

FCC/ISED - TEST REPORT

Report Number : **68.760.23.0753.01** Date of Issue: 2023-10-23

Model/HVIN : **H8249-1.**

Product Type : IP Touch Lite 7

Applicant : ABB Xiamen Smart Technology Co., Ltd.

Address : 4th Floor, No. 881, FangShanXiEr Road, Xiang'An Industrial Area,
Torch Hi-Tech Industrial Development Zone, 361000 Xiamen S.E.Z,
Fujian Province, PEOPLE'S REPUBLIC OF CHINA

Manufacturer : ABB Xiamen Smart Technology Co., Ltd.

Address : 4th Floor, No. 881, FangShanXiEr Road, Xiang'An Industrial Area,
Torch Hi-Tech Industrial Development Zone, 361000 Xiamen S.E.Z,
Fujian Province, PEOPLE'S REPUBLIC OF CHINA

Test Result : **Positive** **Negative**

Total pages including Appendices : **57**

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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:	IP Touch Lite 7
Model no.:	H8249-1.
Product Marketing Name (PMN):	IP Touch Lite 7
Hardware Version Identification No. (HVIN):	H8249-1.
FCC ID:	2AEBL-H8249
IC:	20060-H8249
Options and accessories:	NIL
Ratings:	20-27VDC, 9W
RF Transmission Frequency:	2412MHz - 2462MHz for 2.4GHz Wi-Fi; 5180MHz – 5320MHz, 5500MHz – 5700MHz, 5745MHz – 5825MHz for 5GHz Wi-Fi (This device shall not be capable of transmitting in the band 5600-5650 MHz. This restriction is for the protection of Terminal Doppler Weather Radar (TDWR) operating in this band.)
No. of Operated Channel:	11 for 2.4GHz Wi-Fi; 43 for 5GHz Wi-Fi
Modulation:	802.11b: BPSK, QPSK, CCK, 802.11g: BPSK, QPSK, 16-QAM, 64-QAM 802.11a: BPSK, QPSK, 16-QAM, 64-QAM 802.11n: BPSK, QPSK, 16-QAM, 64-QAM 802.11ac: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
Antenna Type:	Integrated FPC antenna
Antenna Gain:	4.5 dBi for 2.4GHz Wi-Fi 5.3 dBi for 5GHz Wi-Fi
Description of the EUT:	The EUT is an IP Touch Lite 7 supports Wi-Fi functions, 2412MHz - 2462MHz for 2.4GHz Wi-Fi, 5180MHz – 5320MHz, 5500MHz – 5700MHz, 5745MHz – 5825MHz for 5GHz 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.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 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 C63.10-2020.

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	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	--
§15.247 (b) (3) & RSS-247 5.4(d)	Conducted peak output power	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	T: 23.2°C H: 51.5%
RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	T: 23.2°C H: 51.5%
§15.247(a)(2) & RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	T: 23.2°C H: 51.5%
§15.247(e) & RSS-247 5.2(b)	Power spectral density	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	T: 23.2°C H: 51.5%
§15.247(d) & RSS-247 5.5	Spurious RF conducted emissions	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	T: 23.2°C H: 51.5%
§15.247(d) & RSS-247 5.5	Band edge	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	T: 23.2°C 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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	T: 24.7°C H: 49.3%
§15.203 & RSS-Gen 6.8	Antenna requirement	See note 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	--

Note 1: N/A=Not Applicable.

Note 2: The EUT uses an Integrated FPC antenna, which gains are 4.5 dBi for 2.4GHz WIFI and 5.3dBi for 5GHz WIFI. In accordance with §15.203 and RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

EUT supports Wi-Fi functions: 2412MHz - 2462MHz for 2.4GHz Wi-Fi; 5180 - 5320 MHz, 5500 - 5700 MHz and 5745-5825 MHz for 5GHz Wi-Fi.

This submittal(s) (test report) is intended for FCC ID: 2AEBL-H8249, 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: 20060-H8249, complies with RSS-247 and RSS-Gen.

This report is only for 2.4GHz Wi-Fi.

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: 2023-08-11

Testing Start Date: 2023-08-14

Testing End Date: 2023-09-09

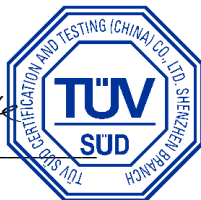
- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Prepared by:

Tested by:

Jessie He
Project Manager



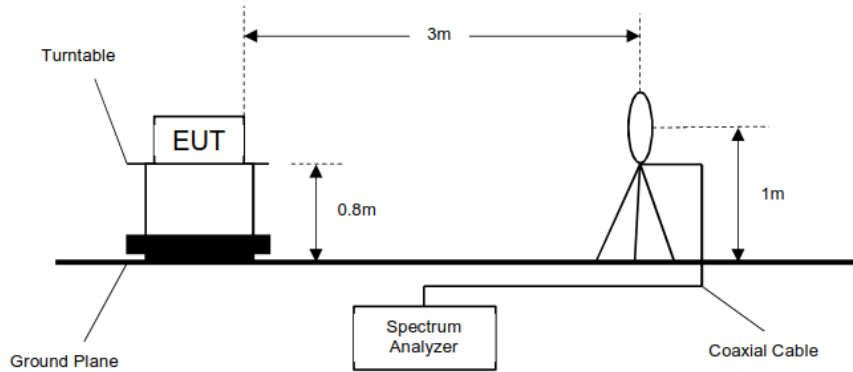
Myron Yu
Project Engineer

Carry Cai
Test Engineer

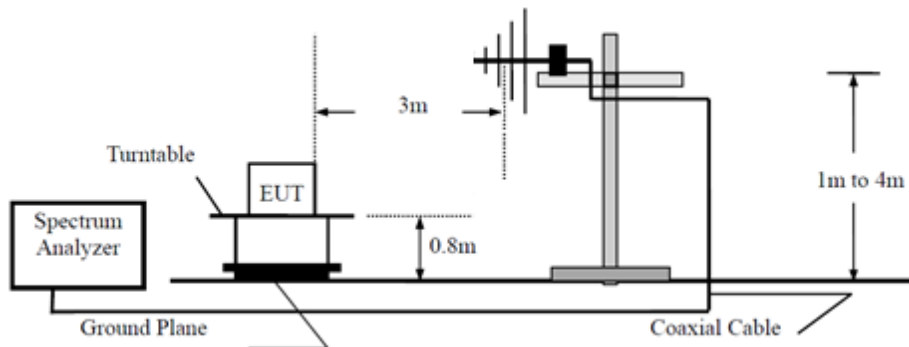
7 Test Setups

7.1 Radiated test setups

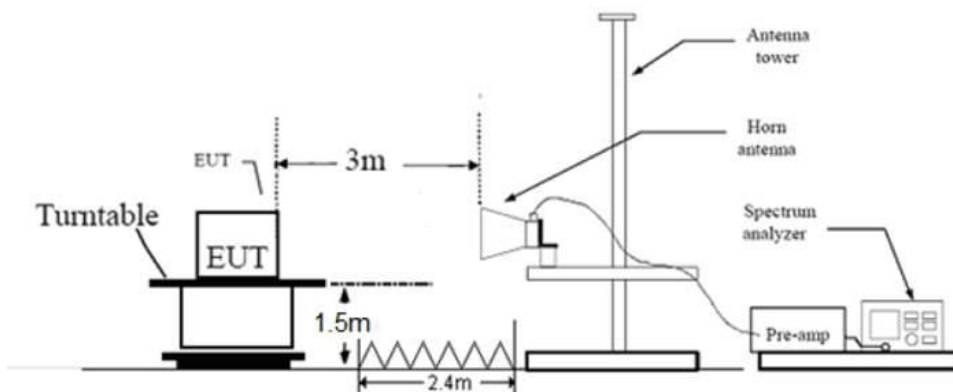
9kHz - 30MHz



Below 1GHz



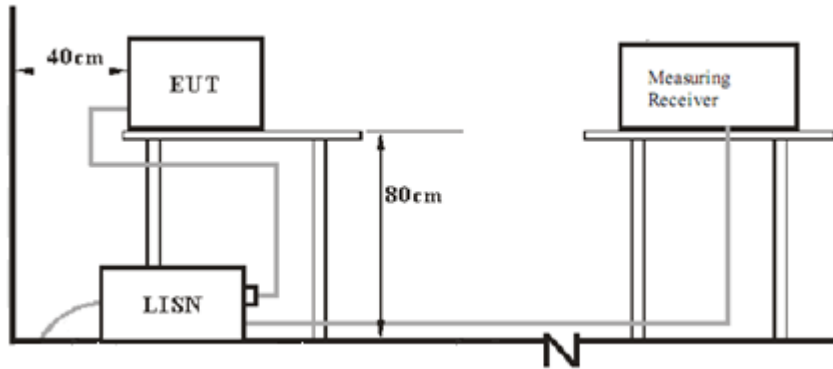
Above 1GHz



7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MODEL NO.(SHIELD)	MANUFACTURER	
Auxiliary Power supply	YSM01	ABB	---
ABB Welcome IP (Outdoor unit)	H81381T-S	ABB	---
PoE switch	TL-SG1210DP	TP-LINK	1225175003885

Test Software Information:

Test Software Version	PuTTY release 0.78	
Mode	Setting TX Power	Data Rate
802.11b	12	11b 1 Mbps
802.11g	13	11g 6 Mbps
802.11n HT20	13	MCS0 6.5 Mbps

The system was configured to channel 1, 6, and 11 for the test.

802.11b/802.11g/802.11n-HT20:

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

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

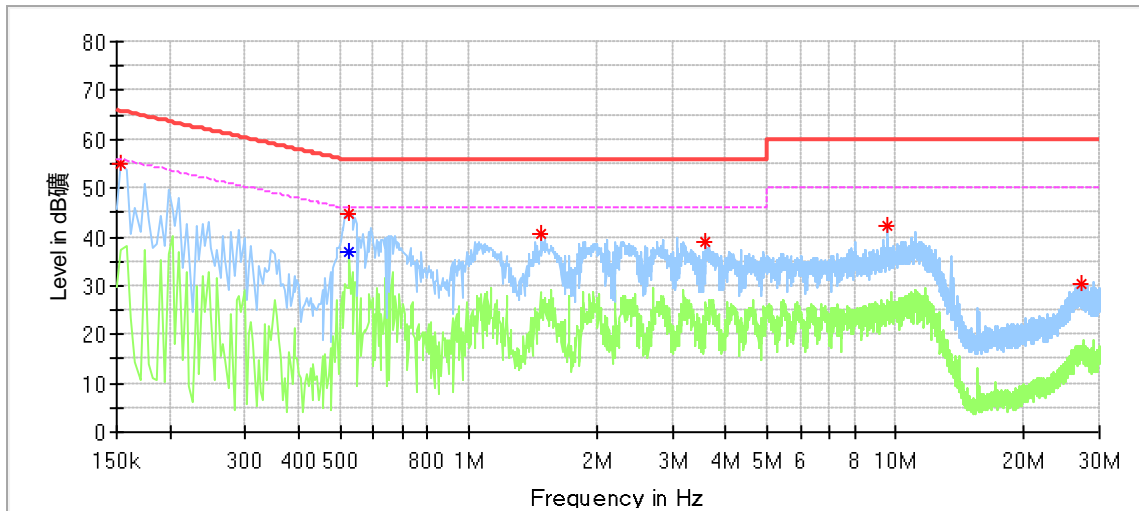
According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequency MHz	QP Limit 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

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

Conducted Emission

Product Type : IP Touch Lite 7
 M/N : H8249-1W
 Operating Condition : WIFI communication mode
 Test Specification : L
 Comment : AC 120V/60Hz

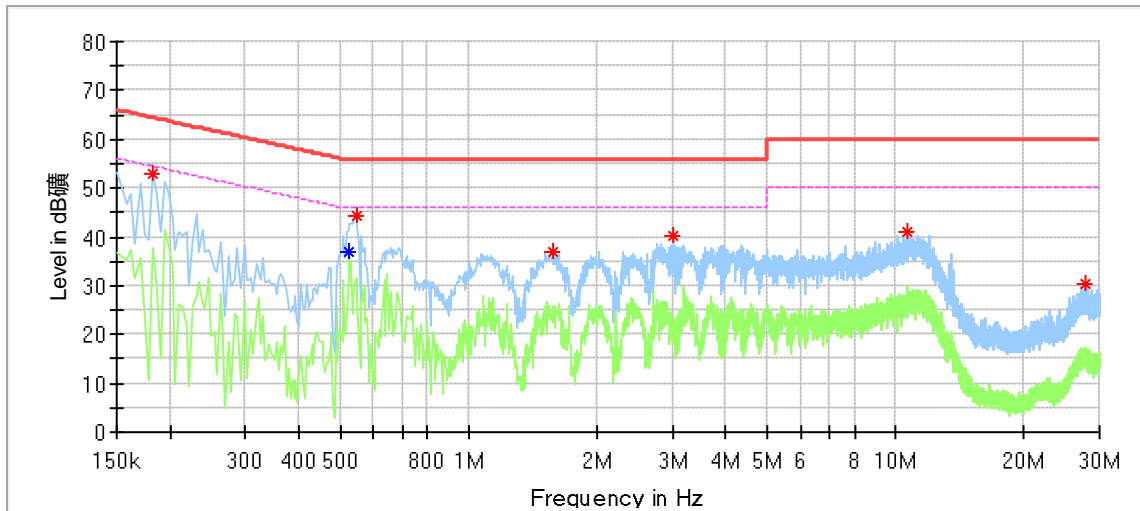


Critical Freqs

Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)
0.154000	54.91	---	65.78	10.87	L1	9.52
0.526000	44.84	---	56.00	11.16	L1	9.59
0.526000	---	37.07	46.00	8.93	L1	9.59
1.474000	40.49	---	56.00	15.51	L1	9.61
3.598000	38.96	---	56.00	17.04	L1	9.68
9.534000	42.05	---	60.00	17.95	L1	9.94
27.282000	30.27	---	60.00	29.73	L1	10.03

Conducted Emission

Product Type : IP Touch Lite 7
 M/N : H8249-1W
 Operating Condition : WIFI communication mode
 Test Specification : N
 Comment : AC 120V/60Hz



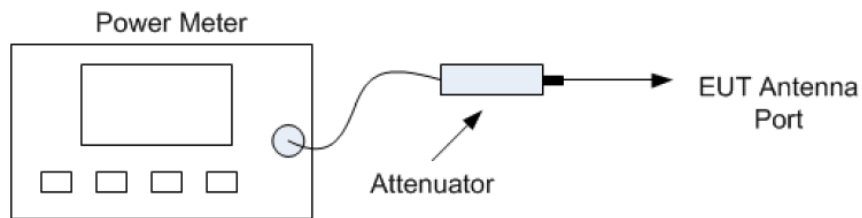
Critical Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.182000	52.93	---	64.39	11.47	N	9.57
0.526000	---	36.83	46.00	9.17	N	9.62
0.546000	44.45	---	56.00	11.55	N	9.62
1.578000	36.74	---	56.00	19.26	N	9.64
3.006000	40.05	---	56.00	15.95	N	9.68
10.642000	41.20	---	60.00	18.80	N	9.97
27.798000	30.51	---	60.00	29.49	N	9.90

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	≤36.2

Test Results

Test Mode	Antenna	Channel [MHz]	Conducted Output Power [dBm]	Antenna Gain [dBi]	EIRP [dBm]	Conducted Output Power Limit [dBm]	EIRP Limit [dBm]	Verdict
11B	Ant1	2412	11.99	4.5	16.49	≤30	≤36.2	PASS
		2437	11.98	4.5	16.48	≤30	≤36.2	PASS
		2462	11.75	4.5	16.25	≤30	≤36.2	PASS
11G	Ant1	2412	13.31	4.5	17.81	≤30	≤36.2	PASS
		2437	13.24	4.5	17.74	≤30	≤36.2	PASS
		2462	13.03	4.5	17.53	≤30	≤36.2	PASS
11N20SISO	Ant1	2412	12.83	4.5	17.33	≤30	≤36.2	PASS
		2437	12.74	4.5	17.24	≤30	≤36.2	PASS
		2462	12.71	4.5	17.21	≤30	≤36.2	PASS

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

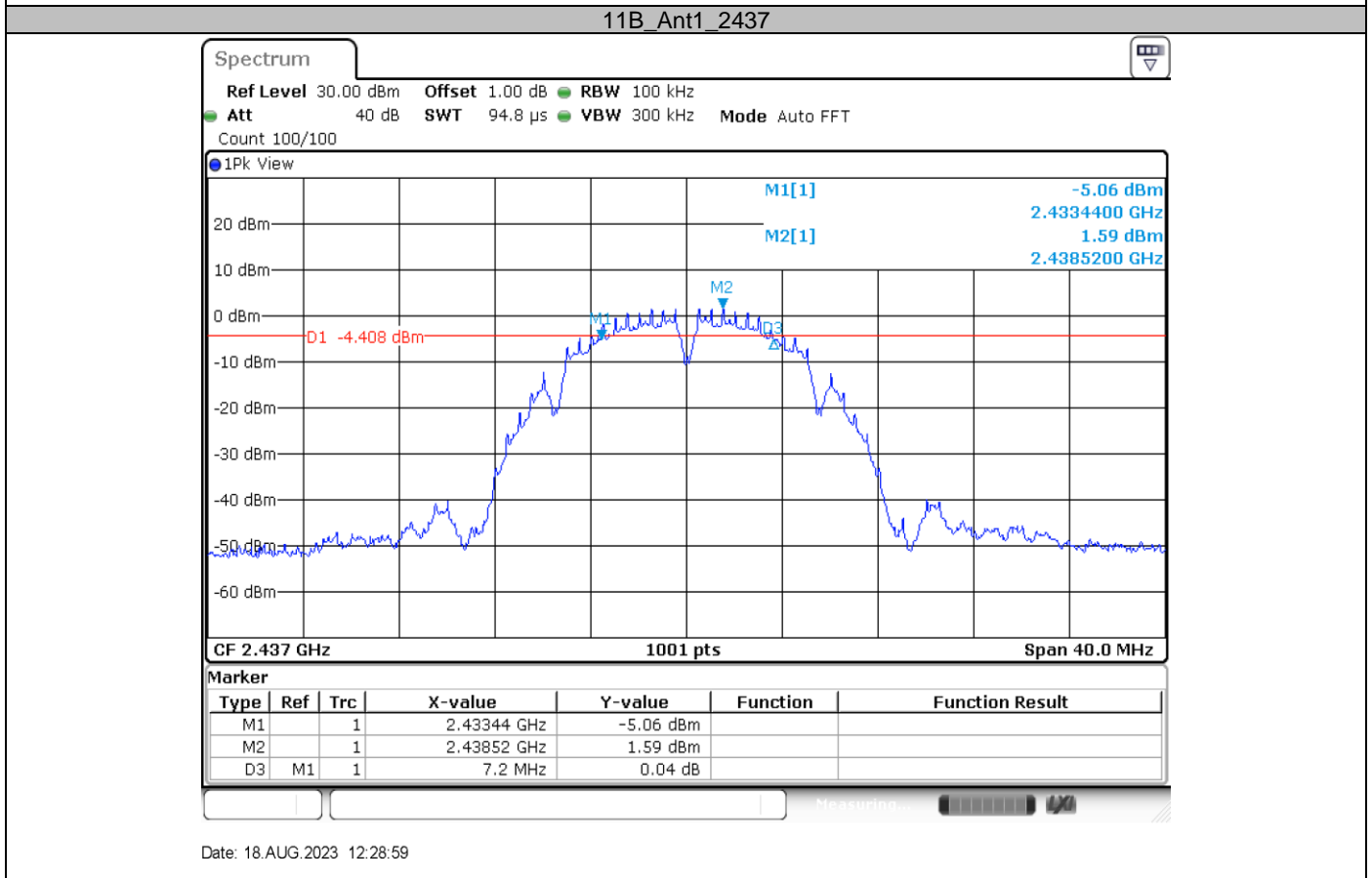
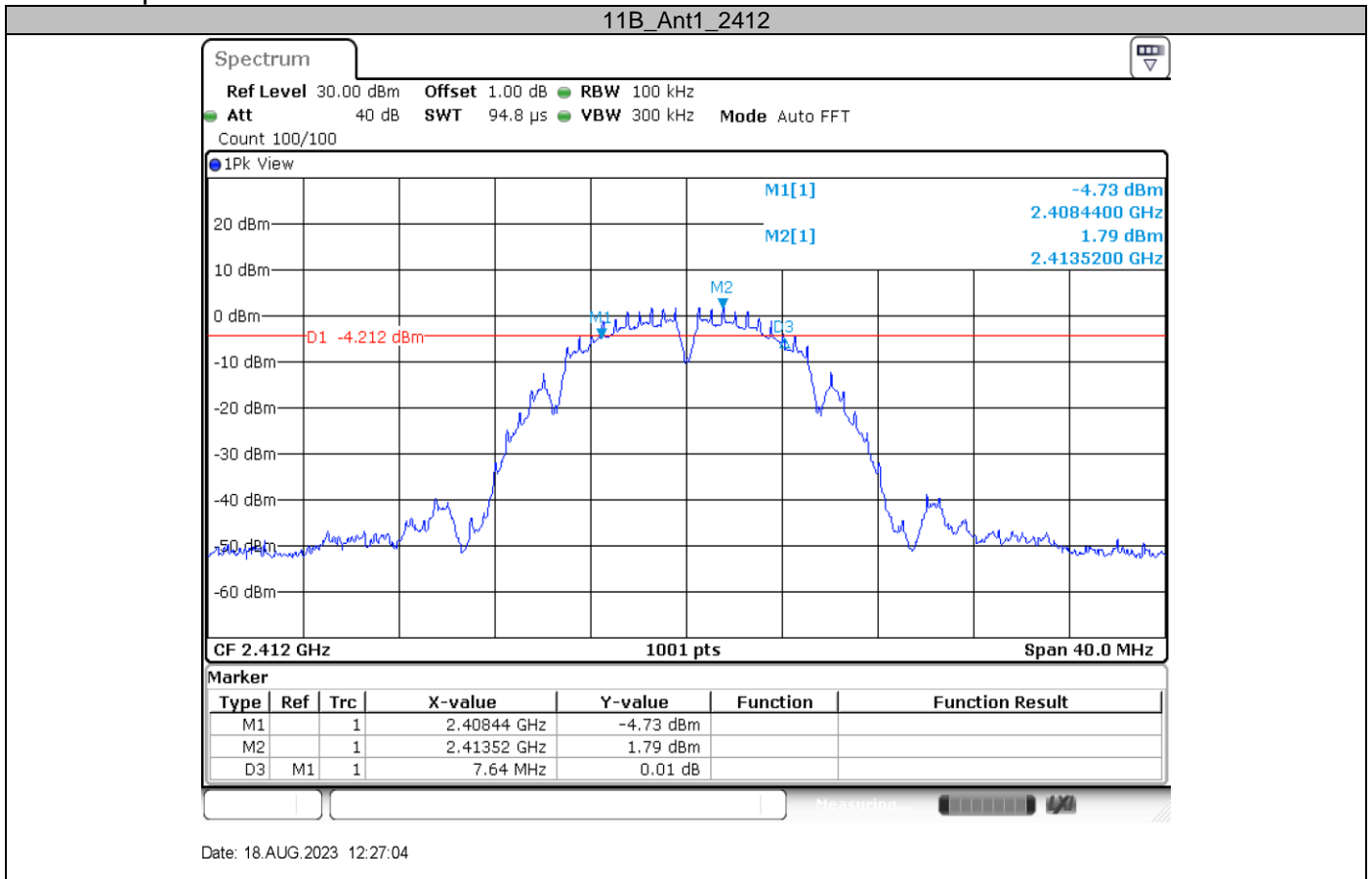
6dB bandwidth Limit [kHz]	99% bandwidth Limit [kHz]
≥500	--

Test result

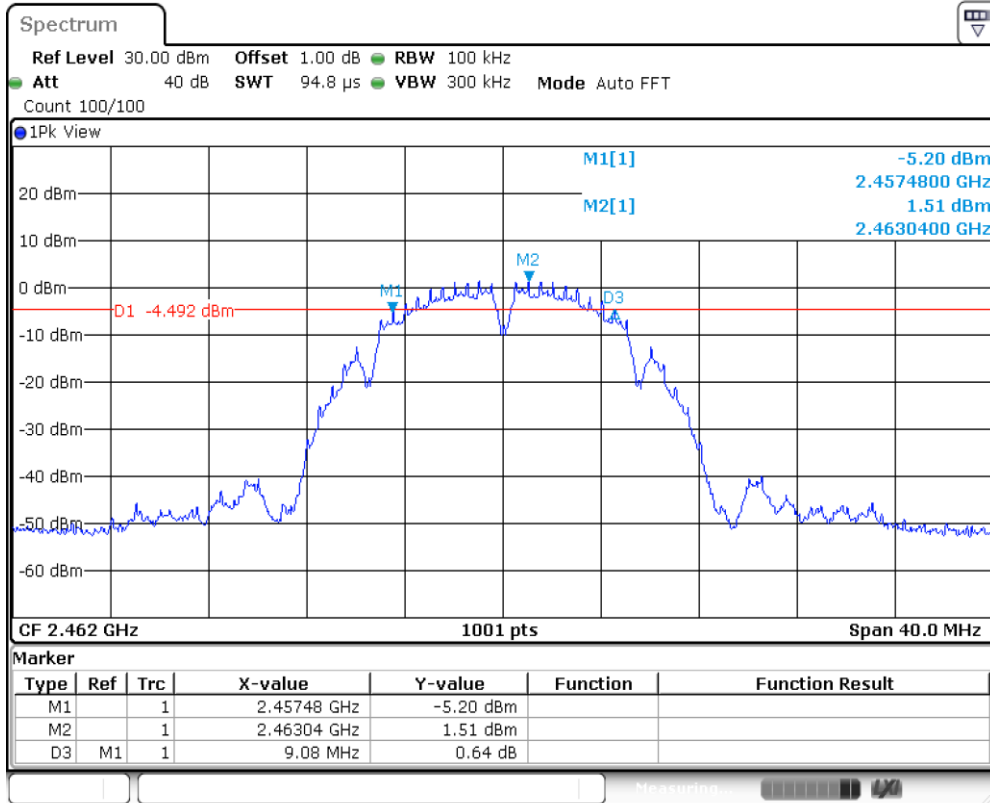
6dB bandwidth

Test Mode	Antenna	Channel [MHz]	DTS BW [MHz]	FL [MHz]	FH [MHz]	Limit [MHz]	Verdict
11B	Ant1	2412	7.640	2408.440	2416.080	0.5	PASS
		2437	7.200	2433.440	2440.640	0.5	PASS
		2462	9.080	2457.480	2466.560	0.5	PASS
11G	Ant1	2412	15.560	2404.400	2419.960	0.5	PASS
		2437	16.400	2428.840	2445.240	0.5	PASS
		2462	15.560	2454.400	2469.960	0.5	PASS
11N20SISO	Ant1	2412	15.240	2404.400	2419.640	0.5	PASS
		2437	17.360	2428.480	2445.840	0.5	PASS
		2462	15.240	2454.400	2469.640	0.5	PASS

Test Graphs

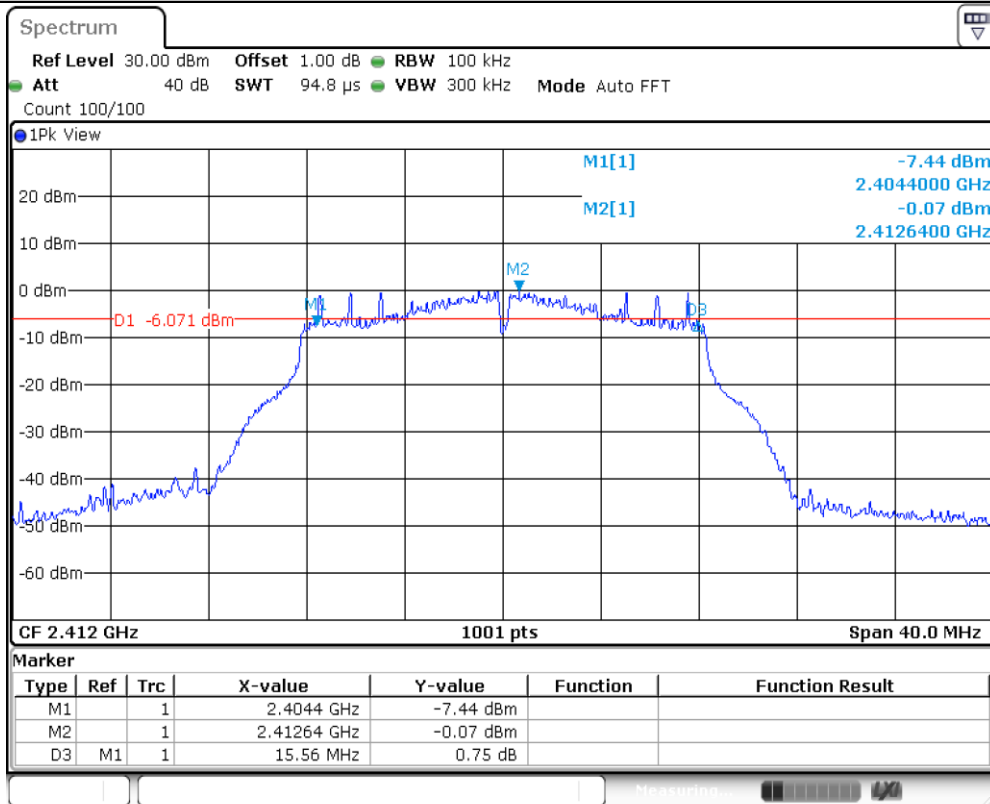


11B_Ant1_2462

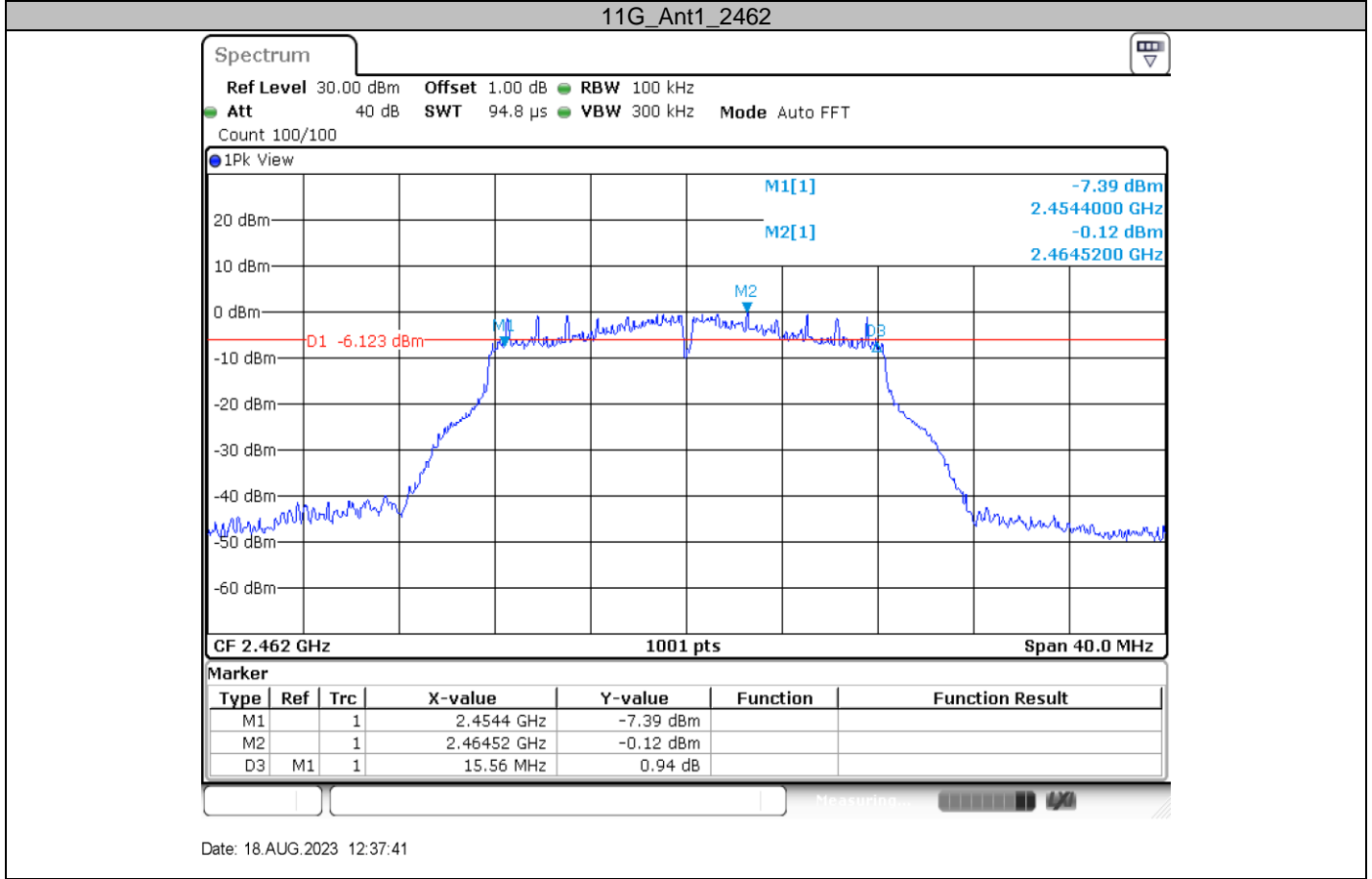
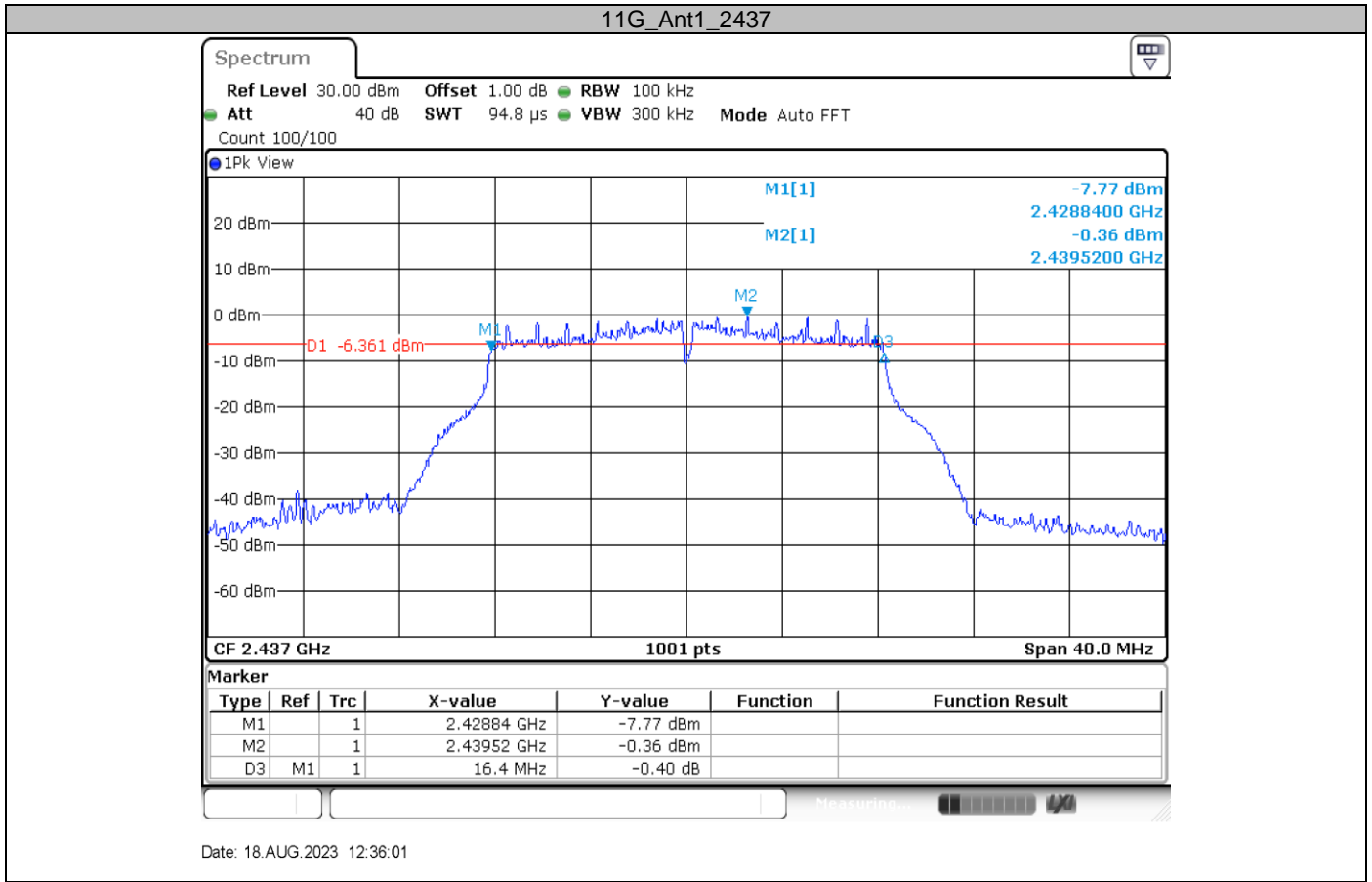


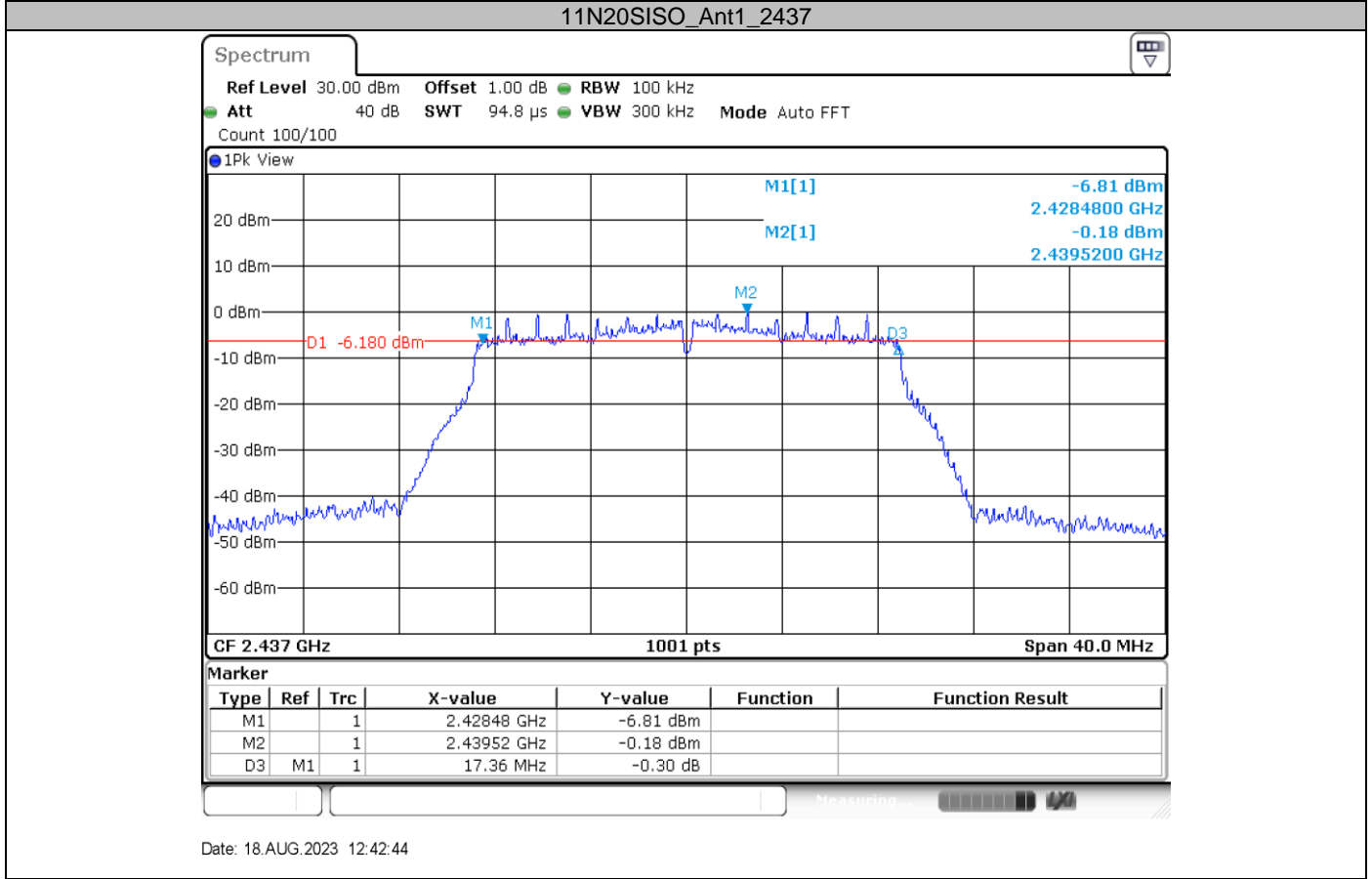
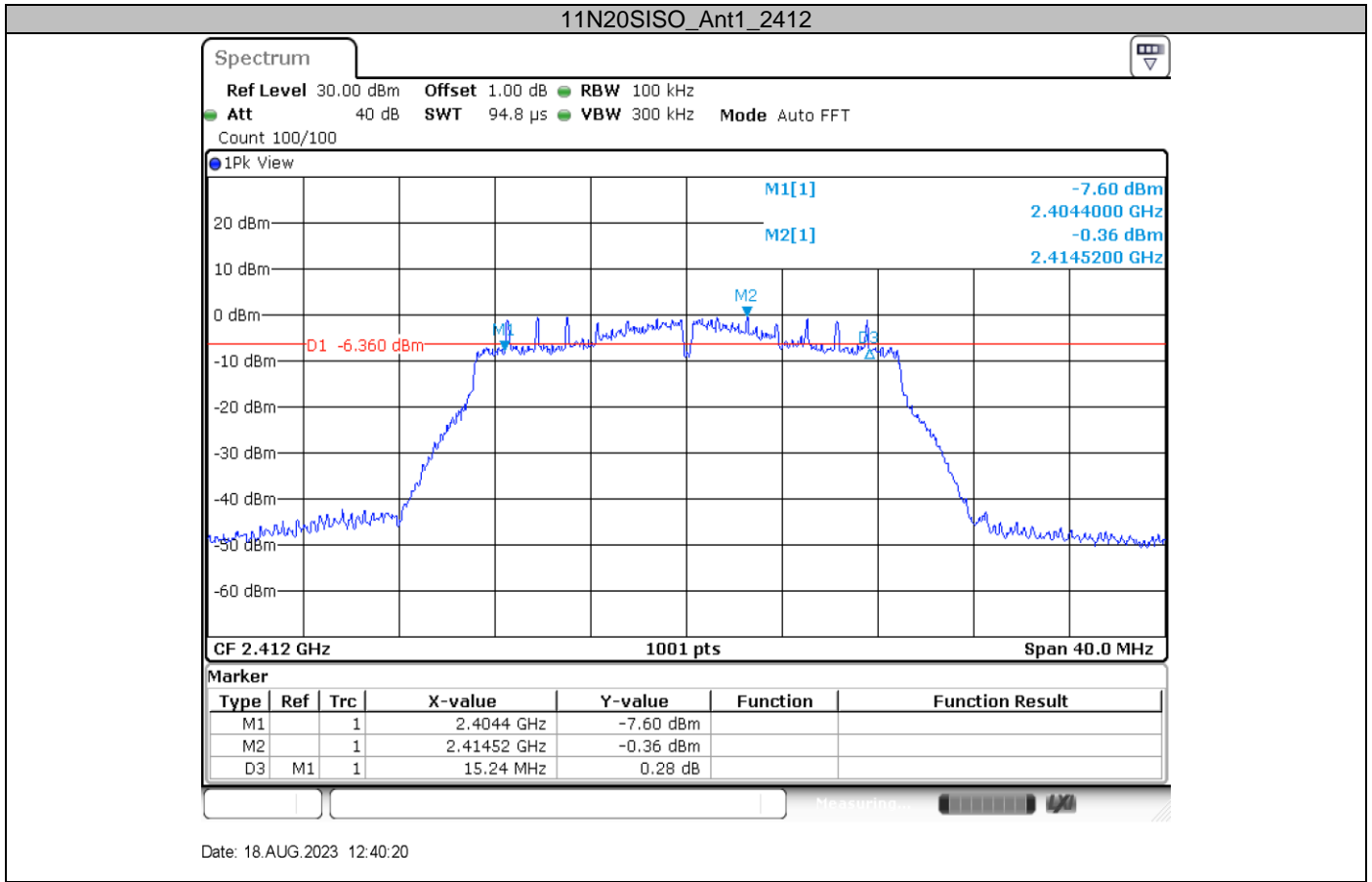
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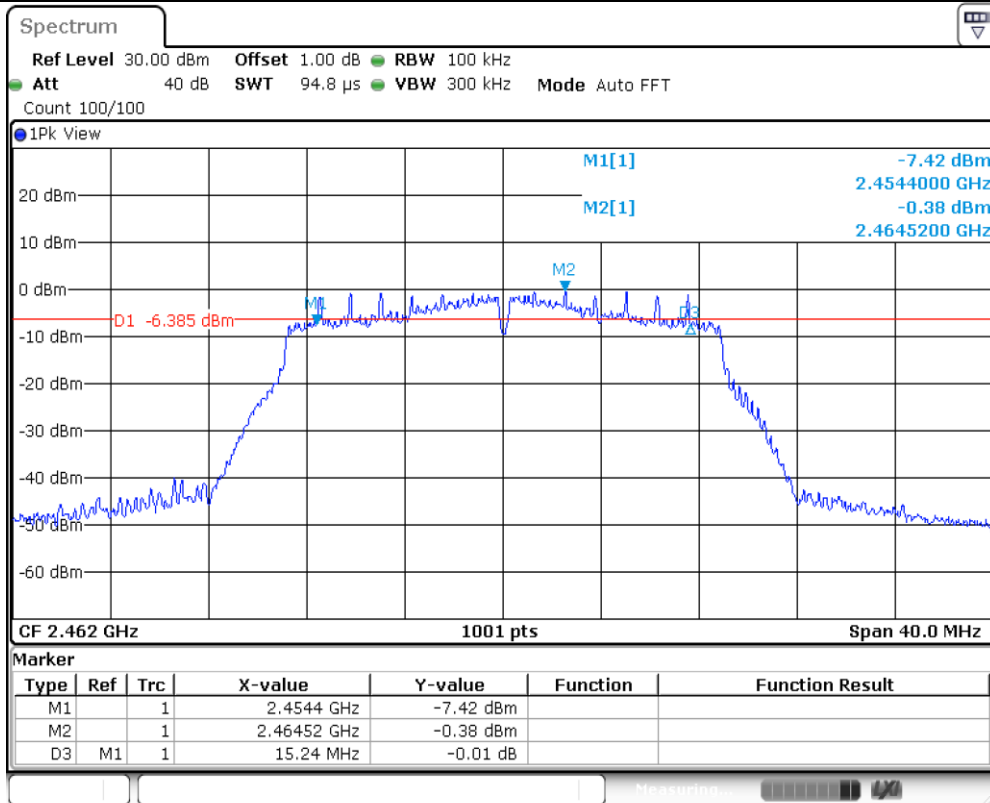


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11N20SISO_Ant1_2462

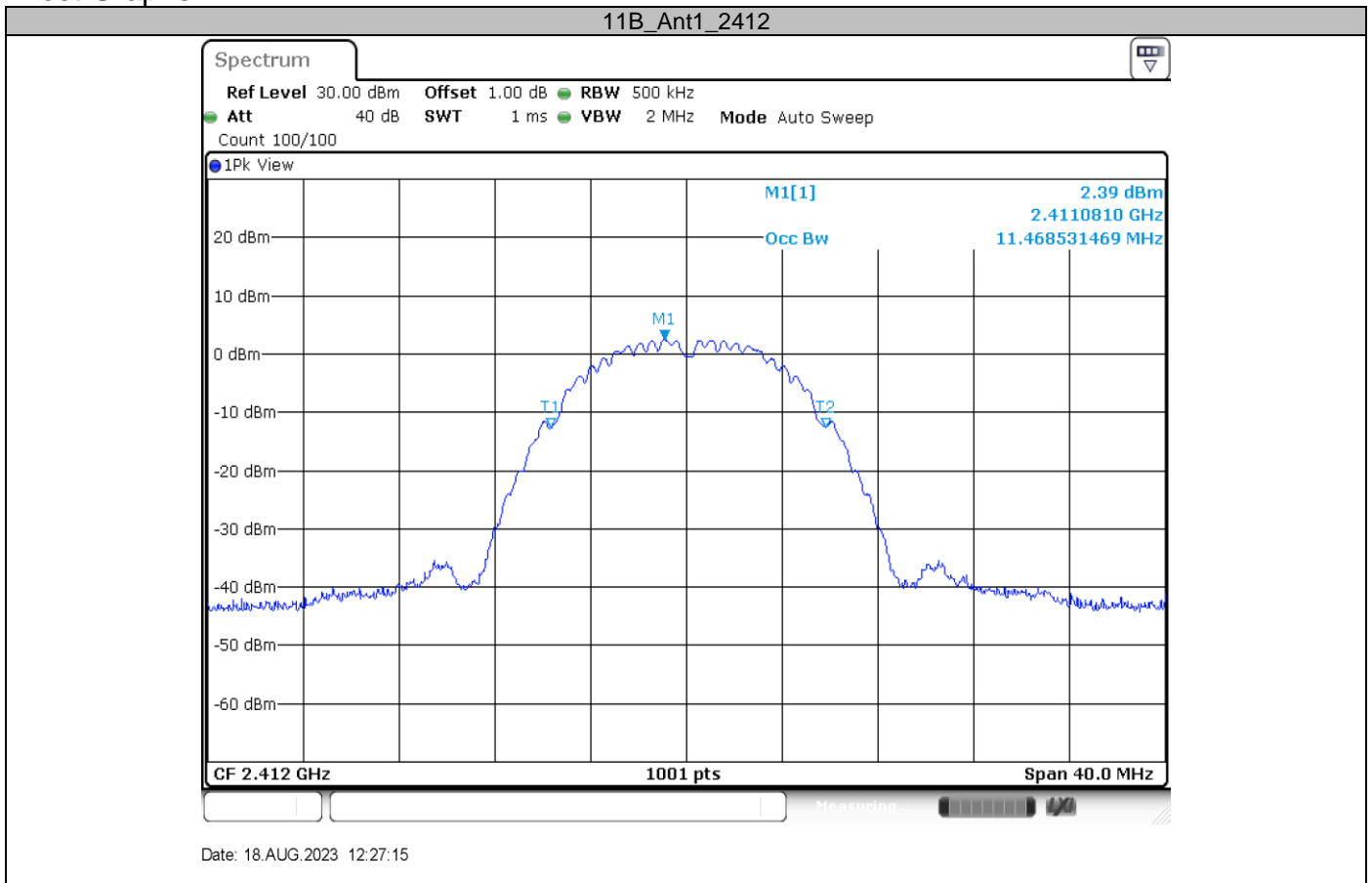


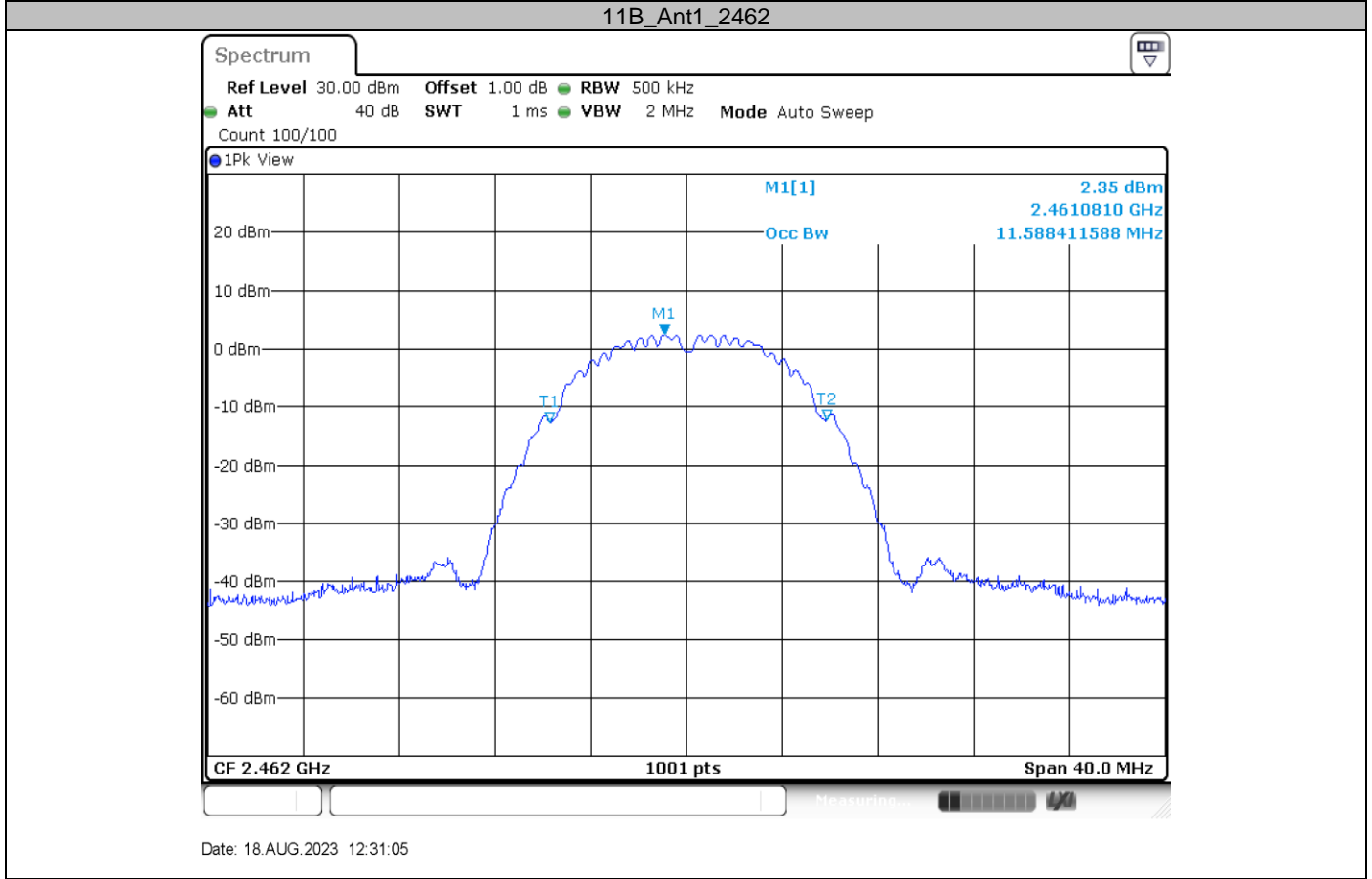
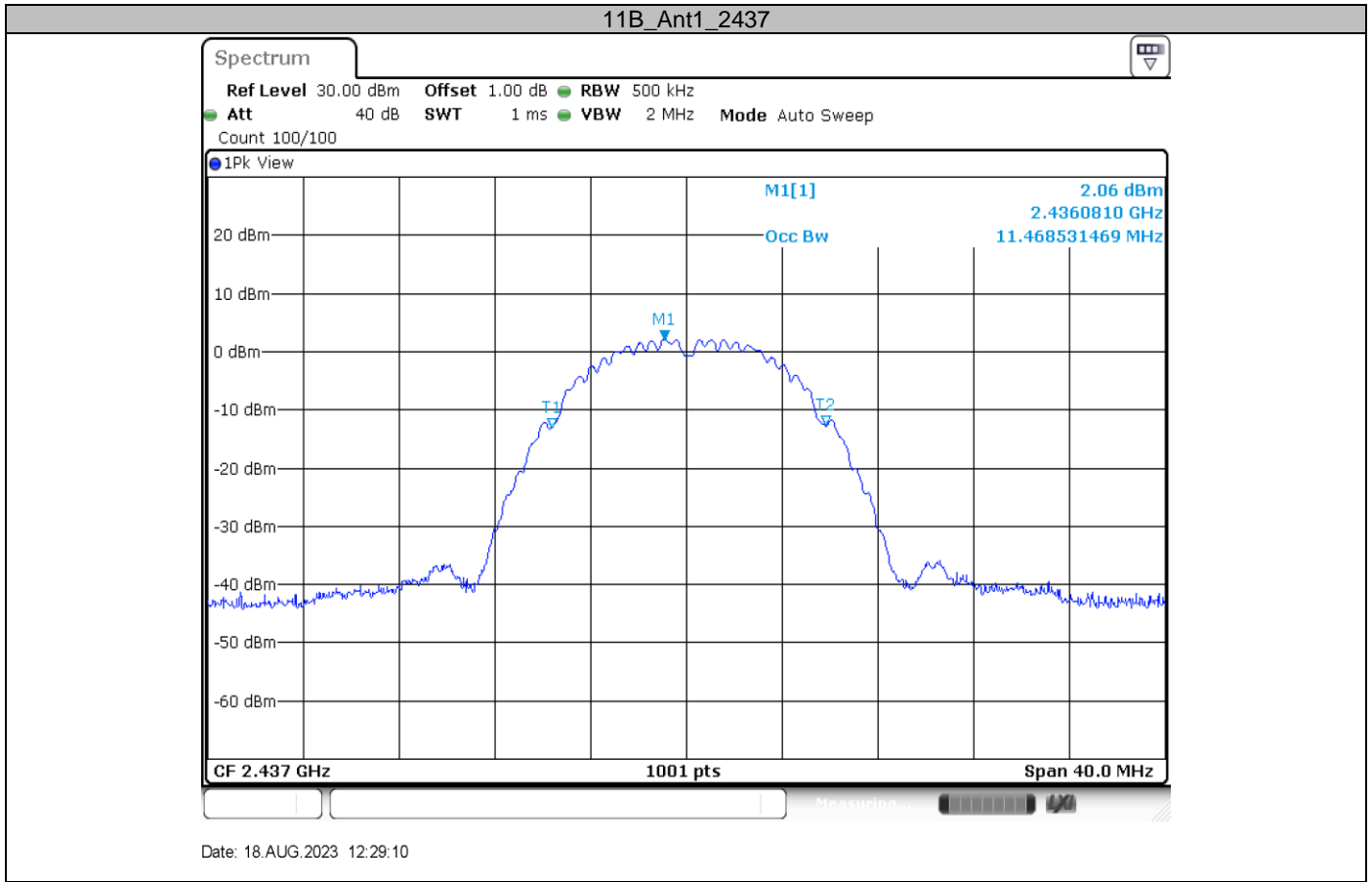
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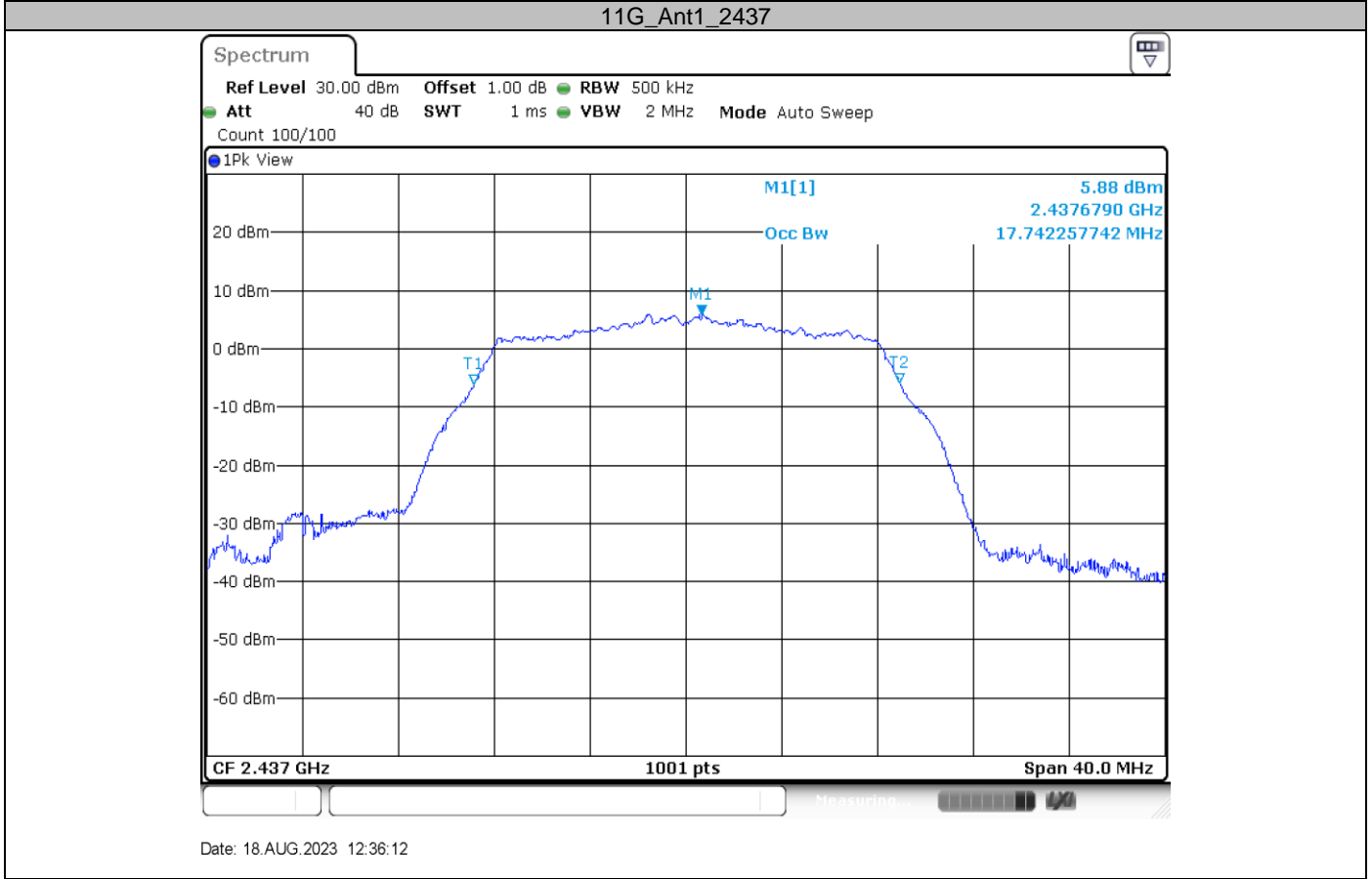
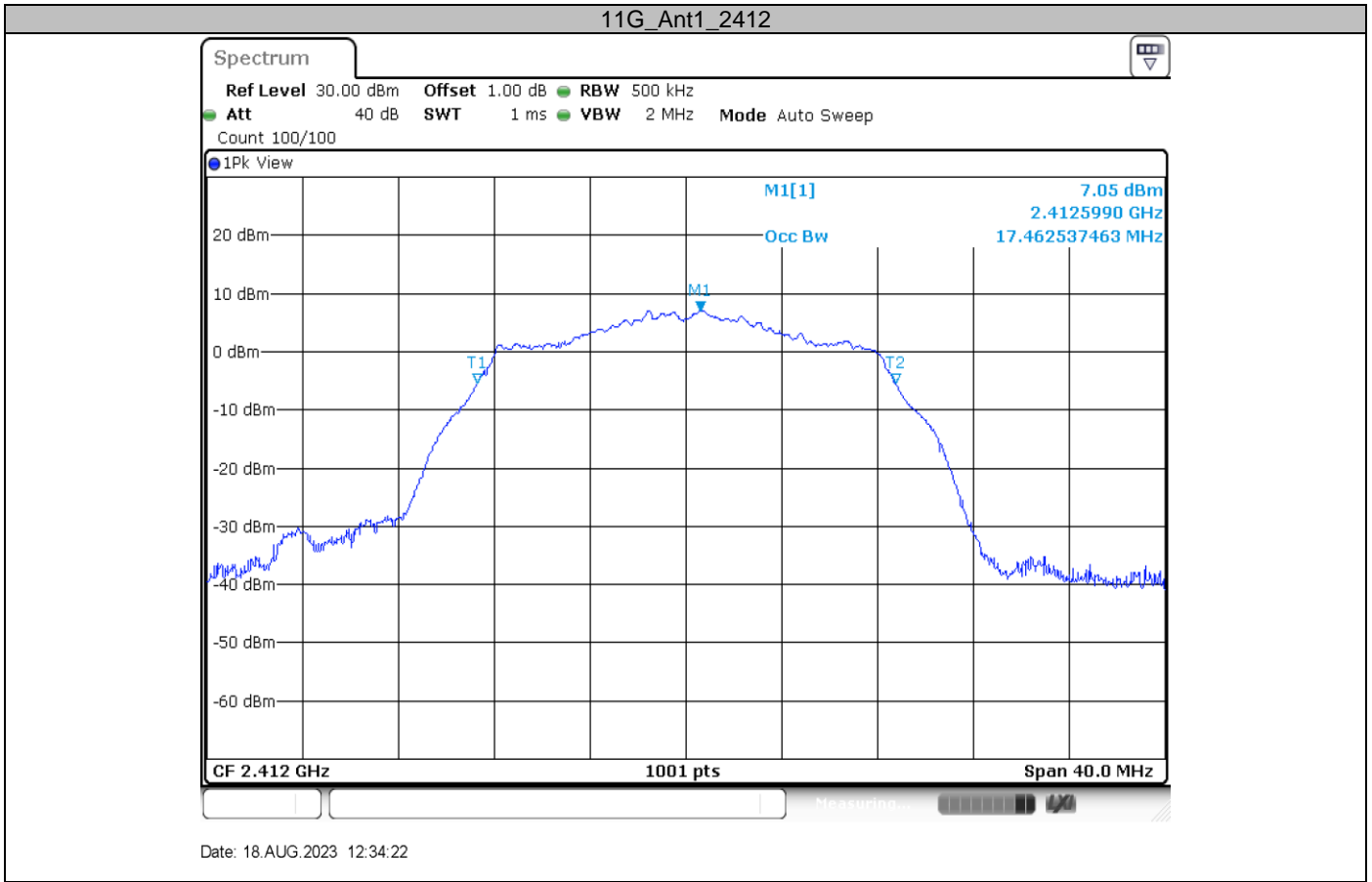
99% bandwidth

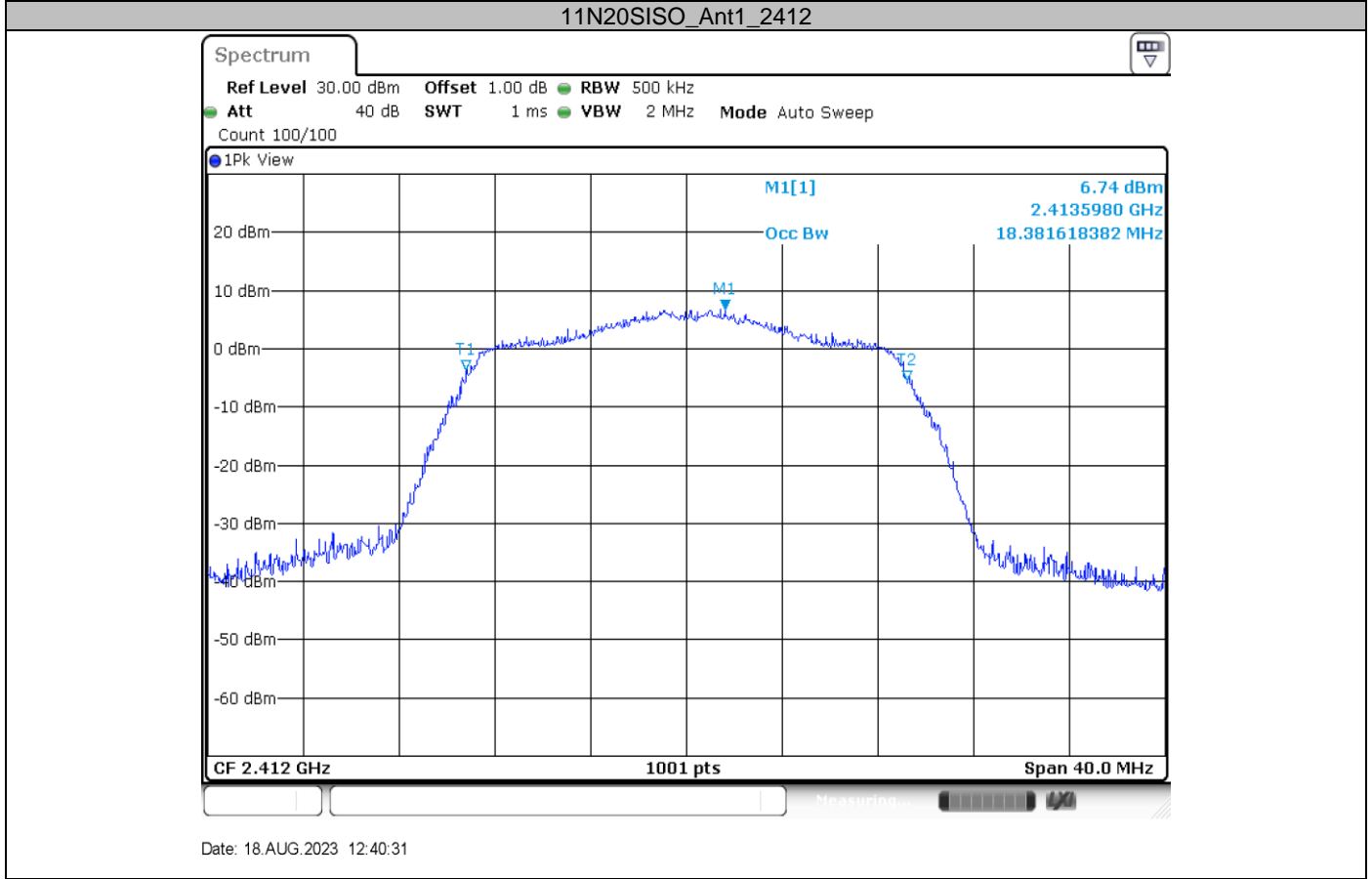
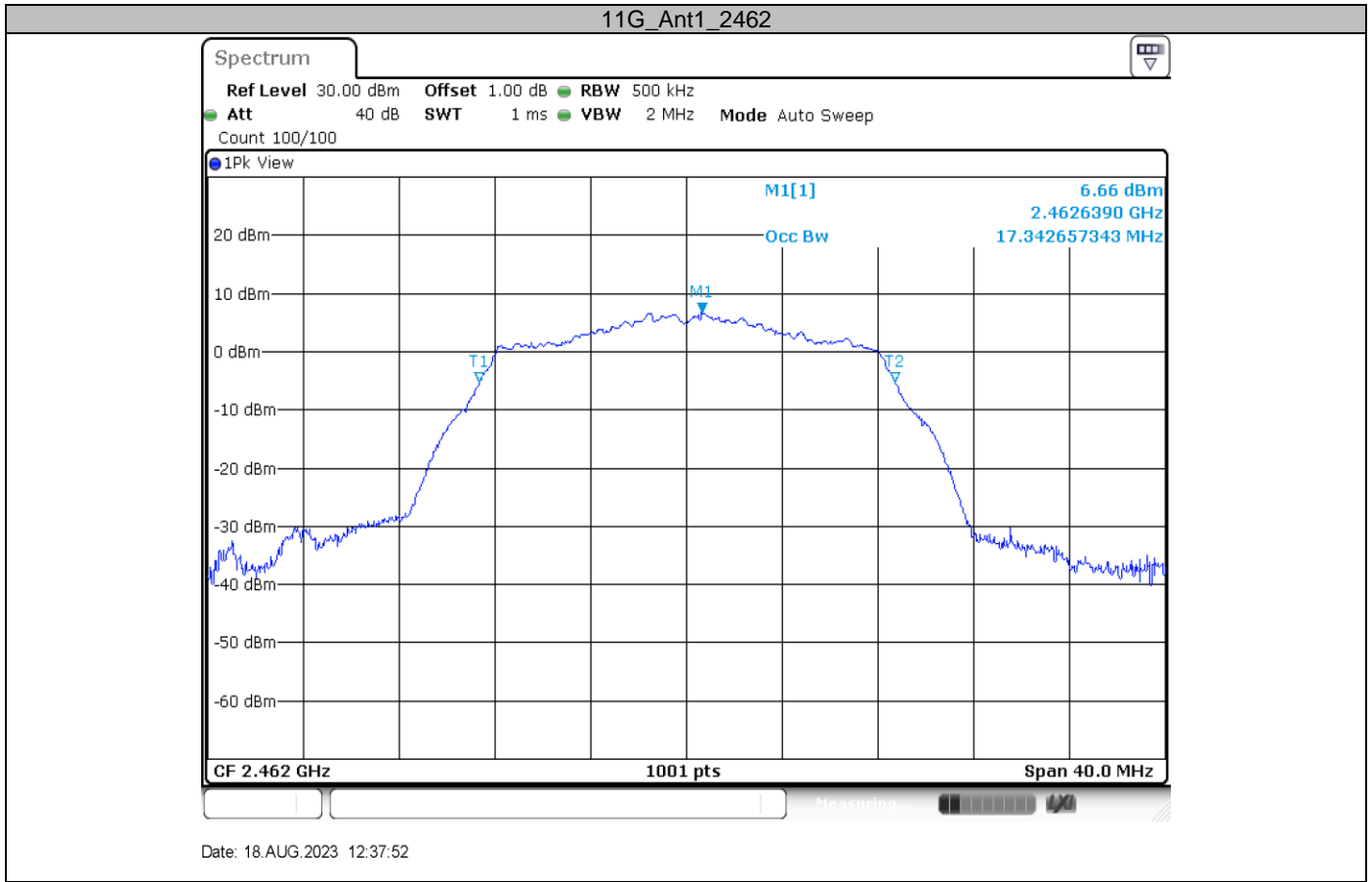
Test Mode	Antenna	Channel [MHz]	OCB [MHz]	FL [MHz]	FH [MHz]	Limit [MHz]	Verdict
11B	Ant1	2412	11.469	2406.326	2417.794	---	PASS
		2437	11.469	2431.366	2442.834	---	PASS
		2462	11.588	2456.286	2467.874	---	PASS
11G	Ant1	2412	17.463	2403.289	2420.751	---	PASS
		2437	17.742	2428.169	2445.911	---	PASS
		2462	17.343	2453.369	2470.711	---	PASS
11N20SISO	Ant1	2412	18.382	2402.809	2421.191	---	PASS
		2437	18.581	2427.769	2446.351	---	PASS
		2462	18.262	2452.929	2471.191	---	PASS

Test Graphs

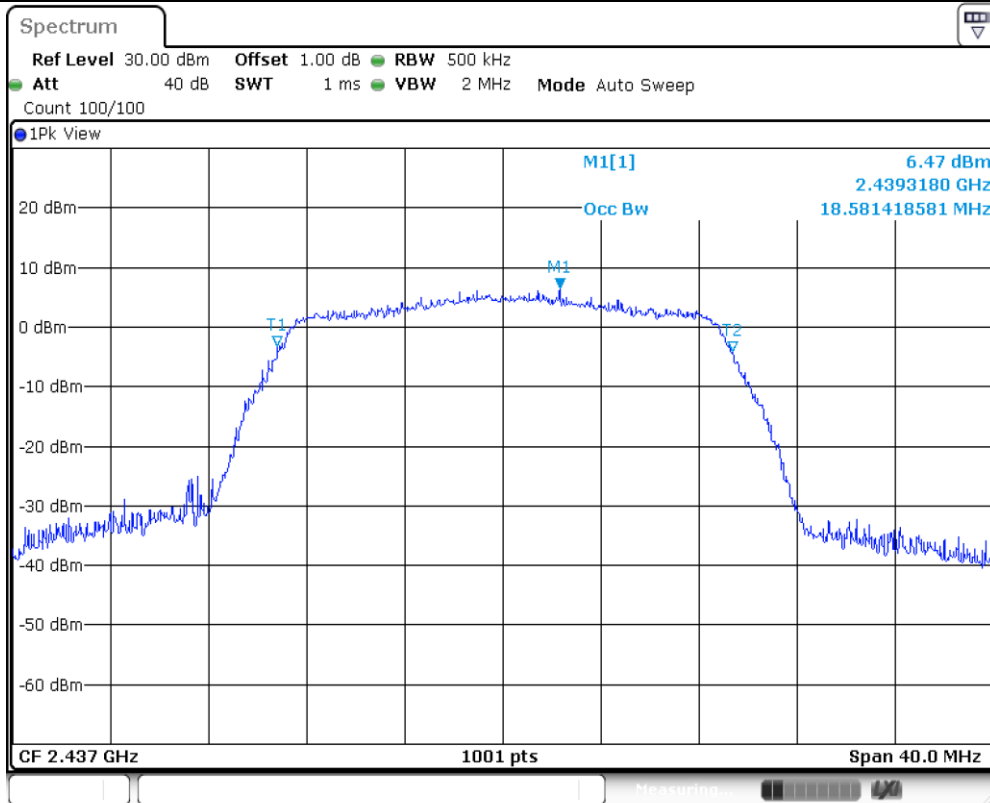






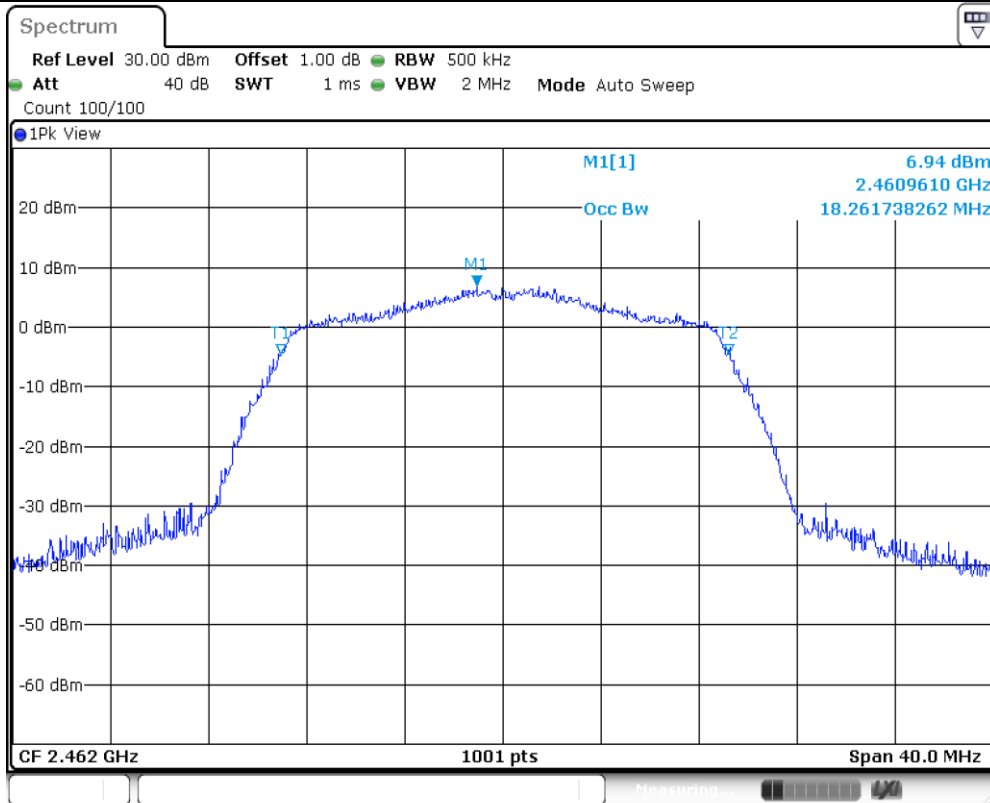


11N20SISO_Ant1_2437



Date: 18.AUG.2023 12:42:55

11N20SISO_Ant1_2462



Date: 18.AUG.2023 12:44:37

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 \geq 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

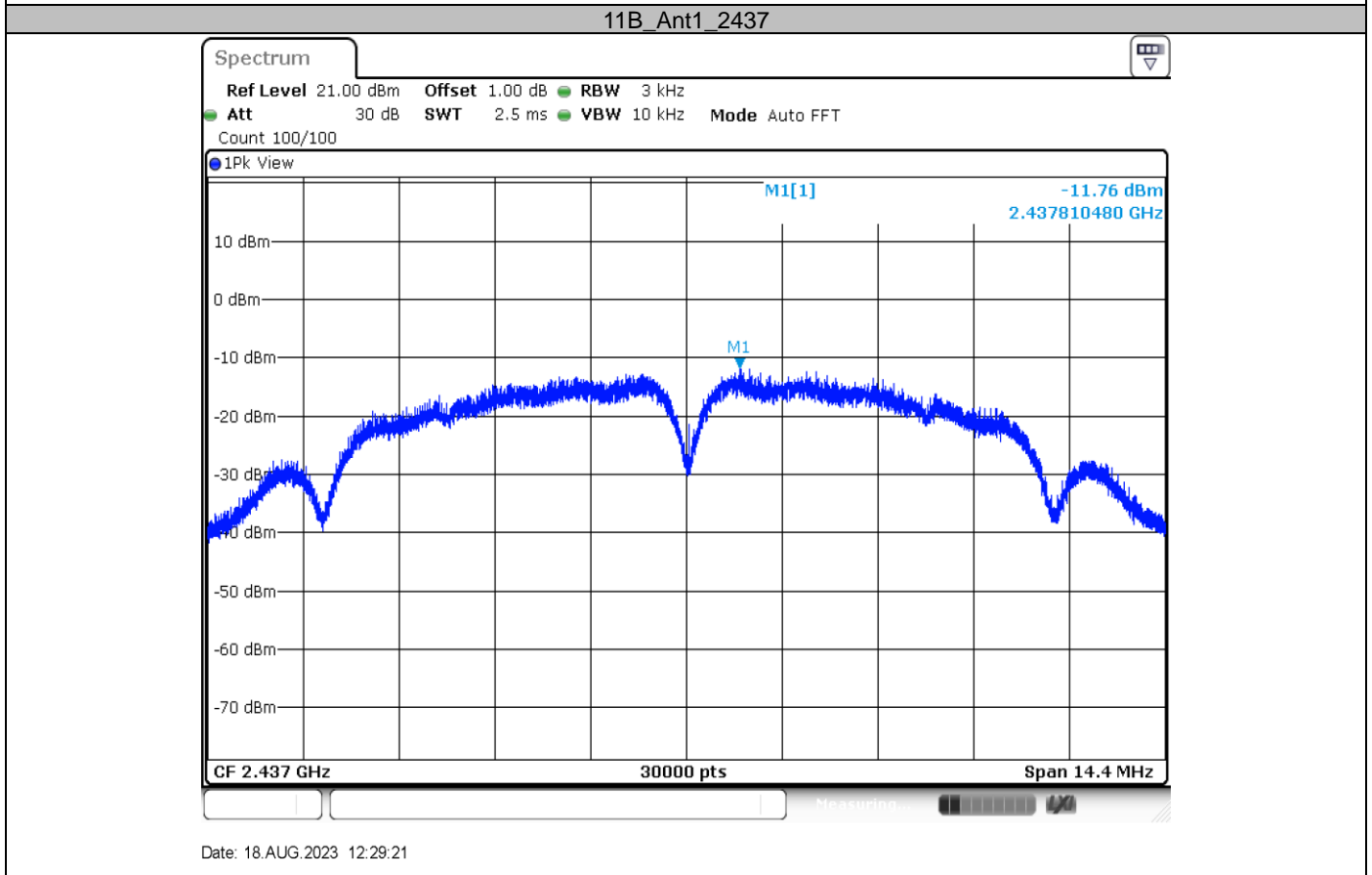
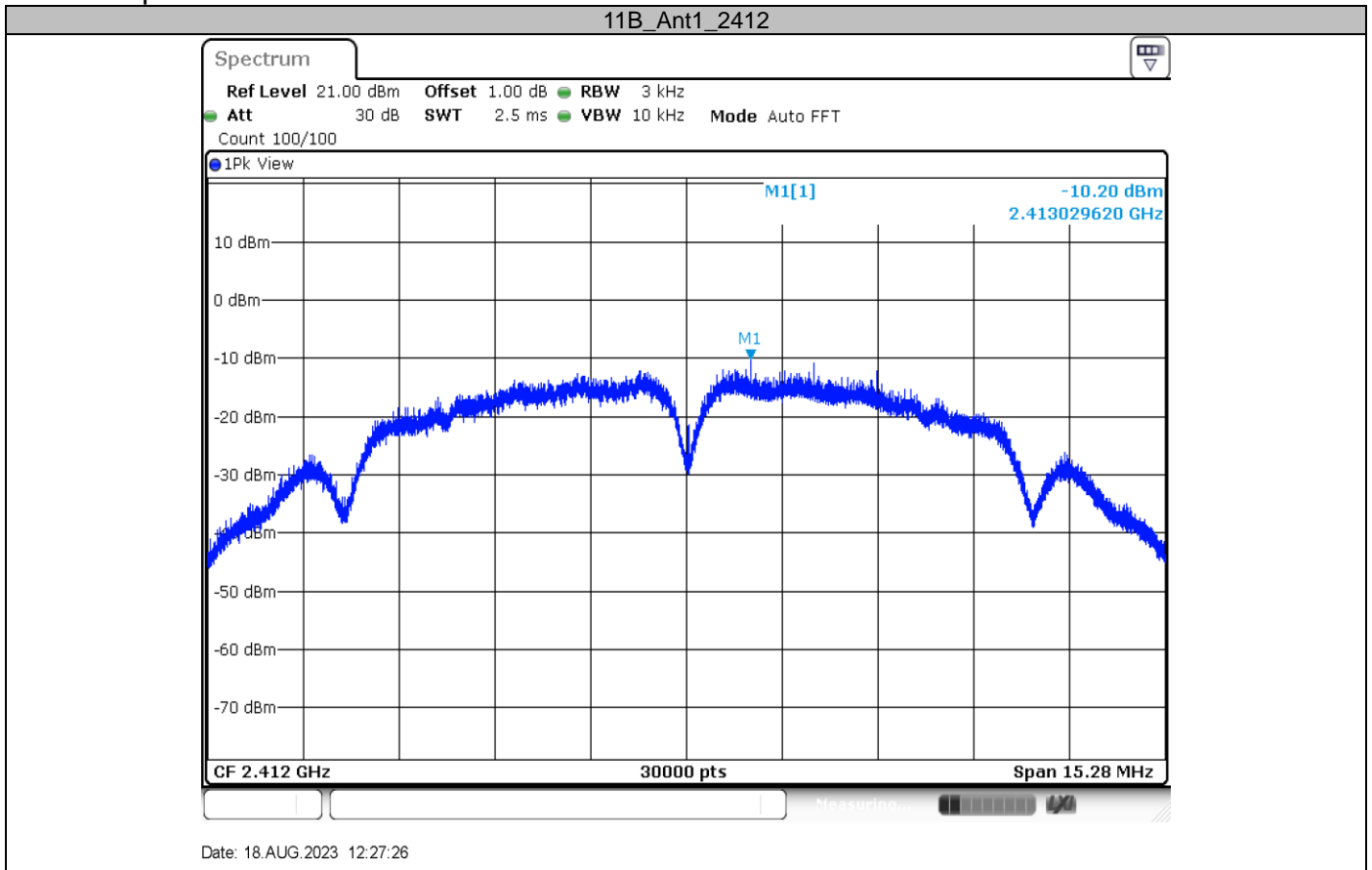
Limit [dBm/3kHz]

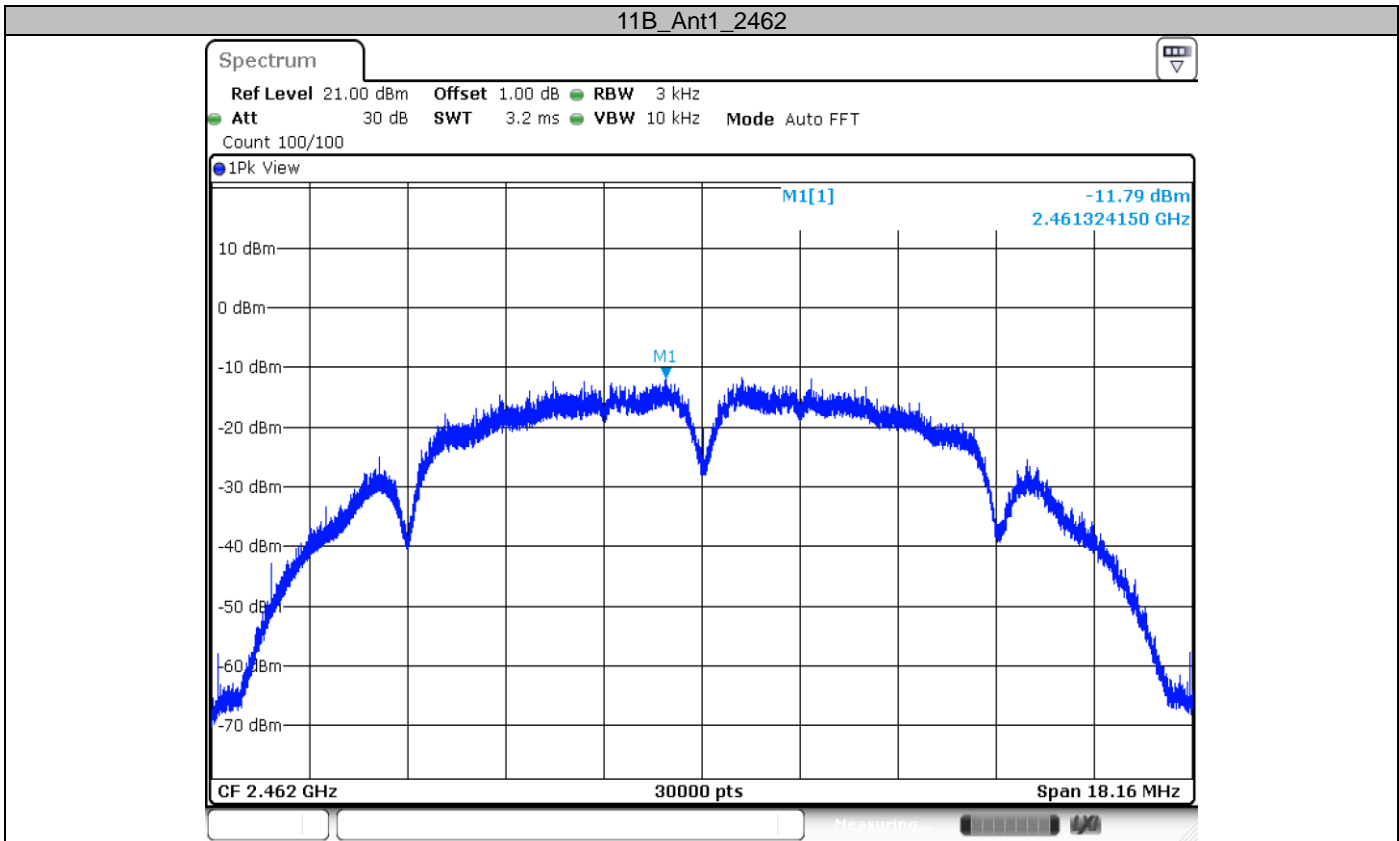
≤ 8

Test Results

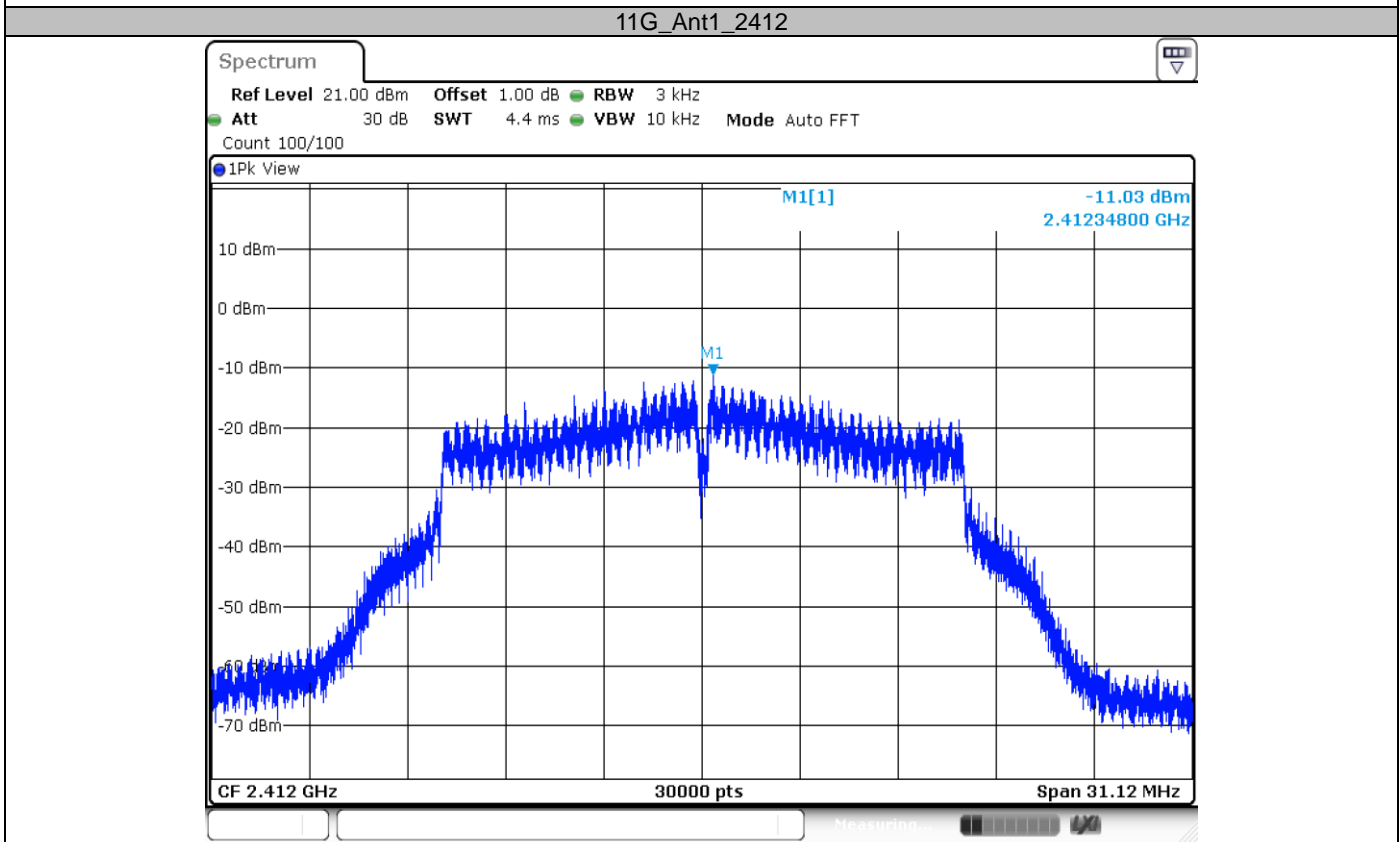
Test Mode	Antenna	Channel [MHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
11B	Ant1	2412	-10.2	≤8	PASS
		2437	-11.76	≤8	PASS
		2462	-11.79	≤8	PASS
11G	Ant1	2412	-11.03	≤8	PASS
		2437	-11.95	≤8	PASS
		2462	-11.45	≤8	PASS
11N20SISO	Ant1	2412	-11.88	≤8	PASS
		2437	-12.24	≤8	PASS
		2462	-12.32	≤8	PASS

Test Graphs

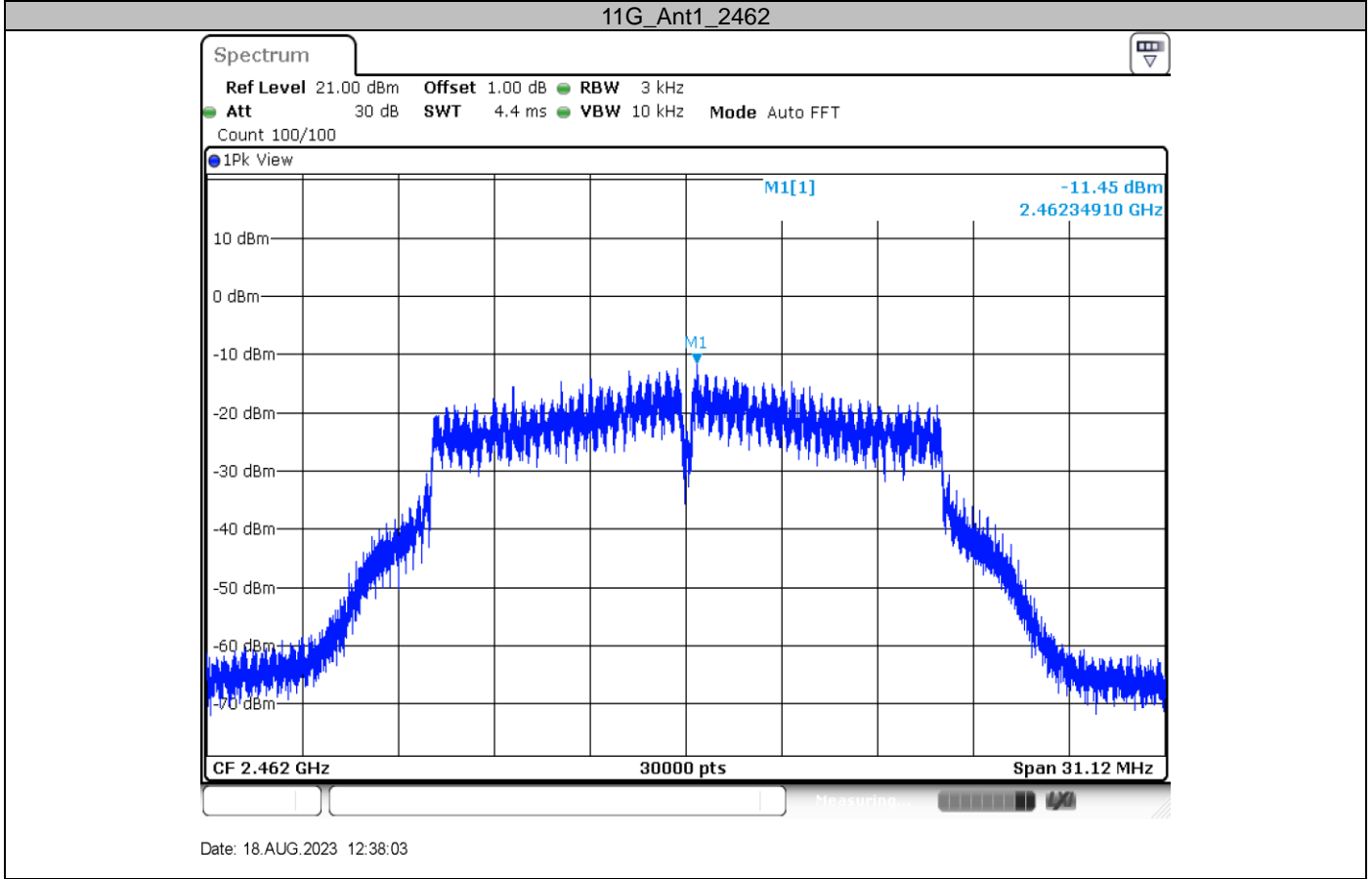
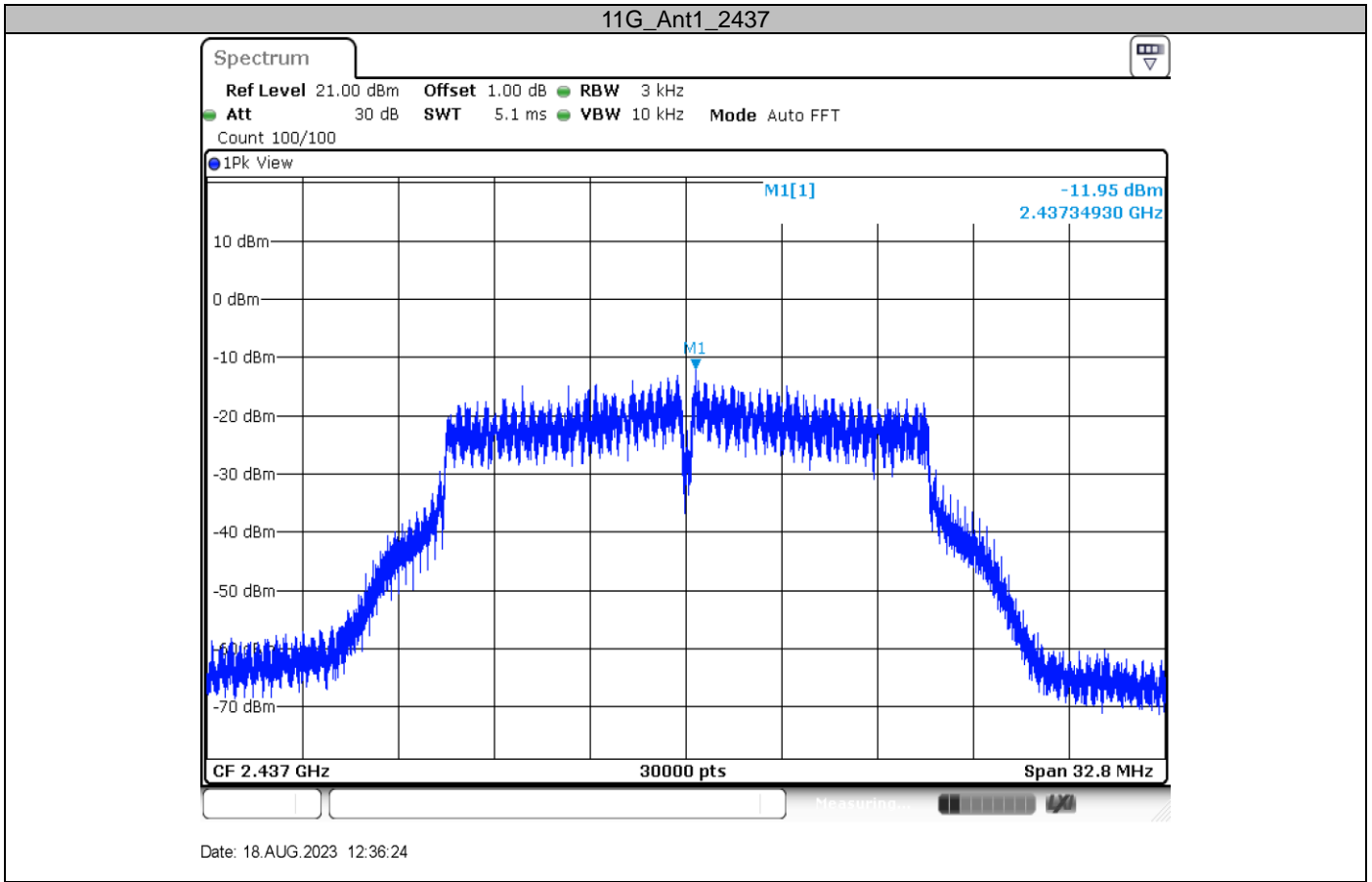




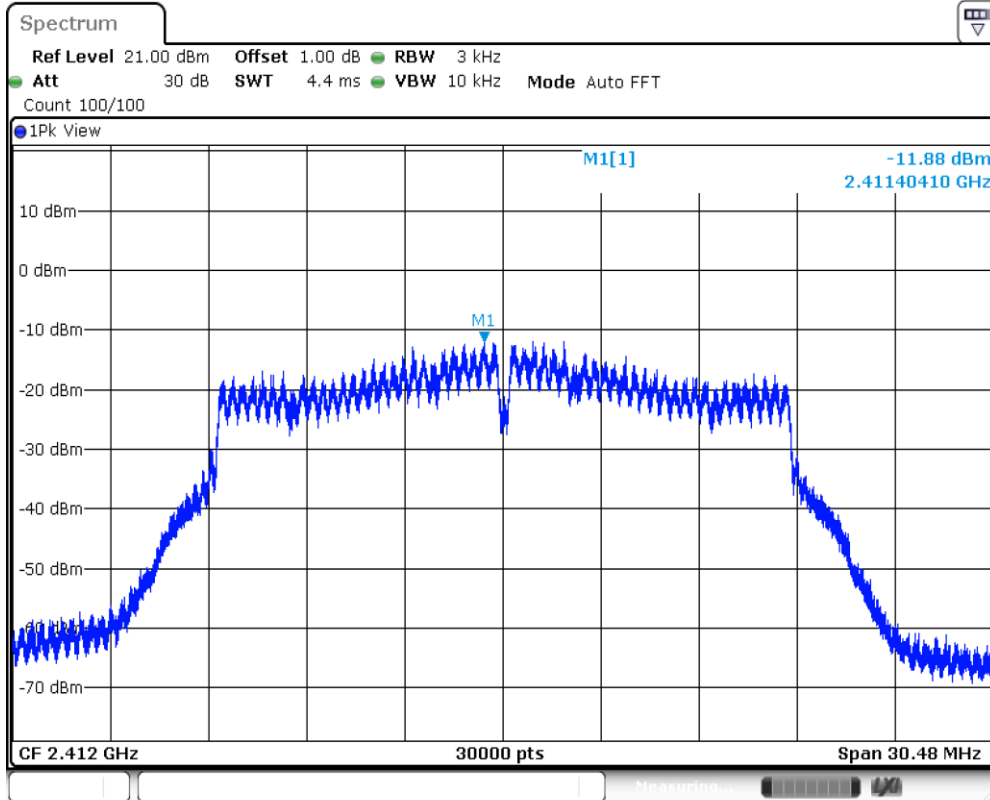
Date: 18.AUG.2023 12:31:16



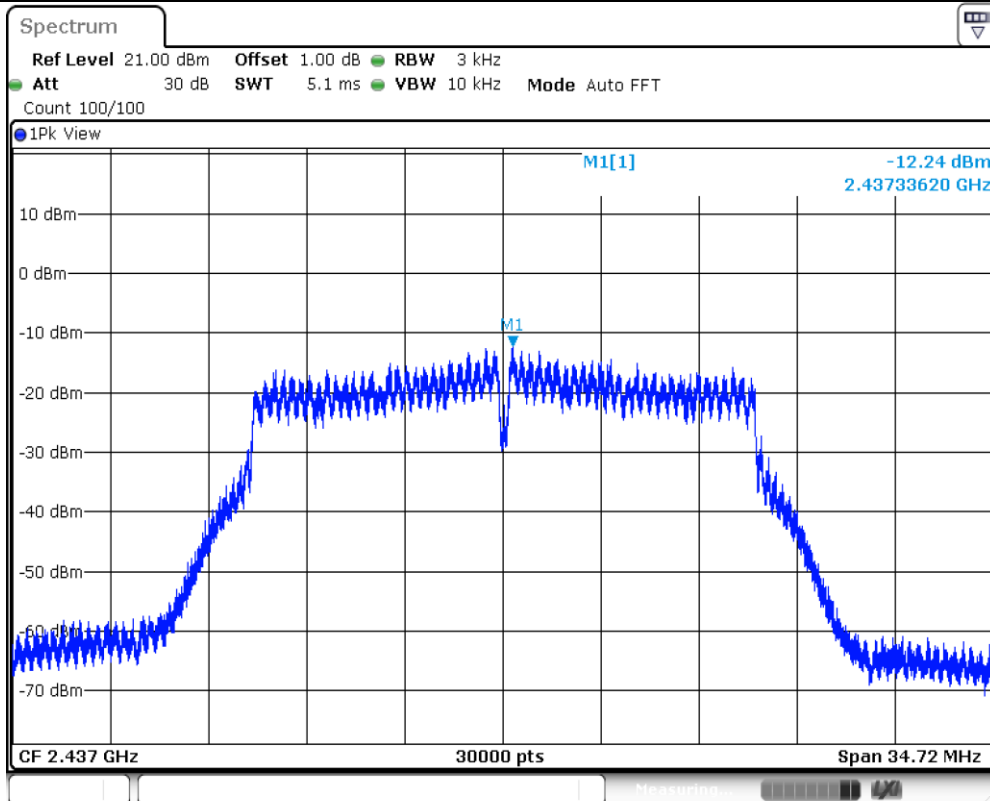
Date: 18.AUG.2023 12:34:34



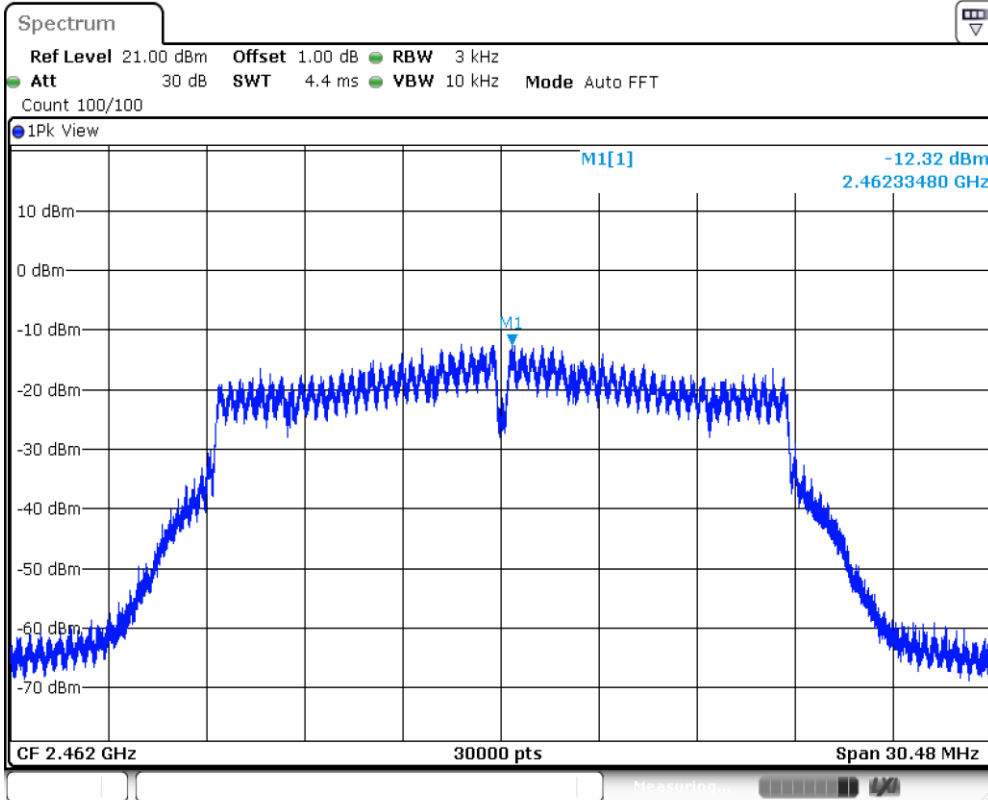
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462



Date: 18.AUG.2023 12:44:48

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.

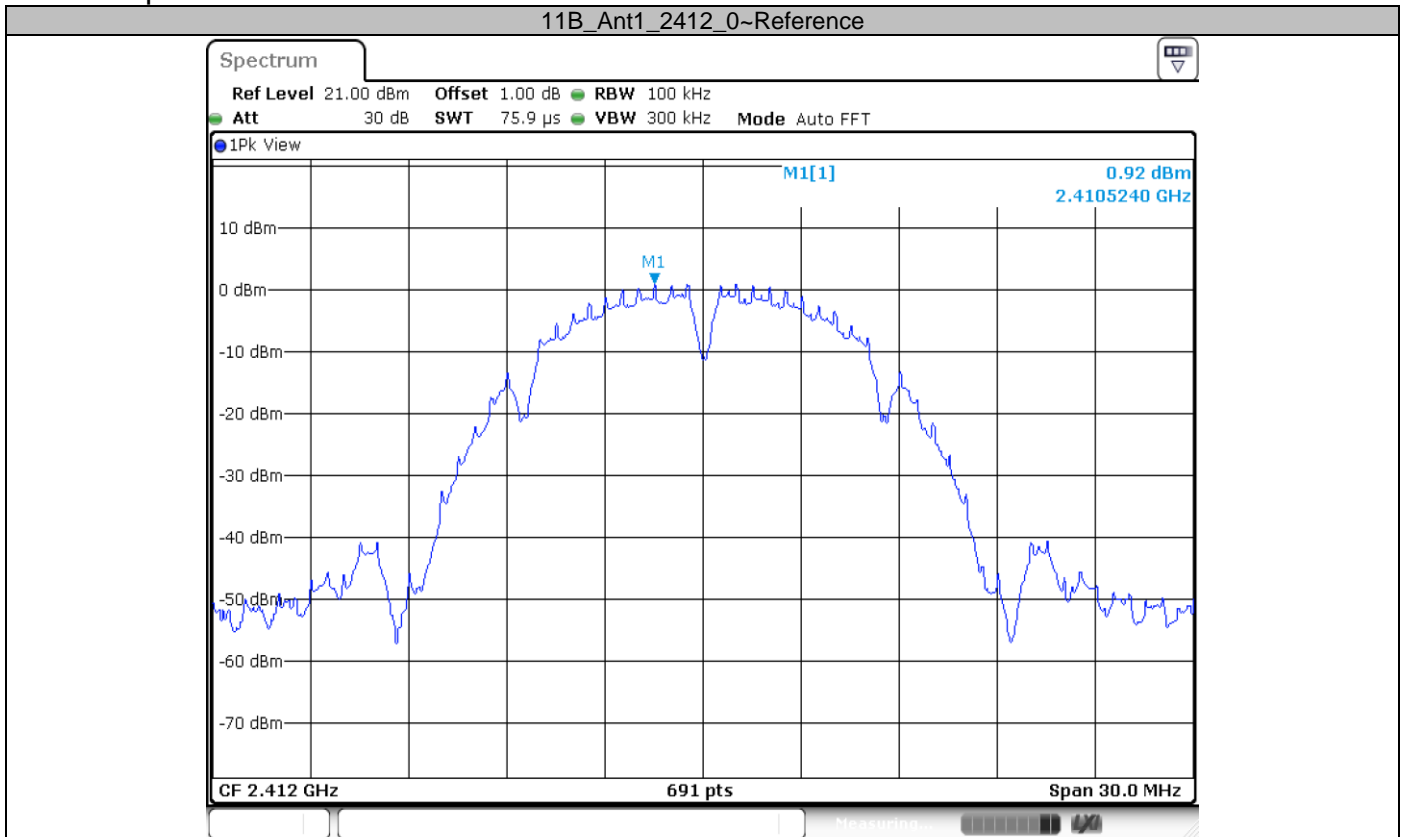
Limit

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

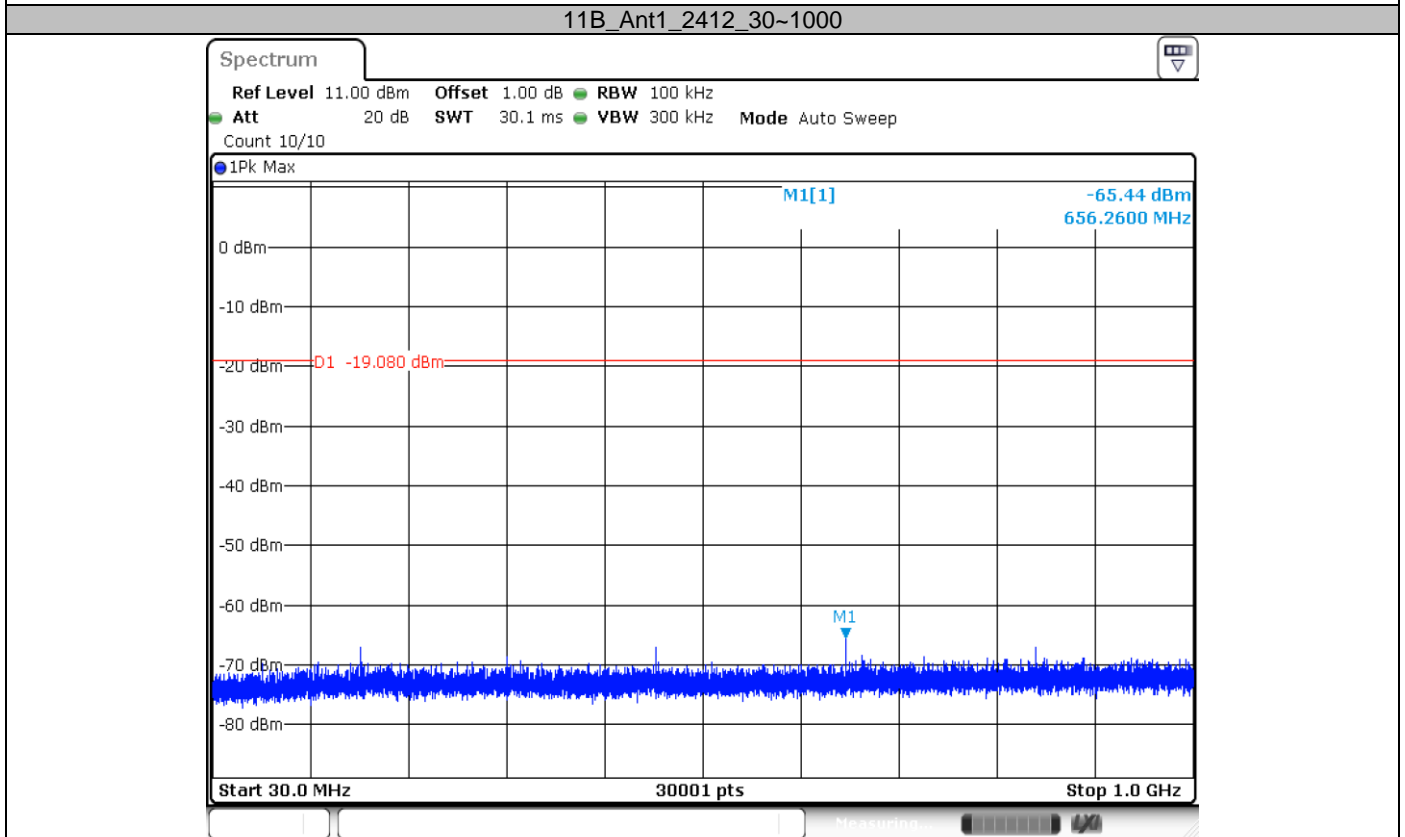
Test Result

Test Mode	Antenna	Channel [MHz]	Freq Range [MHz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	Reference	0.92	0.92	---	PASS
			30~1000	---	-65.44	<=-19.08	PASS
			1000~26500	---	-48.21	<=-19.08	PASS
		2437	Reference	1.88	1.88	---	PASS
			30~1000	---	-66.6	<=-18.12	PASS
			1000~26500	---	-51.72	<=-18.12	PASS
		2462	Reference	2.00	2.00	---	PASS
			30~1000	---	-64.35	<=-18	PASS
			1000~26500	---	-52.77	<=-18	PASS
11G	Ant1	2412	Reference	-0.03	-0.03	---	PASS
			30~1000	---	-61.97	<=-20.03	PASS
			1000~26500	---	-39.72	<=-20.03	PASS
		2437	Reference	-0.53	-0.53	---	PASS
			30~1000	---	-65.71	<=-20.53	PASS
			1000~26500	---	-52.65	<=-20.53	PASS
		2462	Reference	-0.35	-0.35	---	PASS
			30~1000	---	-66.44	<=-20.35	PASS
			1000~26500	---	-52.2	<=-20.35	PASS
11N20SISO	Ant1	2412	Reference	-0.58	-0.58	---	PASS
			30~1000	---	-65.63	<=-20.58	PASS
			1000~26500	---	-42.55	<=-20.58	PASS
		2437	Reference	-0.72	-0.72	---	PASS
			30~1000	---	-66.26	<=-20.72	PASS
			1000~26500	---	-52.2	<=-20.72	PASS
		2462	Reference	0.20	0.20	---	PASS
			30~1000	---	-66.22	<=-19.8	PASS
			1000~26500	---	-51.96	<=-19.8	PASS

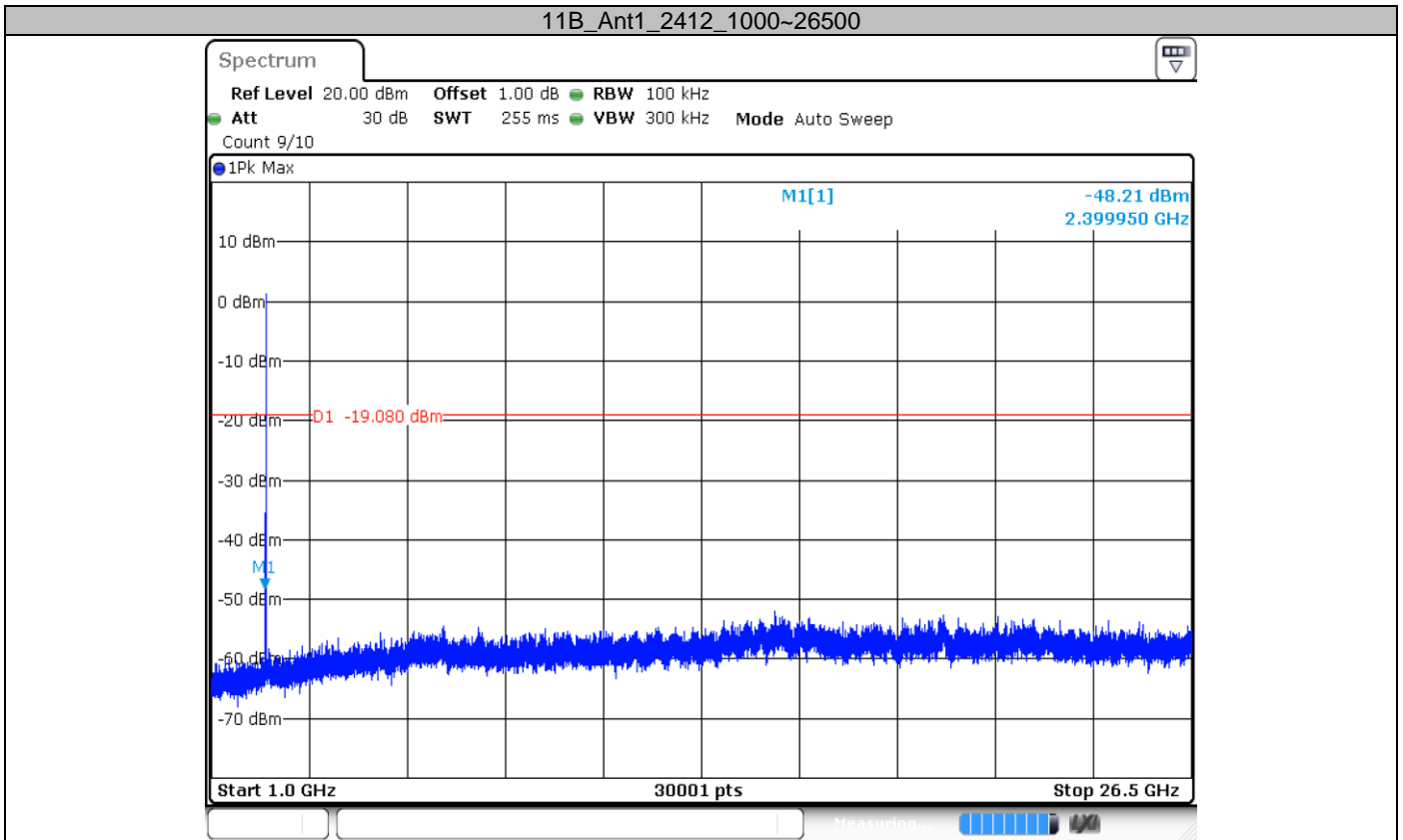
Test Graphs



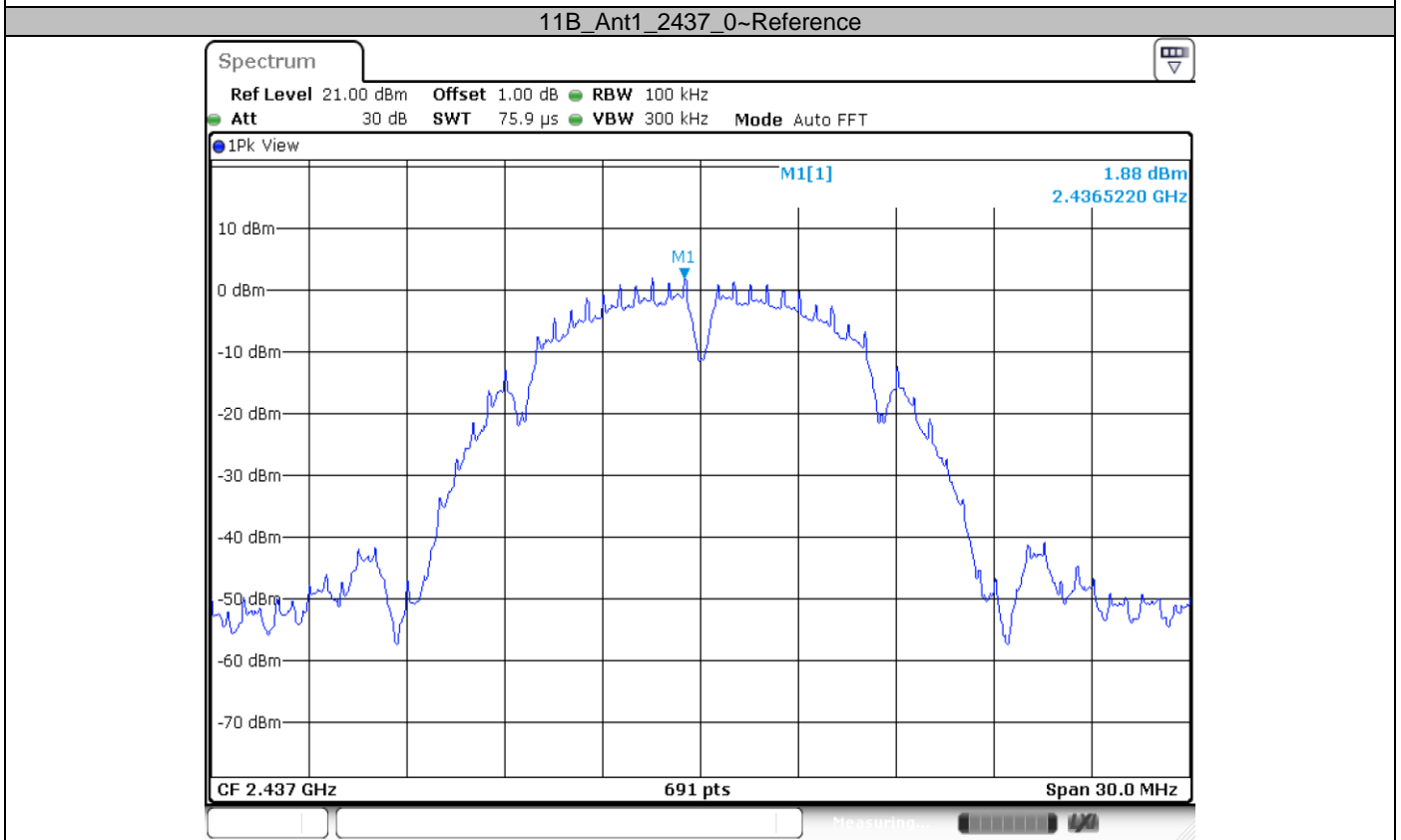
Date: 18.AUG.2023 12:27:41



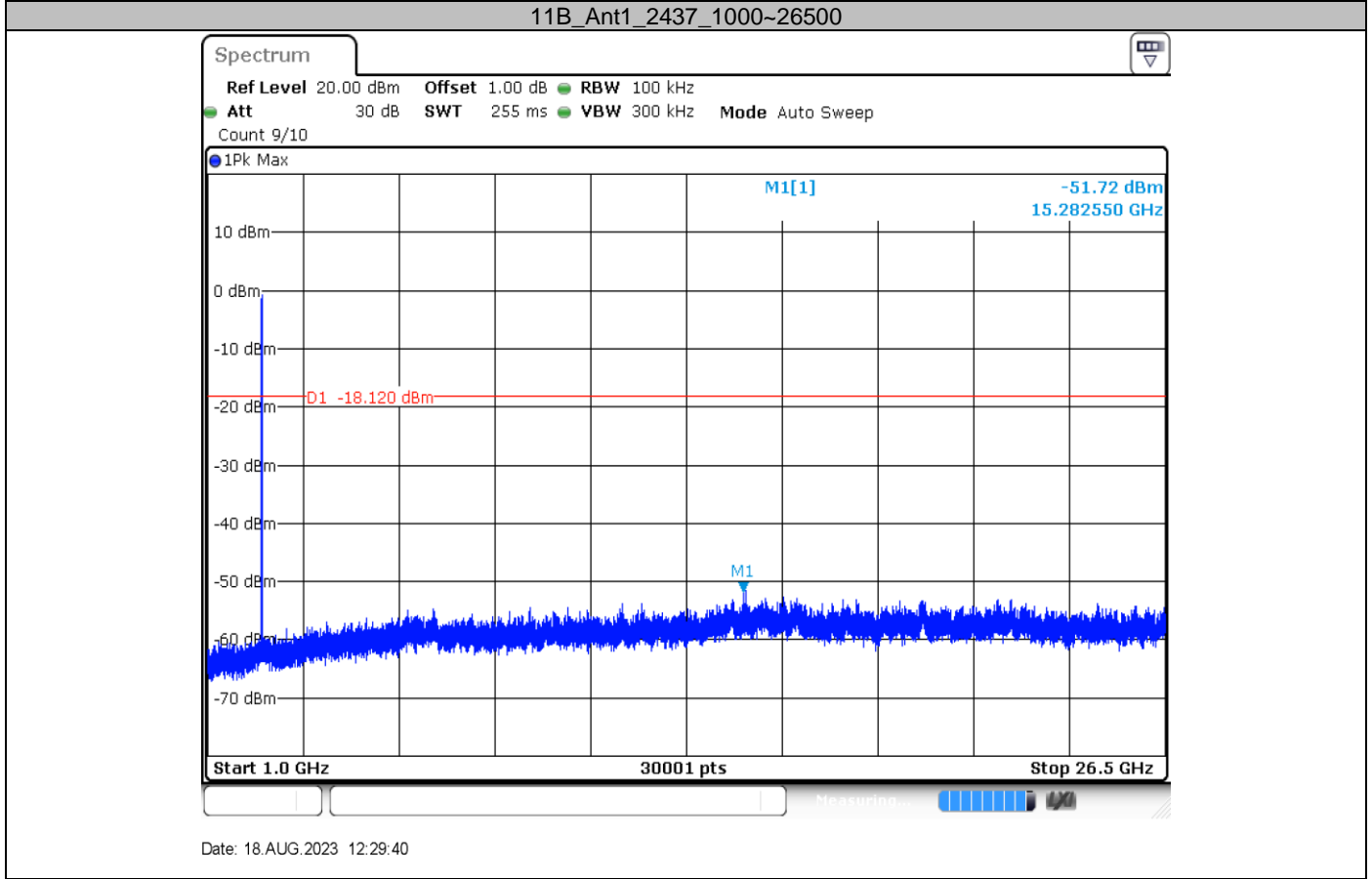
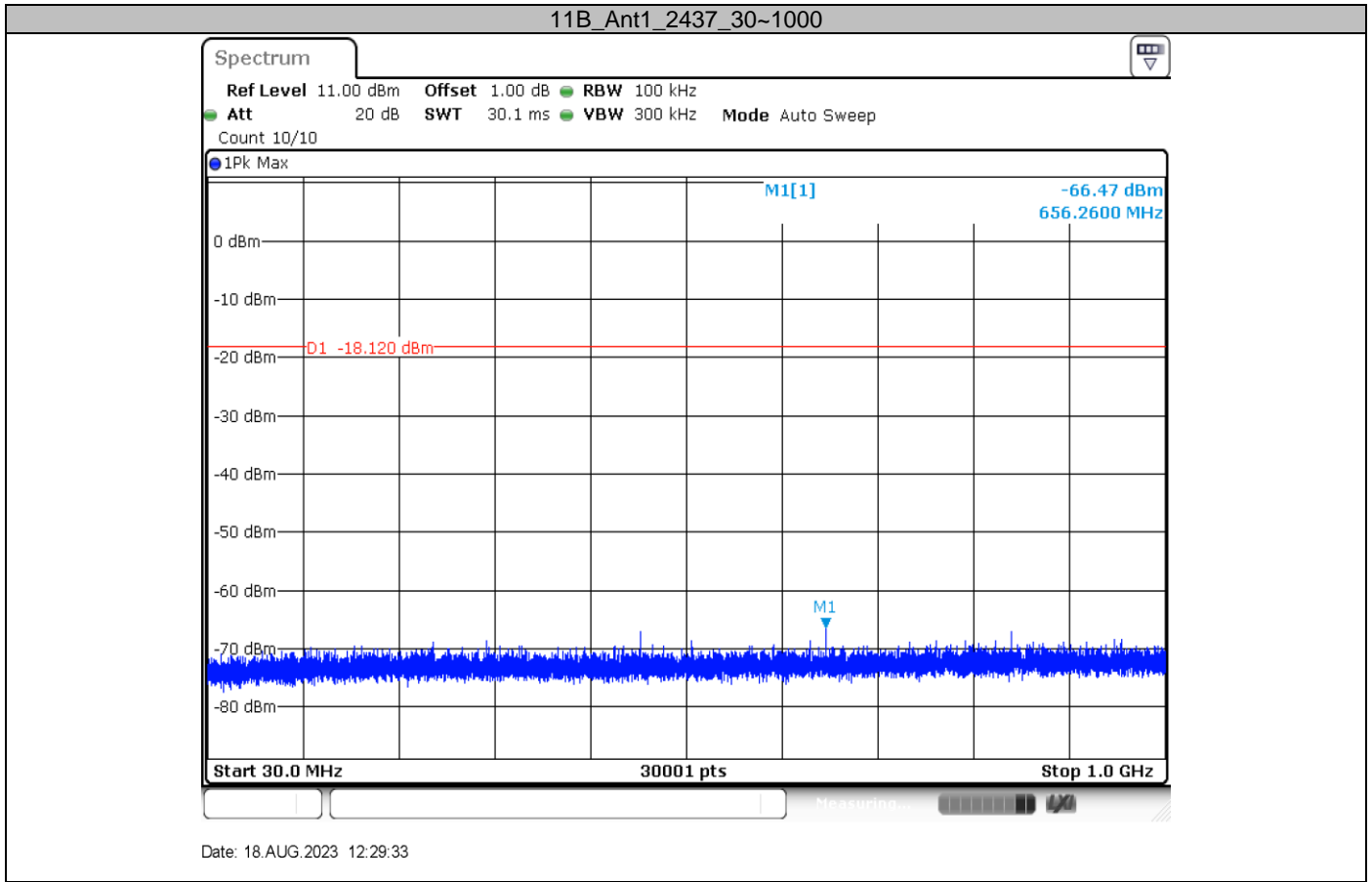
Date: 18.AUG.2023 12:27:47

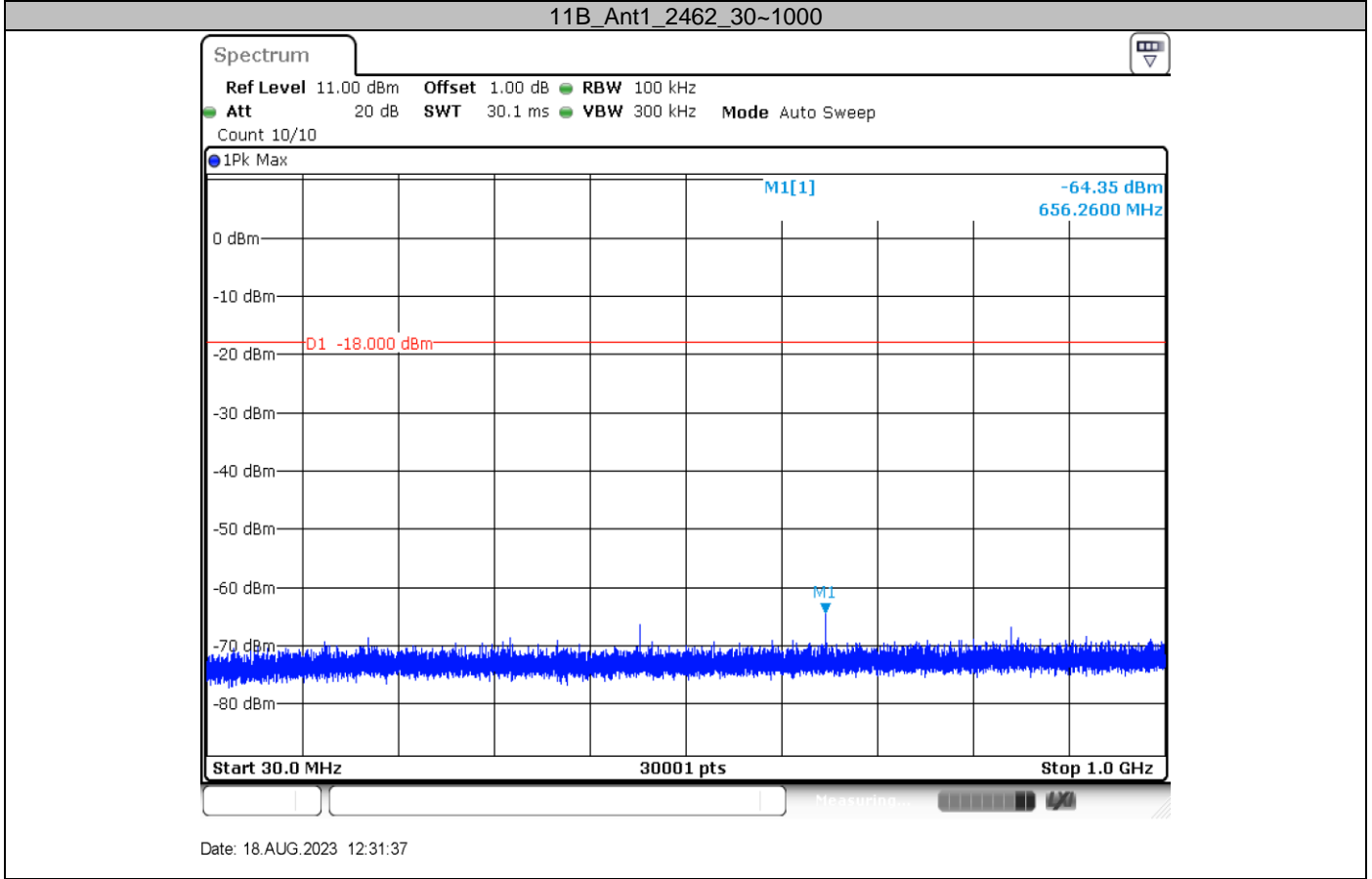
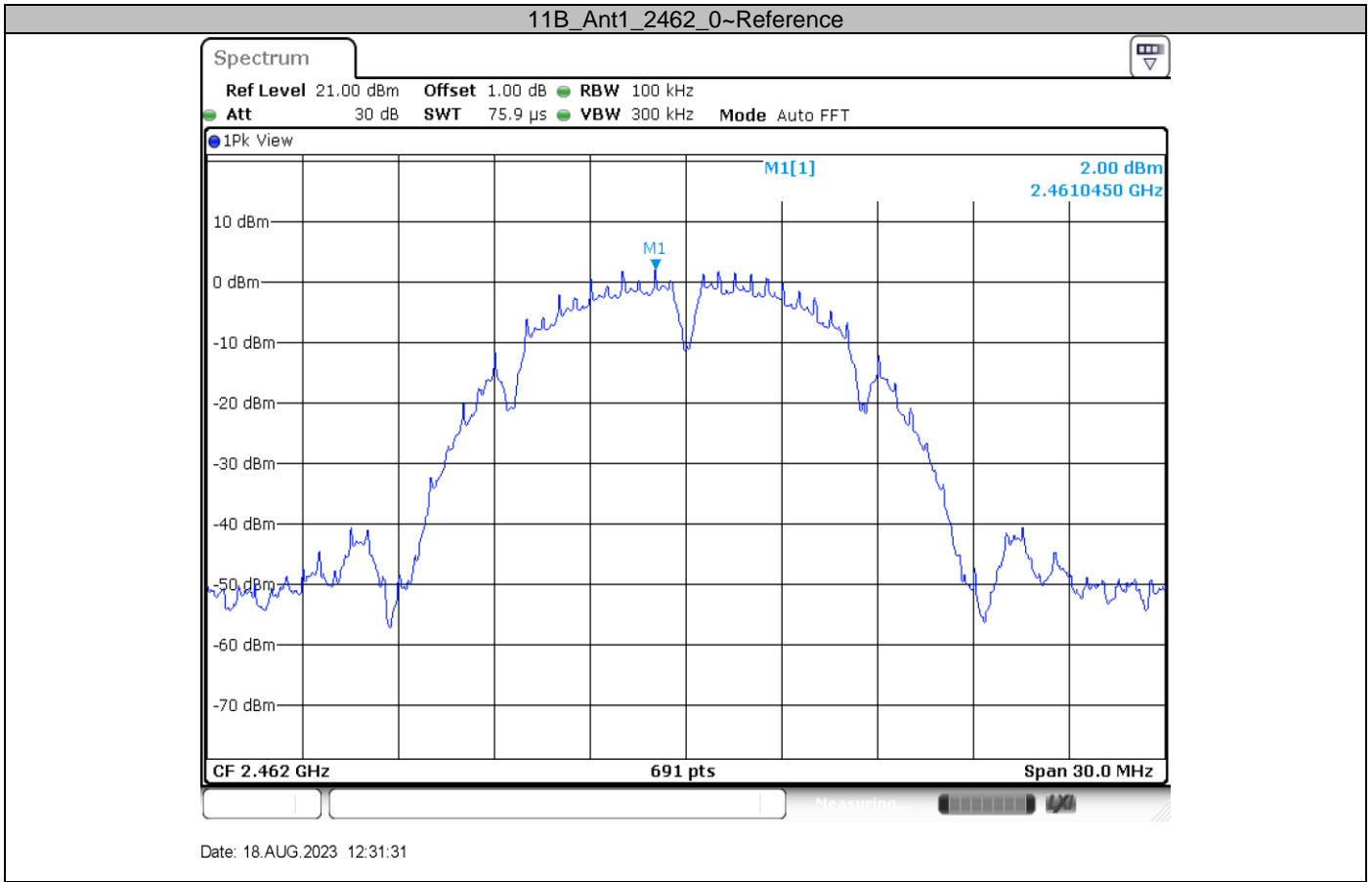


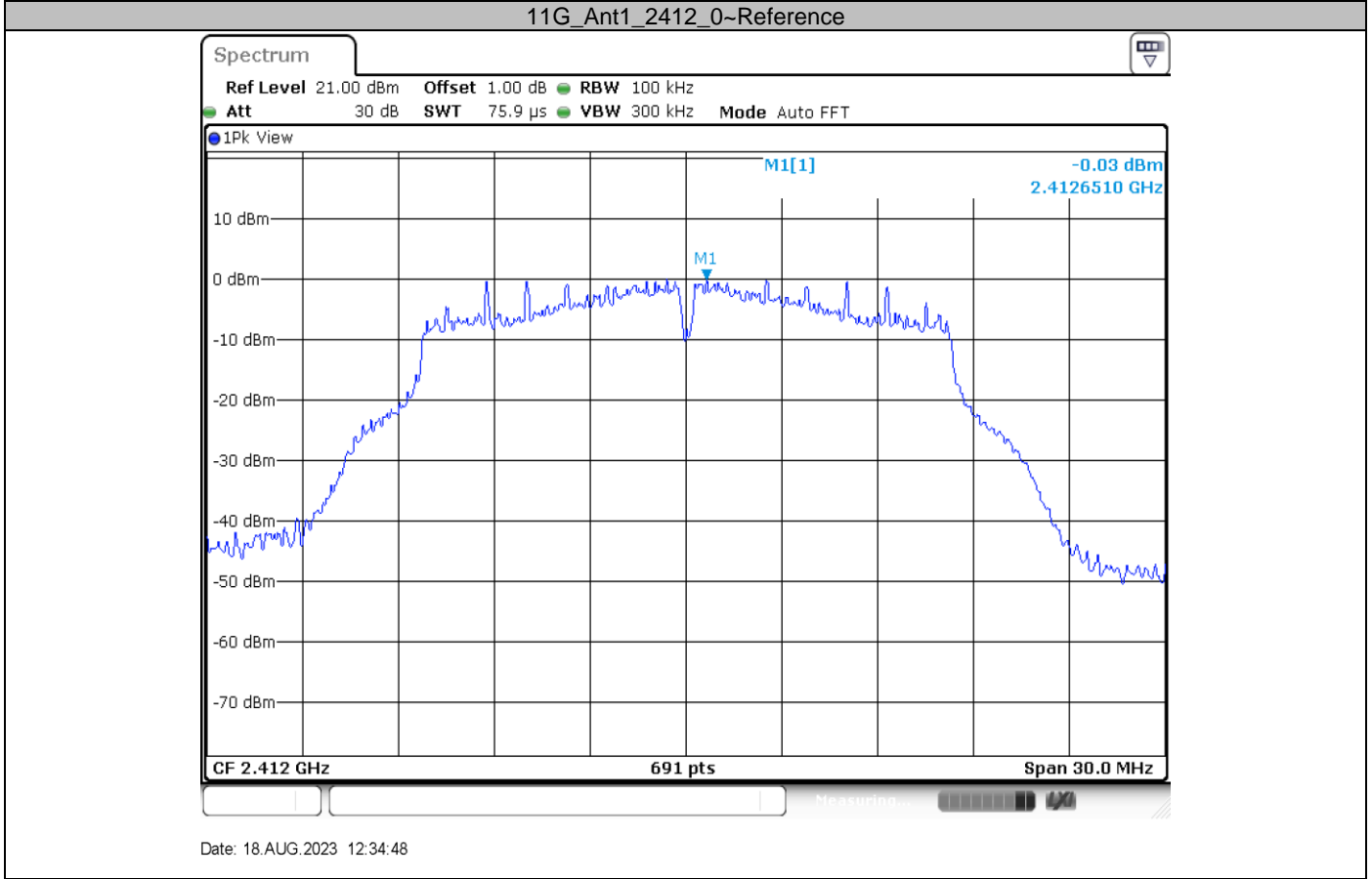
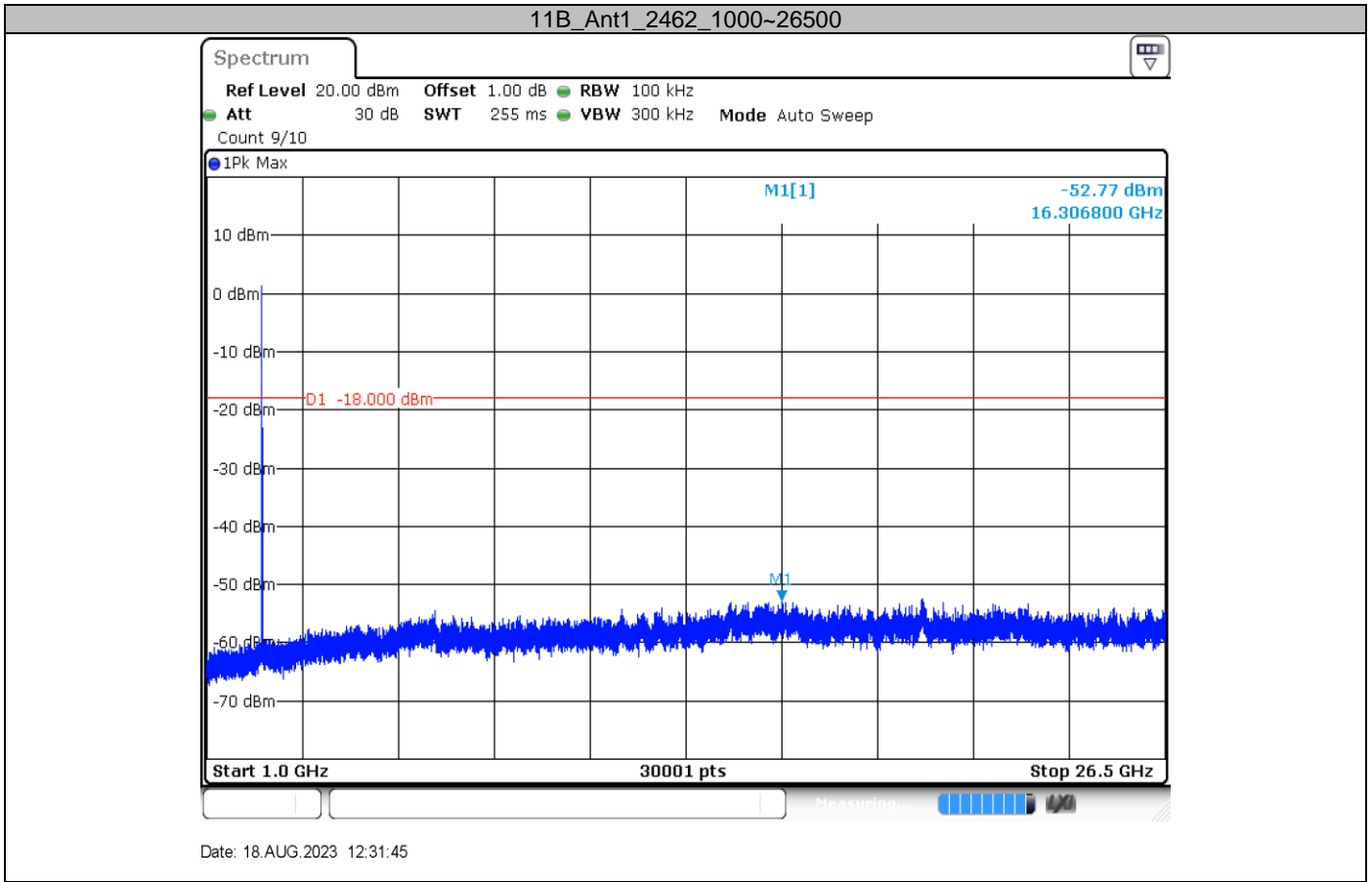
Date: 18.AUG.2023 12:27:55

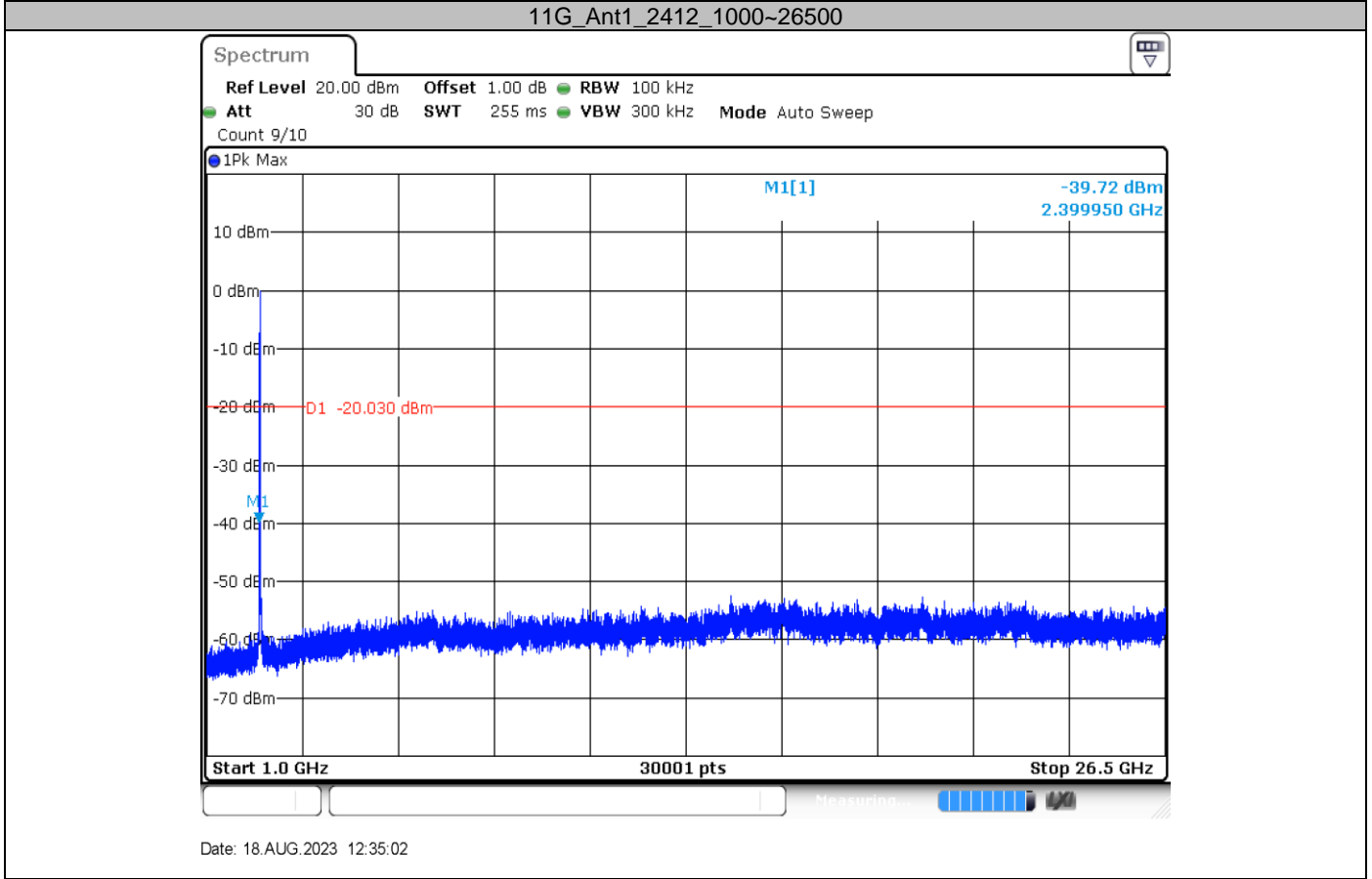
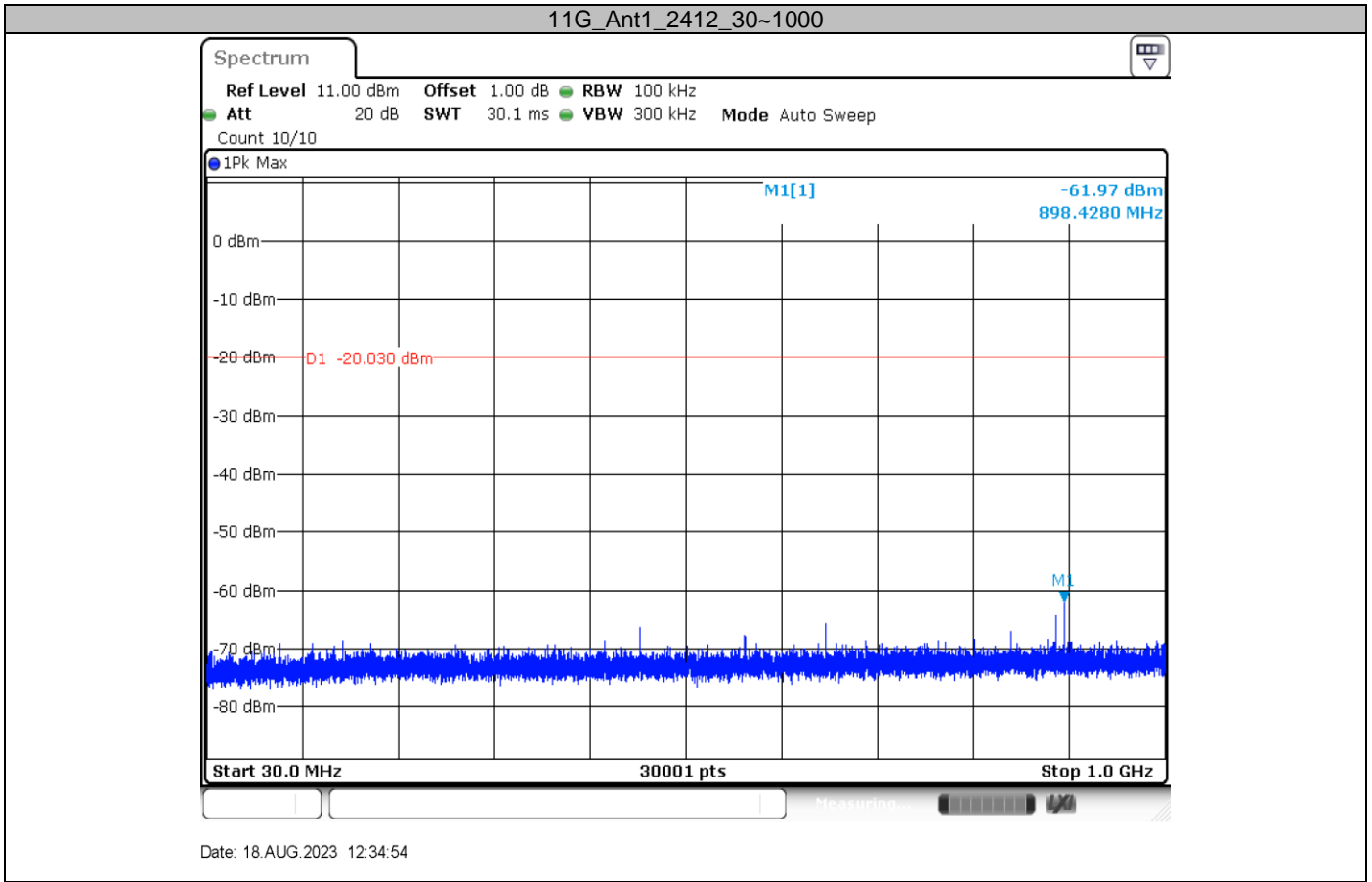


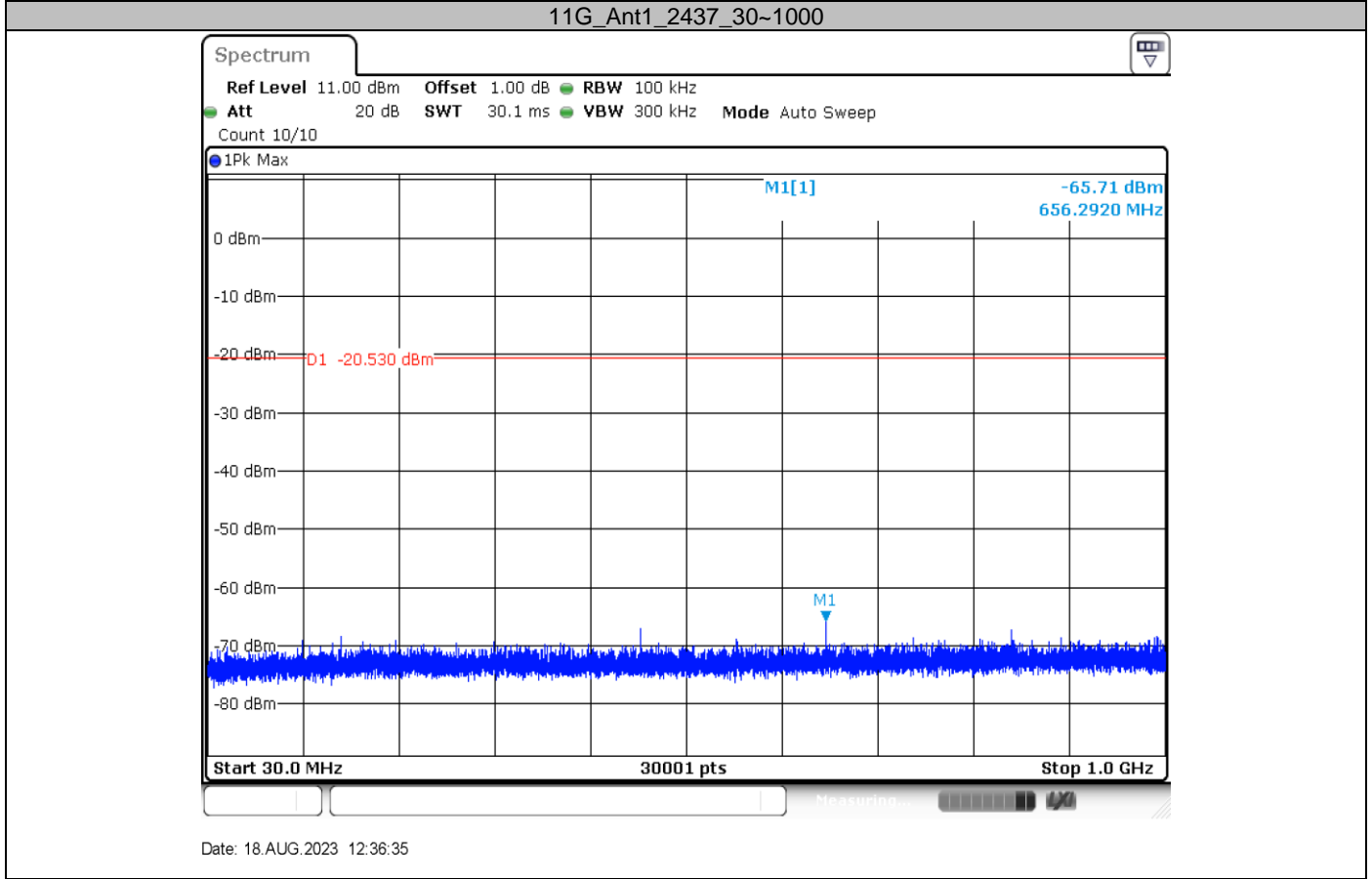
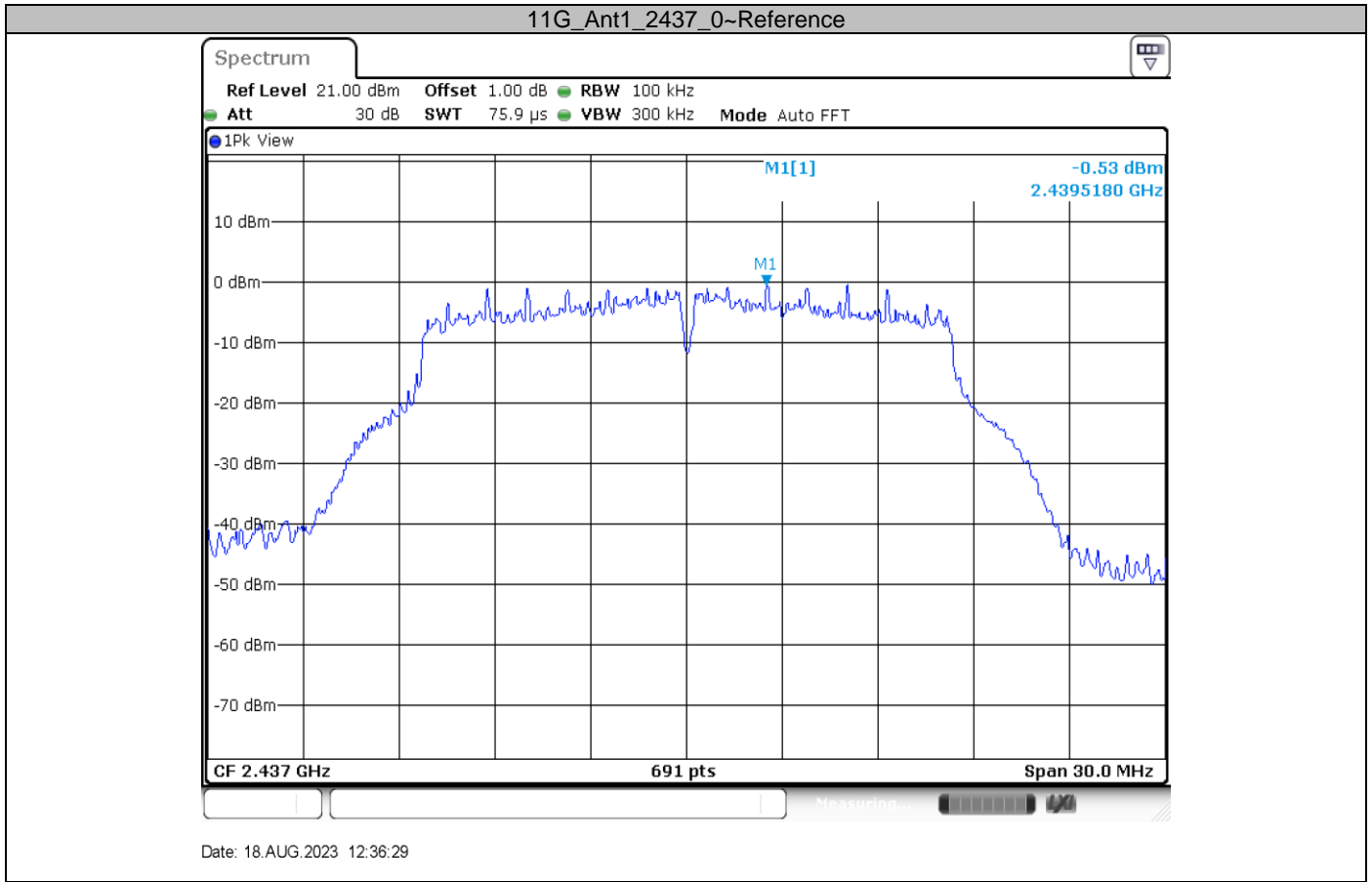
Date: 18.AUG.2023 12:29:26

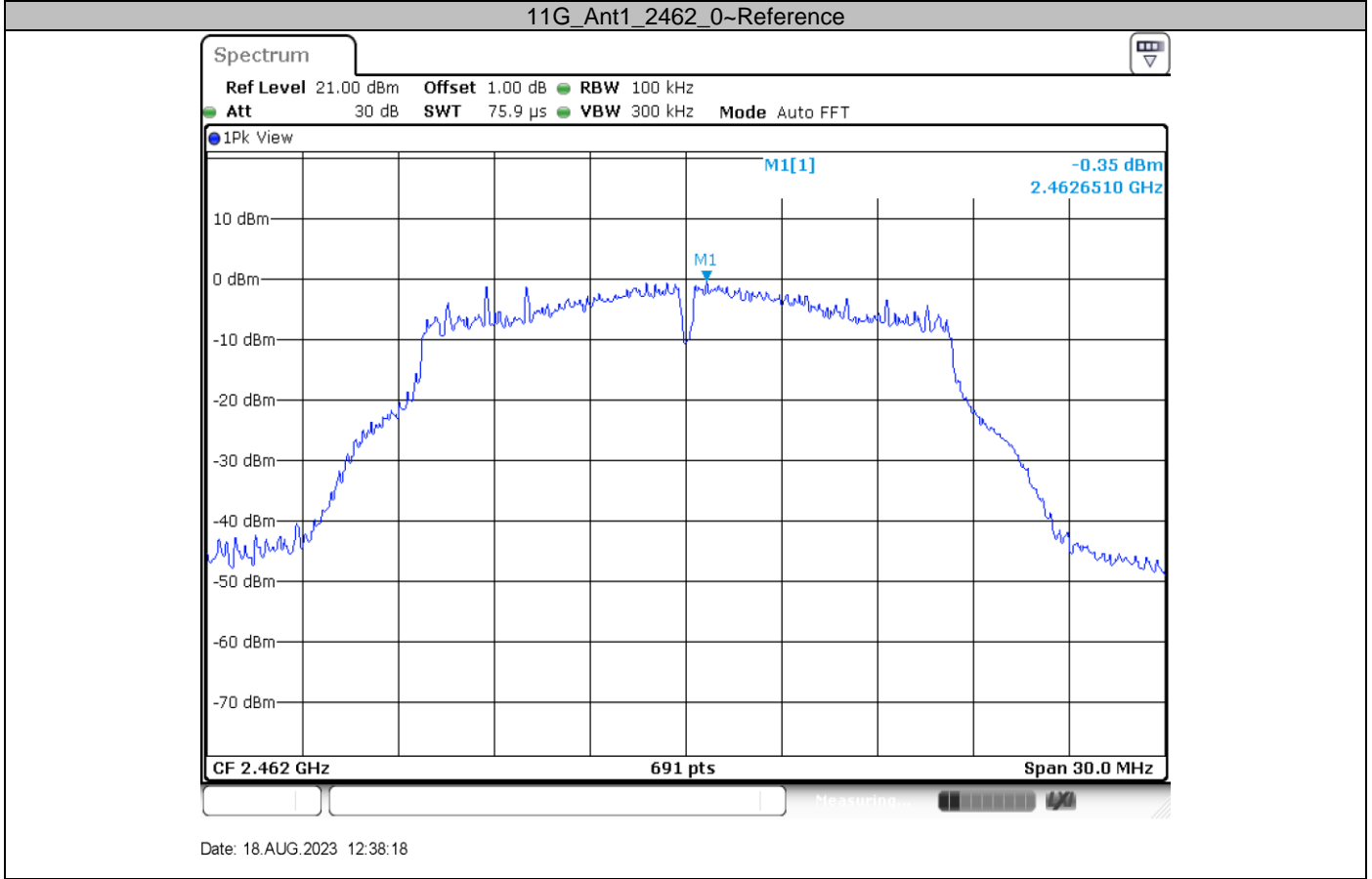
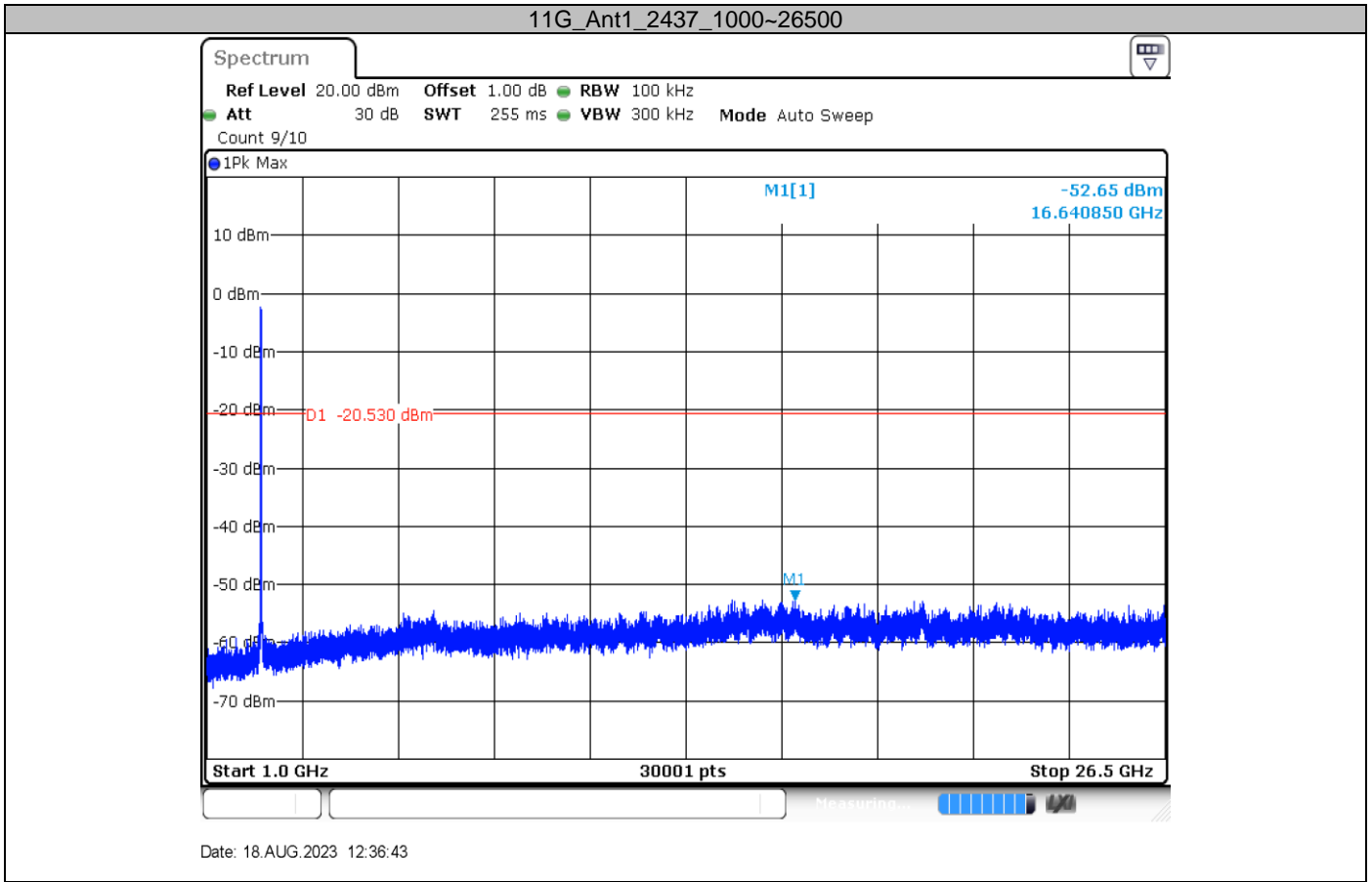


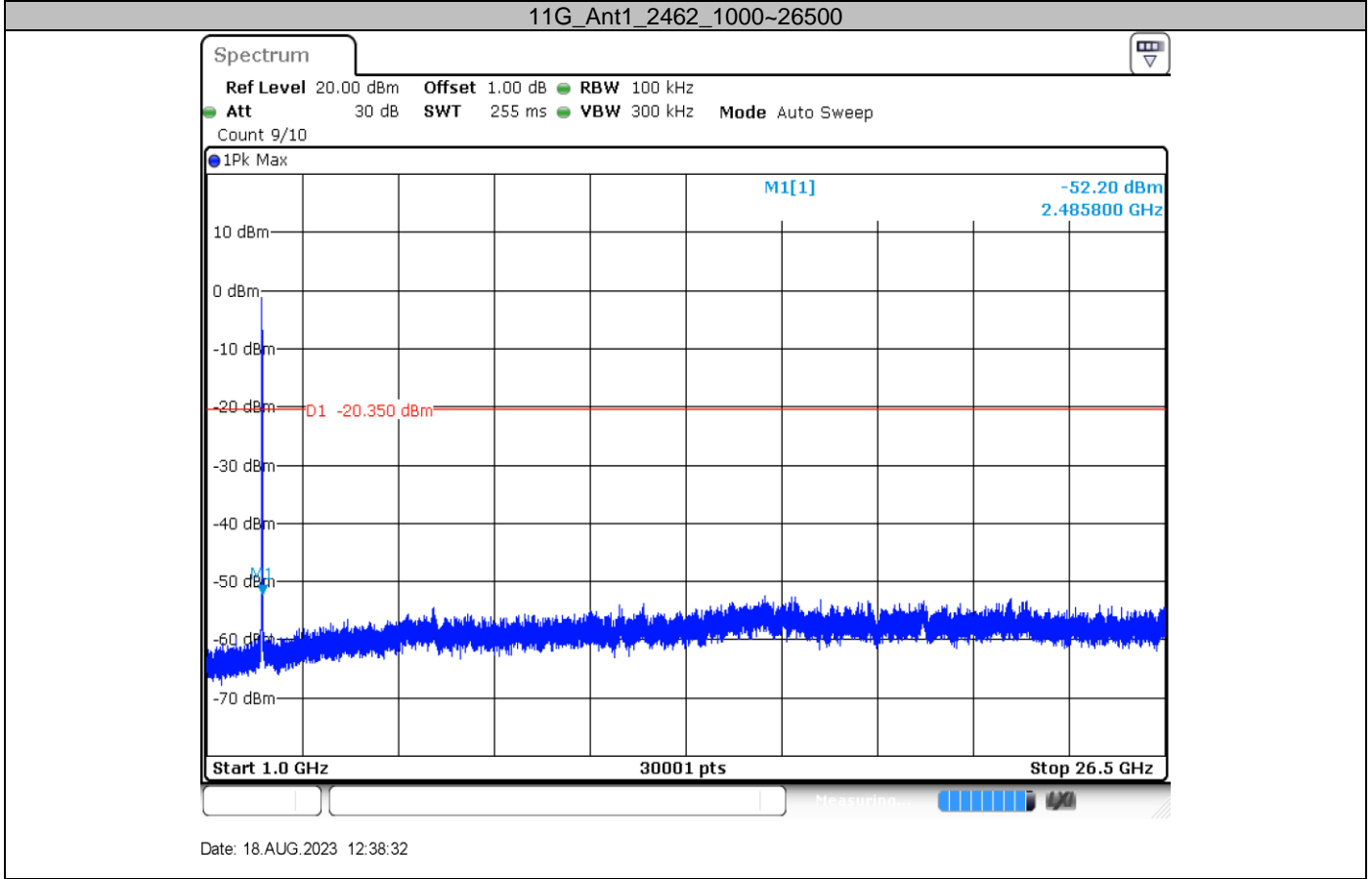
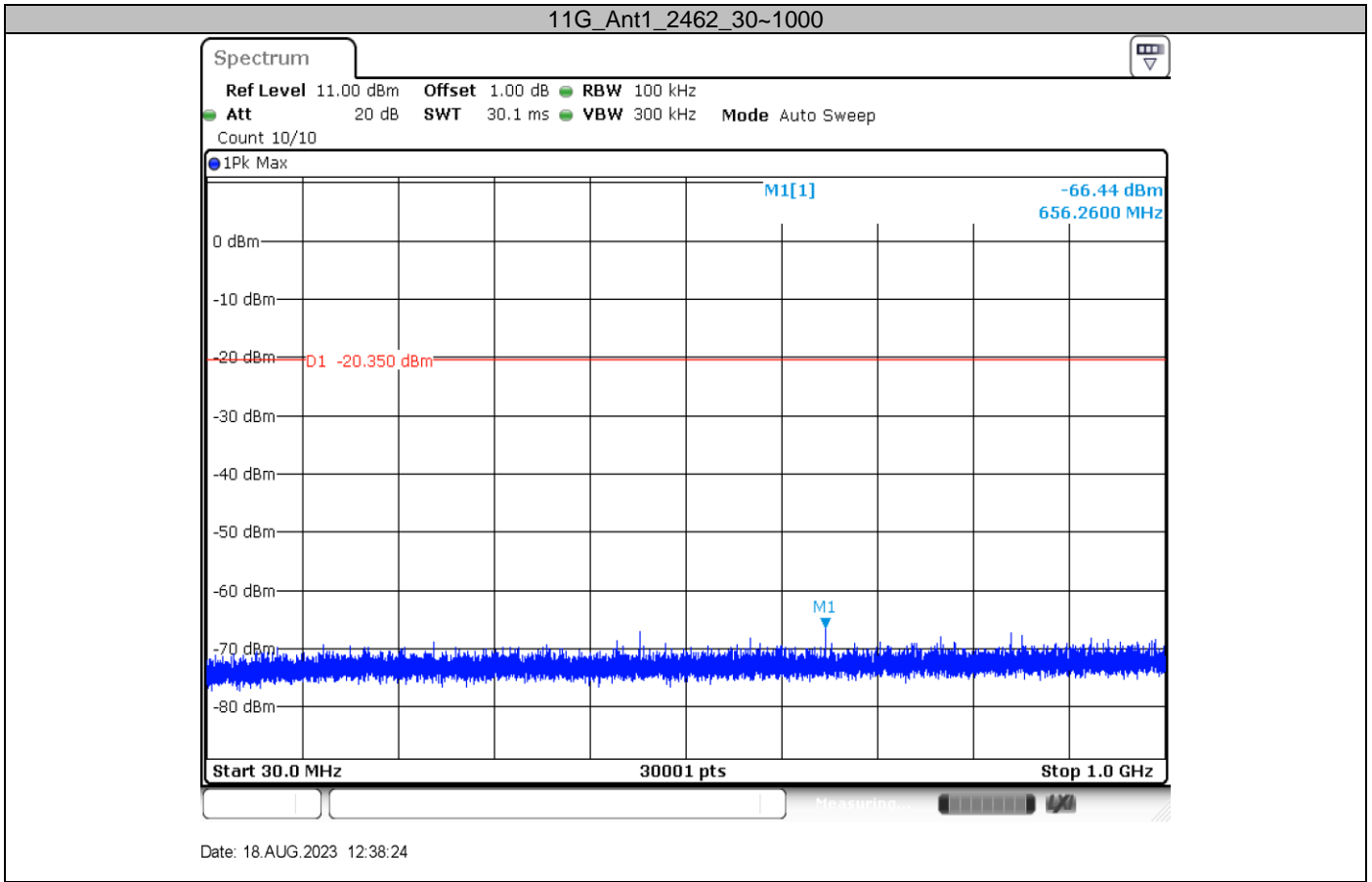


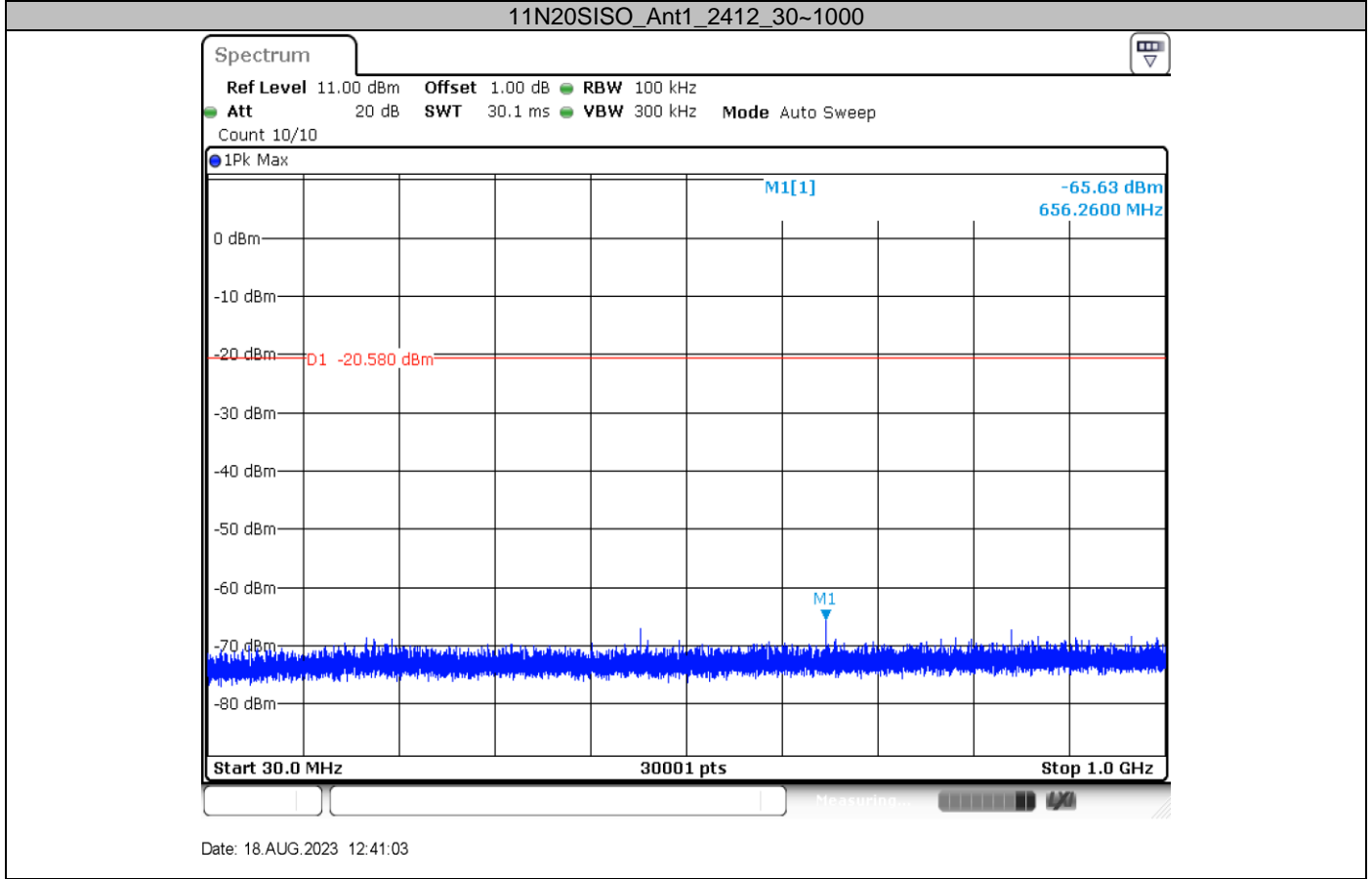
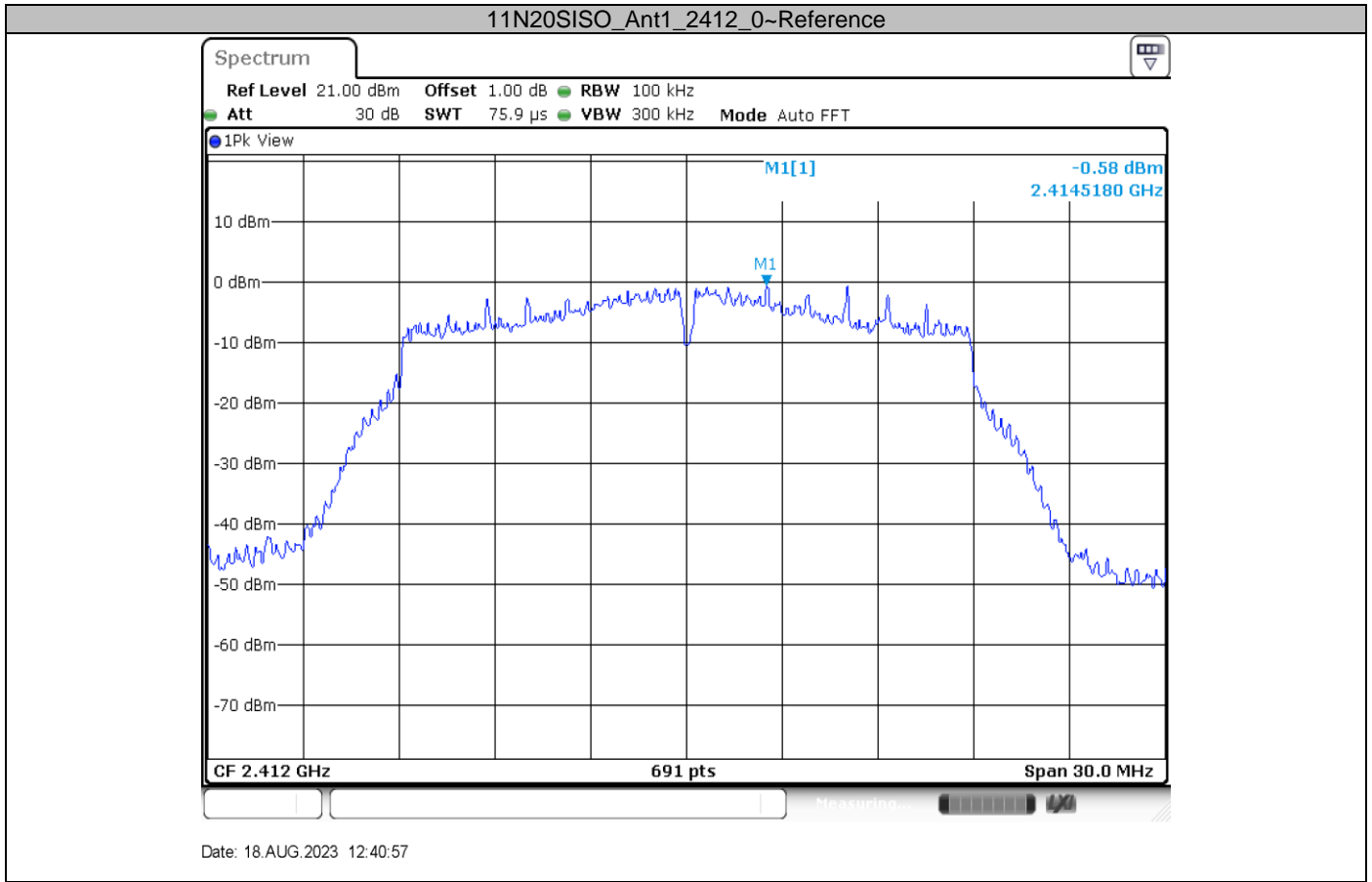


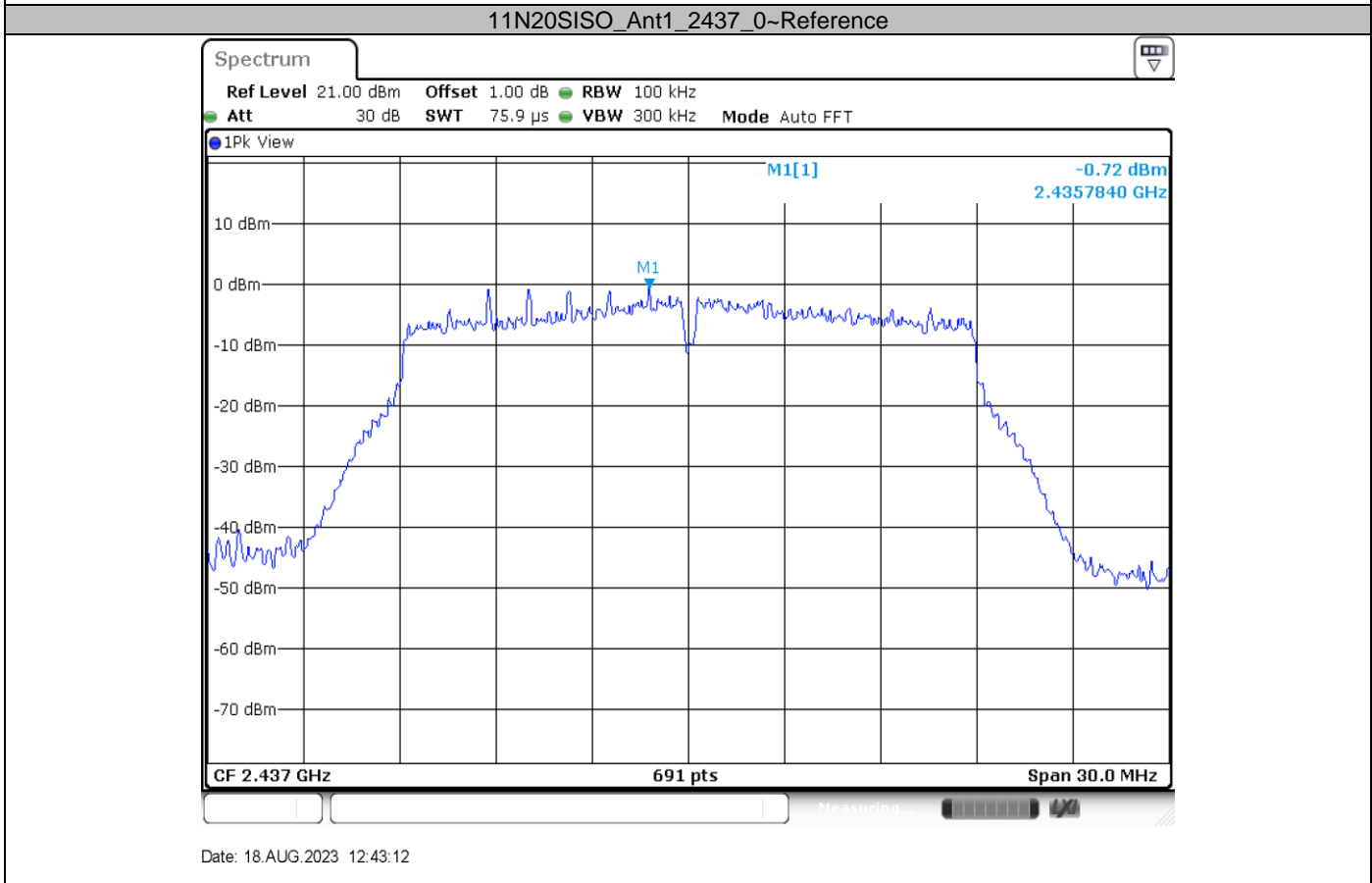
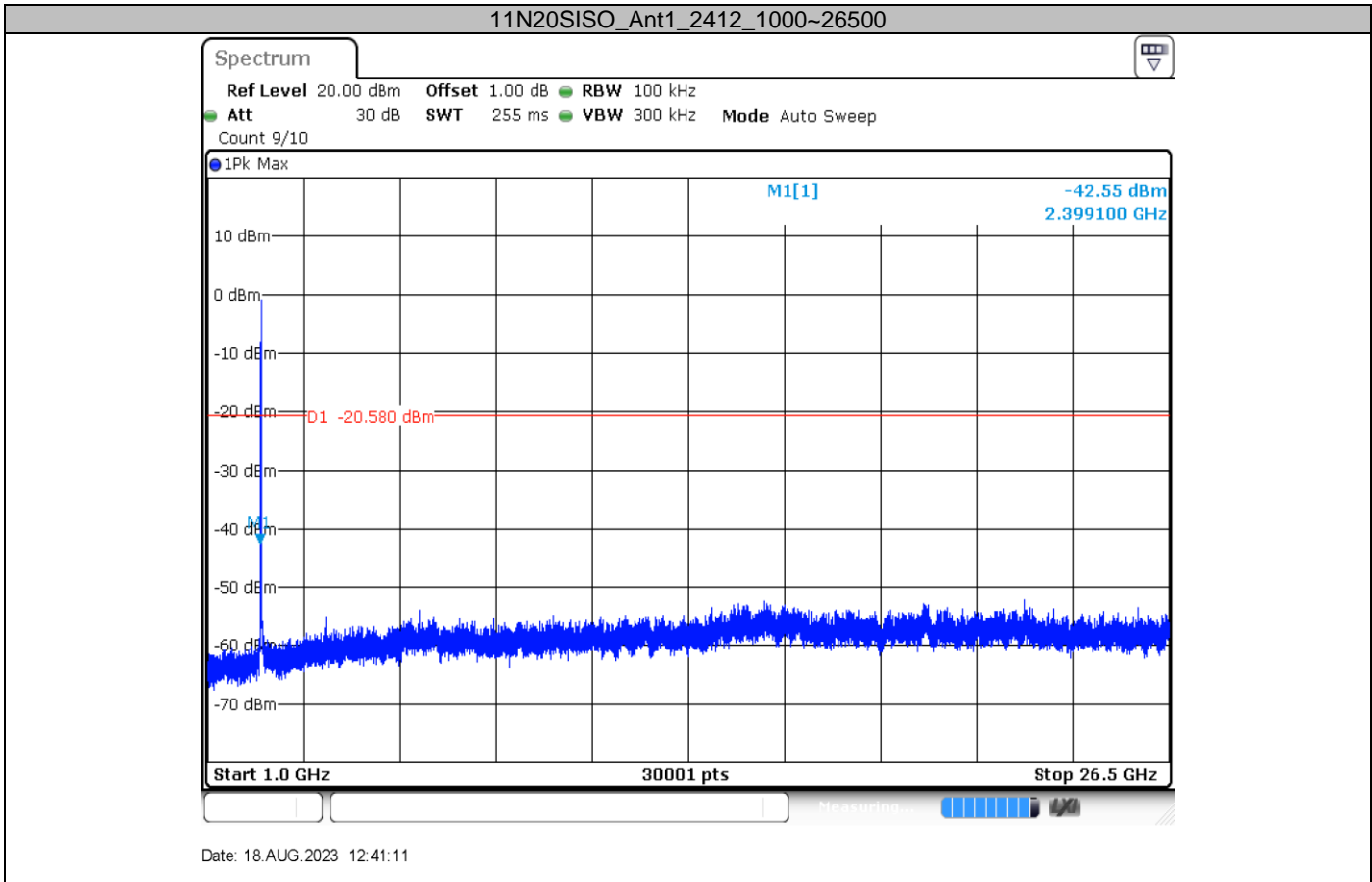


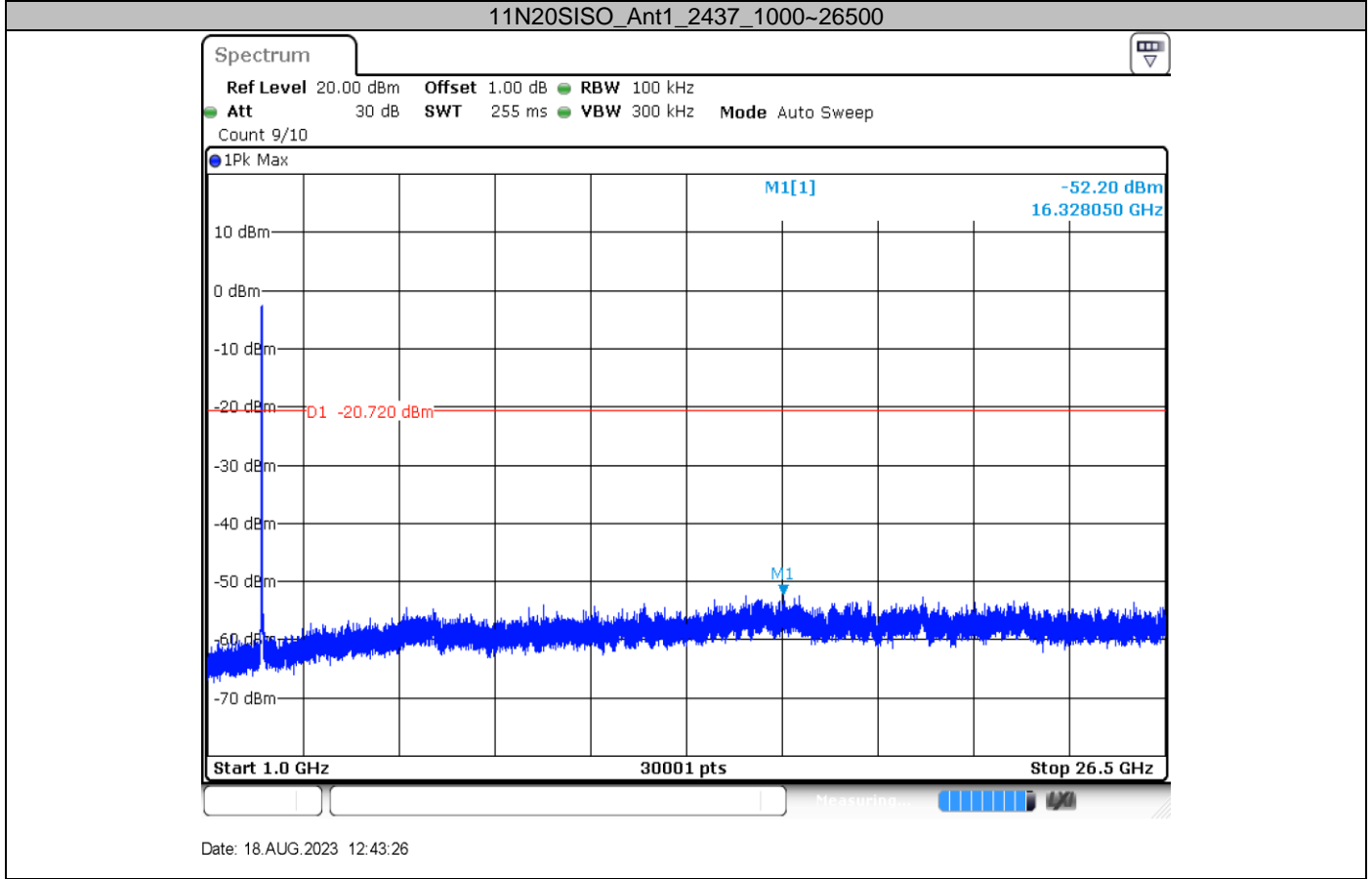
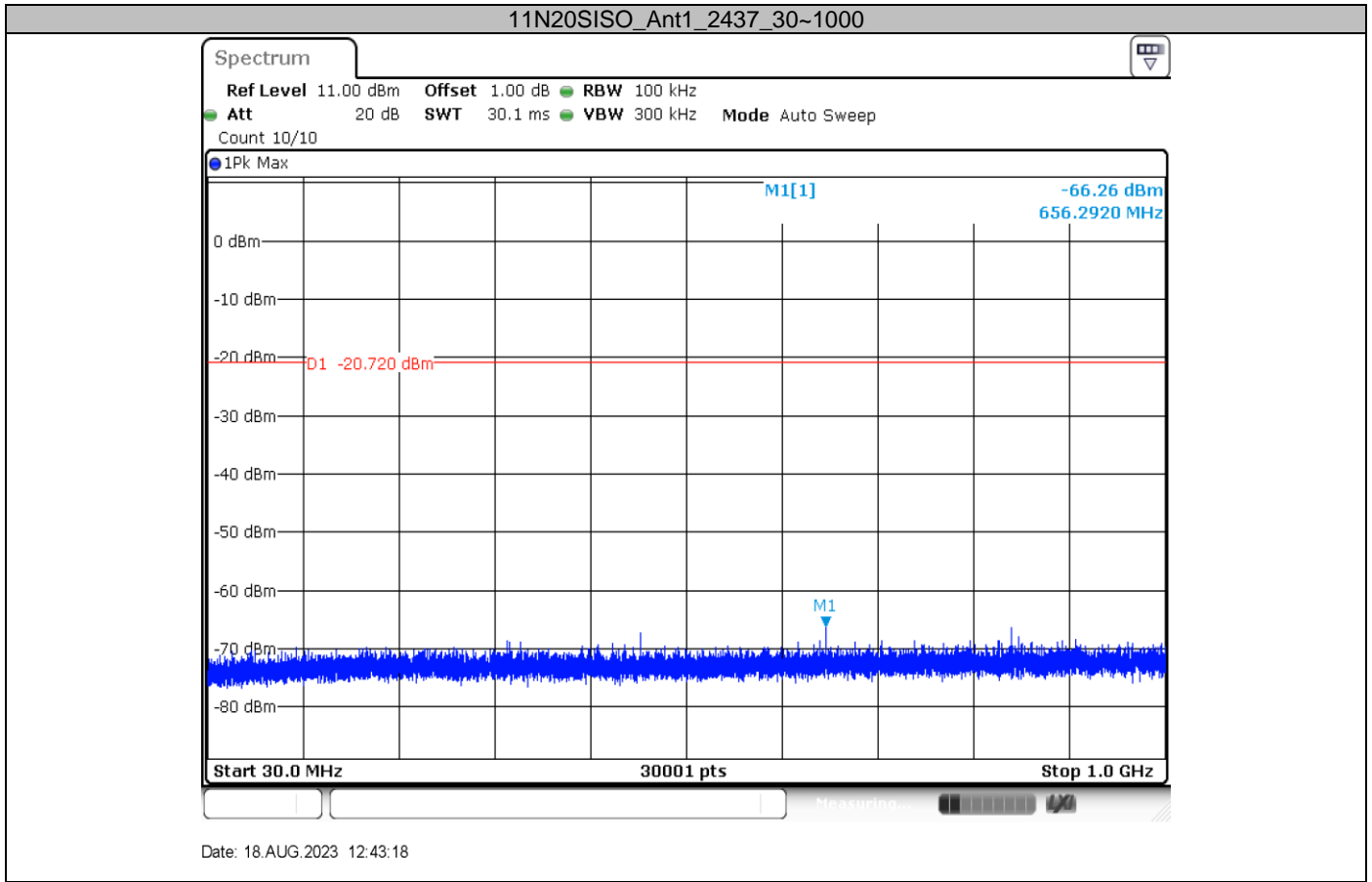


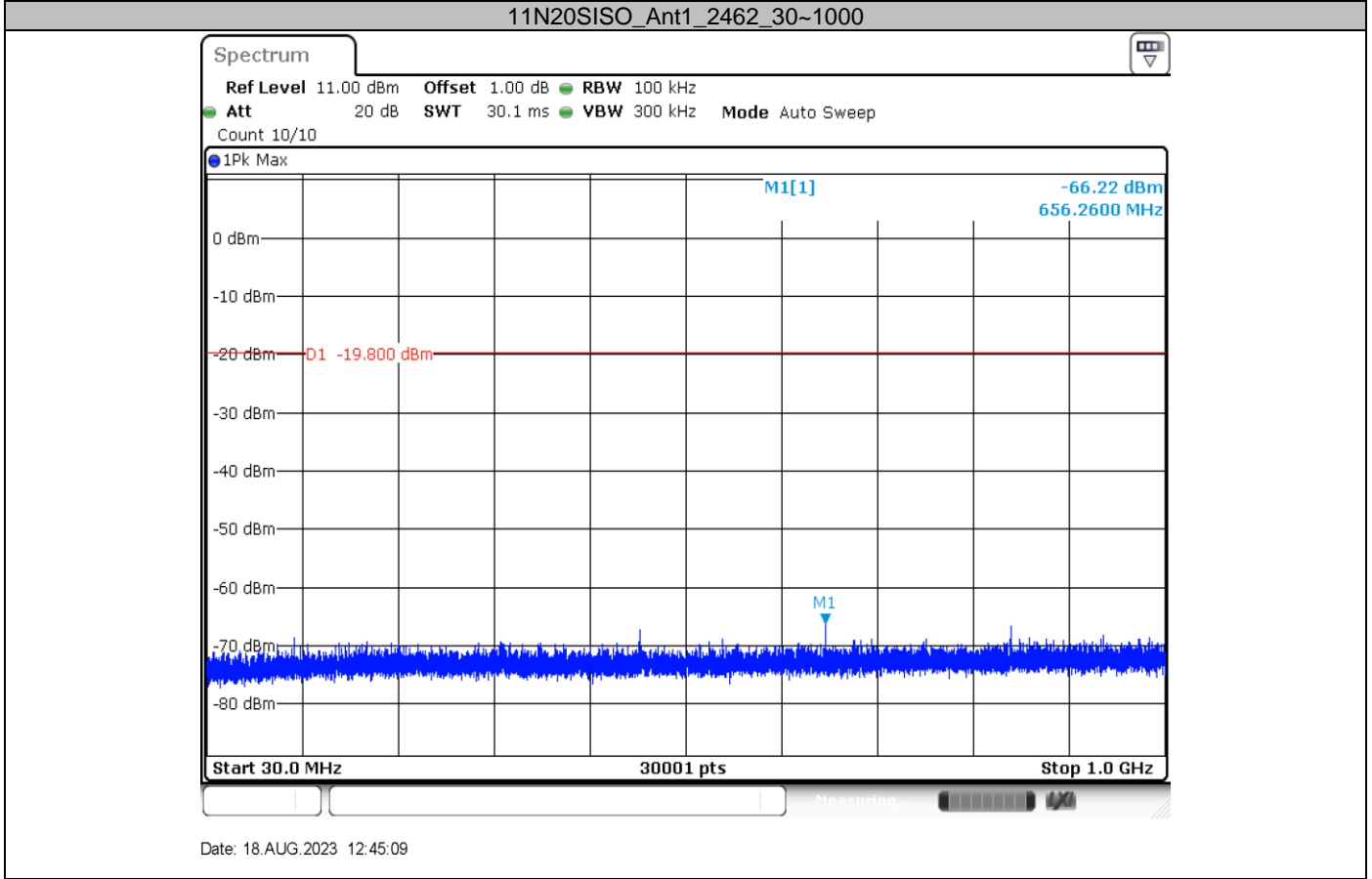
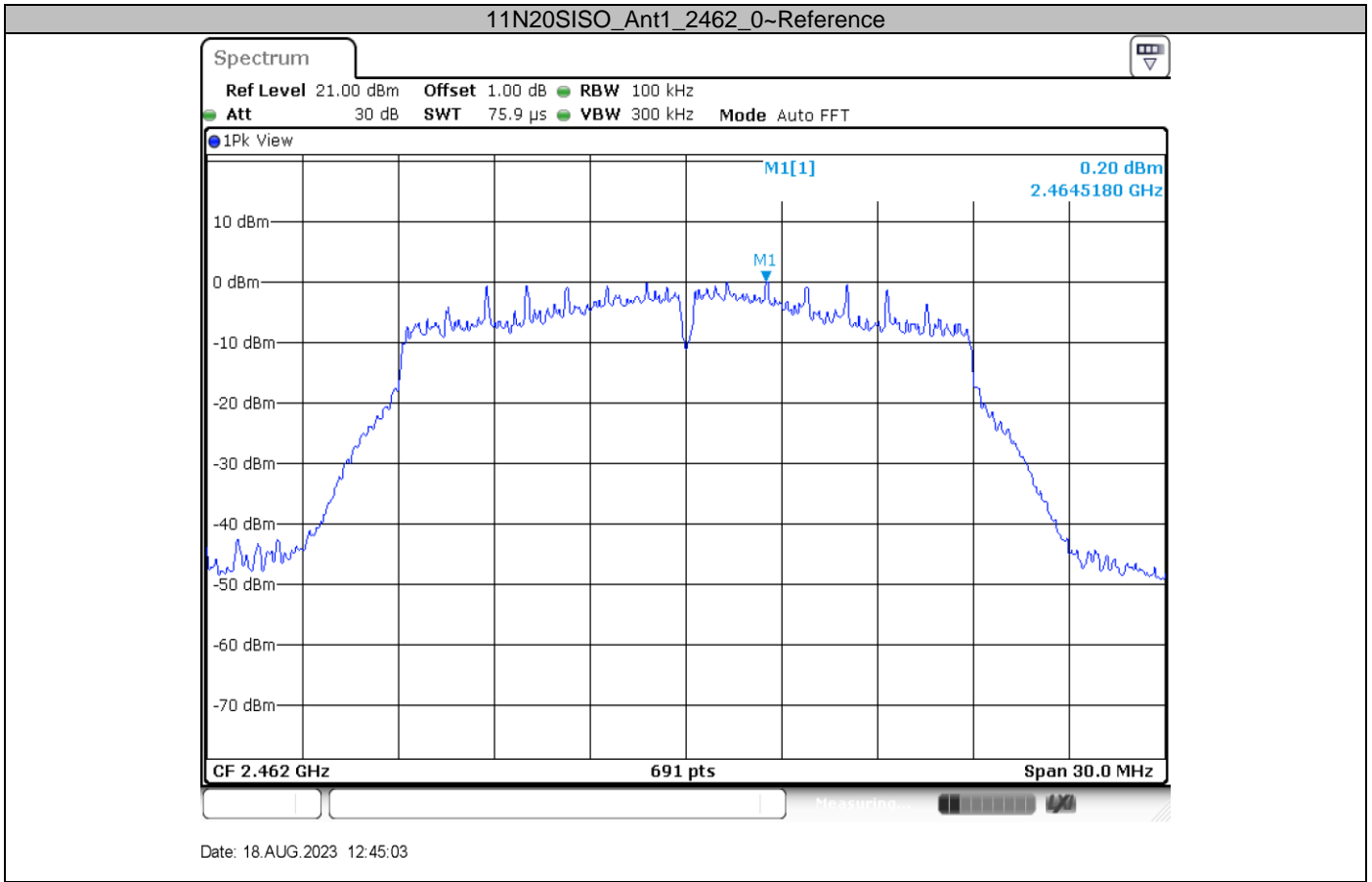


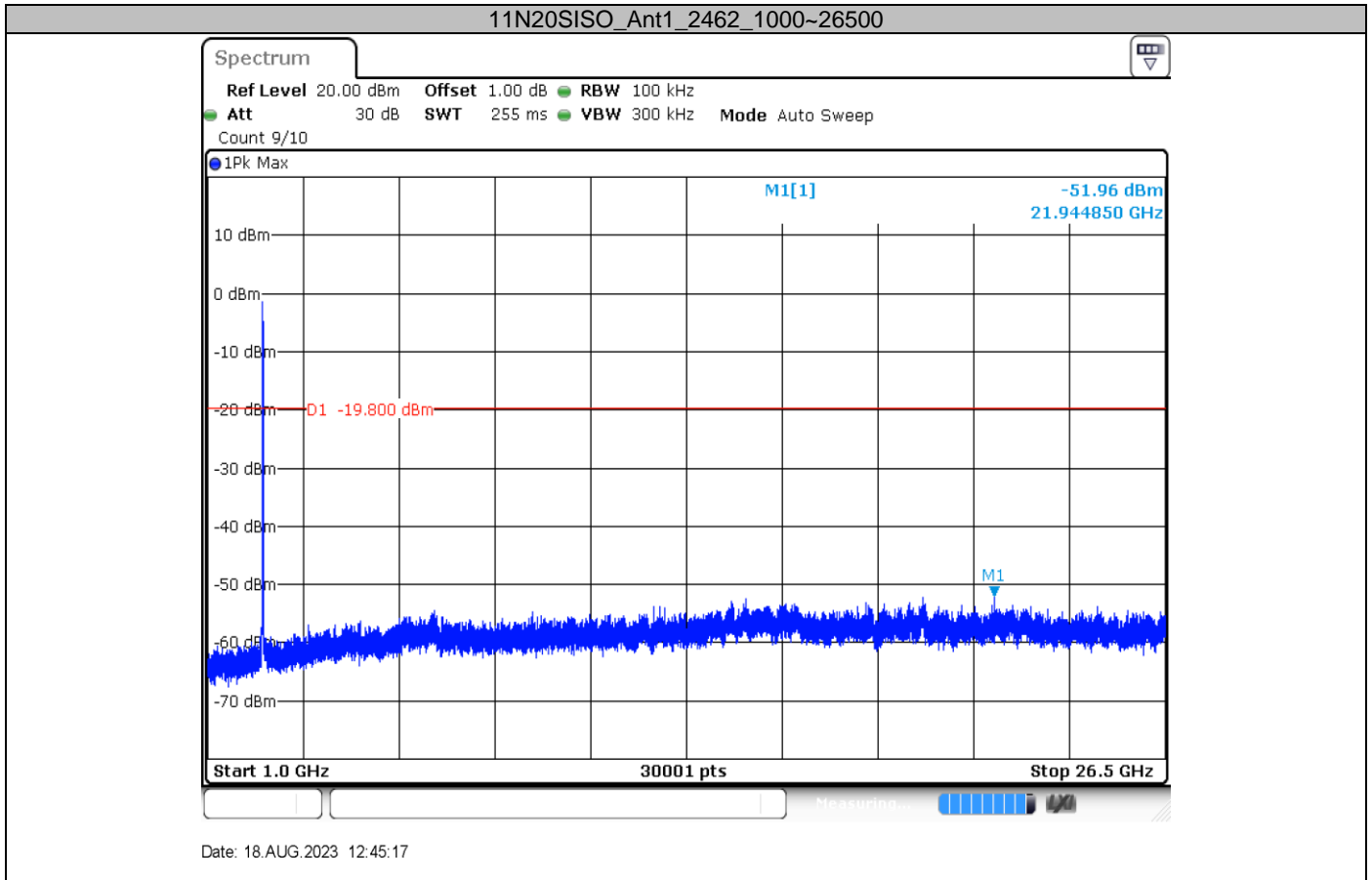












9.6 Band edge testing

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 \geq 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

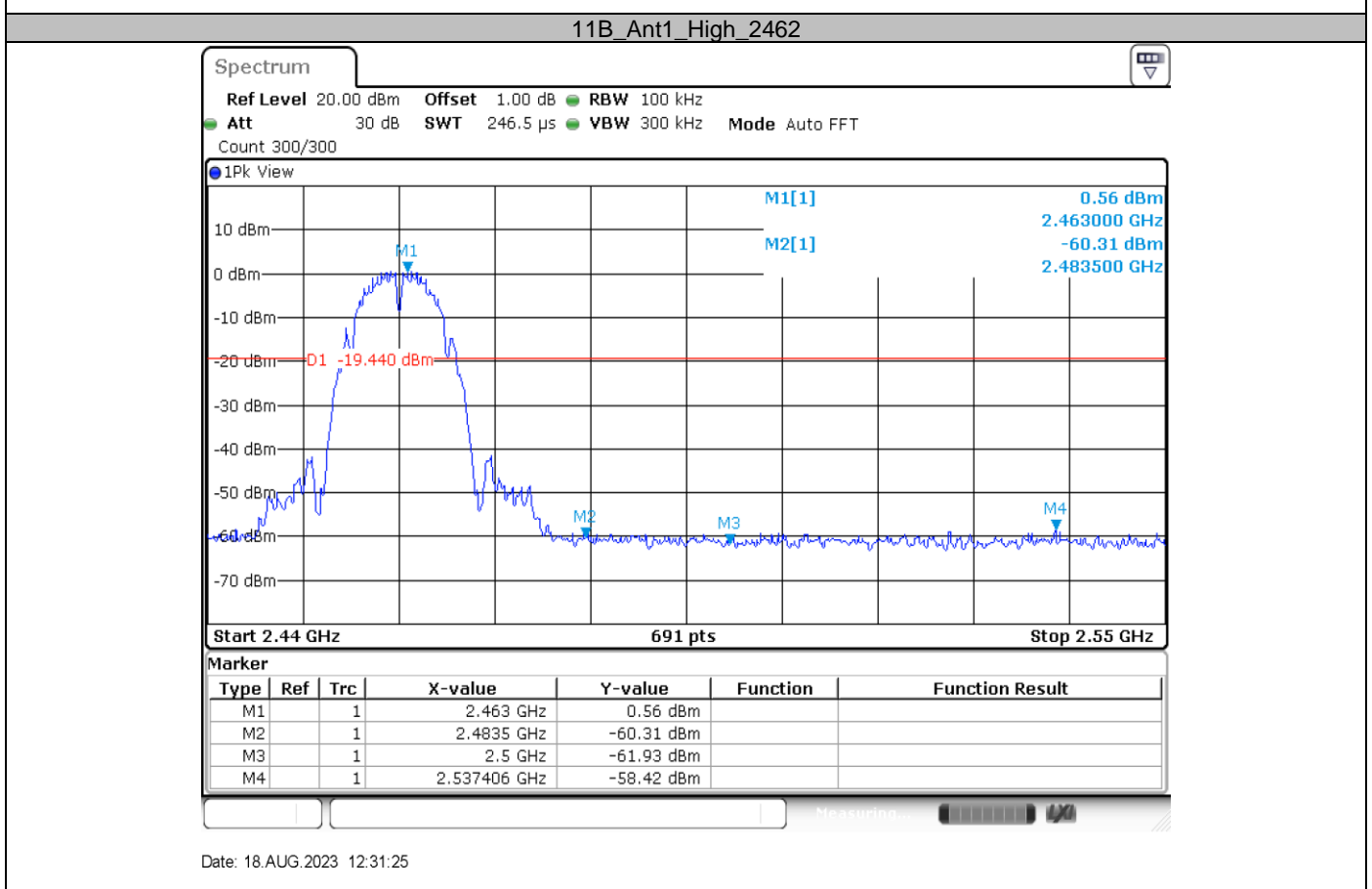
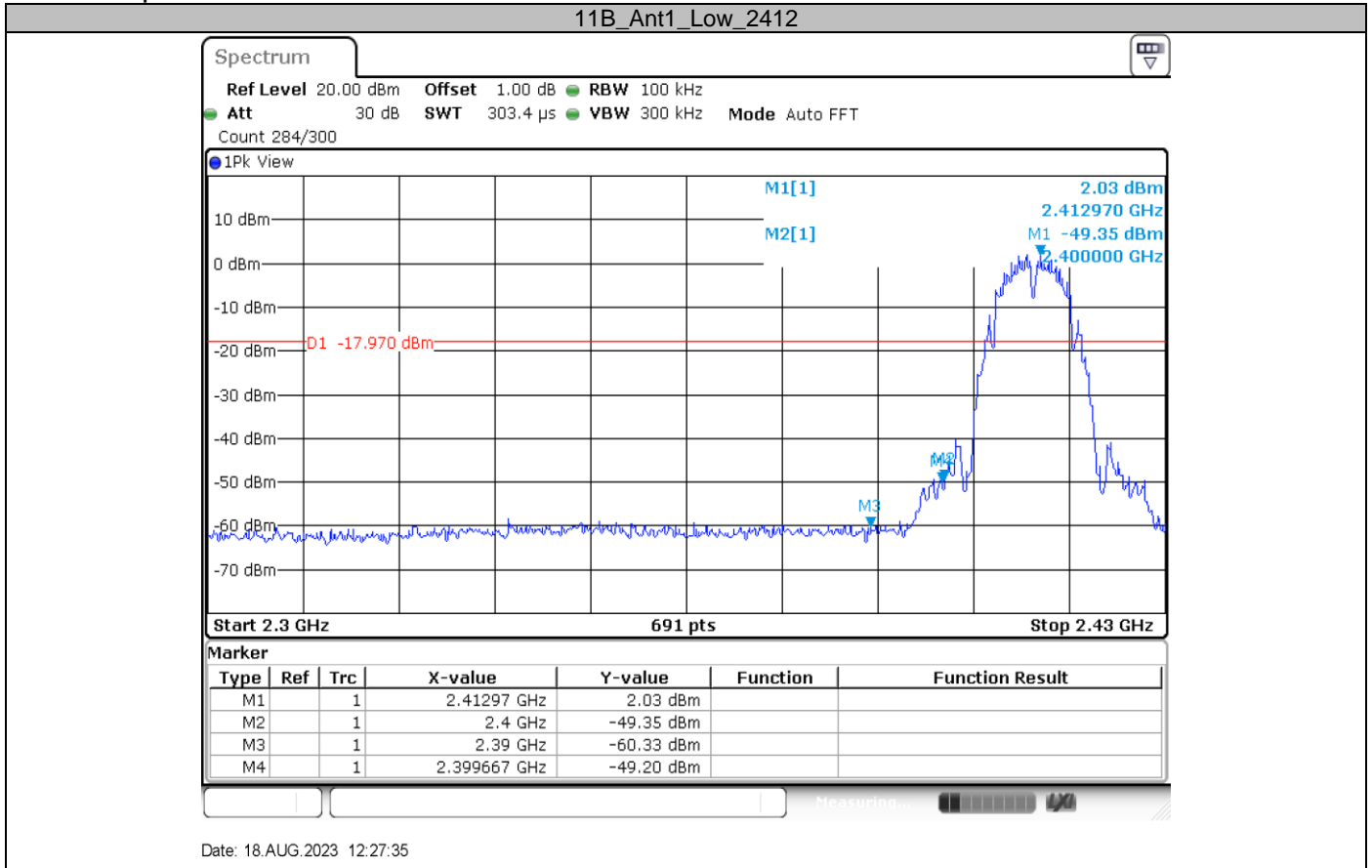
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either 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

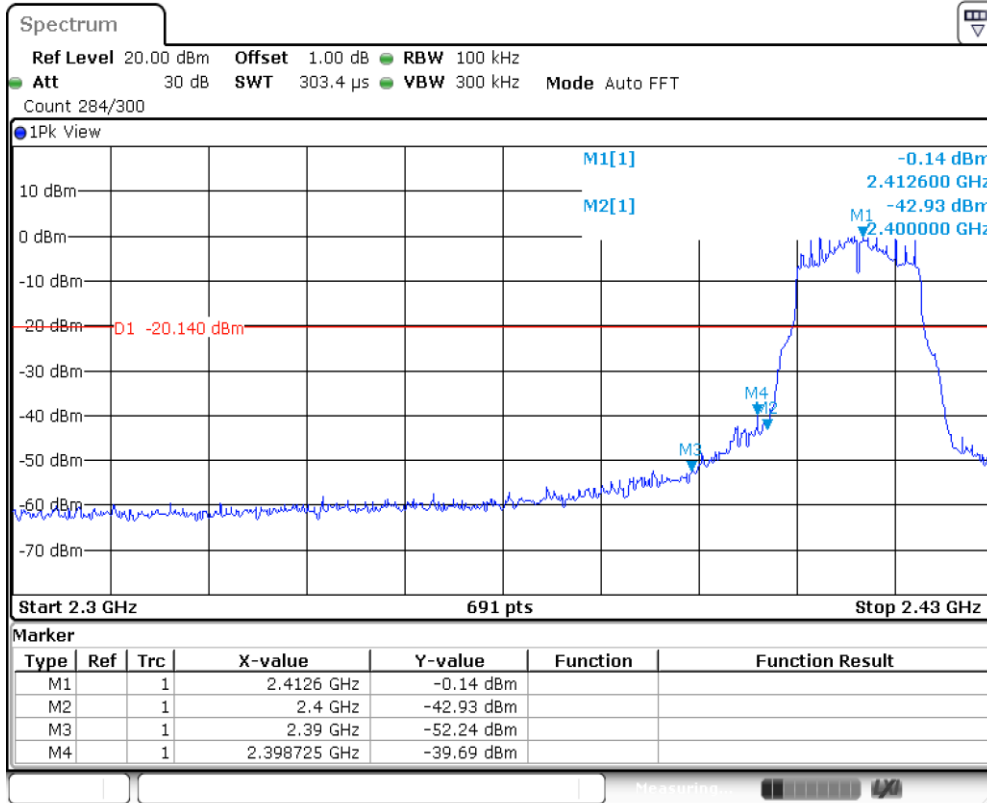
Test result

Test Mode	Antenna	Ch Name	Channel [MHz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	Low	2412	2.03	-49.2	≤ -17.97	PASS
		High	2462	0.56	-58.42	≤ -19.44	PASS
11G	Ant1	Low	2412	-0.14	-39.69	≤ -20.14	PASS
		High	2462	-0.63	-50.39	≤ -20.63	PASS
11N20SISO	Ant1	Low	2412	-0.69	-42.32	≤ -20.69	PASS
		High	2462	-0.30	-53.64	≤ -20.3	PASS

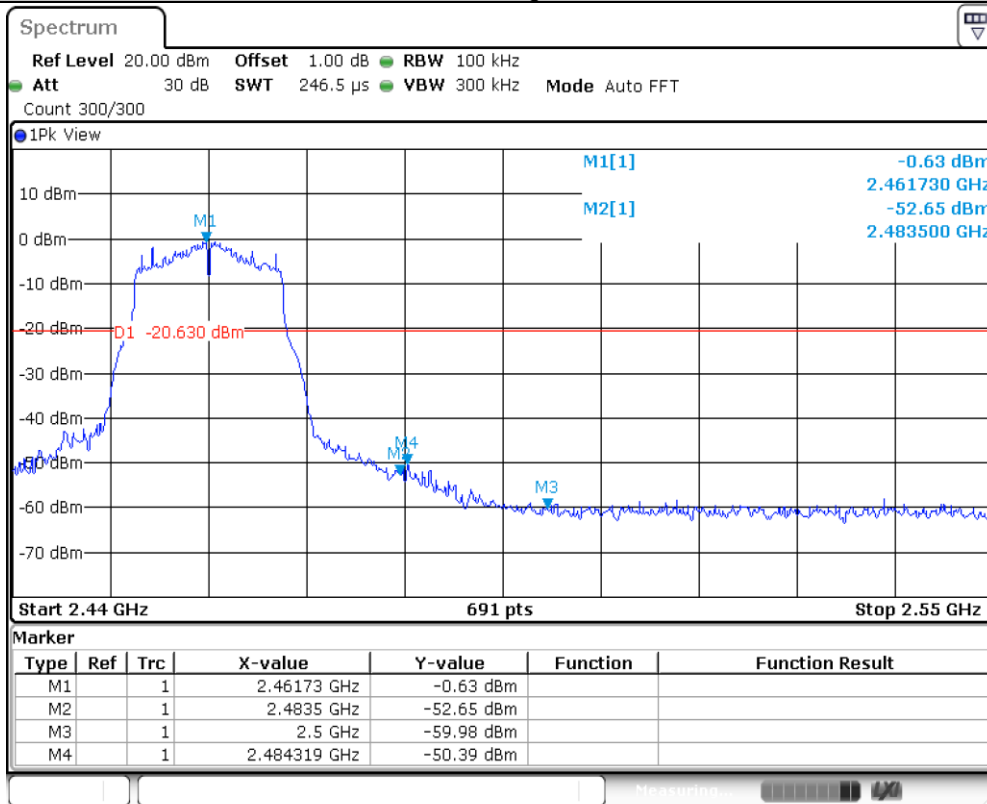
Test Graphs



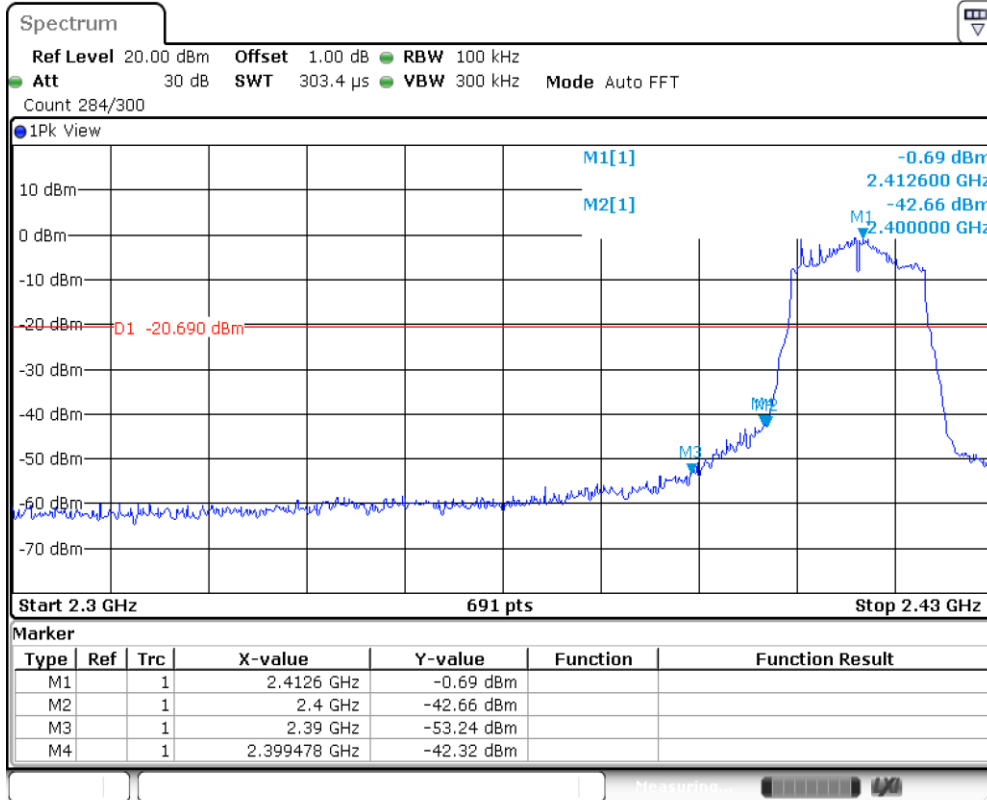
11G_Ant1_Low_2412



11G_Ant1_High_2462

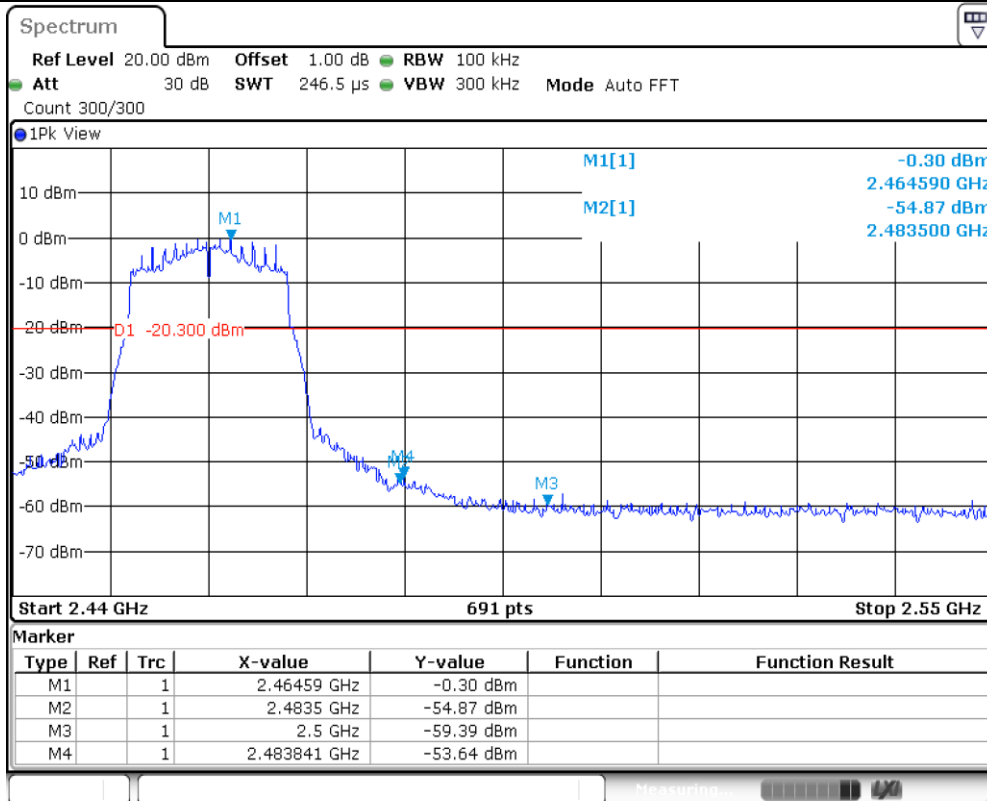


11N20SISO_Ant1_Low_2412



Date: 18.AUG.2023 12:40:51

11N20SISO_Ant1_High_2462



Date: 18.AUG.2023 12:44:57

9.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was placed 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 \geq 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 \geq 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 \geq [3 \times RBW].
 - c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \leq 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.

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 section 8.9, must also comply with the radiated emission limits specified in § 15.209(a) and RSS-Gen section 8.10.

Frequency MHz	Field Strength $\mu\text{V}/\text{m}$	Field Strength $\text{dB}\mu\text{V}/\text{m}$	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 $3\text{m}(\text{dB}\mu\text{V}/\text{m}) = \text{Limit } 300\text{m}(\text{dB}\mu\text{V}/\text{m}) + 40\text{Log}(300\text{m}/3\text{m})$ (Below 30MHz)

Note 2: Limit $3\text{m}(\text{dB}\mu\text{V}/\text{m}) = \text{Limit } 30\text{m}(\text{dB}\mu\text{V}/\text{m}) + 40\text{Log}(30\text{m}/3\text{m})$ (Below 30MHz)

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 (802.11n20) test result is listed in the report.

Transmitting spurious emission test result as below:

Emission below 1GHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
44.711667	24.11	40.00	15.89	100.0	H	303.0	18.07
102.211111	22.72	43.50	20.78	100.0	H	26.0	16.08
281.230000*	31.86	46.00	14.14	100.0	H	0.0	18.09
349.992222	32.06	46.00	13.94	100.0	H	152.0	20.25
468.763333	39.30	46.00	6.70	200.0	H	2.0	22.39
656.242778	39.36	46.00	6.64	100.0	H	329.0	25.64
719.980000	41.73	46.00	4.27	100.0	H	305.0	26.77
47.783333	35.56	40.00	4.44	100.0	V	231.0	18.27
64.785333	36.23	40.00	3.77	100.0	V	48.0	15.45
95.690556	29.52	43.50	13.98	100.0	V	97.0	15.48
219.042222	29.79	46.00	16.21	100.0	V	200.0	16.20
468.763333	37.66	46.00	8.34	100.0	V	184.0	22.39
574.978333	37.86	46.00	8.14	100.0	V	160.0	24.32

Emission above 1GHz

802.11n20_2412MHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1597.000000*	41.42	74.00	32.58	150.0	H	224.0	-9.26
2446.000000	47.86	74.00	26.14	150.0	H	0.0	-4.22
3345.500000	46.39	74.00	27.61	150.0	H	296.0	-0.04
7239.500000	39.56	74.00	34.44	150.0	H	95.0	8.12
10328.000000	41.59	74.00	32.41	150.0	H	238.0	11.44
14664.500000	44.36	74.00	29.64	150.0	H	179.0	16.99
1298.000000	38.83	74.00	35.17	150.0	V	152.0	-10.80
1595.000000*	43.13	74.00	30.87	150.0	V	326.0	-9.28
2418.000000	53.80	74.00	20.20	150.0	V	19.0	-4.45
3197.500000	47.45	74.00	26.55	150.0	V	306.0	-0.22
6987.000000	39.41	74.00	34.59	150.0	V	4.0	7.34
9858.500000	42.10	74.00	31.90	150.0	V	51.0	11.40

802.11n20_2437MHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1301.500000*	40.74	74.00	33.26	150.0	H	27.0	-10.73
1599.500000*	44.86	74.00	29.14	150.0	H	252.0	-9.25
2445.500000	49.43	74.00	24.57	150.0	H	314.0	-4.23
3192.000000	49.64	74.00	24.36	150.0	H	314.0	-0.21
6373.000000	42.44	74.00	31.56	150.0	H	338.0	6.75
9446.000000*	41.60	74.00	32.40	150.0	H	4.0	10.97
1301.000000*	38.65	74.00	35.35	150.0	V	337.0	-10.74
1593.000000*	43.77	74.00	30.23	150.0	V	0.0	-9.29
3199.000000	50.53	74.00	23.47	150.0	V	224.0	-0.22
4004.000000*	48.02	74.00	25.98	150.0	V	285.0	2.90
7864.500000	39.90	74.00	34.10	150.0	V	51.0	8.99
10497.500000	42.38	74.00	31.62	150.0	V	72.0	11.77

802.11n20_2462MHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1594.000000*	41.83	74.00	32.17	150.0	H	337.0	-9.28
2416.000000	53.23	74.00	20.77	150.0	H	132.0	-4.47
3195.500000	49.00	74.00	25.00	150.0	H	47.0	-0.22
4414.000000	50.83	74.00	23.17	150.0	H	111.0	4.33
6392.000000	43.44	74.00	30.56	150.0	H	317.0	6.72
9943.500000	41.03	74.00	32.97	150.0	H	176.0	11.25
1599.500000*	46.37	74.00	27.63	150.0	V	316.0	-9.25
3191.000000	48.90	74.00	25.10	150.0	V	152.0	-0.21
7189.000000	39.96	74.00	34.04	150.0	V	334.0	7.89
10274.000000	41.10	74.00	32.90	150.0	V	235.0	11.43
14044.500000	45.39	74.00	28.61	150.0	V	72.0	15.82

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)

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

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---