FCC RADIO TEST REPORT

FCC ID	:	**TVE-3417T0695A**
Equipment	:	**Network Security Gateway**
Brand Name	:	**FORTINET**
Model Name	:	**FortiWiFi 80F-2R-POExxxxxx, FORTIWIFI-80F-2R-POExxxxxx, FWF-80F-2R-POExxxxxx, FortiWiFi 81F-2R-POExxxxxx, FORTIWIFI-81F-2R-POExxxxxx, FWF-81F-2R-POExxxxxx, FortiWiFi 80F-2R-3G4G-POExxxxxx, FORTIWIFI-80F-2R-3G4G-POExxxxxx, FWF-80F-2R-3G4G-POExxxxxx, FortiWiFi 81F-2R-3G4G-POExxxxxx, FORTIWIFI-81F-2R-3G4G-POExxxxxx, FWF-81F-2R-3G4G-POExxxxxx (where "x" can be used "A-Z", or "0-9", or "-", or blank for software purposes or marketing purposes only)**
Marketing Name	:	**FortiWiFi 80F-2R-POE, FortiWiFi 81F-2R-POE, FortiWiFi 80F-2R-3G4G-POE, FortiWiFi 81F-2R-3G4G-POE**
Applicant	:	**Fortinet Inc. 899 KIFER RD SUNNYVALE CA 94086 UNITED STATES**
Manufacturer	:	**Fortinet Inc. 899 KIFER RD SUNNYVALE CA 94086 UNITED STATES**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Feb. 10, 2021 and testing was started from Mar. 11, 2021 and completed on Mar. 30, 2021. We, Sporton International Inc. Wensan 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 variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
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

Table of Contents

History of this test report **4**
Summary of Test Result **5**
1 General Description **6**
1.1 Product Feature of Equipment Under Test 6
1.2 Modification of EUT 6
1.3 Testing Location 7
1.4 Applicable Standards 7
2 Test Configuration of Equipment Under Test **8**
2.1 Carrier Frequency and Channel 8
2.2 Test Mode 9
2.3 Connection Diagram of Test System 11
2.4 Support Unit used in test configuration and system 11
2.5 EUT Operation Test Setup 11
3 Test Result **12**
3.1 Maximum Conducted Output Power Measurement 12
3.2 Unwanted Emissions Measurement 13
3.3 AC Conducted Emission Measurement 17
3.4 Antenna Requirements 19
4 List of Measuring Equipment **20**
5 Uncertainty of Evaluation **22**
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

History of this test report

Report No.	Version	Description	Issued Date
FR121023B	01	Initial issue of report	Apr. 09, 2021
FR121023B	02	Update FCC Designation Number	Apr. 26, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.403(i)	26dB Bandwidth	Not Required	-
-	2.1049	99% Occupied Bandwidth	Not Required	-
3.1	15.407(a)	Maximum Conducted Output Power	Pass	-
-	15.407(a)	Power Spectral Density	Not Required	-
3.2	15.407(b)	Unwanted Emissions	Pass	Under limit 0.62 dB at 5439.840 MHz
3.3	15.207	AC Conducted Emission	Pass	Under limit 14.60 dB at 12.655 MHz
-	15.407(c)	Automatically Discontinue Transmission	Not Required	-
3.4	15.203 15.407(a)	Antenna Requirement	Pass	-

Note:

1. Not required means after assessing, test items are not necessary to carry out.
2. This is a variant report by adding SKU (Model Name: FWF-81F-2R-3G4G-POE).All the test cases were performed on original report which can be referred to Sporton Report Number FR111826C. Based on the original report, the test cases were verified.

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Lucy Wu

1 General Description

1.1 Product Feature of Equipment Under Test

WCDMA/LTE, Bluetooth - LE, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax and GNSS.

Product Specification subjective to this standard	
Antenna Type	**WWAN:** Dipole Antenna **WLAN:** <Ant. 1> Dipole Antenna <Ant. 2> Dipole Antenna <Ant. 3> Dipole Antenna **Bluetooth - LE:** <Ant. 4> PIFA Antenna **GPS/Glonass/BDS/Galileo :** Dipole Antenna

Antenna information		
5150 MHz ~ 5250 MHz	Peak Gain (dBi)	<Ant. 1>: 3.27 <Ant. 2>: 3.27 <Ant. 3>: 3.27

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

1.2 Modification of EUT

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

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.**
	TH05-HY (TAF Code: 1190)
Remark	The Conducted test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory.

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.**
	CO07-HY, 03CH16-HY

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

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in two degrees (Ant. Horizontal and Ant. Vertical). The worst cases (Ant. Vertical) were recorded in this report.

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

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5150-5250 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40 and 802.11ax HE40.
2. The above Frequency and Channel in "#" were 802.11ac VHT80 and 802.11ax HE80.

2.2 Test Mode

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

Single Mode

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

MIMO Mode

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0
802.11ax HE20	MCS0
802.11ax HE40	MCS0
802.11ax HE80	MCS0

Remark: The device have support beamforming function in 802.11 ac/ax mode, the manufacturer defines worst case were Non Beamforming, other test items only test worst case and documented.

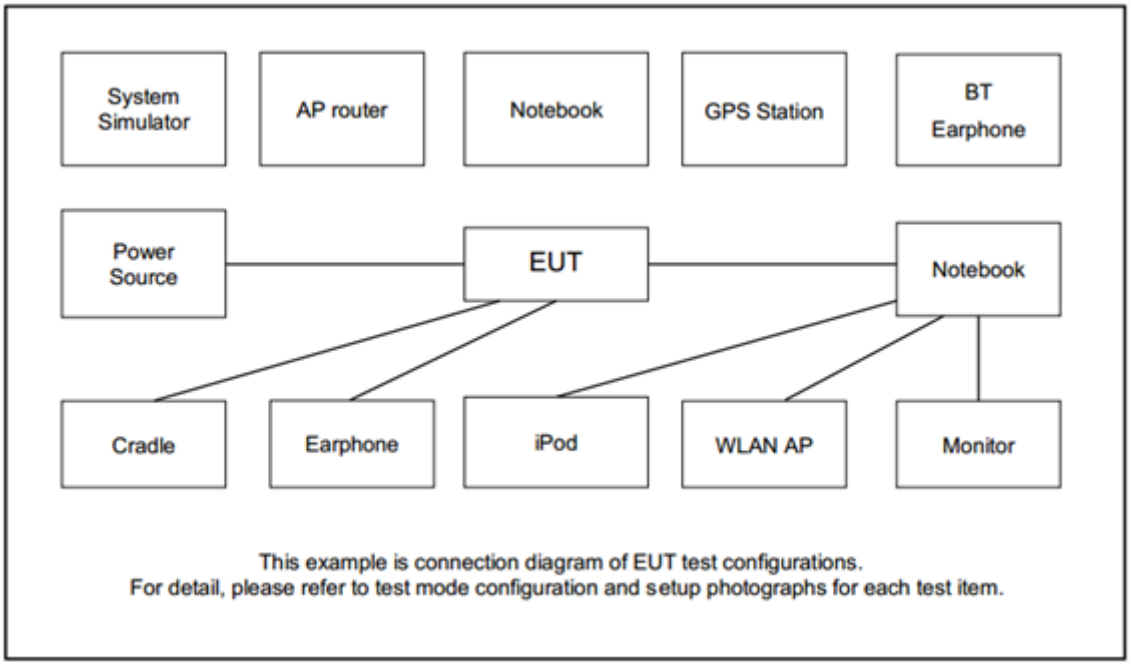
Test Cases	
AC Conducted Emission	Mode 1 : LTE Band 41 Link + Bluetooth Link + WLAN (5GHz) Link + Adapter *2 Mode 2 : LTE Band 41 Idle + Bluetooth Idle + WLAN (5GHz) Idle + Adapter *2
Remark: The worst case of conducted emission is mode 1; only the test data of it was reported.	

Ch. #		Band I：5150-5250 MHz			
		802.11a	802.11n HT20	802.11n HT40	802.11ac VHT80
L	Low	36	-	38	-
M	Middle	-	44	-	42
H	High	-	-	-	-

Ch. #		Band I：5150-5250 MHz	
		802.11ax HE40	802.11ax HE80
L	Low	-	-
M	Middle	-	42
H	High	46	-

Remark: For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power.

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.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	Latitude 5310	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Smart Phone	ACER	T02	FCC Doc	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QSPR Version5.0-00196” 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.

3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For the 5.15–5.25 GHz bands:

■ For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW. For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

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

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

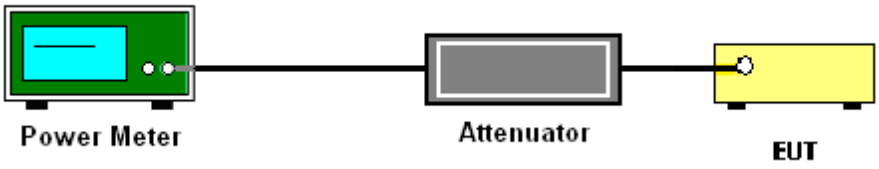
3.1.3 Test Procedures

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

Method PM-G (Measurement using a gated RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit at its maximum power control level.
3. Measure the average power of the transmitter.
4. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

3.1.4 Test Setup



3.1.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.2 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.2.1 Limit of Unwanted Emissions

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

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

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

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

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

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

(3) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of −27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000 MHz

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

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

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

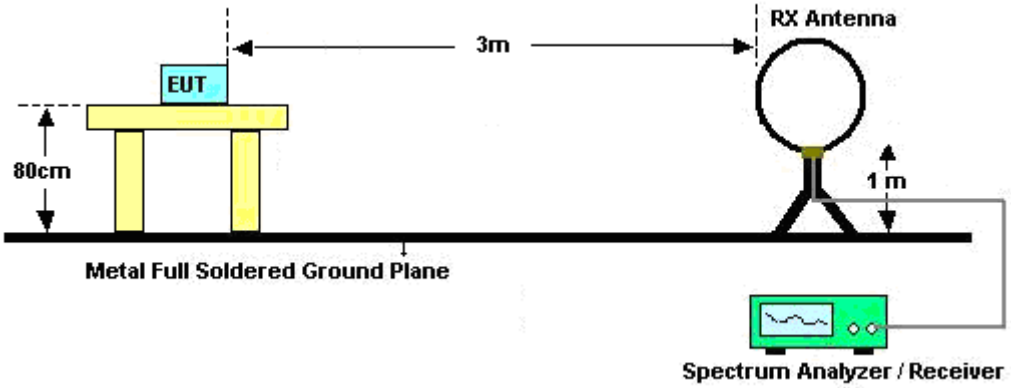
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000 MHz

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

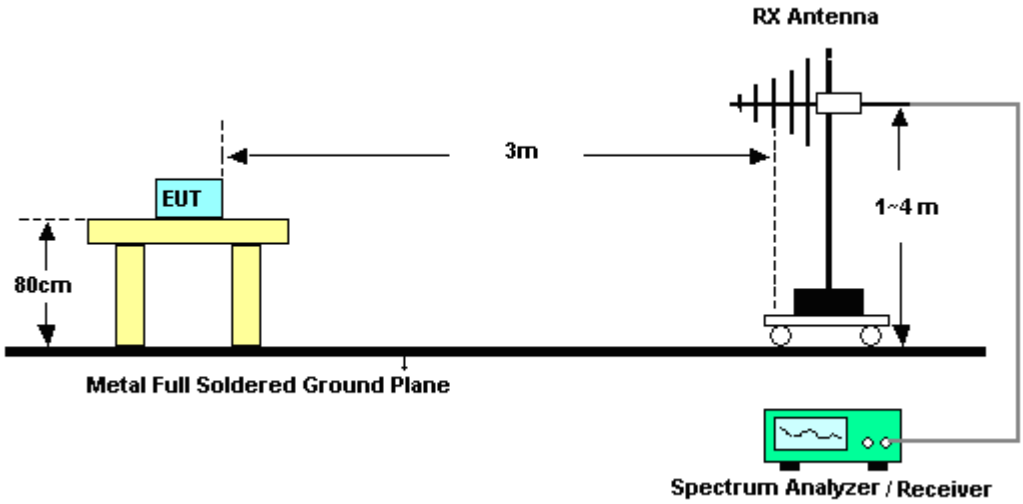
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1 GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.2.4 Test Setup

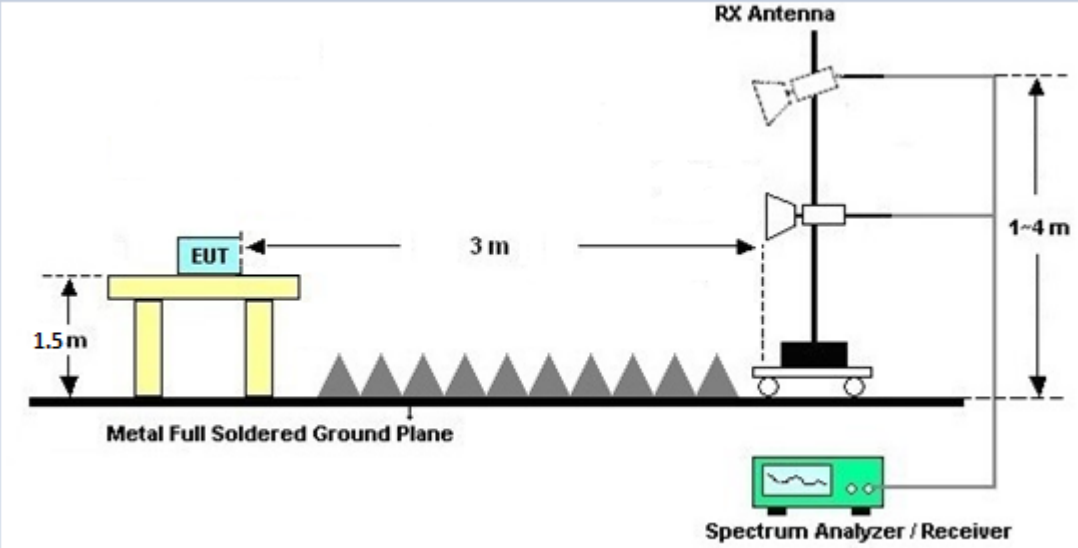
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated test above 1GHz



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

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

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

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.2.7 Duty Cycle

Please refer to Appendix E.

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

Please refer to Appendix C and D.

3.3 AC Conducted Emission Measurement

3.3.1 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.

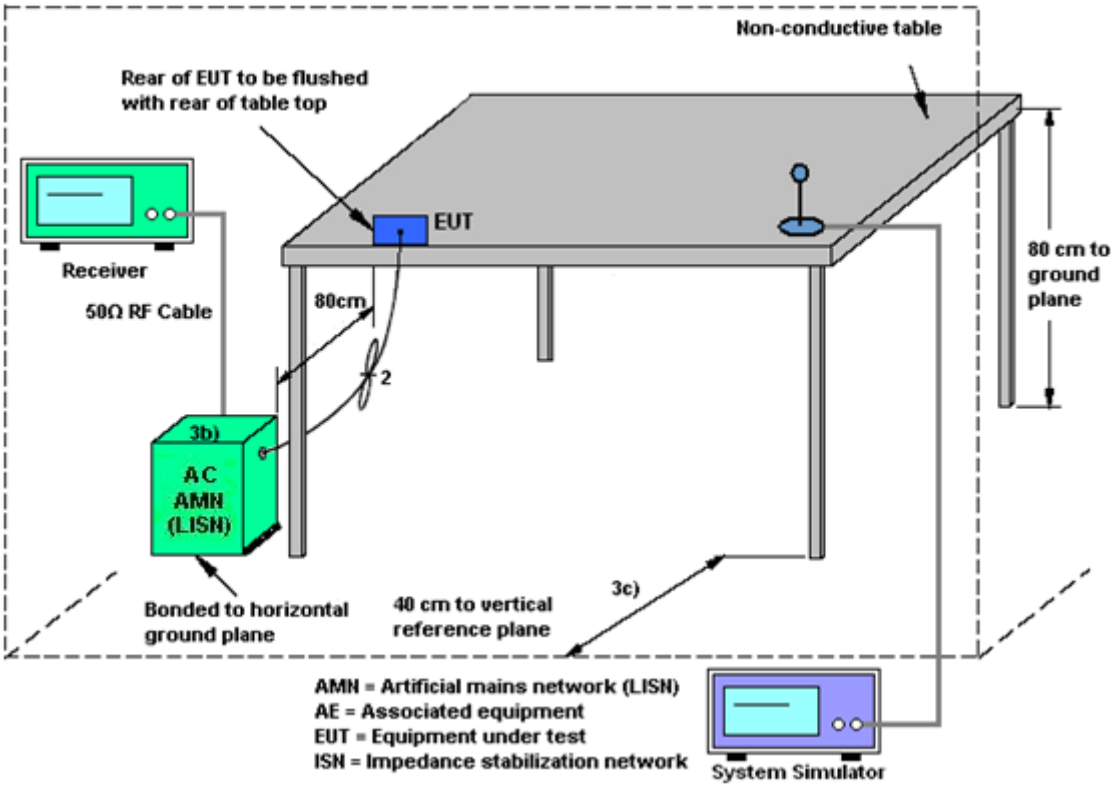
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.3.4 Test Setup



3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.4 Antenna Requirements

3.4.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jul. 14, 2020	Mar. 12, 2021~ Mar. 29, 2021	Jul. 13, 2021	Radiation (03CH16-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00802N1D01 N-06	47020 & 06	30MHz to 1GHz	Oct. 11, 2020	Mar. 12, 2021~ Mar. 29, 2021	Oct. 10, 2021	Radiation (03CH16-HY)
Amplifier	SONOMA	310N	371607	9kHz~1G	Sep. 30, 2020	Mar. 12, 2021~ Mar. 29, 2021	Sep. 29, 2021	Radiation (03CH16-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1G~18GHz	Sep. 29, 2020	Mar. 12, 2021~ Mar. 29, 2021	Sep. 28, 2021	Radiation (03CH16-HY)
Amplifier	EMCI	EMC051845SE	980729	1-18GHz	Jul. 10, 2020	Mar. 12, 2021~ Mar. 29, 2021	Jul. 09, 2021	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~40GHz	May 22, 2020	Mar. 12, 2021~ Mar. 29, 2021	May 21, 2021	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 10, 2020	Mar. 12, 2021~ Mar. 29, 2021	Dec. 09, 2021	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A	MY59053012	3Hz~26.5GHz	Nov. 18, 2020	Mar. 12, 2021~ Mar. 29, 2021	Nov. 17, 2021	Radiation (03CH16-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Jan. 15, 2021	Mar. 12, 2021~ Mar. 29, 2021	Jan. 14, 2022	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11680/4PE	NA	Aug. 29, 2020	Mar. 12, 2021~ Mar. 29, 2021	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11688/4PE	NA	Aug. 29, 2020	Mar. 12, 2021~ Mar. 29, 2021	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	EC-A5-300-5757	NA	Aug. 29, 2020	Mar. 12, 2021~ Mar. 29, 2021	Aug. 28, 2021	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Mar. 12, 2021~ Mar. 29, 2021	N/A	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Mar. 12, 2021~ Mar. 29, 2021	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Mar. 12, 2021~ Mar. 29, 2021	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Mar. 12, 2021~ Mar. 29, 2021	N/A	Radiation (03CH16-HY)
Hygrometer	Testo	608-H1	34913904	N/A	Jul. 27, 2020	Mar. 11, 2021~ Mar. 12, 2021	Jul. 26, 2021	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO10	10MHz~6GHz	Dec. 09, 2020	Mar. 11, 2021~ Mar. 12, 2021	Dec. 08, 2021	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz ~ 40GHz	Jul. 22, 2020	Mar. 11, 2021~ Mar. 12, 2021	Jul. 21, 2021	Conducted (TH05-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2020	Mar. 11, 2021~ Mar. 12, 2021	Mar. 16, 2021	Conducted (TH05-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ACPOWER	AFC-11003G	F3170400 33	N/A	N/A	Mar. 30, 2021	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Mar. 30, 2021	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBE CK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Nov. 02, 2020	Mar. 30, 2021	Nov. 01, 2021	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	N/A	Mar. 30, 2021	N/A	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Feb. 01, 2021	Mar. 30, 2021	Jan. 31, 2022	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Feb. 01, 2021	Mar. 30, 2021	Jan. 31, 2022	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Sep. 11, 2020	Mar. 30, 2021	Sep. 10, 2021	Conduction (CO07-HY)

5 Uncertainty of Evaluation

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.5**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.3**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.7**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Hank Hsu	Temperature:	21~25	°C
Test Date:	2021/03/11~2021/03/12	Relative Humidity:	51~54	%

TEST RESULTS DATA
Average Power Table

FCC Band I single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
					Ant 2	Ant 1	SUM	Ant 2	Ant 1	Ant 2	Ant 1		
11a	6Mbps	1	36	5180	16.10	-		30.00	-	3.27	-		Pass
11a	6Mbps	1	40	5200	19.40	-		30.00	-	3.27	-		Pass
11a	6Mbps	1	44	5220	20.50	-		30.00	-	3.27	-		Pass
11a	6Mbps	1	48	5240	23.60	-		30.00	-	3.27	-		Pass
HT20	MCS0	1	36	5180	15.40	-		30.00	-	3.27	-		Pass
HT20	MCS0	1	40	5200	18.90	-		30.00	-	3.27	-		Pass
HT20	MCS0	1	44	5220	21.90	-		30.00	-	3.27	-		Pass
HT20	MCS0	1	48	5240	23.50	-		30.00	-	3.27	-		Pass
HT40	MCS0	1	38	5190	15.10	-		30.00	-	3.27	-		Pass
HT40	MCS0	1	46	5230	19.30	-		30.00	-	3.27	-		Pass
VHT20	MCS0	1	36	5180	15.30	-		30.00	-	3.27	-		Pass
VHT20	MCS0	1	40	5200	18.60	-		30.00	-	3.27	-		Pass
VHT20	MCS0	1	44	5220	21.80	-		30.00	-	3.27	-		Pass
VHT20	MCS0	1	48	5240	23.40	-		30.00	-	3.27	-		Pass
VHT40	MCS0	1	38	5190	15.00	-		30.00	-	3.27	-		Pass
VHT40	MCS0	1	46	5230	19.20	-		30.00	-	3.27	-		Pass
VHT80	MCS0	1	42	5210	10.30	-		30.00	-	3.27	-		Pass

<CDD Mode>

TEST RESULTS DATA
Average Power Table

FCC Band I MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
					Ant 1	Ant 3	SUM	Ant 1	Ant 3	Ant 1	Ant 3		
11a	6Mbps	2	36	5180	22.30	22.20	25.26	30.00		3.27			Pass
11a	6Mbps	2	44	5220	23.50	22.90	26.22	30.00		3.27			Pass
11a	6Mbps	2	48	5240	23.00	22.70	25.86	30.00		3.27			Pass
HT20	MCS0	2	36	5180	21.90	21.70	24.81	30.00		3.27			Pass
HT20	MCS0	2	44	5220	23.00	22.40	25.72	30.00		3.27			Pass
HT20	MCS0	2	48	5240	22.80	22.60	25.71	30.00		3.27			Pass
HT40	MCS0	2	38	5190	17.10	16.80	19.96	30.00		3.27			Pass
HT40	MCS0	2	46	5230	20.50	20.10	23.31	30.00		3.27			Pass
VHT20	MCS0	2	36	5180	21.80	21.60	24.71	30.00		3.27			Pass
VHT20	MCS0	2	44	5220	22.90	22.30	25.62	30.00		3.27			Pass
VHT20	MCS0	2	48	5240	22.70	22.50	25.61	30.00		3.27			Pass
VHT40	MCS0	2	38	5190	17.00	16.70	19.86	30.00		3.27			Pass
VHT40	MCS0	2	46	5230	20.40	20.00	23.21	30.00		3.27			Pass
VHT80	MCS0	2	42	5210	16.00	15.40	18.72	30.00		3.27			Pass

TEST RESULTS DATA
Average Power Table

FCC Band I MIMO														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
						Ant 1	Ant 3	SUM	Ant 1	Ant 3	Ant 1	Ant 3		
HE20	MCS0	2	36	5180	Full	22.00	21.80	24.91	30.00		3.27			Pass
HE20	MCS0	2	44	5220	Full	23.10	22.50	25.82	30.00		3.27			Pass
HE20	MCS0	2	48	5240	Full	22.90	22.70	25.81	30.00		3.27			Pass
HE40	MCS0	2	38	5190	Full	17.20	16.90	20.06	30.00		3.27			Pass
HE40	MCS0	2	46	5230	Full	20.60	20.20	23.41	30.00		3.27			Pass
HE80	MCS0	2	42	5210	Full	16.10	15.50	18.82	30.00		3.27			Pass

<TXBF Mode>

TEST RESULTS DATA
Average Power Table

FCC Band I MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
					Ant 1	Ant 3	SUM	Ant 1	Ant 3	Ant 1	Ant 3		
VHT20	MCS0	2	36	5180	21.70	21.50	24.61	29.72		6.28			Pass
VHT20	MCS0	2	44	5220	22.80	22.20	25.52	29.72		6.28			Pass
VHT20	MCS0	2	48	5240	22.60	22.40	25.51	29.72		6.28			Pass
VHT40	MCS0	2	38	5190	16.90	16.60	19.76	29.72		6.28			Pass
VHT40	MCS0	2	46	5230	20.30	19.90	23.11	29.72		6.28			Pass
VHT80	MCS0	2	42	5210	15.90	15.30	18.62	29.72		6.28			Pass

Report Number : FR121023B

TEST RESULTS DATA
Average Power Table

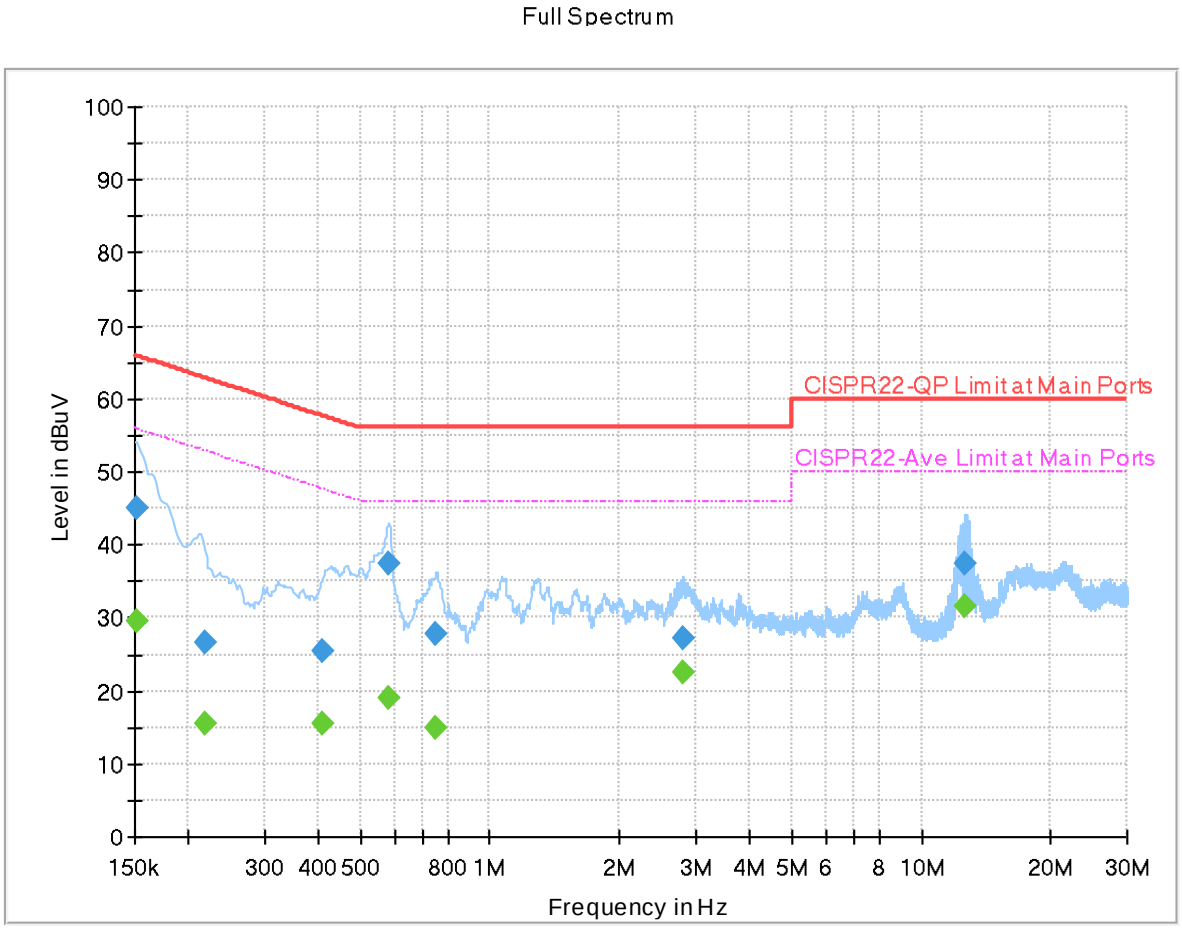
FCC Band I MIMO														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
						Ant 1	Ant 3	SUM	Ant 1	Ant 3	Ant 1	Ant 3		
HE20	MCS0	2	36	5180	Full	21.90	21.70	24.81	29.72		6.28			Pass
HE20	MCS0	2	44	5220	Full	23.00	22.40	25.72	29.72		6.28			Pass
HE20	MCS0	2	48	5240	Full	22.80	22.60	25.71	29.72		6.28			Pass
HE40	MCS0	2	38	5190	Full	17.10	16.80	19.96	29.72		6.28			Pass
HE40	MCS0	2	46	5230	Full	20.50	20.10	23.31	29.72		6.28			Pass
HE80	MCS0	2	42	5210	Full	16.00	15.40	18.72	29.72		6.28			Pass

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Eric Jeng	**Temperature :**	23~25℃
		Relative Humidity :	58~62%

EUT Information

Report NO :	121023
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

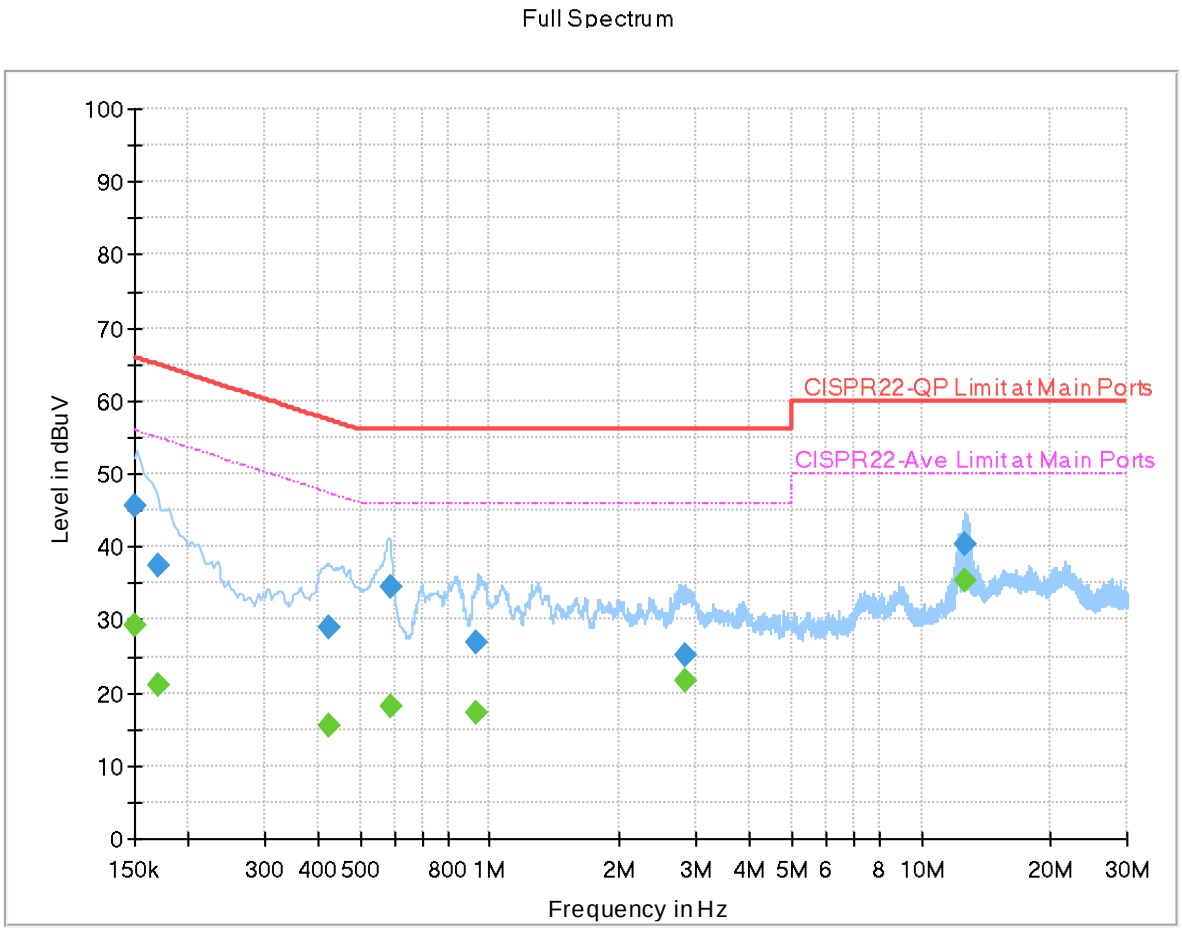


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152520	---	29.48	55.86	26.38	L1	OFF	20.0
0.152520	45.13	---	65.86	20.73	L1	OFF	20.0
0.217500	---	15.43	52.91	37.48	L1	OFF	20.0
0.217500	26.62	---	62.91	36.29	L1	OFF	20.0
0.411000	---	15.51	47.63	32.12	L1	OFF	20.0
0.411000	25.52	---	57.63	32.11	L1	OFF	20.0
0.582990	---	18.91	46.00	27.09	L1	OFF	20.0
0.582990	37.55	---	56.00	18.45	L1	OFF	20.0
0.749220	---	14.96	46.00	31.04	L1	OFF	20.0
0.749220	27.80	---	56.00	28.20	L1	OFF	20.0
2.794110	---	22.58	46.00	23.42	L1	OFF	20.1
2.794110	27.21	---	56.00	28.79	L1	OFF	20.1
12.650100	---	31.59	50.00	18.41	L1	OFF	20.2
12.650100	37.45	---	60.00	22.55	L1	OFF	20.2

EUT Information

Report NO :	121023
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)
0.150000	---	29.11	56.00	26.89	N	OFF	20.0
0.150000	45.60	---	66.00	20.40	N	OFF	20.0
0.170250	---	21.05	54.95	33.90	N	OFF	20.0
0.170250	37.46	---	64.95	27.49	N	OFF	20.0
0.424500	---	15.54	47.36	31.82	N	OFF	20.0
0.424500	28.84	---	57.36	28.52	N	OFF	20.0
0.588750	---	18.26	46.00	27.74	N	OFF	20.0
0.588750	34.45	---	56.00	21.55	N	OFF	20.0
0.933000	---	17.32	46.00	28.68	N	OFF	20.0
0.933000	26.91	---	56.00	29.09	N	OFF	20.0
2.821020	---	21.73	46.00	24.27	N	OFF	20.1
2.821020	25.28	---	56.00	30.72	N	OFF	20.1
12.655410	---	35.40	50.00	14.60	N	OFF	20.2
12.655410	40.38	---	60.00	19.62	N	OFF	20.2

Appendix C. Radiated Spurious Emission

Test Engineer :	Karl Hou, Caster Liao and Andy Yang	Temperature :	20~25°C
		Relative Humidity :	50~60%

Band 1 - 5150~5250MHz

WIFI 802.11n HT20 (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.
2		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT20 CH 44 5220MHz		5150	62.1	-11.9	74	46.92	31.8	13.05	29.67	303	35	P	H
		5149.24	50.67	-3.33	54	35.49	31.8	13.05	29.67	303	35	A	H
	*	5220	114.51	-	-	99.57	31.48	13.15	29.69	303	35	P	H
	*	5220	106.26	-	-	91.32	31.48	13.15	29.69	303	35	A	H
		5372.08	59.73	-14.27	74	44.83	31.19	13.42	29.71	303	35	P	H
		5440.12	49.54	-4.46	54	34.22	31.54	13.5	29.72	303	35	A	H
		5148.98	63.82	-10.18	74	48.64	31.8	13.05	29.67	351	269	P	V
		5148.72	51.02	-2.98	54	35.84	31.8	13.05	29.67	351	269	A	V
	*	5220	116.82	-	-	101.88	31.48	13.15	29.69	351	269	P	V
	*	5220	108.6	-	-	93.66	31.48	13.15	29.69	351	269	A	V
		5369	62.6	-11.4	74	47.72	31.18	13.41	29.71	351	269	P	V
		5439.84	53.22	-0.78	54	37.9	31.54	13.5	29.72	351	269	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI Ant. 2	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)
802.11n HT20 CH 44 5220MHz		10440	48.2	-20	68.2	45.3	39.68	19.43	56.21	100	0	P	H
		15660	55.84	-18.16	74	50.39	37.56	23.32	55.43	200	302	P	H
		15660	46.34	-7.66	54	40.89	37.56	23.32	55.43	200	302	A	H
													H
		10440	48.34	-19.86	68.2	45.44	39.68	19.43	56.21	100	0	P	V
		15660	49.84	-24.16	74	44.39	37.56	23.32	55.43	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 2	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)
802.11n HT40 CH 38 5190MHz		5076.18	54.75	-19.25	74	39.75	31.7	12.96	29.66	234	35	P	H
		5149.76	46.34	-7.66	54	31.16	31.8	13.05	29.67	234	35	A	H
	*	5190	103.59	-	-	88.53	31.64	13.1	29.68	234	35	P	H
	*	5190	95.48	-	-	80.42	31.64	13.1	29.68	234	35	A	H
		5407.36	55.17	-18.83	74	40.07	31.34	13.48	29.72	234	35	P	H
		5440.12	47.31	-6.69	54	31.99	31.54	13.5	29.72	234	35	A	H
		5150	57.26	-16.74	74	42.08	31.8	13.05	29.67	206	84	P	V
		5149.76	49.61	-4.39	54	34.43	31.8	13.05	29.67	206	84	A	V
	*	5190	109.9	-	-	94.84	31.64	13.1	29.68	206	84	P	V
	*	5190	101.41	-	-	86.35	31.64	13.1	29.68	206	84	A	V
		5439.56	60.76	-13.24	74	45.44	31.54	13.5	29.72	206	84	P	V
		5439.84	53.38	-0.62	54	38.06	31.54	13.5	29.72	206	84	A	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI Ant. 2	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)
802.11n HT40 CH 38 5190MHz		10380	48.06	-20.14	68.2	45.36	39.52	19.4	56.22	100	0	P	H
		15570	46.89	-27.11	74	41.16	37.89	23.25	55.41	100	0	P	H
													H
													H
		10380	48.28	-19.92	68.2	45.58	39.52	19.4	56.22	100	0	P	V
		15570	46.81	-27.19	74	41.08	37.89	23.25	55.41	100	0	P	V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 2	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)
802.11ac VHT80 CH 42 5210MHz		5146.38	60.05	-13.95	74	44.88	31.8	13.04	29.67	288	34	P	H
		5150	50.68	-3.32	54	35.5	31.8	13.05	29.67	288	34	A	H
	*	5210	97.69	-	-	82.7	31.54	13.13	29.68	288	34	P	H
	*	5210	89.96	-	-	74.97	31.54	13.13	29.68	288	34	A	H
		5387.48	55.67	-18.33	74	40.68	31.25	13.45	29.71	288	34	P	H
		5439.84	46.11	-7.89	54	30.79	31.54	13.5	29.72	288	34	A	H
		5149.24	57.64	-16.36	74	42.46	31.8	13.05	29.67	351	267	P	V
		5149.5	51.08	-2.92	54	35.9	31.8	13.05	29.67	351	267	A	V
	*	5210	100.52	-	-	85.53	31.54	13.13	29.68	351	267	P	V
	*	5210	92.81	-	-	77.82	31.54	13.13	29.68	351	267	A	V
		5432.84	56.33	-17.67	74	41.05	31.5	13.5	29.72	351	267	P	V
		5360.04	48.2	-5.8	54	33.37	31.14	13.4	29.71	351	267	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant. 2	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)
		10420	48.26	-19.94	68.2	45.42	39.64	19.42	56.22	100	0	P	H
		15630	46.16	-27.84	74	40.62	37.68	23.29	55.43	100	0	P	H
802.11ac													H
VHT80													H
CH 42		10420	48.64	-19.56	68.2	45.8	39.64	19.42	56.22	100	0	P	V
5210MHz		15630	46.69	-27.31	74	41.15	37.68	23.29	55.43	100	0	P	V
													V
													V

Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.

Emission below 1GHz

WIFI 802.11n HT40 (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT40 LF		93.05	29.21	-14.29	43.5	45.18	15.19	1.47	32.63	-	-	P	H
		206.54	32.38	-11.12	43.5	47.68	15.22	2.37	32.89	-	-	P	H
		332.64	34.98	-11.02	46	44.42	19.98	3.07	32.49	-	-	P	H
		461.65	37.21	-8.79	46	42.64	23.49	3.63	32.55	100	34	Q	H
		664.38	32.15	-13.85	46	33.77	26.45	4.43	32.5	-	-	P	H
		897.18	32.35	-13.65	46	30.35	29.14	5.29	32.43	-	-	P	H
													H
													H
													H
													H
													H
													H
		60.07	29.6	-10.4	40	49.31	11.97	1.12	32.8	100	343	Q	V
		219.15	38.45	-7.55	46	53.41	15.42	2.46	32.84	-	-	P	V
		460.68	39.07	-6.93	46	44.53	23.46	3.63	32.55	100	342	Q	V
		631.4	30.59	-15.41	46	32.5	26.36	4.32	32.59	-	-	P	V
		720.64	37.97	-8.03	46	38.58	27.25	4.63	32.49	-	-	P	V
		864.2	32.02	-13.98	46	30.26	29.2	5.14	32.58	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Band 1 - 5150~5250MHz

WIFI 802.11a (Band Edge @ 3m)

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+3		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		5148.46	58.7	-15.3	74	43.52	31.8	13.05	29.67	209	328	P	H
		5150	49.24	-4.76	54	34.06	31.8	13.05	29.67	209	328	A	H
	*	5180	116.05	-	-	100.96	31.68	13.09	29.68	209	328	P	H
	*	5180	107.97	-	-	92.88	31.68	13.09	29.68	209	328	A	H
													H
													H
		5150	61.25	-12.75	74	46.07	31.8	13.05	29.67	400	36	P	V
		5150	52.33	-1.67	54	37.15	31.8	13.05	29.67	400	36	A	V
	*	5180	120.15	-	-	105.06	31.68	13.09	29.68	400	36	P	V
	*	5180	112.23	-	-	97.14	31.68	13.09	29.68	400	36	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1+3	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)
802.11a CH 36 5180MHz		10360	49.4	-18.8	68.2	46.8	39.44	19.39	56.23	100	0	P	H
		15540	47.56	-26.44	74	41.77	37.98	23.22	55.41	100	0	P	H
													H
													H
		10360	49.34	-18.86	68.2	46.74	39.44	19.39	56.23	100	0	P	V
		15540	47.85	-26.15	74	42.06	37.98	23.22	55.41	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

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

WIFI Ant. 1+3	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 46 5230MHz		5149.26	56.77	-17.23	74	41.59	31.8	13.05	29.67	200	310	P	H
		5149.94	48.33	-5.67	54	33.15	31.8	13.05	29.67	200	310	A	H
	*	5230	115.86	-	-	100.97	31.42	13.16	29.69	200	310	P	H
	*	5230	105.79	-	-	90.9	31.42	13.16	29.69	200	310	A	H
		5380.32	54.72	-19.28	74	39.78	31.22	13.43	29.71	200	310	P	H
		5376	45.2	-8.8	54	30.28	31.2	13.43	29.71	200	310	A	H
		5145.52	58.46	-15.54	74	43.29	31.8	13.04	29.67	398	74	P	V
		5149.94	49.14	-4.86	54	33.96	31.8	13.05	29.67	398	74	A	V
	*	5230	120.8	-	-	105.91	31.42	13.16	29.69	398	74	P	V
	*	5230	110.98	-	-	96.09	31.42	13.16	29.69	398	74	A	V
		5352.24	56.31	-17.69	74	41.53	31.11	13.38	29.71	398	74	P	V
		5376	46	-8	54	31.08	31.2	13.43	29.71	398	74	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ax HE40 Full (Harmonic @ 3m)

WIFI Ant. 1+3	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)
		10460	49.29	-18.91	68.2	46.34	39.72	19.44	56.21	100	0	P	H
		15690	47.34	-26.66	74	42	37.44	23.34	55.44	100	0	P	H
802.11ax													H
HE40 Full													H
CH 46		10460	49.41	-18.79	68.2	46.46	39.72	19.44	56.21	100	0	P	V
5230MHz		15690	48.22	-25.78	74	42.88	37.44	23.34	55.44	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ax HE80 Full (Band Edge @ 3m)

WIFI Ant. 1+3	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 HE80 Full CH 42 5210MHz		5149.24	56.87	-17.13	74	41.69	31.8	13.05	29.67	201	42	P	H
		5150	48.26	-5.74	54	33.08	31.8	13.05	29.67	201	42	A	H
	*	5210	105.89			90.9	31.54	13.13	29.68	201	42	P	H
	*	5210	95.98			80.99	31.54	13.13	29.68	201	42	A	H
		5454.96	54.63	-19.37	74	39.22	31.61	13.52	29.72	201	42	P	H
		5409.88	42.46	-11.54	54	27.34	31.36	13.48	29.72	201	42	A	H
		5146.12	60.97	-13.03	74	45.8	31.8	13.04	29.67	400	75	P	V
		5147.94	50.15	-3.85	54	34.98	31.8	13.04	29.67	400	75	A	V
	*	5210	110.2			95.21	31.54	13.13	29.68	400	75	P	V
	*	5210	100.95			85.96	31.54	13.13	29.68	400	75	A	V
		5360.88	53.33	-20.67	74	38.5	31.14	13.4	29.71	400	75	P	V
		5376	43.61	-10.39	54	28.69	31.2	13.43	29.71	400	75	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ax HE80 Full (Harmonic @ 3m)

WIFI Ant. 1+3	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)
		10420	48.91	-19.29	68.2	46.07	39.64	19.42	56.22	100	0	P	H
		15630	46.6	-27.4	74	41.06	37.68	23.29	55.43	100	0	P	H
802.11ax													H
HE80 Full													H
CH 42		10420	48.18	-20.02	68.2	45.34	39.64	19.42	56.22	100	0	P	V
5210MHz		15630	46.42	-27.58	74	40.88	37.68	23.29	55.43	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

WIFI 802.11a Full (LF @ 3m)

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+3		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		97.9	25.57	-17.93	43.5	40.78	15.88	1.52	32.61	-	-	P	H
		332.64	35.35	-10.65	46	44.79	19.98	3.07	32.49	-	-	P	H
		457.77	38.88	-7.12	46	44.38	23.42	3.62	32.54	100	26	QP	H
		600.36	35.44	-10.56	46	38.24	25.65	4.22	32.67	-	-	P	H
		749.74	35.87	-10.13	46	35.64	28.16	4.7	32.63	-	-	P	H
		927.25	33.32	-12.68	46	30.01	29.92	5.38	31.99	-	-	P	H
													H
													H
													H
													H
													H
802.11a													H
LF		98.87	34.08	-9.42	43.5	49.19	15.96	1.54	32.61	-	-	P	V
		333.61	27.58	-18.42	46	36.99	20.01	3.07	32.49	-	-	P	V
		464.56	38.79	-7.21	46	44.15	23.55	3.65	32.56	100	215	QP	V
		600.36	35.6	-10.4	46	38.4	25.65	4.22	32.67	-	-	P	V
		713.85	35.56	-10.44	46	36.48	26.92	4.62	32.46	-	-	P	V
		914.64	33.51	-12.49	46	30.84	29.51	5.35	32.19	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

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+3		(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

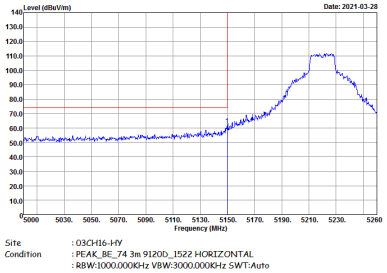
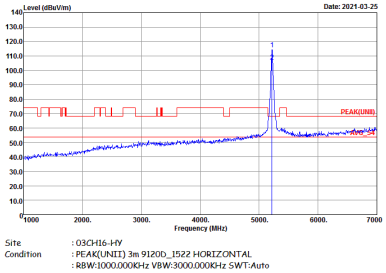
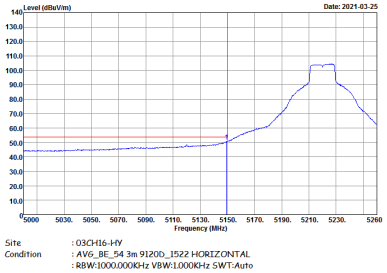
Test Engineer :	Karl Hou, Caster Liao and Andy Yang	**Temperature :**	20~25°C
		Relative Humidity :	50~60%

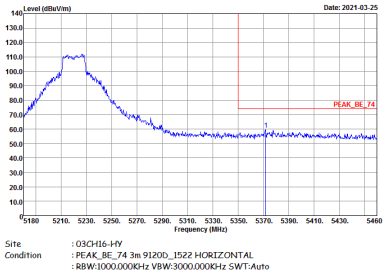
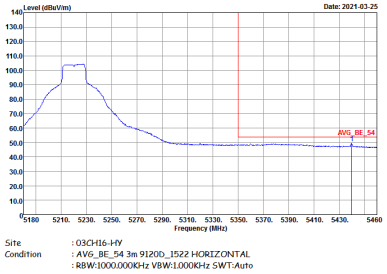
Note symbol

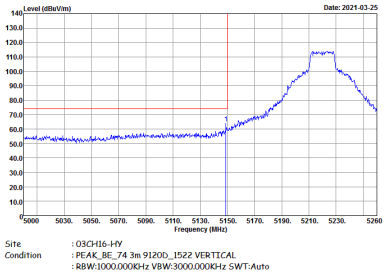
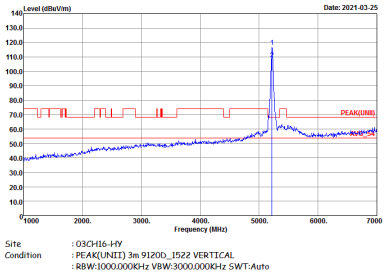
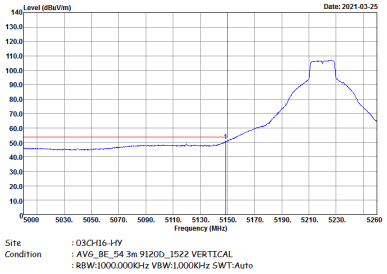
-L	**Low channel location**
-R	**High channel location**

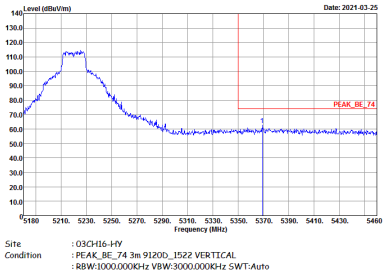
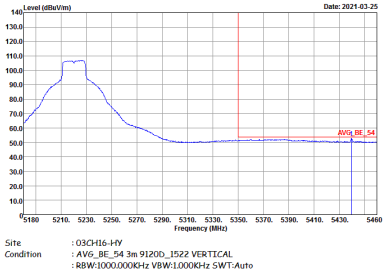
Band 1 - 5150~5250MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

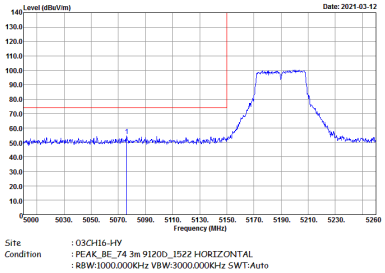
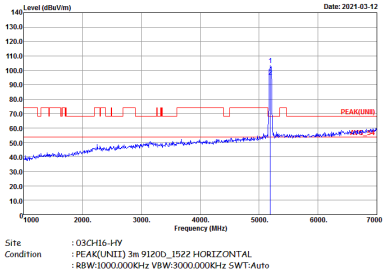
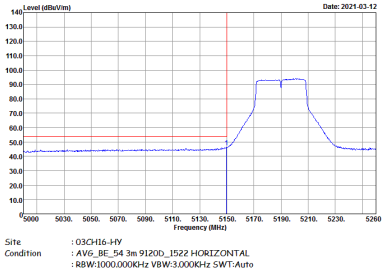
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - L	
2	Horizontal	Fundamental
Peak		
Avg.		Left blank

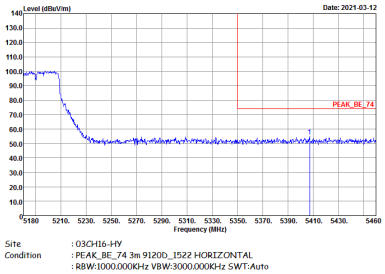
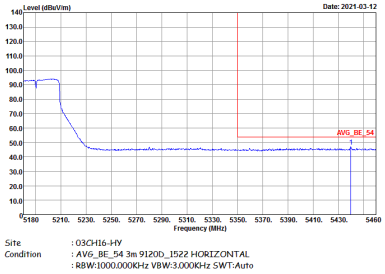
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - R	
2	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

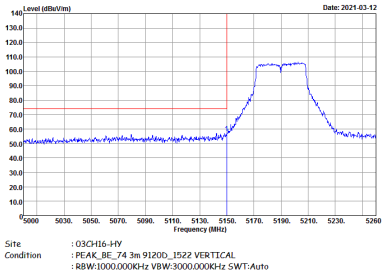
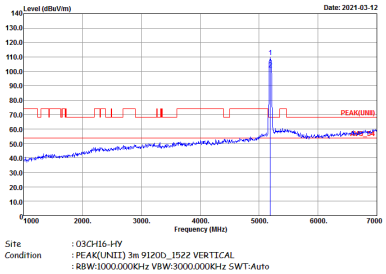
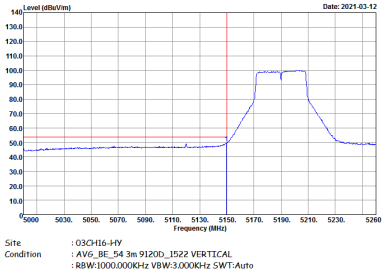
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - L	
2	Vertical	Fundamental
Peak		
Avg.		Left blank

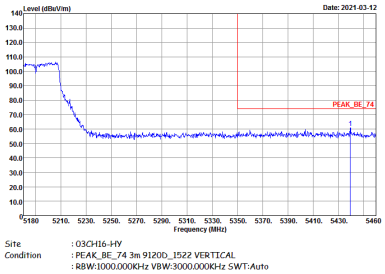
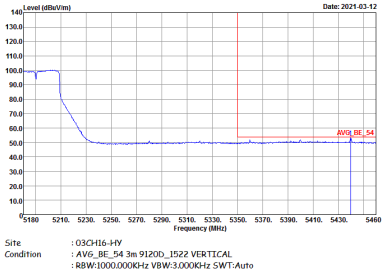
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - R	
2	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

Band 1 5150~5250MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - L	
2	Horizontal	Fundamental
Peak		
Avg.		Left blank

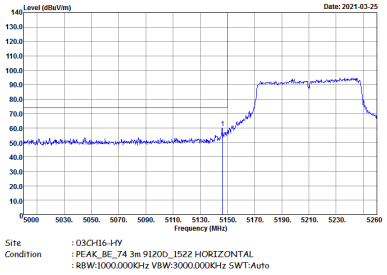
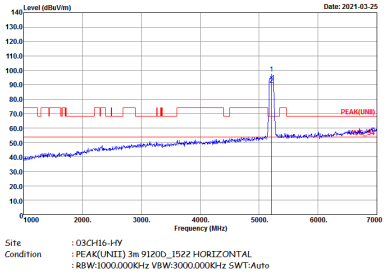
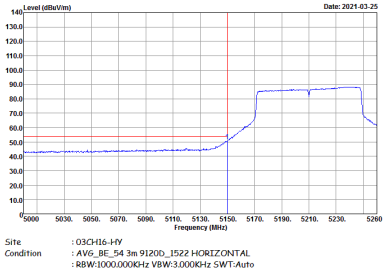
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - R	
2	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

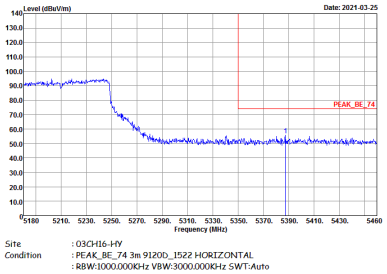
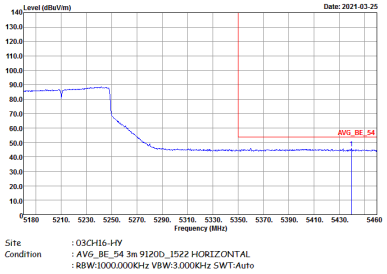
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - L	
2	Vertical	Fundamental
Peak		
Avg.		Left blank

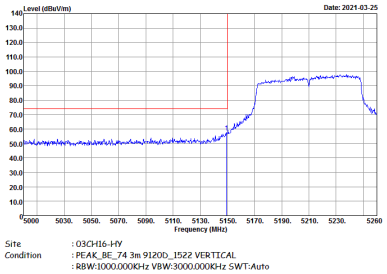
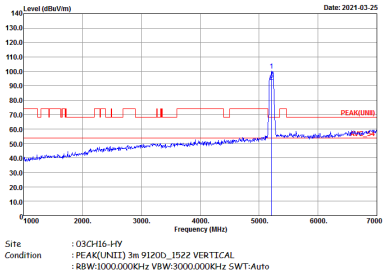
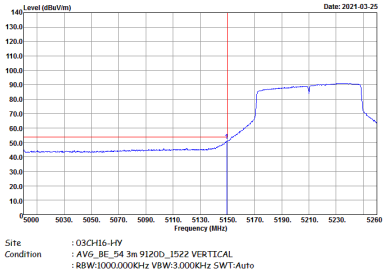
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - R	
2	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

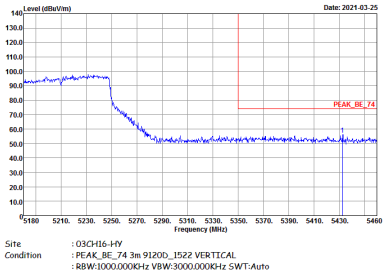
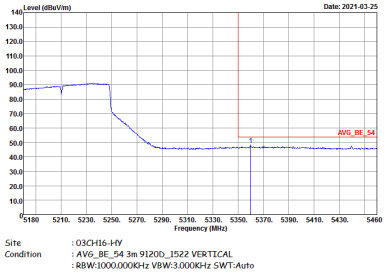
Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - L	
2	Horizontal	Fundamental
Peak		
Avg.		Left blank

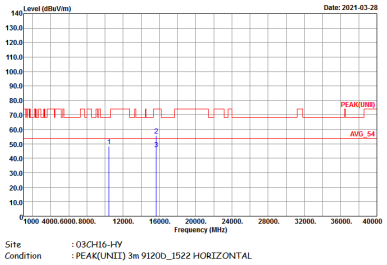
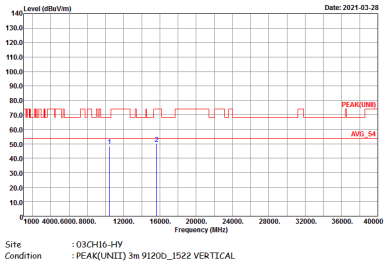
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - R	
2	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - L	
2	Vertical	Fundamental
Peak		
Avg.		Left blank

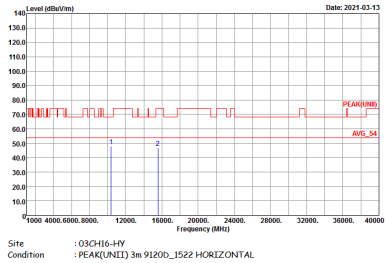
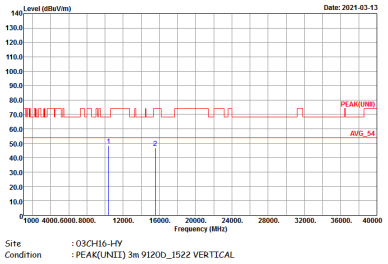
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - R	
2	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

Band 1 - 5150~5250MHz

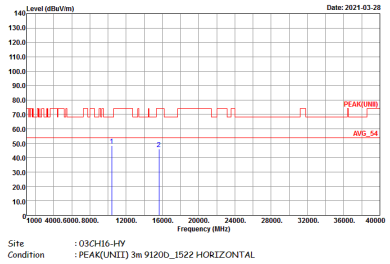
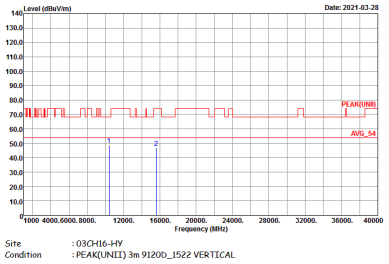
WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT20 CH44 5220MHz	
2	Horizontal	Vertical
Peak Avg.		

Band 1 5150~5250MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

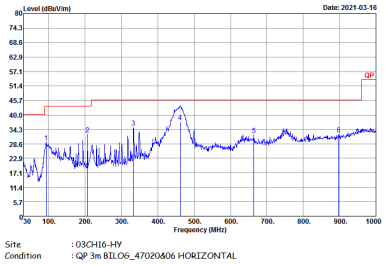
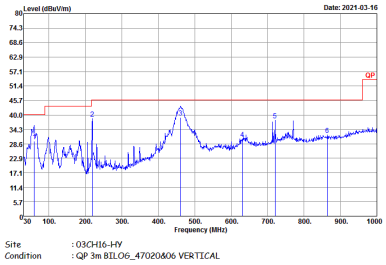
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT40 CH38 5190MHz	
2	Horizontal	Vertical
Peak Avg.		

Band 1 5150~5250MHz
WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz	
2	Horizontal	Vertical
Peak Avg.		

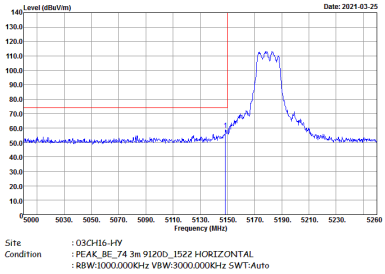
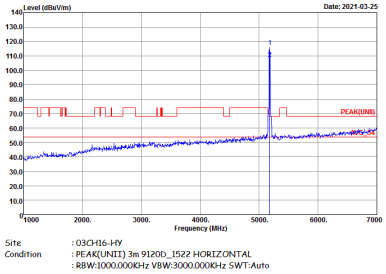
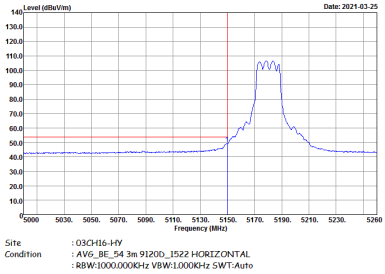
Emission below 1GHz

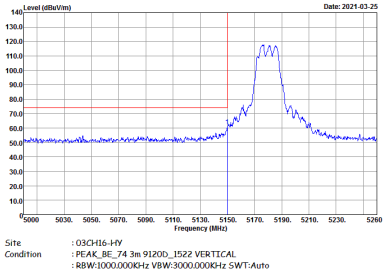
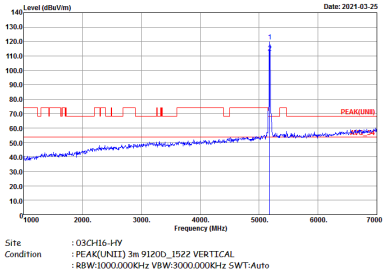
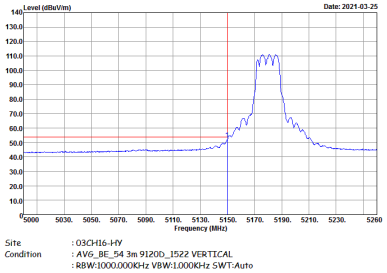
5GHz WIFI 802.11n HT40 (LF)

WIFI	5GHz WIFI	
ANT	802.11n HT40 LF	
2	Horizontal	Vertical
QP / Peak		

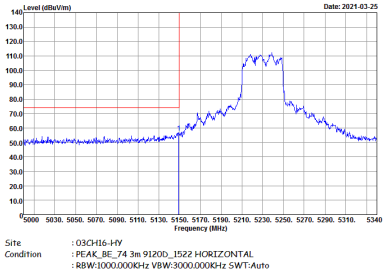
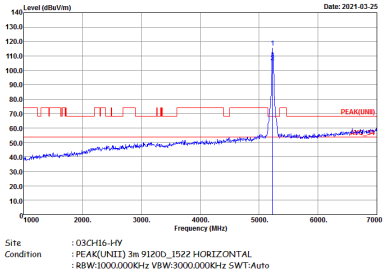
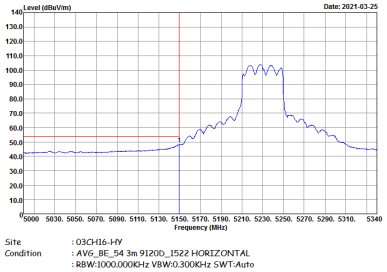
Band 1 - 5150~5250MHz

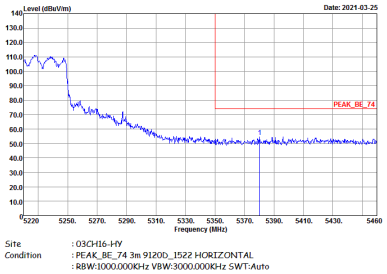
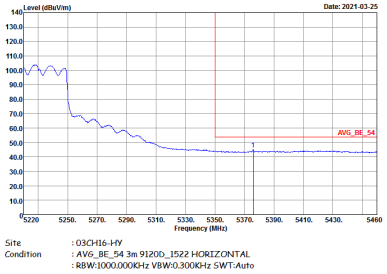
WIFI 802.11a (Band Edge @ 3m)

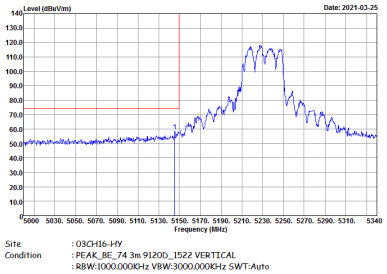
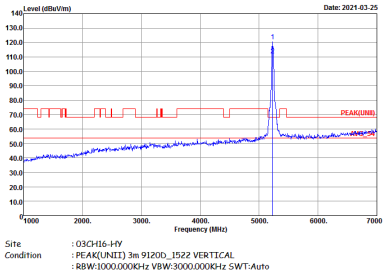
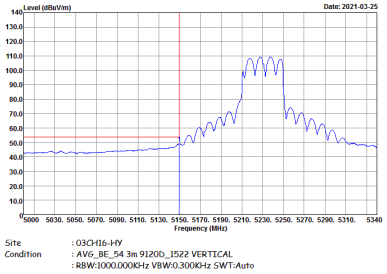
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1+3	Horizontal	Fundamental
Peak		
Avg.		Left blank

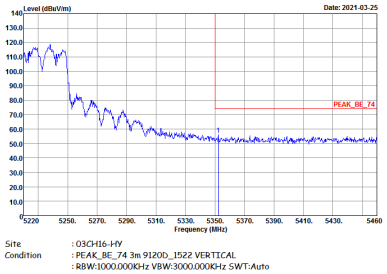
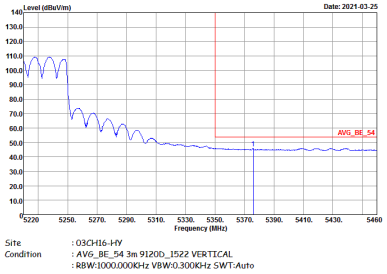
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1+3	Vertical	Fundamental
Peak		
Avg.		Left blank

Band 1 5150~5250MHz
WIFI 802.11ax HE40 Full (Band Edge @ 3m)

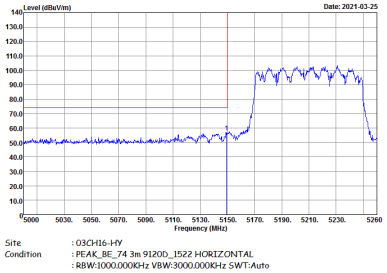
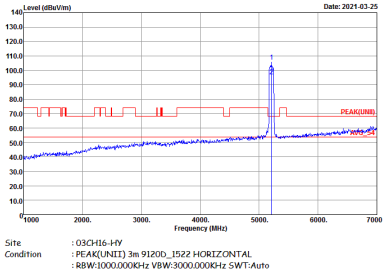
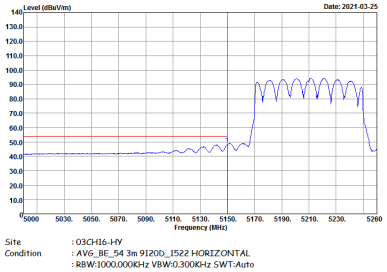
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full CH46 5230MHz - L	
1+3	Horizontal	Fundamental
Peak		
Avg.		Left blank

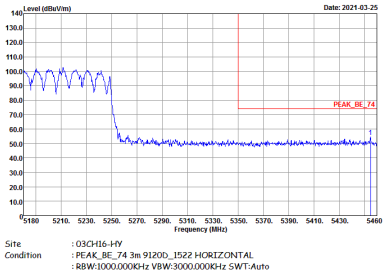
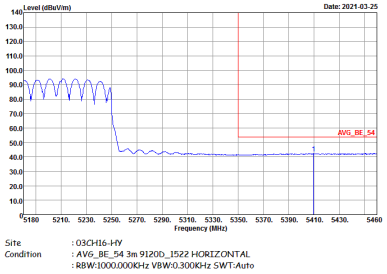
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full CH46 5230MHz - R	
1+3	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

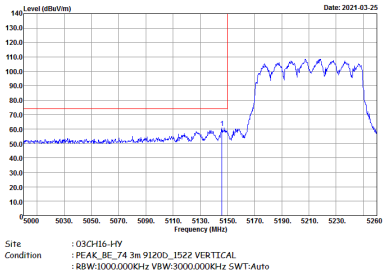
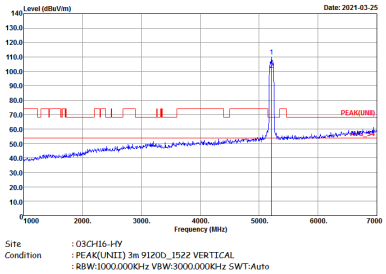
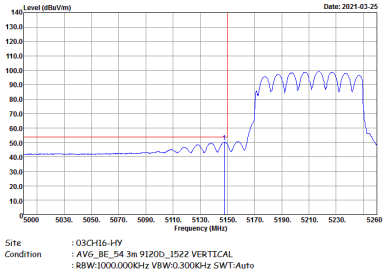
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full CH46 5230MHz - L	
1+3	Vertical	Fundamental
Peak		
Avg.		Left blank

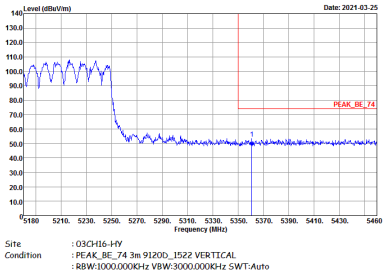
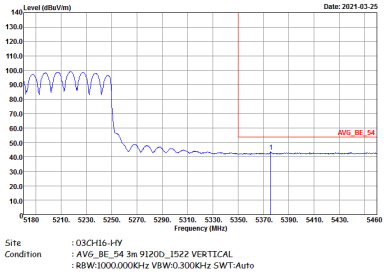
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full CH46 5230MHz - R	
1+3	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

Band 1 5150~5250MHz
WIFI 802.11ax HE80 Full (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - L	
1+3	Horizontal	Fundamental
Peak		
Avg.		Left blank

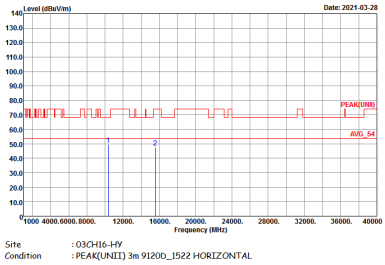
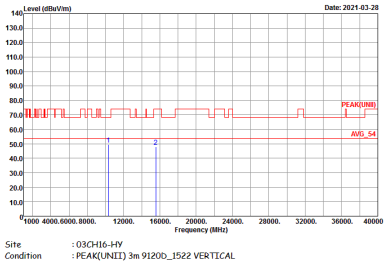
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - R	
1+3	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - L	
1+3	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - R	
1+3	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

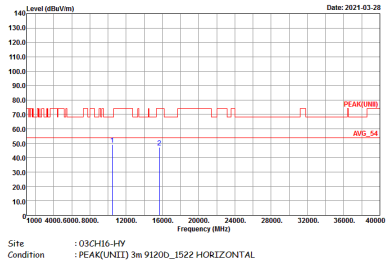
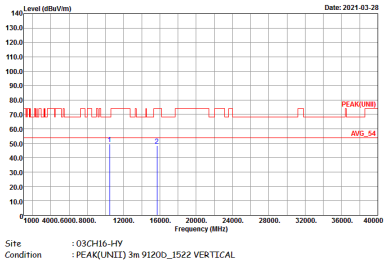
Band 1 - 5150~5250MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11a CH36 5180MHz	
1+3	Horizontal	Vertical
Peak Avg.		

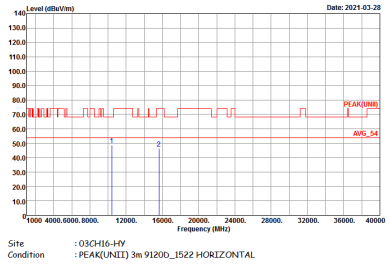
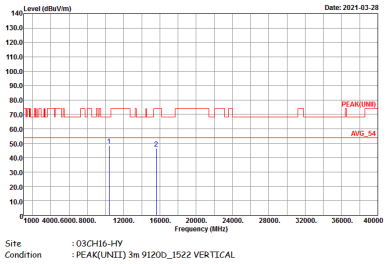
Band 1 5150~5250MHz

WIFI 802.11ax HE40 Full (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11ax HE40 Full CH46 5230MHz	
1+3	Horizontal	Vertical
Peak Avg.		

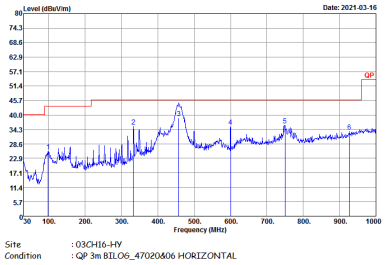
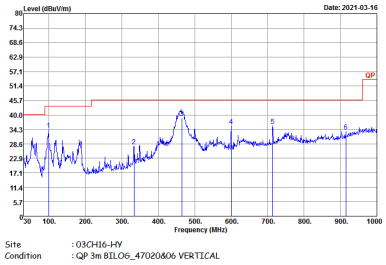
Band 1 5150~5250MHz

WIFI 802.11ax HE80 Full (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz	
1+3	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

5GHz WIFI 802.11a Full (LF)

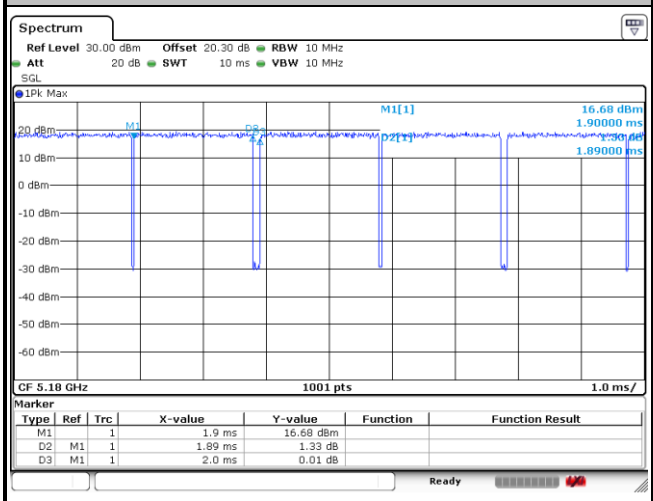
WIFI	5GHz WIFI	
ANT	802.11a Full LF	
1+3	Horizontal	Vertical
QP / Peak		

Appendix E. Duty Cycle Plots

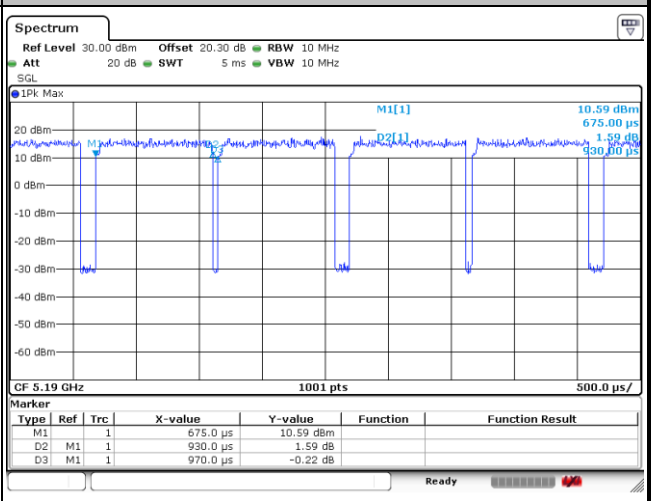
Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
2	5GHz 802.11n HT20	94.50	1890	0.53	1kHz	0.25
2	5GHz 802.11n HT40	95.88	930	1.08	3kHz	0.18
2	5GHz 802.11ac VHT80	91.00	455	2.20	3kHz	0.41
1+3	802.11a for Ant 1	94.29	1980	0.51	1kHz	0.26
1+3	802.11a for Ant 3	93.81	1970	0.51	1kHz	0.28
1+3	5GHz 802.11ax HE20 Full RU for Ant 1	96.12	5445	0.18	300Hz	0.17
1+3	5GHz 802.11ax HE20 Full RU for Ant 3	96.21	5465	0.18	300Hz	0.17
1+3	5GHz 802.11ax HE40 Full RU for Ant 1	96.14	5480	0.18	300Hz	0.17
1+3	5GHz 802.11ax HE40 Full RU for Ant 3	95.61	5440	0.18	300Hz	0.19
1+3	5GHz 802.11ax HE80 Full RU for Ant 1	93.80	5450	0.18	300Hz	0.28
1+3	5GHz 802.11ax HE80 Full RU for Ant 3	93.81	5460	0.18	300Hz	0.28

<Ant. 2>

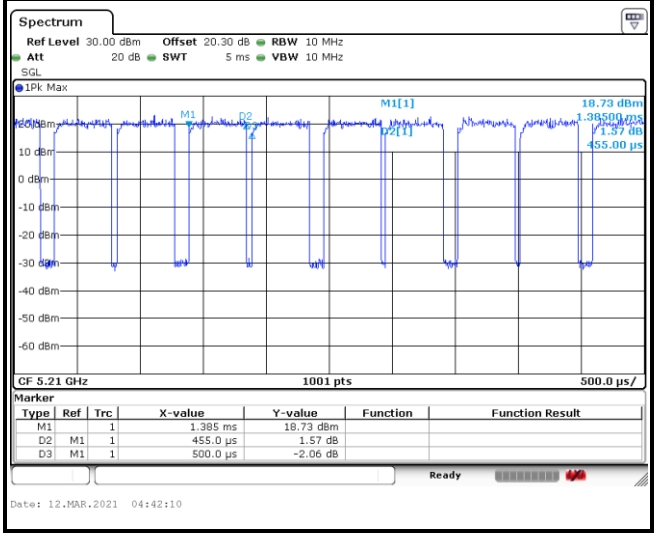
802.11n HT20



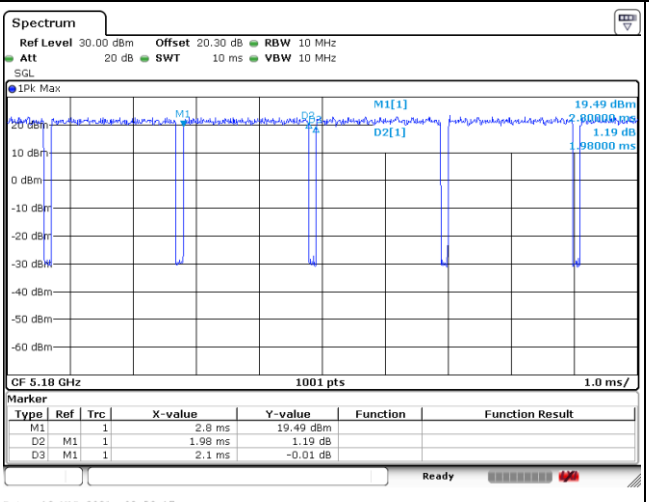
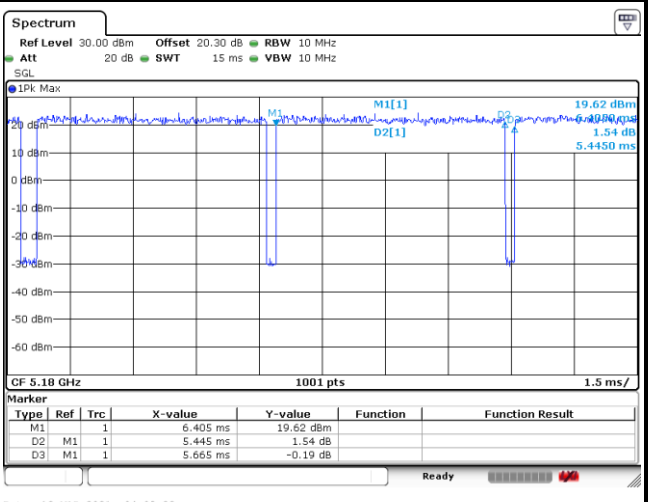
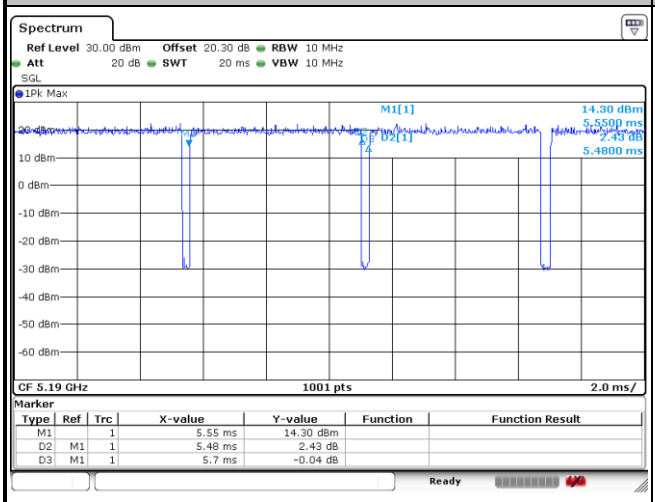
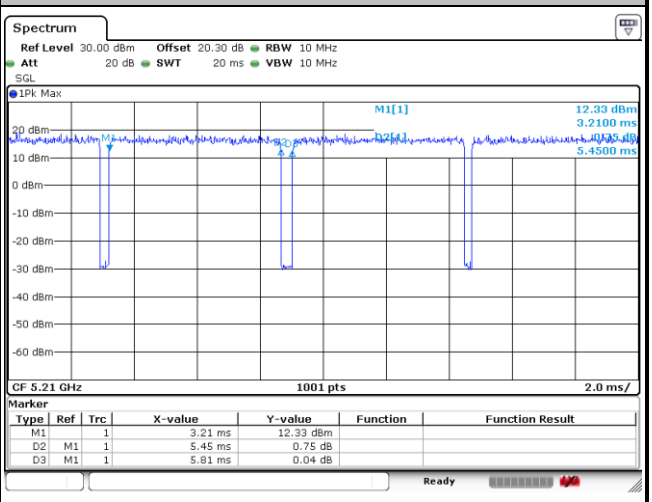
802.11n HT40



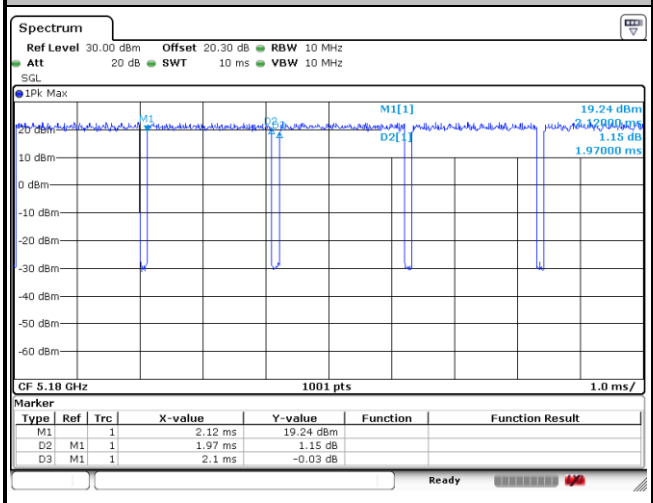
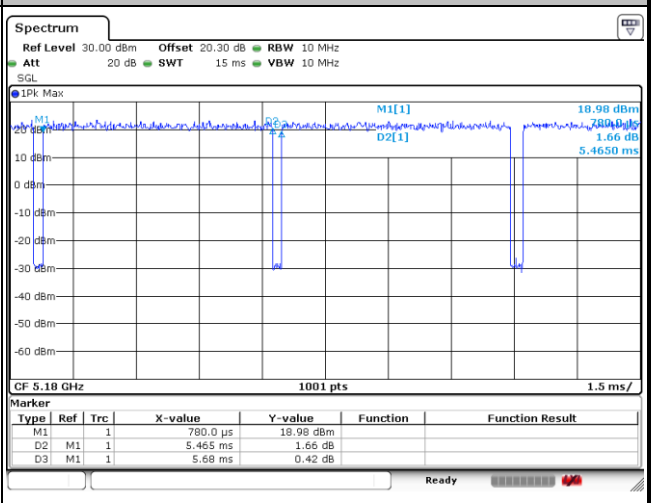
802.11ac VHT80

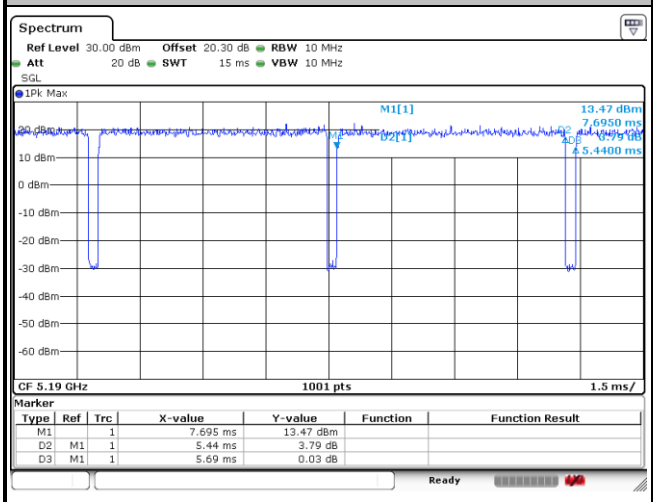
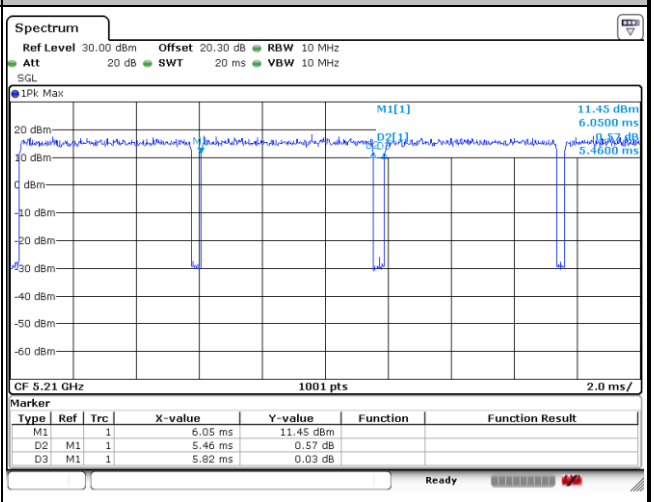


MIMO <Ant. 1>

802.11a	802.11ax HE20 Full RU
	
802.11ax HE40 Full RU	802.11ax HE80 Full RU
	

MIMO <Ant. 3>

802.11a	802.11ax HE20 Full RU
	

802.11ax HE40 Full RU	802.11ax HE80 Full RU
	

THE END