FCC RADIO TEST REPORT

FCC ID	:	**PKRISGM2000B**
Equipment	:	**Wireless Hotspot Modem**
Brand Name	:	**Inseego**
Model Name	:	**M2000B**
Marketing Name	:	**M2000**
Applicant	:	**Inseego Corporation** **9710 Scranton Road Suite 200, San Diego, CA 92121**
Manufacturer	:	**Inseego Corporation** **9710 Scranton Road Suite 200, San Diego, CA 92121**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Jul. 30, 2020 and testing was started from Aug. 14, 2020 and completed on Sep. 14, 2020. 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 variant report apply exclusively to the tested model / sample. Without written approval of 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, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR041658B	01	Initial issue of report	Sep. 23, 2020

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 5.48 dB at 5149.500 MHz
3.3	15.207	AC Conducted Emission	Pass	Under limit 15.11 dB at 0.154 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 which can be referred Declaration of Similarity Letter. All the test cases were performed on original report which can be referred to Sporton Report Number FR041657B as Appendix G. 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: Celery Wei

1 General Description

1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Antenna Type	WWAN: Fixed Internal Antenna WLAN: <Ant. 0>: Fixed Internal Antenna <Ant. 1>: Fixed Internal Antenna GPS: Fixed Internal Antenna

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, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	**Sporton Site No.**	
	TH05-HY	CO05-HY

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

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH15-HY

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

FCC designation No.: TW1190 and TW0007

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.
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, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

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

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
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, 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.

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

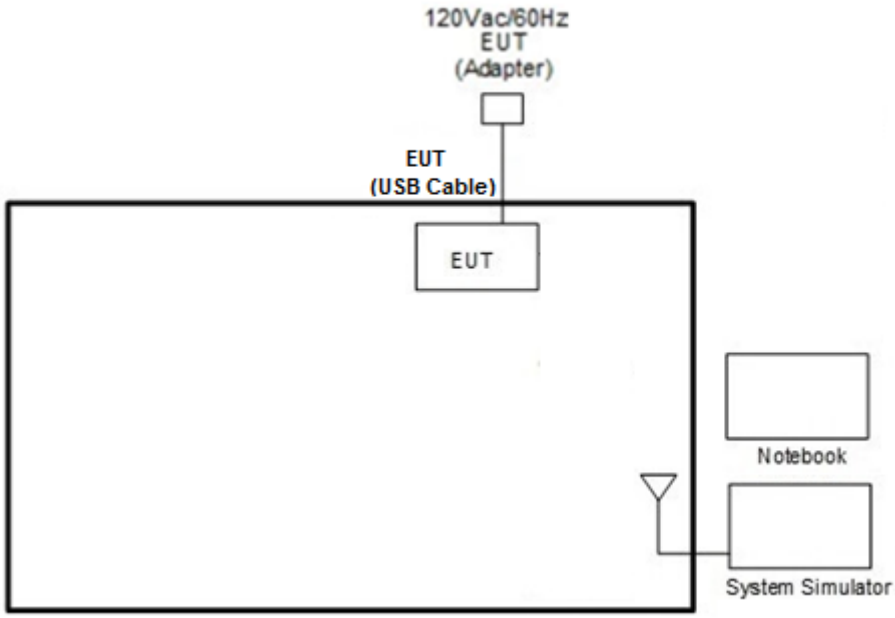
Test Cases	
AC Conducted Emission	Mode 1 : WCDMA Band V Idle + WLAN (5GHz) Link + Battery 1 + USB Cable (Charging from AC Adapter)
Remark: For Radiated Test Cases, the tests were performed with Battery 2.	

Ch. #		Band I：5150-5250 MHz	
		802.11ax HE40	802.11ax HE80
L	Low	38	-
M	Middle	-	42
H	High	-	-

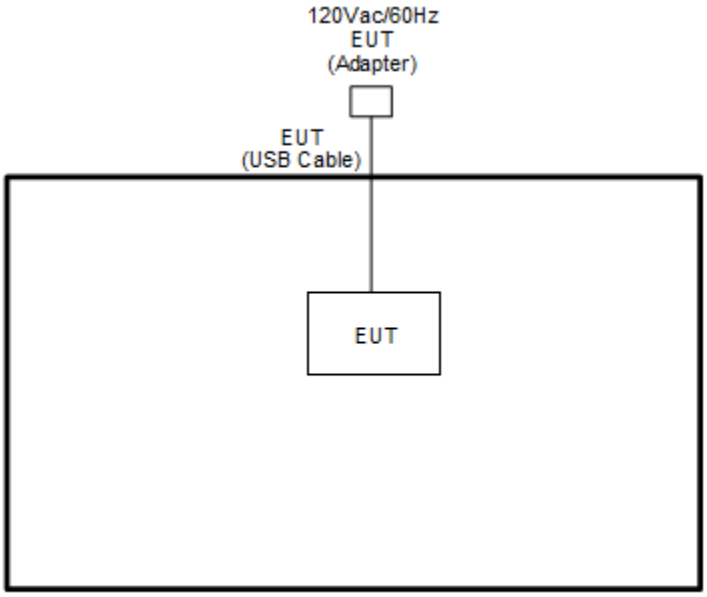
Remark: For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power, the worst mode of WLAN and LTE for simultaneous transmission were verified and compliant.

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<WLAN Tx Mode>



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.	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 “QRCT V4.0.00142.0” 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.

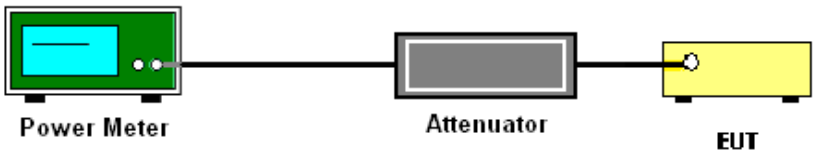
3.1.3 Test Procedures

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

Method PM-G (Measurement using an 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.

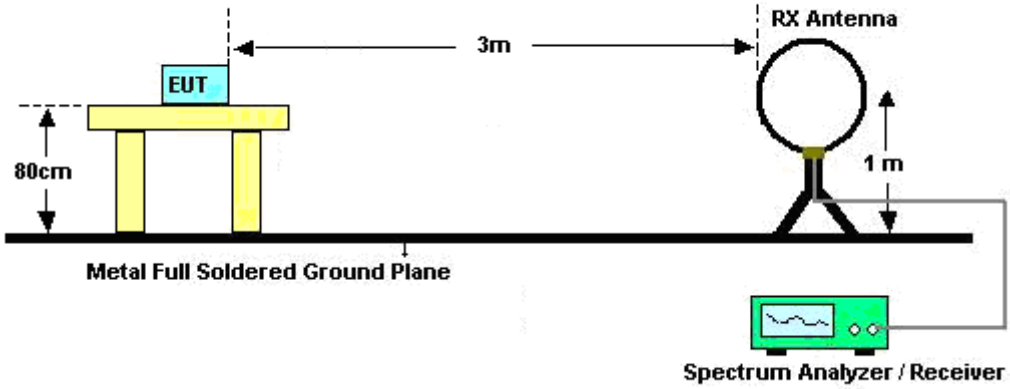
   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

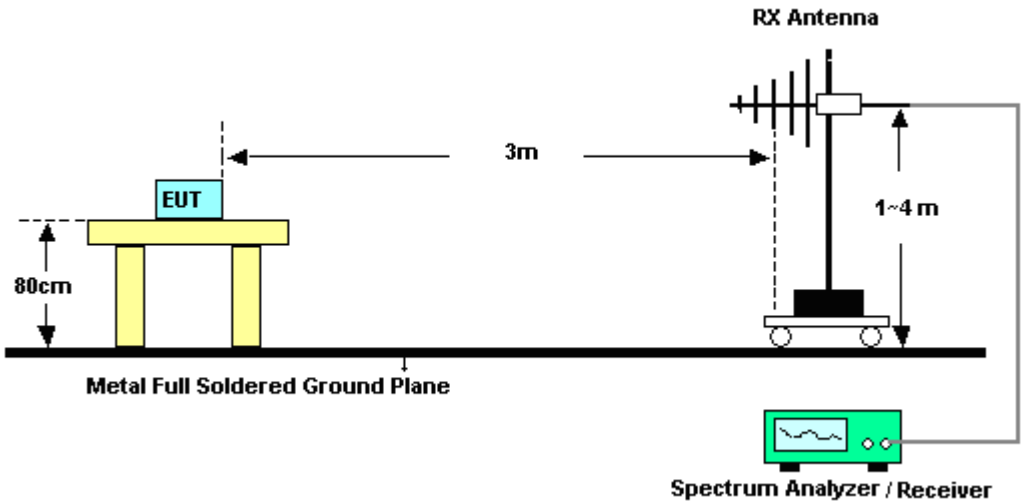
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.2.4 Test Setup

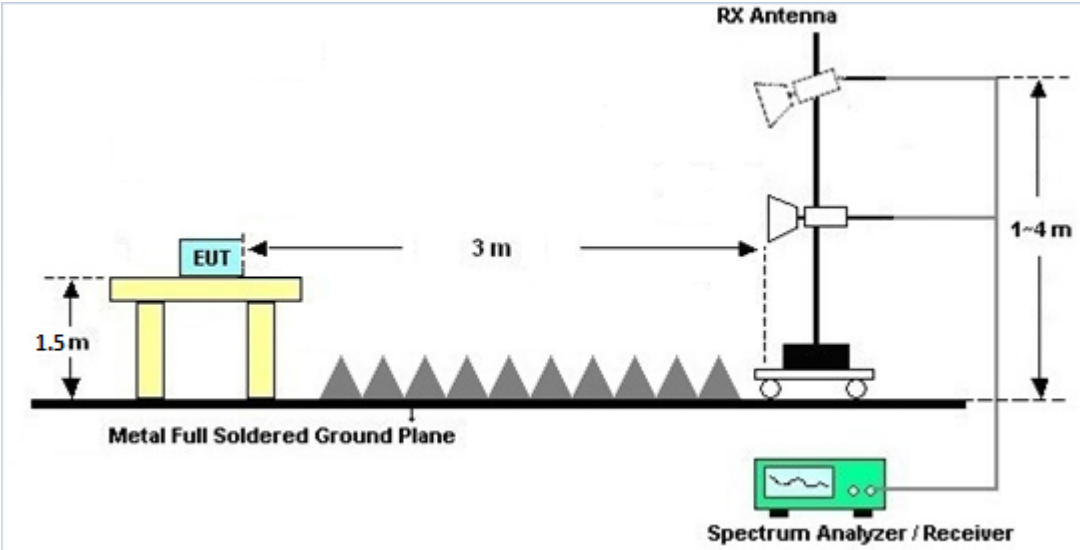
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions 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.

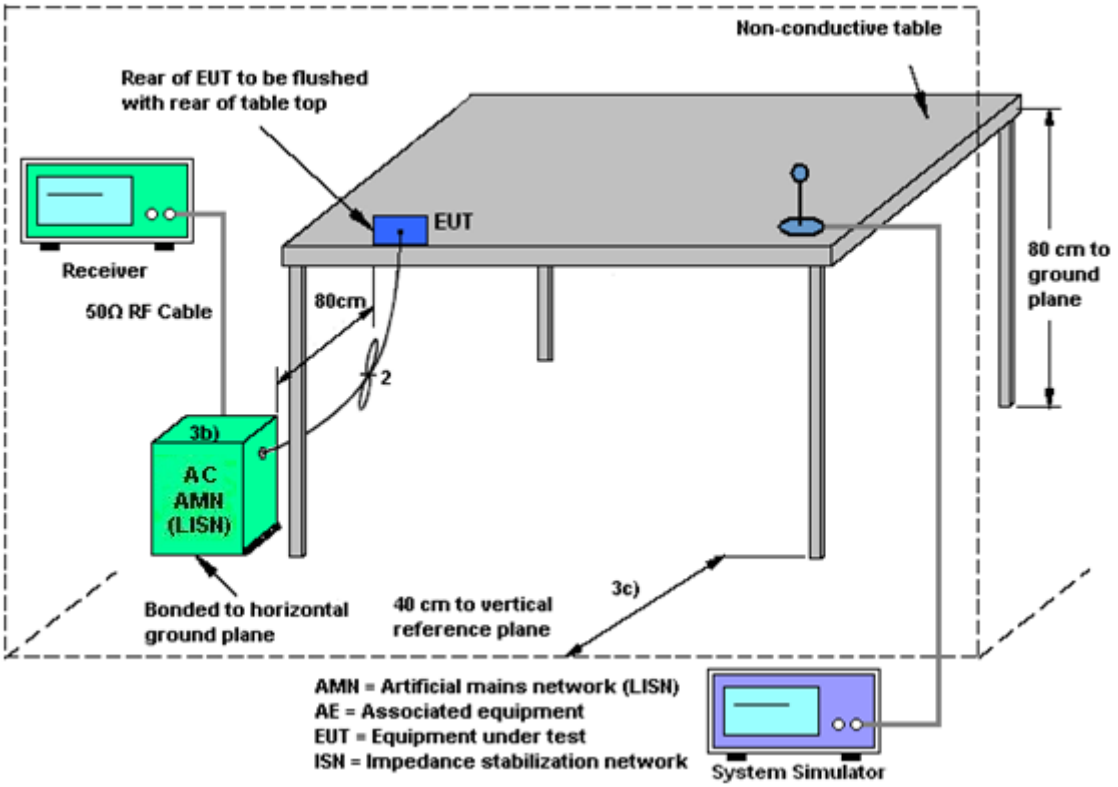
3.3.2 Measuring Instruments

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 should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.3.4 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	Jan. 09, 2020	Sep. 13, 2020~ Sep. 14, 2020	Jan. 08, 2021	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&00800N1D01N-06	41912&05	30MHz to 1GHz	Feb. 09, 2020	Sep. 13, 2020~ Sep. 14, 2020	Feb. 08, 2021	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 27, 2019	Sep. 13, 2020~ Sep. 14, 2020	Dec. 26, 2020	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1620	1-18GHz	Oct. 28, 2019	Sep. 13, 2020~ Sep. 14, 2020	Oct. 27, 2020	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 10, 2019	Sep. 13, 2020~ Sep. 14, 2020	Dec. 09, 2020	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055006	1GHz~18GHz	May 07, 2020	Sep. 13, 2020~ Sep. 14, 2020	May 06, 2021	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	1GHz~26.5GHz	Aug. 21, 2020	Sep. 13, 2020~ Sep. 14, 2020	Aug. 20, 2021	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 13, 2019	Sep. 13, 2020~ Sep. 14, 2020	Dec. 12, 2020	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Nov. 01, 2019	Sep. 13, 2020~ Sep. 14, 2020	Oct. 31, 2020	Radiation (03CH15-HY
Spectrum Analyzer	Agilent	E4446A	MY50180136	3Hz~44GHz	May 04, 2020	Sep. 13, 2020~ Sep. 14, 2020	May 03, 2021	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Sep. 13, 2020~ Sep. 14, 2020	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Sep. 13, 2020~ Sep. 14, 2020	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k5)	RK-000451	N/A	N/A	Sep. 13, 2020~ Sep. 14, 2020	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY36980/4	30M-18G	Apr. 14, 2020	Sep. 13, 2020~ Sep. 14, 2020	Apr. 13, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9838/4PE	30M-18G	Apr. 14, 2020	Sep. 13, 2020~ Sep. 14, 2020	Apr. 13, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY37710/4	30M-18G	Apr. 17, 2020	Sep. 13, 2020~ Sep. 14, 2020	Apr. 16, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz-40GHz	Feb. 25, 2020	Sep. 13, 2020~ Sep. 14, 2020	Feb. 24, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 25, 2020	Sep. 13, 2020~ Sep. 14, 2020	Feb. 24, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 12, 2020	Sep. 13, 2020~ Sep. 14, 2020	Mar. 11, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN4	1.53G Low Pass	Jul. 03, 2020	Sep. 13, 2020~ Sep. 14, 2020	Jul. 02, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN6	6.75GHz High Pass Filter	Jul. 03, 2020	Sep. 13, 2020~ Sep. 14, 2020	Jul. 02, 2021	Radiation (03CH15-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 02, 2020	Sep. 10, 2020~ Sep. 11, 2020	Mar. 01, 2021	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO10	10MHz~6GHz	Dec. 23, 2019	Sep. 10, 2020~ Sep. 11, 2020	Dec. 22, 2020	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 15, 2019	Sep. 10, 2020~ Sep. 11, 2020	Nov. 14, 2020	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz-40GHz	Dec. 30, 2019	Sep. 10, 2020~ Sep. 11, 2020	Dec. 29, 2020	Conducted (TH05-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2020	Sep. 10, 2020~ Sep. 11, 2020	Mar. 16, 2021	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Aug. 14, 2020	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 15, 2019	Aug. 14, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 07, 2019	Aug. 14, 2020	Nov. 06, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 15, 2019	Aug. 14, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Aug. 14, 2020	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2020	Aug. 14, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 02, 2020	Aug. 14, 2020	Jan. 01, 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))	2.3

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.4

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

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

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Kai Liao/Hank Hsu	Temperature:	21~25	°C
Test Date:	2020/9/10~2020/9/11	Relative Humidity:	51~54	%

Report Number : FR041658B

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 0	Ant 1	SUM	Ant 0	Ant 1	Ant 0	Ant 1		
11a	6Mbps	1	36	5180	11.40	12.00		24.00	24.00	2.60	3.00		Pass
11a	6Mbps	1	44	5220	11.40	12.00		24.00	24.00	2.60	3.00		Pass
11a	6Mbps	1	48	5240	11.40	12.30		24.00	24.00	2.60	3.00		Pass
HT20	MCS0	1	36	5180	11.50	12.20		24.00	24.00	2.60	3.00		Pass
HT20	MCS0	1	44	5220	11.50	11.80		24.00	24.00	2.60	3.00		Pass
HT20	MCS0	1	48	5240	11.20	12.10		24.00	24.00	2.60	3.00		Pass
HT40	MCS0	1	38	5190	11.10	11.90		24.00	24.00	2.60	3.00		Pass
HT40	MCS0	1	46	5230	11.10	11.60		24.00	24.00	2.60	3.00		Pass
VHT20	MCS0	1	36	5180	11.40	12.10		24.00	24.00	2.60	3.00		Pass
VHT20	MCS0	1	44	5220	11.40	11.70		24.00	24.00	2.60	3.00		Pass
VHT20	MCS0	1	48	5240	11.10	12.00		24.00	24.00	2.60	3.00		Pass
VHT40	MCS0	1	38	5190	11.00	11.80		24.00	24.00	2.60	3.00		Pass
VHT40	MCS0	1	46	5230	11.00	11.50		24.00	24.00	2.60	3.00		Pass
VHT80	MCS0	1	42	5210	11.30	12.10		24.00	24.00	2.60	3.00		Pass

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 0	Ant 1	SUM	Ant 0	Ant 1	Ant 0	Ant 1		
11a	6Mbps	2	36	5180	12.40	12.90	15.67	24.00		3.00			Pass
11a	6Mbps	2	44	5220	11.80	12.50	15.17	24.00		3.00			Pass
11a	6Mbps	2	48	5240	12.40	13.10	15.77	24.00		3.00			Pass
HT20	MCS0	2	36	5180	12.20	12.60	15.41	24.00		3.00			Pass
HT20	MCS0	2	44	5220	12.10	12.60	15.37	24.00		3.00			Pass
HT20	MCS0	2	48	5240	12.20	12.90	15.57	24.00		3.00			Pass
HT40	MCS0	2	38	5190	12.30	12.70	15.51	24.00		3.00			Pass
HT40	MCS0	2	46	5230	11.80	12.50	15.17	24.00		3.00			Pass
VHT20	MCS0	2	36	5180	12.10	12.50	15.31	24.00		3.00			Pass
VHT20	MCS0	2	44	5220	12.00	12.50	15.27	24.00		3.00			Pass
VHT20	MCS0	2	48	5240	12.10	12.80	15.47	24.00		3.00			Pass
VHT40	MCS0	2	38	5190	12.20	12.60	15.41	24.00		3.00			Pass
VHT40	MCS0	2	46	5230	11.70	12.40	15.07	24.00		3.00			Pass
VHT80	MCS0	2	42	5210	11.90	12.60	15.27	24.00		3.00			Pass

Report Number : FR041658B

TEST RESULTS DATA
Average Power Table

FCC Band I single antenna														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
						Ant 0	Ant 1	SUM	Ant 0	Ant 1	Ant 0	Ant 1		
HE20	MCS0	1	36	5180	Full	11.70	12.30		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	36	5180	26/0	3.60	4.00		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	36	5180	52/37	6.30	6.20		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	36	5180	106/53	10.00	9.40		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	44	5220	Full	11.60	11.90		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	44	5220	26/4	4.10	3.70		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	48	5240	Full	11.30	12.20		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	48	5240	26/8	3.80	2.90		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	48	5240	52/40	7.10	6.00		24.00	24.00	2.60	3.00		Pass
HE20	MCS0	1	48	5240	106/54	9.60	9.10		24.00	24.00	2.60	3.00		Pass
HE40	MCS0	1	38	5190	Full	11.50	12.30		24.00	24.00	2.60	3.00		Pass
HE40	MCS0	1	38	5190	242/61	10.40	10.00		24.00	24.00	2.60	3.00		Pass
HE40	MCS0	1	46	5230	Full	11.20	12.00		24.00	24.00	2.60	3.00		Pass
HE40	MCS0	1	46	5230	242/62	10.40	10.00		24.00	24.00	2.60	3.00		Pass
HE80	MCS0	1	42	5210	Full	11.40	12.20		24.00	24.00	2.60	3.00		Pass
HE80	MCS0	1	42	5210	484/65	10.40	9.80		24.00	24.00	2.60	3.00		Pass
HE80	MCS0	1	42	5210	484/66	9.90	9.10		24.00	24.00	2.60	3.00		Pass

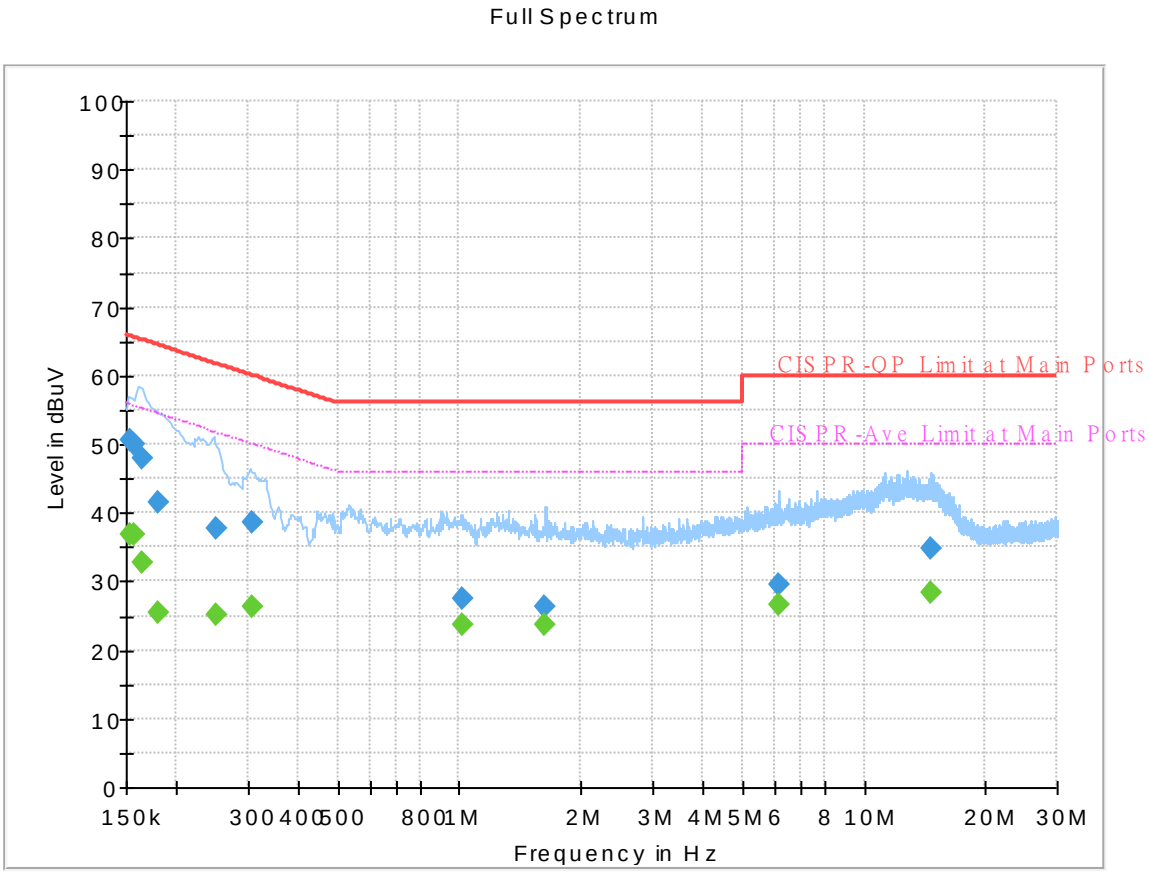
FCC Band I MIMO														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
						Ant 0	Ant 1	SUM	Ant 0	Ant 1	Ant 0	Ant 1		
HE20	MCS0	2	36	5180	Full	12.30	12.70	15.51	24.00		3.00			Pass
HE20	MCS0	2	36	5180	26/0	4.70	3.00	6.94	24.00		3.00			Pass
HE20	MCS0	2	36	5180	52/37	6.40	6.70	9.56	24.00		3.00			Pass
HE20	MCS0	2	36	5180	106/53	9.50	10.00	12.77	24.00		3.00			Pass
HE20	MCS0	2	44	5220	Full	12.20	12.70	15.47	24.00		3.00			Pass
HE20	MCS0	2	44	5220	26/4	4.00	4.70	7.37	24.00		3.00			Pass
HE20	MCS0	2	48	5240	Full	12.30	13.00	15.67	24.00		3.00			Pass
HE20	MCS0	2	48	5240	52/40	6.10	6.90	9.53	24.00		3.00			Pass
HE20	MCS0	2	48	5240	106/54	9.40	9.90	12.67	24.00		3.00			Pass
HE40	MCS0	2	38	5190	Full	12.60	13.00	15.81	24.00		3.00			Pass
HE40	MCS0	2	38	5190	242/61	9.80	10.40	13.12	24.00		3.00			Pass
HE40	MCS0	2	46	5230	Full	12.20	12.90	15.57	24.00		3.00			Pass
HE40	MCS0	2	46	5230	242/62	9.90	10.60	13.27	24.00		3.00			Pass
HE80	MCS0	2	42	5210	Full	12.50	13.10	15.82	24.00		3.00			Pass
HE80	MCS0	2	42	5210	484/65	9.80	10.30	13.07	24.00		3.00			Pass
HE80	MCS0	2	42	5210	484/66	9.20	10.10	12.68	24.00		3.00			Pass

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Howard Huang	**Temperature :**	23~25℃
		Relative Humidity :	42~45%

EUT Information

Report NO :	041658
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

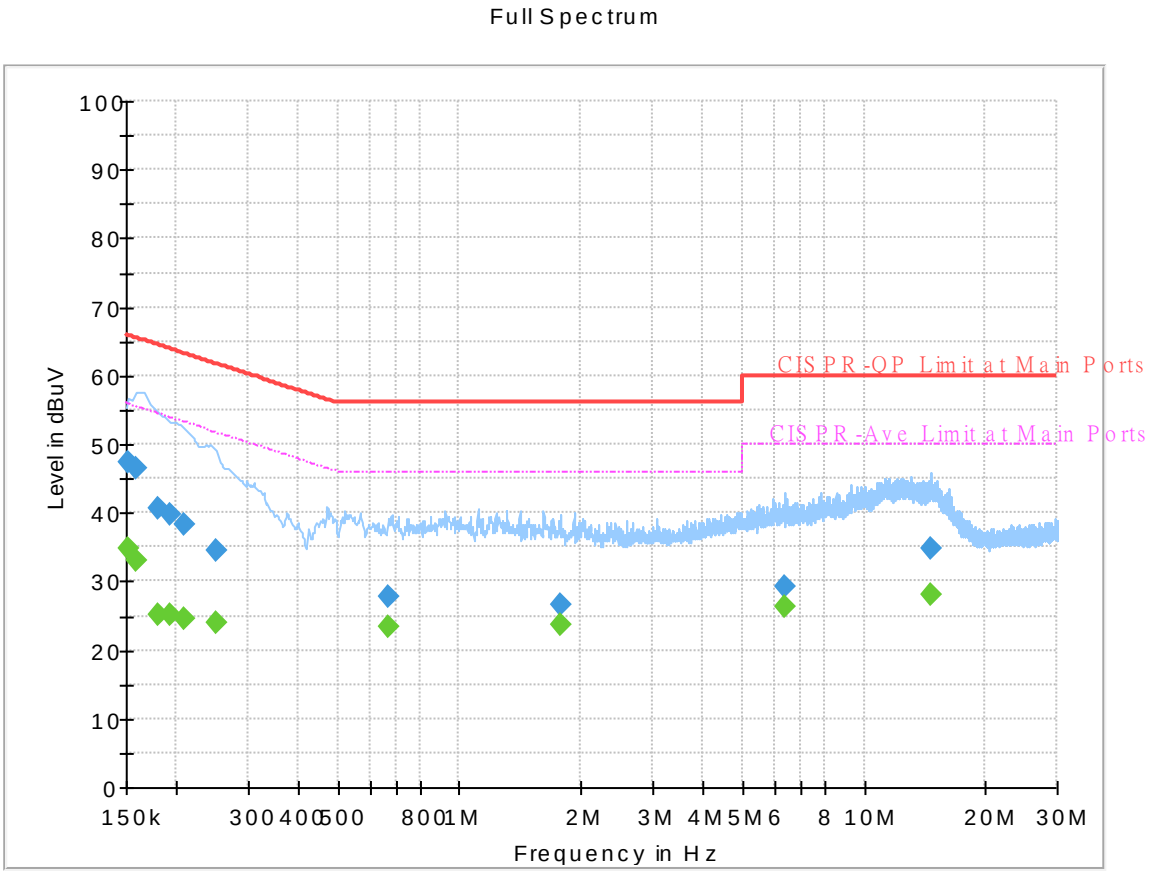


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.154050	---	36.98	55.78	18.80	L1	OFF	19.6
0.154050	50.67	---	65.78	15.11	L1	OFF	19.6
0.156750	---	36.79	55.63	18.84	L1	OFF	19.6
0.156750	50.10	---	65.63	15.53	L1	OFF	19.6
0.163500	---	32.60	55.28	22.68	L1	OFF	19.6
0.163500	47.88	---	65.28	17.40	L1	OFF	19.6
0.179160	---	25.32	54.53	29.21	L1	OFF	19.6
0.179160	41.53	---	64.53	23.00	L1	OFF	19.6
0.250710	---	25.01	51.73	26.72	L1	OFF	19.6
0.250710	37.83	---	61.73	23.90	L1	OFF	19.6
0.306780	---	26.29	50.06	23.77	L1	OFF	19.6
0.306780	38.57	---	60.06	21.49	L1	OFF	19.6
1.014000	---	23.83	46.00	22.17	L1	OFF	19.6
1.014000	27.49	---	56.00	28.51	L1	OFF	19.6
1.631580	---	23.62	46.00	22.38	L1	OFF	19.6
1.631580	26.26	---	56.00	29.74	L1	OFF	19.6
6.186750	---	26.51	50.00	23.49	L1	OFF	19.9
6.186750	29.49	---	60.00	30.51	L1	OFF	19.9
14.637750	---	28.39	50.00	21.61	L1	OFF	20.2
14.637750	34.69	---	60.00	25.31	L1	OFF	20.2

EUT Information

Report NO :	041658
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)
0.152363	---	34.84	55.87	21.03	N	OFF	19.5
0.152363	47.48	---	65.87	18.39	N	OFF	19.5
0.159000	---	32.93	55.52	22.59	N	OFF	19.5
0.159000	46.41	---	65.52	19.11	N	OFF	19.5
0.179250	---	25.12	54.52	29.40	N	OFF	19.5
0.179250	40.63	---	64.52	23.89	N	OFF	19.5
0.191940	---	25.20	53.95	28.75	N	OFF	19.5
0.191940	39.77	---	63.95	24.18	N	OFF	19.5
0.208500	---	24.48	53.27	28.79	N	OFF	19.5
0.208500	38.45	---	63.27	24.82	N	OFF	19.5
0.251250	---	24.00	51.72	27.72	N	OFF	19.5
0.251250	34.52	---	61.72	27.20	N	OFF	19.5
0.665250	---	23.52	46.00	22.48	N	OFF	19.5
0.665250	27.85	---	56.00	28.15	N	OFF	19.5
1.774230	---	23.64	46.00	22.36	N	OFF	19.6
1.774230	26.52	---	56.00	29.48	N	OFF	19.6
6.344340	---	26.40	50.00	23.60	N	OFF	19.7
6.344340	29.10	---	60.00	30.90	N	OFF	19.7
14.681490	---	28.13	50.00	21.87	N	OFF	19.9
14.681490	34.77	---	60.00	25.23	N	OFF	19.9

Appendix C. Radiated Spurious Emission

Test Engineer :	Leo Lee, Mancy Chou and Bigshow Wang	Temperature :	22~24°C
		Relative Humidity :	45~58%

Band 1 - 5150~5250MHz

WIFI 802.11ax HE40 Partial 242 (Band Edge @ 3m)

WIFI Ant. 0+1	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 Partial 242/61 CH 38 5190MHz		5149.5	67.61	-6.39	74	55.03	32.1	10.49	30.01	100	302	P	H
		5149.76	48.19	-5.81	54	35.61	32.1	10.49	30.01	100	302	A	H
	*	5190	107.49	-	-	95.09	31.86	10.55	30.01	100	302	P	H
	*	5190	97.48	-	-	85.08	31.86	10.55	30.01	100	302	A	H
		5442.08	52.94	-21.06	74	40.52	31.7	10.71	29.99	100	302	P	H
		5456.36	41.97	-12.03	54	29.49	31.74	10.73	29.99	100	302	A	H
		5150	67.58	-6.42	74	55	32.1	10.49	30.01	330	135	P	V
		5149.76	47.76	-6.24	54	35.18	32.1	10.49	30.01	330	135	A	V
	*	5190	106.68	-	-	94.28	31.86	10.55	30.01	330	135	P	V
	*	5190	96.43	-	-	84.03	31.86	10.55	30.01	330	135	A	V
		5417.16	52.69	-21.31	74	40.3	31.7	10.68	29.99	330	135	P	V
		5433.4	41.97	-12.03	54	29.56	31.7	10.7	29.99	330	135	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 (Band Edge @ 3m)

WIFI Ant. 0+1	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		5148.98	58.81	-15.19	74	46.23	32.1	10.49	30.01	100	300	P	H
		5149.5	48.52	-5.48	54	35.94	32.1	10.49	30.01	100	300	A	H
	*	5210	105.31	-	-	93.01	31.74	10.57	30.01	100	300	P	H
	*	5210	93.49	-	-	81.19	31.74	10.57	30.01	100	300	A	H
		5416.04	52.52	-21.48	74	40.14	31.7	10.68	30	100	300	P	H
		5398.12	41.73	-12.27	54	29.38	31.69	10.66	30	100	300	A	H
		5145.08	58.34	-15.66	74	45.77	32.09	10.49	30.01	347	129	P	V
		5150	46.17	-7.83	54	33.59	32.1	10.49	30.01	347	129	A	V
	*	5210	103.68	-	-	91.38	31.74	10.57	30.01	347	129	P	V
	*	5210	92.95	-	-	80.65	31.74	10.57	30.01	347	129	A	V
		5398.96	51.98	-22.02	74	39.63	31.69	10.66	30	347	129	P	V
		5460	41.66	-12.34	54	29.16	31.76	10.73	29.99	347	129	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. 0+1	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		10420	47.95	-20.25	68.2	54.43	40.1	14.41	60.99	100	0	P	H
		15630	46.9	-27.1	74	54.22	37.64	17.32	62.28	100	0	P	H
													H
													H
		10420	47.98	-20.22	68.2	54.46	40.1	14.41	60.99	100	0	P	V
		15630	46.33	-27.67	74	53.65	37.64	17.32	62.28	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 802.11ax HE80 Full (LF @ 3m)

WIFI Ant. 0+1	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 LF		78.5	25.86	-14.14	40	43.72	13.48	1.19	32.53	-	-	P	H
		195.87	27.42	-16.08	43.5	42.74	15.07	1.99	32.38	-	-	P	H
		343.31	36.19	-9.81	46	46.13	19.99	2.52	32.45	-	-	P	H
		358.83	34.78	-11.22	46	44.13	20.45	2.59	32.39	-	-	P	H
		746.83	36.82	-9.18	46	37.8	27.66	3.82	32.46	-	-	P	H
		891.36	38.28	-7.72	46	37.43	28.51	4.27	31.93	100	0	P	H
													H
													H
													H
													H
													H
													H
		37.76	27.78	-12.22	40	38.82	20.51	0.79	32.34	-	-	P	V
		189.08	26.2	-17.3	43.5	41.64	14.99	1.95	32.38	-	-	P	V
		346.22	30.03	-15.97	46	39.92	20.02	2.54	32.45	-	-	P	V
		358.83	30.83	-15.17	46	40.18	20.45	2.59	32.39	-	-	P	V
		713.85	38.41	-7.59	46	40.53	26.57	3.72	32.41	-	-	P	V
		889.42	38.58	-7.42	46	37.75	28.49	4.26	31.92	100	0	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+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

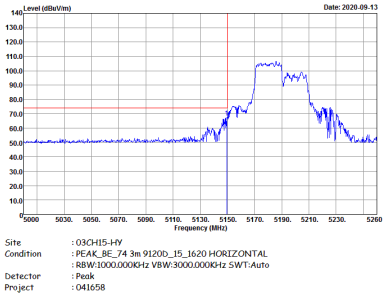
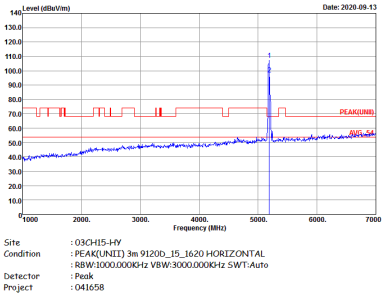
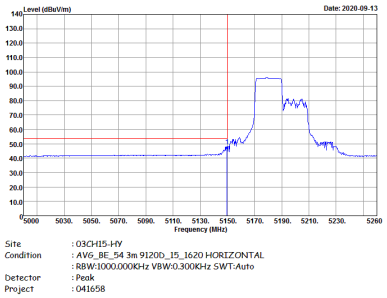
Test Engineer :	Leo Lee, Mancy Chou and Bigshow Wang	**Temperature :**	22~24°C
		Relative Humidity :	45~58%

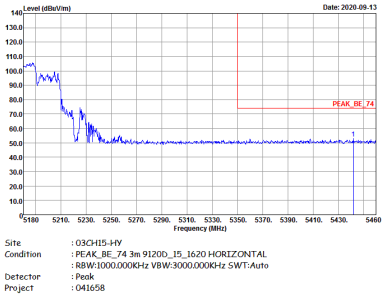
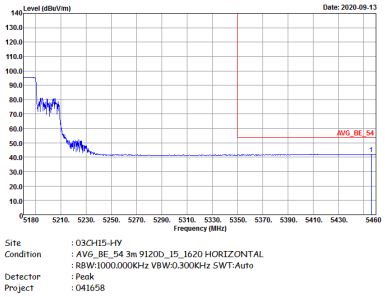
Note symbol

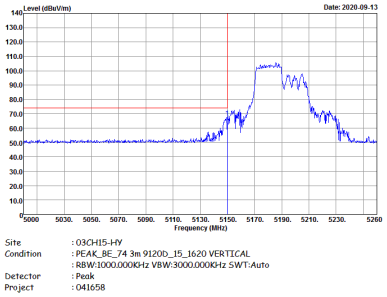
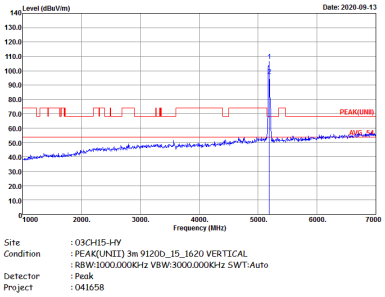
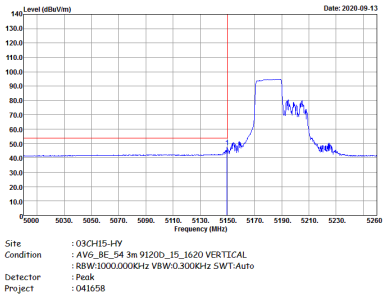
-L	**Low channel location**
-R	**High channel location**

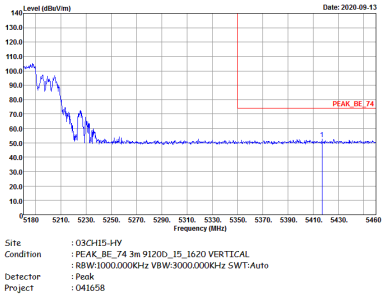
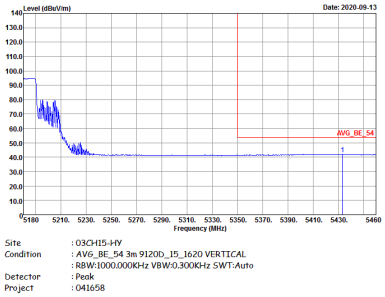
Band 1 - 5150~5250MHz

WIFI 802.11ax HE40 Partial 242 (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Partial 242/61 CH38 5190MHz - L	
0+1	Horizontal	Fundamental
Peak		
Avg.		Left blank

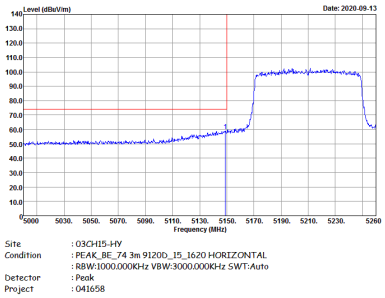
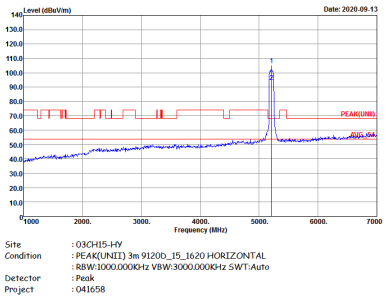
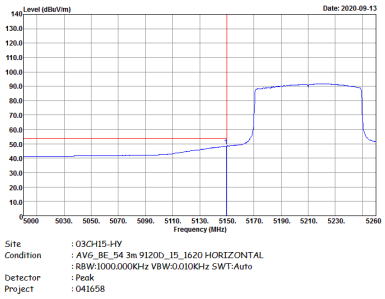
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Partial 242/61 CH38 5190MHz - R	
0+1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

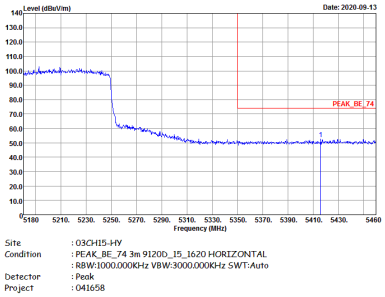
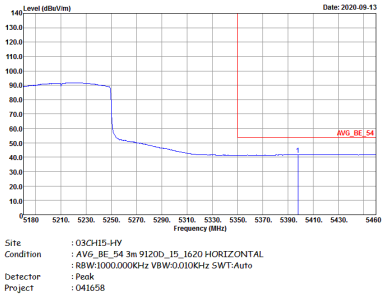
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Partial 242/61 CH38 5190MHz - L	
0+1	Vertical	Fundamental
Peak		
Avg.		Left blank

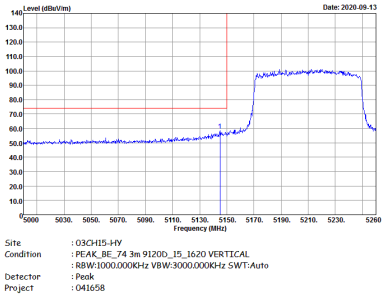
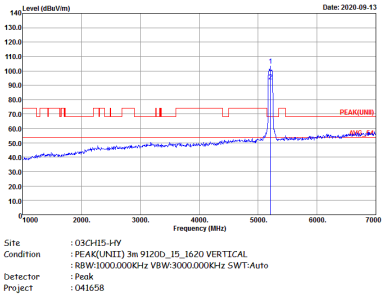
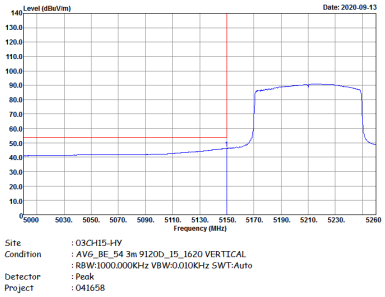
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE40 Partial 242/61 CH38 5190MHz - R	
0+1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

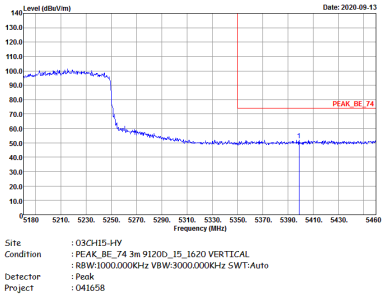
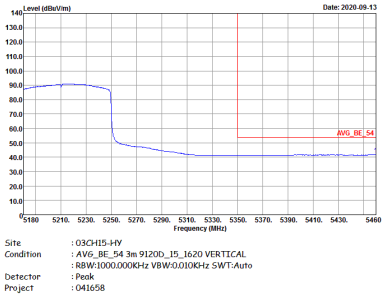
Band 1 5150~5250MHz

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

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - L	
0+1	Horizontal	Fundamental
Peak		
Avg.		Left blank

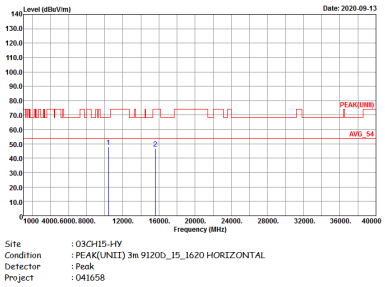
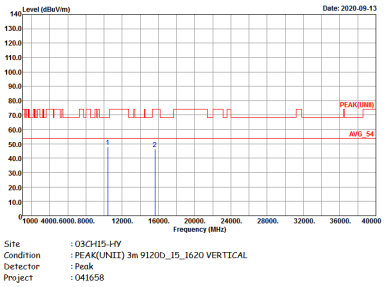
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - R	
0+1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - L	
0+1	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz - R	
0+1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

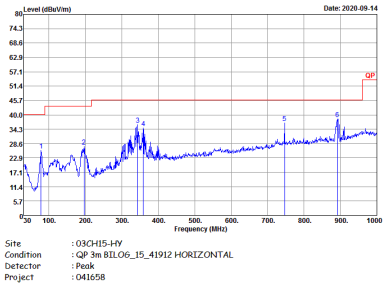
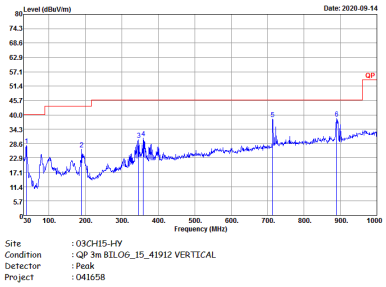
Band 1 - 5150~5250MHz

WIFI 802.11ax HE80 Full (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11ax HE80 Full CH42 5210MHz	
0+1	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

5GHz WIFI 802.11ax HE80 Full (LF)

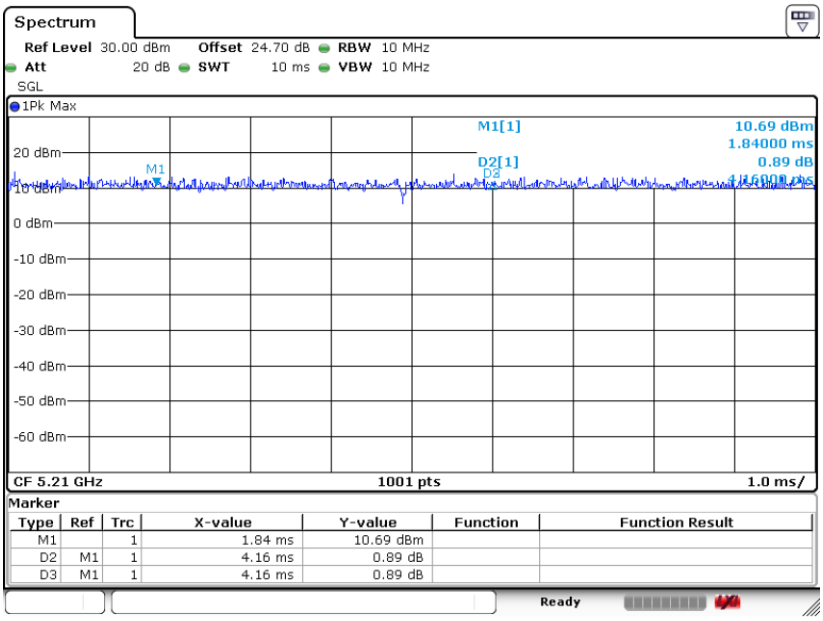
WIFI	5GHz WIFI	
ANT	802.11ax HE80 Full LF	
0+1	Horizontal	Vertical
QP / Peak		

Appendix E. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
0+1	5GHz 802.11ax HE40 Partial RU 242/61	97.48	4650	0.22	0.3kHz	0.11
0+1	5GHz 802.11ax HE80 Full RU for Ant 0	100.00	-	-	10Hz	0.00
0+1	5GHz 802.11ax HE80 Full RU for Ant 1	100.00	-	-	10Hz	0.00

MIMO <Ant. 0>

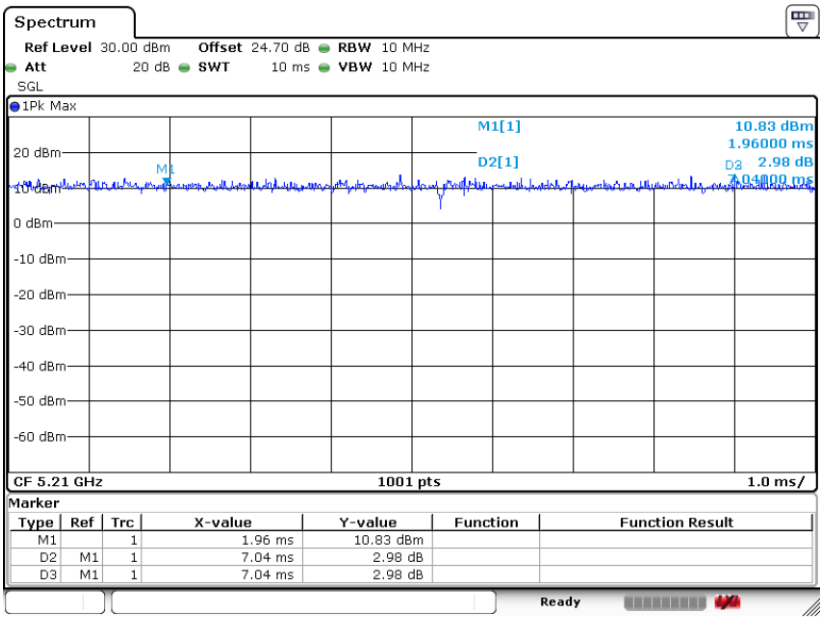
802.11ax HE80 Full RU



Date: 10.SEP.2020 22:13:15

MIMO <Ant. 1>

802.11ax HE80 Full RU



Date: 10.SEP.2020 22:16:17