



FCC RF Test Report

APPLICANT : Motorola Mobility LLC
EQUIPMENT : Mobile Cellular Phone
BRAND NAME : Motorola
MODEL NAME : XT2301-4
FCC ID : IHDT56AH3
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System
TEST DATE(S) : Sep. 19, 2022 ~ Jan. 30, 2022

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



Sporton International Inc. (Kunshan)

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People's Republic of China**



TABLE OF CONTENTS

REVISION HISTORY	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Applicant	5
1.2 Manufacturer	5
1.3 Product Feature of Equipment Under Test.....	5
1.4 Product Specification of Equipment Under Test.....	5
1.5 Modification of EUT	6
1.6 Specification of Accessory.....	6
1.7 Testing Location	7
1.8 Test Software.....	7
1.9 Applicable Standards.....	7
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	8
2.1 Carrier Frequency and Channel	8
2.2 Test Mode.....	9
2.3 Connection Diagram of Test System.....	10
2.4 Support Unit used in test configuration and system	11
2.5 EUT Operation Test Setup	11
2.6 Measurement Results Explanation Example.....	11
3 TEST RESULT	12
3.1 6dB Bandwidth Measurement	12
3.2 Output Power Measurement.....	13
3.3 Power Spectral Density Measurement	16
3.4 Conducted Band Edges and Spurious Emission Measurement	18
3.5 Radiated Band Edges and Spurious Emission Measurement	19
3.6 AC Conducted Emission Measurement.....	23
3.7 Antenna Requirements.....	25
4 LIST OF MEASURING EQUIPMENT	26
5 UNCERTAINTY OF EVALUATION	27
APPENDIX A. CONDUCTED TEST RESULTS	
APPENDIX B. AC CONDUCTED EMISSION TEST RESULT	
APPENDIX C. RADIATED SPURIOUS EMISSION	
APPENDIX D. DUTY CYCLE PLOTS	
APPENDIX E. SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR282619C	Rev. 01	Initial issue of report	Oct. 19, 2022

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.1	-	99% Bandwidth	-	Report Only	-
3.2	15.247(b)	Power Output Measurement	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
3.4	15.247(d)	Conducted Band Edges	$\leq 20\text{dBc}$	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 3.12 dB at 7305 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 10.05 dB at 0.175 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

Motorola Mobility LLC

222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

1.2 Manufacturer

Motorola Mobility LLC

222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Cellular Phone
Brand Name	Motorola
Model Name	XT2301-4
FCC ID	IHDT56AH3
IMEI Code	Conducted: 354336350016531/354336350016549 Conduction: 354336350016432/354336350016440 Radiation: 358645690037858
HW Version	DVT2
SW Version	TTR33.76
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	MIMO <Ant.1+2> 802.11b : 26.83 dBm (0.4819 W) 802.11g : 27.77 dBm (0.5984 W) 802.11n HT20 : 28.11 dBm (0.6471 W) 802.11n HT40 : 24.03 dBm (0.2529 W) 802.11ax HE20 : 28.40 dBm (0.6918 W) 802.11ax HE40 : 24.17 dBm (0.2612 W)		
Antenna Type / Gain	Ant.1: IFA Antenna type with gain -6.2 dBi Ant 2: LOOP Antenna type with gain -6.5 dBi		
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n /ax: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM /1024QAM)		
Antenna Function Description		Ant. 1	Ant. 2
	802.11 b/g/n/ax MIMO	V	V

Remark:

1. For 802.11n HT20/HT40 & 802.11ax HE20/HE40 mode, the whole testing have assessed only 802.11ax HE20/HE40 by referring to the higher output power.
2. 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/PSD/RSE, the full RU power > partial RU, therefore the full RU perform full test and Partial RU verified power/PSD/RSE.
3. WIFI support CDD MIMO mode only by manufacturer declared.
4. Ant. 1/2 corresponds to ant. 4/6 in the EP report respectively.

1.5 Modification of EUT

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

1.6 Specification of Accessory

Specification of Accessory				
AC Adapter 1 (US)	Brand Name	Motorola(Chenyang)	Model Name	MC-1251
AC Adapter 1 (EU)	Brand Name	Motorola(Chenyang)	Model Name	MC-1252
AC Adapter 1 (UK)	Brand Name	Motorola(Chenyang)	Model Name	MC-1253
AC Adapter 1 (AU)	Brand Name	Motorola(Chenyang)	Model Name	MC-1255
AC Adapter 1 (AR)	Brand Name	Motorola(Chenyang)	Model Name	MC-1256
AC Adapter 1 (BR)	Brand Name	Motorola(Chenyang)	Model Name	MC-1257
AC Adapter 2 (US)	Brand Name	Motorola(AOHAI)	Model Name	MC-1251
AC Adapter 2 (EU)	Brand Name	Motorola(AOHAI)	Model Name	MC-1252
AC Adapter 2 (UK)	Brand Name	Motorola(AOHAI)	Model Name	MC-1253
AC Adapter 2 (IN)	Brand Name	Motorola(AOHAI)	Model Name	MC-1254
AC Adapter 2 (AU)	Brand Name	Motorola(AOHAI)	Model Name	MC-1255
AC Adapter 2 (AR)	Brand Name	Motorola(AOHAI)	Model Name	MC-1256
AC Adapter 2 (BR)	Brand Name	Motorola(AOHAI)	Model Name	MC-1257
AC Adapter 2 (CHILE)	Brand Name	Motorola(AOHAI)	Model Name	MC-1259
Battery	Brand Name	Motorola(ATL)	Model Name	PF46
Earphone	Brand Name	Motorola(Lyand)	Model Name	MI181C(SH38D62338)
USB Cable	Brand Name	Motorola (Saibao)	Model Name	SC18D24968
C to HDMI HDMI/USBC Cable 1	Brand Name	Motorola (Linxee)	Model Name	SC18D02146
C to HDMI HDMI/USBC Cable 2	Brand Name	Motorola (Linxee)	Model Name	SC18D38847

1.7 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 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-KS 03CH06-KS TH01-KS	CN1257	314309

1.8 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24a1
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.9 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:

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 (Z 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
802.11ax HE20	MCS0
802.11ax HE40	MCS0

CO-location

WIFI 802.11b CH06 Tx + Part 96-LTE_B48_BW_20M Link

Test Cases

AC
Conducted
Emission

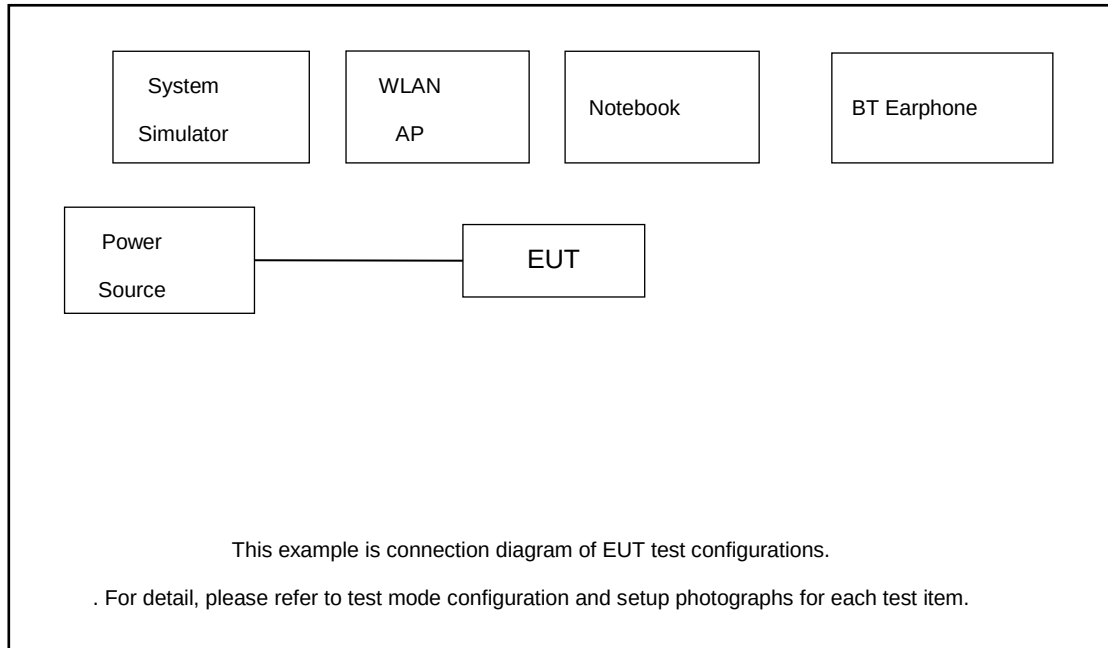
Mode 1 :GSM 850 Idle+BT Link+WLAN Link(2.4G)+ Adaptor(2)+ USB Cable

Remark:

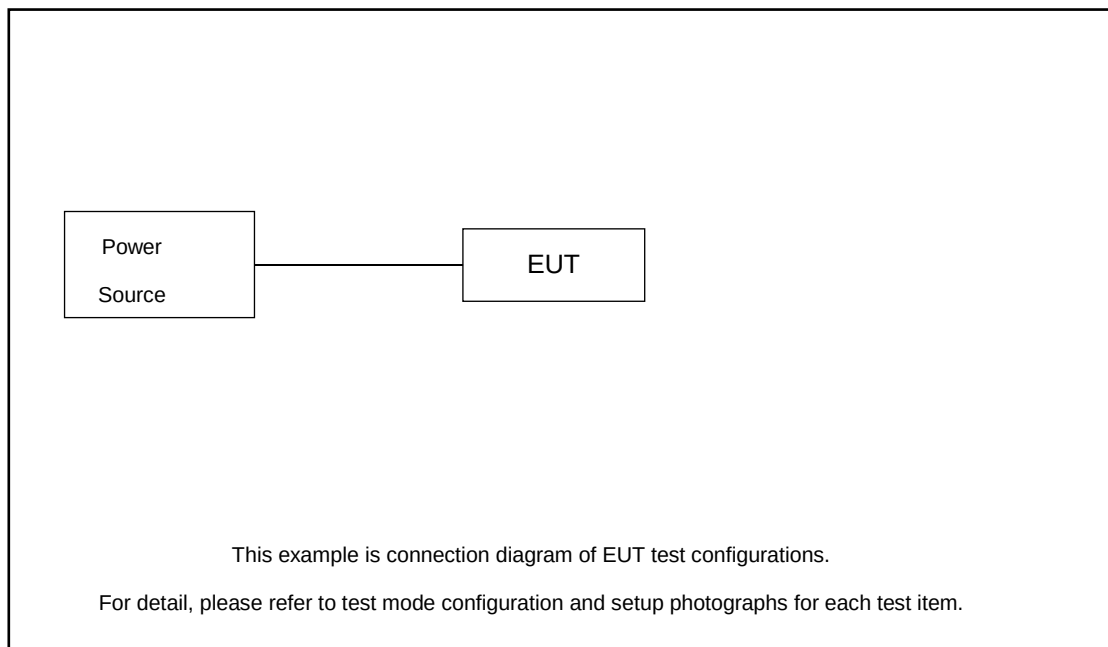
1. For Radiated Test Cases, The tests were performance with Adapter and USB Cable

2.3 Connection Diagram of Test System

AC Conducted Emission:



Radiated Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	LTE Base Station	Anritus	MT8821C	N/A	N/A	Unshielded,1.8m
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Notebook	Lenovo	V130-15IKB005	N/A	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
4.	Bluetooth Earphone	Lenovo	LBH308	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 2.95 dB and 10dB attenuator.

$$\begin{aligned}
 \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\
 &= 2.95 + 10 = 12.95 \text{ (dB)}
 \end{aligned}$$

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

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

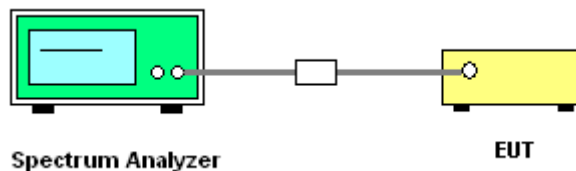
3.1.2 Measuring Instruments

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) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB 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.

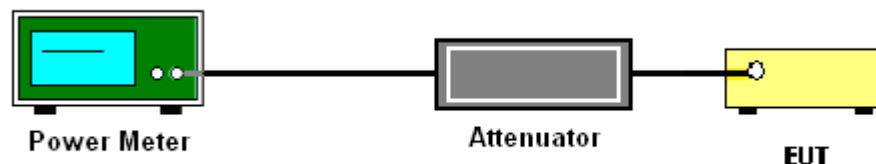
3.2.2 Measuring Instruments

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																	
Mod.	Ru Config	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
						Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11b		1Mbps	2	1	2412	23.81	23.83	26.83	30.00		-6.20		20.63		36.00		Pass
11b		1Mbps	2	6	2437	21.95	21.61	24.79	30.00		-6.20		18.59		36.00		Pass
11b		1Mbps	2	11	2462	22.37	22.17	25.28	30.00		-6.20		19.08		36.00		Pass
11g		6Mbps	2	1	2412	23.89	23.71	26.81	30.00		-6.20		20.61		36.00		Pass
11g		6Mbps	2	6	2437	24.34	25.14	27.77	30.00		-6.20		21.57		36.00		Pass
11g		6Mbps	2	9	2452	23.95	24.07	27.02	30.00		-6.20		20.82		36.00		Pass
11g		6Mbps	2	10	2457	23.93	22.79	26.41	30.00		-6.20		20.21		36.00		Pass
11g		6Mbps	2	11	2462	19.68	18.75	22.25	30.00		-6.20		16.05		36.00		Pass
HT20		MCS0	2	1	2412	19.79	18.88	22.37	30.00		-6.20		16.17		36.00		Pass
HT20		MCS0	2	2	2417	24.47	24.39	27.44	30.00		-6.20		21.24		36.00		Pass
HT20		MCS0	2	6	2437	24.36	25.74	28.11	30.00		-6.20		21.91		36.00		Pass
HT20		MCS0	2	9	2452	23.82	24.04	26.94	30.00		-6.20		20.74		36.00		Pass
HT20		MCS0	2	10	2457	22.44	20.71	24.67	30.00		-6.20		18.47		36.00		Pass
HT20		MCS0	2	11	2462	17.89	17.52	20.72	30.00		-6.20		14.52		36.00		Pass
HT40		MCS0	2	3	2422	20.95	20.54	23.76	30.00		-6.20		17.56		36.00		Pass
HT40		MCS0	2	6	2437	20.82	21.21	24.03	30.00		-6.20		17.83		36.00		Pass
HT40	MCS0	2	9	2452	19.13	18.76	21.96	30.00		-6.20		15.76		36.00		Pass	
HE20	FULL	MCS0	2	1	2412	19.95	18.99	22.51	30.00		-6.20		16.31		36.00		Pass
HE20	26RU	MCS0	2	1	2412	12.36	9.88	14.30	30.00		-6.20		8.10		36.00		Pass
HE20	52RU	MCS0	2	1	2412	14.48	13.86	17.19	30.00		-6.20		10.99		36.00		Pass
HE20	106RU	MCS0	2	1	2412	17.93	17.51	20.74	30.00		-6.20		14.54		36.00		Pass
HE20	FULL	MCS0	2	2	2417	24.66	24.74	27.71	30.00		-6.20		21.51		36.00		Pass
HE20	FULL	MCS0	2	6	2437	24.62	26.04	28.40	30.00		-6.20		22.20		36.00		Pass
HE20	26RU	MCS0	2	6	2437	19.26	19.71	22.50	30.00		-6.20		16.30		36.00		Pass
HE20	52RU	MCS0	2	6	2437	20.25	20.72	23.50	30.00		-6.20		17.30		36.00		Pass
HE20	106RU	MCS0	2	6	2437	22.69	23.47	26.11	30.00		-6.20		19.91		36.00		Pass
HE20	FULL	MCS0	2	9	2452	24.01	24.32	27.18	30.00		-6.20		20.98		36.00		Pass
HE20	FULL	MCS0	2	10	2467	22.63	20.87	24.85	30.00		-6.20		18.65		36.00		Pass
HE20	FULL	MCS0	2	11	2462	17.94	17.63	20.80	30.00		-6.20		14.60		36.00		Pass
HE20	26RU	MCS0	2	11	2462	11.38	9.07	13.39	30.00		-6.20		7.19		36.00		Pass
HE20	52RU	MCS0	2	11	2462	12.63	10.55	14.72	30.00		-6.20		8.52		36.00		Pass
HE20	106RU	MCS0	2	11	2462	15.61	13.41	17.66	30.00		-6.20		11.46		36.00		Pass
HE40	FULL	MCS0	2	3	2422	21.09	20.69	23.90	30.00		-6.20		17.70		36.00		Pass
HE40	FULL	MCS0	2	6	2437	20.98	21.33	24.17	30.00		-6.20		17.97		36.00		Pass
HE40	FULL	MCS0	2	9	2452	19.17	18.82	22.01	30.00		-6.20		15.81		36.00		Pass



3.2.6 Test Result of Average Output Power (Reporting Only)

2.4GHz Band										
Mod.	Ru Config	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)		
						Ant 1	Ant 2	Ant 1	Ant 2	SUM
11b		1Mbps	2	1	2412	0.09	0.09	20.90	20.75	23.84
11b		1Mbps	2	6	2437	0.09	0.09	18.55	18.86	21.72
11b		1Mbps	2	11	2462	0.09	0.09	19.34	19.18	22.27
11g		6Mbps	2	1	2412	0.02	0.02	18.25	18.08	21.18
11g		6Mbps	2	6	2437	0.02	0.02	19.17	20.03	22.64
11g		6Mbps	2	9	2452	0.02	0.02	18.71	19.14	21.94
11g		6Mbps	2	10	2457	0.02	0.02	18.76	17.89	21.36
11g		6Mbps	2	11	2462	0.02	0.02	13.98	14.20	17.11
HT20		MCS0	2	1	2412	0.00	0.00	13.82	13.79	16.82
HT20		MCS0	2	2	2417	0.00	0.00	19.45	19.09	22.28
HT20		MCS0	2	6	2437	0.00	0.00	19.19	20.07	22.66
HT20		MCS0	2	9	2452	0.00	0.00	18.63	19.14	21.90
HT20		MCS0	2	10	2457	0.00	0.00	16.88	15.32	19.18
HT20		MCS0	2	11	2462	0.00	0.00	11.98	12.26	15.13
HT40		MCS0	2	3	2422	0.00	0.00	14.78	14.71	17.76
HT40		MCS0	2	6	2437	0.00	0.00	14.62	15.30	17.98
HT40		MCS0	2	9	2452	0.00	0.00	12.35	12.72	15.55
HE20	FULL	MCS0	2	1	2412	0.00	0.00	14.14	13.51	16.85
HE20	26RU	MCS0	2	1	2412	0.20	0.20	4.05	3.14	6.63
HE20	52RU	MCS0	2	1	2412	0.20	0.20	6.67	6.01	9.36
HE20	106RU	MCS0	2	1	2412	0.21	0.21	9.94	9.68	12.82
HE20	FULL	MCS0	2	2	2417	0.00	0.00	19.48	19.21	22.36
HE20	FULL	MCS0	2	6	2437	0.00	0.00	19.27	20.16	22.75
HE20	26RU	MCS0	2	6	2437	0.20	0.20	12.22	12.53	15.39
HE20	52RU	MCS0	2	6	2437	0.20	0.20	12.88	13.46	16.19
HE20	106RU	MCS0	2	6	2437	0.21	0.21	15.08	15.90	18.52
HE20	FULL	MCS0	2	9	2452	0.00	0.00	18.81	19.25	22.05
HE20	FULL	MCS0	2	10	2457	0.00	0.00	16.92	15.39	19.23
HE20	FULL	MCS0	2	11	2462	0.00	0.00	12.26	12.09	15.19
HE20	26RU	MCS0	2	11	2462	0.20	0.20	3.33	1.53	5.53
HE20	52RU	MCS0	2	11	2462	0.20	0.20	4.81	3.42	7.18
HE20	106RU	MCS0	2	11	2462	0.21	0.21	7.96	6.27	10.21
HE40	FULL	MCS0	2	3	2422	0.00	0.00	14.97	14.62	17.81
HE40	FULL	MCS0	2	6	2437	0.00	0.00	14.92	15.22	18.08
HE40	FULL	MCS0	2	9	2452	0.00	0.00	12.83	12.55	15.70

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 the bin-by-bin summation to obtain the combined spectrum. For the 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.

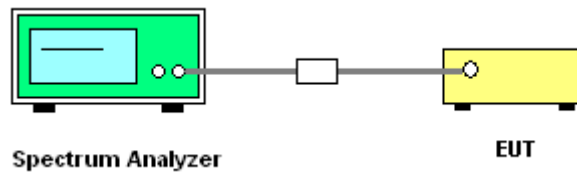
Method (b): Measure and sum spectral maxima across the outputs.

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.

Method (c): Measure and add 10 log(NANT) dB, where NANT is the number of outputs.

The measurement on each individual output were performed with the same span and number on each individual output. The quantity $10 \log(\text{NANT})$ dB is added to each spectrum value before comparing to the emission limit.

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.

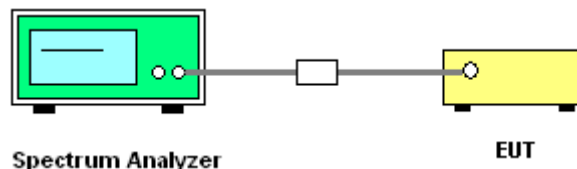
3.4.2 Measuring Instruments

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 11.13
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

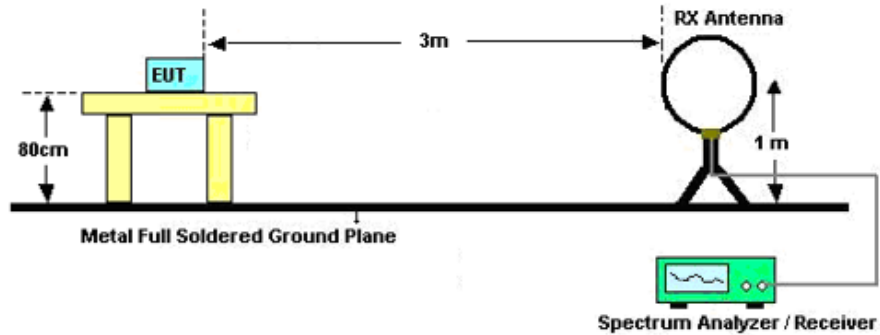
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

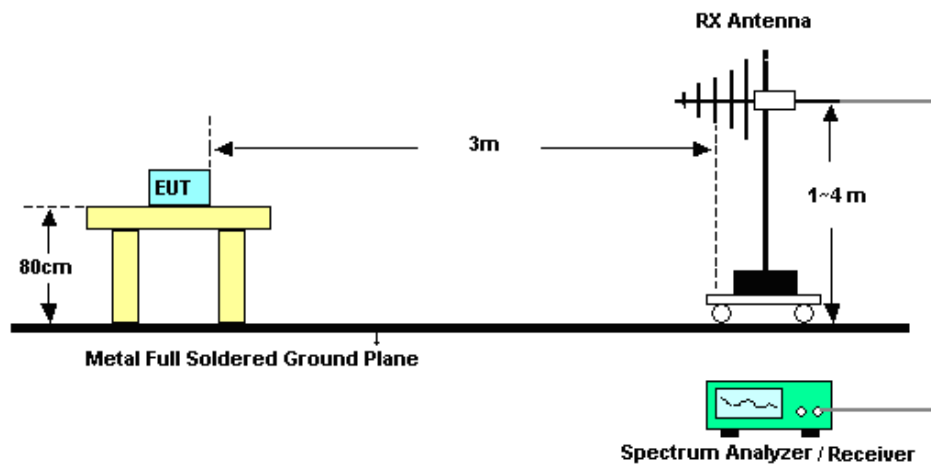
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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 $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.
For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, 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

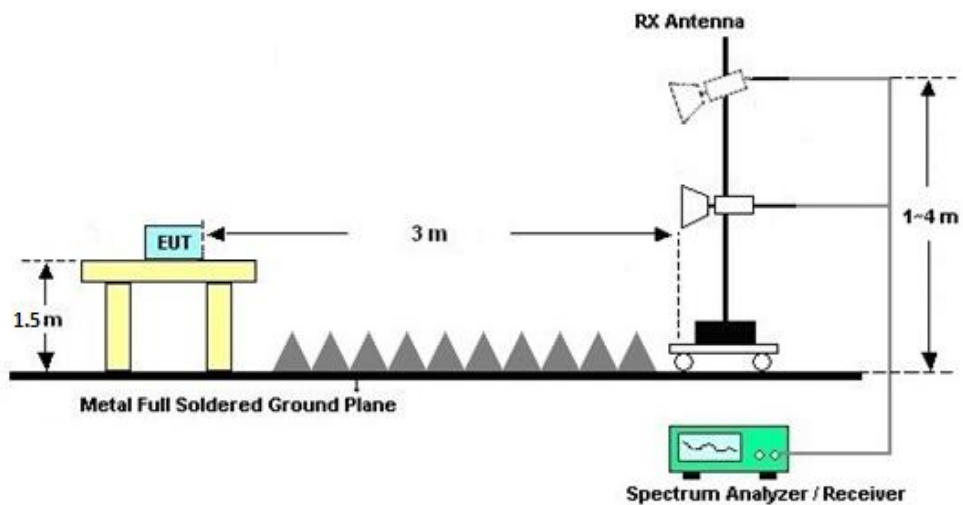
For radiated emissions below 30MHz



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 (dB μ V)	
	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.

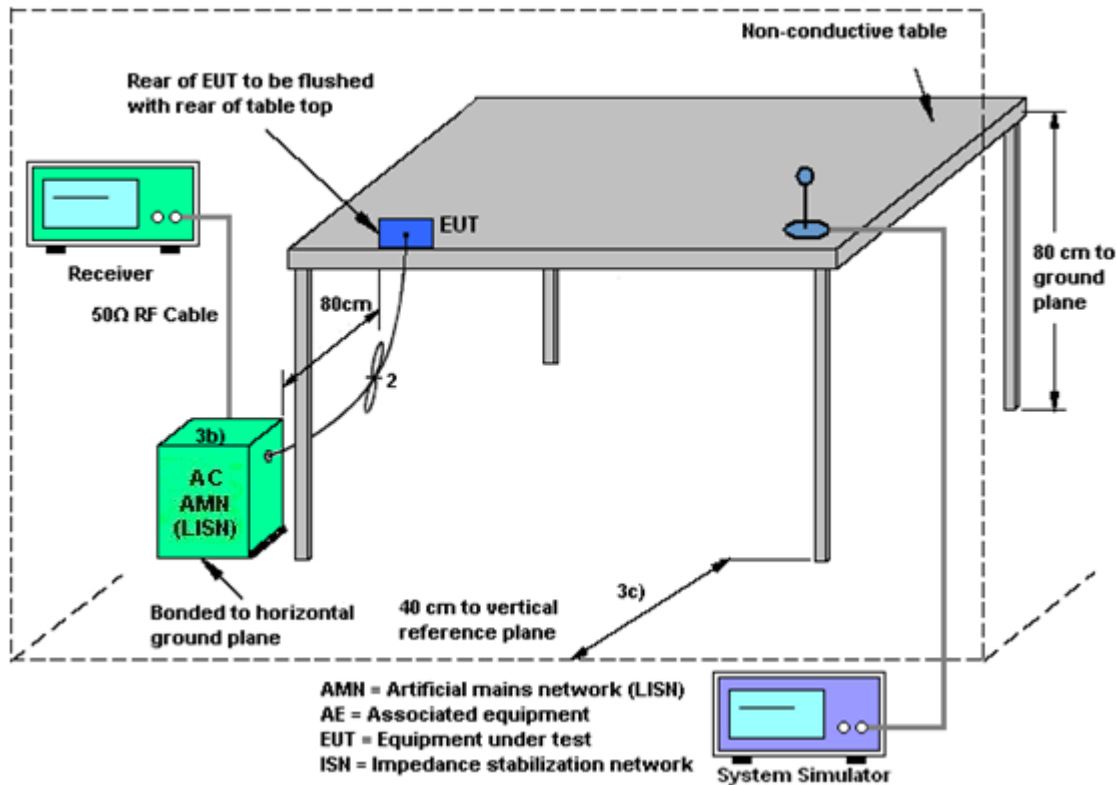
3.6.2 Measuring Instruments

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>						
			DG	DG	Power	PSD
			for	for	Limit	Limit
	Ant. 1	Ant. 2	Power	PSD	Reduction	Reduction
	(dBi)	(dBi)	(dBi)	(dBi)	(dB)	(dB)
2.4 GHz	-6.20	-6.50	-6.20	-3.34	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	101040	10Hz~40GHz	Oct. 14, 2021	Sep. 19, 2022~ Sep. 29, 2022	Oct. 13, 2022	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2022	Sep. 19, 2022~ Sep. 29, 2022	Jan. 04, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2022	Sep. 19, 2022~ Sep. 29, 2022	Jan. 04, 2023	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz; Max 30dBm	Oct. 16, 2021	Sep 30, 2022	Oct. 15, 2022	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY60242126	10Hz~44GHz	Oct. 26, 2021	Sep 30, 2022	Oct. 25, 2022	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2022	Sep 30, 2022	Oct. 29, 2023	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz~1GHz	May 27, 2022	Sep 30, 2022	May 26, 2023	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00240138	1GHz~18GHz	Jul. 19, 2022	Sep 30, 2022	Jul. 18, 2023	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 05, 2022	Sep 30, 2022	Jan. 04, 2023	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	380827	9KHz ~1GHZ	Jul. 30, 2022	Sep 30, 2022	Jul. 29, 2023	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2022	Sep 30, 2022	Jan. 04, 2023	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1GHz-18GHz	Jul. 30, 2022	Sep 30, 2022	Jul. 29, 2023	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270319	500MHz~26.5GHz	Oct. 14, 2021	Sep 30, 2022	Oct. 13, 2022	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Sep 30, 2022	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Sep 30, 2022	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Sep 30, 2022	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 20, 2022	Sep 26, 2022	Apr. 19, 2023	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 14, 2021	Sep 26, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC LISN	R&S	ENV216	100334	9kHz~30MHz	Oct. 14, 2021	Sep 26, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 14, 2021	Sep 26, 2022	Oct. 13, 2022	Conduction (CO01-KS)

NCR: No Calibration Required

5 Uncertainty of Evaluation

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 Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.78dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
---	-------

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
---	-------

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



Appendix A. Conducted Test Results



Case No. : <u>FR282619C</u>	
Ambient Condition: <u>25</u> °C, <u>45</u> %RH	
Test Date: <u>2022.9.19~2022.9.29</u>	Test Engineer: <u>Jiang Jun</u>

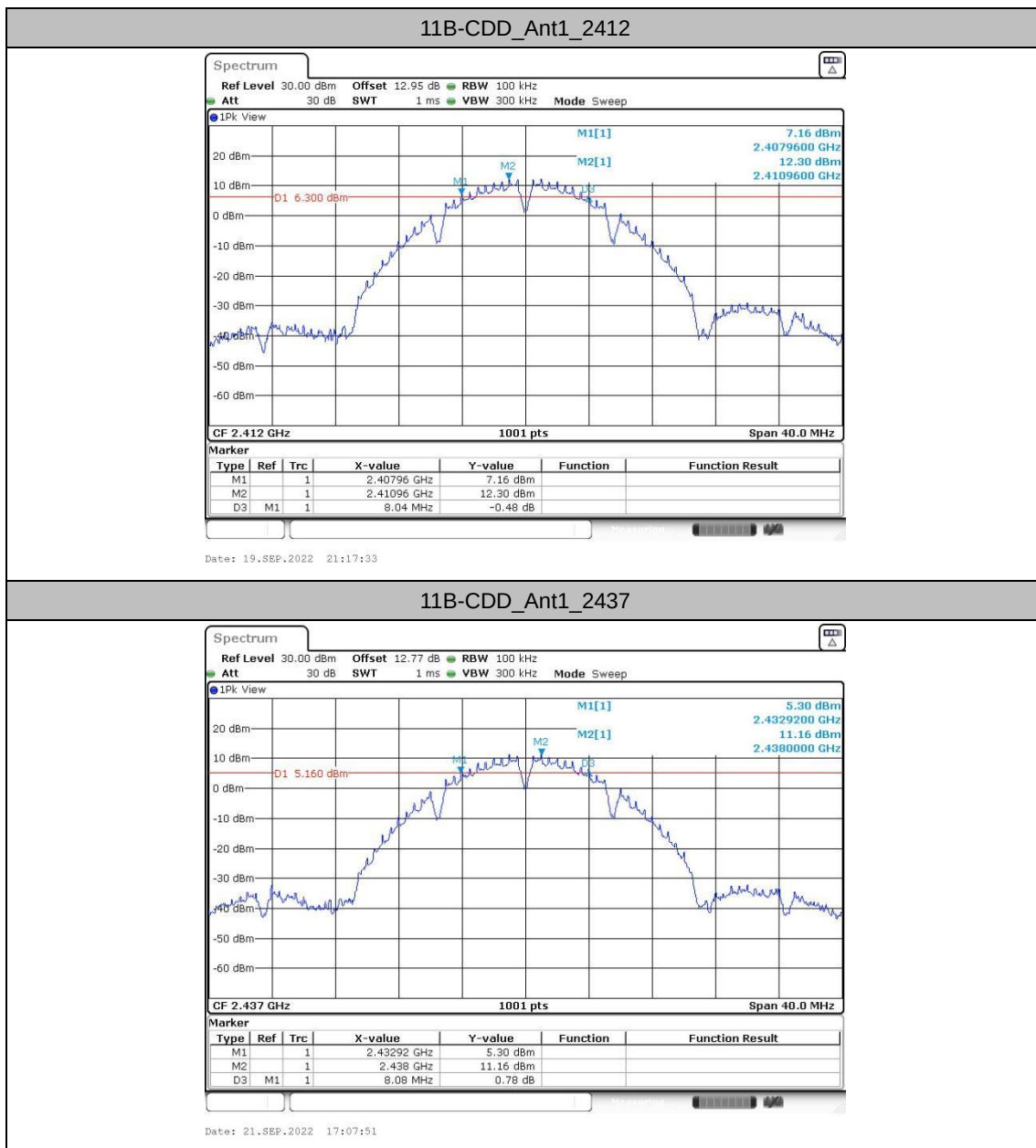
DTS Bandwidth

Test Result

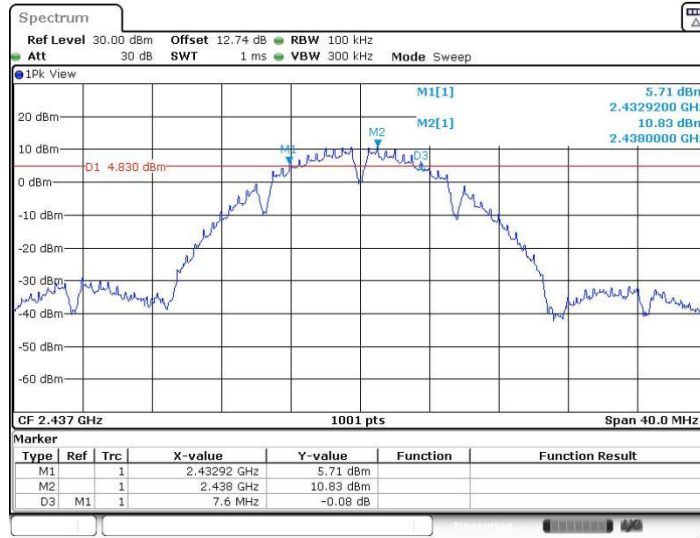
TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	8.04	2407.96	2416.00	0.5	PASS
	Ant2	2412	9.12	2406.92	2416.04	0.5	PASS
	Ant1	2437	8.08	2432.92	2441.00	0.5	PASS
	Ant2	2437	7.60	2432.92	2440.52	0.5	PASS
	Ant1	2462	7.08	2458.44	2465.52	0.5	PASS
	Ant2	2462	7.08	2458.44	2465.52	0.5	PASS
11G-CDD	Ant1	2412	16.04	2404.08	2420.12	0.5	PASS
	Ant2	2412	16.36	2403.80	2420.16	0.5	PASS
	Ant1	2437	16.28	2428.84	2445.12	0.5	PASS
	Ant2	2437	16.32	2428.80	2445.12	0.5	PASS
	Ant1	2452	16.36	2443.80	2460.16	0.5	PASS
	Ant2	2452	16.32	2443.84	2460.16	0.5	PASS
	Ant1	2457	16.32	2448.80	2465.12	0.5	PASS
	Ant2	2457	15.92	2449.20	2465.12	0.5	PASS
	Ant1	2462	16.32	2453.84	2470.16	0.5	PASS
	Ant2	2462	16.04	2453.80	2469.84	0.5	PASS
11AX20MIMO	Ant1	2412	19.08	2402.44	2421.52	0.5	PASS
	Ant2	2412	18.88	2402.56	2421.44	0.5	PASS
	Ant1	2417	18.92	2407.52	2426.44	0.5	PASS
	Ant2	2417	19.08	2407.44	2426.52	0.5	PASS
	Ant1	2437	18.64	2427.84	2446.48	0.5	PASS
	Ant2	2437	19.04	2427.44	2446.48	0.5	PASS
	Ant1	2452	18.84	2442.60	2461.44	0.5	PASS
	Ant2	2452	18.56	2442.92	2461.48	0.5	PASS
	Ant1	2457	18.92	2447.48	2466.40	0.5	PASS
	Ant2	2457	18.36	2447.76	2466.12	0.5	PASS
	Ant1	2462	19.00	2452.44	2471.44	0.5	PASS
	Ant2	2462	16.96	2452.56	2469.52	0.5	PASS
11AX40MIMO	Ant1	2422	38.00	2403.04	2441.04	0.5	PASS
	Ant2	2422	37.92	2403.04	2440.96	0.5	PASS
	Ant1	2437	38.16	2417.96	2456.12	0.5	PASS
	Ant2	2437	38.24	2417.80	2456.04	0.5	PASS
	Ant1	2452	38.08	2432.96	2471.04	0.5	PASS
	Ant2	2452	38.00	2432.88	2470.88	0.5	PASS



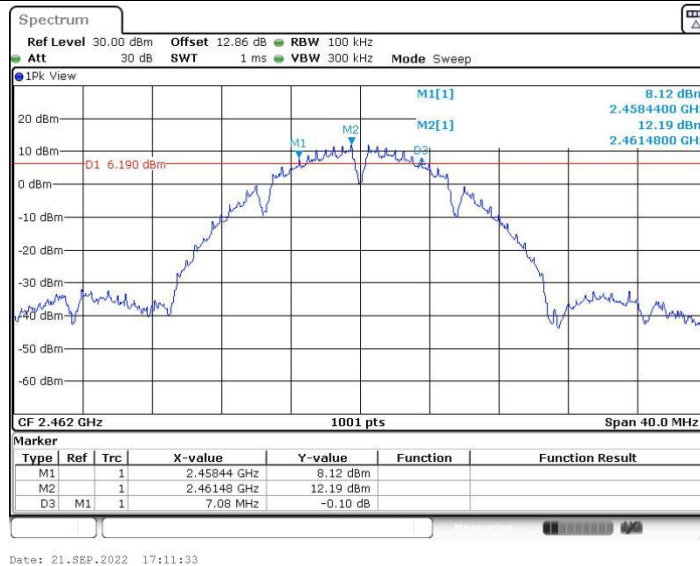
Test Graphs



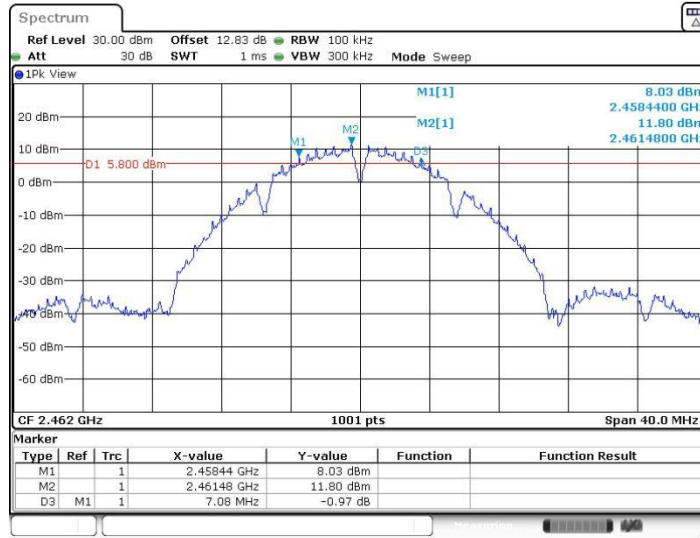
11B-CDD_Ant2_2437



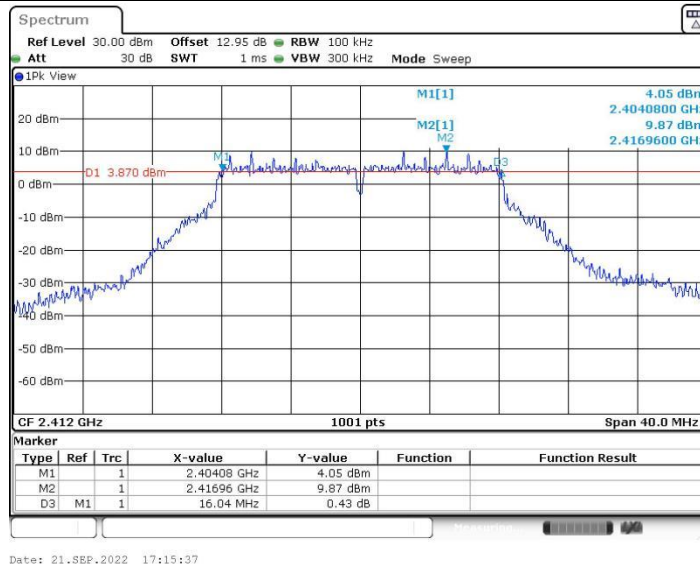
11B-CDD_Ant1_2462



11B-CDD_Ant2_2462

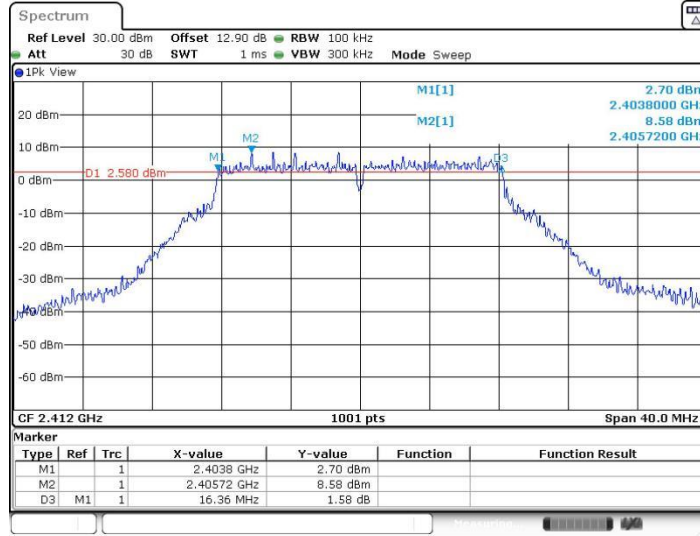


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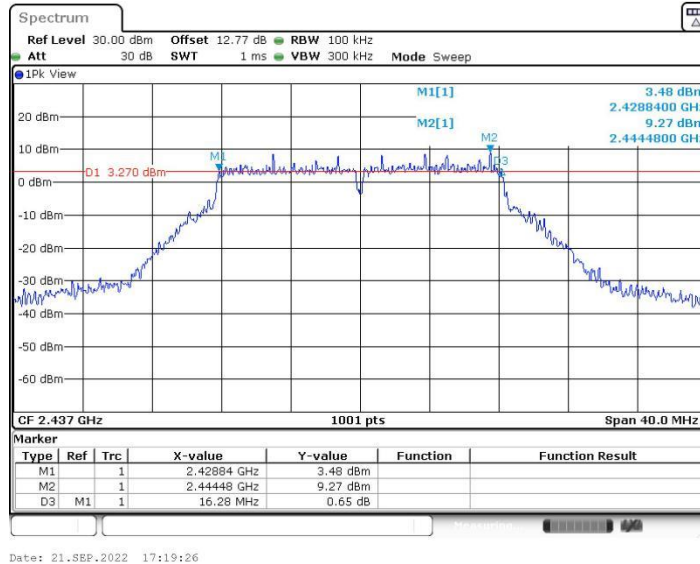




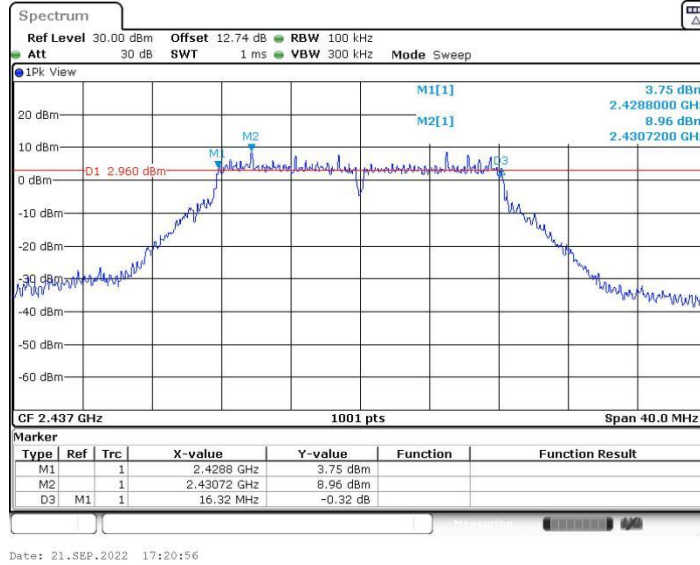
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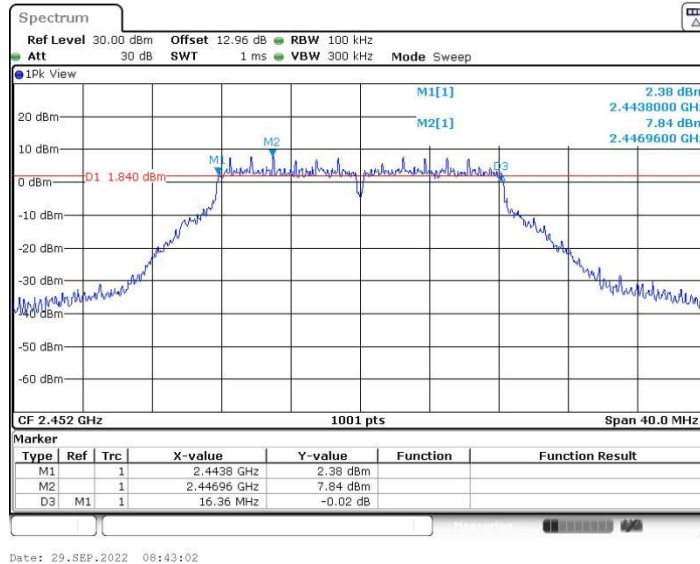
11G-CDD_Ant1_2437



11G-CDD_Ant2_2437

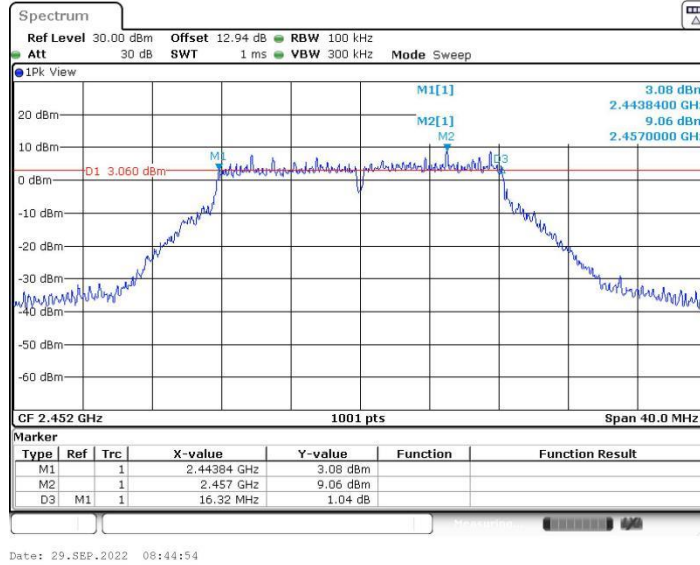


11G-CDD_Ant1_2452

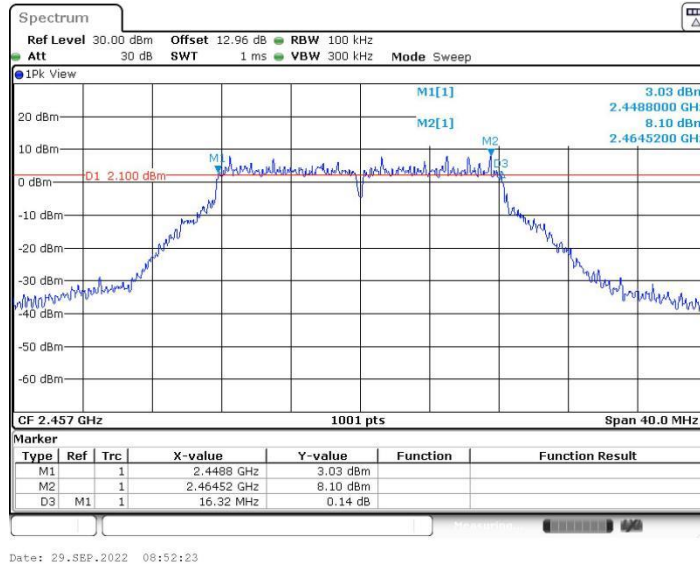


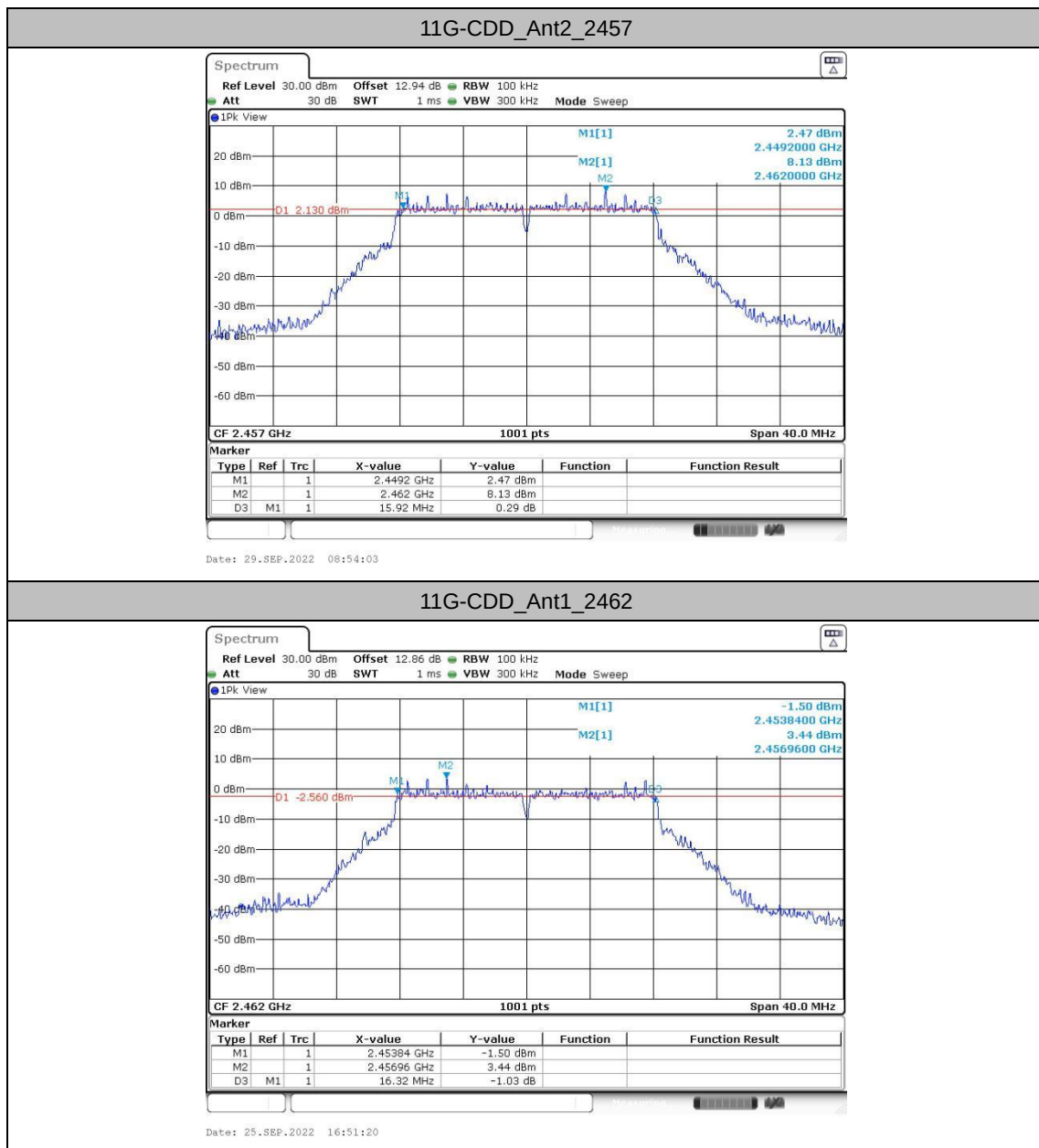


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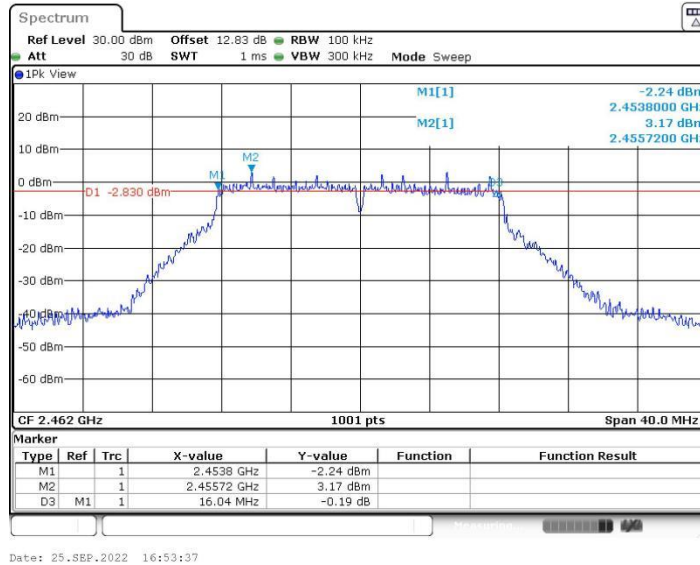


11G-CDD_Ant1_2457

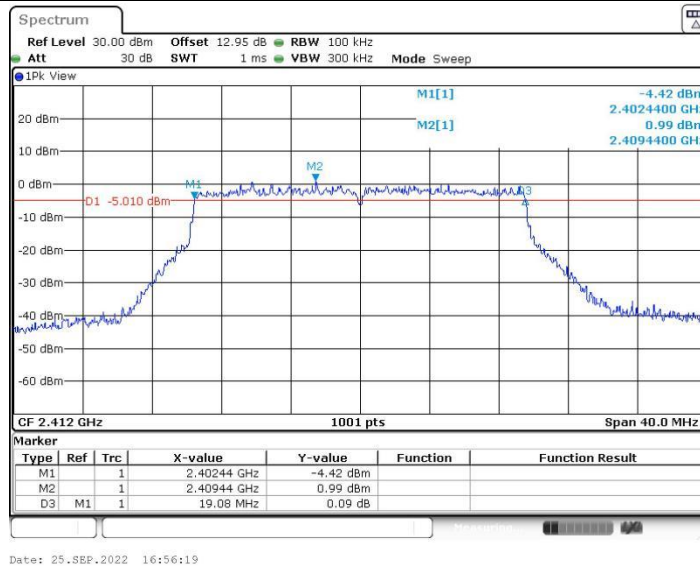


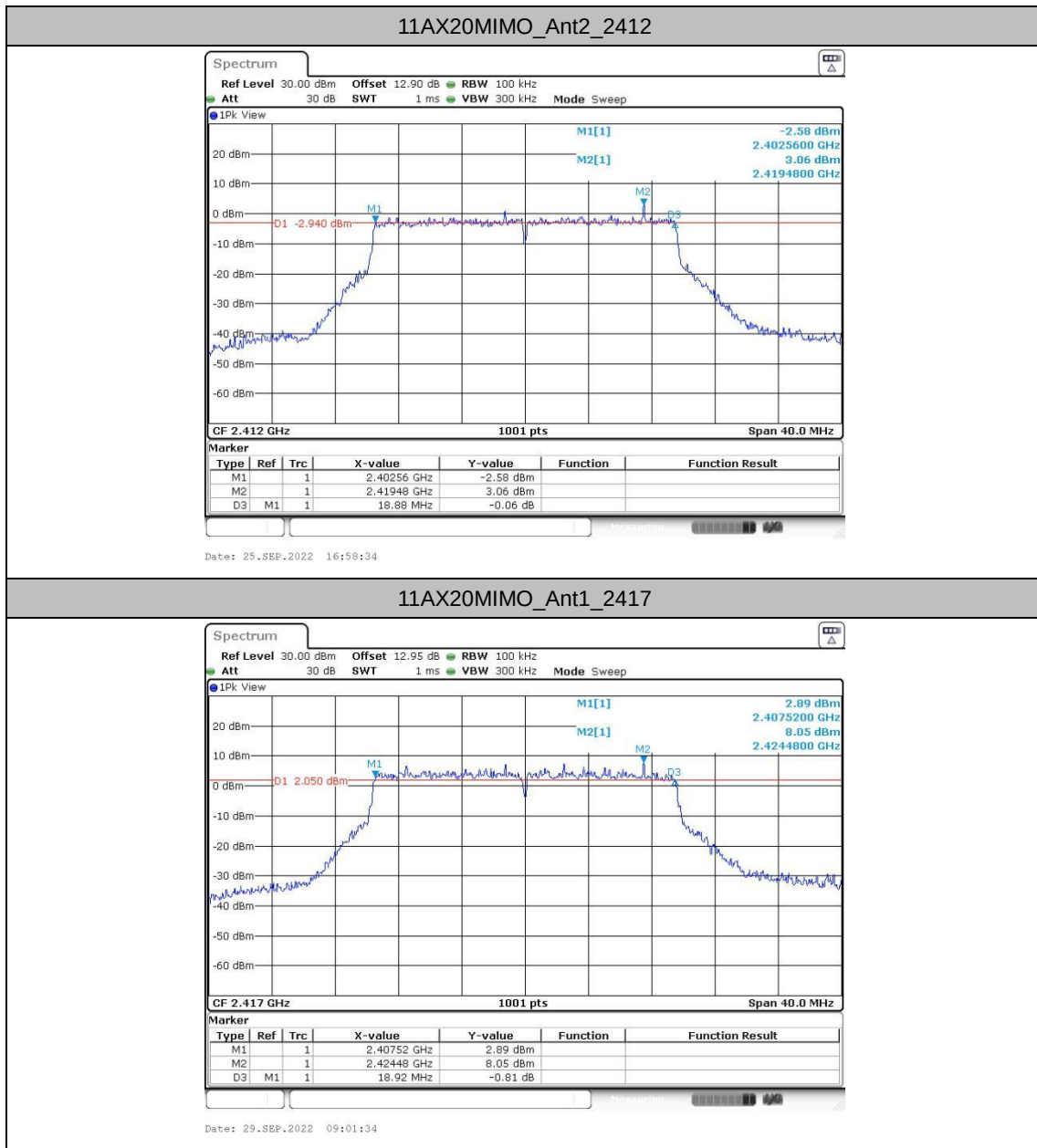


11G-CDD_Ant2_2462

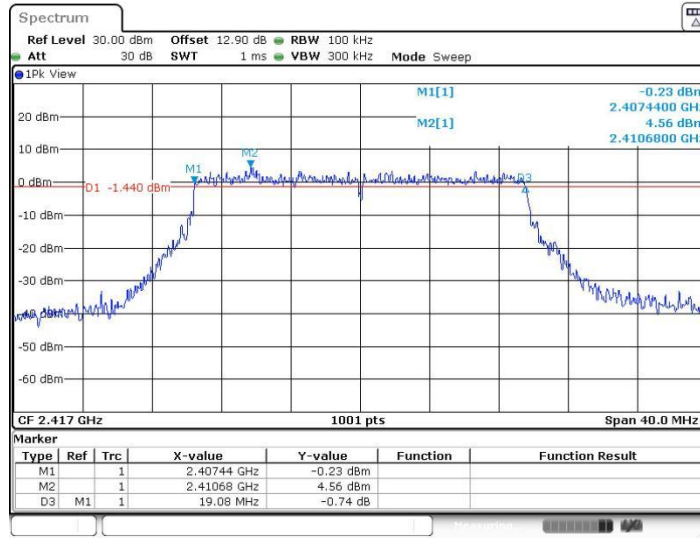


11AX20MIMO_Ant1_2412

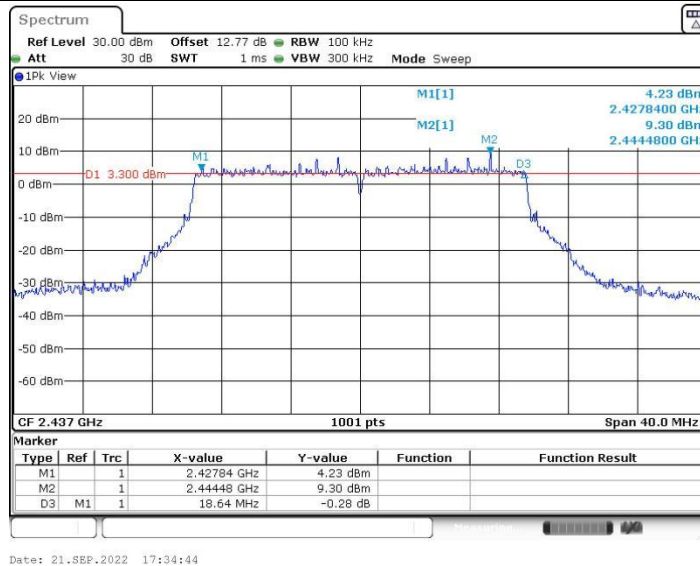


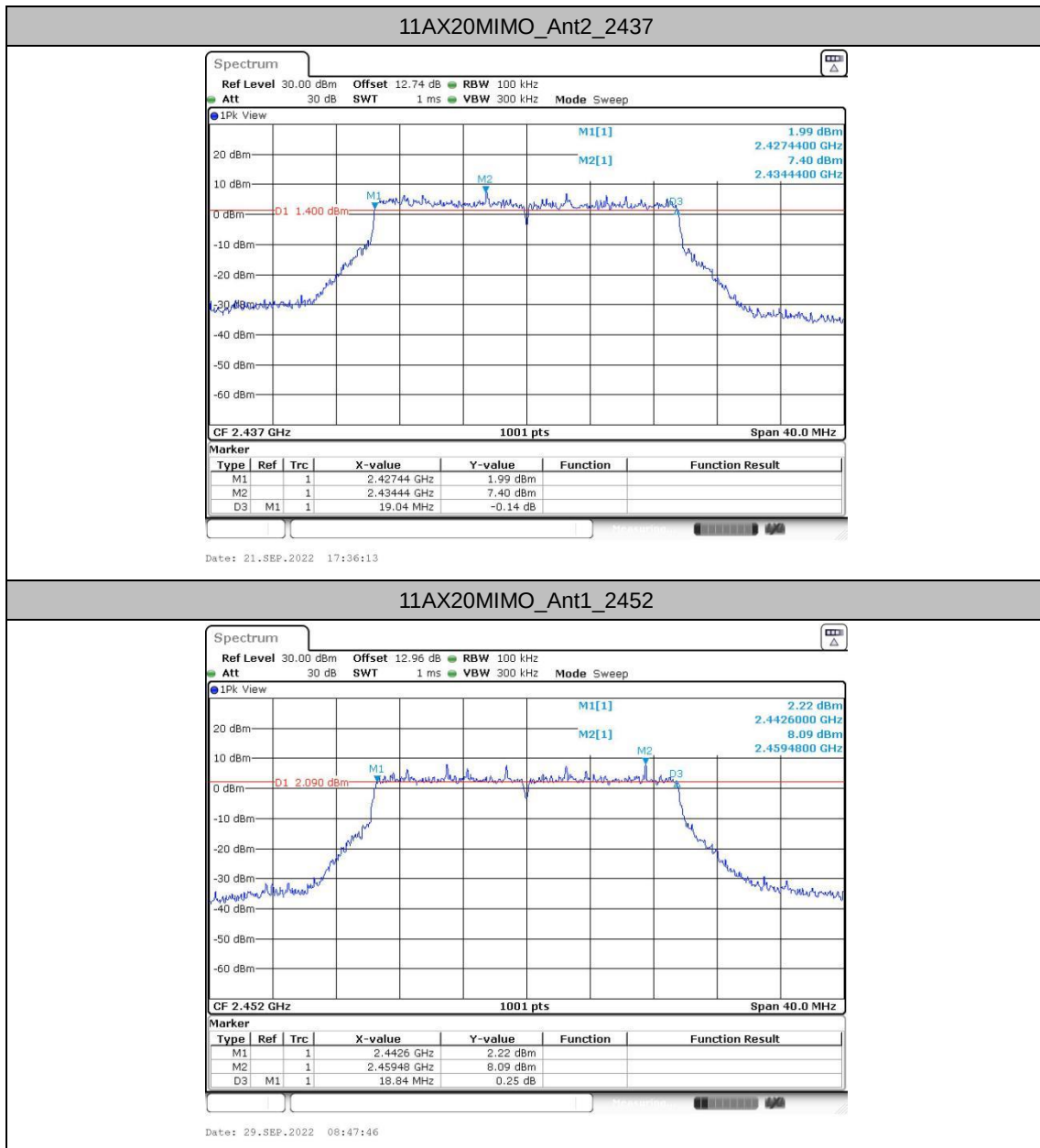


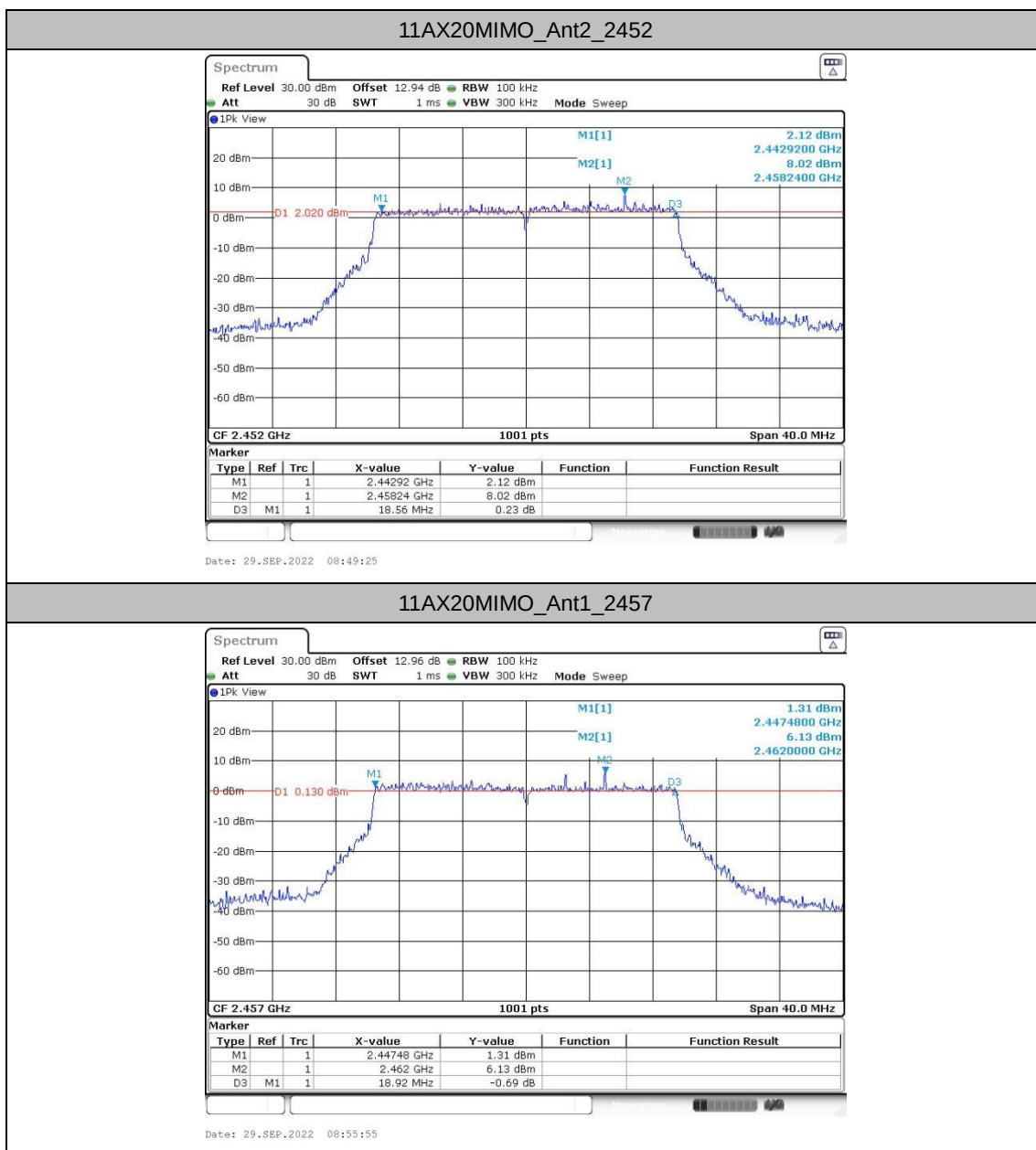
11AX20MIMO_Ant2_2417



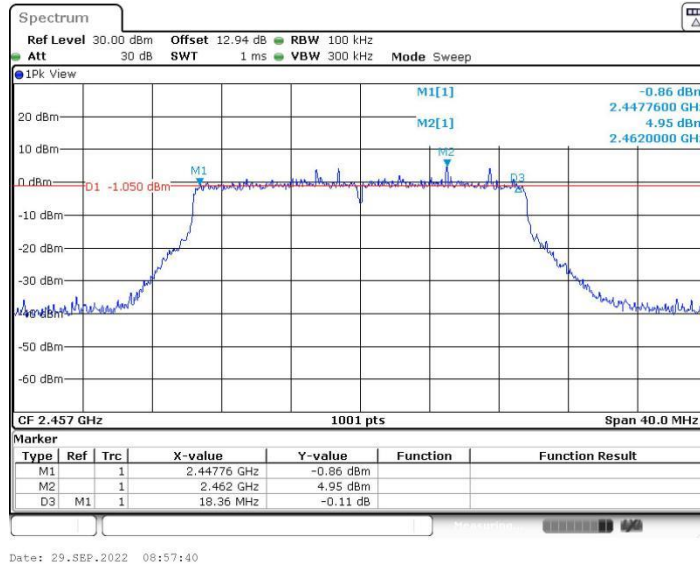
11AX20MIMO_Ant1_2437



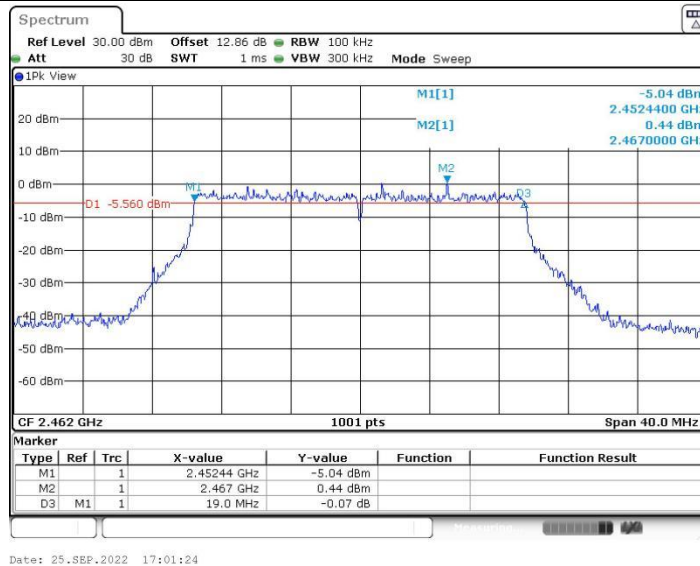


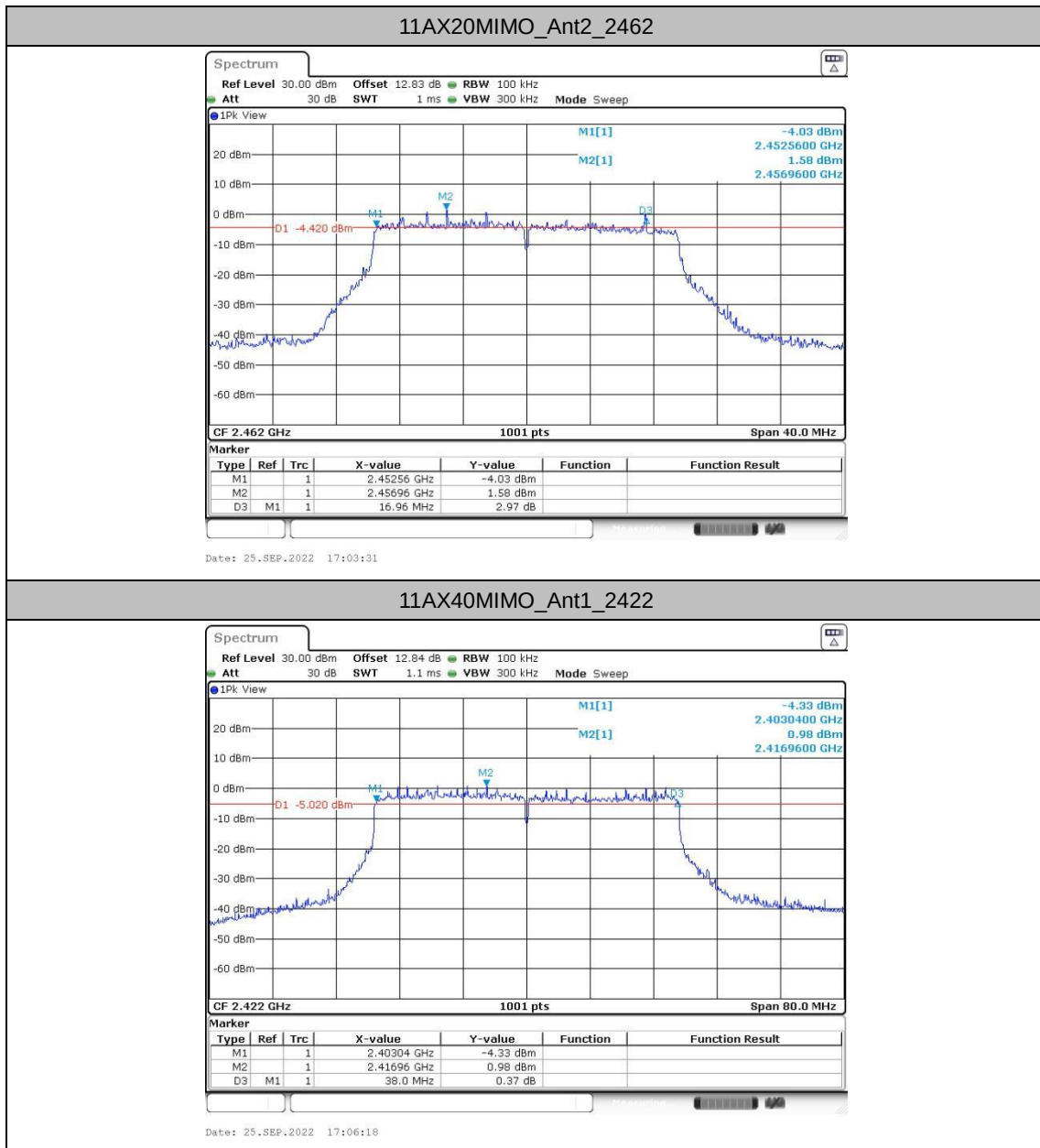


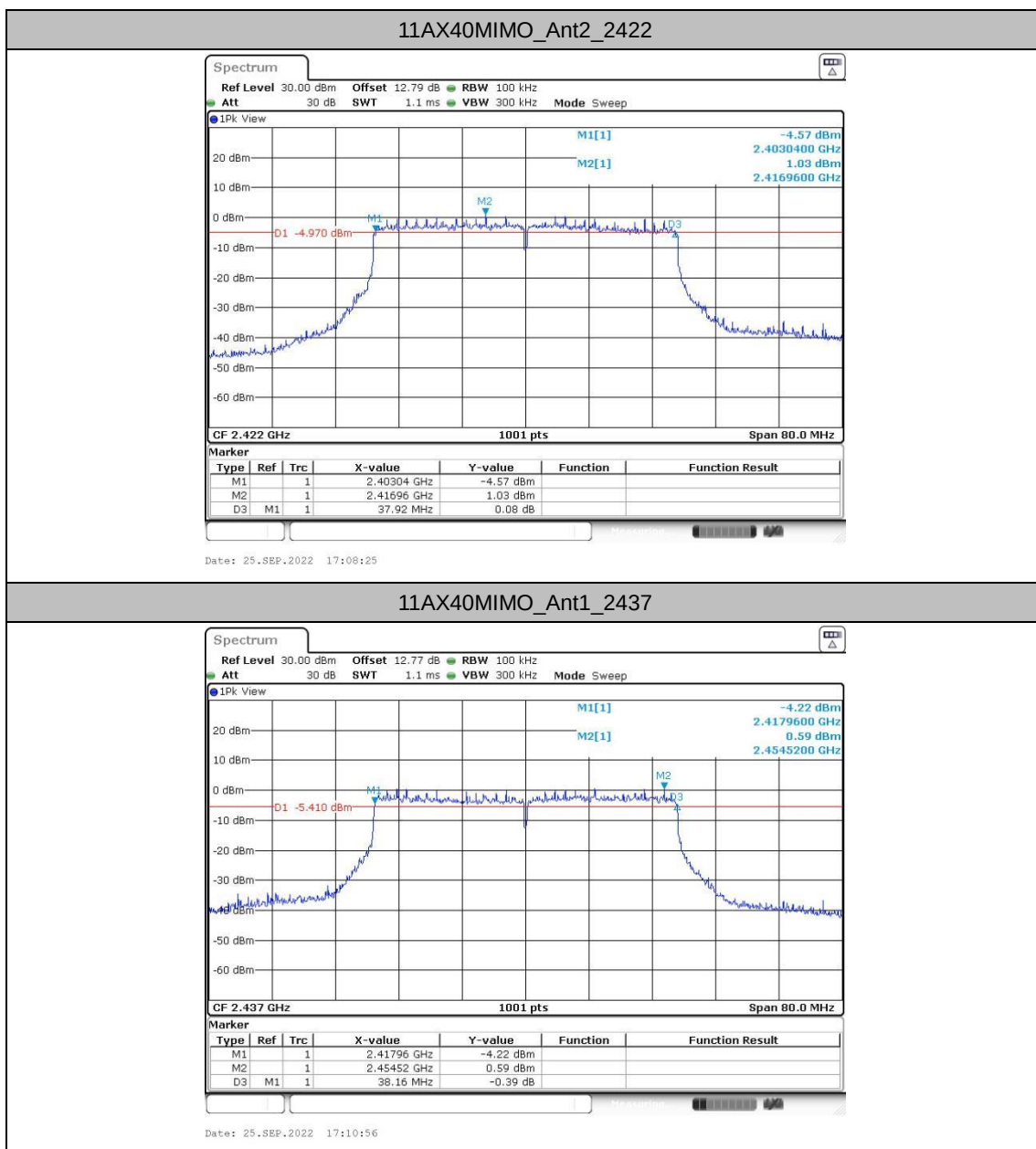
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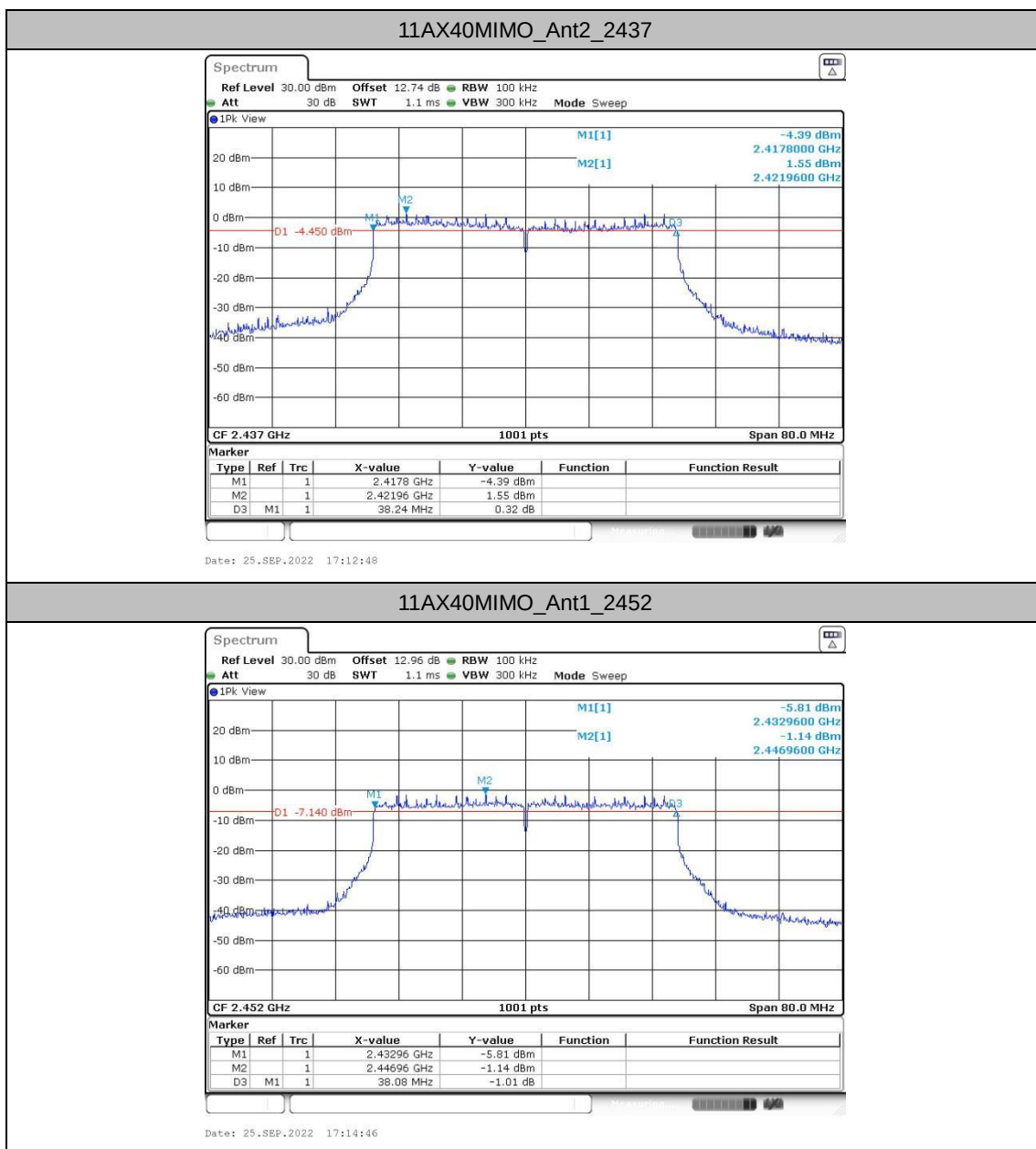


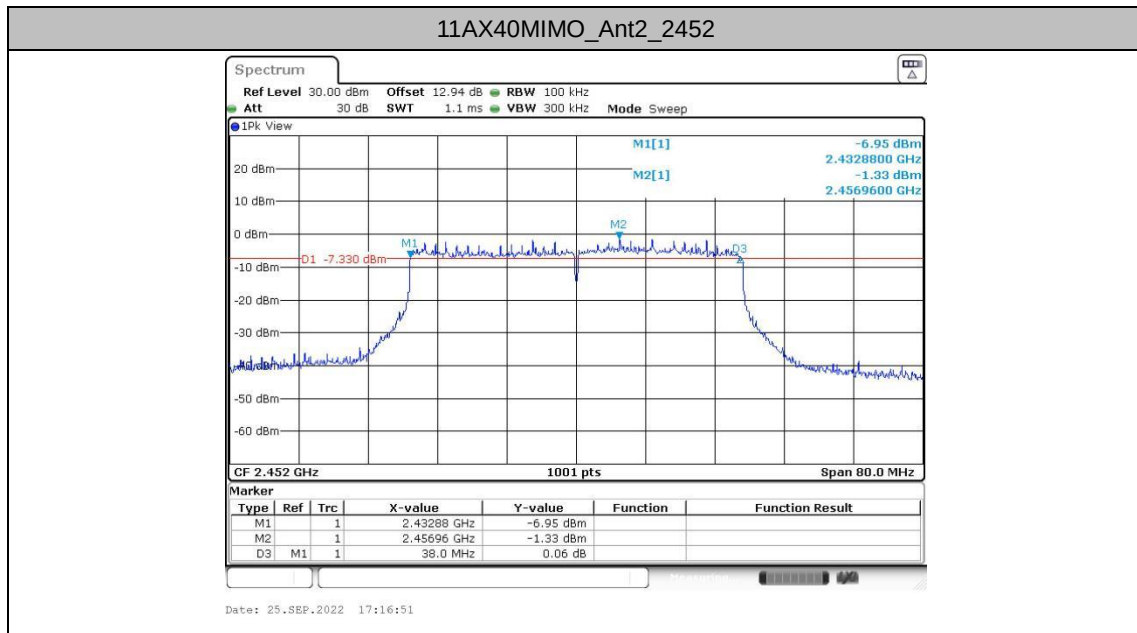
11AX20MIMO_Ant1_2462











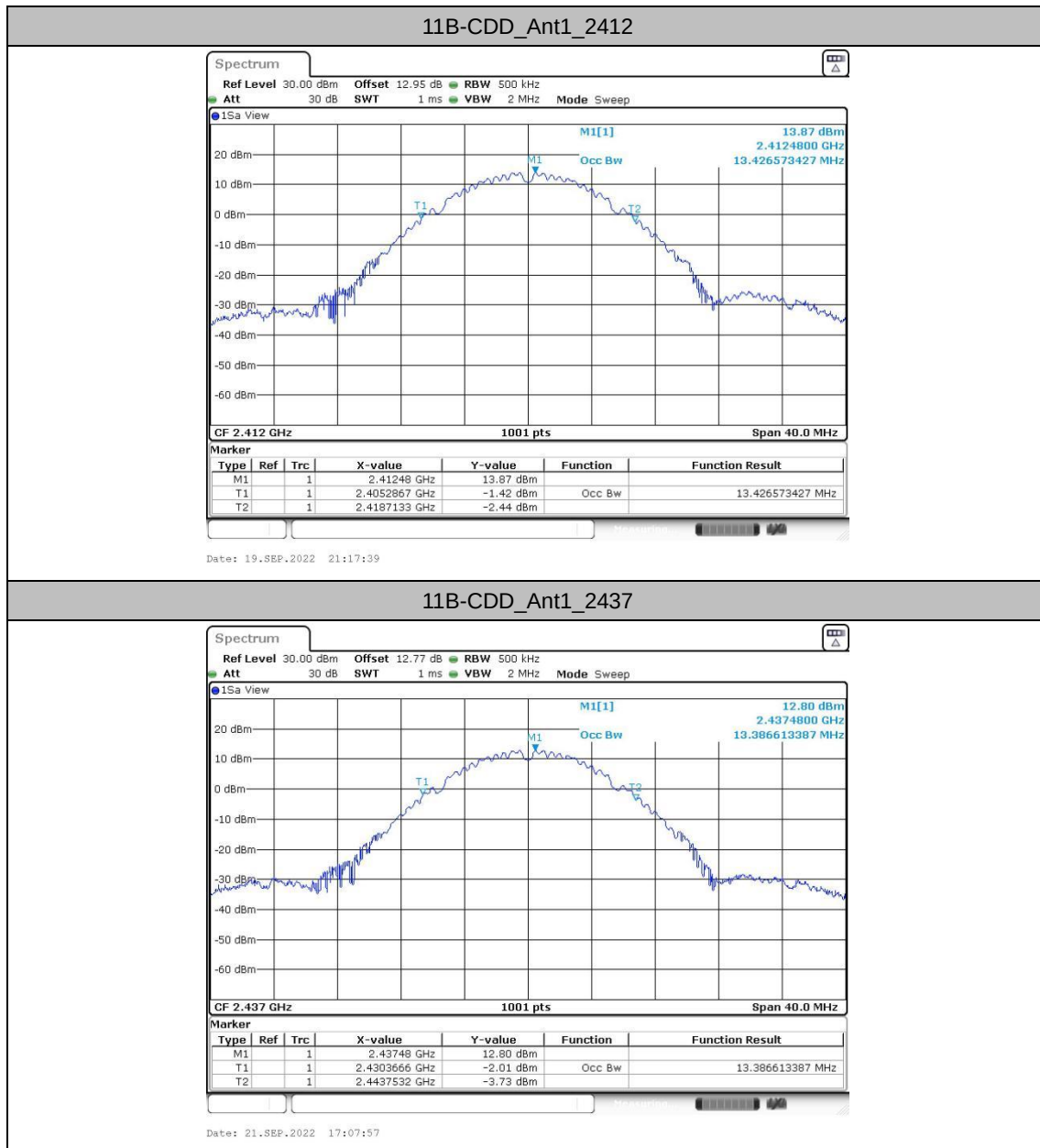


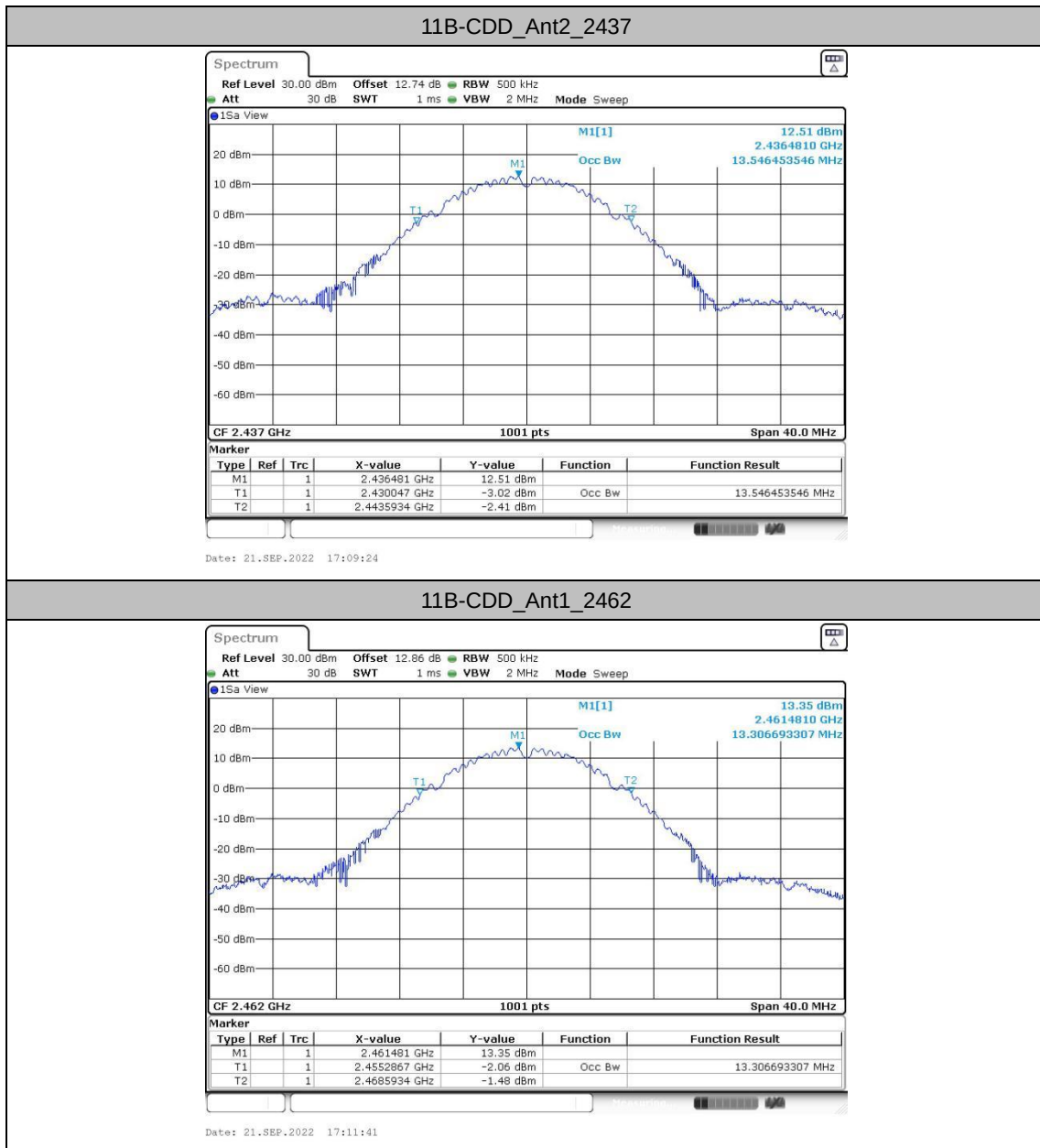
Occupied Channel Bandwidth

Test Result

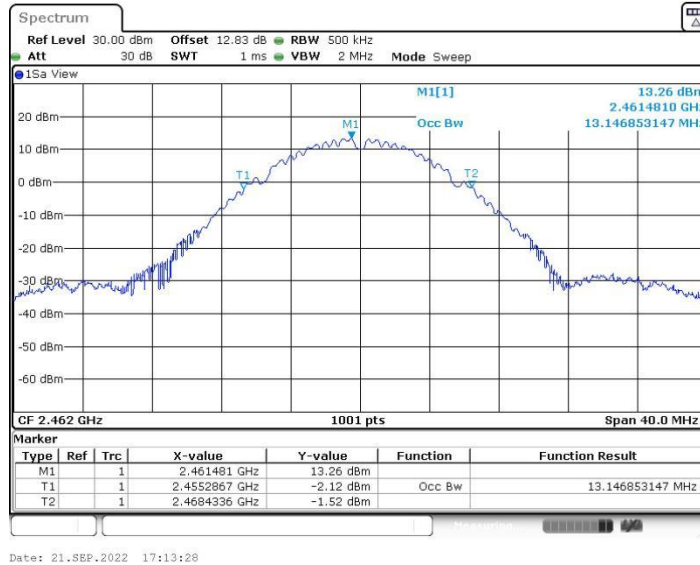
TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	13.427	2405.2867	2418.7133	---	---
	Ant2	2412	39.281	2392.3796	2431.6603	---	---
	Ant1	2437	13.387	2430.3666	2443.7532	---	---
	Ant2	2437	13.546	2430.0470	2443.5934	---	---
	Ant1	2462	13.307	2455.2867	2468.5934	---	---
	Ant2	2462	13.147	2455.2867	2468.4336	---	---
11G-CDD	Ant1	2412	18.102	2402.9291	2421.0310	---	---
	Ant2	2412	17.822	2403.2088	2421.0310	---	---
	Ant1	2437	18.142	2427.9690	2446.1109	---	---
	Ant2	2437	18.102	2427.7293	2445.8312	---	---
	Ant1	2452	18.142	2442.8492	2460.9910	---	---
	Ant2	2452	17.742	2443.2488	2460.9910	---	---
	Ant1	2457	18.142	2447.8092	2465.9510	---	---
	Ant2	2457	17.622	2448.1688	2465.7912	---	---
	Ant1	2462	18.102	2452.8492	2470.9510	---	---
	Ant2	2462	17.582	2453.0490	2470.6314	---	---
11AX20MIMO	Ant1	2412	19.341	2402.3297	2421.6703	---	---
	Ant2	2412	19.421	2402.3297	2421.7502	---	---
	Ant1	2417	19.381	2407.2498	2426.6304	---	---
	Ant2	2417	19.421	2407.2498	2426.6703	---	---
	Ant1	2437	19.461	2427.2897	2446.7502	---	---
	Ant2	2437	19.5	2427.1299	2446.6304	---	---
	Ant1	2452	19.381	2442.2897	2461.6703	---	---
	Ant2	2452	19.421	2442.2897	2461.7103	---	---
	Ant1	2457	19.381	2447.2498	2466.6304	---	---
	Ant2	2457	19.301	2447.3696	2466.6703	---	---
	Ant1	2462	19.421	2452.2098	2471.6304	---	---
	Ant2	2462	19.301	2452.2498	2471.5504	---	---
11AX40MIMO	Ant1	2422	38.521	2402.7393	2441.2607	---	---
	Ant2	2422	38.282	2402.8192	2441.1009	---	---
	Ant1	2437	38.442	2417.7393	2456.1808	---	---
	Ant2	2437	38.601	2417.6593	2456.2607	---	---
	Ant1	2452	38.362	2432.8192	2471.1808	---	---
	Ant2	2452	38.442	2432.6593	2471.1009	---	---

Test Graphs





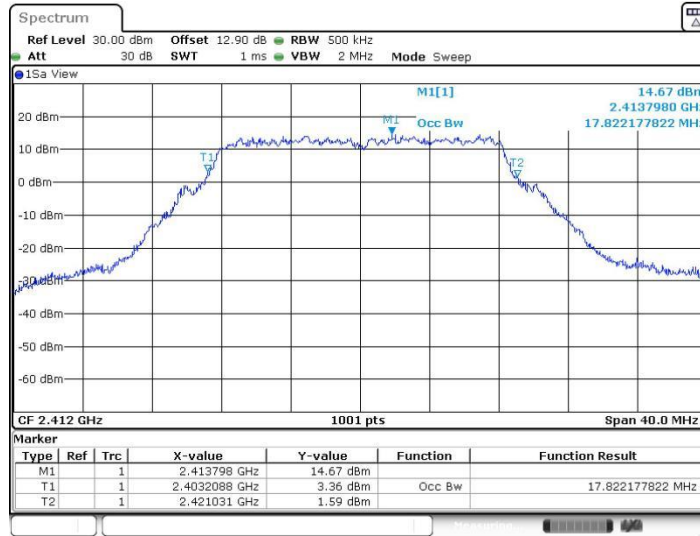
11B-CDD_Ant2_2462



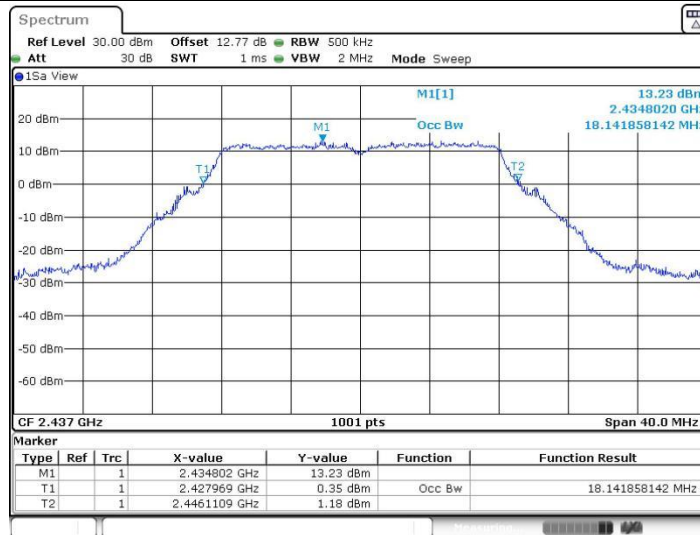
11G-CDD_Ant1_2412



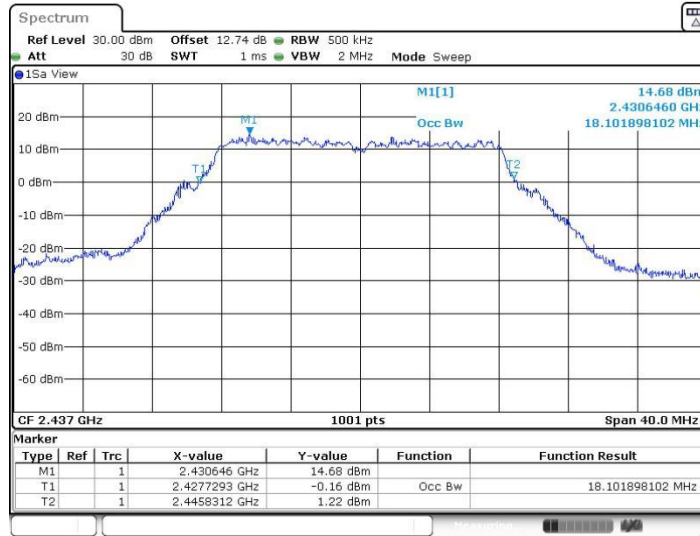
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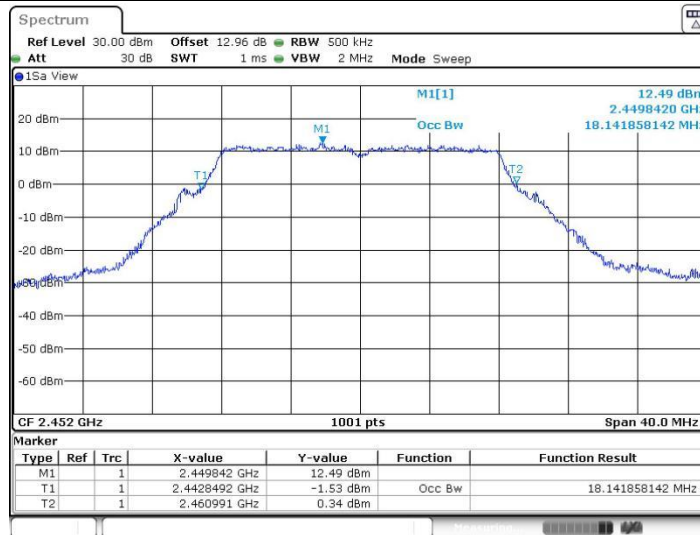
11G-CDD_Ant1_2437



11G-CDD_Ant2_2437

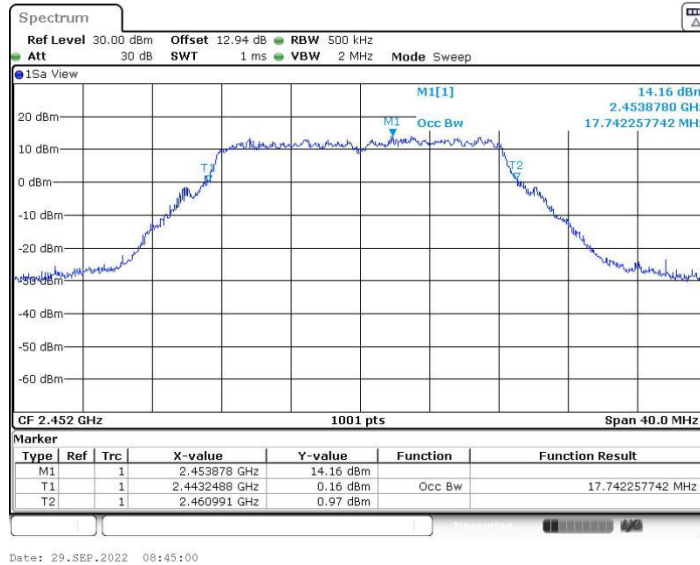


11G-CDD_Ant1_2452

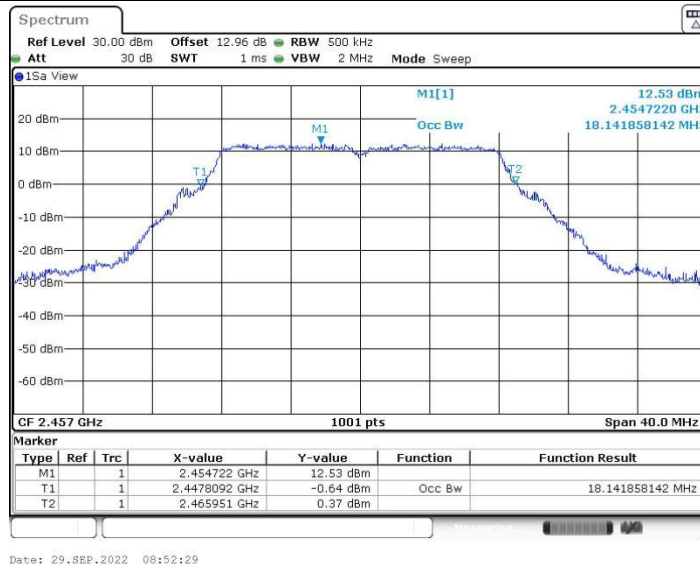




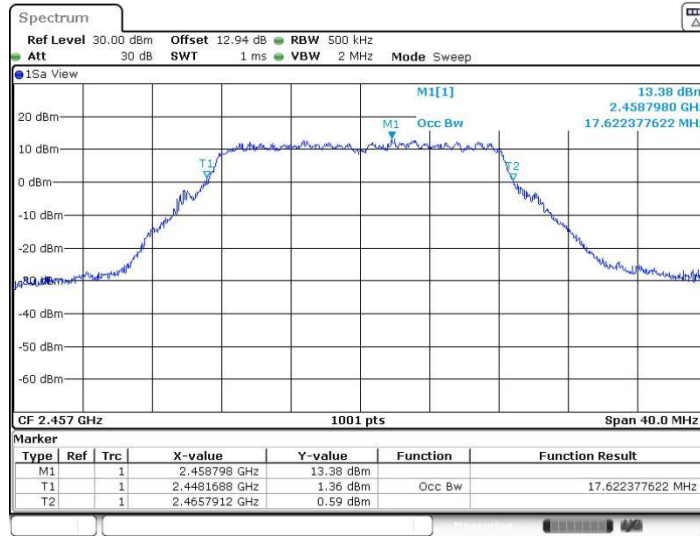
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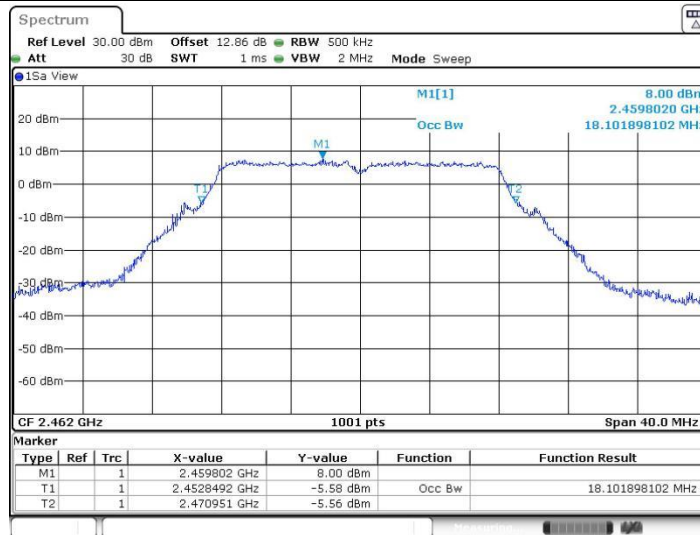
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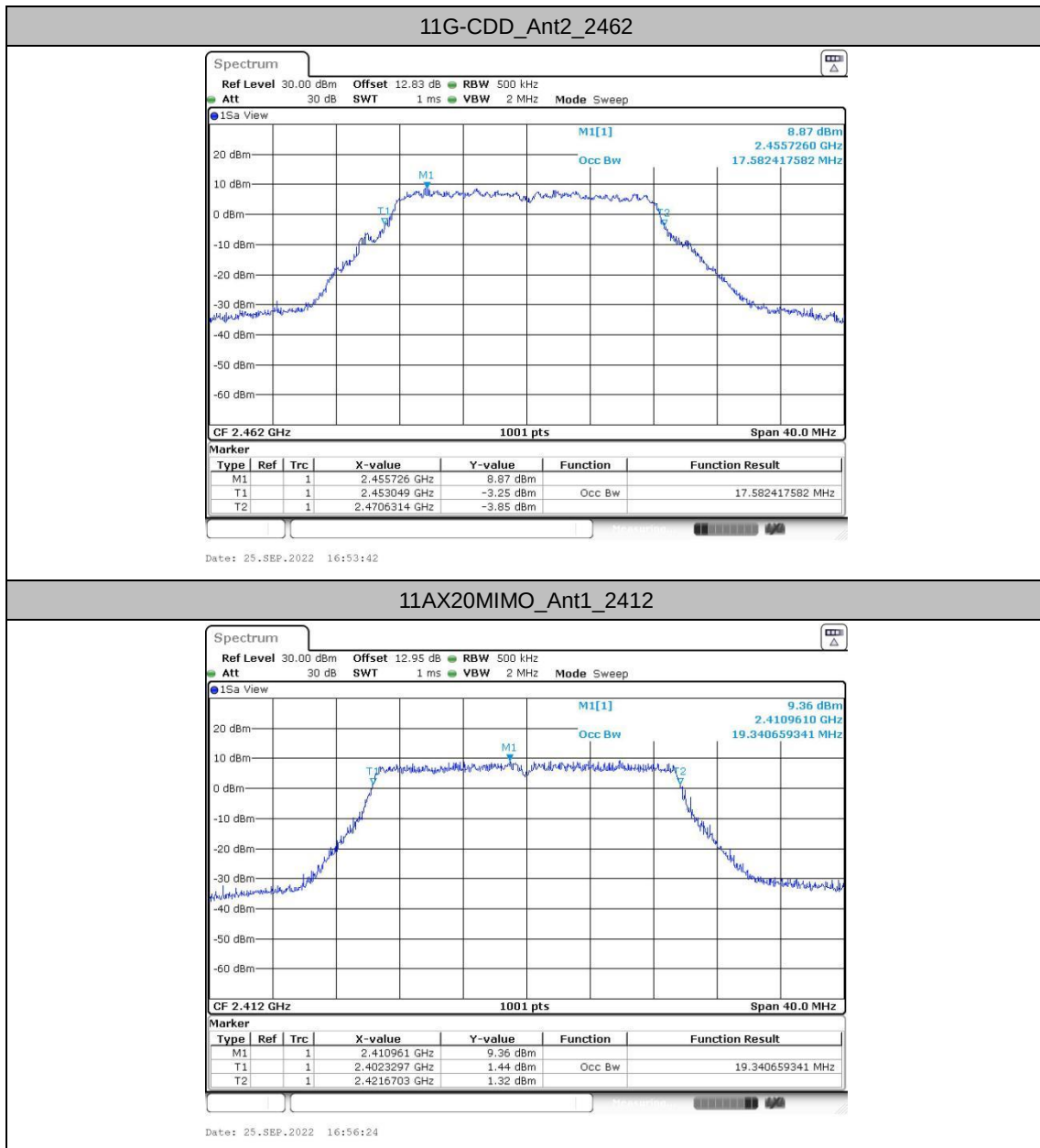


11G-CDD_Ant2_2457

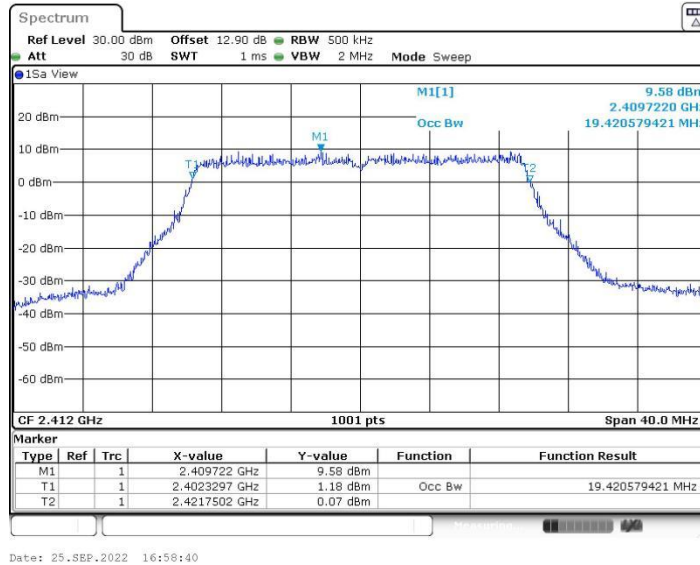


11G-CDD_Ant1_2462

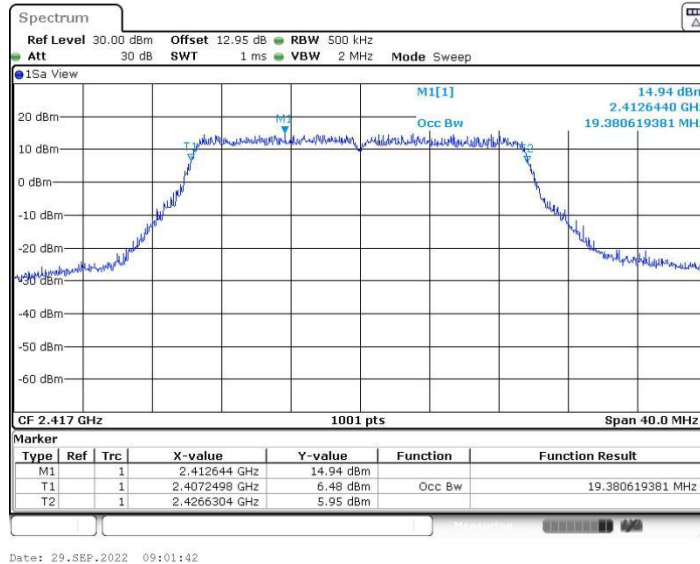




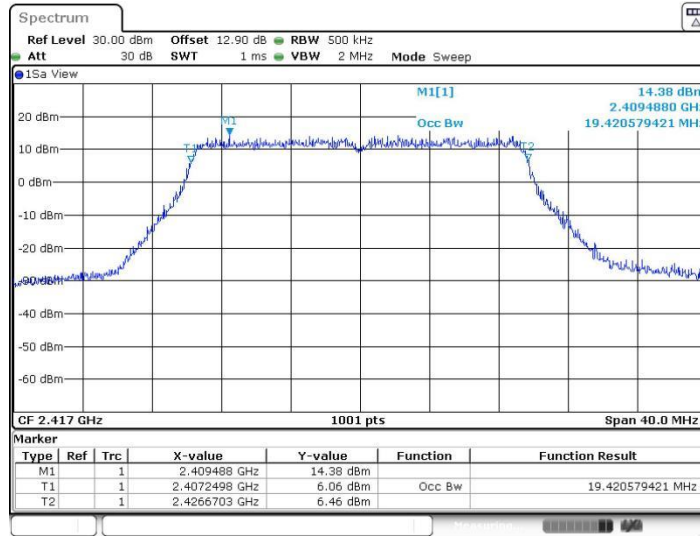
11AX20MIMO_Ant2_2412



11AX20MIMO_Ant1_2417



11AX20MIMO_Ant2_2417



11AX20MIMO_Ant1_2437

