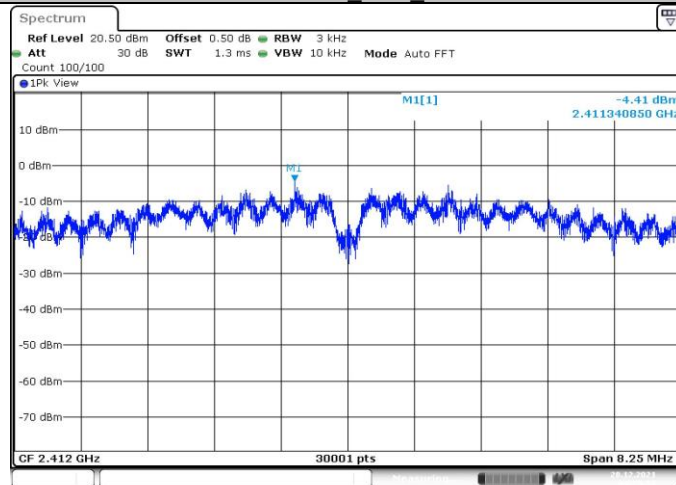
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11G_Ant1_2462



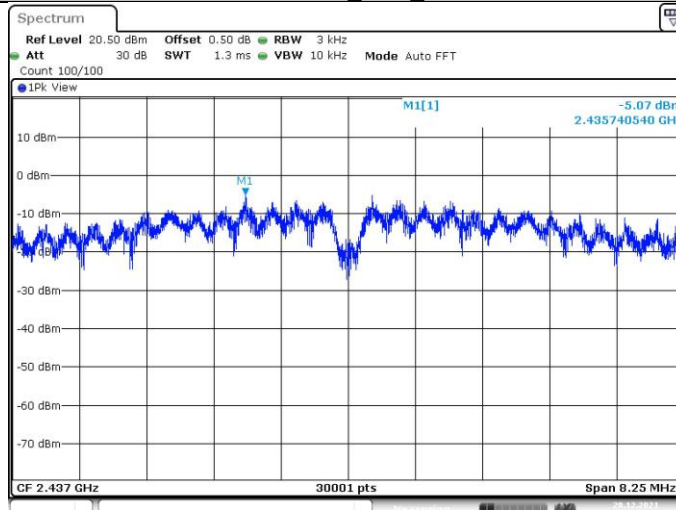
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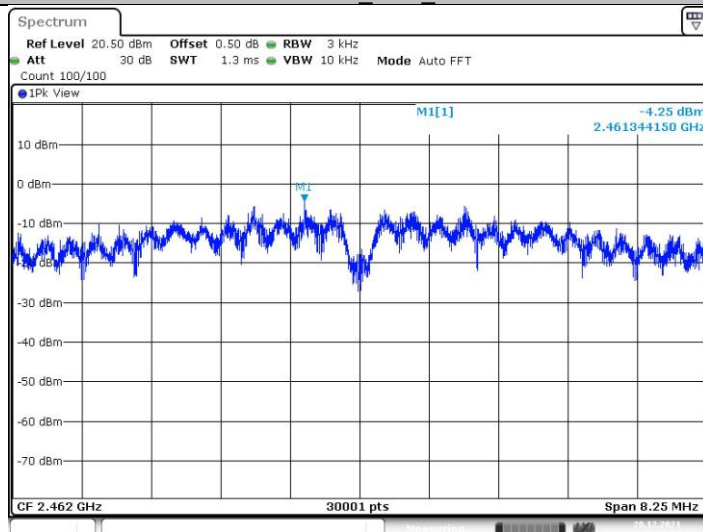
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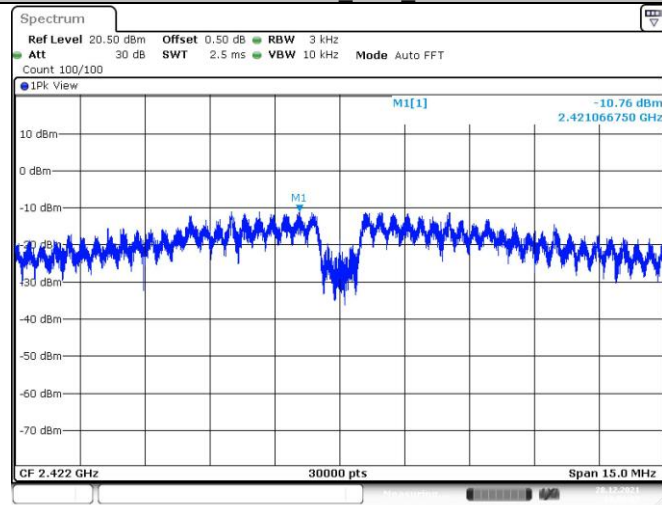
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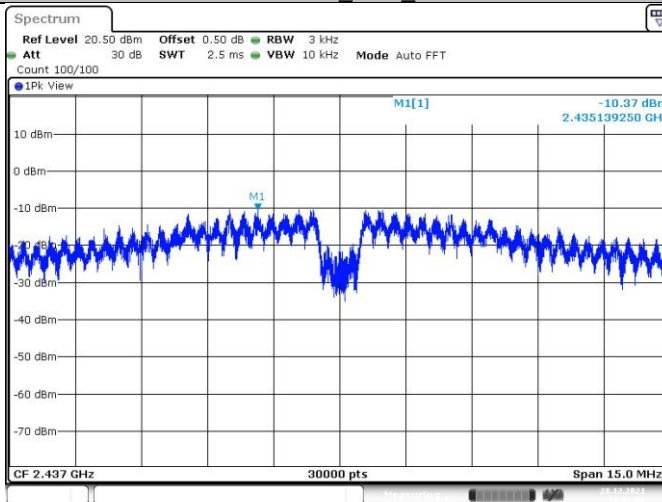
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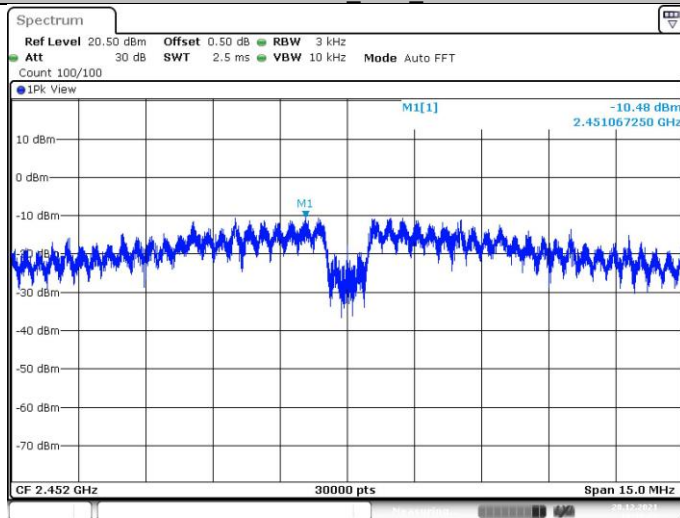
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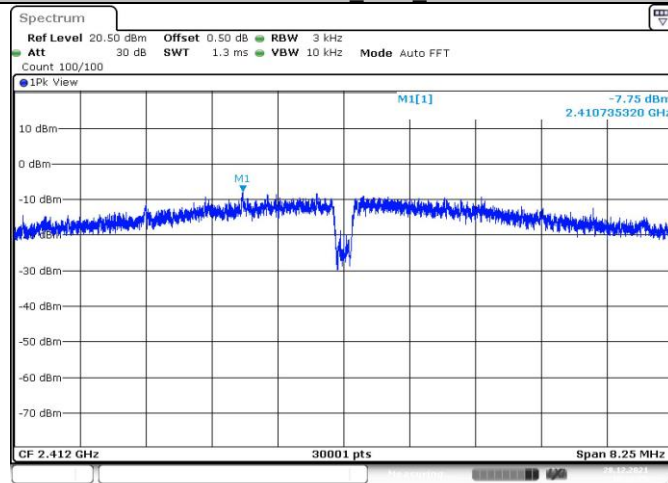
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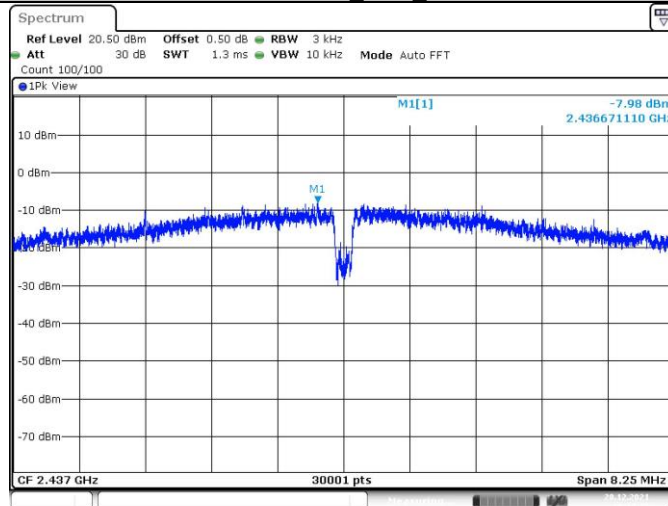
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11AX20SISO Ant1 2412



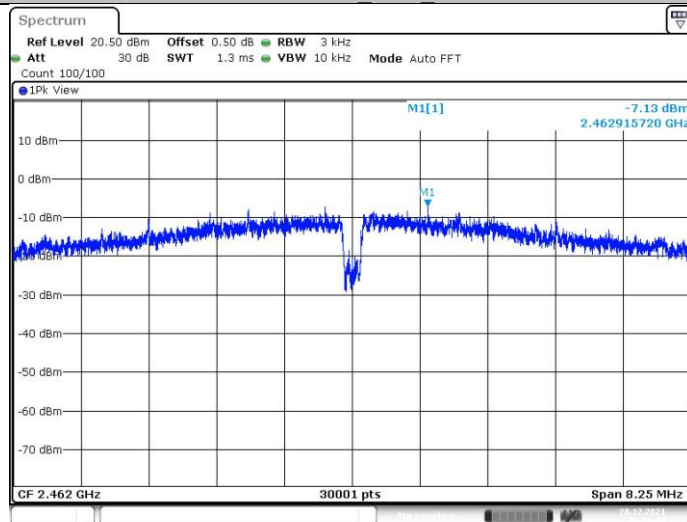
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Date: 28 DEC 2021 10:14:20

11AX20SISO Ant1 2462



Date: 28 DEC 2021 10:16:03