FCC RF Test Report

FCC ID	:	**UZ7WS3012**
EQUIPMENT	:	**Wearable Computer**
BRAND NAME	:	**Zebra**
MODEL NAME	:	**WS3012**
APPLICANT	:	**Zebra Technologies Corporation** **3 Overlook Point, Lincolnshire, IL 60069**
MANUFACTURER	:	**Zebra Technologies Corporation** **3 Overlook Point, Lincolnshire, IL 60069**
STANDARD	:	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	:	**(DTS) Digital Transmission System**
TEST DATE(S)	:	**Jun. 23, 2025 ~ Aug. 29, 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.

This report contains data that were produced under subcontract by Sporton International Inc. (Shenzhen).

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

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
FR540105C	Rev. 01	Initial issue of report	Sep. 01, 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	≤ 30dBc	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 1.01 dB at 2483.50 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 16.28 dB at 0.363 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 Product Feature of Equipment Under Test

Product Feature	
Equipment	Wearable Computer
Brand Name	Zebra
Model Name	WS3012
FCC ID	UZ7WS3012
SN Code	Conducted: 251445247E0039 Conduction: 251435247E0054 Radiation: 251435247E0064/251435247E0060
HW Version	EV2
SW Version	14-05-29.00-UN-U00-PRD-APL-04
MFD	202505
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.

Supported Unit used in test configuration and system				
AC Adapter 1 (USB A) USB Wall Charger	**Brand Name**	Zebra	**Part Number**	PWR-WUA5V12W0US
AC Adapter 2 (USB C) USB Wall Charger	**Brand Name**	Zebra	**Part Number**	PWR-WUA5V45W1US
USB Cable 1 (Type A to Type C)	**Brand Name**	Zebra	**Part Number**	CBL-WS5X-USBA-01
USB Cable 2 (Type C to Type C)	**Brand Name**	Zebra	**Part Number**	CBL-EC5X-USBC3A-01
Clip mount	**Brand Name**	Zebra	**Part Number**	SG-WS3X-CLPJK-01
Earphone 1 (Wire headset USB-C)	**Brand Name**	Zebra	**Part Number**	HDST-USBC-PTT1-01
Earphone 2 (Rugged Bluetooth Headset)	**Brand Name**	Zebra	**Part Number**	HS3100-OTH
Earphone 3 (3.5mm PTT Headset)	**Brand Name**	Zebra	**Part Number**	HDST-35MM-PTT1-02

1.2 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Average) Output Power to antenna	**MIMO<ANT0+1>** 802.11b : 20.69 dBm (0.1172 W) 802.11g : 21.41 dBm (0.1384 W) 802.11n HT20 : 21.88 dBm (0.1542 W) 802.11ac VHT20 : 21.81 dBm (0.1517 W) 802.11ax HE20 : 20.91 dBm (0.1233 W
99% Occupied Bandwidth	802.11b : 12.391MHz 802.11g : 18.274MHz 802.11n HT20 : 19.194MHz 802.11ax HE20 : 19.246MHz
Antenna Type / Gain	**<ANT0>:** IFA Antenna type with gain 0.13 dBi **<ANT1>:** IFA Antenna type with gain 0.97 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) 802.11ax : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)

Note:

1. The device supports WLAN MIMO CDD mode.
2. For WLAN 802.11b/n/ac/ax SISO & MIMO mode, the whole testing has assessed only MIMO mode by referring to the higher normal output power.
3. For WLAN 802.11g SISO & MIMO mode, the whole testing has assessed SISO & MIMO mode for full test.
4. For 802.11n/11ac mode, the whole testing have assessed only 802.11n HT20 by referring to the higher output power.
5. 802.11ax support OFDMA full RU tone and partial RU tone, both full RU and partial RU-left (for low CH) and partial RU-right (for high CH) test output power, the full RU power/PSD > partial RU, therefore the full RU perform full, and partial RU verify bandedge/spurious.

1.3 Modification of EUT

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

1.4 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 03CH05-KS	CN1257	314309

Sporton International Inc. (ShenZhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International Inc. (ShenZhen)		
Test Site Location	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City, Guangdong Province 518103 People's Republic of China TEL: +86-755-86066985		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	TH01-SZ	CN1256	421272

Test data subcontracted: Conducted test case in section 3.1~3.4&3.7 of this report.

1.5 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH05-KS	AUDIX	E3	210616
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.6 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 C63.10-2020

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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.

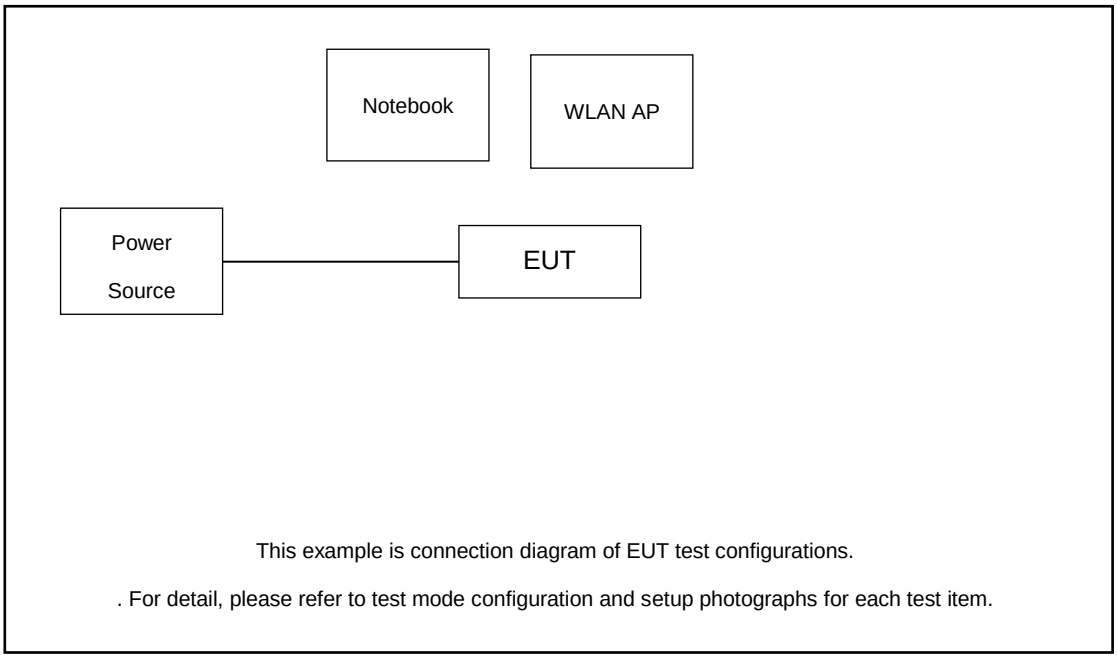
MIMO Antenna

Modulation	Data Rate
802.11b	**1 Mbps**
802.11g	**6 Mbps**
802.11n HT20	**MCS0**
802.11ac VHT20 (Covered by HT20)	**MCS0**
802.11ax HE20	**MCS0**

Test Cases	
AC Conducted Emission	Mode 1 :WLAN Link (2.4G) + Bluetooth Link + USB TYPE-A to TYPE-C cable +USB Cable1 (Charging from Adapter1)
Remark: For Radiated Test Cases, The tests were performance with Adapter 1 and USB Cable 1	

2.3 Connection Diagram of Test System

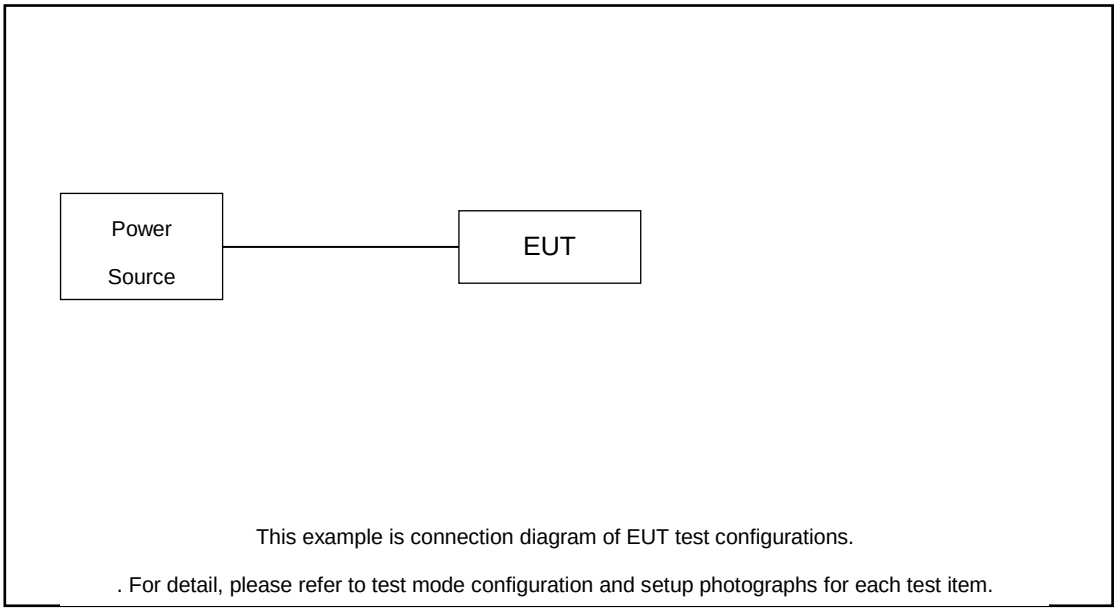
AC Conducted Emission:



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	DELL	Latiude 3400	N/A	N/A	Unshielded,1.8m
2.	WLAN AP	Dlink	DIR-820L	KA2IR820LA1	N/A	Unshielded,1.8m

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 2.12 dB and 20dB attenuator.

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

= 2.12 + 20 = 22.12 (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 C63.10-2020 clause 11.8.1 for 6dB BW and 6.9.3 for 99% occupied bandwidth measurements
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) = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz. Set the Video bandwidth (VBW) ≥ 3*RBW. Detector = Peak. 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 output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the 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.

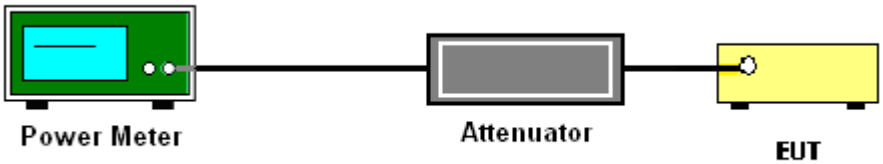
3.2.2 Measuring Instruments

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 C63.10-2020 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 Average Output Power

2.4GHz Band Single Antenna																		
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail	Setting	
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1		Ant 0	Ant 1
11g	6Mbps	1	1	2412	16.92	16.99	/	30.00	30.00	0.13	0.97	17.05	17.96	36.00	36.00	Pass	17.00	17.00
11g	6Mbps	1	6	2437	16.44	16.87		30.00	30.00	0.13	0.97	16.57	17.84	36.00	36.00	Pass	16.50	17.00
11g	6Mbps	1	11	2462	13.68	16.36		30.00	30.00	0.13	0.97	13.81	17.33	36.00	36.00	Pass	14.00	17.00

2.4GHz Band MIMO																		
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail	Setting	
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1		Ant 0	Ant 1
11b	1Mbps	2	1	2412	16.87	16.89	19.89	30.00		0.97		20.86		36.00		Pass	17.00	
11b	1Mbps	2	6	2437	17.60	17.76	20.69	30.00		0.97		21.66		36.00		Pass	17.50	
11b	1Mbps	2	11	2462	17.57	17.28	20.44	30.00		0.97		21.41		36.00		Pass	17.50	
11g	6Mbps	2	1	2412	14.79	15.00	17.91	30.00		0.97		18.88		36.00		Pass	15.00	
11g	6Mbps	2	2	2417	15.28	15.57	18.44	30.00		0.97		19.41		36.00		Pass	15.50	
11g	6Mbps	2	6	2437	18.08	18.70	21.41	30.00		0.97		22.38		36.00		Pass	18.00	
11g	6Mbps	2	9	2452	16.92	17.43	20.19	30.00		0.97		21.16		36.00		Pass	17.00	
11g	6Mbps	2	10	2457	14.92	15.08	18.01	30.00		0.97		18.98		36.00		Pass	15.00	
11g	6Mbps	2	11	2462	14.77	14.94	17.87	30.00		0.97		18.84		36.00		Pass	15.00	
HT20	MCS0	2	1	2412	14.23	14.59	17.42	30.00		0.97		18.39		36.00		Pass	14.50	
HT20	MCS0	2	2	2417	15.63	15.80	18.73	30.00		0.97		19.70		36.00		Pass	16.00	
HT20	MCS0	2	6	2437	18.58	19.15	21.88	30.00		0.97		22.85		36.00		Pass	18.50	
HT20	MCS0	2	8	2447	16.60	16.64	19.63	30.00		0.97		20.60		36.00		Pass	16.50	
HT20	MCS0	2	9	2452	15.35	15.87	18.63	30.00		0.97		19.60		36.00		Pass	15.50	
HT20	MCS0	2	10	2457	14.98	15.19	18.10	30.00		0.97		19.07		36.00		Pass	15.00	
HT20	MCS0	2	11	2462	12.85	12.94	15.91	30.00		0.97		16.88		36.00		Pass	13.00	
VHT20	MCS0	2	1	2412	14.20	14.52	17.37	30.00		0.97		18.34		36.00		Pass	14.50	
VHT20	MCS0	2	2	2417	15.57	15.74	18.67	30.00		0.97		19.64		36.00		Pass	16.00	
VHT20	MCS0	2	6	2437	18.53	19.05	21.81	30.00		0.97		22.78		36.00		Pass	18.50	
VHT20	MCS0	2	8	2447	16.53	16.57	19.56	30.00		0.97		20.53		36.00		Pass	16.50	
VHT20	MCS0	2	9	2452	15.29	15.81	18.57	30.00		0.97		19.54		36.00		Pass	15.50	
VHT20	MCS0	2	10	2457	14.93	15.14	18.05	30.00		0.97		19.02		36.00		Pass	15.00	
VHT20	MCS0	2	11	2462	12.83	12.90	15.88	30.00		0.97		16.85		36.00		Pass	13.00	

2.4GHz Band MIMO																		
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail	Setting	
						Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1		Ant 0	Ant 1
HE20	MCS0	2	1	2412	Full	14.99	15.31	18.16	30.00		0.97		19.13		36.00		Pass	14.50	
HE20	MCS0	2	1	2412	26/0	5.40	4.41	7.94	30.00		0.97		8.91		36.00		Pass	5.50	
HE20	MCS0	2	1	2412	52/37	8.05	7.69	10.88	30.00		0.97		11.85		36.00		Pass	8.50	
HE20	MCS0	2	1	2412	106/53	12.04	11.89	14.98	30.00		0.97		15.95		36.00		Pass	11.50	
HE20	MCS0	2	2	2417	Full	15.64	15.88	18.77	30.00		0.97		19.74		36.00		Pass	15.50	
HE20	MCS0	2	6	2437	Full	17.71	18.09	20.91	30.00		0.97		21.88		36.00		Pass	17.50	
HE20	MCS0	2	6	2437	26/0	8.73	9.23	12.00	30.00		0.97		12.97		36.00		Pass	9.50	
HE20	MCS0	2	6	2437	52/37	11.46	12.30	14.91	30.00		0.97		15.88		36.00		Pass	11.50	
HE20	MCS0	2	6	2437	106/53	14.79	15.61	18.23	30.00		0.97		19.20		36.00		Pass	14.50	
HE20	MCS0	2	10	2457	Full	15.17	15.47	18.33	30.00		0.97		19.30		36.00		Pass	15.00	
HE20	MCS0	2	11	2462	Full	12.78	13.04	15.92	30.00		0.97		16.89		36.00		Pass	12.50	
HE20	MCS0	2	11	2462	26/8	5.49	4.47	8.02	30.00		0.97		8.99		36.00		Pass	5.00	
HE20	MCS0	2	11	2462	52/40	8.06	7.38	10.74	30.00		0.97		11.71		36.00		Pass	7.50	
HE20	MCS0	2	11	2462	106/54	10.52	10.84	13.69	30.00		0.97		14.66		36.00		Pass	10.00	

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.

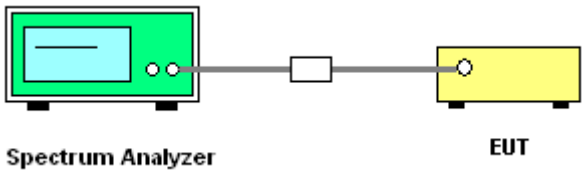
3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2020 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 (b): Measure and sum spectral maxima across the outputs.

   The measurement on each individual output were performed with the same span and number on each individual output. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs.

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.

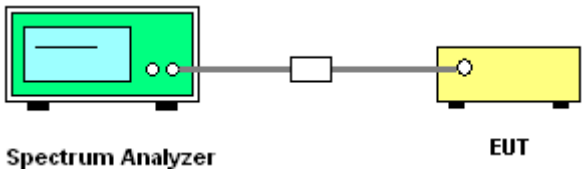
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2020 clause 11.11.3
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

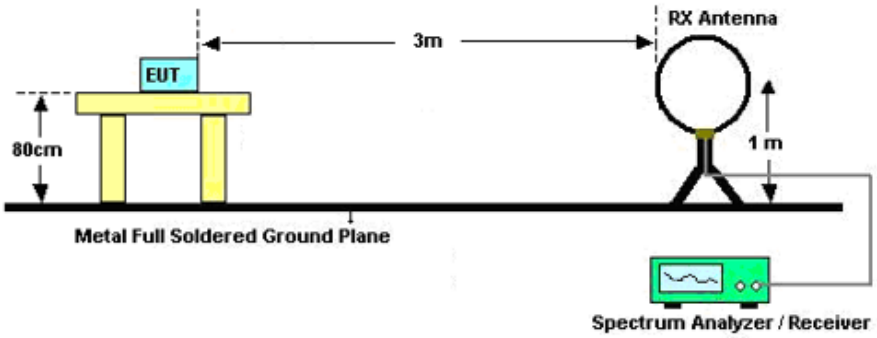
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

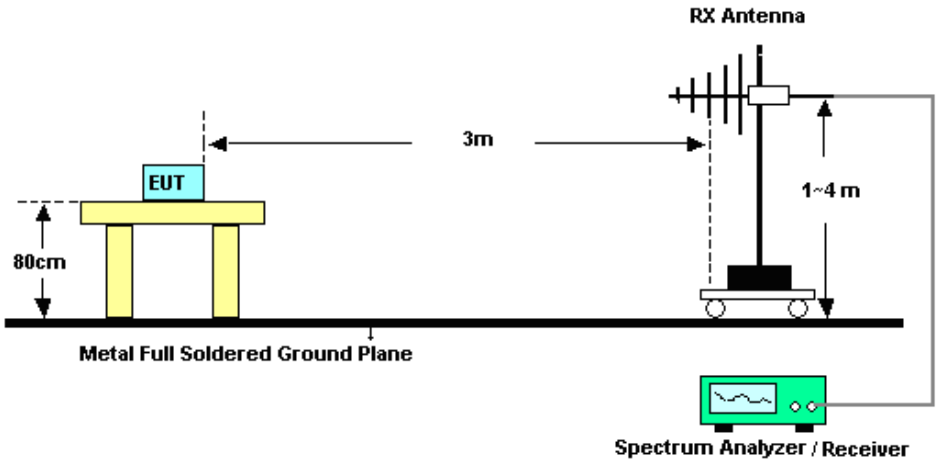
1. The testing follows ANSI C63.10-2020 clause 6.3, 6.5, 6.6, 11.11 and 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in 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

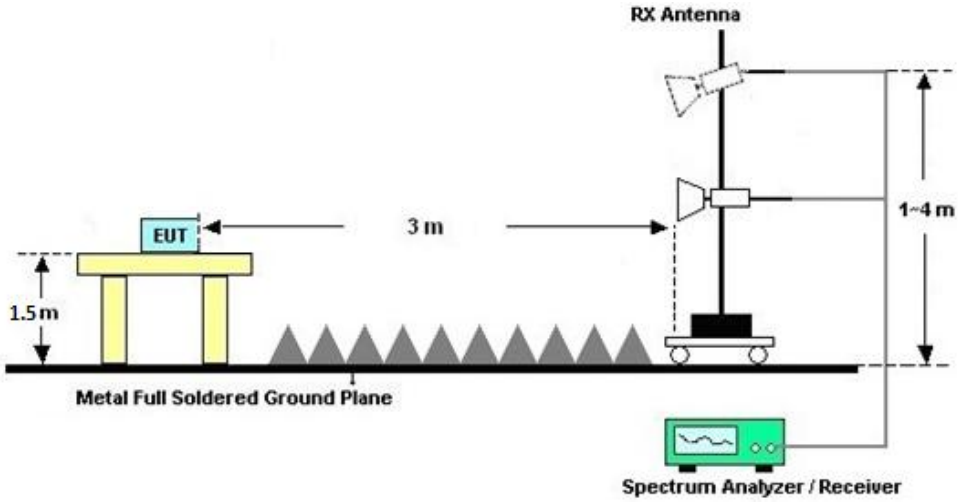
For radiated emissions below 30MHz



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.

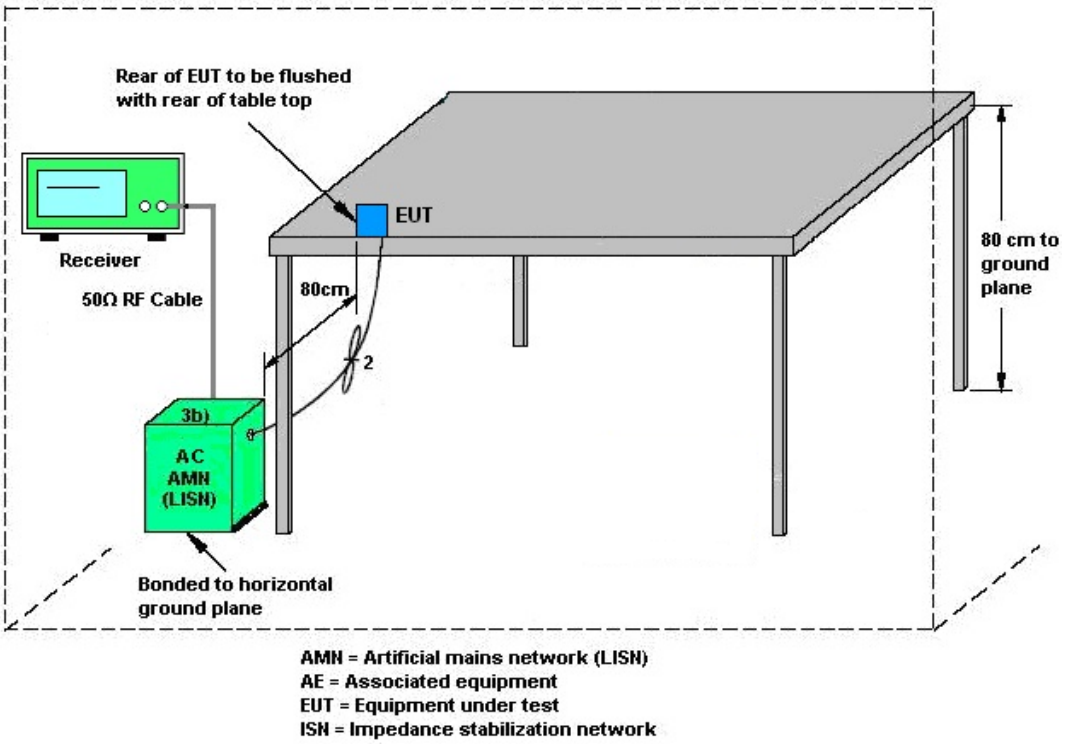
3.6.2 Measuring Instruments

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.

	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	0.13	0.97	0.97	3.57	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
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 02, 2025	Jun. 28, 2025~ Aug. 29, 2025	Apr. 01, 2026	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 25, 2024	Jun. 28, 2025~ Aug. 29, 2025	Dec. 24, 2025	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Oct. 14, 2024	Jun. 28, 2025~ Aug. 29, 2025	Oct. 13, 2025	Conducted (TH01-SZ)
EMI Test Receiver	Keysight	N9038A	MY57290151	3Hz~8.5GHz;Max 30dBm	Jul. 04, 2024	Jun. 29, 2025	Jul. 03, 2025	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY60242126	10Hz-44G,MAX 30dB	Oct. 10, 2024	Jun. 29, 2025	Oct. 09, 2025	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2E	101125	9kHz~30MHz	Sep. 08, 2024	Jun. 29, 2025	Sep. 07, 2025	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	Mar. 24, 2025	Jun. 29, 2025	Mar. 23, 2026	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00251982	1GHz~18GHz	Aug. 16, 2024	Jun. 29, 2025	Aug. 15, 2025	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101116	18GHz~40GHz	Oct. 22, 2024	Jun. 29, 2025	Oct. 21, 2025	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 03, 2024	Jun. 29, 2025	Jul. 02, 2025	Radiation (03CH05-KS)
Amplifier	EM	EM18G40GA	060851	18~40GHz	Jan. 02, 2025	Jun. 29, 2025	Jan. 01, 2026	Radiation (03CH05-KS)
high gain Amplifier	EM	EM01G18GA	060843	1Ghz-18Ghz	Jan. 02, 2025	Jun. 29, 2025	Jan. 01, 2026	Radiation (03CH05-KS)
Amplifier	EM	EM01G18GA	060833	1Ghz-18Ghz	Jan. 02, 2025	Jun. 29, 2025	Jan. 01, 2026	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jun. 29, 2025	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jun. 29, 2025	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jun. 29, 2025	NCR	Radiation (03CH05-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 16, 2025	Jun. 23, 2025	Apr. 15, 2026	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Aug. 20, 2024	Jun. 23, 2025	Aug. 19, 2025	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Dec. 24, 2024	Jun. 23, 2025	Dec. 23, 2025	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 09, 2024	Jun. 23, 2025	Oct. 08, 2025	Conduction (CO01-KS)

NCR: No Calibration Required

5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10. 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

Test Item	Uncertainty
Conducted Spurious Emission & Bandedge	±1.34 dB
Occupied Channel Bandwidth	±0.012 MHz
Conducted Power	±1.34 dB
Conducted Power Spectral Density	±1.32 dB
Frequency	±1.3 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))	6.18 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.88 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.36 dB

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

Appendix A. Conducted Test Results

DTS Bandwidth

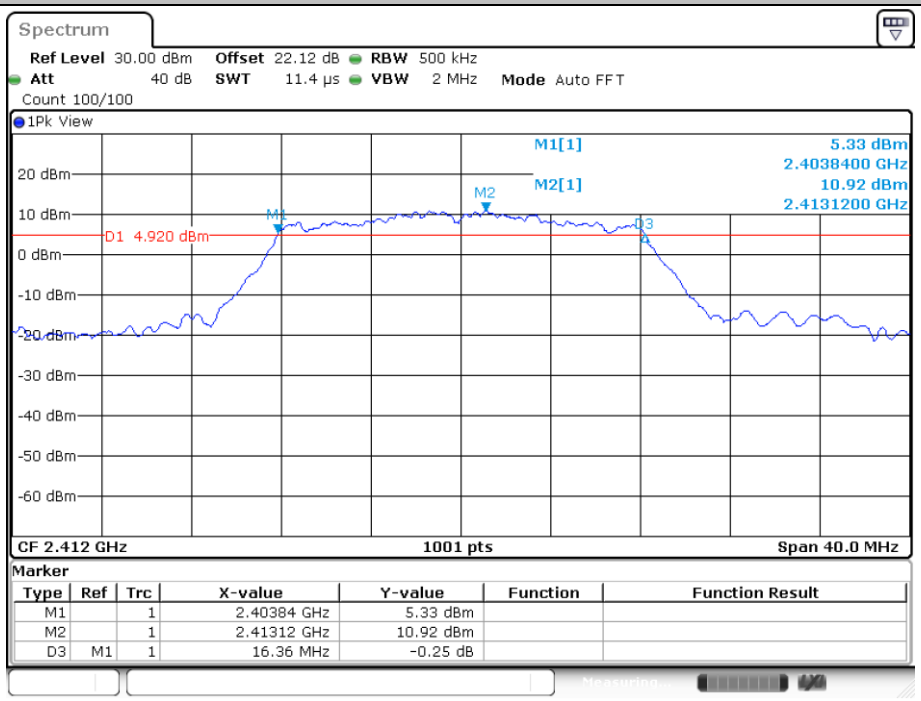
Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11G	Ant0	2412	16.36	2403.84	2420.20	0.5	PASS
	Ant1	2412	16.48	2403.84	2420.32	0.5	PASS
	Ant0	2437	16.40	2428.80	2445.20	0.5	PASS
	Ant1	2437	16.20	2428.84	2445.04	0.5	PASS
	Ant0	2462	16.36	2453.84	2470.20	0.5	PASS
	Ant1	2462	16.24	2453.80	2470.04	0.5	PASS
11B-CDD	Ant0	2412	8.08	2407.96	2416.04	0.5	PASS
	Ant1	2412	7.76	2408.36	2416.12	0.5	PASS
	Ant0	2437	7.68	2432.96	2440.64	0.5	PASS
	Ant1	2437	7.68	2432.92	2440.60	0.5	PASS
	Ant0	2462	8.08	2457.96	2466.04	0.5	PASS
	Ant1	2462	7.68	2458.36	2466.04	0.5	PASS
11G-CDD	Ant0	2412	16.36	2403.84	2420.20	0.5	PASS
	Ant1	2412	16.08	2404.28	2420.36	0.5	PASS
	Ant0	2417	16.16	2409.04	2425.20	0.5	PASS
	Ant1	2417	13.24	2411.48	2424.72	0.5	PASS
	Ant0	2437	16.32	2428.88	2445.20	0.5	PASS
	Ant1	2437	16.20	2428.88	2445.08	0.5	PASS
	Ant0	2452	16.32	2443.88	2460.20	0.5	PASS
	Ant1	2452	16.24	2443.92	2460.16	0.5	PASS
	Ant0	2457	16.36	2448.92	2465.28	0.5	PASS
	Ant1	2457	16.36	2448.84	2465.20	0.5	PASS
	Ant0	2462	16.36	2453.80	2470.16	0.5	PASS
	Ant1	2462	16.28	2453.80	2470.08	0.5	PASS
11N20MIMO	Ant0	2412	17.60	2403.24	2420.84	0.5	PASS
	Ant1	2412	17.40	2403.56	2420.96	0.5	PASS
	Ant0	2417	16.96	2408.68	2425.64	0.5	PASS
	Ant1	2417	17.20	2408.68	2425.88	0.5	PASS
	Ant0	2437	17.48	2428.28	2445.76	0.5	PASS
	Ant1	2437	17.52	2428.16	2445.68	0.5	PASS
	Ant0	2447	17.56	2438.28	2455.84	0.5	PASS
	Ant1	2447	17.64	2438.24	2455.88	0.5	PASS
	Ant0	2452	17.52	2443.24	2460.76	0.5	PASS

	Ant1	2452	17.44	2443.28	2460.72	0.5	PASS
	Ant0	2457	17.84	2448.04	2465.88	0.5	PASS
	Ant1	2457	17.60	2448.24	2465.84	0.5	PASS
	Ant0	2462	17.60	2453.20	2470.80	0.5	PASS
	Ant1	2462	17.40	2453.36	2470.76	0.5	PASS
11AX20MIMO	Ant0	2412	18.12	2402.72	2420.84	0.5	PASS
	Ant1	2412	18.60	2402.72	2421.32	0.5	PASS
	Ant0	2417	18.64	2407.76	2426.40	0.5	PASS
	Ant1	2417	15.48	2410.72	2426.20	0.5	PASS
	Ant0	2437	17.12	2428.68	2445.80	0.5	PASS
	Ant1	2437	17.44	2427.72	2445.16	0.5	PASS
	Ant0	2457	18.84	2447.60	2466.44	0.5	PASS
	Ant1	2457	18.92	2447.56	2466.48	0.5	PASS
	Ant0	2462	18.40	2453.04	2471.44	0.5	PASS
	Ant1	2462	18.76	2452.52	2471.28	0.5	PASS

Test Graphs

11G_Ant0_2412



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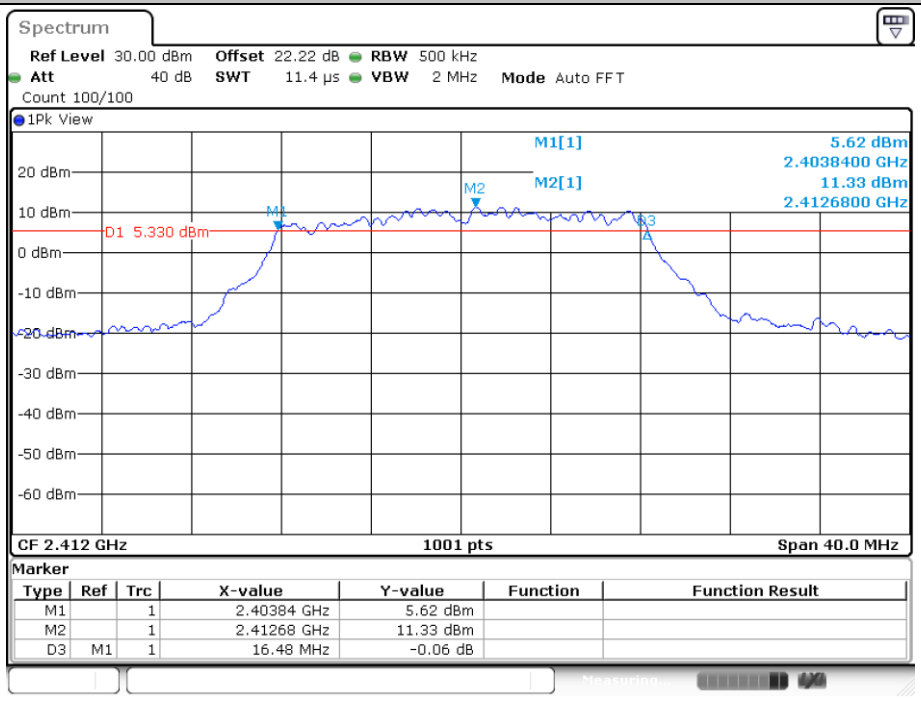

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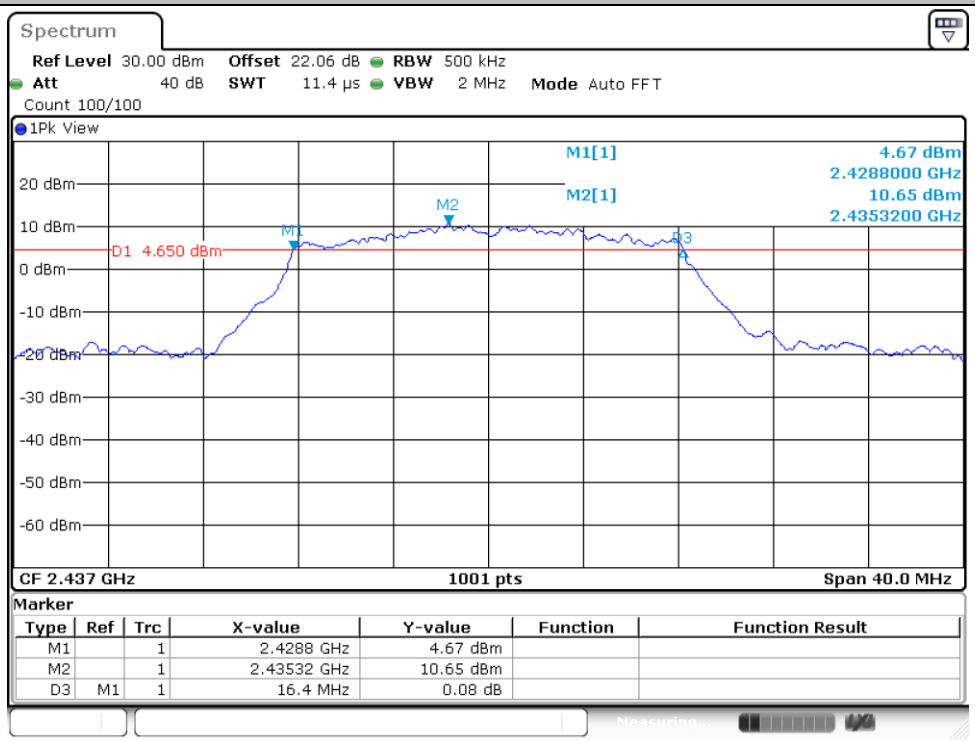

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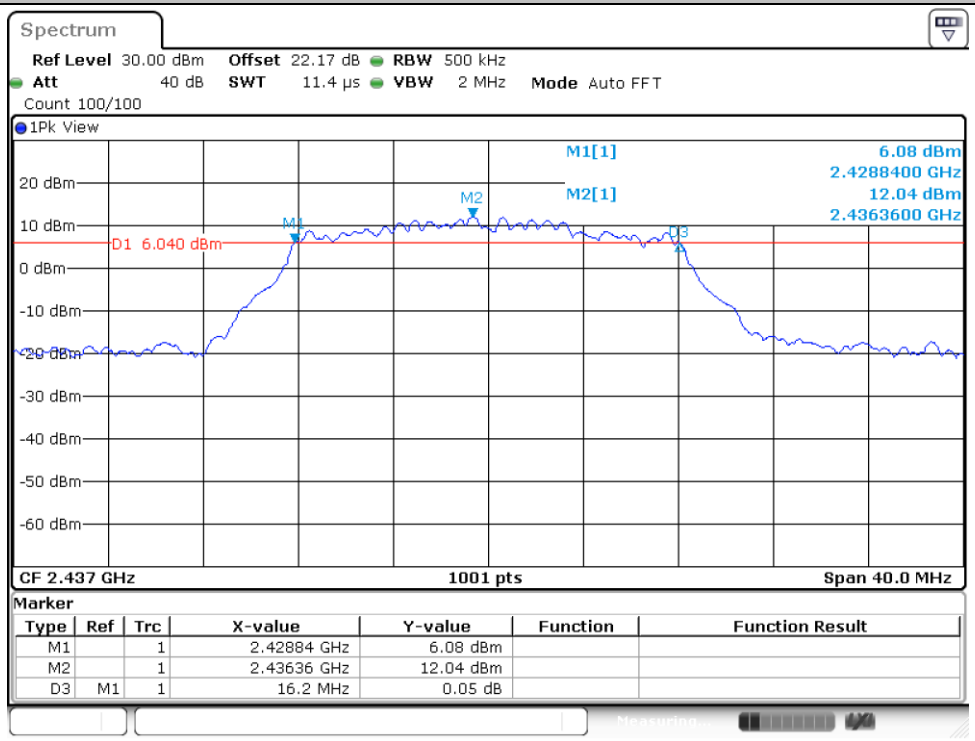

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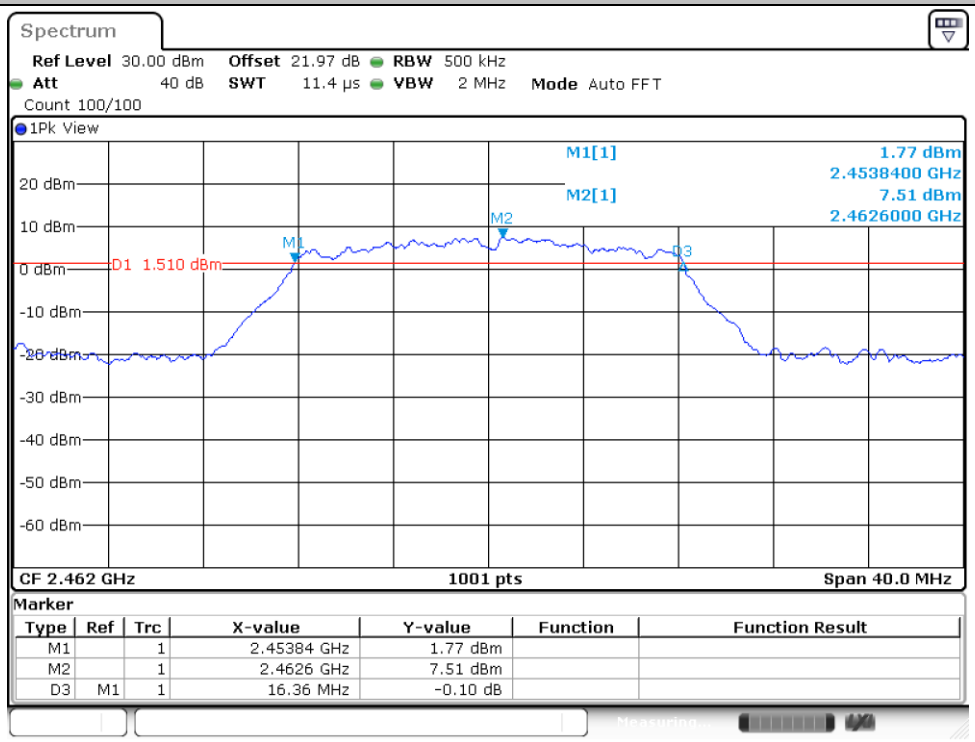

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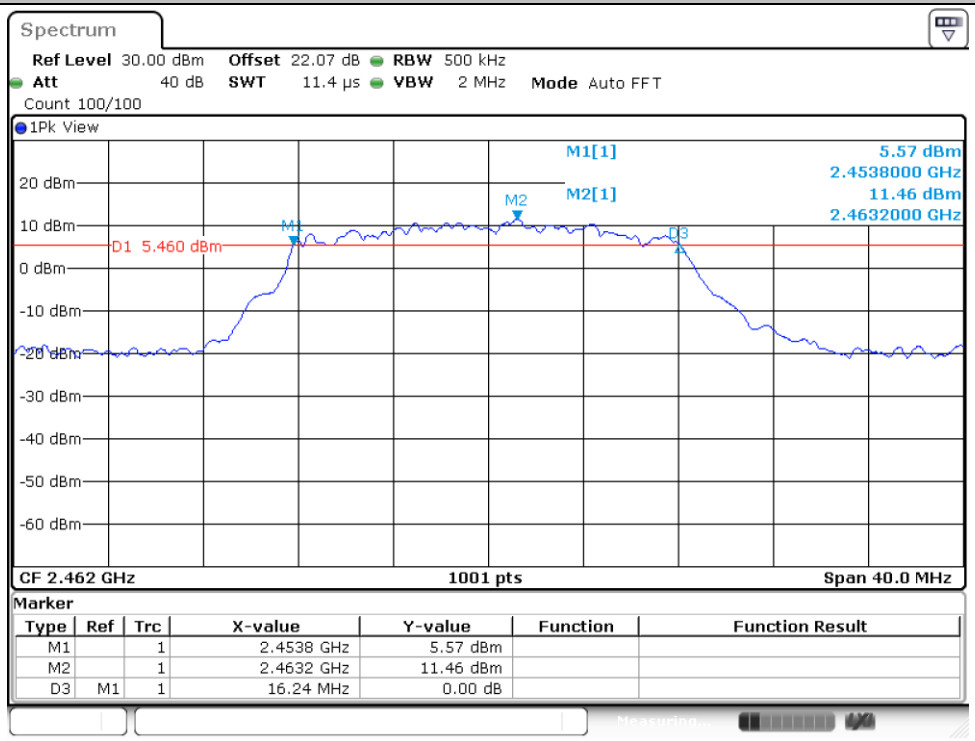

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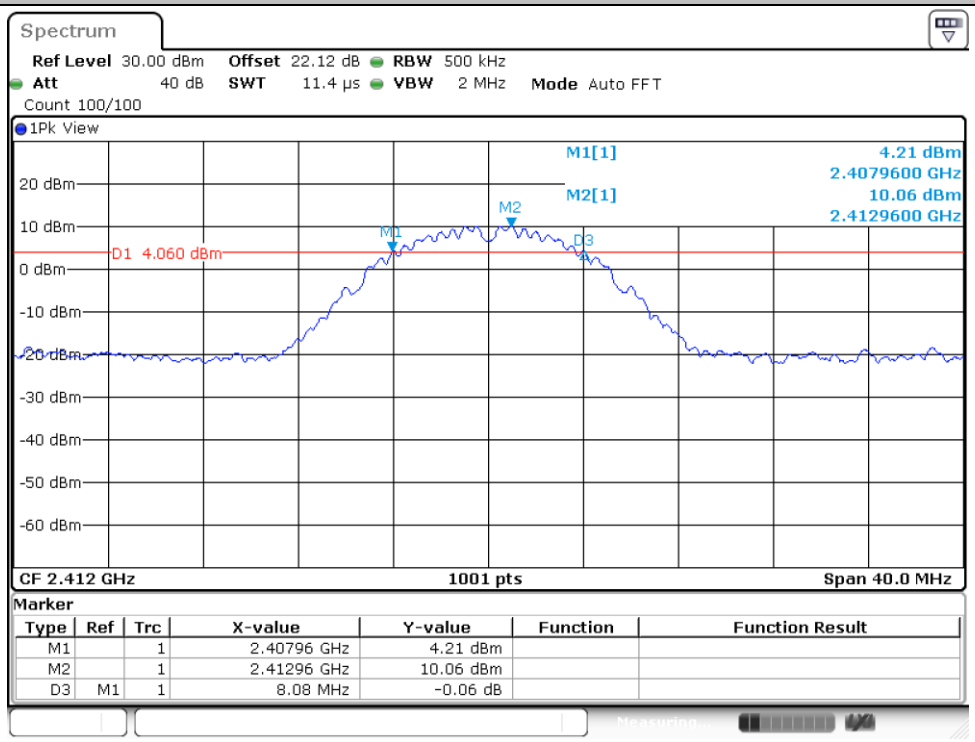

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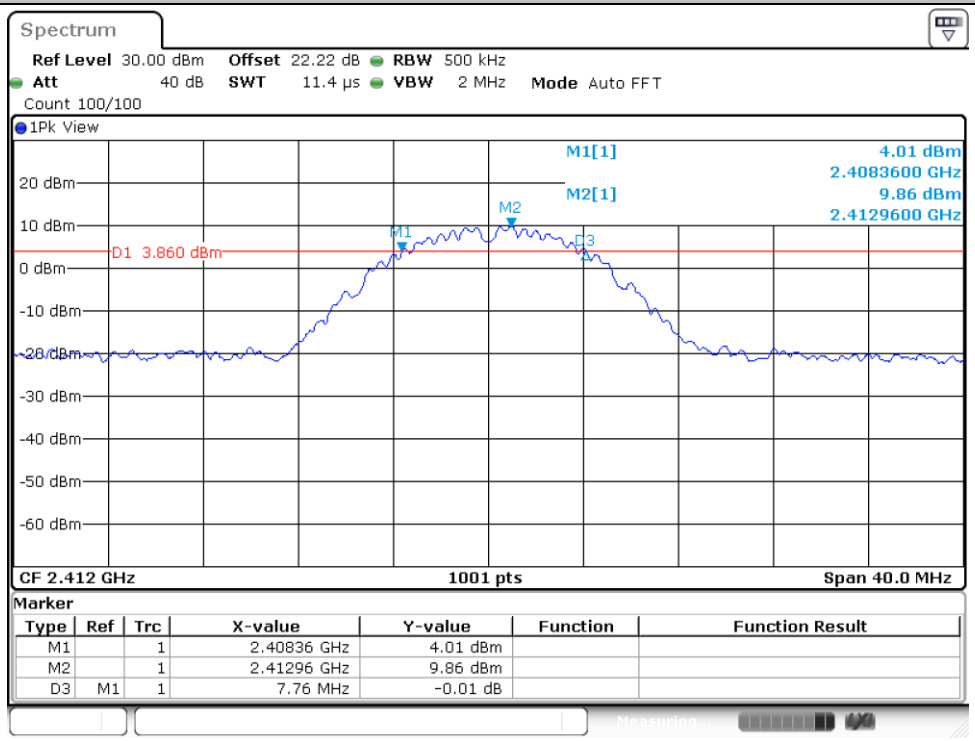

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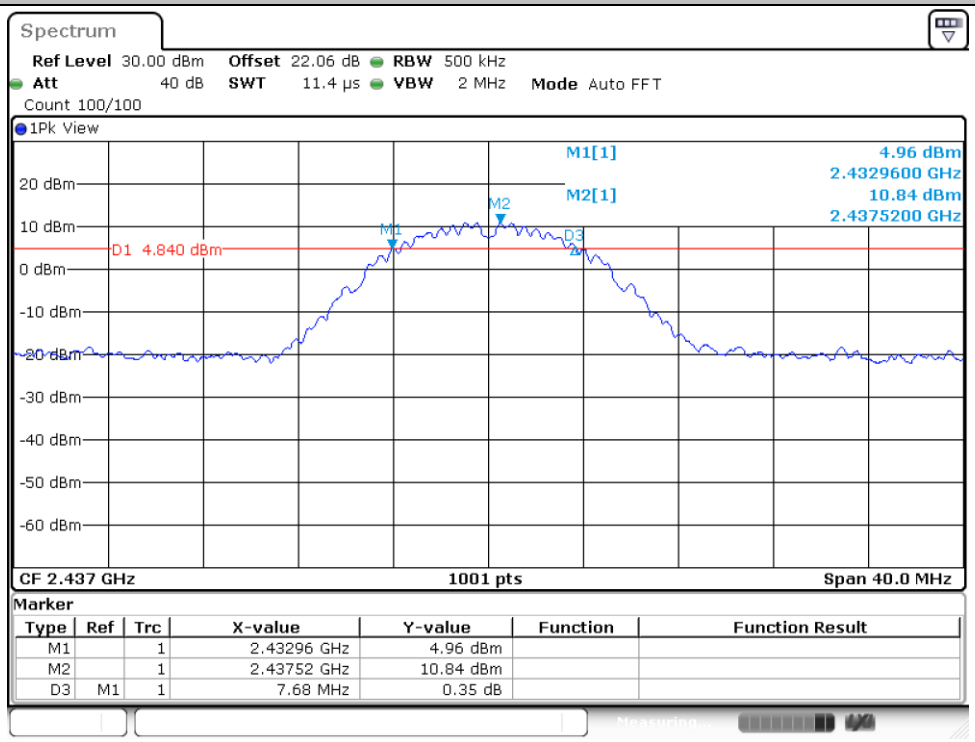

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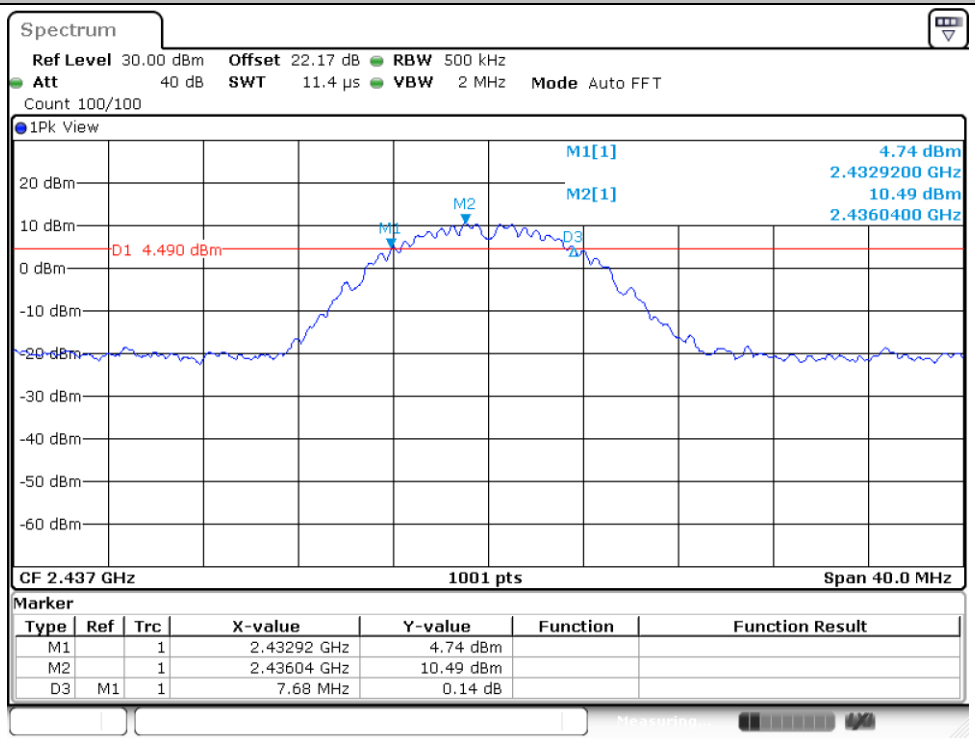

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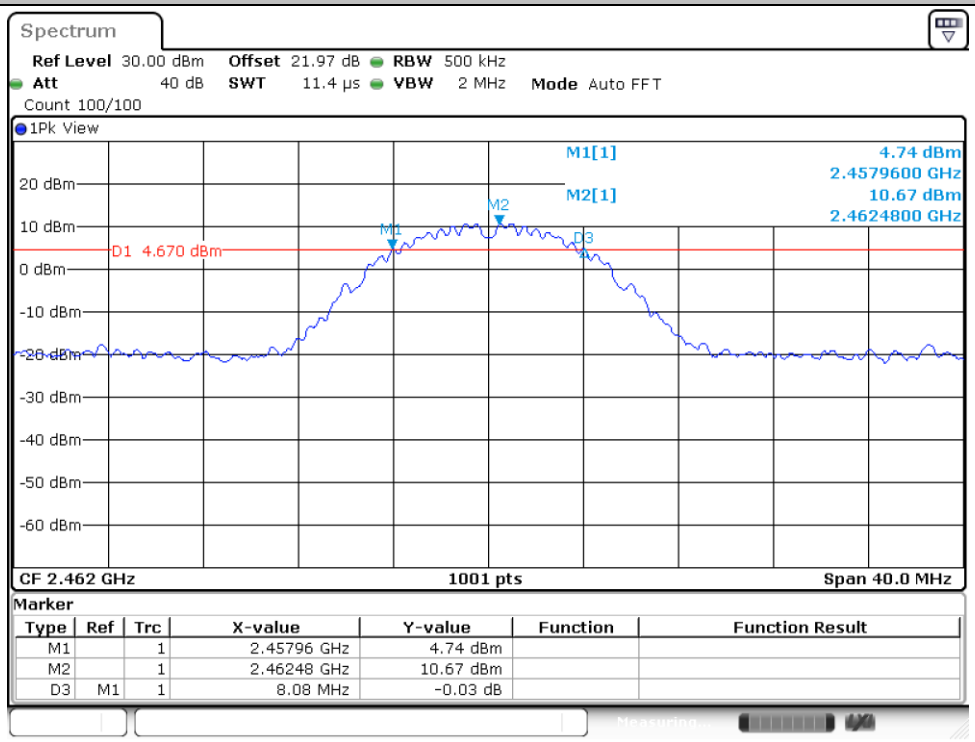

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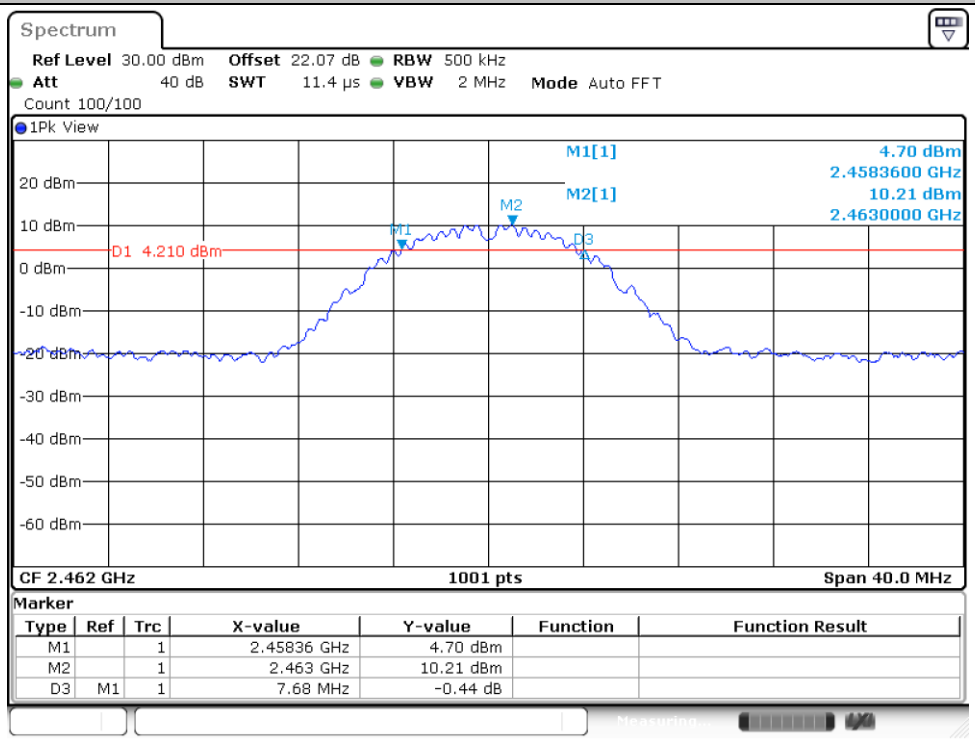

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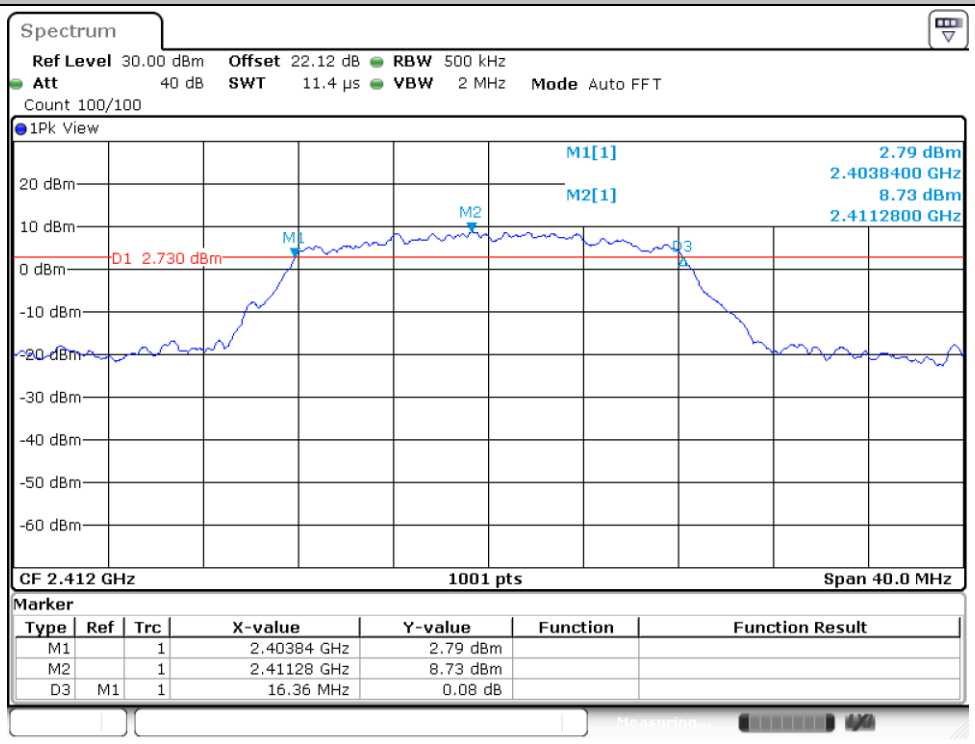

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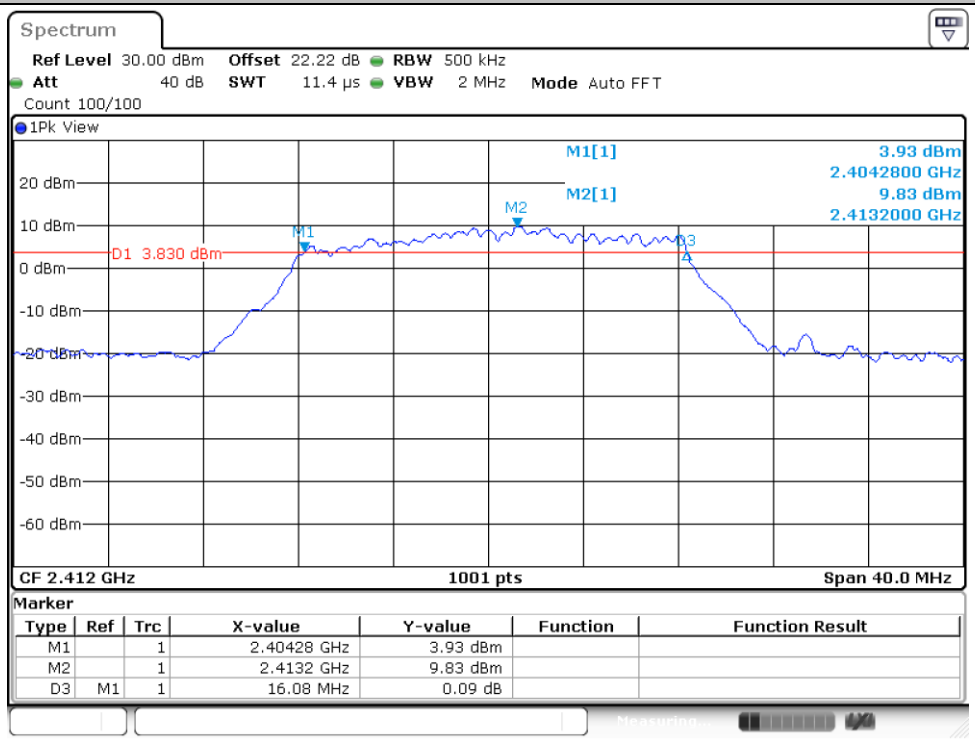

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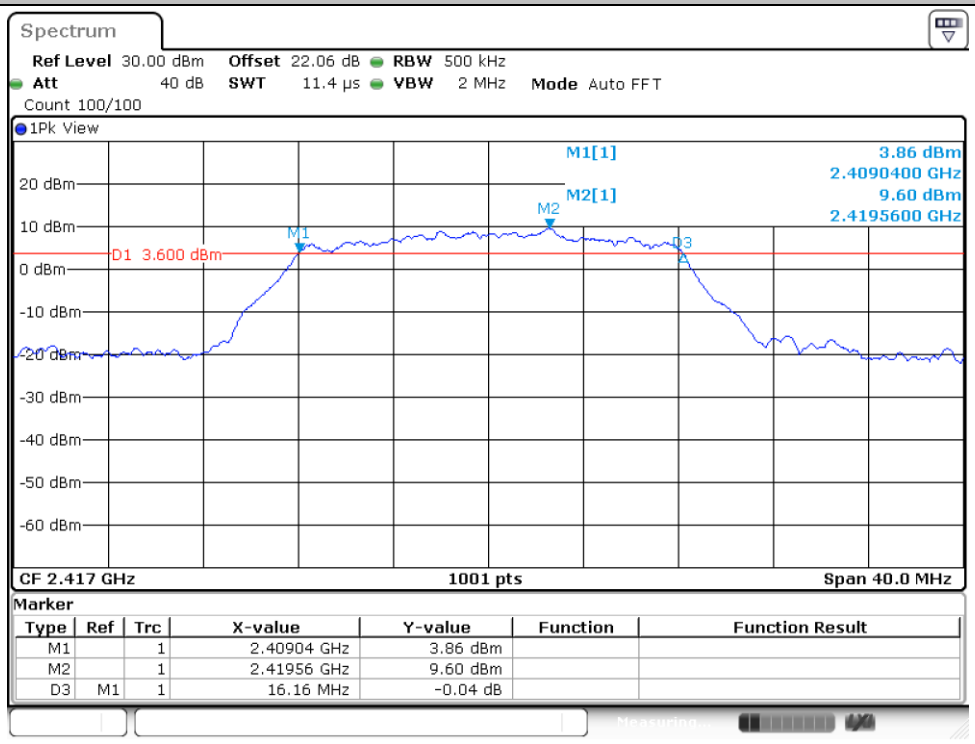

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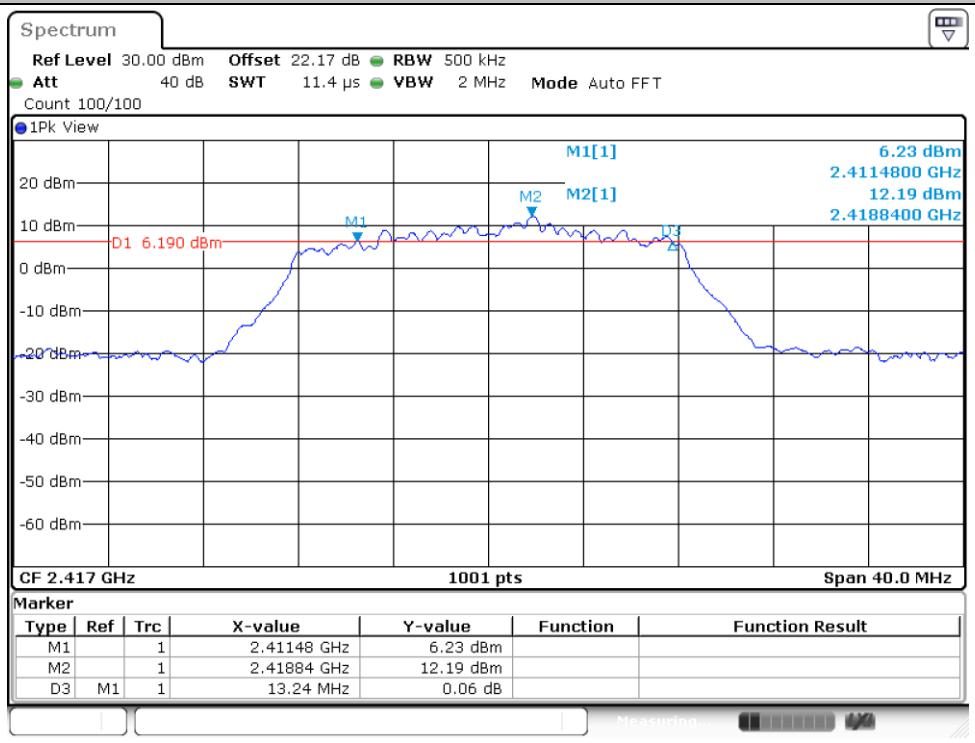

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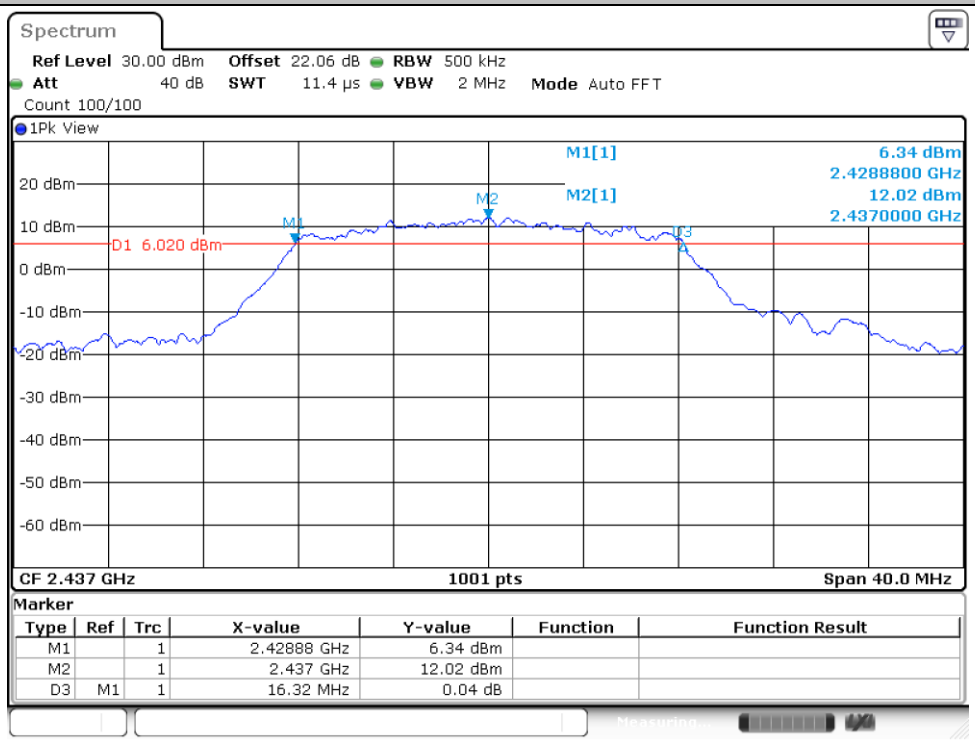

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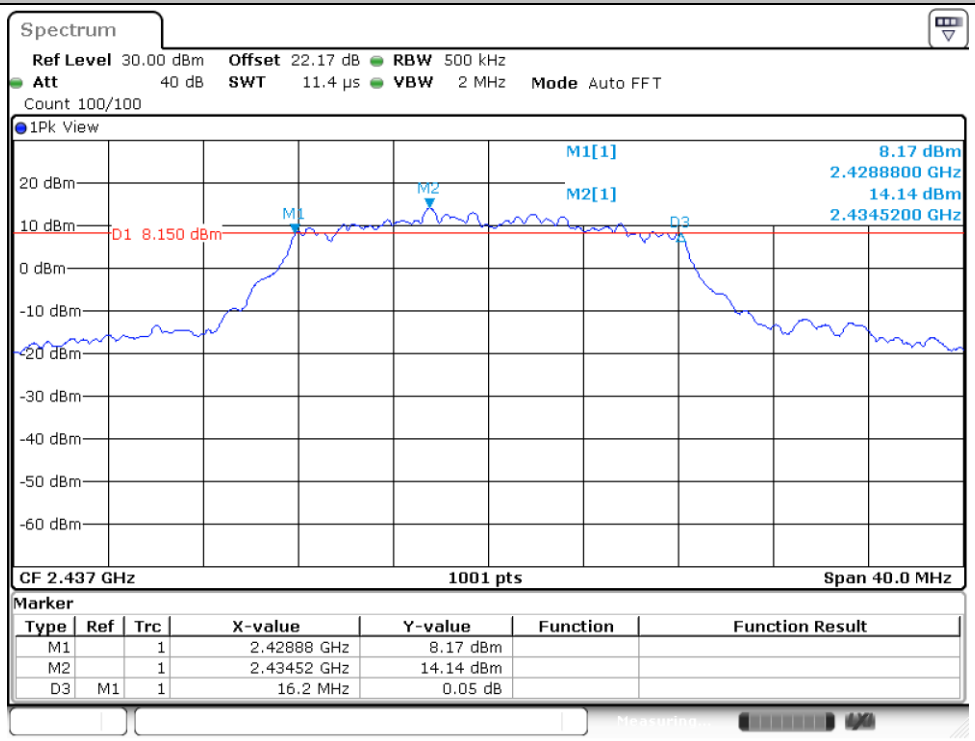
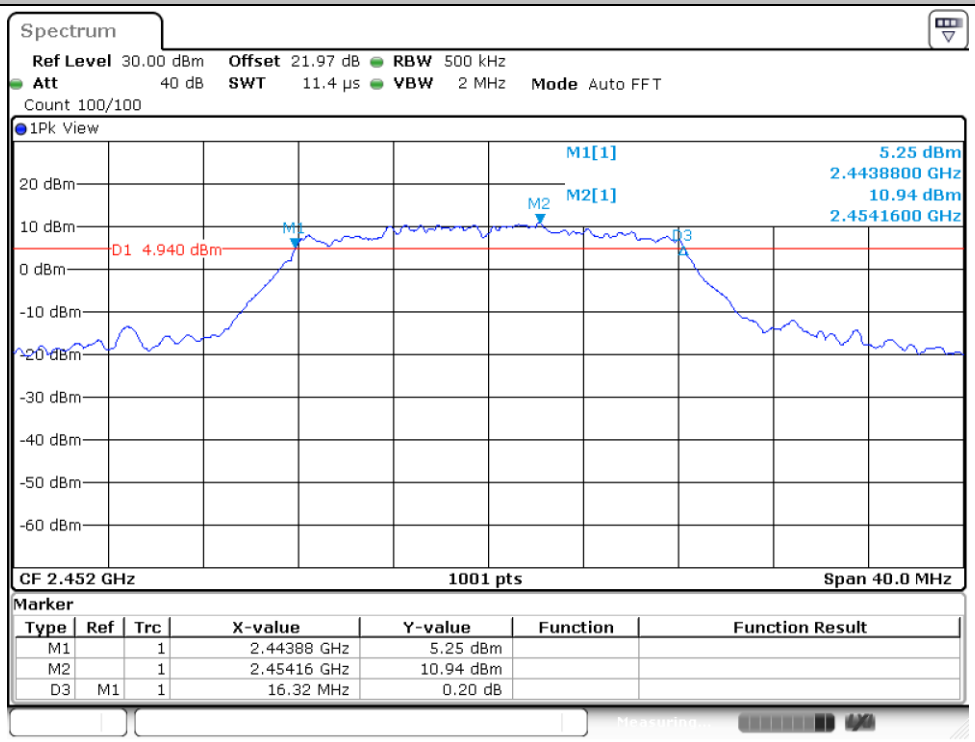


Date: 22.AUG.2025 04:31:14

11G-CDD_Ant0_2452



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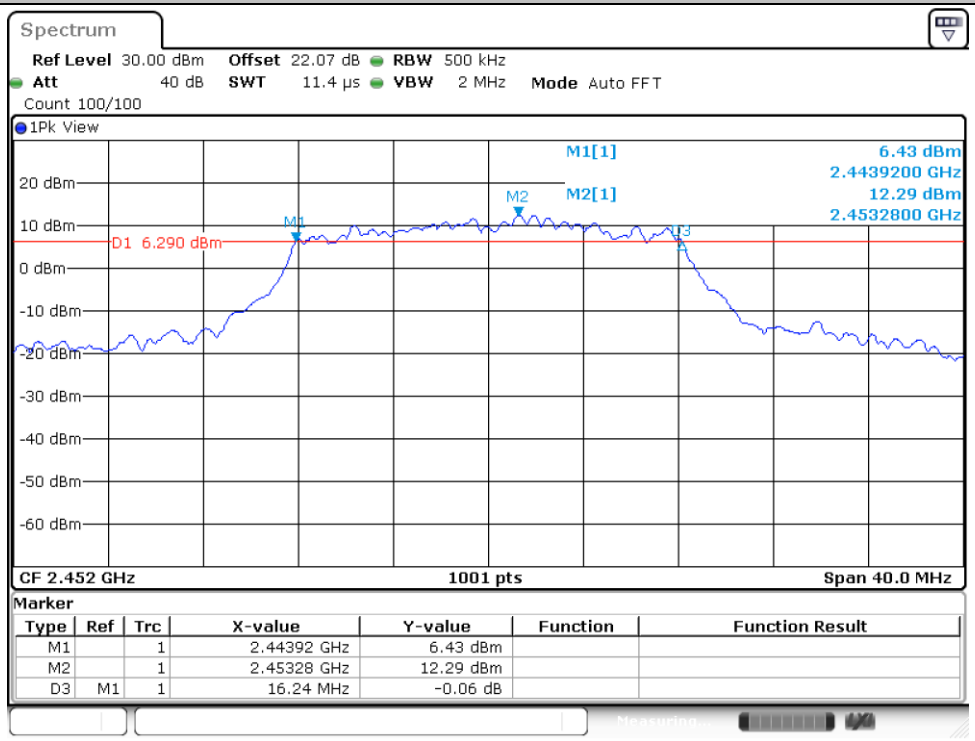
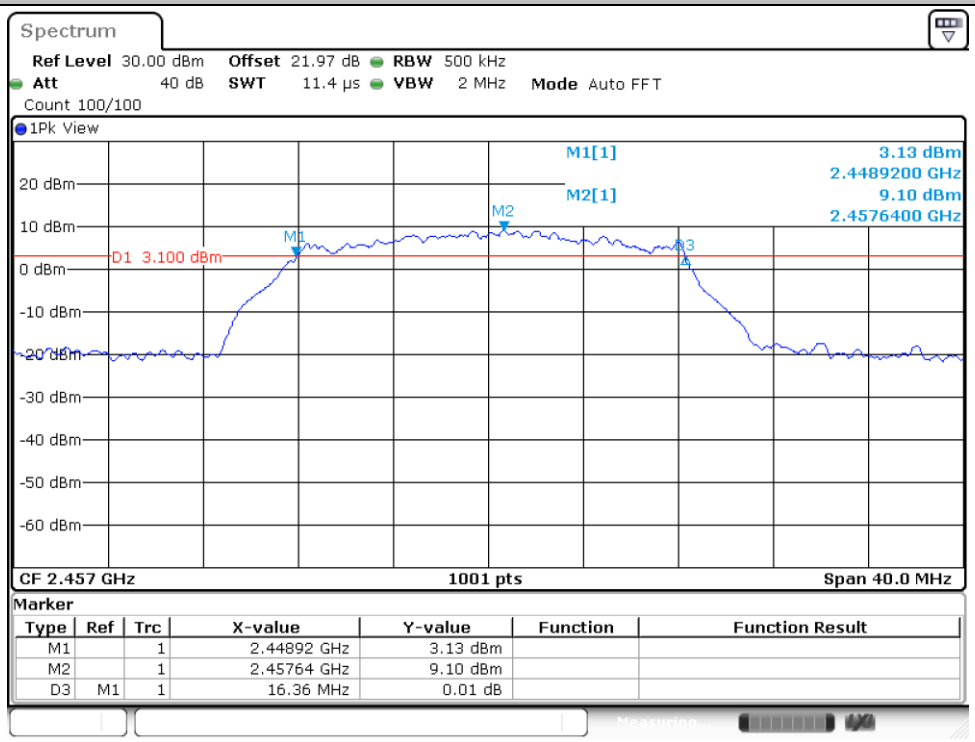


Date: 22.AUG.2025 04:34:39

11G-CDD_Ant0_2457



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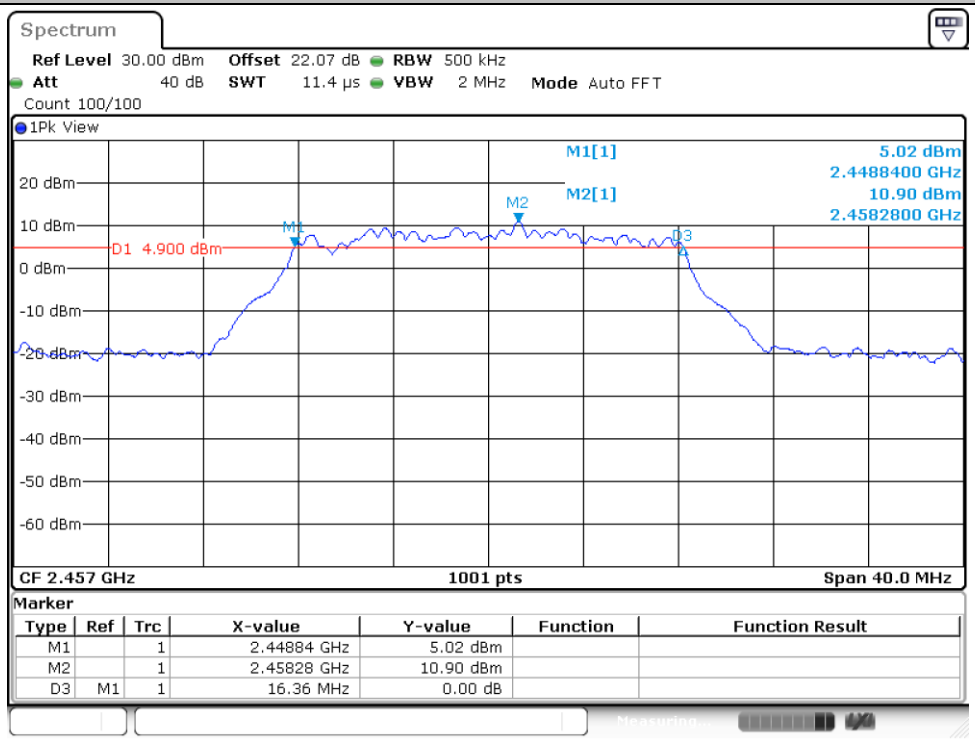

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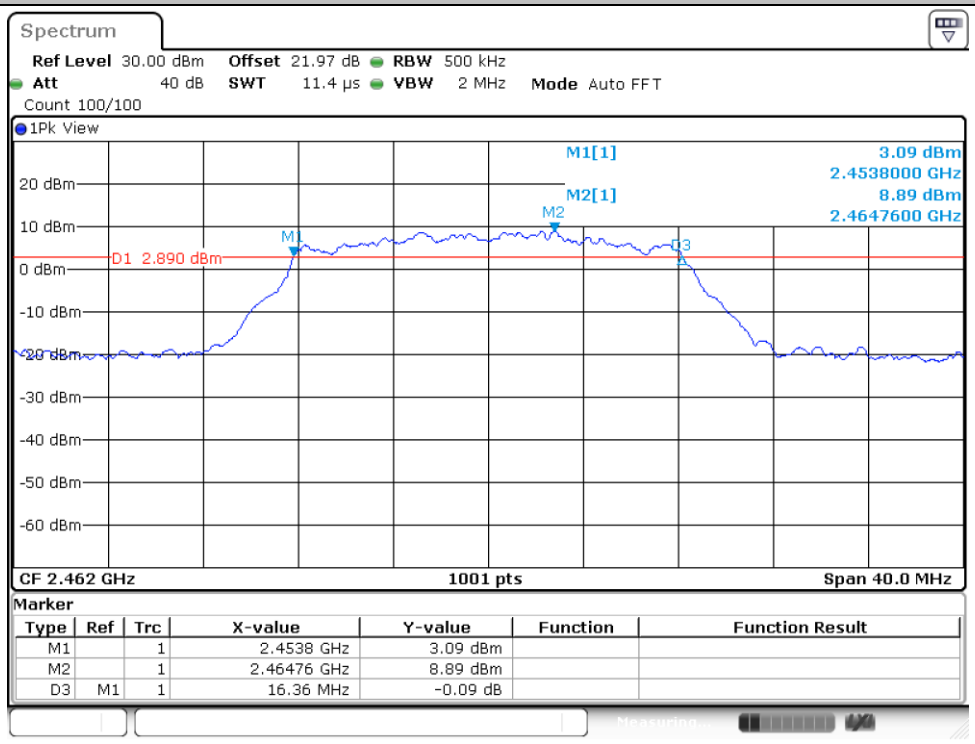

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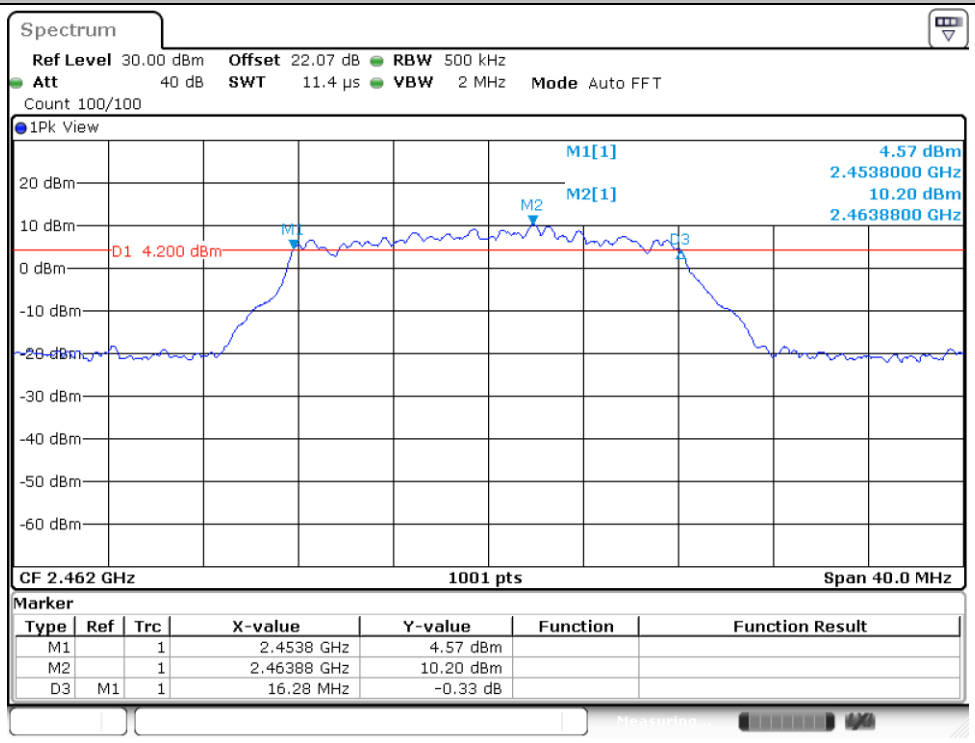
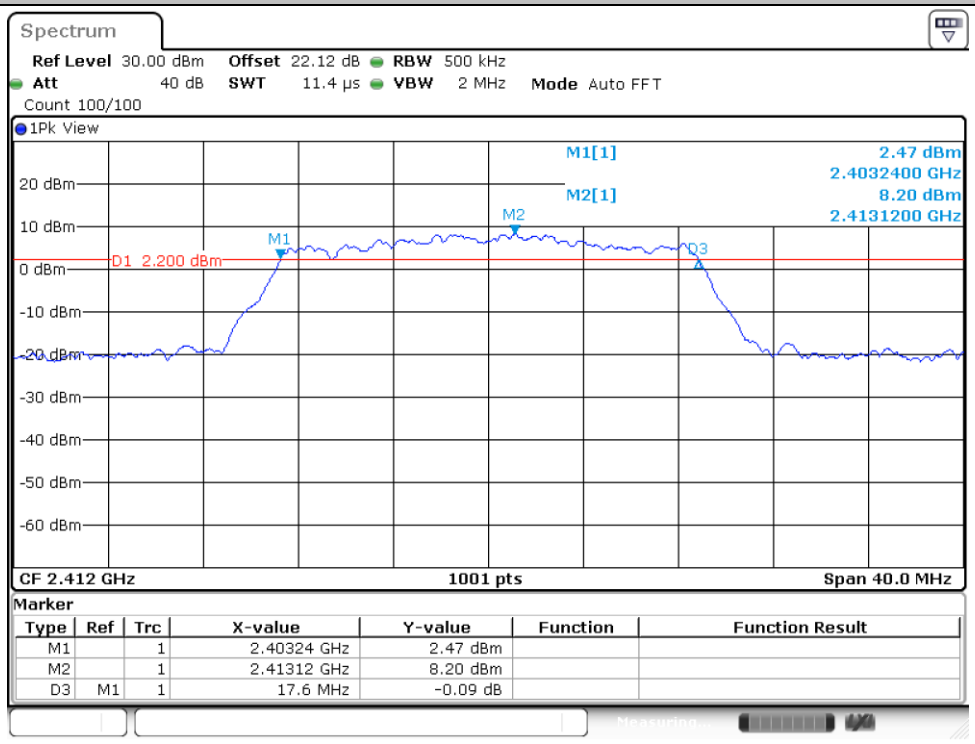


Date: 22.AUG.2025 04:40:47

11N20MIMO_Ant0_2412



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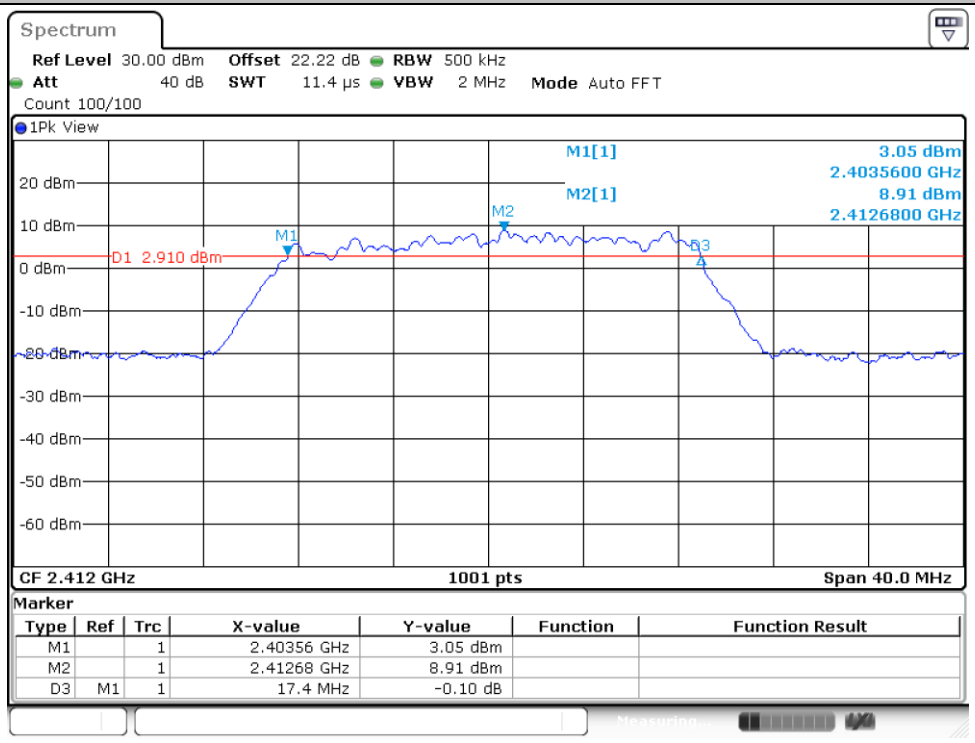

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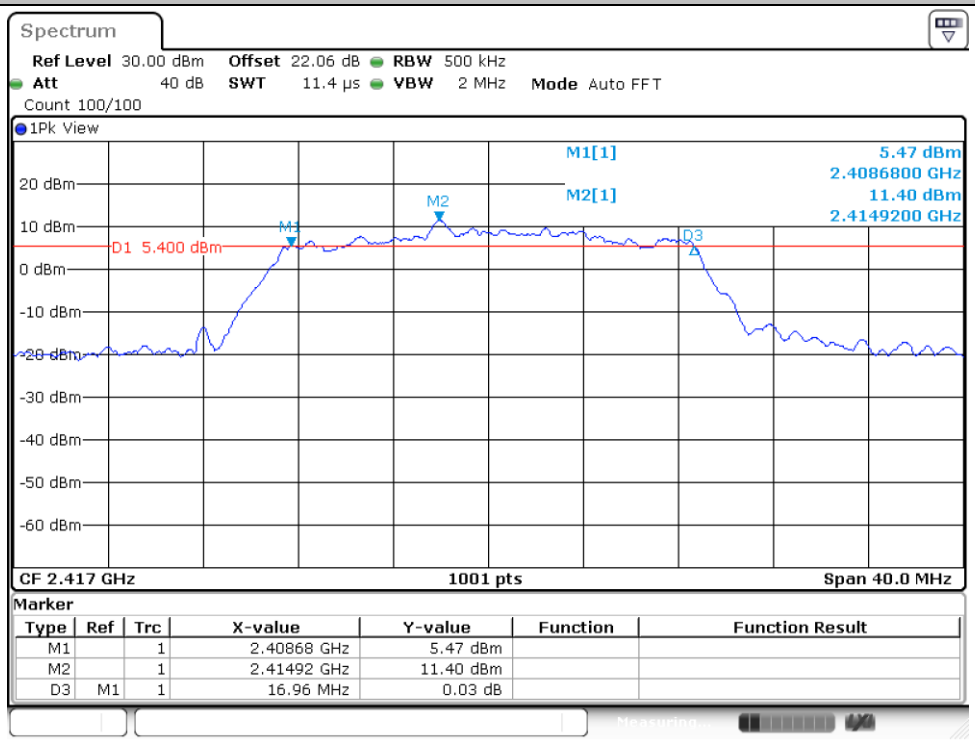

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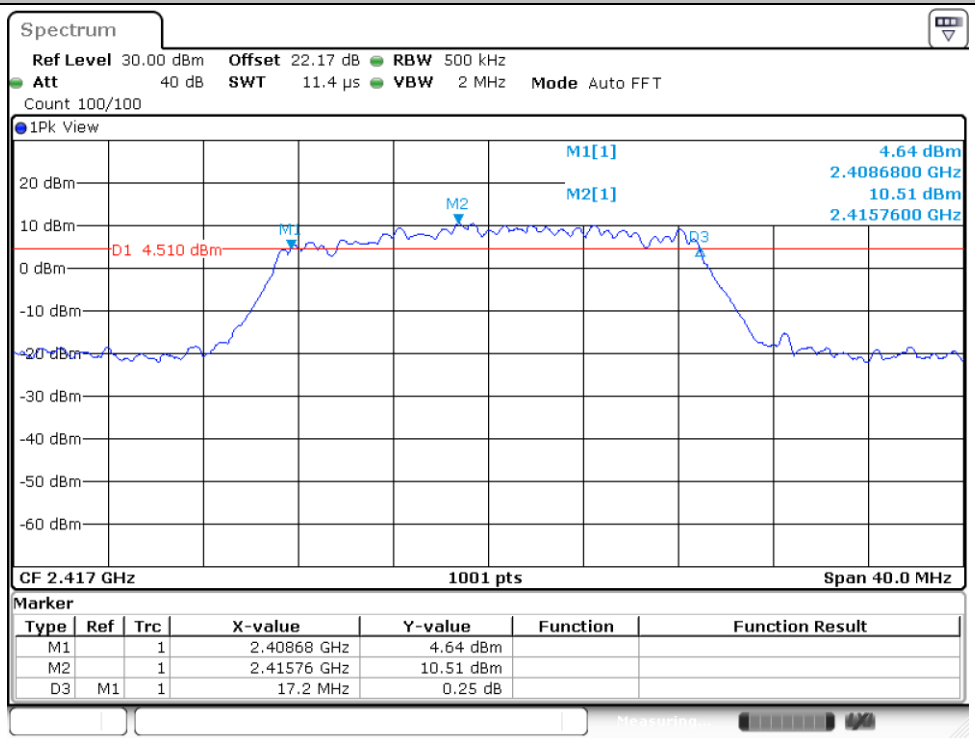

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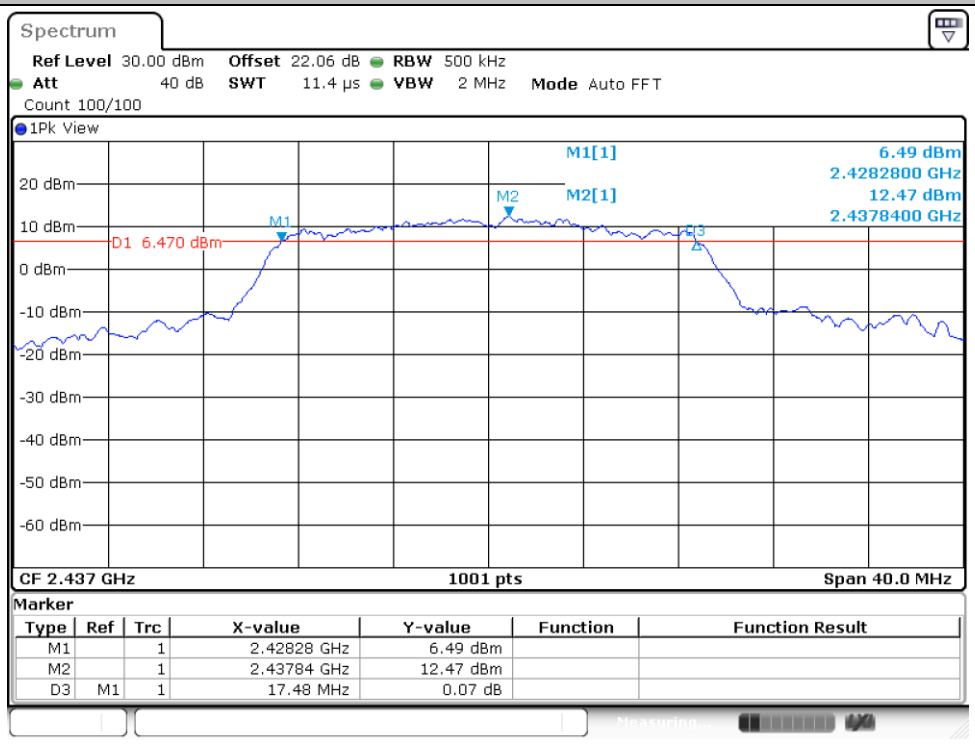

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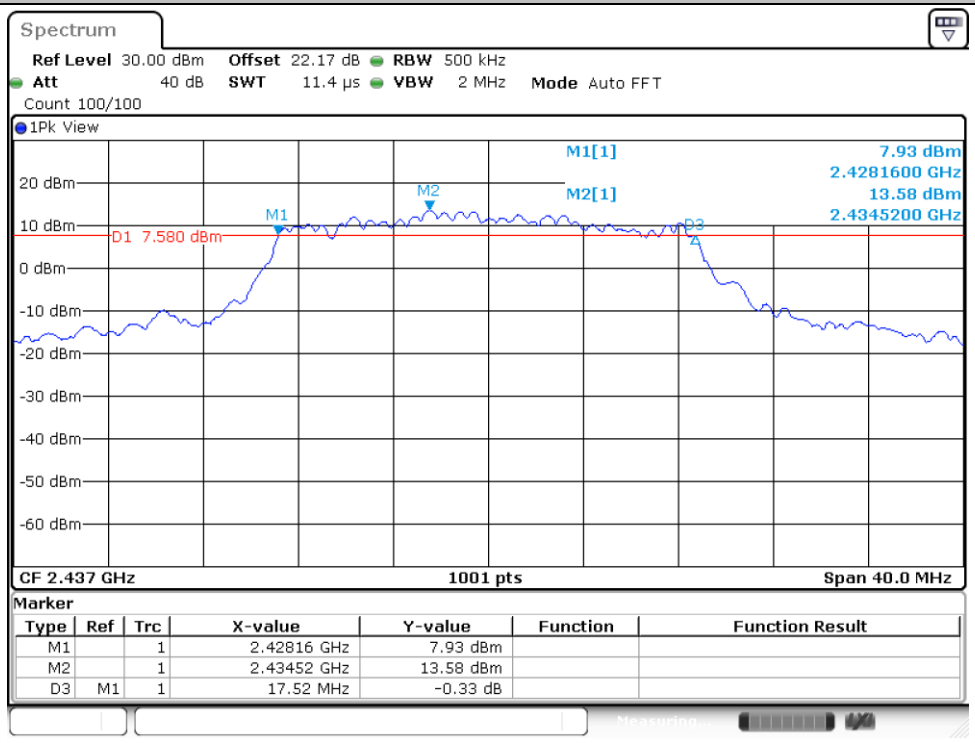

Date: 22.AUG.2025 04:50:07

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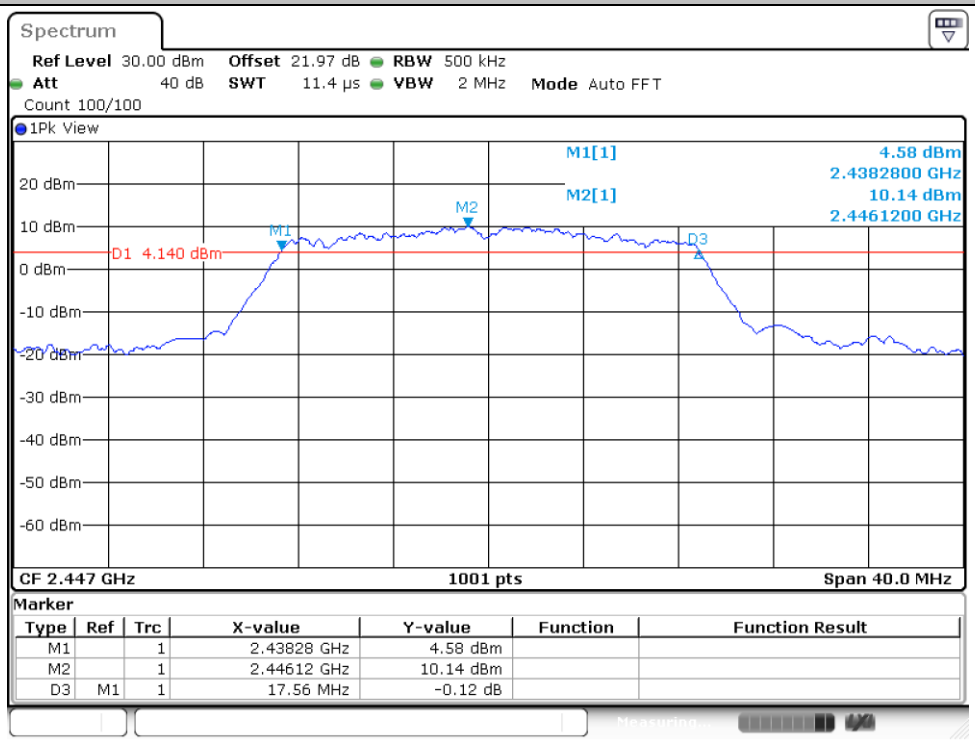
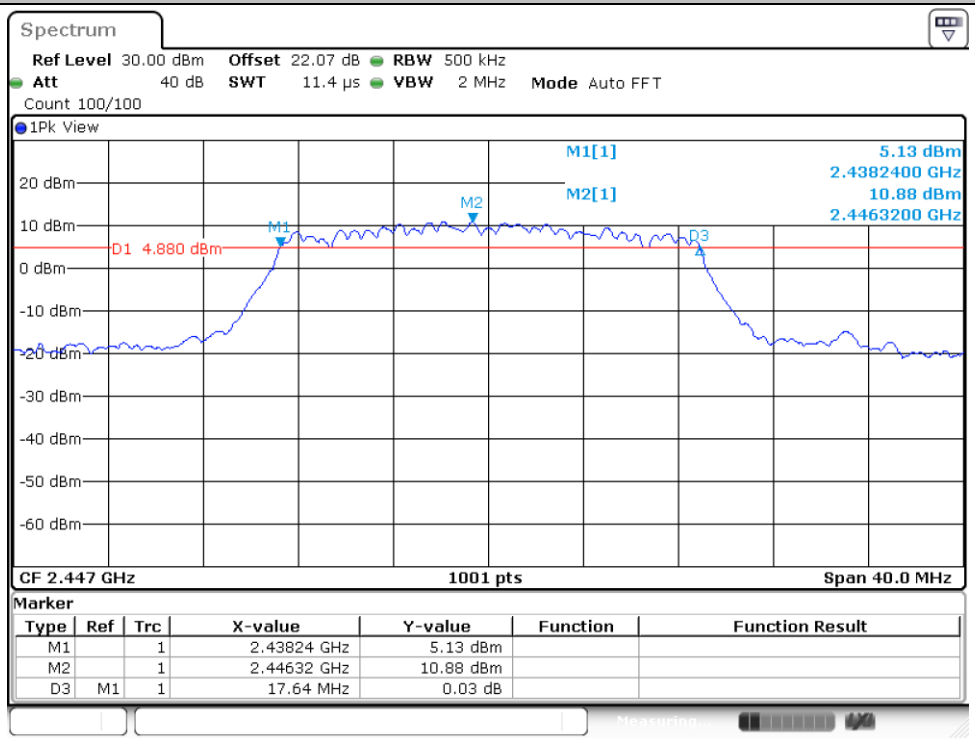


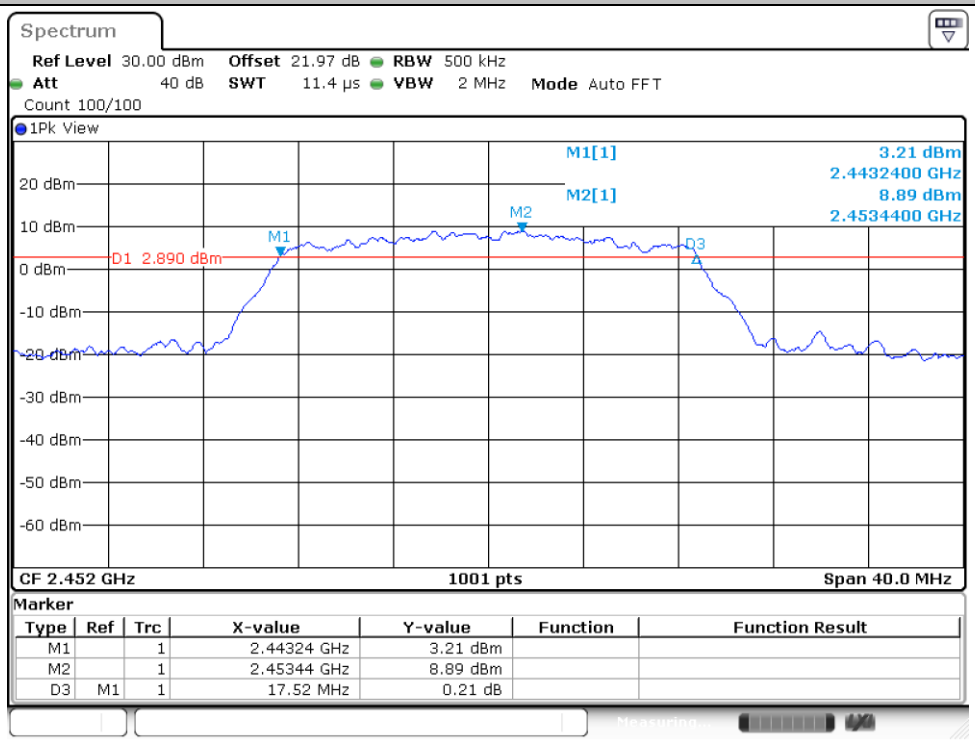
Date: 22.AUG.2025 04:51:59

11N20MIMO_Ant1_2447



Date: 22.AUG.2025 04:53:05

11N20MIMO_Ant0_2452



Date: 22.AUG.2025 04:54:24

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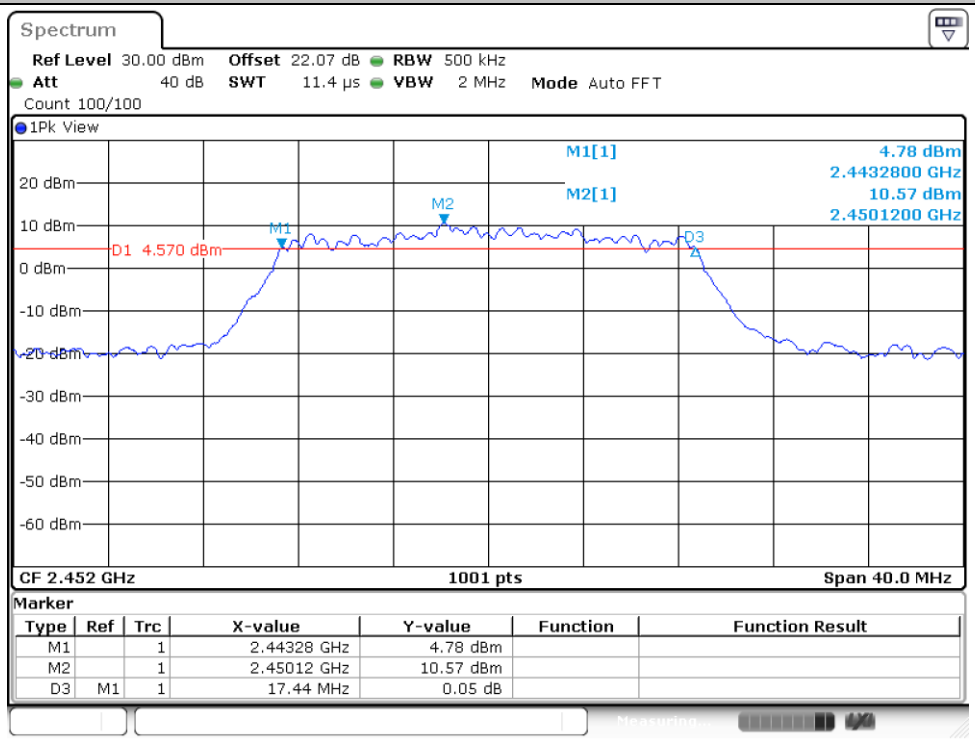

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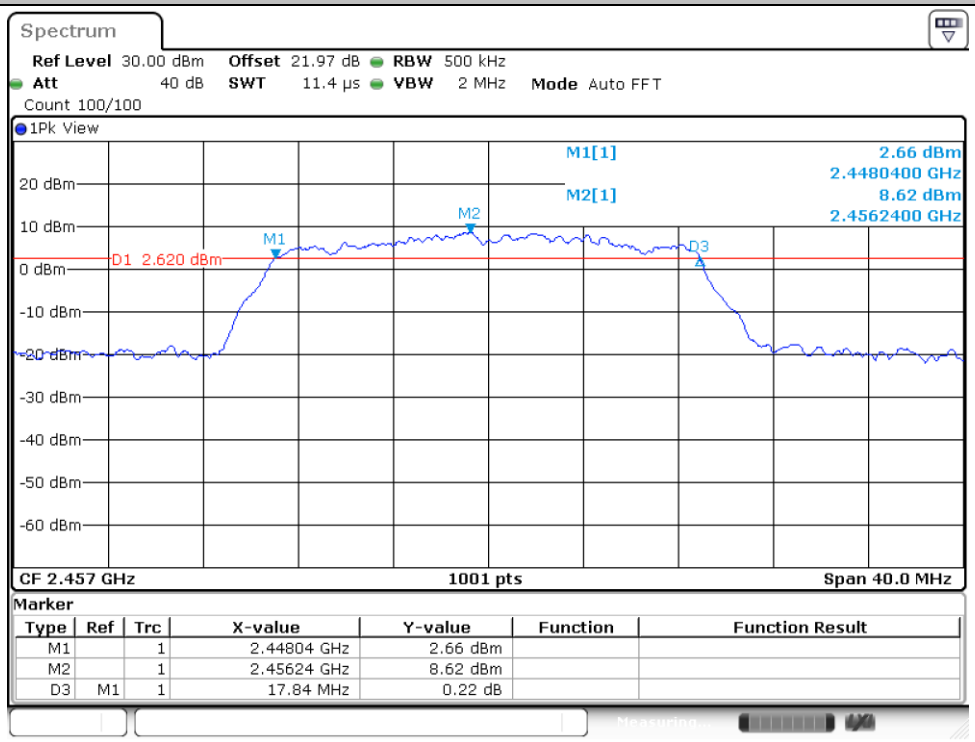
11N20MIMO_Ant0_2457



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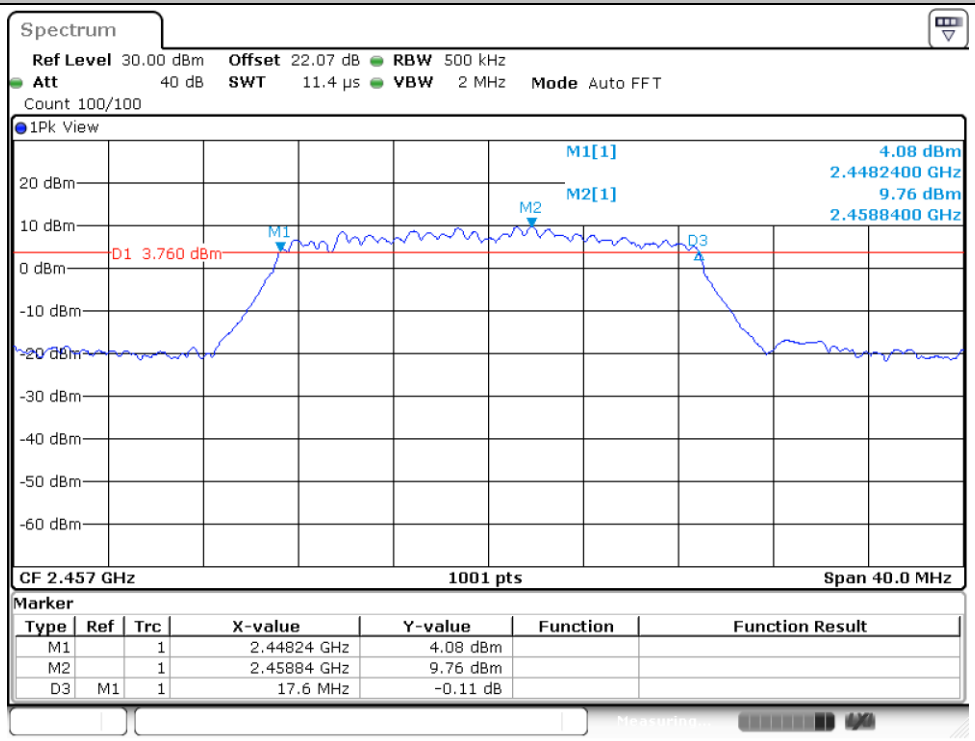
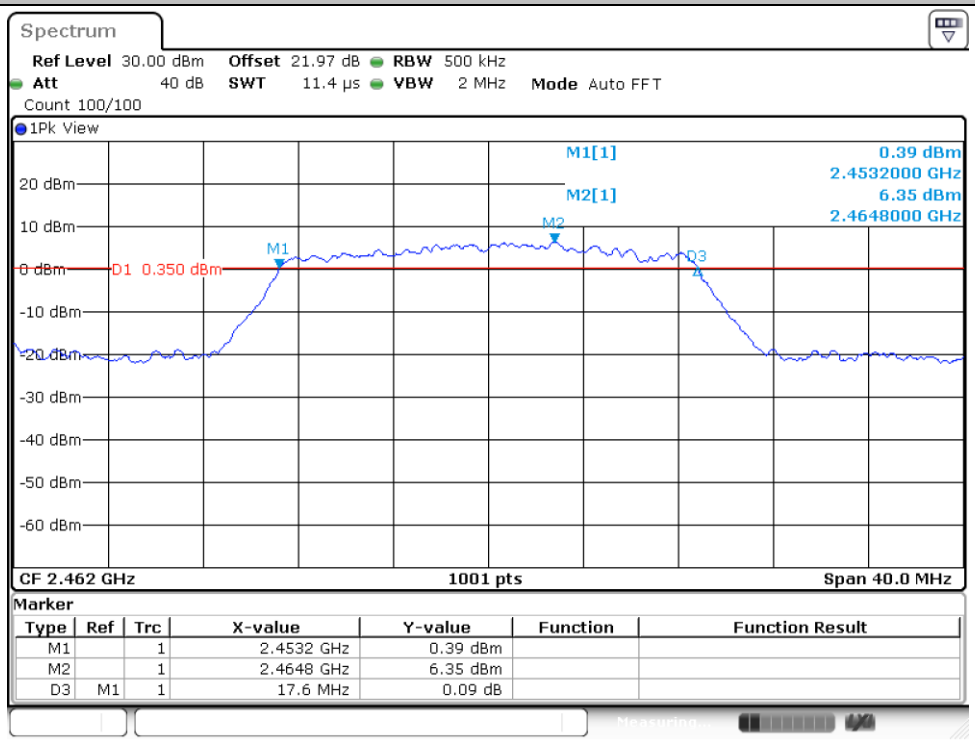


Date: 22.AUG.2025 04:58:24

11N20MIMO_Ant0_2462



Date: 22.AUG.2025 04:59:36

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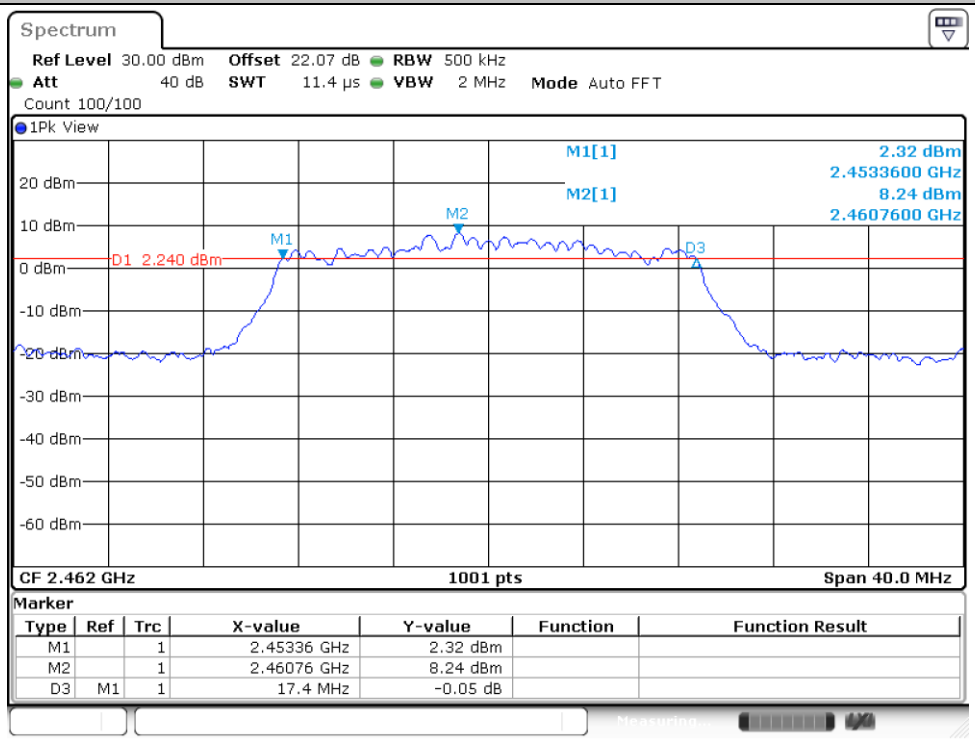
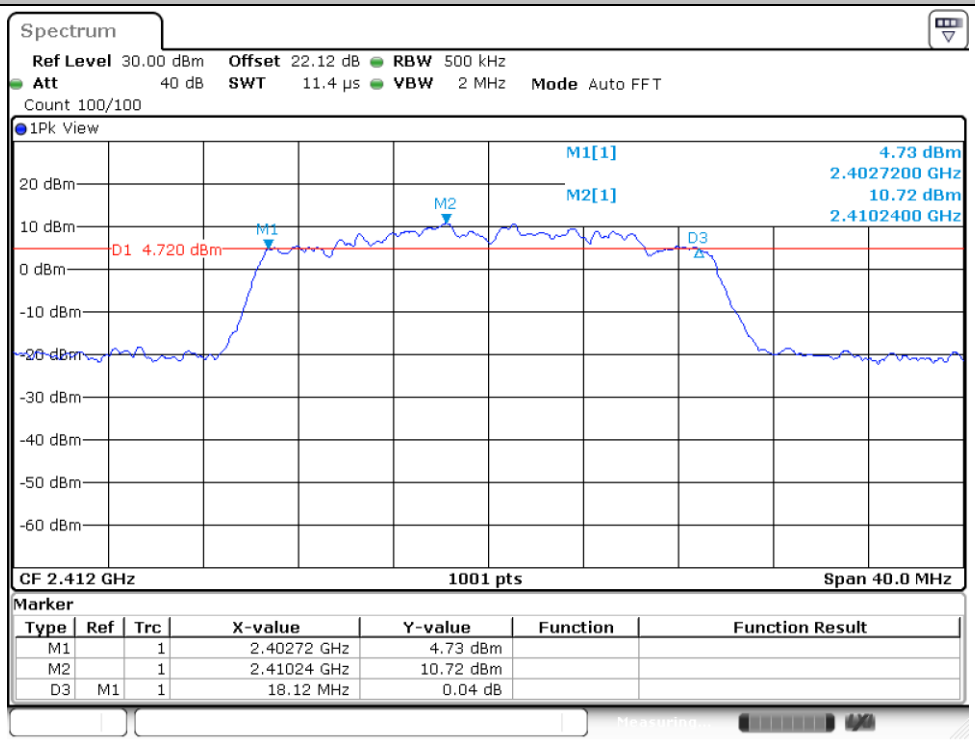


Date: 22.AUG.2025 05:02:25

11AX20MIMO_Ant0_2412



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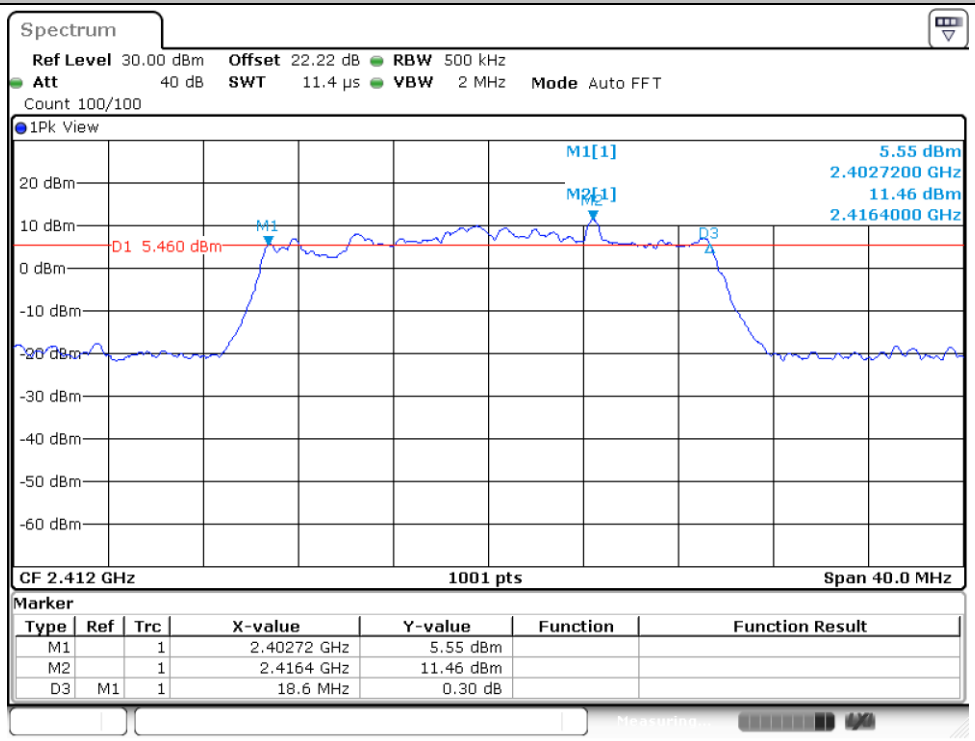

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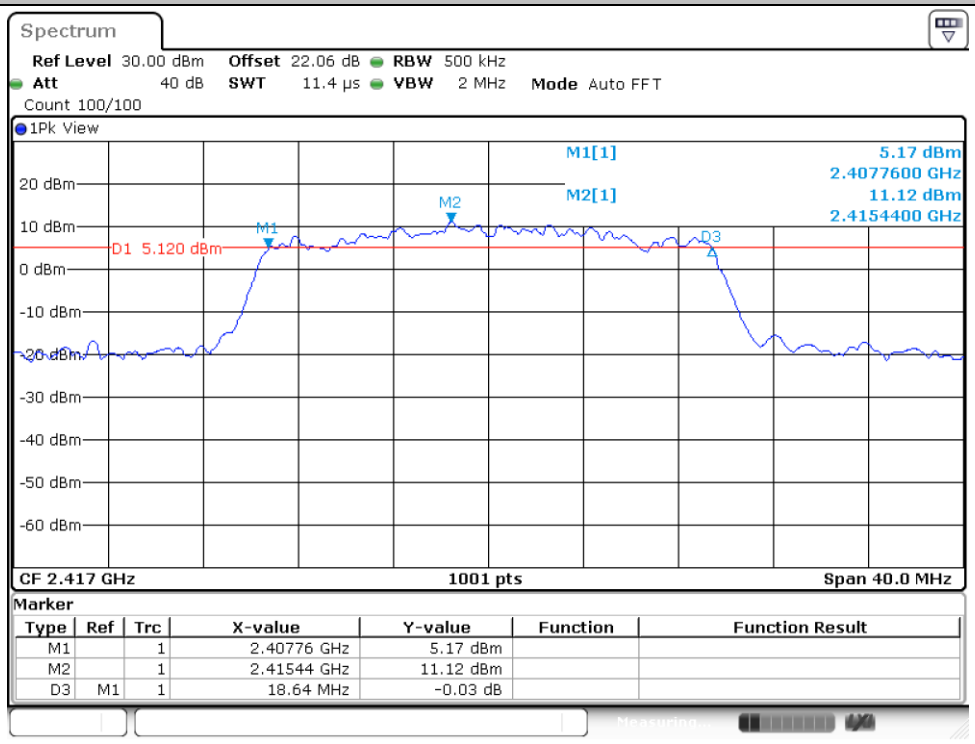

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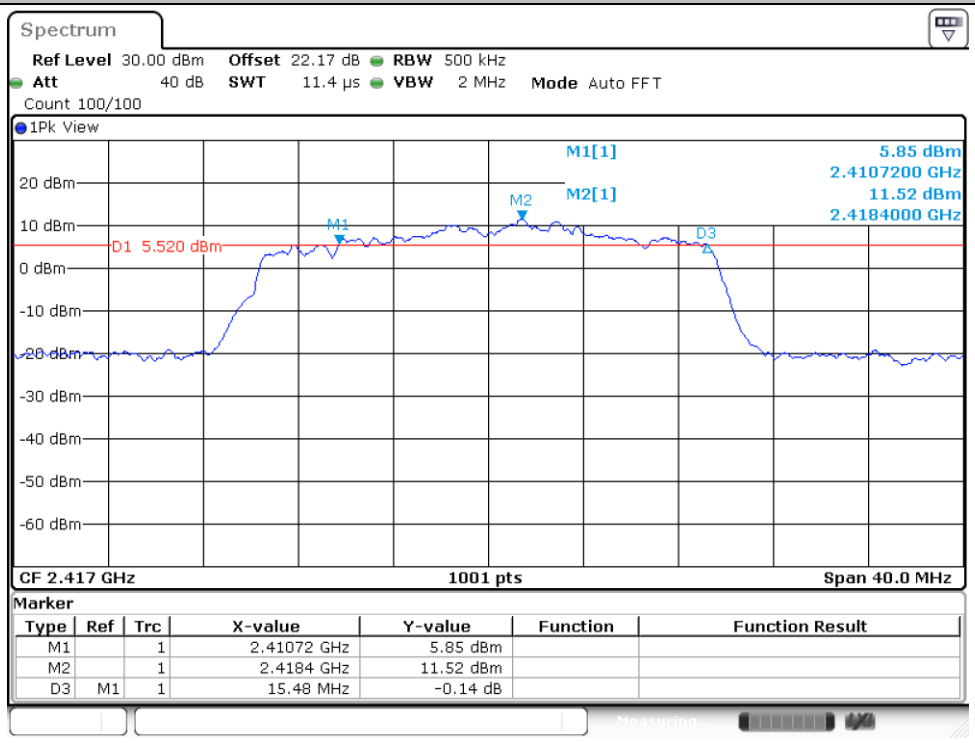

Date: 22.AUG.2025 05:50:11

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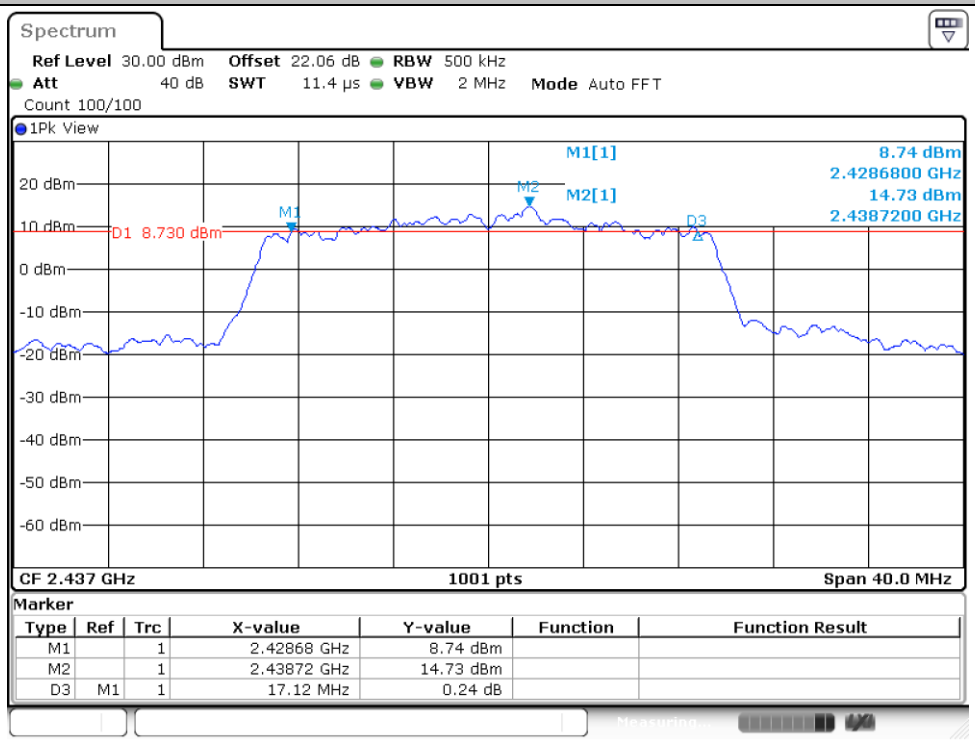

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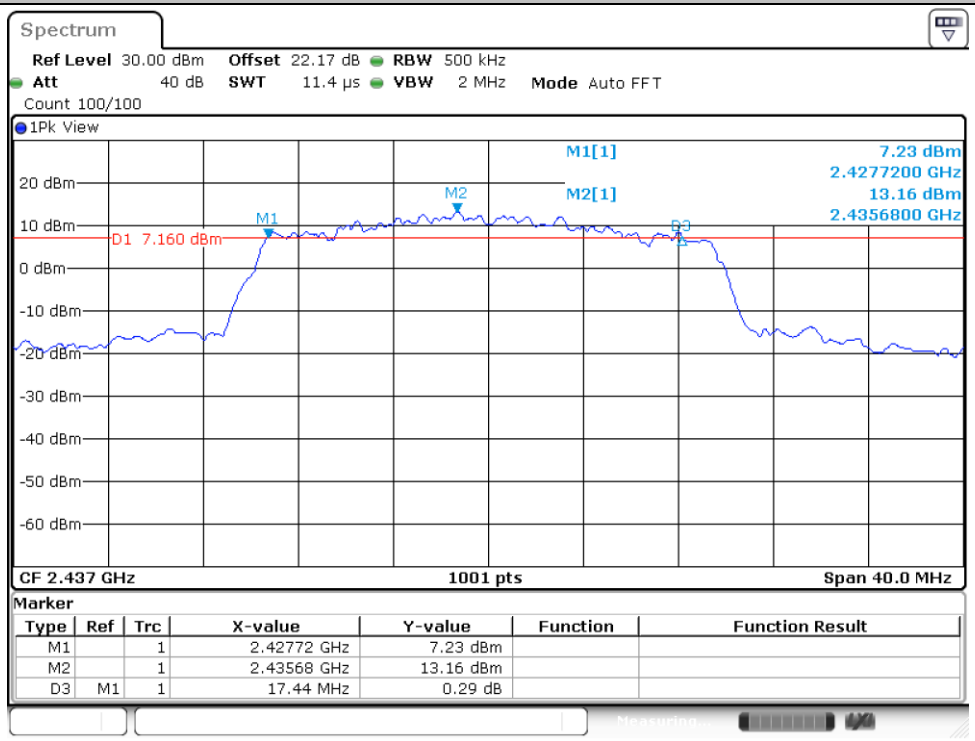

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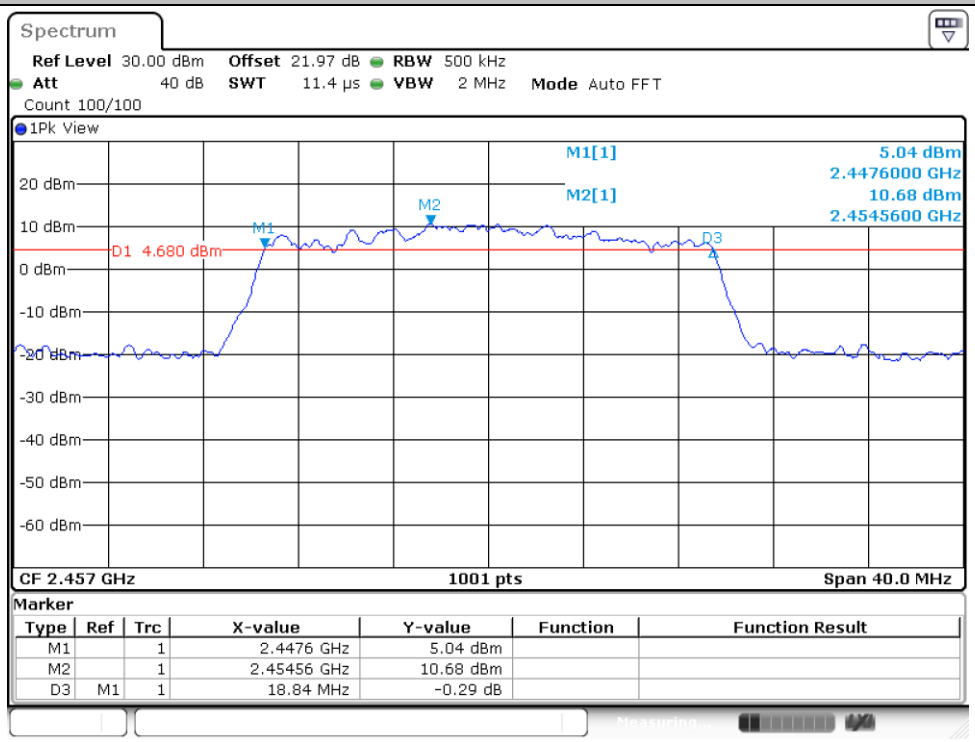

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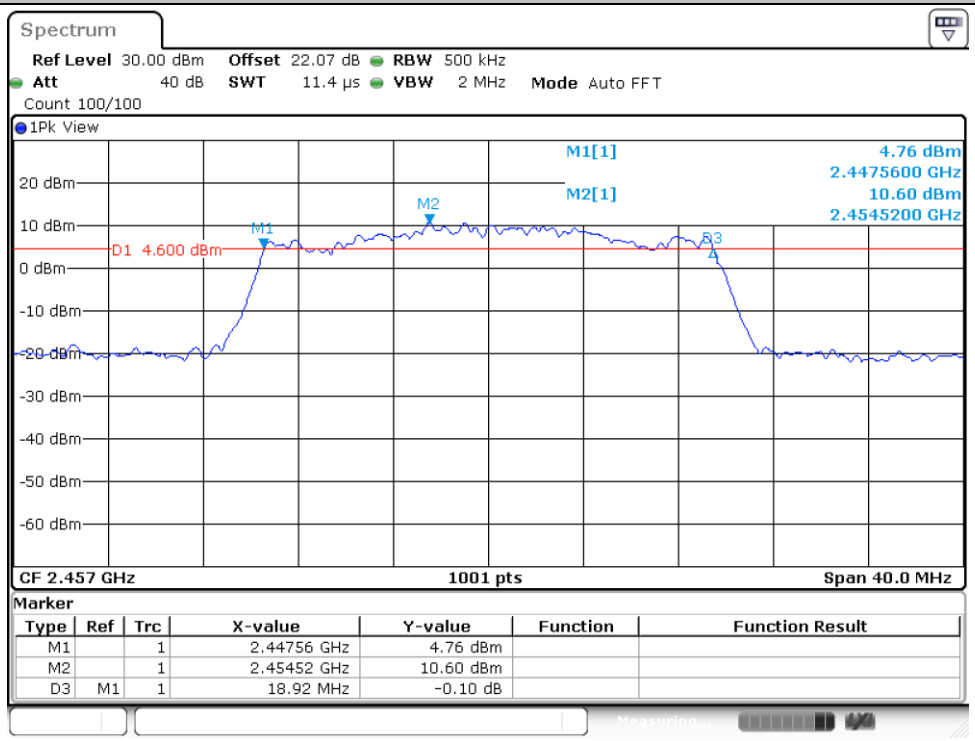

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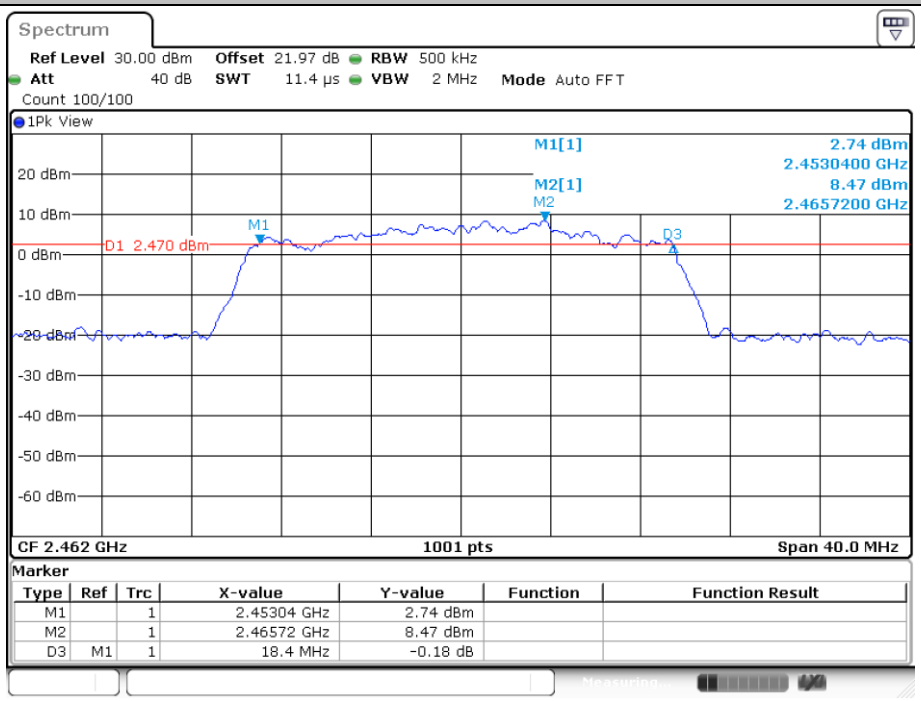
11AX20MIMO_Ant0_2462



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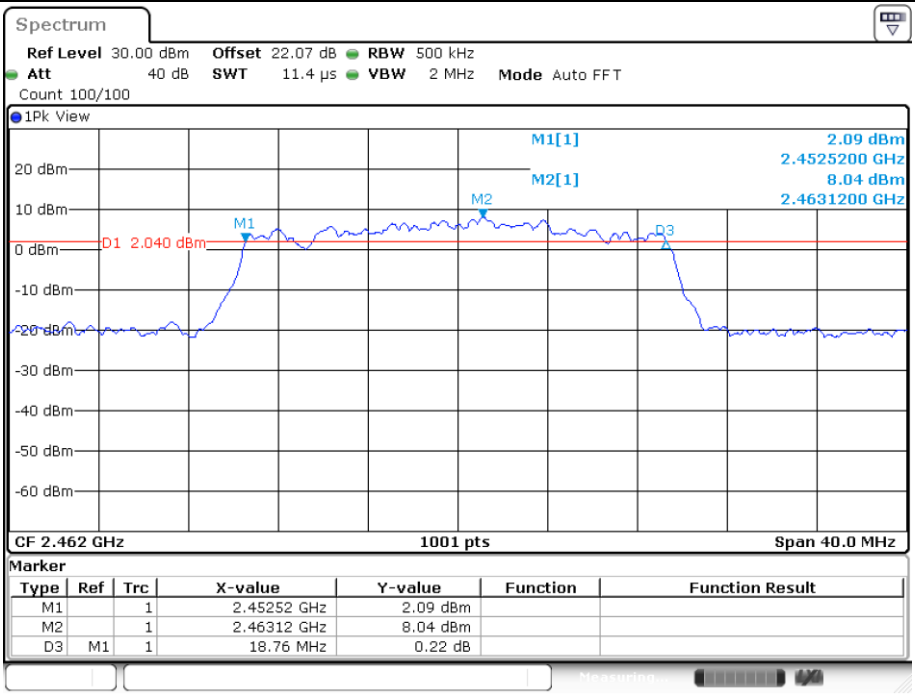


Date: 22.AUG.2025 06:00:52

Occupied Channel Bandwidth

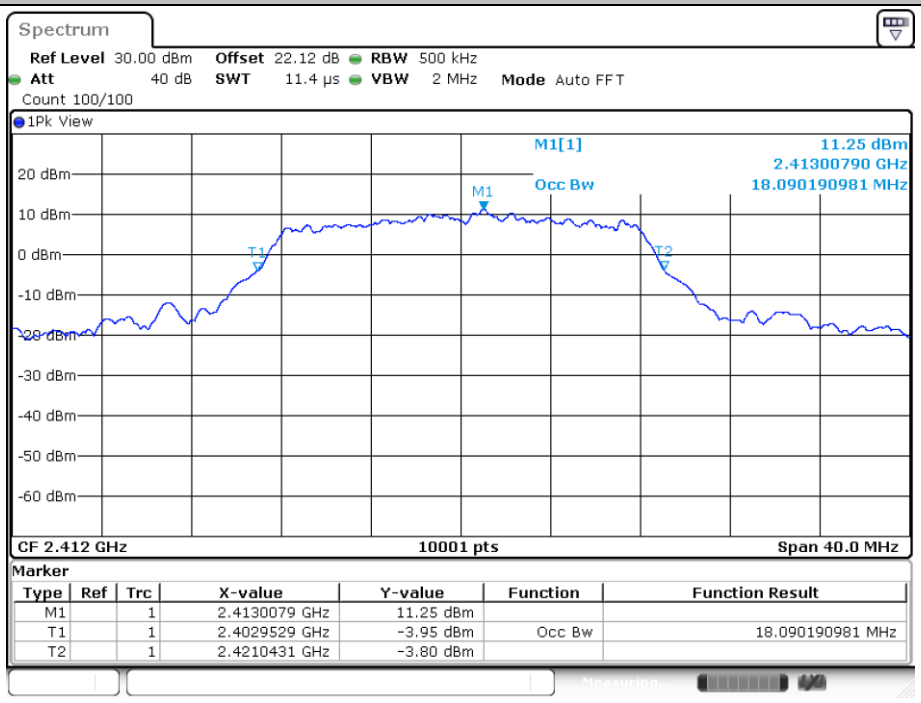
Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]
11G	Ant0	2412	18.090	2402.9529	2421.0431
	Ant1	2412	17.742	2403.1769	2420.9191
	Ant0	2437	17.610	2428.2409	2445.8511
	Ant1	2437	17.674	2428.1889	2445.8631
	Ant0	2462	17.898	2453.1649	2471.0631
	Ant1	2462	17.670	2453.1169	2470.7871
11B-CDD	Ant0	2412	12.383	2405.8806	2418.2634
	Ant1	2412	12.055	2406.1966	2418.2514
	Ant0	2437	12.303	2430.9006	2443.2034
	Ant1	2437	12.251	2430.8526	2443.1034
	Ant0	2462	12.391	2455.9286	2468.3194
	Ant1	2462	12.107	2456.0166	2468.1234
11G-CDD	Ant0	2412	17.922	2403.1689	2421.0911
	Ant1	2412	17.758	2403.4489	2421.2071
	Ant0	2417	17.978	2408.1569	2426.1351
	Ant1	2417	17.290	2408.5448	2425.8351
	Ant0	2437	18.270	2427.8889	2446.1591
	Ant1	2437	17.646	2428.1169	2445.7631
	Ant0	2452	18.078	2442.8369	2460.9151
	Ant1	2452	17.170	2443.4329	2460.6031
	Ant0	2457	18.274	2447.7849	2466.0591
	Ant1	2457	17.658	2448.3289	2465.9871
	Ant0	2462	17.854	2453.0769	2470.9311
	Ant1	2462	17.258	2453.3449	2470.6031
11N20MIMO	Ant0	2412	18.954	2402.5409	2421.4951
	Ant1	2412	18.218	2403.0049	2421.2231
	Ant0	2417	18.478	2407.8009	2426.2791
	Ant1	2417	18.362	2407.8969	2426.2591
	Ant0	2437	19.194	2427.4130	2446.6070
	Ant1	2437	18.478	2427.7449	2446.2231
	Ant0	2447	18.838	2437.6249	2456.4631
	Ant1	2447	18.282	2437.8889	2456.1711
	Ant0	2452	18.866	2442.6169	2461.4831
	Ant1	2452	18.130	2443.0009	2461.1311

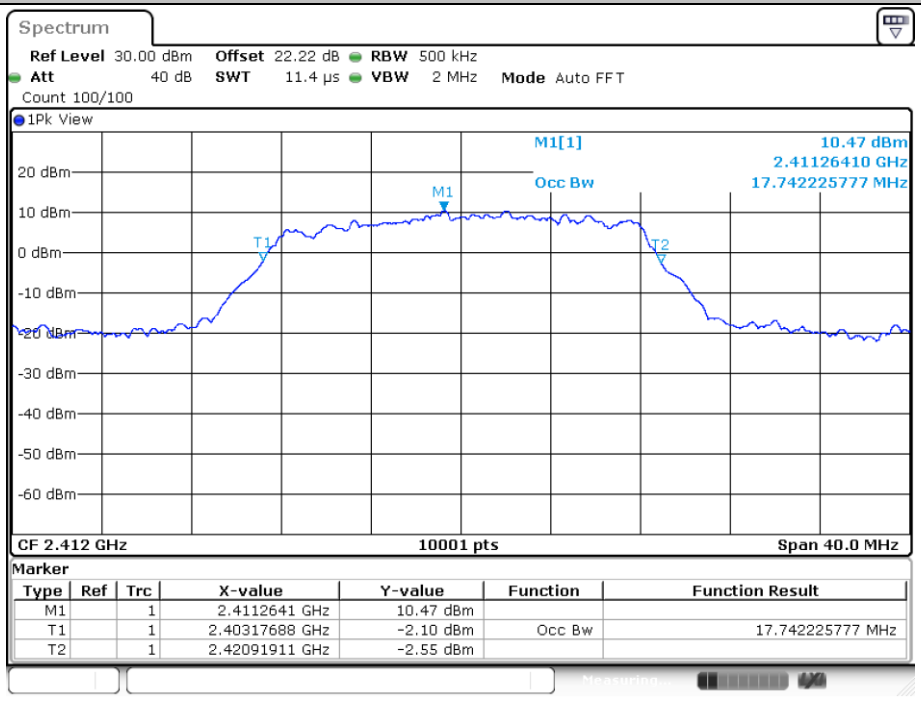
	Ant0	2457	18.682	2447.7009	2466.3831
	Ant1	2457	18.266	2447.8129	2466.0791
	Ant0	2462	18.978	2452.6409	2471.6190
	Ant1	2462	18.290	2452.8529	2471.1431
11AX20MIMO	Ant0	2412	19.058	2402.4650	2421.5230
	Ant1	2412	19.082	2402.4850	2421.5670
	Ant0	2417	19.082	2407.5169	2426.5990
	Ant1	2417	19.078	2407.4850	2426.5630
	Ant0	2437	19.214	2427.4970	2446.7110
	Ant1	2437	19.118	2427.4010	2446.5190
	Ant0	2457	19.082	2447.4730	2466.5550
	Ant1	2457	19.246	2447.4530	2466.6990
	Ant0	2462	19.226	2452.3890	2471.6150
	Ant1	2462	19.098	2452.4250	2471.5230

Test Graphs

11G_Ant0_2412



11G_Ant1_2412



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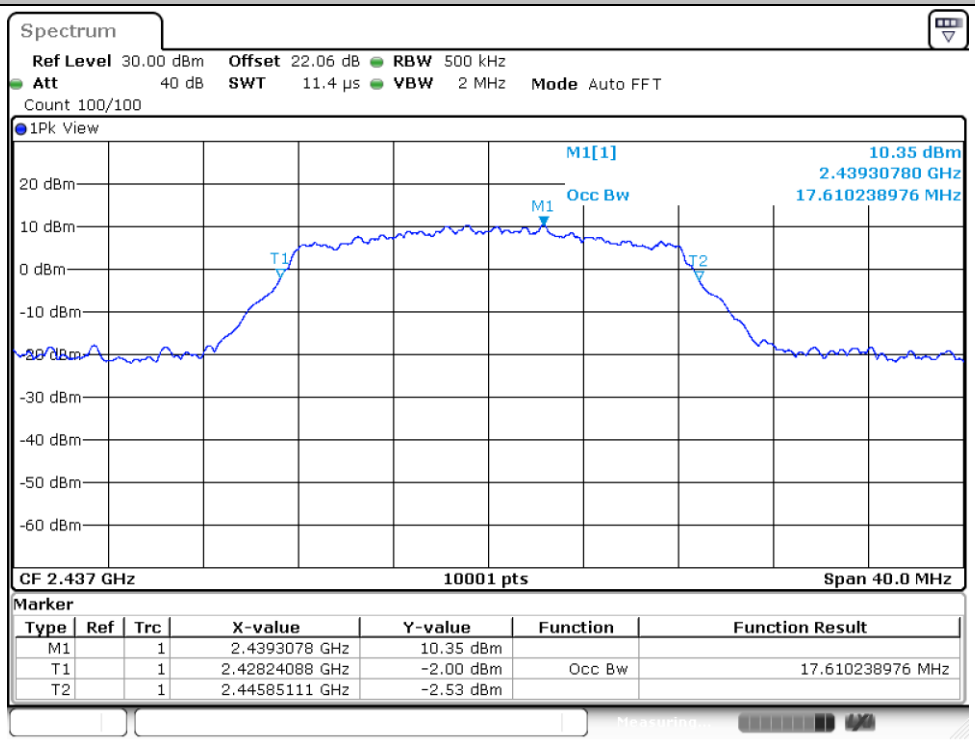

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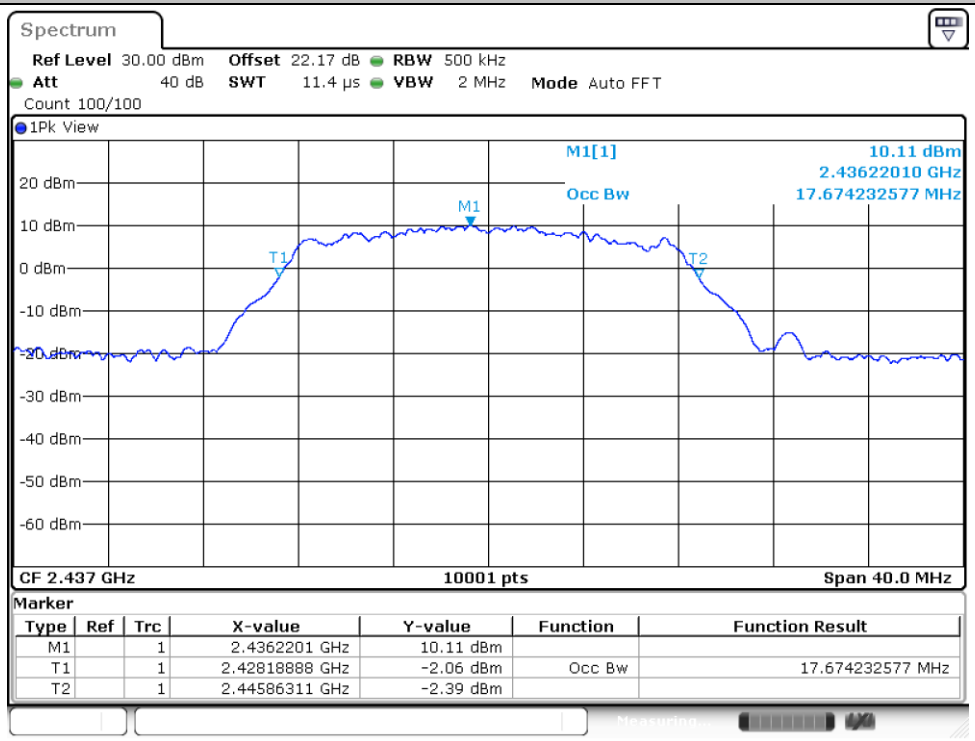
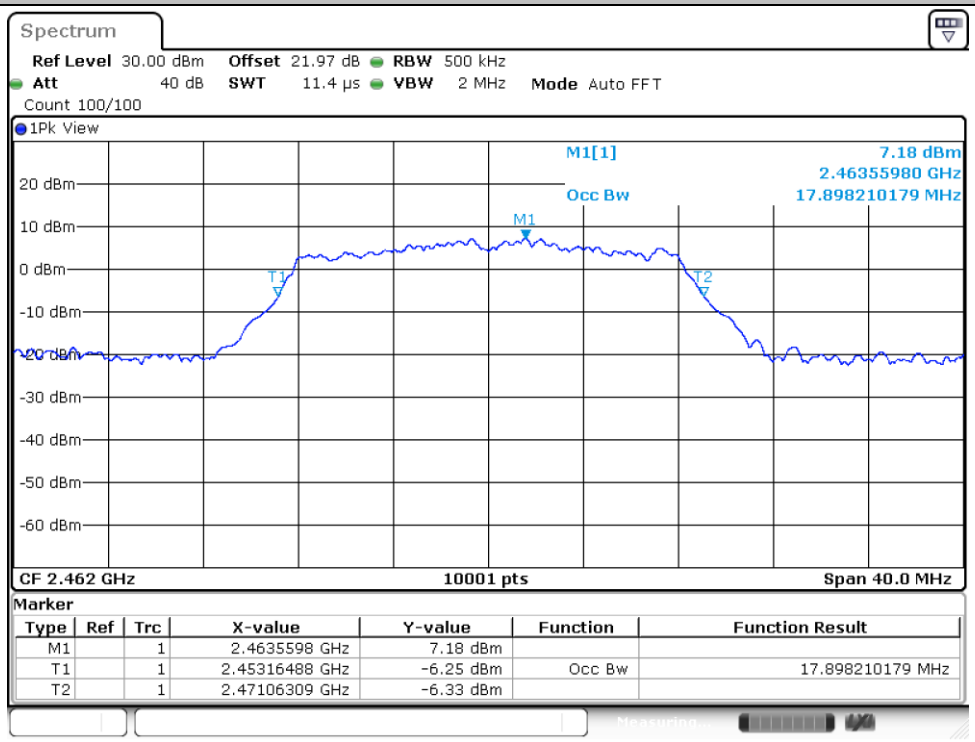


Date: 16.JUL.2025 15:06:46

11G_Ant0_2462



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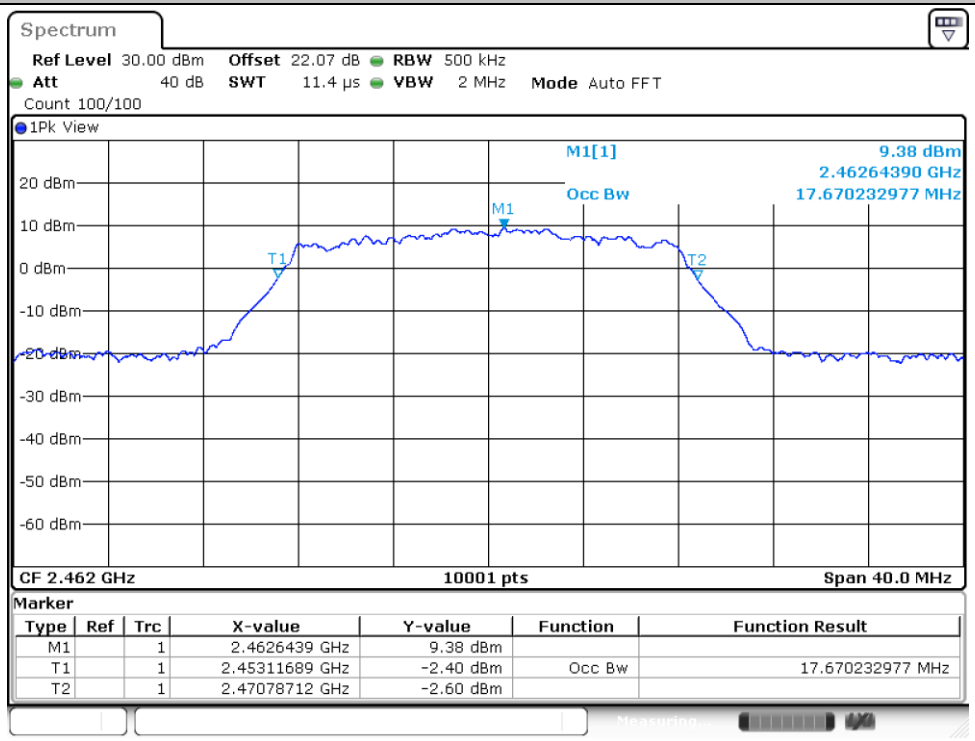
11G_Ant1_2462



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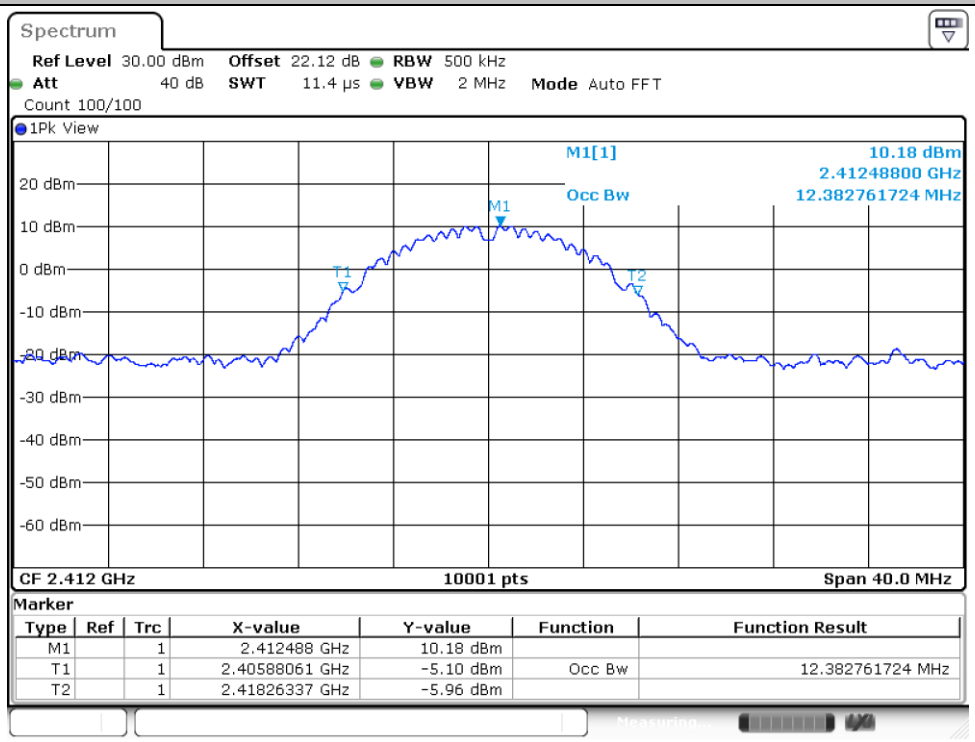
11B-CDD_Ant0_2412



Date: 29.JUN.2025 01:59:15

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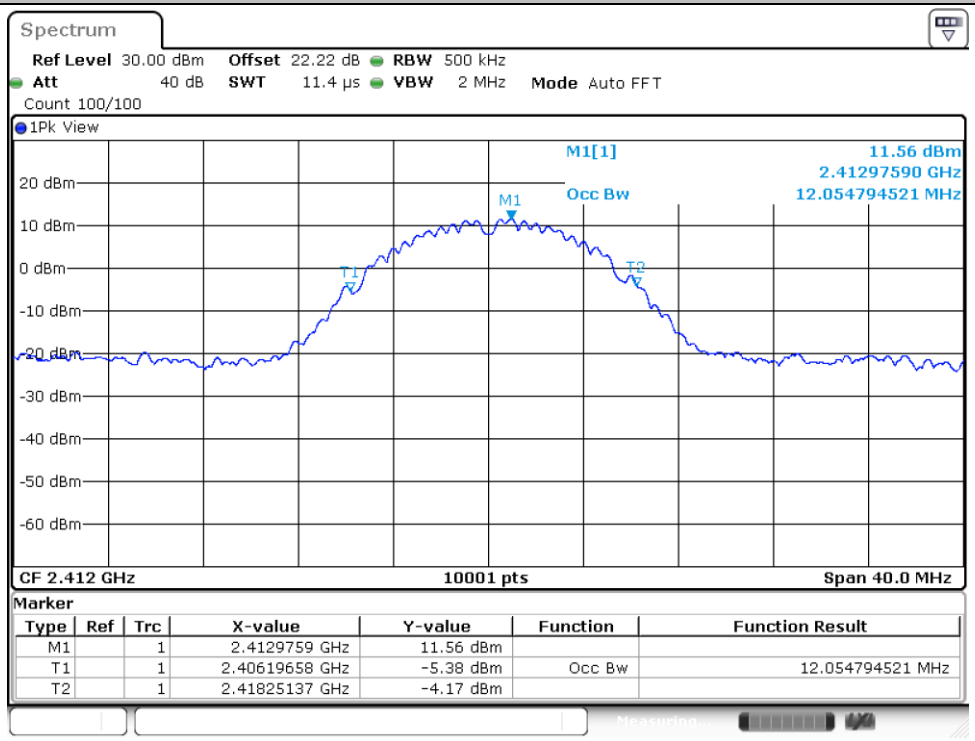

Date: 29.JUN.2025 02:00:26

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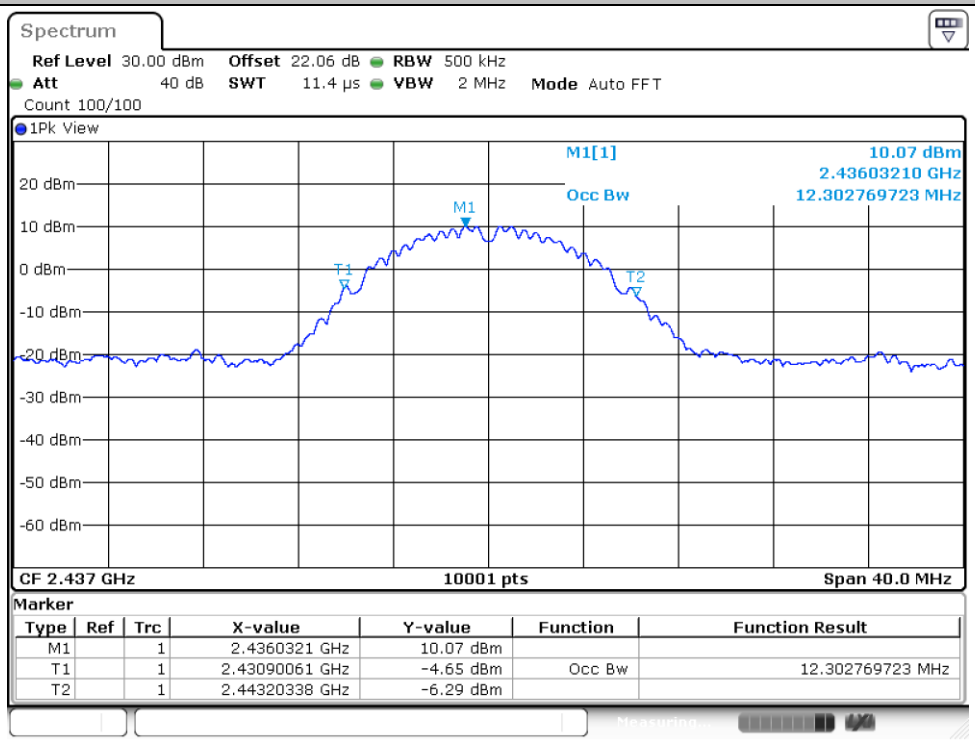

Date: 29.JUN.2025 02:02:30

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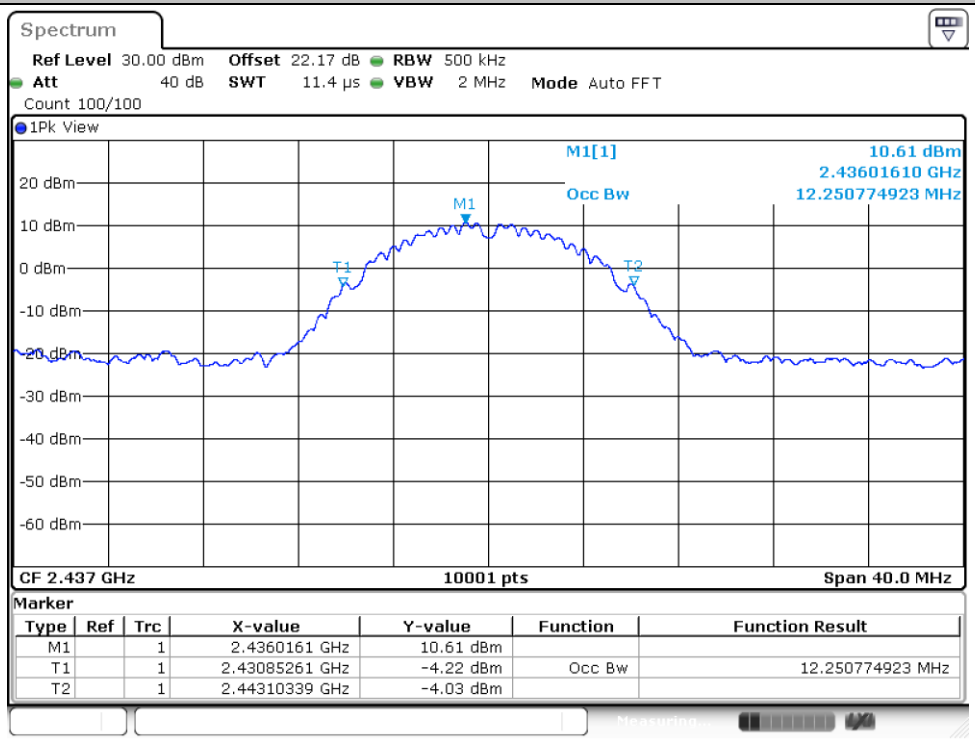

Date: 29.JUN.2025 02:03:32

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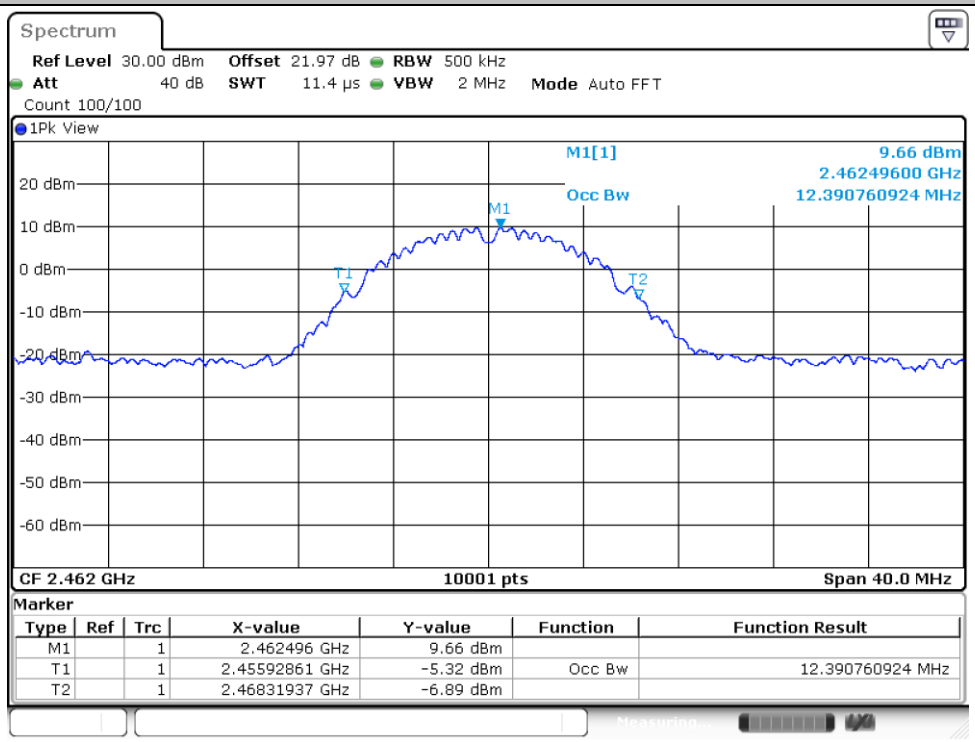
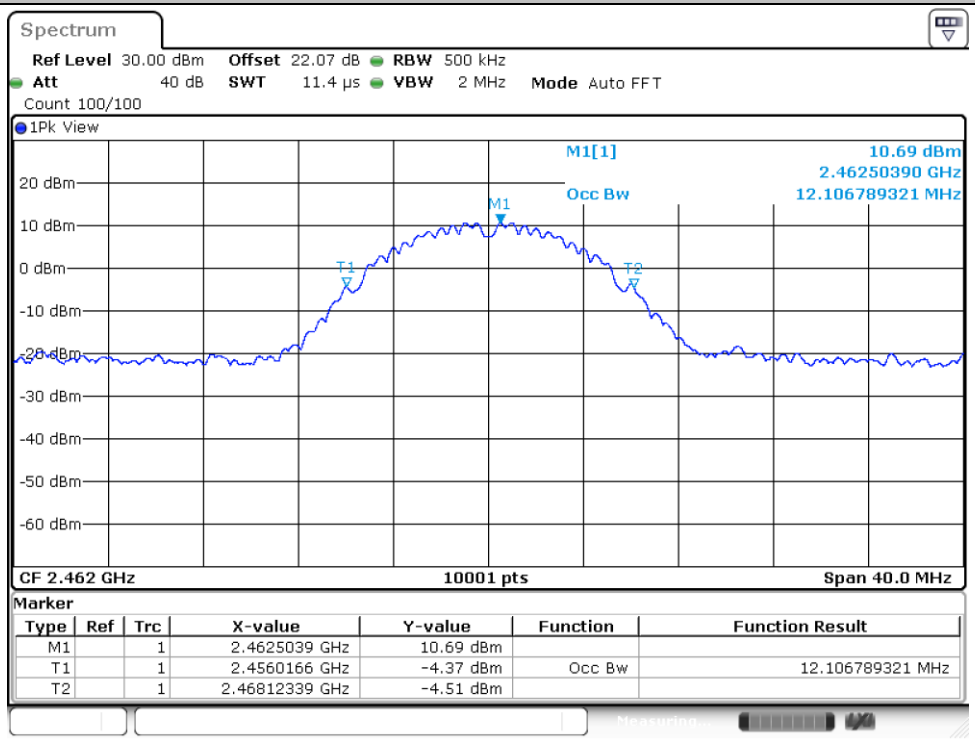


Date: 29.JUN.2025 02:04:47

11B-CDD_Ant1_2462



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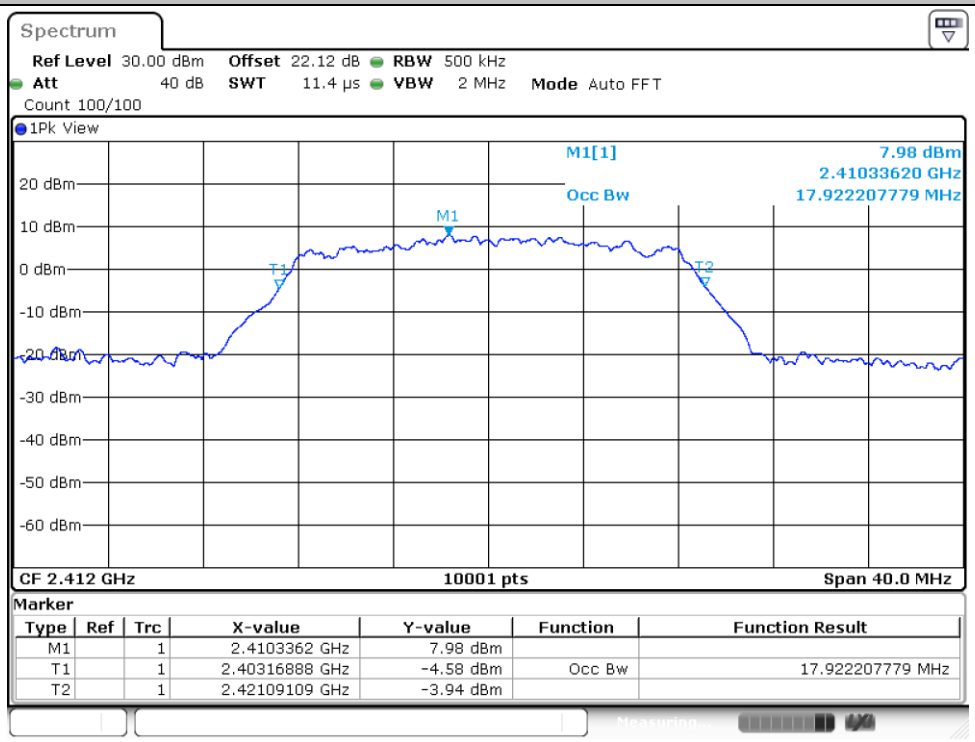
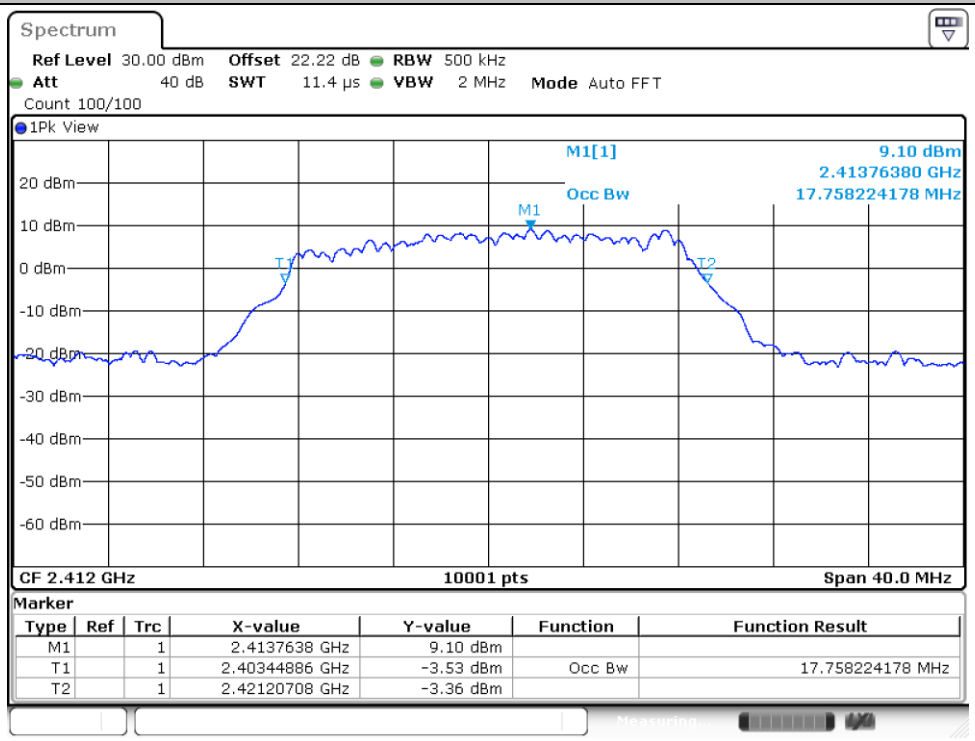


Date: 28.JUN.2025 22:46:22

11G-CDD_Ant1_2412



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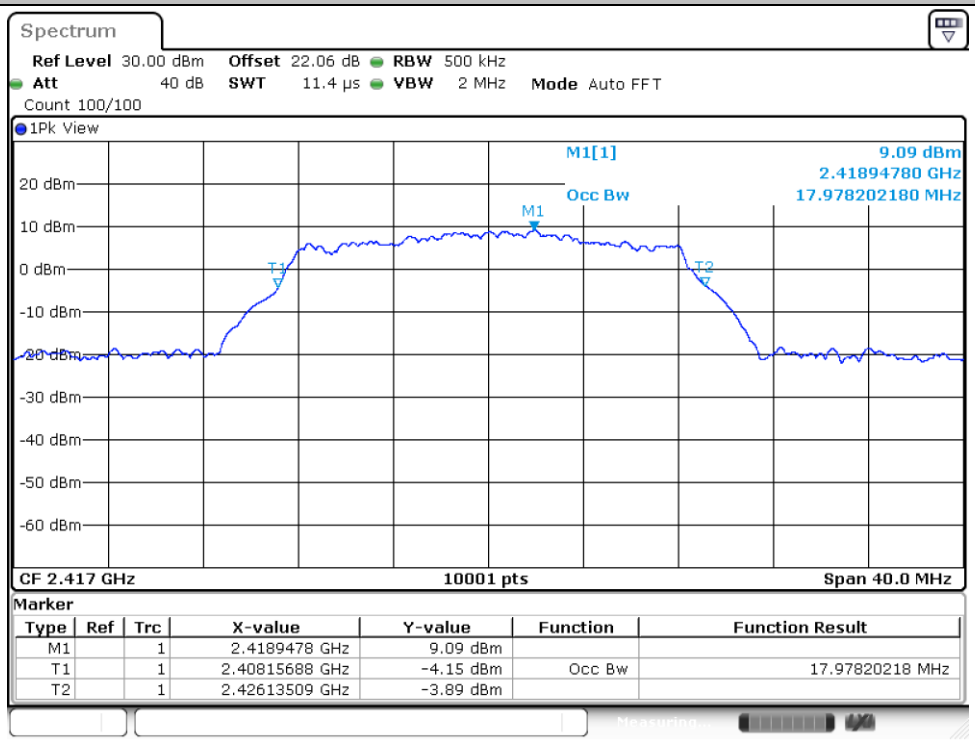
11G-CDD_Ant0_2417



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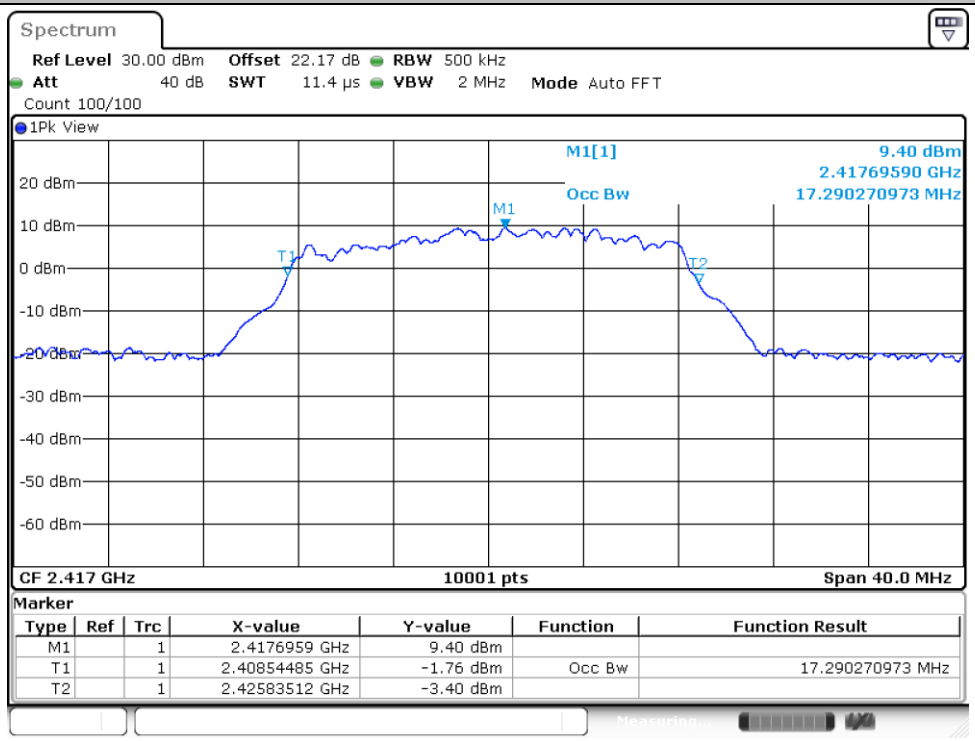

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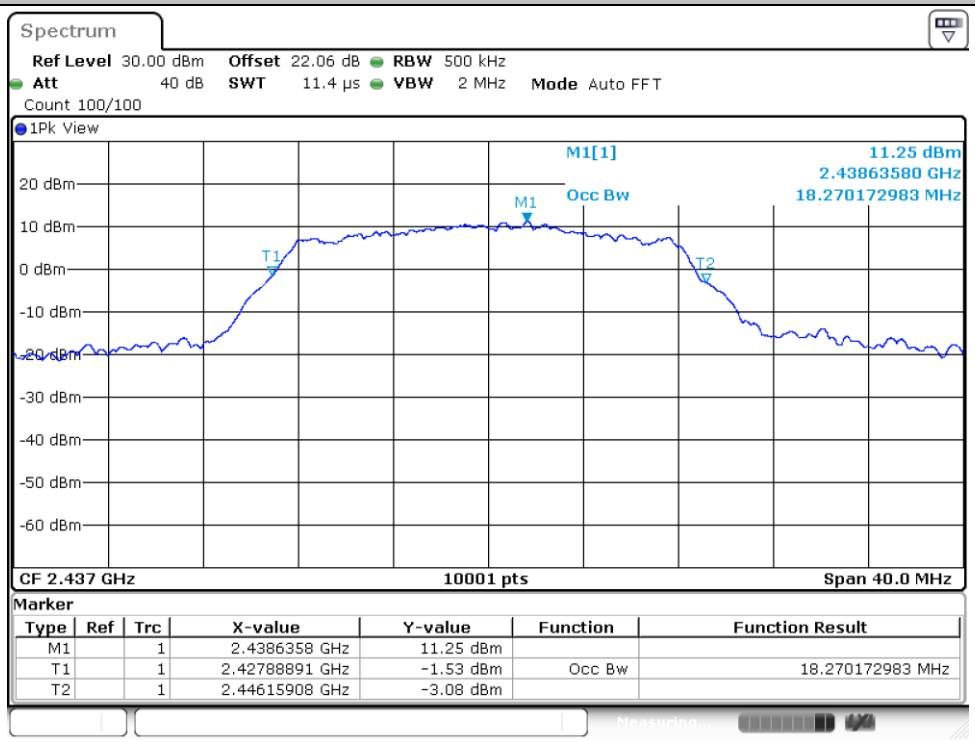

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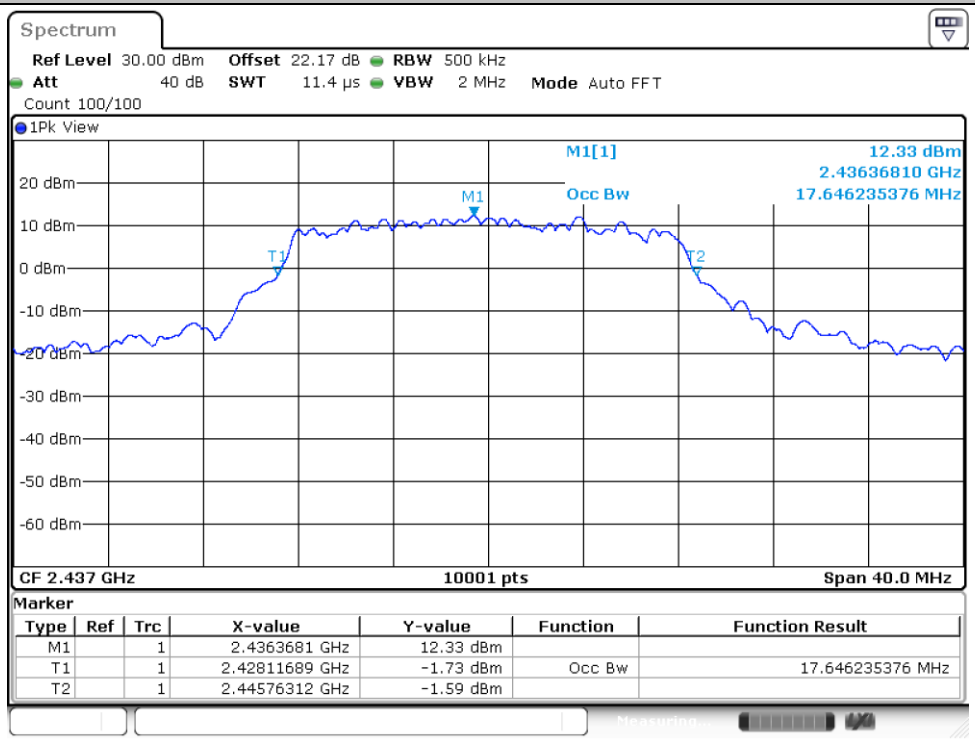

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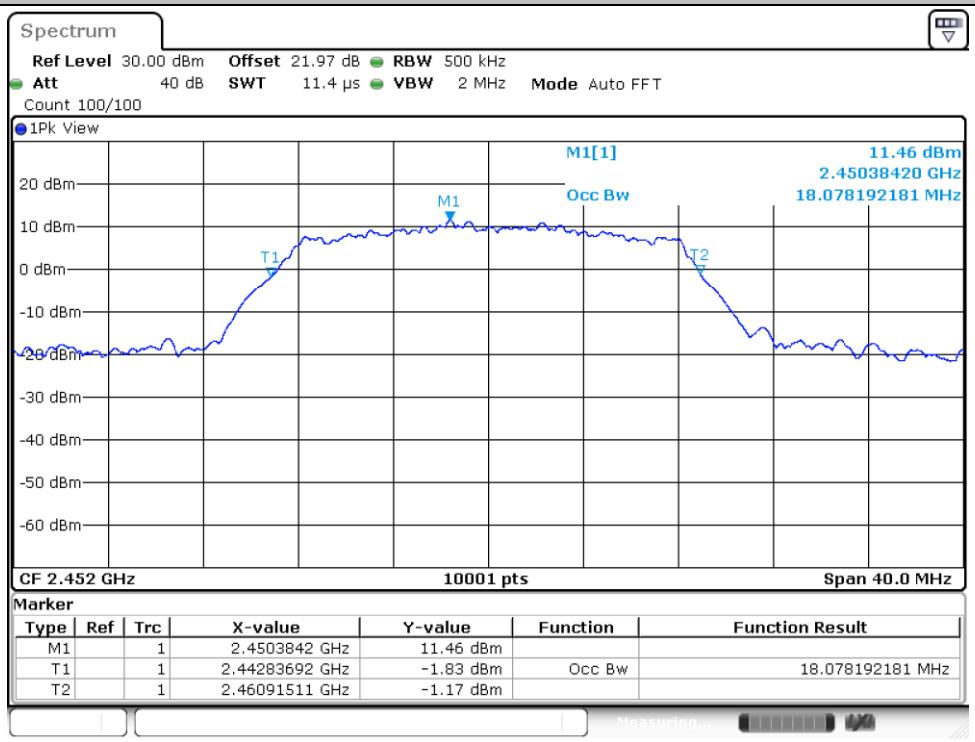

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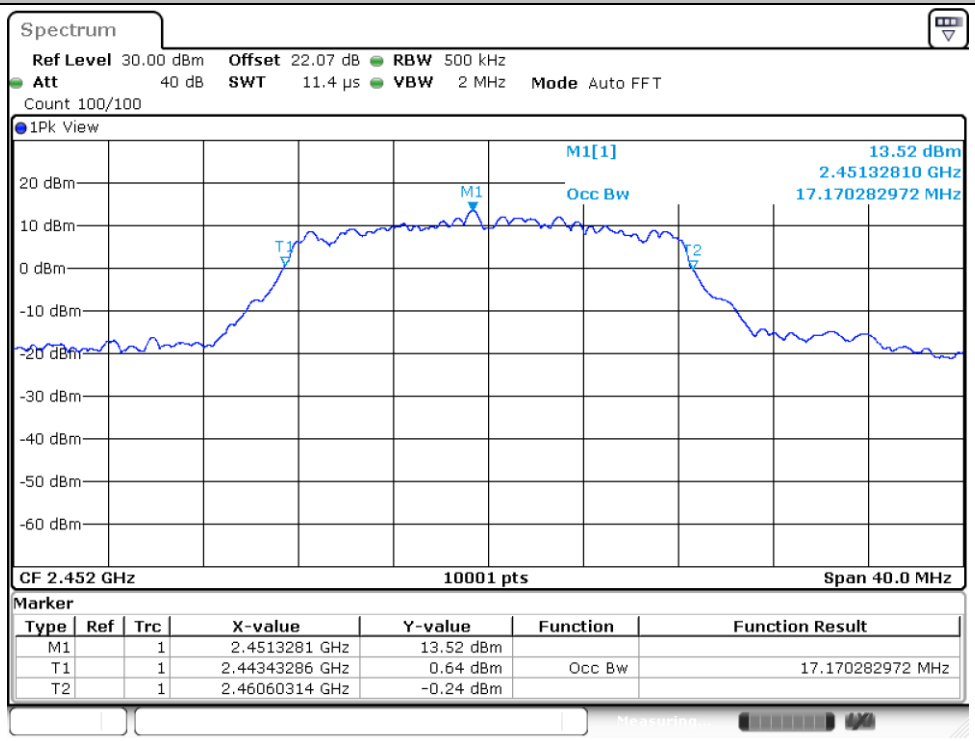
11G-CDD_Ant1_2452



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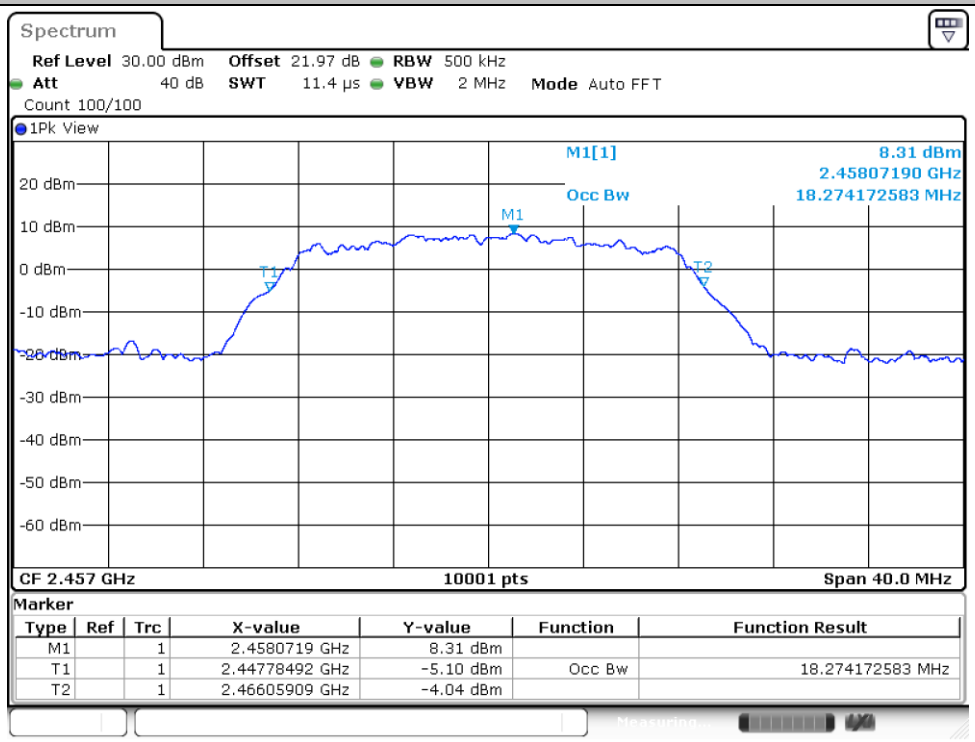

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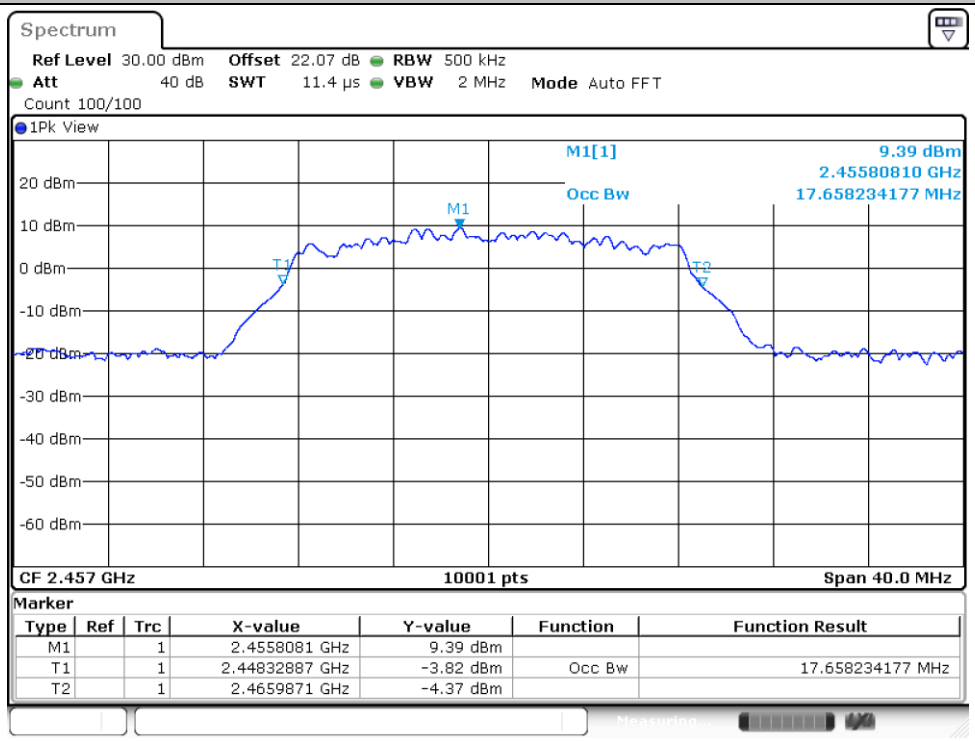

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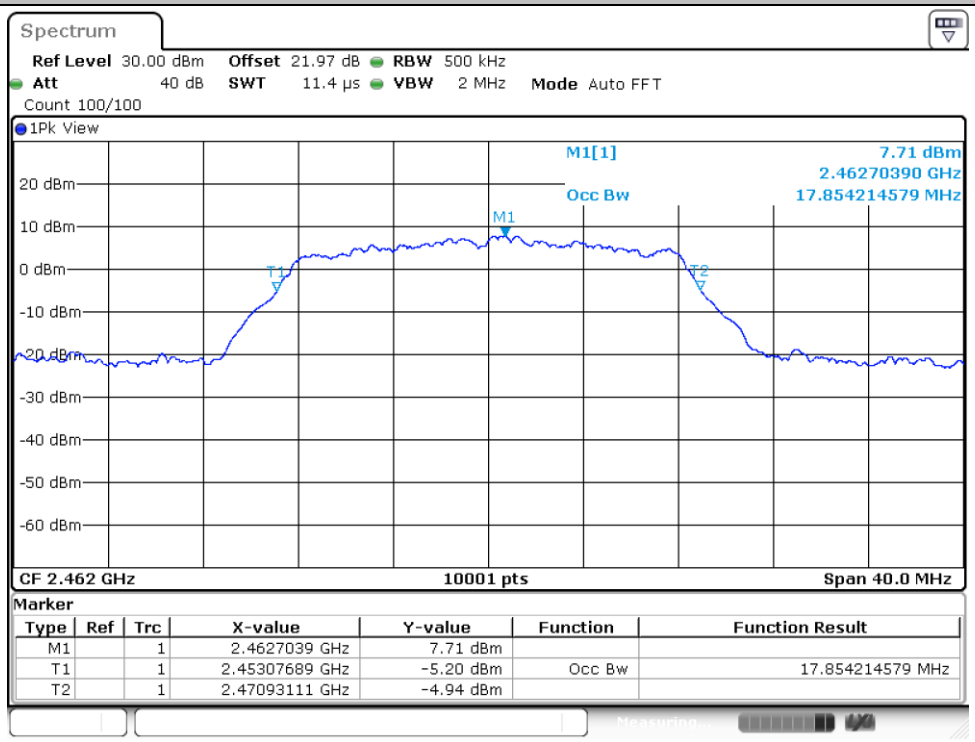

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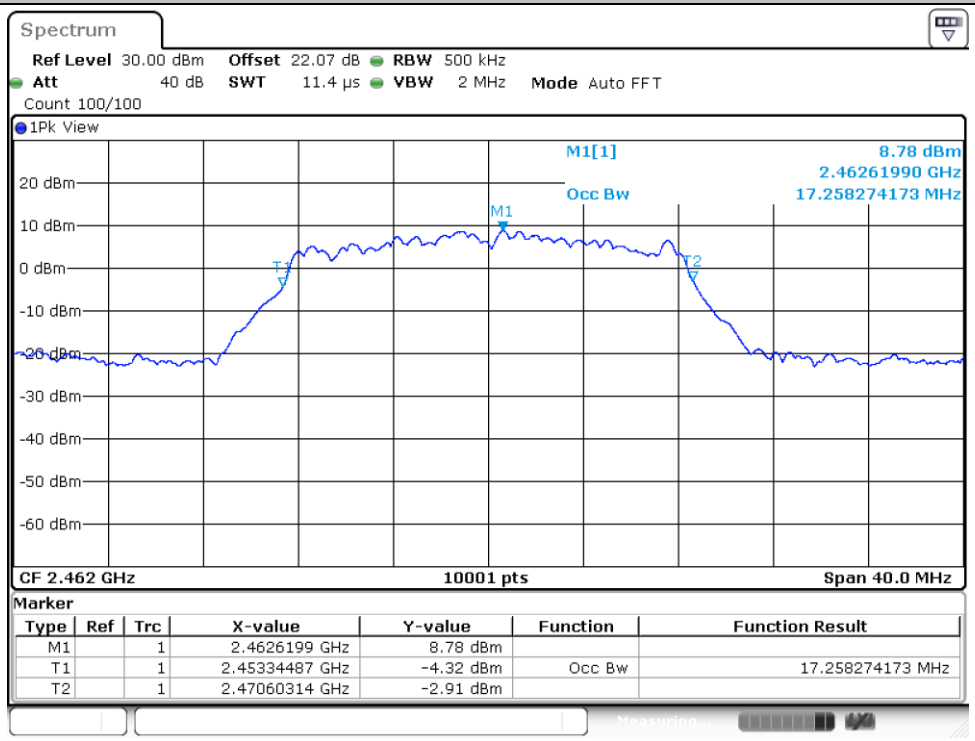

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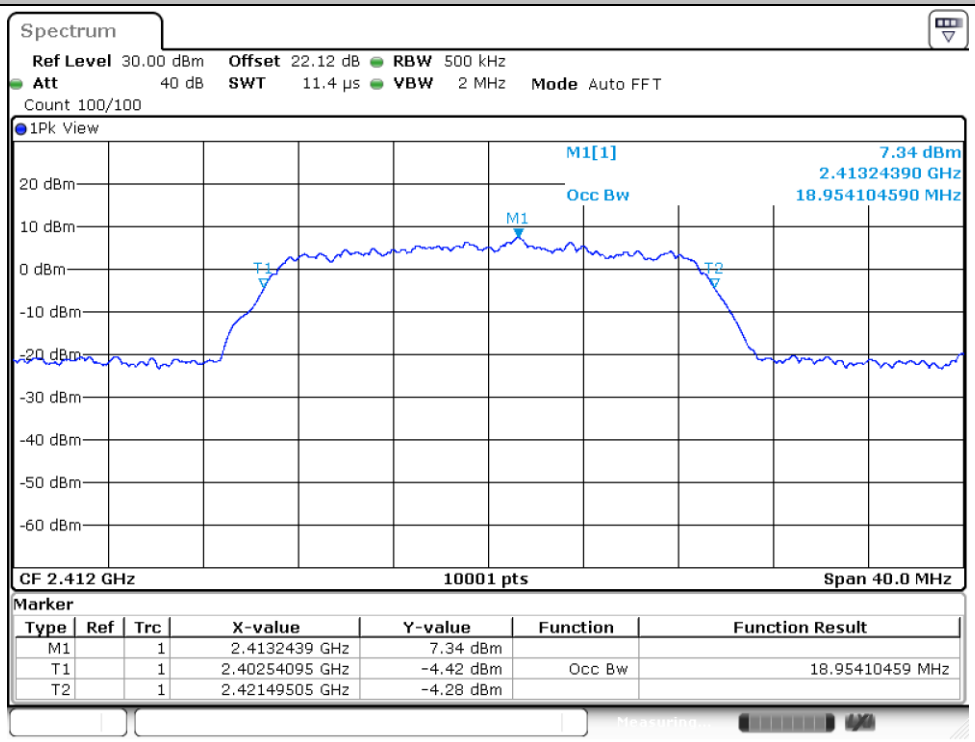
11N20MIMO_Ant0_2412



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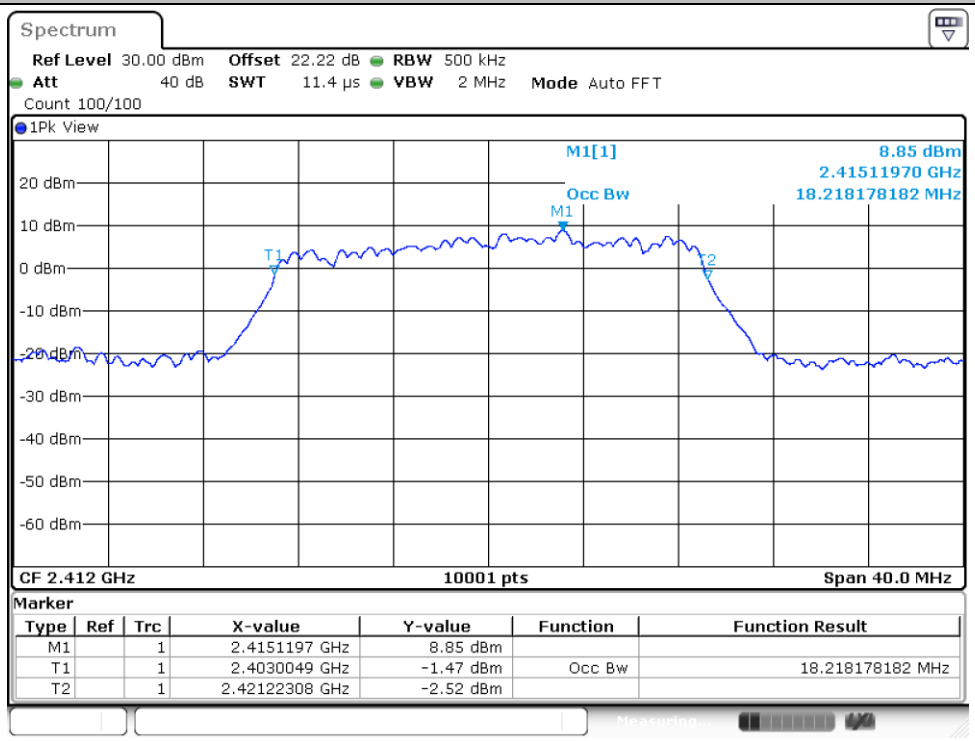

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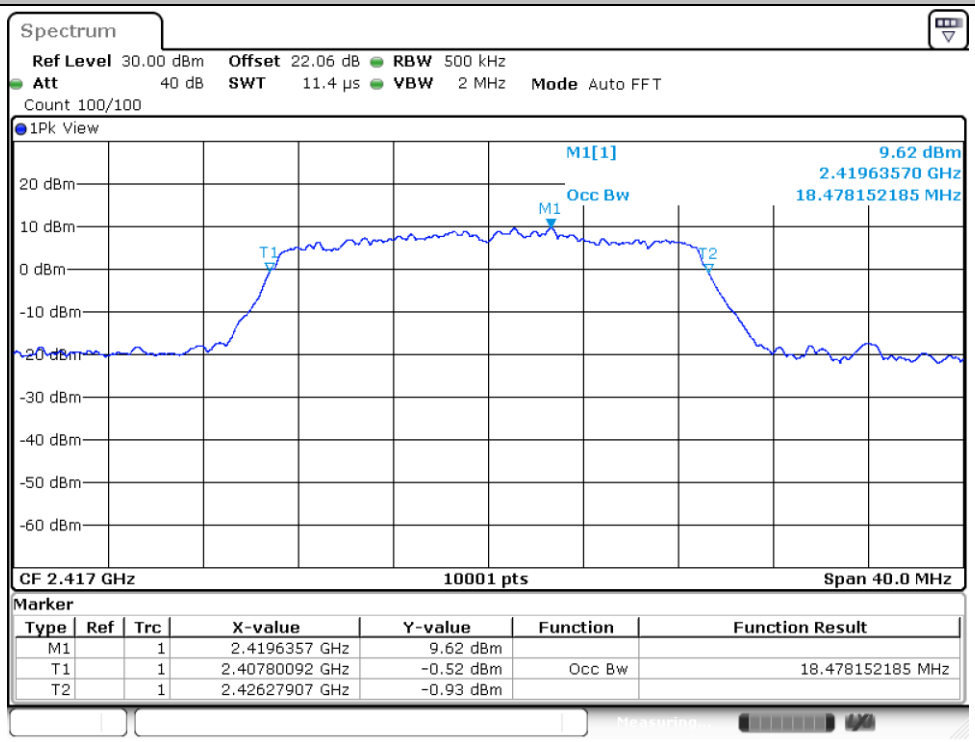

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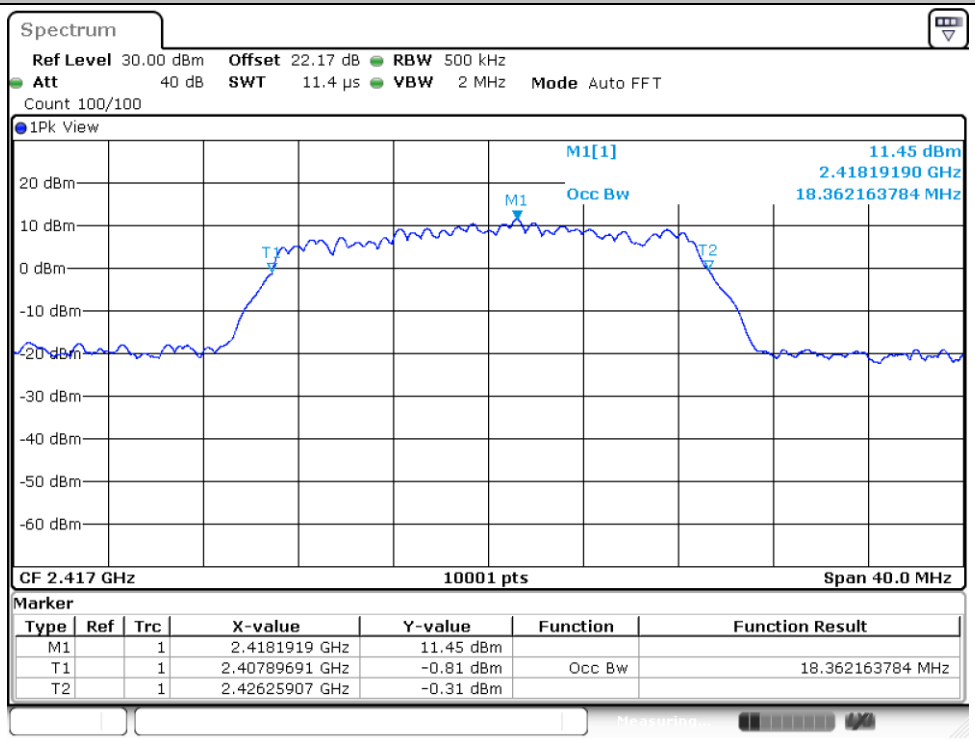

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