TEST REPORT

Applicant:	SparkFun Electronics
Address of Applicant:	6333 Dry Creek Parkway, Niwot, Colorado 80503, United States
Manufacturer:	Shanghai Limosa Info Tech Co.Ltd
Address of Manufacturer:	Bd.1-307,No.99,Lane.215,Road Gaoguang, Qingpu District, Shanghai
Product name:	GNSS Receiver
Model(s):	Torch X2, RTK Torch, Torch X2T, Torch X2i, ES980 Pro
Rating(s):	USB-C 4.5~5.5V, 3A max
Trademark:	/
Standards:	47 CFR PART 15 Subpart C section 15.247
FCC ID:	2ASW8-SPNTTX2
Data of Receipt:	2025-12-23
Date of Test:	2025-12-23~2026-01-05
Date of Issue:	2026-01-05
Test Result	**Pass***

* In the configuration tested, the test item complied with the standards specified above.

Authorized for issue by:

Test by:

Jan.05, 2026 Chivas Tsang Chivas
Project Engineer
Date *Name/Position* *Signature*

Reviewed by:

Jan.05, 2026 Victor Meng Victor
Project Manager
Date *Name/Position* *Signature*

Testing Laboratory information:

Testing Laboratory Name	:	ITL Co., Ltd
Address	:	No. 8 Jinqianling Street 5, Huangjiang Town, Dongguan, Guangdong, 523757 P.R.C.
Testing location	:	Same as above
Tel	:	0086-769-39001678
Fax	:	0086-20-62824387
E-mail	:	itl@i-testlab.com

Possible test case verdicts:

- test case does not apply to the test object . : N/A
- test object does meet the requirement ..... : P (Pass)
- test object does not meet the requirement . : F (Fail)

General remarks:

The Test Results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report would be invalid test report without all the signatures of testing technician and approver.

General product information:

This family of GNSS RTK devices, including models ES980 Pro, RTK Torch, Torch X2, Torch X2T, and Torch X2i, shares identical electrical circuit design, RF characteristics, and antenna systems. The differences between these models are solely related to firmware features and functional enhancements, as described below: ES980 Pro VS RTK Torch: no difference. RTK Torch vs. Torch X2: The primary difference lies in the built-in GNSS positioning algorithms and regional support. The two models utilize different firmware configurations to accommodate varying regional requirements and performance optimizations. Torch X2T: This model builds upon the RTK Torch/Torch X2 platform by adding tilt measurement functionality, enabling accurate positioning even when the device is not perfectly level. Torch X2i: Based on the Torch X2T, this model further incorporates an integrated laser rangefinder, providing additional distance measurement capability. All other hardware and RF components remain consistent across the series. These variations do not affect RF compliance or operating parameters.

All listed variants are therefore electrically and functionally equivalent to the certified model Torch X2.

1 Test Summary

Test	Test Requirement	Test method	Result
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.247 (a)(2)	ANSI C63.10:2020	PASS
Maximum Conducted Output Power	FCC PART 15 C section 15.247(b)(3)	ANSI C63.10:2020	PASS
Power Spectral Density	FCC PART 15 C section 15.247(e)	ANSI C63.10:2020	PASS
Conducted Spurious Emission (30 MHz to 25GHz)	FCC PART 15 C section 15.209 &15.247(d)	ANSI C63.10:2020	PASS
Radiated Spurious Emission (9 KHz to 25 GHz)	FCC PART 15 C section 15.209 &15.247(d)	ANSI C63.10:2020	PASS
Band Edges	FCC PART 15 C section 15.209 &15.247(d)	ANSI C63.10:2020	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207	ANSI C63.10:2020	PASS
Radiated Emissions which fall in the restricted bands	FCC PART 15 C section 15.209	ANSI C63.10:2020	PASS
Duty Cycle	FCC PART 15 C section 15.247	ANSI C63.10:2020	PASS

2 Contents

3 General Information

3.1 Client Information

Applicant: SparkFun Electronics

Address of Applicant: 6333 Dry Creek Parkway, Niwot, Colorado 80503, United States

3.2 General Description of E.U.T.

Name: GNSS Receiver

Model No.: Torch X2

Trade Mark: /

Operating Frequency: 802.11 b/g/n(HT20): 2412MHz - 2462MHz
802.11 n(HT40): 2422MHz - 2452MHz

802.11b, 802.11g, 802.11n (20MHz): 11

Channels:

Working Frequency of Each Channel:			
channel	Frequency	channel	Frequency
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432		
6	2437		
7	2437		

802.11n (40MHz): 7

Working Frequency of Each Channel:			
channel	Frequency		
1	2422		
2	2427		
3	2432		
4	2437		
5	2442		
6	2447		
7	2452		

Type of Modulation: CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM

Antenna Type: RG1.13 Antenna with 2.78 dBi peak gain

3.3 Details of E.U.T.

EUT Power Supply: USB-C 4.5~5.5V, 3A max

3.4 Description of Support Units

The EUT has been tested as an independent unit for fixed frequency by testing lab.

3.5 Test Location

All tests were performed at:

ITL Co., Ltd
No. 8 Jinqianling Street 5, Huangjiang Town, Dongguan, Guangdong, 523757 P.R.C.
0086-769-39001678
itl@i-testlab.com

No tests were sub-contracted.

3.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS Lab code:L9342**
- **FCC Designation No.:CN5035**
- **IC Registration NO.: 12593A**
- **NVLAP LAB CODE: 600199-0**

3.7 Measurement Uncertainty

The below measurement uncertainties given below are based on a 95% confidence level (base on a coverage factor (k=2).)

Parameter	Uncertainty
Radio frequency	2.25%
total RF power, conducted	±1.34 dB
RF power density, conducted	±1.49 dB
All emissions, radiated	±2.72 dB
Temperature	±5.02 dB
Humidity	±0.8°C
DC and low frequency voltages	±1.5 %

4 Instruments Used during Test

No.	Test Equipment	Manufacturer	Model	Serial No.	Cal Data	Due Date
DGITL-115	50Ω Coaxial Cable	Mini-cicuts	CBL	C001	2025.03.14	2026.03.14
DGITL-182	Test software	2.0.0.0	MTS 8310	/	/	/
DGITL-190	Filter	COM-MW	K6-2400-2483.5-100S5010-007	12230496	2025.01.10	2026.01.09
DGITL-191	Filter	COM-MW	K6-5150-5850-100S5010-003	12234382	2025.01.10	2026.01.09
DGITL- 301	Semi-Anechoic chamber	ETS•Lindgren	9*6*6	CT000874-1181	2023.08.02	2026.08.02
DGITL- 307	EMI test receiver	SCHWARZBECK	ESVS10	833616/003	2025.03.14	2026.03.14
DGITL-376	Wideband Radio Communication Tester	SCHWARZBECK	CMW500	LR114195	2025.03.14	2026.03.14
DGITL-349a	Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	259268	2025.03.14	2026.03.14
DGITL- 306	Spectrum Analyzer	Agilent Technologies	N9010A	MY54200334	2025.03.14	2026.03.14
DGITL- 352	Pre Amplifier	Mlnl-Clrcuits	ZFC-1000HX	SN292801110	2025.03.14	2026.03.14
DGITL-375	Spectrum Analyzer	SCHWARZBECK	FSV40-N	6625-01-588-5515	2025.03.14	2026.03.14
DGITL-309	Horn Antenna	ETS Lindgren	3117	SN00152265	2025.05.13	2027.05.14
DGITL-308	Bilog Antenna	ETS· Lindgren	3142E	156975	2025.05.13	2027.05.14
DGITL-350	Wideband Amplifier Super Ultra	Mlnl-Clrcuits	ZVA-183X-S+	SN986401426	2025.03.14	2026.03.14
DGITL-371	Pre Amplifier	teramicrowave	TALA-0040G35	18081001	2025.03.14	2026.03.14
DGITL-363	Active Loop Antenna	SCHWARZBECK	FMZB1519B	00062	2024.05.15	2026.05.11

5 Test Results

5.1 E.U.T. test conditions

Test Voltage: AC 120V, 60Hz

Temperature: 23.2 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

Requirements:

15.31(e): For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

15.32: Power supplies and CPU boards used with personal computers and for which separate authorizations are required to be obtained shall be tested as follows: Testing shall be in accordance with the procedures specified in Section 15.31 of this part.

Test frequencies and frequency range:

According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	**Upper frequency range of measurement**
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz whichever is lower, unless otherwise specified

EUT channels and frequencies list:

Working Frequency of Each Channel:			
channel	Frequency	channel	Frequency
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432		
6	2437		
7	2437		

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	2412MHz, 2437MHz, 2462MHz
TM2	802.11g	2412MHz, 2437MHz, 2462MHz
TM3	802.11n (20MHz)	2412MHz, 2437MHz, 2462MHz
TM5	802.11n (40MHz)	2422MHz, 2437MHz, 2452MHz

5.2 Antenna requirement

Standard requirement

15.203 requirement:

For intentional device. According to 15.203. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz bands that are used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.2.1 Test Result (Antenna requirement)

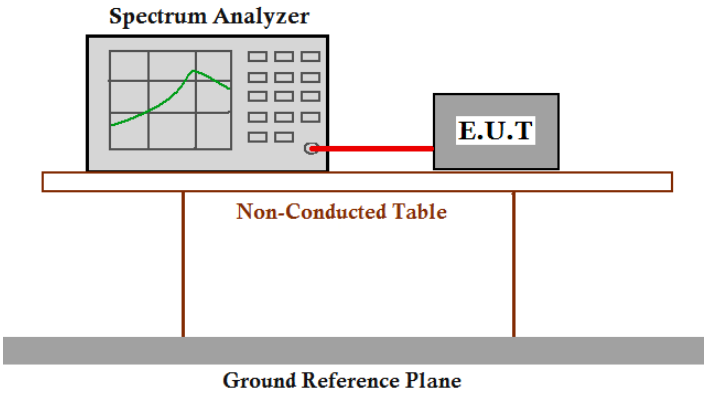
The antenna is a RG 1.13 Antenna and no consideration of replacement. The best-case gain of the antenna is 2.78 dBi.

Test Result: The unit does meet the FCC requirements.

5.3 Occupied Bandwidth

Test Requirement:	FCC Part 15 C section 15.247 (a)(2)Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Method:	ANSI C63.10:2020
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channels and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

5.3.1 Test Configuration



Test Procedure:

1. The testing follows the Measurement Procedure of ANSI C63.10:2020 Section 11.8 and 6.9.3.

2. For 6dB EBW :
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be at least three times RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.6.2.
d) Steps a) through c) might require iteration to adjust within the specified tolerances.
e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
f) Set detection mode to peak and trace mode to max-hold.
g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
h) Determine the "−xx dB down amplitude" using [(reference value) - xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.

i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "−xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value.
k) The dBc bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

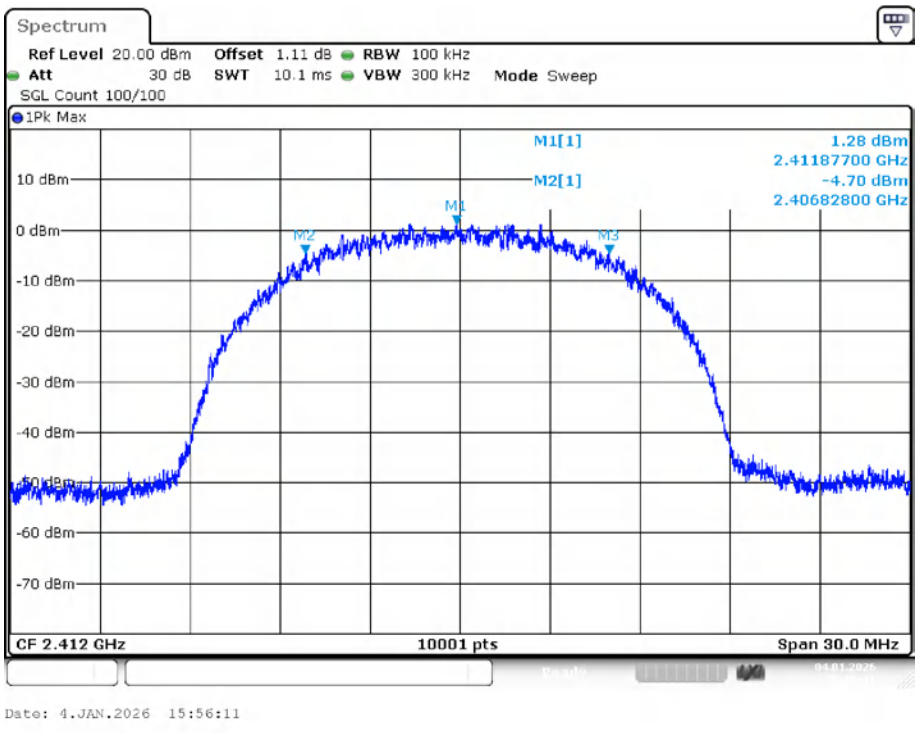
3. For 99% OBW:
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be at least three times RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.6.2.
d) Steps a) through c) might require iteration to adjust within the specified range.
e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max-hold mode (until the trace stabilizes) shall be used.
f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
h) The occupied bandwidth shall be reported by providing spectral plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

5.3.2 Test Result (-6dB bandwidth)

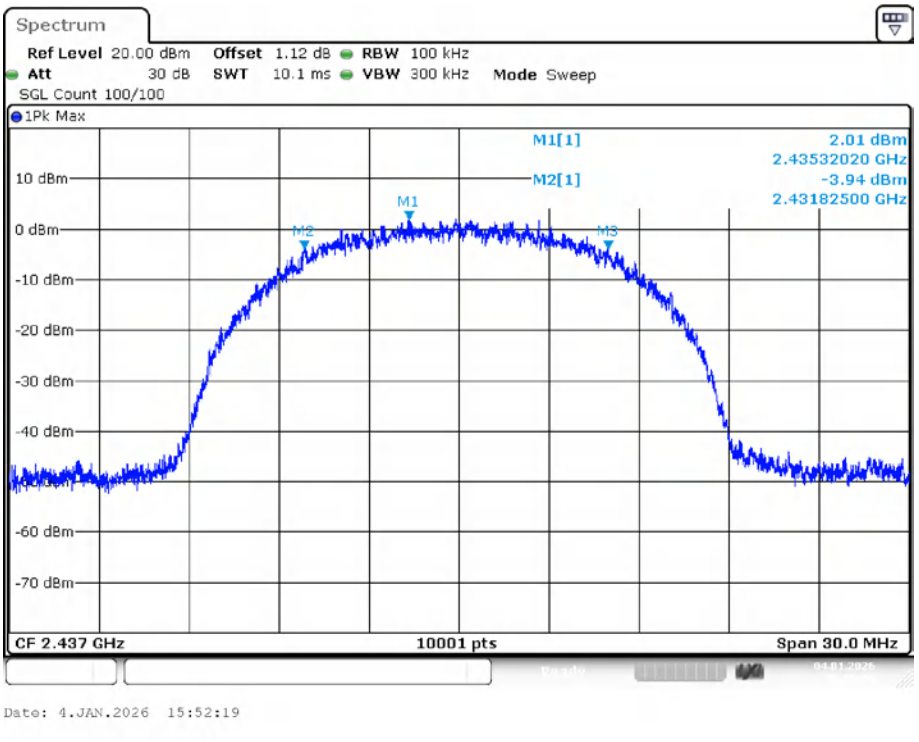
Test mode	Test Frequency (MHz)	-6dB bandwidth (MHz)	Limit (KHz)	Test Result
802.11b	2412	10.131	≥500	Pass
	2437	10.137	≥500	Pass
	2462	9.42	≥500	Pass
802.11g	2412	16.485	≥500	Pass
	2437	16.473	≥500	Pass
	2462	16.467	≥500	Pass
802.11n (HT20)	2412	17.433	≥500	Pass
	2437	17.22	≥500	Pass
	2462	17.16	≥500	Pass
802.11n (HT40)	2422	33.228	≥500	Pass
	2437	33.198	≥500	Pass
	2452	33.738	≥500	Pass

-6db bandwidth:

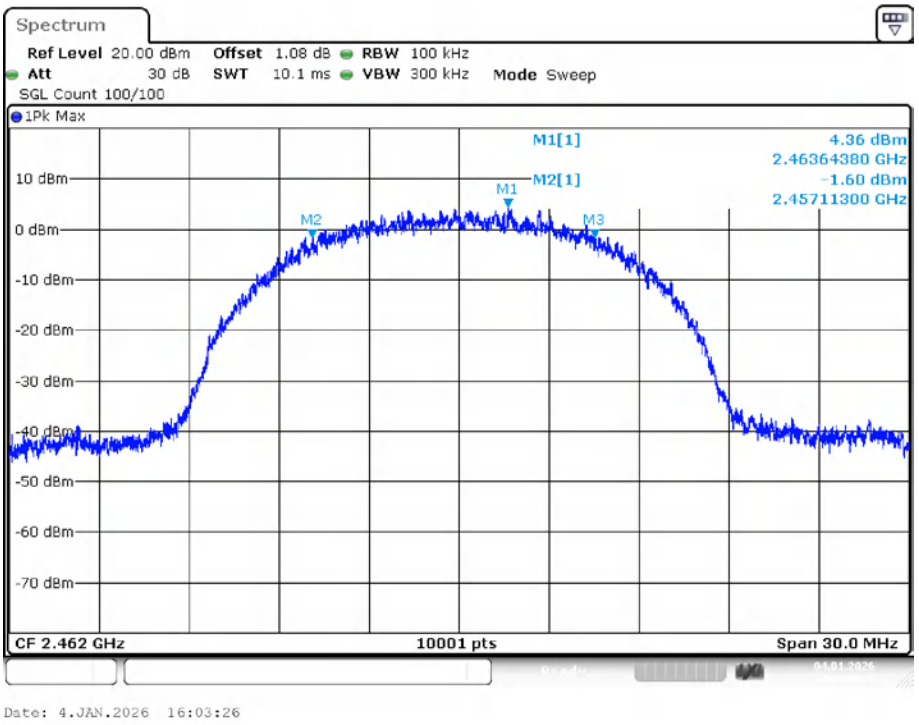
Result plot as follows:



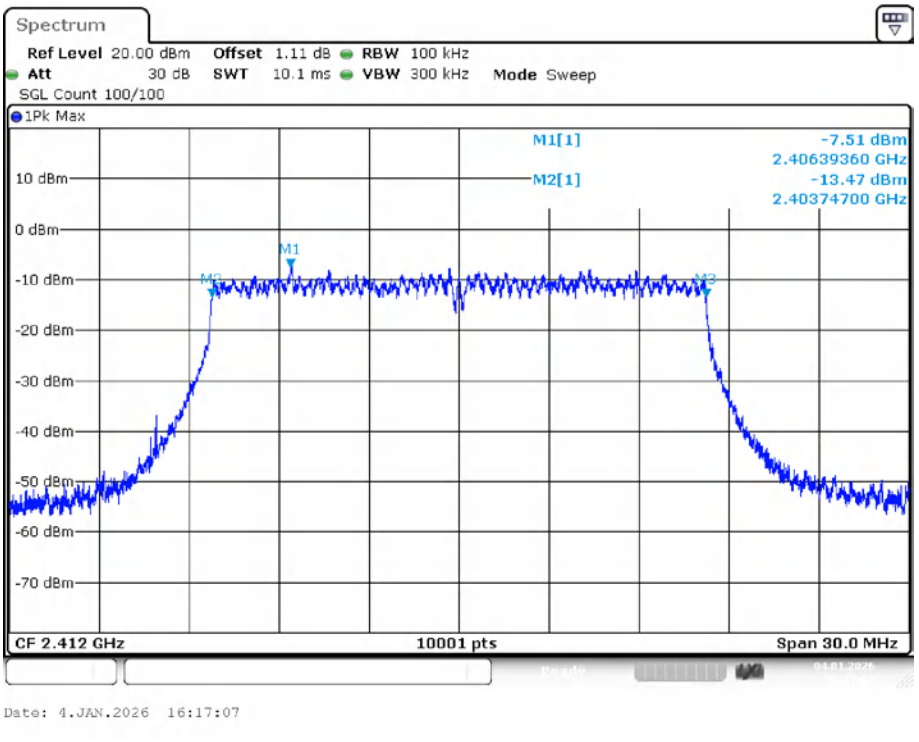
-6dB Bandwidth NVNT b 2412MHz Ant1



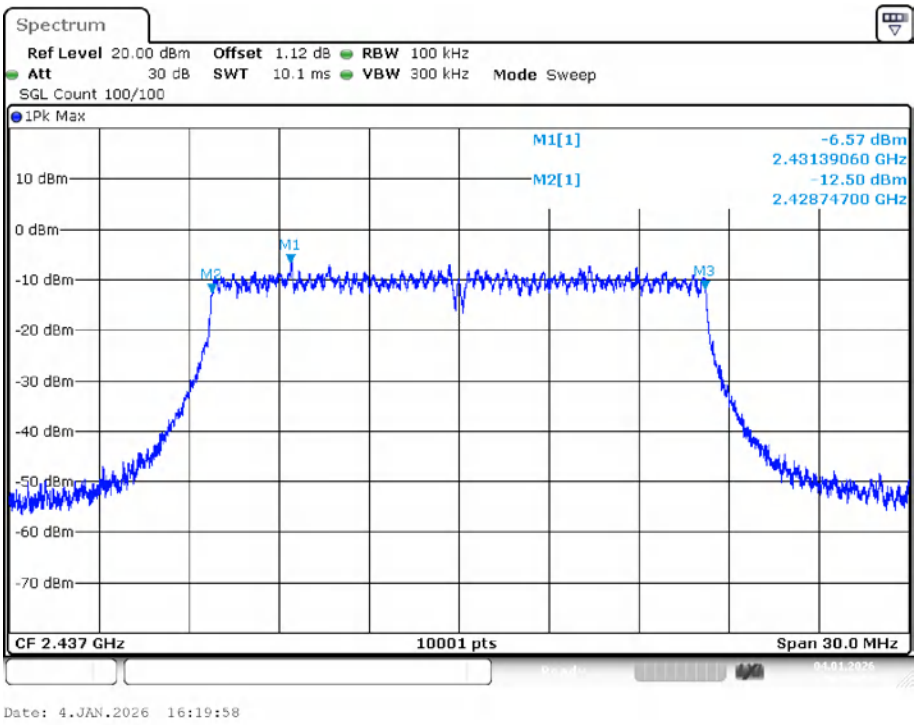
-6dB Bandwidth NVNT b 2437MHz Ant1



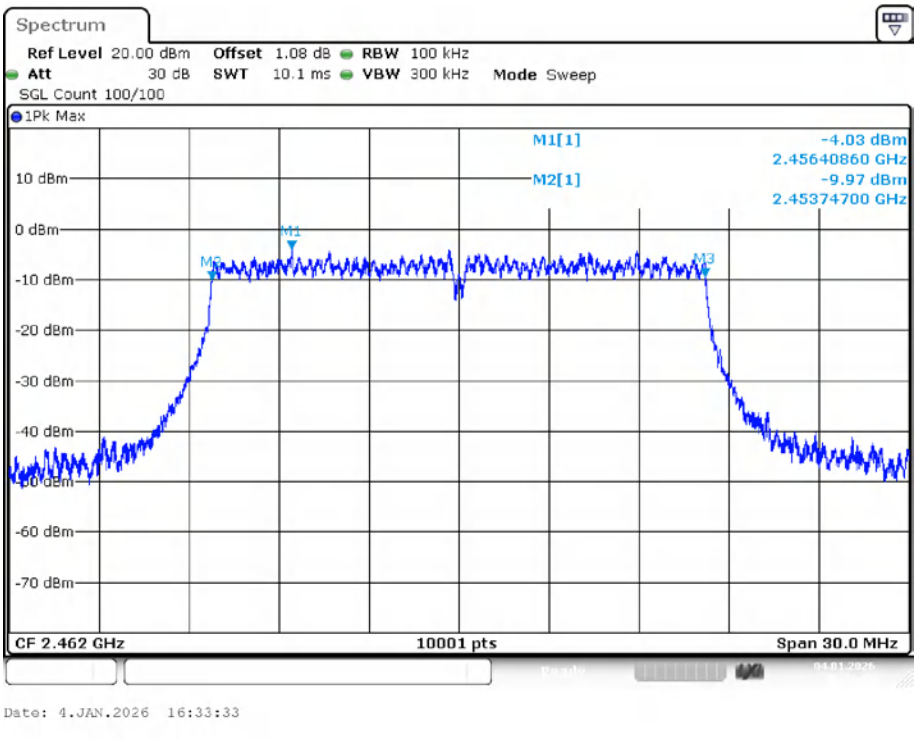
-6dB Bandwidth NVNT b 2462MHz Ant1



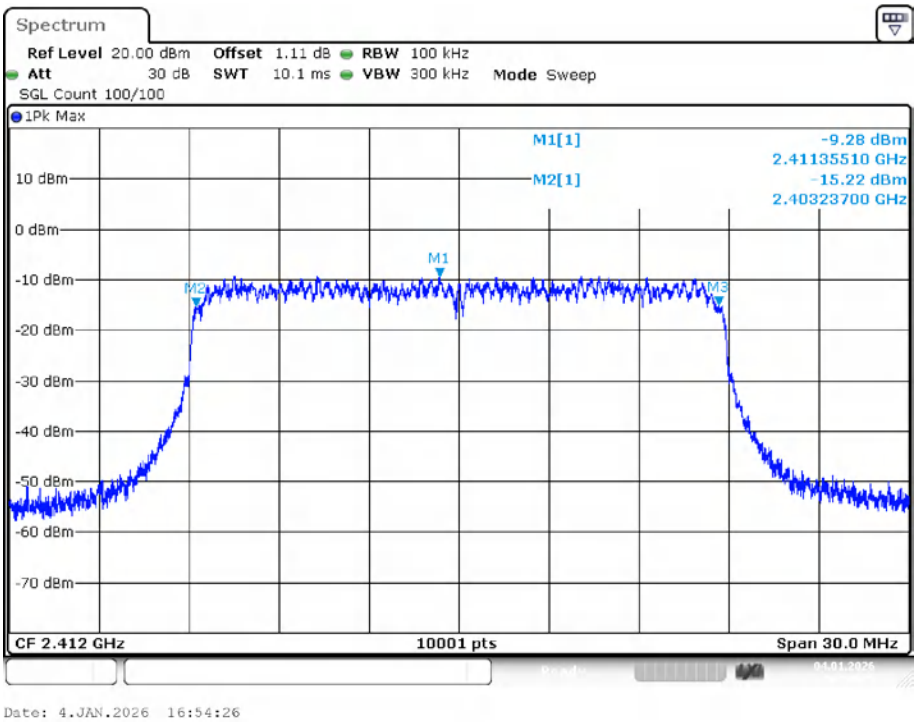
-6dB Bandwidth NVNT g 2412MHz Ant1



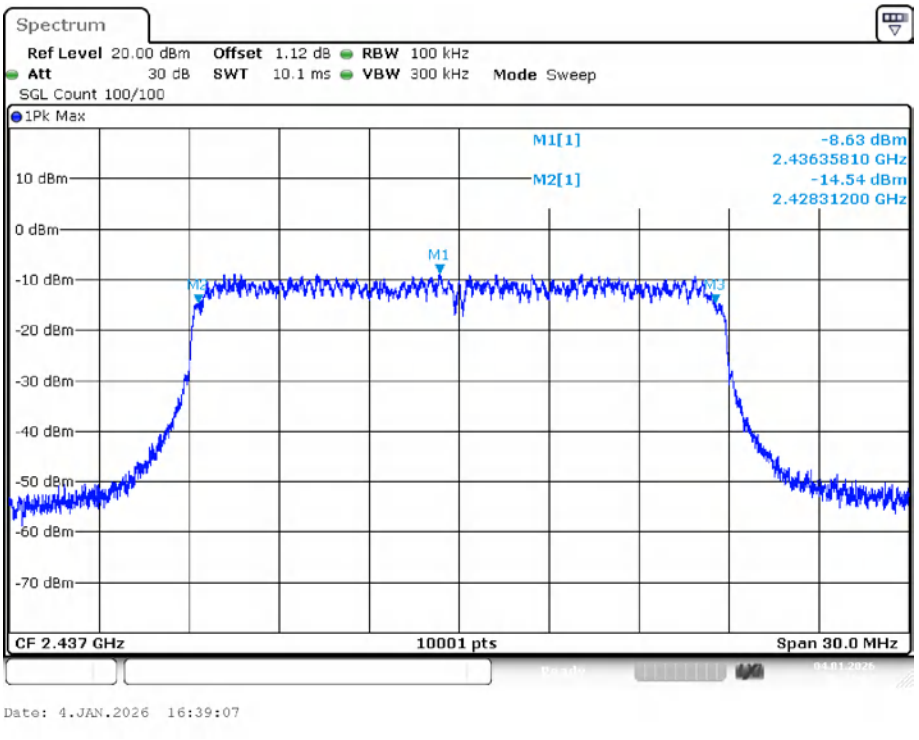
-6dB Bandwidth NVNT g 2437MHz Ant1



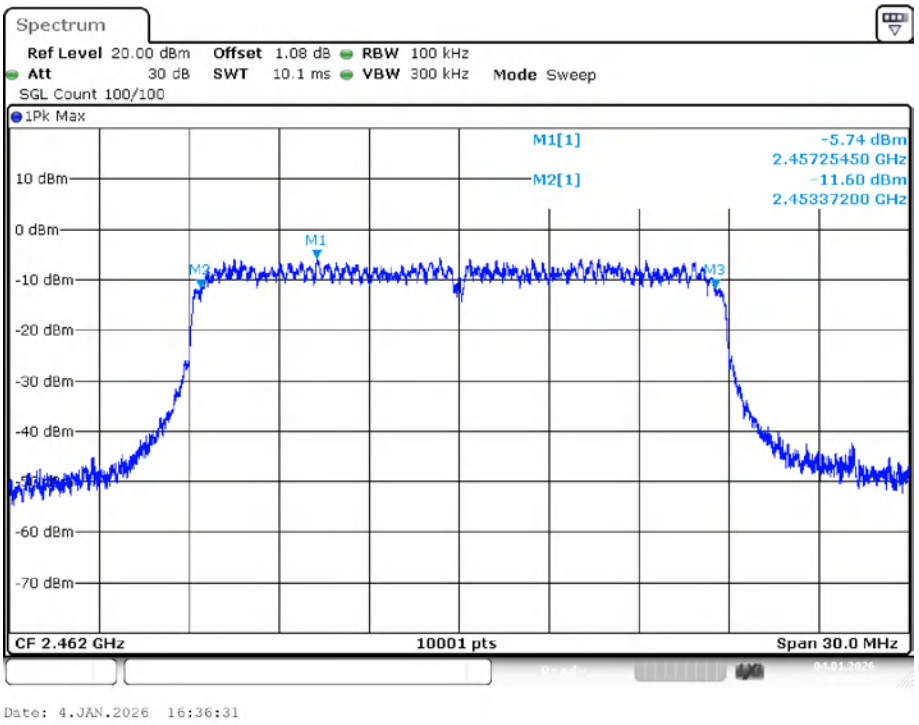
-6dB Bandwidth NVNT g 2462MHz Ant1



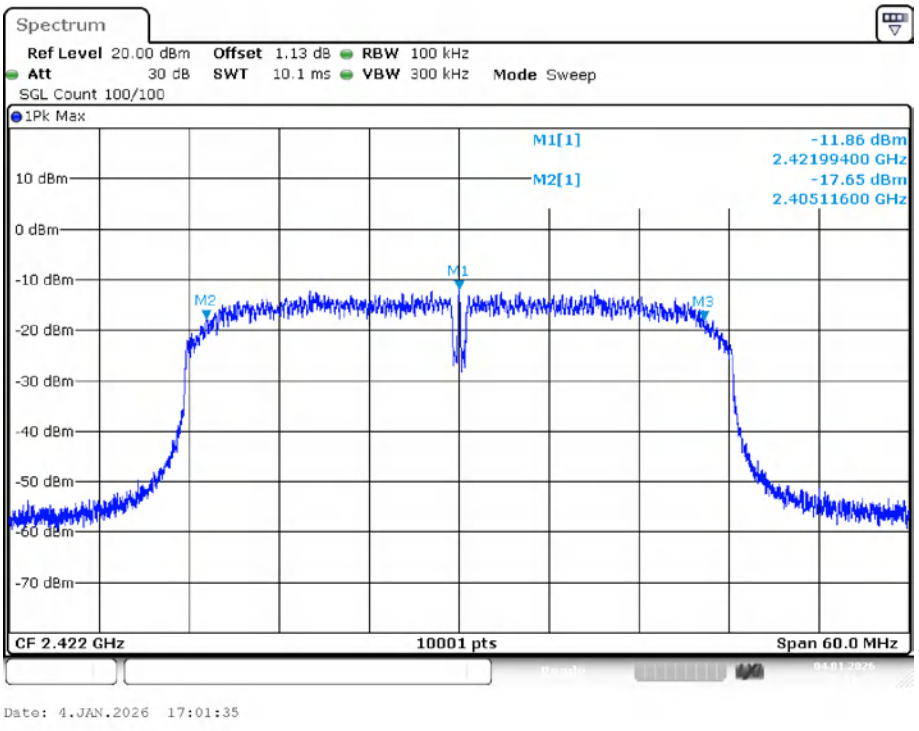
-6dB Bandwidth NVNT n20 2412MHz Ant1



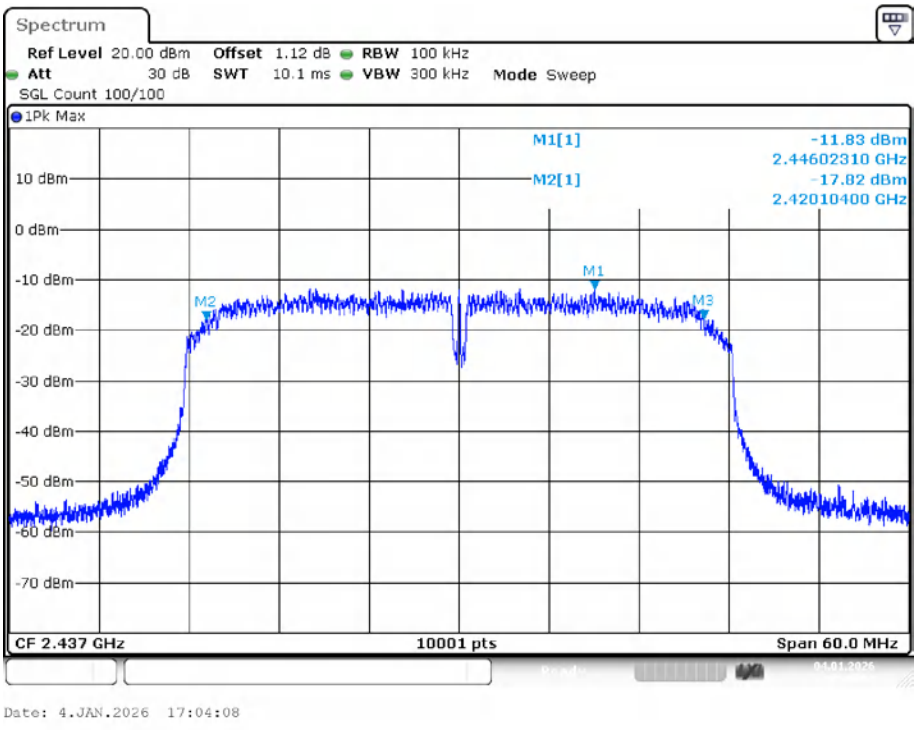
-6dB Bandwidth NVNT n20 2437MHz Ant1



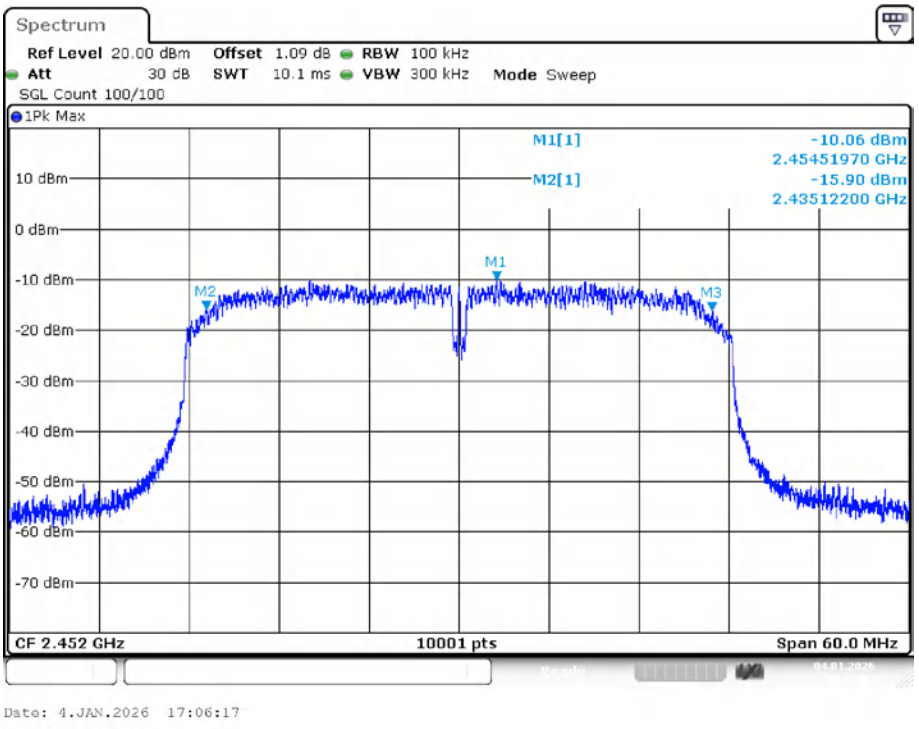
-6dB Bandwidth NVNT n20 2462MHz Ant1



-6dB Bandwidth NVNT n40 2422MHz Ant1



-6dB Bandwidth NVNT n40 2437MHz Ant1



-6dB Bandwidth NVNT n40 2452MHz Ant1

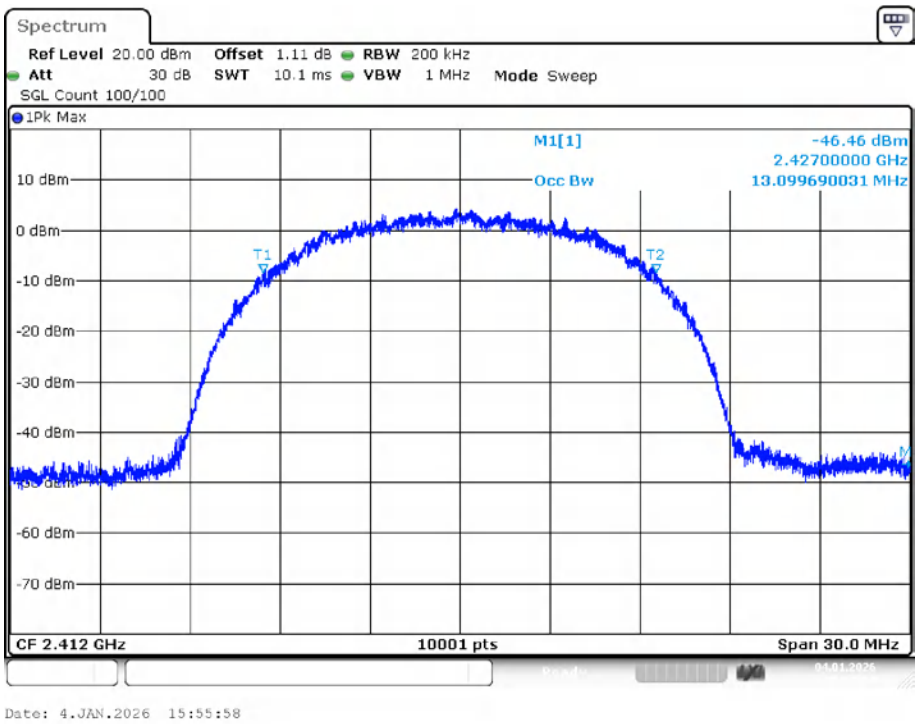
Test Result: The unit does meet the FCC requirements.

5.3.3 Test Result (99% power bandwidth)

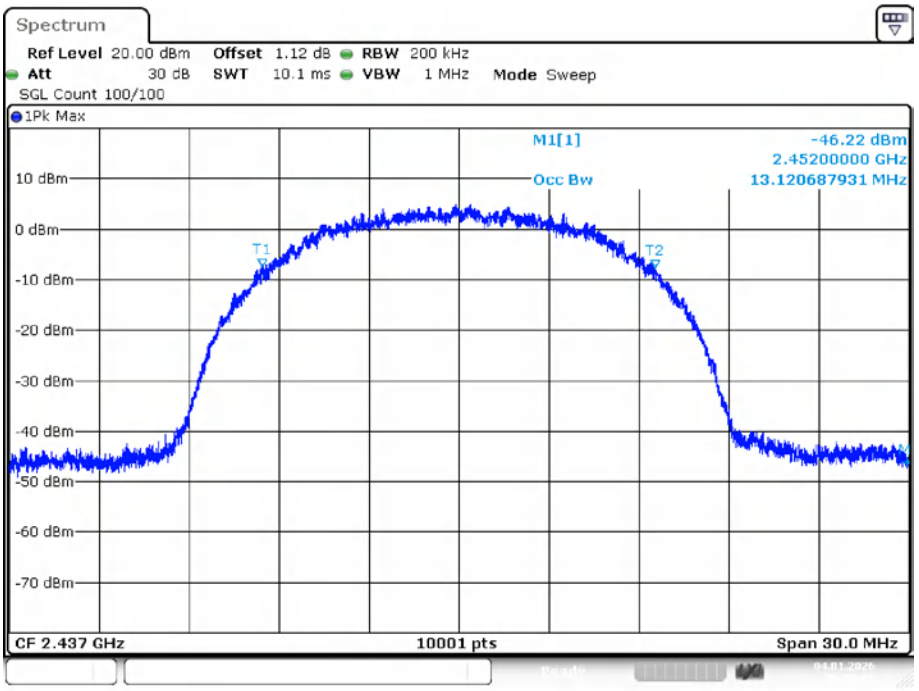
Test mode	Test Frequency (MHz)	99% bandwidth (MHz)	Test Result
802.11b	2412	13.1	Pass
	2437	13.121	Pass
	2462	13.187	Pass
802.11g	2412	16.414	Pass
	2437	16.432	Pass
	2462	16.42	Pass
802.11n (HT20)	2412	17.326	Pass
	2437	17.323	Pass
	2462	17.317	Pass
802.11n (HT40)	2422	34.803	Pass
	2437	34.827	Pass
	2452	34.839	Pass

99% power bandwidth:

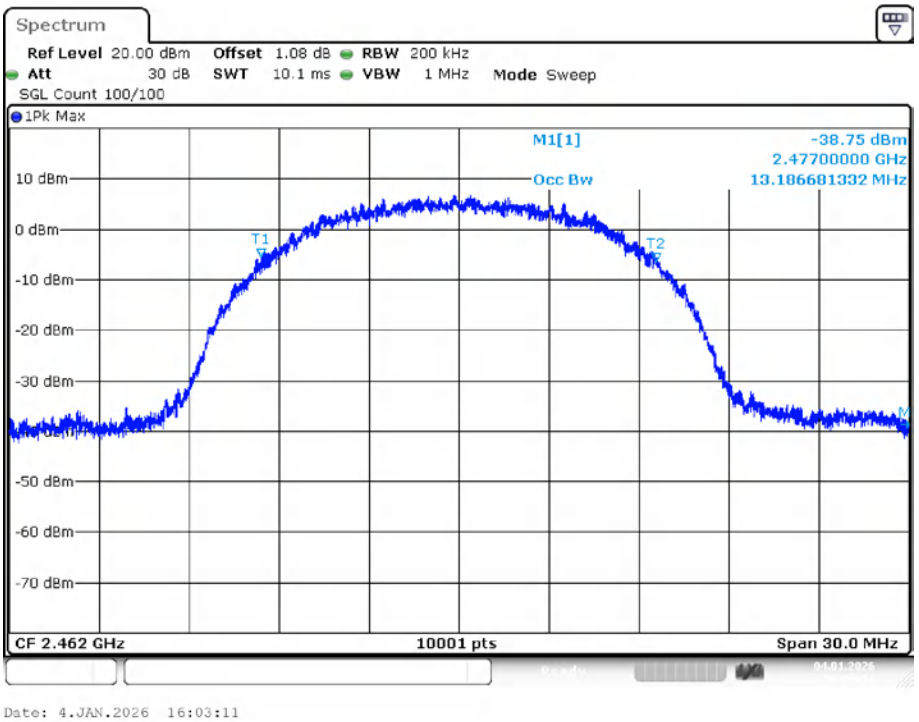
Result plot as follows:



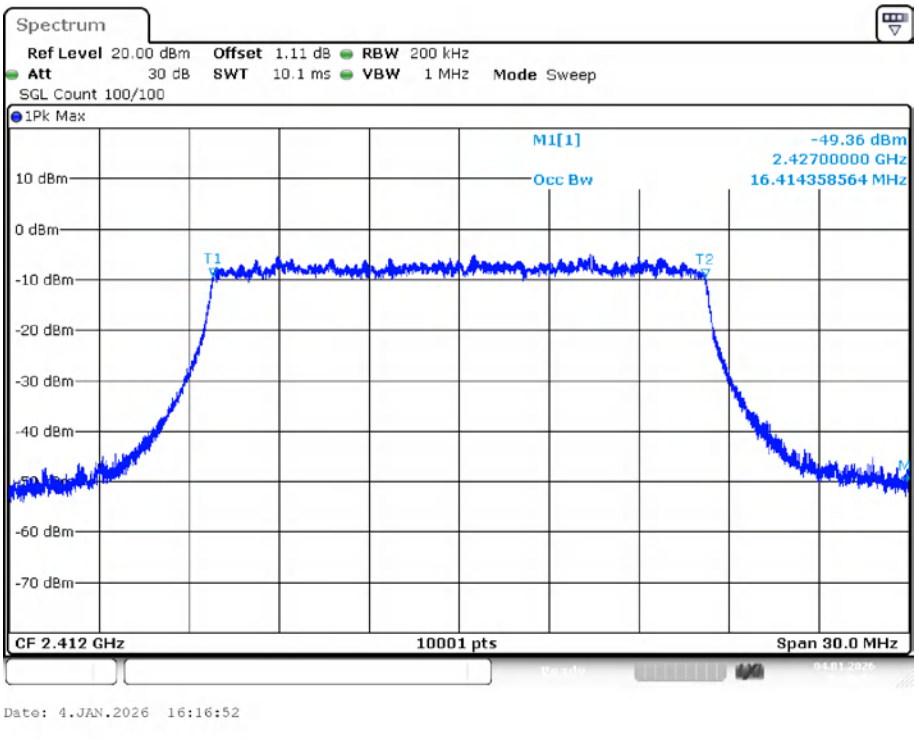
OBW NVNT b 2412MHz Ant1



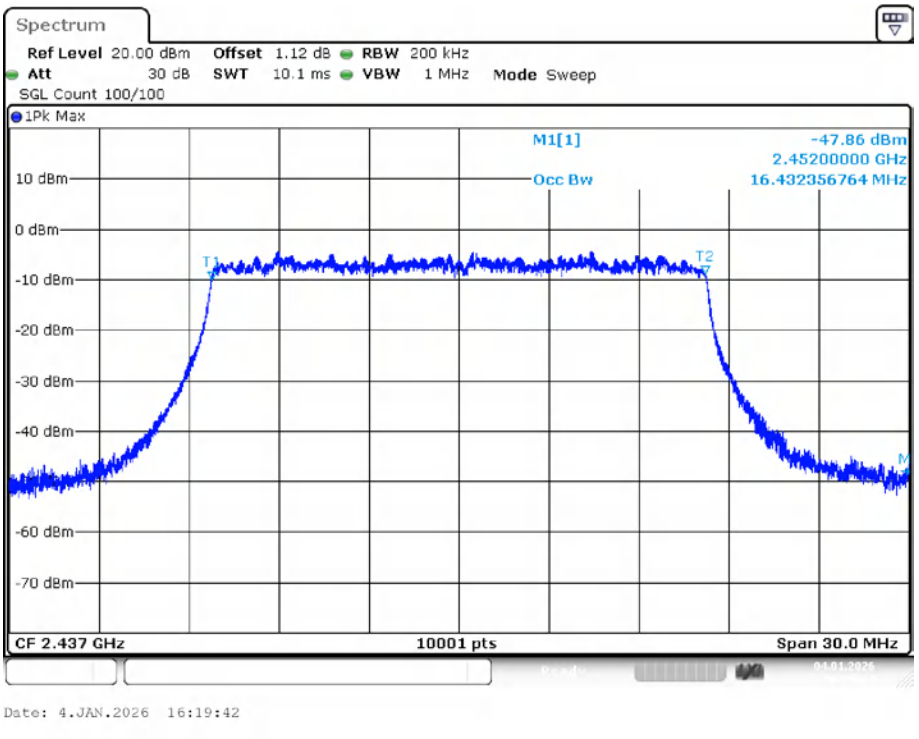
OBW NVNT b 2437MHz Ant1



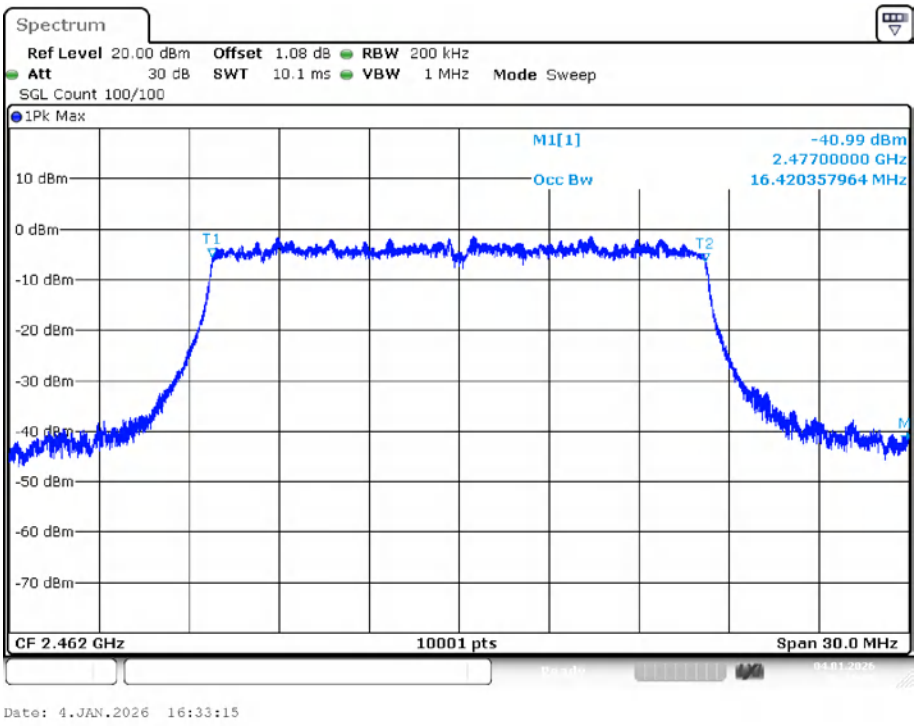
OBW NVNT b 2462MHz Ant1



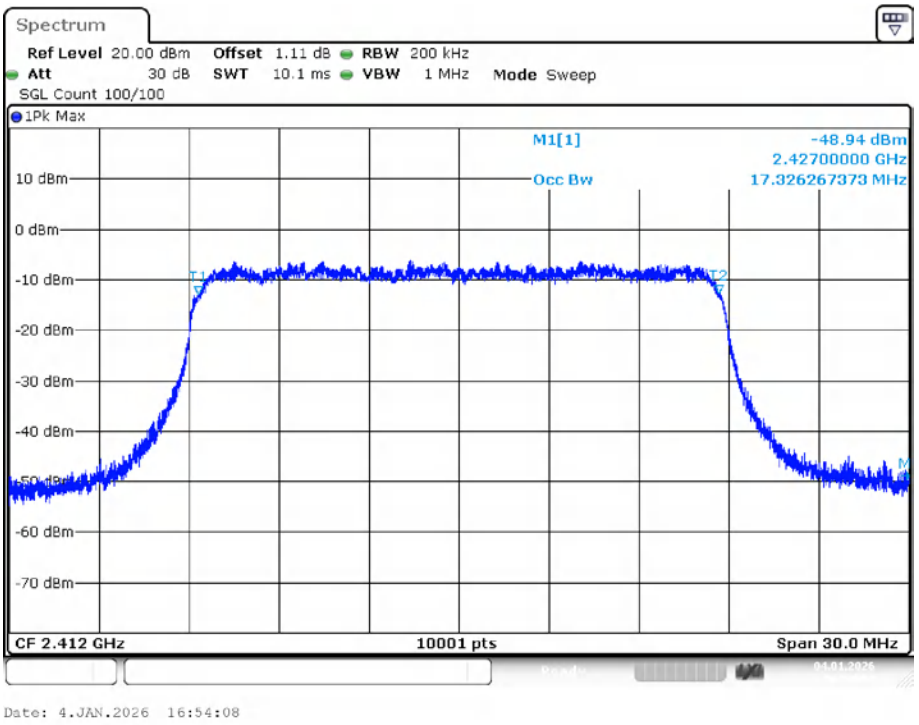
OBW NVNT g 2412MHz Ant1



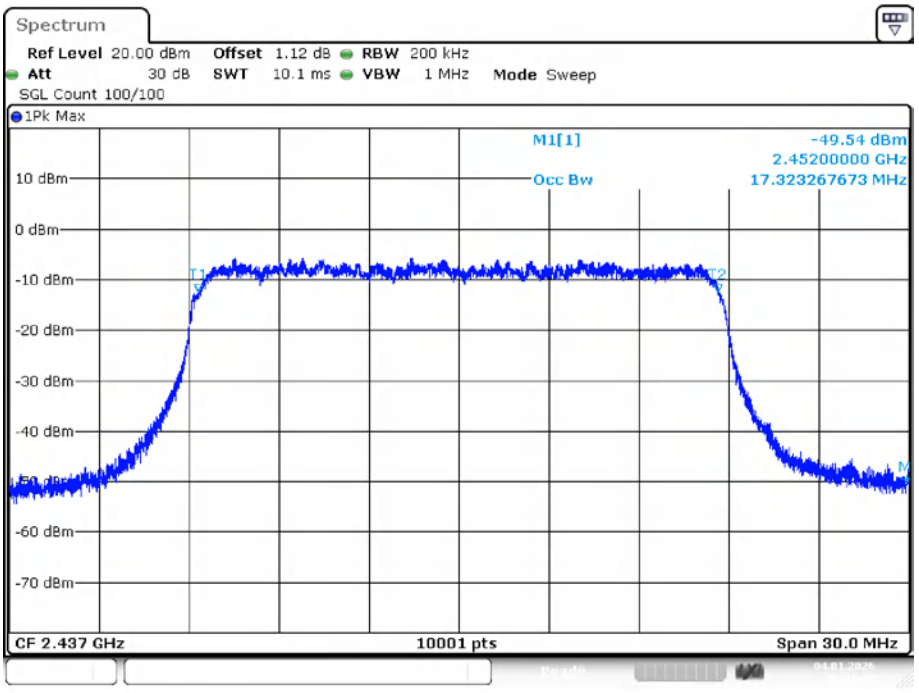
OBW NVNT g 2437MHz Ant1



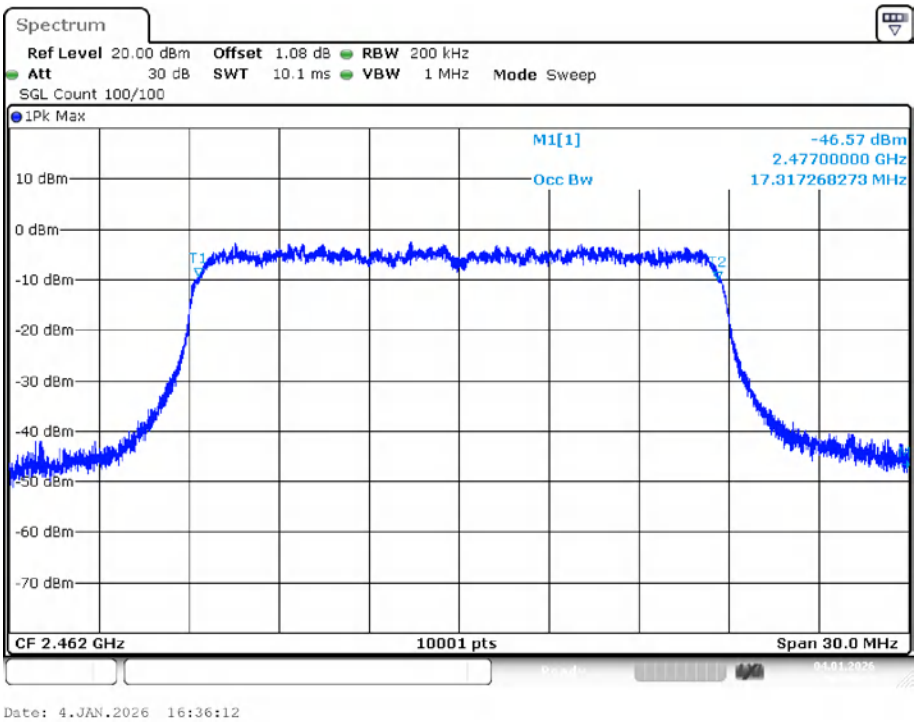
OBW NVNT g 2462MHz Ant1



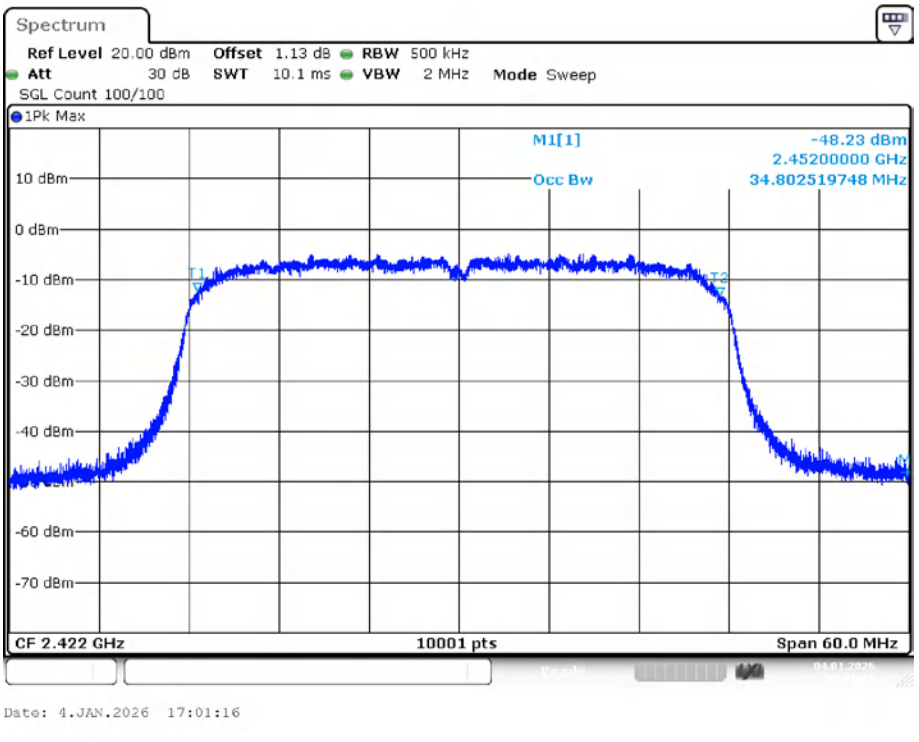
OBW NVNT n20 2412MHz Ant1



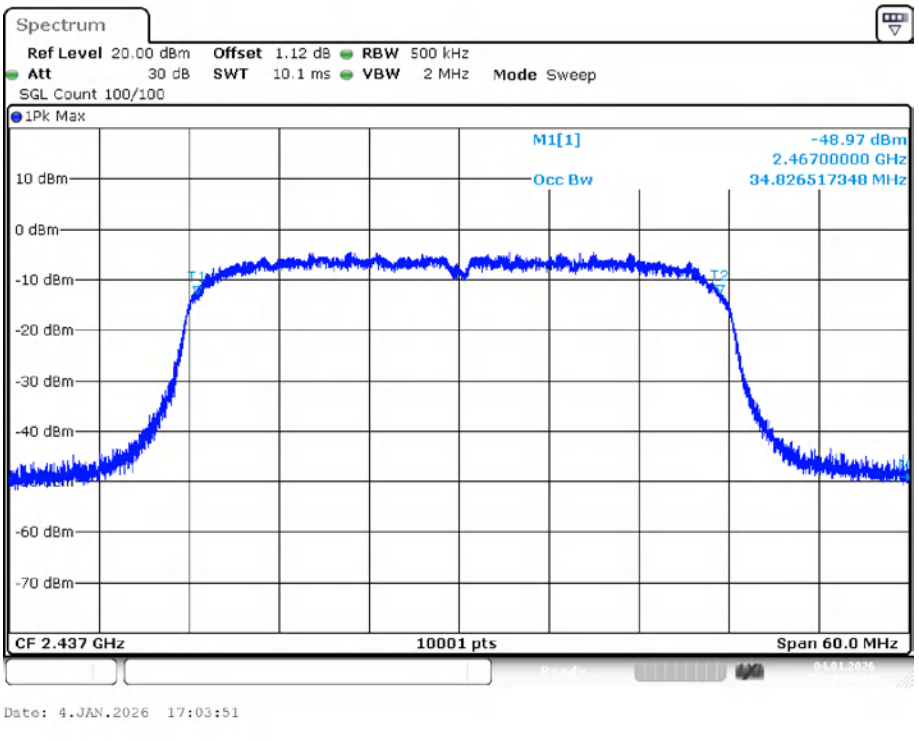
OBW NVNT n20 2437MHz Ant1



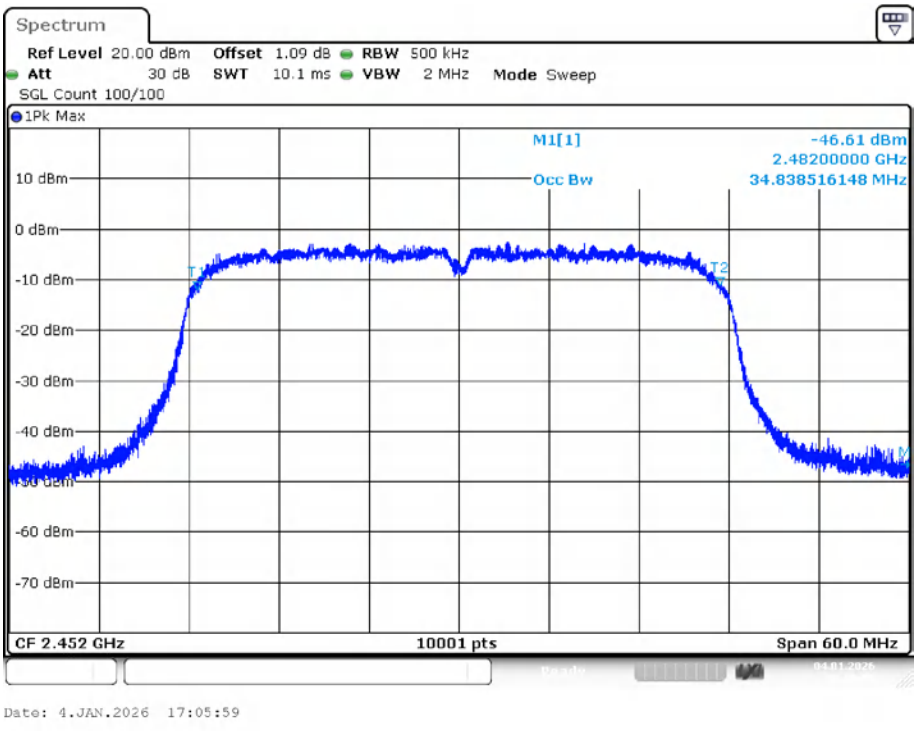
OBW NVNT n20 2462MHz Ant1



OBW NVNT n40 2422MHz Ant1



OBW NVNT n40 2437MHz Ant1



OBW NVNT n40 2452MHz Ant1

Test Result: The unit does meet the FCC requirements.

5.4 Maximum Conducted Output Power

Test Requirement: FCC Part 15 C section 15.247

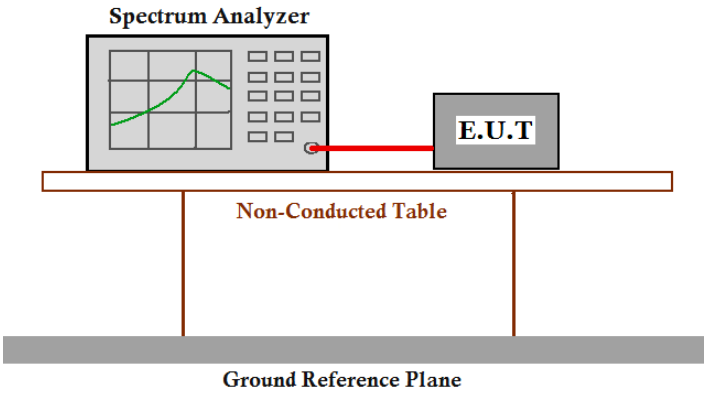
(b)(3) For systems using digital modulation in the 902-928 MHz,

2400-2483.5 MHz and 5725-5850 MHz bands: 1 Watt.
Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b) (1), (b) (2), and (b) (3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Method: ANSI C63.10:2020

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channels and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

5.4.1 Test Configuration



Test Procedure:

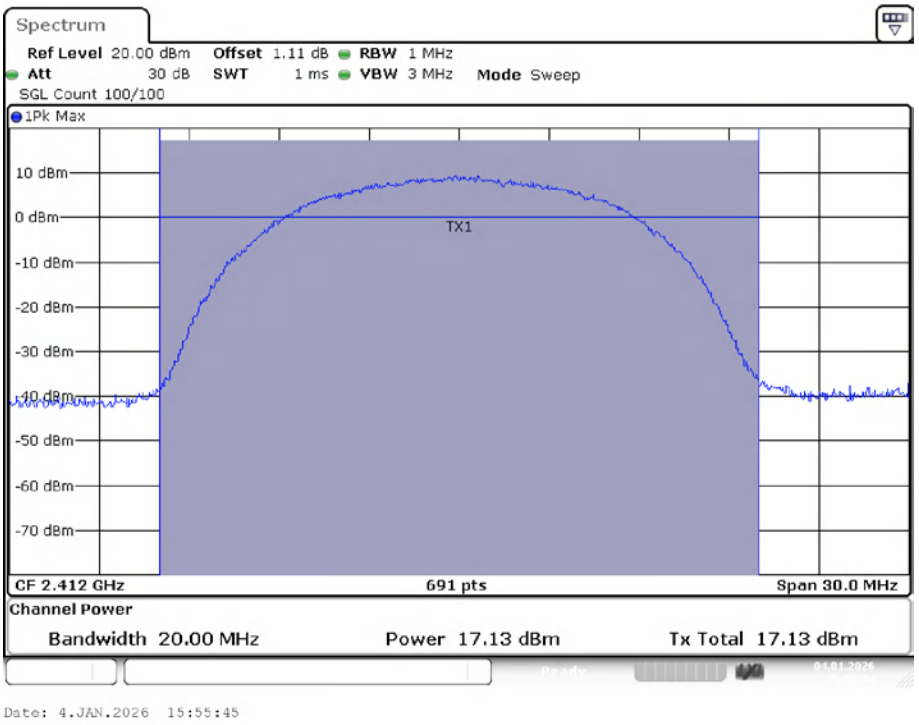
1. The testing follows the Measurement Procedure of ANSI C63.10:2020 Section 11.9.2.2.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings:
   Set instrument center frequency to DS channel center frequency/Set span to at least l.5 times the OBW / RBW = 1% to 5% of the OBW, not to exceed 1 MHz. / Set VBW ≥ [3 x RBW]./Detector: RMS / Sweep time: Auto / Trace mode: Average / Trace average at least 100 traces in power averaging(rms) mode.
5. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
6. Add [10 log (1 / D)], where D is the duty cycle), to the measured PSD to compute the average PSD during the actual transmission time.
7. Record the measurement results in the test report.

5.4.2 Test Result (Maximum Conducted Output Power)

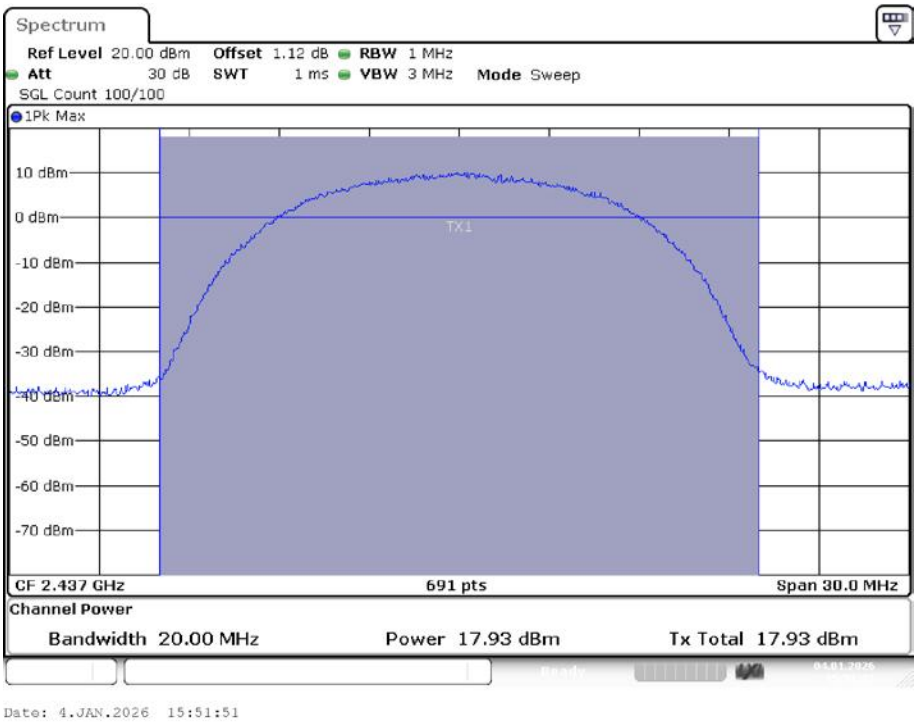
Test mode	Test Frequency (MHz)	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)
802.11b	2412	17.126	0	17.126	30
	2437	17.929	0	17.929	30
	2462	19.921	0	19.921	30
802.11g	2412	12.974	0	12.974	30
	2437	13.808	0	13.808	30
	2462	16.705	0	16.705	30
802.11n (HT20)	2412	11.761	0	11.761	30
	2437	12.22	0	12.22	30
	2462	15.171	0	15.171	30
802.11n (HT40)	2422	11.489	0	11.489	30
	2437	11.84	0	11.84	30
	2452	13.664	0	13.664	30

Note: Total Power (dBm) = Conducted Power (dBm) + Duty Factor (dB)

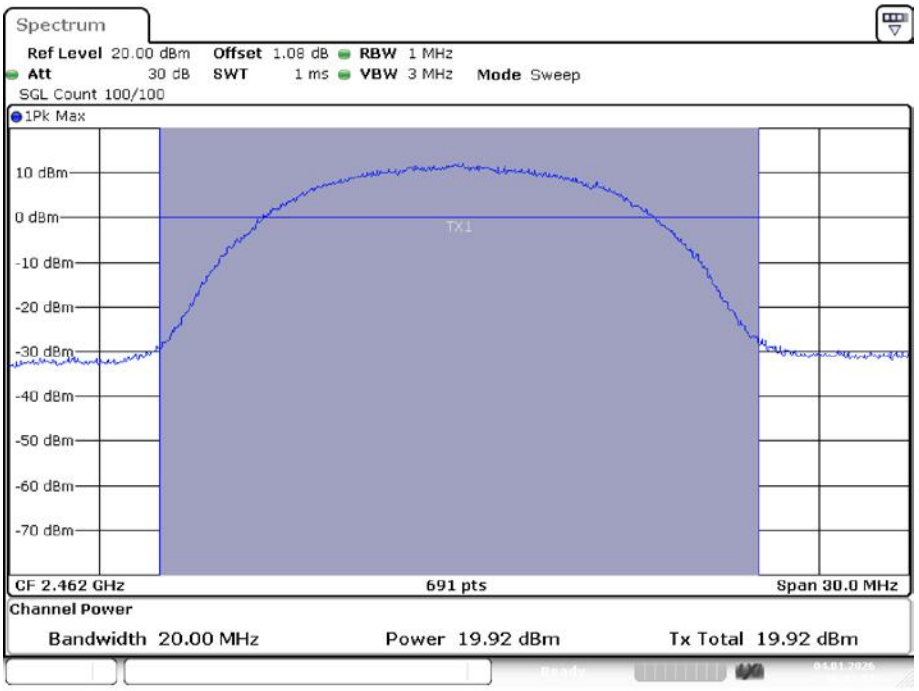
Result plot as follows:



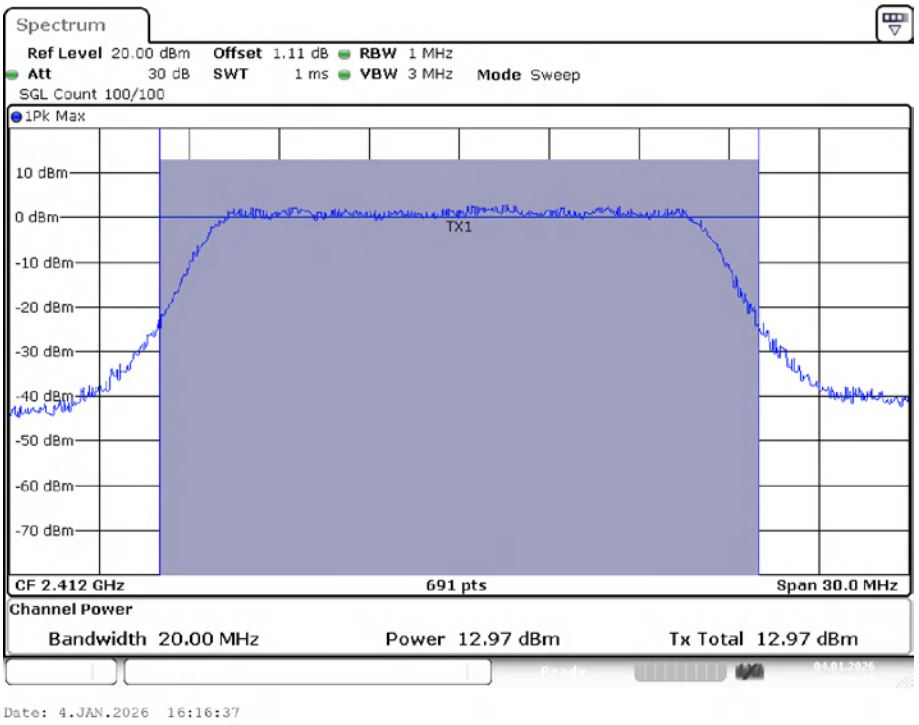
Power NVNT b 2412MHz Ant1



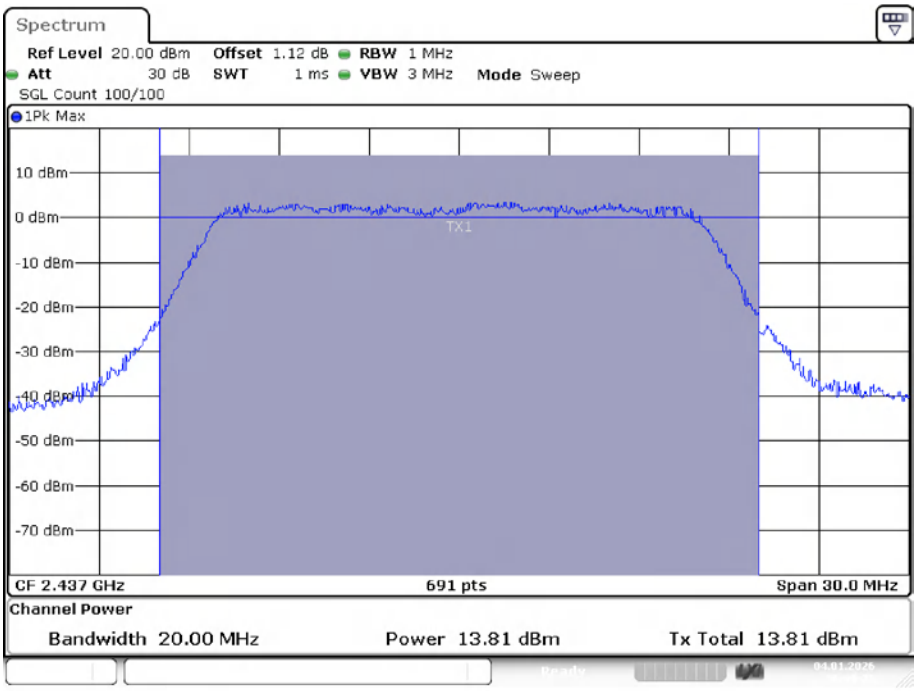
Power NVNT b 2437MHz Ant1



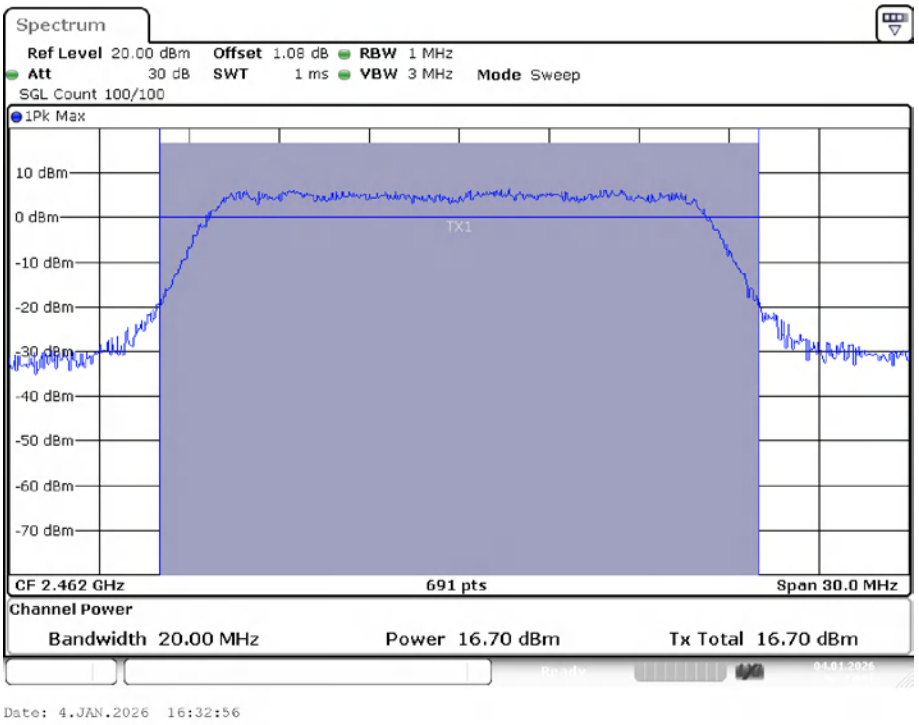
Power NVNT b 2462MHz Ant1



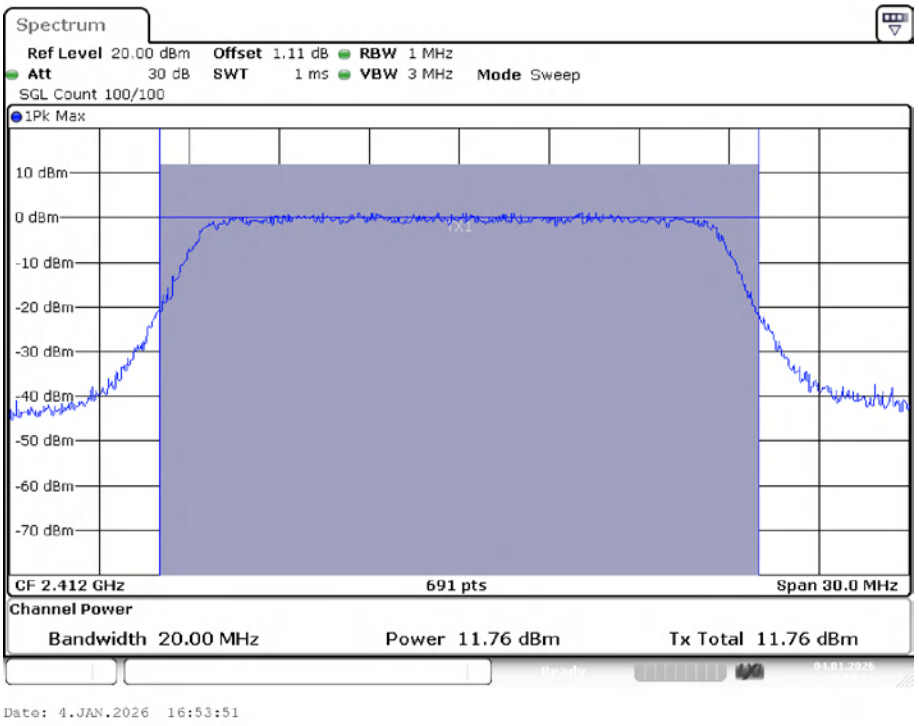
Power NVNT g 2412MHz Ant1



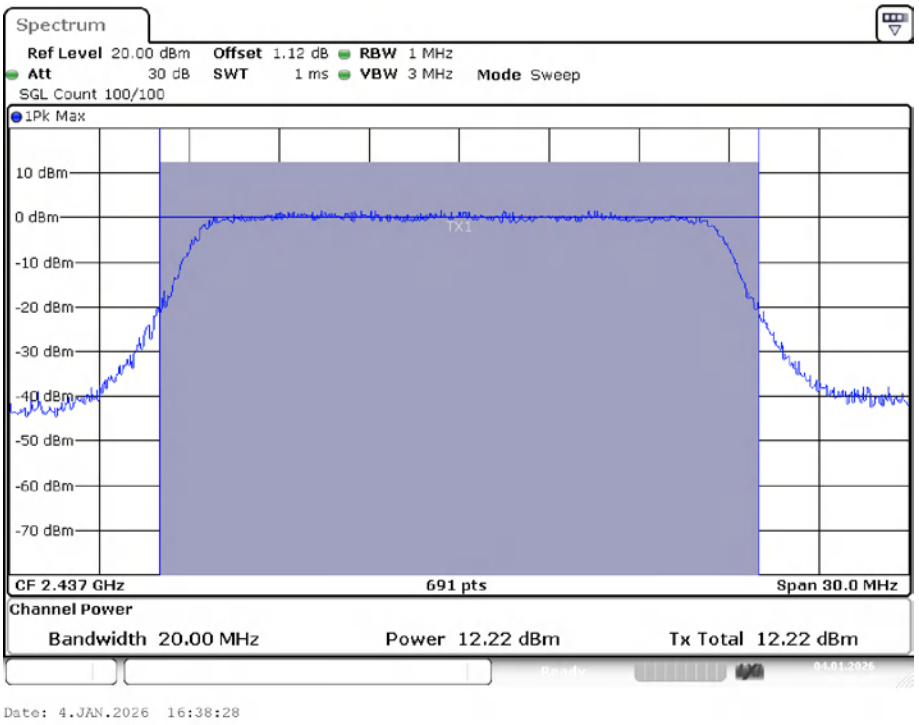
Power NVNT g 2437MHz Ant1



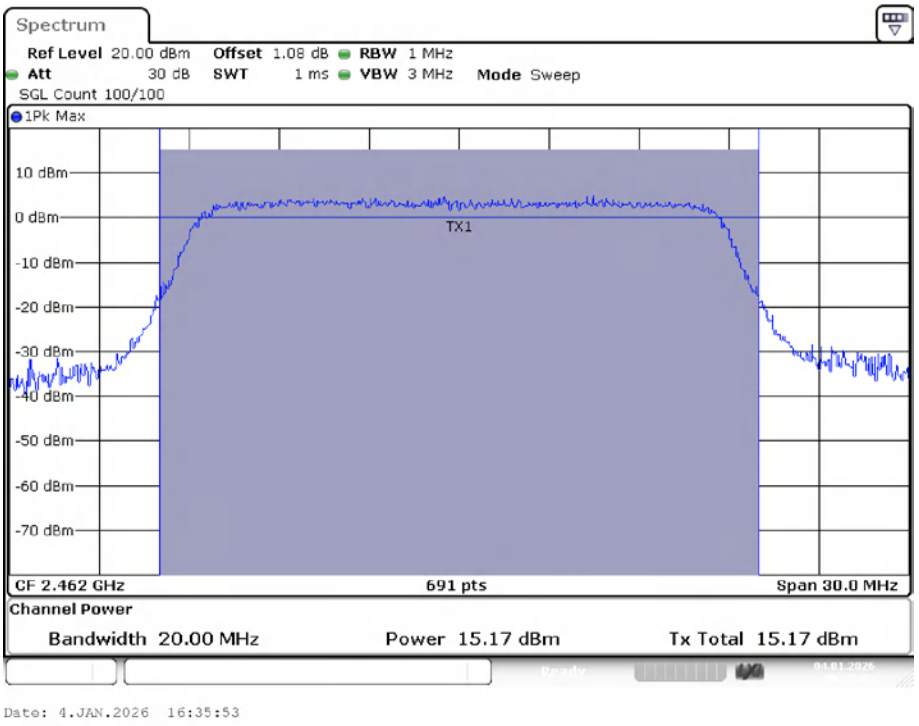
Power NVNT g 2462MHz Ant1



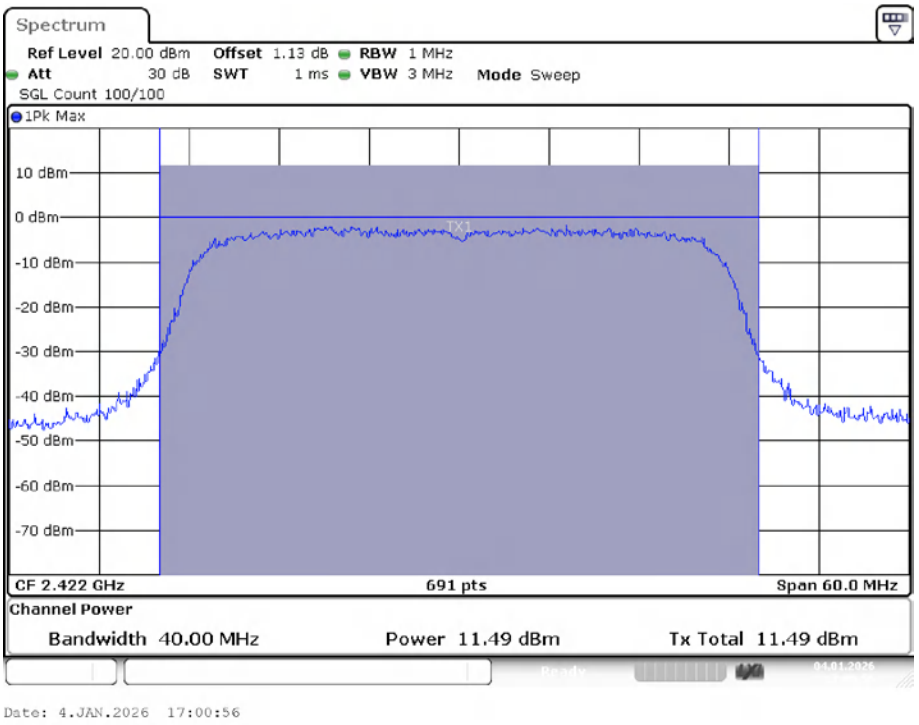
Power NVNT n20 2412MHz Ant1



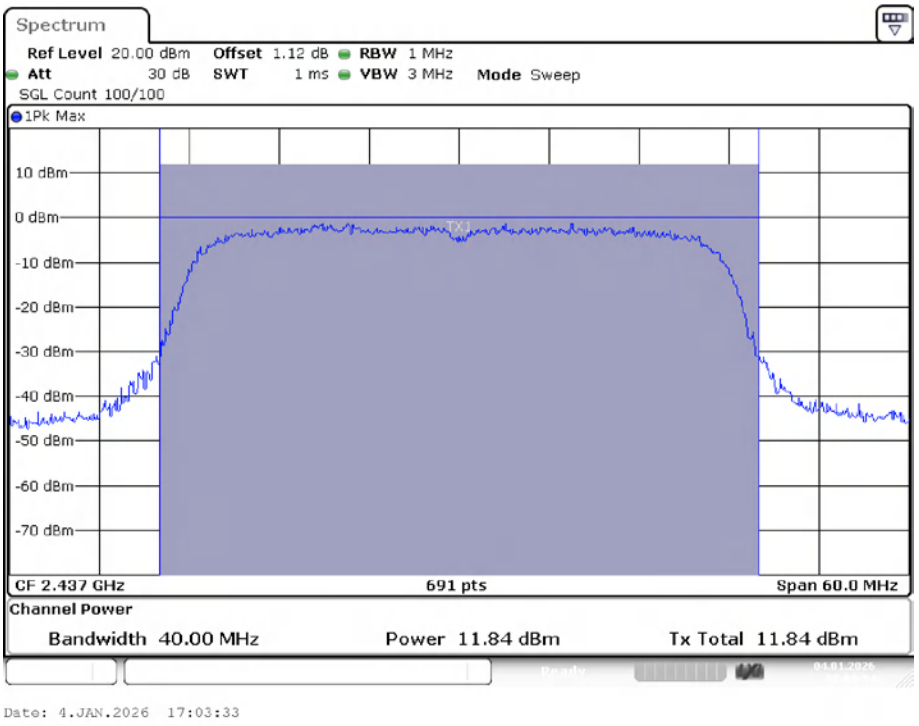
Power NVNT n20 2437MHz Ant1



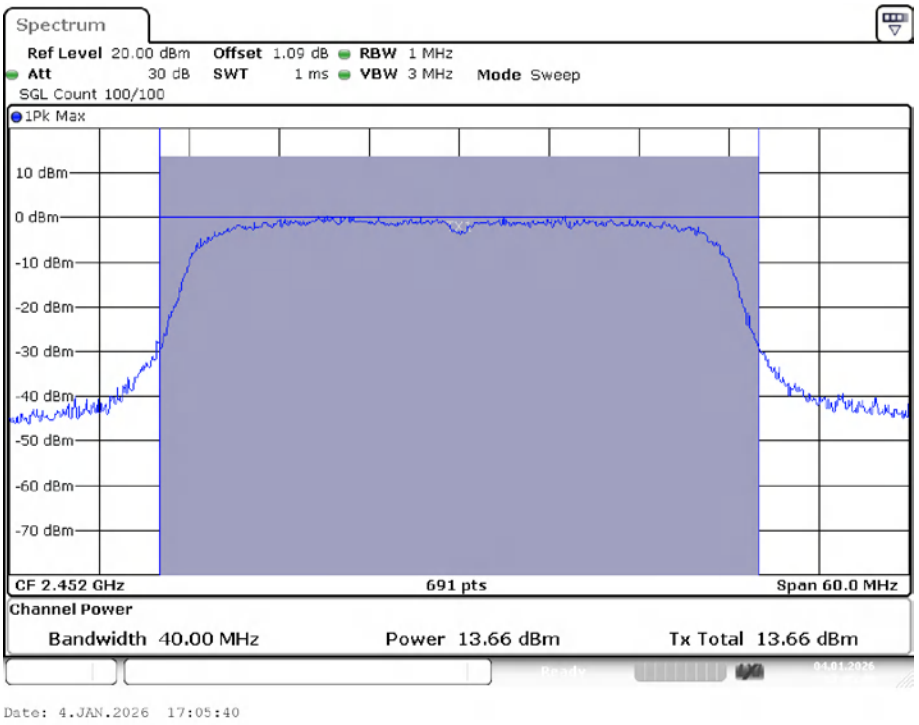
Power NVNT n20 2462MHz Ant1



Power NVNT n40 2422MHz Ant1



Power NVNT n40 2437MHz Ant1



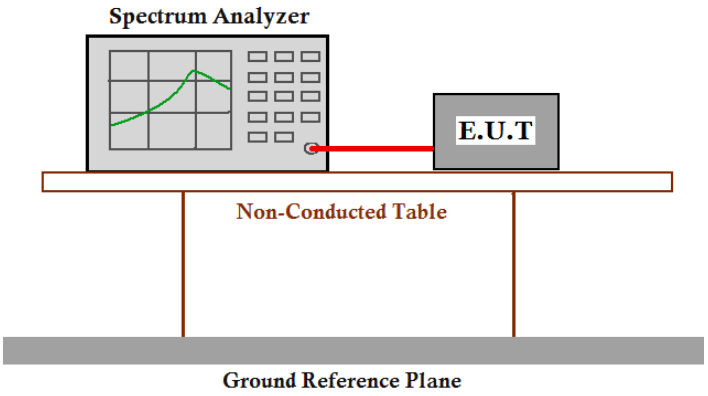
Power NVNT n40 2452MHz Ant1

Test Result: The unit does meet the FCC requirements.

5.5 Power Spectral Density

Test Requirement:	FCC Part 15 C section 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Test Method:	ANSI C63.10:2020
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channel and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

5.5.1 Test Configuration



Test Procedure:

1. The testing follows the Measurement Procedure of ANSI C63.10:2020 Section 11.10.5.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
   The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings:
   Set instrument center frequency to DTS channel center frequency / Set the span to 1.5 times the DTS bandwidth; Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz ; Set the VBW to: 10 kHz ≤ RBW ≤ 300 kHz; Detector: RMS / Sweep time: Auto couple / Trace mode: Average / Employ trace averaging (rms) mode over a minimum of 100 traces / Use the peak marker function to determine the maximum power level.
5. Add [10 log (1 / D)], where D is the duty cycle), to the measured PSD to compute the average PSD

during the actual transmission time.

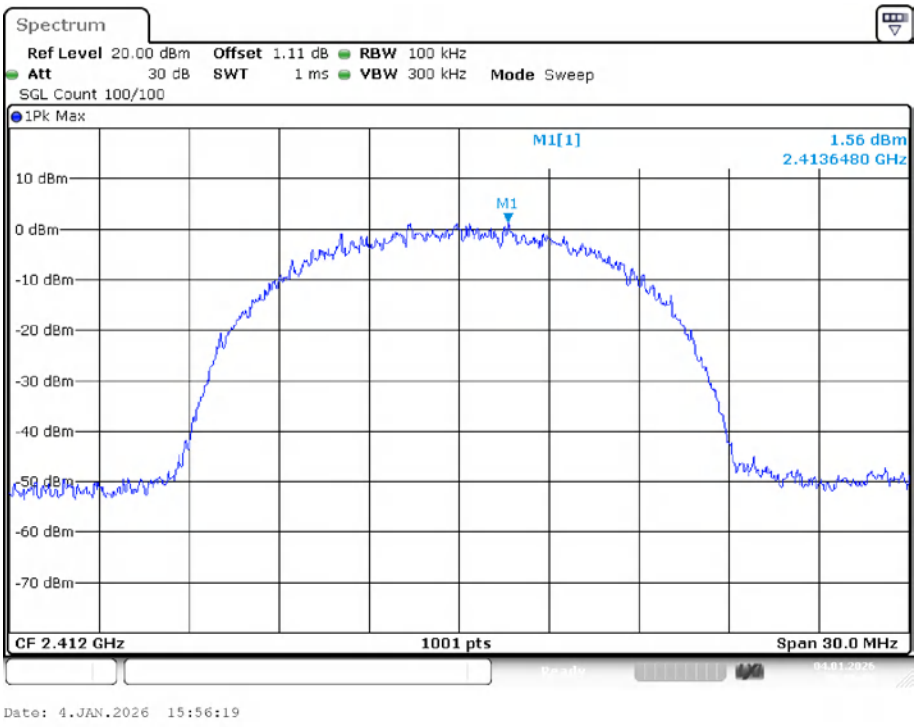
6. Record the measurement results in the test report.

5.5.2 Test Result (Power Spectral Density)

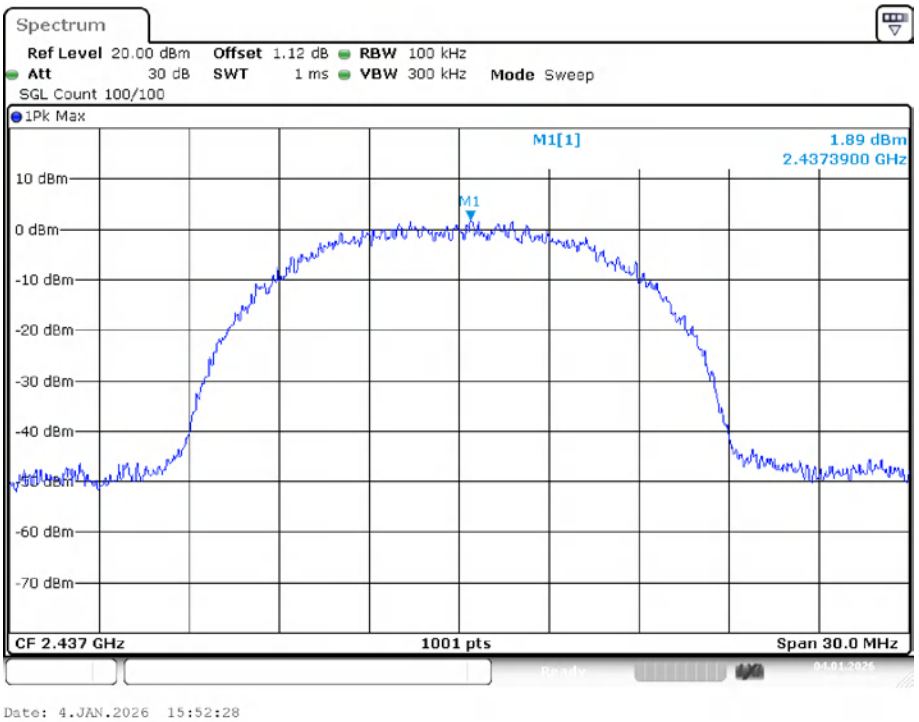
Test mode	Test Frequency (MHz)	Duty Factor (dB)	Max PSD (dBm/100KHz)	Total PSD (dBm/100KHz)	Limit (dBm/3KHz)
802.11b	2412	0	1.56	1.56	8
	2437	0	1.892	1.892	
	2462	0	3.985	3.985	
802.11g	2412	0	-7.599	-7.599	
	2437	0	-6.725	-6.725	
	2462	0	-3.761	-3.761	
802.11n (HT20)	2412	0	-9.252	-9.252	
	2437	0	-8.753	-8.753	
	2462	0	-5.809	-5.809	
802.11n (HT40)	2422	0	-11.973	-11.973	
	2437	0	-11.963	-11.963	
	2452	0	-10.049	-10.049	

Note: Total PSD (dBm/100KHz) = Duty Factor (dB) + Max PSD (dBm/100KHz)

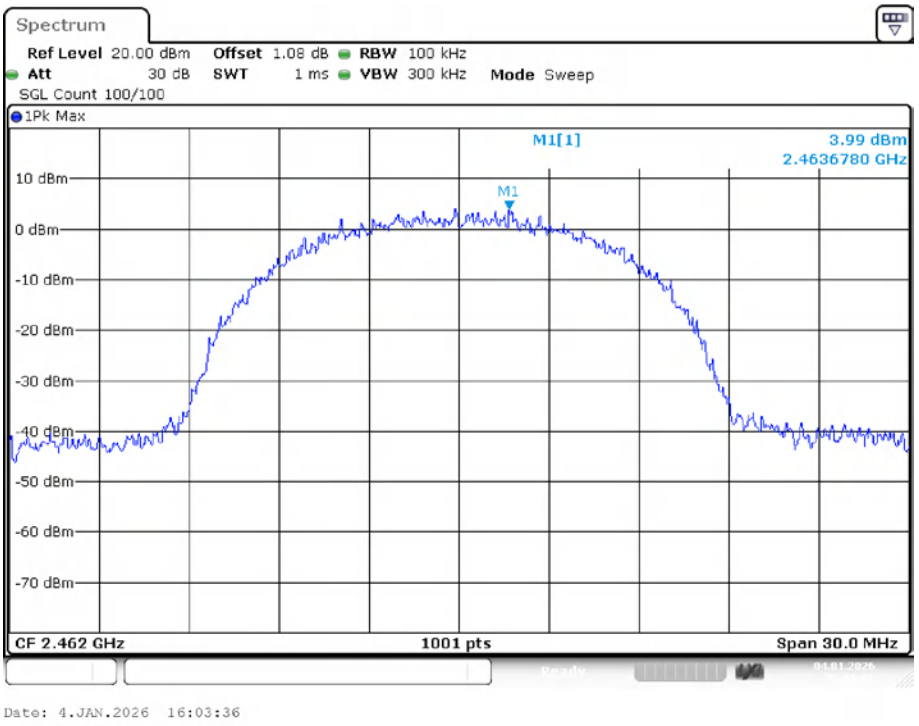
Result plot as follows:



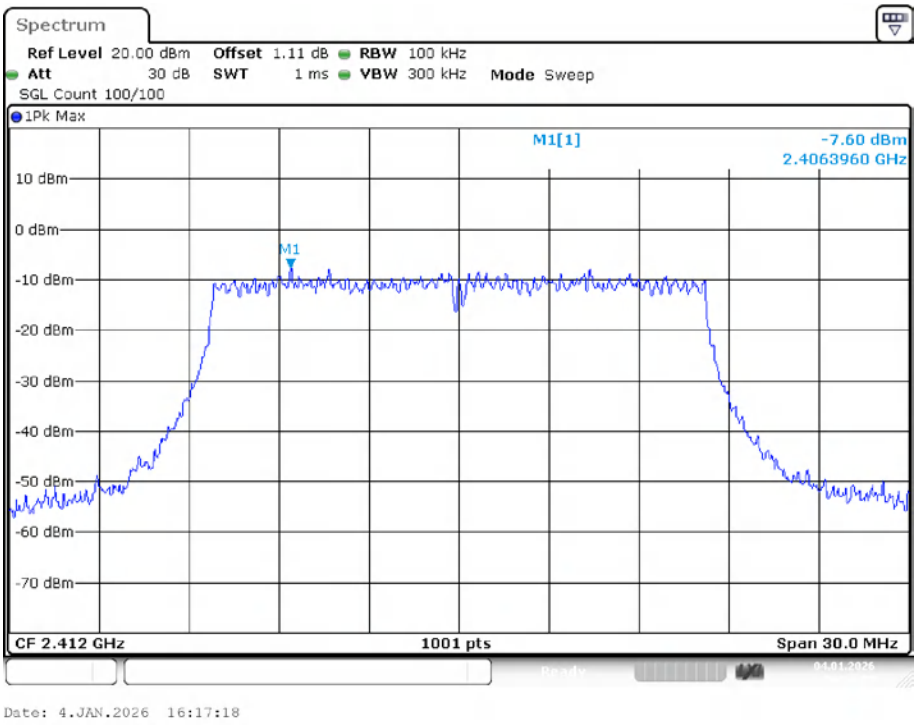
PSD NVNT b 2412MHz Ant1



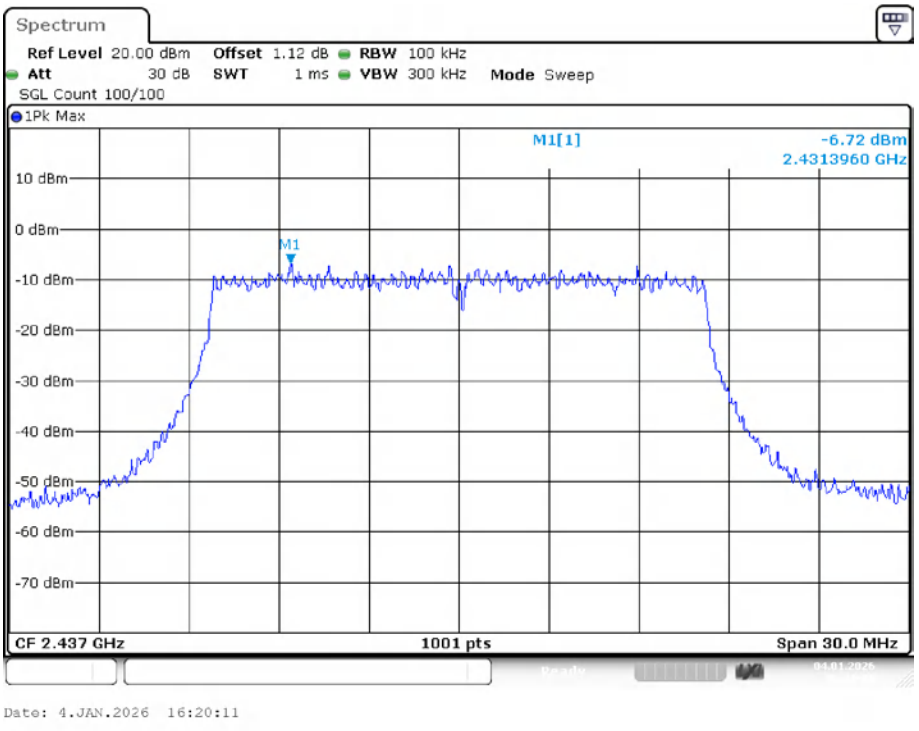
PSD NVNT b 2437MHz Ant1



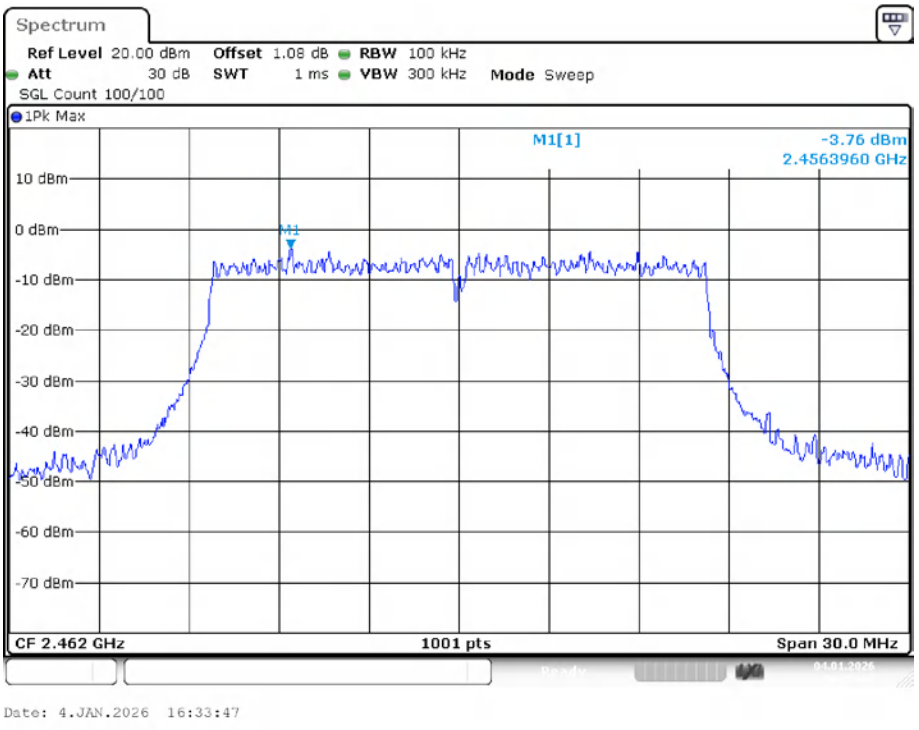
PSD NVNT b 2462MHz Ant1



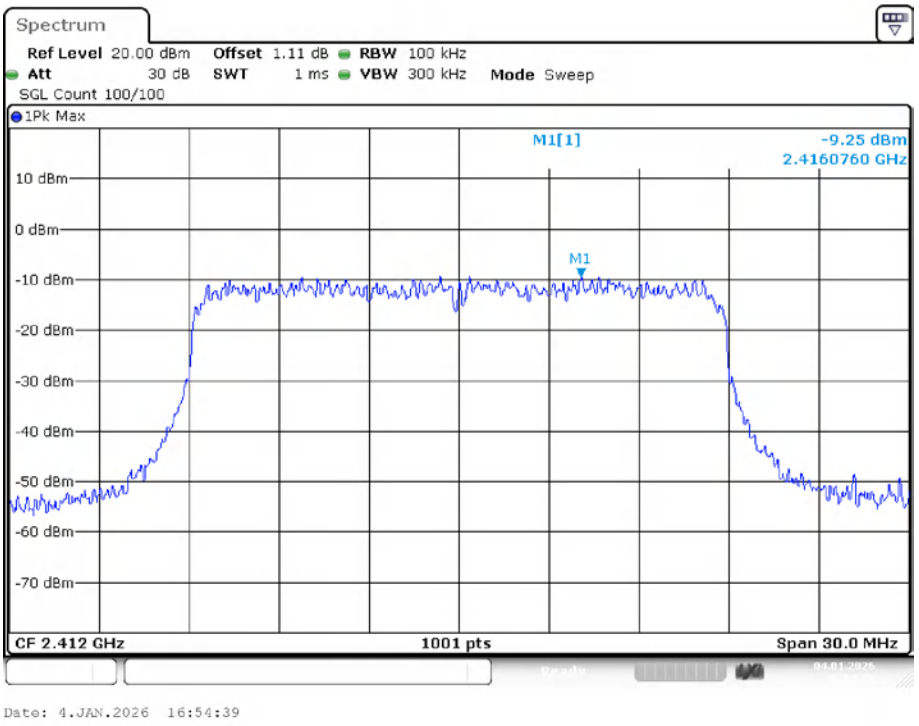
PSD NVNT g 2412MHz Ant1



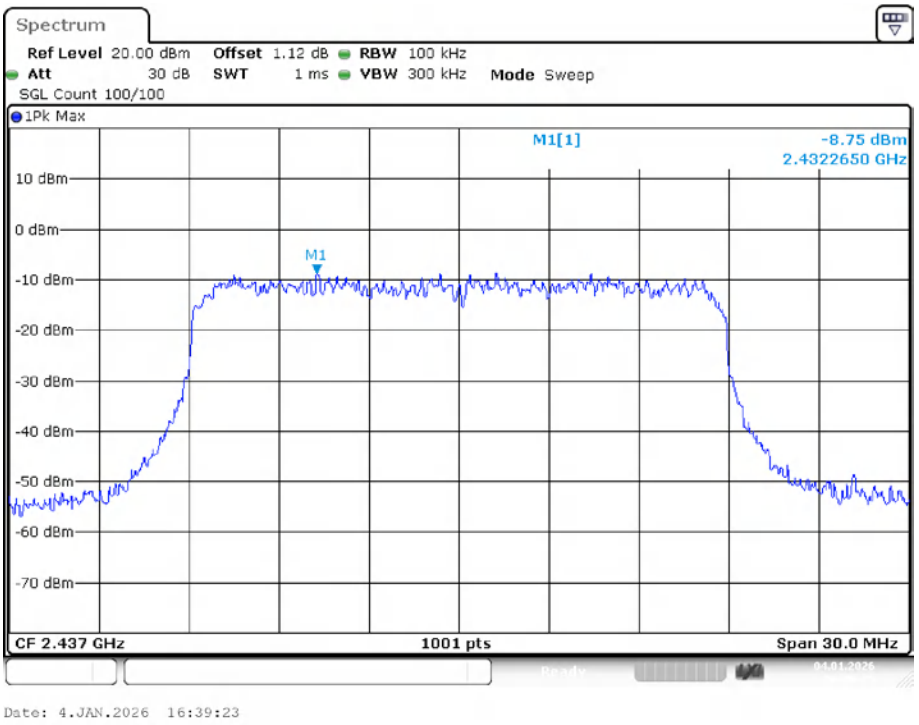
PSD NVNT g 2437MHz Ant1



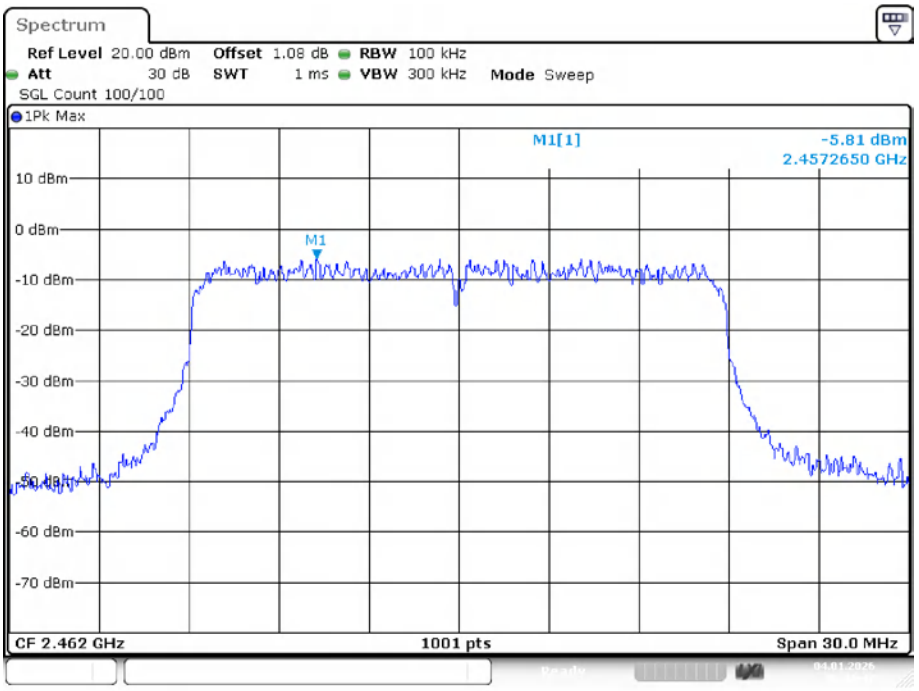
PSD NVNT g 2462MHz Ant1



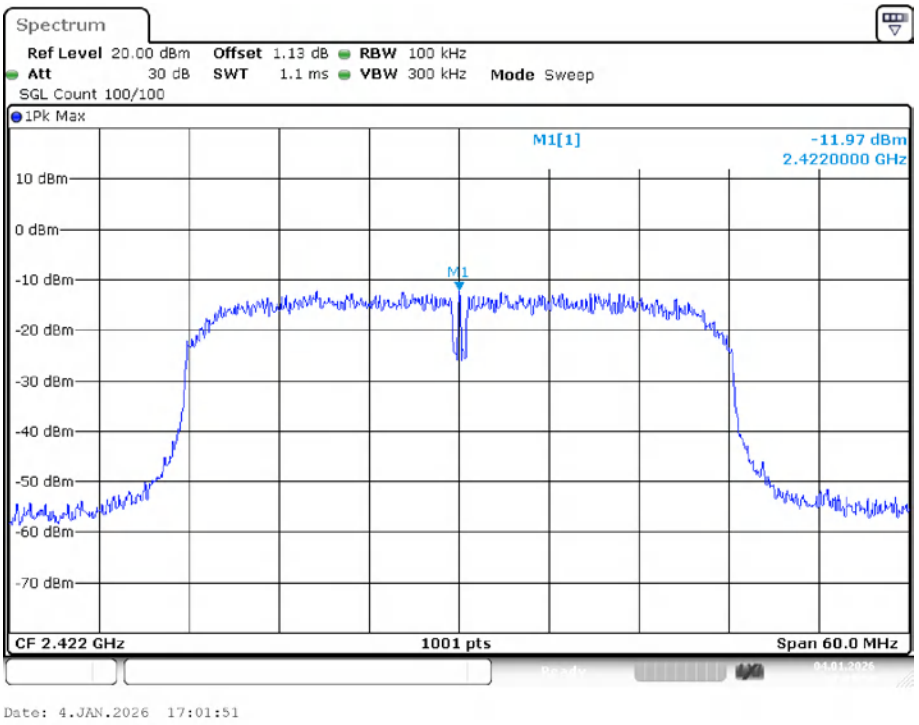
PSD NVNT n20 2412MHz Ant1



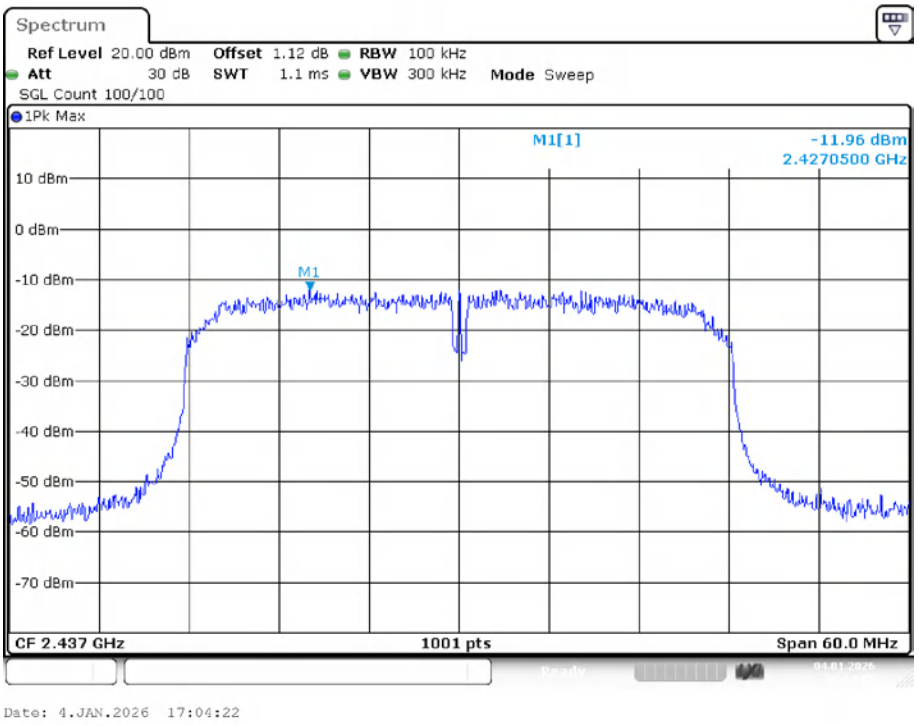
PSD NVNT n20 2437MHz Ant1



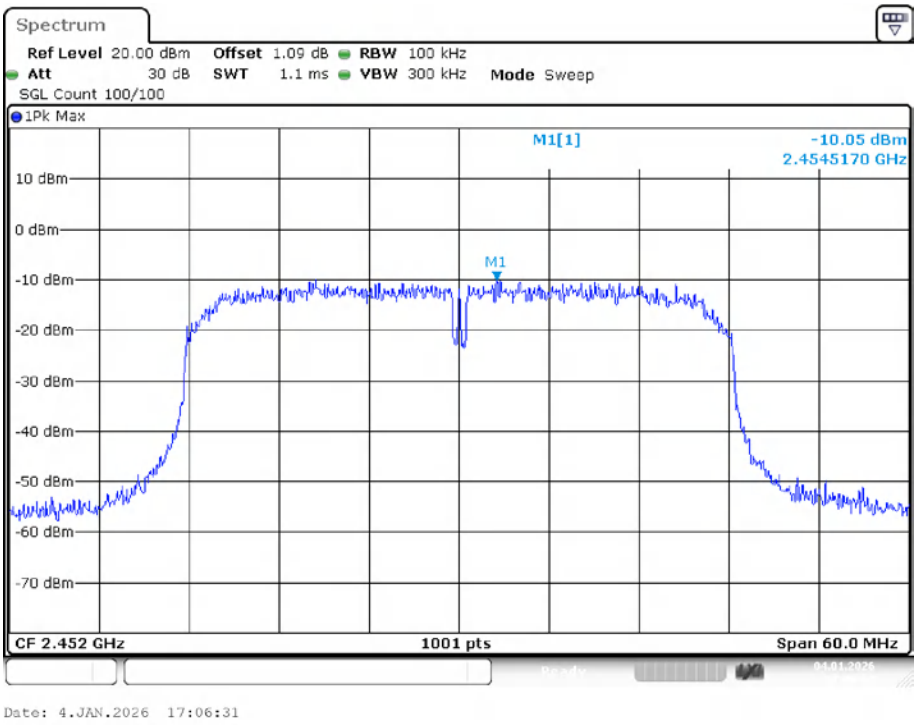
PSD NVNT n20 2462MHz Ant1



PSD NVNT n40 2422MHz Ant1



PSD NVNT n40 2437MHz Ant1



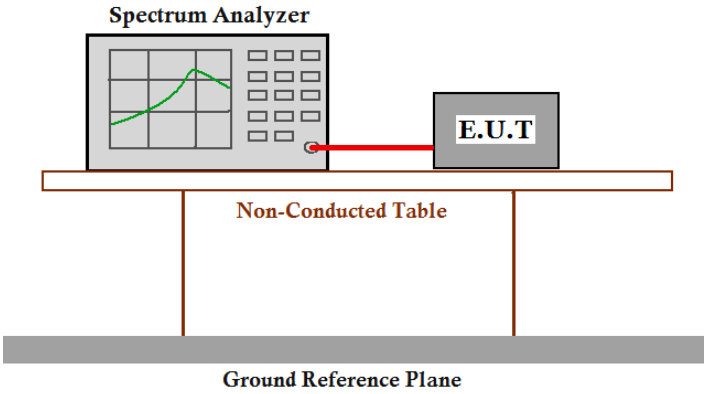
PSD NVNT n40 2452MHz Ant1

Test Result: The unit does meet the FCC requirements.

5.6 Conducted Spurious Emissions

Test Requirement:	FCC Part 15 C section 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 30 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 the transmitter demonstrates compliance with the averaging conducted power limits.
Test Method:	ANSI C63.10:2020
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channel and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

5.6.1 Test Configuration



Test Procedure:

1. The testing follows the Measurement Procedure of ANSI C63.10:2020 Section 11.11.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings

   Reference level measurement: Set spectrum analyzer center frequency to DTS channel center frequency / Set the span to >1.5 times the DTS bandwidth /RBW: 100KHz/VBW: 300KHz/Detector: Peak / Sweep time: Auto couple / Trace mode: Max hold / Allow trace to fully stabilize Use the peak marker function to determine the maximum PSD level and attenuate it by 30dB.Emission level measurement: Set the center frequency and span to encompass frequency range to be measured /RBW: 100KHz/VBW: 300KHz/ Detector: Peak / Sweep time: Auto couple / Trace mode: Max hold /

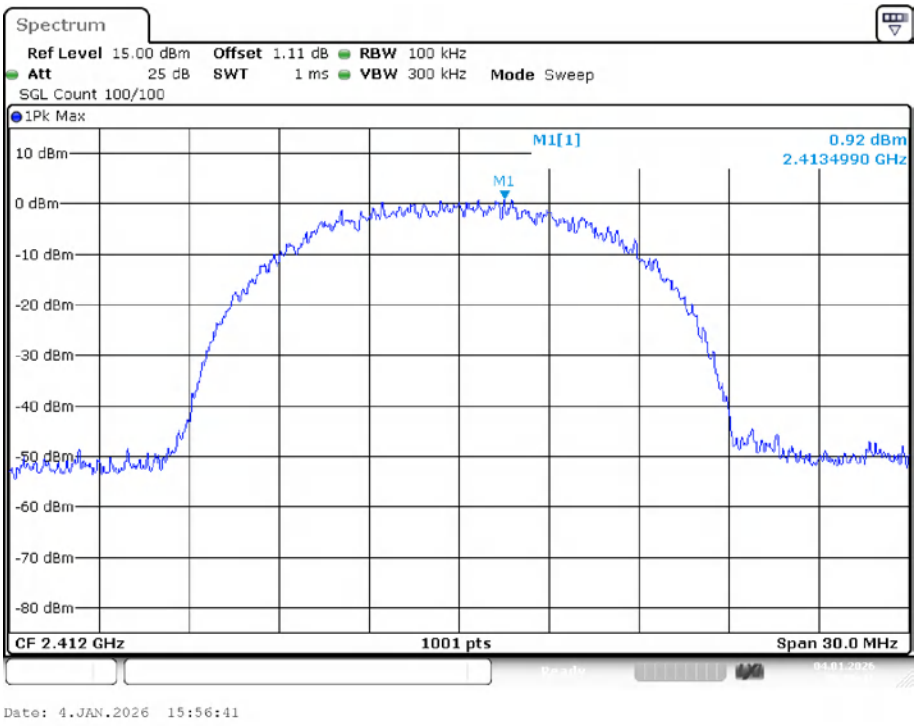
Allow trace to fully stabilize / Use the peak marker function to determine the maximum amplitude level.

5. Record the measurement results in the test report.

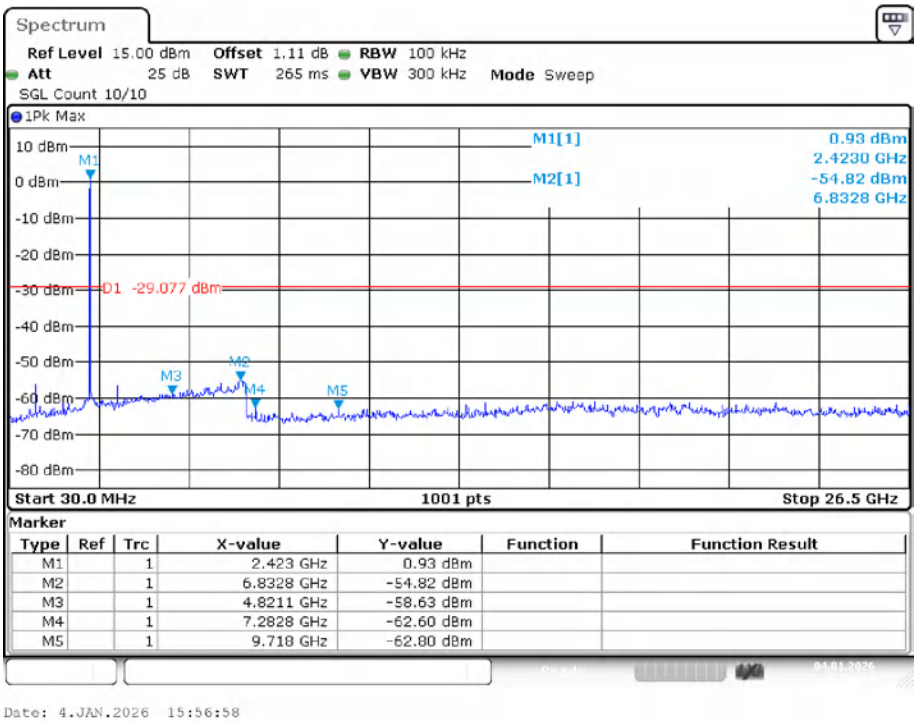
5.6.2 Test Result (Conducted Spurious Emissions)

Test mode	Test Frequency (MHz)	Max Value (dBc)	Limit (dBc)
802.11b	2412	-55.73	-30
	2437	-55.18	-30
	2462	-58.92	-30
802.11g	2412	-46.89	-30
	2437	-47.1	-30
	2462	-50.15	-30
802.11n (HT20)	2412	-44.66	-30
	2437	-45.52	-30
	2462	-48.39	-30
802.11n (HT40)	2422	-42.65	-30
	2437	-42.31	-30
	2452	-44.23	-30

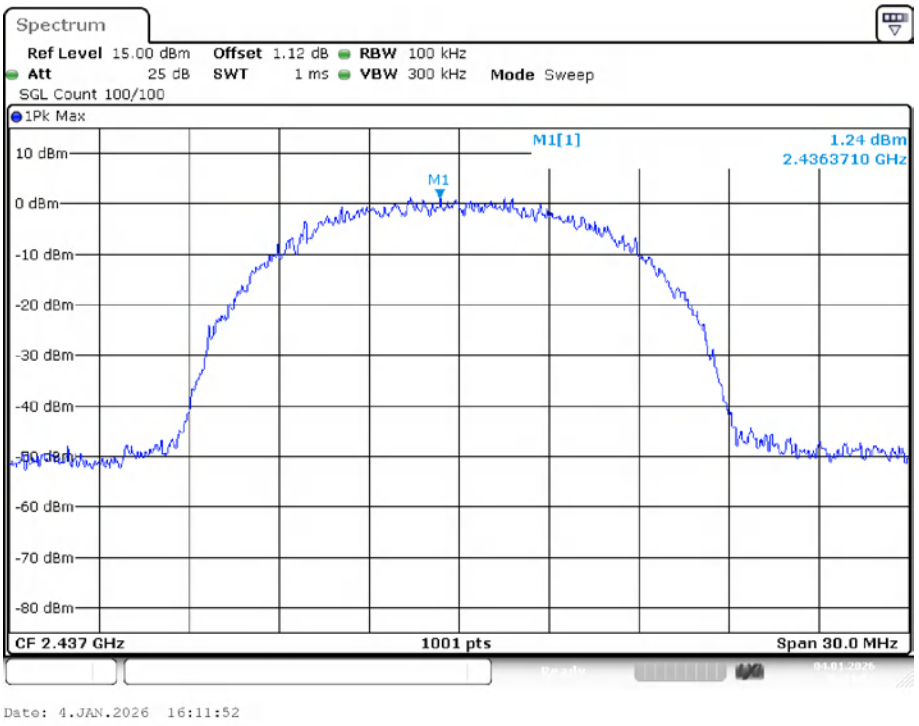
Result plot as follows:



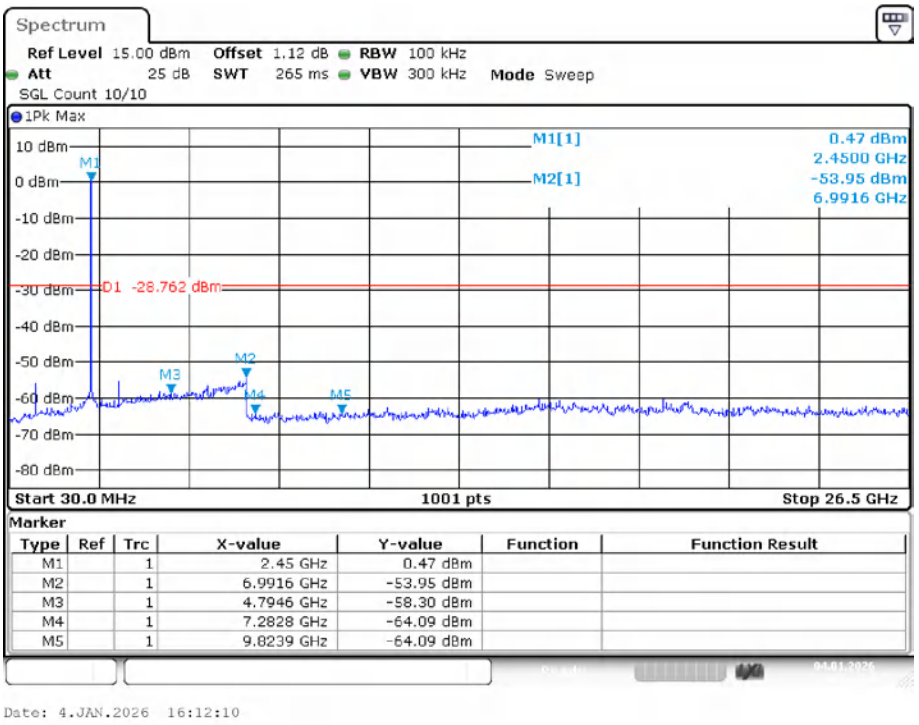
Tx. Spurious NVNT b 2412MHz Ant1 Ref



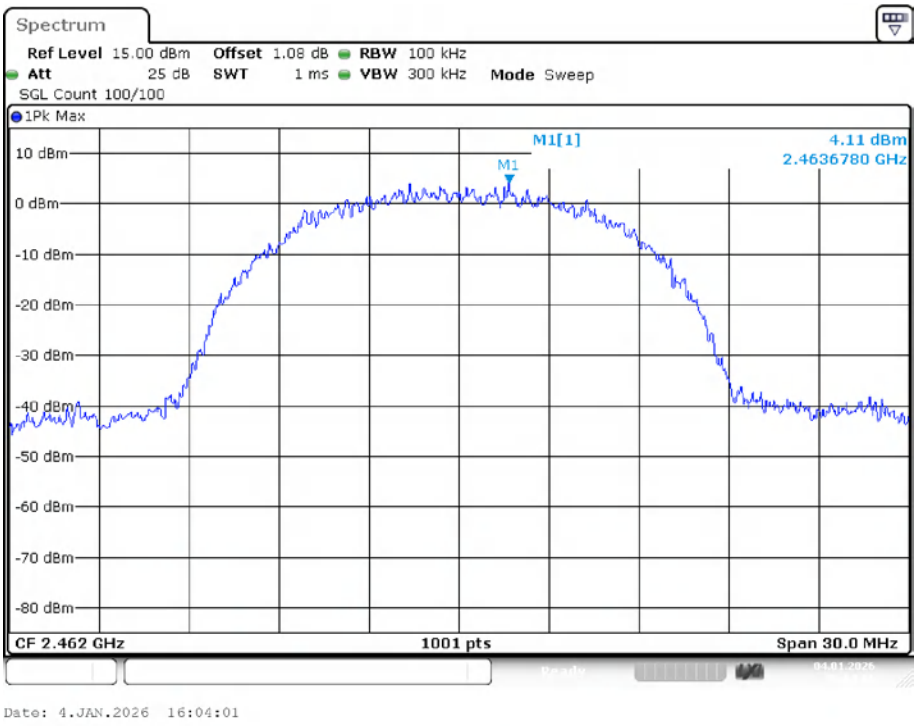
Tx. Spurious NVNT b 2412MHz Ant1 Emission



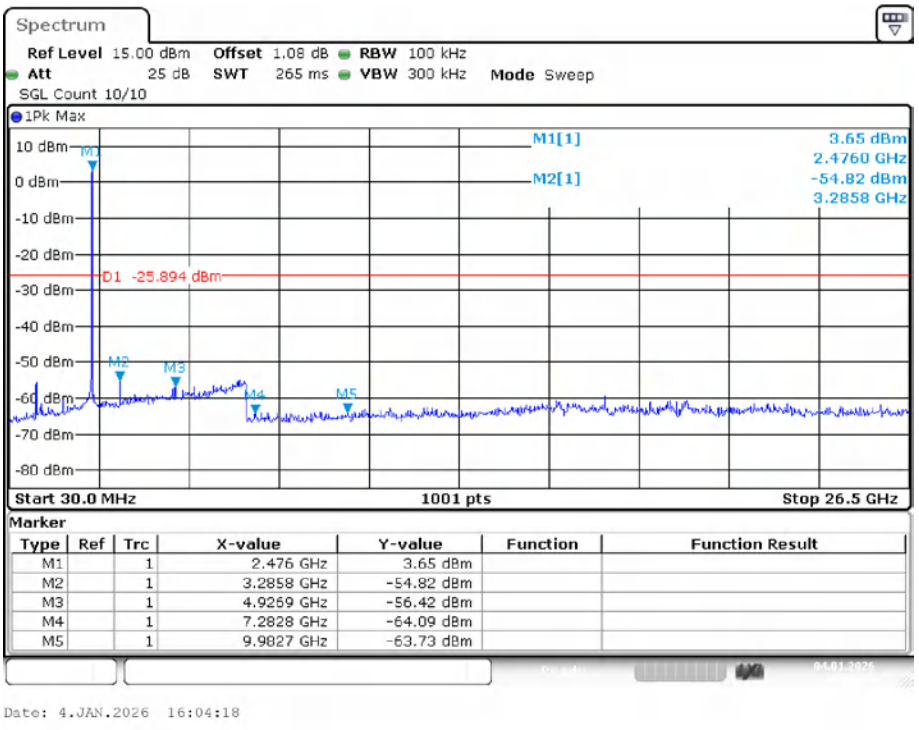
Tx. Spurious NVNT b 2437MHz Ant1 Ref



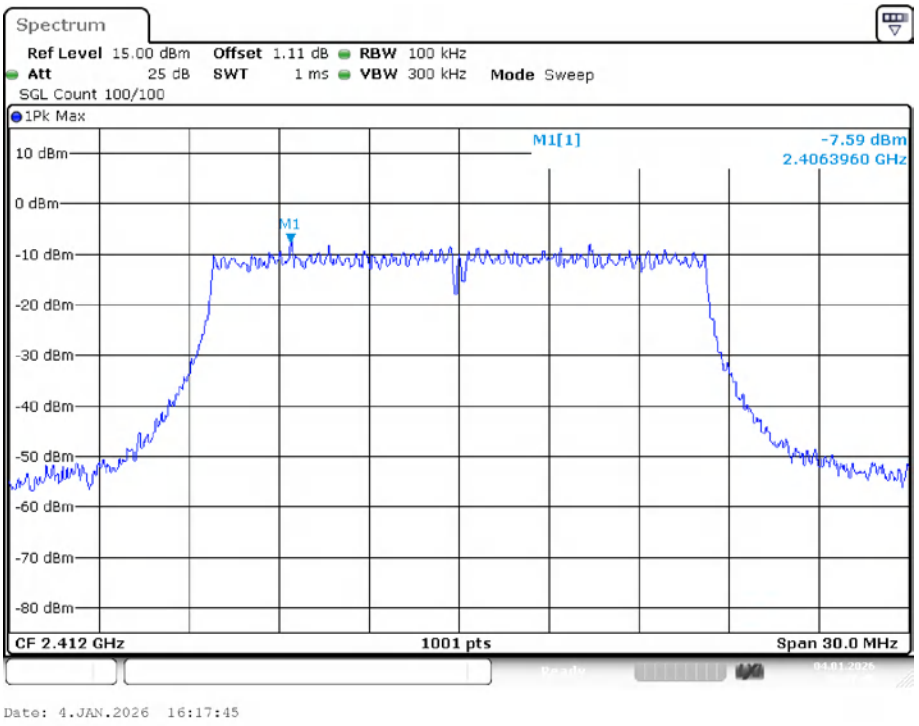
Tx. Spurious NVNT b 2437MHz Ant1 Emission



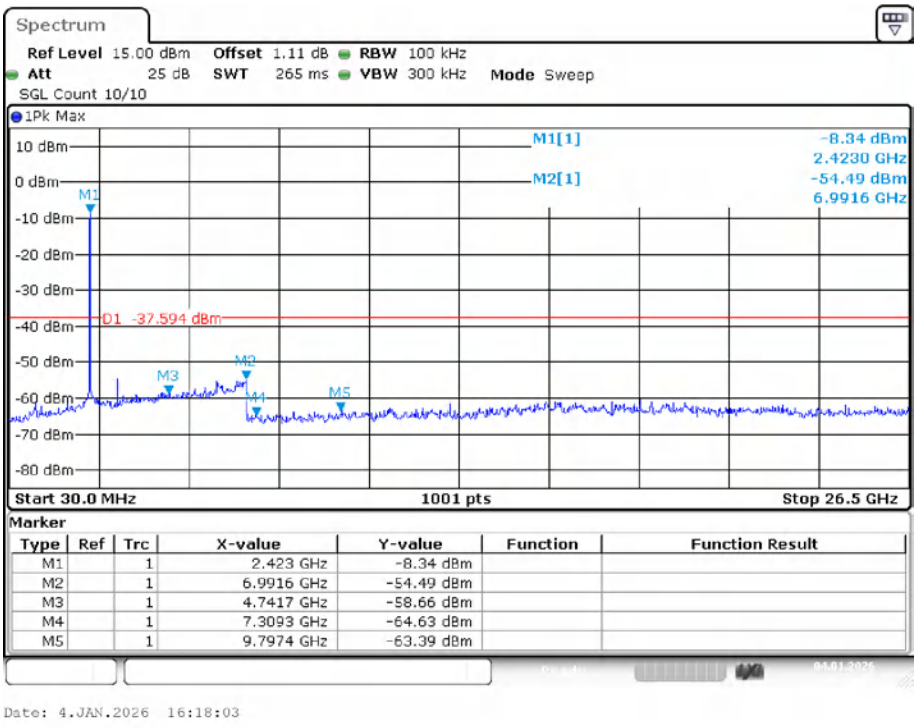
Tx. Spurious NVNT b 2462MHz Ant1 Ref



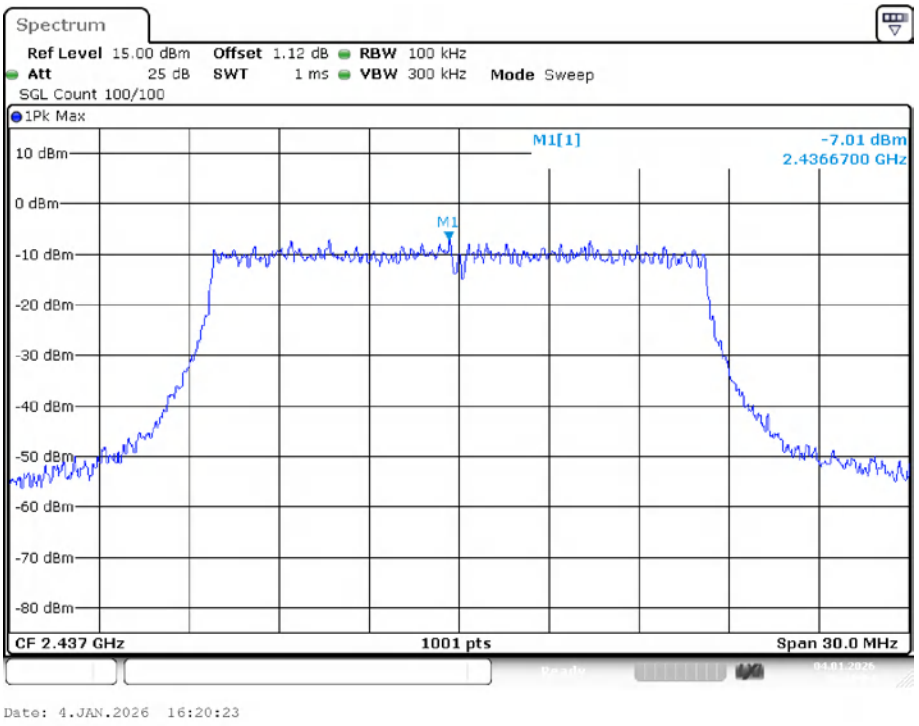
Tx. Spurious NVNT b 2462MHz Ant1 Emission



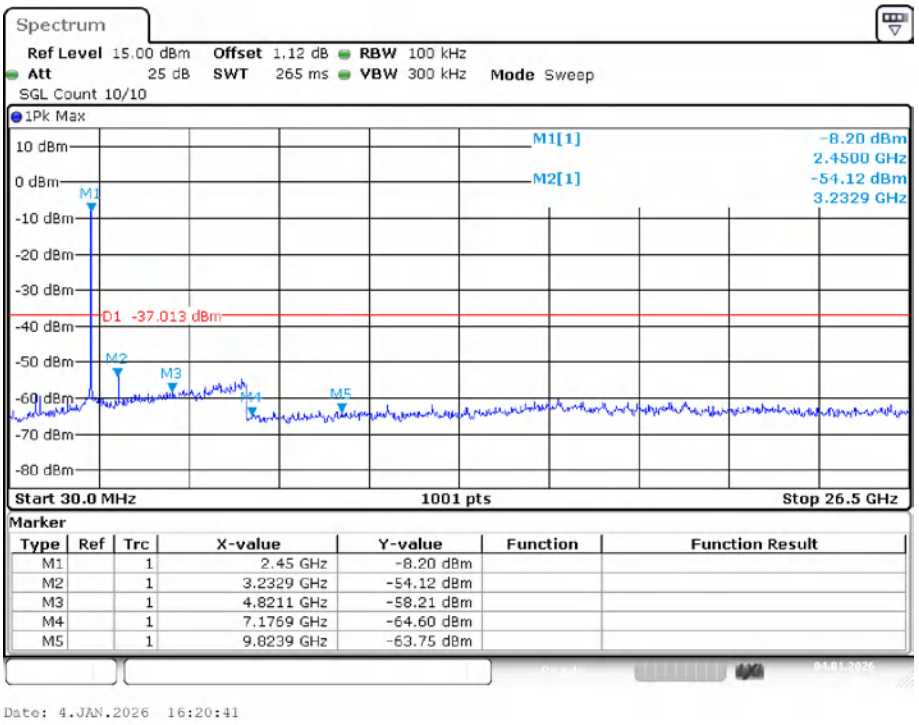
Tx. Spurious NVNT g 2412MHz Ant1 Ref



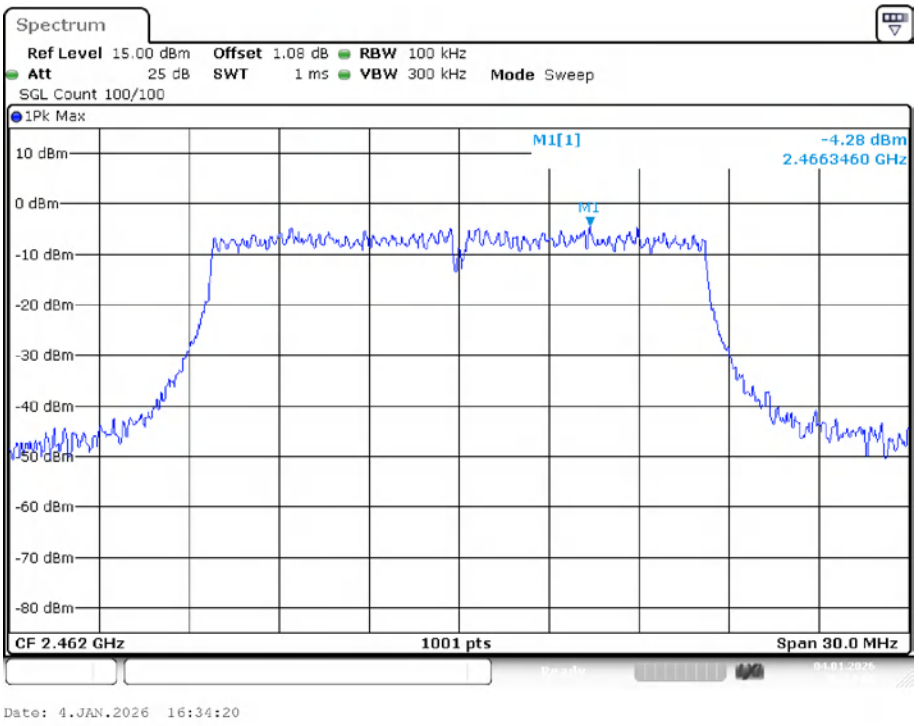
Tx. Spurious NVNT g 2412MHz Ant1 Emission



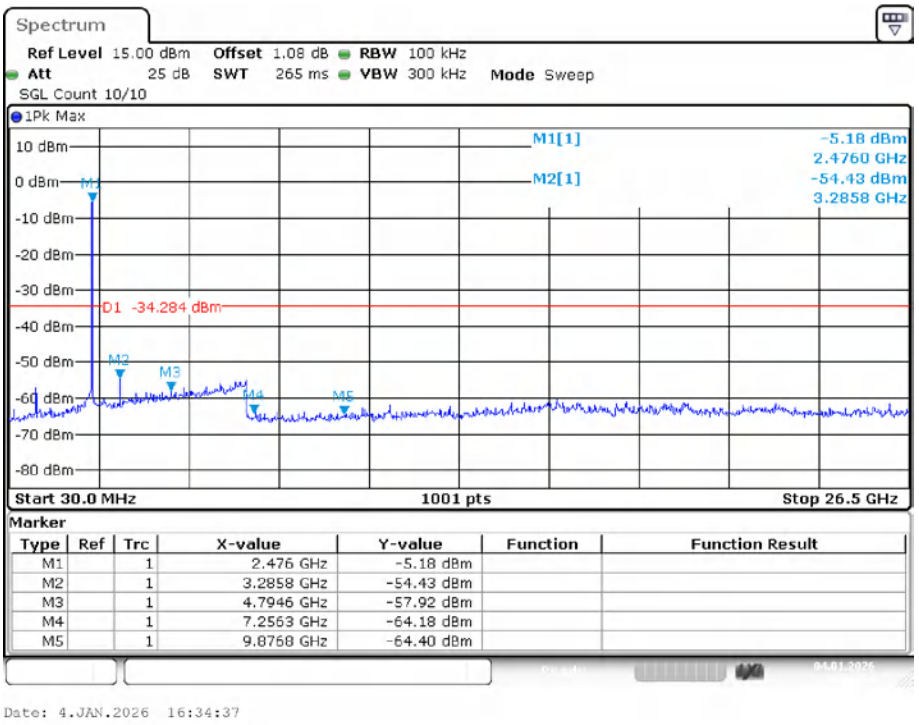
Tx. Spurious NVNT g 2437MHz Ant1 Ref



Tx. Spurious NVNT g 2437MHz Ant1 Emission



Tx. Spurious NVNT g 2462MHz Ant1 Ref



Tx. Spurious NVNT g 2462MHz Ant1 Emission