



FCC RF Test Report

APPLICANT : OnePlus Technology (Shenzhen) Co.,Ltd.
EQUIPMENT : Mobile Phone
BRAND NAME : ONEPLUS
MODEL NAME : CPH2419, CPH2417
FCC ID : 2ABZ2-AA497
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System
TEST DATE(S) : May 25, 2022 ~ Jun. 05, 2022

We, Sporton International Inc. (Shenzhen), 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. (Shenzhen), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia



Sporton International Inc. (ShenZhen)

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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.....	6
1.5 Modification of EUT	6
1.6 Testing Location	7
1.7 Test Software.....	7
1.8 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	10
2.5 EUT Operation Test Setup	11
2.6 Measurement Results Explanation Example.....	11
3 TEST RESULT	12
3.1 6dB and 99% Bandwidth Measurement	12
3.2 Output Power Measurement.....	13
3.3 Power Spectral Density Measurement	14
3.4 Conducted Band Edges and Spurious Emission Measurement	16
3.5 Radiated Band Edges and Spurious Emission Measurement	17
3.6 AC Conducted Emission Measurement.....	21
3.7 Antenna Requirements.....	23
4 LIST OF MEASURING EQUIPMENT	24
5 UNCERTAINTY OF EVALUATION	25
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
FR251121C	Rev. 01	Initial issue of report	Jul. 08, 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 5.32 dB at 2388.68 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 16.48 dB at 0.230 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

OnePlus Technology (Shenzhen) Co.,Ltd.

18C02, 18C03, 18C04, 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen,Guangdong, China.

1.2 Manufacturer

OnePlus Technology (Shenzhen) Co.,Ltd.

18C02, 18C03, 18C04, 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen,Guangdong, China.

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Phone
Brand Name	ONEPLUS
Model Name	CPH2419, CPH2417
FCC ID	2ABZ2-AA497
IMEI Code	Conducted:861677060020313/861677060028209 Conduction: 861677060027524 Radiation: 861677060027938
HW Version	2AA495-0
SW Version	CPH2419_11_A.03
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. The different model name is for different market purpose.

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 : 24.2 dBm (0.2630 W) 802.11g : 26.66 dBm (0.4634 W) 802.11n HT20 : 27.39 dBm (0.5483 W) 802.11n HT40 : 27.45 dBm (0.5559 W) 802.11ac VHT20 : 27.19 dBm (0.5236 W) 802.11ac VHT40 : 27.32 dBm (0.5395 W) 802.11ax HE20 : 27.55 dBm (0.5689 W) 802.11ax HE40 : 27.73 dBm (0.5929 W)
99% Occupied Bandwidth	<Ant.1> 802.11b : 14.35 MHz 802.11g : 16.86 MHz 802.11ax HE20 : 19.10 MHz 802.11ax HE40 : 38.12 MHz <Ant.2> 802.11b : 14.31 MHz 802.11g : 16.74 MHz 802.11ax HE20 : 19.18 MHz 802.11ax HE40 : 38.20 MHz
Antenna Type / Gain	<Ant.1>: Fixed Internal Antenna type with gain -1 dBi <Ant.2>: Fixed Internal Antenna type with gain 0.8 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 / 4096QAM)

Note:

1. WLAN Ant. 1/2 corresponds to Ant. 4/7 of the EUT Antenna map respectively.
2. WLAN Ant. 1/2 support CDD MIMO mode.
3. For 802.11n & 802.11ac & 802.11ax mode, the whole testing have assessed only 802.11ax HE20/HE40 by referring to the higher output power.
4. 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.

1.5 Modification of EUT

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

1.6 Testing Location

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	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-SZ TH01-SZ	CN1256	421272

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 China 518103 TEL: +86-755-33202398		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH01-SZ	CN1256	421272

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH01-SZ	AUDIX	E3	6.2009-8-24
2.	CO01-SZ	AUDIX	E3	6.120613b

1.8 Applicable Standards

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

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

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

2 Test Configuration of Equipment Under Test

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

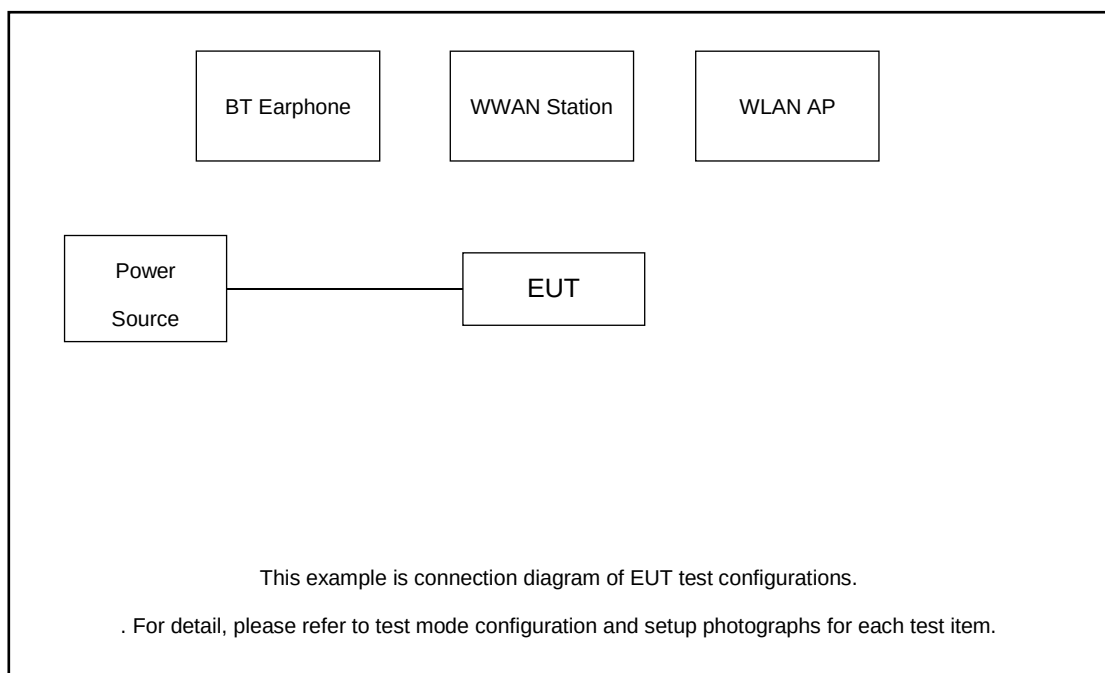
MIMO Antenna

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ax HE20	MCS0
802.11ax HE40	MCS0

RSE Simultaneous transmission
802.11ax HE40 CH03(2422MHz)+ LTE Band48 Link

Test Cases	
AC Conducted Emission	Mode 1 :GSM850 Idle+ Bluetooth Link+ WLAN Link(2.4G)+ USB Cable 1(Charging from Adapter1)+ Battery 1 Mode 2 GSM850 Idle+ Bluetooth Link+ WLAN Link(2.4G)+ USB Cable 1(Charging from Adapter1)+ Battery 1
Remark: 1. AC conduction Mode 1 is tested as soon as the EUT powered on (cold status), Mode 2 is tested after EUT charged for five minutes (warm status), only the worst Mode 2 is reported. 2. For Radiated Test Cases, The tests were performed with Adapter and USB Cable. 3. RSE Simultaneous transmission mode is assessed from the worst WLAN TX and worst WWAN Link mode.	

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Base Station(LTE)	Anritsu	MT8820C	N/A	N/A	Unshielded,1.8m
2.	Base Station	R&S	CBT32	N/A	N/A	Unshielded,1.8m
3.	WLAN AP	Dlink	DIR-820L	KA2IR820LA1	N/A	Unshielded,1.8m
4.	Bluetooth Earphone	Samsung	EO-MG900	PYAHS-107W	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 2.12 dB and 20dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 2.12 + 20 = 22.12 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

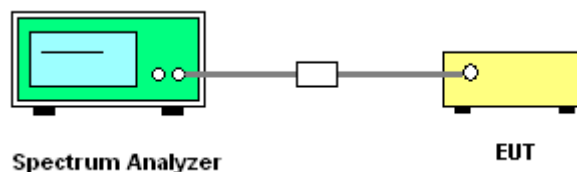
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. 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) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

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

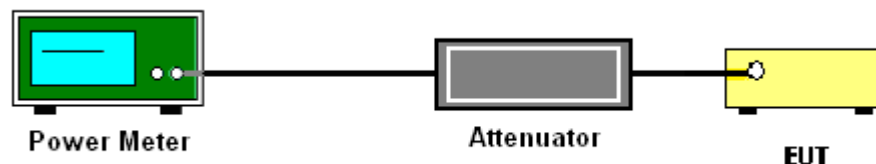
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

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.

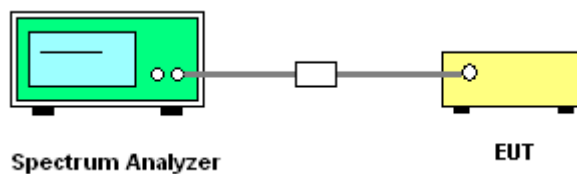
If measurements performed using method (2) plus $10 \log(N)$ exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

Method (1): Measure and sum the spectra across the outputs.

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

Method (2): Measure and add $10 \log(N)$ dB, where N is the number of outputs. (N=2)

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.

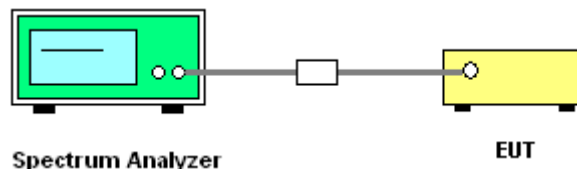
3.4.2 Measuring Instruments

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

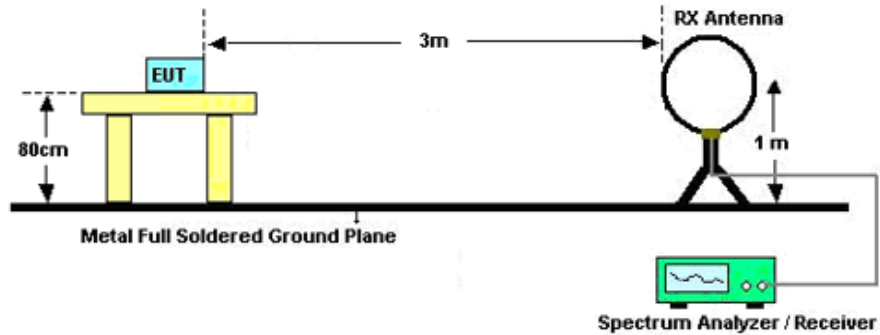
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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:

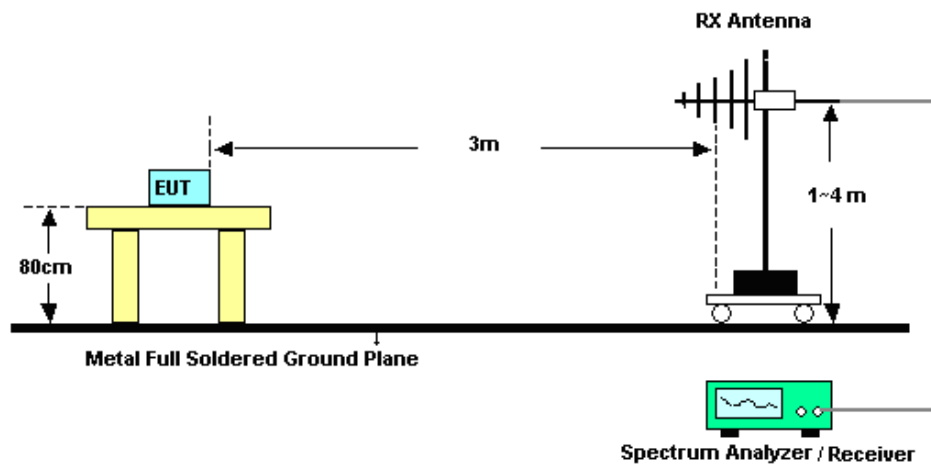
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

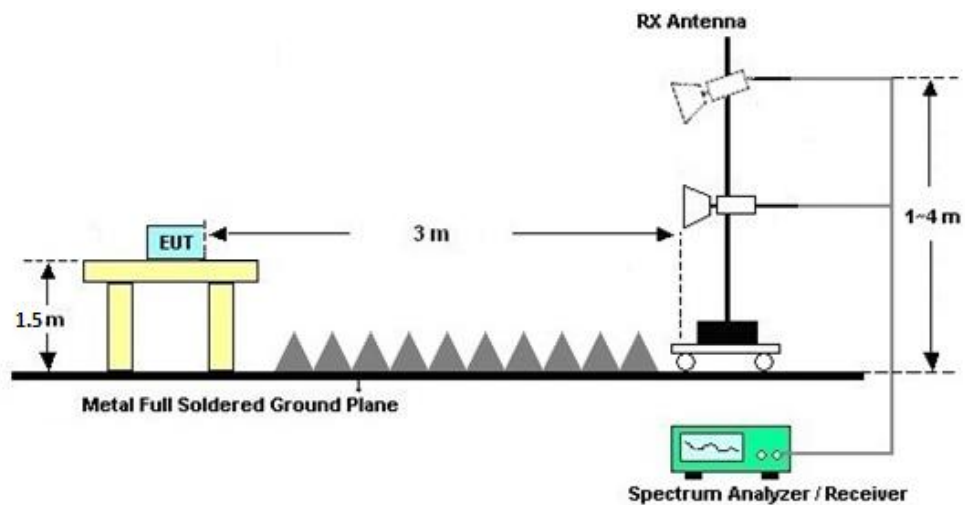
For radiated emissions below 30MHz



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.

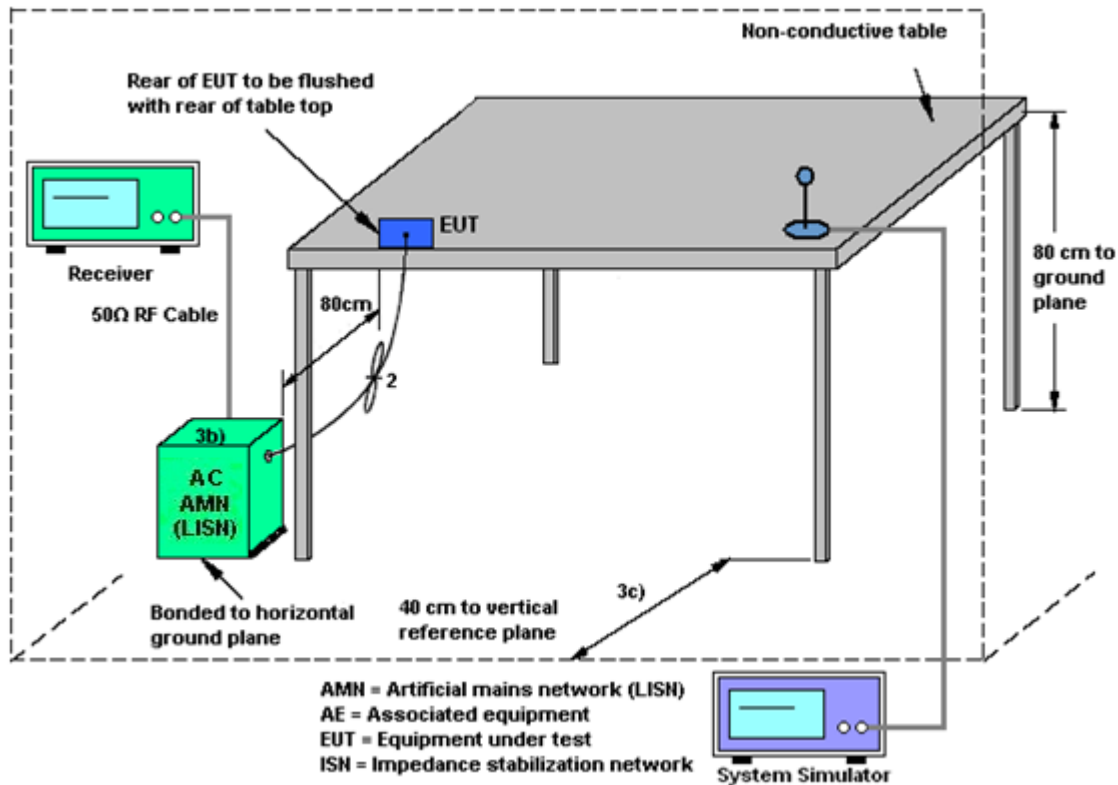
3.6.2 Measuring Instruments

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	-1.00	0.80	0.80	2.96	0.00	0.00

Power Limit Reduction = $DG(\text{Power}) - 6\text{dBi}$, (min = 0)

PSD Limit Reduction = $DG(\text{PSD}) - 6\text{dBi}$, (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. 07, 2022	May 25, 2022~Jun. 05, 2022	Apr. 08, 2023	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 28, 2021	May 25, 2022~Jun. 05, 2022	Dec. 27, 2022	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1542004	50MHz Bandwidth	Dec. 28, 2021	May 25, 2022~Jun. 05, 2022	Dec. 27, 2022	Conducted (TH01-SZ)
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Dec. 27, 2021	May 30, 2022~Jun. 01, 2022	Dec. 26, 2022	Radiation (03CH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Jul. 14, 2021	May 30, 2022~Jun. 01, 2022	Jul. 13, 2022	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jun. 22, 2021	May 30, 2022~Jun. 01, 2022	Jun. 21, 2022	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz~2GHz	Sep. 28, 2021	May 30, 2022~Jun. 01, 2022	Sep. 27, 2022	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Jul. 18, 2021	May 30, 2022~Jun. 01, 2022	Jul. 17, 2022	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Apr. 10, 2022	May 30, 2022~Jun. 01, 2022	Apr. 09, 2023	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 06, 2022	May 30, 2022~Jun. 01, 2022	Apr. 05, 2023	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1943528	1GHz~18GHz	Oct. 22, 2021	May 30, 2022~Jun. 01, 2022	Oct. 21, 2022	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5GHz	Oct. 22, 2021	May 30, 2022~Jun. 01, 2022	Oct. 21, 2022	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 13, 2021	May 30, 2022~Jun. 01, 2022	Jul. 12, 2022	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	May 30, 2022~Jun. 01, 2022	NCR	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	May 30, 2022~Jun. 01, 2022	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	May 30, 2022~Jun. 01, 2022	NCR	Radiation (03CH01-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Sep. 01, 2021	May 31, 2022	Aug. 31, 2022	Conduction (CO01-SZ)
AC LISN	R&S	ENV216	100063	9kHz~30MHz	Sep. 01, 2021	May 31, 2022	Aug. 31, 2022	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 29, 2021	May 31, 2022	Oct. 28, 2022	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 14, 2021	May 31, 2022	Jul. 13, 2022	Conduction (CO01-SZ)

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 Measurement

Test Item	Uncertainty
Conducted Power	± 1.34 dB
Conducted Emissions	± 1.34 dB
Occupied Channel Bandwidth	± 0.13 %
Conducted Power Spectral Density	± 1.32 dB

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.2dB
---	-------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.2dB
---	-------

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% ($U = 2Uc(y)$)	4.3dB
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----- THE END -----



Appendix A. Conducted Test Results

**Ambient Condition:** 25 °C, 45 %RH**Test Date:** May 25, 2022~Jun. 05, 2022**Test Engineer:** Zhang Xue Yi

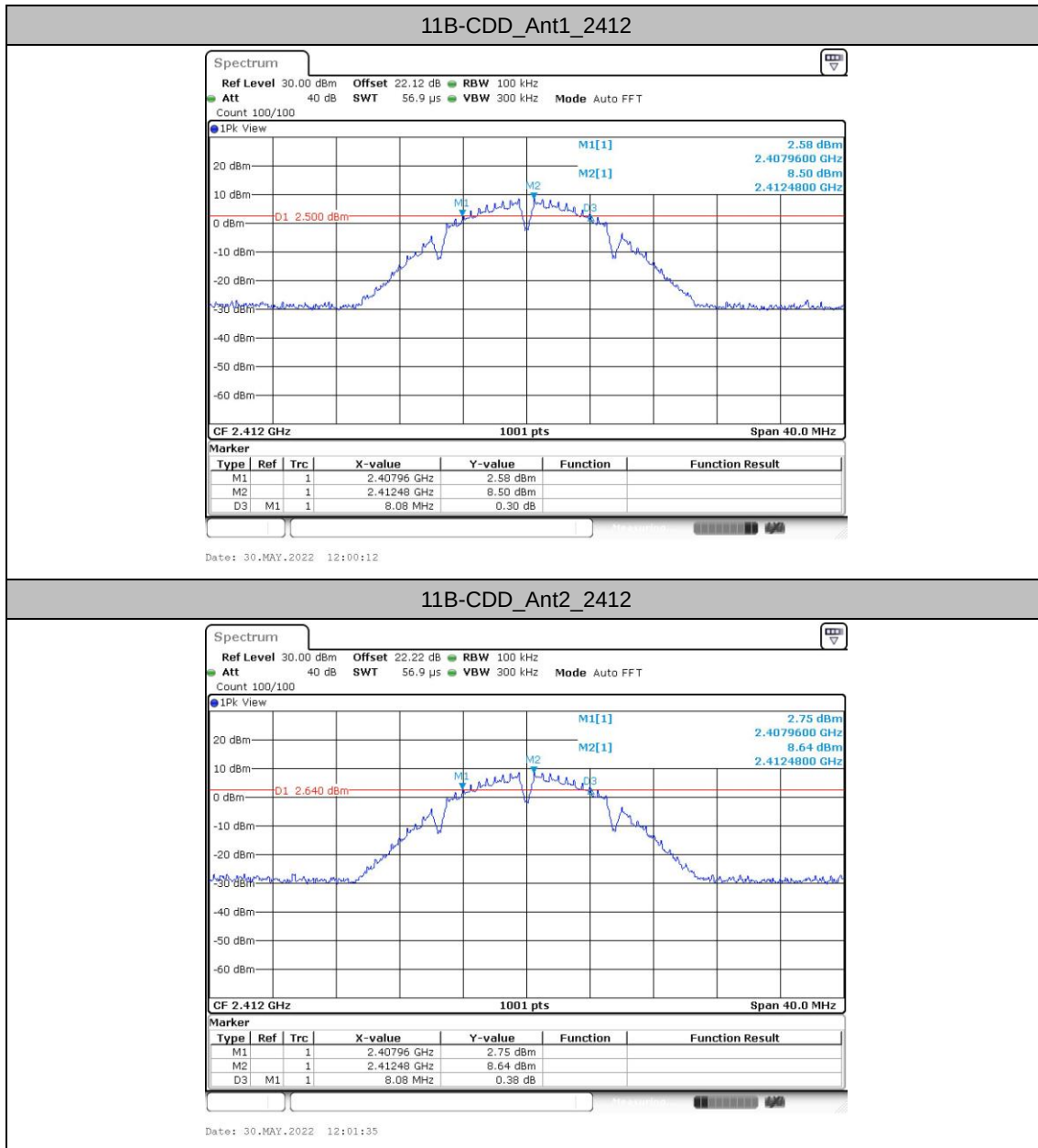
DTS Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	8.08	2407.96	2416.04	0.5	PASS
	Ant2	2412	8.08	2407.96	2416.04	0.5	PASS
	Ant1	2437	8.08	2432.96	2441.04	0.5	PASS
	Ant2	2437	8.08	2432.96	2441.04	0.5	PASS
	Ant1	2462	8.08	2457.96	2466.04	0.5	PASS
	Ant2	2462	8.08	2457.96	2466.04	0.5	PASS
11G-CDD	Ant1	2412	15.96	2404.20	2420.16	0.5	PASS
	Ant2	2412	15.92	2404.24	2420.16	0.5	PASS
	Ant1	2437	16.32	2428.84	2445.16	0.5	PASS
	Ant2	2437	15.92	2429.24	2445.16	0.5	PASS
	Ant1	2462	16.04	2453.84	2469.88	0.5	PASS
	Ant2	2462	16.32	2453.84	2470.16	0.5	PASS
11AX20MIMO	Ant1	2412	18.64	2402.84	2421.48	0.5	PASS
	Ant2	2412	18.20	2403.28	2421.48	0.5	PASS
	Ant1	2437	18.68	2427.76	2446.44	0.5	PASS
	Ant2	2437	18.16	2428.24	2446.40	0.5	PASS
	Ant1	2462	18.64	2452.52	2471.16	0.5	PASS
	Ant2	2462	18.68	2452.64	2471.32	0.5	PASS
11AX40MIMO	Ant1	2422	36.24	2404.16	2440.40	0.5	PASS
	Ant2	2422	36.16	2404.48	2440.64	0.5	PASS
	Ant1	2437	37.44	2418.28	2455.72	0.5	PASS
	Ant2	2437	37.68	2418.20	2455.88	0.5	PASS
	Ant1	2452	38.08	2432.96	2471.04	0.5	PASS
	Ant2	2452	35.76	2434.48	2470.24	0.5	PASS

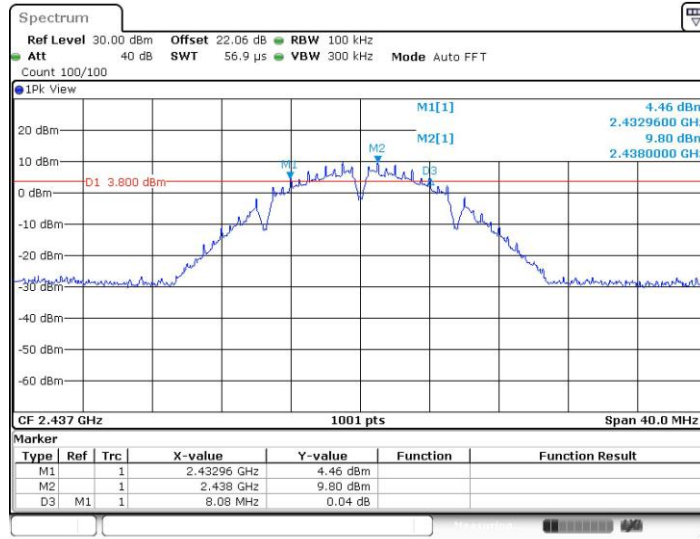


Test Graphs

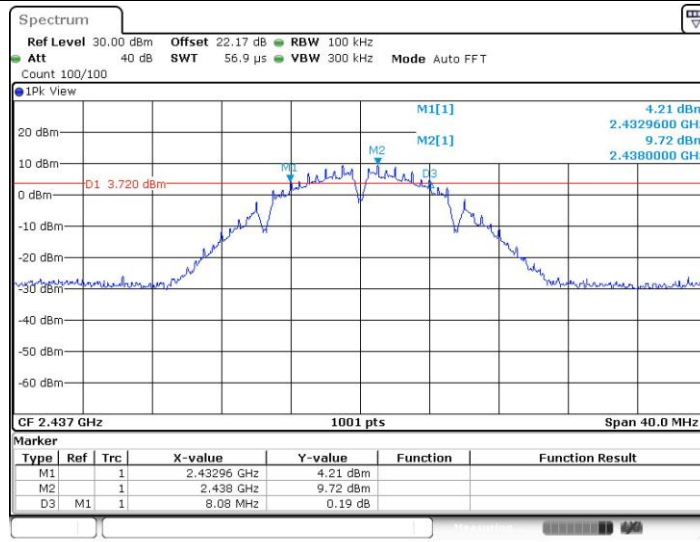




11B-CDD_Ant1_2437

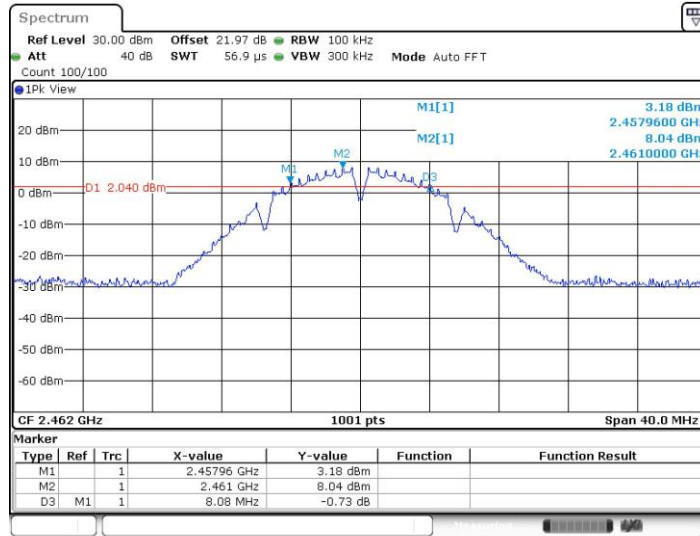


11B-CDD_Ant2_2437



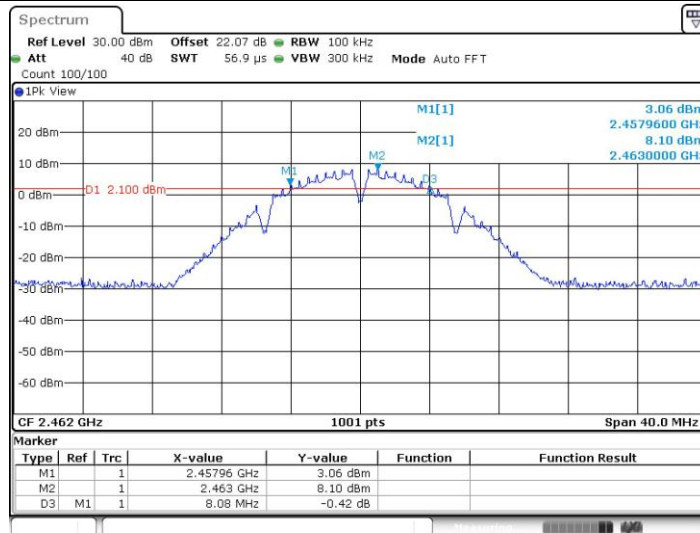


11B-CDD_Ant1_2462



Date: 30.MAY.2022 13:37:15

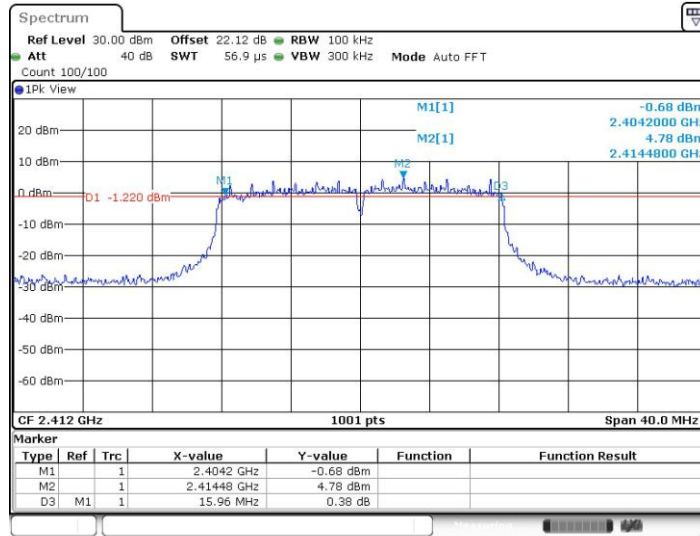
11B-CDD_Ant2_2462



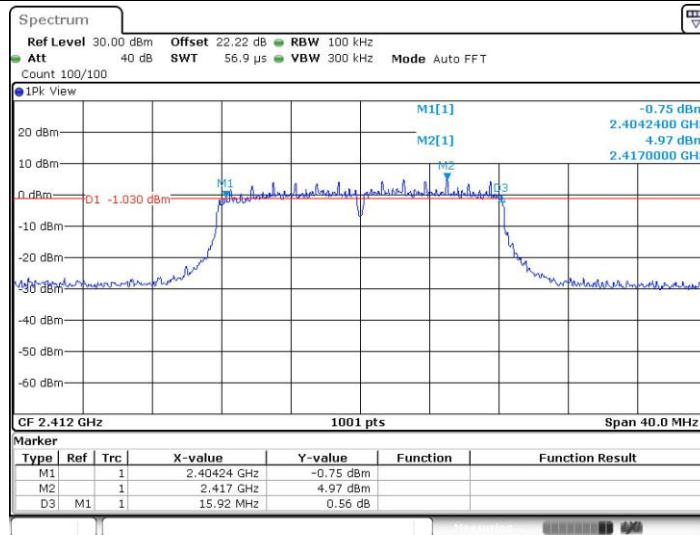
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11G-CDD_Ant1_2412

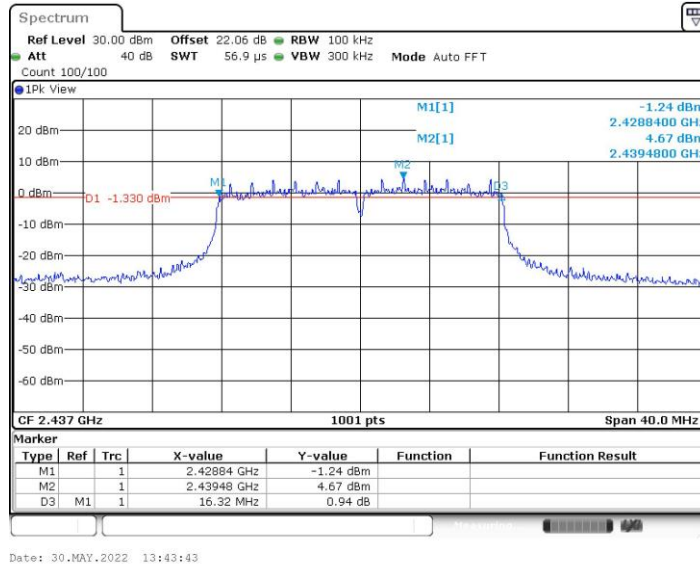


11G-CDD_Ant2_2412

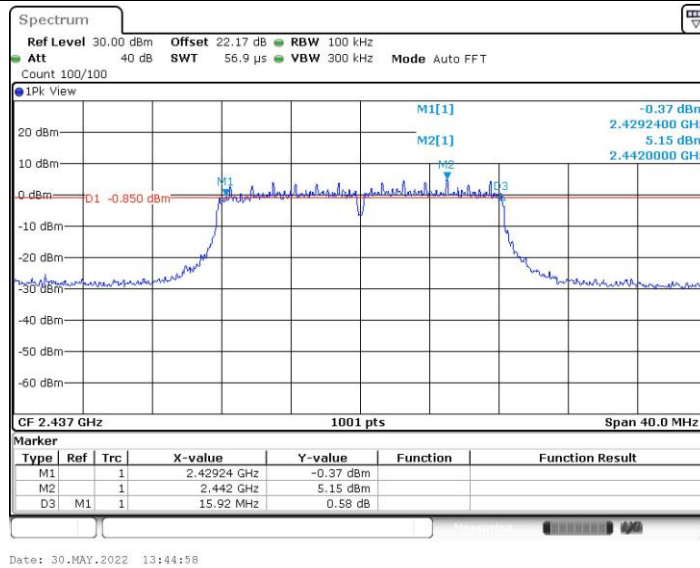




11G-CDD_Ant1_2437

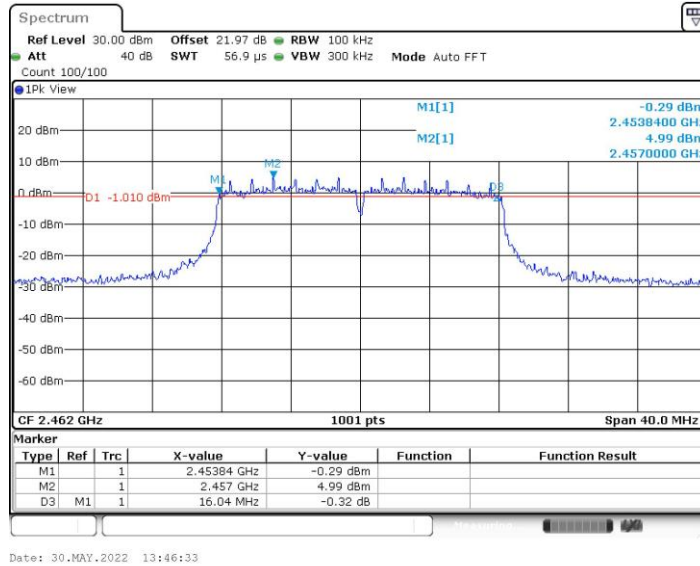


11G-CDD_Ant2_2437

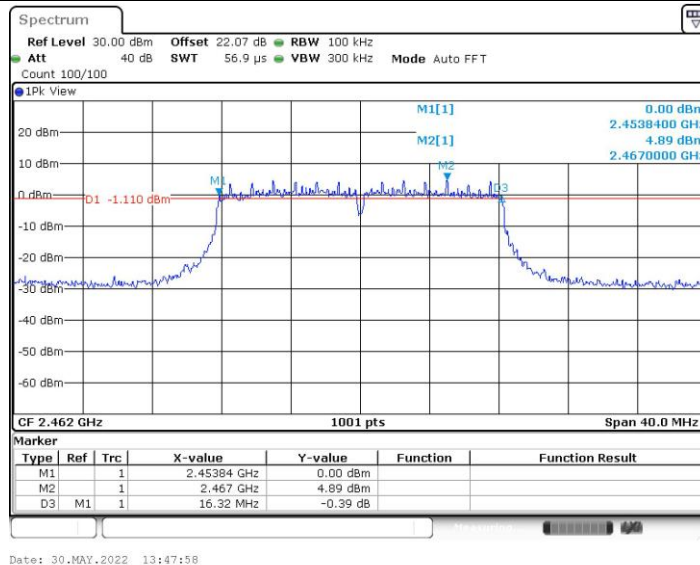




11G-CDD_Ant1_2462

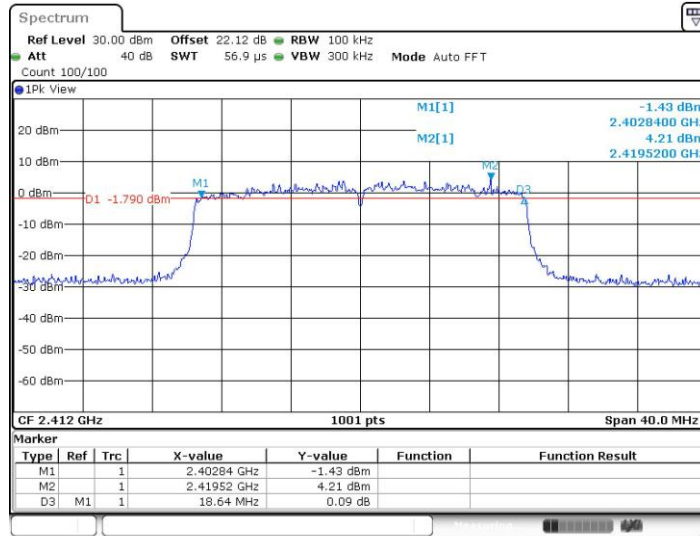


11G-CDD_Ant2_2462



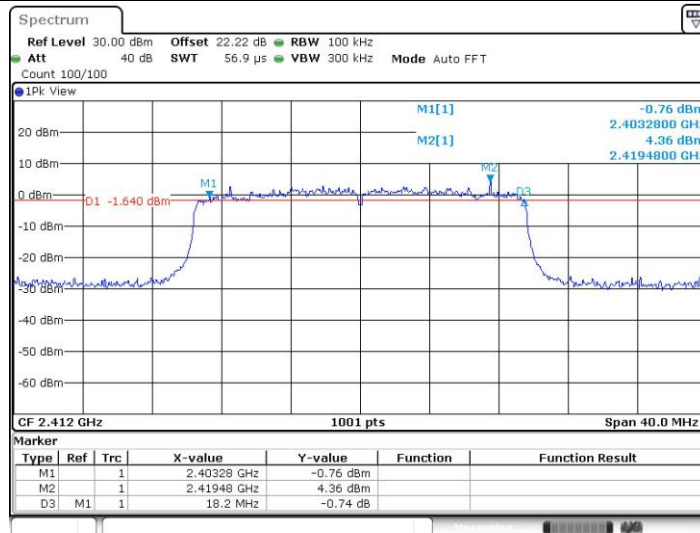


11AX20MIMO_Ant1_2412



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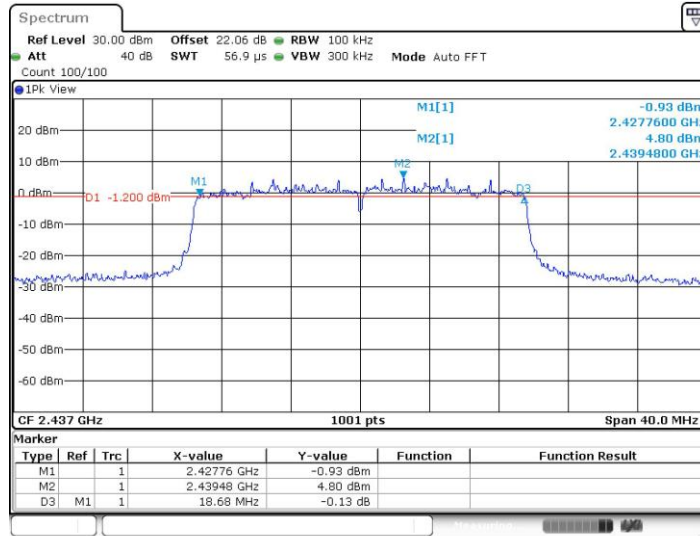
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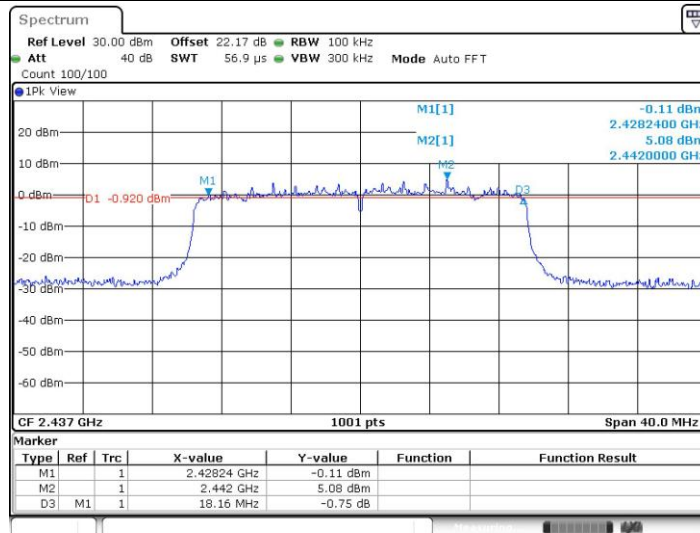


11AX20MIMO_Ant1_2437



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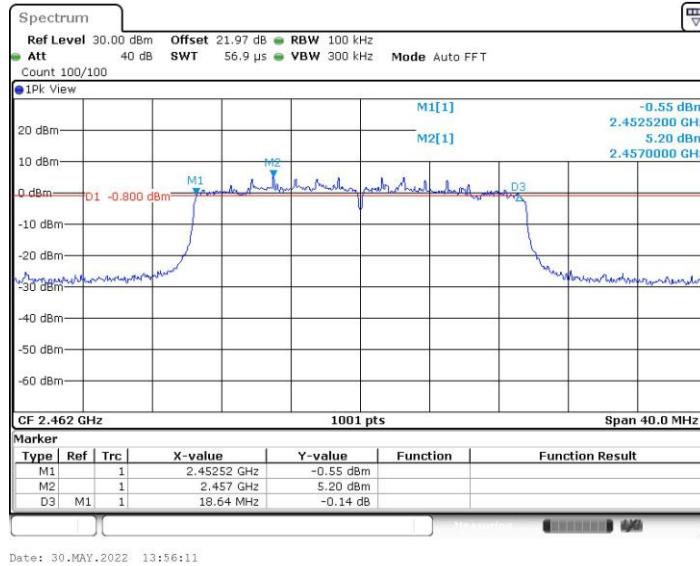
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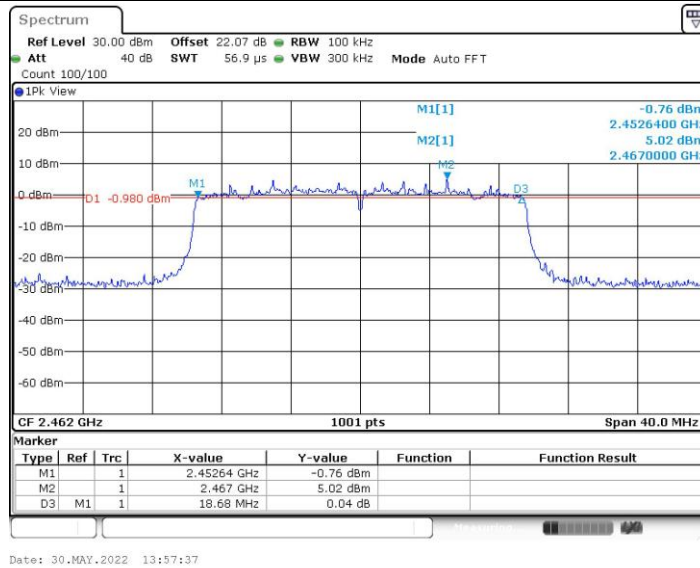
Date: 30.MAY.2022 13:54:02



11AX20MIMO_Ant1_2462

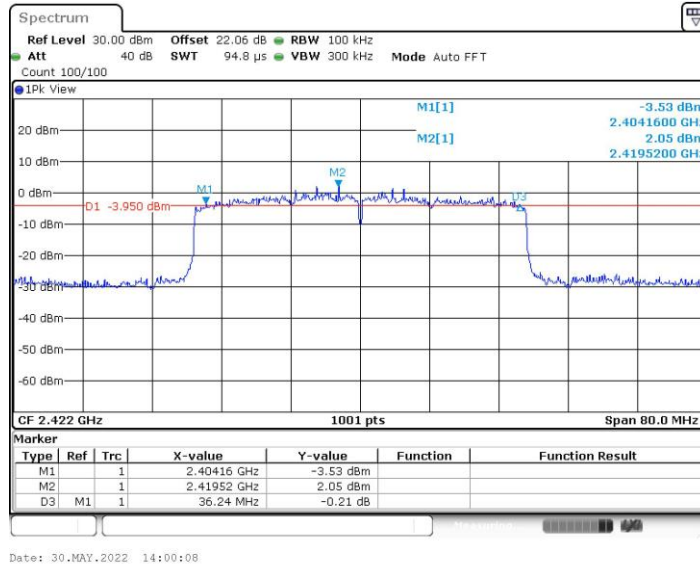


11AX20MIMO_Ant2_2462

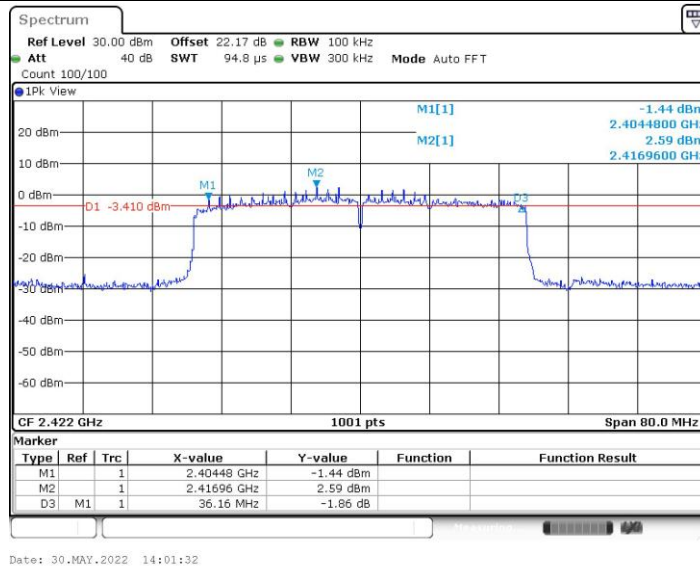




11AX40MIMO_Ant1_2422

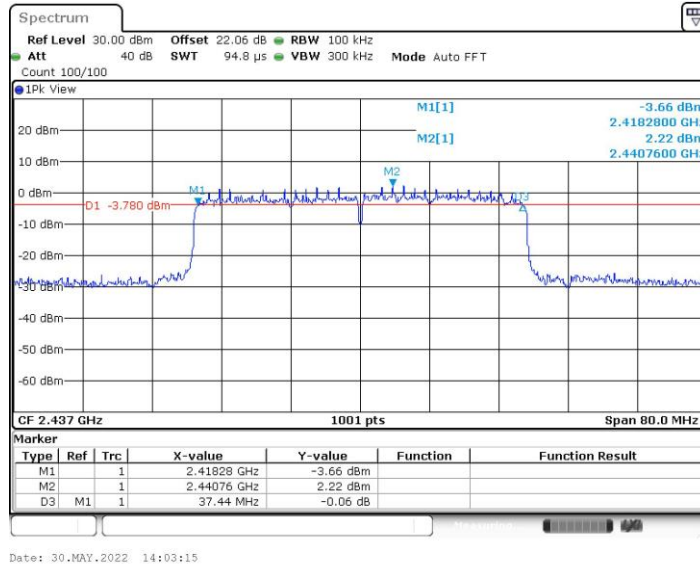


11AX40MIMO_Ant2_2422

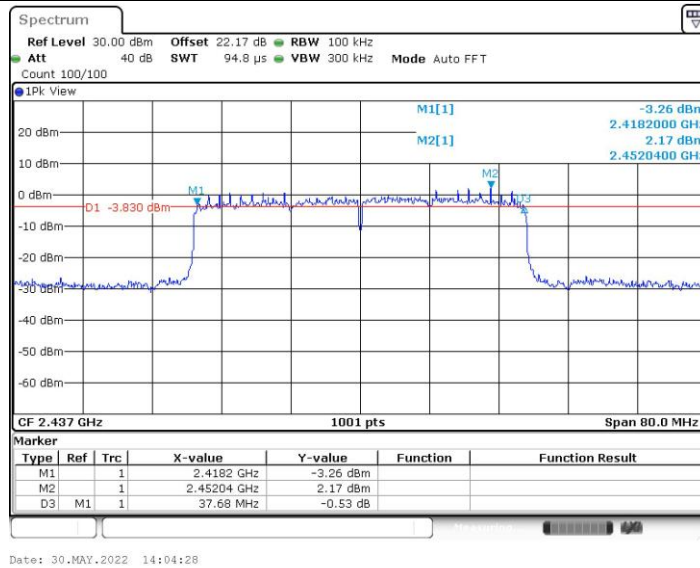




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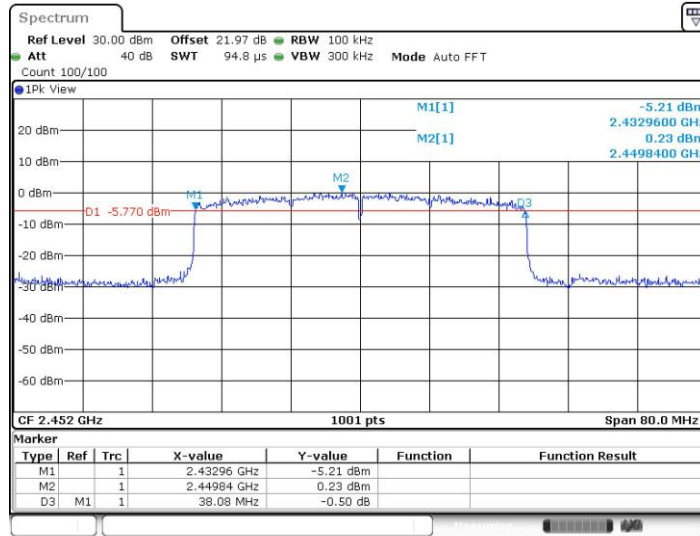


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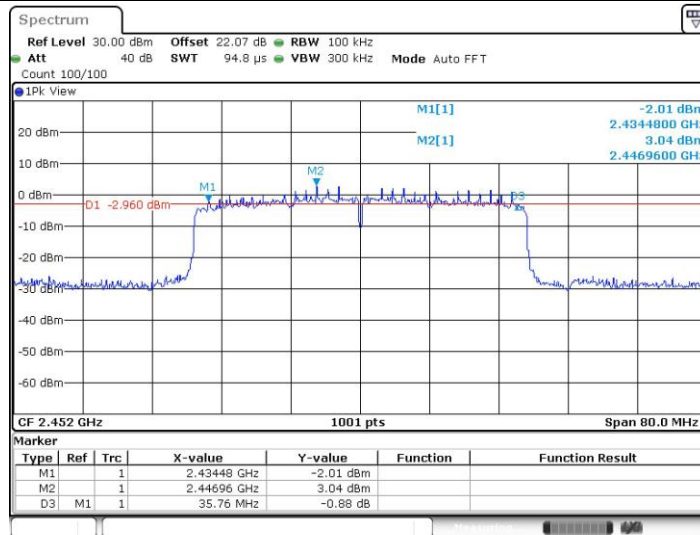




11AX40MIMO_Ant1_2452



11AX40MIMO_Ant2_2452





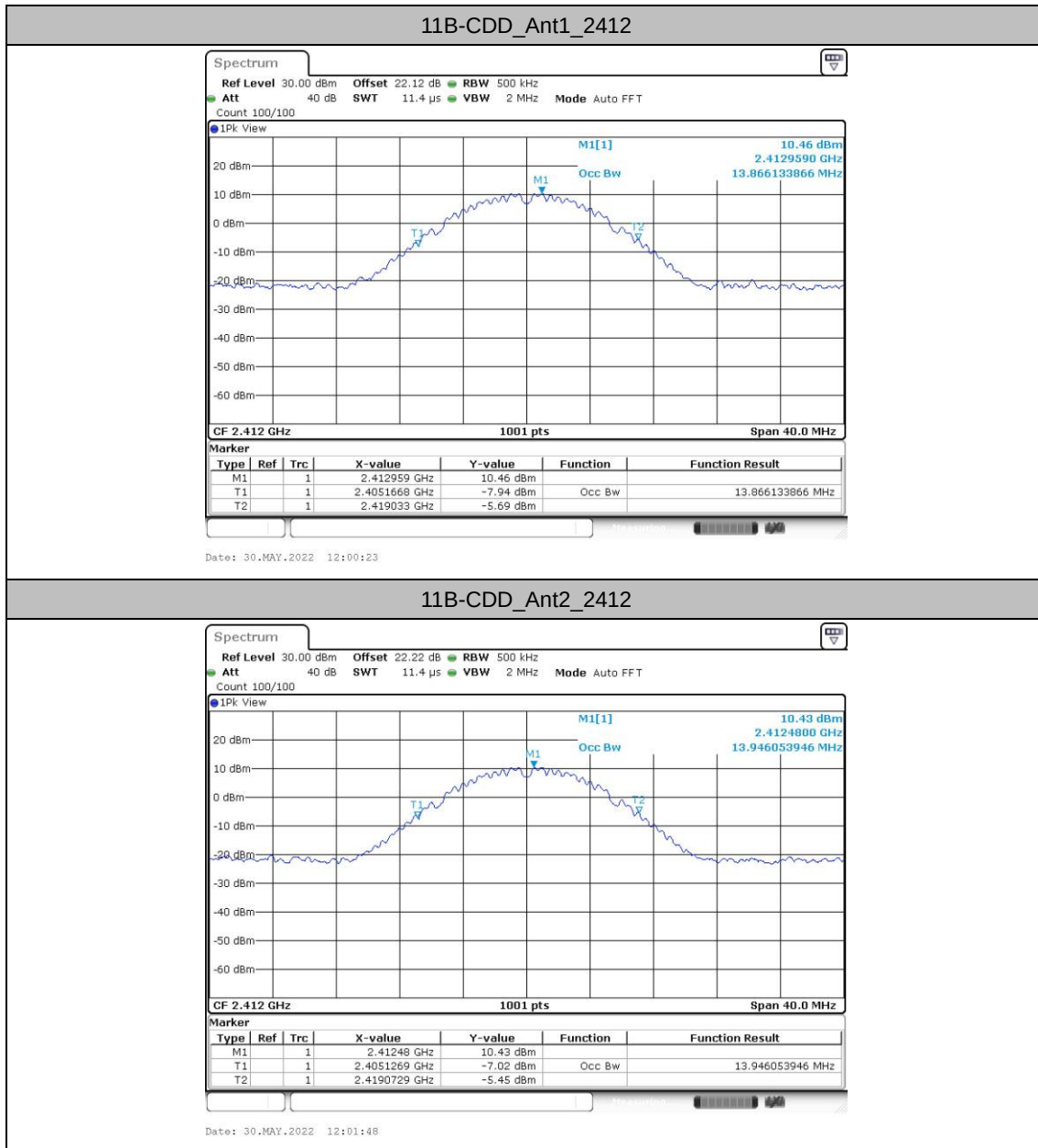
Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	13.866	2405.167	2419.033	---	---
	Ant2	2412	13.946	2405.127	2419.073	---	---
	Ant1	2437	14.346	2429.927	2444.273	---	---
	Ant2	2437	14.306	2429.967	2444.273	---	---
	Ant1	2462	14.146	2454.887	2469.033	---	---
	Ant2	2462	14.226	2454.887	2469.113	---	---
11G-CDD	Ant1	2412	16.663	2403.688	2420.352	---	---
	Ant2	2412	16.543	2403.768	2420.312	---	---
	Ant1	2437	16.863	2428.528	2445.392	---	---
	Ant2	2437	16.743	2428.648	2445.392	---	---
	Ant1	2462	16.823	2453.489	2470.312	---	---
	Ant2	2462	16.623	2453.688	2470.312	---	---
11AX20MIMO	Ant1	2412	18.981	2402.569	2421.550	---	---
	Ant2	2412	18.981	2402.529	2421.510	---	---
	Ant1	2437	19.101	2427.450	2446.550	---	---
	Ant2	2437	19.101	2427.490	2446.590	---	---
	Ant1	2462	19.021	2452.450	2471.471	---	---
	Ant2	2462	19.181	2452.410	2471.590	---	---
11AX40MIMO	Ant1	2422	37.882	2403.059	2440.941	---	---
	Ant2	2422	37.802	2403.139	2440.941	---	---
	Ant1	2437	38.122	2417.979	2456.101	---	---
	Ant2	2437	38.202	2417.899	2456.101	---	---
	Ant1	2452	37.962	2432.979	2470.941	---	---
	Ant2	2452	38.042	2432.979	2471.021	---	---

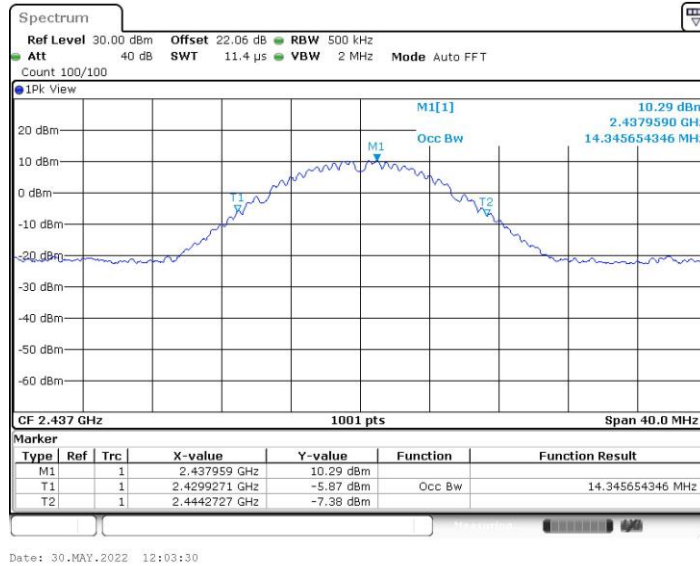


Test Graphs

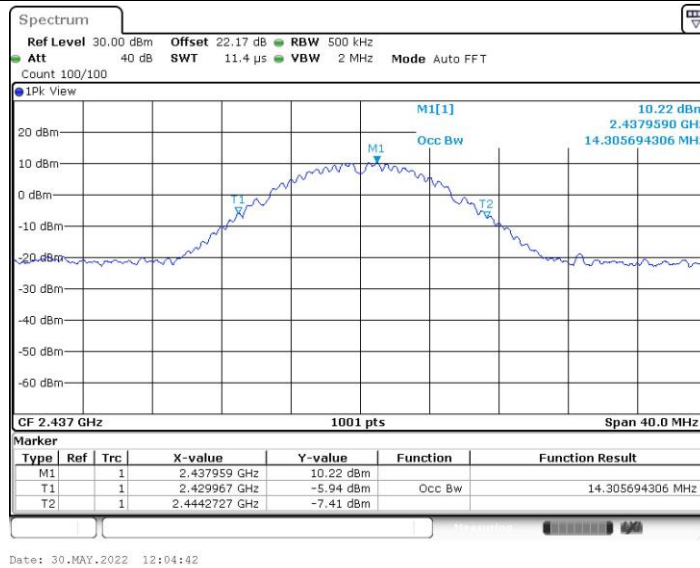




11B-CDD_Ant1_2437

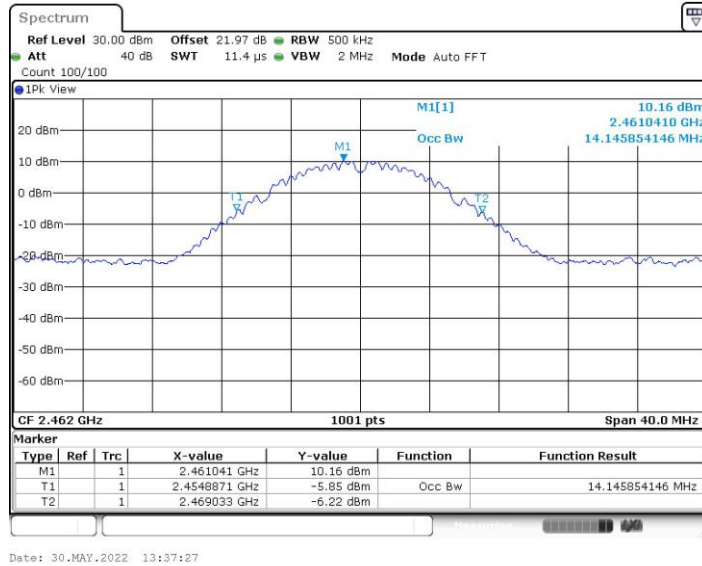


11B-CDD_Ant2_2437

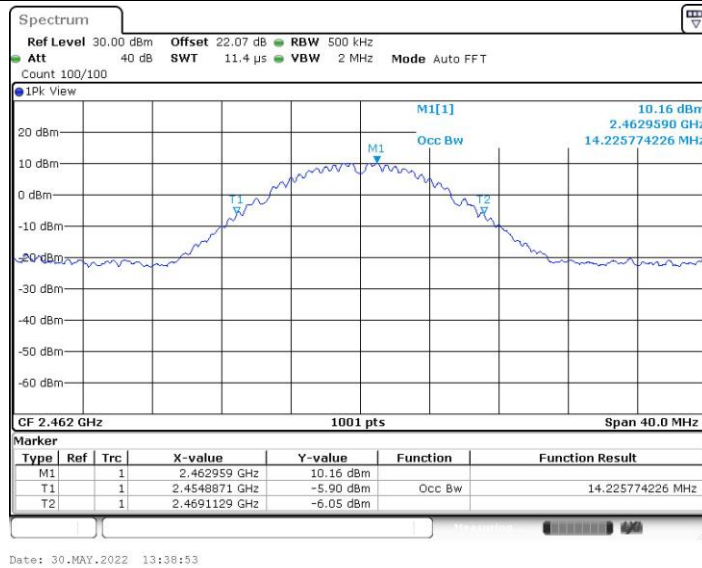




11B-CDD_Ant1_2462

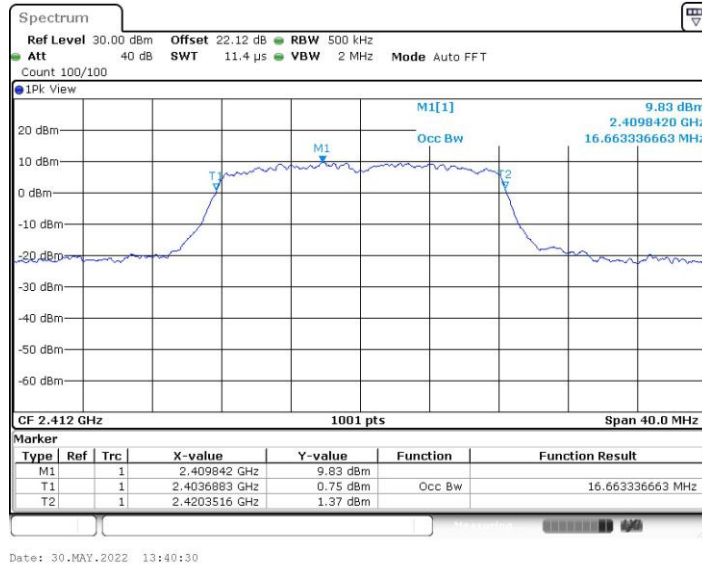


11B-CDD_Ant2_2462

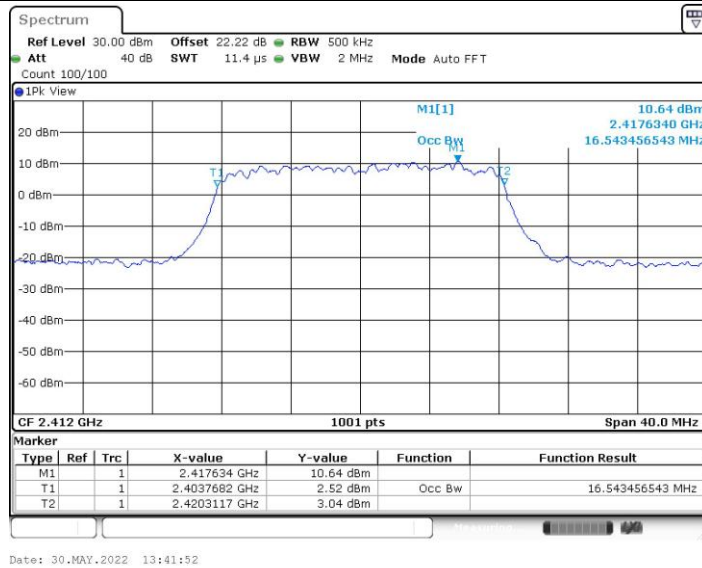




11G-CDD_Ant1_2412

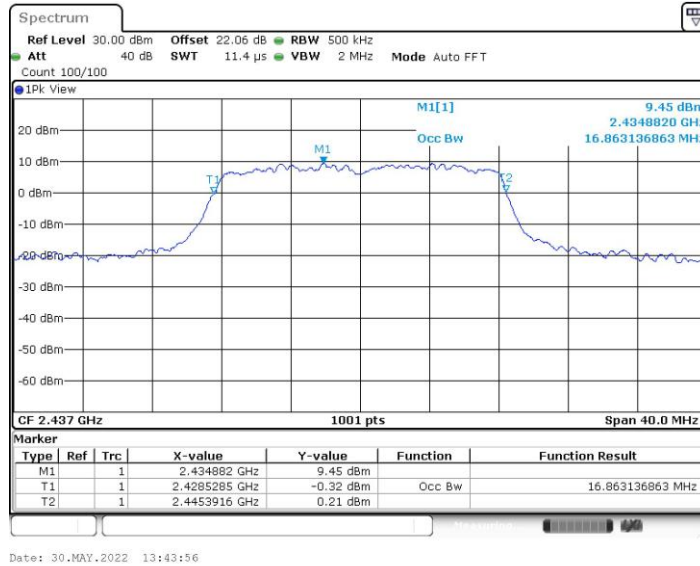


11G-CDD_Ant2_2412

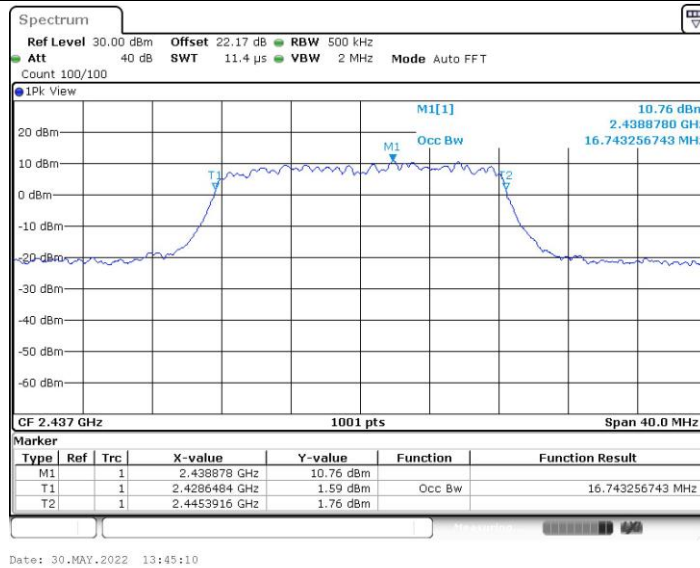




11G-CDD_Ant1_2437

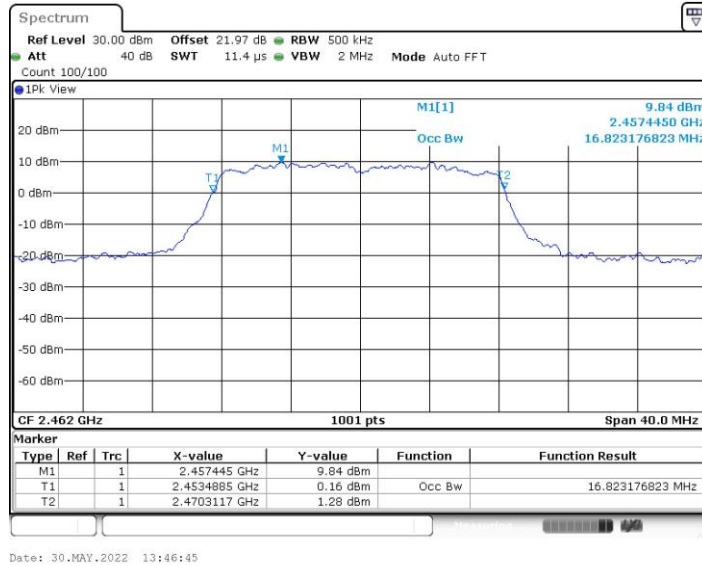


11G-CDD_Ant2_2437

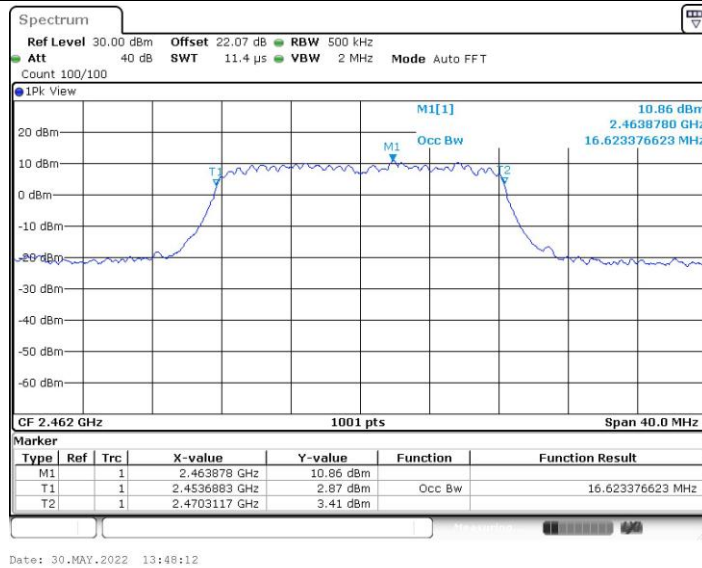




11G-CDD_Ant1_2462

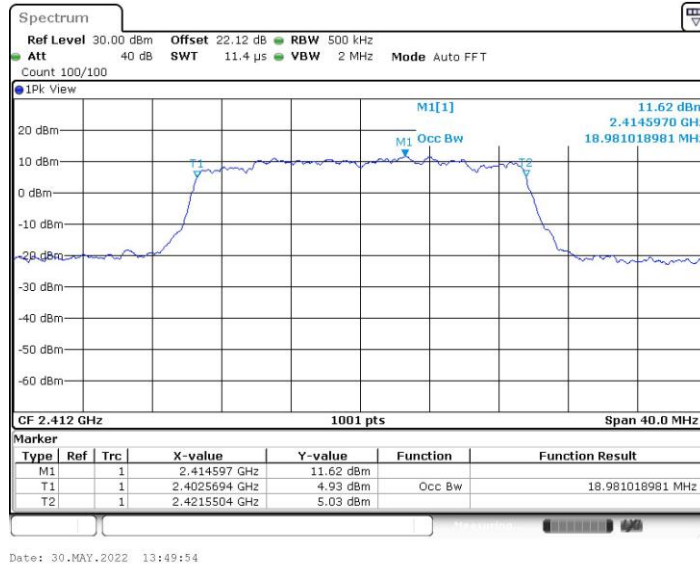


11G-CDD_Ant2_2462

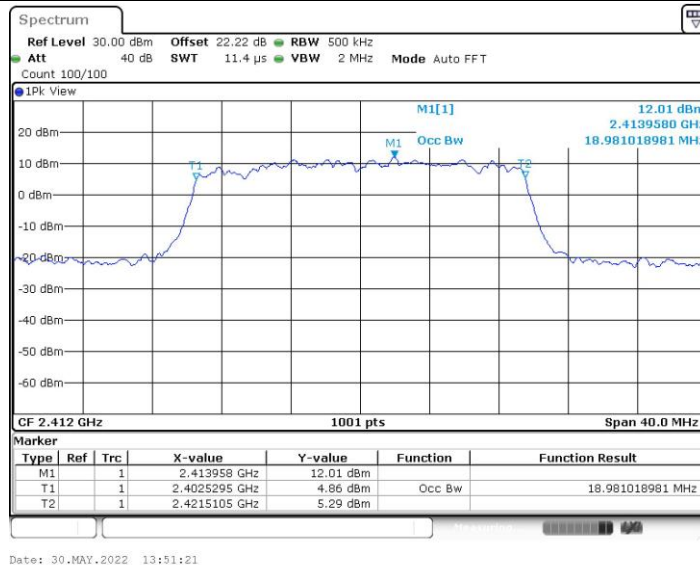




11AX20MIMO_Ant1_2412

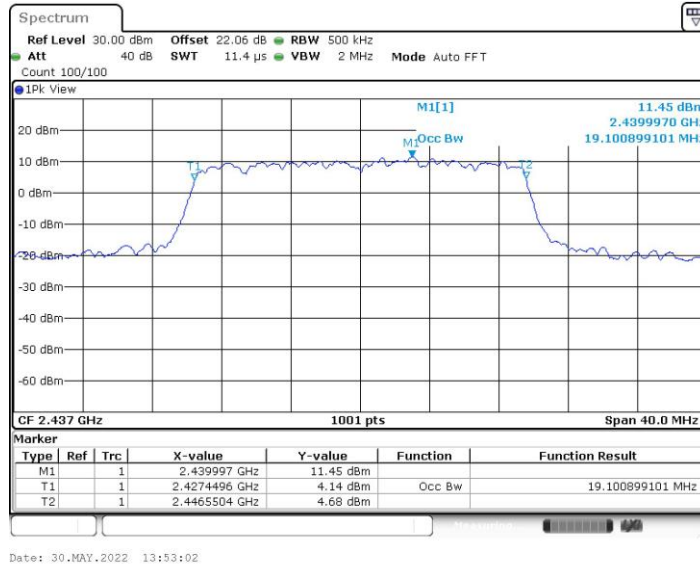


11AX20MIMO_Ant2_2412

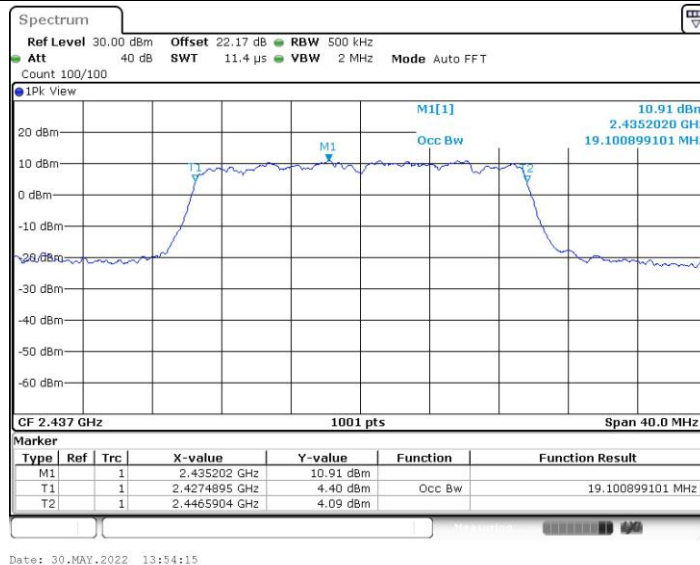




11AX20MIMO_Ant1_2437

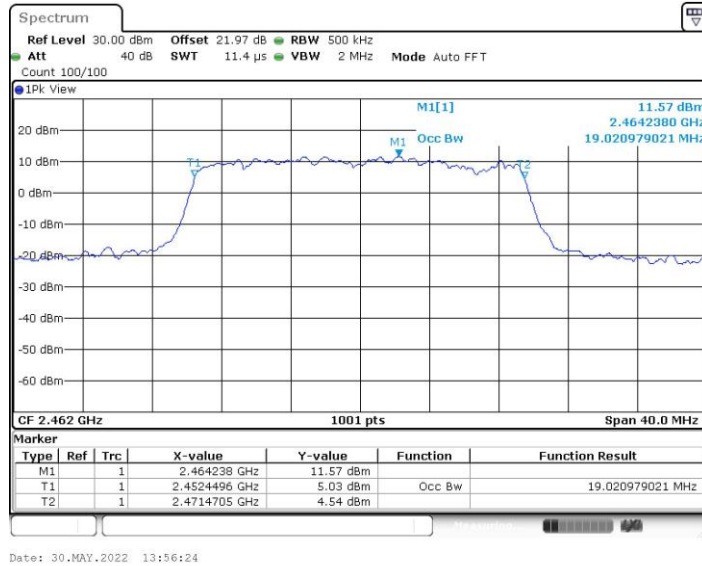


11AX20MIMO_Ant2_2437

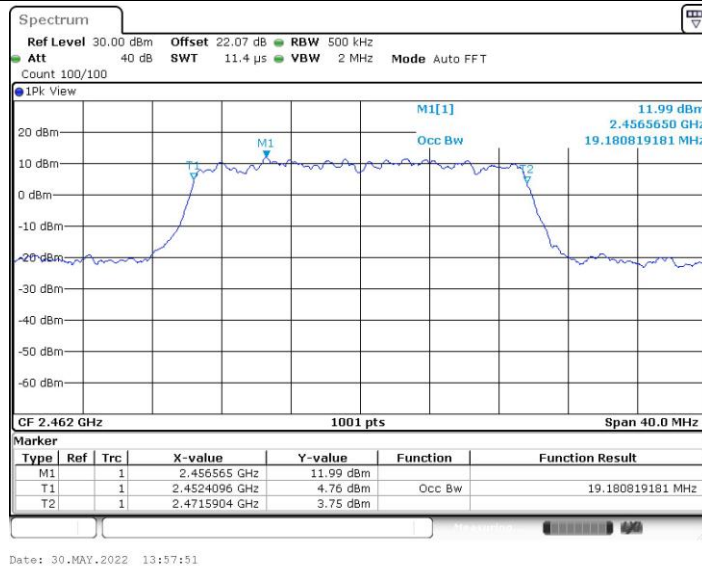




11AX20MIMO_Ant1_2462

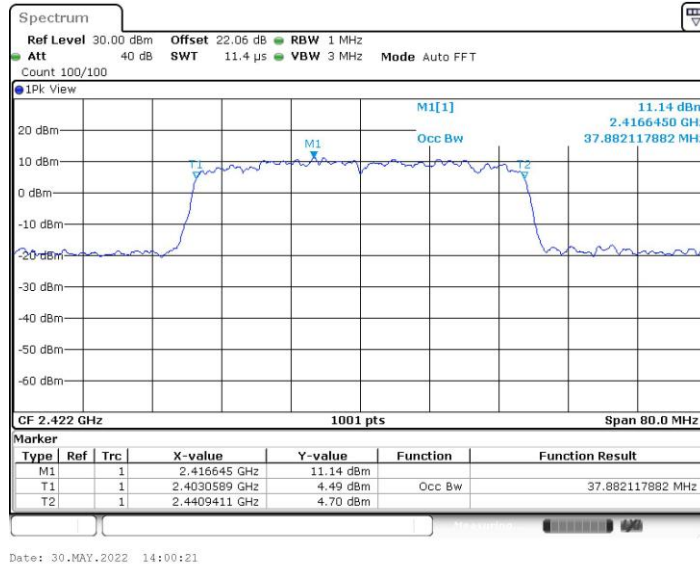


11AX20MIMO_Ant2_2462

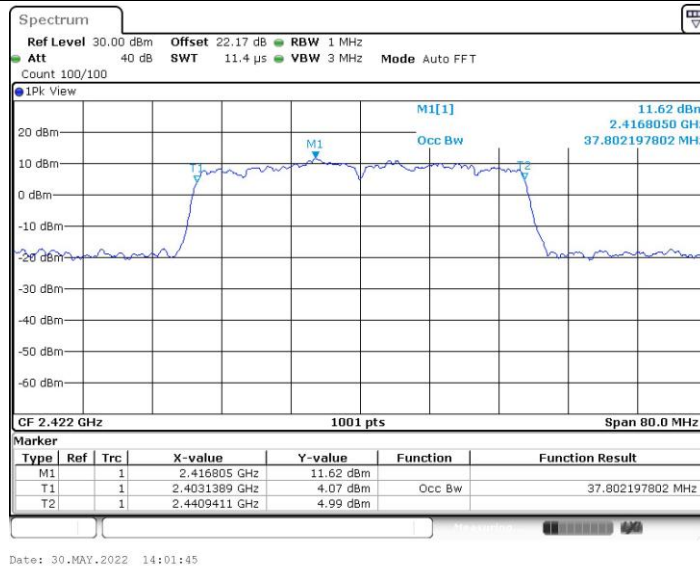




11AX40MIMO_Ant1_2422

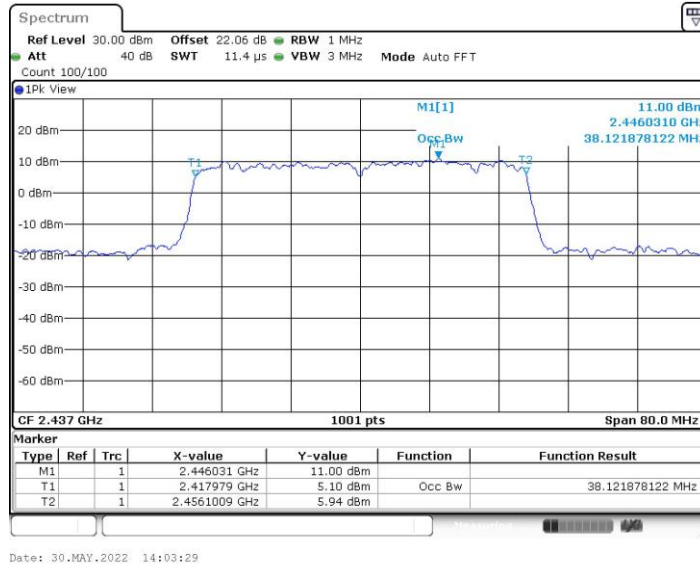


11AX40MIMO_Ant2_2422

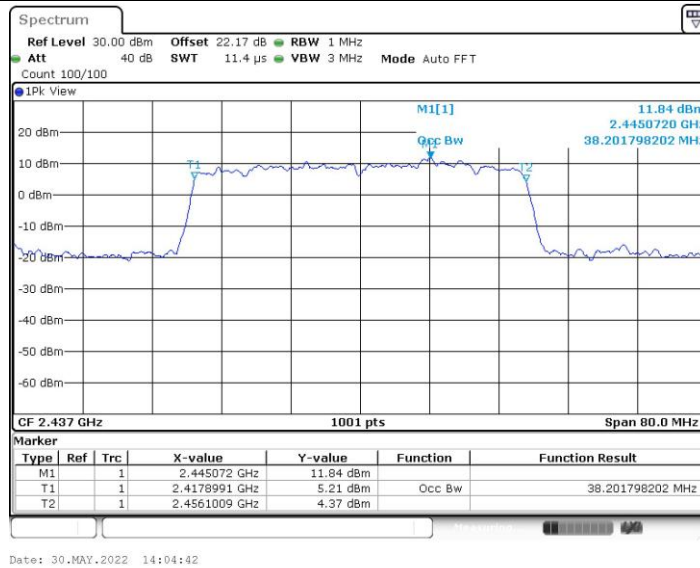




11AX40MIMO_Ant1_2437

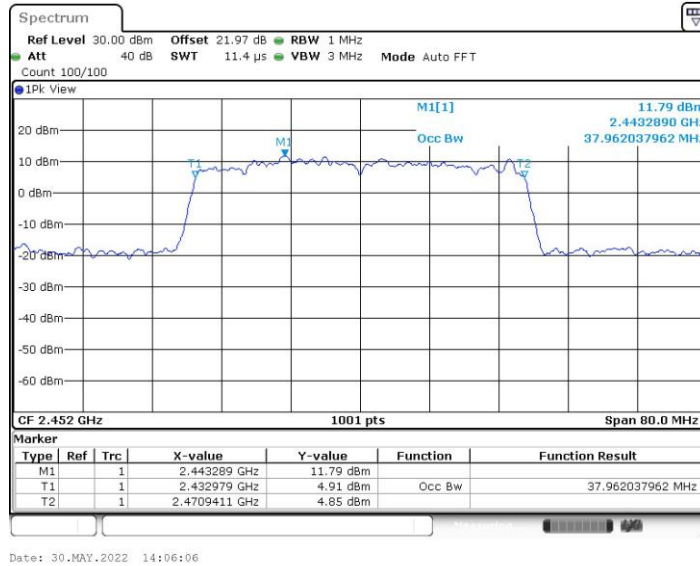


11AX40MIMO_Ant2_2437

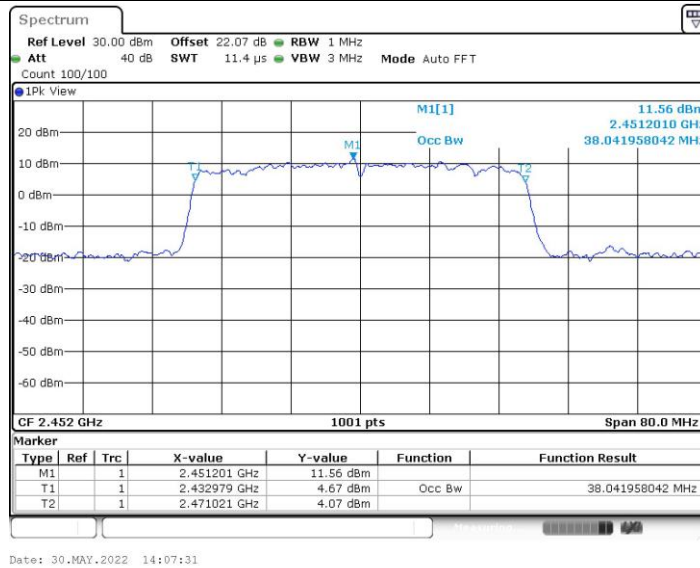




11AX40MIMO_Ant1_2452



11AX40MIMO_Ant2_2452





Maximum conducted output power

Test Result Peak Power

TestMode	Antenna	Freq(MHz)	Peak Power[dBm]	Conducted Limit[dBm]	Verdict
11B-CDD	Ant1	2412	21.25	≤30.00	PASS
	Ant2	2412	20.88	≤30.00	PASS
	total	2412	24.08	≤30.00	PASS
	Ant1	2437	21.42	≤30.00	PASS
	Ant2	2437	20.95	≤30.00	PASS
	total	2437	24.2	≤30.00	PASS
	Ant1	2462	21.33	≤30.00	PASS
	Ant2	2462	20.83	≤30.00	PASS
	total	2462	24.1	≤30.00	PASS
11G-CDD	Ant1	2412	23.56	≤30.00	PASS
	Ant2	2412	23.72	≤30.00	PASS
	total	2412	26.65	≤30.00	PASS
	Ant1	2437	23.73	≤30.00	PASS
	Ant2	2437	23.52	≤30.00	PASS
	total	2437	26.64	≤30.00	PASS
	Ant1	2462	23.62	≤30.00	PASS
	Ant2	2462	23.68	≤30.00	PASS
	total	2462	26.66	≤30.00	PASS
11N20MIMO	Ant1	2412	24.29	≤30.00	PASS
	Ant2	2412	24.47	≤30.00	PASS
	total	2412	27.39	≤30.00	PASS
	Ant1	2437	23.78	≤30.00	PASS
	Ant2	2437	23.91	≤30.00	PASS
	total	2437	26.86	≤30.00	PASS
	Ant1	2462	24.19	≤30.00	PASS
	Ant2	2462	24.21	≤30.00	PASS
	total	2462	27.21	≤30.00	PASS



11N40MIMO	Ant1	2422	24.06	≤30.00	PASS
	Ant2	2422	24.18	≤30.00	PASS
	total	2422	27.13	≤30.00	PASS
	Ant1	2437	24.33	≤30.00	PASS
	Ant2	2437	24.54	≤30.00	PASS
	total	2437	27.45	≤30.00	PASS
	Ant1	2452	23.76	≤30.00	PASS
	Ant2	2452	24.17	≤30.00	PASS
	total	2452	26.98	≤30.00	PASS
11AC20MIMO	Ant1	2412	24.09	≤30.00	PASS
	Ant2	2412	24.27	≤30.00	PASS
	total	2412	27.19	≤30.00	PASS
	Ant1	2437	23.58	≤30.00	PASS
	Ant2	2437	23.71	≤30.00	PASS
	total	2437	26.66	≤30.00	PASS
	Ant1	2462	23.99	≤30.00	PASS
	Ant2	2462	24.01	≤30.00	PASS
	total	2462	27.01	≤30.00	PASS
11AC40MIMO	Ant1	2422	23.91	≤30.00	PASS
	Ant2	2422	24.03	≤30.00	PASS
	total	2422	26.98	≤30.00	PASS
	Ant1	2437	24.25	≤30.00	PASS
	Ant2	2437	24.37	≤30.00	PASS
	total	2437	27.32	≤30.00	PASS
	Ant1	2452	23.57	≤30.00	PASS
	Ant2	2452	24.03	≤30.00	PASS
	total	2452	26.82	≤30.00	PASS
11AX20MIMO	Ant1	2412	24.47	≤30.00	PASS
	Ant2	2412	24.54	≤30.00	PASS
	total	2412	27.52	≤30.00	PASS
	Ant1	2437	23.93	≤30.00	PASS
	Ant2	2437	24.19	≤30.00	PASS
	total	2437	27.07	≤30.00	PASS
	Ant1	2462	24.52	≤30.00	PASS
	Ant2	2462	24.56	≤30.00	PASS
	total	2462	27.55	≤30.00	PASS



11AX40MIMO	Ant1	2422	24.13	≤30.00	PASS
	Ant2	2422	24.42	≤30.00	PASS
	total	2422	27.29	≤30.00	PASS
	Ant1	2437	24.58	≤30.00	PASS
	Ant2	2437	24.86	≤30.00	PASS
	total	2437	27.73	≤30.00	PASS
	Ant1	2452	23.97	≤30.00	PASS
	Ant2	2452	24.35	≤30.00	PASS
	total	2452	27.17	≤30.00	PASS

**Test Result Average Power (Reference only)**

Test Mode	Antenna	Freq (MHz)	Average power [dBm]	Duty Cycle [%]	DC Factor [dBm]	Result [dBm]
11B-CDD	Ant1	2412	18.93	97.06	0.13	19.06
	Ant2	2412	19.75	97.06	0.13	19.88
	total	2412	---	---	---	22.50
	Ant1	2437	18.88	97.06	0.13	19.01
	Ant2	2437	19.20	97.06	0.13	19.33
	total	2437	---	---	---	22.18
	Ant1	2462	18.55	97.06	0.13	18.68
	Ant2	2462	18.42	97.06	0.13	18.55
	total	2462	---	---	---	21.63
11G-CDD	Ant1	2412	16.48	99.06	0.04	16.52
	Ant2	2412	16.55	99.53	0.02	16.57
	total	2412	---	---	---	19.47
	Ant1	2437	17.02	99.06	0.04	17.06
	Ant2	2437	17.15	99.53	0.02	17.17
	total	2437	---	---	---	20.13
	Ant1	2462	16.05	99.06	0.04	16.09
	Ant2	2462	16.26	99.53	0.02	16.28
	total	2462	---	---	---	19.15
11N20MIMO	Ant1	2412	17.05	99.63	0.02	17.07
	Ant2	2412	17.13	99.63	0.02	17.15
	total	2412	---	---	---	20.12
	Ant1	2437	17.08	99.63	0.02	17.10
	Ant2	2437	17.16	99.63	0.02	17.18
	total	2437	---	---	---	20.15
	Ant1	2462	15.52	99.63	0.02	15.54
	Ant2	2462	15.78	99.63	0.02	15.80
	total	2462	---	---	---	18.68



11N40MIMO	Ant1	2422	16.28	99.63	0.02	16.30
	Ant2	2422	16.61	99.63	0.02	16.63
	total	2422	---	---	---	19.48
	Ant1	2437	16.58	99.63	0.02	16.60
	Ant2	2437	16.52	99.63	0.02	16.54
	total	2437	---	---	---	19.58
	Ant1	2452	15.24	99.63	0.02	15.26
	Ant2	2452	15.43	99.63	0.02	15.45
	total	2452	---	---	---	18.37
11AC20MIMO	Ant1	2412	17.03	99.63	0.02	17.05
	Ant2	2412	17.09	99.63	0.02	17.11
	total	2412	---	---	---	20.09
	Ant1	2437	17.05	99.63	0.02	17.07
	Ant2	2437	17.12	99.63	0.02	17.14
	total	2437	---	---	---	20.12
	Ant1	2462	15.48	99.63	0.02	15.50
	Ant2	2462	15.77	99.63	0.02	15.79
	total	2462	---	---	---	18.66
11AC40MIMO	Ant1	2422	16.25	99.63	0.02	16.27
	Ant2	2422	16.56	99.63	0.02	16.58
	total	2422	---	---	---	19.44
	Ant1	2437	16.52	99.63	0.02	16.54
	Ant2	2437	16.48	99.63	0.02	16.50
	total	2437	---	---	---	19.53
	Ant1	2452	15.18	99.63	0.02	15.20
	Ant2	2452	15.37	99.63	0.02	15.39
	total	2452	---	---	---	18.31
11AX20MIMO	Ant1	2412	17.23	99.63	0.02	17.25
	Ant2	2412	17.34	99.45	0.02	17.36
	total	2412	---	---	---	20.32
	Ant1	2437	17.28	99.63	0.02	17.30
	Ant2	2437	17.35	99.45	0.02	17.37
	total	2437	---	---	---	20.35
	Ant1	2462	15.63	99.63	0.02	15.65
	Ant2	2462	15.85	99.45	0.02	15.87
	total	2462	---	---	---	18.77



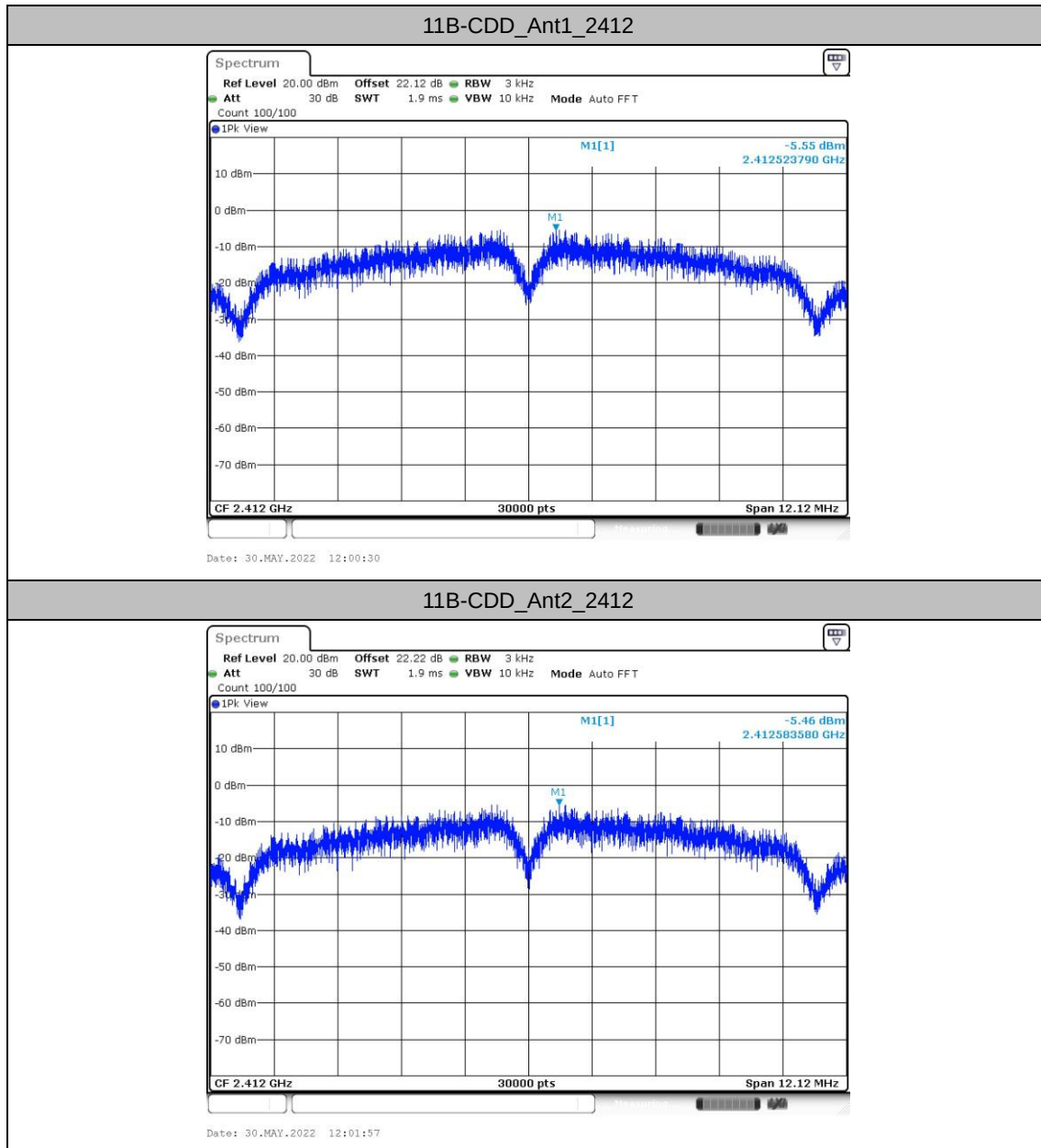
11AX40MIMO	Ant1	2422	16.42	99.63	0.02	16.44
	Ant2	2422	16.66	99.64	0.02	16.68
	total	2422	---	---	---	19.57
	Ant1	2437	16.74	99.63	0.02	16.76
	Ant2	2437	16.69	99.64	0.02	16.71
	total	2437	---	---	---	19.75
	Ant1	2452	15.33	99.63	0.02	15.35
	Ant2	2452	15.59	99.64	0.02	15.61
	total	2452	---	---	---	18.49

**Maximum power spectral density (3K PSD)
Test Result**

TestMode	Antenna	Freq(MHz)	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
11B-CDD	Ant1	2412	-5.55	≤8.00	PASS
	Ant2	2412	-5.46	≤8.00	PASS
	total	2412	-2.49	≤8.00	PASS
	Ant1	2437	-5.16	≤8.00	PASS
	Ant2	2437	-5.06	≤8.00	PASS
	total	2437	-2.10	≤8.00	PASS
	Ant1	2462	-4.38	≤8.00	PASS
	Ant2	2462	-4.25	≤8.00	PASS
	total	2462	-1.30	≤8.00	PASS
11G-CDD	Ant1	2412	-9.49	≤8.00	PASS
	Ant2	2412	-10.18	≤8.00	PASS
	total	2412	-6.81	≤8.00	PASS
	Ant1	2437	-9.06	≤8.00	PASS
	Ant2	2437	-9.18	≤8.00	PASS
	total	2437	-6.11	≤8.00	PASS
	Ant1	2462	-9.91	≤8.00	PASS
	Ant2	2462	-9.24	≤8.00	PASS
	total	2462	-6.55	≤8.00	PASS
11AX20MIMO	Ant1	2412	-9.04	≤8.00	PASS
	Ant2	2412	-10.19	≤8.00	PASS
	total	2412	-6.57	≤8.00	PASS
	Ant1	2437	-10.3	≤8.00	PASS
	Ant2	2437	-10.32	≤8.00	PASS
	total	2437	-7.30	≤8.00	PASS
	Ant1	2462	-9.94	≤8.00	PASS
	Ant2	2462	-10.12	≤8.00	PASS
	total	2462	-7.02	≤8.00	PASS
11AX40MIMO	Ant1	2422	-12.16	≤8.00	PASS
	Ant2	2422	-11.83	≤8.00	PASS
	total	2422	-8.98	≤8.00	PASS
	Ant1	2437	-11.28	≤8.00	PASS
	Ant2	2437	-12.33	≤8.00	PASS
	total	2437	-8.76	≤8.00	PASS
	Ant1	2452	-12.1	≤8.00	PASS
	Ant2	2452	-12.29	≤8.00	PASS
	total	2452	-9.18	≤8.00	PASS

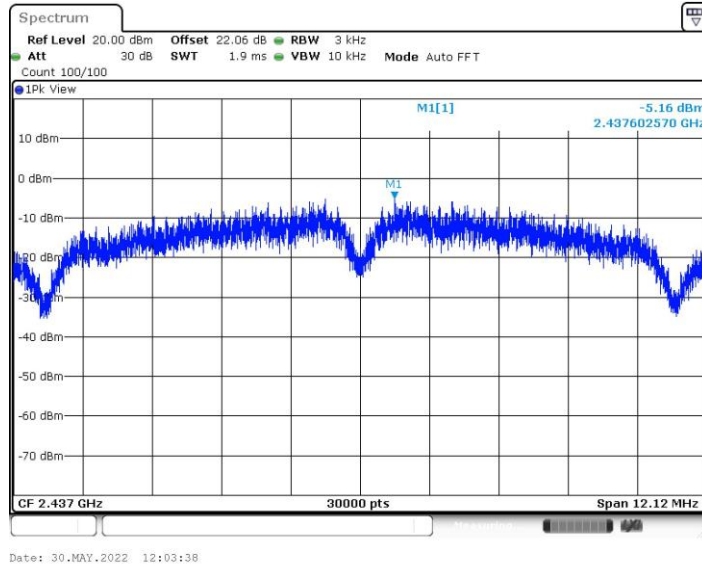


Test Graphs

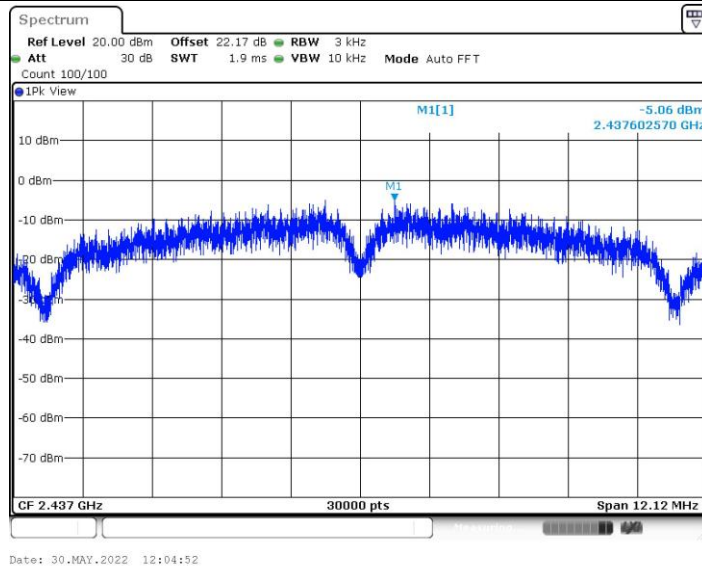




11B-CDD_Ant1_2437

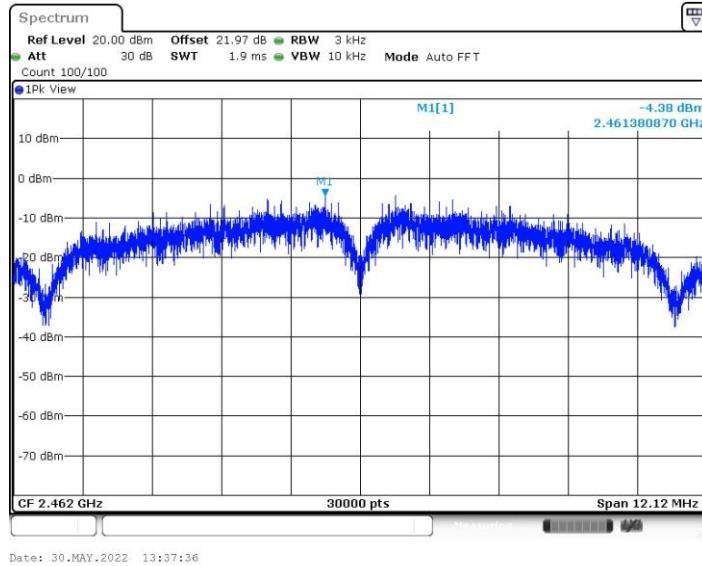


11B-CDD_Ant2_2437

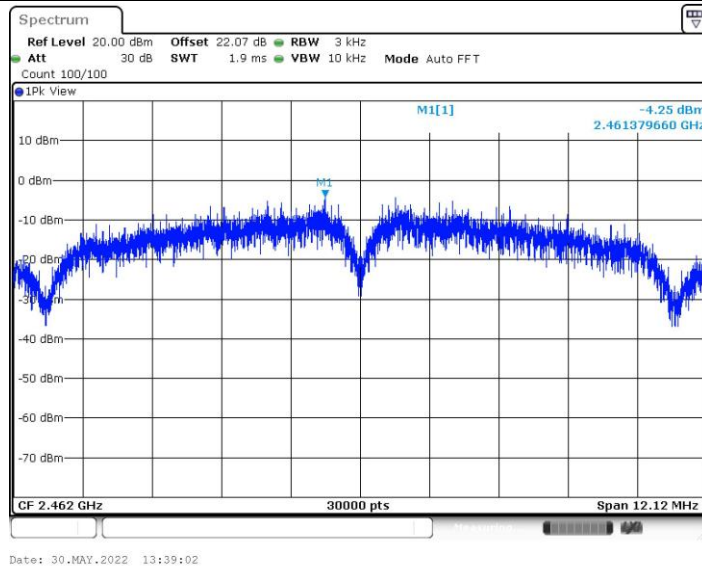




11B-CDD_Ant1_2462

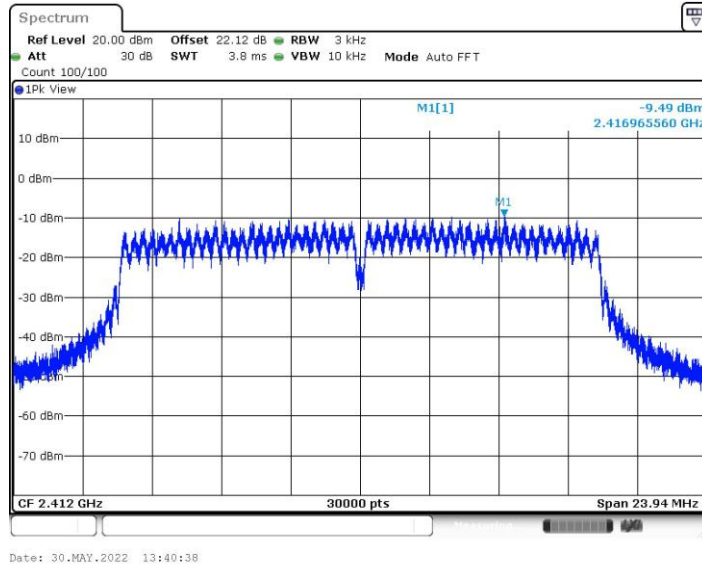


11B-CDD_Ant2_2462

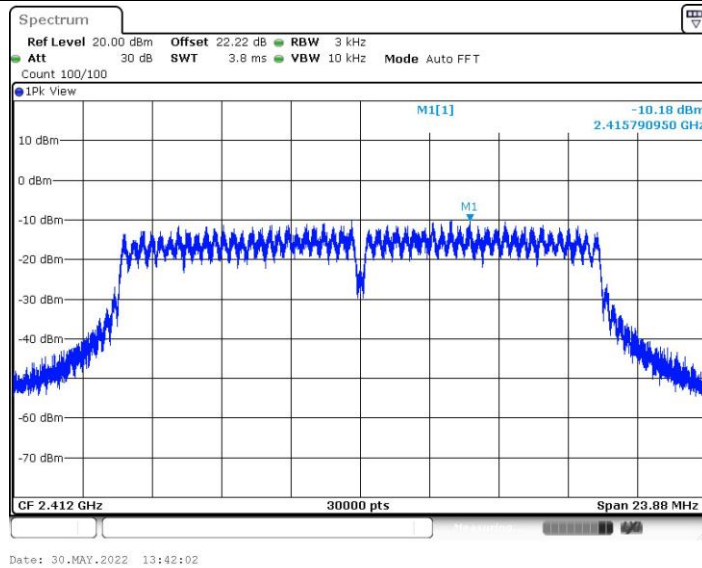




11G-CDD_Ant1_2412

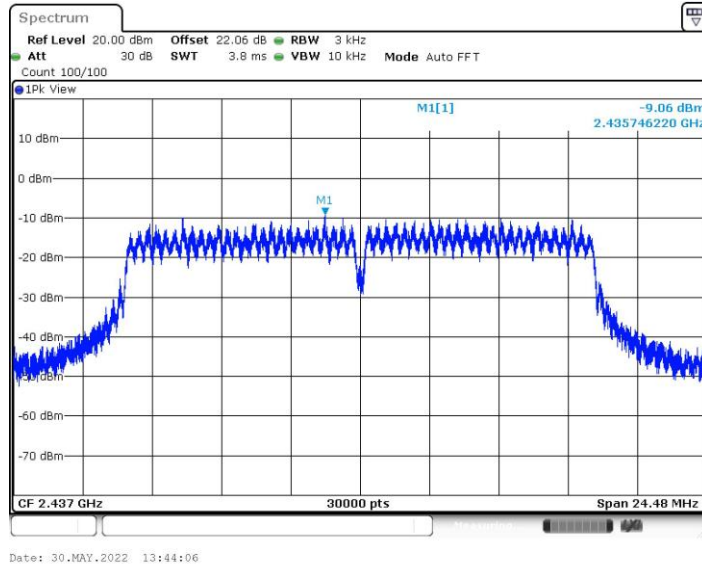


11G-CDD_Ant2_2412

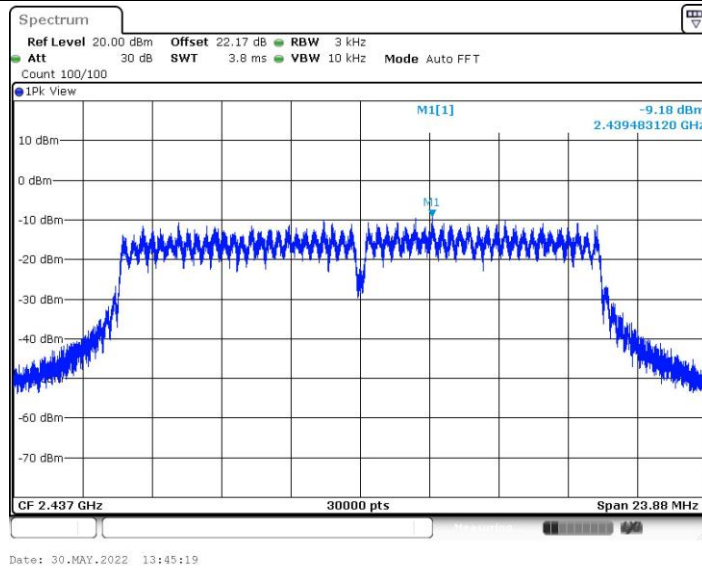




11G-CDD_Ant1_2437

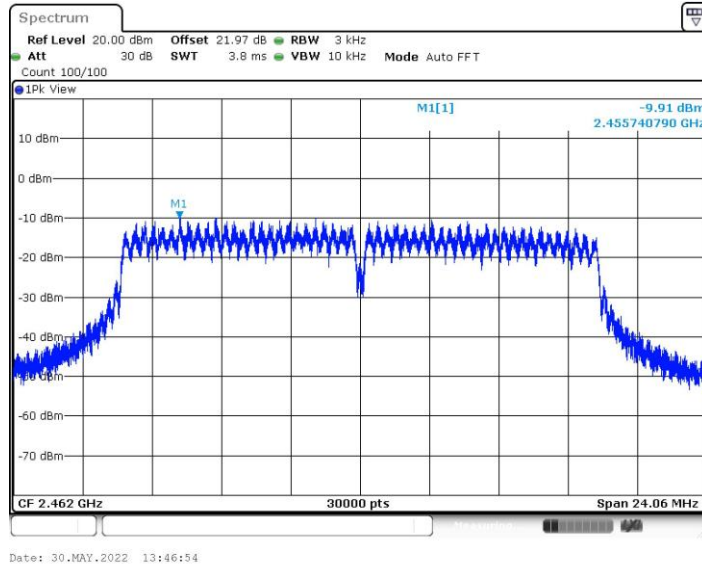


11G-CDD_Ant2_2437

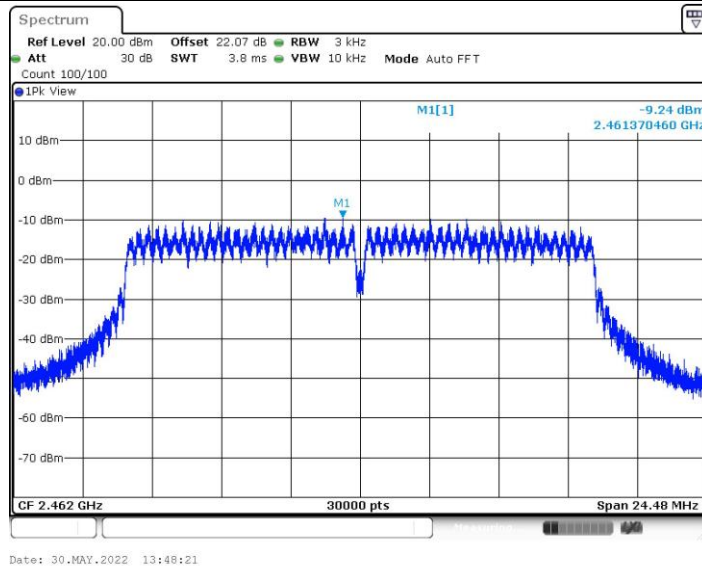




11G-CDD_Ant1_2462

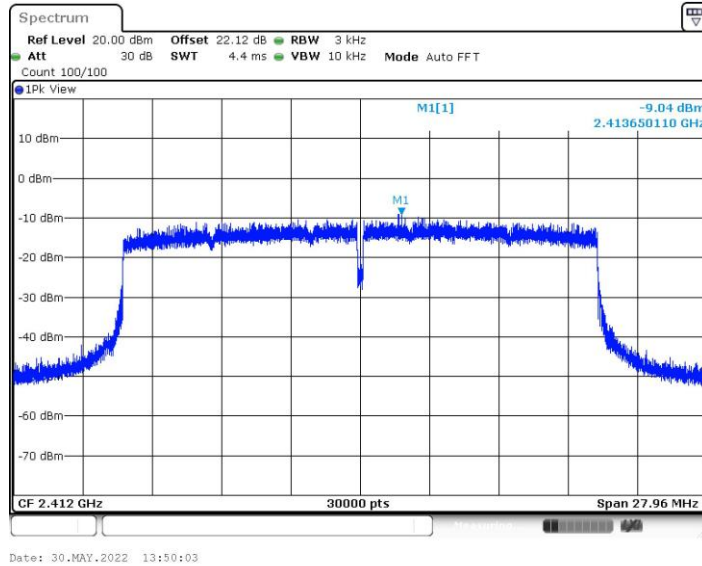


11G-CDD_Ant2_2462





11AX20MIMO_Ant1_2412



11AX20MIMO_Ant2_2412

