

FCC/IC - TEST REPORT

Report Number : **709502204656-00A** Date of Issue: October 9, 2022Model : HEWRQU1, 0011800292X, KZW-W008Product Type : Wi-Fi 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 : 67

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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

Description of the Equipment Under Test

Product: Wi-Fi Module

PMN / HVIN / Model no.: HEWRQU1

FCC ID: 2ANDL-HEWRQU1

IC: 23243-HEWRQU1

Rating: DC 4.5-5.5V

RF Transmission Frequency: For 802.11b/g/n-HT20: 2412~2462 MHz
For 802.11n(HT40): 2422~2452 MHz

No. of Operated Channel: 2.4GHz WIFI: 11 for 802.11b/802.11g/802.11(H20)
7 for 802.11n(HT40)

Modulation: For 2.4GHz WIFI:
Direct Sequence Spread Spectrum (DSSS) for 802.11b
Orthogonal Frequency Division Multiplexing (OFDM) for 802.11g/n

Channel list:

802.11b/g/n(HT20)					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						

Antenna Type: PCB antenna

Antenna Gain: 2.0dBi

Description of the EUT: The Equipment Under Test (EUT) is a Wi-Fi Module which support 2.4G Wi-Fi. There are three models in all, only difference is the model name. We chose model HEWRQU1 to perform all tests it and listed the worst data in this report.

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 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
RSS-Gen Issue 5 Amendment 2 February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2 February 2017	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 and ANSI C63.10 (2013).

5 Summary of Test Results

Technical Requirements						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207 & RSS-GEN 8.8	Conducted emission AC power port	12-16	Site 1	☒	☐	☐
§15.247 (b) (1) & RSS-247 5.4(d)	Conducted peak output power and e.i.r.p.	17	Site 1	☒	☐	☐
§15.247(a)(1) & RSS-247 5.1(b)	20dB bandwidth	---	---	☐	☐	☒
§15.247(a)(1) & RSS-247 5.1(b)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii) & RSS-247 5.1(d)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii) & RSS-247 5.1(d)	Dwell Time	---	---	☐	☐	☒
§15.247(a)(2) & RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	18-26	Site 1	☒	☐	☐
§15.247(e) & RSS-247 5.2(b)	Power spectral density	27-31	Site 1	☒	☐	☐
§15.247(d) & RSS-247 5.5	Spurious RF conducted emissions	32-44	Site 1	☒	☐	☐
§15.247(d) & RSS-247 5.5	Band edge	45-53	Site 1	☒	☐	☐
§15.247(d) & §15.209 & RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	54-63	Site 1	☒	☐	☐
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses PCB antenna, which gain is 2.0dBi. In accordance to §15.203 and RSS-Gen 6.8, 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-HEWRQU1, IC: 23243-HEWRQU1 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-247, 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: September 27, 2022

Testing Start Date: September 28, 2022

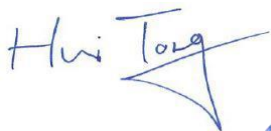
Testing End Date: October 8, 2022

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

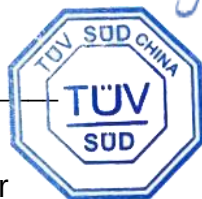
Reviewed by:

Prepared by:

Tested by:



Hui TONG
Review Engineer



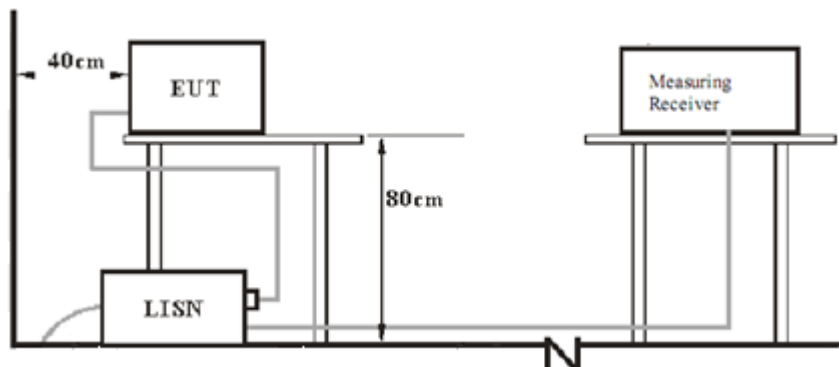
Jiaxi XU
Project Engineer



Cheng Huali
Test Engineer

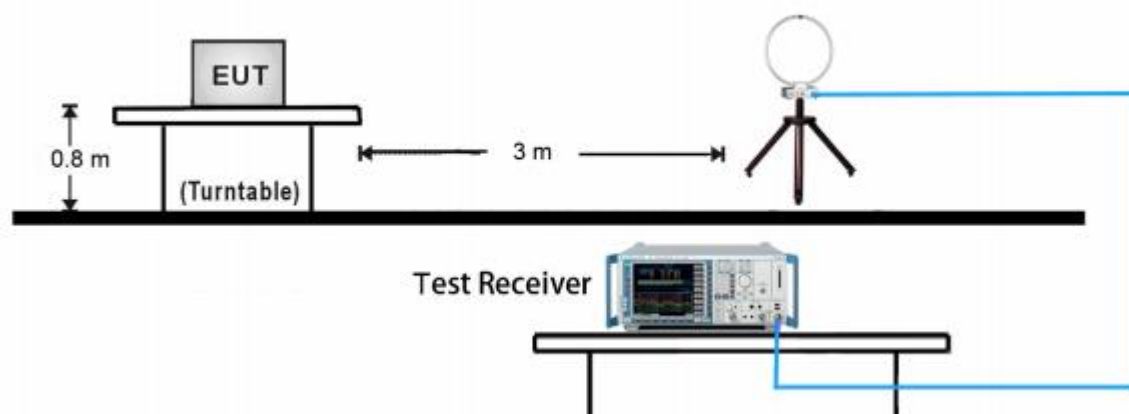
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

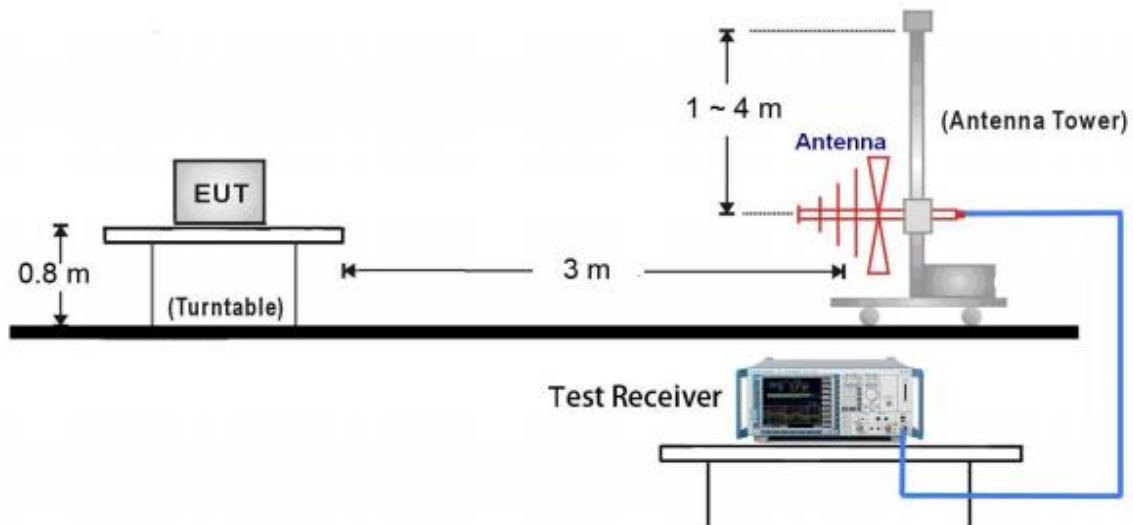


7.2 Radiated test setups

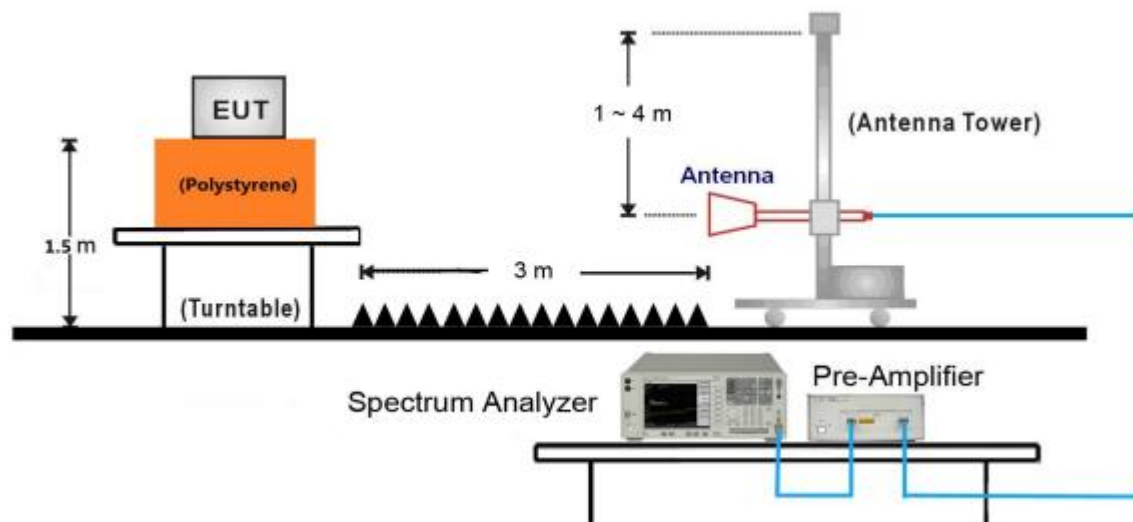
9kHz ~ 30MHz Test Setup:



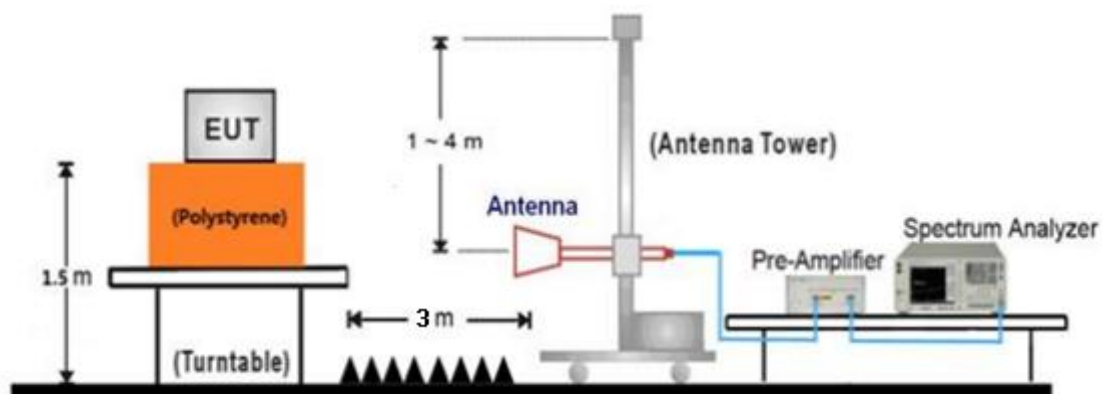
30MHz ~ 1GHz Test Setup:



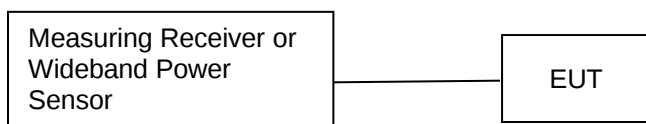
1GHz ~ 18GHz Test Setup:



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	Lenove	E470	PF-OU5TS7 17/09

Test software: mptool 1v16

The system was configured to channel 1(2412MHz), 6(2437MHz), and 11(2462MHz) for 802.11 b/g/n HT20 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

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

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

150k-30MHz Conducted Emission Test

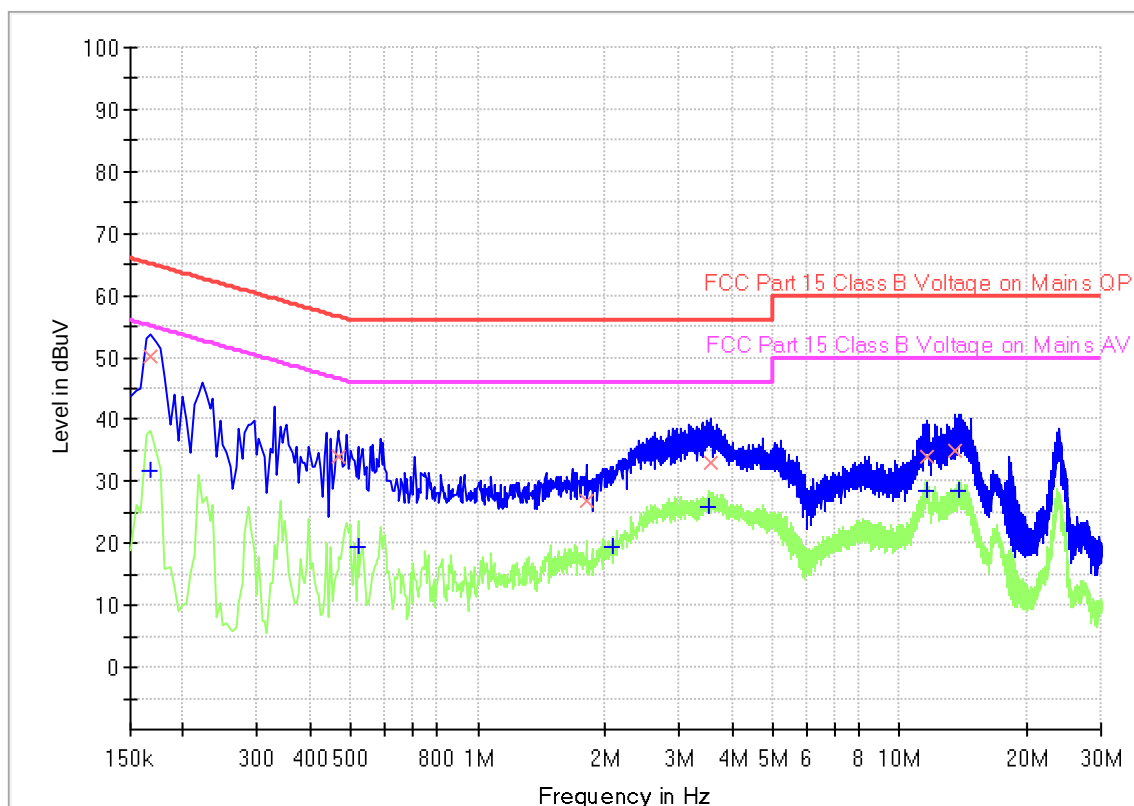
EUT Information

EUT Name: Wi-Fi Module
Model: HEWRQU1
Client: Hangzhou Tuya Information Technology Co.,Ltd
Op Cond: Power on, TX_2412MHz for g mode, AC 120V/60Hz, T21.3, H56.3%,
Operator: Cheng Huali
Standard: FCC Part 15B Class B
Comment: Phase L
Sample No.: SHA-680435-1

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN
Receiver: [ESR 3]
Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.168000	---	31.69	55.06	23.37	1000.0	9.000	L1	19.5
0.168000	50.30	---	65.06	14.76	1000.0	9.000	L1	19.5
0.465000	34.08	---	56.60	22.52	1000.0	9.000	L1	19.5
0.519000	---	19.39	46.00	26.61	1000.0	9.000	L1	19.5
1.806000	26.84	---	56.00	29.16	1000.0	9.000	L1	19.5
2.089500	---	19.43	46.00	26.57	1000.0	9.000	L1	19.5
3.538500	---	25.78	46.00	20.22	1000.0	9.000	L1	19.6
3.561000	33.08	---	56.00	22.92	1000.0	9.000	L1	19.6
11.580000	---	28.49	50.00	21.51	1000.0	9.000	L1	19.7
11.620500	33.93	---	60.00	26.07	1000.0	9.000	L1	19.7
13.546500	35.11	---	60.00	24.89	1000.0	9.000	L1	19.7
13.879500	---	28.41	50.00	21.59	1000.0	9.000	L1	19.7

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

150k-30MHz Conducted Emission Test

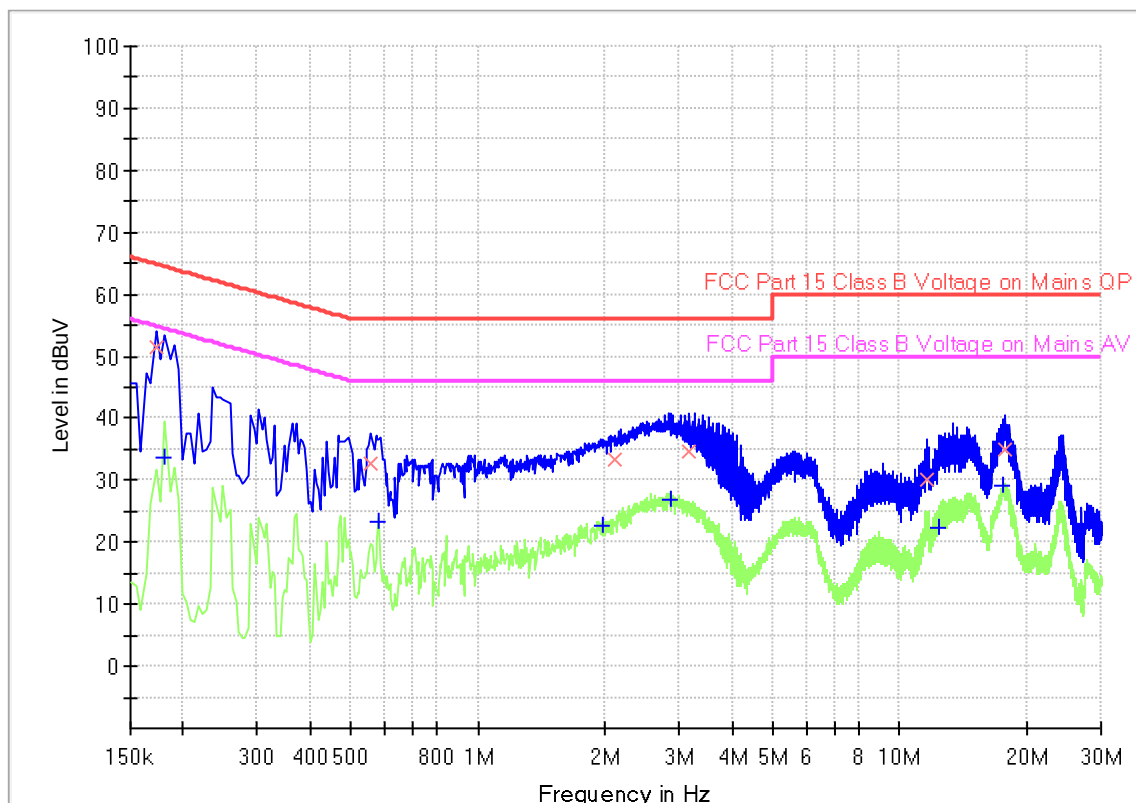
EUT Information

EUT Name:	Wi-Fi Module
Model	HEWRQU1
Client:	Hangzhou Tuya Information Technology Co.,Ltd
Op Cond	Power on, TX_2412MHz for g mode, AC 120V/60Hz, T21.3, H56.3%,
Operator:	Cheng Huali
Standard	FCC Part 15B Class B
Comment:	Phase N
Sample No.:	SHA-680435-1

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.172500	51.50	---	64.84	13.34	1000.0	9.000	N	19.5
0.181500	---	33.55	54.42	20.87	1000.0	9.000	N	19.5
0.555000	32.71	---	56.00	23.29	1000.0	9.000	N	19.5
0.582000	---	23.36	46.00	22.64	1000.0	9.000	N	19.5
1.977000	---	22.66	46.00	23.34	1000.0	9.000	N	19.5
2.121000	33.25	---	56.00	22.75	1000.0	9.000	N	19.5
2.868000	---	26.74	46.00	19.26	1000.0	9.000	N	19.5
3.174000	34.63	---	56.00	21.37	1000.0	9.000	N	19.5
11.584500	30.20	---	60.00	29.80	1000.0	9.000	N	19.7
12.403500	---	22.32	50.00	27.68	1000.0	9.000	N	19.7
17.538000	---	29.15	50.00	20.85	1000.0	9.000	N	19.8
17.731500	34.96	---	60.00	25.04	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 and e.i.r.p.

Test Method

1. Use the following spectrum analyzer settings:
RBW > the 6 dB bandwidth of the emission being measured, VBW≥3RBW, Span≥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

According to §15.247 (b) (1) & RSS-247 5.4(d), conducted peak output power limit as below:

	Frequency Range	Limit	Limit
	MHz	W	dBm
Conducted peak output power	2400-2483.5	≤1	≤30
e.i.r.p.	2400-2483.5	≤4	≤36

Test result as below table

802.11b: Antenna gain=2.0dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (1)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	16.35	≤30	Pass	18.35	≤36	Pass
2437MHz	15.96	≤30	Pass	17.96	≤36	Pass
2462MHz	15.95	≤30	Pass	17.95	≤36	Pass

802.11g: Antenna gain=2.0dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (1)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	23.34	≤30	Pass	25.34	≤36	Pass
2437MHz	23.08	≤30	Pass	25.08	≤36	Pass
2462MHz	22.90	≤30	Pass	24.90	≤36	Pass

802.11n(HT20): Antenna gain=2.0dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (1)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2412MHz	21.79	≤30	Pass	23.79	≤36	Pass
2437MHz	21.63	≤30	Pass	23.63	≤36	Pass
2462MHz	21.57	≤30	Pass	23.57	≤36	Pass

802.11n(HT40): Antenna gain=2.0dBi						
Frequency (MHz)	Conducted Peak Output Power (dBm) §15.247 (b) (1)			e.i.r.p. (dBm) RSS-247 5.4(d)		
	Result	limit	Verdict	Result	limit	Verdict
2422MHz	21.94	≤30	Pass	23.94	≤36	Pass
2437MHz	21.80	≤30	Pass	23.80	≤36	Pass
2452MHz	21.79	≤30	Pass	23.79	≤36	Pass

9.3 6dB bandwidth and 99% Occupied 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 Method for 99 % Bandwidth

1. Use the following spectrum analyzer settings:
RBW=1% to 5% of the actual occupied, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, 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

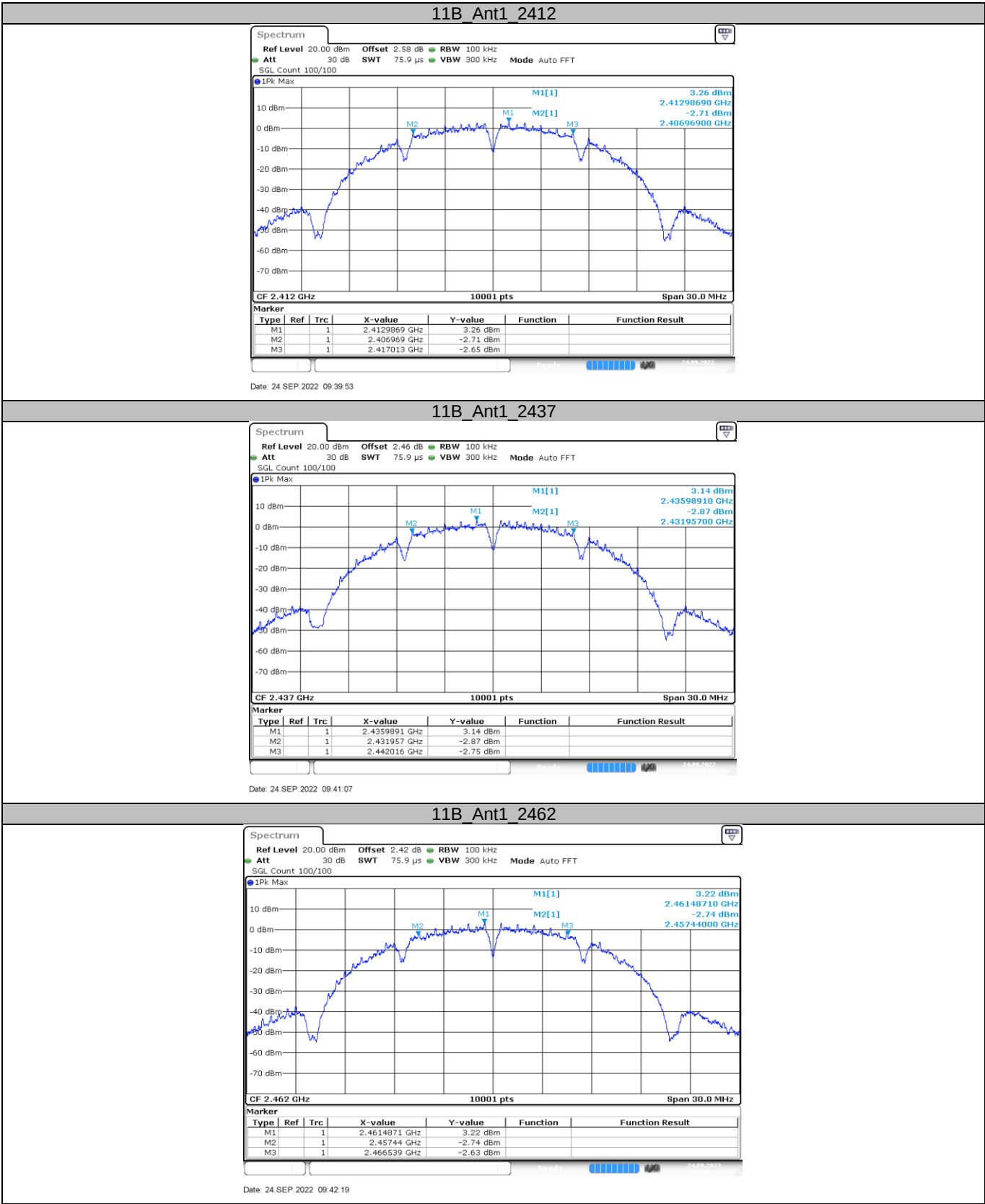
Limit [kHz]

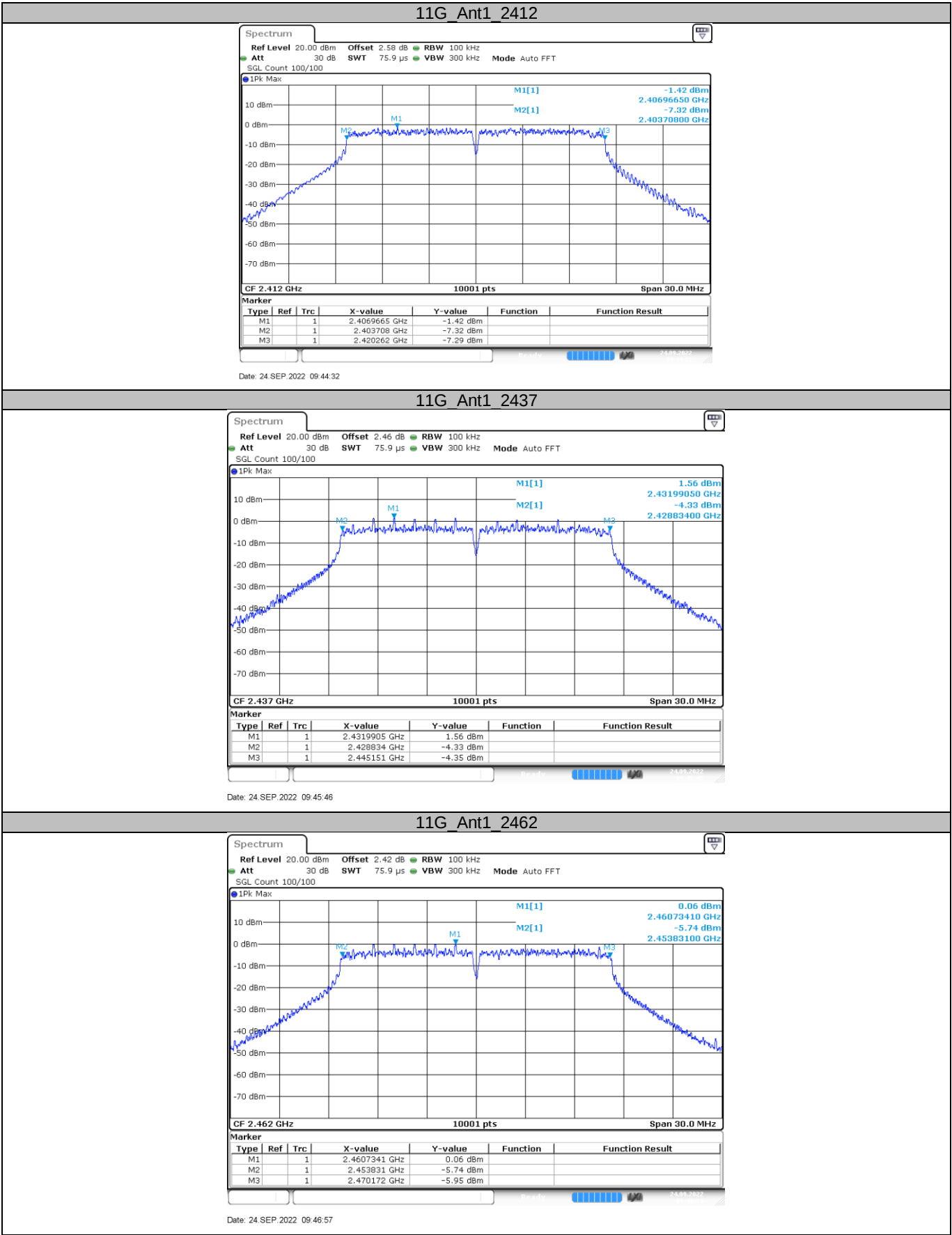
N/A

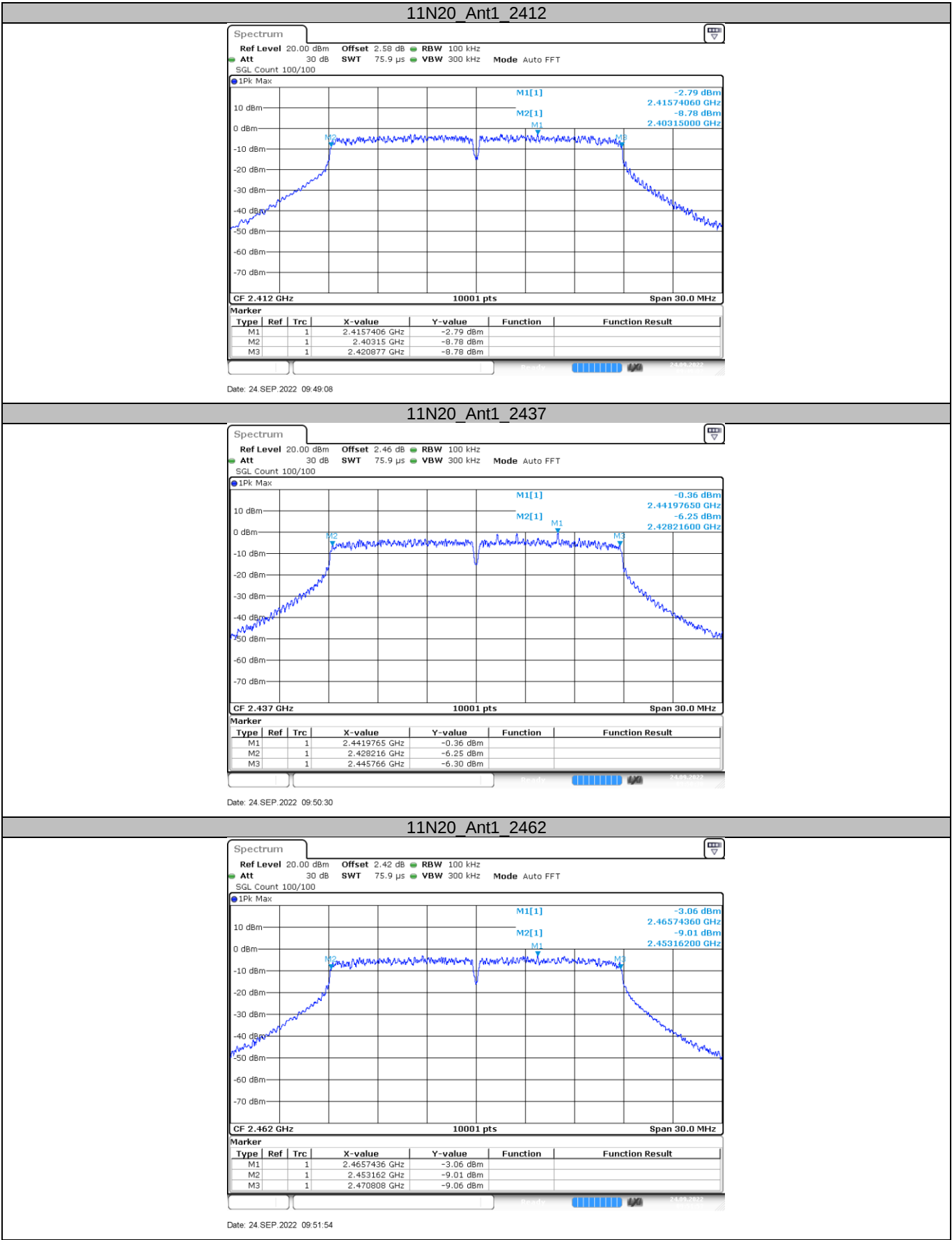
Test result

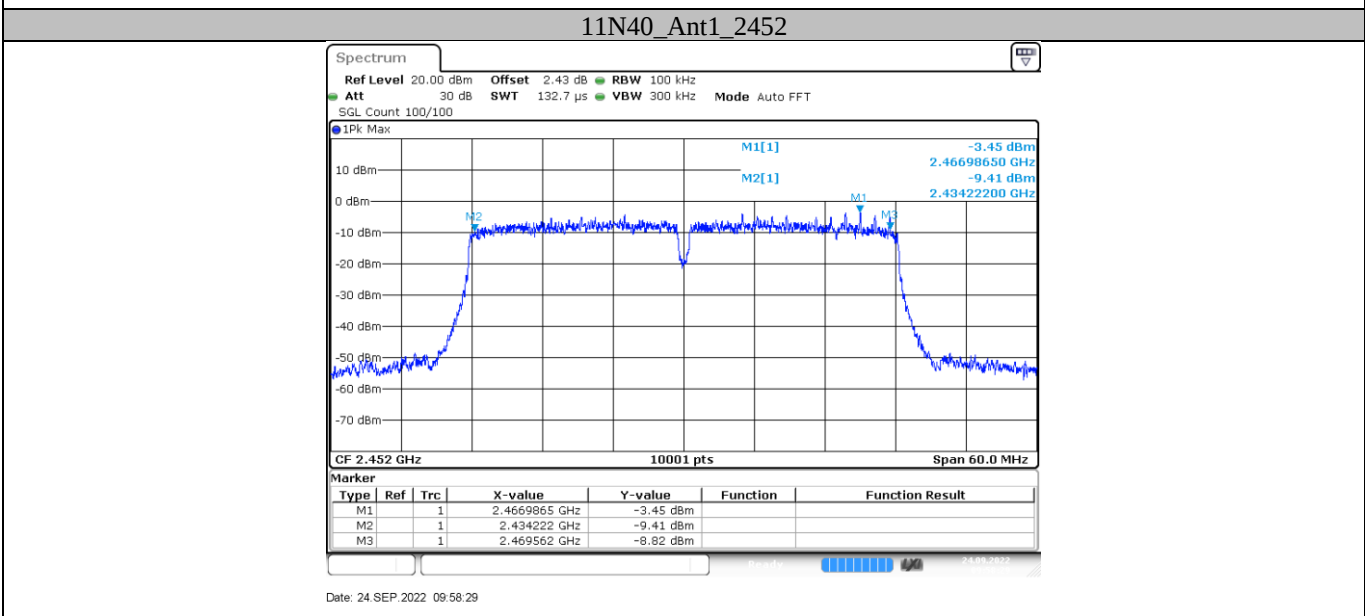
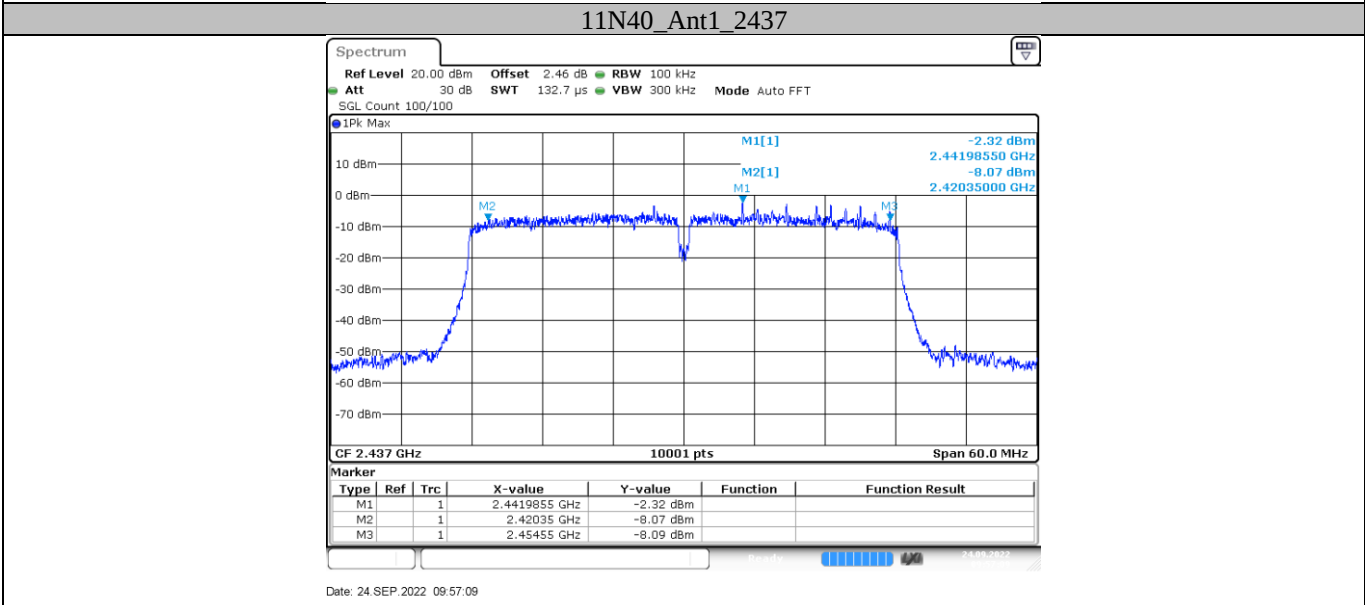
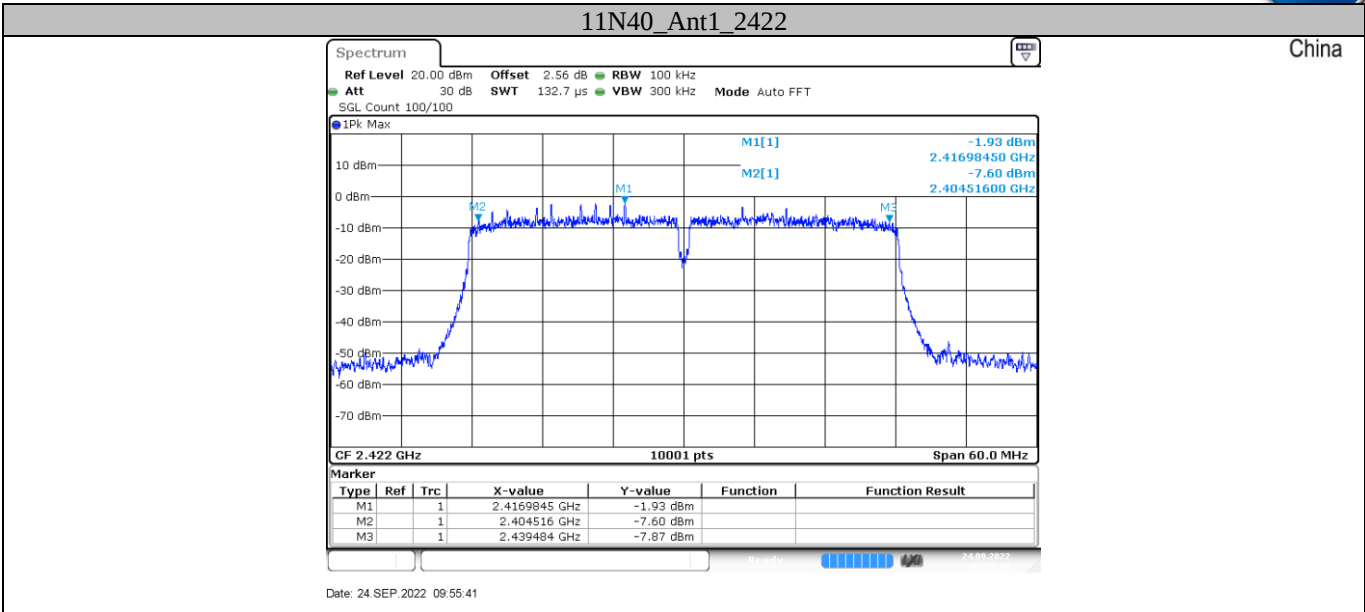
Test Mode	Frequency MHz	6dB bandwidth (MHz)		Result	99% occupied bandwidth MHz
		result	limit	verdict	
802.11b	2412	10.044	≥ 0.5	Pass	14.696
	2437	10.059	≥ 0.5	Pass	14.687
	2462	9.099	≥ 0.5	Pass	14.711
802.11g	2412	16.554	≥ 0.5	Pass	16.585
	2437	16.317	≥ 0.5	Pass	16.600
	2462	16.341	≥ 0.5	Pass	16.678
802.11n(HT20)	2412	17.727	≥ 0.5	Pass	17.776
	2437	17.550	≥ 0.5	Pass	17.731
	2462	17.646	≥ 0.5	Pass	17.677
802.11n(HT40)	2422	34.968	≥ 0.5	Pass	35.738
	2437	34.200	≥ 0.5	Pass	35.702
	2452	35.340	≥ 0.5	Pass	35.756

6 dB Bandwidth

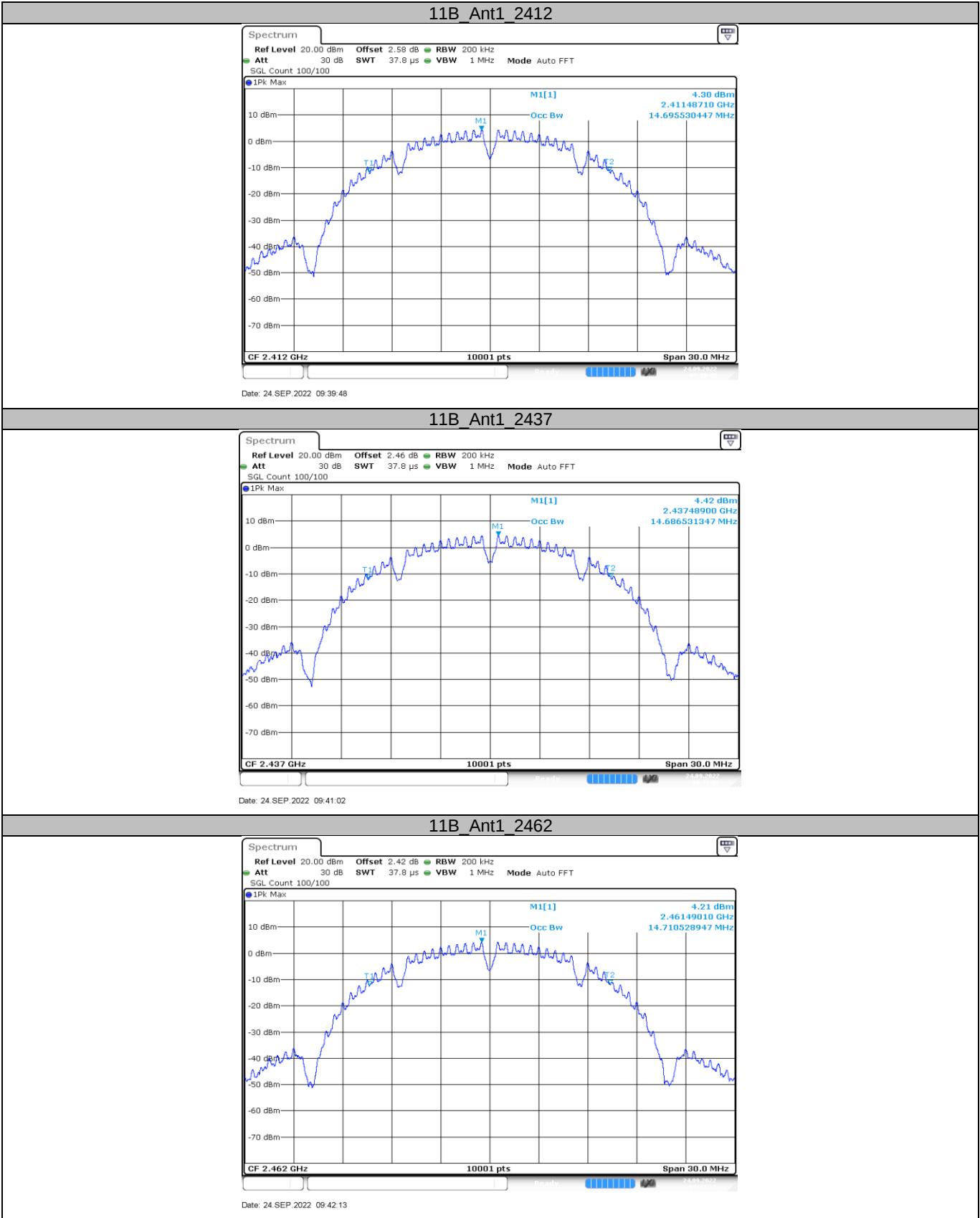


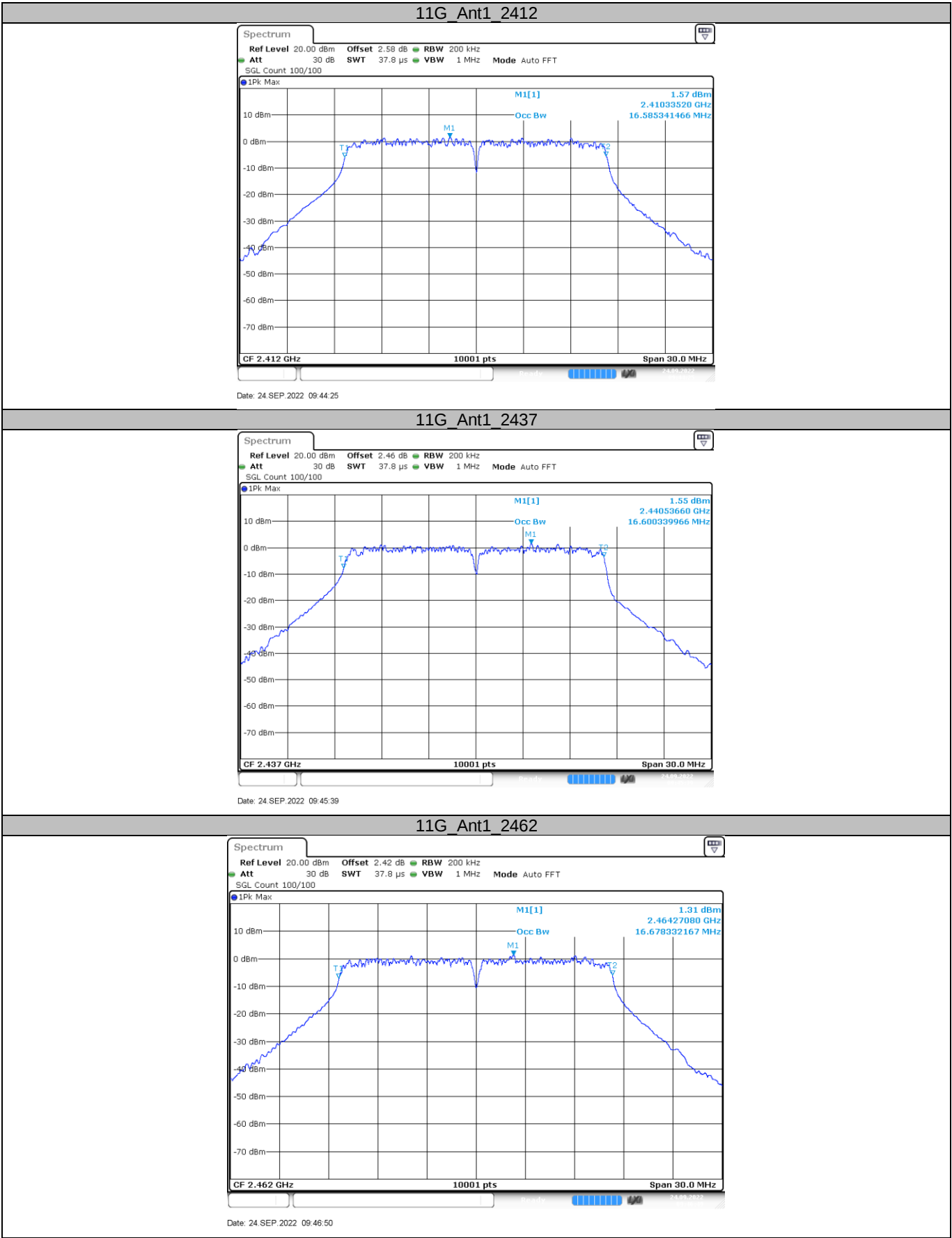




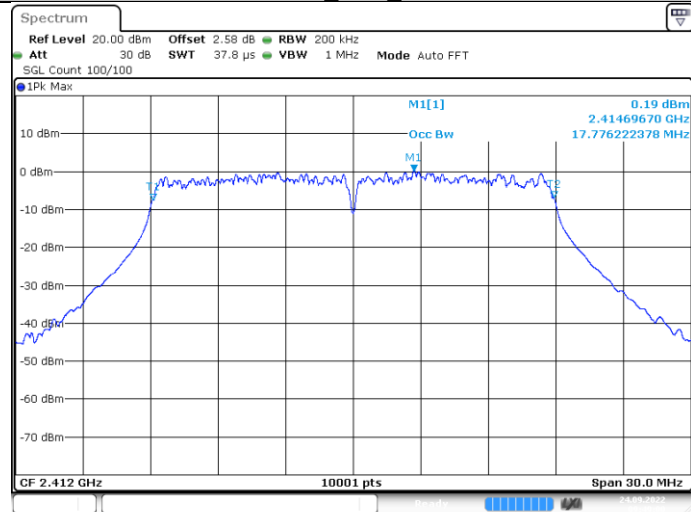


99% Bandwidth



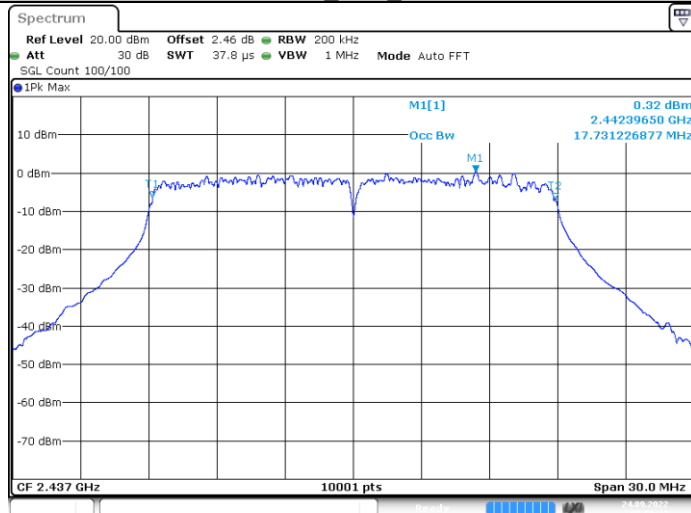


11N20_Ant1_2412



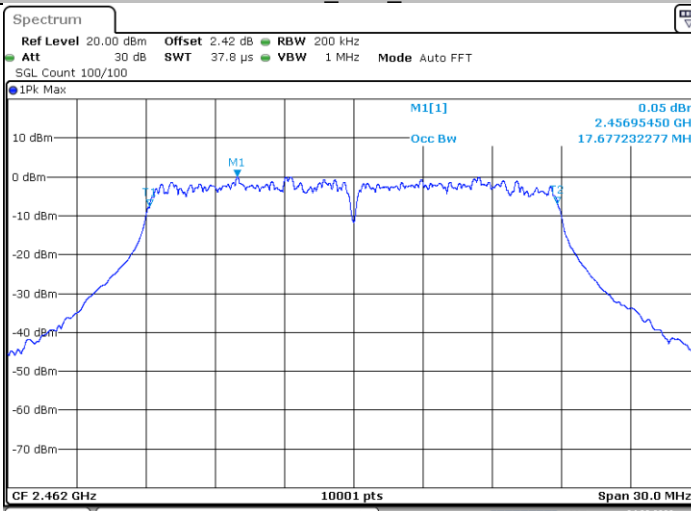
Date: 24 SEP. 2022 09:49:00

11N20_Ant1_2437



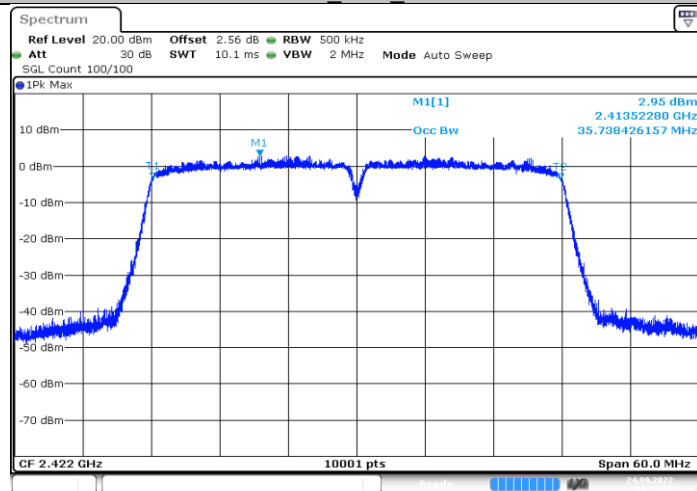
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11N20_Ant1_2462



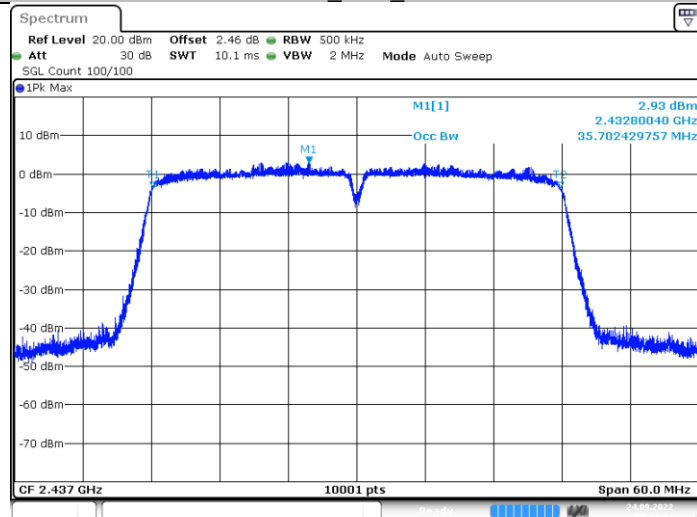
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11N40_Ant1_2422



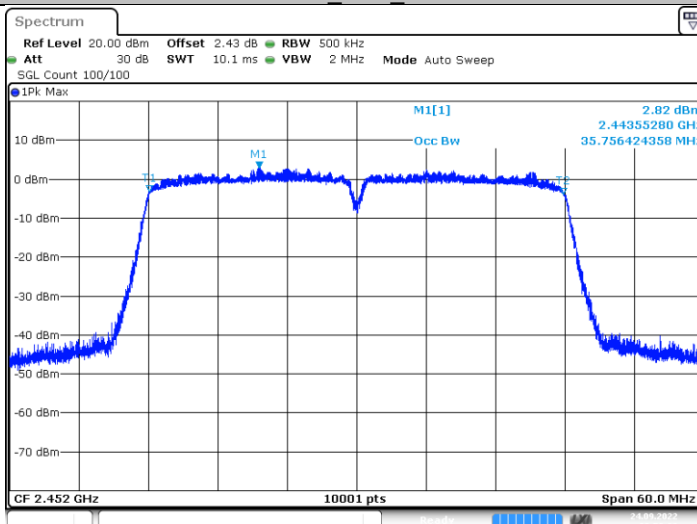
Date: 24.SEP.2022 09:55:35

11N40_Ant1_2437



Date: 24.SEP.2022 09:57:03

11N40_Ant1_2452



Date: 24.SEP.2022 09:58:22

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 $\geq$ 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]

≤ 8

Test result

802.11 b

Frequency MHz	Power spectral density dBm/3kHz	Result
Low channel 2412MHz	-0.80	Pass
Middle channel 2437MHz	-11.00	Pass
High channel 2462MHz	-1.25	Pass

802.11 g

Frequency MHz	Power spectral density dBm	Result
Low channel 2412MHz	-13.41	Pass
Middle channel 2437MHz	-13.31	Pass
High channel 2462MHz	-14.59	Pass

802.11 n (HT20)

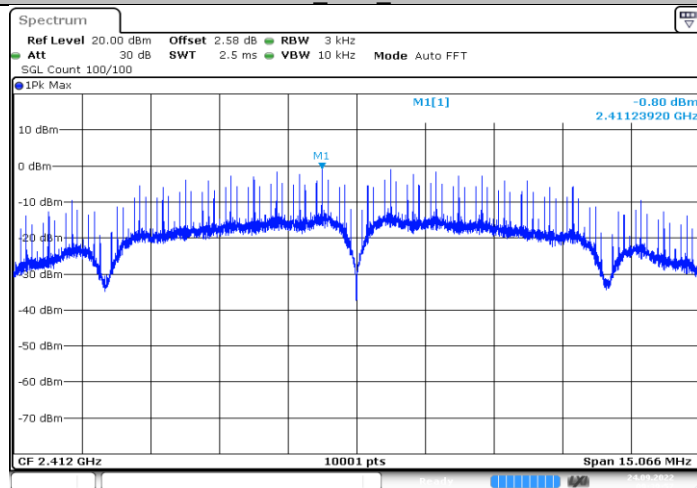
Frequency MHz	Power spectral density dBm	Result
Low channel 2412MHz	-14.92	Pass
Middle channel 2437MHz	-15.20	Pass
High channel 2462MHz	-15.64	Pass

802.11 n (HT40)

Frequency MHz	Power spectral density dBm	Result
Low channel 2422MHz	-18.06	Pass
Middle channel 2437MHz	-18.24	Pass
High channel 2452MHz	-18.45	Pass

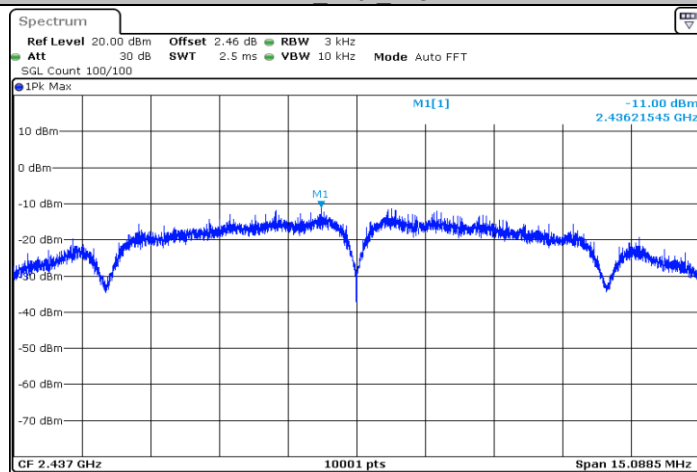
Power spectral density

11B Ant1 2412



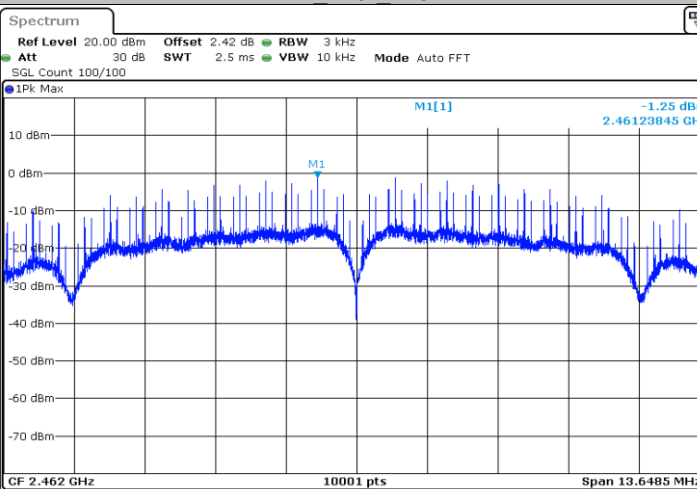
Date: 24 SEP. 2022 09:39:58

11B Ant1 2437

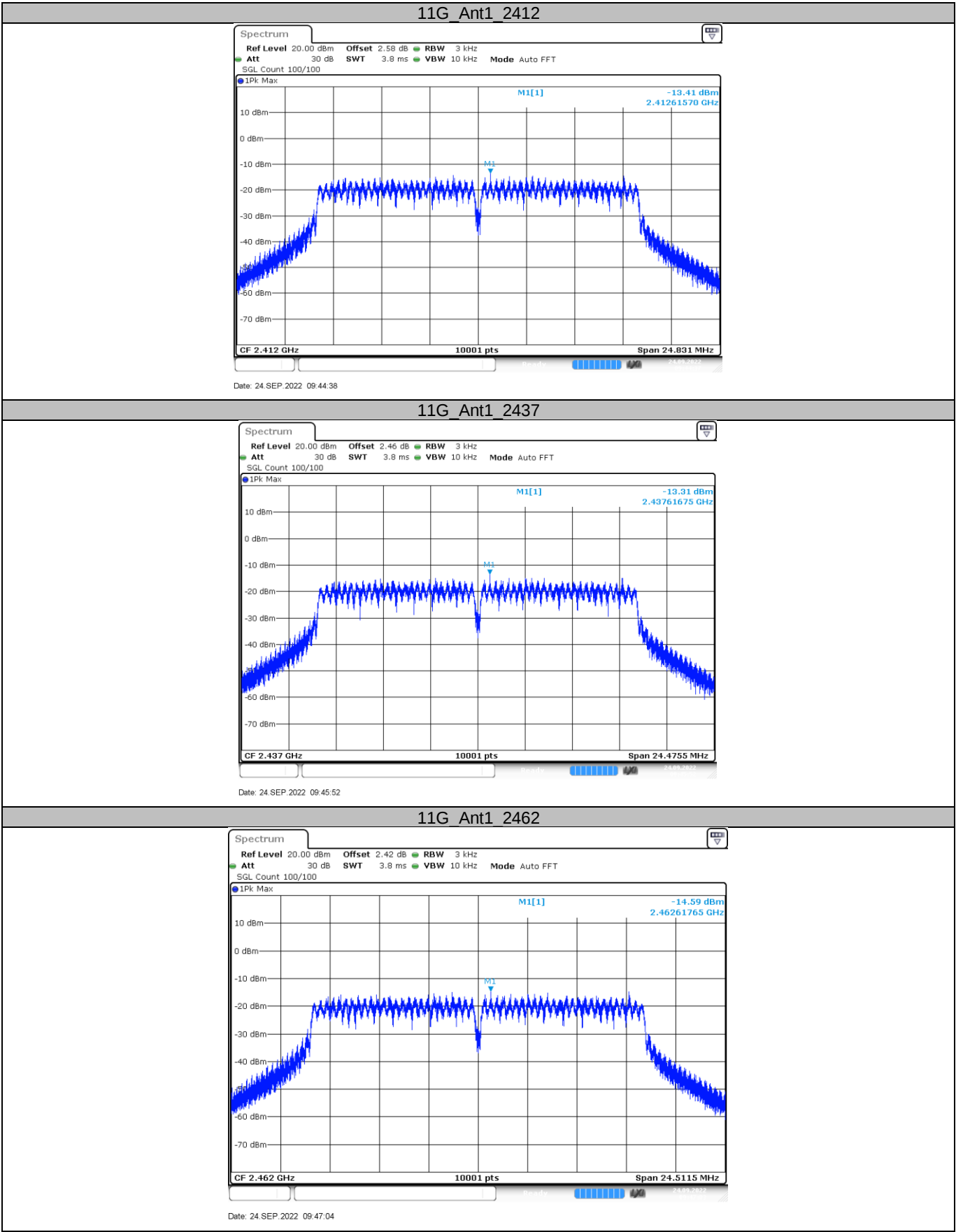


Date: 24 SEP. 2022 09:41:12

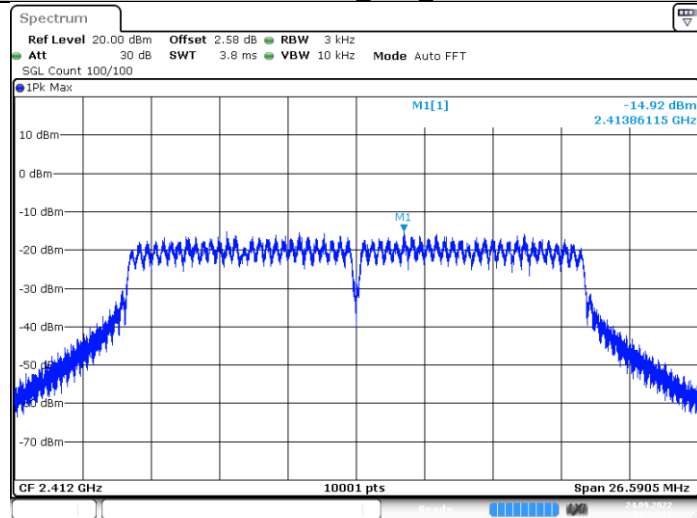
11B Ant1 2462



Date: 24 SEP. 2022 09:42:24

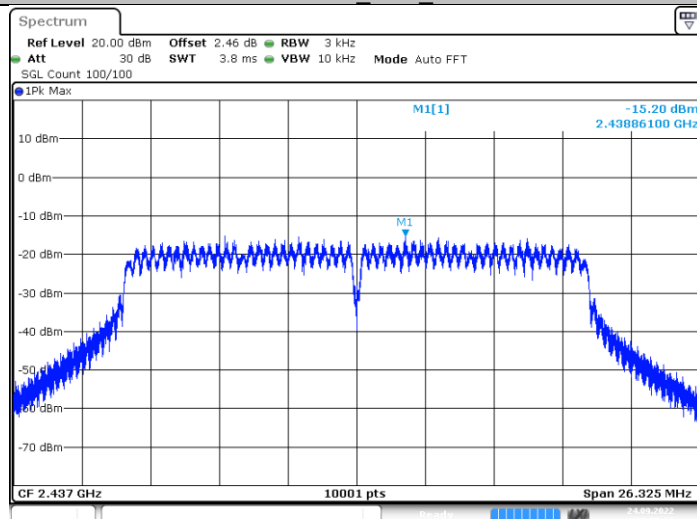


11N20SISO_Ant1_2412



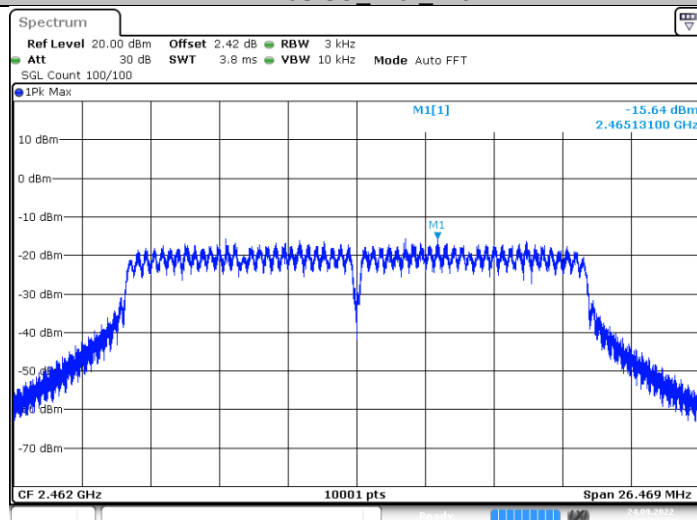
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11N20SISO_Ant1_2437



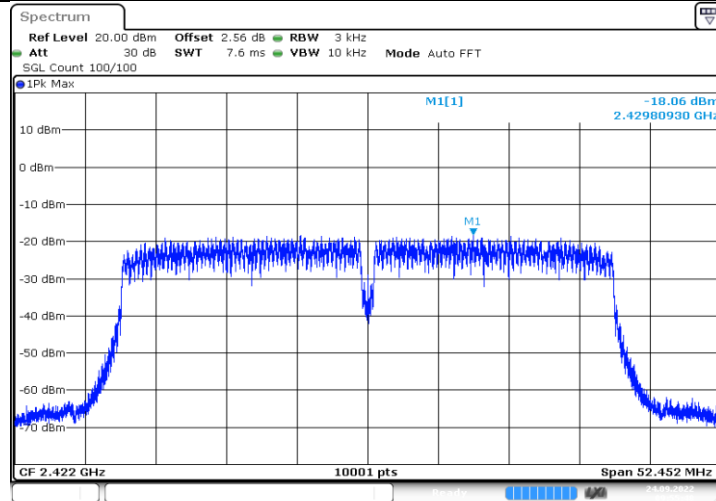
Date: 24.SEP.2022 09:50:38

11N20SISO_Ant1_2462



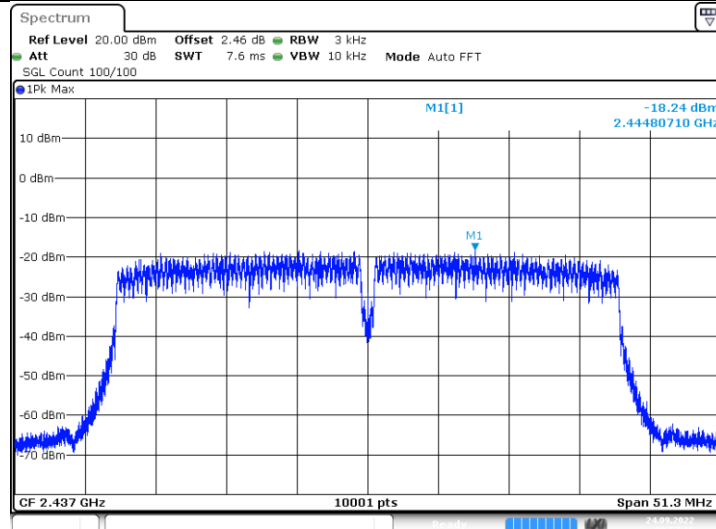
Date: 24.SEP.2022 09:52:02

11N40SISO_Ant1_2422



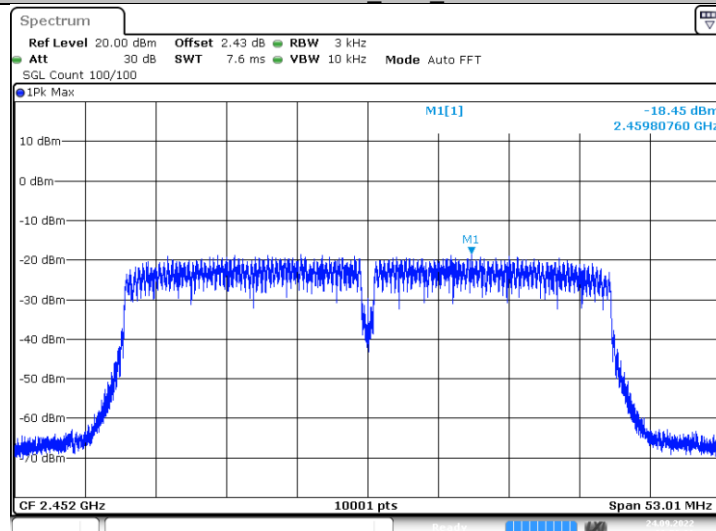
Date: 24 SEP. 2022 09:55:48

11N40SISO_Ant1_2437



Date: 24 SEP. 2022 09:57:16

11N40SISO_Ant1_2452



Date: 24 SEP. 2022 09:58:36