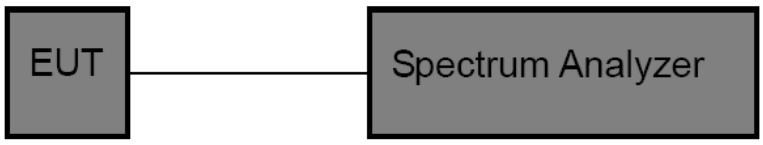
3.4. Band Edge and Spurious Emissions (Conducted)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d) / RSS-247 5.5
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 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 paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Configuration



Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW ≥ RBW, scan up through 10th harmonic.
   Sweep = auto, Detector function = peak, Trace = max hold.
4. Measure and record the results in the test report.

Test Mode

Please refer to the clause 2.4.

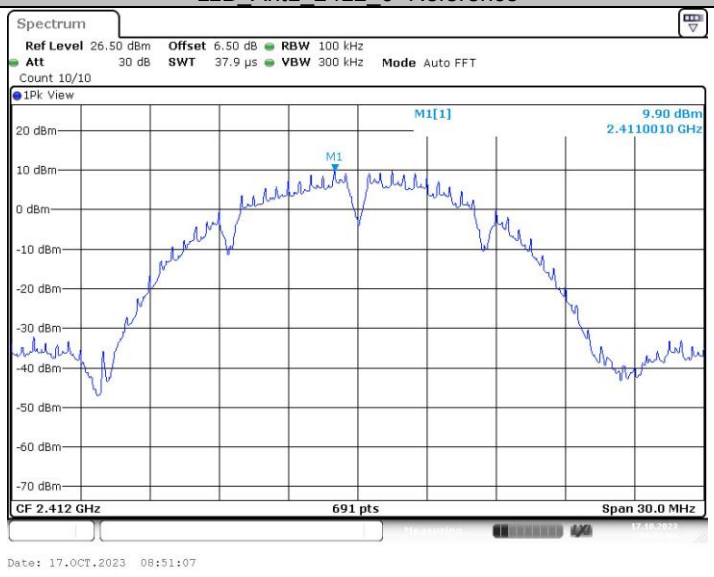
Test Result

Conducted Spurious Emission

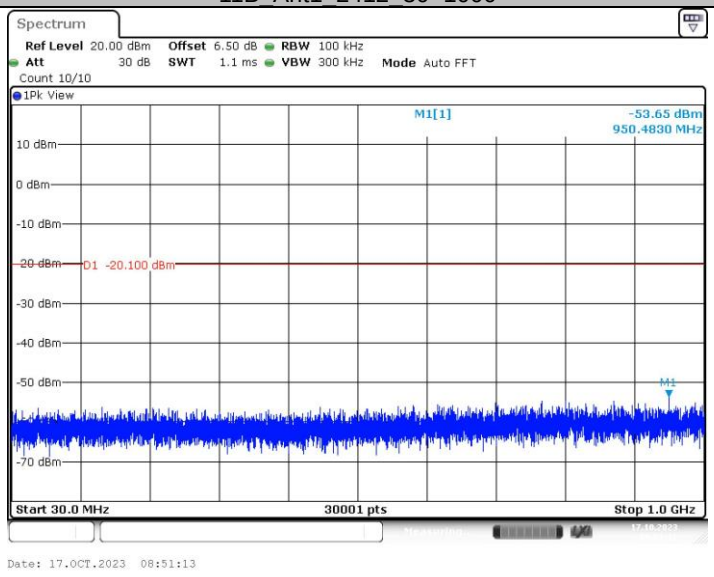
Test Mode	Channel	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	2412	Reference	9.90	9.90	---	PASS
		30~1000	9.90	-53.65	≤-20.10	PASS
		1000~26500	9.90	-35.40	≤-20.10	PASS
	2437	Reference	10.29	10.29	---	PASS
		30~1000	10.29	-54.32	≤-19.71	PASS
		1000~26500	10.29	-35.88	≤-19.71	PASS
	2462	Reference	9.88	9.88	---	PASS
		30~1000	9.88	-54.57	≤-20.12	PASS
		1000~26500	9.88	-36.05	≤-20.12	PASS
11G	2412	Reference	4.86	4.86	---	PASS
		30~1000	4.86	-54.83	≤-25.14	PASS
		1000~26500	4.86	-35.95	≤-25.14	PASS
	2437	Reference	2.75	2.75	---	PASS
		30~1000	2.75	-54.10	≤-27.25	PASS
		1000~26500	2.75	-36.54	≤-27.25	PASS
	2462	Reference	3.62	3.62	---	PASS
		30~1000	3.62	-54.52	≤-26.38	PASS
		1000~26500	3.62	-35.92	≤-26.38	PASS
11N20SISO	2412	Reference	2.42	2.42	---	PASS
		30~1000	2.42	-54.42	≤-27.58	PASS
		1000~26500	2.42	-35.82	≤-27.58	PASS
	2437	Reference	2.63	2.63	---	PASS
		30~1000	2.63	-53.31	≤-27.37	PASS
		1000~26500	2.63	-35.88	≤-27.37	PASS
	2462	Reference	2.41	2.41	---	PASS
		30~1000	2.41	-54.61	≤-27.59	PASS
		1000~26500	2.41	-36.73	≤-27.59	PASS

Test Graphs:

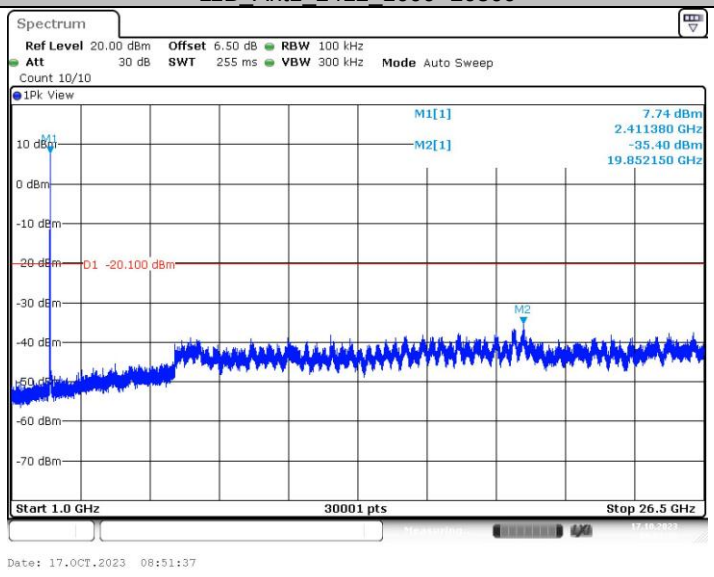
11B_Ant1_2412_0~Reference



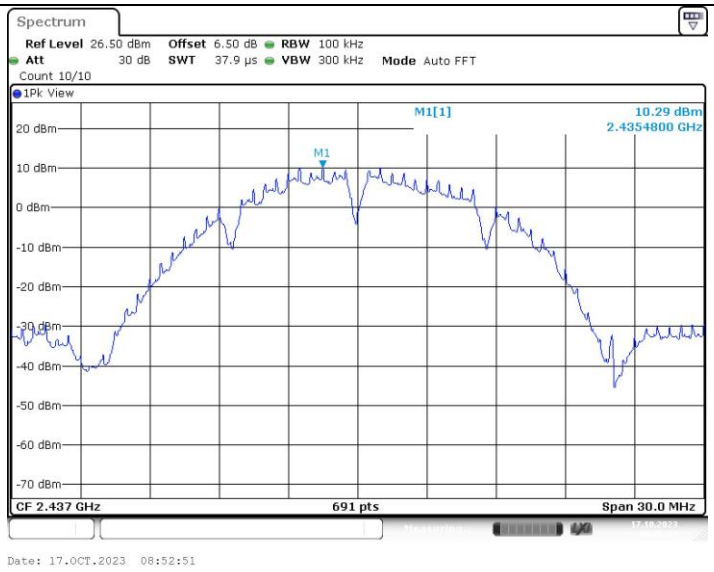
11B_Ant1_2412_30~1000



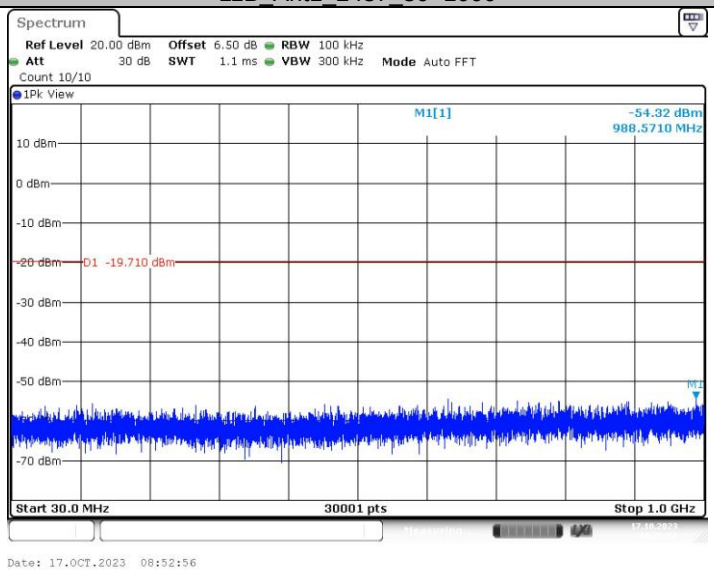
11B_Ant1_2412_1000~26500



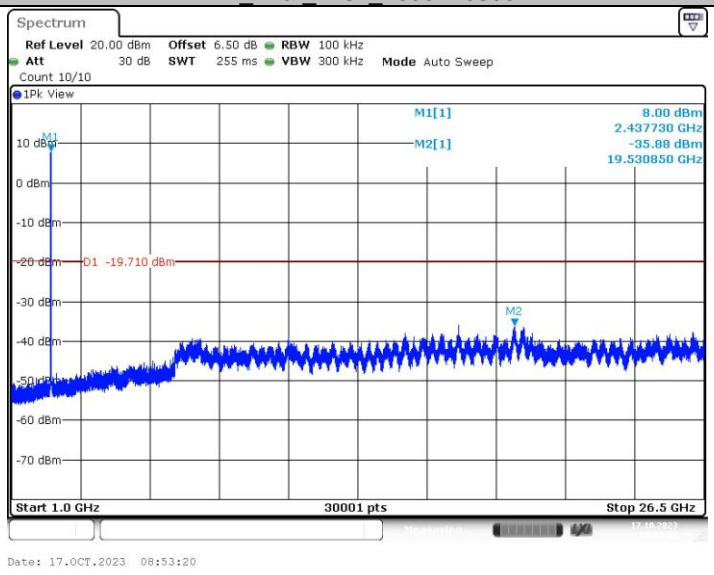
11B_Ant1_2437_0~Reference



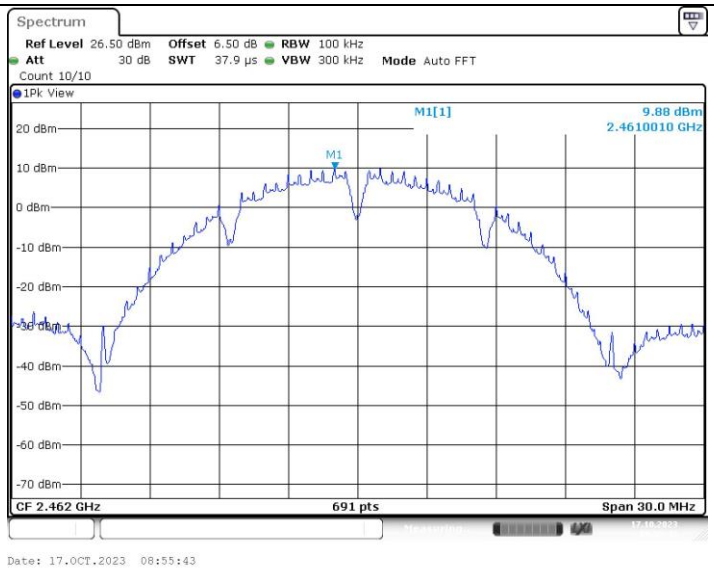
11B_Ant1_2437_30~1000



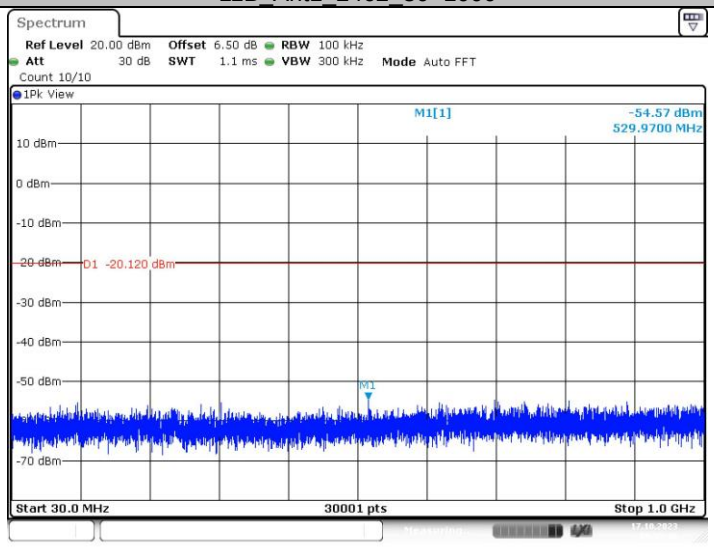
11B_Ant1_2437_1000~26500



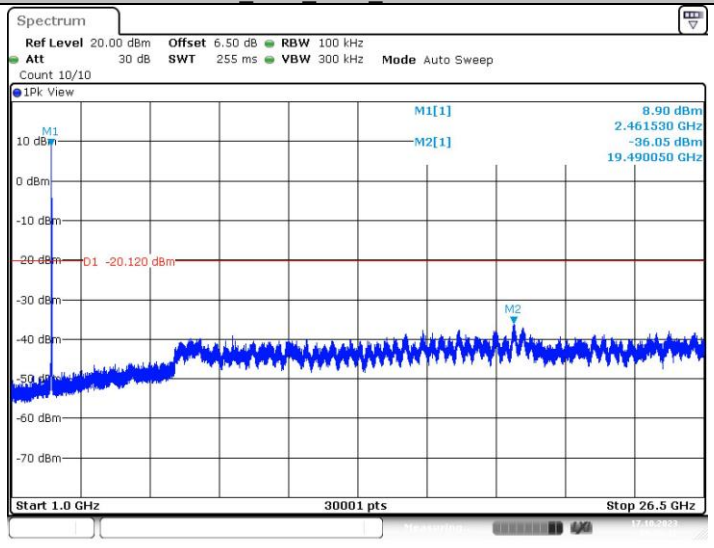
11B_Ant1_2462_0~Reference



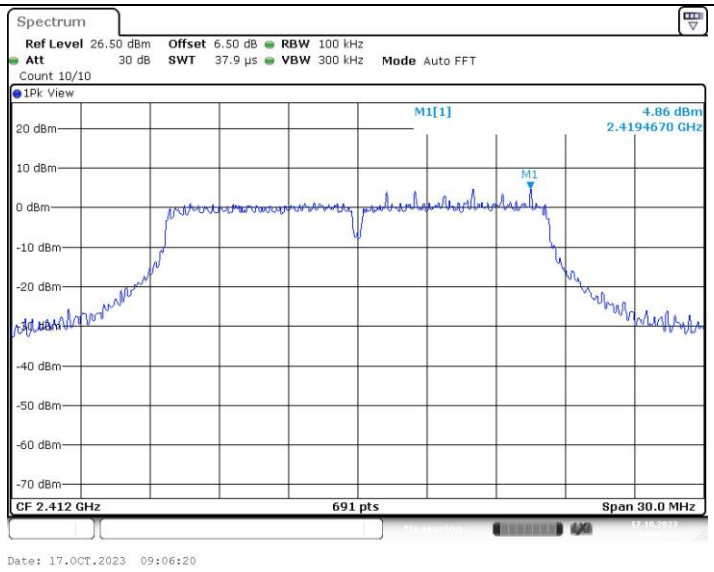
11B_Ant1_2462_30~1000



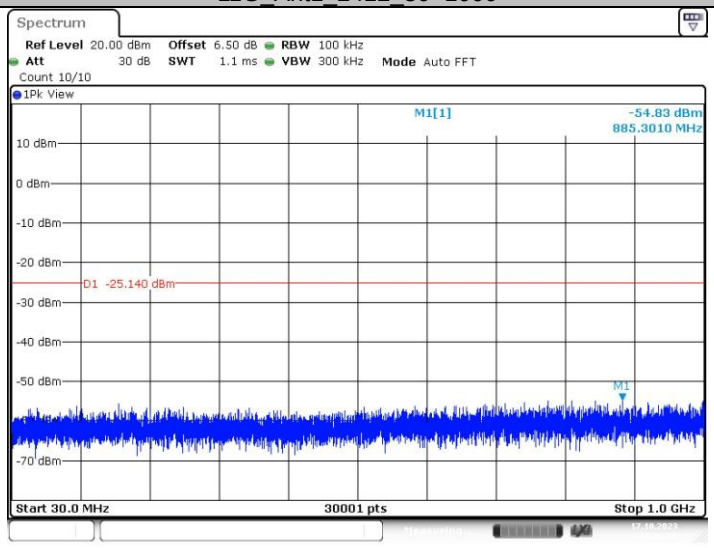
11B_Ant1_2462_1000~26500



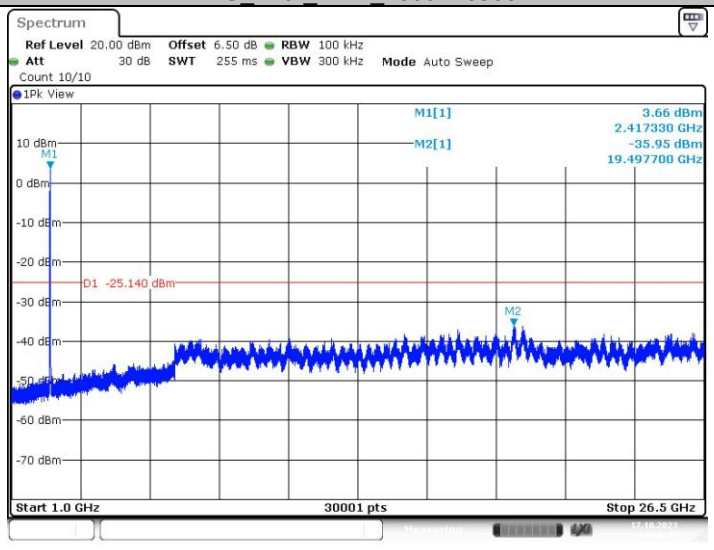
11G_Ant1_2412_0~Reference



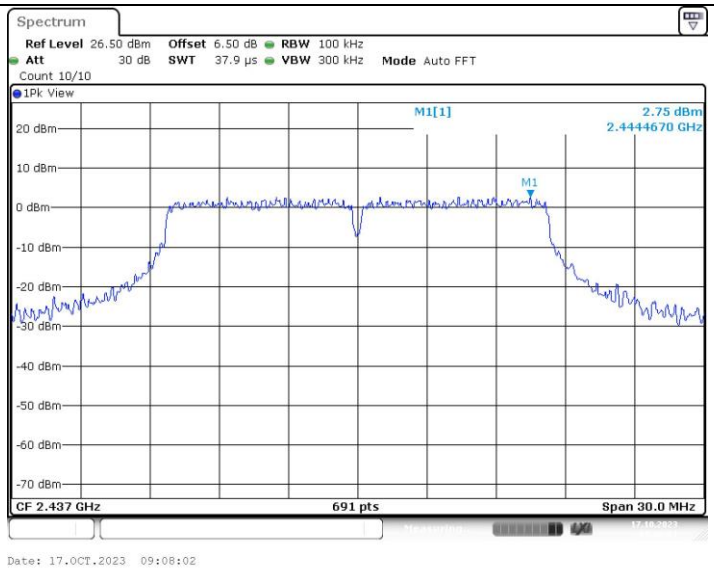
11G_Ant1_2412_30~1000



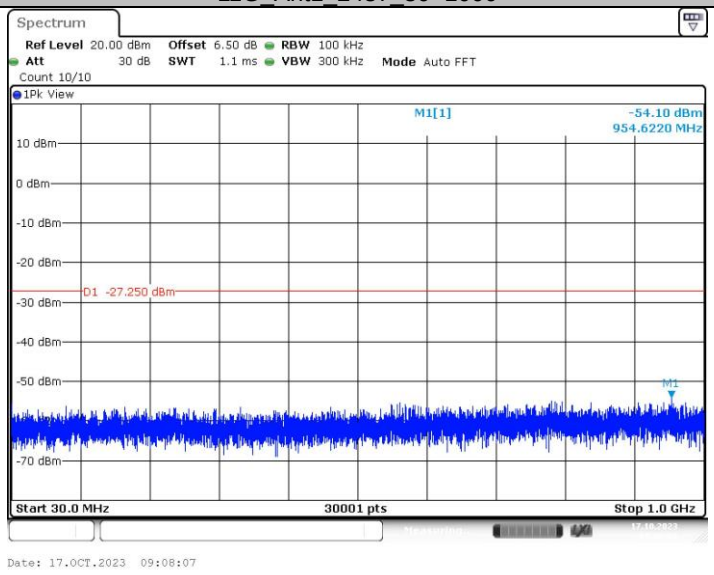
11G_Ant1_2412_1000~26500



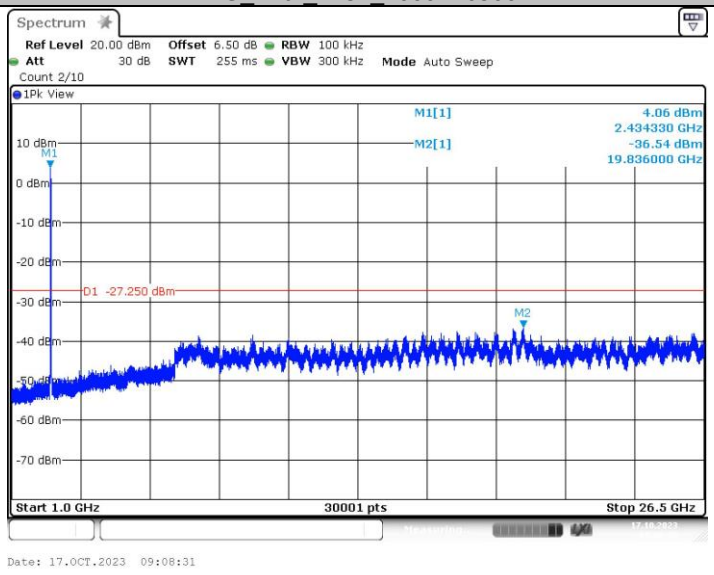
11G_Ant1_2437_0~Reference



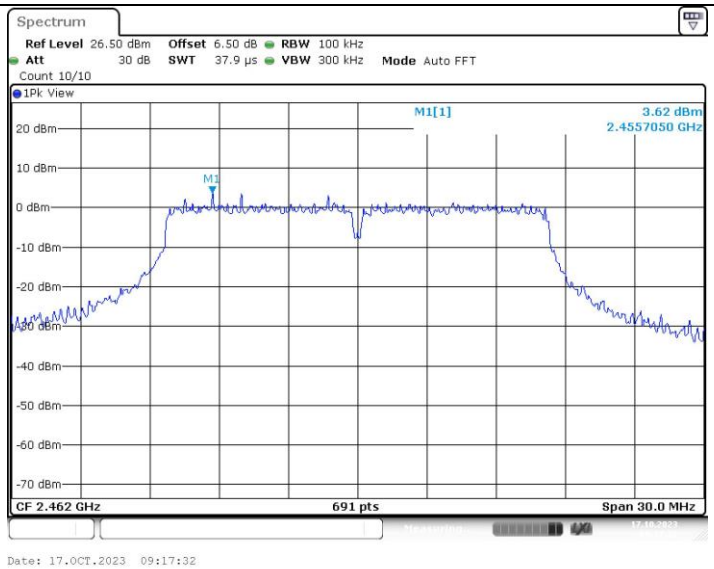
11G_Ant1_2437_30~1000



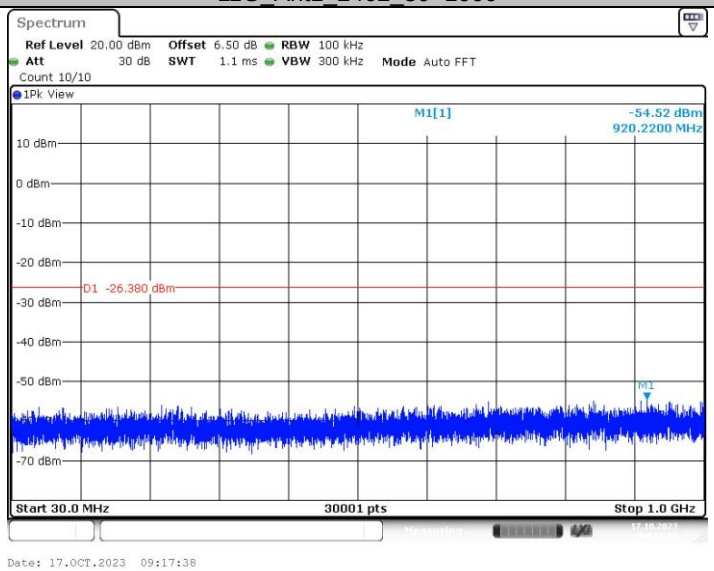
11G_Ant1_2437_1000~26500



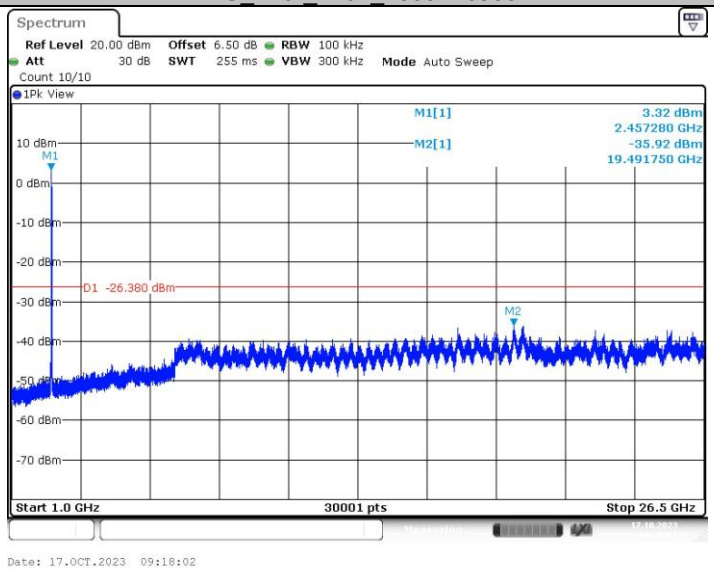
11G_Ant1_2462_0~Reference



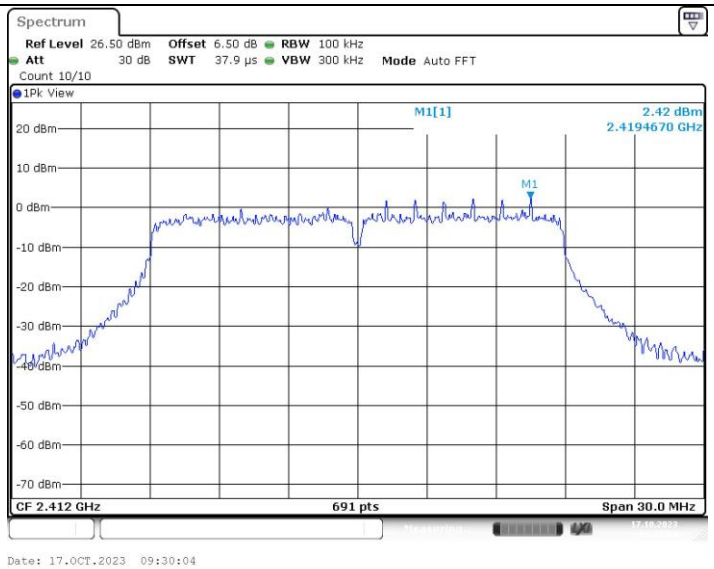
11G_Ant1_2462_30~1000



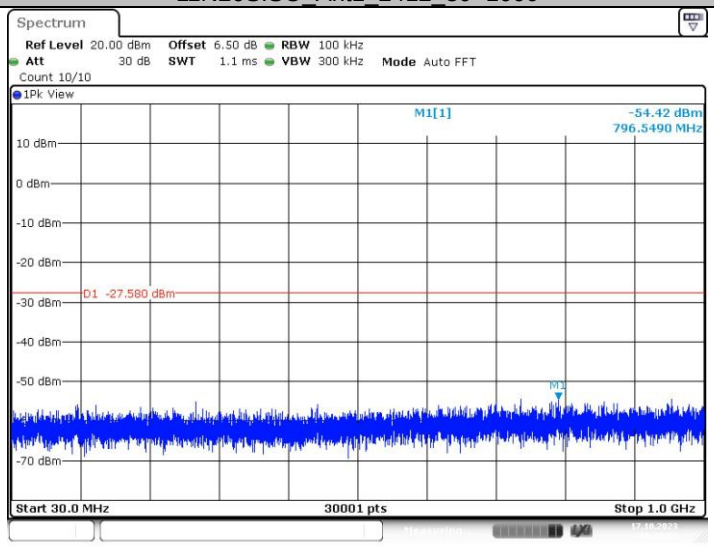
11G_Ant1_2462_1000~26500



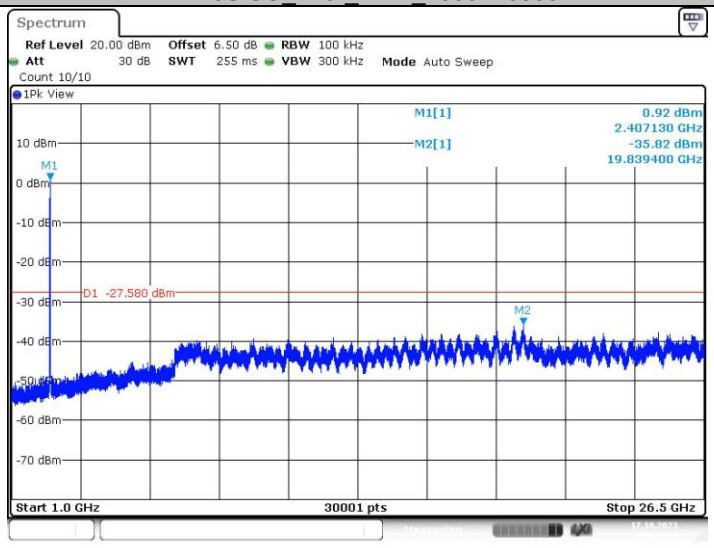
11N20SISO_Ant1_2412_0~Reference



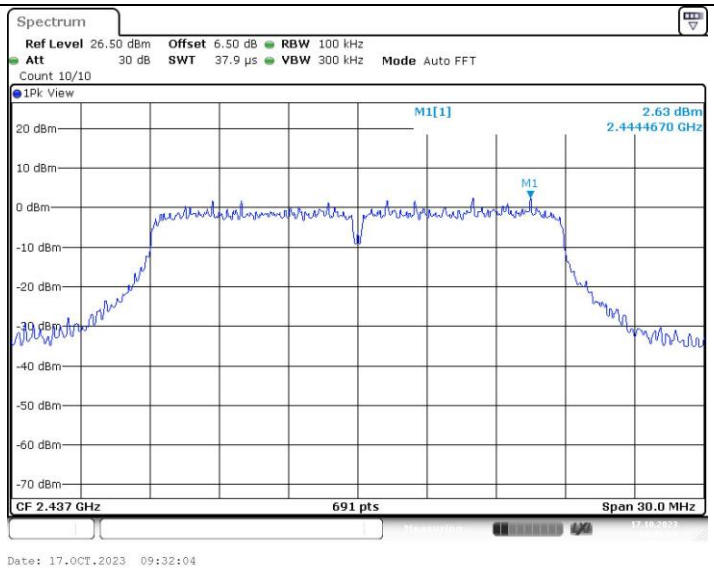
11N20SISO_Ant1_2412_30~1000



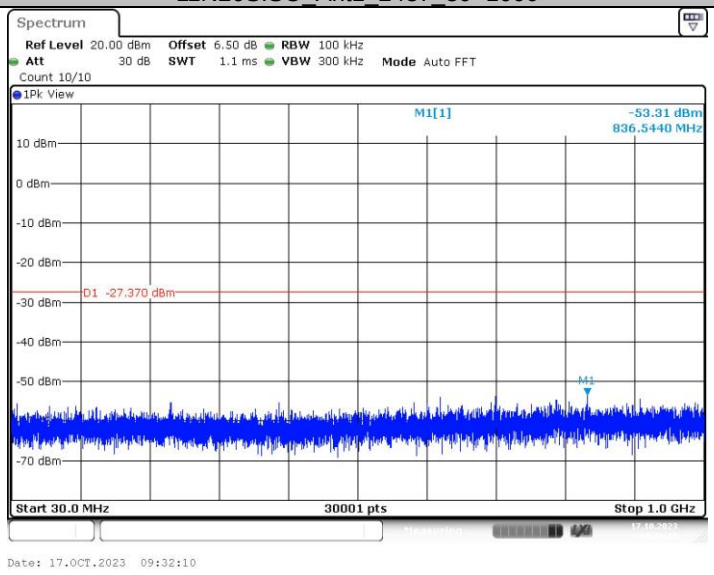
11N20SISO_Ant1_2412_1000~26500



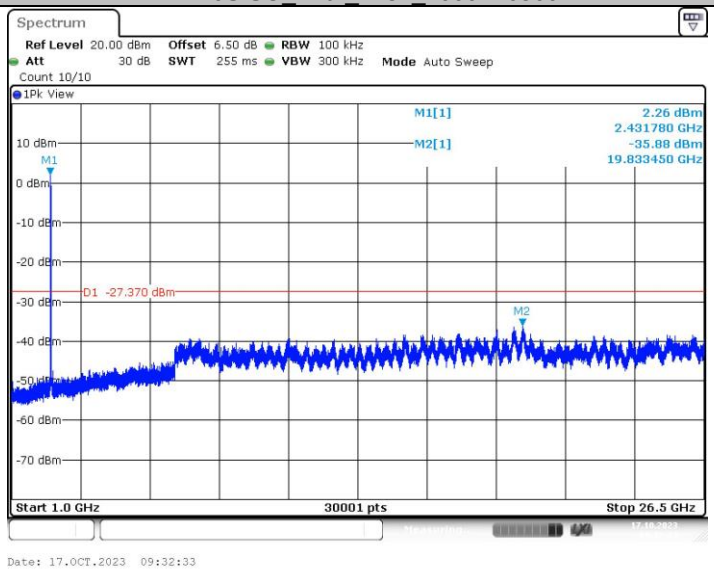
11N20SISO_Ant1_2437_0~Reference



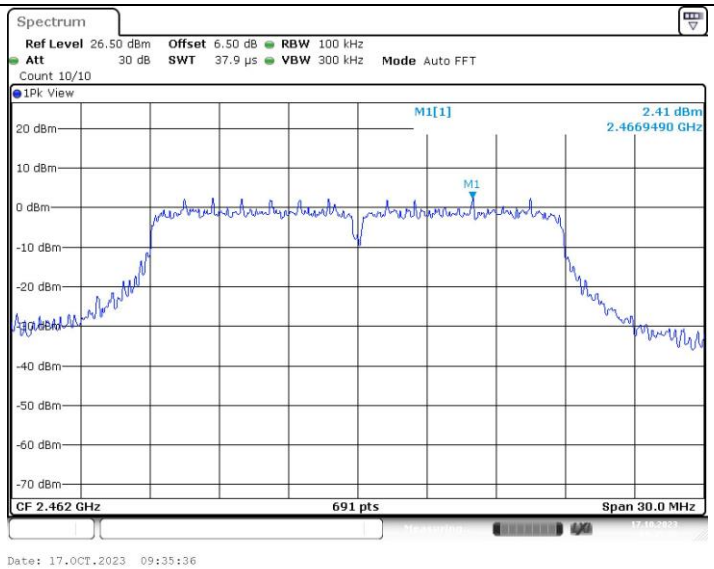
11N20SISO_Ant1_2437_30~1000



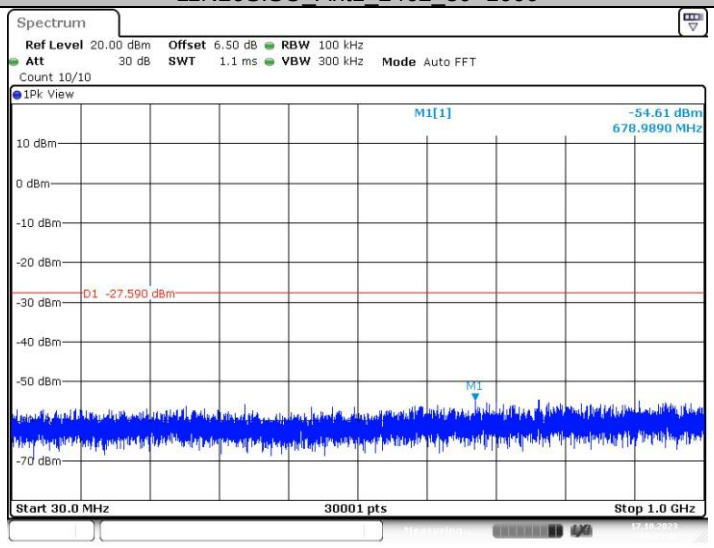
11N20SISO_Ant1_2437_1000~26500



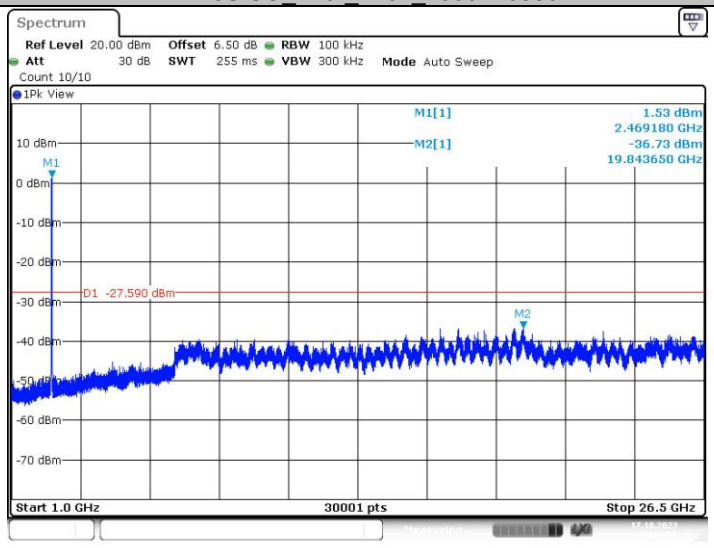
11N20SISO_Ant1_2462_0~Reference



11N20SISO_Ant1_2462_30~1000



11N20SISO_Ant1_2462_1000~26500

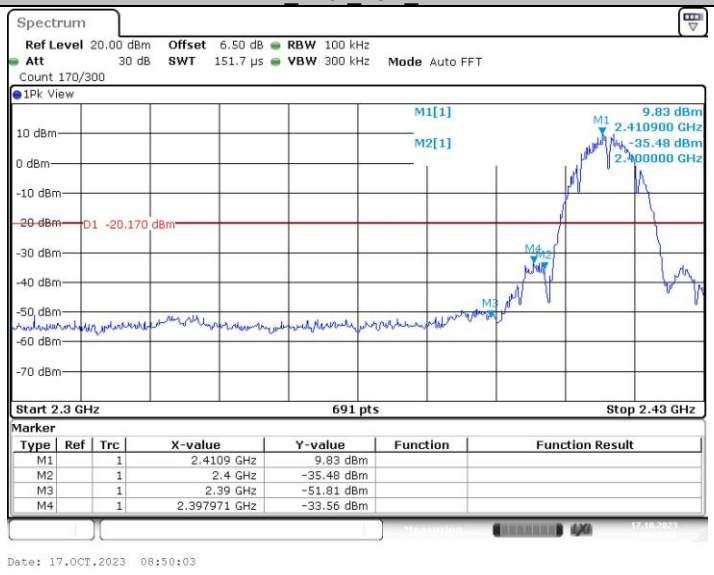


Conducted Band Edge

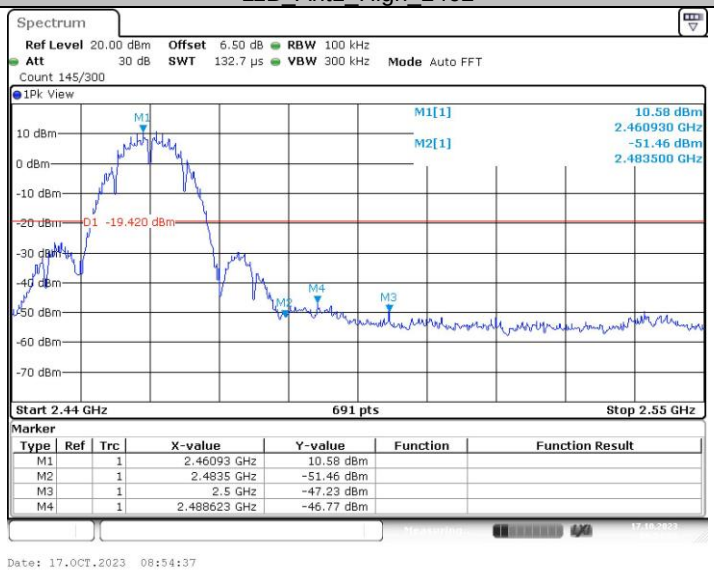
Test Mode	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Low	2412	9.83	-33.56	≤-20.17	PASS
	High	2462	10.58	-46.77	≤-19.42	PASS
11G	Low	2412	5.04	-25.76	≤-24.96	PASS
	High	2462	1.59	-40.27	≤-28.41	PASS
11N20SISO	Low	2412	1.21	-33.61	≤-28.79	PASS
	High	2462	3.49	-39.79	≤-26.51	PASS

Test Graphs:

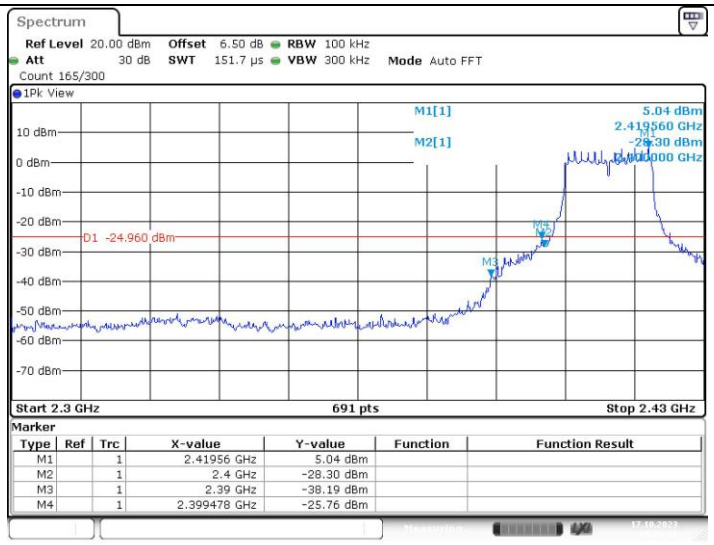
11B_Ant1_Low_2412



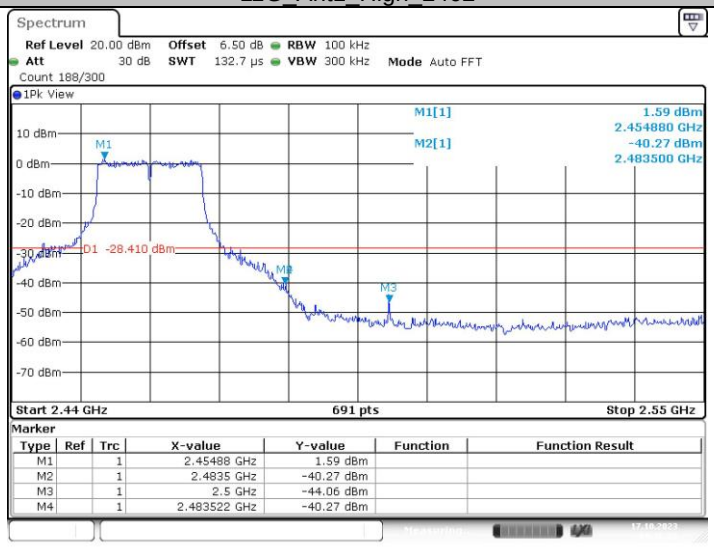
11B_Ant1_High_2462



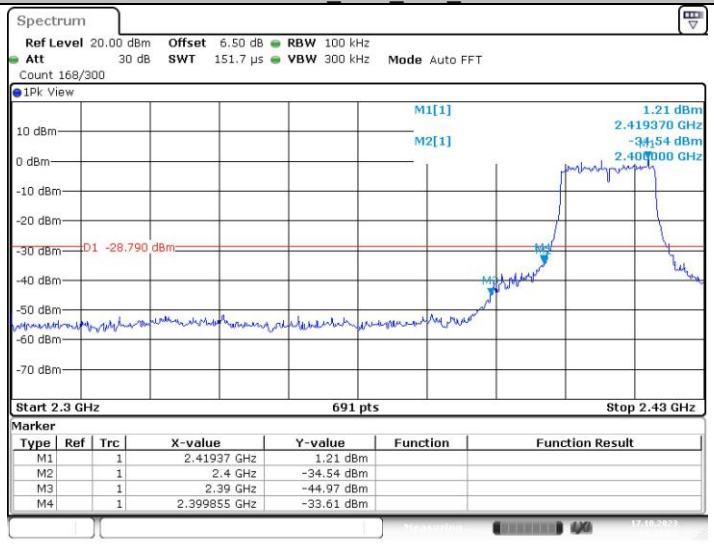
11G_Ant1_Low_2412



11G_Ant1_High_2462



11N20SISO_Ant1_Low_2412



11N20SISO_Ant1_High_2462


Spectrum
Ref Level 20.00 dBm Offset 6.50 dB RBW 100 kHz
Att 30 dB SWT 132.7 µs VBW 300 kHz Mode Auto FFT
Count 183/300
1Pk View
M1[1] 3.49 dBm
2.466980 GHz
M2[1] -39.79 dBm
2.483500 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
D1 -26.510 dBm
M1
M2
M3
Start 2.44 GHz
691 pts
Stop 2.55 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.46698 GHz 3.49 dBm
M2 1 2.4835 GHz -39.79 dBm
M3 1 2.5 GHz -44.54 dBm
M4 1 2.483522 GHz -39.79 dBm
Date: 17.OCT.2023 09:34:32

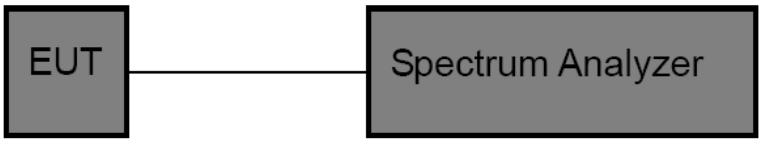
3.5. DTS Bandwidth

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2) / RSS-247 5.2 a

Test Item	Limit	Frequency Range (MHz)
DTS Bandwidth	≥500 kHz (6dB bandwidth)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. DTS Spectrum Setting:
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.
   OCB Spectrum Setting:
   (1) Set RBW = 1% ~ 5% occupied bandwidth.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

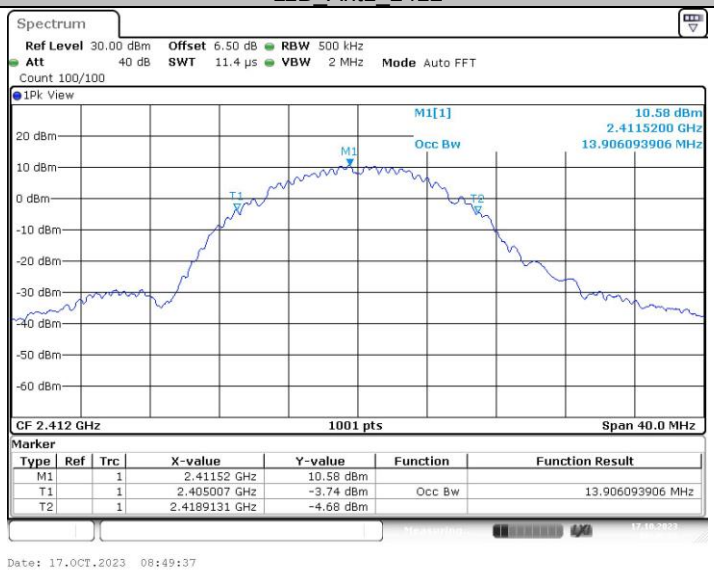
Please refer to the clause 2.4.

Test Result

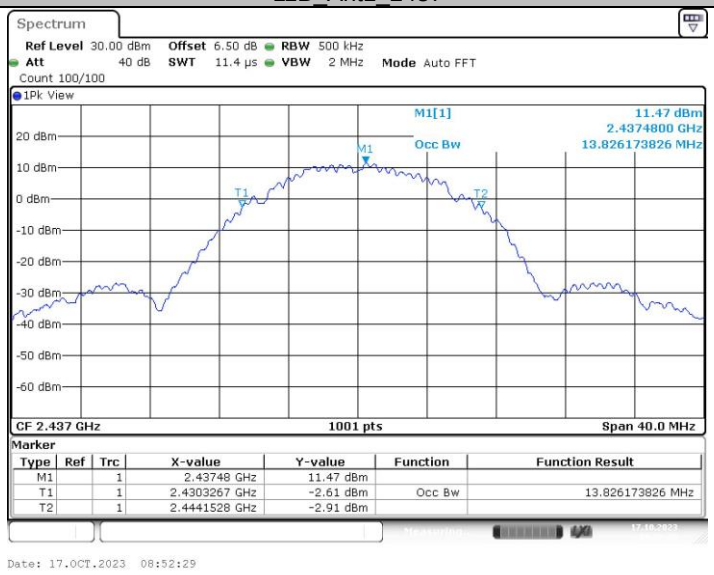
Test Mode	Channel	Occupied Bandwidth [MHz]	DTS Bandwidth [MHz]	Limit[MHz]	Verdict
11B	2412	13.906	9.00	0.5	PASS
	2437	13.826	9.08	0.5	PASS
	2462	14.066	9.08	0.5	PASS
11G	2412	17.662	16.36	0.5	PASS
	2437	17.423	16.36	0.5	PASS
	2462	17.502	16.36	0.5	PASS
11N20SISO	2412	18.142	17.56	0.5	PASS
	2437	18.462	17.60	0.5	PASS
	2462	18.222	17.56	0.5	PASS

Occupied Bandwidth:

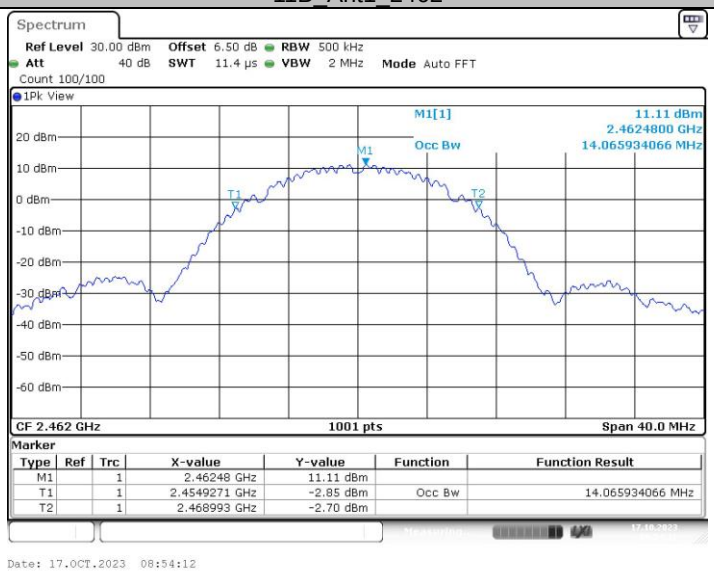
11B_Ant1_2412



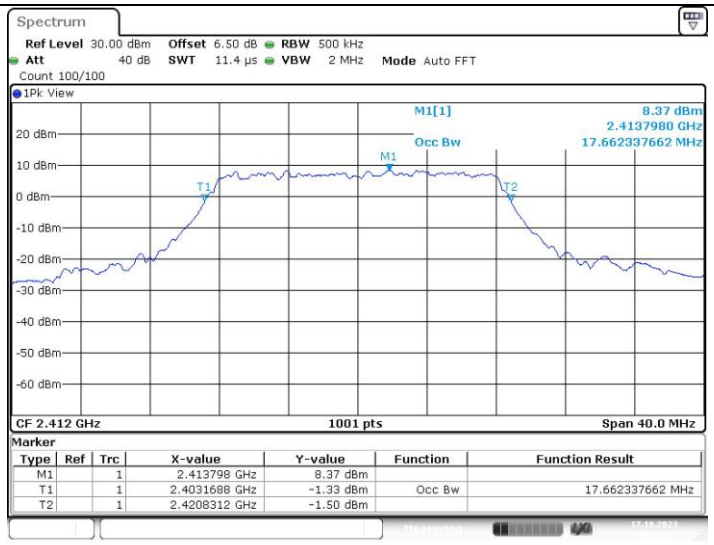
11B_Ant1_2437



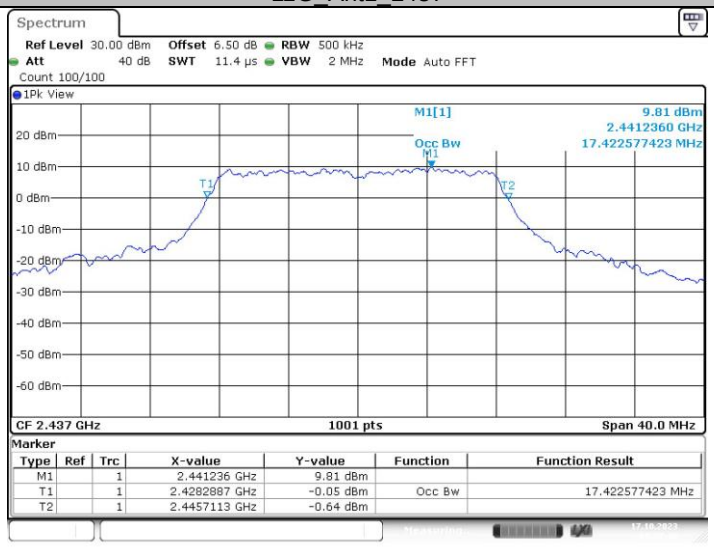
11B_Ant1_2462



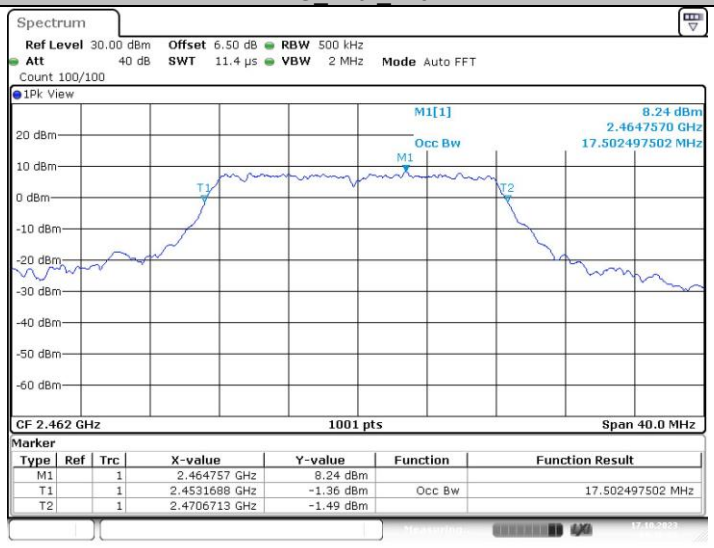
11G_Ant1_2412



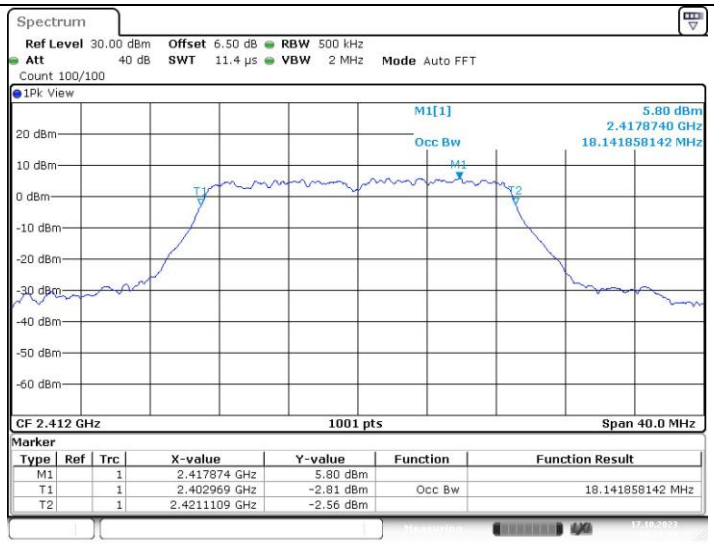
11G_Ant1_2437



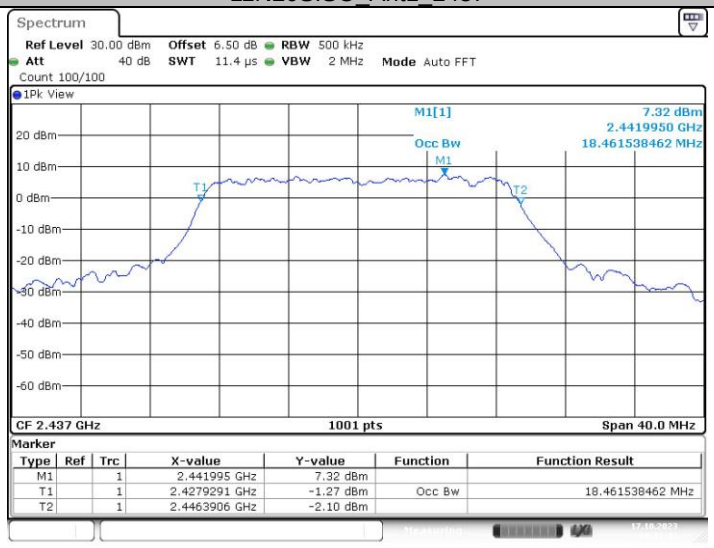
11G_Ant1_2462



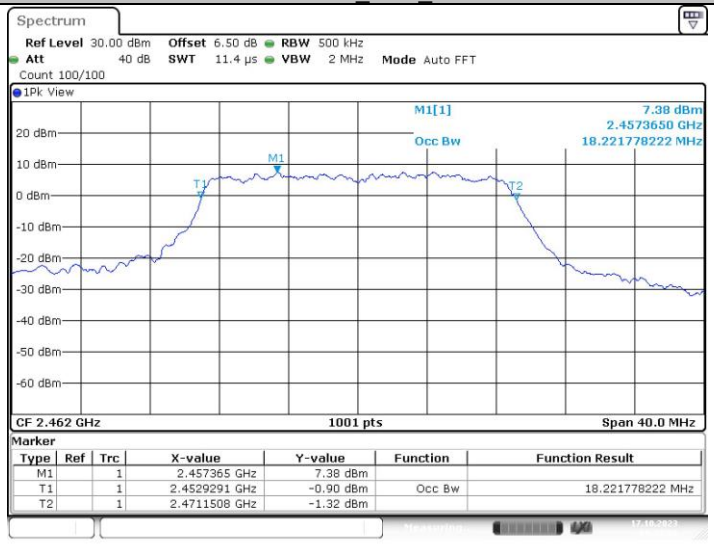
11N20SISO_Ant1_2412



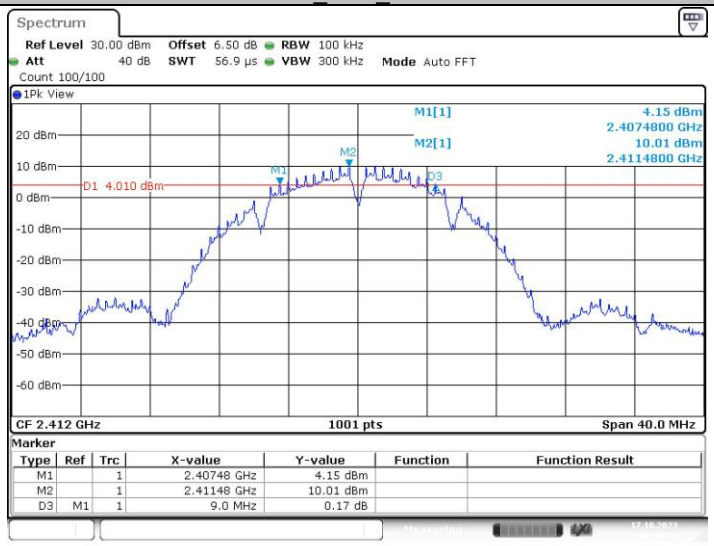
11N20SISO_Ant1_2437

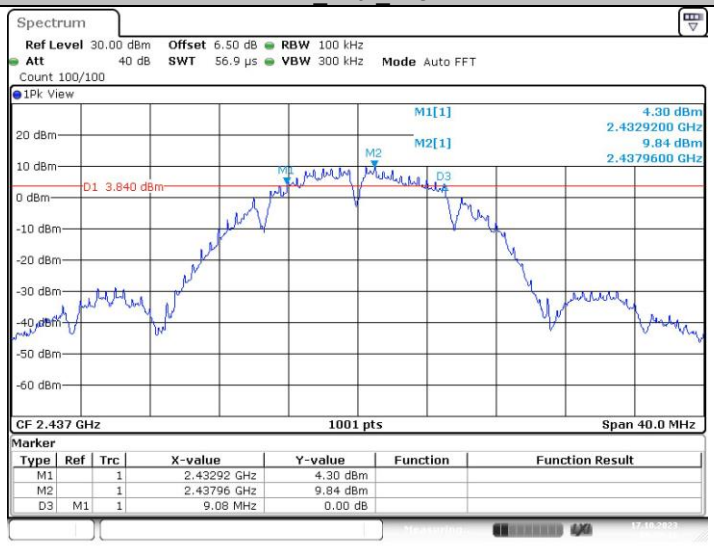


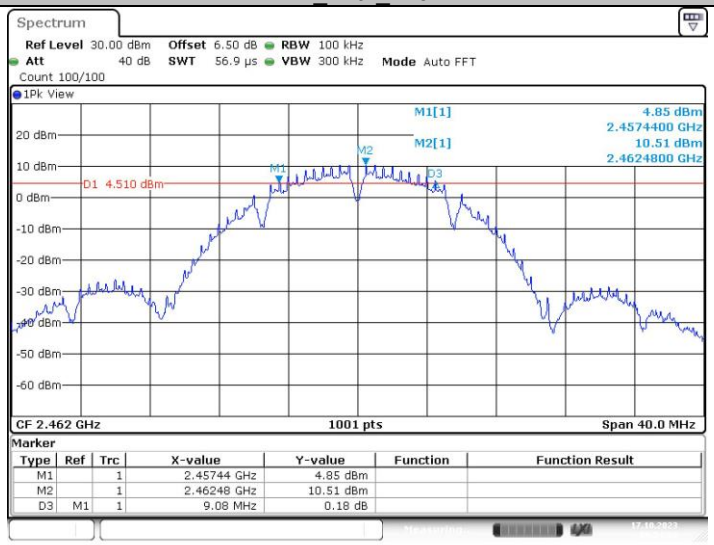
11N20SISO_Ant1_2462



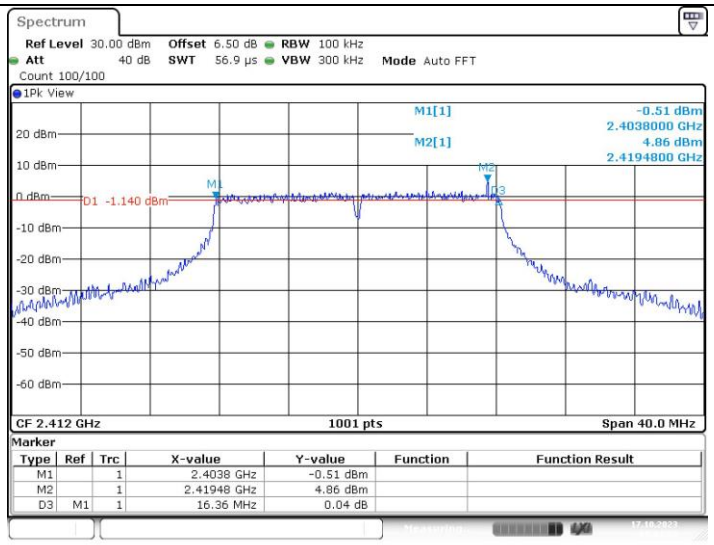
DTS Bandwidth:

11B_Ant1_2412


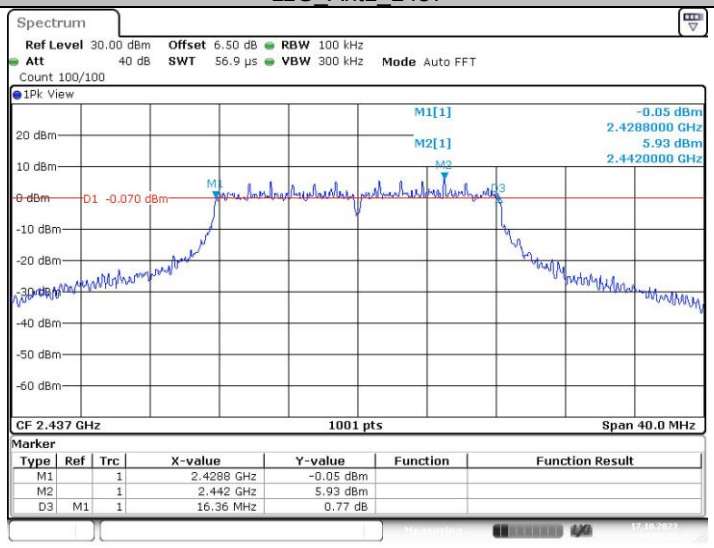
11B_Ant1_2437


11B_Ant1_2462


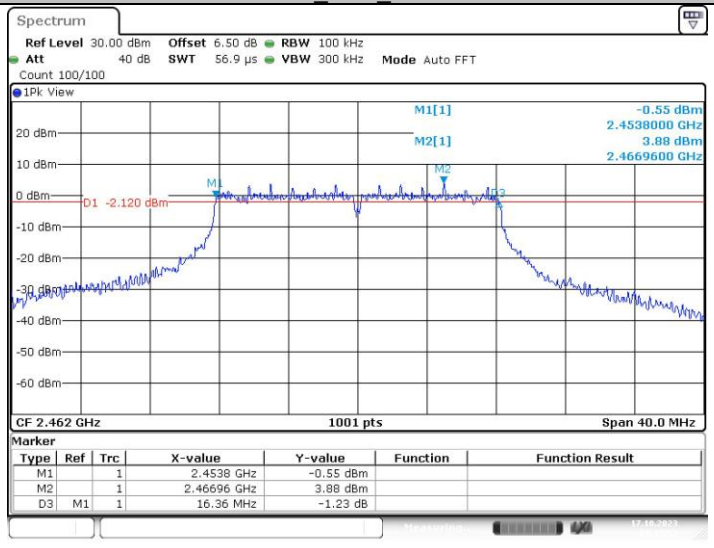
11G_Ant1_2412



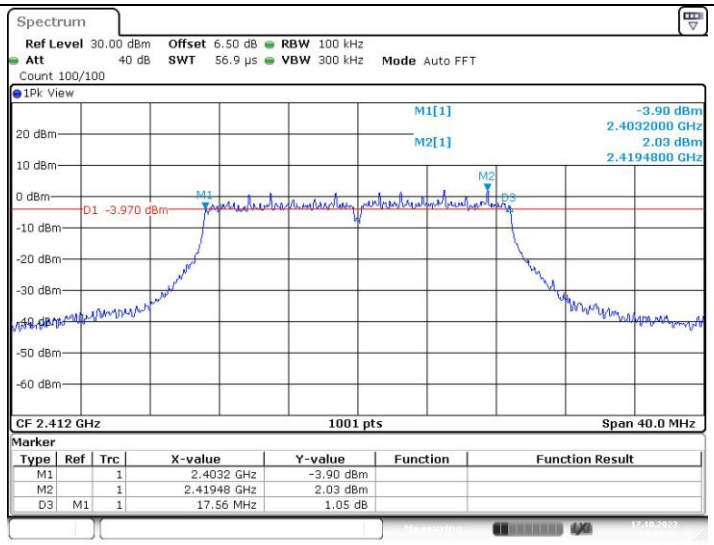
11G_Ant1_2437



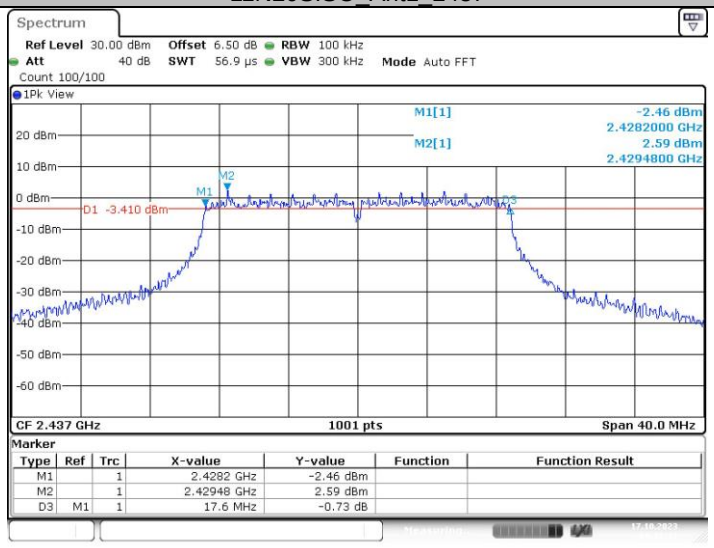
11G_Ant1_2462



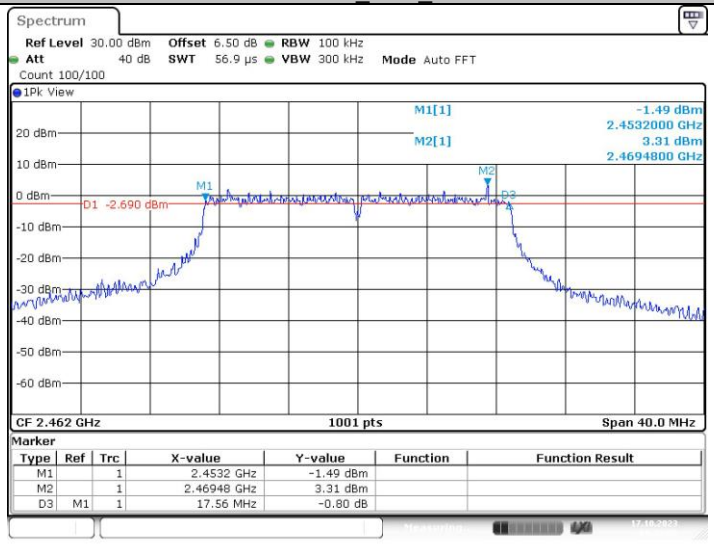
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462



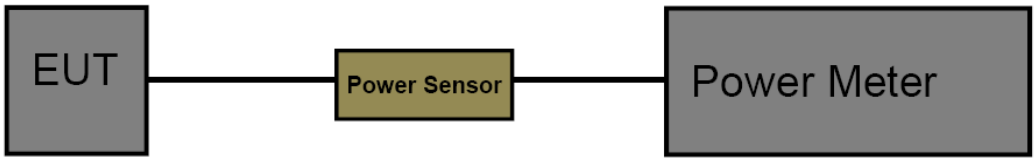
3.6. Peak Output Power

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(3) / RSS-247 5.4 d

Section	Test Item	Limit	Frequency Range (MHz)
FCC CFR 47 Part15.247 (b)(3)	Maximum Conducted Output Power	1 Watt or 30dBm	2400~2483.5
ISED RSS-247 5.4 d	EIRP	4 Watt or 36dBm	2400~2483.5

Test Configuration



Test Procedure

1. The maximum conducted output power may be measured using a broadband Peak RF power meter.
2. Peak power measurements were performed only when the EUT was transmitting at its AVG power control level using a broadband power meter with a pulse sensor.
3. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.
   Record the measurement data.

Test Mode

Please refer to the clause 2.4.

Test Result

Test Mode	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	2412	17.71	≤30	PASS
	2437	18.38	≤30	PASS
	2462	18.44	≤30	PASS
11G	2412	15.03	≤30	PASS
	2437	16.05	≤30	PASS
	2462	14.64	≤30	PASS
11N20SISO	2412	12.62	≤30	PASS
	2437	13.74	≤30	PASS
	2462	13.86	≤30	PASS

Test Mode	Channel	Result[dBm]	EIRP[dBm]	Limit[dBm]	Verdict
11B	2412	17.71	20.68	≤36	PASS
	2437	18.38	21.35	≤36	PASS
	2462	18.44	21.41	≤36	PASS
11G	2412	15.03	18.00	≤36	PASS
	2437	16.05	19.02	≤36	PASS
	2462	14.64	17.61	≤36	PASS
11N20SISO	2412	12.62	15.59	≤36	PASS
	2437	13.74	16.71	≤36	PASS
	2462	13.86	16.83	≤36	PASS

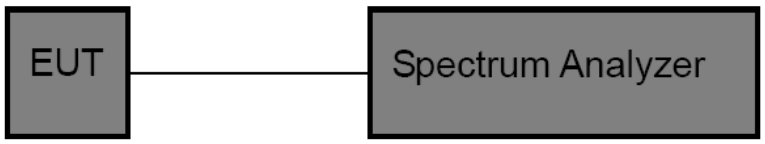
3.7. Power Spectral Density

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (e) / RSS-247 5.2 b

Test Item	Limit	Frequency Range (MHz)
Power Spectral Density	8 dBm (in any 3 kHz)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:

Set analyzer center frequency to DTS channel center frequency.
Set the span to 1.5 times the DTS bandwidth.
Set the RBW to: 3 kHz.
Set the VBW to: 10 kHz.
Detector: peak.
Sweep time: auto.

Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

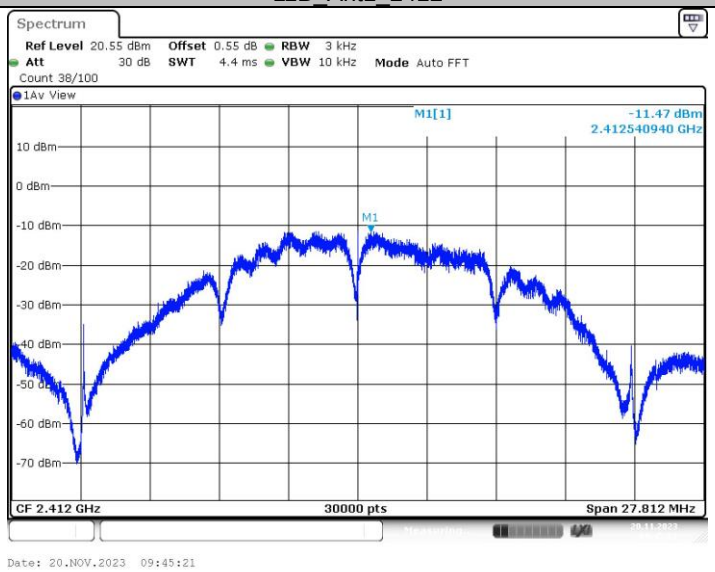
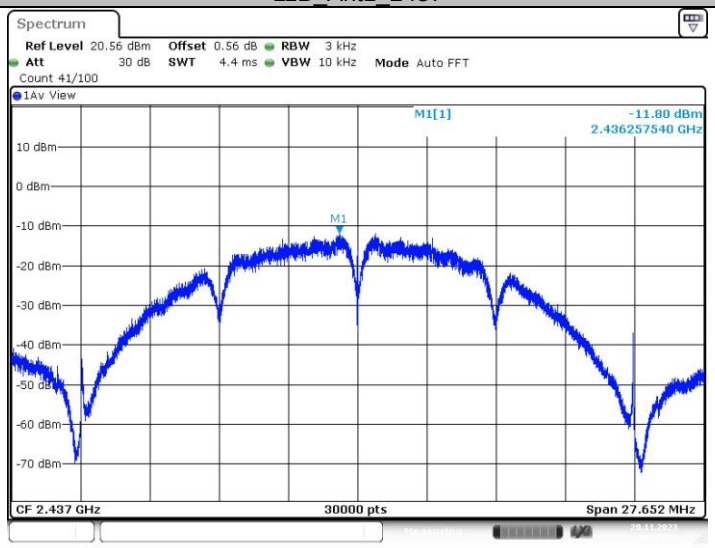
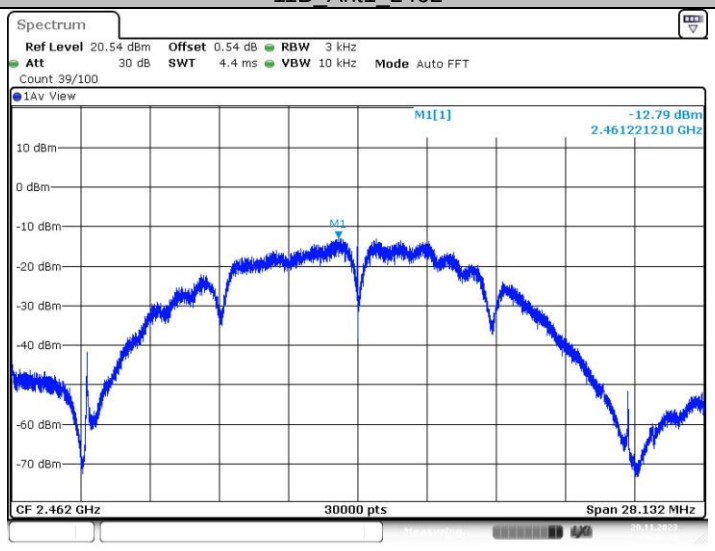
Test Mode

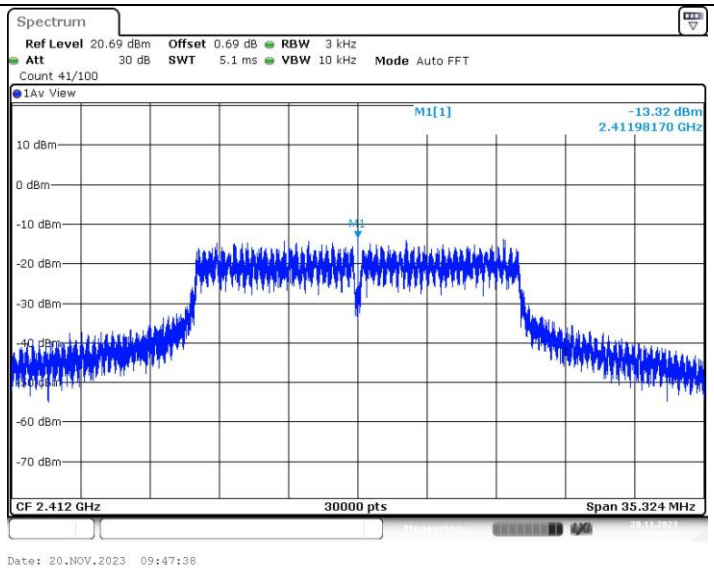
Please refer to the clause 2.4.

Test Result

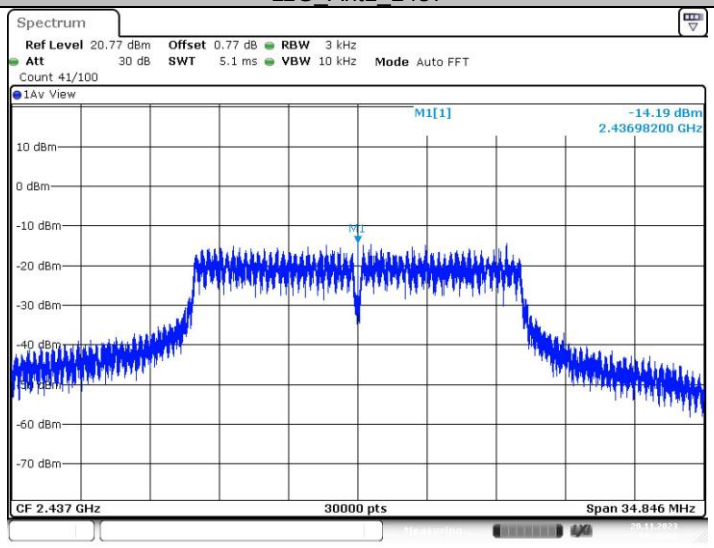
Test Mode	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11B	2412	-11.47	≤8	PASS
	2437	-11.80	≤8	PASS
	2462	-12.79	≤8	PASS
11G	2412	-13.32	≤8	PASS
	2437	-14.19	≤8	PASS
	2462	-15.17	≤8	PASS
11N20SISO	2412	-12.38	≤8	PASS
	2437	-12.68	≤8	PASS
	2462	-16.22	≤8	PASS

Test plot as follows:

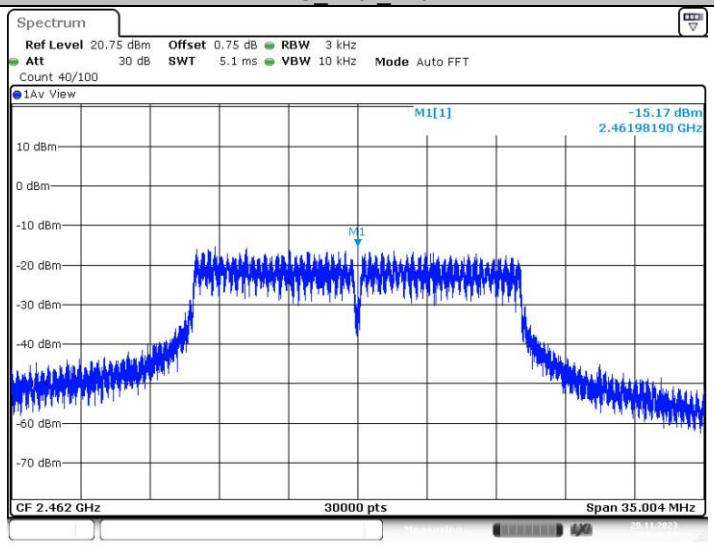
11B_Ant1_2412

11B_Ant1_2437

11B_Ant1_2462

11G_Ant1_2412



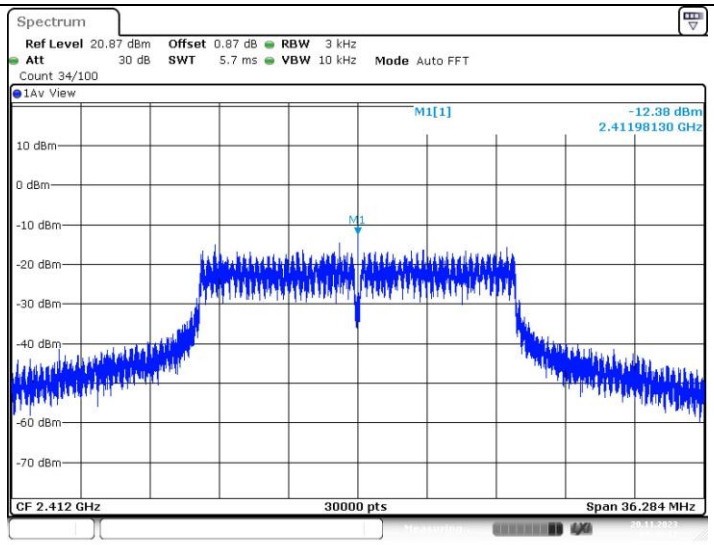
11G_Ant1_2437



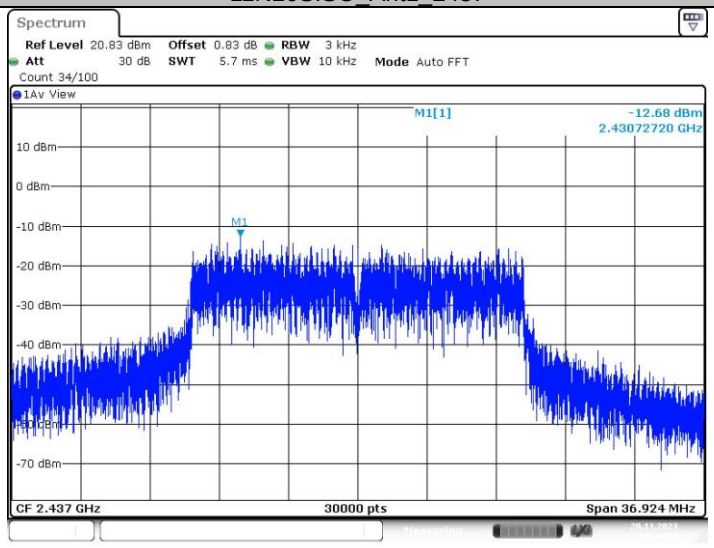
11G_Ant1_2462



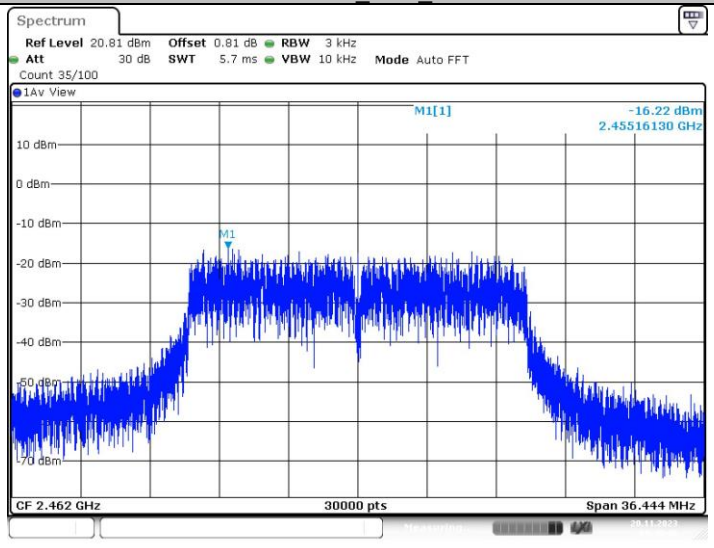
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462

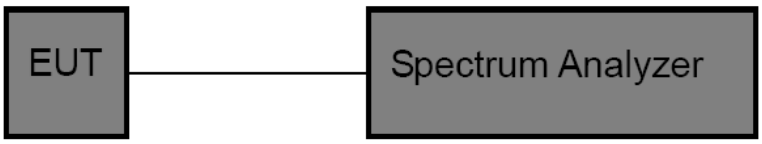


3.8. Duty Cycle

Limit

None, for report purposes only.

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:

Set analyzer center frequency to test channel center frequency.
Set the span to 0Hz.
Set the RBW to 10MHz.
Set the VBW to 10MHz.
Detector: Peak.
Sweep time: Auto.
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

Test Mode

Please refer to the clause 2.4.

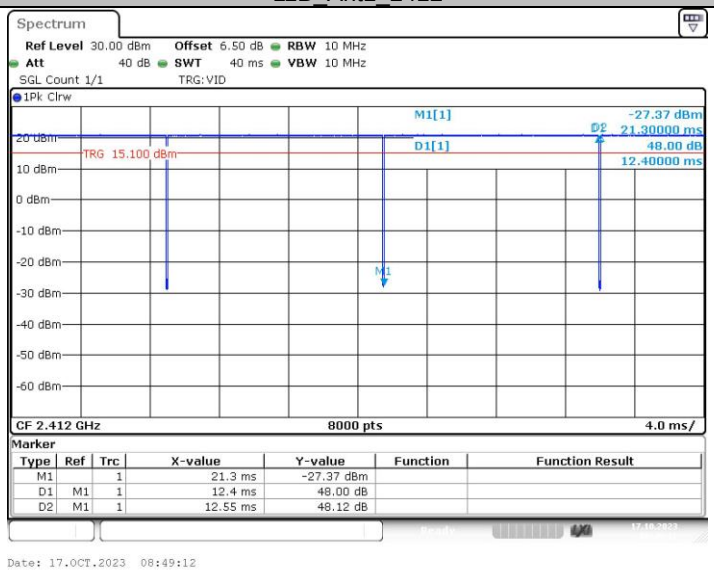
Test Result

Test Mode	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW (kHz)	Final Setting for VBW (kHz)
11B	2412	12.40	12.55	98.80	/	0.01
	2437	12.40	12.56	98.73	/	0.01
	2462	12.40	12.52	99.04	/	0.01
11G	2412	2.05	2.14	95.79	0.49	1
	2437	2.05	2.18	94.04	0.49	1
	2462	2.05	2.17	94.47	0.49	1
11N20SISO	2412	1.90	2.07	91.79	0.53	1
	2437	1.91	2.06	92.72	0.52	1
	2462	1.91	2.05	93.17	0.52	1

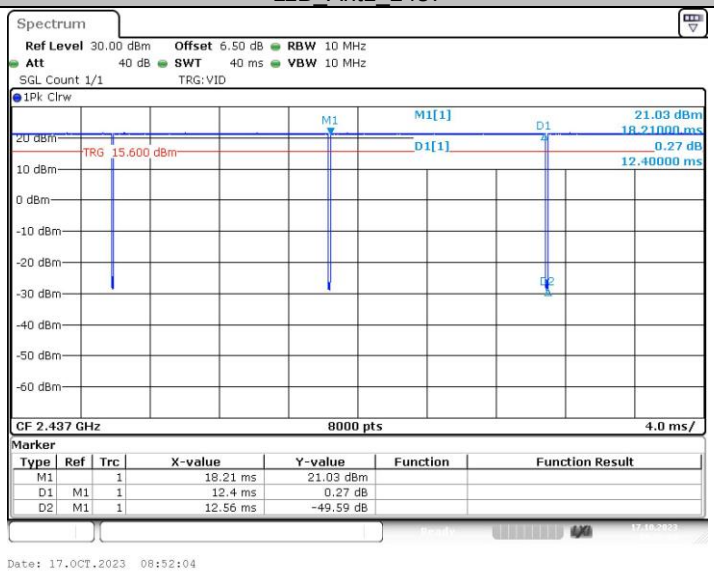
Note: Duty Cycle>98%, VBW=10Hz

Test plot as follows:

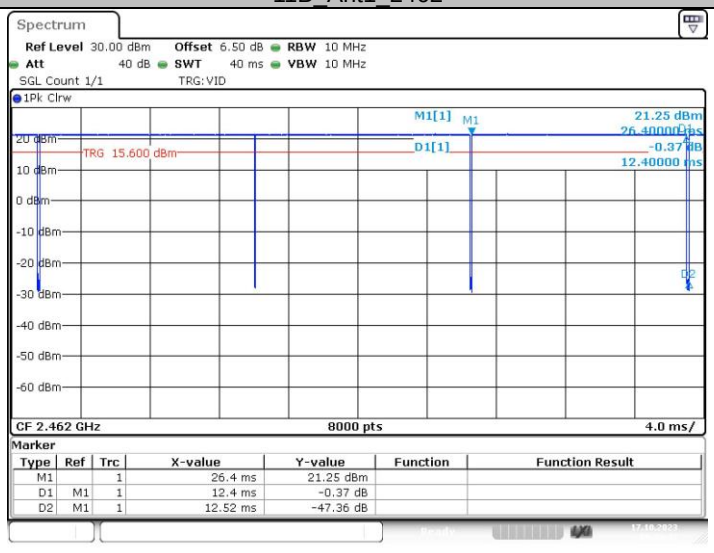
11B_Ant1_2412



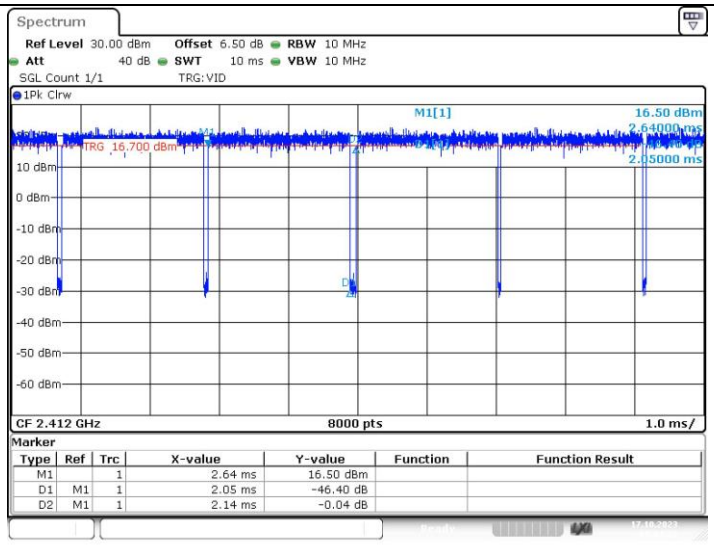
11B_Ant1_2437



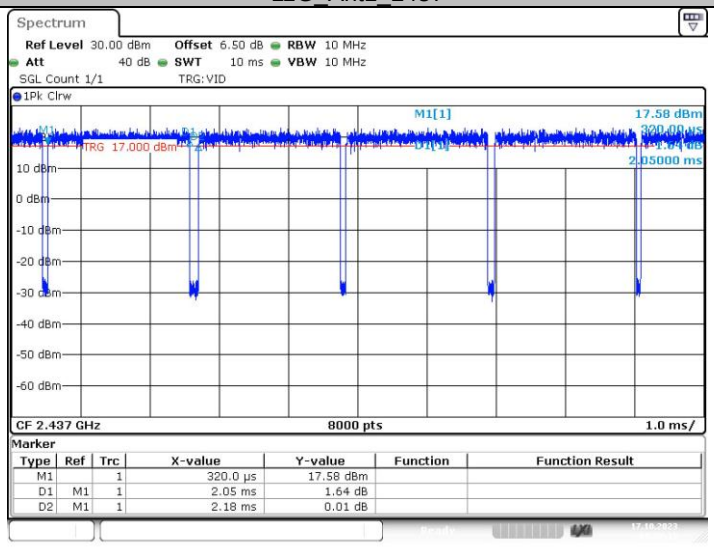
11B_Ant1_2462



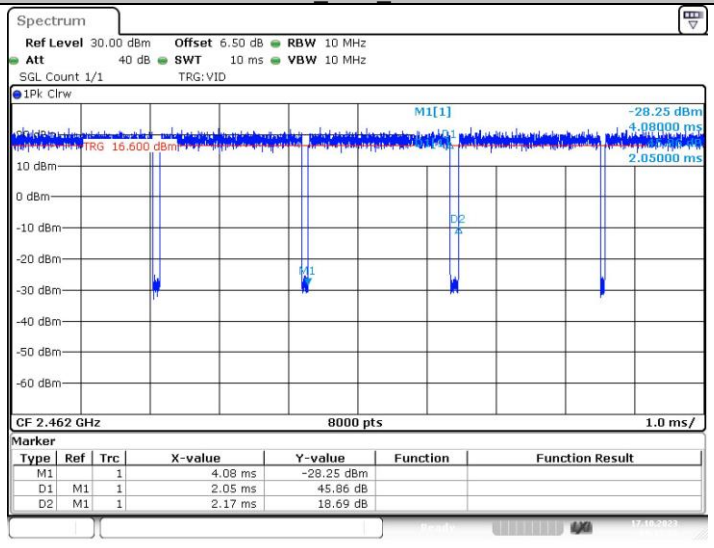
11G_Ant1_2412



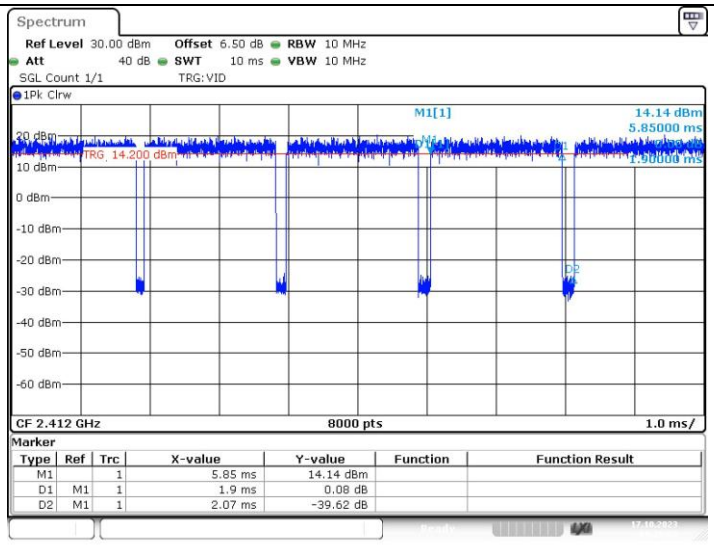
11G_Ant1_2437



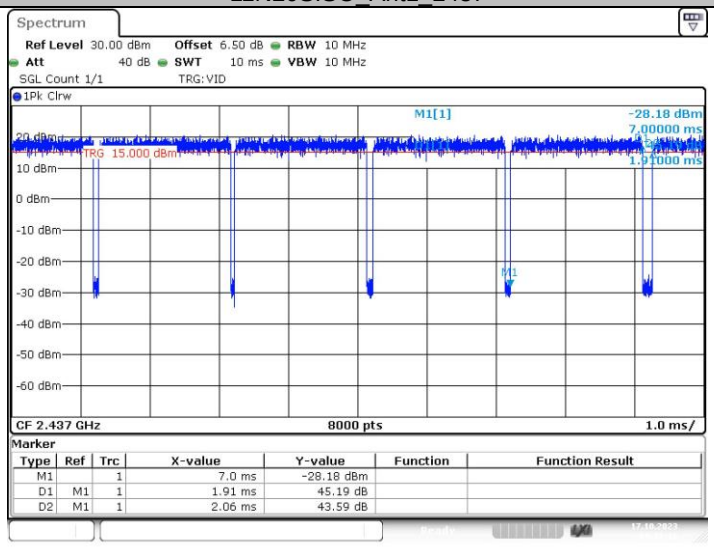
11G_Ant1_2462



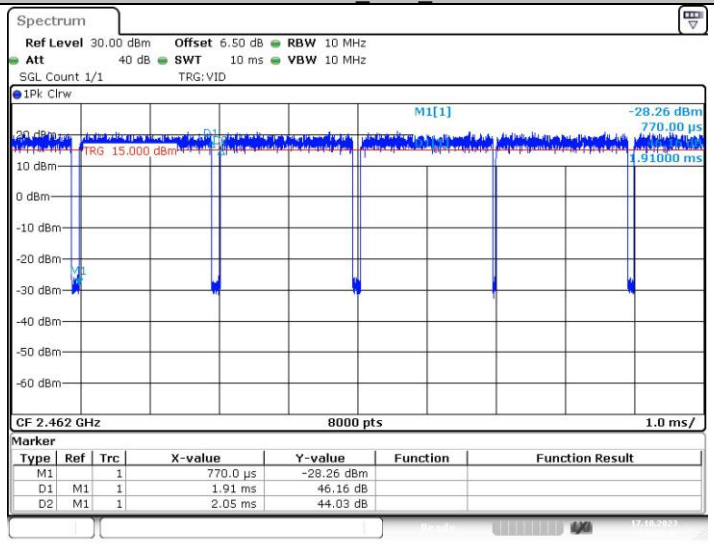
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462



3.9. Antenna Requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C 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 antenna that uses a unique coupling to the intentional radiator, 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.
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i)
(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi 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 6dBi.

Test Result

The directional gain of the antenna is less than 6dBi, please refer to the EUT internal photographs antenna photo.

************************THE END*************************