FCC RADIO TEST REPORT

FCC ID	:	**PY321100529**
Equipment	:	**Netgear 5G MHS Travel Router**
Brand Name	:	**Netgear**
Model Name	:	**MR6500**
Applicant	:	**Netgear Inc** **350 E. Plumeria Drive, San Jose, CA 95134, United States**
Manufacturer	:	**Netgear Inc** **350 E. Plumeria Drive, San Jose, CA 95134, United States**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Nov. 03, 2021 and testing was performed from Nov. 03, 2021 to Dec. 20, 2021. We, Sporton International Inc. EMC & Wireless Communications Laboratory, 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 from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

Table of Contents

History of this test report **3**

Summary of Test Result **4**

1 General Description **5**

1.1 Product Feature of Equipment Under Test 5
1.2 Modification of EUT 5
1.3 Testing Location 6
1.4 Applicable Standards 6

2 Test Configuration of Equipment Under Test **7**

2.1 Carrier Frequency and Channel 7
2.2 Test Mode 7
2.3 Connection Diagram of Test System 8
2.4 Support Unit used in test configuration and system 9
2.5 EUT Operation Test Setup 9
2.6 Measurement Results Explanation Example 9

3 Test Result **10**

3.1 6dB and 99% Bandwidth Measurement 10
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 41
3.6 AC Conducted Emission Measurement 45
3.7 Antenna Requirements 47

4 List of Measuring Equipment **48**

5 Uncertainty of Evaluation **50**

Appendix A. Conducted Test Results
Appendix B. AC Conducted Emission Test Result
Appendix C. Radiated Spurious Emission
Appendix D. Radiated Spurious Emission Plots
Appendix E. Duty Cycle Plots
Appendix F. Setup Photographs

History of this test report

Report No.	Version	Description	Issue Date
FR190614A	01	Initial issue of report	Jan. 03, 2022
FR190614A	02	1. Revise Product Feature of Equipment Under Test 2. Revise test mode in section 2.1	Jan. 28, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)	Power Output Measurement	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges	Pass	-
		Conducted Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	6.49 dB under the limit at 52.140 MHz
3.6	15.207	AC Conducted Emission	Pass	17.20 dB under the limit at 0.600 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

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

Reviewed by: Avis Chuang

Report Producer: Tina Chuang

1 General Description

1.1 Product Feature of Equipment Under Test

LTE/5G NR, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, Wi-Fi 6GHz 802.11a/n/ac/ax, and GPS

Product Feature	
Antenna Type	WWAN: **<Ant. 1>**: Monopole Antenna **<Ant. 2>**: Monopole Antenna WLAN: **<Ant. 3>**: Monopole Antenna **<Ant. 4>**: Monopole Antenna GPS: PIFA Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	Ant. 3: 2.63 Ant. 4: 2.15

Remark: The above EUT's information is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	CO05-HY, 03CH07-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	TH05-HY (TAF Code: 3786)
Remark	The Conducted test item subcontracted to Sporton International Inc. Wensan Laboratory.

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW3786

1.4 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Z plane as worst plane.

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

The final test modes consider the modulation and the worst data rates as shown in the table below.

MIMO Antenna

Modulation	Data Rate
802.11b	**1 Mbps**
802.11g	**6 Mbps**
802.11n HT20 (Covered by HE20)	**MCS0**
802.11n HT40 (Covered by HE40)	**MCS0**
802.11ac VHT20 (Covered by HE20)	**MCS0**
802.11ac VHT40 (Covered by HE40)	**MCS0**
802.11ax HE20	**MCS0**
802.11ax HE40	**MCS0**

Note: Since the verify power, the smaller power can be covered by the higher power. The SISO Mode is covered by MIMO Mode.

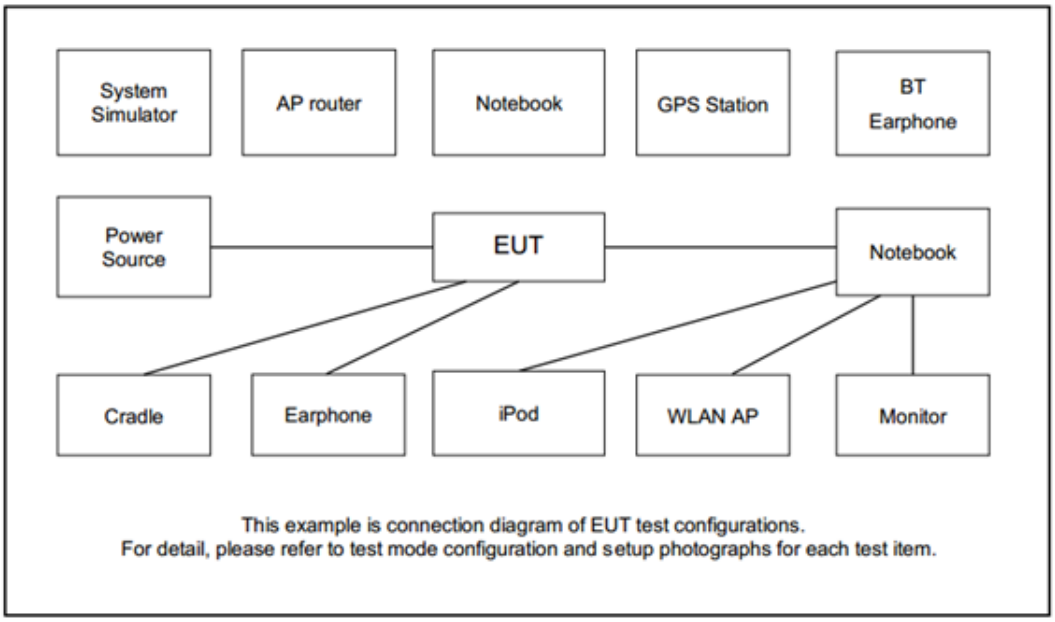
Test Cases	
AC Conducted Emission	Mode 1 : LTE Band 7 Link + WLAN (2.4GHz) Link – Master + WLAN (5GHz) Link – Master + USB Cable (Charging from AC Adapter) + Battery

Ch. #	2400-2483.5 MHz			
	802.11b	802.11g	802.11ax HE20	802.11ax HE40
Low	01	01	01	03
Middle	06	06	06	06
High	11	11	11	09

Remark:

1. For radiation spurious emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.
2. For Radiated Test Cases, the tests were performed with Adapter 1.

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	5G Wireless Test Platform	Anritsu	MT8000A	N/A	N/A	Unshielded,1.8m
2.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “QSPR v5.0.00188” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

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 4.2 dB and 10 dB attenuator.

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

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

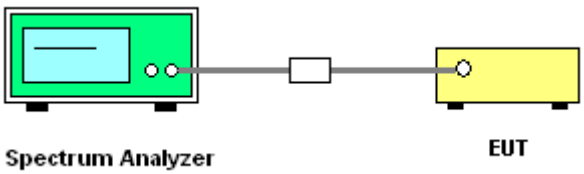
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to 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) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
6. Measure and record the results in the test report.

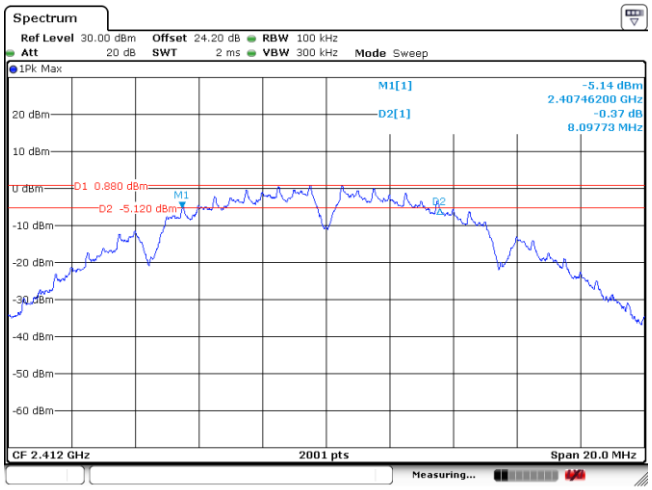
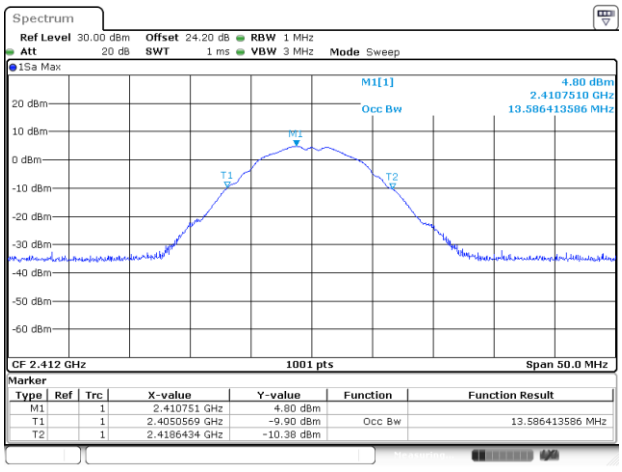
3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

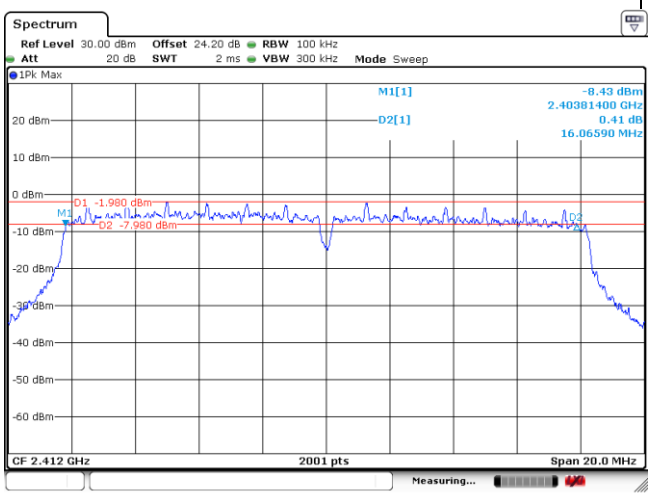
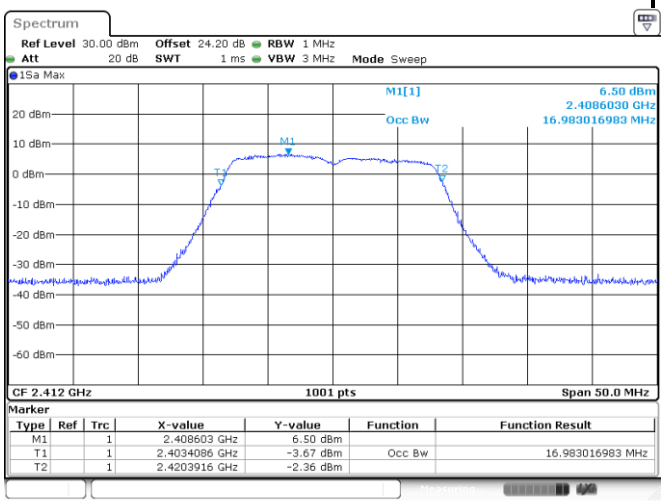
Please refer to Appendix A.

<802.11b CH1>

6dB Bandwidth	99% Occupied Bandwidth
	

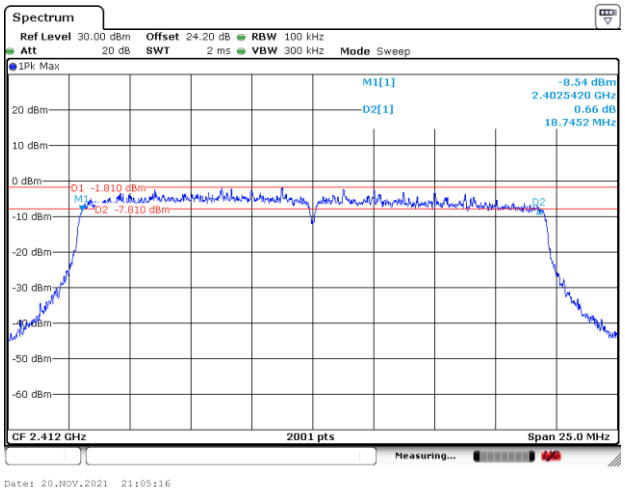
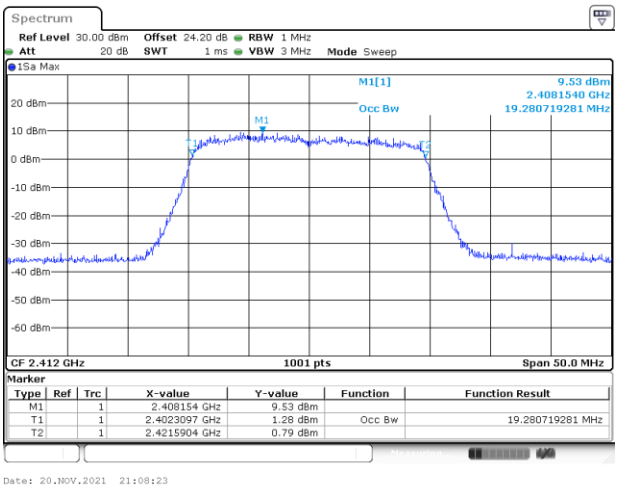
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11g CH1>

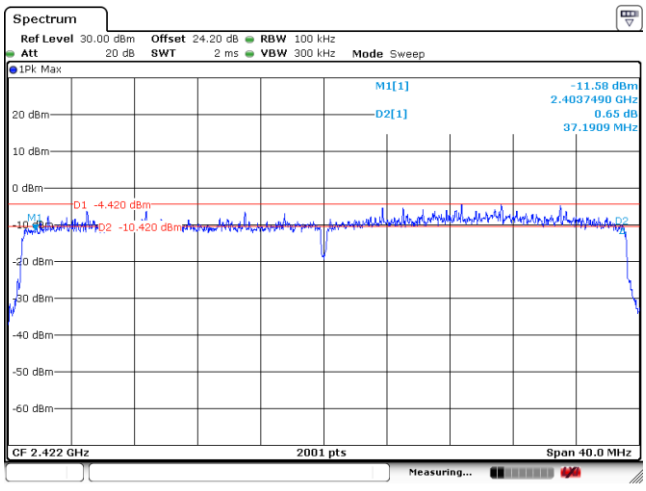
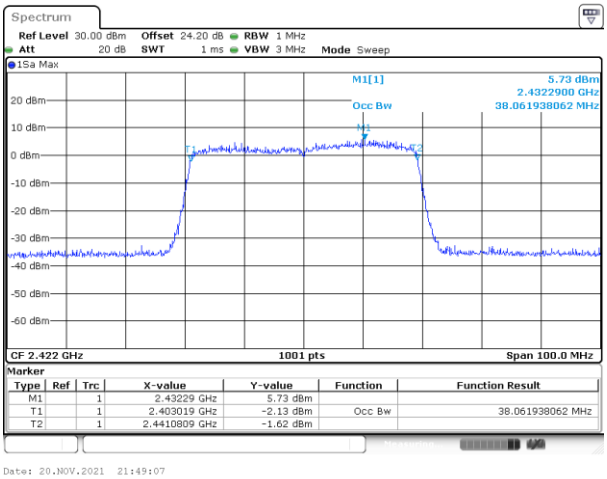
6dB Bandwidth	99% Occupied Bandwidth
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11ax HE20 CH36>

6dB Bandwidth	99% Occupied Bandwidth
	

<802.11ax HE40 CH3>

6dB Bandwidth	99% Occupied Bandwidth
	

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna with directional gain greater than 6 dBi 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 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

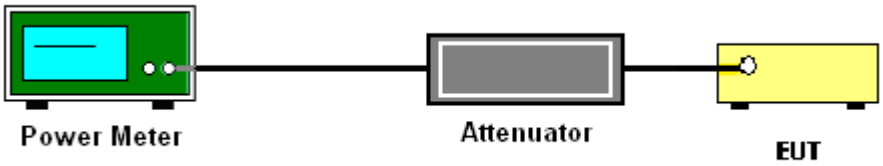
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

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 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to 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.

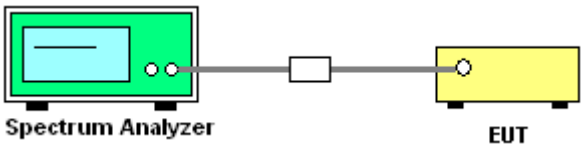
   If measurements performed using method (2) plus 10 log (N) exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

   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)

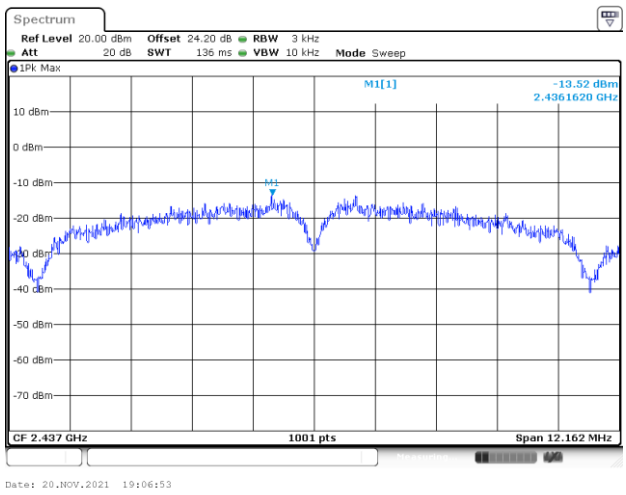
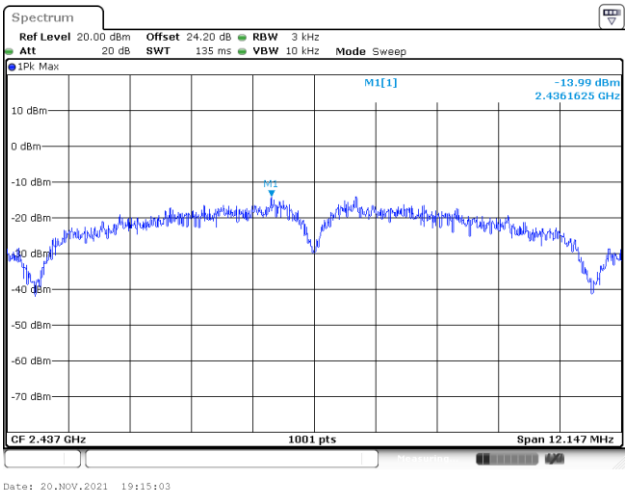
3.3.4 Test Setup



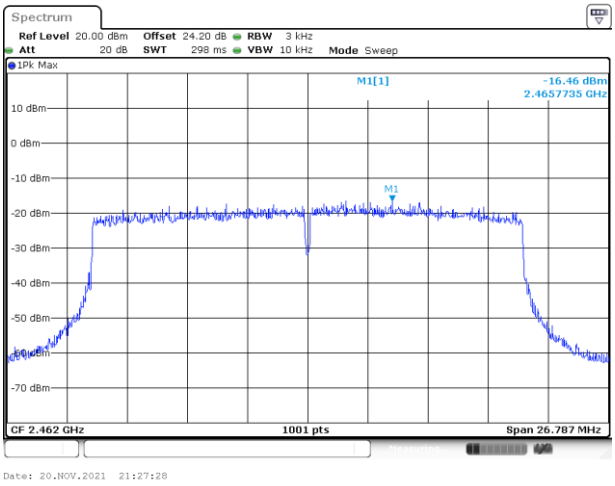
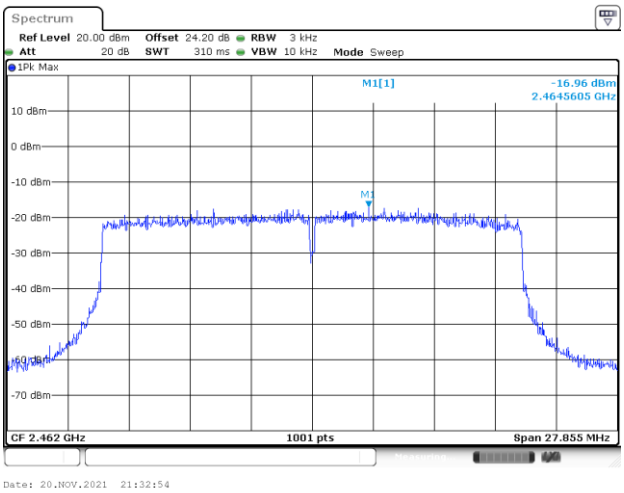
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

<802.11b/g/n/ac Mode>

Worst Case Power Density (dBm/3kHz)	
MIMO Ant. 3	MIMO Ant. 4
	

<802.11ax Mode>

Worst Case Power Density (dBm/3kHz)	
MIMO Ant. 3	MIMO Ant. 4
	

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.

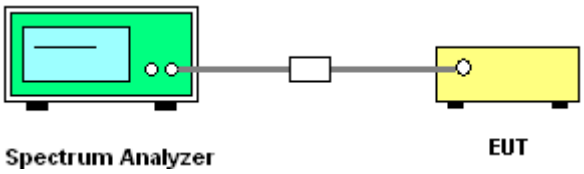
3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to 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.

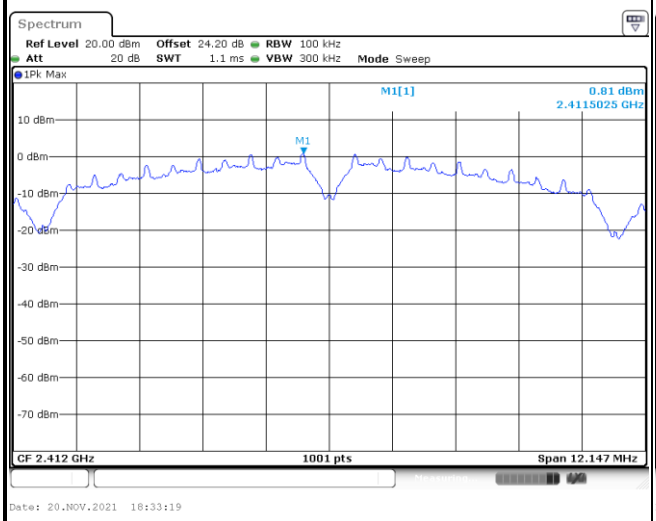
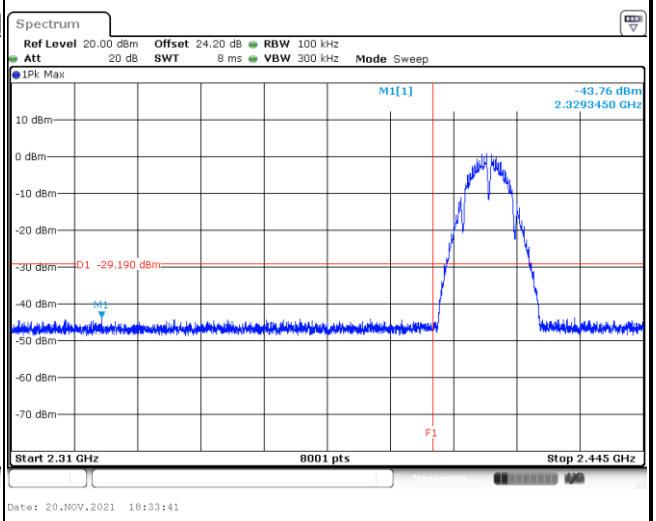
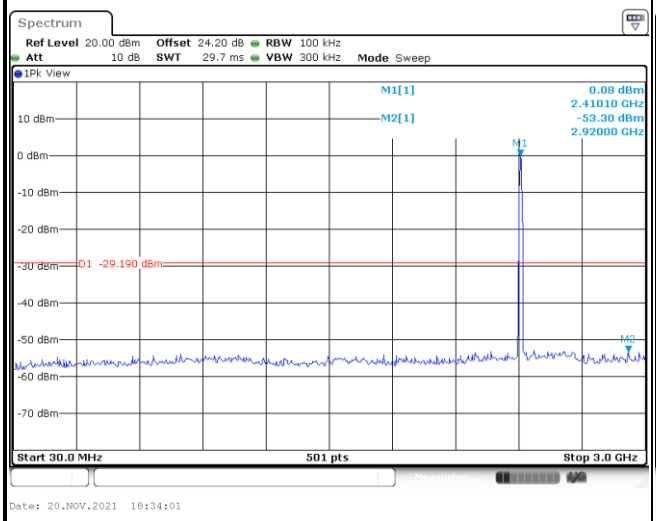
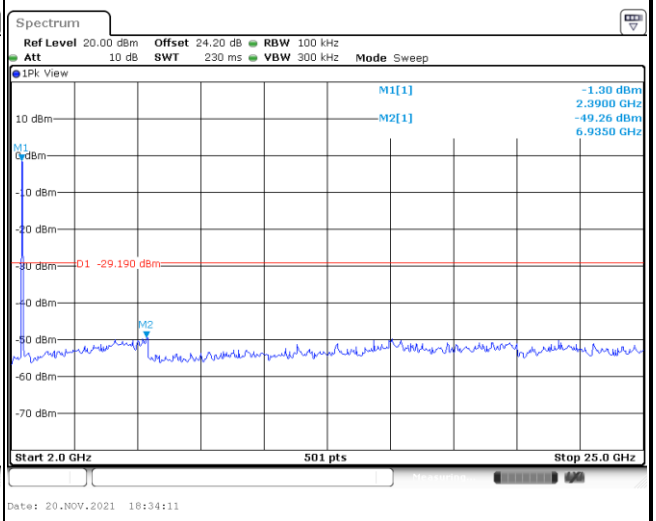
3.4.4 Test Setup



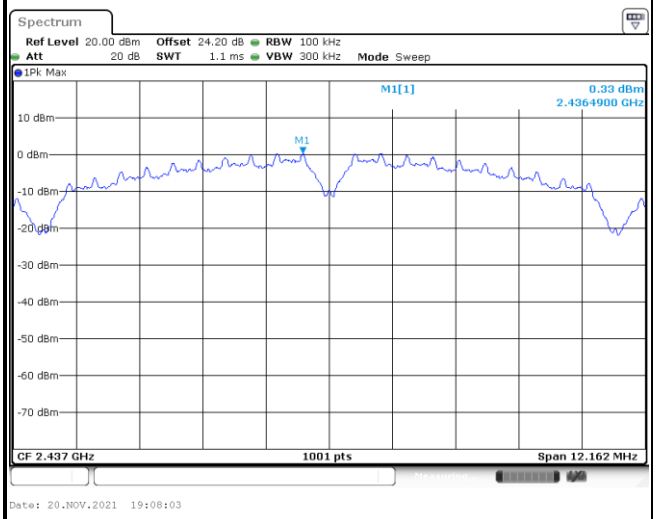
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

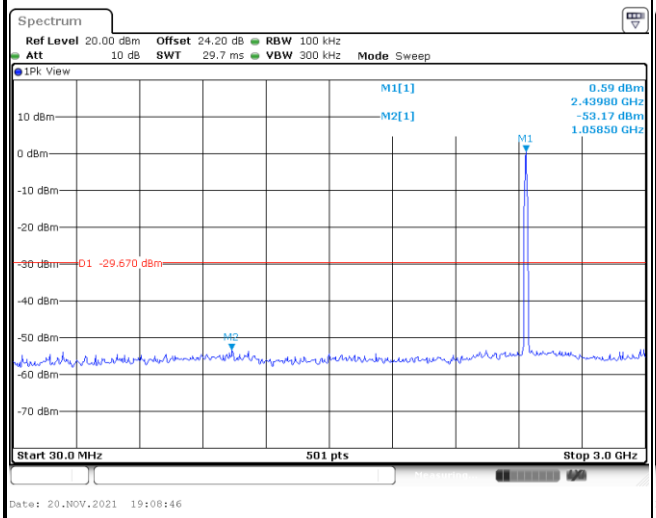
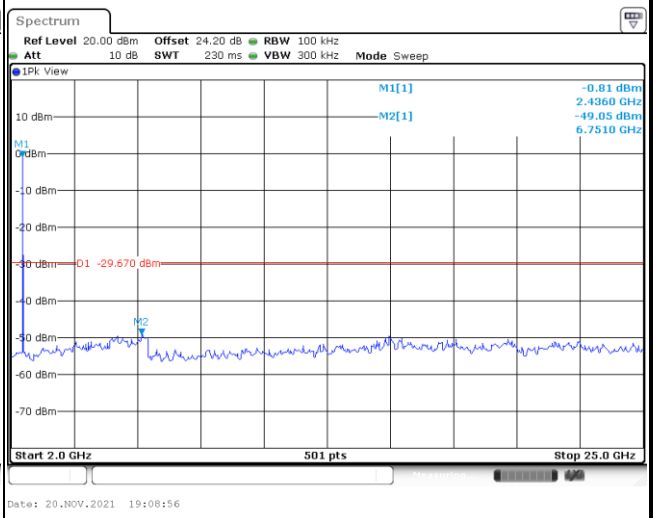
Number of TX = 2, Ant. 3 (Measured)

Test Mode :	802.11b	Test Channel :	01

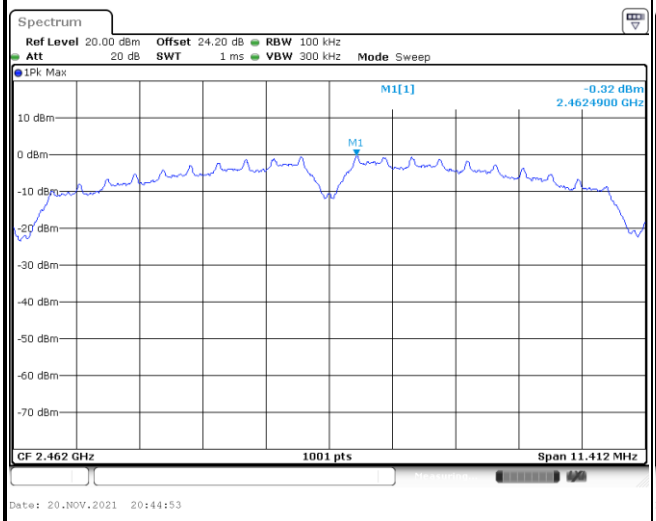
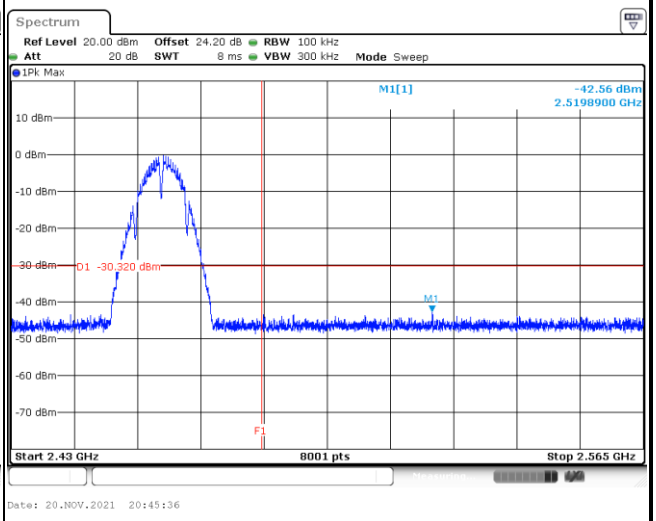
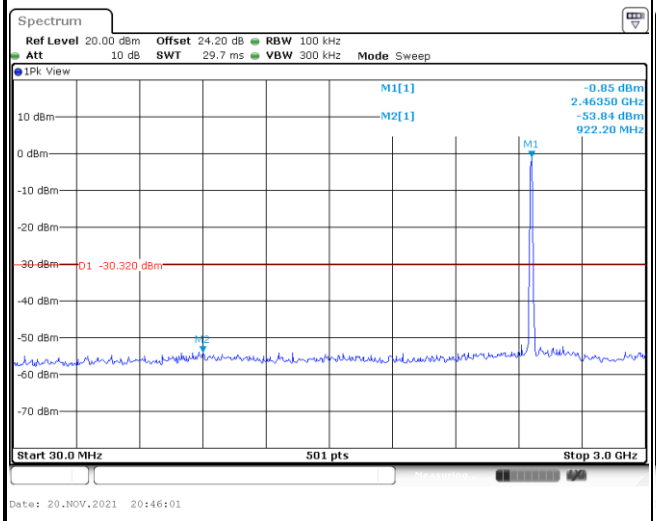
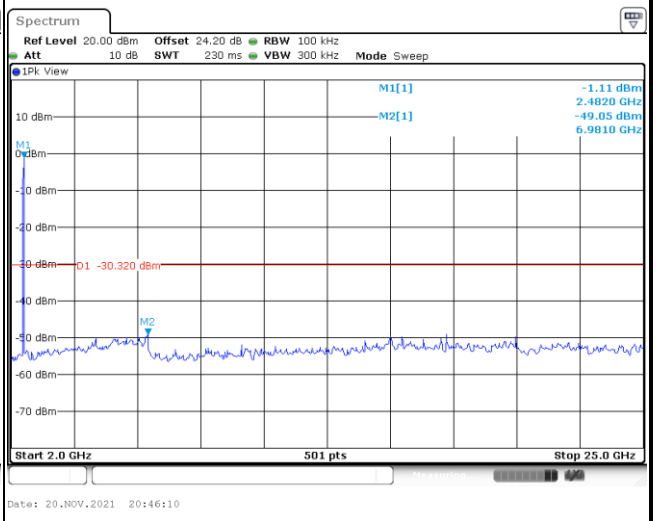
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11b	Test Channel :	06

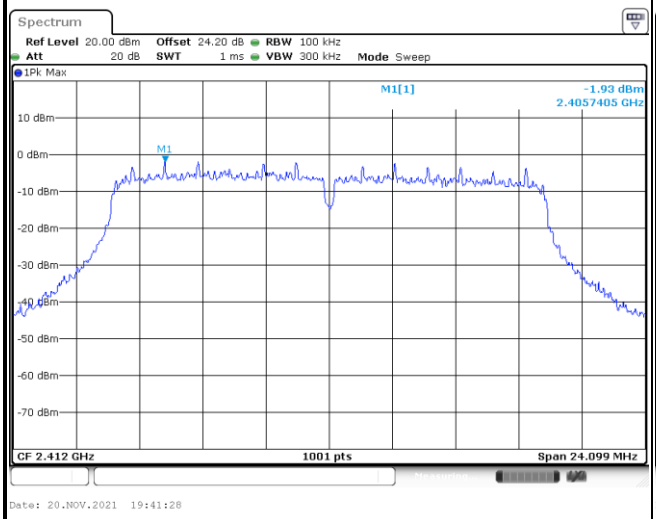
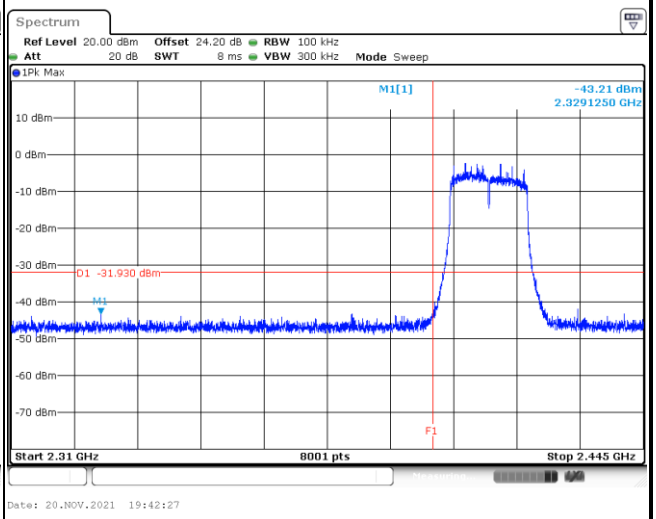
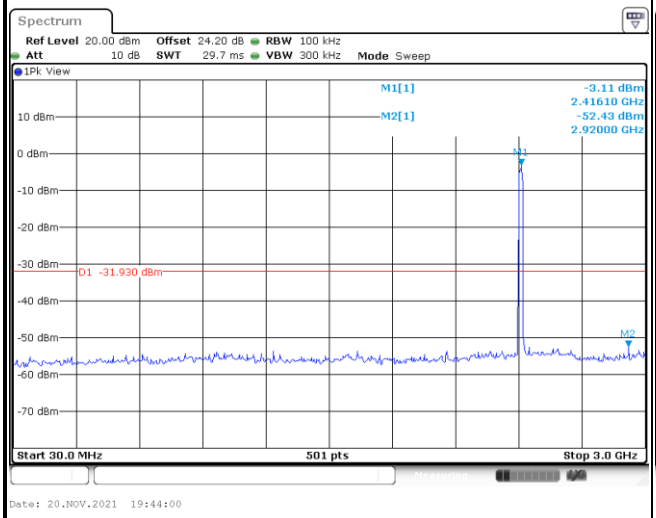
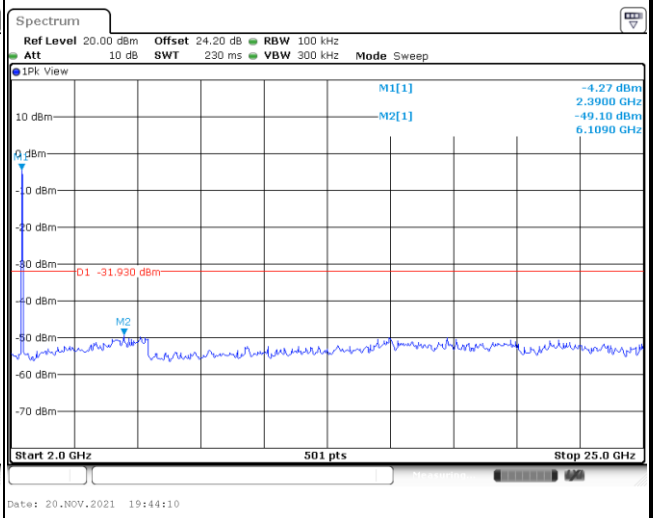
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

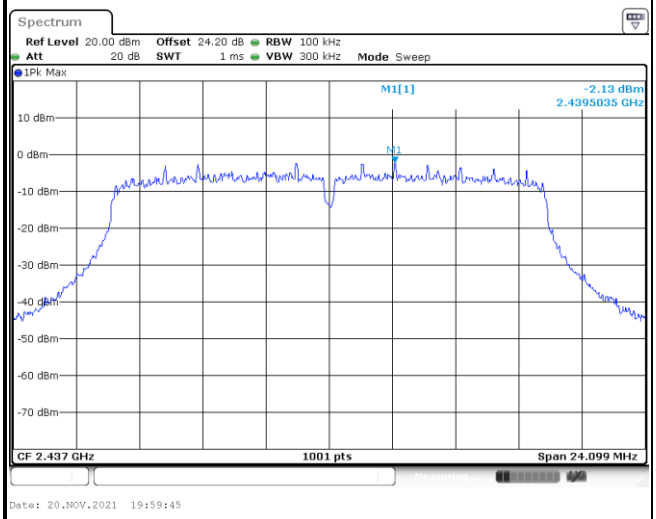
Test Mode :	802.11b	Test Channel :	11

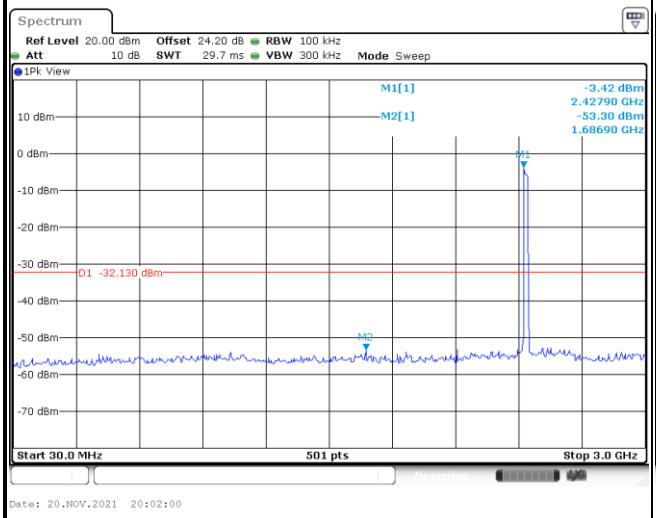
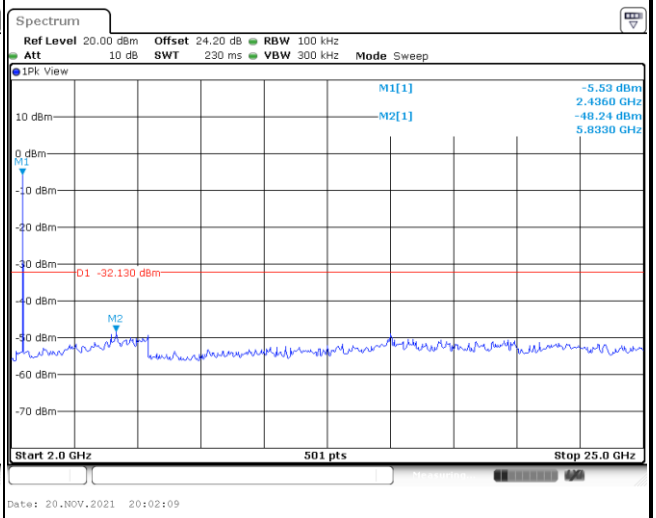
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	01

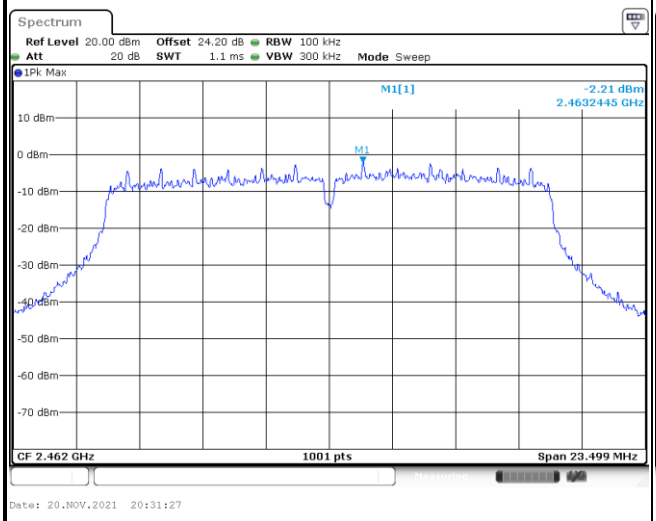
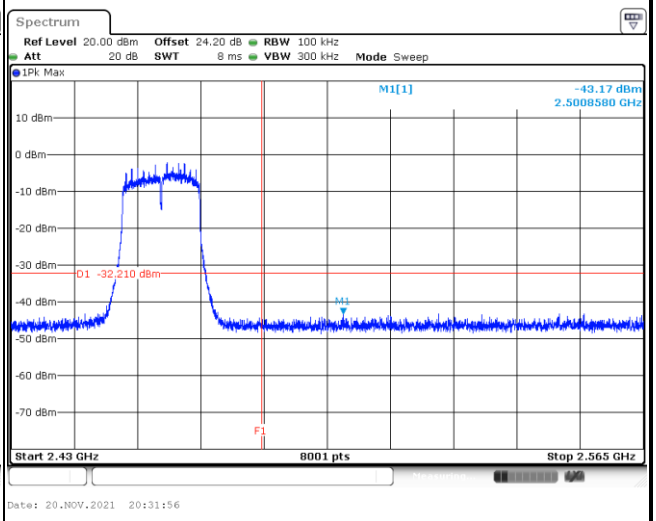
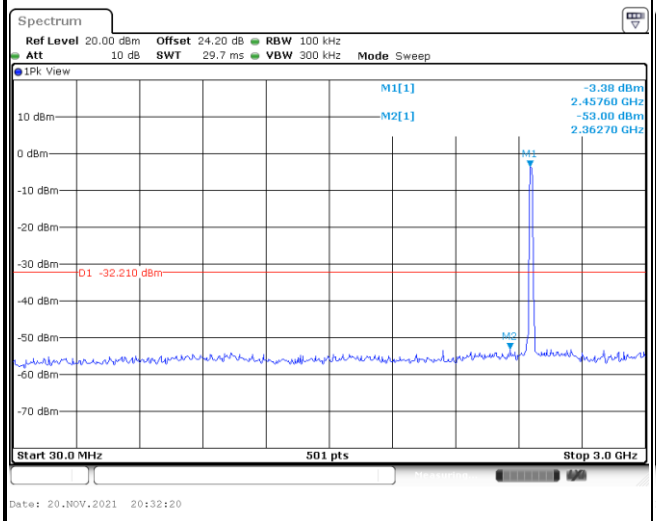
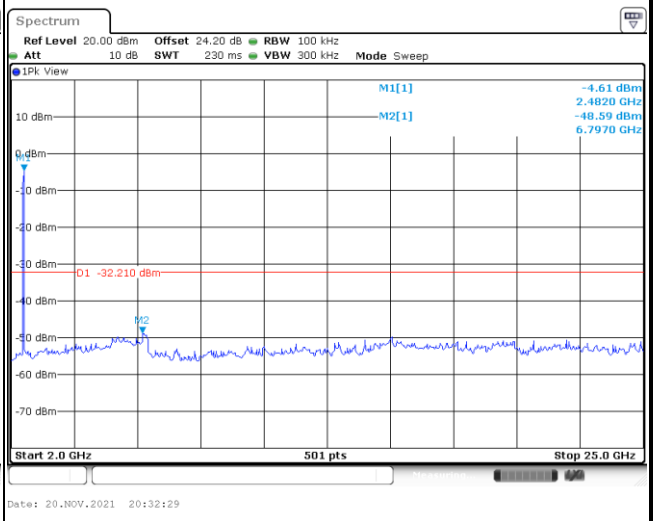
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	06

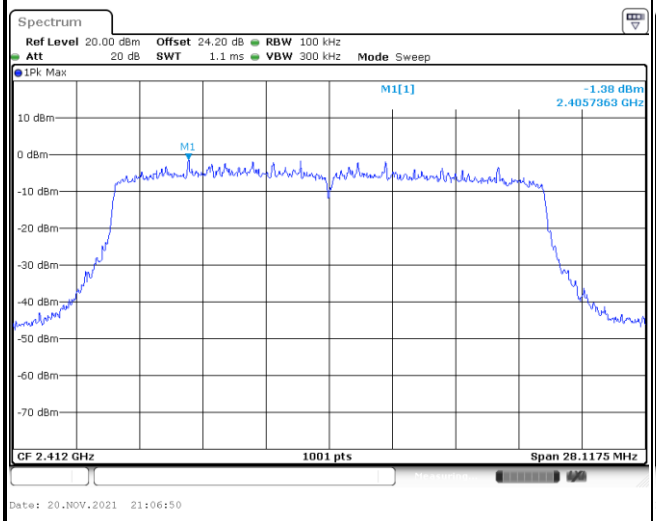
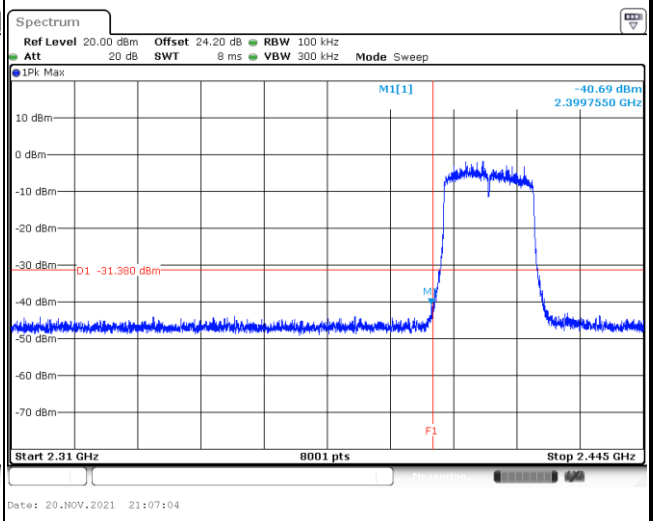
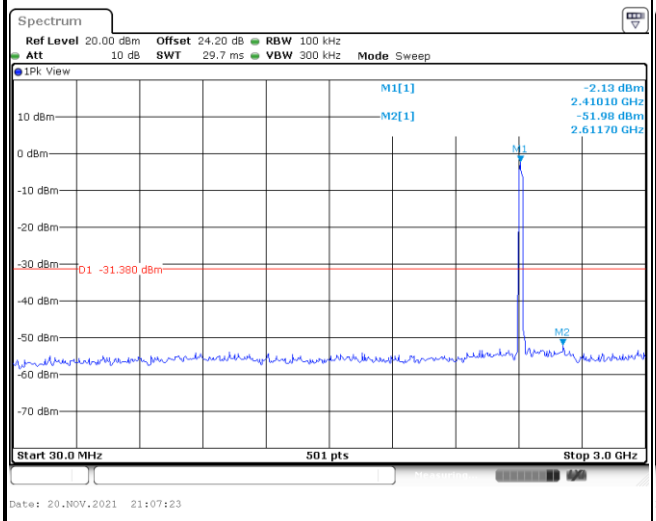
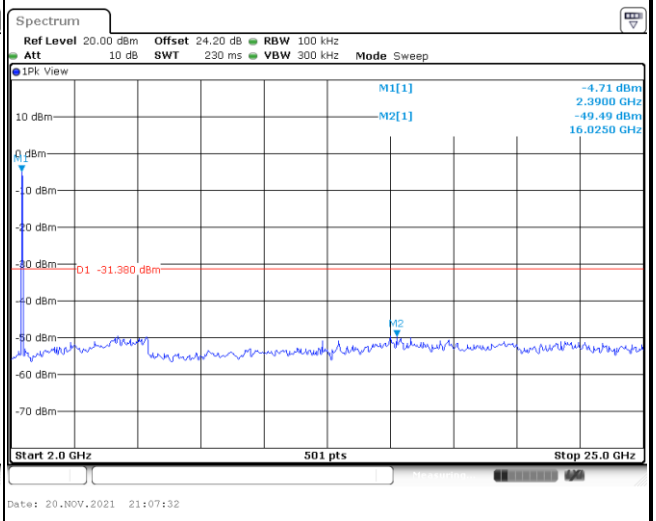
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

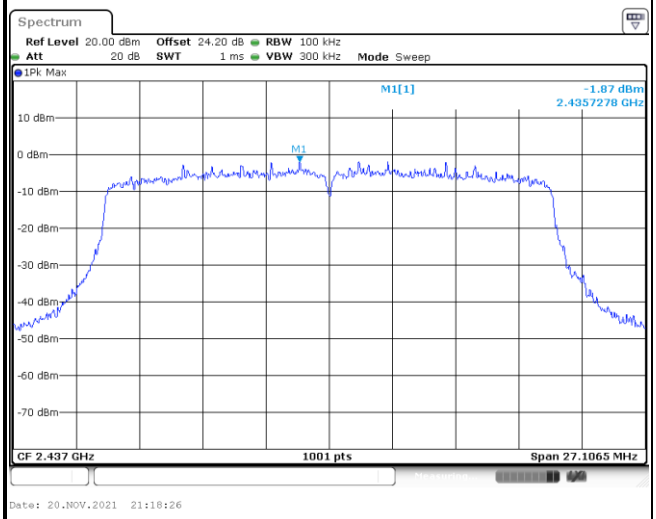
Test Mode :	802.11g	Test Channel :	11

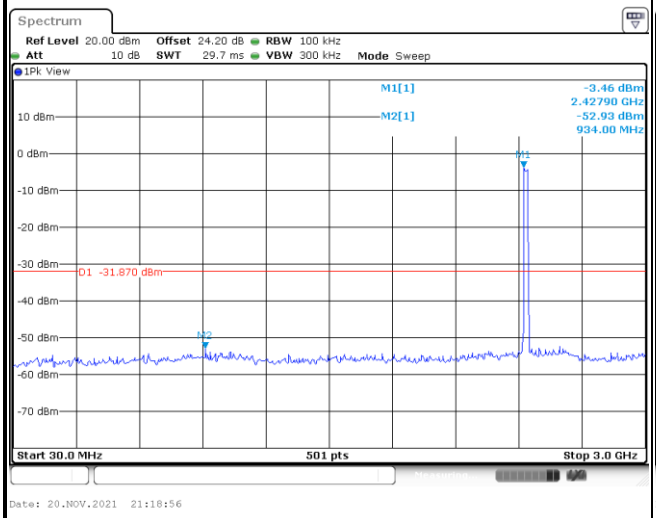
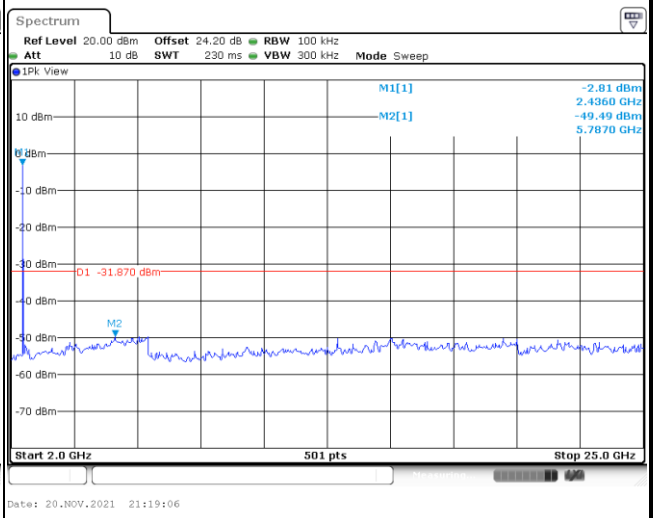
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	01 Full RU

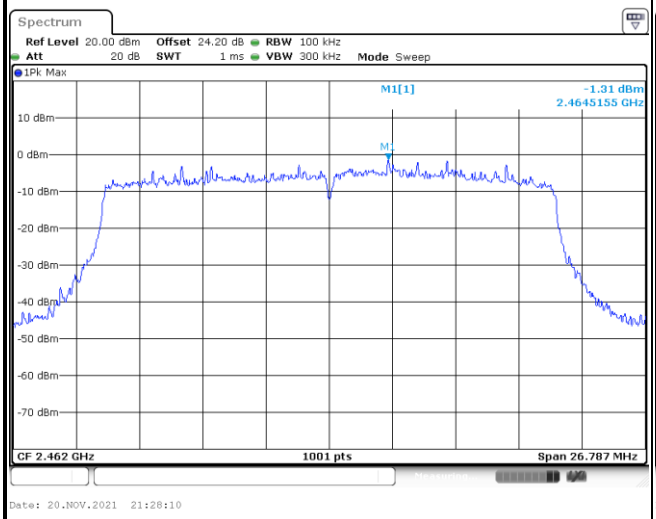
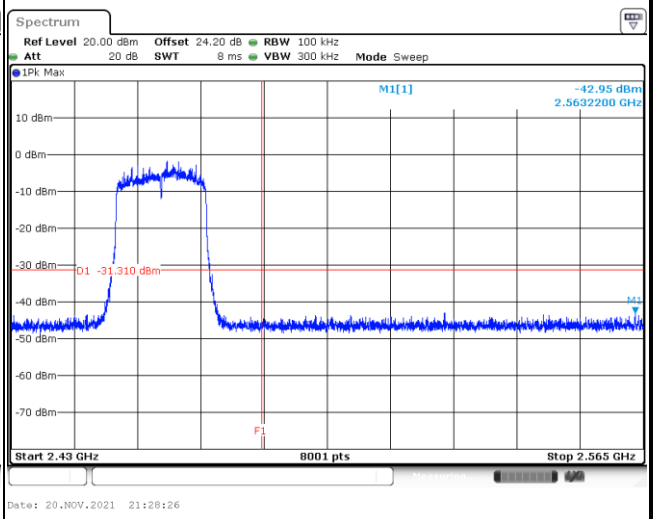
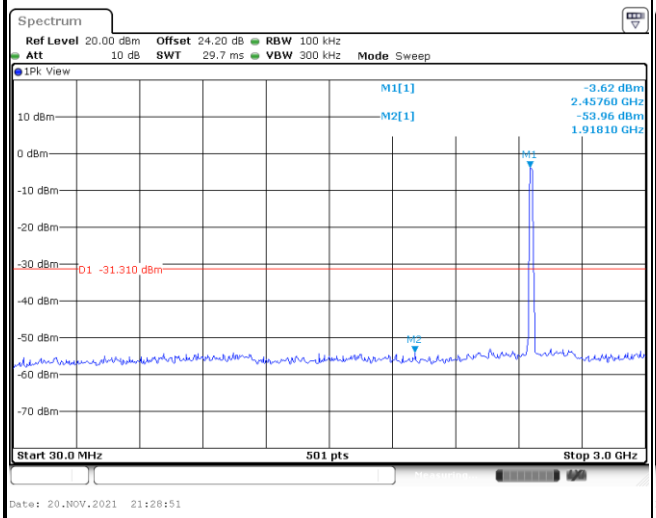
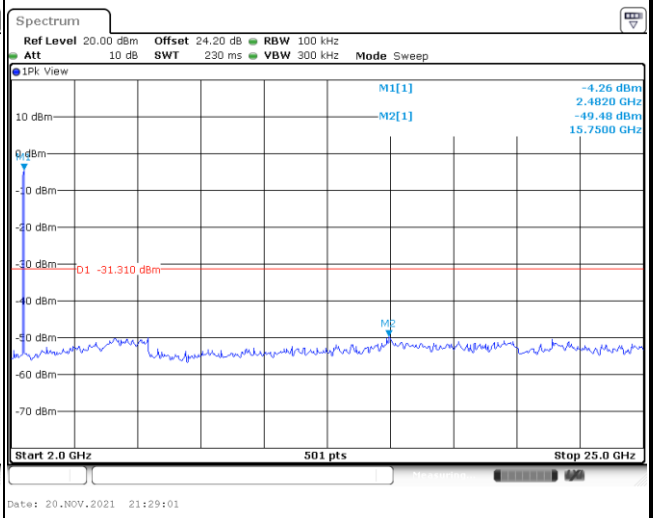
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	06 Full RU

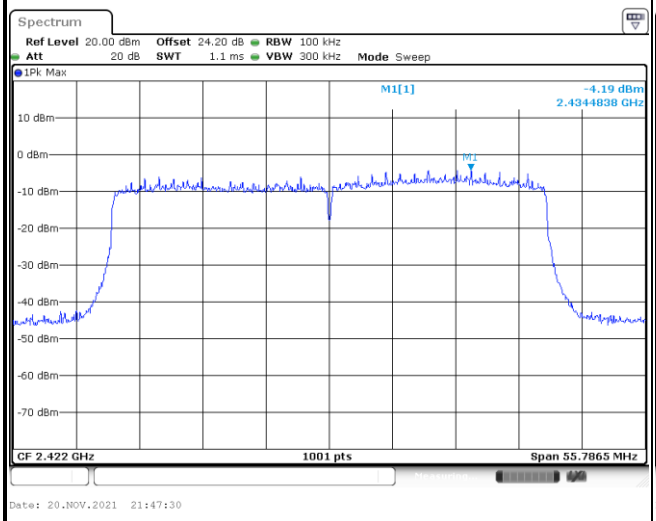
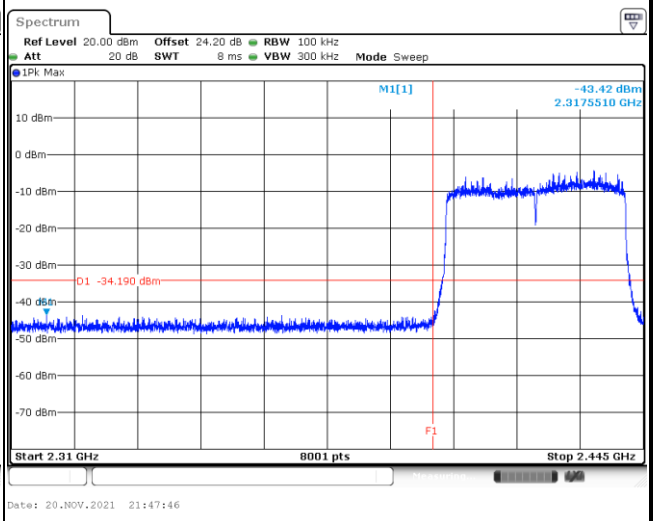
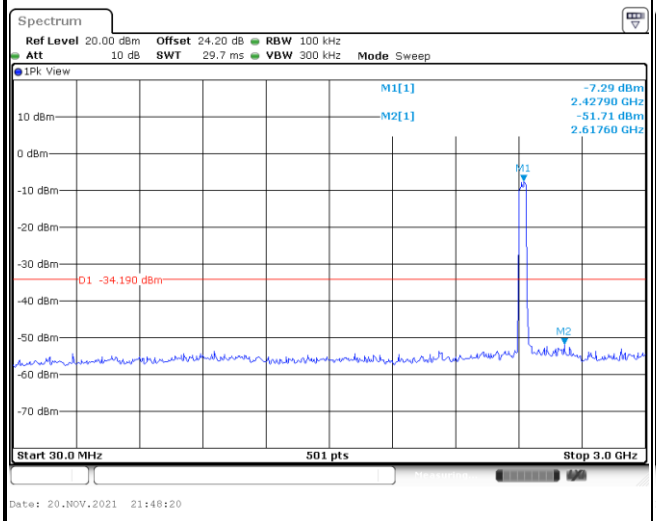
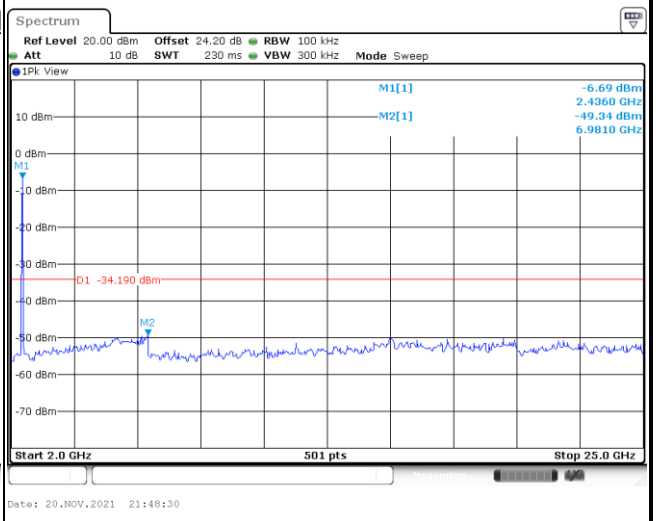
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

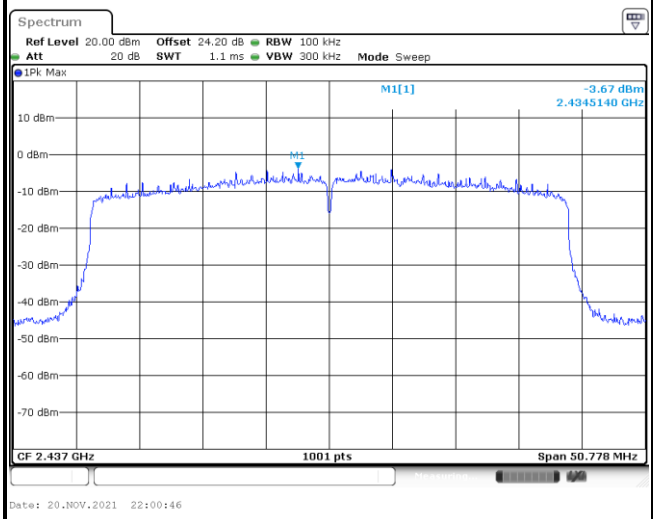
Test Mode :	802.11ax HE20	Test Channel :	11 Full RU

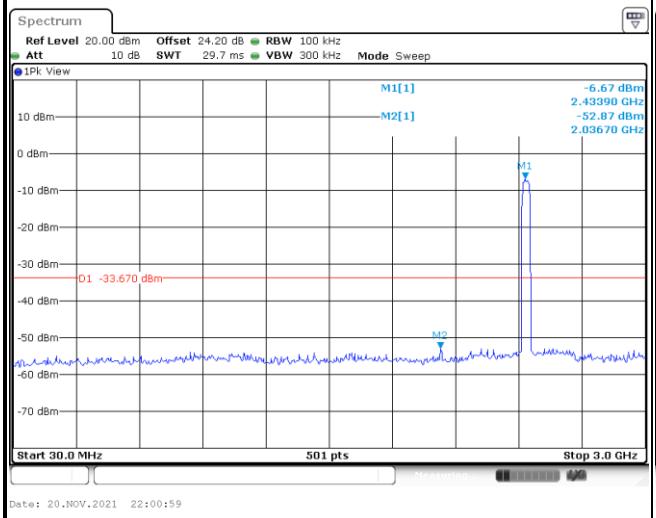
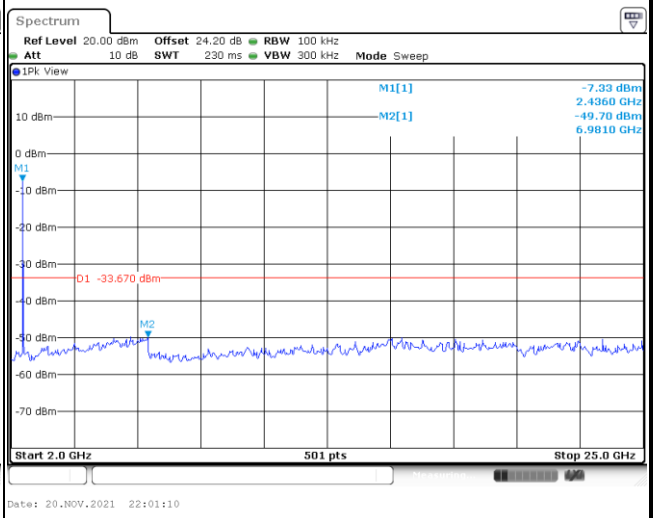
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	03 Full RU

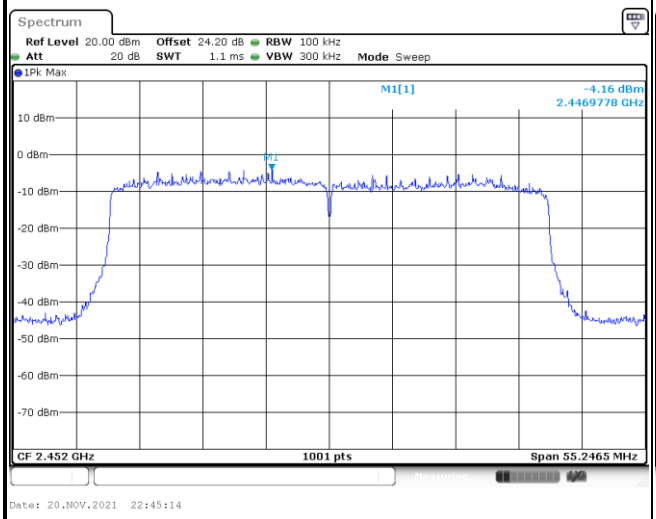
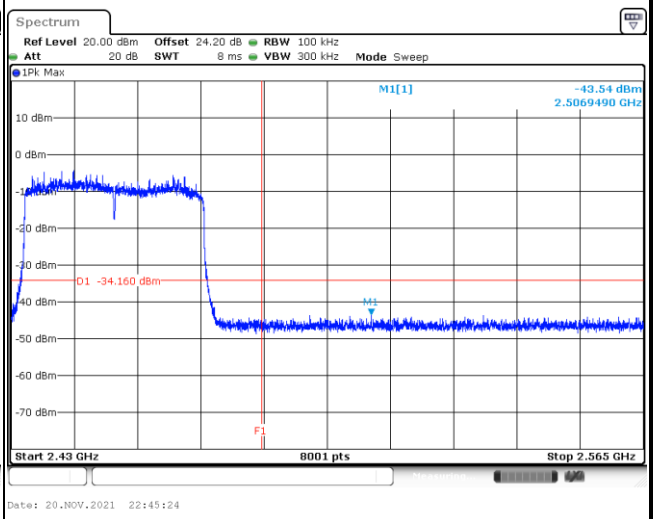
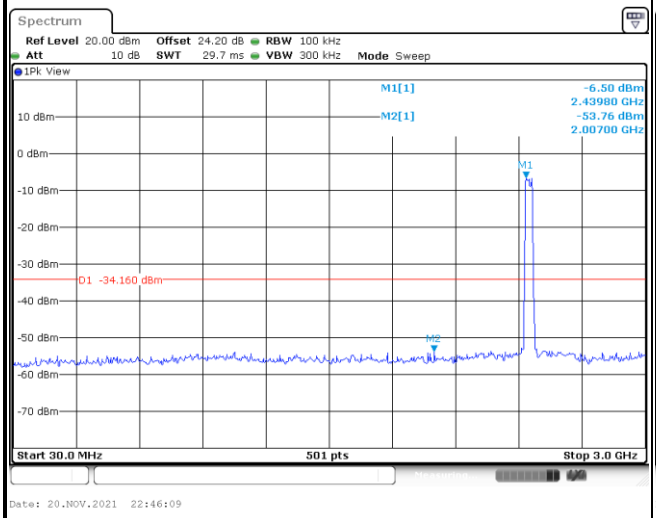
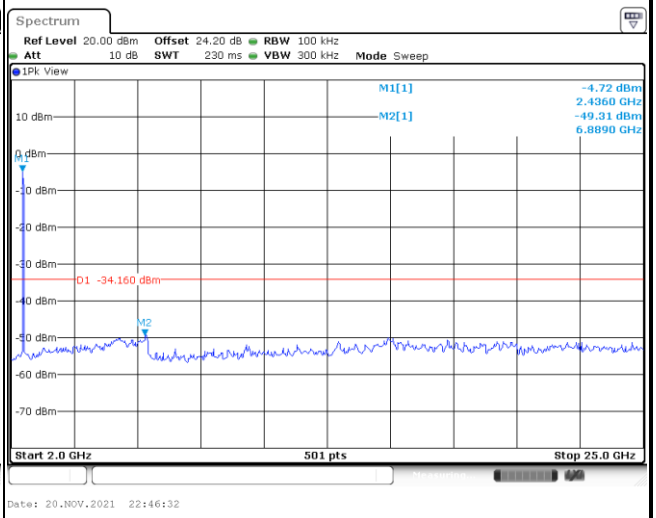
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	06 Full RU

100kHz PSD reference Level	Mid Channel Plot
	

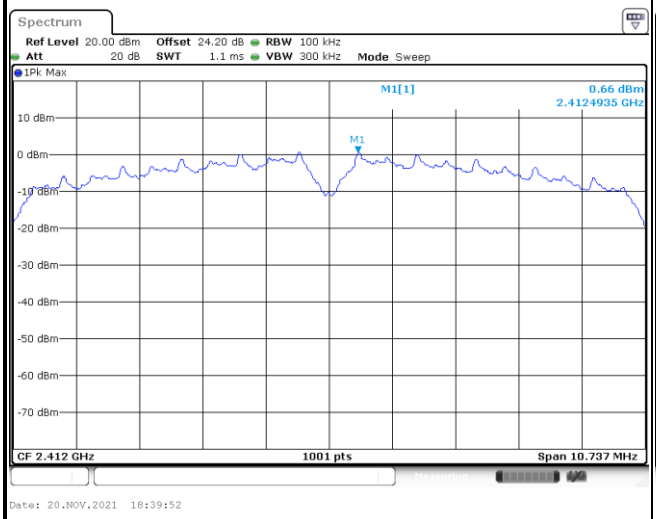
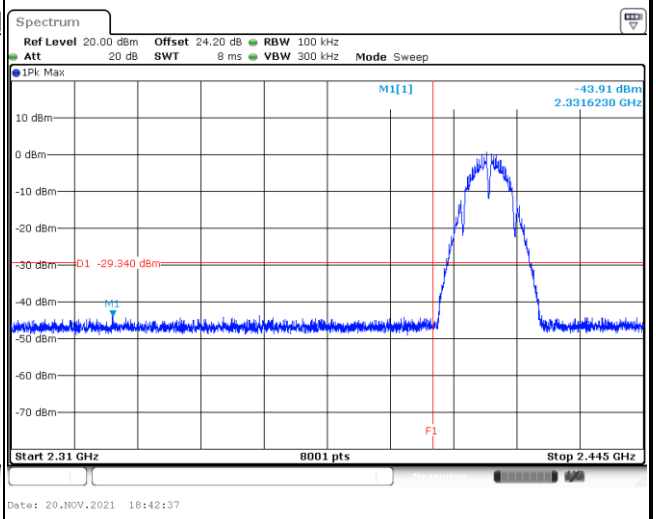
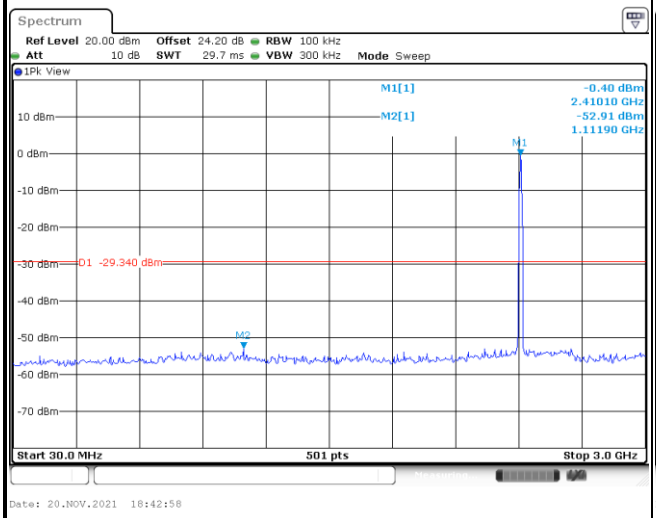
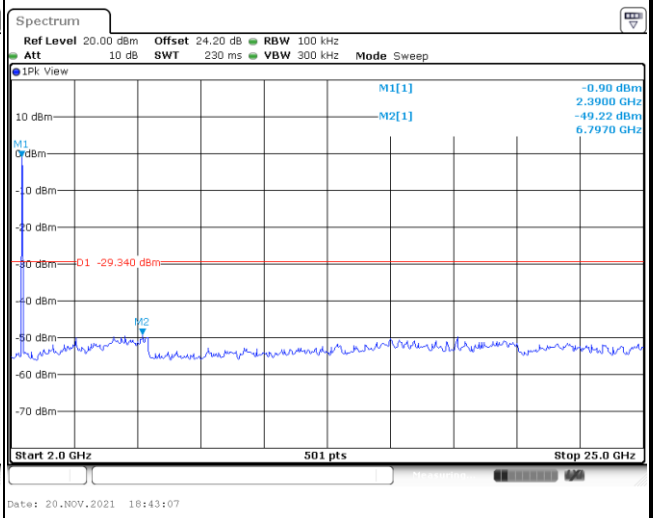
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11ax HE40	Test Channel :	09 Full RU

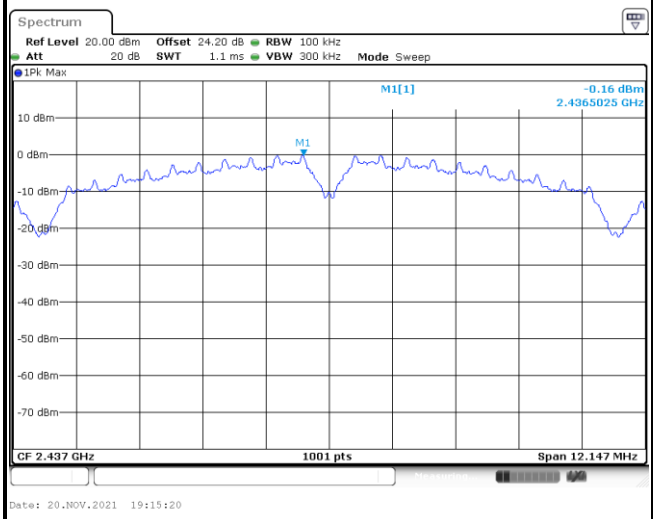
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

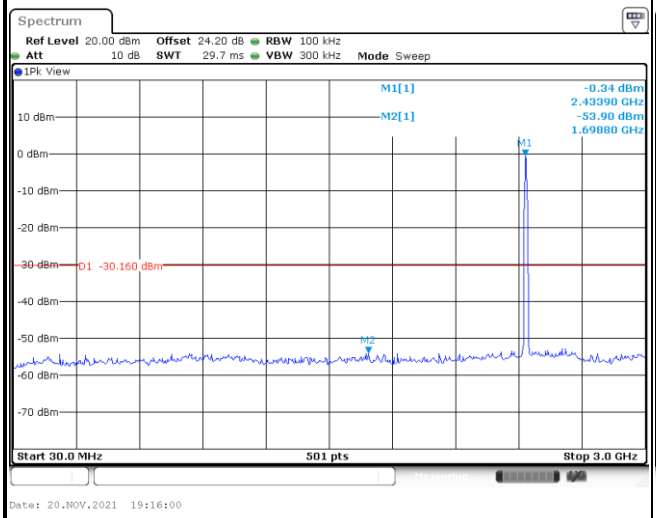
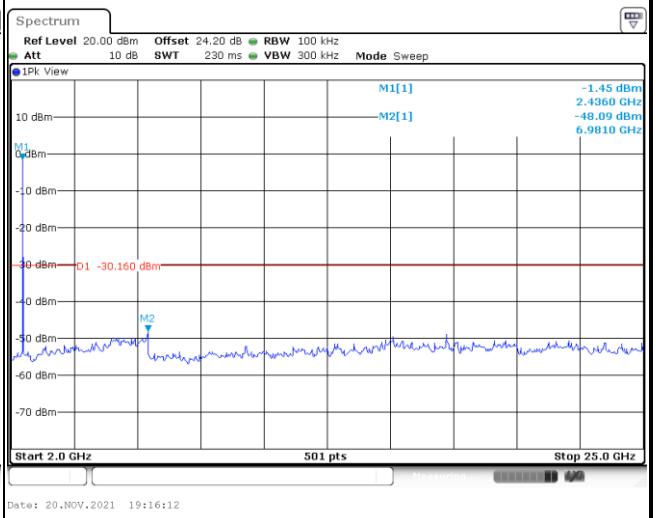
Number of TX = 2, Ant. 4 (Measured)

Test Mode :	802.11b	Test Channel :	01

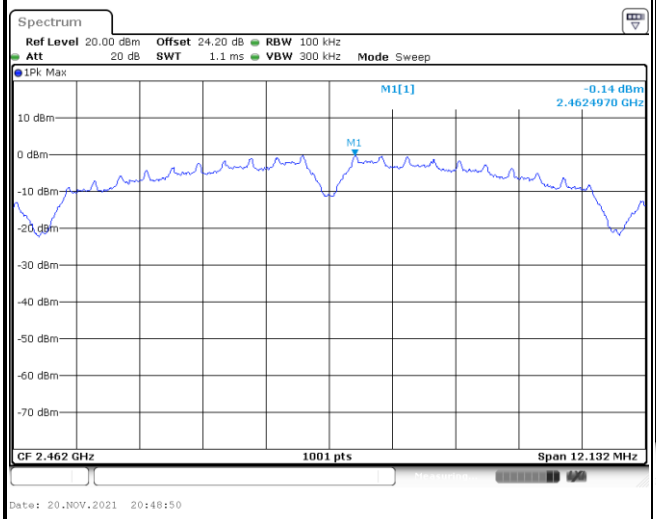
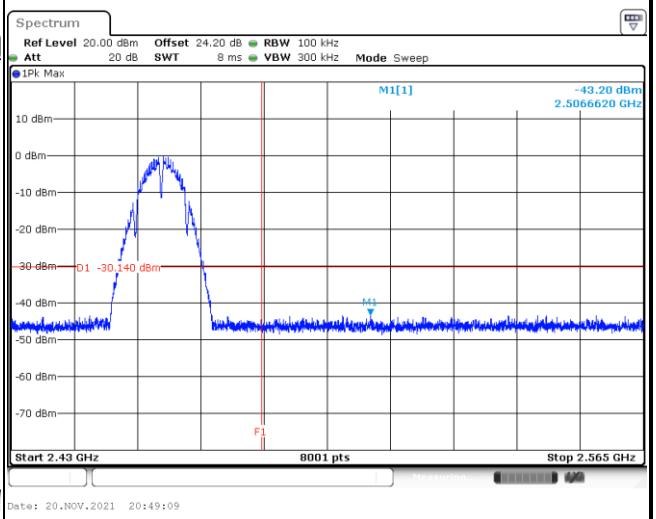
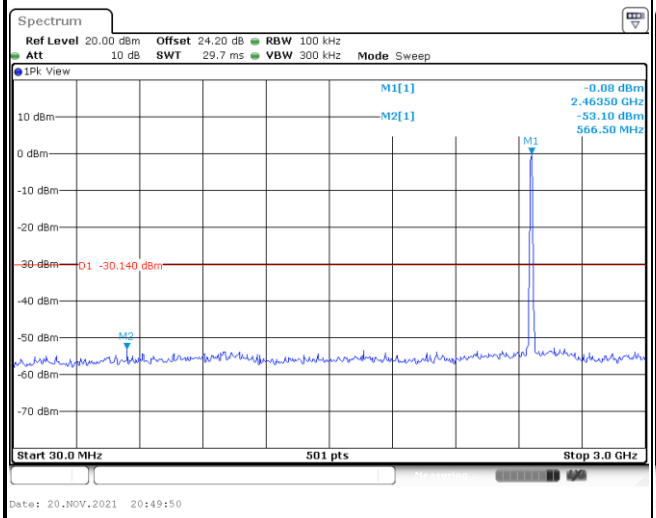
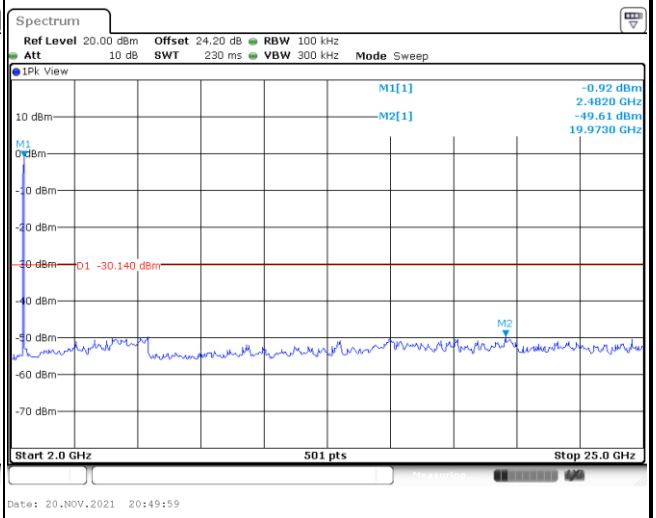
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11b	Test Channel :	06

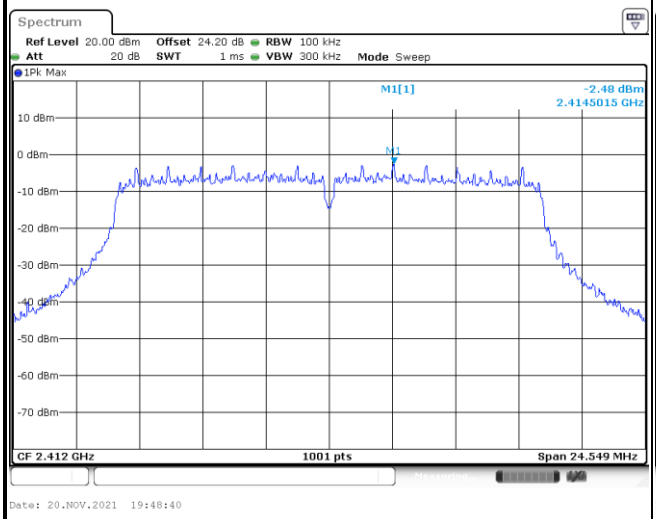
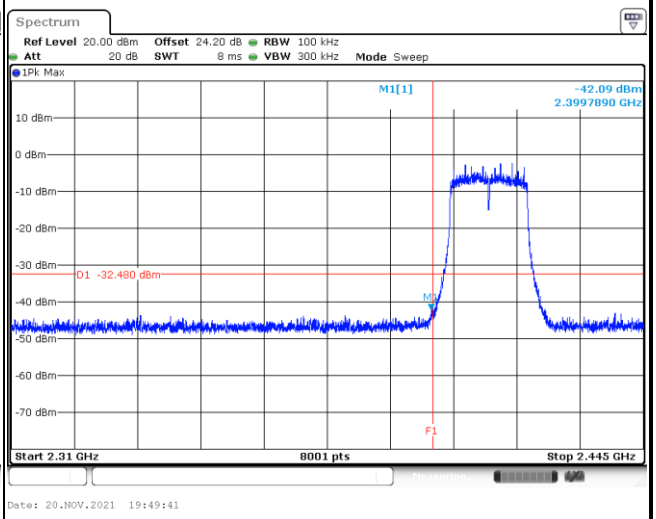
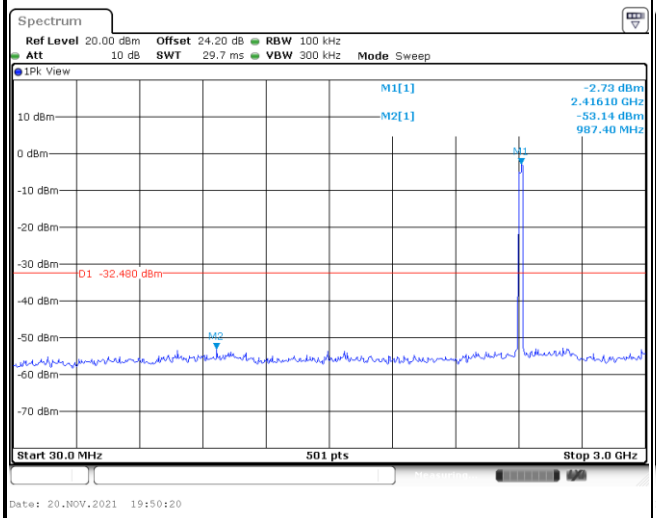
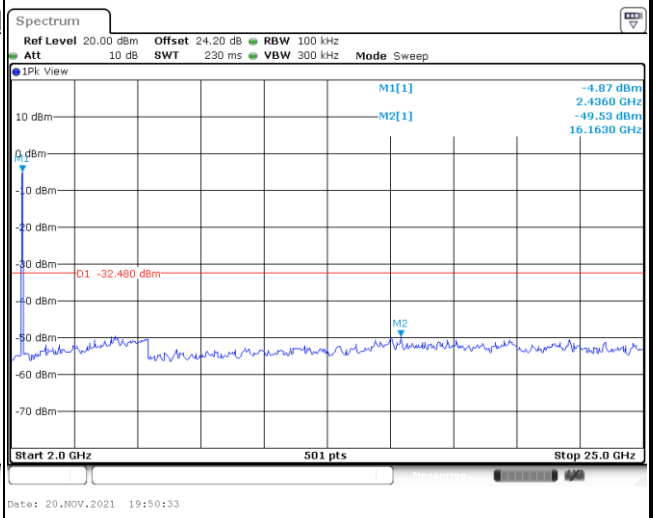
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

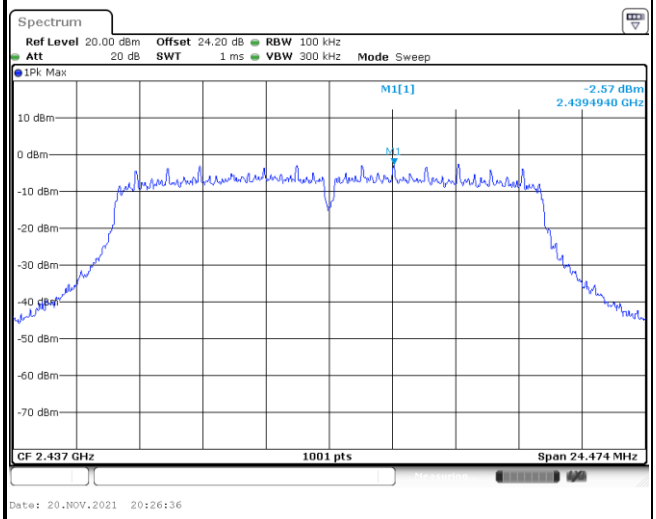
Test Mode :	802.11b	Test Channel :	11

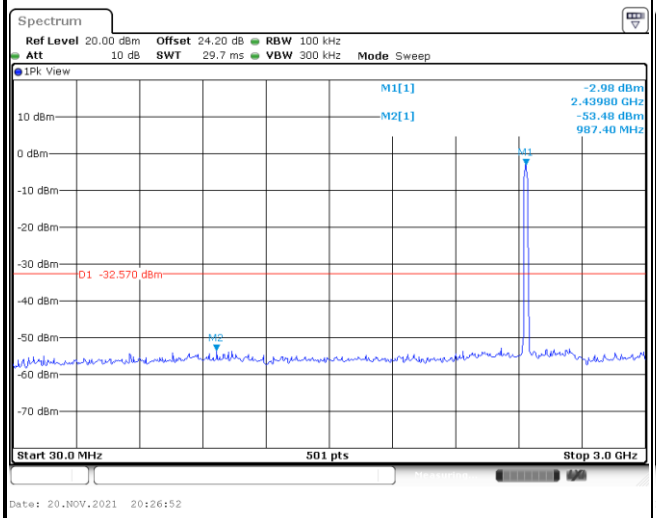
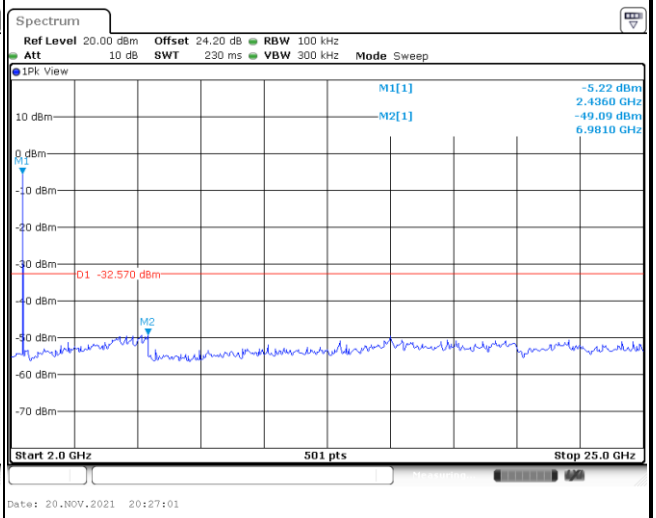
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	01

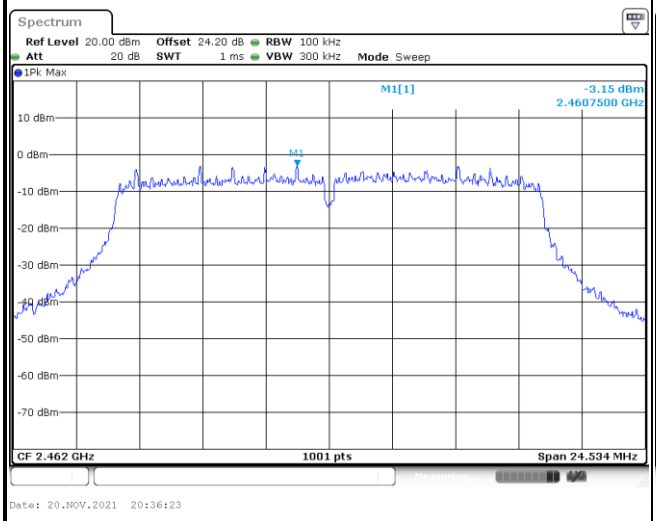
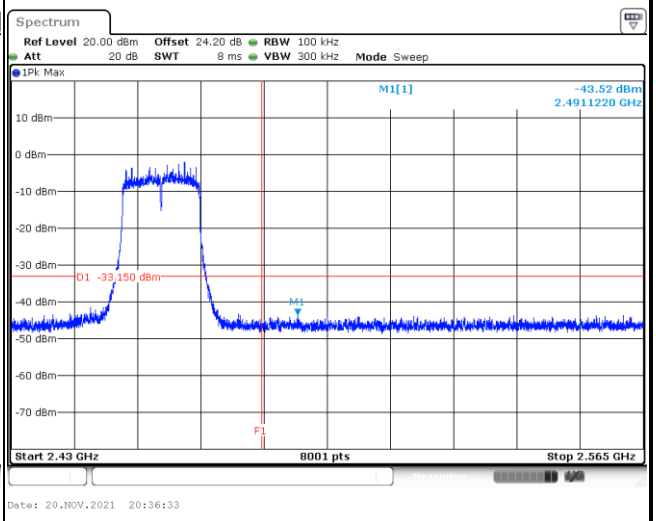
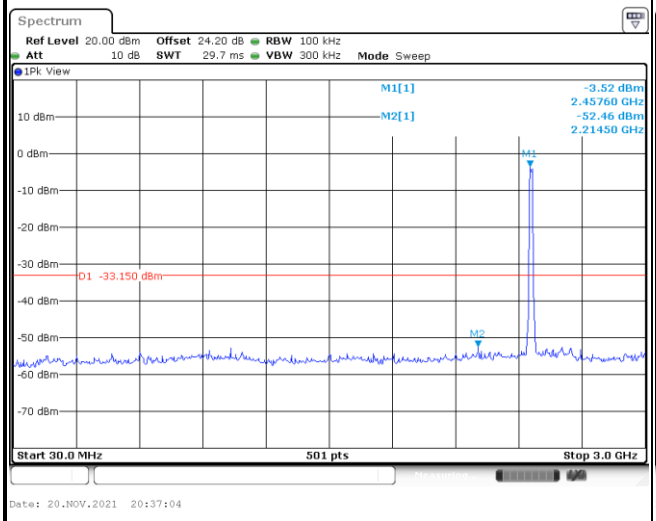
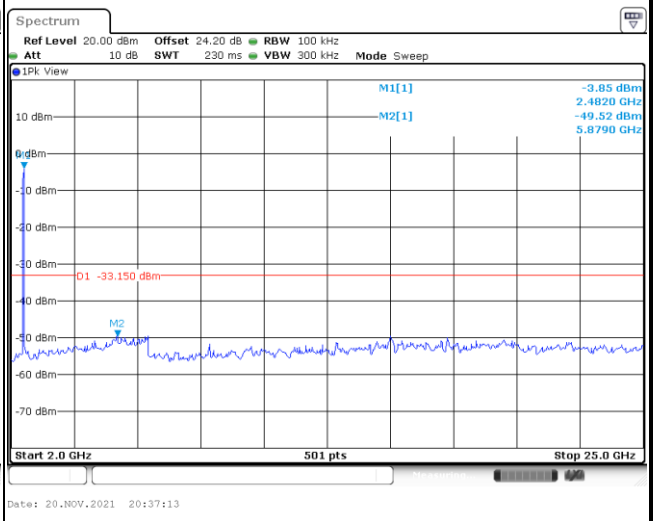
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	06

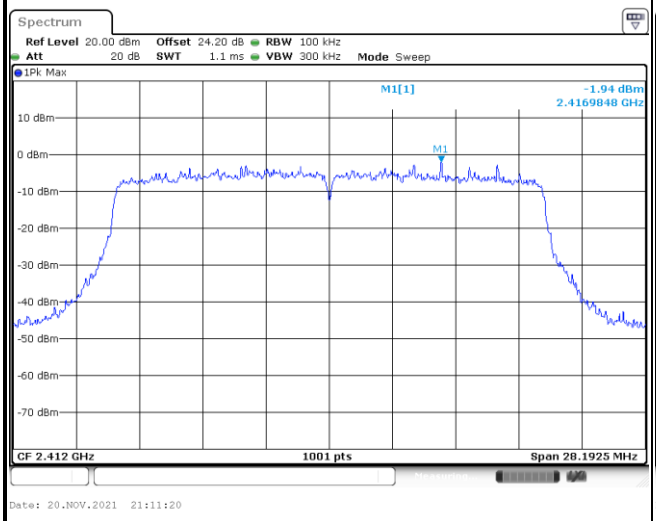
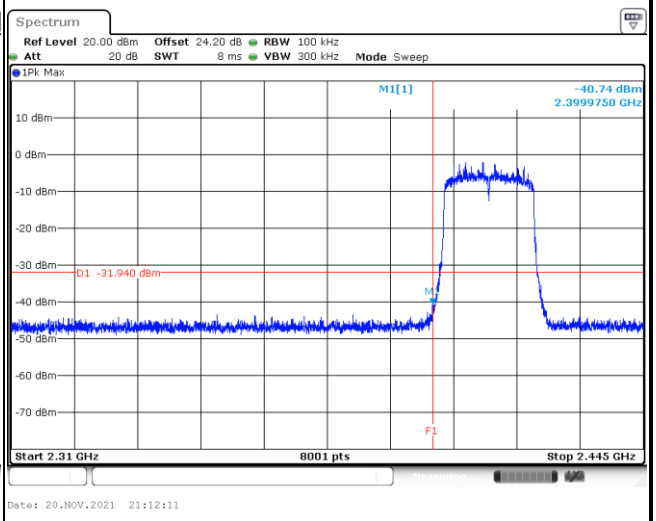
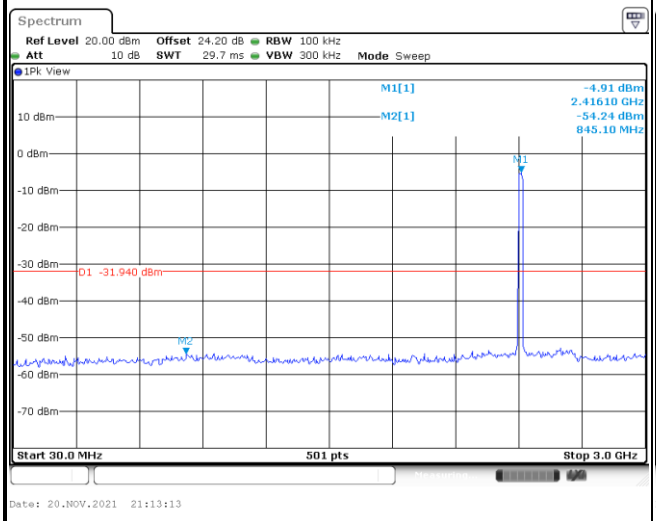
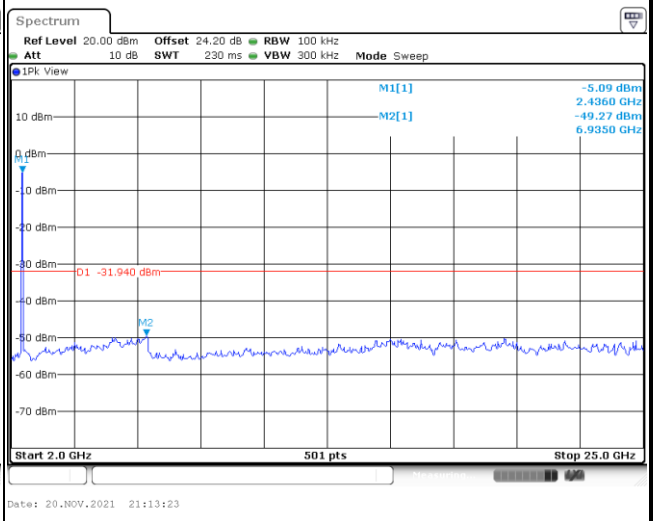
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

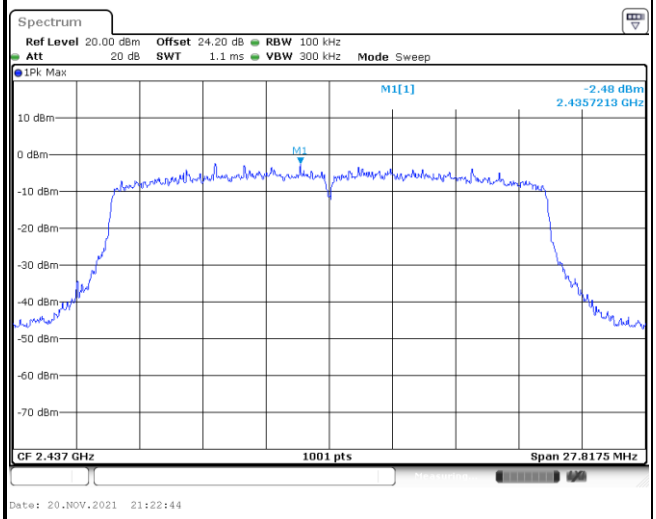
Test Mode :	802.11g	Test Channel :	11

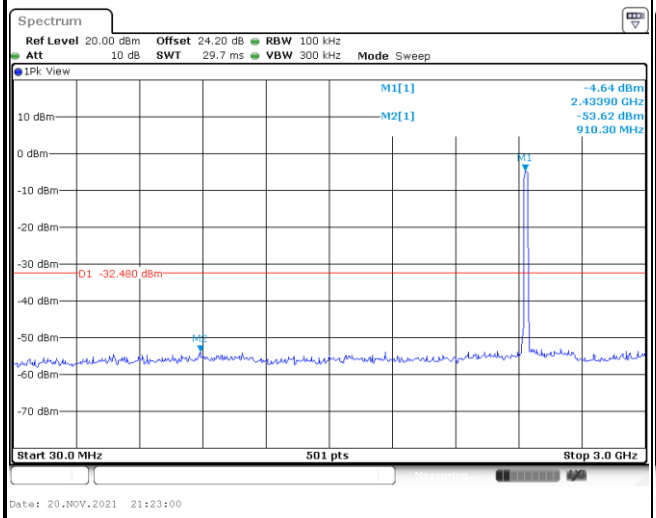
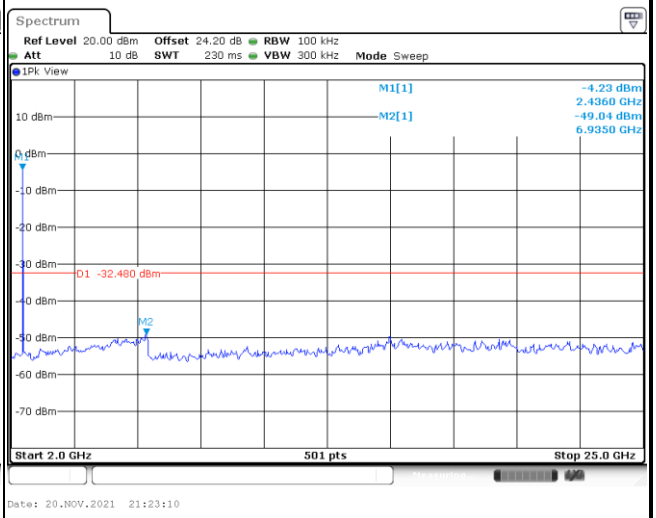
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	01 Full RU

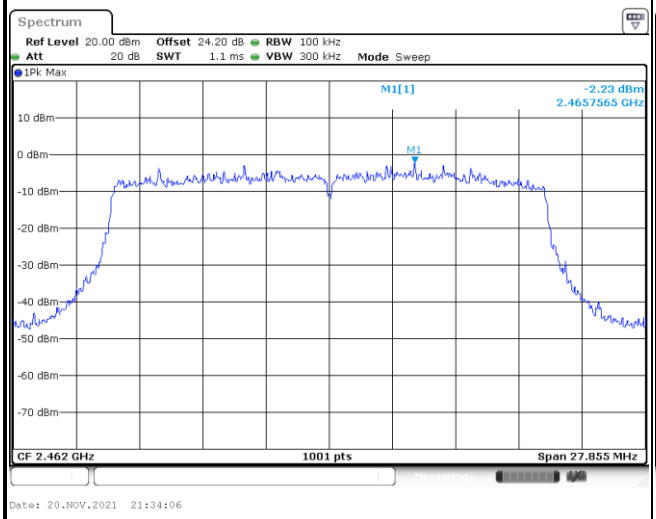
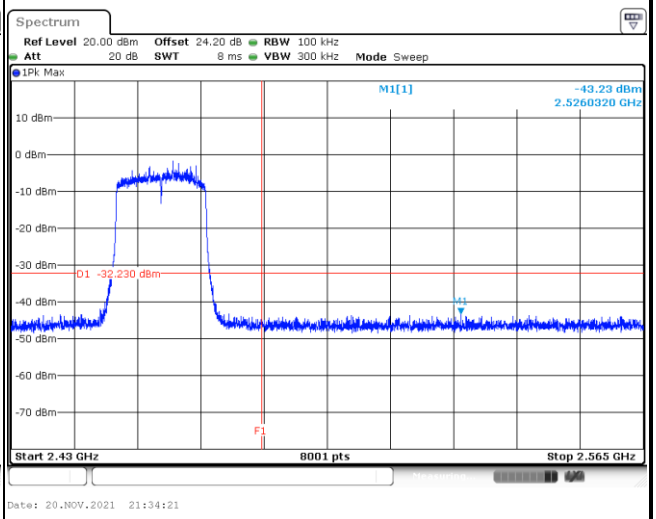
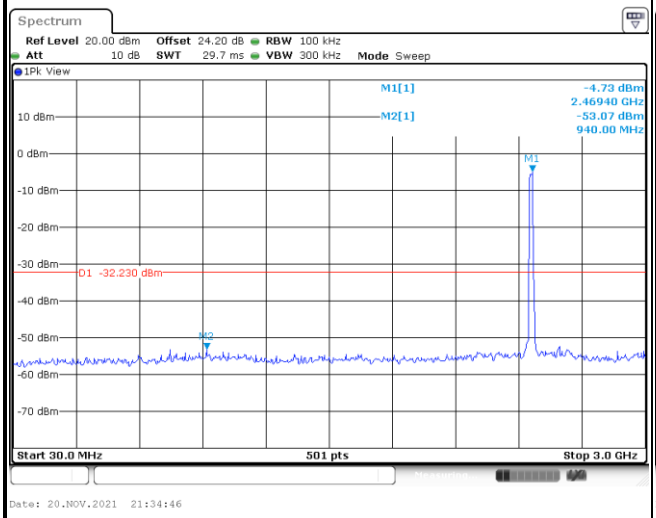
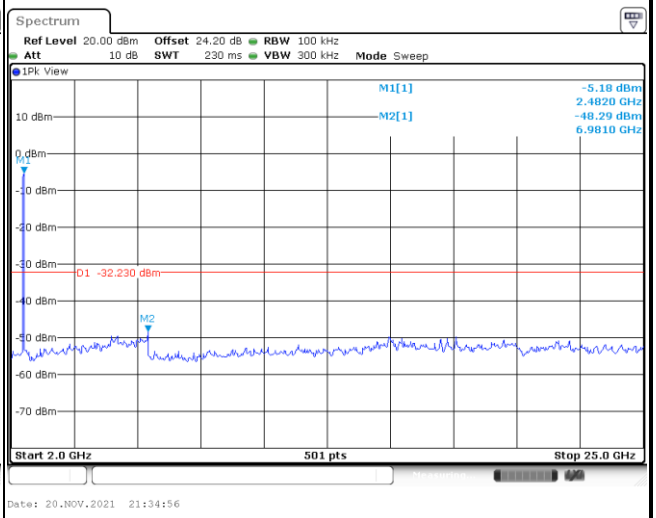
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	06 Full RU

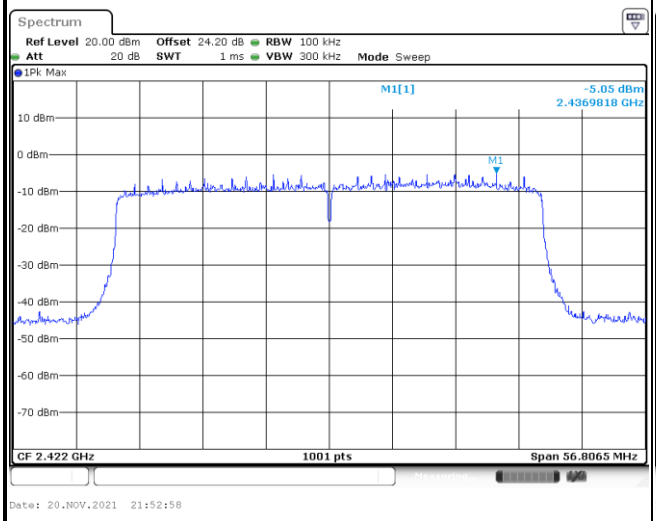
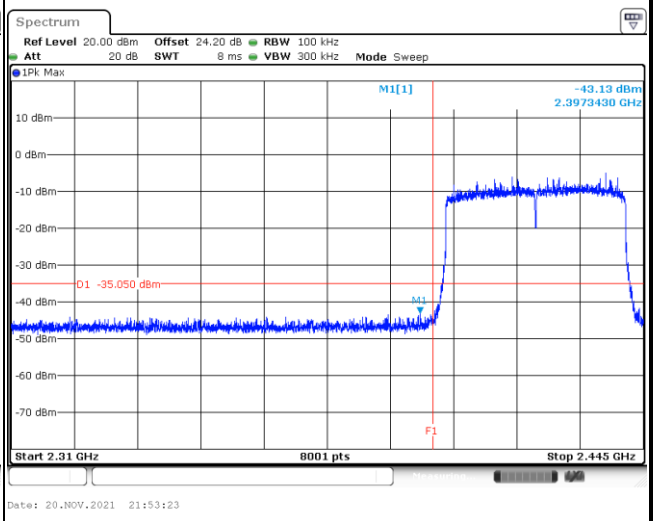
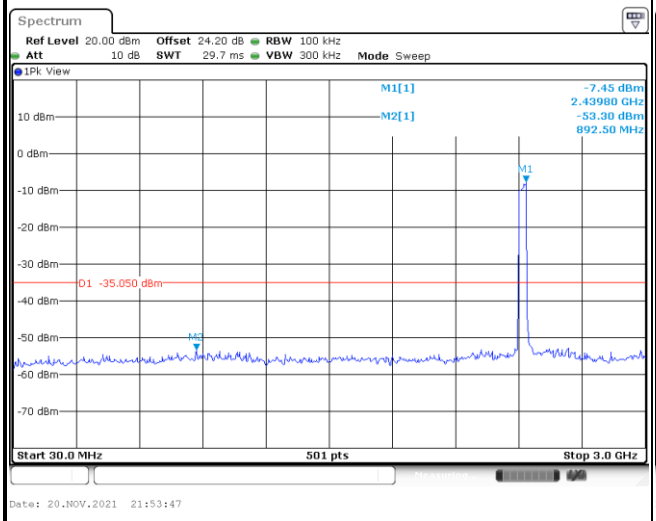
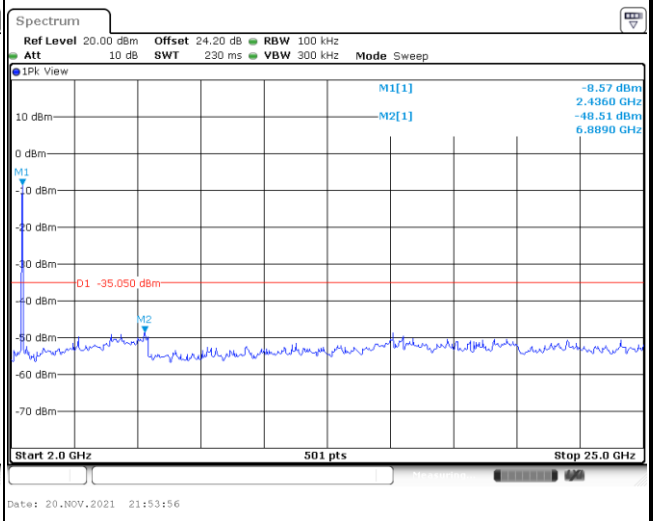
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

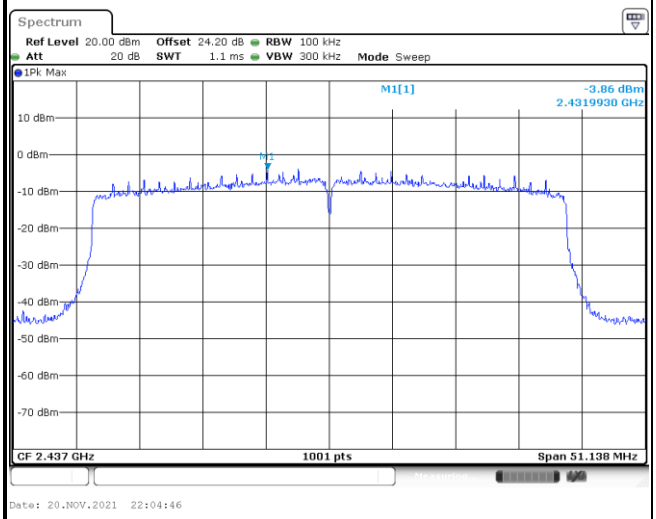
Test Mode :	802.11ax HE20	Test Channel :	11 Full RU

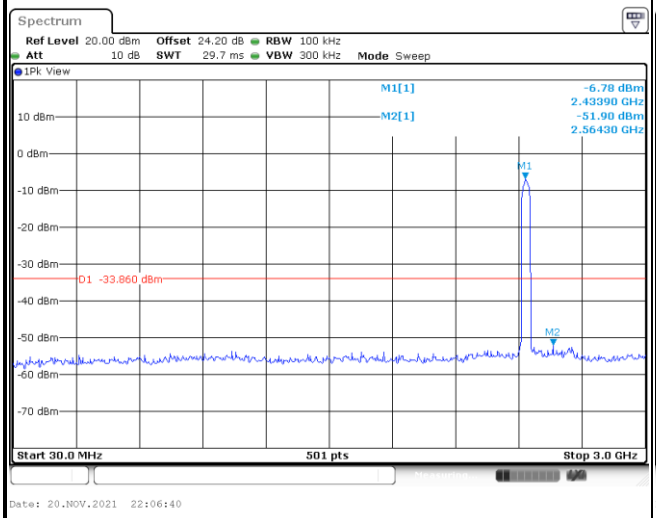
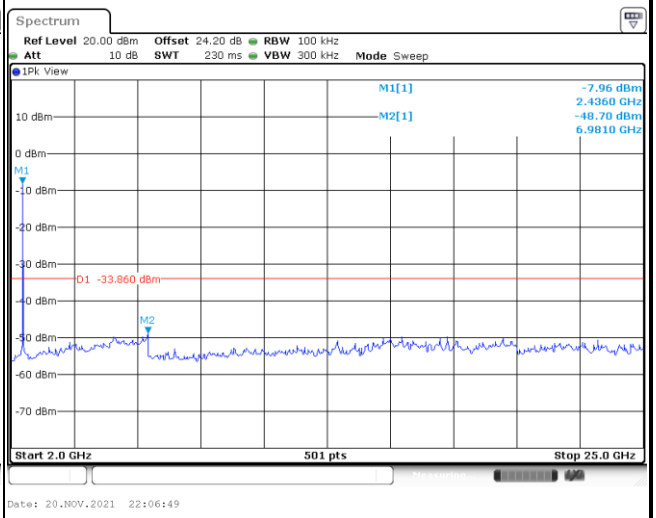
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	03 Full RU

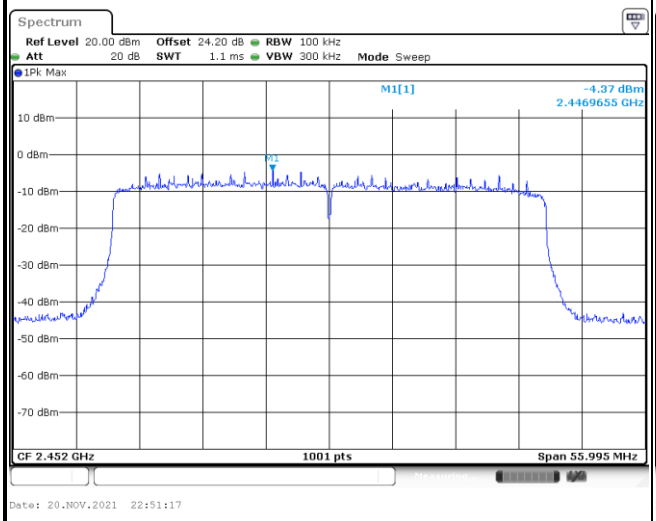
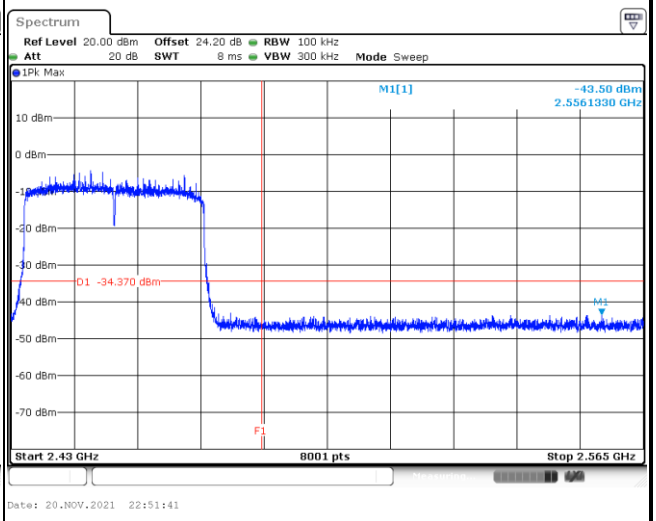
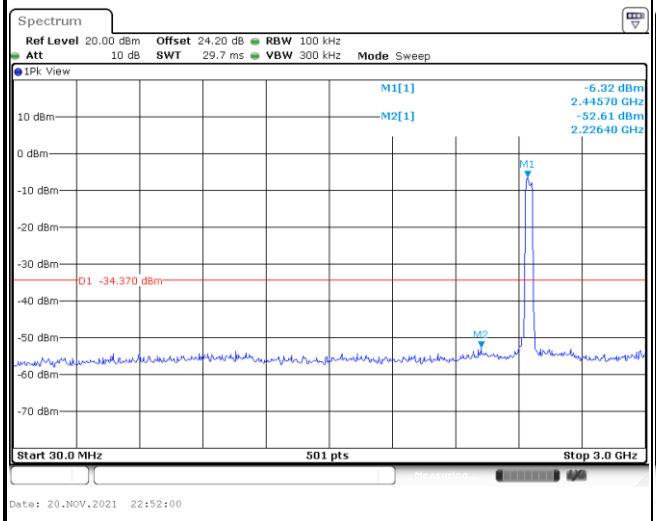
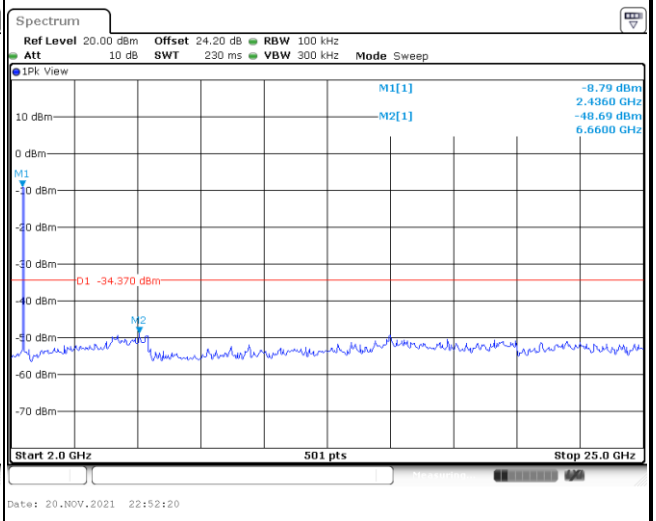
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	06 Full RU

100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11ax HE40	Test Channel :	09 Full RU

100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

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 is 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

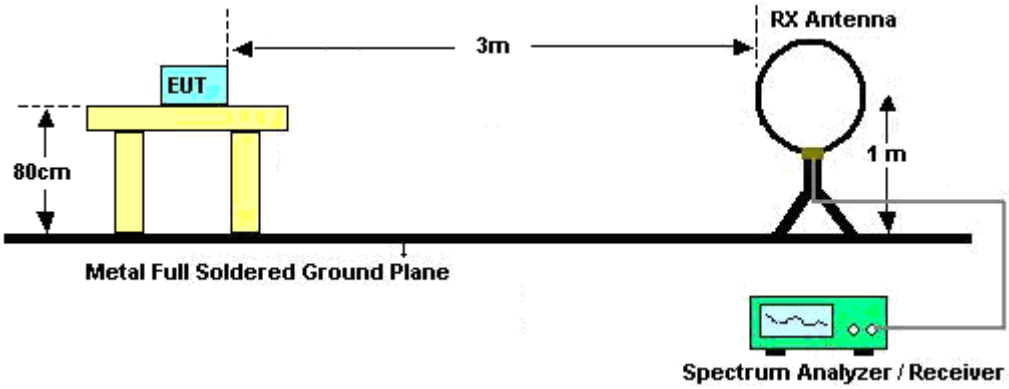
Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

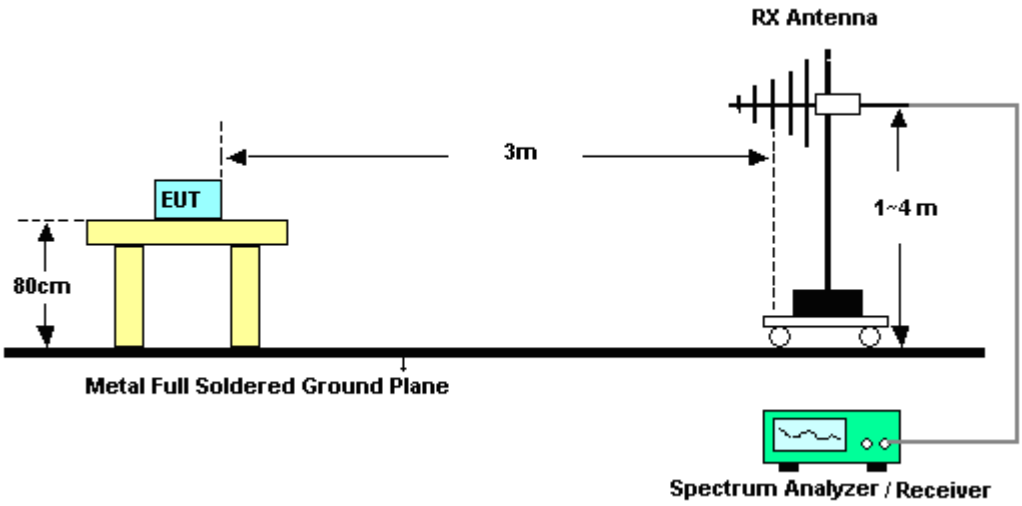
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3 MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

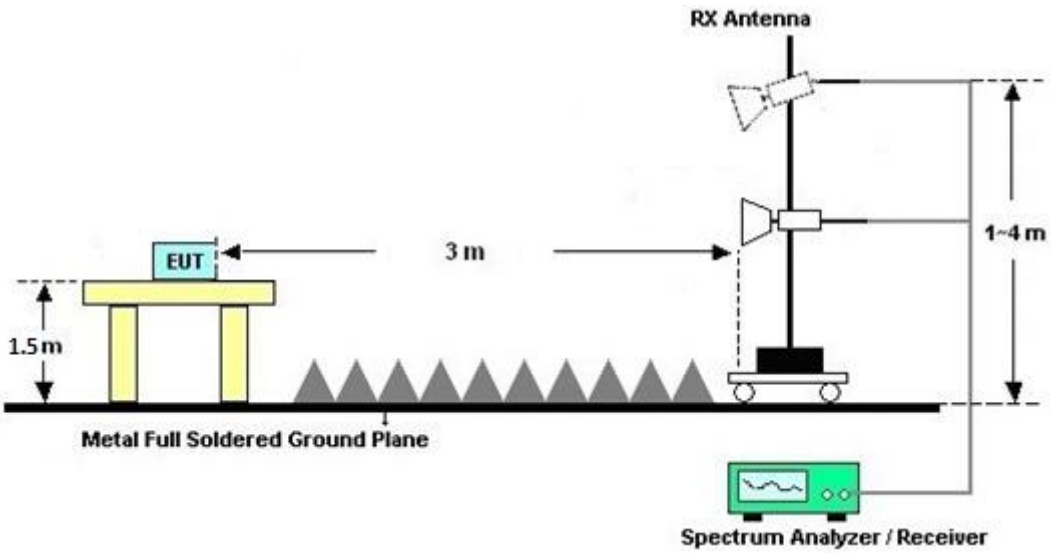
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



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

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

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

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

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

*Decreases with the logarithm of the frequency.

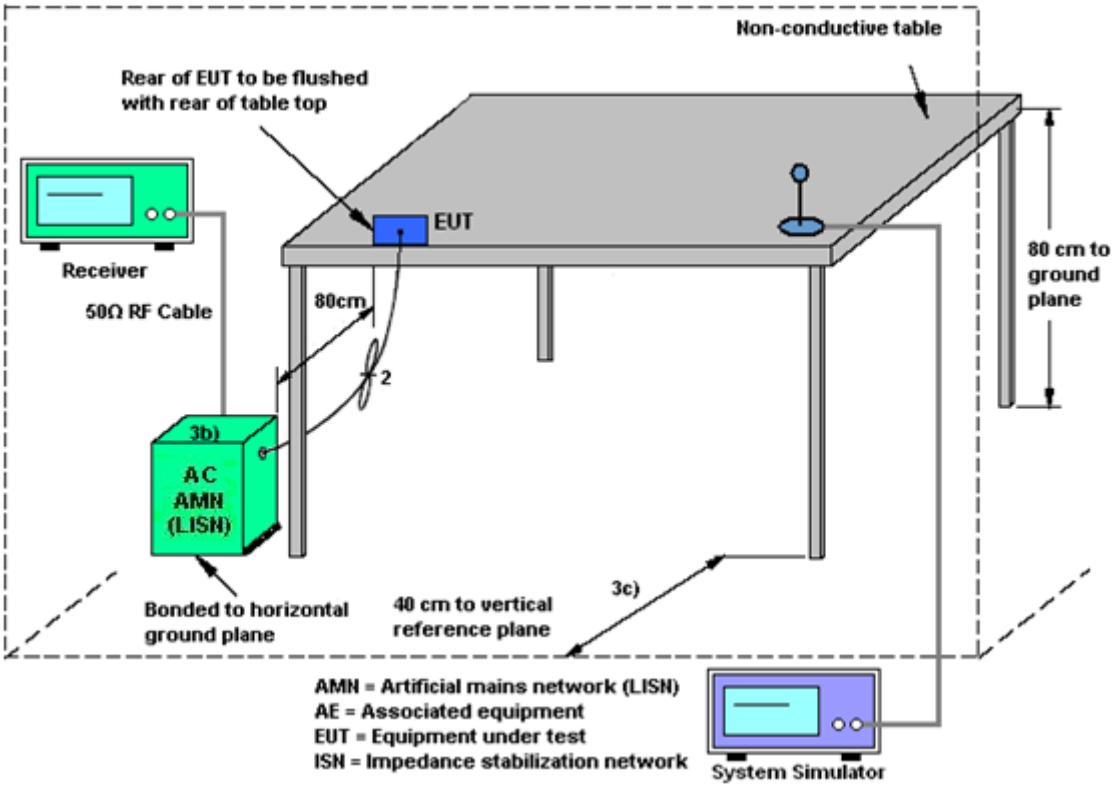
3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is 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 shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
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 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

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

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

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

For power measurements on IEEE 802.11 devices,

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

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

The EUT supports CDD mode.

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

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

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

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

<CDD Modes>

	Ant. 3 (dBi)	Ant. 4 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
2.4 GHz	2.63	2.15	2.63	5.40	0.00	0.00

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

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

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	35419 & 03	30MHz~1GHz	Apr. 28, 2021	Dec. 17, 2021~ Dec. 20, 2021	Apr. 27, 2022	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 03, 2021	Dec. 17, 2021~ Dec. 20, 2021	Dec. 02, 2022	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Dec. 17, 2021~ Dec. 20, 2021	Jan. 03, 2022	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz~18GHz	Apr. 22, 2021	Dec. 17, 2021~ Dec. 20, 2021	Apr. 21, 2022	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 04, 2021	Dec. 17, 2021~ Dec. 20, 2021	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 04, 2021	Dec. 17, 2021~ Dec. 20, 2021	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 23, 2021	Dec. 17, 2021~ Dec. 20, 2021	Jul. 22, 2022	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Jul. 22, 2021	Dec. 17, 2021~ Dec. 20, 2021	Jul. 21, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682-4	30MHz to 18GHz	Feb. 24, 2021	Dec. 17, 2021~ Dec. 20, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971-4	9kHz to 18GHz	Feb. 24, 2021	Dec. 17, 2021~ Dec. 20, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655-4	9kHz to 18GHz	Feb. 24, 2021	Dec. 17, 2021~ Dec. 20, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2,80 1606/2	18GHz~40GHz	Feb. 24, 2021	Dec. 17, 2021~ Dec. 20, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 17, 2021	Dec. 17, 2021~ Dec. 20, 2021	Sep. 16, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 03, 2021	Dec. 17, 2021~ Dec. 20, 2021	Apr. 02, 2022	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	N/A	Dec. 17, 2021~ Dec. 20, 2021	N/A	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Dec. 17, 2021~ Dec. 20, 2021	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	Dec. 17, 2021~ Dec. 20, 2021	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Dec. 17, 2021~ Dec. 20, 2021	N/A	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	Dec. 17, 2021~ Dec. 20, 2021	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 09, 2021	Dec. 17, 2021~ Dec. 20, 2021	Mar. 08, 2022	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917025 1	18GHz~40GHz	Nov. 30, 2021	Dec. 17, 2021~ Dec. 20, 2021	Nov. 29, 2022	Radiation (03CH07-HY)
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 01, 2021	Nov. 08, 2021~ Nov. 20, 2021	Feb. 28, 2022	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	13I00030SNO 31(NO:182)	10MHz~6GHz	Dec. 30, 2020	Nov. 08, 2021~ Nov. 20, 2021	Dec. 29, 2021	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Nov. 08, 2021~ Nov. 20, 2021	Aug. 29, 2022	Conducted (TH05-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW191204(B OX8)	N/A	Jan. 07, 2021	Nov. 08, 2021~ Nov. 20, 2021	Jan. 06, 2022	Conducted (TH05-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Nov. 03, 2021	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 30, 2020	Nov. 03, 2021	Nov. 29, 2021	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 18, 2020	Nov. 03, 2021	Nov. 17, 2021	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 01, 2020	Nov. 03, 2021	Nov. 30, 2021	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Nov. 03, 2021	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Jul. 28, 2021	Nov. 03, 2021	Jul. 27, 2022	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 31, 2020	Nov. 03, 2021	Dec. 30, 2021	Conduction (CO05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.1 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.1 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.8 dB

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Benny Ku/Shiming Liu	Temperature:	24.2~26.3	°C
Test Date:	2021/11/8~2021/11/20	Relative Humidity:	65.8~71.2	%

Report Number : FR190614A

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band MIMO										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant3	Ant4	Ant3	Ant4		
11b	1Mbps	2	1	2412	13.59	13.49	8.10	7.16	0.50	Pass
11b	1Mbps	2	6	2437	13.34	13.29	8.11	8.10	0.50	Pass
11b	1Mbps	2	11	2462	13.34	13.44	7.61	8.09	0.50	Pass
11g	6Mbps	2	1	2412	16.98	17.03	16.07	16.37	0.50	Pass
11g	6Mbps	2	6	2437	16.83	16.93	16.07	16.32	0.50	Pass
11g	6Mbps	2	11	2462	16.93	17.03	15.67	16.36	0.50	Pass

Report Number : FR190614A

TEST RESULTS DATA
Average Output Power

2.4GHz Band MIMO																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant3	Ant4	SUM	Ant3	Ant4	Ant3	Ant4	Ant3	Ant4	Ant3	Ant4	
11b	1Mbps	2	1	2412	10.00	9.60	12.81	30.00		2.63		15.44		36.00		Pass
11b	1Mbps	2	6	2437	10.00	9.60	12.81	30.00		2.63		15.44		36.00		Pass
11b	1Mbps	2	11	2462	9.80	9.60	12.71	30.00		2.63		15.34		36.00		Pass
11g	6Mbps	2	1	2412	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
11g	6Mbps	2	6	2437	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
11g	6Mbps	2	11	2462	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
HT20	MCS0	2	1	2412	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
HT20	MCS0	2	6	2437	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
HT20	MCS0	2	11	2462	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
HT40	MCS0	2	3	2422	9.90	9.20	12.57	30.00		2.63		15.20		36.00		Pass
HT40	MCS0	2	6	2437	9.60	9.60	12.61	30.00		2.63		15.24		36.00		Pass
HT40	MCS0	2	9	2452	9.90	9.40	12.67	30.00		2.63		15.30		36.00		Pass
VHT20	MCS0	2	1	2412	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
VHT20	MCS0	2	6	2437	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
VHT20	MCS0	2	11	2462	9.90	9.60	12.76	30.00		2.63		15.39		36.00		Pass
VHT40	MCS0	2	3	2422	9.90	9.20	12.57	30.00		2.63		15.20		36.00		Pass
VHT40	MCS0	2	6	2437	9.60	9.60	12.61	30.00		2.63		15.24		36.00		Pass
VHT40	MCS0	2	9	2452	9.90	9.40	12.67	30.00		2.63		15.30		36.00		Pass

Note: Measured power (dBm) has offset with cable loss.

Report Number : FR190614A

TEST RESULTS DATA
Peak Power Spectral Density

2.4GHz Band MIMO												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant3	Ant4	Worse + 3.01	Ant3	Ant4	Ant3	Ant4	
11b	1Mbps	2	1	2412	-13.58	-13.88	-10.57	5.40		8.00		Pass
11b	1Mbps	2	6	2437	-13.52	-13.99	-10.51	5.40		8.00		Pass
11b	1Mbps	2	11	2462	-14.02	-13.96	-10.95	5.40		8.00		Pass
11g	6Mbps	2	1	2412	-17.51	-17.77	-14.50	5.40		8.00		Pass
11g	6Mbps	2	6	2437	-17.58	-17.42	-14.41	5.40		8.00		Pass
11g	6Mbps	2	11	2462	-17.42	-17.68	-14.41	5.40		8.00		Pass

Measured power density (dBm) has offset with cable loss.

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band MIMO											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
						Ant3	Ant4	Ant3	Ant4		
HE20	MCS0	2	1	2412	Full	19.28	19.28	18.75	18.80	0.50	Pass
HE20	MCS0	2	6	2437	Full	19.23	19.18	18.07	18.55	0.50	Pass
HE20	MCS0	2	11	2462	Full	19.28	19.28	17.86	18.57	0.50	Pass
HE40	MCS0	2	3	2422	Full	38.06	37.86	37.19	37.87	0.50	Pass
HE40	MCS0	2	6	2437	Full	37.46	37.56	33.85	34.09	0.50	Pass
HE40	MCS0	2	9	2452	Full	37.76	37.86	36.83	37.33	0.50	Pass

TEST RESULTS DATA
Average Output Power

2.4GHz Band MIMO																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
						Ant3	Ant4	SUM	Ant3	Ant4	Ant3	Ant4	Ant3	Ant4	Ant3	Ant4	
HE20	MCS0	2	1	2412	Full	10.00	9.70	12.86	30.00		2.63		15.49		36.00		Pass
HE20	MCS0	2	6	2437	Full	10.00	9.70	12.86	30.00		2.63		15.49		36.00		Pass
HE20	MCS0	2	11	2462	Full	10.00	9.70	12.86	30.00		2.63		15.49		36.00		Pass
HE40	MCS0	2	3	2422	Full	10.00	9.30	12.67	30.00		2.63		15.30		36.00		Pass
HE40	MCS0	2	6	2437	Full	9.70	9.70	12.71	30.00		2.63		15.34		36.00		Pass
HE40	MCS0	2	9	2452	Full	10.00	9.50	12.77	30.00		2.63		15.40		36.00		Pass

Note: Measured power (dBm) has offset with cable loss.

TEST RESULTS DATA
Peak Power Spectral Density

2.4GHz Band MIMO														
Mod.	Data Rate	NTx	CH.	Freq. (MHz)	RU Config.	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
						Ant3	Ant4	Worse + 3.01	Ant3	Ant4	Ant3	Ant4	
HE20	MCS0	2	1	2412	Full	-16.98	-16.80	-13.79	5.40		8.00		Pass
HE20	MCS0	2	6	2437	Full	-16.53	-16.78	-13.52	5.40		8.00		Pass
HE20	MCS0	2	11	2462	Full	-16.46	-16.96	-13.45	5.40		8.00		Pass
HE40	MCS0	2	3	2422	Full	-19.30	-19.90	-16.29	5.40		8.00		Pass
HE40	MCS0	2	6	2437	Full	-19.00	-19.51	-15.99	5.40		8.00		Pass
HE40	MCS0	2	9	2452	Full	-19.15	-19.36	-16.14	5.40		8.00		Pass

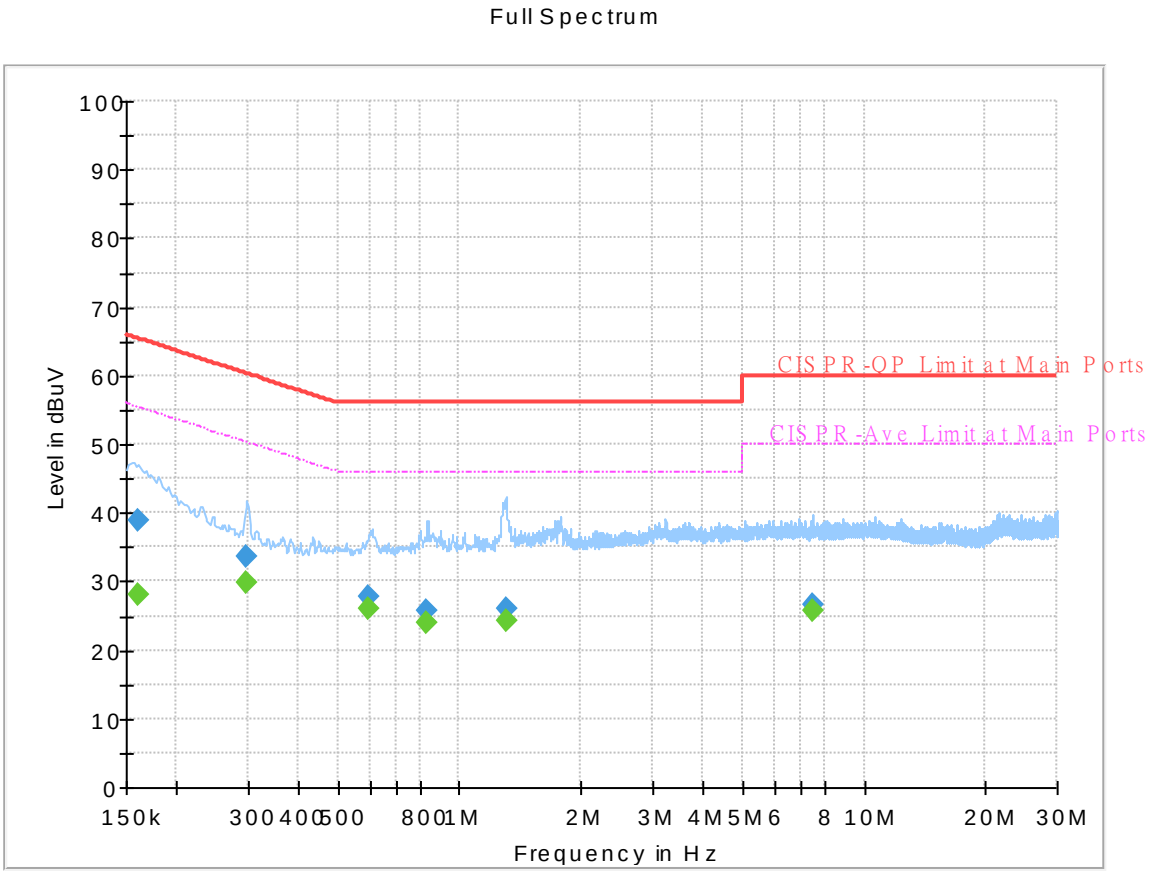
Measured power density (dBm) has offset with cable loss.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Calivn Wang	**Temperature :**	23~26℃
		Relative Humidity :	45~55%

EUT Information

Report NO :	190614
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

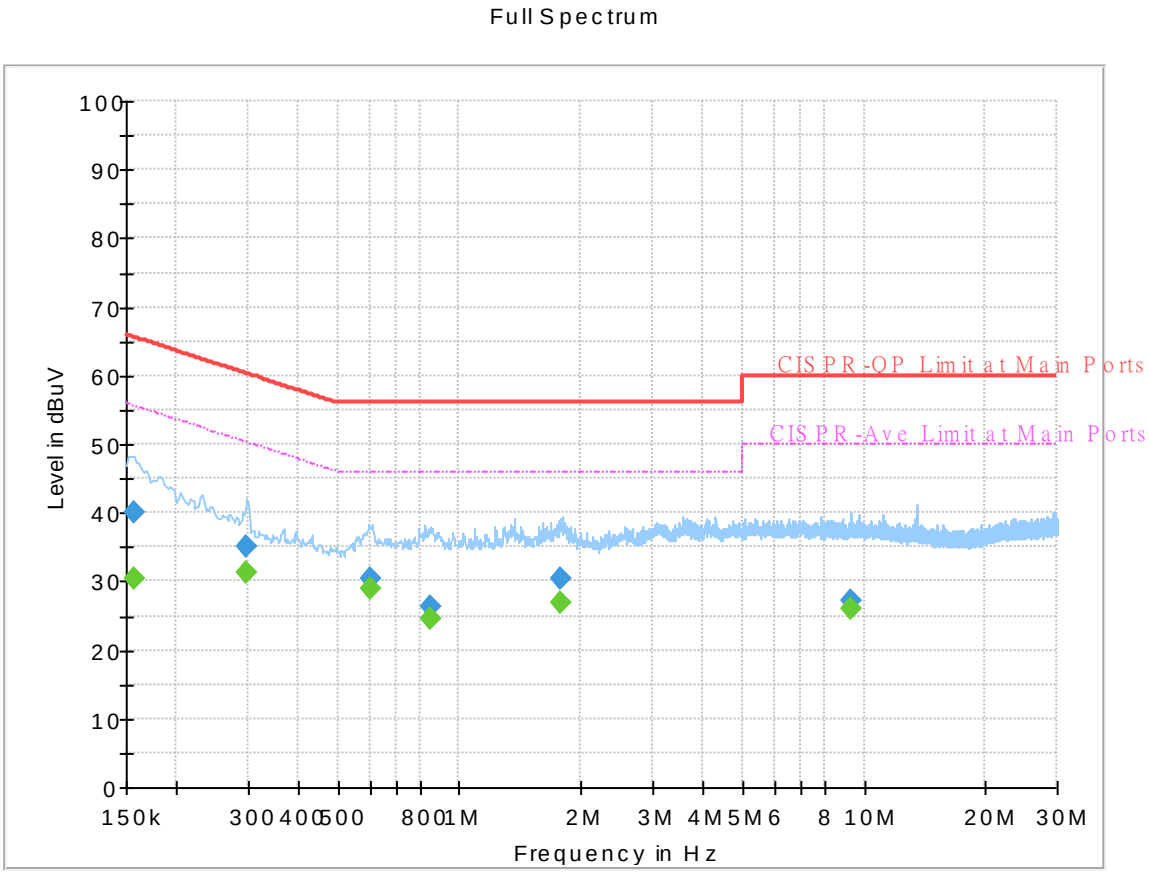


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.161250	---	28.17	55.40	27.23	L1	OFF	19.7
0.161250	38.79	---	65.40	26.61	L1	OFF	19.7
0.297600	---	29.90	50.31	20.41	L1	OFF	19.7
0.297600	33.49	---	60.31	26.82	L1	OFF	19.7
0.597210	---	25.89	46.00	20.11	L1	OFF	19.9
0.597210	27.78	---	56.00	28.22	L1	OFF	19.9
0.829500	---	23.92	46.00	22.08	L1	OFF	20.1
0.829500	25.61	---	56.00	30.39	L1	OFF	20.1
1.301100	---	24.39	46.00	21.61	L1	OFF	20.2
1.301100	25.94	---	56.00	30.06	L1	OFF	20.2
7.489500	---	25.74	50.00	24.26	L1	OFF	20.1
7.489500	26.61	---	60.00	33.39	L1	OFF	20.1

EUT Information

Report NO :	190614
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	---	30.40	55.63	25.23	N	OFF	19.7
0.156750	40.08	---	65.63	25.55	N	OFF	19.7
0.298500	---	31.37	50.28	18.91	N	OFF	19.7
0.298500	35.15	---	60.28	25.13	N	OFF	19.7
0.600000	---	28.80	46.00	17.20	N	OFF	19.9
0.600000	30.50	---	56.00	25.50	N	OFF	19.9
0.852000	---	24.52	46.00	21.48	N	OFF	20.1
0.852000	26.39	---	56.00	29.61	N	OFF	20.1
1.772250	---	26.94	46.00	19.06	N	OFF	20.2
1.772250	30.34	---	56.00	25.66	N	OFF	20.2
9.318750	---	26.02	50.00	23.98	N	OFF	20.1
9.318750	27.14	---	60.00	32.86	N	OFF	20.1

Appendix C. Radiated Spurious Emission

Test Engineer :	Jesse Wang, Stan Hsieh, and Ken Wu	Temperature :	23.1~25.3°C
		Relative Humidity :	53.6~59.1%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
3+4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2387.805	54.75	-19.25	74	40	32.03	18.13	35.41	233	185	P	H
		2389.8	43.81	-10.19	54	29.05	32.04	18.14	35.42	233	185	A	H
	*	2412	103.33	-	-	88.43	32.12	18.2	35.42	233	185	P	H
	*	2412	100.33	-	-	85.43	32.12	18.2	35.42	233	185	A	H
													H
													H
		2379.72	54.43	-19.57	74	39.76	31.98	18.1	35.41	105	97	P	V
		2388.96	43.79	-10.21	54	29.03	32.03	18.14	35.41	105	97	A	V
	*	2412	103.3	-	-	88.4	32.12	18.2	35.42	105	97	P	V
	*	2412	100.12	-	-	85.22	32.12	18.2	35.42	105	97	A	V
													V
													V
802.11b CH 06 2437MHz		2367.54	54.38	-19.62	74	39.84	31.91	18.04	35.41	240	187	P	H
		2389.8	43.82	-10.18	54	29.06	32.04	18.14	35.42	240	187	A	H
	*	2437	102.86	-	-	87.91	32.17	18.21	35.43	240	187	P	H
	*	2437	99.74	-	-	84.79	32.17	18.21	35.43	240	187	A	H
		2486.21	54.8	-19.2	74	39.66	32.34	18.25	35.45	240	187	P	H
		2493.49	44.32	-9.68	54	29.16	32.37	18.25	35.46	240	187	A	H
		2370.48	54.95	-19.05	74	40.39	31.92	18.05	35.41	125	107	P	V
		2389.8	43.84	-10.16	54	29.08	32.04	18.14	35.42	125	107	A	V
	*	2437	102.66	-	-	87.71	32.17	18.21	35.43	125	107	P	V
	*	2437	99.7	-	-	84.75	32.17	18.21	35.43	125	107	A	V
		2496.64	54.9	-19.1	74	39.71	32.39	18.26	35.46	125	107	P	V
		2493.21	44.37	-9.63	54	29.21	32.37	18.25	35.46	125	107	A	V

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 11 2462MHz	*	2462	103.58	-	-	88.54	32.25	18.23	35.44	233	186	P	H
	*	2462	100.43	-	-	85.39	32.25	18.23	35.44	233	186	A	H
		2491.2	54.52	-19.48	74	39.36	32.36	18.25	35.45	233	186	P	H
		2493.84	44.3	-9.7	54	29.13	32.38	18.25	35.46	233	186	A	H
													H
													H
	*	2462	103.81	-	-	88.77	32.25	18.23	35.44	105	116	P	V
	*	2462	100.7	-	-	85.66	32.25	18.23	35.44	105	116	A	V
		2486.12	55.73	-18.27	74	40.59	32.34	18.25	35.45	105	116	P	V
		2498.68	44.29	-9.71	54	29.1	32.39	18.26	35.46	105	116	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	42.42	-31.58	74	53.29	34.2	12.9	57.97	-	-	P	H
													H
													H
													H
		4824	42.26	-31.74	74	53.13	34.2	12.9	57.97	-	-	P	V
													V
													V
													V
802.11b CH 06 2437MHz		4874	42.89	-31.11	74	53.74	34.2	12.86	57.91	-	-	P	H
		7311	41.71	-32.29	74	48.6	36.1	14.92	57.91	-	-	P	H
													H
													H
		4874	42.61	-31.39	74	53.46	34.2	12.86	57.91	-	-	P	V
		7311	41.73	-32.27	74	48.62	36.1	14.92	57.91	-	-	P	V
													V
													V
802.11b CH 11 2462MHz		4924	41.88	-32.12	74	52.64	34.25	12.84	57.85	-	-	P	H
		7386	41.05	-32.95	74	47.88	36.24	14.91	57.98	-	-	P	H
													H
													H
		4924	42.16	-31.84	74	52.92	34.25	12.84	57.85	-	-	P	V
		7386	40.53	-33.47	74	47.36	36.24	14.91	57.98	-	-	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Band Edge @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2368.275	54.09	-19.91	74	39.55	31.91	18.04	35.41	148	192	P	H
		2390	44.17	-9.83	54	29.41	32.04	18.14	35.42	148	192	A	H
	*	2412	107.57	-	-	92.68	32.11	18.2	35.42	148	192	P	H
	*	2412	100.04	-	-	85.15	32.11	18.2	35.42	148	192	A	H
													H
													H
		2389.8	54.54	-19.46	74	39.78	32.04	18.14	35.42	330	43	P	V
		2390	44.15	-9.85	54	29.39	32.04	18.14	35.42	330	43	A	V
	*	2412	106.07	-	-	91.17	32.12	18.2	35.42	330	43	P	V
	*	2412	98.98	-	-	84.08	32.12	18.2	35.42	330	43	A	V
													V
													V
802.11g CH 11 2462MHz	*	2462	107.4	-	-	92.36	32.25	18.23	35.44	100	190	P	H
	*	2462	99.94	-	-	84.9	32.25	18.23	35.44	100	190	A	H
		2486.96	54.29	-19.71	74	39.15	32.35	18.24	35.45	100	190	P	H
		2483.68	44.76	-9.24	54	29.63	32.33	18.25	35.45	100	190	A	H
													H
													H
	*	2462	106.39	-	-	91.35	32.25	18.23	35.44	311	46	P	V
	*	2462	99.15	-	-	84.11	32.25	18.23	35.44	311	46	A	V
		2492.08	54.63	-19.37	74	39.47	32.37	18.25	35.46	311	46	P	V
		2483.52	44.59	-9.41	54	29.46	32.33	18.25	35.45	311	46	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz
WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 06 2437MHz		4874	42.17	-31.83	74	53.02	34.2	12.86	57.91	-	-	P	H
		7311	42.05	-31.95	74	48.94	36.1	14.92	57.91	-	-	P	H
													H
													H
		4874	42.43	-31.57	74	53.28	34.2	12.86	57.91	-	-	P	V
		7311	42.06	-31.94	74	48.95	36.1	14.92	57.91	-	-	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

2.4GHz 2400~2483.5MHz

WIFI 802.11ax HE20 Full (Band Edge @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		2326.8	54.3	-19.7	74	40.04	31.8	17.85	35.39	148	190	P	H
		2390	44.72	-9.28	54	29.96	32.04	18.14	35.42	148	190	A	H
	*	2412	108.42	-	-	93.52	32.12	18.2	35.42	148	190	P	H
	*	2412	100.32	-	-	85.42	32.12	18.2	35.42	148	190	A	H
802.11ax													H
HE20 Full													H
CH 01		2316.72	54.85	-19.15	74	40.64	31.8	17.8	35.39	252	58	P	V
2412MHz		2389.485	43.88	-10.12	54	29.11	32.04	18.14	35.41	252	58	A	V
	*	2412	105.72	-	-	90.82	32.12	18.2	35.42	252	58	P	V
	*	2412	97.4	-	-	82.5	32.12	18.2	35.42	252	58	A	V
													V
													V
	*	2462	108.57	-	-	93.53	32.25	18.23	35.44	176	189	P	H
	*	2462	99.74	-	-	84.7	32.25	18.23	35.44	176	189	A	H
		2483.52	55.15	-18.85	74	40.02	32.33	18.25	35.45	176	189	P	H
		2483.52	44.69	-9.31	54	29.56	32.33	18.25	35.45	176	189	A	H
802.11ax													H
HE20 Full													H
CH 11	*	2462	109.19	-	-	94.15	32.25	18.23	35.44	312	47	P	V
2462MHz	*	2462	98.75	-	-	83.71	32.25	18.23	35.44	312	47	A	V
		2495.72	55.36	-18.64	74	40.19	32.38	18.25	35.46	312	47	P	V
		2483.52	44.43	-9.57	54	29.3	32.33	18.25	35.45	312	47	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11 ax HE20 Full (Harmonic @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ax HE20 Full CH 06 2437MHz		4874	43.56	-30.44	74	54.41	34.2	12.86	57.91	-	-	P	H
		7311	42.14	-31.86	74	49.03	36.1	14.92	57.91	-	-	P	H
													H
													H
		4874	42.87	-31.13	74	53.72	34.2	12.86	57.91	-	-	P	V
		7311	43.52	-30.48	74	50.41	36.1	14.92	57.91	-	-	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

2.4GHz 2400~2483.5MHz

WIFI 802.11ax HE40 Full (Band Edge @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ax HE40 Full CH 03 2422MHz		2388.26	54.83	-19.17	74	40.08	32.03	18.13	35.41	143	192	P	H
		2389.94	44.8	-9.2	54	30.04	32.04	18.14	35.42	143	192	A	H
	*	2422	105.23	-	-	90.32	32.14	18.2	35.43	143	192	P	H
	*	2422	96.91	-	-	82	32.14	18.2	35.43	143	192	A	H
		2494.61	54.38	-19.62	74	39.21	32.38	18.25	35.46	143	192	P	H
		2492.09	44.3	-9.7	54	29.14	32.37	18.25	35.46	143	192	A	H
		2352	54.43	-19.57	74	40.05	31.81	17.97	35.4	357	50	P	V
		2389.66	43.9	-10.1	54	29.13	32.04	18.14	35.41	357	50	A	V
	*	2422	105.89	-	-	90.98	32.14	18.2	35.43	357	50	P	V
	*	2422	96.38	-	-	81.47	32.14	18.2	35.43	357	50	A	V
		2486.28	55.33	-18.67	74	40.18	32.35	18.25	35.45	357	50	P	V
		2495.8	44.29	-9.71	54	29.12	32.38	18.25	35.46	357	50	A	V
802.11ax HE40 Full CH 09 2452MHz		2385.46	54.66	-19.34	74	39.94	32.01	18.12	35.41	229	189	P	H
		2389.8	43.83	-10.17	54	29.07	32.04	18.14	35.42	229	189	A	H
	*	2452	104.17	-	-	89.18	32.21	18.22	35.44	229	189	P	H
	*	2452	96.52	-	-	81.53	32.21	18.22	35.44	229	189	A	H
		2493	54.57	-19.43	74	39.41	32.37	18.25	35.46	229	189	P	H
		2483.5	45.08	-8.92	54	29.95	32.33	18.25	35.45	229	189	A	H
		2383.36	54.58	-19.42	74	39.88	32	18.11	35.41	359	50	P	V
		2389.8	43.8	-10.2	54	29.04	32.04	18.14	35.42	359	50	A	V
	*	2452	105.61	-	-	90.62	32.21	18.22	35.44	359	50	P	V
	*	2452	95.85	-	-	80.86	32.21	18.22	35.44	359	50	A	V
		2487.82	54.49	-19.51	74	39.35	32.35	18.24	35.45	359	50	P	V
		2483.62	44.36	-9.64	54	29.23	32.33	18.25	35.45	359	50	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz WIFI 802.11ax HE40 (LF)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz 802.11ax HE40 LF		52.14	27.47	-12.53	40	42.86	13.31	1.31	30.01	-	-	P	H
		91.56	33.76	-9.74	43.5	47.3	14.84	1.61	29.99	-	-	P	H
		162.57	30.69	-12.81	43.5	42.2	16.34	2.13	29.98	-	-	P	H
		741.7	29.86	-16.14	46	27.86	27.46	4.24	29.7	-	-	P	H
		855.1	31.86	-14.14	46	27.63	28.82	4.62	29.21	-	-	P	H
		957.3	33.41	-12.59	46	26.52	30.67	4.9	28.68	-	-	P	H
		30.27	33.01	-6.99	40	37.76	24.37	0.91	30.03	-	-	P	V
		52.14	33.51	-6.49	40	48.9	13.31	1.31	30.01	-	-	P	V
		86.16	33.49	-6.51	40	47.75	14.15	1.59	30	-	-	P	V
		751.5	30.19	-15.81	46	27.98	27.64	4.25	29.68	-	-	P	V
		841.1	30.55	-15.45	46	26.84	28.45	4.57	29.31	-	-	P	V
		948.2	33.14	-12.86	46	26.83	30.17	4.86	28.72	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Radiated Spurious Emission Plots

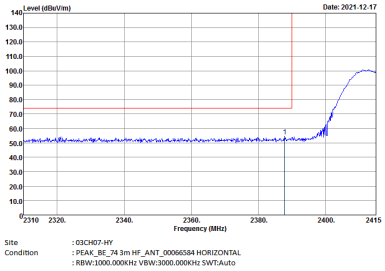
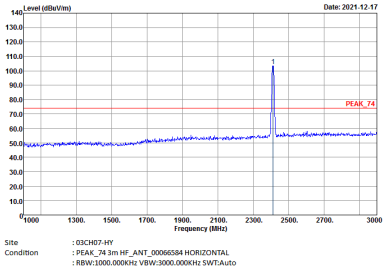
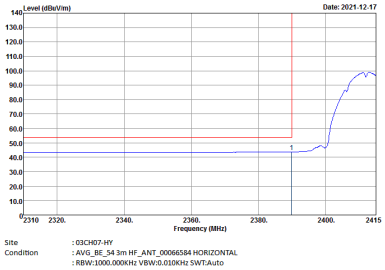
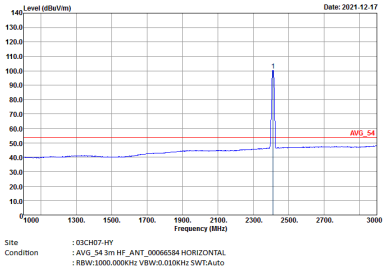
Test Engineer :	Jesse Wang, Stan Hsieh, and Ken Wu	**Temperature :**	23.1~25.3°C
		Relative Humidity :	53.6~59.1%

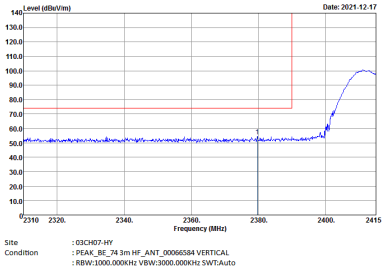
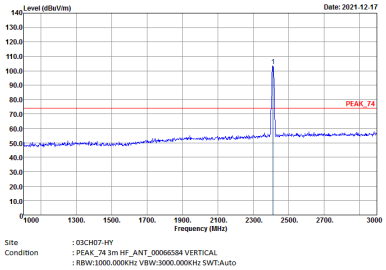
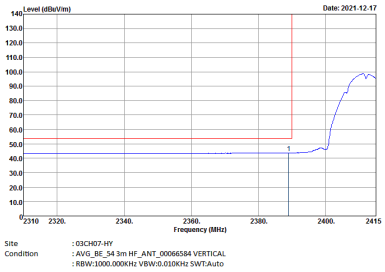
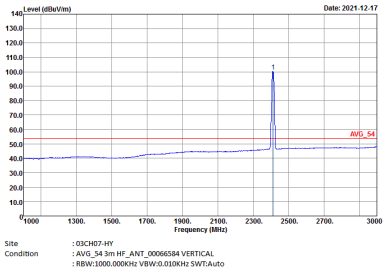
Note symbol

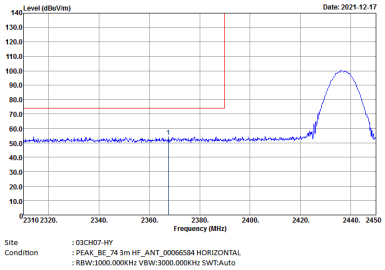
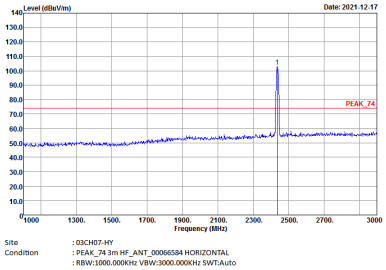
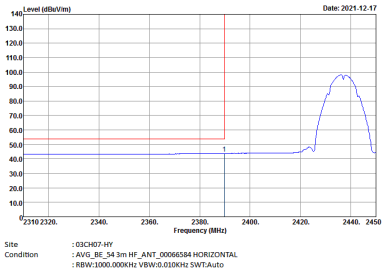
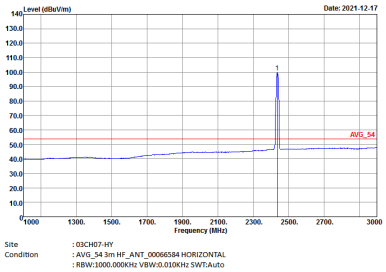
-L	**Low channel location**
-R	**High channel location**

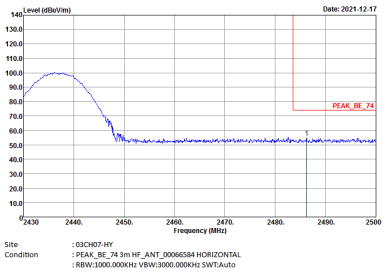
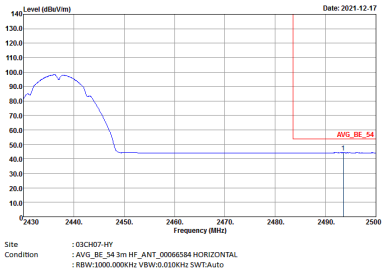
2.4GHz 2400~2483.5MHz

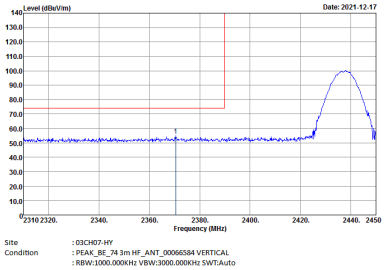
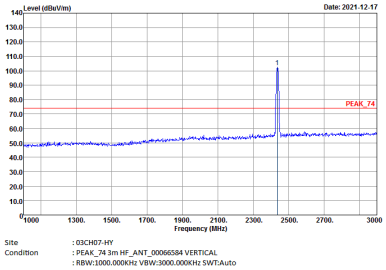
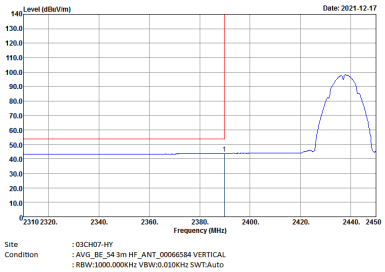
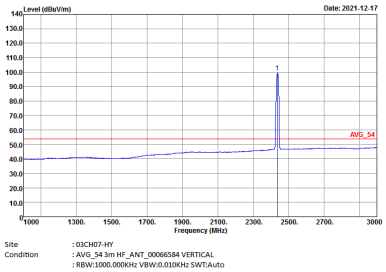
WIFI 802.11b (Band Edge @ 3m)

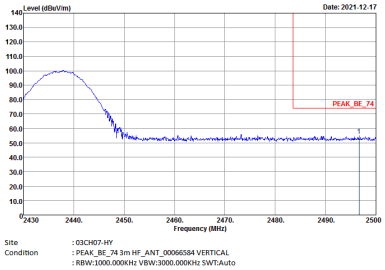
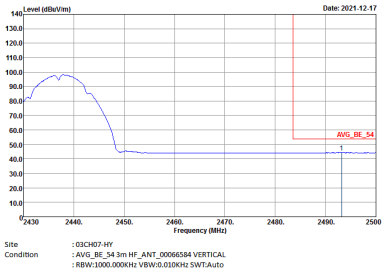
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
3+4	Horizontal	Fundamental
Peak		
Avg.		

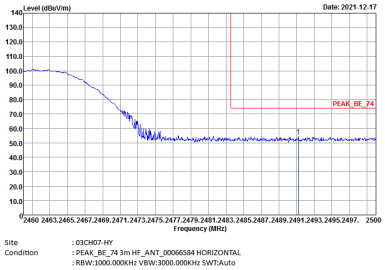
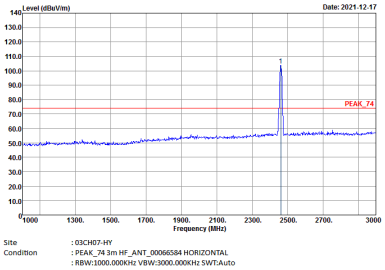
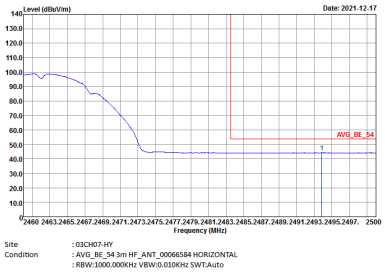
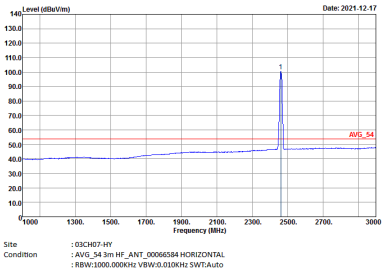
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
3+4	Vertical	Fundamental
Peak		
Avg.		

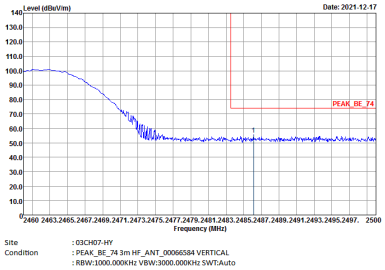
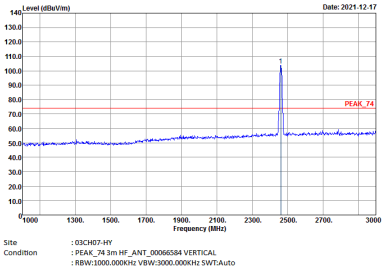
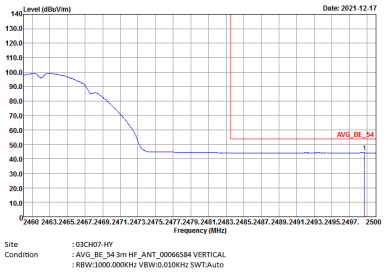
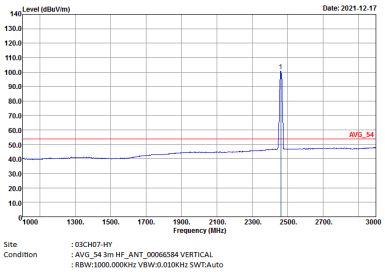
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
3+4	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
3+4	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
3+4	Vertical	Fundamental
Peak		
Avg.		

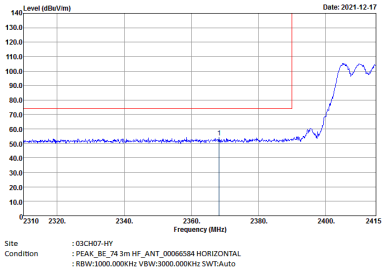
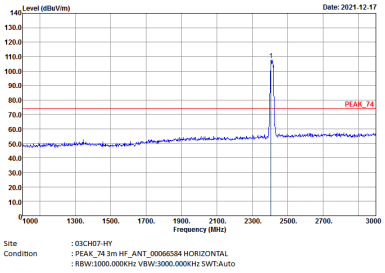
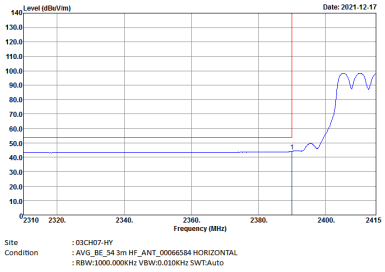
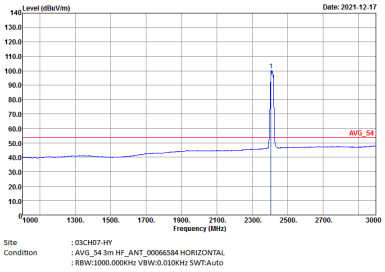
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
3+4	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

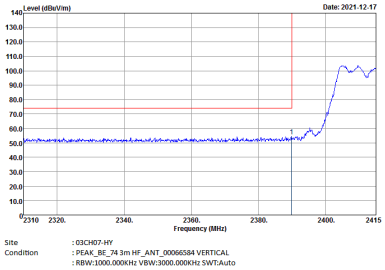
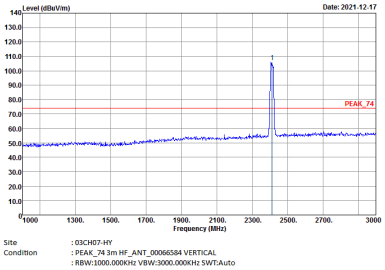
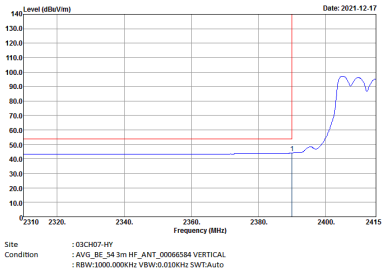
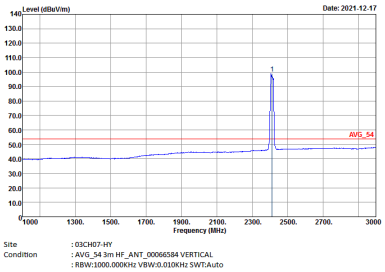
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
3+4	Horizontal	Fundamental
Peak		
Avg.		

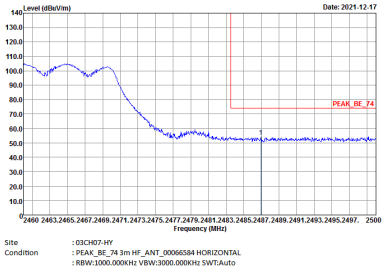
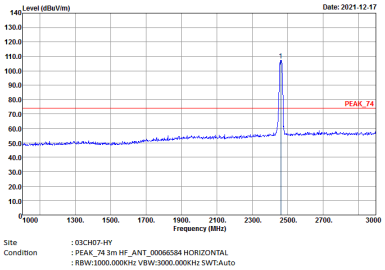
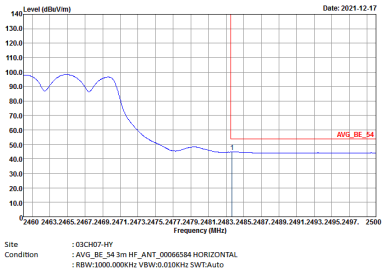
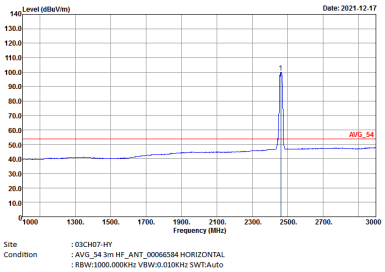
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
3+4	Vertical	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
3+4	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
3+4	Vertical	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
3+4	Horizontal	Fundamental
Peak		
Avg.