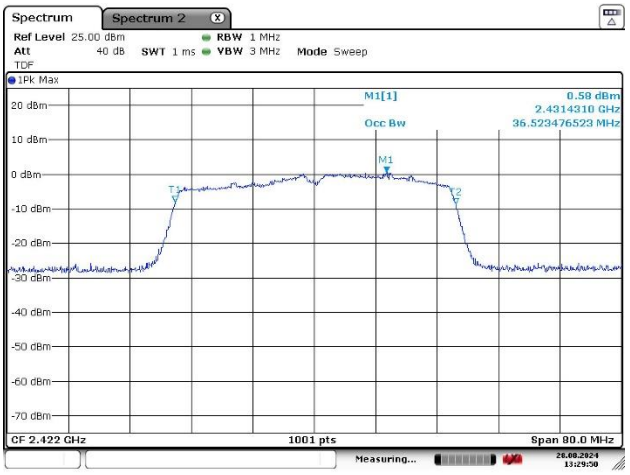
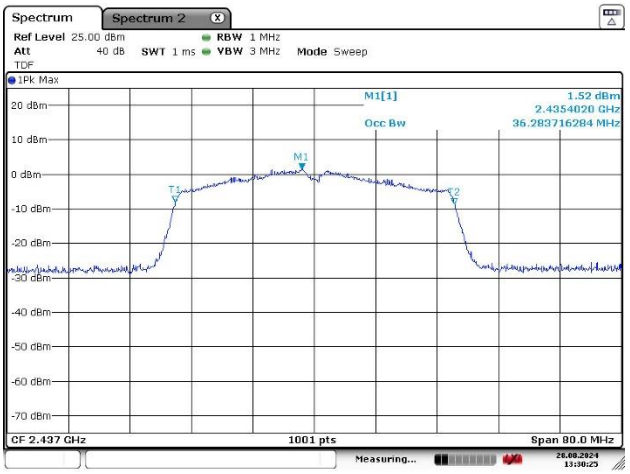
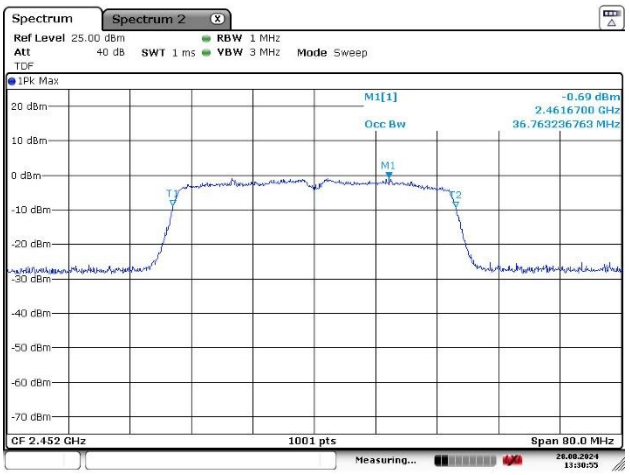
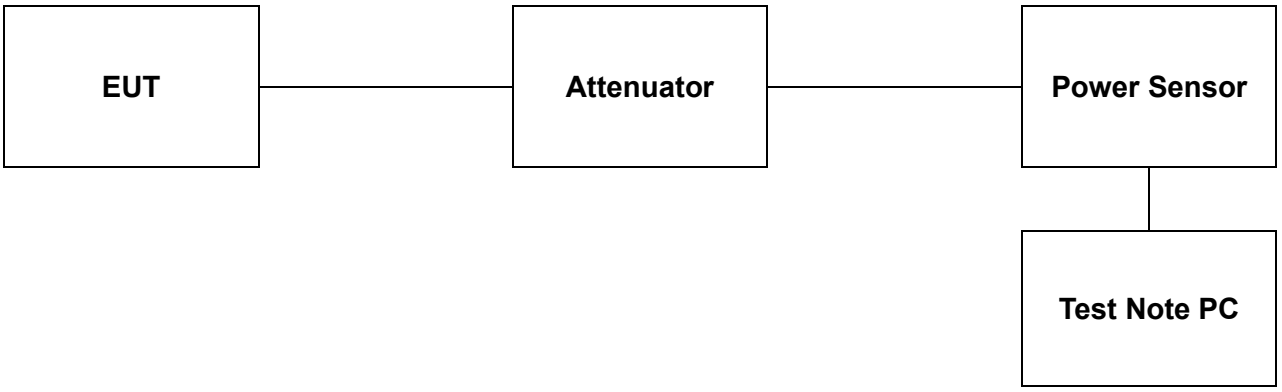
11n_HT40

Port 1_Low Channel	Port 2_Low Channel
	
Port 1_Middle Channel	**Port 2_Middle Channel**
	
Port 1_High Channel	**Port 2_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		Channel	Frequency (㎒)	Average Power Result (dB m)	Peak Power Result (dB m)	Limit (dB m)
SISO	11b	Low	2 412	**6.47**	**9.22**	30
		Middle	2 437	5.01	7.63	
		High	2 462	5.38	7.79	

Mode		Ch.	Freq. (㎒)	Average Power Result (dB m)			Peak Power Result (dB m)			Limit (dB m)
				Port 1	Port 2	MIMO	Port 1	Port 2	MIMO	
MIMO	11g	Low	2 412	2.27	4.01	6.24	8.68	10.42	12.65	27.98
		Middle	2 437	2.73	3.18	5.97	9.19	9.91	12.58	
		High	2 462	3.36	4.09	**6.75**	10.05	10.96	**13.54**	
	11n_HT20	Low	2 412	1.99	3.60	5.88	8.68	10.12	12.47	
		Middle	2 437	2.33	2.75	5.56	9.17	9.72	12.46	
		High	2 462	2.94	3.72	**6.36**	9.65	10.68	**13.21**	
	11n_HT40	Low	2 422	3.96	3.91	**6.95**	10.23	10.69	**13.48**	
		Middle	2 437	2.72	4.30	6.59	8.93	10.49	12.79	
		High	2 452	3.71	3.49	6.61	10.20	10.14	13.18	

Remark;

1. According to KDB 662911 D01 v02r01, conducted power of each port (Port 1+Port 2) was combined by using below calculation.
2. MIMO: Port 1 + Port 2 = 10 log {10^(Port 1 power / 10)+10^(Port 2 power / 10)}
3. Conduction output power limit is reduced in accordance with Part 15.247 and RSS-247 Issue 3 due to direction gain exceeding 6 dBi.

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 ㎑)
SISO	11b	Low	2 412	-18.16	8
		Middle	2 437	-22.39	
		High	2 462	-21.16	

Mode		Ch.	Frequency (㎒)	Measured PSD (dB m/3 ㎑)			Limit (dB m/3 ㎑)
				Port 1	Port 2	MIMO	
MIMO	11g	Low	2 412	-24.25	-22.30	-20.16	8
		Middle	2 437	-23.05	-21.70	-19.31	
		High	2 462	-22.82	-20.58	-18.55	
	11n_HT20	Low	2 412	-23.56	-21.51	-19.40	
		Middle	2 437	-22.03	-20.48	-18.18	
		High	2 462	-21.74	-19.08	-17.20	
	11n_HT40	Low	2 422	-24.29	-24.47	-21.37	
		Middle	2 437	-24.92	-23.22	-20.98	
		High	2 452	-24.66	-25.03	-21.83	

Remark;

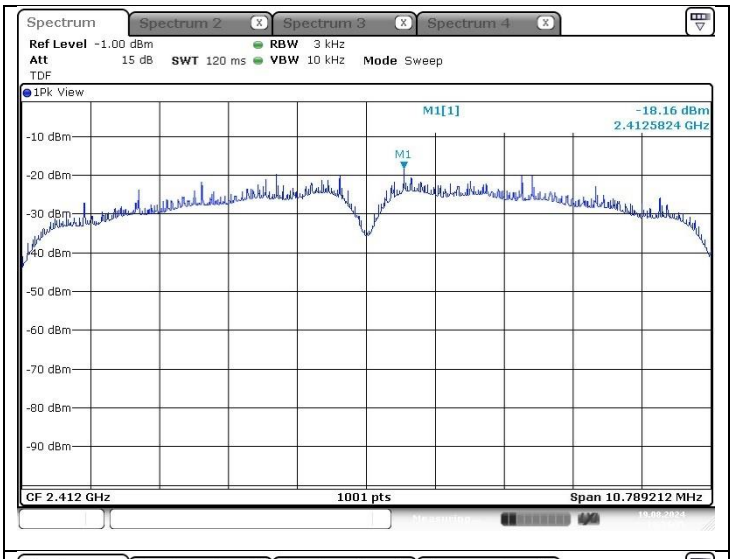
1. According to KDB 662911 D01 v02r01, PSD each port (Port 1+Port 2) was combined by using below calculation.

2. MIMO: Port 1 + Port 2 = 10 log {10^(Port 1 PSD / 10)+10^(Port 2 PSD / 10)}

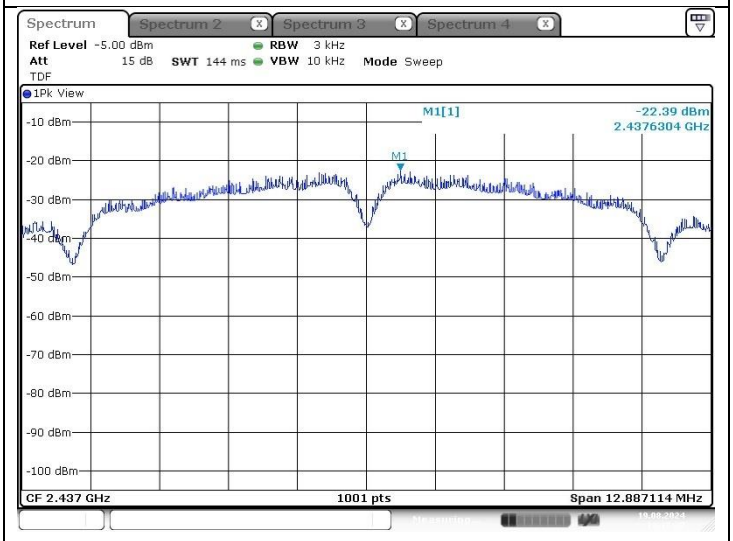
SISO

11b

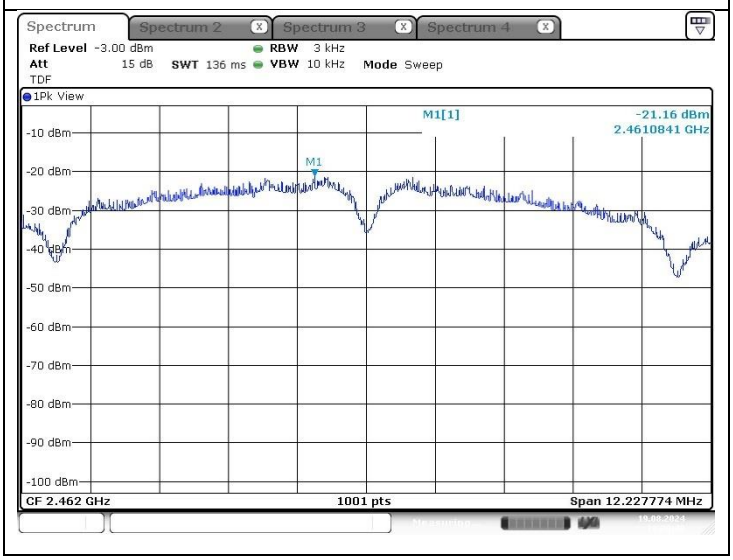
Low Channel



Middle Channel

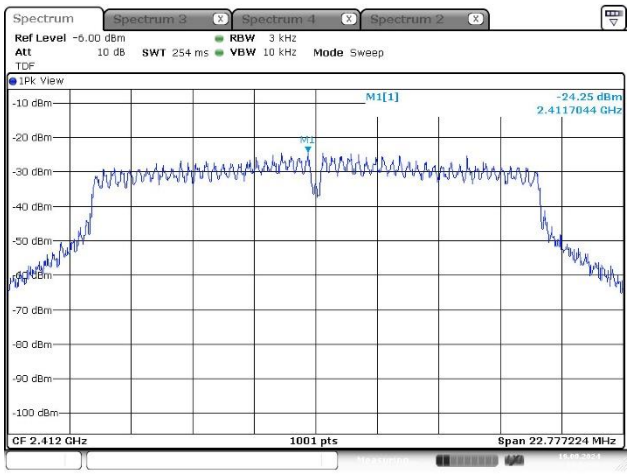
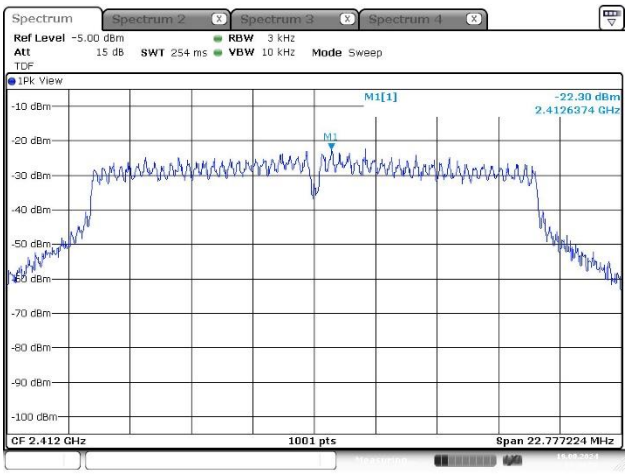
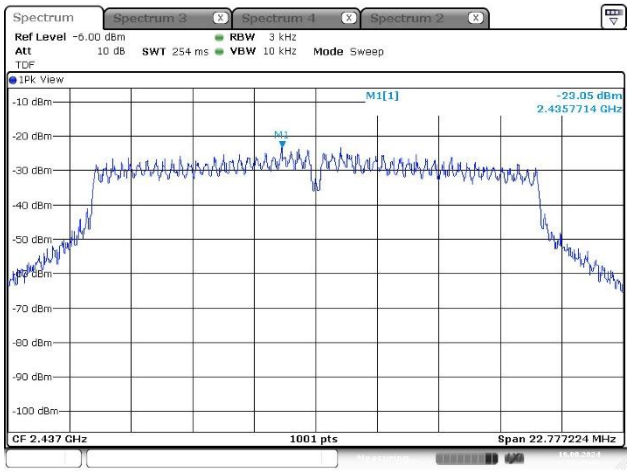
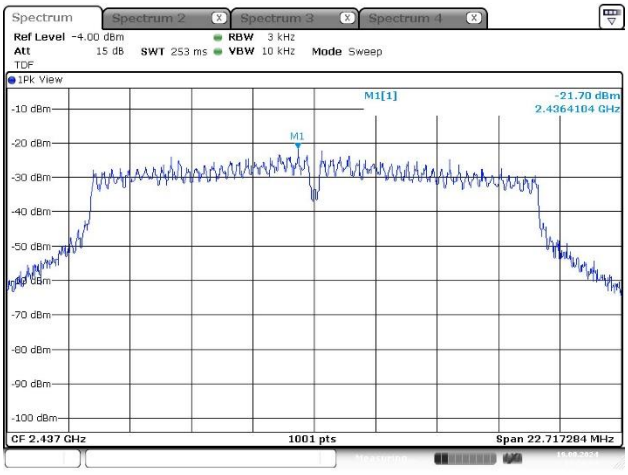
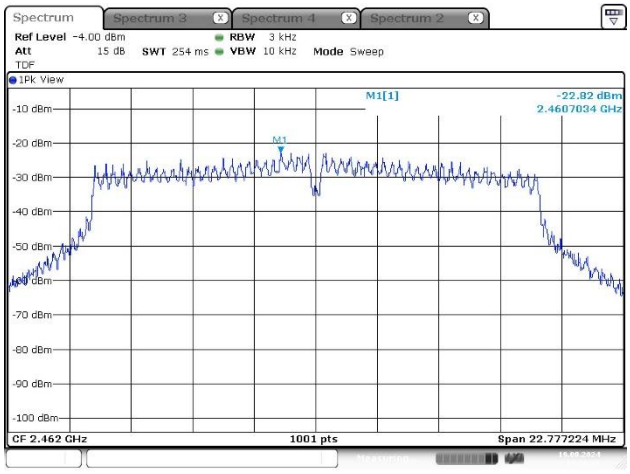
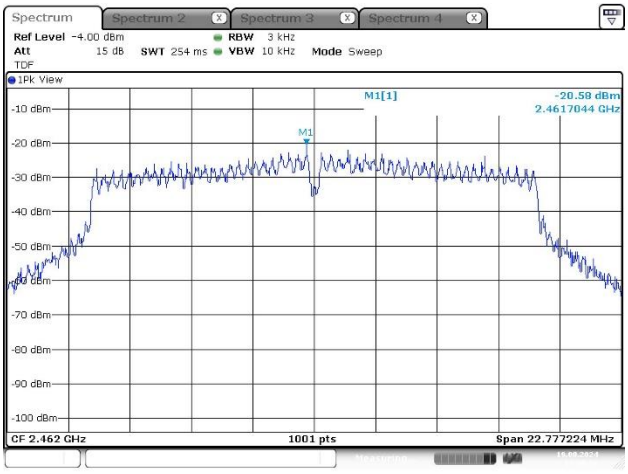


High Channel

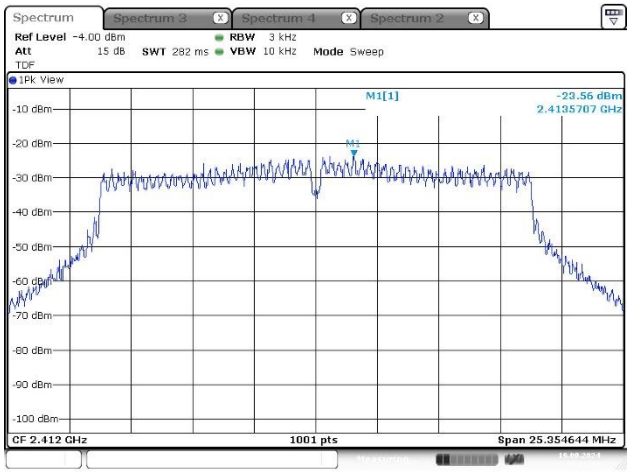
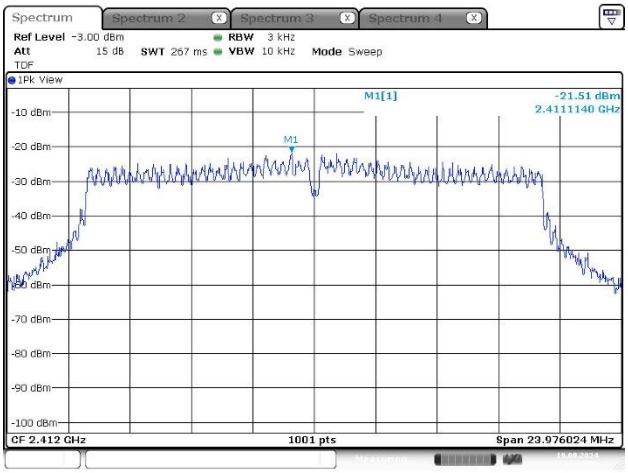
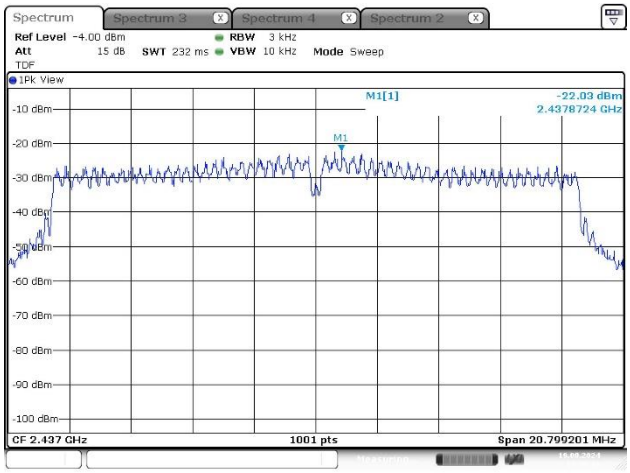
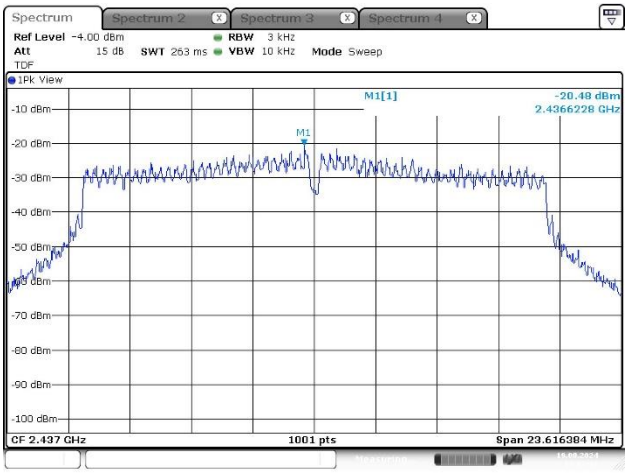
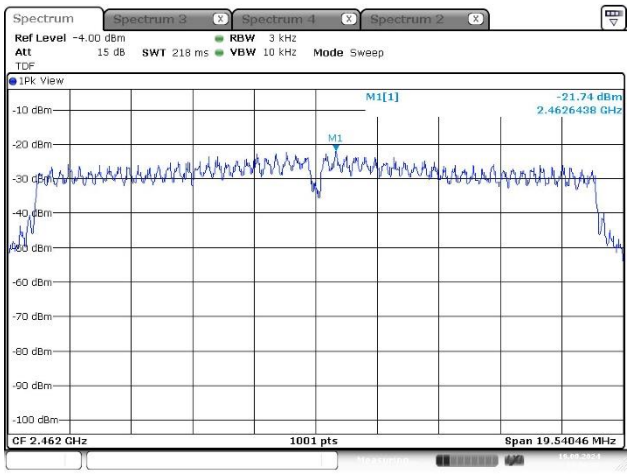
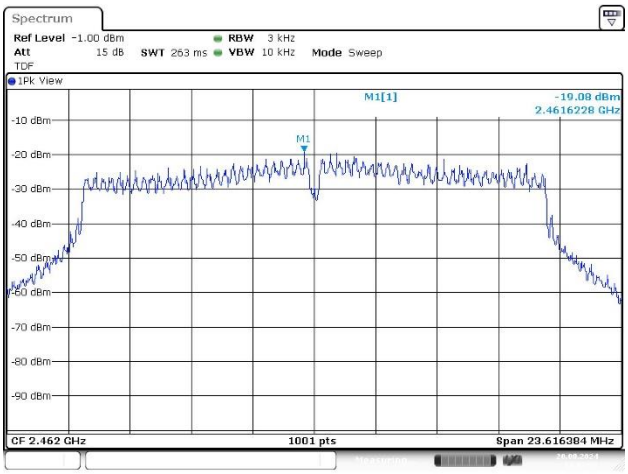


MIMO(CDD)

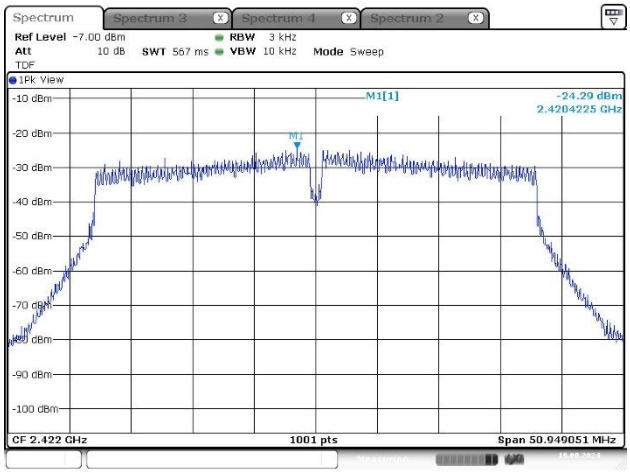
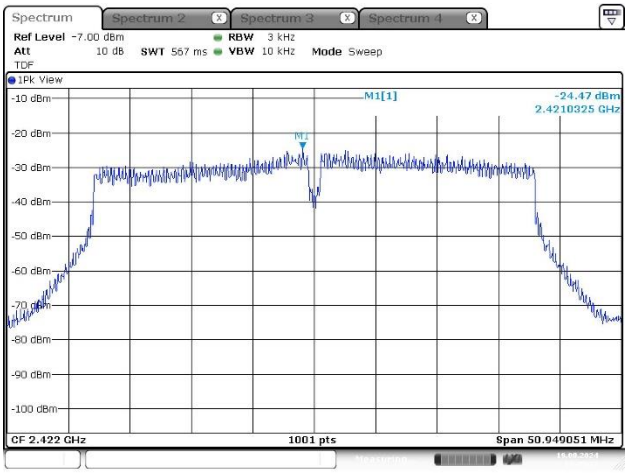
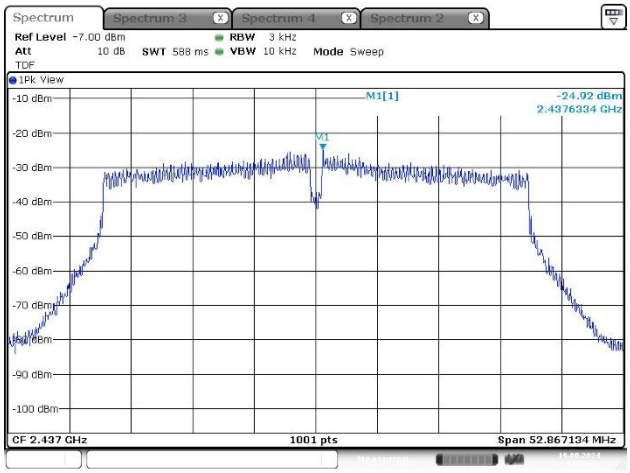
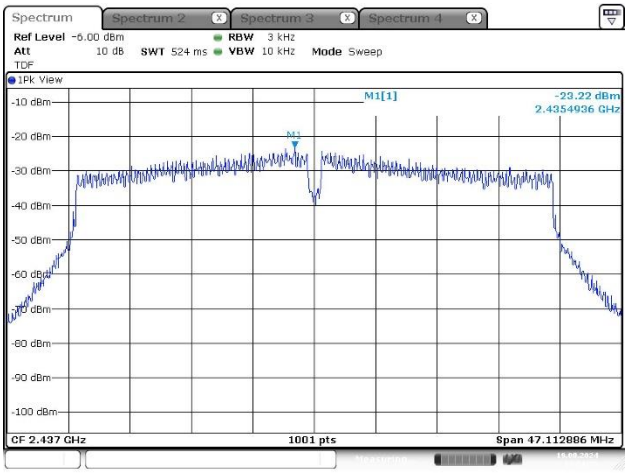
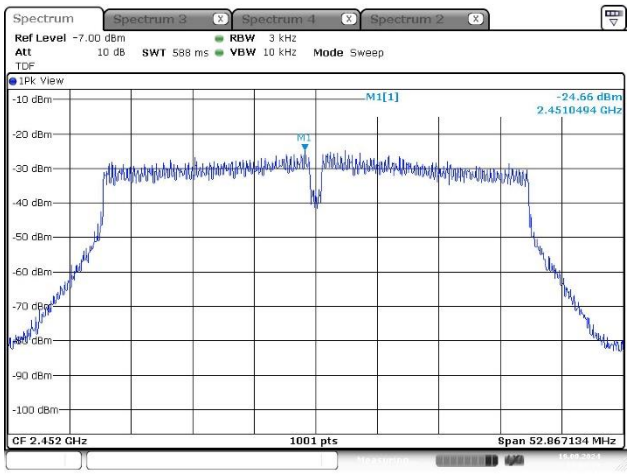
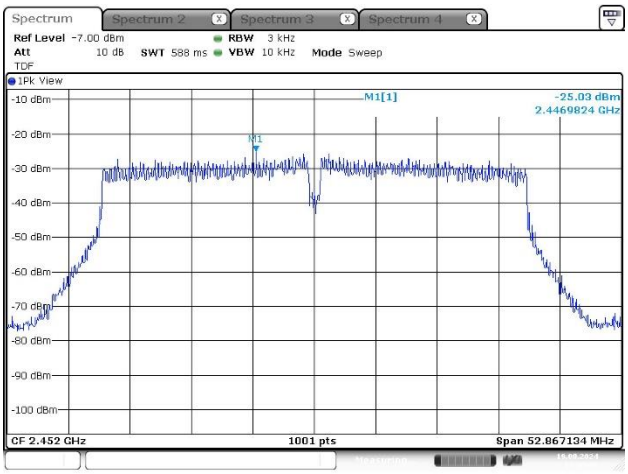
11g

Port 1_Low Channel	Port 2_Low Channel
	
Port 1_Middle Channel	**Port 2_Middle Channel**
	
Port 1_High Channel	**Port 2_High Channel**
	

11n_HT20

Port 1_Low Channel	Port 2_Low Channel
	
Port 1_Middle Channel	**Port 2_Middle Channel**
	
Port 1_High Channel	**Port 2_High Channel**
	

11n_HT40

Port 1_Low Channel	Port 2_Low Channel
	
Port 1_Middle Channel	**Port 2_Middle Channel**
	
Port 1_High Channel	**Port 2_High Channel**
	

6. Antenna Requirement

6.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. And according to FCC 47 CFR Section §15.247(b) if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power shall be reduced appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.2. Antenna Connected Construction

Band	**2 400 MHz ~ 2 483.5 MHz**			
Mode	**11b, 11g, 11n_HT20/40 and 11ac_VHT20/40**			
Gain (dBi)	Ant. 1	Ant. 2	Ant. 3	Ant. 4
	5.06	4.96	1.40	2.90
Directional Gain (dBi)	8.02			

According to ANSI C63.10-2013 14.4.3, unequal antenna gains with equal transmit powers.
a) If transmit signals are correlated, then
Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N_{ANT}$] dBi

Note that the purpose of the factor 20 in the denominator of each exponent and the square of the sum of terms is to combine the signal levels coherently.

In Directional Gain were calculated with worst gain.

- End of the Test Report -