FCC RF Test Report

APPLICANT	:	SHANGHAI KINGNUO INTELLICOM TECHNOLOGY CO., LTD
EQUIPMENT	:	WiFi6 Wireless Bridge Core Board
BRAND NAME	:	KingNuo IntelliCom
MODEL NAME	:	XPC660-PIE-U
FCC ID	:	2BNUI-XPC660PIEU
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System
TEST DATE(S)	:	Jan. 09, 2025 ~ Feb. 08, 2025

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia

ACCREDITED
Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR4D1004A	Rev. 01	Initial issue of report	Mar. 19, 2025

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Report Only	-
3.2	15.247(b)	Power Output Measurement	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	-
		Conducted Spurious Emission		Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.02 dB at 4924.00 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 9.24 dB at 0.152 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

1 General Description

1.1 Applicant

SHANGHAI KINGNUO INTELLICOM TECHNOLOGY CO., LTD
Floor 5, building 11, No. 6055, Jinhai highway, Fengxian District,Shanghai

1.2 Manufacturer

SHANGHAI KINGNUO INTELLICOM TECHNOLOGY CO., LTD
Floor 5, building 11, No. 6055, Jinhai highway, Fengxian District,Shanghai

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	WiFi6 Wireless Bridge Core Board
Brand Name	KingNuo IntelliCom
Model Name	XPC660-PIE-U
FCC ID	2BNUI-XPC660PIEU
SN Code	Conducted/Conduction/Radiation: XPC660CN900001
SW Version	V300R24C02B025
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to antenna	**<SISO Ant0>** 802.11b : 22.02 dBm (0.1592 W) **<SISO Ant1>** 802.11b : 17.64 dBm (0.0581 W) **<MIMO Ant0+1>** 802.11g : 29.39 dBm (0.8690 W) 802.11n HT20 : 28.81 dBm (0.7603 W) 802.11n HT40 : 27.46 dBm (0.5572 W) 802.11ax HE20 : 29.00 dBm (0.7943 W) 802.11ax HE40 : 28.22 dBm (0.6637 W)
99% Occupied Bandwidth	**<MIMO Ant0+1>** 802.11b : 12.947MHz 802.11g : 17.103MHz 802.11n HT20 : 18.182MHz 802.11n HT40 : 36.284MHz 802.11ax HE20 : 18.941MHz 802.11ax HE40 : 37.802MHz
Antenna Type / Gain	**<Ant 0> :** Dipole Antenna with gain 2.57 dBi **<Ant 1> :** Dipole Antenna with gain 2.57 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ax : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)

Note:

1. 802.11b supports SISO mode only.
2. The device supports WLAN MIMO CDD mode for 802.11g/n/ax.
3. For WLAN SISO & MIMO mode, the whole testing has assessed only MIMO mode by referring to the higher normal output power.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	CO01-KS 03CH08-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	TH01-KS	Tonscend	JS1120-3 test system China_210602	3.3.10
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437	-	-

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

SISO Antenna

Modulation	Data Rate
802.11b	1 Mbps

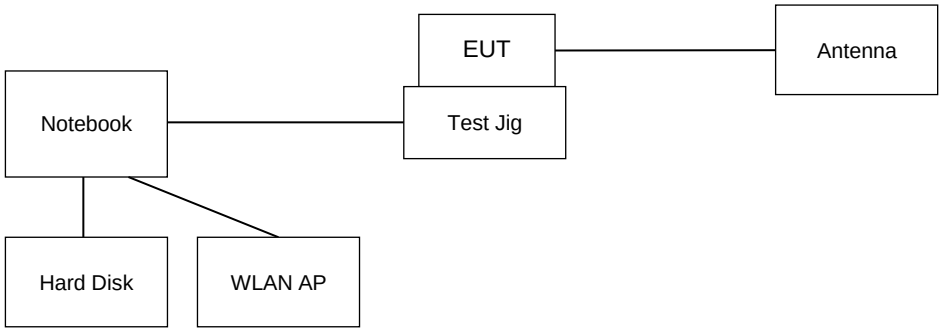
MIMO Antenna

Modulation	Data Rate
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ax HE20	MCS0
802.11ax HE40	MCS0

Test Cases	
AC Conducted Emission	Mode 1 :WLAN TX + Charging from NB + Test Jig
Remark: For Radiated Test Cases, The tests were performance with Adapter and USB Cable.	

2.3 Connection Diagram of Test System

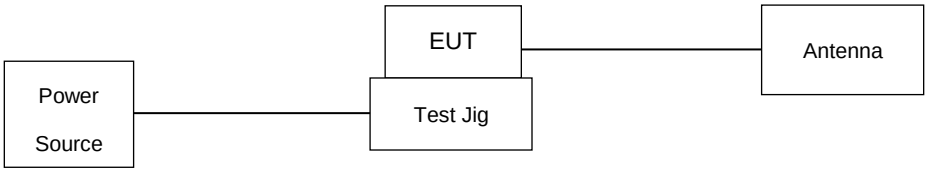
AC Conducted Emission:



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

Radiated Emission:



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
2.	Hard DISK	WD	C6B	N/A	N/A	N/A
3.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
4.	Adapter	N/A	N/A	N/A	N/A	N/A
5.	Antenna	N/A	N/A	N/A	N/A	N/A
6.	Test Jig	N/A	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 11.91 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 11.91 + 10 = 21.91 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

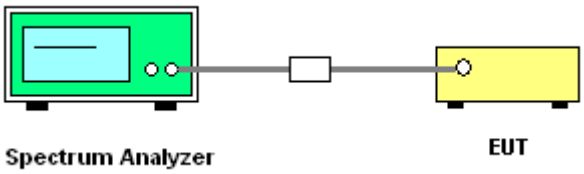
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) ≥ 3*RBW. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1%~5% of OBW and set the Video bandwidth (VBW) approximately three times the RBW.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

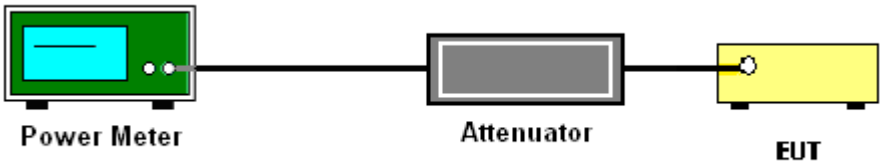
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
2. The RF output of EUT was connected to the power meter 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. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

2.4GHz Band Single Antenna																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
11b	1Mbps	1	1	2412	21.79	17.64		30.00	30.00	2.57	2.57	24.36	20.21	36.00	36.00	Pass
11b	1Mbps	1	6	2437	21.24	17.10		30.00	30.00	2.57	2.57	23.81	19.67	36.00	36.00	Pass
11b	1Mbps	1	11	2462	22.02	16.41		30.00	30.00	2.57	2.57	24.59	18.98	36.00	36.00	Pass

2.4GHz Band MIMO																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
11g	6Mbps	2	1	2412	25.58	24.54	28.10	30.00		2.57		30.67		36.00		Pass
11g	6Mbps	2	6	2437	26.86	25.84	29.39	30.00		2.57		31.96		36.00		Pass
11g	6Mbps	2	11	2462	25.58	24.14	27.93	30.00		2.57		30.50		36.00		Pass
HT20	MCS0	2	1	2412	25.56	25.15	28.37	30.00		2.57		30.94		36.00		Pass
HT20	MCS0	2	6	2437	26.18	25.38	28.81	30.00		2.57		31.38		36.00		Pass
HT20	MCS0	2	11	2462	24.87	22.04	26.69	30.00		2.57		29.26		36.00		Pass
HT40	MCS0	2	3	2422	21.06	18.81	23.09	30.00		2.57		25.66		36.00		Pass
HT40	MCS0	2	6	2437	25.03	23.77	27.46	30.00		2.57		30.03		36.00		Pass
HT40	MCS0	2	9	2452	22.58	20.07	24.51	30.00		2.57		27.08		36.00		Pass

2.4GHz Band MIMO																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
						Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
HE20	MCS0	2	1	2412	Full	24.61	23.13	26.94	30.00		2.57		29.51		36.00		Pass
HE20	MCS0	2	6	2437	Full	26.40	25.54	29.00	30.00		2.57		31.57		36.00		Pass
HE20	MCS0	2	11	2462	Full	24.53	22.08	26.49	30.00		2.57		29.06		36.00		Pass
HE40	MCS0	2	3	2422	Full	22.75	20.28	24.70	30.00		2.57		27.27		36.00		Pass
HE40	MCS0	2	6	2437	Full	25.77	24.57	28.22	30.00		2.57		30.79		36.00		Pass
HE40	MCS0	2	9	2452	Full	23.41	21.46	25.55	30.00		2.57		28.12		36.00		Pass

3.2.6 Test Result of Average Output Power (Reporting Only)

2.4GHz Band Single Antenna																				
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power with duty factor (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail	Setting	
					Ant 0	Ant 1	Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1		Ant 0	Ant 1
11b	1Mbps	1	1	2412	0.06	0.06	19.38	15.22		30.00	30.00	2.57	2.57	21.95	17.79	36.00	36.00	Pass	50.00	67.00
11b	1Mbps	1	6	2437	0.06	0.06	18.81	14.68		30.00	30.00	2.57	2.57	21.38	17.25	36.00	36.00	Pass	58.00	73.00
11b	1Mbps	1	11	2462	0.06	0.06	19.62	13.98		30.00	30.00	2.57	2.57	22.19	16.55	36.00	36.00	Pass	56.00	77.00

2.4GHz Band MIMO																				
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power with duty factor (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail	Setting	
					Ant0	Ant1	Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1		Ant0	Ant1
11g	6Mbps	2	1	2412	0.35	0.33	16.73	14.36	18.72	30.00		2.57		21.29		36.00		Pass	17.00	
11g	6Mbps	2	6	2437	0.35	0.33	18.39	15.90	20.33	30.00		2.57		22.90		36.00		Pass	13.00	
11g	6Mbps	2	11	2462	0.35	0.33	16.57	13.01	18.16	30.00		2.57		20.73		36.00		Pass	19.00	
HT20	MCS0	2	1	2412	0.37	0.37	17.55	16.08	19.89	30.00		2.57		22.46		36.00		Pass	14.00	
HT20	MCS0	2	6	2437	0.37	0.37	18.50	16.91	20.79	30.00		2.57		23.36		36.00		Pass	12.00	
HT20	MCS0	2	11	2462	0.37	0.37	16.21	13.92	18.22	30.00		2.57		20.79		36.00		Pass	21.00	
HT40	MCS0	2	3	2422	0.67	0.67	11.07	8.35	12.93	30.00		2.57		15.50		36.00		Pass	29.00	
HT40	MCS0	2	6	2437	0.67	0.67	15.98	13.45	17.91	30.00		2.57		20.48		36.00		Pass	18.00	
HT40	MCS0	2	9	2452	0.67	0.67	12.53	9.79	14.38	30.00		2.57		16.95		36.00		Pass	25.00	

2.4GHz Band MIMO																				
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Duty Factor (dB)		Average Conducted Power with duty factor (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail	Setting	
						Ant0	Ant1	Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1		Ant0	Ant1
HE20	MCS0	2	1	2412	Full	0.40	0.40	15.34	12.94	17.31	30.00		2.57		19.88		36.00		Pass	19.00	
HE20	MCS0	2	6	2437	Full	0.40	0.40	17.72	15.26	19.67	30.00		2.57		22.24		36.00		Pass	13.00	
HE20	MCS0	2	11	2462	Full	0.40	0.40	15.52	12.18	17.17	30.00		2.57		19.74		36.00		Pass	20.00	
HE40	MCS0	2	3	2422	Full	0.68	0.73	11.16	8.60	13.08	30.00		2.57		15.65		36.00		Pass	28.00	
HE40	MCS0	2	6	2437	Full	0.68	0.73	15.76	13.21	17.68	30.00		2.57		20.25		36.00		Pass	18.00	
HE40	MCS0	2	9	2452	Full	0.68	0.73	12.20	9.48	14.06	30.00		2.57		16.63		36.00		Pass	25.00	

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

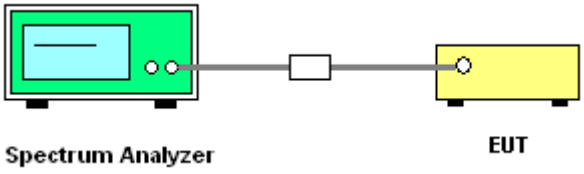
3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01:

   Method (a): Measure and sum the spectra across the outputs.

   The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

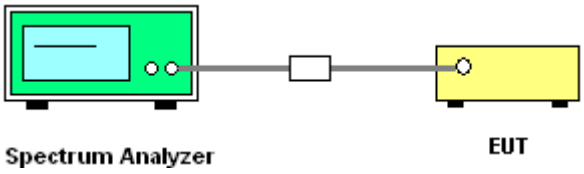
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 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. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Please refer to Appendix A.

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

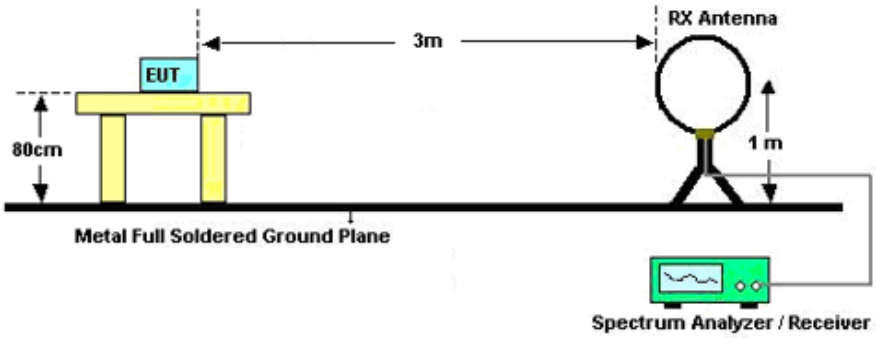
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

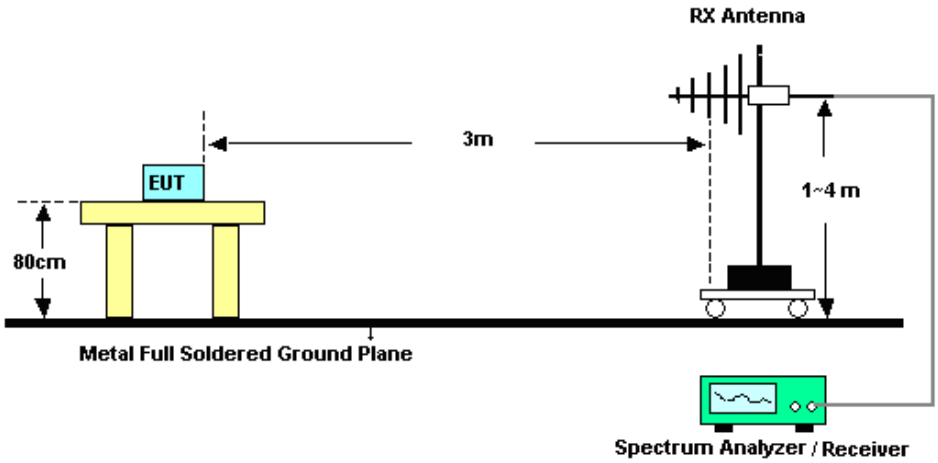
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

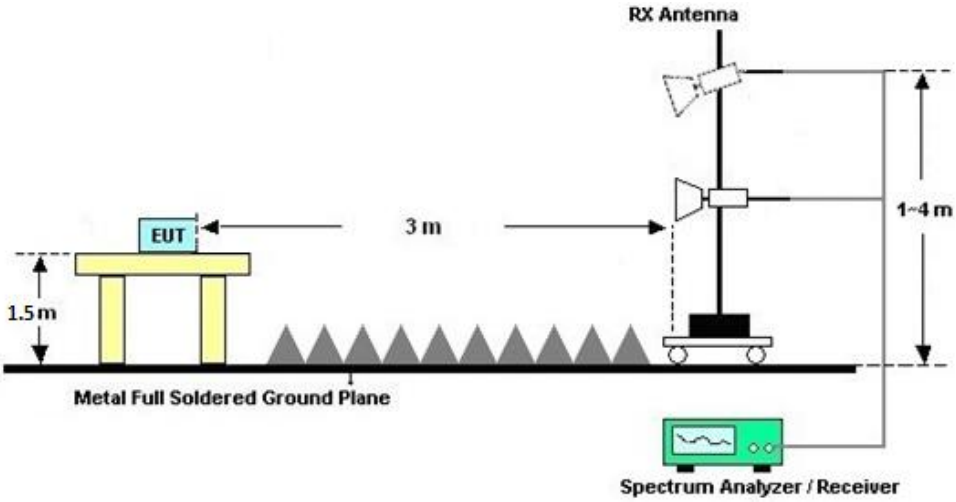
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

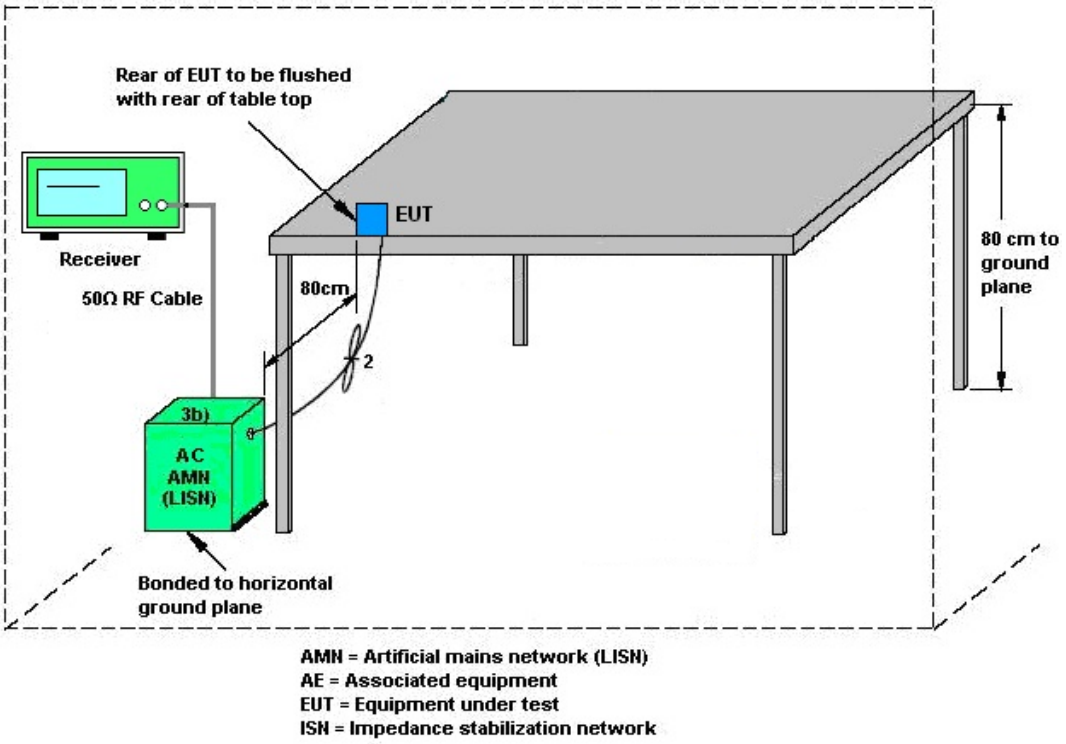
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain G_{ANT} is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

<CDD Modes>

	Ant. 0 (dBi)	Ant. 1 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
2.4 GHz	2.57	2.57	2.57	5.58	0.00	0.00

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

PSD Limit Reduction = DG(PSD) – 6dBi, (min = 0)

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Keysight	N9038A	MY57290151	3Hz~8.5GHz;Max 30dBm	Jul. 04, 2024	Jan. 14, 2025~ Feb. 08, 2025	Jul. 03, 2025	Radiation (03CH08-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY57441079	10Hz-44GHz	Oct. 09, 2024	Jan. 14, 2025~ Feb. 08, 2025	Oct. 08, 2025	Radiation (03CH08-KS)
Loop Antenna	R&S	HFH2-Z2E	101125	9kHz~30MHz	Sep. 08, 2024	Jan. 14, 2025~ Feb. 08, 2025	Sep. 07, 2025	Radiation (03CH08-KS)
Bilog Antenna	TESEQ	CBL 6111D	59915	30MHz-1GHz	Aug. 18, 2024	Jan. 14, 2025~ Feb. 08, 2025	Aug.17, 2025	Radiation (03CH08-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00240138	1GHz~18GHz	Jul. 06, 2024	Jan. 14, 2025~ Feb. 08, 2025	Jul. 05, 2025	Radiation (03CH08-KS)
high gain Amplifier	EM	EM01G18GA	060890	1Ghz-18Ghz	Jul. 23, 2024	Jan. 14, 2025~ Feb. 08, 2025	Jul. 22, 2025	Radiation (03CH08-KS)
SHF-EHF Horn	Com-power	AH-840	101116	18GHz~40GHz	Oct. 22, 2024	Jan. 14, 2025~ Feb. 08, 2025	Oct. 21, 2025	Radiation (03CH08-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 03, 2024	Jan. 14, 2025~ Feb. 08, 2025	Jul. 02, 2025	Radiation (03CH08-KS)
Amplifier	Keysight	83017A	MY53270417	500MHz~26.5GHz	Oct. 09, 2024	Jan. 14, 2025~ Feb. 08, 2025	Oct. 08, 2025	Radiation (03CH08-KS)
Amplifier	EM	EM18G40GGA	060737	18~40GHz	Jan. 03, 2025	Jan. 14, 2025~ Feb. 08, 2025	Jan. 02, 2026	Radiation (03CH08-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Jan. 14, 2025~ Feb. 08, 2025	NCR	Radiation (03CH08-KS)
Turn Table	EM	EM 1000-T	N/A	0~360 degree	NCR	Jan. 14, 2025~ Feb. 08, 2025	NCR	Radiation (03CH08-KS)
Antenna Mast	EM	EM 1000-A	N/A	1 m~4 m	NCR	Jan. 14, 2025~ Feb. 08, 2025	NCR	Radiation (03CH08-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 18, 2024	Jan. 09, 2025	Apr. 17, 2025	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Aug. 20, 2024	Jan. 09, 2025	Aug. 19, 2025	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Apr. 18, 2024	Jan. 09, 2025	Apr. 17, 2025	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 09, 2024	Jan. 09, 2025	Oct. 08, 2025	Conduction (CO01-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 10, 2024	Feb. 05, 2025~ Feb. 08, 2025	Oct. 09, 2025	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 02, 2025	Feb. 05, 2025~ Feb. 08, 2025	Jan. 01, 2026	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 02, 2025	Feb. 05, 2025~ Feb. 08, 2025	Jan. 01, 2026	Conducted (TH01-KS)

NCR: No Calibration Required

5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Conducted Spurious Emission & Bandedge	**±2.22 dB**
Occupied Channel Bandwidth	**±0.1%**
Conducted Power	**±0.50 dB**
Conducted Power Spectral Density	**±0.90 dB**
Frequency	**±0.04 Hz**

Uncertainty of AC Conducted Emission Measurement (0.15 MHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.84 dB**

Uncertainty of Radiated Emission Measurement (9 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.30 dB**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.04 dB**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.26 dB**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.40 dB**

---------- THE END ----------

Appendix A. Conducted Test Results

Ambient Condition: 25 ℃, 45 %RH	
According Standard: ■Part15C	
Test Date: 2025.2.5~2025.2.8	**Test Engineer:** Smile

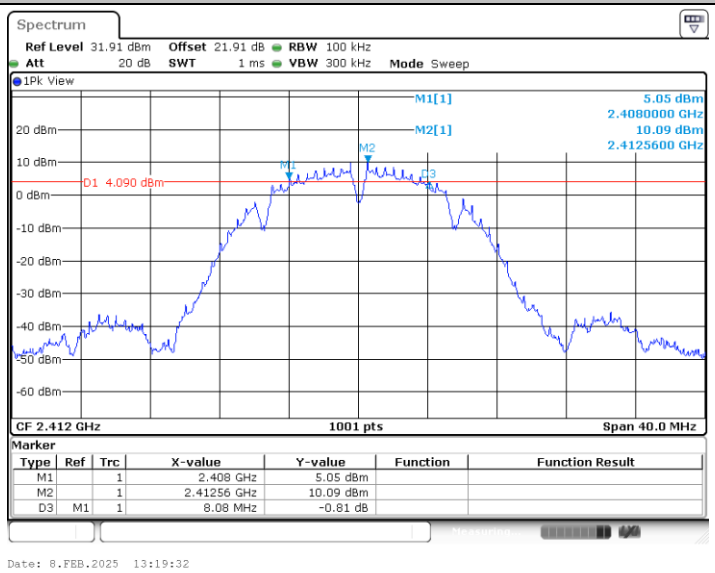
DTS Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant0	2412	8.08	2408.00	2416.08	0.5	PASS
	Ant1	2412	8.08	2408.00	2416.08	0.5	PASS
	Ant0	2437	8.56	2432.52	2441.08	0.5	PASS
	Ant1	2437	8.08	2433.00	2441.08	0.5	PASS
	Ant0	2462	8.56	2457.52	2466.08	0.5	PASS
	Ant1	2462	8.56	2458.00	2466.56	0.5	PASS
11G-CDD	Ant0	2412	16.04	2403.92	2419.96	0.5	PASS
	Ant1	2412	16.00	2403.92	2419.92	0.5	PASS
	Ant0	2437	15.80	2429.16	2444.96	0.5	PASS
	Ant1	2437	16.08	2428.88	2444.96	0.5	PASS
	Ant0	2462	16.32	2453.88	2470.20	0.5	PASS
	Ant1	2462	16.08	2453.88	2469.96	0.5	PASS
11N20-CDD	Ant0	2412	16.28	2403.92	2420.20	0.5	PASS
	Ant1	2412	16.92	2403.28	2420.20	0.5	PASS
	Ant0	2437	16.80	2428.64	2445.44	0.5	PASS
	Ant1	2437	16.44	2428.76	2445.20	0.5	PASS
	Ant0	2462	16.76	2453.68	2470.44	0.5	PASS
	Ant1	2462	16.32	2453.88	2470.20	0.5	PASS
11N40MIMO	Ant0	2422	35.20	2404.48	2439.68	0.5	PASS
	Ant1	2422	35.12	2404.48	2439.60	0.5	PASS
	Ant0	2437	35.12	2419.48	2454.60	0.5	PASS
	Ant1	2437	35.12	2419.48	2454.60	0.5	PASS
	Ant0	2452	35.12	2434.48	2469.60	0.5	PASS
	Ant1	2452	35.12	2434.48	2469.60	0.5	PASS
11AX20MIMO	Ant0	2412	18.16	2403.00	2421.16	0.5	PASS
	Ant1	2412	17.08	2403.40	2420.48	0.5	PASS
	Ant0	2437	16.96	2429.24	2446.20	0.5	PASS
	Ant1	2437	17.36	2428.36	2445.72	0.5	PASS
	Ant0	2462	17.40	2453.36	2470.76	0.5	PASS
	Ant1	2462	17.44	2453.28	2470.72	0.5	PASS
11AX40MIMO	Ant0	2422	35.92	2403.76	2439.68	0.5	PASS
	Ant1	2422	35.92	2403.68	2439.60	0.5	PASS
	Ant0	2437	36.40	2419.40	2455.80	0.5	PASS
	Ant1	2437	36.00	2418.60	2454.60	0.5	PASS
	Ant0	2452	36.16	2433.84	2470.00	0.5	PASS
	Ant1	2452	35.20	2434.40	2469.60	0.5	PASS

Test Graphs

11B_Ant0_2412



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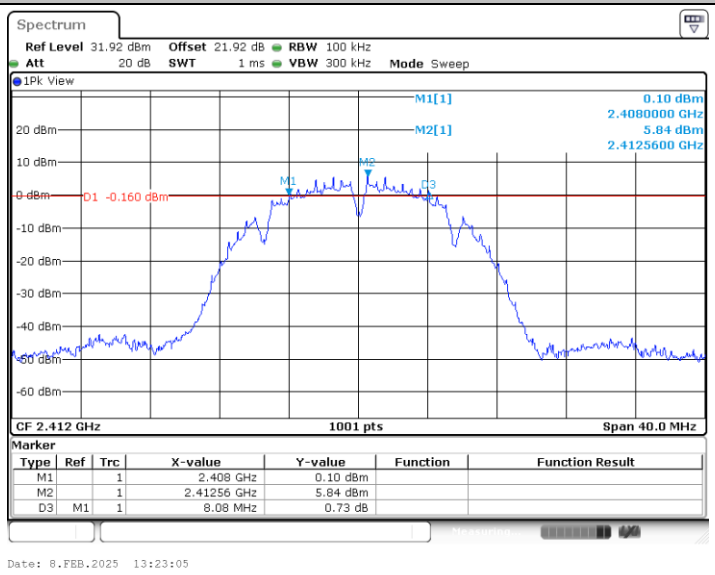

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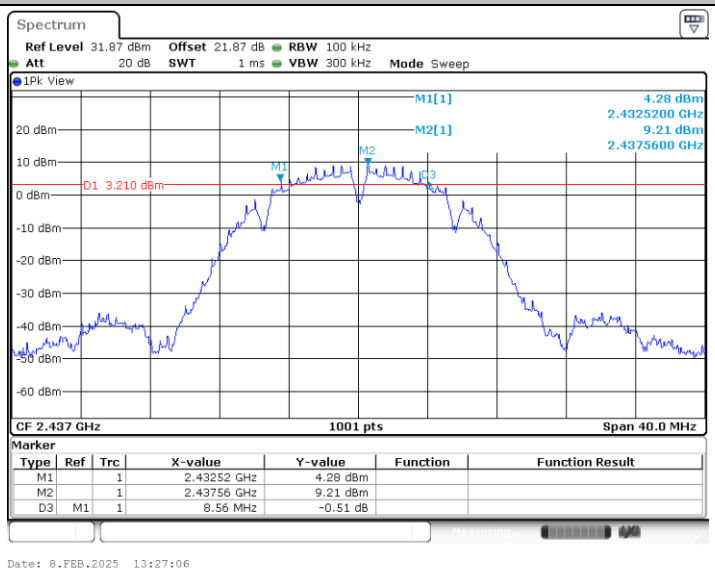

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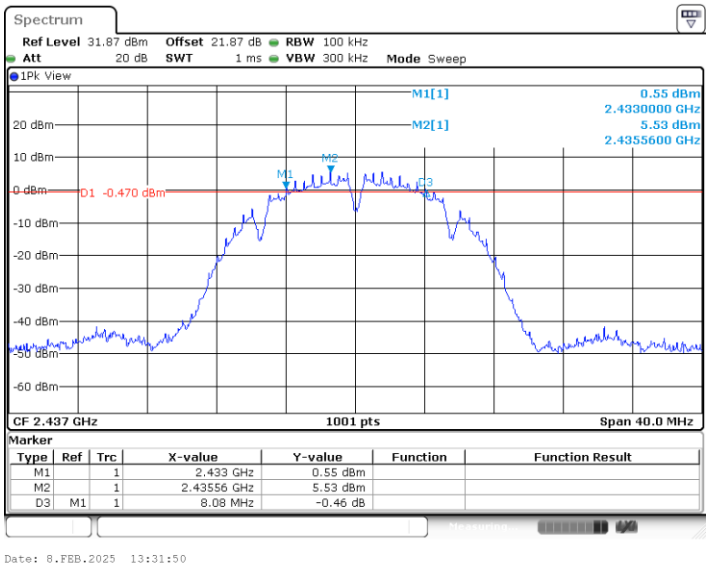

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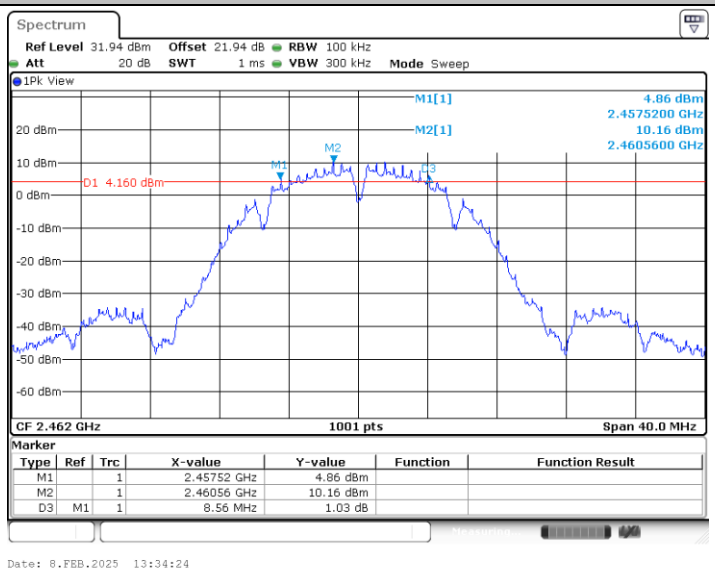

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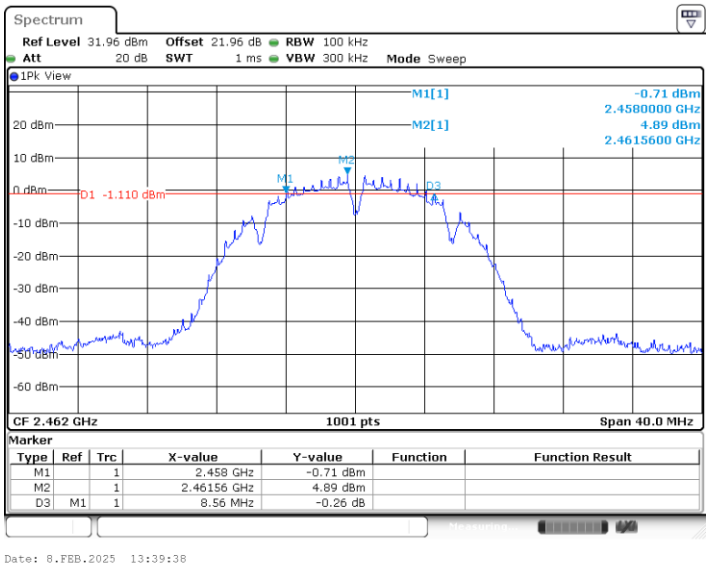

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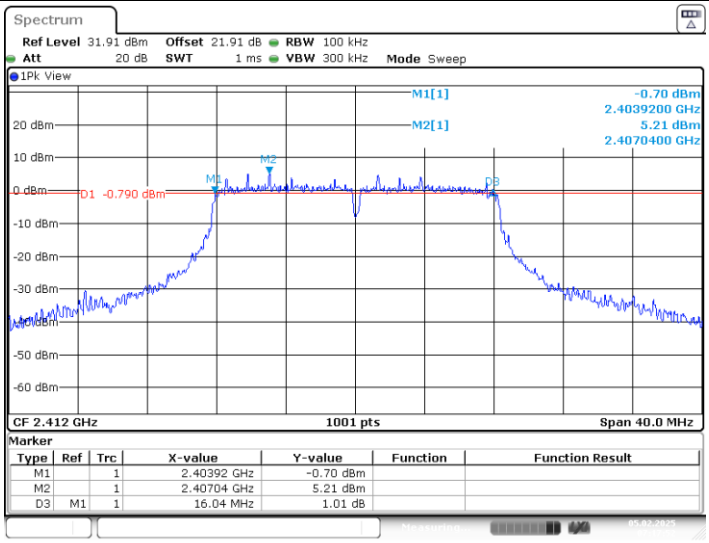

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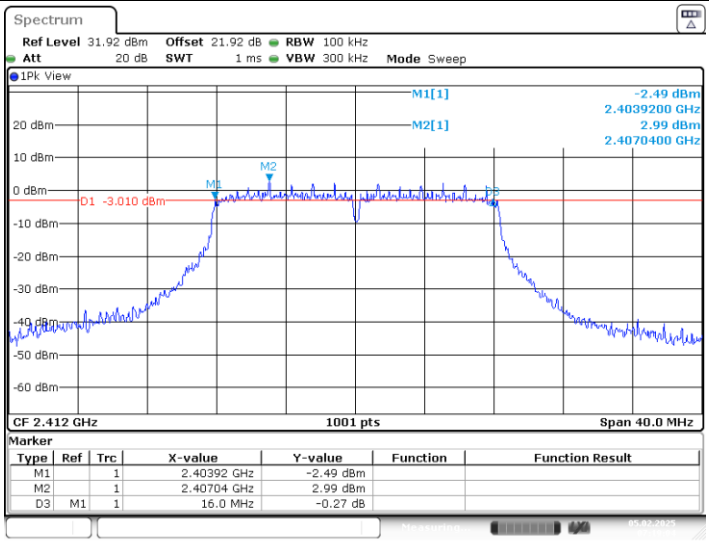

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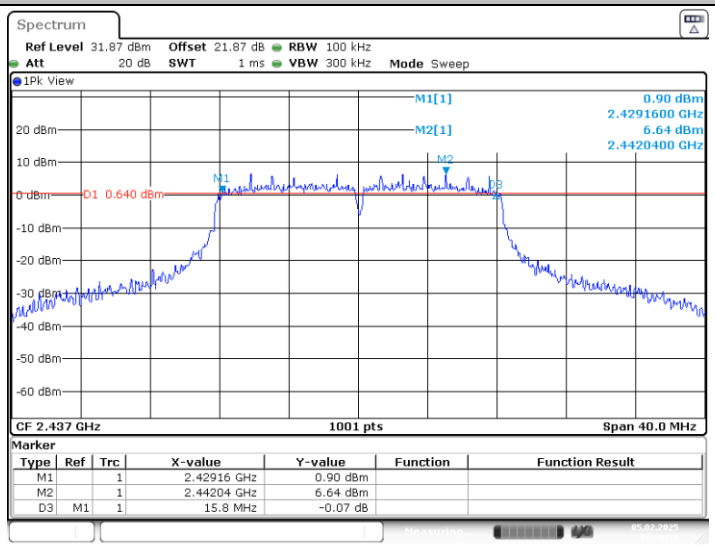

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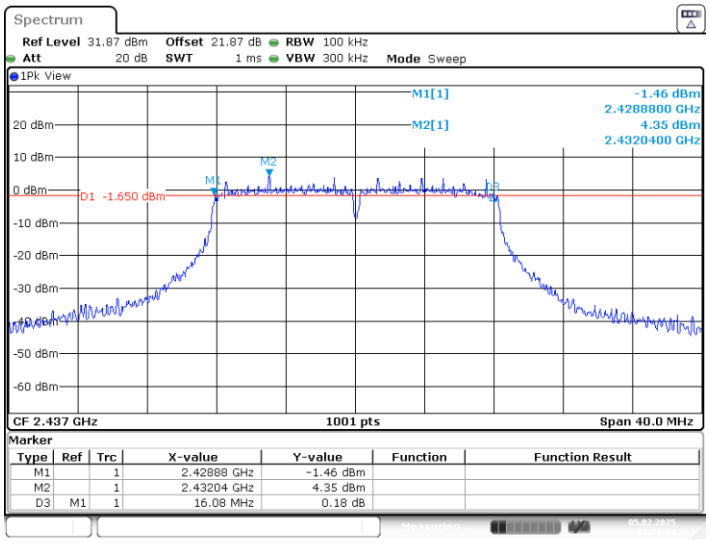

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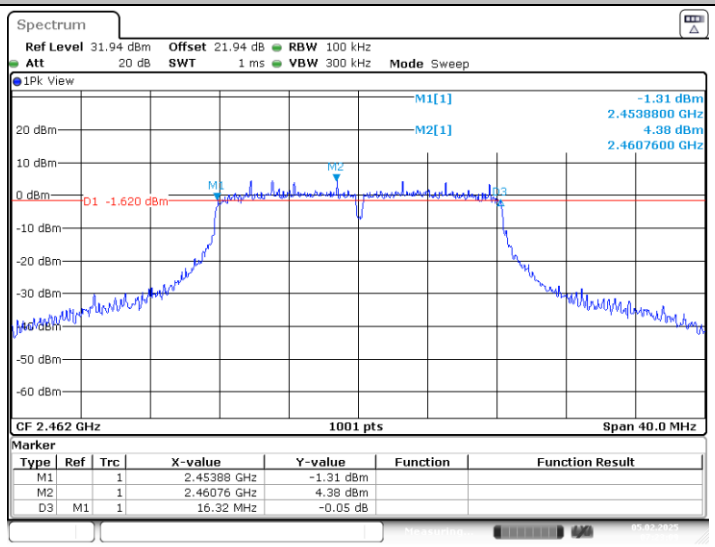

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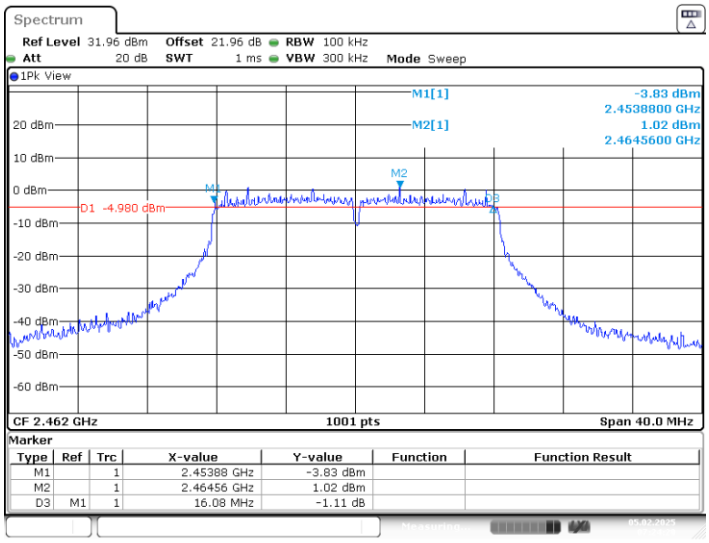

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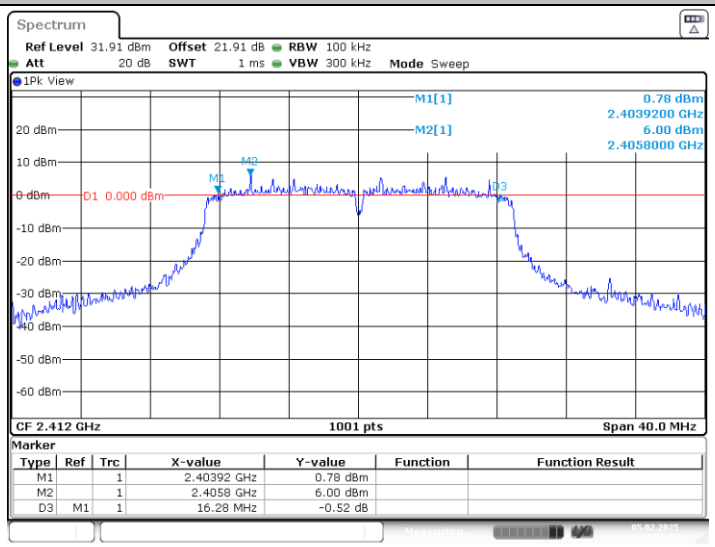

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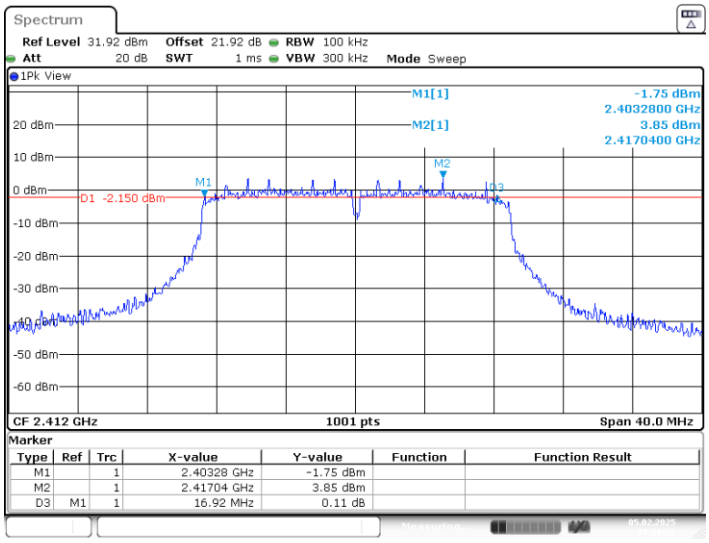

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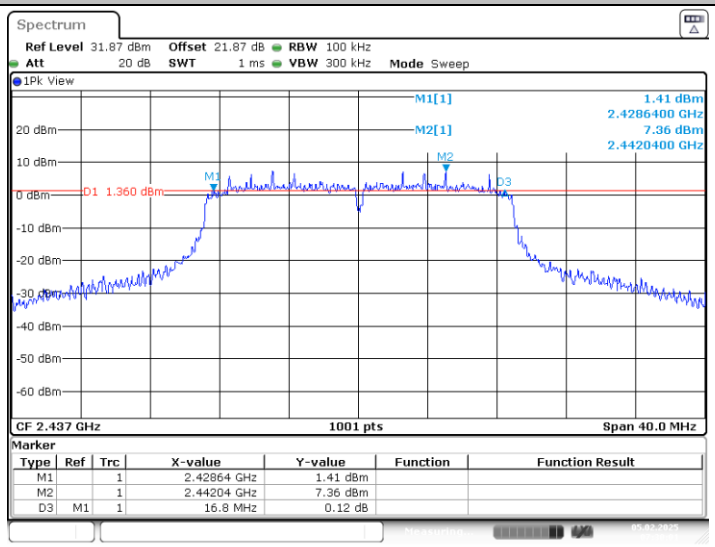

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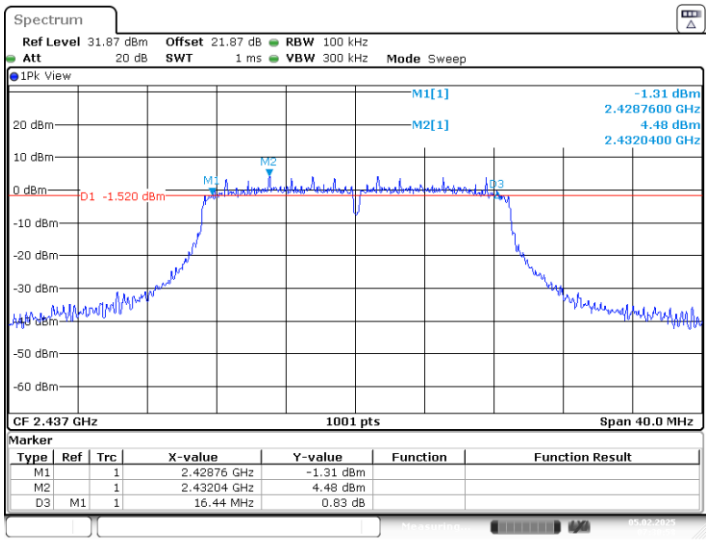
11N20-CDD_Ant1_2437



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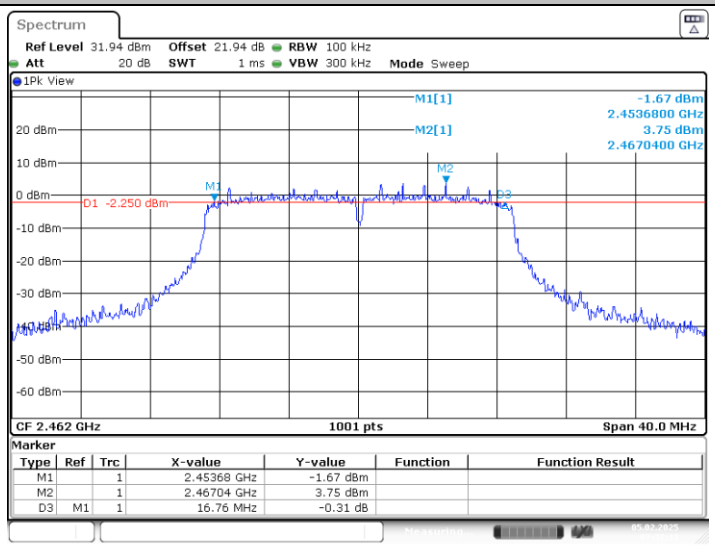
11N20-CDD_Ant0_2462



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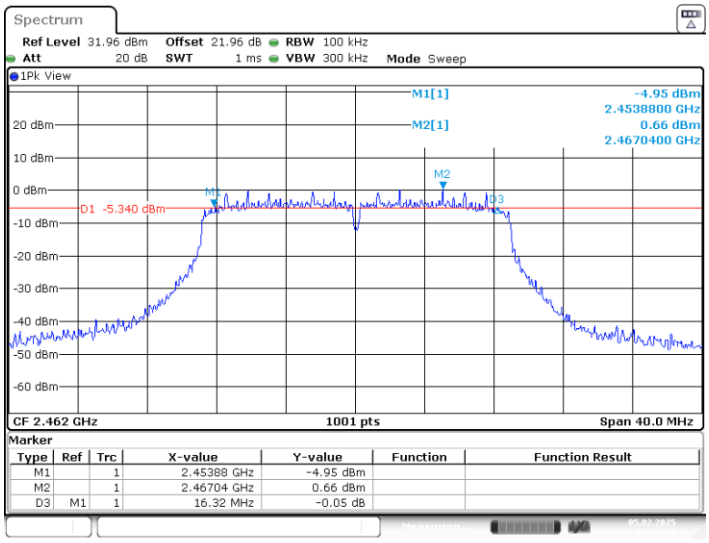
11N20-CDD_Ant1_2462



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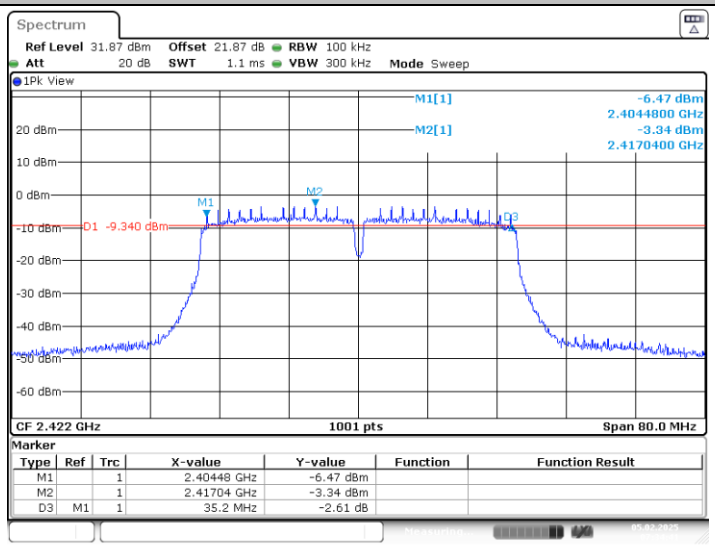
11N40MIMO_Ant0_2422



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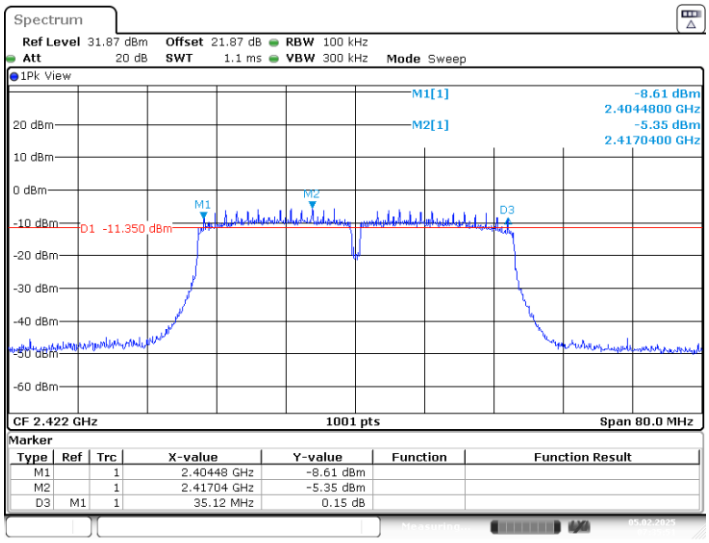

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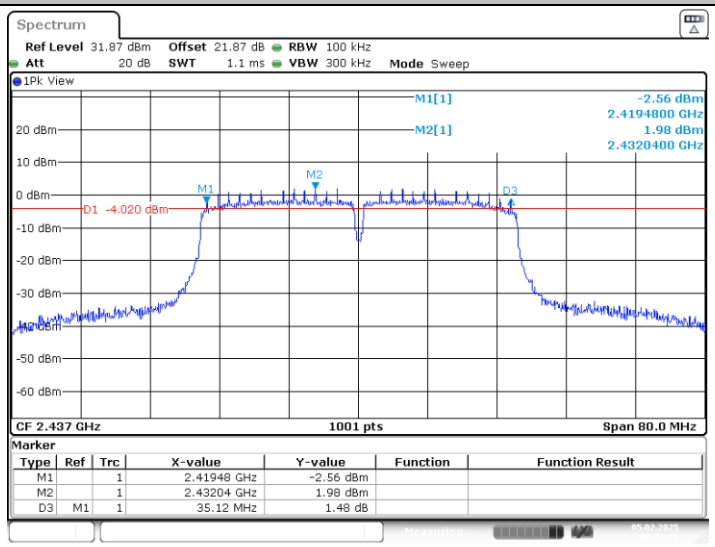

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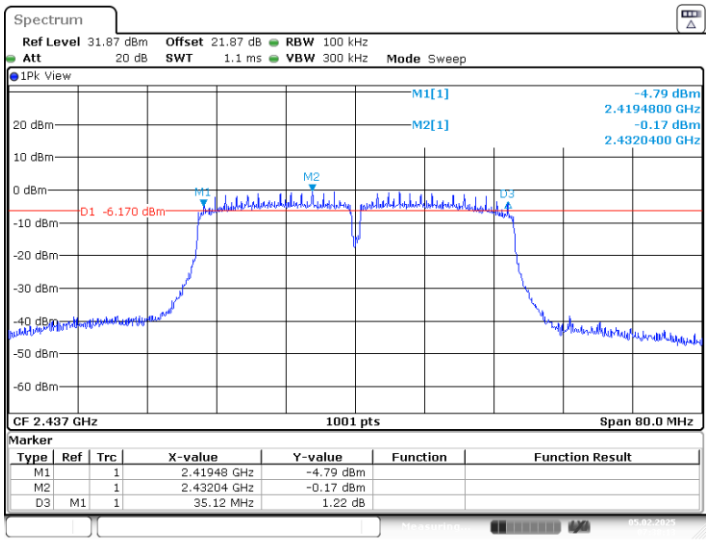

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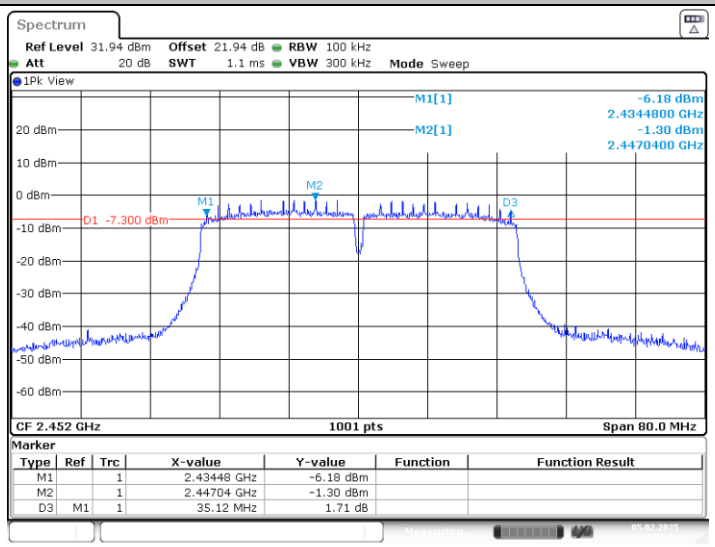
11N40MIMO_Ant0_2452



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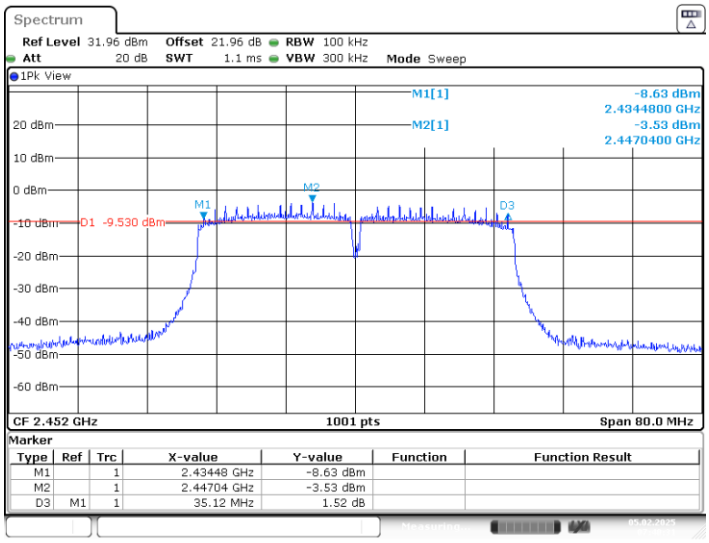

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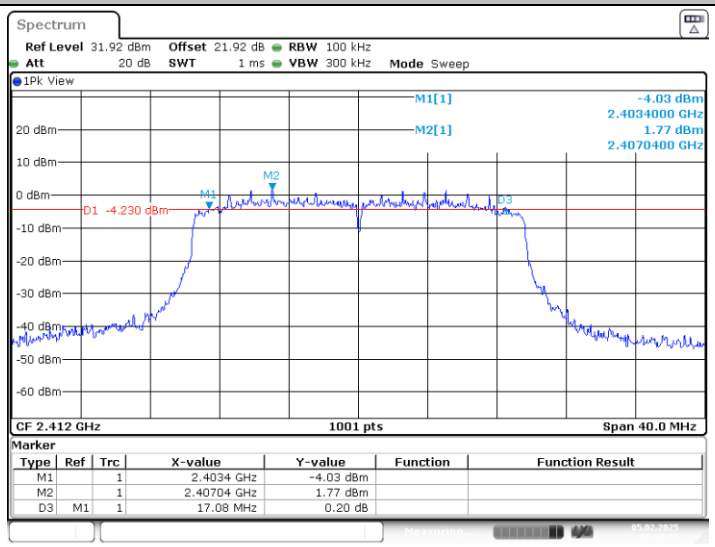
11AX20MIMO_Ant1_2412



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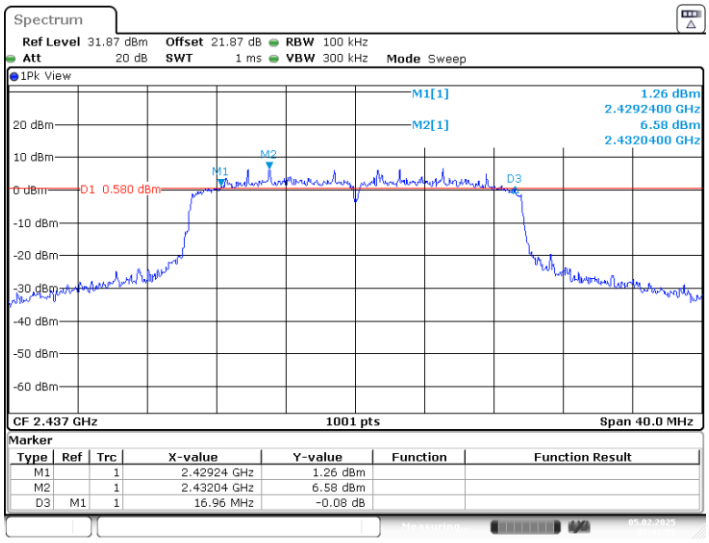

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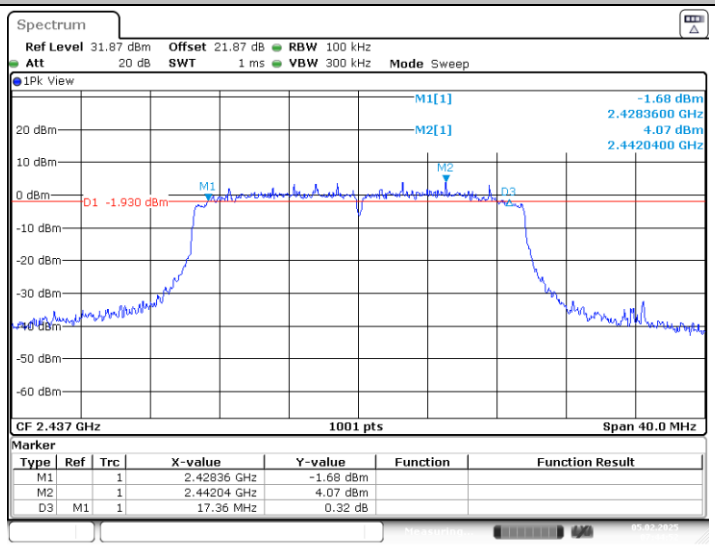

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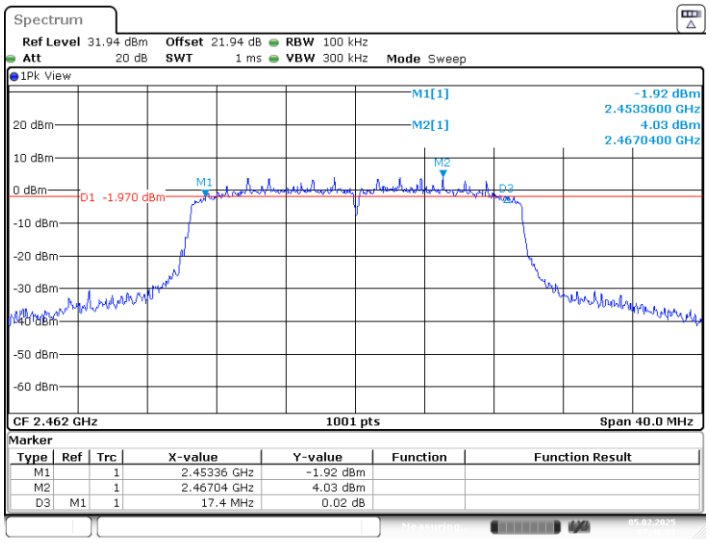

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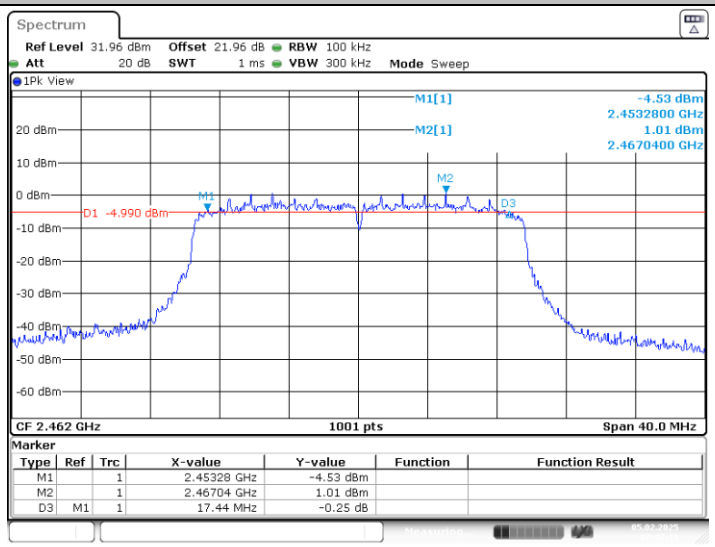

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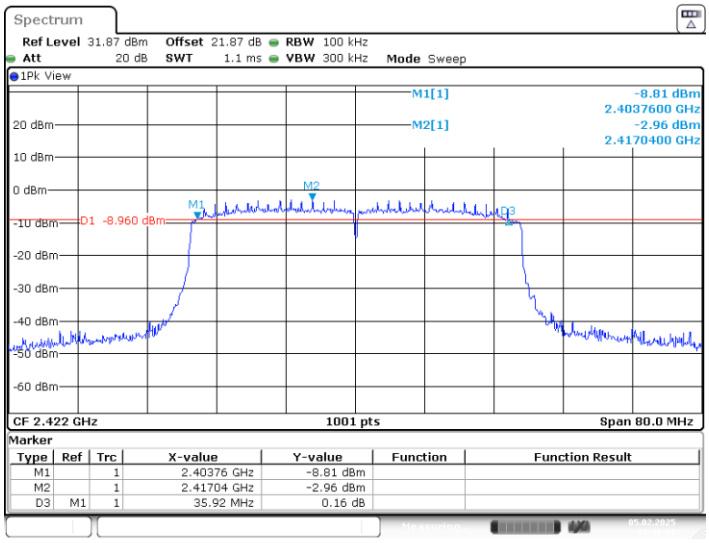

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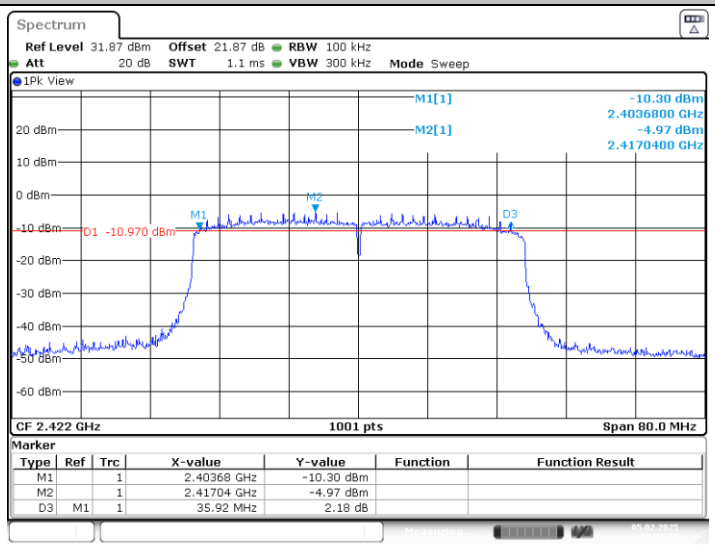

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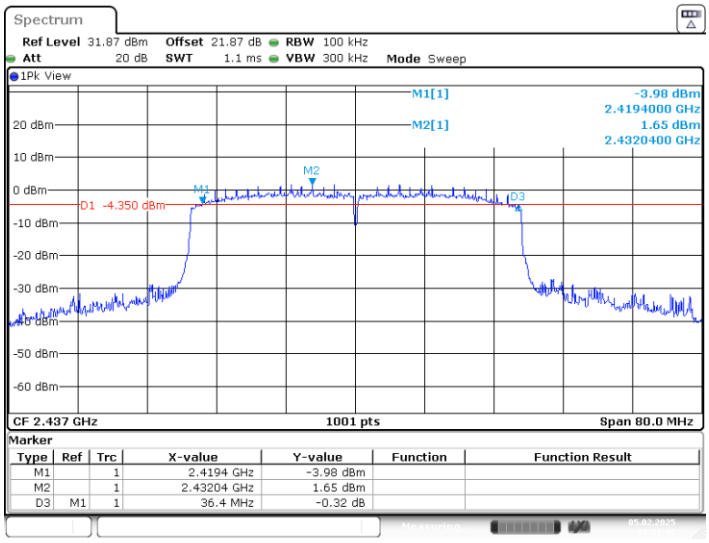

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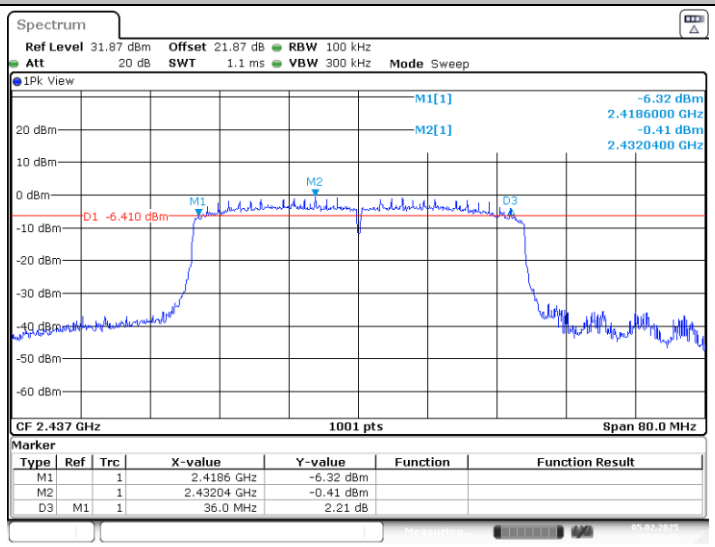

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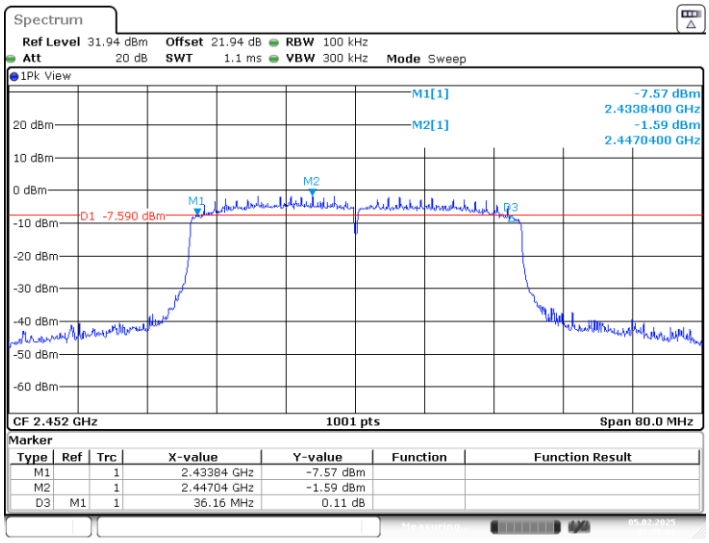

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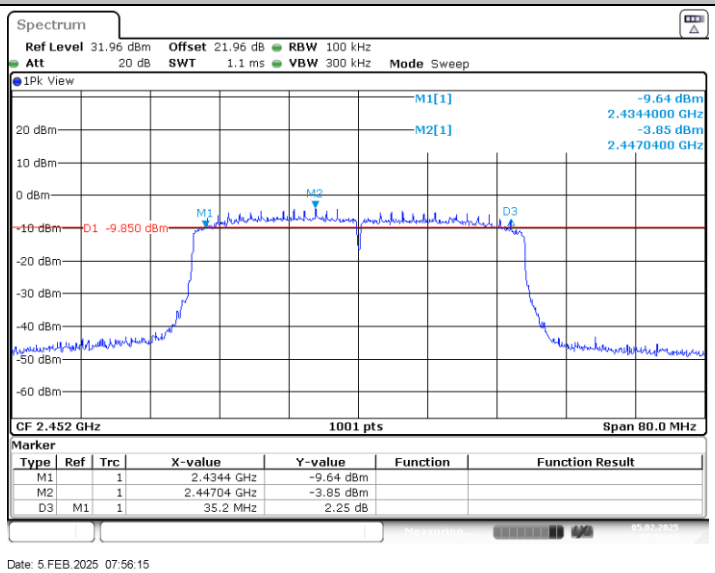


Date: 5.FEB.2025 07:56:15

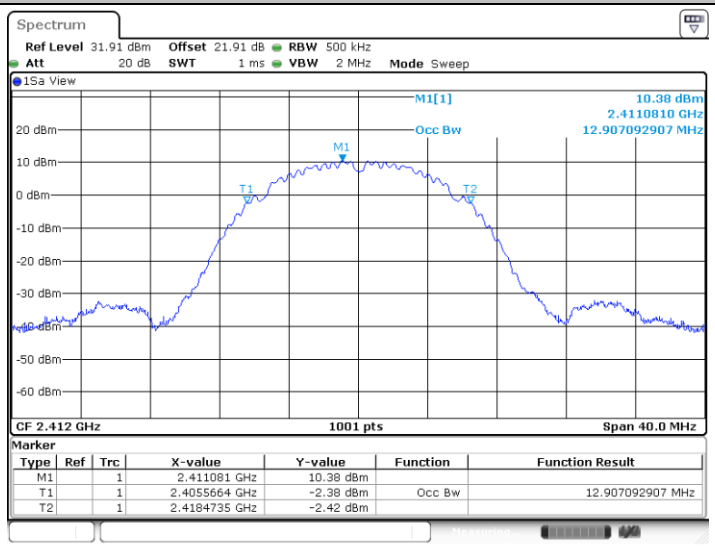
Occupied Channel Bandwidth

Test Result

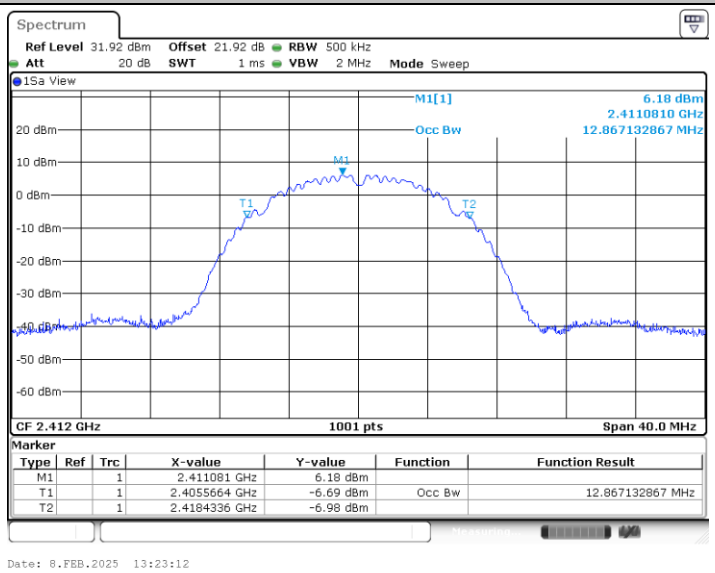
TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant0	2412	12.907	2405.5664	2418.4735	---	---
	Ant1	2412	12.867	2405.5664	2418.4336	---	---
	Ant0	2437	12.947	2430.5664	2443.5135	---	---
	Ant1	2437	12.827	2430.6064	2443.4336	---	---
	Ant0	2462	12.947	2455.5664	2468.5135	---	---
	Ant1	2462	12.827	2455.6064	2468.4336	---	---
11G-CDD	Ant0	2412	17.063	2403.4885	2420.5514	---	---
	Ant1	2412	16.783	2403.6084	2420.3916	---	---
	Ant0	2437	17.103	2428.4885	2445.5914	---	---
	Ant1	2437	16.783	2428.6484	2445.4316	---	---
	Ant0	2462	17.063	2453.4885	2470.5514	---	---
	Ant1	2462	16.743	2453.6484	2470.3916	---	---
11N20-CDD	Ant0	2412	18.102	2402.9690	2421.0709	---	---
	Ant1	2412	17.822	2403.0889	2420.9111	---	---
	Ant0	2437	18.182	2427.9690	2446.1508	---	---
	Ant1	2437	17.862	2428.0889	2445.9510	---	---
	Ant0	2462	18.062	2452.9690	2471.0310	---	---
	Ant1	2462	17.862	2453.0889	2470.9510	---	---
11N40MIMO	Ant0	2422	36.204	2403.8581	2440.0619	---	---
	Ant1	2422	36.284	2403.8581	2440.1419	---	---
	Ant0	2437	36.284	2418.8581	2455.1419	---	---
	Ant1	2437	36.204	2418.9381	2455.1419	---	---
	Ant0	2452	36.124	2433.9381	2470.0619	---	---
	Ant1	2452	36.204	2433.8581	2470.0619	---	---
11AX20MIMO	Ant0	2412	18.941	2402.5694	2421.5105	---	---
	Ant1	2412	18.941	2402.5295	2421.4705	---	---
	Ant0	2437	18.941	2427.5694	2446.5105	---	---
	Ant1	2437	18.901	2427.5694	2446.4705	---	---
	Ant0	2462	18.941	2452.5694	2471.5105	---	---
	Ant1	2462	18.941	2452.5694	2471.5105	---	---
11AX40MIMO	Ant0	2422	37.802	2403.1389	2440.9411	---	---
	Ant1	2422	37.722	2403.1389	2440.8611	---	---
	Ant0	2437	37.722	2418.1389	2455.8611	---	---
	Ant1	2437	37.642	2418.2188	2455.8611	---	---
	Ant0	2452	37.722	2433.1389	2470.8611	---	---
	Ant1	2452	37.722	2433.1389	2470.8611	---	---

Test Graphs

11B_Ant0_2412



11B_Ant1_2412



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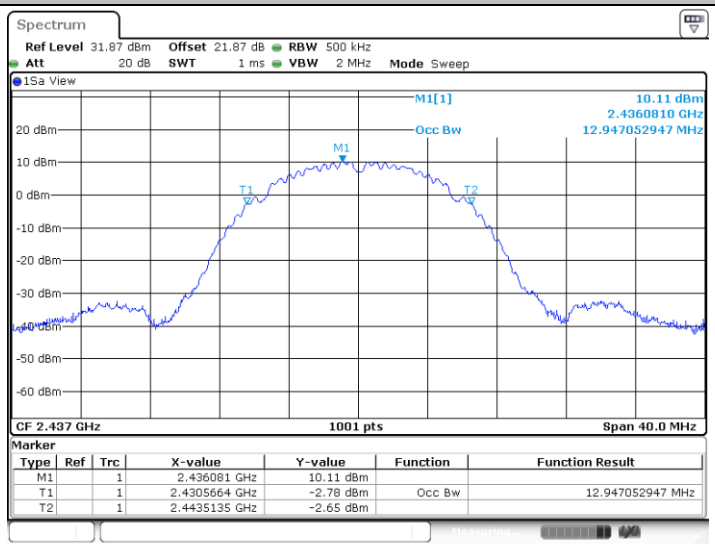

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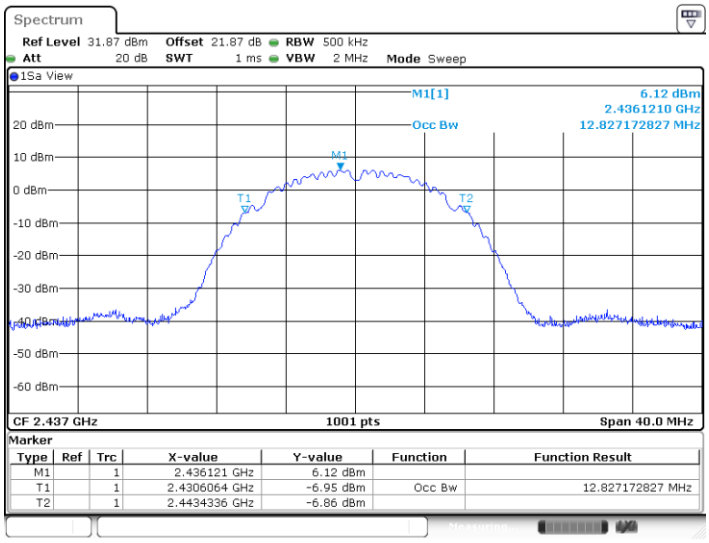

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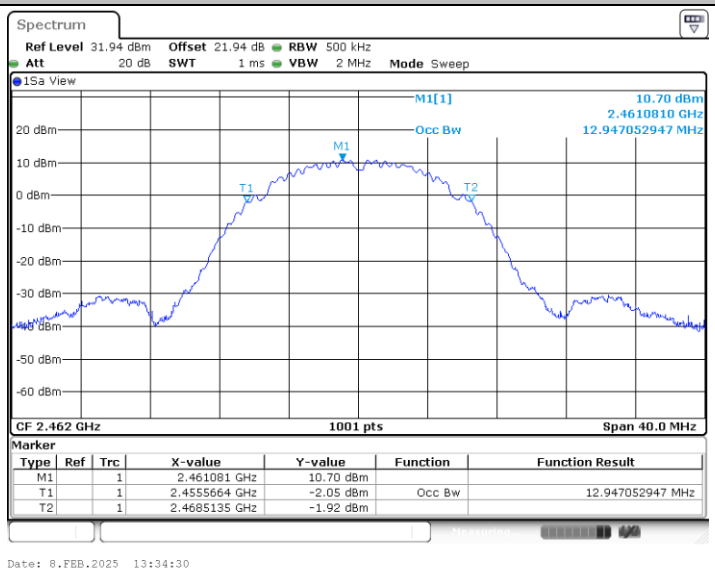

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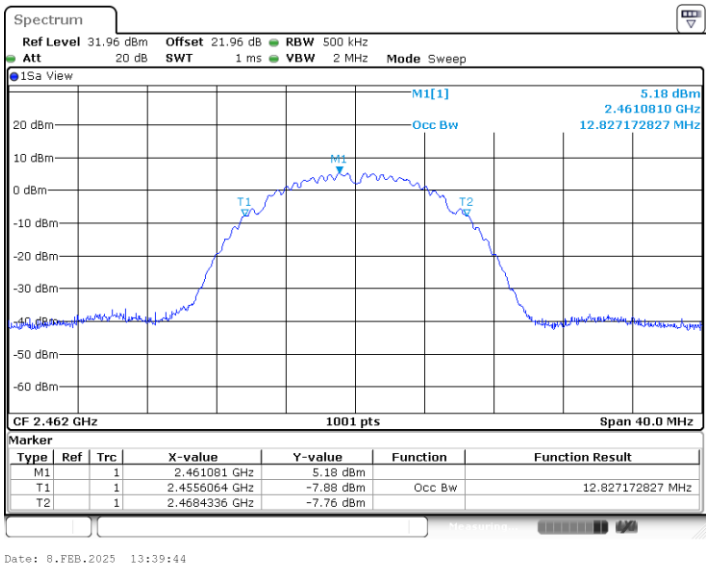

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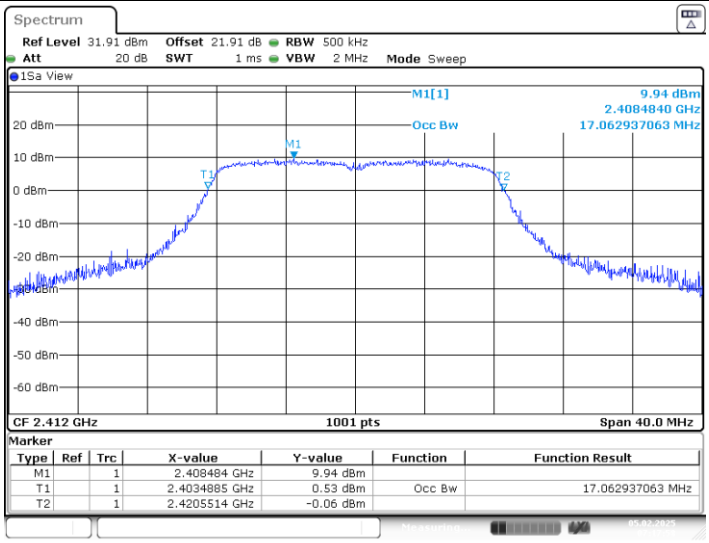

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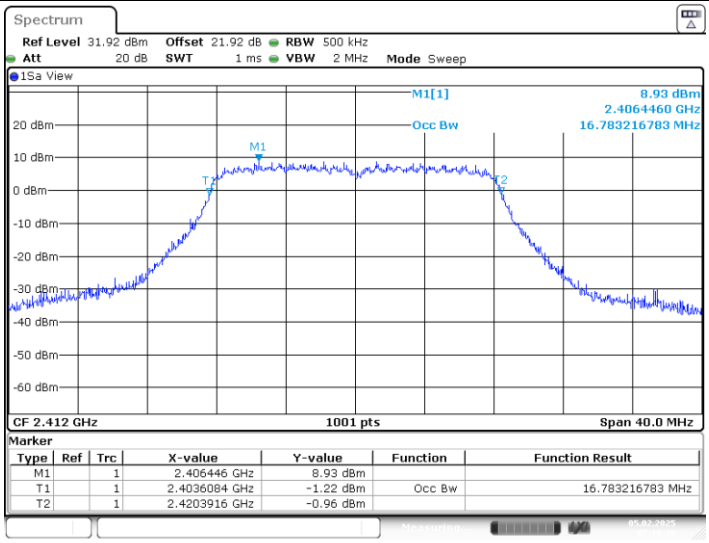

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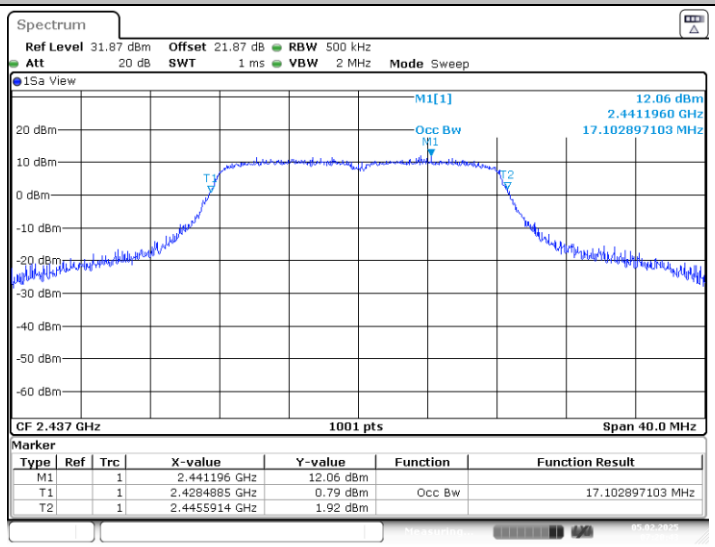

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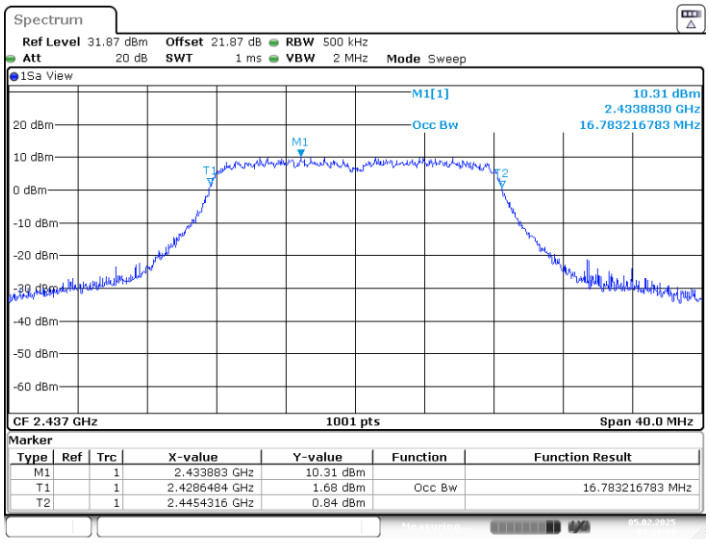

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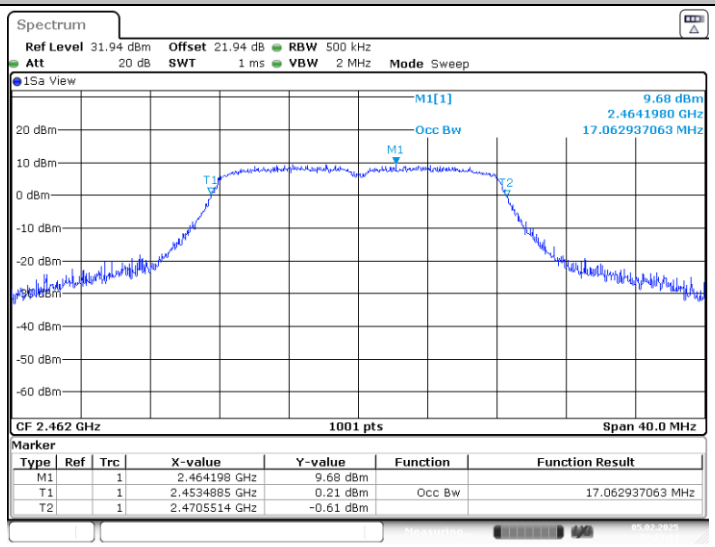

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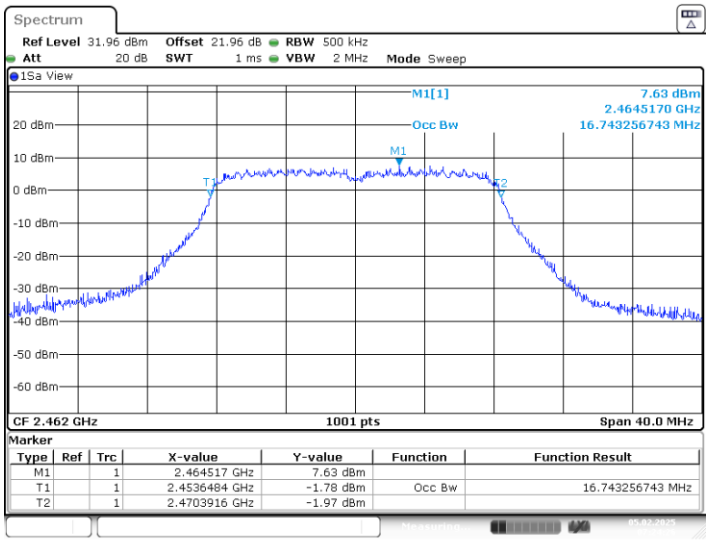

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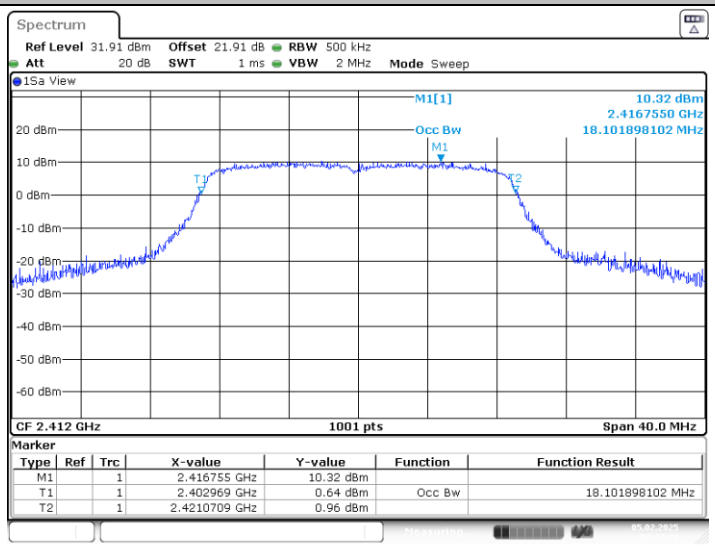

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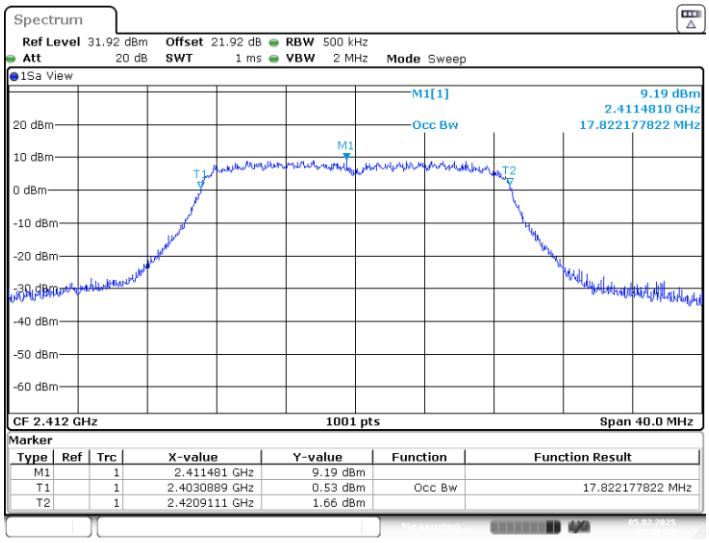

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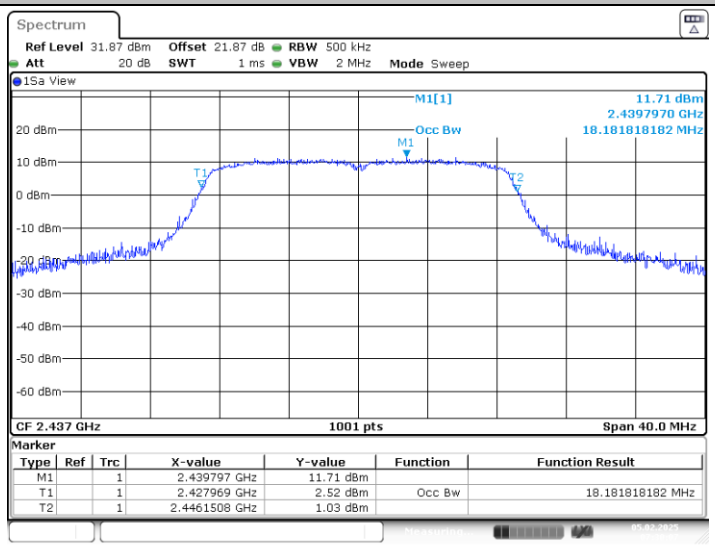

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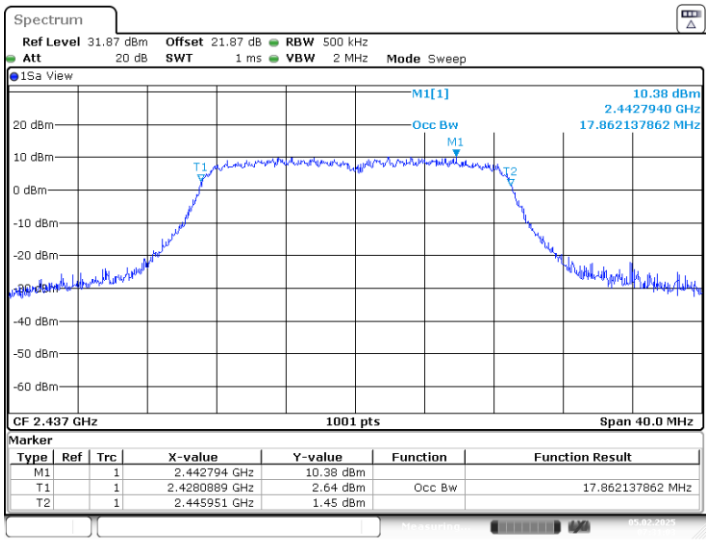

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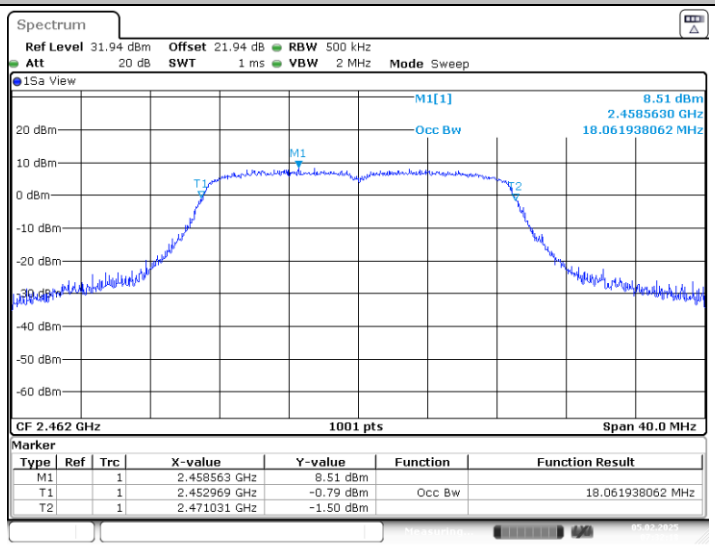

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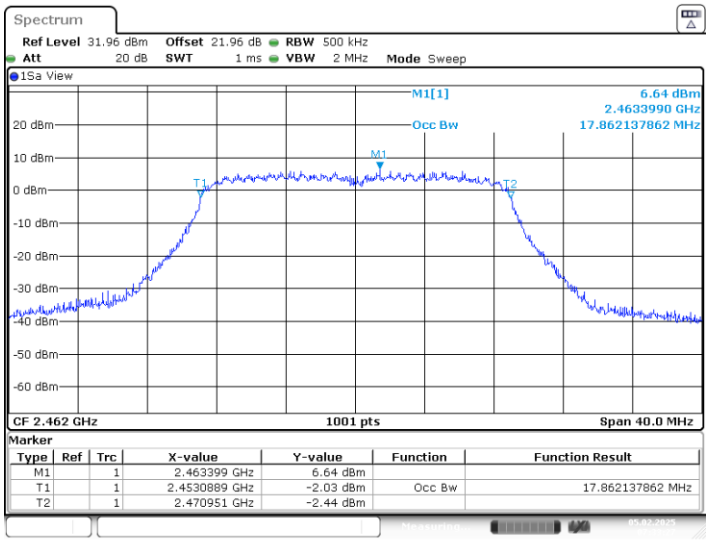

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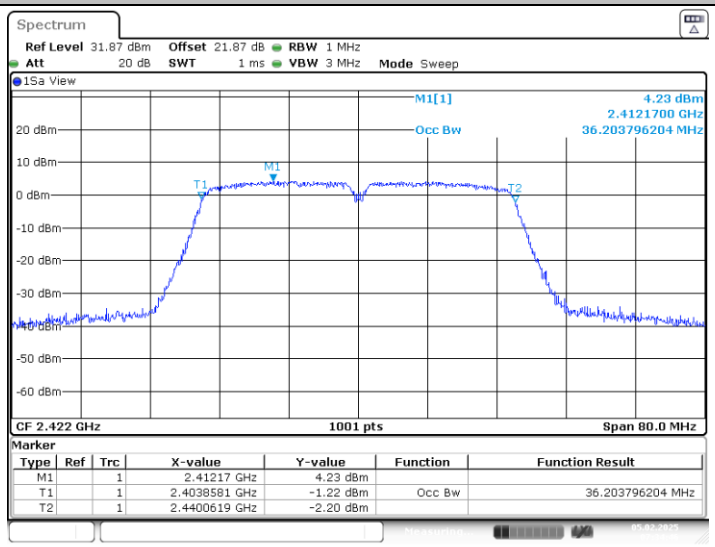

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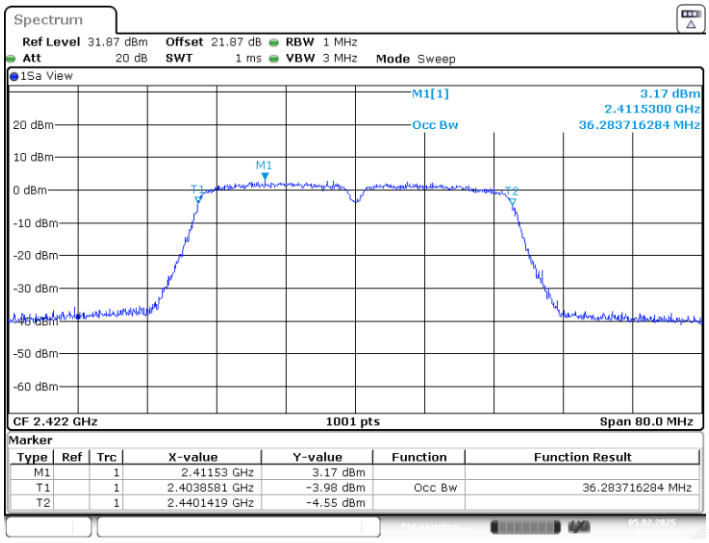

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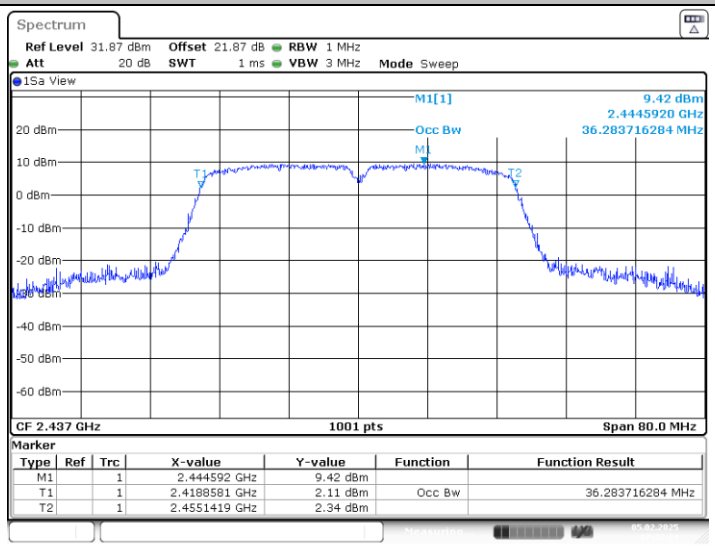

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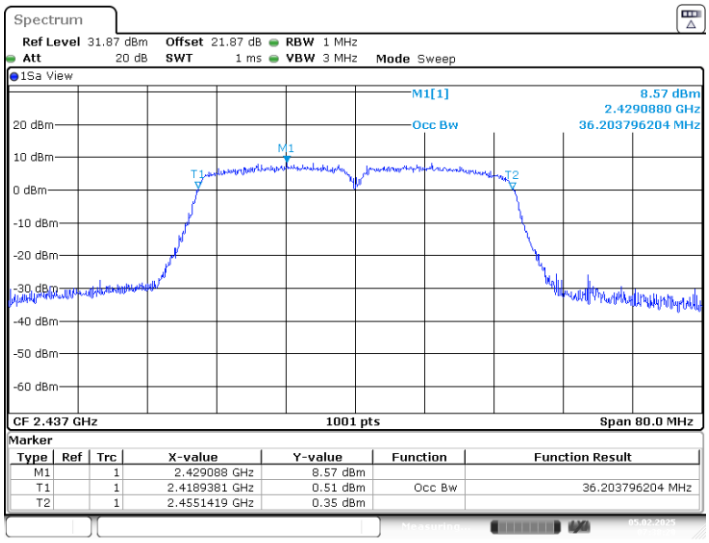
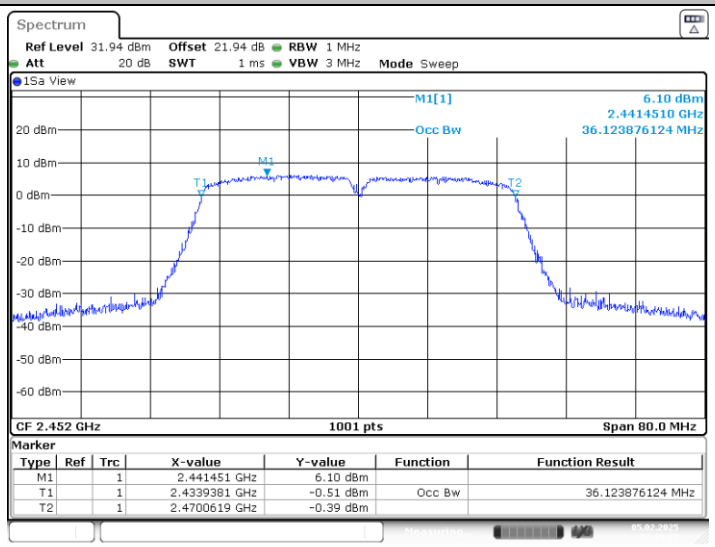


Date: 5.FEB.2025 07:38:20

11N40MIMO_Ant0_2452



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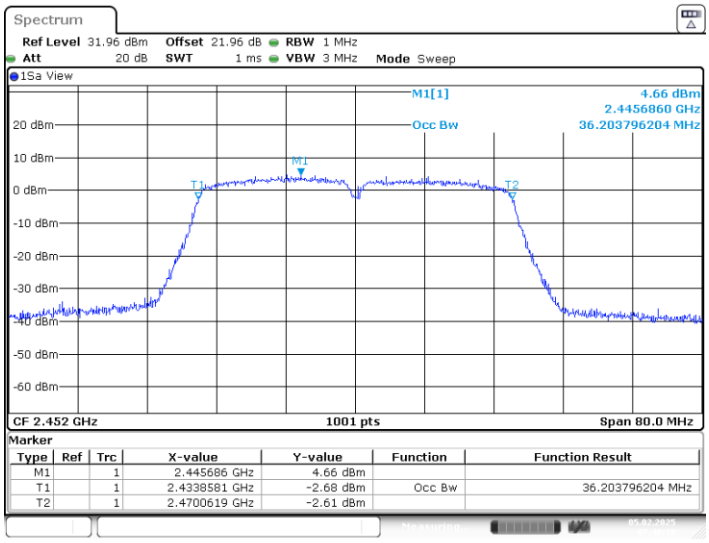
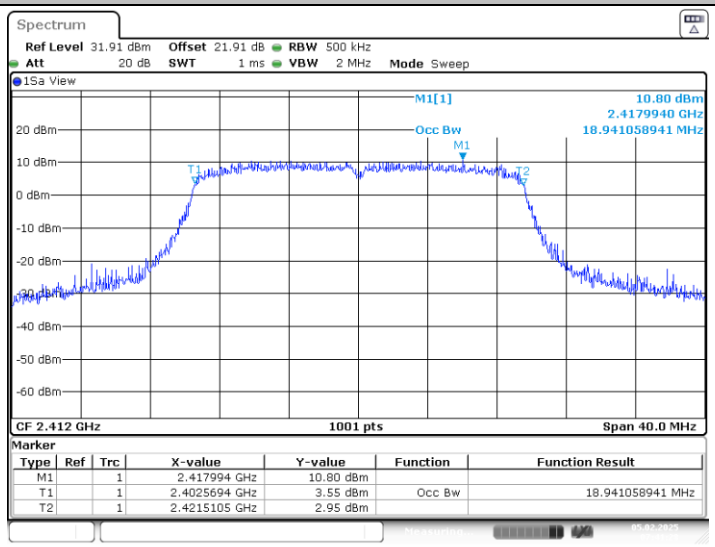
11N40MIMO_Ant1_2452



Date: 5.FEB.2025 07:40:37

11AX20MIMO_Ant0_2412



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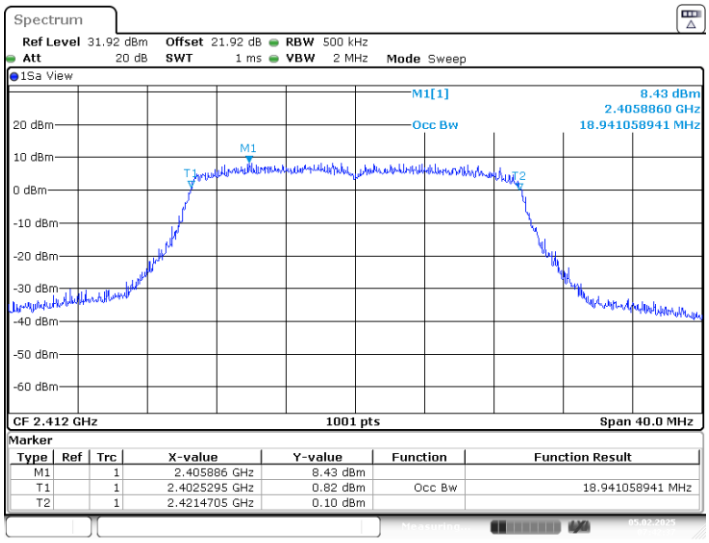
11AX20MIMO_Ant1_2412



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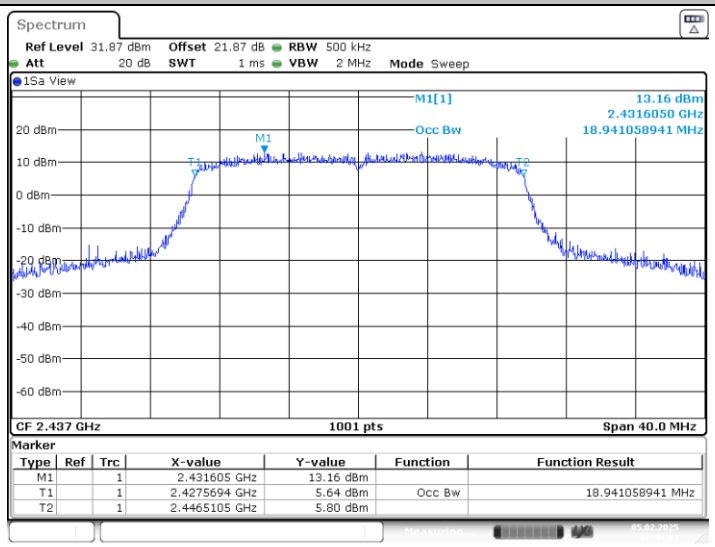
11AX20MIMO_Ant0_2437



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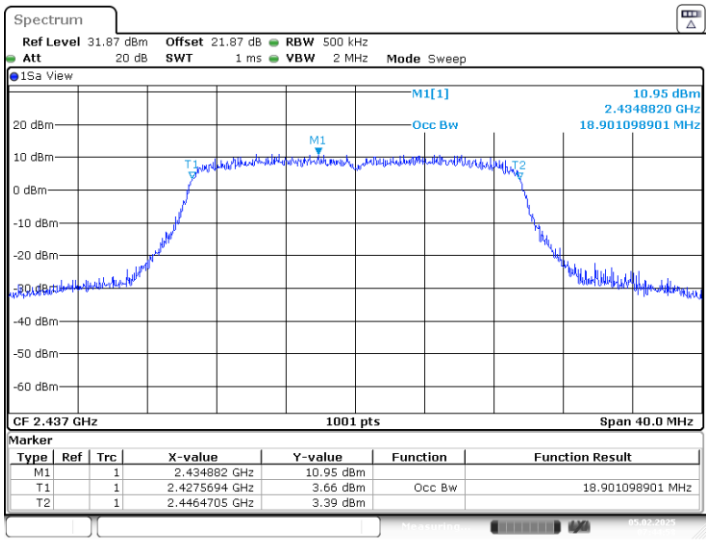
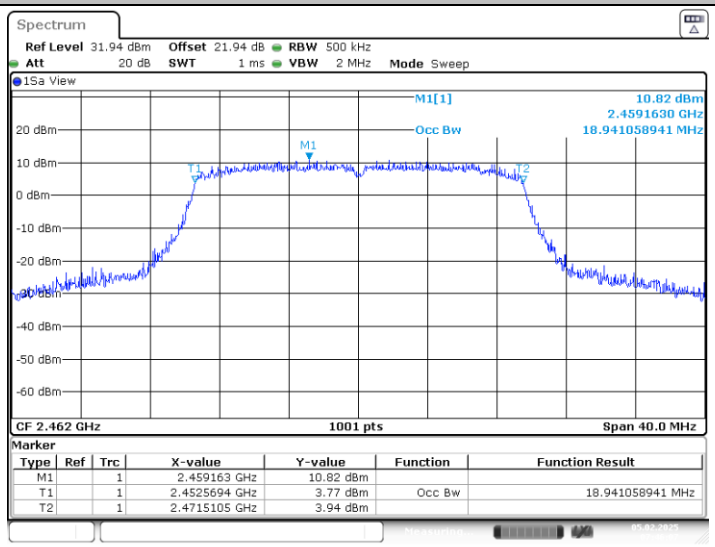


Date: 5.FEB.2025 07:44:58

11AX20MIMO_Ant0_2462



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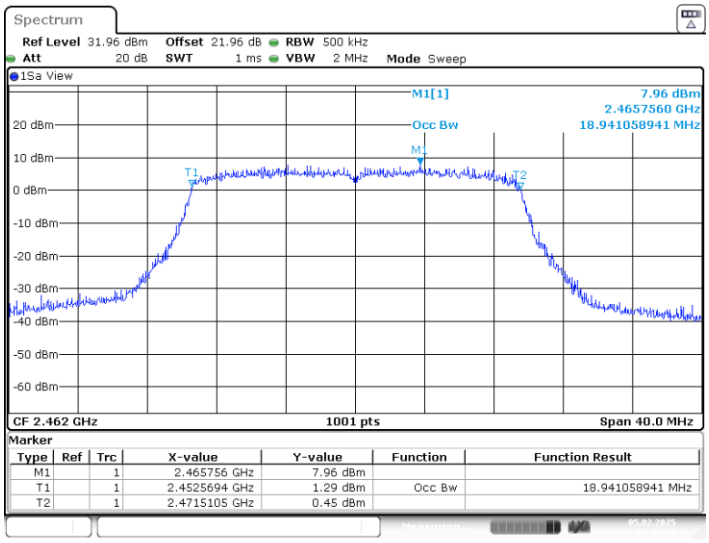
11AX20MIMO_Ant1_2462



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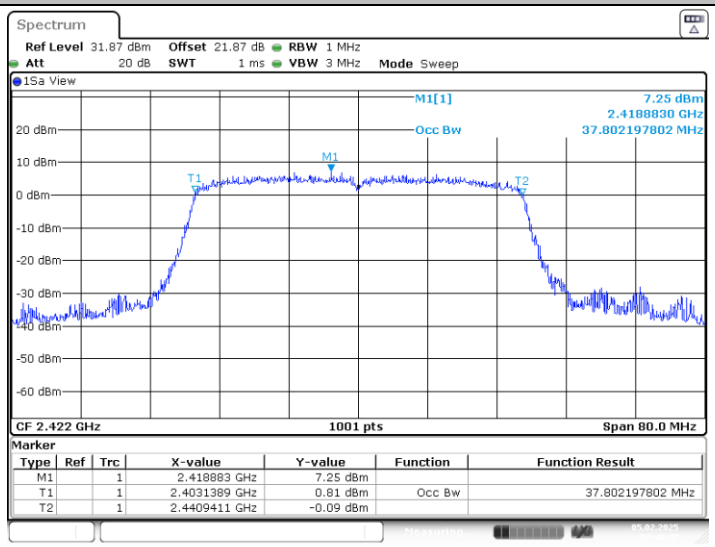
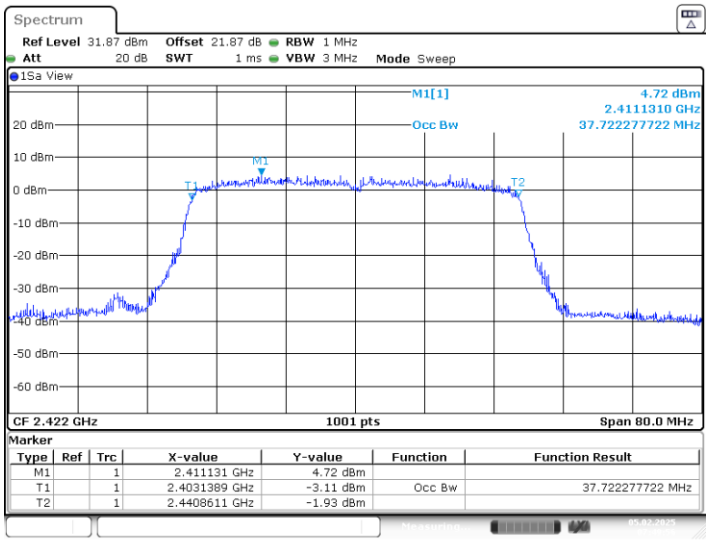
11AX40MIMO_Ant0_2422



Date: 5.FEB.2025 07:48:48

11AX40MIMO_Ant1_2422



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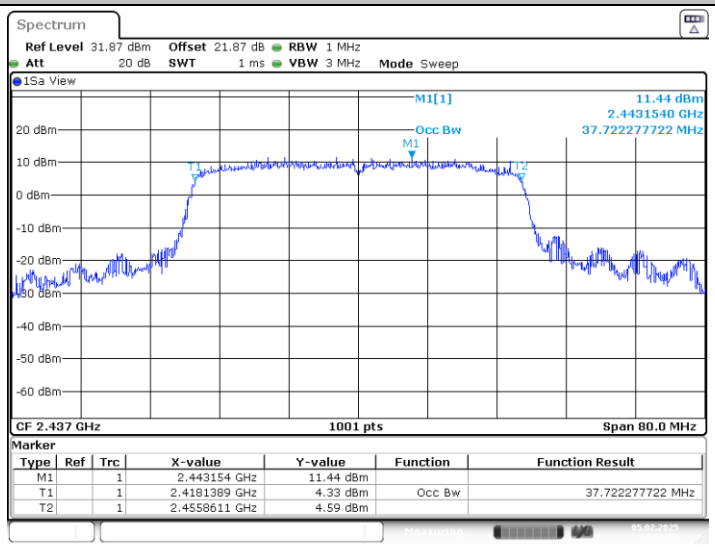

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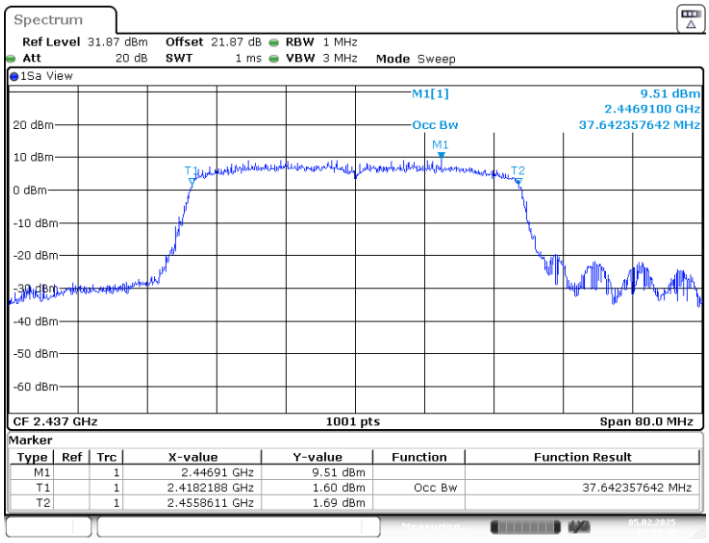

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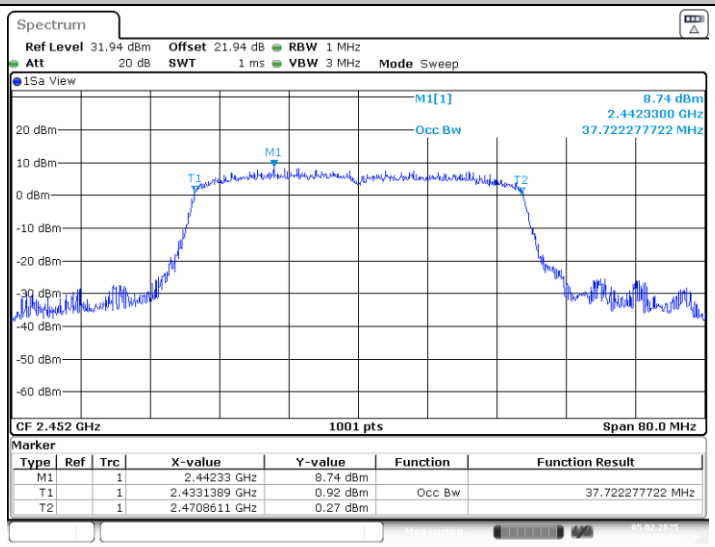
11AX40MIMO_Ant0_2452



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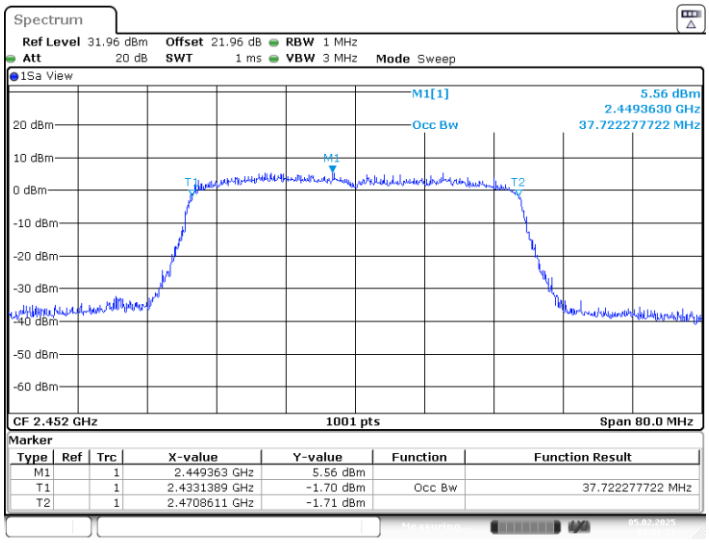


Date: 5.FEB.2025 07:56:22

Maximum power spectral density

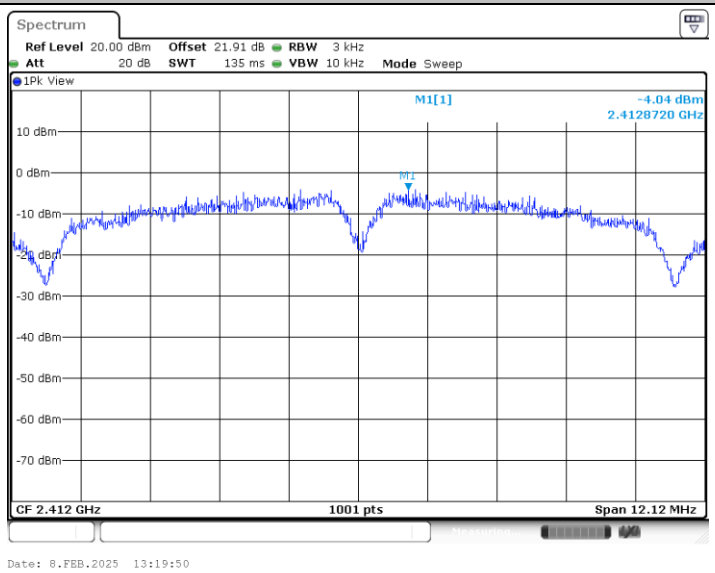
Test Result

TestMode	Antenna	Freq(MHz)	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
11B	Ant0	2412	-4.04	≤8.00	PASS
	Ant1	2412	-8.43	≤8.00	PASS
	Ant0	2437	-4.15	≤8.00	PASS
	Ant1	2437	-8.22	≤8.00	PASS
	Ant0	2462	-3.85	≤8.00	PASS
	Ant1	2462	-9.37	≤8.00	PASS
11G-CDD	Ant0	2412	-9.16	≤8.00	PASS
	Ant1	2412	-11.55	≤8.00	PASS
	total	2412	-7.18	≤8.00	PASS
	Ant0	2437	-7.51	≤8.00	PASS
	Ant1	2437	-8.8	≤8.00	PASS
	total	2437	-5.10	≤8.00	PASS
	Ant0	2462	-9.43	≤8.00	PASS
	Ant1	2462	-12.77	≤8.00	PASS
	total	2462	-7.78	≤8.00	PASS
11N20-CDD	Ant0	2412	-8.49	≤8.00	PASS
	Ant1	2412	-10.28	≤8.00	PASS
	total	2412	-6.28	≤8.00	PASS
	Ant0	2437	-7.22	≤8.00	PASS
	Ant1	2437	-9.6	≤8.00	PASS
	total	2437	-5.24	≤8.00	PASS
	Ant0	2462	-11.03	≤8.00	PASS
	Ant1	2462	-12.62	≤8.00	PASS
	total	2462	-8.74	≤8.00	PASS
11N40MIMO	Ant0	2422	-18.1	≤8.00	PASS
	Ant1	2422	-19.8	≤8.00	PASS
	total	2422	-15.86	≤8.00	PASS
	Ant0	2437	-13.37	≤8.00	PASS
	Ant1	2437	-14.66	≤8.00	PASS
	total	2437	-10.96	≤8.00	PASS
	Ant0	2452	-15.02	≤8.00	PASS
	Ant1	2452	-18.28	≤8.00	PASS
	total	2452	-13.34	≤8.00	PASS
11AX20MIMO	Ant0	2412	-10.09	≤8.00	PASS

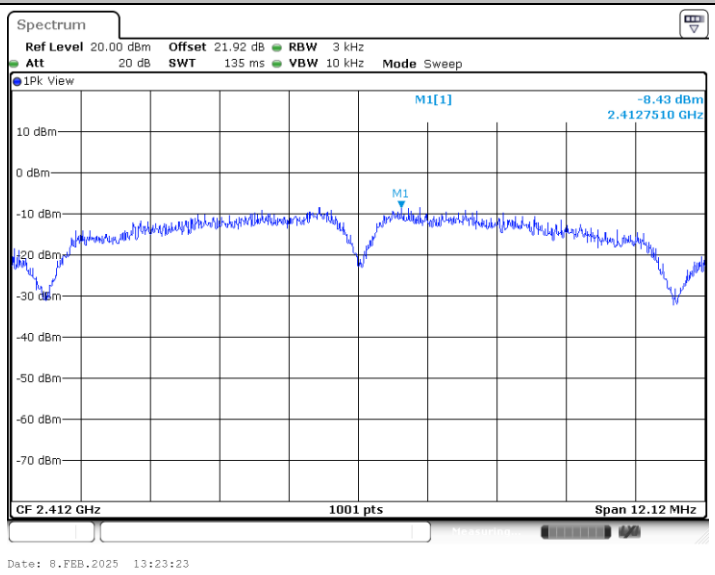
	Ant1	2412	-11.64	≤8.00	PASS
	total	2412	-7.79	≤8.00	PASS
	Ant0	2437	-8.49	≤8.00	PASS
	Ant1	2437	-10.81	≤8.00	PASS
	total	2437	-6.49	≤8.00	PASS
	Ant0	2462	-10.27	≤8.00	PASS
	Ant1	2462	-13.17	≤8.00	PASS
	total	2462	-8.47	≤8.00	PASS
11AX40MIMO	Ant0	2422	-17.16	≤8.00	PASS
	Ant1	2422	-19.26	≤8.00	PASS
	total	2422	-15.07	≤8.00	PASS
	Ant0	2437	-12.45	≤8.00	PASS
	Ant1	2437	-15.48	≤8.00	PASS
	total	2437	-10.70	≤8.00	PASS
	Ant0	2452	-17.2	≤8.00	PASS
	Ant1	2452	-19.45	≤8.00	PASS
	total	2452	-15.17	≤8.00	PASS

Test Graphs

11B_Ant0_2412



11B_Ant1_2412



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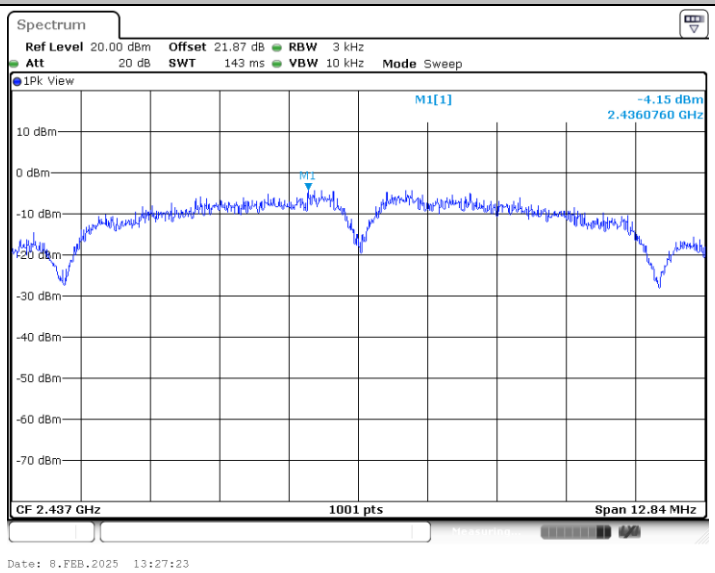

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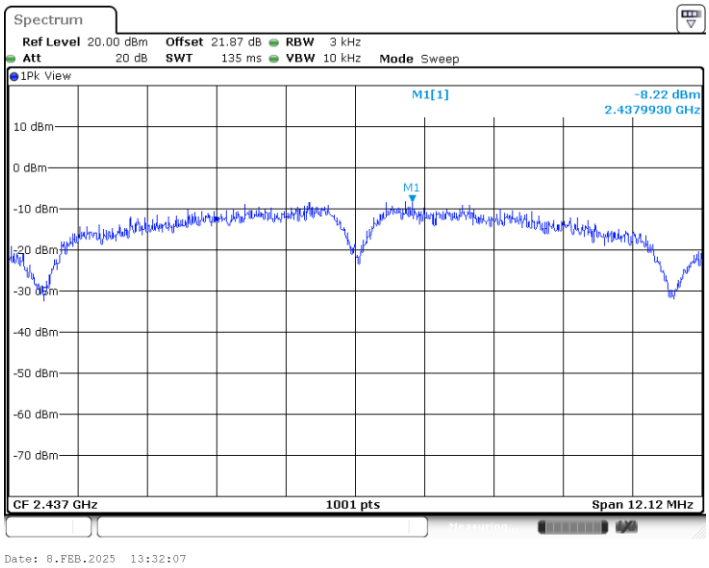
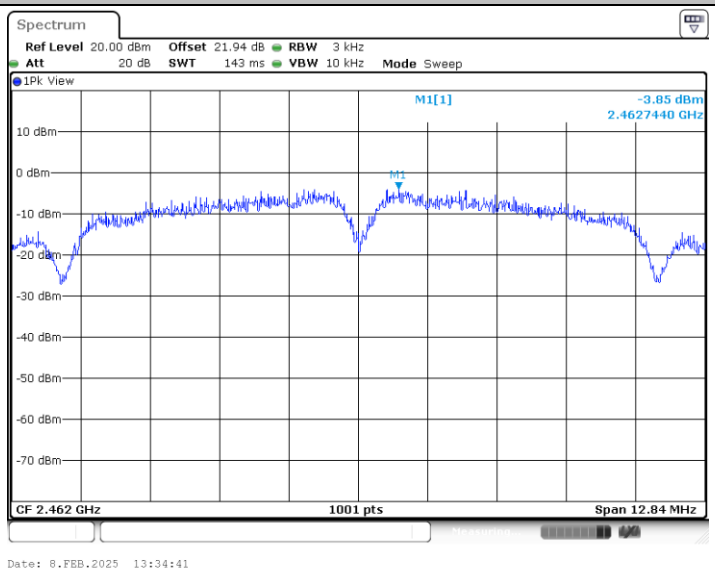
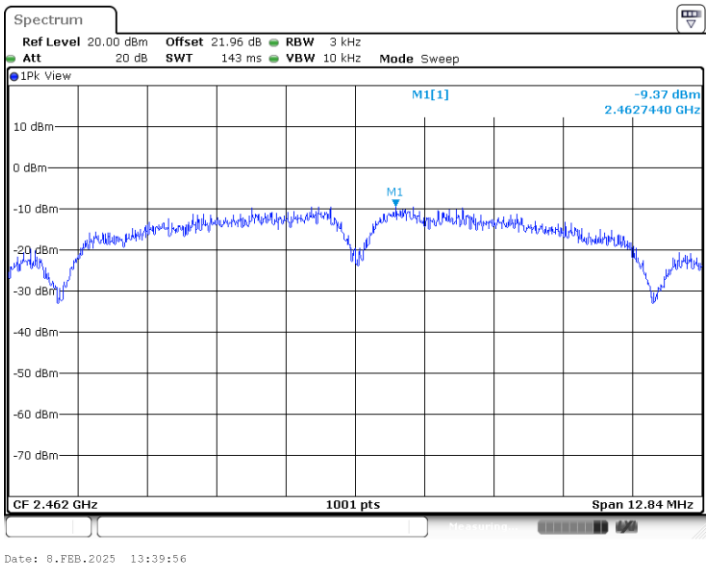


11B_Ant0_2462



11B_Ant1_2462