FCC RF Test Report

APPLICANT	:	Franklin Technology Inc.
EQUIPMENT	:	Mobile Hotspot
MODEL NAME	:	RG2100
FCC ID	:	XHG-RG2100
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure
TEST DATE(S)	:	Sep. 02, 2022 ~ Sep. 08, 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

ACCREDITED
Cert #5145.02

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

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 7
1.6 Testing Location 7
1.7 Test Software 7
1.8 Applicable Standards 8

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST **9**

2.1 Carrier Frequency and Channel 9
2.2 Test Mode 10
2.3 Connection Diagram of Test System 12
2.4 Support Unit used in test configuration and system 13
2.5 EUT Operation Test Setup 13
2.6 Measurement Results Explanation Example 13

3 TEST RESULT **14**

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement 14
3.2 Maximum Conducted Output Power Measurement 16
3.3 Power Spectral Density Measurement 18
3.4 Unwanted Emissions Measurement 21
3.5 AC Conducted Emission Measurement 26
3.6 Antenna Requirements 28

4 LIST OF MEASURING EQUIPMENT **29**

5 UNCERTAINTY OF EVALUATION **30**

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
FR262007-01B	Rev. 01	Initial issue of report	Sep. 09, 2022

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit for U-NII-1 ~ U-NII-2C	Limit for U-NII-3	Result	Remark
3.1	2.1049 & 15.403(i)	6dB, 26dB & 99% Bandwidth	-	> 500kHz	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 30 dBm	≤ 30 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 17 dBm	≤ 30 dBm/500kHz	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	15.407(b)(4)(i) &15.209(a)	Pass	Under limit 0.29 dB at 5144.480 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	15.207(a)	Pass	Under limit 9.82 dB at 0.177 MHz
3.6	15.203 & 15.407(a)	Antenna Requirement	N/A	N/A	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
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

Franklin Technology Inc.
906 JEI Platz, 186, Gasan digital 1-ro, Gumcheon-Gu, Seoul, South Korea, 08502

1.2 Manufacturer

Franklin Technology Inc.
906 JEI Platz, 186, Gasan digital 1-ro, Gumcheon-Gu, Seoul, South Korea, 08502

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Hotspot
Model Name	RG2100
FCC ID	XHG-RG2100
HW Version	P1
SW Version	RG2100.TM.1354
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 Frequency Range	5180 MHz ~ 5240 MHz 5745 MHz ~ 5825 MHz
Maximum Output Power to Antenna	**MIMO <Ant. 1 + 2>** **<5180 MHz ~ 5240 MHz>** 802.11n HT20 : 16.36 dBm / 0.0433 W 802.11n HT40 : 16.30 dBm / 0.0427 W 802.11ac VHT20: 15.66 dBm / 0.0368 W 802.11ac VHT40: 14.38 dBm / 0.0274 W 802.11ac VHT80: 14.72 dBm / 0.0296 W 802.11ax HE20: 16.34 dBm / 0.0431 W 802.11ax HE40: 16.07 dBm / 0.0405 W 802.11ax HE80: 16.36 dBm / 0.0433 W **<5745 MHz ~ 5825 MHz>** 802.11n HT20 : 16.34 dBm / 0.0431 W 802.11n HT40 : 16.31 dBm / 0.0428 W 802.11ac VHT20: 15.18 dBm / 0.0330 W 802.11ac VHT40: 14.16 dBm / 0.0261 W 802.11ac VHT80: 14.56 dBm / 0.0286 W 802.11ax HE20: 15.95 dBm / 0.0394 W 802.11ax HE40: 15.54 dBm / 0.0358 W 802.11ax HE80: 15.95 dBm / 0.0394 W
99% Occupied Bandwidth	**<Ant. 1 + 2>** **<5180 MHz ~ 5240 MHz>** 802.11n HT20 : 17.822 MHz 802.11n HT40 : 36.364 MHz 802.11ax HE80: 77.522 MHz **<5745 MHz ~ 5825 MHz>** 802.11n HT20 : 18.062 MHz 802.11n HT40 : 36.523 MHz 802.11ax HE80: 77.842 MHz
Antenna Type / Gain	**<5180 MHz ~ 5240 MHz>** <Ant. 1> : PIFA Antenna with gain -3.00 dBi <Ant. 2> : PIFA Antenna with gain -2.84 dBi **<5745 MHz ~ 5825 MHz>** <Ant. 1> : PIFA Antenna with gain -3.00 dBi <Ant. 2> : PIFA Antenna with gain -2.84 dBi
Type of Modulation	802.11n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac/ax : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)

Note:

1. For WLAN SISO & CDD MIMO mode, the whole testing has assessed only MIMO mode by referring to the higher normal conducted power.
2. For 802.11n HT20 / ac VHT20 / ax HE20 and 802.11n HT40 / ac VHT40 / ax HE40 mode, the whole testing has assessed only 802.11n HT20/ HT40 by referring to their higher conducted power.
3. 802.11ax does not support Partial RU tone mode.

4. WLAN 5G Ant. 1 / Ant. 2 corresponding to EUT Photo Ant. 6 / Ant. 7.
5. This device support hotspot mode on UNII-1/UNII-3.

1.5 Modification of EUT

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

1.6 Testing Location

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

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	CO01-KS 03CH07-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH07-KS	AUDIX	E3	6.2009-8-24al
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

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

- 47 CFR Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- 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 (X plane) were recorded in this report.

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

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5180-5240 MHz U-NII-1	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5745-5825 MHz U-NII-3	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155#	5775	165	5825

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "#" were 802.11ac VHT80.

2.2 Test Mode

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

MIMO Mode

Modulation	Data Rate
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ax HE80	MCS0

AC Conducted Emission	Mode 1 : WLAN (5GHz) Link+ Battery+ USB Cable(Charging from Adapter)

Simultaneous transmission
802.11n HT20 CH06(2437MHz) Tx + 802.11n HT40 CH38(5190MHz) Tx + LTE Band48(BW=20M)Link

Ch. #		U-NII-1 5180-5240 MHz	U-NII-3 5745-5825 MHz
		802.11n HT20	802.11n HT20
L	Low	36	149
M	Middle	44	157
H	High	48	165

Ch. #		U-NII-1 5180-5240 MHz	U-NII-3 5745-5825 MHz
		802.11n HT40	802.11n HT40
L	Low	38	151
M	Middle	-	-
H	High	46	159

Ch. #		U-NII-1 5180-5240 MHz	U-NII-3 5745-5825 MHz
		802.11ac VHT80	802.11ac VHT80
L	Low	-	-
M	Middle	42	155
H	High	-	-

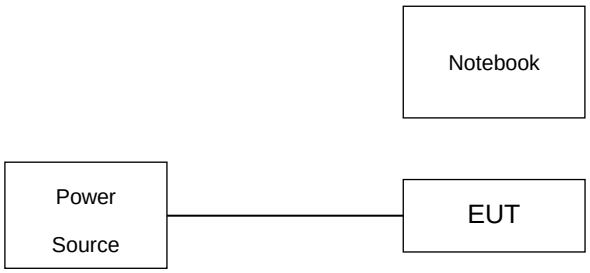
Ch. #		U-NII-1 5180-5240 MHz	U-NII-3 5745-5825 MHz
		802.11ax HE20	802.11ax HE20
L	Low	36	149
M	Middle	44	157
H	High	48	165

Ch. #		U-NII-1 5180-5240 MHz	U-NII-3 5745-5825 MHz
		802.11ax HE40	802.11ax HE40
L	Low	38	151
M	Middle	-	-
H	High	46	159

Ch. #		U-NII-1 5180-5240 MHz	U-NII-3 5745-5825 MHz
		802.11ax HE80	802.11ax HE80
L	Low	-	-
M	Middle	42	155
H	High	-	-

2.3 Connection Diagram of Test System

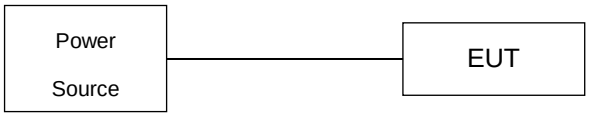
AC Conducted Emission:



This example is connection diagram of EUT test configurations.

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

Radiated Emission:



This example is connection diagram of EUT test configurations.

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

2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

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

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

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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 4.87 dB and 10dB attenuator.

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

= 4.87 + 10 = 14.87 (dB)

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

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

26dB and 99% Occupied bandwidth are reporting only.

3.1.2 Measuring Instruments

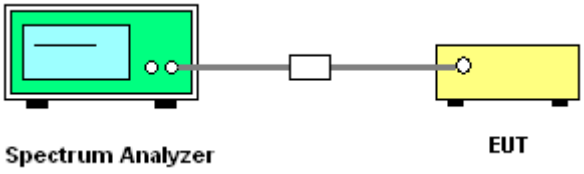
The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

☒	Section C) Bandwidth Measurement 1. Emission Bandwidth (EBW)
	1. Set RBW = approximately 1% of the emission bandwidth. **2.** Set the VBW > RBW. **3.** Detector = Peak. **4.** Trace mode = max hold **5.** Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%. **6.** For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1MHz and set the Video bandwidth (VBW) ≥ 3 * RBW. **7.** Measure and record the results in the test report.
☒	Section C) Bandwidth Measurement 2. Minimum Emission Bandwidth for the band 5.725 - 5.85 GHz
	1. Set RBW = 100kHz. **2.** Set the VBW ≥ 3 x RBW. **3.** Detector = Peak. **4.** Trace mode = max hold **5.** Measure the maximum width of the emission that is 6 dB down from the peak of the emission. **6.** Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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3.2.2 Measuring Instruments

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

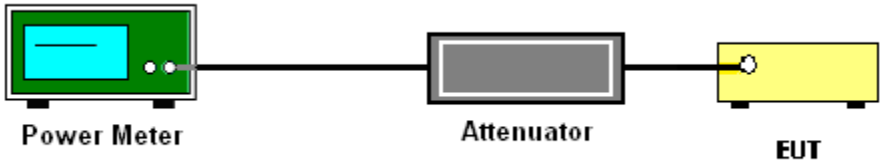
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.
4. For MIMO mode, the measure-and-sum technique should be used for measuring the in-band transmit power of a device.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04. Section F) Maximum power spectral density.

For devices operating in the bands 5.15 - 5.25 GHz

 # Method SA-2 #

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz.
- Set VBW ≥ 3 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.

For devices operating in the band 5.725 - 5.85 GHz

 # Method SA-2 #

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz.
- Set VBW ≥ 1 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add 10 log(500kHz/RBW) to the test result.
- Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.

1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
3. 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.

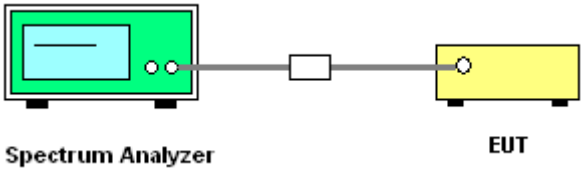
   Method (b): Measure and sum spectral maxima across the outputs.

   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(N_{ANT}) dB, where N_{ANT} 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(N_{ANT}) 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 Unwanted Emissions Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part15.205.

3.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

(2) For transmitters operating in the 5.725-5.85 GHz band:
15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(3) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

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

(4) EIRP (dBm)	Field Strength at 3m (dBµV/m)
- 27	68.3

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.77$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBµV/m

d_{Meas} is the measurement distance, in m

(4) ANSI C63.10-2013 clause 12.7.3 note 97

As specified by regulatory requirements, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit. However, an out-of-band emission that complies with both the average and peak general regulatory limits is not required to satisfy the peak emission limit.

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 FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

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

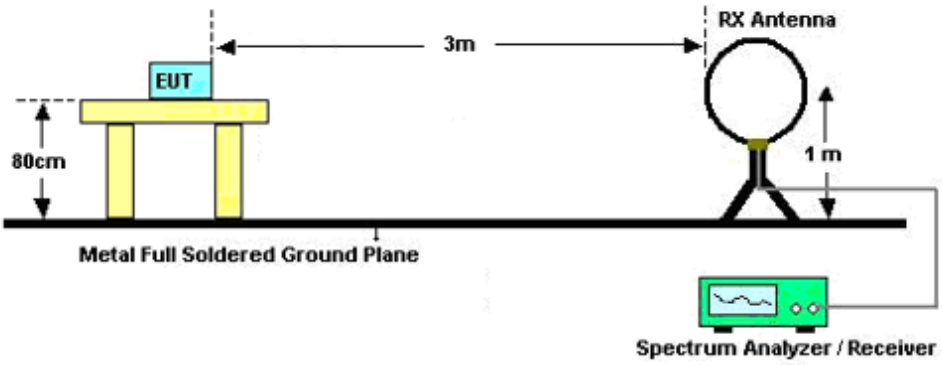
(4) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- RBW = 1 MHz
- VBW = 3 MHz
- Detector = power averaging (rms), set span/(# of points in sweep) ≥ RBW/2.
- Averaging type = power averaging(RMS)
- The correction factor shall be offset is 10 log (1/x), where x is the duty cycle.

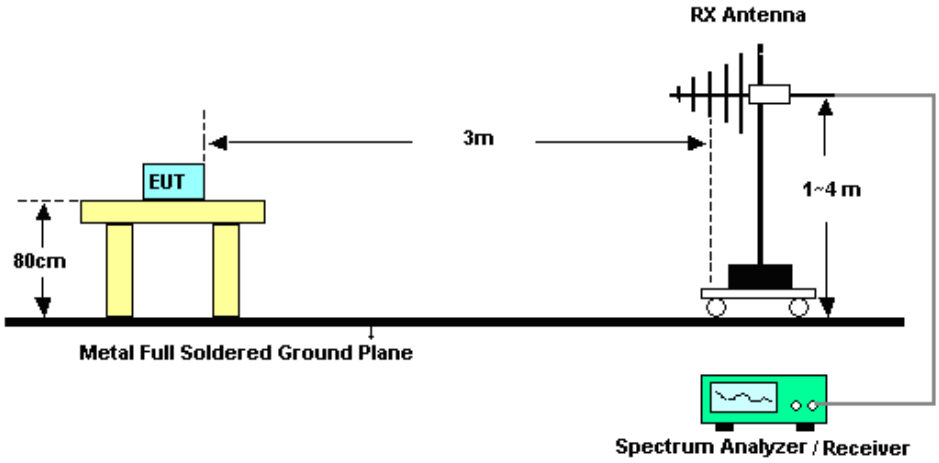
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
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 average 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.

3.4.4 Test Setup

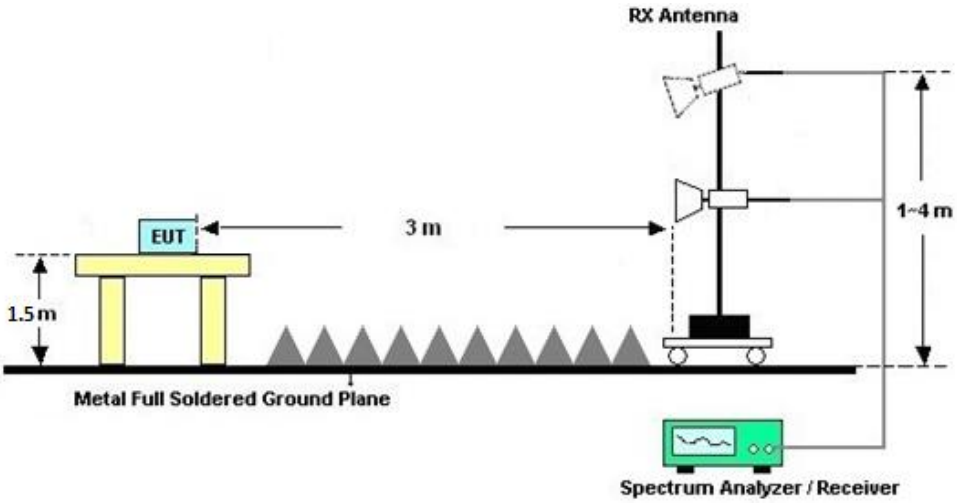
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix C.

3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

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

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

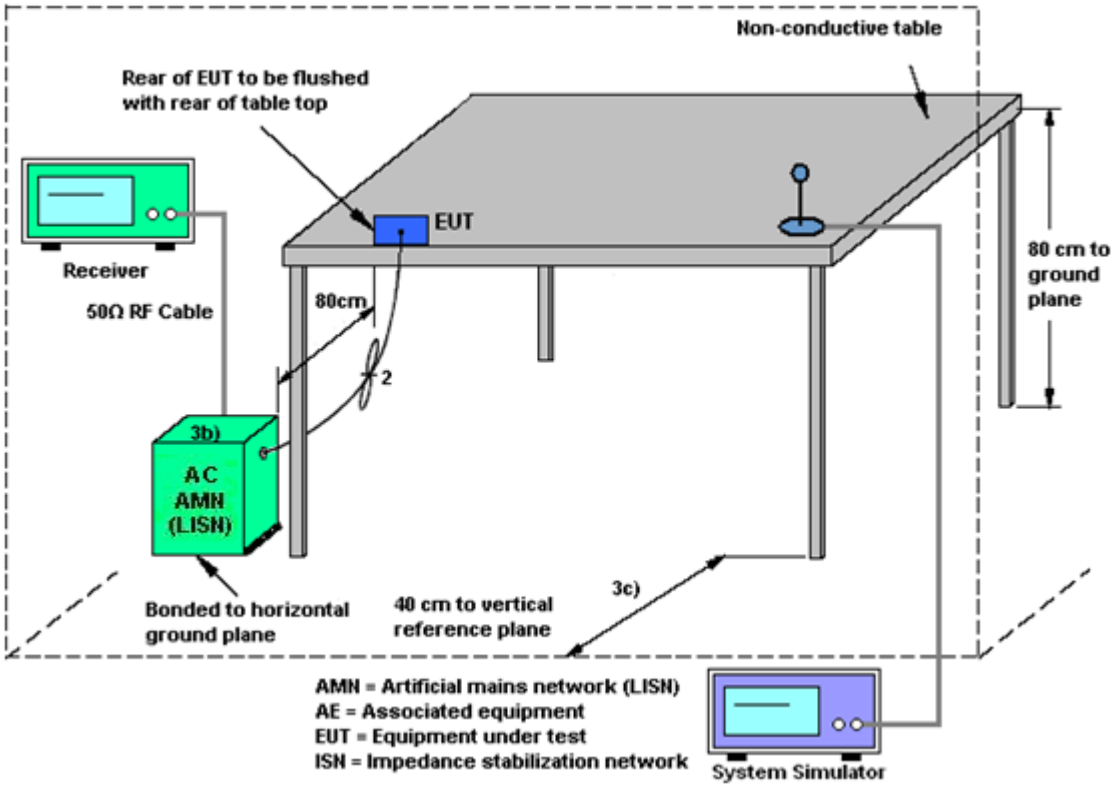
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room 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 with Maximum Hold Mode.

3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.6 Antenna Requirements

3.6.1 Standard Applicable

According to FCC 47 CFR Section 15.407(a)(1)(2) ,if transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = GANT + Array Gain, where Array Gain is as follows.

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

Array Gain = 10 log(NANT/NSS=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4.

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

The EUT supports CDD mode.

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

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

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

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

<CDD Modes>

	Ant. 1 (dBi)	Ant. 2 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
UNII-1	-3.00	-2.84	-2.84	0.09	0.00	0.00
UNII-3	-3.00	-2.84	-2.84	0.09	0.00	0.00

Power limit reduction = Composite gain – 6dBi, (min = 0)

PSD limit reduction = Composite gain + PSD Array gain – 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. 07, 2022~ Sep. 08, 2022	Oct. 13, 2022	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2022	Sep. 07, 2022~ Sep. 08, 2022	Jan. 04, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2022	Sep. 07, 2022~ Sep. 08, 2022	Jan. 04, 2023	Conducted (TH01-KS)
Temperature &humidity chamber	Hongzhan	LP-150U	H2014011440	-40~+150°C 20%~95%RH	Jul. 15, 2022	Sep. 07, 2022~ Sep. 08, 2022	Jul. 14, 2023	Conducted (TH01-KS)
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Max 30dBm	Oct. 16, 2021	Sep. 08, 2022	Oct. 15, 2022	Radiation (03CH07-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55370528	10Hz-44G,MAX 30dB	Oct. 16, 2021	Sep. 08, 2022	Oct. 15, 2022	Radiation (03CH07-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2021	Sep. 08, 2022	Oct. 29, 2022	Radiation (03CH07-KS)
Bilog Antenna	TeseQ	CBL6111D	59913	30MHz-1GHz	Sep. 07, 2022	Sep. 08, 2022	Sep. 06, 2023	Radiation (03CH07-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 06, 2022	Sep. 08, 2022	Apr. 05, 2023	Radiation (03CH07-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Jul. 30, 2021	Sep. 08, 2022	Jul. 29, 2023	Radiation (03CH07-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2022	Sep. 08, 2022	Jan. 04, 2023	Radiation (03CH07-KS)
Amplifier	SONOMA	310N	413740	9KHz-1GHz	Jan. 05, 2022	Sep. 08, 2022	Jan. 04, 2023	Radiation (03CH07-KS)
Amplifier	Keysight	83017A	MY53270316	500MHz~26.5GHz	Oct. 16, 2021	Sep. 08, 2022	Oct. 15, 2022	Radiation (03CH07-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2022	Sep. 08, 2022	Jan. 04, 2023	Radiation (03CH07-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Sep. 08, 2022	NCR	Radiation (03CH07-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Sep. 08, 2022	NCR	Radiation (03CH07-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Sep. 08, 2022	NCR	Radiation (03CH07-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 24, 2022	Sep. 02, 2022	May 23, 2023	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 14, 2021	Sep. 02, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 24, 2022	Sep. 02, 2022	May 23, 2023	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 14, 2021	Sep. 02, 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))	**2.94dB**

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

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

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**

Appendix A. Conducted Test Results

Conducted Test Results

Test Engineer:	Long Wu	Temperature:	21~25	°C
Test Date:	2022/9/7~2022/9/8	Relative Humidity:	51~54	%

Report Number : FR262007-01B

TEST RESULTS DATA
Average Power Table

FCC U-NII-1 MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
HT20	MCS0	2	36	5180	13.35	13.34	16.36	30.00		-2.84			Pass
HT20	MCS0	2	44	5220	13.29	13.28	16.30	30.00		-2.84			Pass
HT20	MCS0	2	48	5240	13.16	13.11	16.15	30.00		-2.84			Pass
HT40	MCS0	2	38	5190	12.01	11.71	14.87	30.00		-2.84			Pass
HT40	MCS0	2	46	5230	13.26	13.31	16.30	30.00		-2.84			Pass
VHT20	MCS0	2	36	5180	12.87	12.42	15.66	30.00		-2.84			Pass
VHT20	MCS0	2	44	5220	12.64	12.45	15.56	30.00		-2.84			Pass
VHT20	MCS0	2	48	5240	12.35	12.39	15.38	30.00		-2.84			Pass
VHT40	MCS0	2	38	5190	11.58	11.14	14.38	30.00		-2.84			Pass
VHT40	MCS0	2	46	5230	11.43	11.11	14.28	30.00		-2.84			Pass
VHT80	MCS0	2	42	5210	11.85	11.57	14.72	30.00		-2.84			Pass

Report Number : FR262007-01B

TEST RESULTS DATA
Average Power Table

FCC U-NII-1 MIMO														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
						Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
HE20	MCS0	2	36	5180	Full	13.33	13.32	16.34	30.00		-2.84			Pass
HE20	MCS0	2	44	5220	Full	13.28	13.27	16.29	30.00		-2.84			Pass
HE20	MCS0	2	48	5240	Full	13.13	13.08	16.12	30.00		-2.84			Pass
HE40	MCS0	2	38	5190	Full	11.66	11.75	14.72	30.00		-2.84			Pass
HE40	MCS0	2	46	5230	Full	12.94	13.17	16.07	30.00		-2.84			Pass
HE80	MCS0	2	42	5210	Full	12.28	12.46	15.38	30.00		-2.84			Pass

TEST RESULTS DATA
Average Power Table

U-NII-3 MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
HT20	MCS0	2	149	5745	13.43	13.23	16.34	30.00		-2.84		Pass
HT20	MCS0	2	157	5785	13.47	13.04	16.27	30.00		-2.84		Pass
HT20	MCS0	2	165	5825	13.45	12.76	16.13	30.00		-2.84		Pass
HT40	MCS0	2	151	5755	13.18	12.86	16.03	30.00		-2.84		Pass
HT40	MCS0	2	159	5795	13.43	13.17	16.31	30.00		-2.84		Pass
VHT20	MCS0	2	149	5745	12.53	11.78	15.18	30.00		-2.84		Pass
VHT20	MCS0	2	157	5785	12.49	11.76	15.15	30.00		-2.84		Pass
VHT20	MCS0	2	165	5825	12.67	11.35	15.07	30.00		-2.84		Pass
VHT40	MCS0	2	151	5755	11.09	11.06	14.09	30.00		-2.84		Pass
VHT40	MCS0	2	159	5795	11.25	11.04	14.16	30.00		-2.84		Pass
VHT80	MCS0	2	155	5775	11.58	11.52	14.56	30.00		-2.84		Pass

TEST RESULTS DATA
Average Power Table

U-NII-3 MIMO														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
						Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
HE20	MCS0	2	149	5745	Full	13.21	12.66	15.95	30.00		-2.84		Pass
HE20	MCS0	2	157	5785	Full	13.03	12.53	15.80	30.00		-2.84		Pass
HE20	MCS0	2	165	5825	Full	13.14	12.19	15.70	30.00		-2.84		Pass
HE40	MCS0	2	151	5755	Full	12.82	12.22	15.54	30.00		-2.84		Pass
HE40	MCS0	2	159	5795	Full	12.71	12.11	15.43	30.00		-2.84		Pass
HE80	MCS0	2	155	5775	Full	13.11	12.77	15.95	30.00		-2.84		Pass

Ambient Condition: 25 ℃, 45 %RH,	
Test Date: 2022/9/7 ~ 2022/9/8	**Test Engineer:** Long Wu

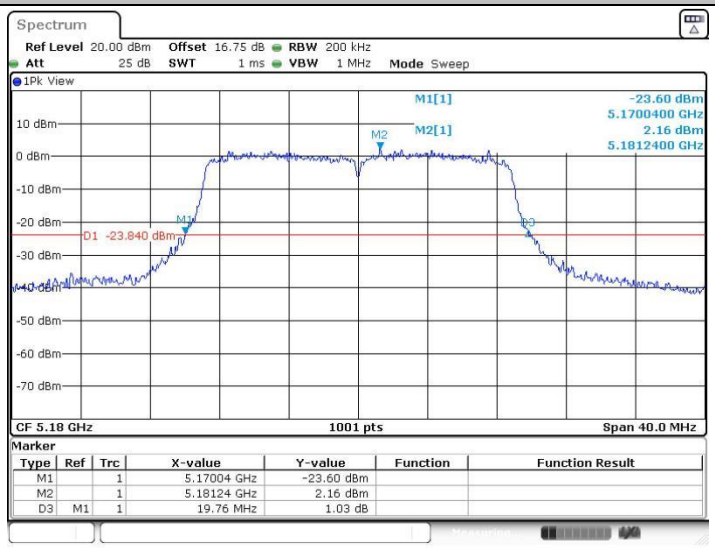
Emission Bandwidth

Test Result

TestMode	Antenna	Frequency[MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11N20MIMO	Ant1	5180	19.76	5170.04	5189.80	---	---
	Ant2	5180	19.80	5170.16	5189.96	---	---
	Ant1	5220	19.88	5210.04	5229.92	---	---
	Ant2	5220	20.16	5209.80	5229.96	---	---
	Ant1	5240	19.96	5230.00	5249.96	---	---
	Ant2	5240	19.96	5229.96	5249.92	---	---
	Ant1	5745	23.96	5733.12	5757.08	---	---
	Ant2	5745	20.16	5734.84	5755.00	---	---
	Ant1	5785	23.84	5772.48	5796.32	---	---
	Ant2	5785	20.52	5774.72	5795.24	---	---
	Ant1	5825	22.72	5813.20	5835.92	---	---
	Ant2	5825	20.64	5814.56	5835.20	---	---
11N40MIMO	Ant1	5190	40.08	5169.84	5209.92	---	---
	Ant2	5190	39.92	5170.08	5210.00	---	---
	Ant1	5230	40.08	5209.92	5250.00	---	---
	Ant2	5230	40.16	5210.00	5250.16	---	---
	Ant1	5755	40.56	5734.84	5775.40	---	---
	Ant2	5755	39.76	5735.00	5774.76	---	---
	Ant1	5795	50.72	5768.28	5819.00	---	---
	Ant2	5795	39.92	5774.92	5814.84	---	---
11AX80MIMO	Ant1	5210	82.72	5168.56	5251.28	---	---
	Ant2	5210	82.24	5168.88	5251.12	---	---
	Ant1	5775	84.32	5733.08	5817.40	---	---
	Ant2	5775	82.40	5733.56	5815.96	---	---

Test Graphs

11N20MIMO_Ant1_5180



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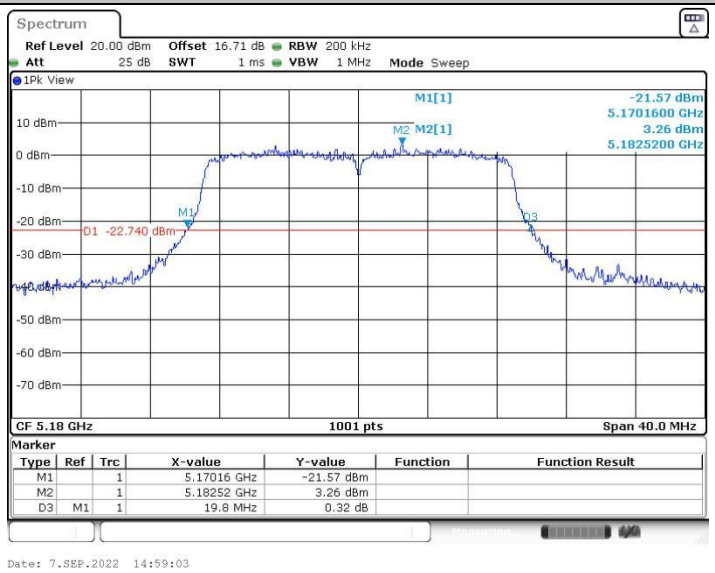

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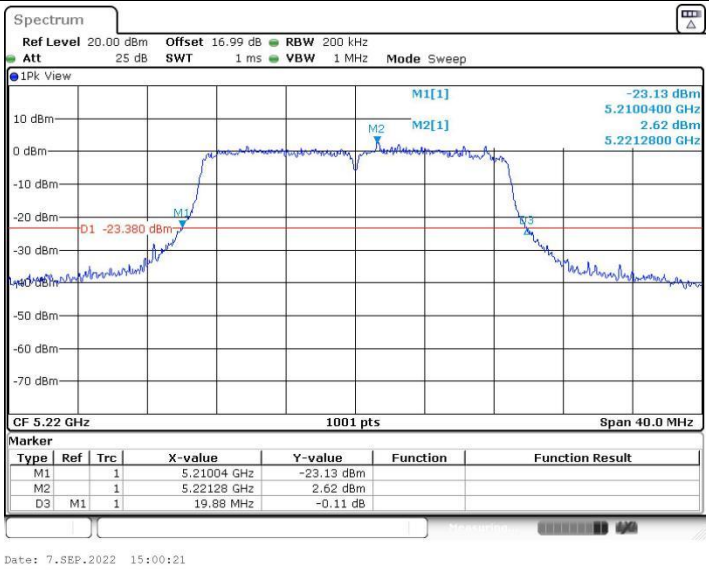

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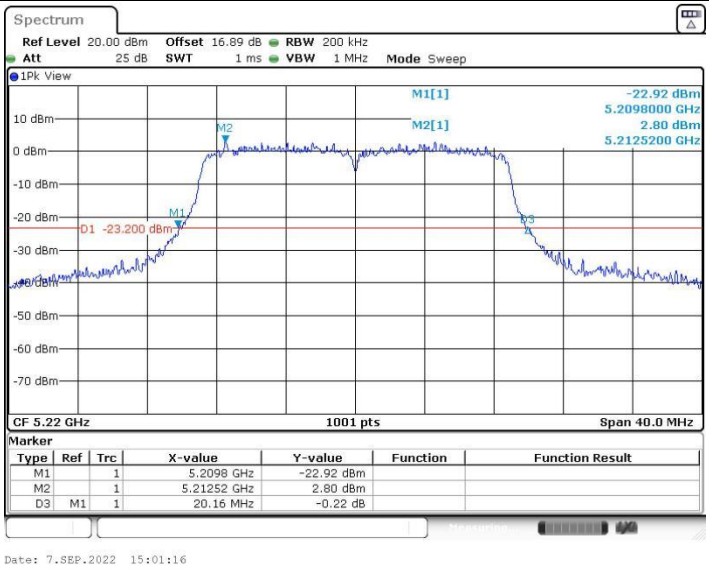

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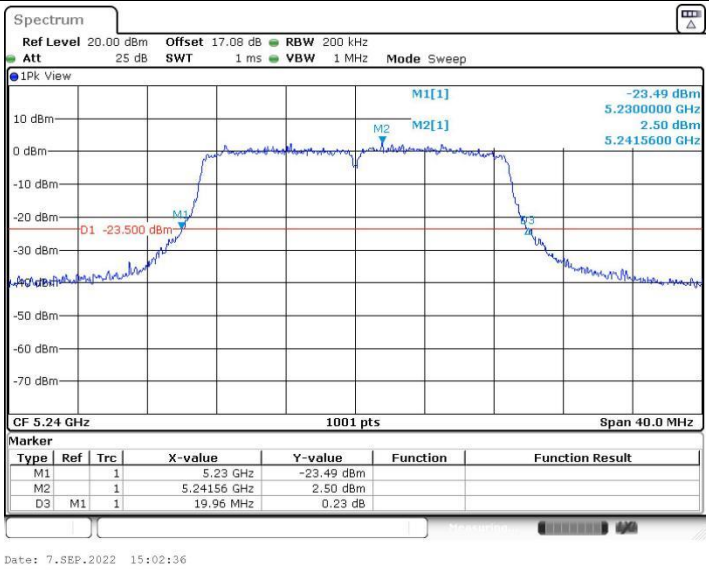

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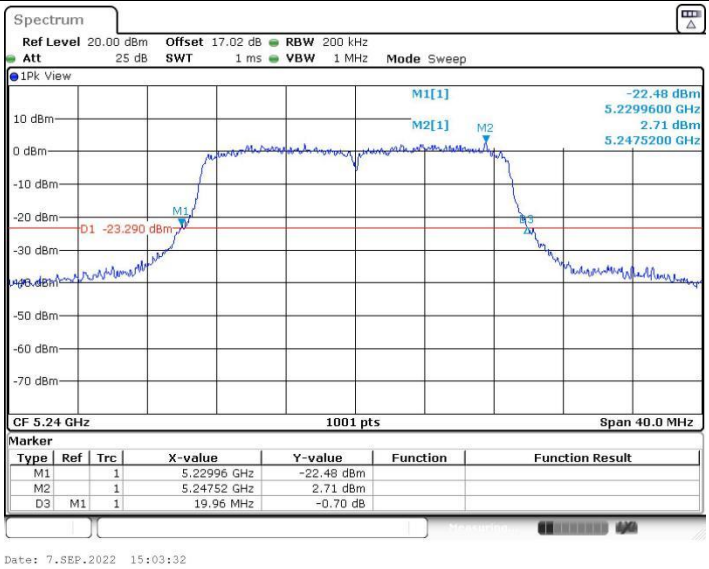

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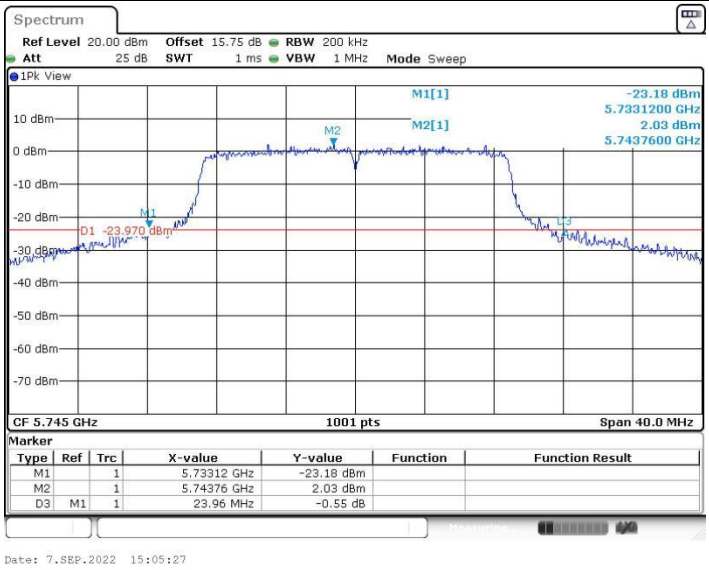

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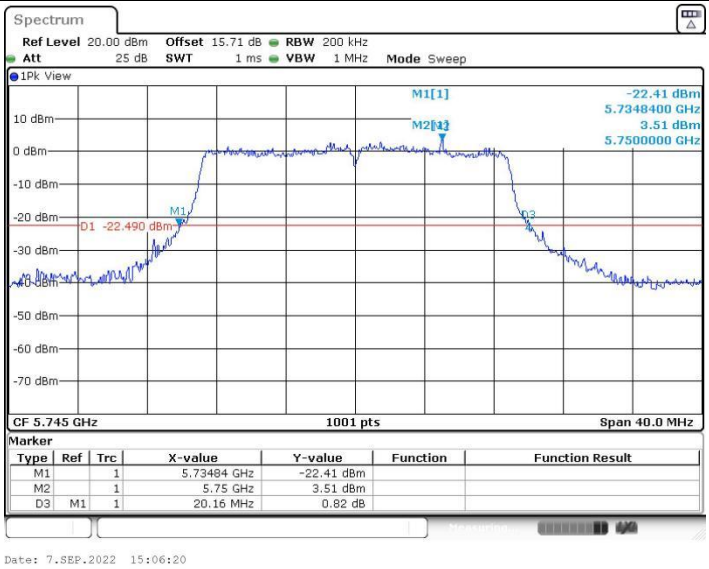

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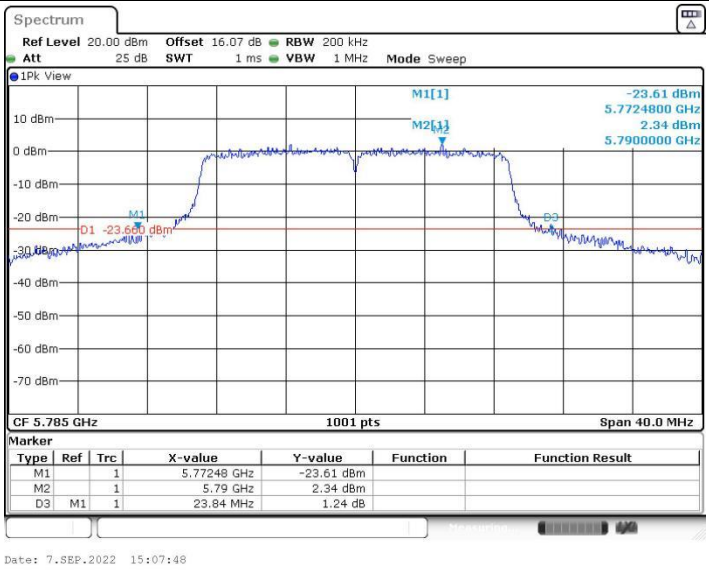

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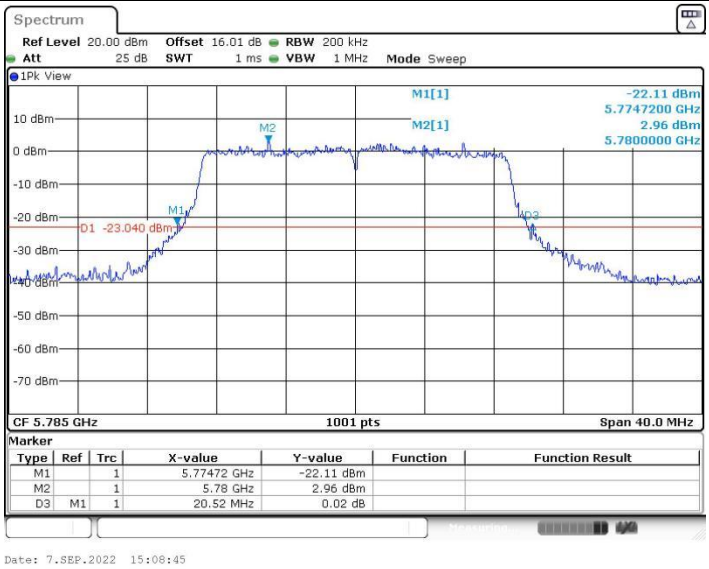

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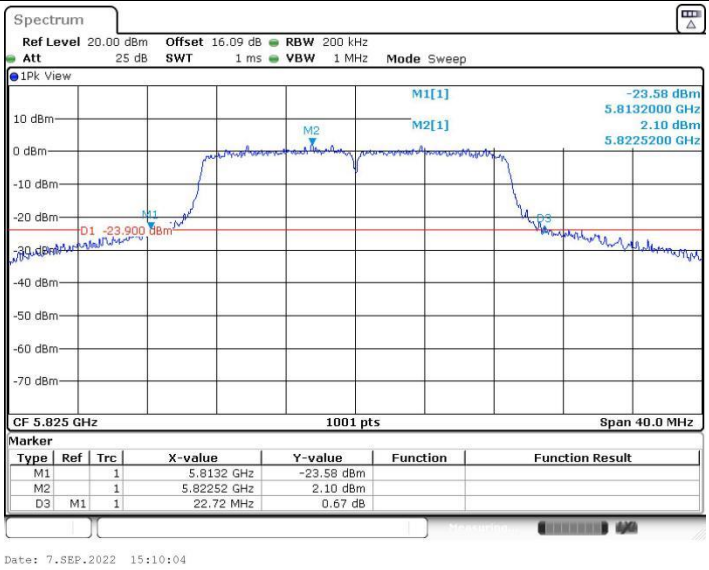

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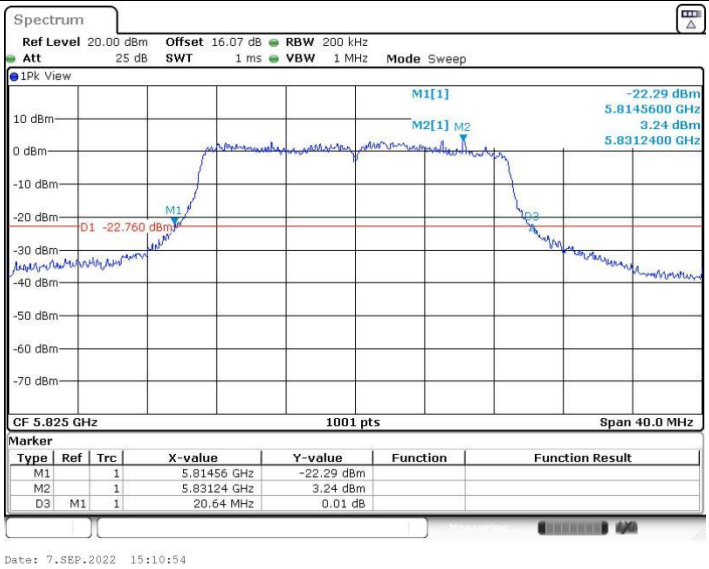

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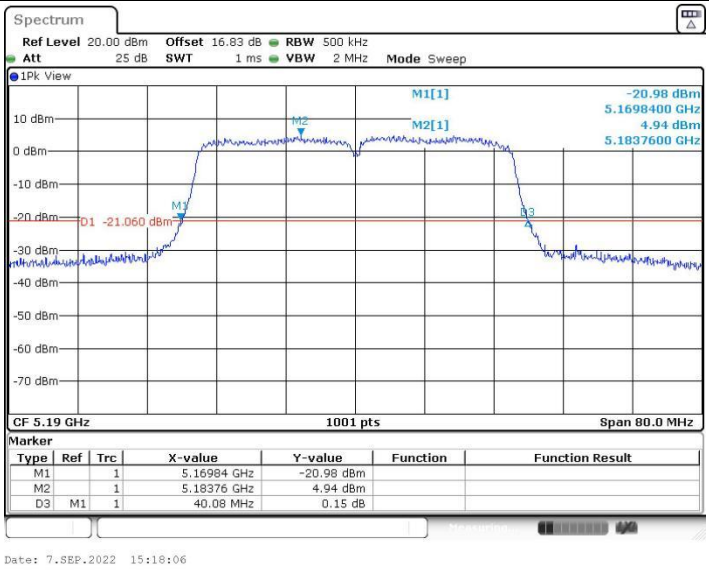

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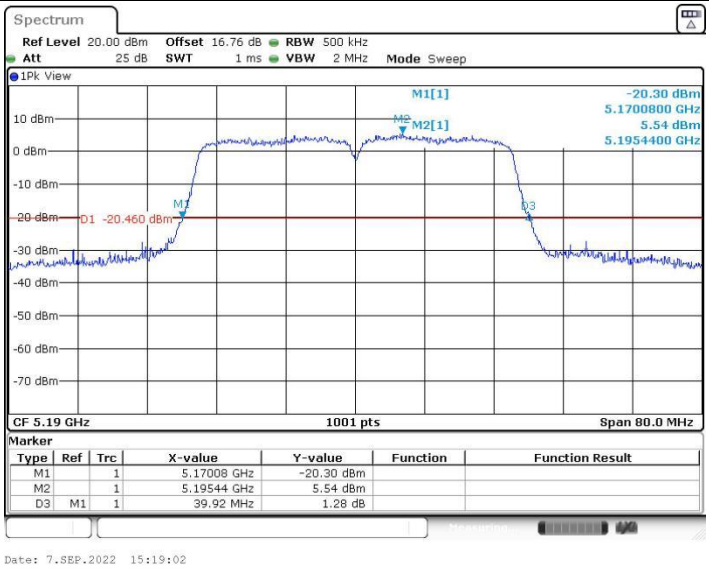

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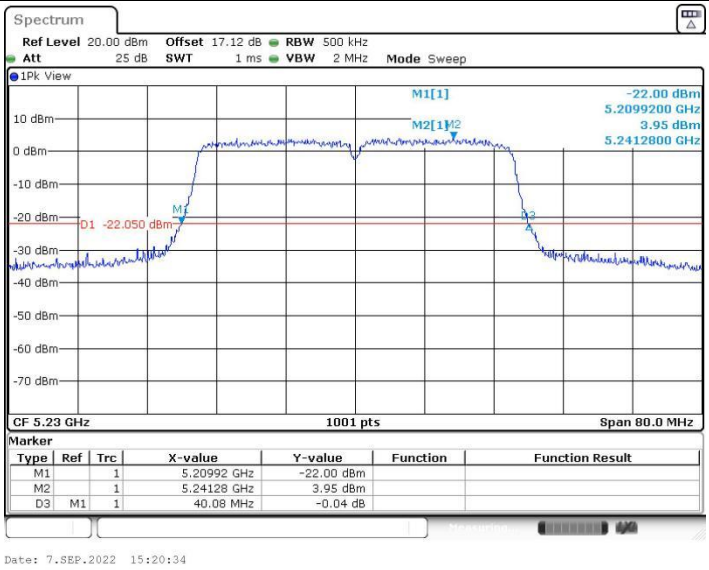

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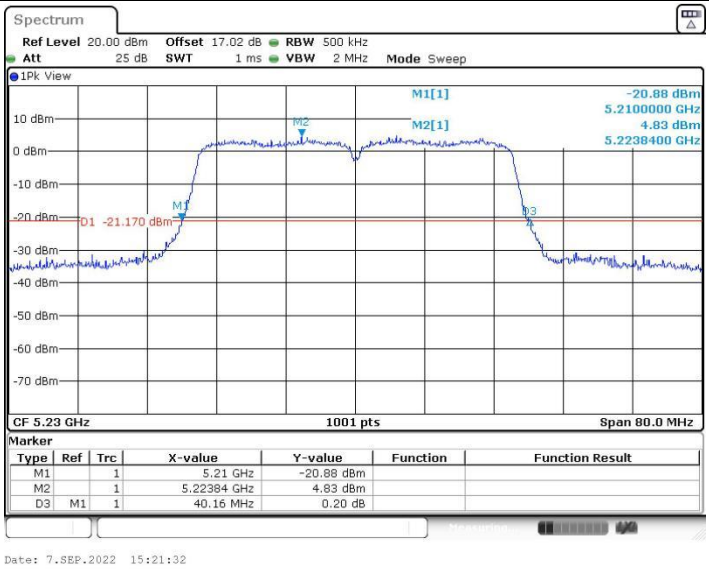
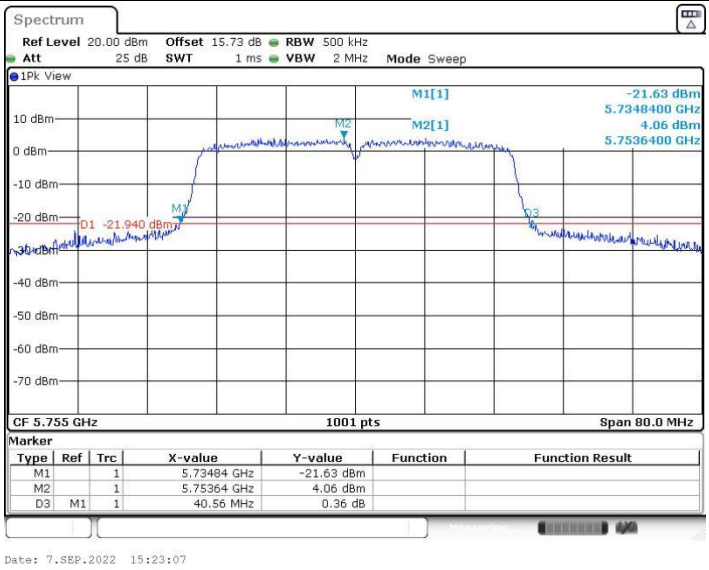
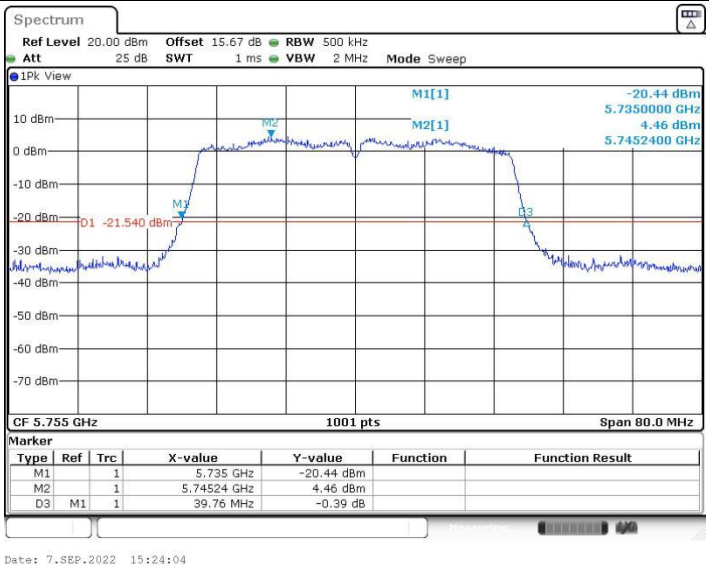


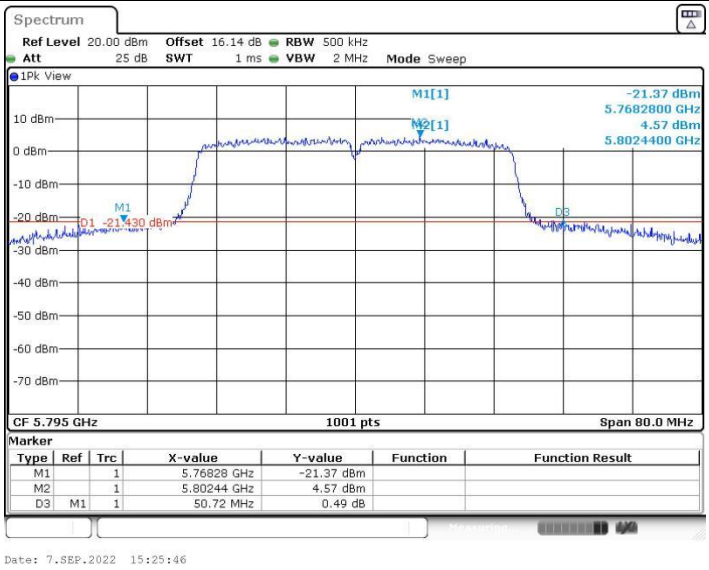
11N40MIMO_Ant1_5755



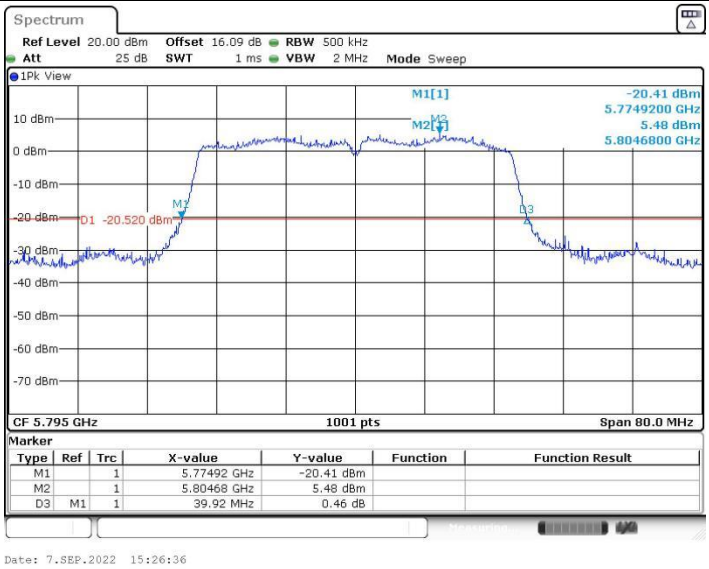
11N40MIMO_Ant2_5755



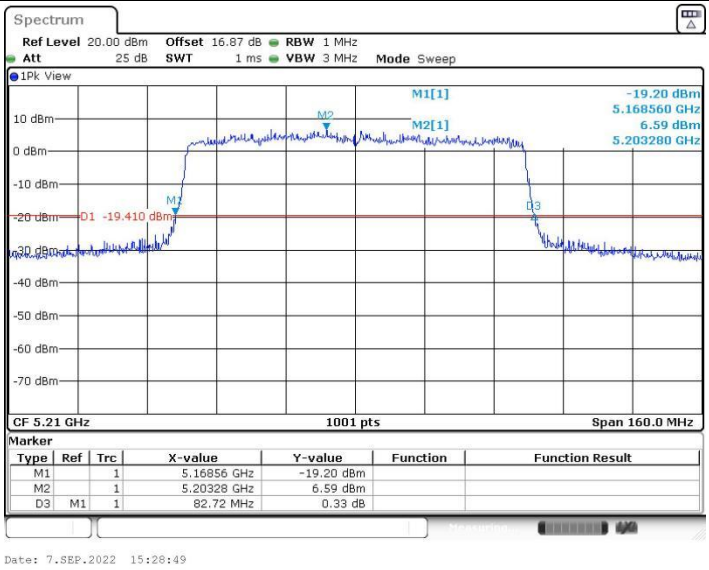
11N40MIMO_Ant1_5795



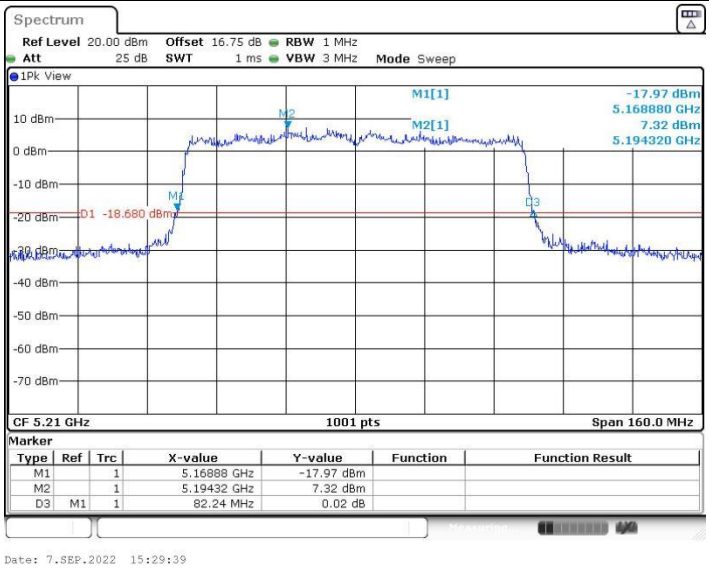
11N40MIMO_Ant2_5795



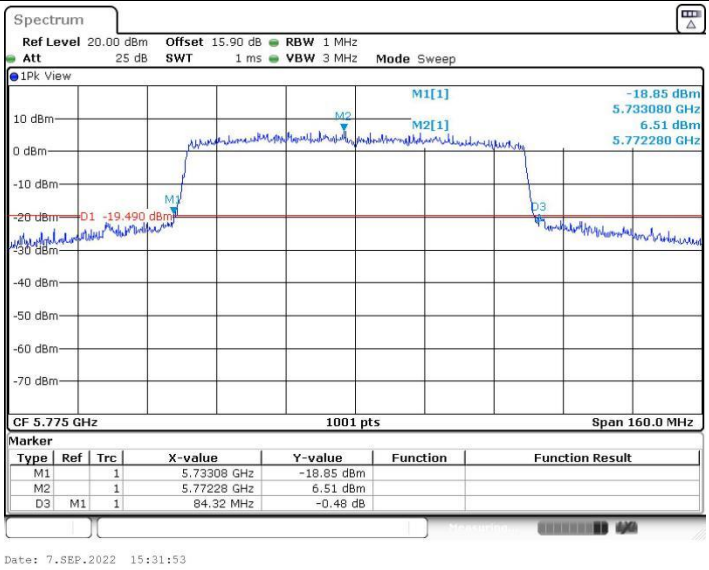
11AX80MIMO_Ant1_5210



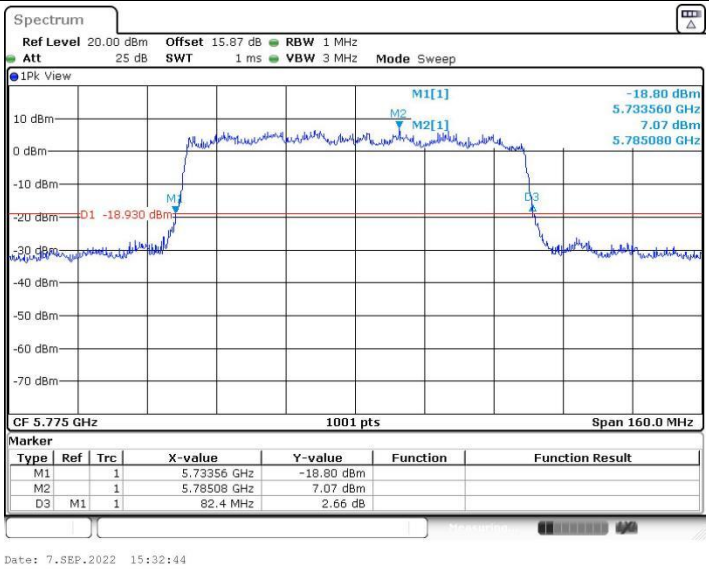
11AX80MIMO_Ant2_5210



11AX80MIMO_Ant1_5775



11AX80MIMO_Ant2_5775



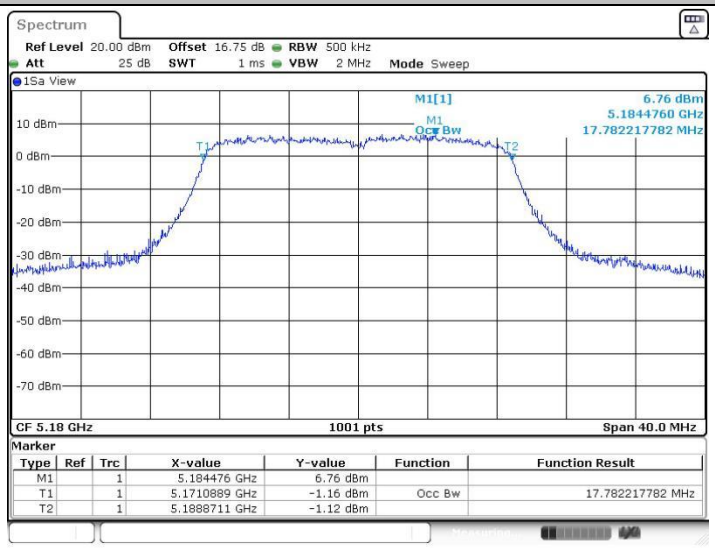
Occupied channel bandwidth

Test Result

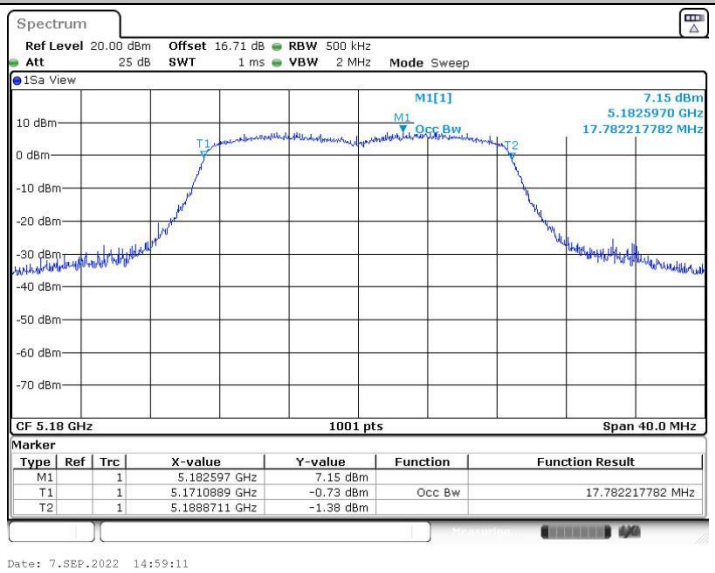
TestMode	Antenna	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11N20MIMO	Ant1	5180	17.782	5171.0889	5188.8711	---	---
	Ant2	5180	17.782	5171.0889	5188.8711	---	---
	Ant1	5220	17.822	5211.0490	5228.8711	---	---
	Ant2	5220	17.782	5211.0889	5228.8711	---	---
	Ant1	5240	17.782	5231.0889	5248.8711	---	---
	Ant2	5240	17.782	5231.1289	5248.9111	---	---
	Ant1	5745	18.022	5736.0090	5754.0310	---	---
	Ant2	5745	17.942	5736.0090	5753.9510	---	---
	Ant1	5785	18.062	5775.9690	5794.0310	---	---
	Ant2	5785	17.982	5775.9690	5793.9510	---	---
	Ant1	5825	18.022	5815.9690	5833.9910	---	---
	Ant2	5825	17.942	5815.9291	5833.8711	---	---
11N40MIMO	Ant1	5190	36.204	5171.8581	5208.0619	---	---
	Ant2	5190	36.124	5171.9381	5208.0619	---	---
	Ant1	5230	36.364	5211.7782	5248.1419	---	---
	Ant2	5230	36.284	5211.8581	5248.1419	---	---
	Ant1	5755	36.364	5736.7782	5773.1419	---	---
	Ant2	5755	36.204	5736.7782	5772.9820	---	---
	Ant1	5795	36.523	5776.6983	5813.2218	---	---
	Ant2	5795	36.284	5776.7782	5813.0619	---	---
11AX80MIMO	Ant1	5210	77.522	5171.1588	5248.6813	---	---
	Ant2	5210	77.522	5171.1588	5248.6813	---	---
	Ant1	5775	77.842	5735.9990	5813.8412	---	---
	Ant2	5775	77.682	5735.9990	5813.6813	---	---

Test Graphs

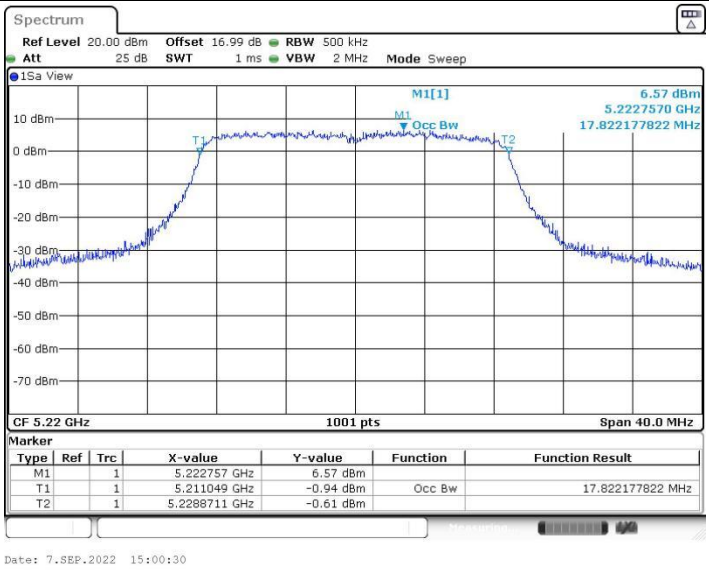
11N20MIMO_Ant1_5180



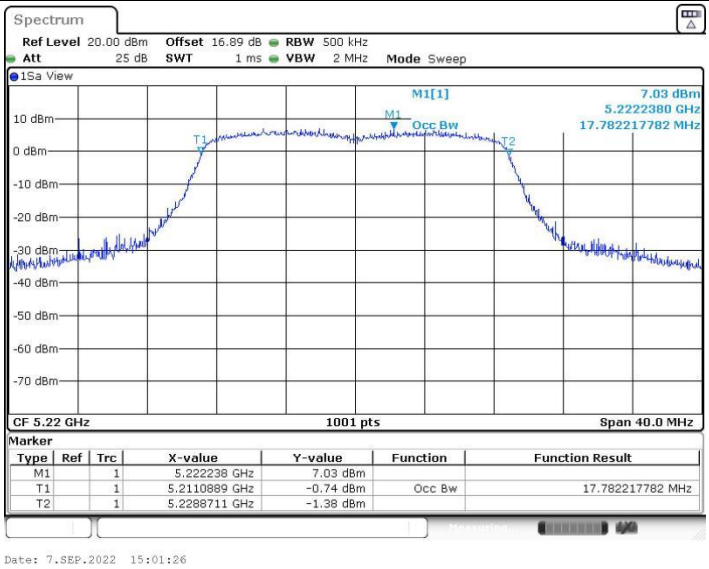
11N20MIMO_Ant2_5180



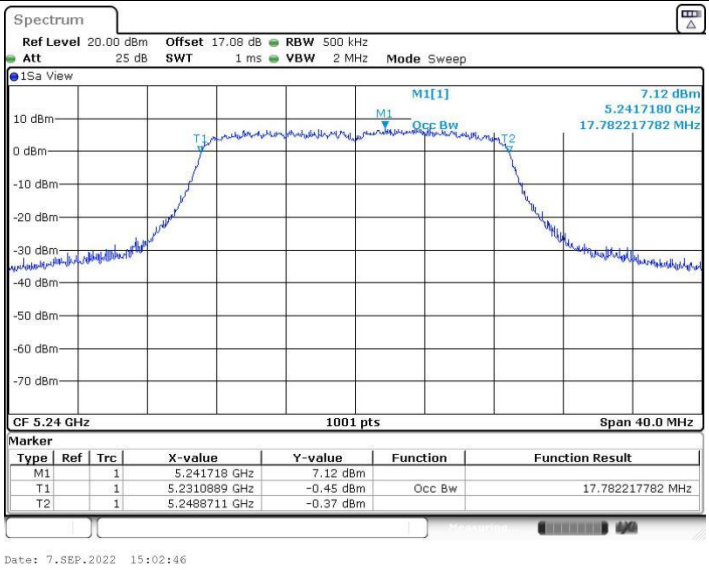
11N20MIMO_Ant1_5220



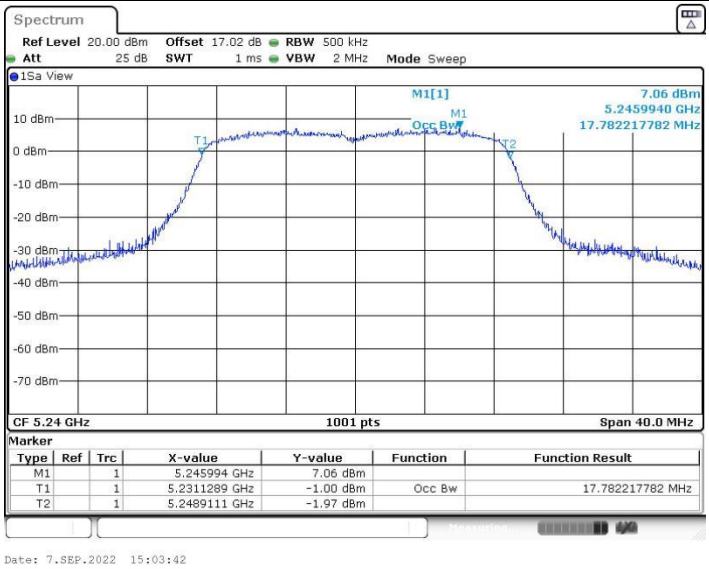
11N20MIMO_Ant2_5220



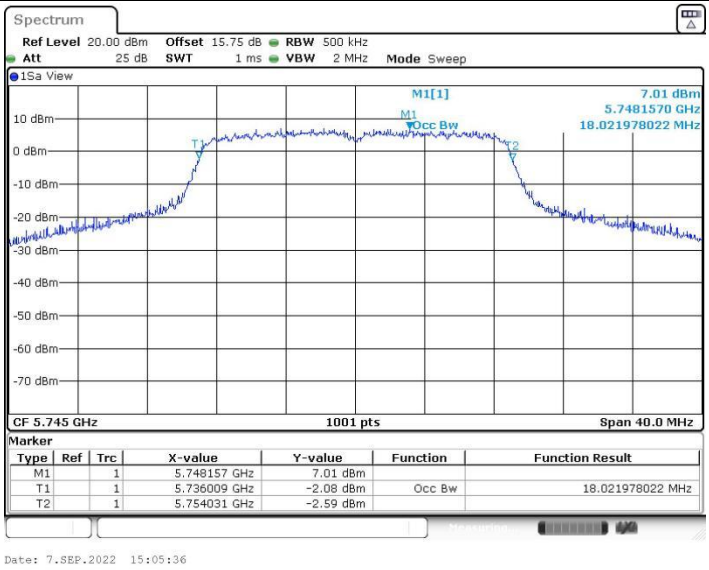
11N20MIMO_Ant1_5240



11N20MIMO_Ant2_5240

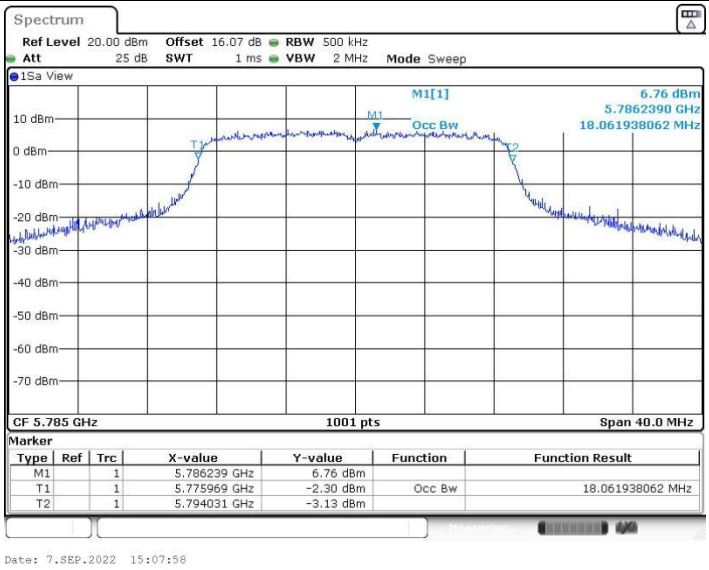


11N20MIMO_Ant1_5745

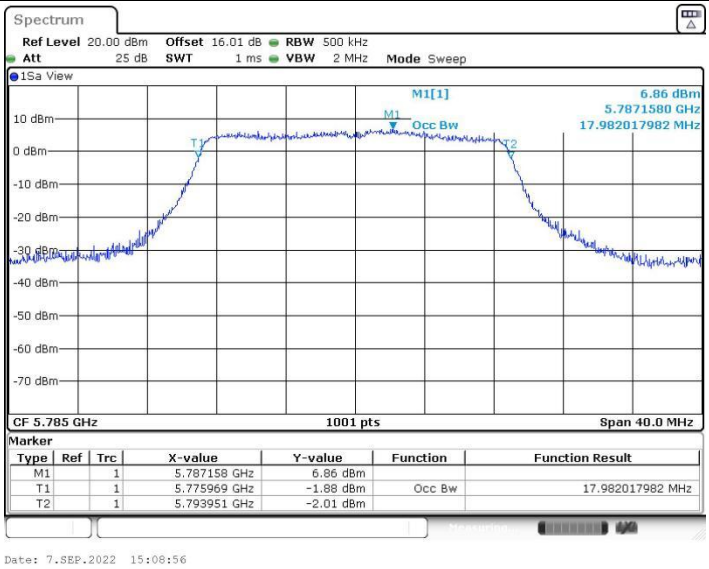


11N20MIMO_Ant2_5745

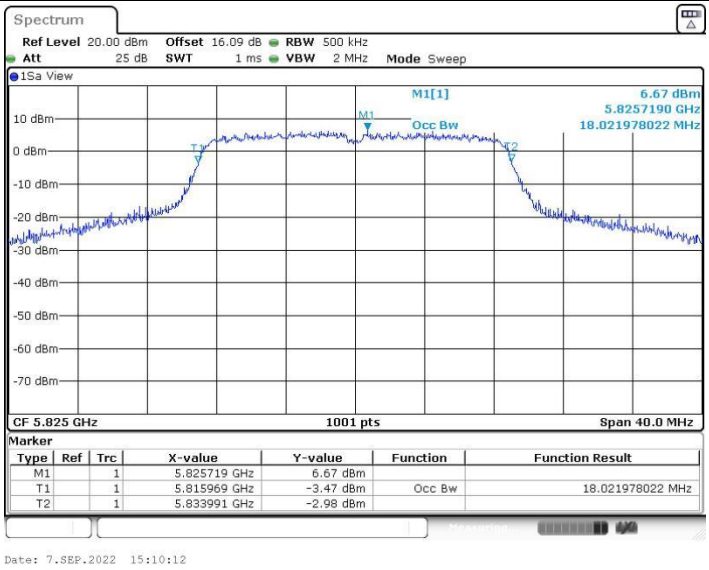
11N20MIMO_Ant1_5785



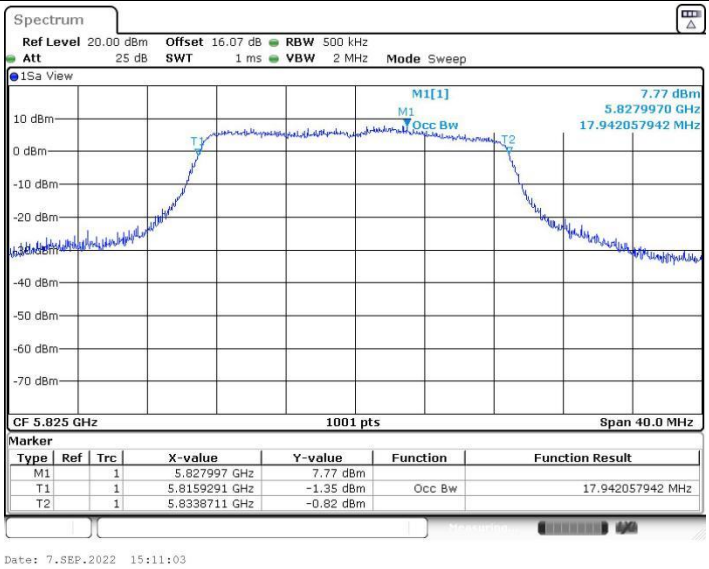
11N20MIMO_Ant2_5785



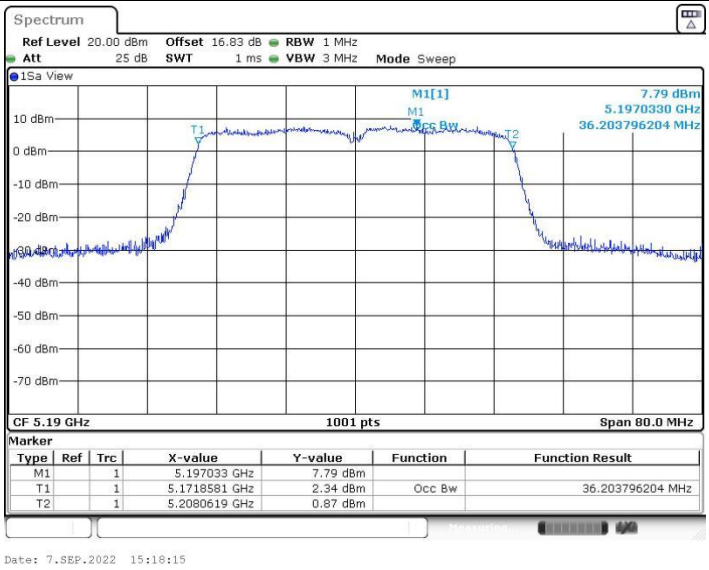
11N20MIMO_Ant1_5825



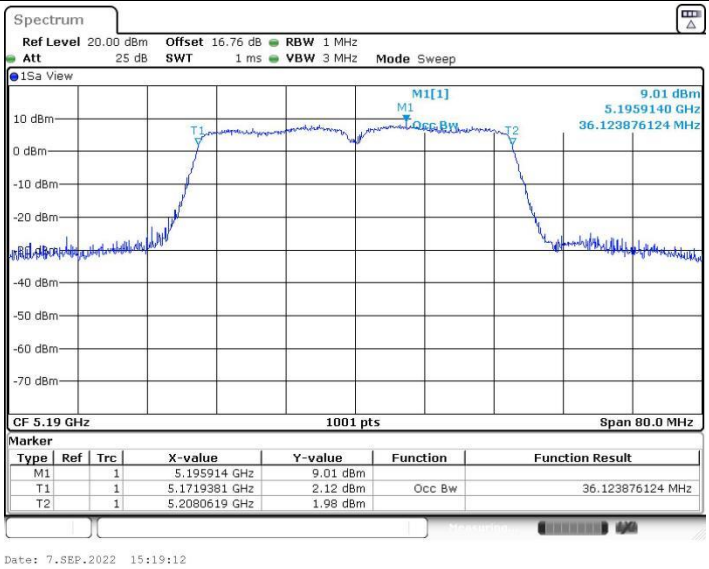
11N20MIMO_Ant2_5825



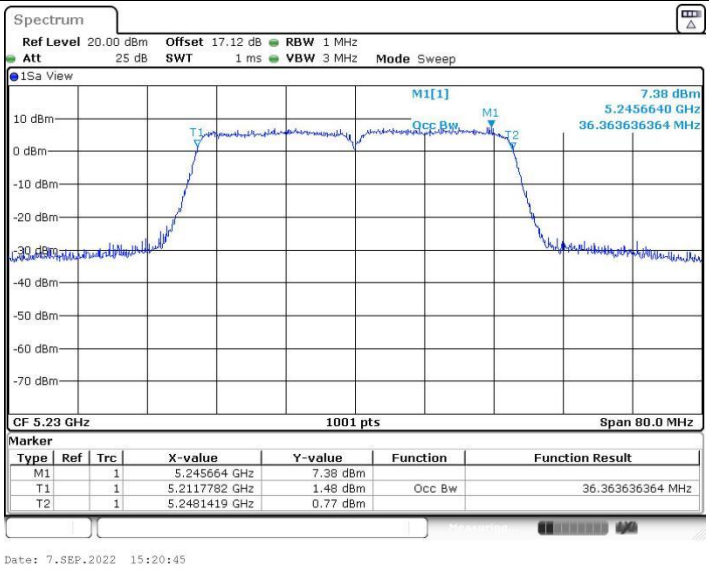
11N40MIMO_Ant1_5190



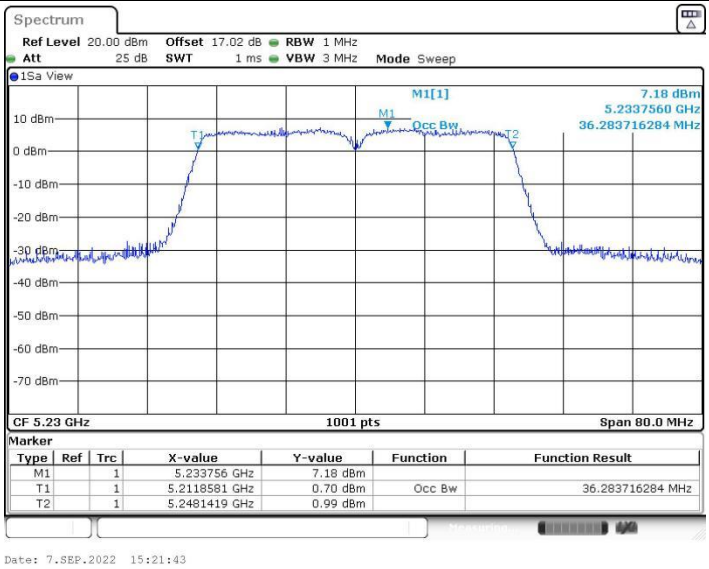
11N40MIMO_Ant2_5190



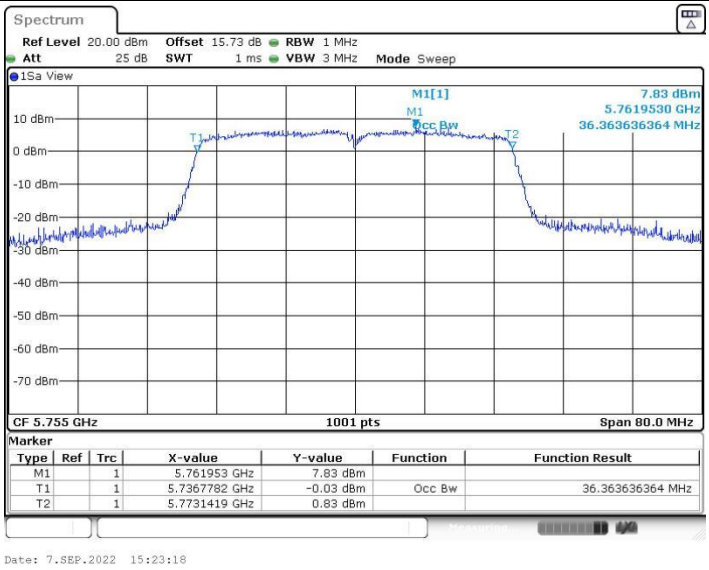
11N40MIMO_Ant1_5230



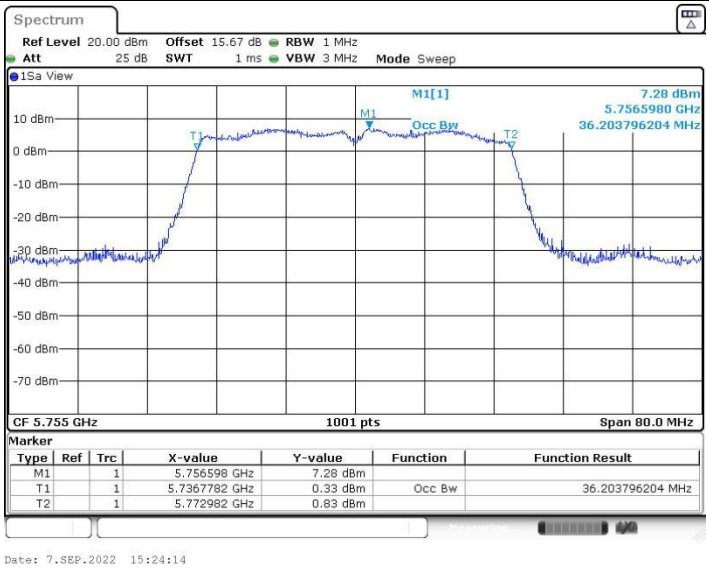
11N40MIMO_Ant2_5230



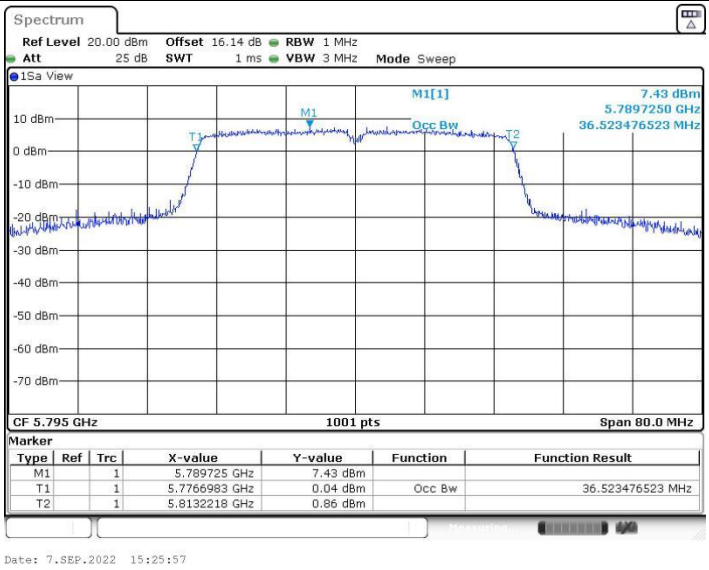
11N40MIMO_Ant1_5755



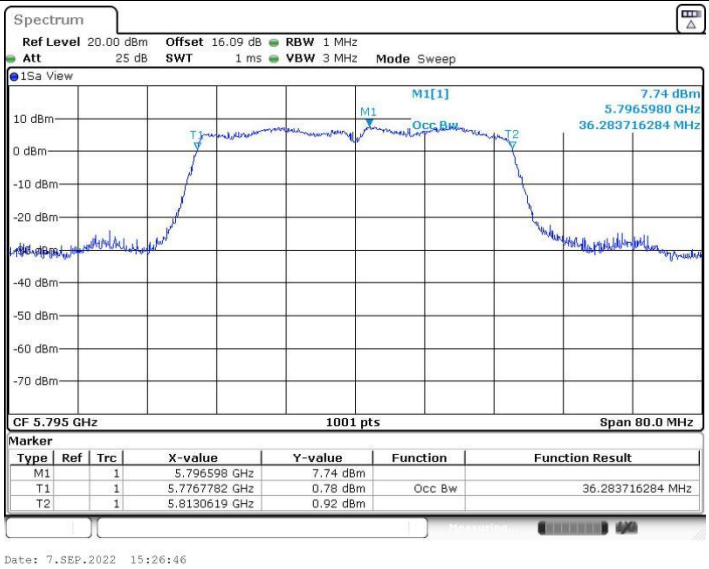
11N40MIMO_Ant2_5755



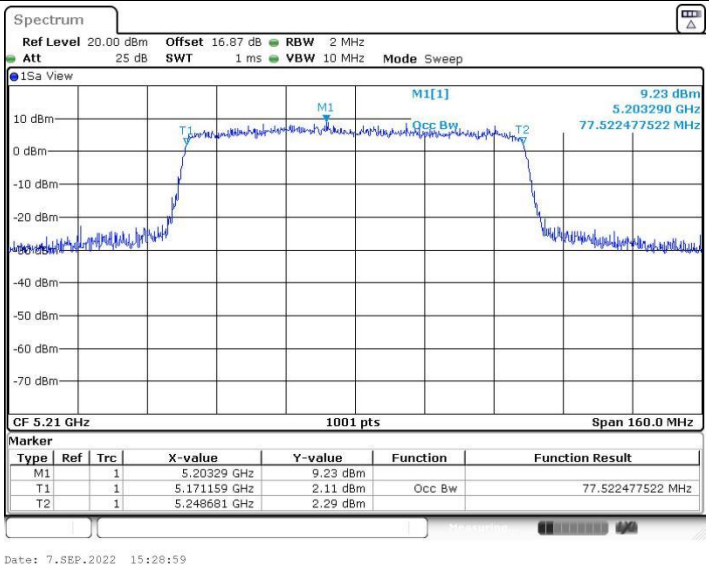
11N40MIMO_Ant1_5795



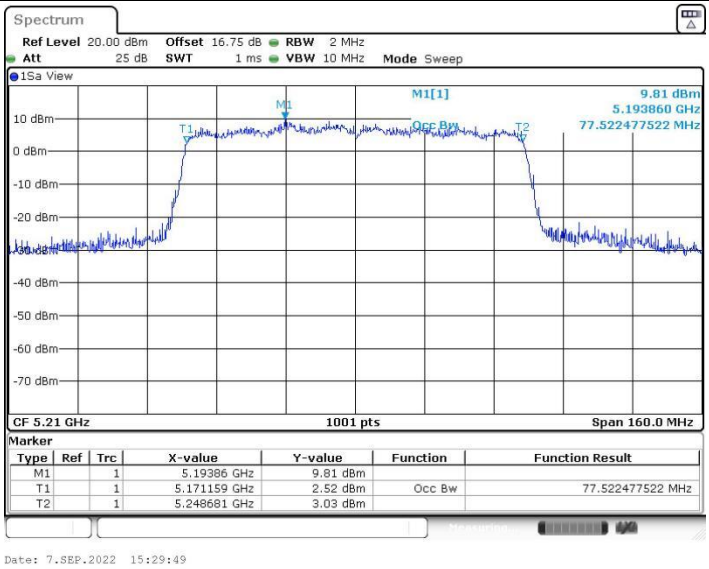
11N40MIMO_Ant2_5795



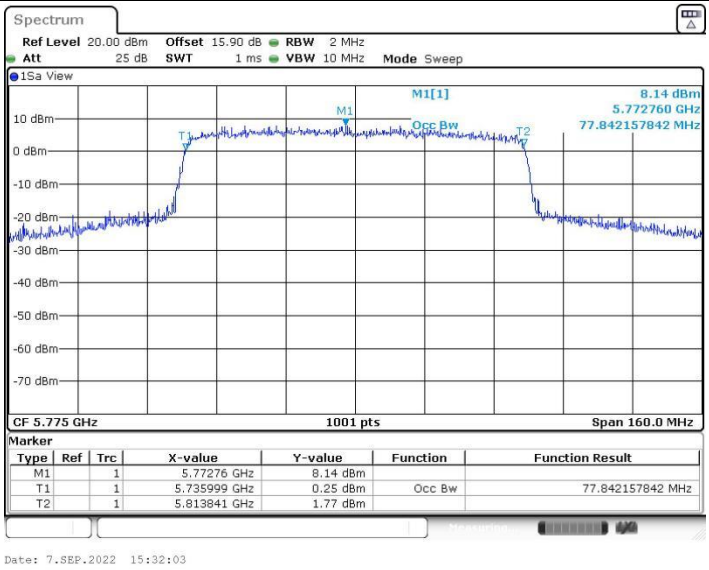
11AX80MIMO_Ant1_5210



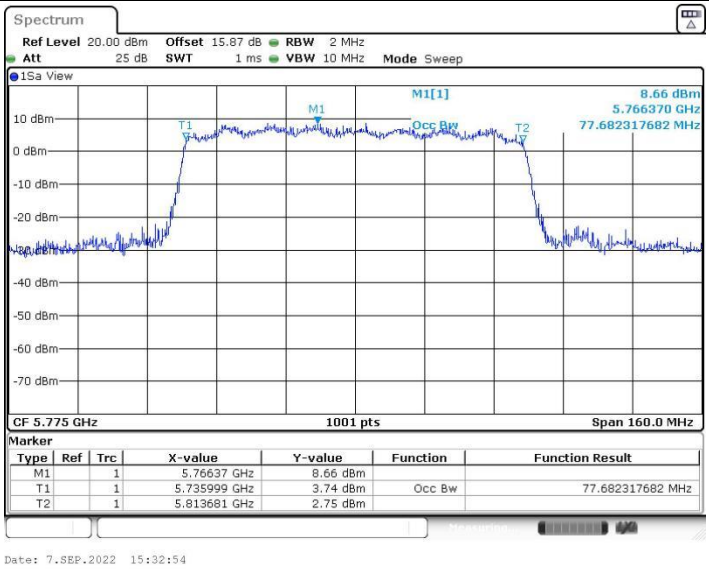
11AX80MIMO_Ant2_5210



11AX80MIMO_Ant1_5775



11AX80MIMO_Ant2_5775



Min emission bandwidth

Test Result B4

TestMode	Antenna	Frequency[MHz]	6db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11N20MIMO	Ant1	5745	17.56	5736.20	5753.76	0.5	PASS
	Ant2	5745	17.56	5736.20	5753.76	0.5	PASS
	Ant1	5785	17.56	5776.20	5793.76	0.5	PASS
	Ant2	5785	17.56	5776.20	5793.76	0.5	PASS
	Ant1	5825	17.56	5816.20	5833.76	0.5	PASS
	Ant2	5825	16.56	5816.20	5832.76	0.5	PASS
11N40MIMO	Ant1	5755	35.92	5737.24	5773.16	0.5	PASS
	Ant2	5755	35.44	5737.08	5772.52	0.5	PASS
	Ant1	5795	35.92	5776.84	5812.76	0.5	PASS
	Ant2	5795	35.36	5777.24	5812.60	0.5	PASS
11AX80MIMO	Ant1	5775	76.48	5736.28	5812.76	0.5	PASS
	Ant2	5775	76.96	5735.96	5812.92	0.5	PASS