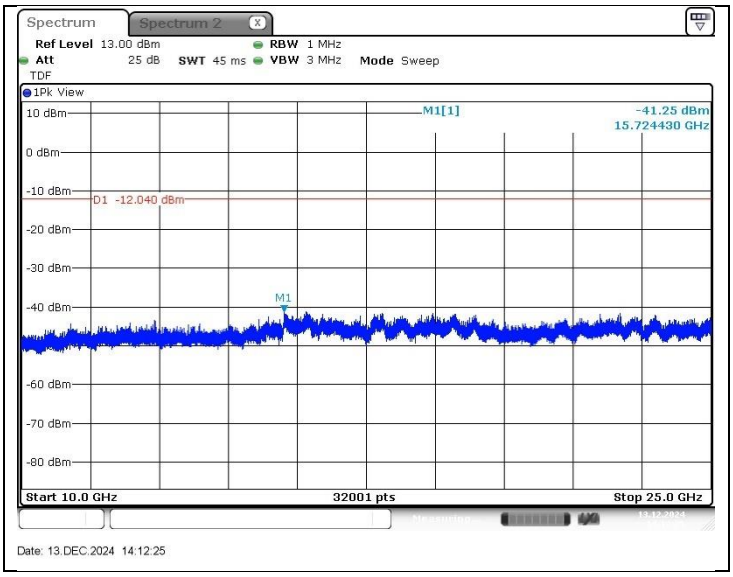
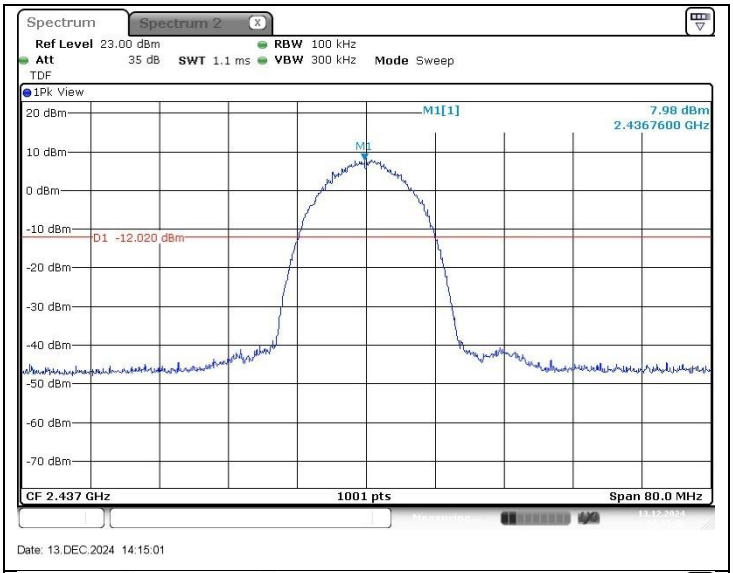
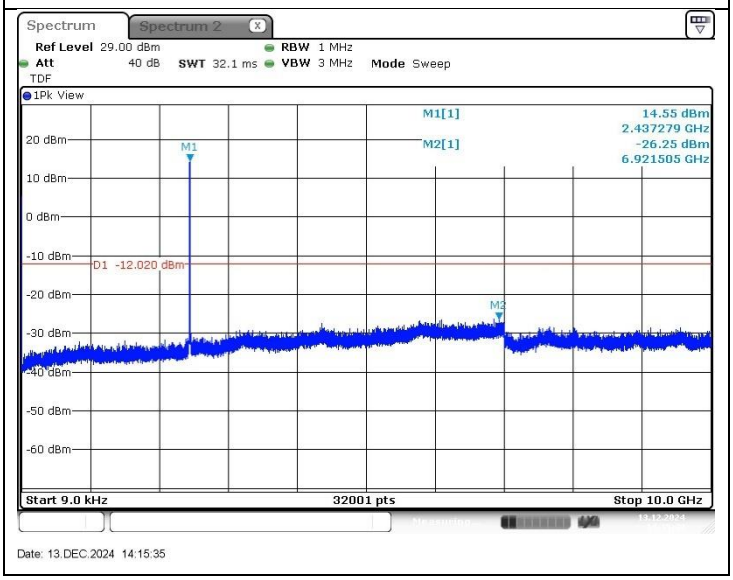
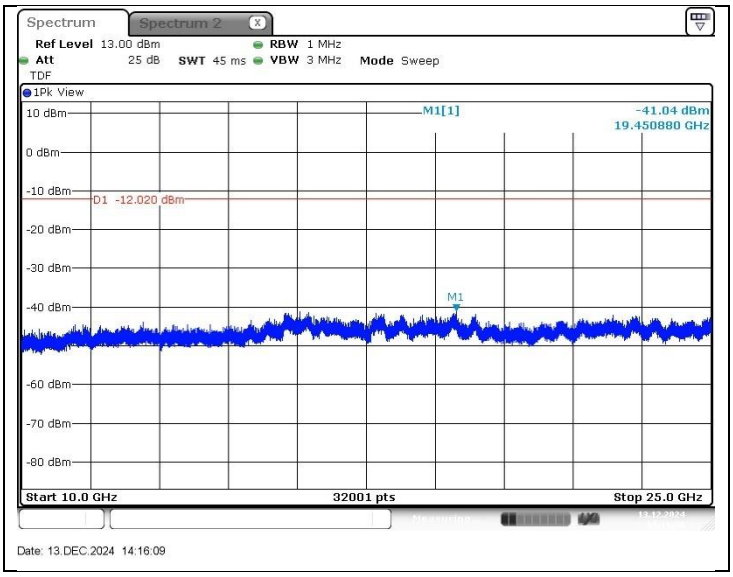


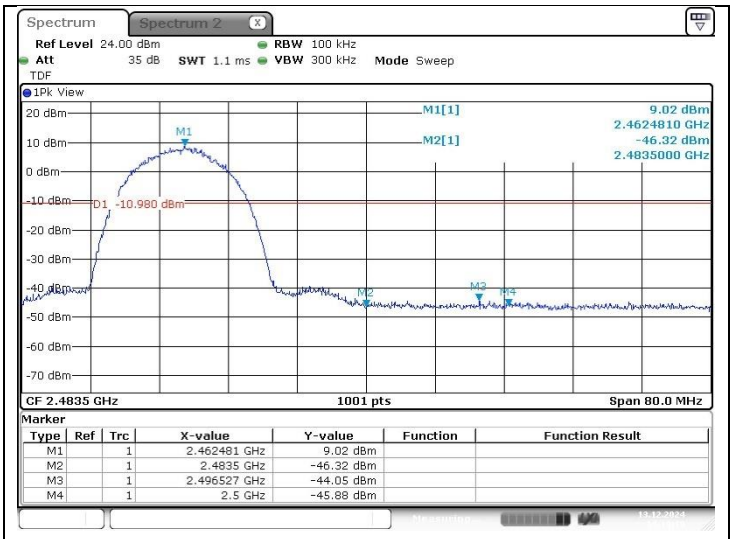
Middle Channel

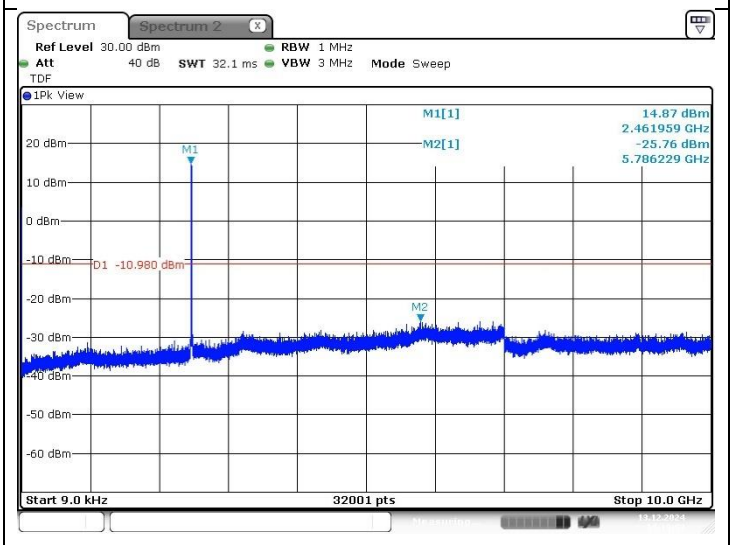


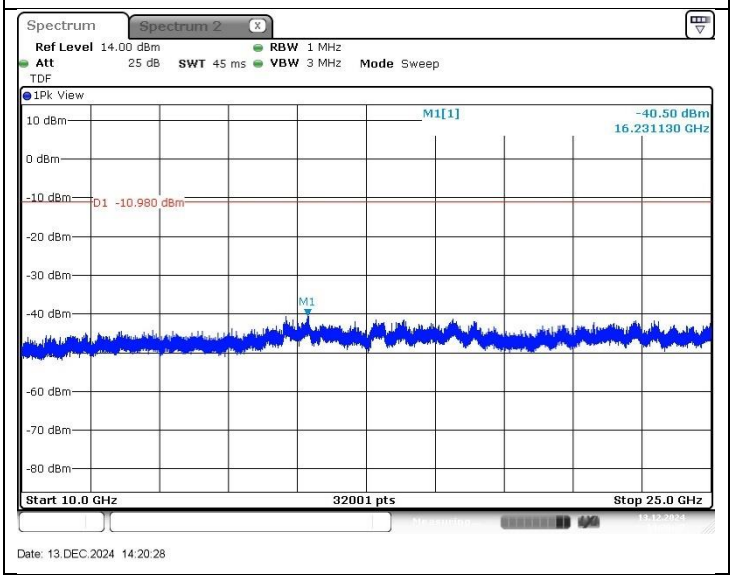



Spectrum
Spectrum 2
Ref Level 13.00 dBm
RBW 1 MHz
Att 25 dB
SWT 45 ms
VBW 3 MHz
Mode Sweep
TDF
1Pk View
M1[1]
-41.04 dBm
19.450880 GHz
10 dBm
0 dBm
-10 dBm
D1 -12.020 dBm
-20 dBm
-30 dBm
-40 dBm
-60 dBm
-70 dBm
-80 dBm
M1
Start 10.0 GHz
32001 pts
Stop 25.0 GHz
Date: 13.DEC.2024 14:16:09

High Channel

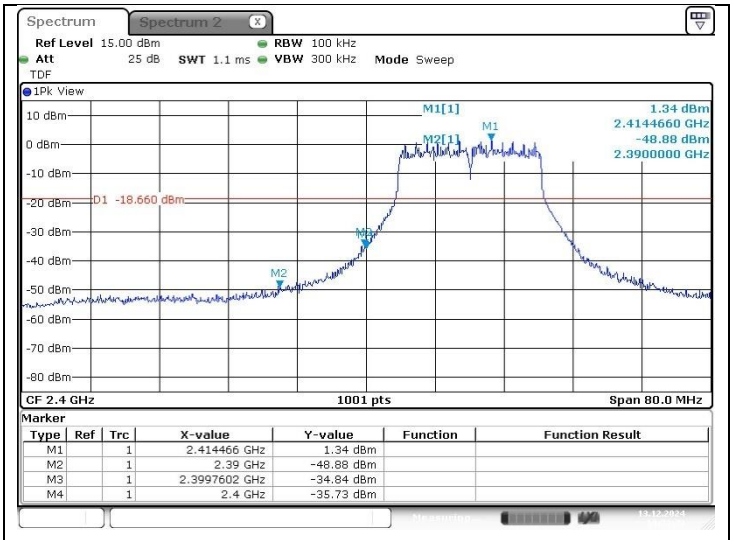


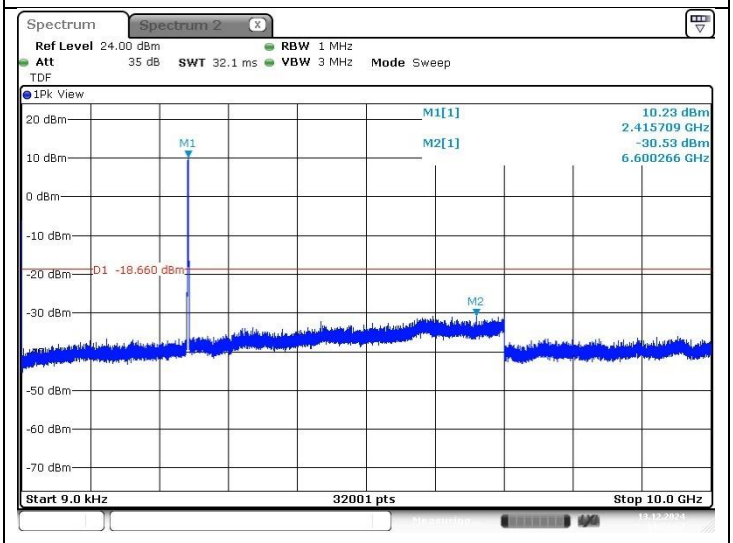


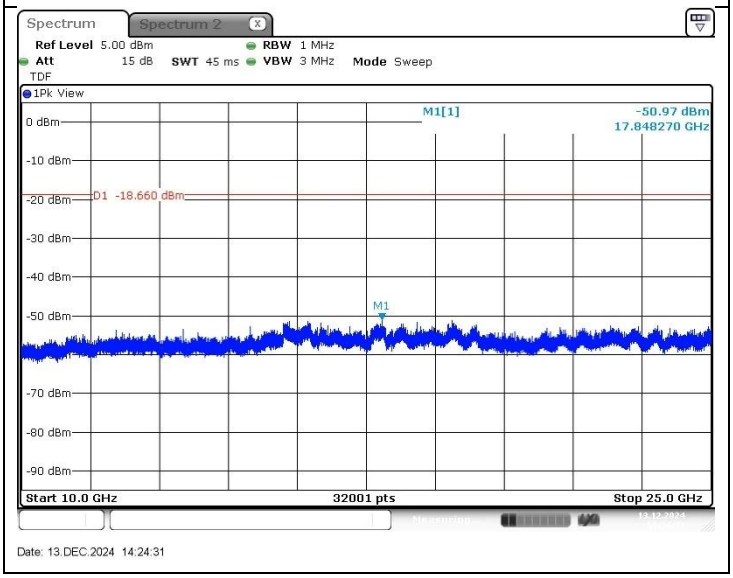


11g

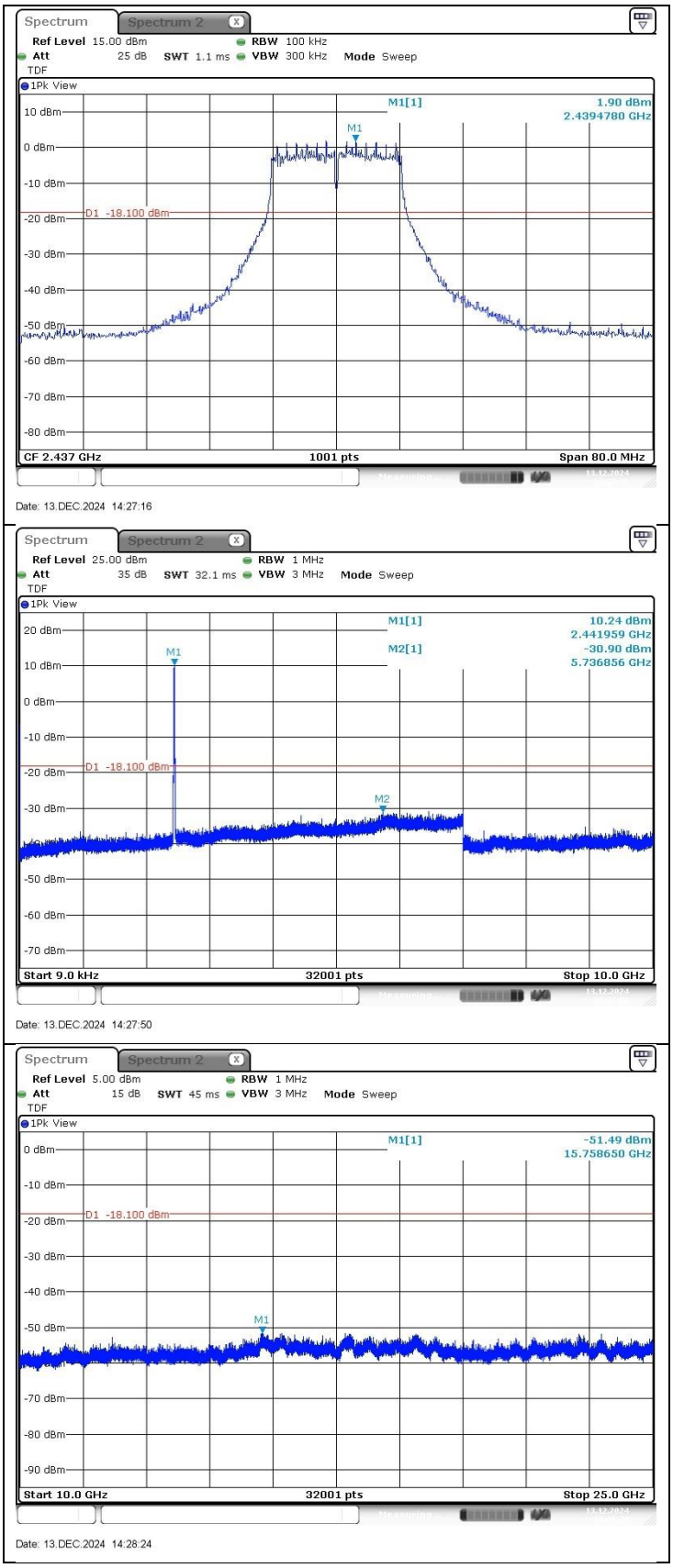
Low Channel



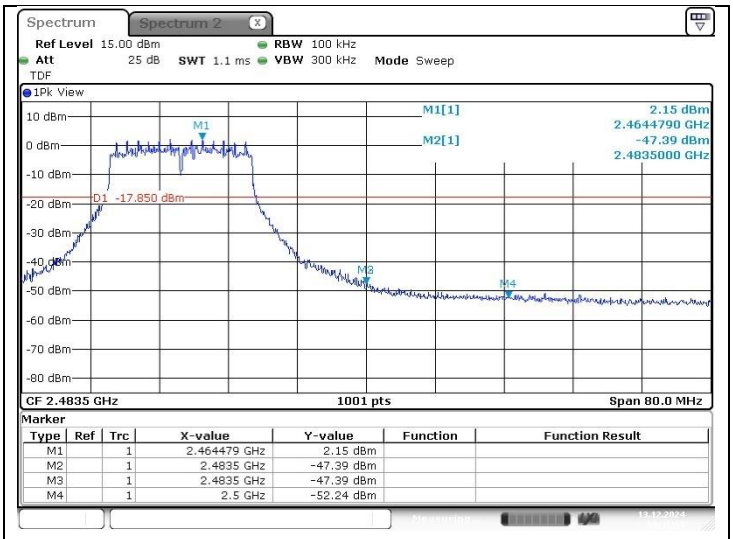


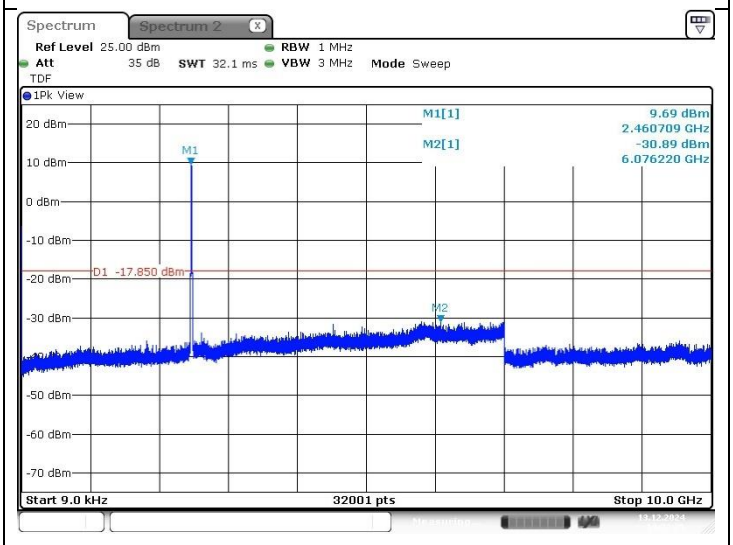


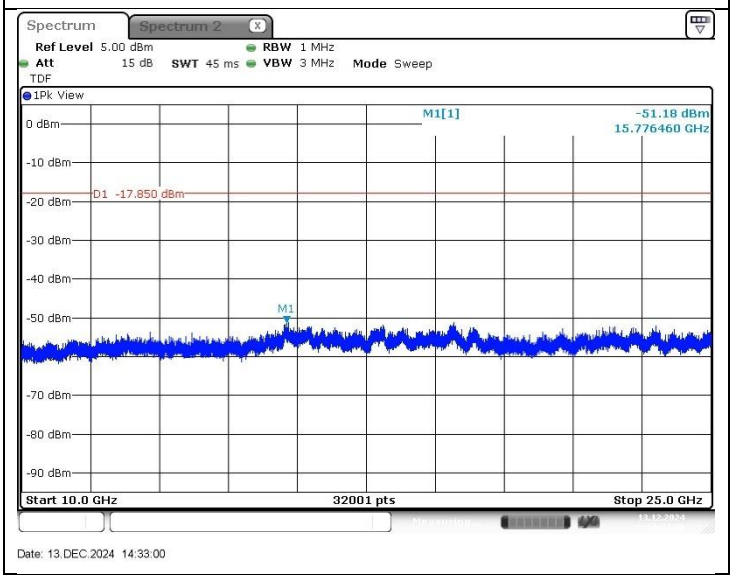
Middle Channel



High Channel

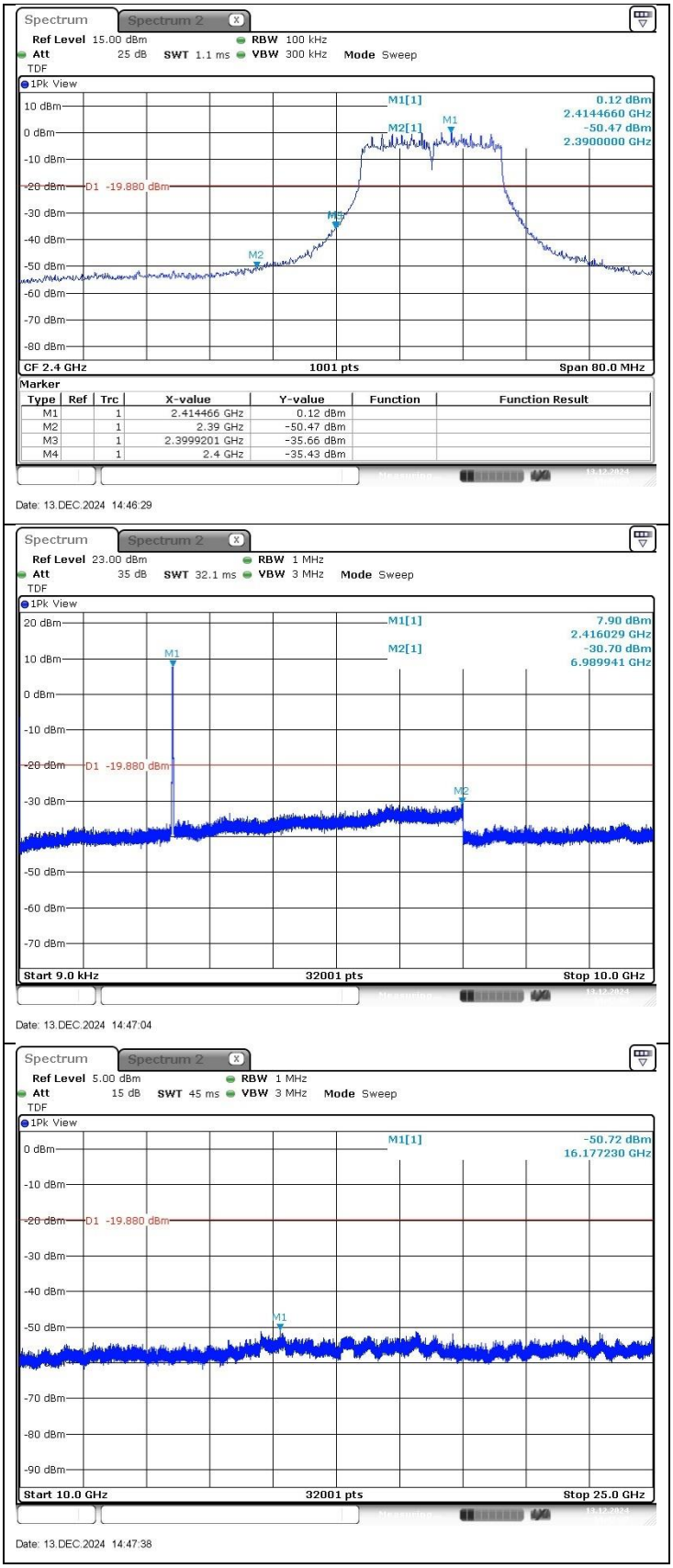




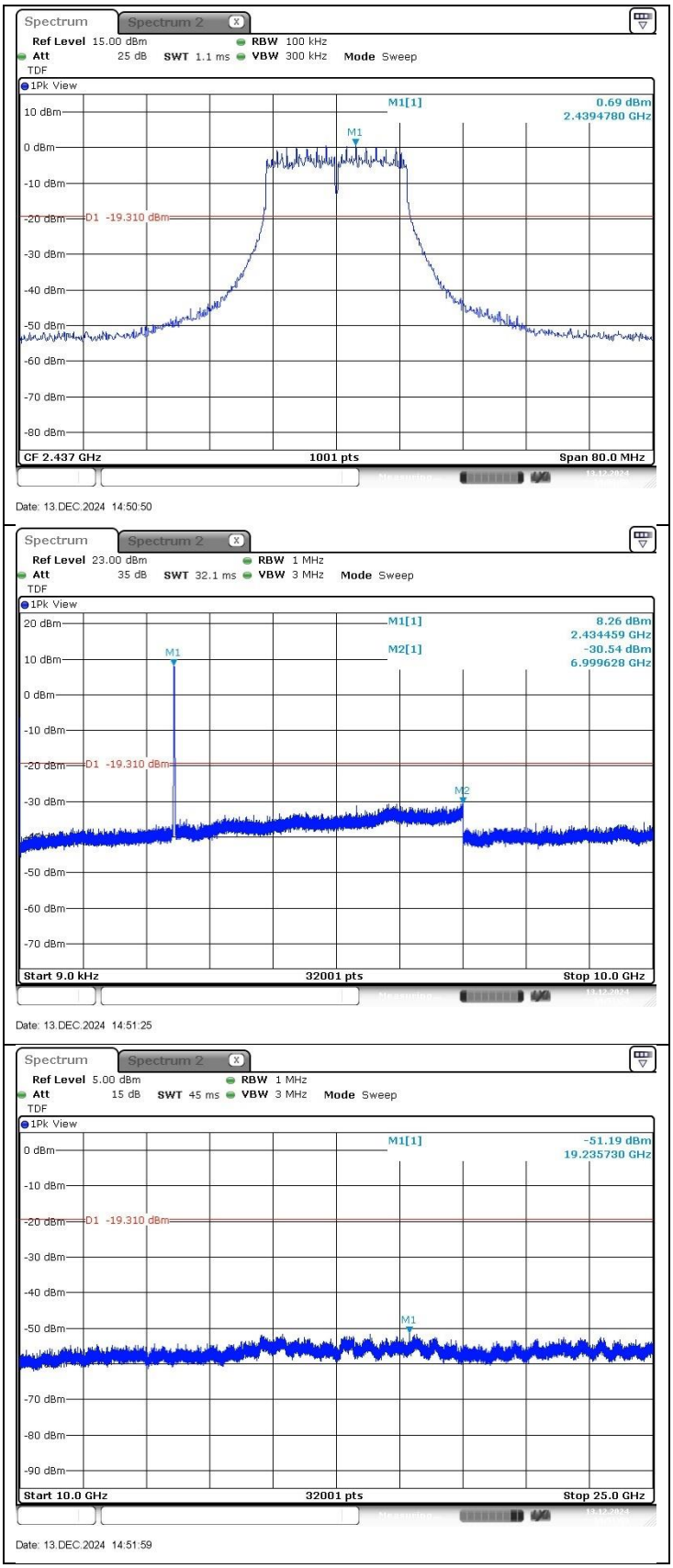


11n_H20

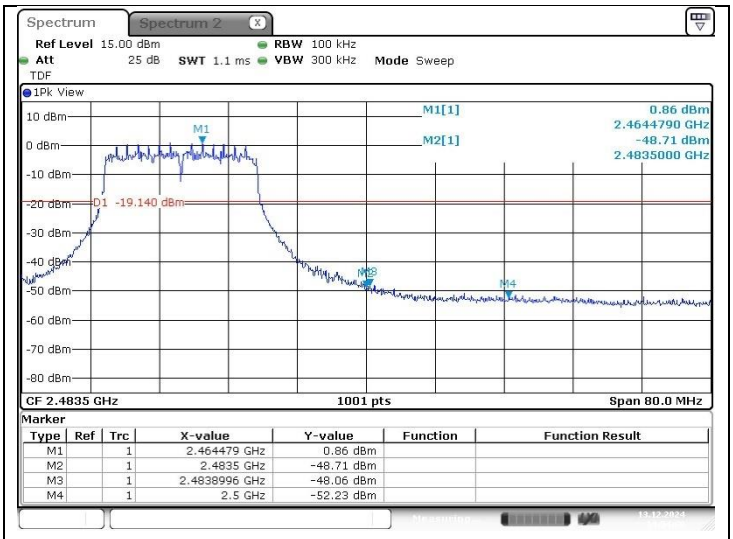
Low Channel

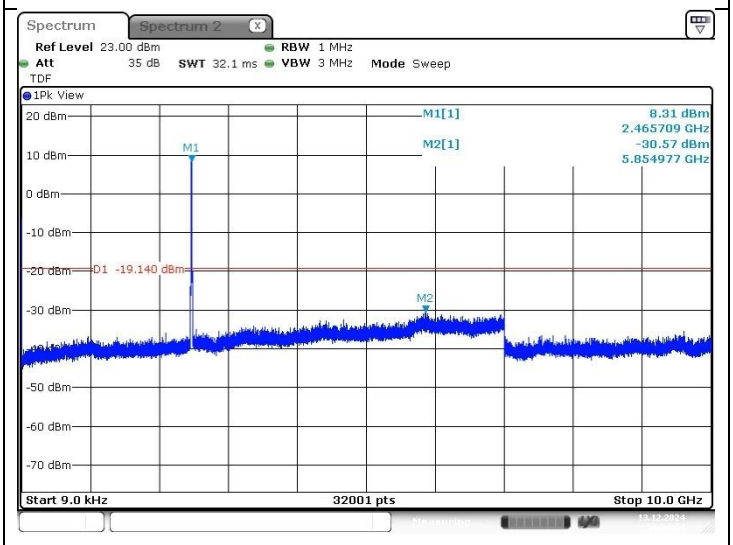


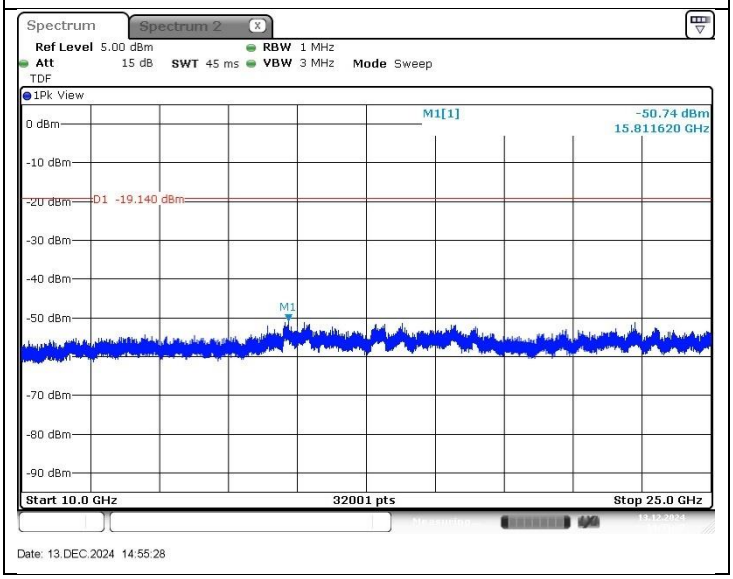
Middle Channel



High Channel







3. 6 dB Bandwidth and 99 % Bandwidth

3.1. Test Setup

3.2. Limit

3.2.1. FCC

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ bands. The minimum 6 dB bandwidth shall be at least 500 ㎑.

3.2.2. IC

According to RSS-247 Issue 3, 5.2(a), the minimum 6 dB bandwidth shall be 500 ㎑.

3.3. Test Procedure

3.3.1. 6 dB Bandwidth

The test follows section 11.8 DTS bandwidth of ANSI C63.10-2013.
Tests performed using section 11.8.1 Option 1.

- Option 1:
1. Set RBW to = 100 ㎑.
2. Set the VBW ≥ [3 x RBW].
3. Detector = peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.3.2. 99 % Bandwidth

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

● The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

● The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

● The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

● The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level 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, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).

3.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Mode		Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)	99 % Bandwidth (㎒)	Minimum Bandwidth (㎑)
5 V	11b	Low	2 412	9.031	13.946	500
		Middle	2 437	7.832	13.906	
		High	2 462	8.472	13.946	
	11g	Low	2 412	16.464	16.663	
		Middle	2 437	16.504	16.863	
		High	2 462	16.344	16.703	
	11n_HT20	Low	2 412	17.662	18.022	
		Middle	2 437	17.503	17.782	
		High	2 462	17.702	17.822	

Mode		Channel	Frequency (㎒)	6 ㏈ Bandwidth (㎒)	99 % Bandwidth (㎒)	Minimum Bandwidth (㎑)
12 V	11b	Low	2 412	8.711	13.946	500
		Middle	2 437	8.911	13.906	
		High	2 462	9.151	13.906	
	11g	Low	2 412	16.424	16.703	
		Middle	2 437	16.464	16.863	
		High	2 462	16.464	16.823	
	11n_HT20	Low	2 412	17.423	17.782	
		Middle	2 437	17.662	17.942	
		High	2 462	17.662	17.862	

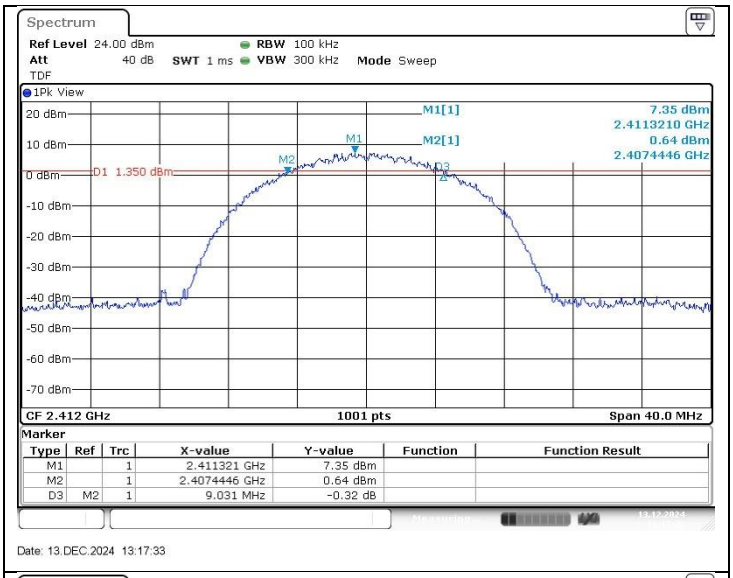
- Test plot(s)

- 5 V

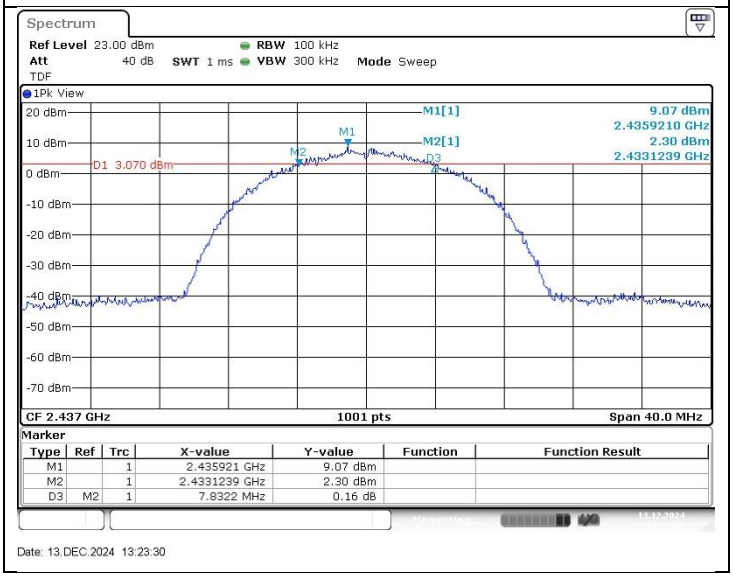
11b

6 dB Bandwidth

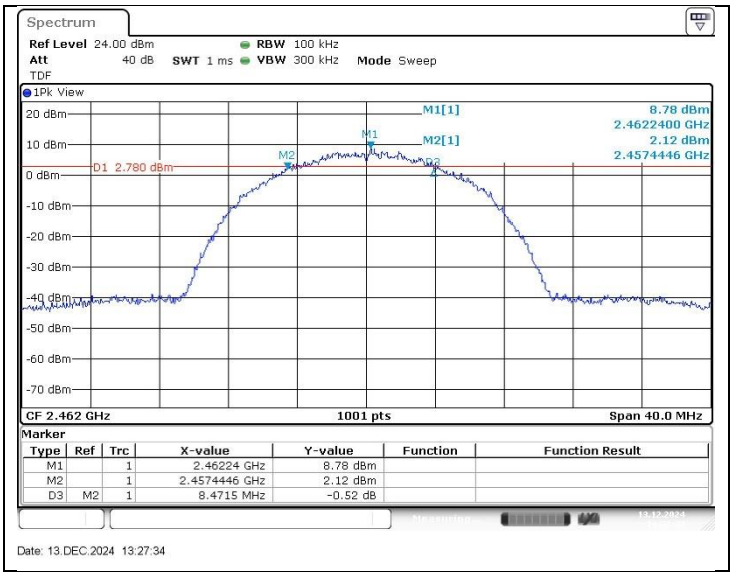
Low Channel



Middle Channel

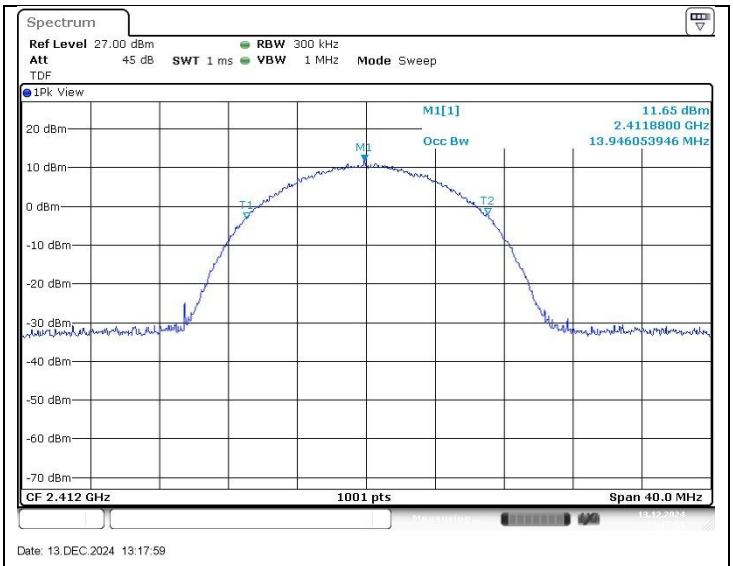


High Channel



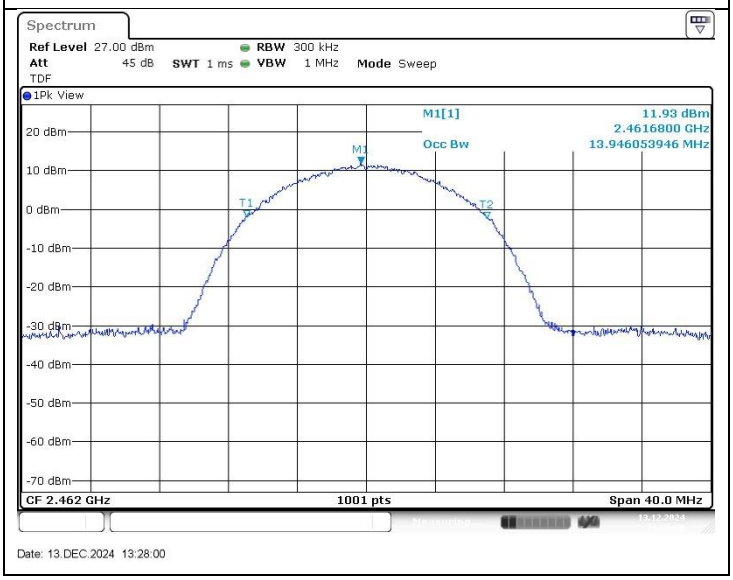
99 % Bandwidth

Low Channel



Middle Channel

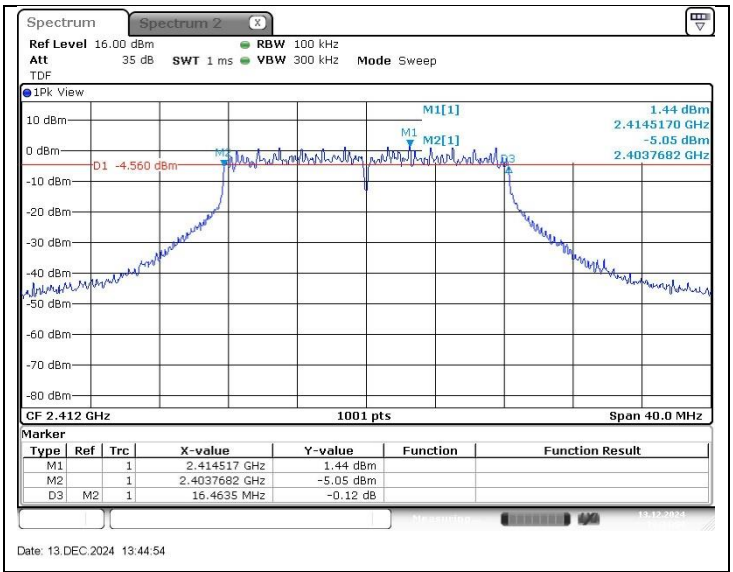
High Channel



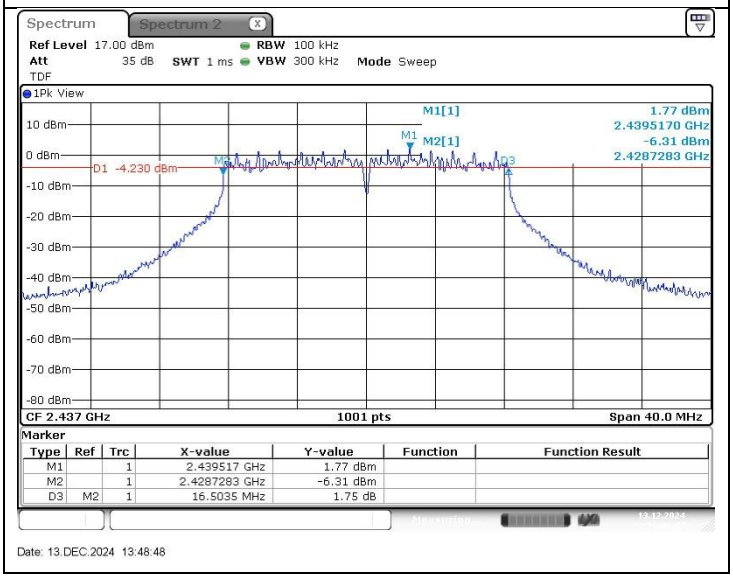
11g

6 dB Bandwidth

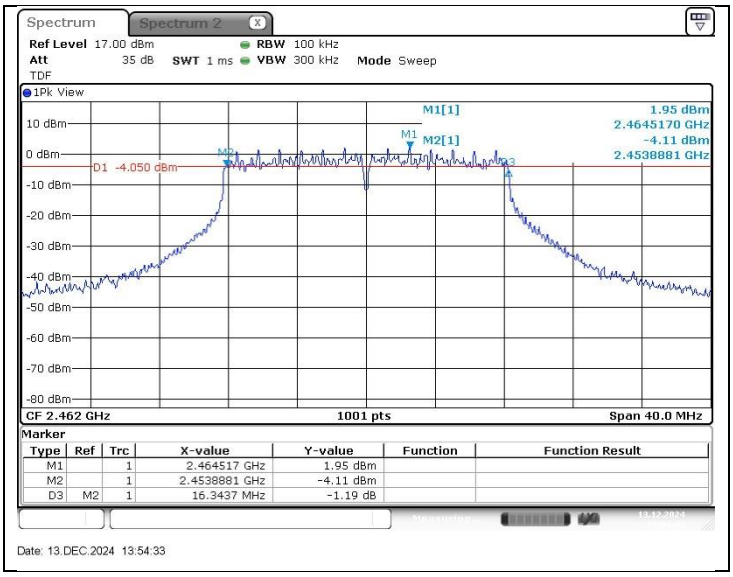
Low Channel



Middle Channel

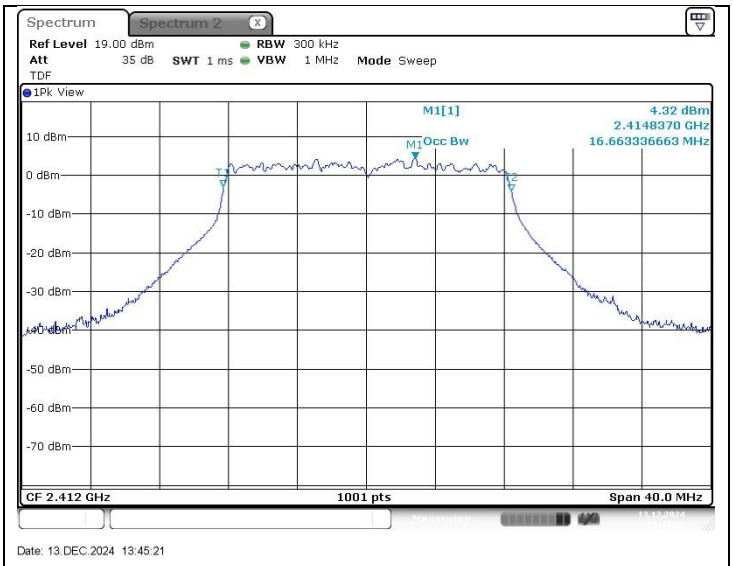


High Channel



99 % Bandwidth

Low Channel



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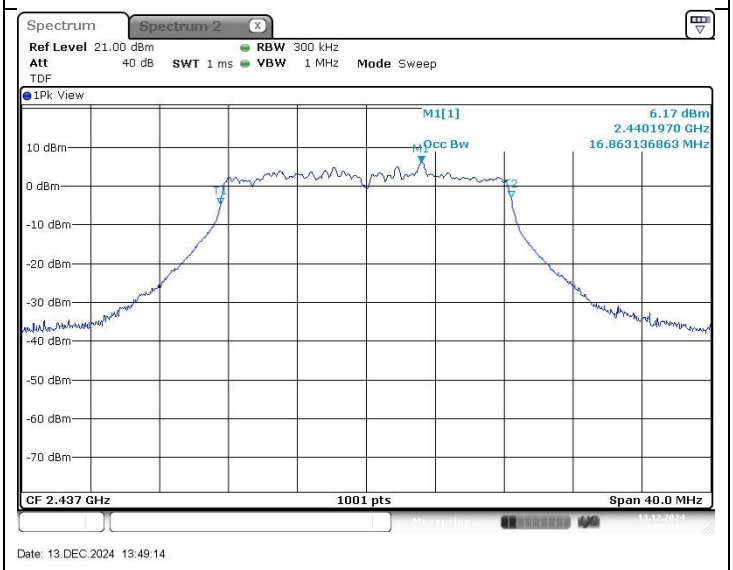

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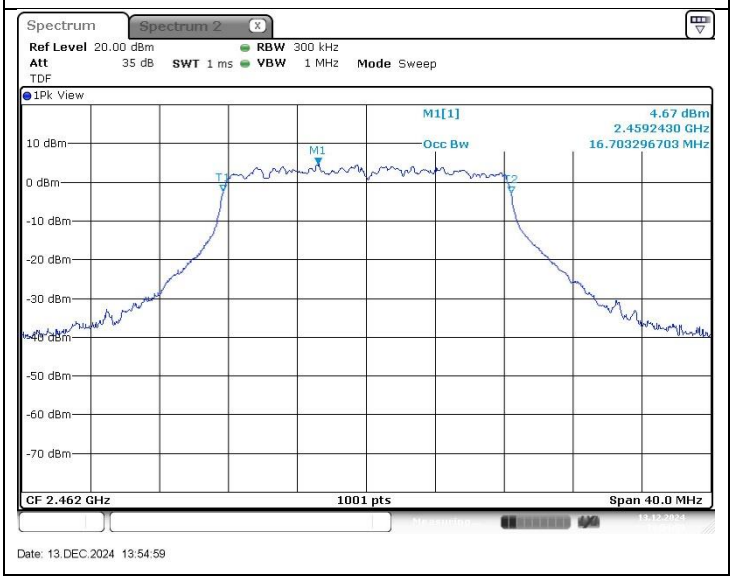
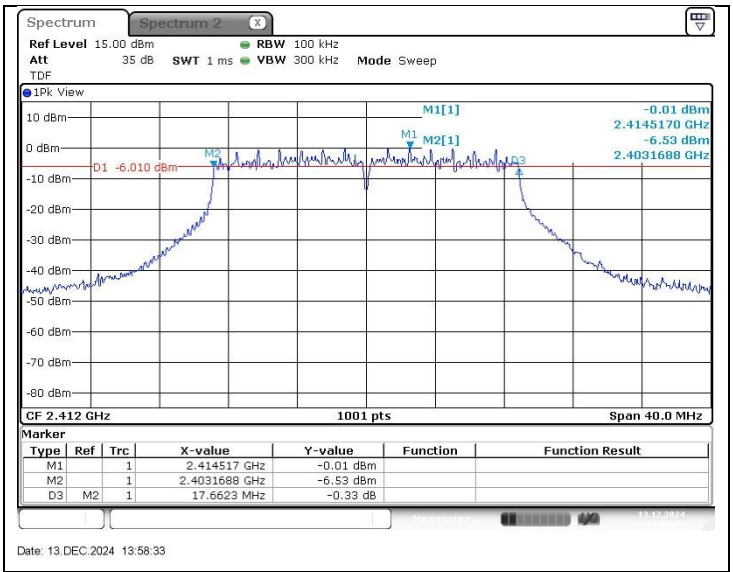


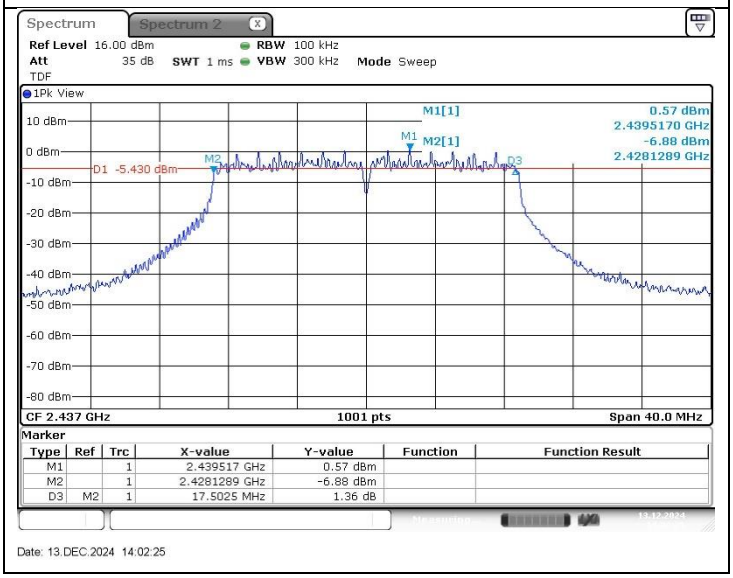
11n_HT20

6 dB Bandwidth

Low Channel



Middle Channel



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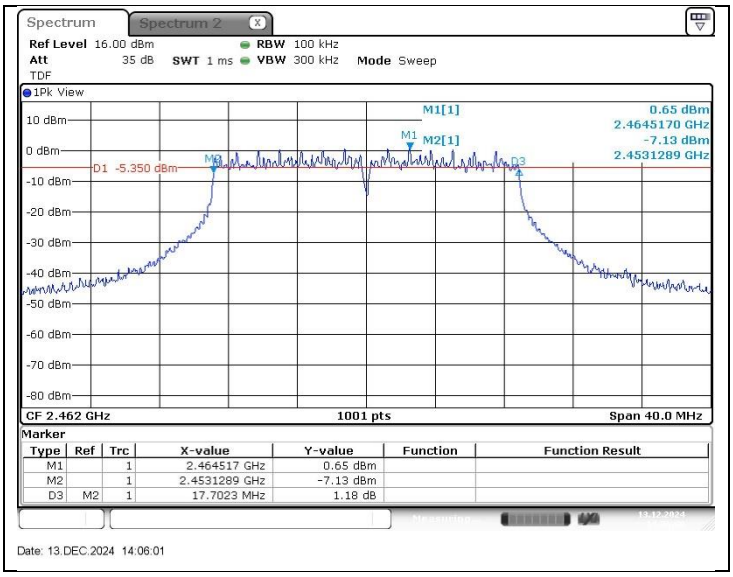
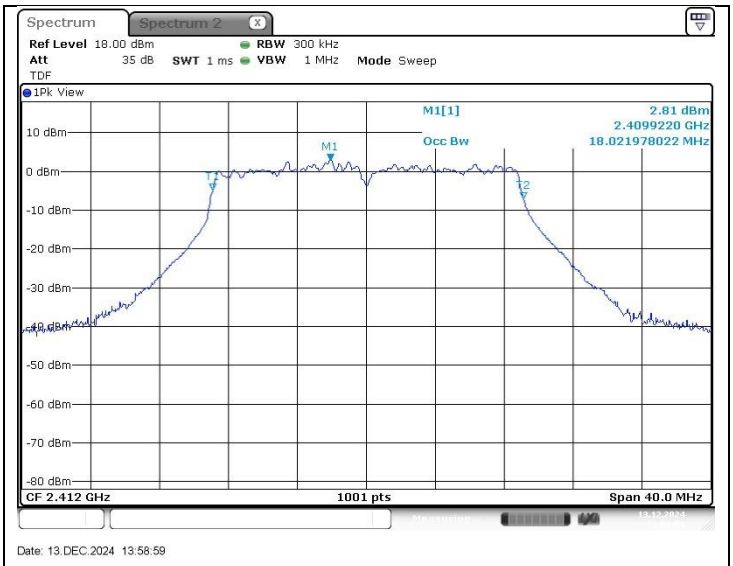


99 % Bandwidth

Low Channel



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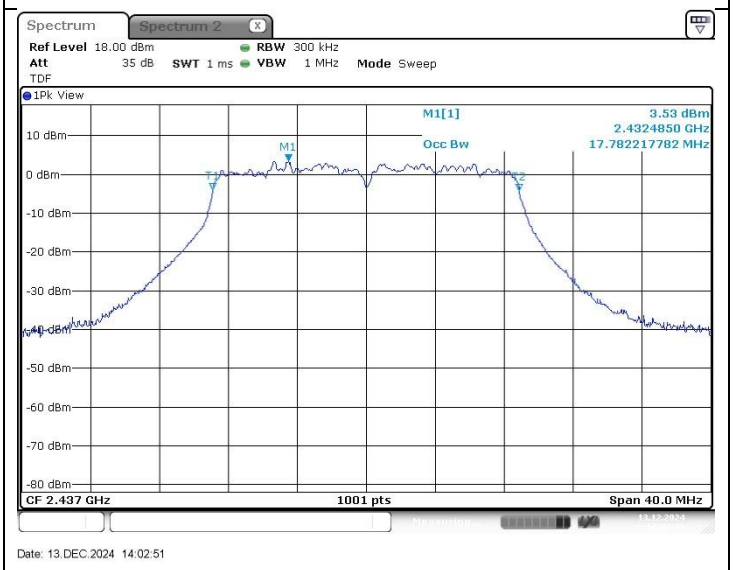

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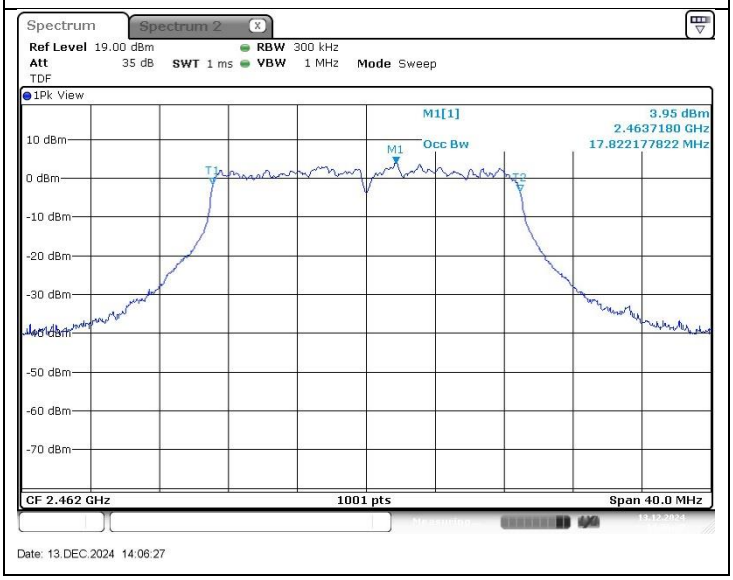
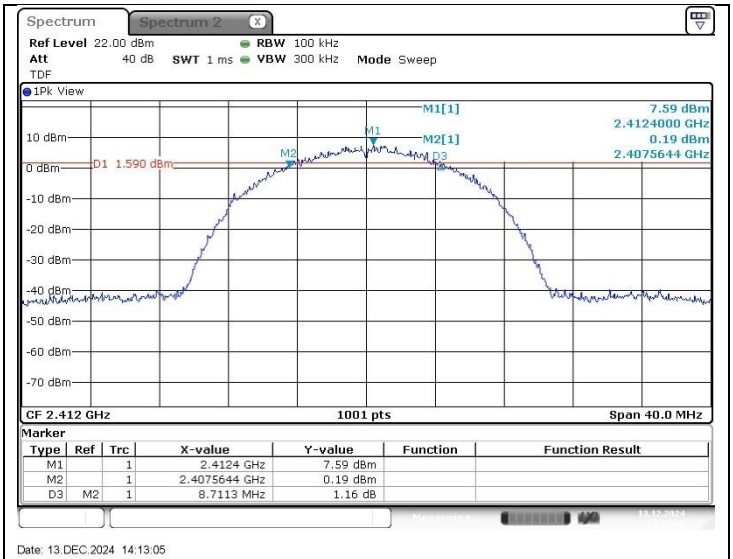


- 12 V

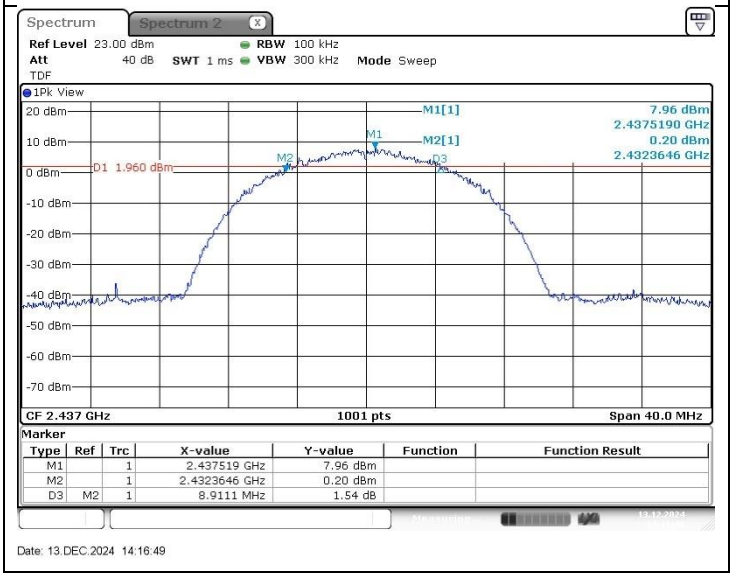
11b

6 dB Bandwidth

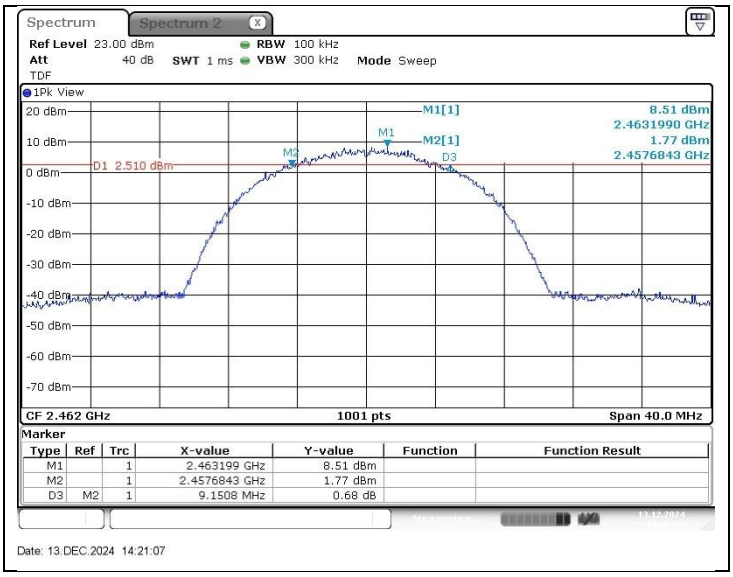
Low Channel



Middle Channel



High Channel

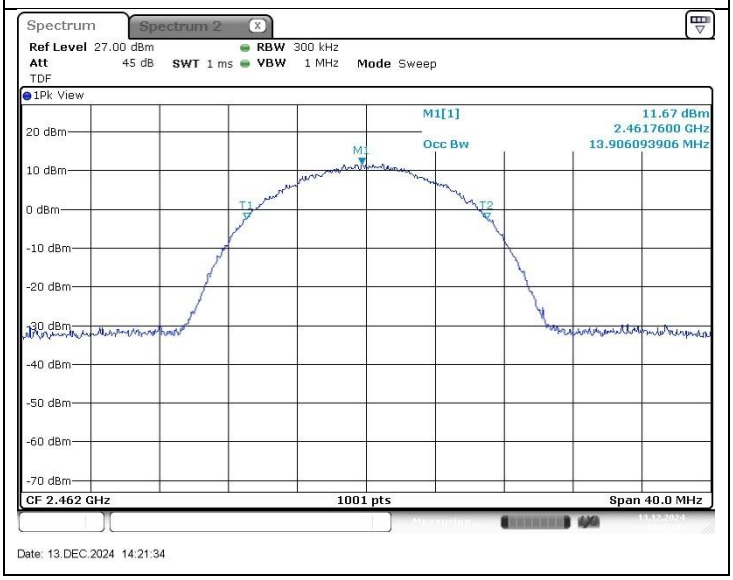


99 % Bandwidth

Low Channel

Middle Channel

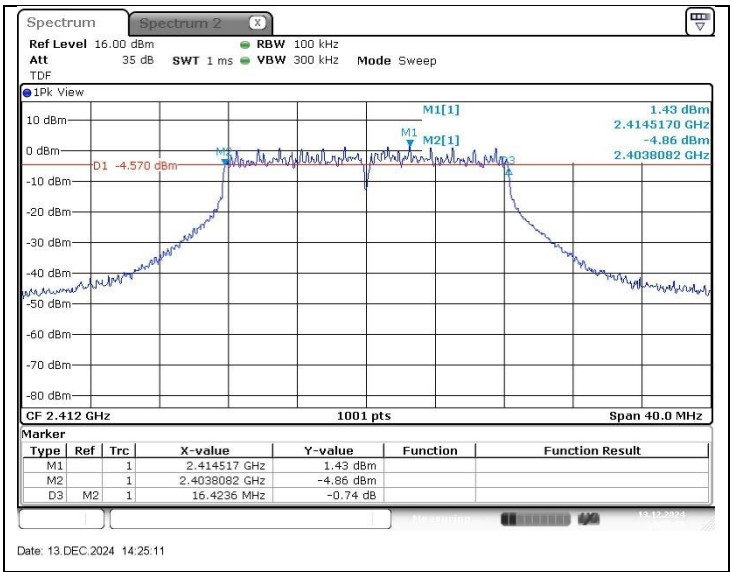
High Channel



11g

6 dB Bandwidth

Low Channel



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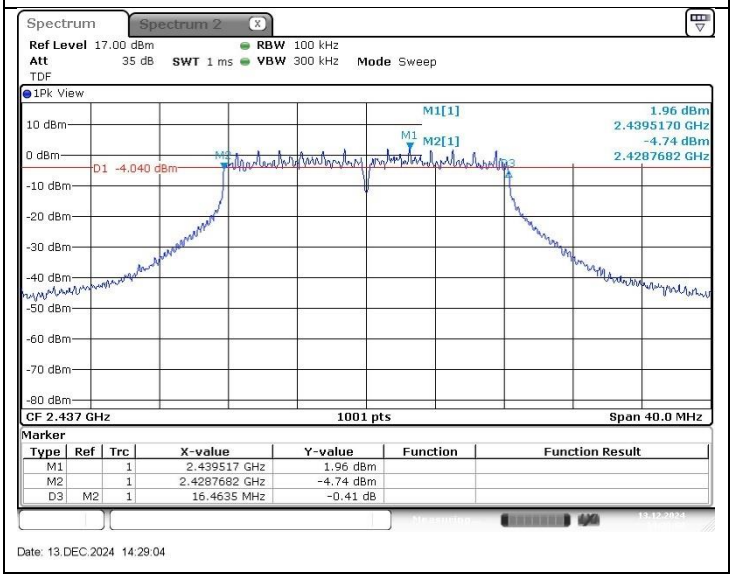

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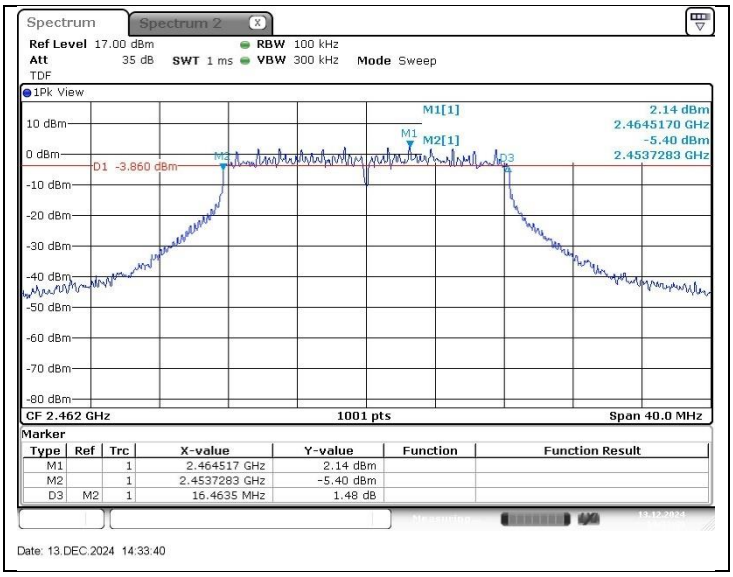
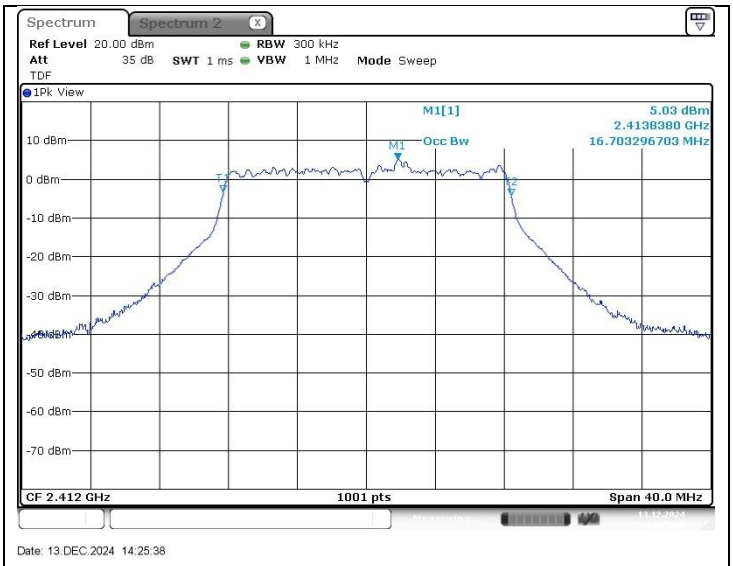


99 % Bandwidth

Low Channel



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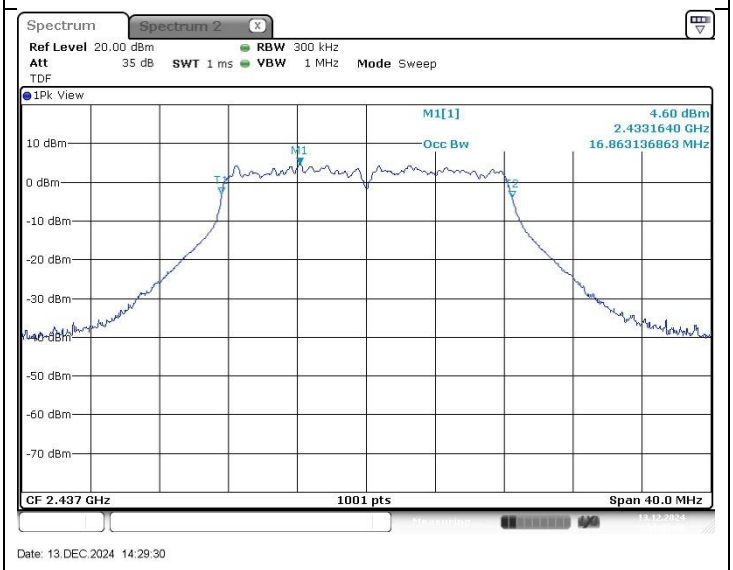
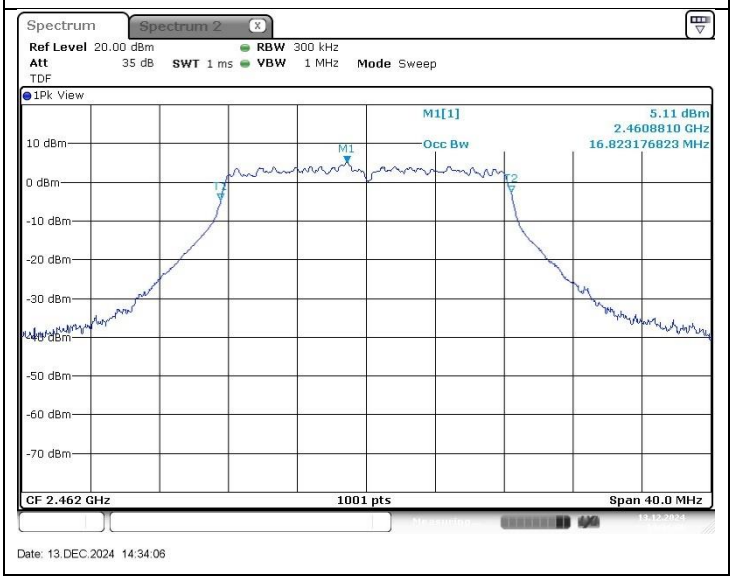


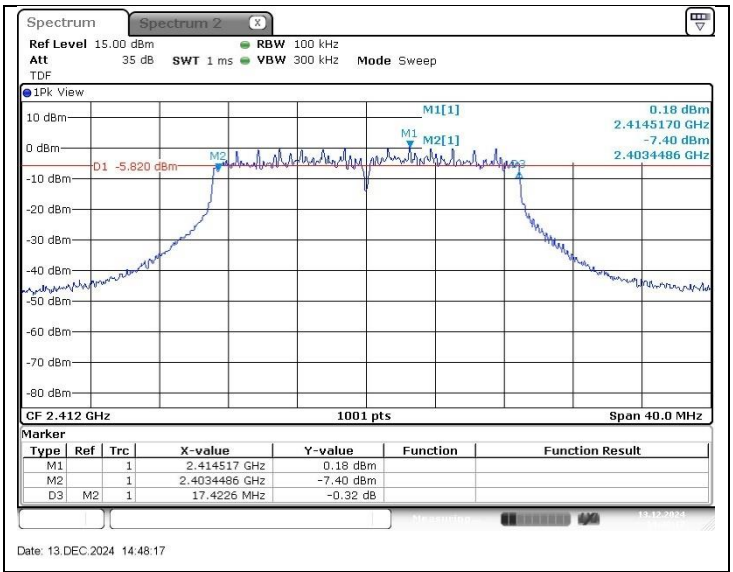
High Channel



11n_HT20

6 dB Bandwidth

Low Channel



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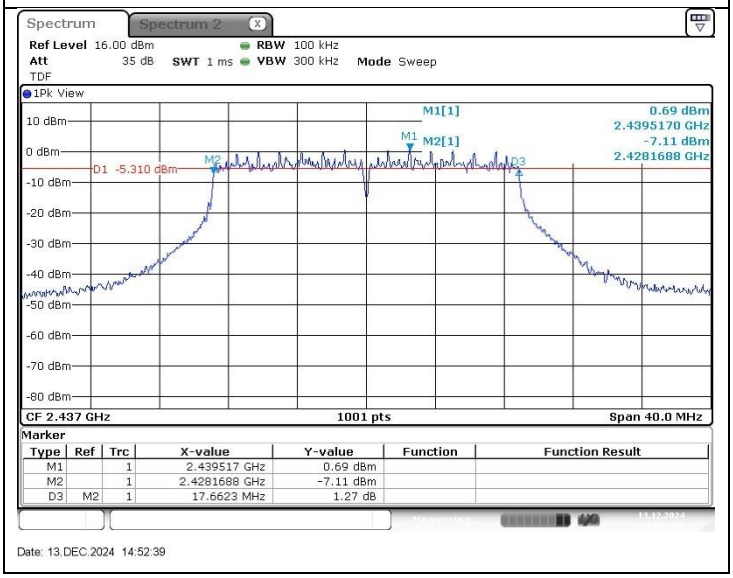

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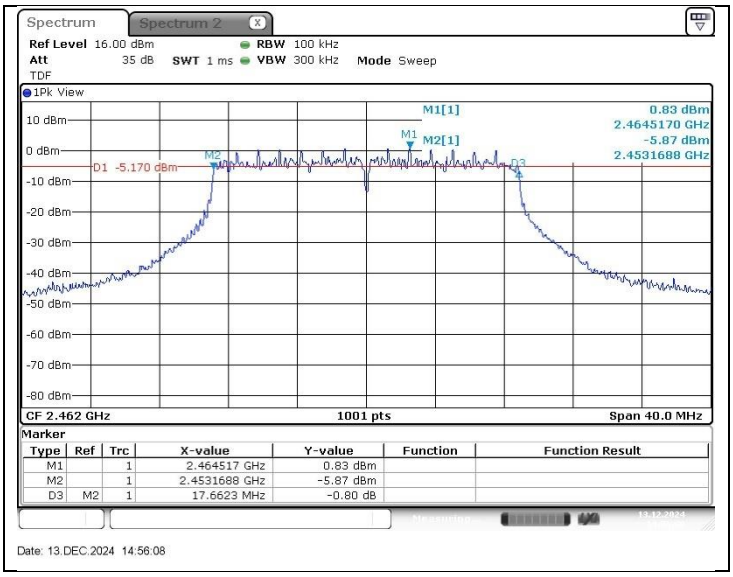
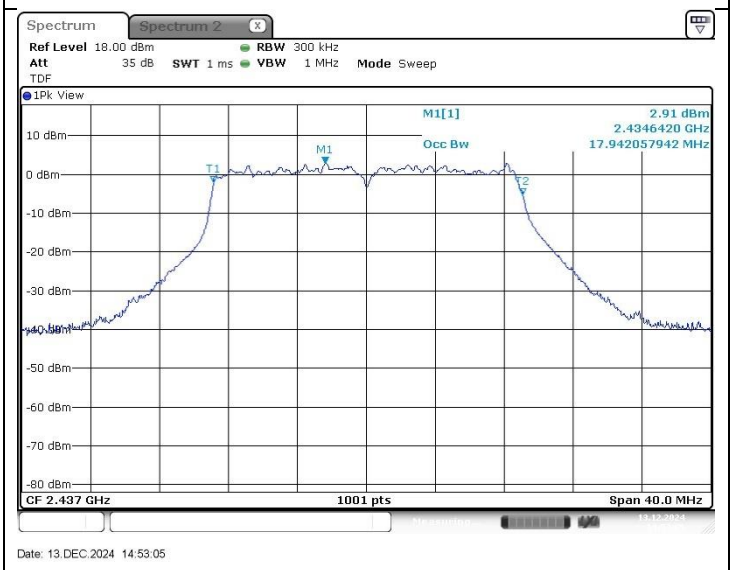


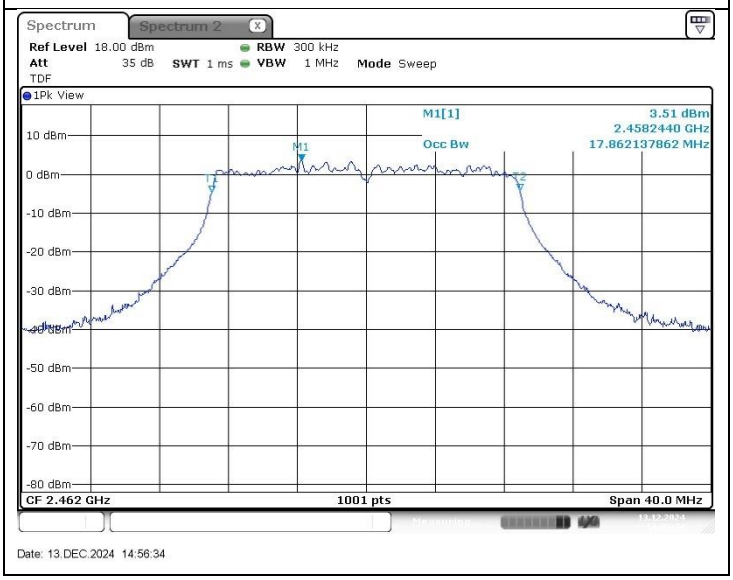
99 % Bandwidth

Low Channel

Middle Channel

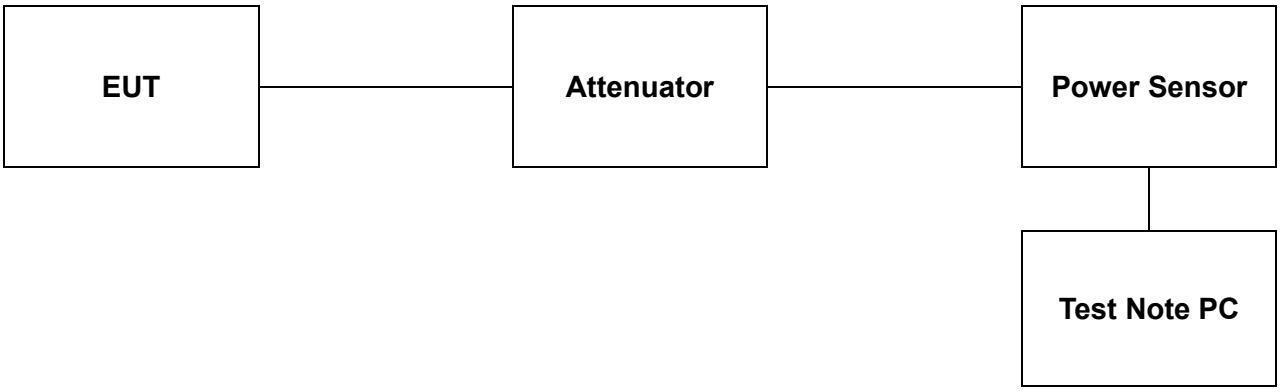


High Channel



4. Maximum Peak Conducted Output Power

4.1. Test Setup



4.2. Limit

4.2.1. FCC

According to §15.247(b)(3), for systems using digital modulation in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 ㏈i. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 ㏈i are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

4.2.2. IC

According to RSS-247 Issue 3, 5.4(d), for DTSs employing digital modulation techniques operating in the bands 902-928 ㎒ and 2 400-2 483.5 ㎒, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

4.3. Test Procedure

The test follows section 11.9.1.3 of ANSI C63.10-2013.

PKPM1 Peak-reading power meter method
- The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The test follows section 11.9.2.3.2 of ANSI C63.10-2013.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)
- Alternatively, measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

Multiple outputs of a transmitter of form multiple transmitters
- According to KDB 662911 D01 Multiple Transmitter Output v02r01, the measure-and-sum technique shall be used for measuring in-band transmit power of a device. Total power is the sum of the conducted power levels measured at the various output ports.

Test program: (S/W name: R&S Power Viewer, Version: 3.2.0)

1. Initially overall offset for attenuator and cable loss is measured per frequency.
2. Measured offset is inserted in test program in advance of measurement for output power.
3. Power for each frequency (channel) of device is investigated as final result.
4. Final result reported on this section from R&S power viewer program includes with several factors and test program shows only final result.

4.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Mode		Ch.	Freq. (㎒)	Average Power Result (㏈m)	Peak Power Result (㏈m)	Limit (㏈m)
5 V	11b	Low	2 412	17.38	20.85	30.00
		Middle	2 437	17.78	21.27	
		High	2 462	**17.82**	**21.39**	
	11g	Low	2 412	13.68	23.44	
		Middle	2 437	13.85	**23.49**	
		High	2 462	**14.10**	23.15	
	11n_HT20	Low	2 412	12.55	21.60	
		Middle	2 437	12.89	22.59	
		High	2 462	**13.33**	**22.83**	

Mode		Ch.	Freq. (㎒)	Average Power Result (㏈m)	Peak Power Result (㏈m)	Limit (㏈m)
12 V	11b	Low	2 412	17.42	20.88	30.00
		Middle	2 437	17.60	20.98	
		High	2 462	**17.83**	**21.49**	
	11g	Low	2 412	13.52	**23.40**	
		Middle	2 437	13.89	23.04	
		High	2 462	**14.23**	23.21	
	11n_HT20	Low	2 412	12.45	21.68	
		Middle	2 437	12.99	22.22	
		High	2 462	**13.05**	**22.46**	

5. Power Spectral Density

5.1. Test Setup

5.2. Limit

5.2.1 FCC

According to §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 ㏈m in any 3 ㎑ 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.

5.2.2 IC

According to RSS-247 Issue 3, 5.2(b), the transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 ㏈m in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

5.3. Test Procedure

The measurements are recorded using the PKPSD measurement procedure in section 11.10.2 of ANSI C63.10-2013.

- This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to 3 ㎑ ≤ RBW ≤ 100 ㎑.
4. Set the VBW ≥ [3 x RBW].
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds requirement, then reduce RBW (but no less than 3 ㎑) and repeat.
11. Multiple outputs of a transmitter of form multiple transmitters
    According to KDB 662911 D01 Multiple Transmitter Output v02r01, Measure and sum technique, spectra are measured at each output of the device at the required resolution bandwidth. The individual spectra are then summed mathematically in linear power units.

5.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

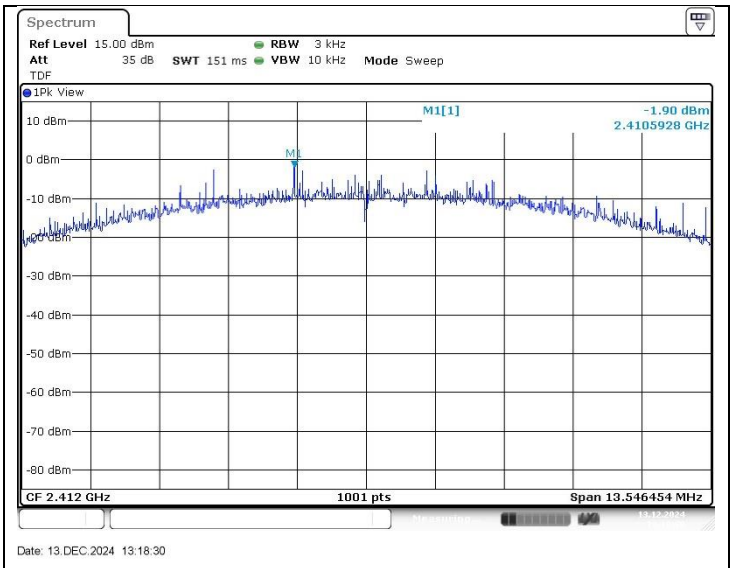
Mode		Channel	Frequency (㎒)	Measured PSD (dB m/3 ㎑)	Limit (dB m/3 ㎑)
5 V	11b	Low	2 412	-1.90	8
		Middle	2 437	-2.48	
		High	2 462	-4.03	
	11g	Low	2 412	-12.95	
		Middle	2 437	-13.70	
		High	2 462	-13.78	
	11n_HT20	Low	2 412	-14.84	
		Middle	2 437	-13.45	
		High	2 462	-13.60	

Mode		Channel	Frequency (㎒)	Measured PSD (dB m/3 ㎑)	Limit (dB m/3 ㎑)
5 V	11b	Low	2 412	-4.69	8
		Middle	2 437	-1.93	
		High	2 462	-4.68	
	11g	Low	2 412	-14.39	
		Middle	2 437	-13.66	
		High	2 462	-13.51	
	11n_HT20	Low	2 412	-14.02	
		Middle	2 437	-15.64	
		High	2 462	-14.14	

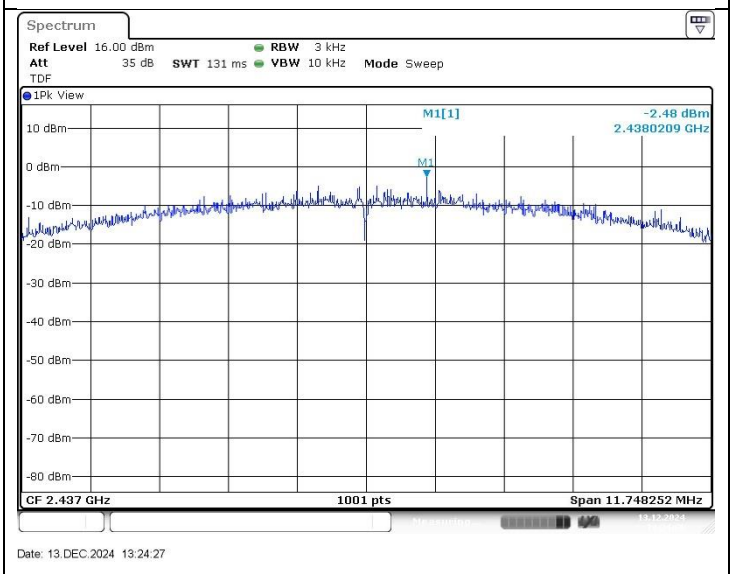
5 V

11b

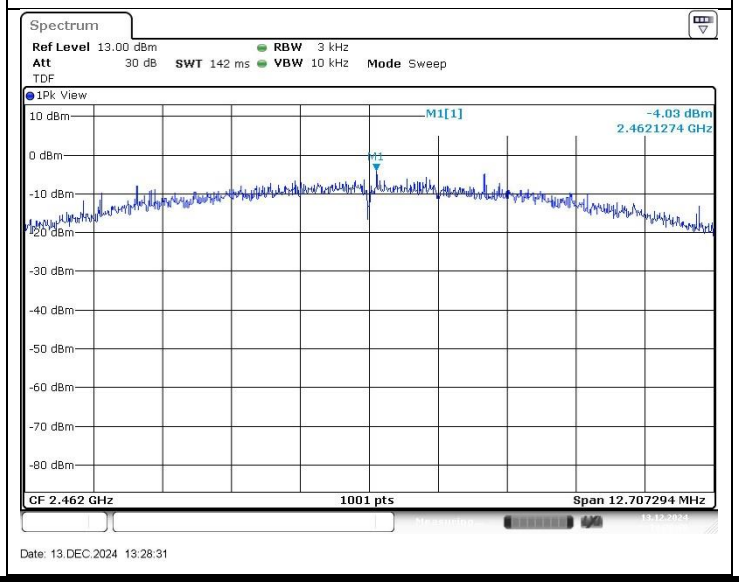
Low Channel



Middle Channel

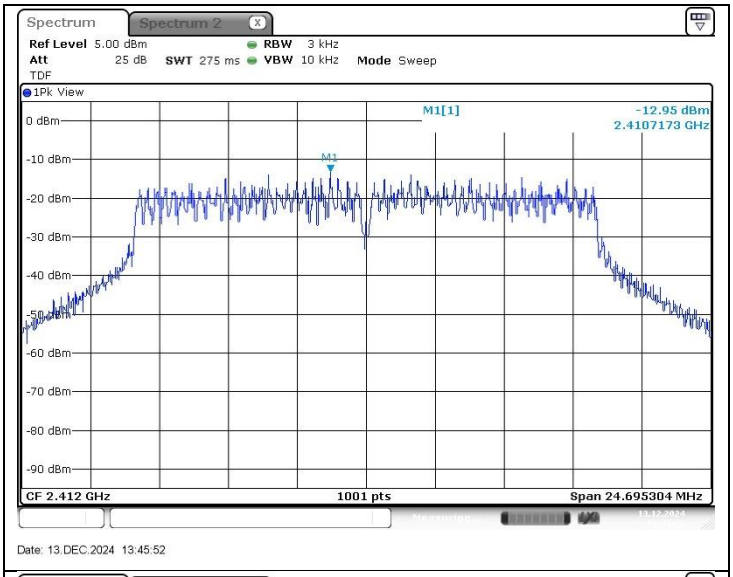


High Channel

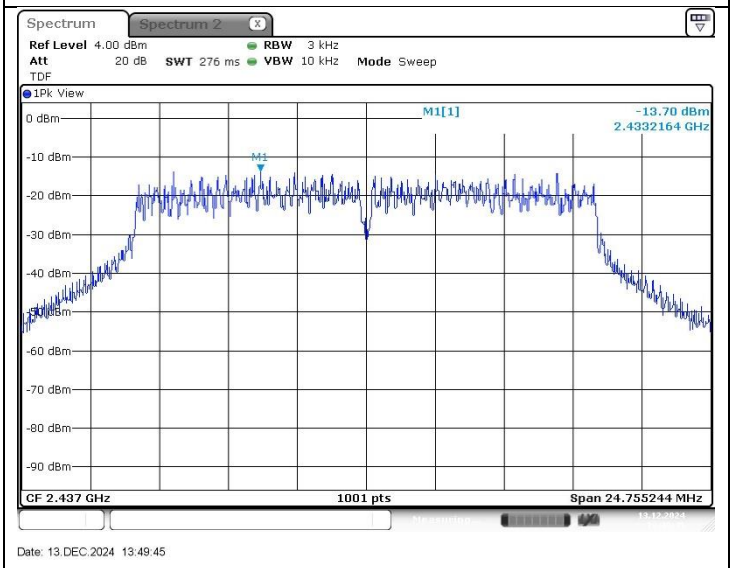


11g

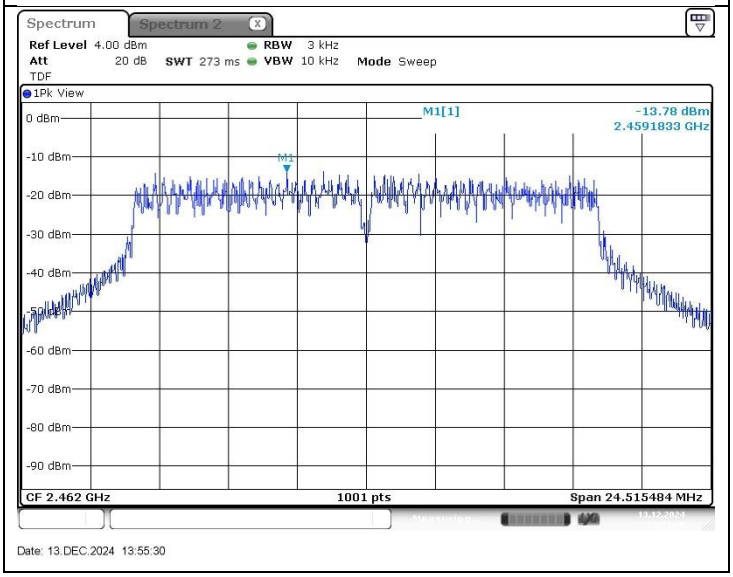
Low Channel



Middle Channel

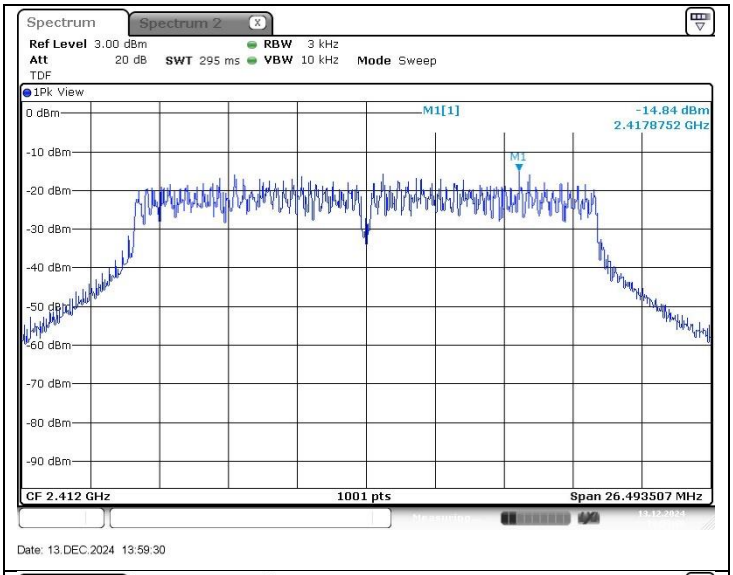


High Channel

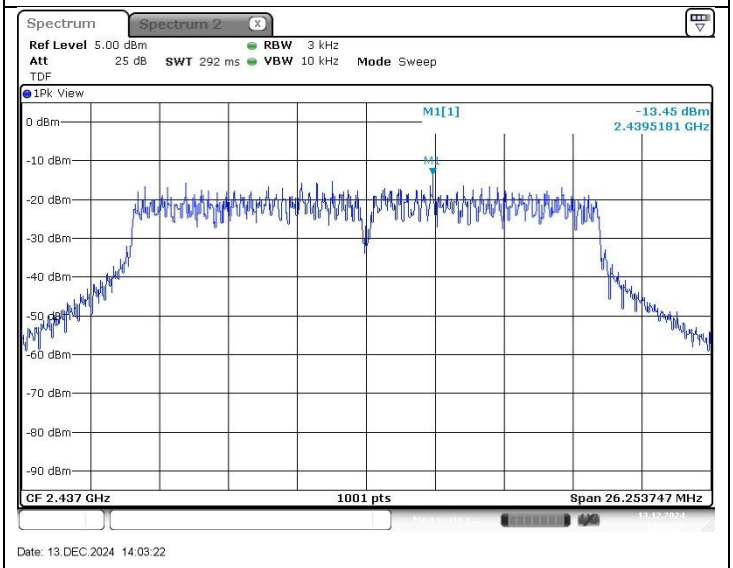


11n_HT20

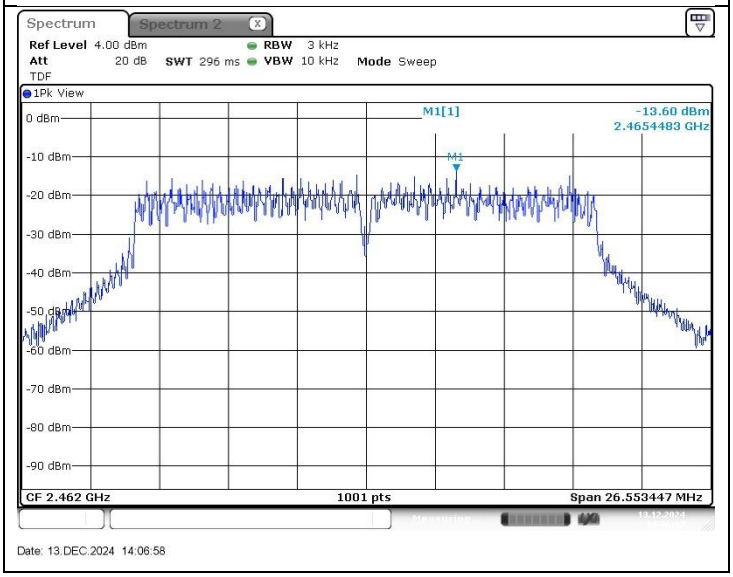
Low Channel



Middle Channel



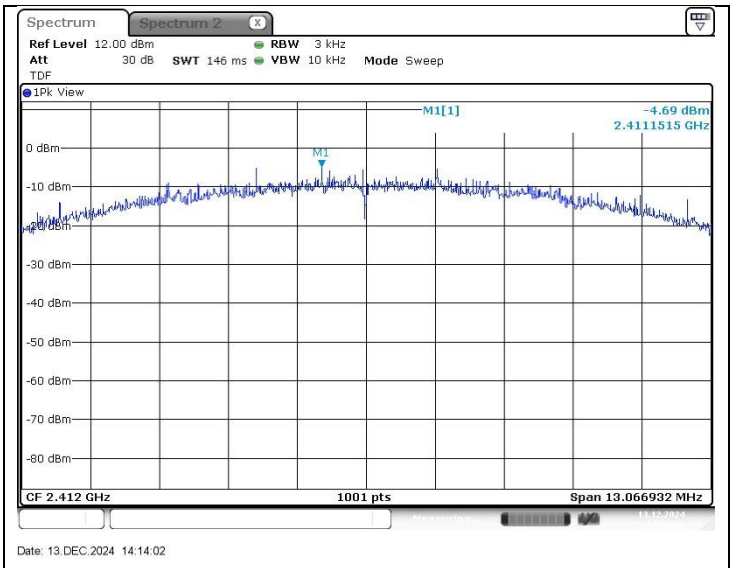
High Channel



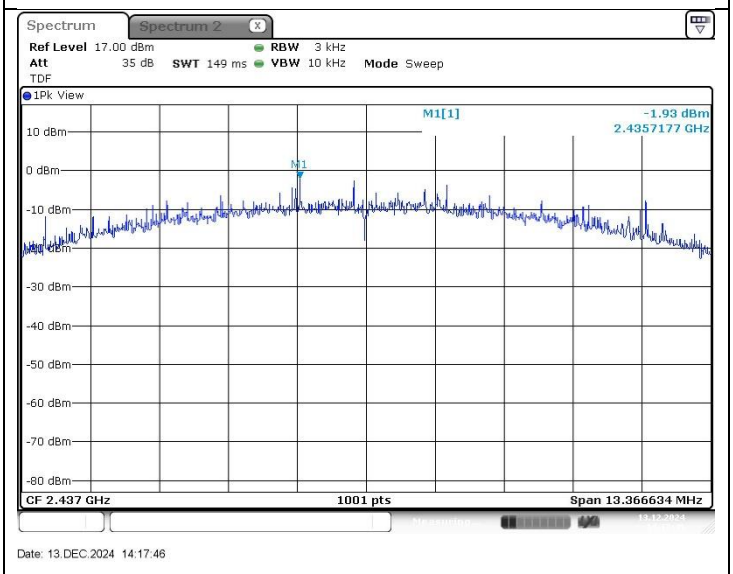
12 V

11b

Low Channel



Middle Channel



High Channel