FCC RADIO TEST REPORT

FCC ID	:	**APYHRO00304**
Equipment	:	**Smart phone**
Brand Name	:	**SHARP**
Model Name	:	**APYHRO00304**
Applicant	:	**SHARP CORPORATION** **1 Takumi-Cho, Sakai-Ku, Sakai-Shi, Osaka 590-8522, Japan**
Manufacturer	:	**SHARP CORPORATION** **1 Takumi-Cho, Sakai-Ku, Sakai-Shi, Osaka 590-8522, Japan**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Sep. 14, 2021 and testing was started from Oct. 09, 2021 and completed on Oct. 13, 2021. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this 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 333, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR190730-01E	01	Initial issue of report	Oct. 28, 2021
FR190730-01E	02	Revise applicant information	Nov. 01, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.403(i)	26dB Bandwidth	-	See Note
-	2.1049	99% Occupied Bandwidth	-	See Note
3.1	15.407(a)	Maximum Conducted Output Power	Pass	-
-	15.407(a)	Power Spectral Density	-	See Note
3.2	15.407(b)	Unwanted Emissions	Pass	Under limit 0.92 dB at 5350.560 MHz
-	15.207	AC Conducted Emission	-	See Note
3.3	15.203 15.407(a)	Antenna Requirement	Pass	-

Note: The RF circuit, output power level and antenna performance is the same in WLAN function across all two FCC ID APYHRO00303 and APYHRO00304, since the change, only verify RF output power and radiated spurious emission test data the worst mode was reported in this report.

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: Keven Cheng

Report Producer: Cindy Liu

1 General Description

1.1 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac, NFC, and GNSS

Product Specification subjective to this standard	
Antenna Type	WWAN <Ant.0>: PIFA Antenna <Ant.1>: PIFA Antenna <Ant.2>: PIFA Antenna WLAN: Loop Antenna Bluetooth: Loop Antenna GPS/Glonass/BDS/Galileo: PIFA Antenna NFC: Loop Antenna

Antenna information		
5150 MHz ~ 5250 MHz	Peak Gain (dBi)	-0.19
5250 MHz ~ 5350 MHz	Peak Gain (dBi)	-0.19
5470 MHz ~ 5725 MHz	Peak Gain (dBi)	0.49

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.**
	TH02-HY

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.**
	03CH13-HY (TAF Code: 3786)
Remark	The Radiated Spurious Emissions test item subcontracted to Sporton International Inc. Wensan Laboratory.

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

FCC designation No.: TW1190 and TW3786

1.4 Applicable Standards

According to the specifications 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.
- 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

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: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find X Plane as worst plane

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		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5250-5350 MHz Band 2 (U-NII-2A)	52	5260	60	5300
	54*	5270	62*	5310
	56	5280	64	5320
	58#	5290		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5470-5725 MHz Band 3 (U-NII-2C)	100	5500	112	5560
	102*	5510	116	5580
	104	5520	132	5660
	106#	5530	134*	5670
	108	5540	136	5680
	110*	5550	140	5700

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
TDWR Channel	118*	5590	124	5620
	120	5600	126*	5630
	122#	5610	128	5640

Note:

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

2.2 Test Mode

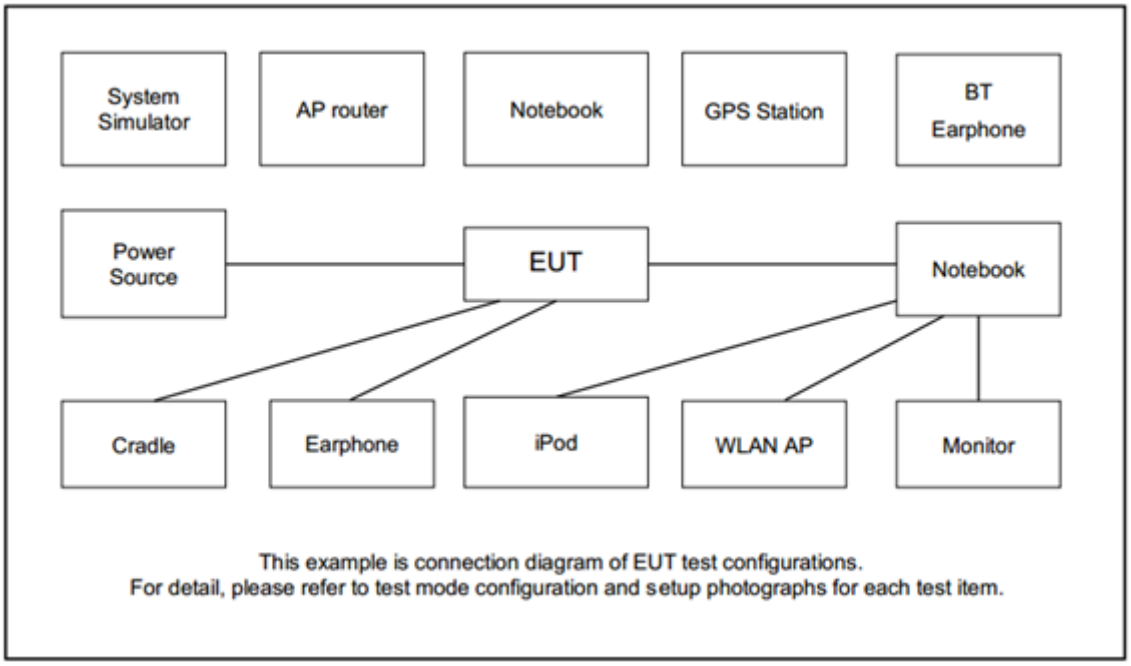
Final test modes are considering the modulation and worse data rates as below table.

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

Ch. #		Band I：5150-5250 MHz	Band II：5250-5350 MHz	Band III：5470-5725MHz
		802.11n HT20	802.11ac VHT80	802.11ac VHT80
L	Low	36	-	106
M	Middle	-	58	-
H	High	-	-	-

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.	Earphone	Nokia	WH-108	FCC DoC	Unshielded,1.5m	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT Ver.4.0.00158.0” 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.

For the 5.25–5.725 GHz bands:

■ The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz.

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.

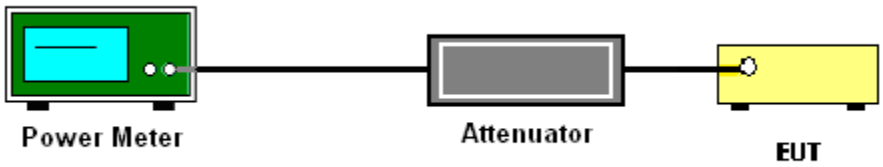
3.1.3 Test Procedures

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.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5600 MHz and 5650-5725MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725MHz band shall not exceed an EIRP of -27 dBm/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

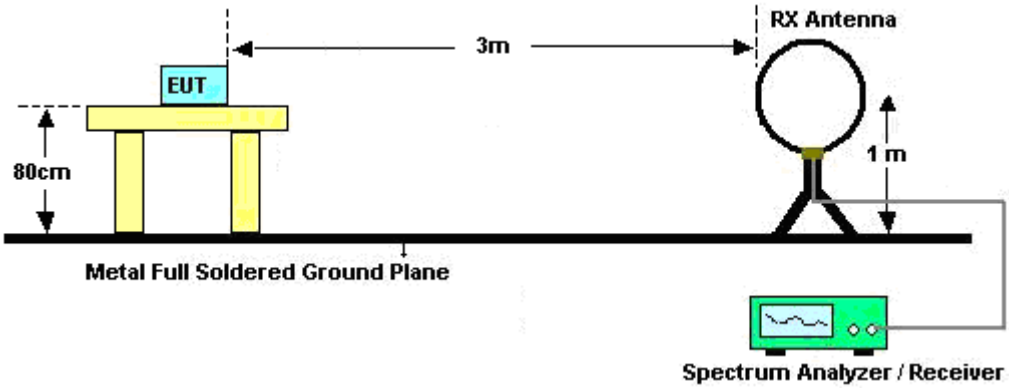
(3) Procedures for Average Unwanted Emissions Measurements Above 1000 MHz

- 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.

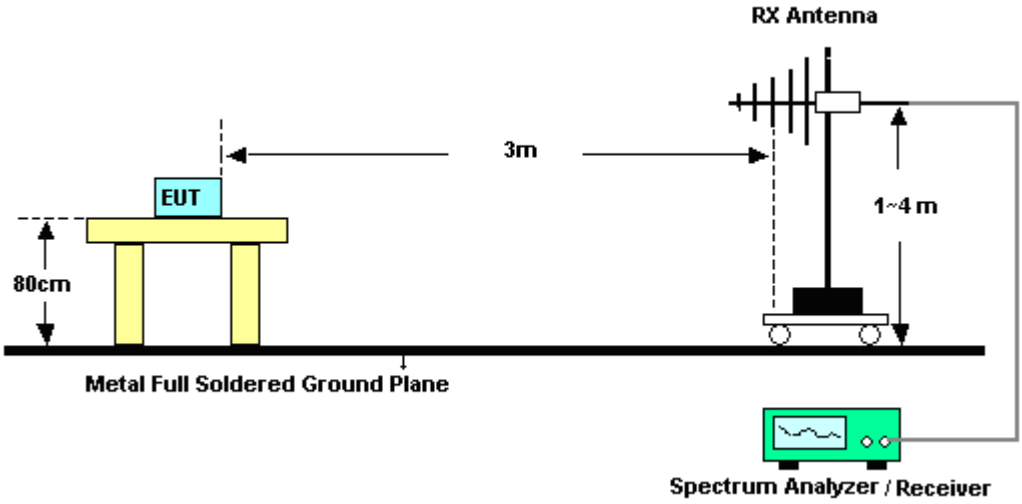
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband 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. Radiated testing below 1GHz was performed by adjusting the antenna tower from 1m to 4m and by rotating the turn table from 0degree to 360 degree to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6dB margin against QP limit line, the position is marked as "-".
7. Radiated testing above 1GHz was performed by adjusting the antenna tower from 1m to 4m and by rotating the turn table from 0degree to 360 degree to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6dB margin against average limit line, the position is marked as "-".

3.2.4 Test Setup

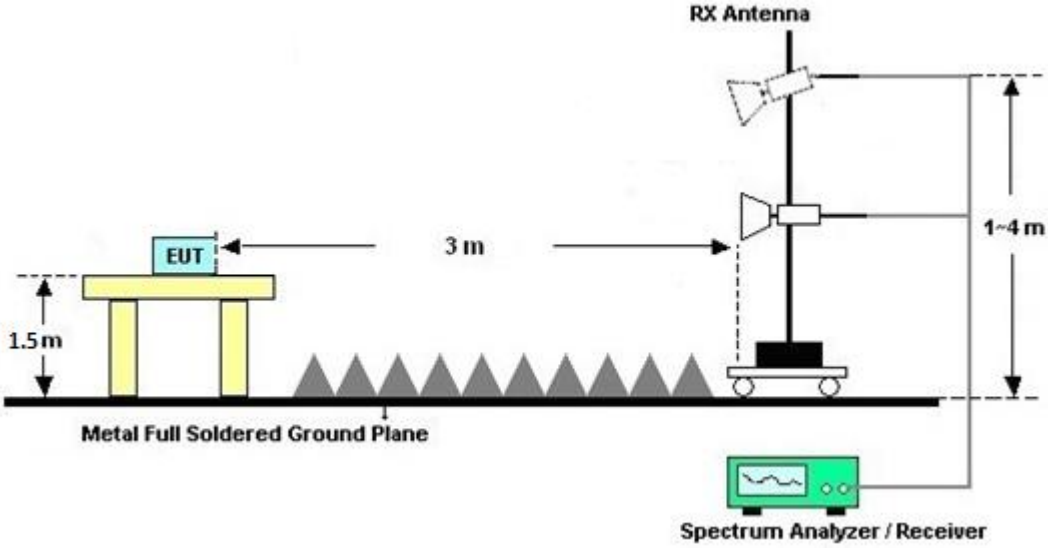
For radiated emissions below 30MHz



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

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.2.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.

3.3 Antenna Requirements

3.3.1 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.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 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	100315	9 kHz~30 MHz	Jan. 04, 2021	Oct. 12, 2021~ Oct. 13, 2021	Jan. 03, 2022	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz ~ 18GHz	Jul. 13, 2021	Oct. 12, 2021~ Oct. 13, 2021	Jul. 12, 2022	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02294	1GHz ~ 18GHz	Jun. 23, 2021	Oct. 12, 2021~ Oct. 13, 2021	Jun. 22, 2022	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 11, 2020	Oct. 12, 2021~ Oct. 13, 2021	Dec. 10, 2021	Radiation (03CH13-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 16, 2020	Oct. 12, 2021~ Oct. 13, 2021	Dec. 15, 2021	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 18, 2021	Oct. 12, 2021~ Oct. 13, 2021	May 17, 2022	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY53270147	1GHz~26.5GHz	Oct. 28, 2020	Oct. 12, 2021~ Oct. 13, 2021	Oct. 27, 2021	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 11, 2020	Oct. 12, 2021~ Oct. 13, 2021	Dec. 10, 2021	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 18, 2021	Oct. 12, 2021~ Oct. 13, 2021	Mar. 17, 2022	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Oct. 12, 2021~ Oct. 13, 2021	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Oct. 12, 2021~ Oct. 13, 2021	N/A	Radiation (03CH13-HY)
Software	Audix	E3 6.2009-8-24	RK-000992	N/A	N/A	Oct. 12, 2021~ Oct. 13, 2021	N/A	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30M-18G	Feb. 10, 2021	Oct. 12, 2021~ Oct. 13, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30M-18G	Feb. 10, 2021	Oct. 12, 2021~ Oct. 13, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Feb. 22, 2021	Oct. 12, 2021~ Oct. 13, 2021	Feb. 21, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz~40GHz	Mar. 11, 2021	Oct. 12, 2021~ Oct. 13, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/4	30M-18G	Feb. 10, 2021	Oct. 12, 2021~ Oct. 13, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 11, 2021	Oct. 12, 2021~ Oct. 13, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN12	1.53GHz Low Pass Filter	Sep. 14, 2021	Oct. 12, 2021~ Oct. 13, 2021	Sep. 13, 2022	Radiation (03CH13-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN5	6.75GHz High Pass Filter	Mar. 11, 2021	Oct. 12, 2021~ Oct. 13, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 01, 2021	Oct. 09, 2021	Feb. 28, 2022	Conducted (TH02-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO12	10MHz~6GHz	Dec. 16, 2020	Oct. 09, 2021	Dec. 15, 2021	Conducted (TH02-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101565	10Hz ~ 40GHz	Nov. 13, 2020	Oct. 09, 2021	Nov. 12, 2021	Conducted (TH02-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2021	Oct. 09, 2021	Mar. 16, 2022	Conducted (TH02-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.3 dB**

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.9 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Jacob Yu	Temperature:	22.9~24.9	°C
Test Date:	2021/10/9	Relative Humidity:	50.4~52.4	%

Report Number : FR190730-01E

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 4	-	SUM	Ant 4	-	Ant 4	-		
11a	6Mbps	1	36	5180	18.60	-		24.00	-	-0.19	-		Pass
11a	6Mbps	1	44	5220	18.50	-		24.00	-	-0.19	-		Pass
11a	6Mbps	1	48	5240	18.70	-		24.00	-	-0.19	-		Pass
HT20	MCS0	1	36	5180	18.40	-		24.00	-	-0.19	-		Pass
HT20	MCS0	1	44	5220	18.60	-		24.00	-	-0.19	-		Pass
HT20	MCS0	1	48	5240	18.40	-		24.00	-	-0.19	-		Pass
HT40	MCS0	1	38	5190	15.30	-		24.00	-	-0.19	-		Pass
HT40	MCS0	1	46	5230	18.50	-		24.00	-	-0.19	-		Pass
VHT20	MCS0	1	36	5180	18.30	-		24.00	-	-0.19	-		Pass
VHT20	MCS0	1	44	5220	18.50	-		24.00	-	-0.19	-		Pass
VHT20	MCS0	1	48	5240	18.30	-		24.00	-	-0.19	-		Pass
VHT40	MCS0	1	38	5190	15.20	-		24.00	-	-0.19	-		Pass
VHT40	MCS0	1	46	5230	18.40	-		24.00	-	-0.19	-		Pass
VHT80	MCS0	1	42	5210	15.70	-		24.00	-	-0.19	-		Pass

TEST RESULTS DATA
Average Power Table

FCC Band II single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		EIRP Power Limit (dBm)	Pass/Fail
					Ant 4	-	SUM	Ant 4	-	Ant 4	-		
11a	6Mbps	1	52	5260	18.80	-		23.98	-	-0.19	-	30	Pass
11a	6Mbps	1	60	5300	18.70	-		23.98	-	-0.19	-	30	Pass
11a	6Mbps	1	64	5320	18.60	-		23.98	-	-0.19	-	30	Pass
HT20	MCS0	1	52	5260	18.60	-		23.98	-	-0.19	-	30	Pass
HT20	MCS0	1	60	5300	18.60	-		23.98	-	-0.19	-	30	Pass
HT20	MCS0	1	64	5320	18.50	-		23.98	-	-0.19	-	30	Pass
HT40	MCS0	1	54	5270	18.50	-		23.98	-	-0.19	-	30	Pass
HT40	MCS0	1	62	5310	13.60	-		23.98	-	-0.19	-	30	Pass
VHT20	MCS0	1	52	5260	18.50	-		23.98	-	-0.19	-	30	Pass
VHT20	MCS0	1	60	5300	18.50	-		23.98	-	-0.19	-	30	Pass
VHT20	MCS0	1	64	5320	18.40	-		23.98	-	-0.19	-	30	Pass
VHT40	MCS0	1	54	5270	18.40	-		23.98	-	-0.19	-	30	Pass
VHT40	MCS0	1	62	5310	13.50	-		23.98	-	-0.19	-	30	Pass
VHT80	MCS0	1	58	5290	13.50	-		23.98	-	-0.19	-	30	Pass

TEST RESULTS DATA
Average Power Table

FCC Band III single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		EIRP Power Limit (dBm)	Pass/Fail
					Ant 4	-	SUM	Ant 4	-	Ant 4	-		
11a	6Mbps	1	100	5500	18.70	-		23.98	-	0.49	-	30	Pass
11a	6Mbps	1	116	5580	18.80	-		23.98	-	0.49	-	30	Pass
11a	6Mbps	1	140	5700	18.50	-		23.98	-	0.49	-	30	Pass
HT20	MCS0	1	100	5500	18.50	-		23.98	-	0.49	-	30	Pass
HT20	MCS0	1	116	5580	18.70	-		23.98	-	0.49	-	30	Pass
HT20	MCS0	1	140	5700	18.80	-		23.98	-	0.49	-	30	Pass
HT40	MCS0	1	102	5510	17.40	-		23.98	-	0.49	-	30	Pass
HT40	MCS0	1	110	5550	18.60	-		23.98	-	0.49	-	30	Pass
HT40	MCS0	1	134	5670	18.60	-		23.98	-	0.49	-	30	Pass
VHT20	MCS0	1	100	5500	18.40	-		23.98	-	0.49	-	30	Pass
VHT20	MCS0	1	116	5580	18.60	-		23.98	-	0.49	-	30	Pass
VHT20	MCS0	1	140	5700	18.70	-		23.98	-	0.49	-	30	Pass
VHT40	MCS0	1	102	5510	17.30	-		23.98	-	0.49	-	30	Pass
VHT40	MCS0	1	110	5550	18.50	-		23.98	-	0.49	-	30	Pass
VHT40	MCS0	1	134	5670	18.50	-		23.98	-	0.49	-	30	Pass
VHT80	MCS1	1	106	5530	15.00	-		23.98	-	0.49	-	30	Pass
VHT80	MCS1	1	122	5610	18.60	-		23.98	-	0.49	-	30	Pass

Appendix B. Radiated Spurious Emission

Test Engineer :	Jacky Hong	Temperature :	20~25°C
		Relative Humidity :	50~60%

Band 1 - 5150~5250MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 36 5180MHz		5147.94	63.03	-10.97	74	51.96	32.2	6.28	27.41	107	217	P	H
		5150	52.19	-1.81	54	41.12	32.2	6.28	27.41	107	217	A	H
	*	5180	108.04	-	-	97.08	32.08	6.28	27.4	107	217	P	H
	*	5180	99.95	-	-	88.99	32.08	6.28	27.4	107	217	A	H
													H
													H
		5147.42	58.96	-15.04	74	47.9	32.19	6.28	27.41	393	175	P	V
		5150	48.65	-5.35	54	37.58	32.2	6.28	27.41	393	175	A	V
	*	5180	102.52	-	-	91.56	32.08	6.28	27.4	393	175	P	V
	*	5180	94.36	-	-	83.4	32.08	6.28	27.4	393	175	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 802.11n HT20 (Harmonic @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 36 5180MHz		10360	49.54	-18.66	68.2	55.91	39.94	10.15	56.46	-	-	P	H
		15540	45.41	-28.59	74	50.12	39.44	12.03	56.18	-	-	P	H
													H
		10360	52.48	-15.72	68.2	58.85	39.94	10.15	56.46	-	-	P	V
		15540	45.52	-28.48	74	50.23	39.44	12.03	56.18	-	-	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Band 2 - 5250~5350MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 58 5290MHz		5010.2	53.47	-20.53	74	42.82	31.86	6.24	27.45	100	219	P	H
		5010.54	43.92	-10.08	54	33.27	31.86	6.24	27.45	100	219	A	H
	*	5290	97.47	-	-	86.78	31.72	6.34	27.37	100	219	P	H
	*	5290	90.34	-	-	79.65	31.72	6.34	27.37	100	219	A	H
		5356.56	58.95	-15.05	74	48.3	31.64	6.37	27.36	100	219	P	H
		5350.56	53.08	-0.92	54	42.47	31.6	6.37	27.36	100	219	A	H
		5098.6	52.11	-21.89	74	41.17	32.1	6.26	27.42	399	152	P	V
		5033.32	43.97	-10.03	54	33.16	32	6.25	27.44	399	152	A	V
	*	5290	91.86	-	-	81.17	31.72	6.34	27.37	399	152	P	V
	*	5290	83.99	-	-	73.3	31.72	6.34	27.37	399	152	A	V
		5444.64	50.26	-23.74	74	39.29	31.9	6.4	27.33	399	152	P	V
		5455.68	42.57	-11.43	54	31.57	31.92	6.41	27.33	399	152	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 2 5250~5350MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 58 5290MHz		10580	47.79	-20.41	68.2	53.64	40.24	10.26	56.35	-	-	P	H
		15870	45.93	-28.07	74	50.67	38.67	12.07	55.48	-	-	P	H
													H
		10580	46.93	-21.27	68.2	52.78	40.24	10.26	56.35	-	-	P	V
		15870	45.64	-28.36	74	50.38	38.67	12.07	55.48	-	-	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 106 5530MHz		5451.28	59	-15	74	48.01	31.91	6.41	27.33	106	219	P	H
		5465.44	62.34	-5.86	68.2	51.3	31.96	6.41	27.33	106	219	P	H
		5458.72	52.63	-1.37	54	41.62	31.93	6.41	27.33	106	219	A	H
	*	5530	97.36	-	-	86.23	32.04	6.43	27.34	106	219	P	H
	*	5530	88.69	-	-	77.56	32.04	6.43	27.34	106	219	A	H
		5765	50.72	-17.48	68.2	39.43	32.4	6.4	27.51	106	219	P	H
		5459.44	55.6	-18.4	74	44.58	31.94	6.41	27.33	385	162	P	V
		5468.56	54.73	-13.47	68.2	43.68	31.97	6.41	27.33	385	162	P	V
		5459.68	46.84	-7.16	54	35.82	31.94	6.41	27.33	385	162	A	V
	*	5530	94.3	-	-	83.17	32.04	6.43	27.34	385	162	P	V
	*	5530	85.68	-	-	74.55	32.04	6.43	27.34	385	162	A	V
		5745.785	50.9	-17.3	68.2	39.61	32.38	6.41	27.5	385	162	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 3 5470~5725MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 106 5530MHz		11060	47.67	-26.33	74	52.54	40.4	10.5	55.77	-	-	P	H
		16590	47.23	-20.97	68.2	50.52	39.81	12.29	55.39	-	-	P	H
													H
		11060	47.82	-26.18	74	52.69	40.4	10.5	55.77	-	-	P	V
		16590	46.99	-21.21	68.2	50.28	39.81	12.29	55.39	-	-	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Emission below 1GHz

5GHz WIFI 802.11ac VHT80 (LF @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
5GHz 802.11ac VHT80 LF		30.97	21.03	-18.97	40	28.69	23.85	0.72	32.23	-	-	P	H
		263.77	20.98	-25.02	46	31.77	19.71	1.51	32.01	-	-	P	H
		349.13	23.49	-22.51	46	33.2	20.27	1.72	31.7	-	-	P	H
		631.4	26.44	-19.56	46	30.69	25.91	2.26	32.42	-	-	P	H
		859.35	31.32	-14.68	46	31.1	28.83	2.55	31.16	-	-	P	H
		943.74	32.05	-13.95	46	30.43	29.85	2.59	30.82	-	-	P	H
													H
													H
													H
													H
													H
													H
		30.97	21.25	-18.75	40	28.91	23.85	0.72	32.23	-	-	P	V
		120.21	23.03	-20.47	43.5	36.62	17.5	1.15	32.24	-	-	P	V
		427.7	24.46	-21.54	46	31.43	22.79	1.89	31.65	-	-	P	V
		562.53	27.02	-18.98	46	31.3	25.91	2.15	32.34	-	-	P	V
		855.47	31.16	-14.84	46	30.96	28.82	2.55	31.17	-	-	P	V
		948.59	31.99	-14.01	46	29.99	30.2	2.6	30.8	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

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		(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 C. Radiated Spurious Emission Plots

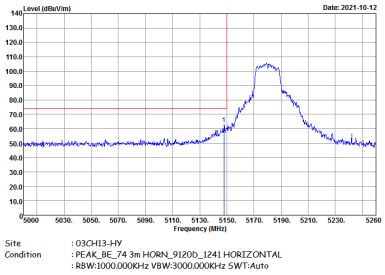
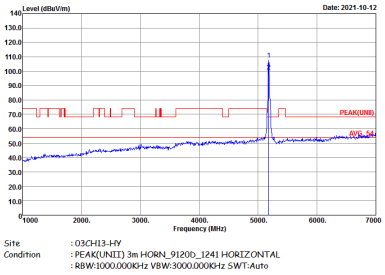
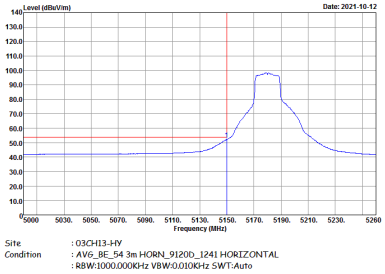
Test Engineer :	Jacky Hong	**Temperature :**	20~25°C
		Relative Humidity :	50~60%

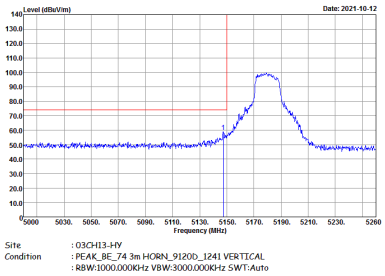
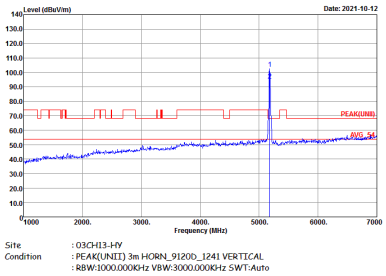
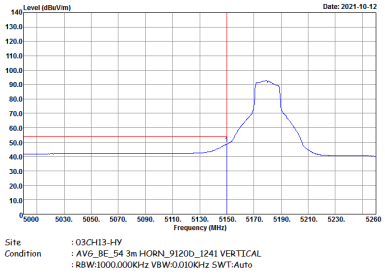
Note symbol

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

Band 1 - 5150~5250MHz

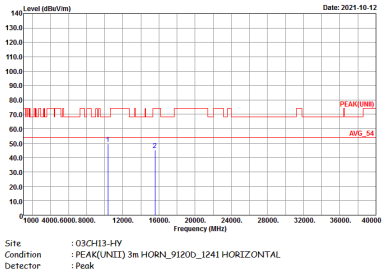
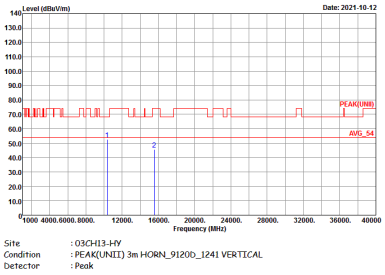
WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH36 5180MHz	
4	Horizontal	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH36 5180MHz	
4	Vertical	Fundamental
Peak		
Avg.		Left blank

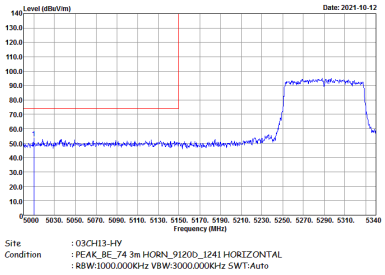
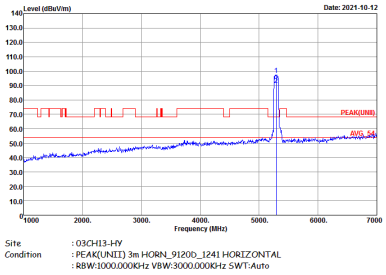
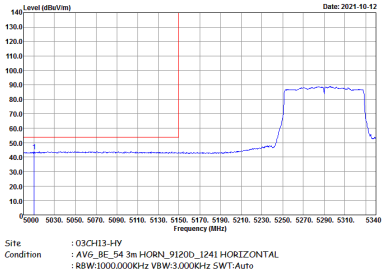
Band 1 - 5150~5250MHz

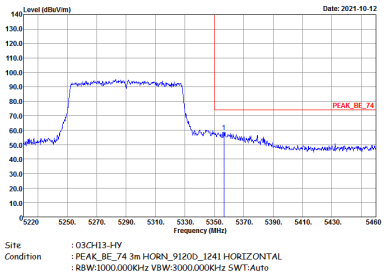
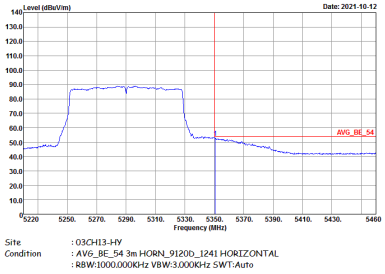
WIFI 802.11n HT20 (Harmonic @ 3m)

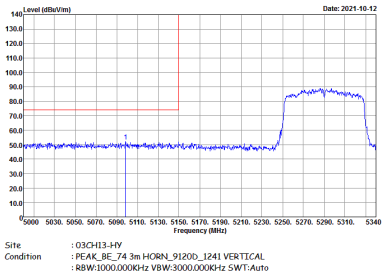
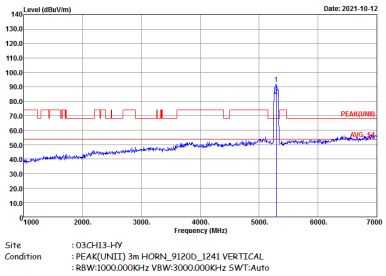
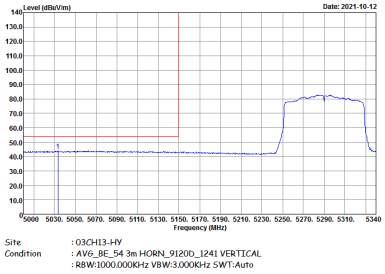
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT20 CH36 5180MHz	
4	Horizontal	Vertical
Peak Avg.		

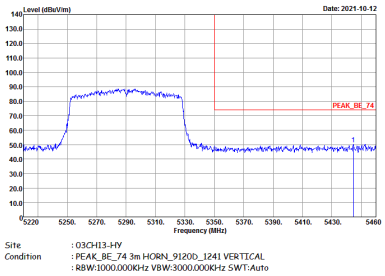
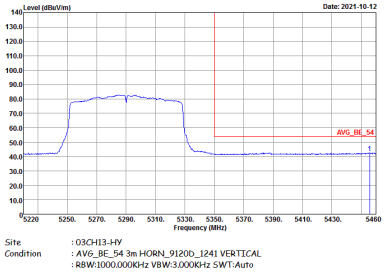
Band 2 - 5250~5350MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - L	
4	Horizontal	Fundamental
Peak		
Avg.		Left blank

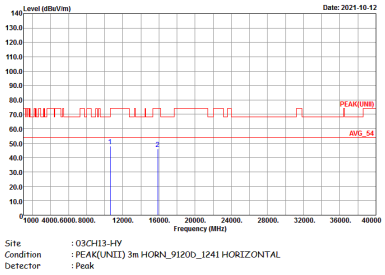
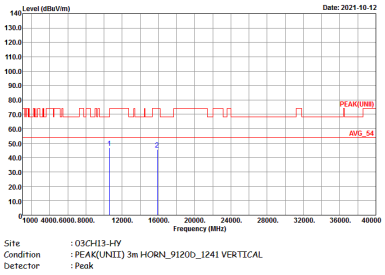
WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - R	
4	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - L	
4	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 2 5250~5350MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz - R	
4	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

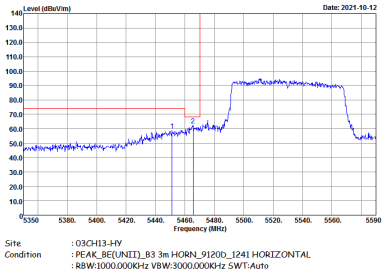
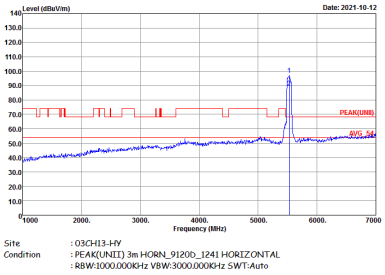
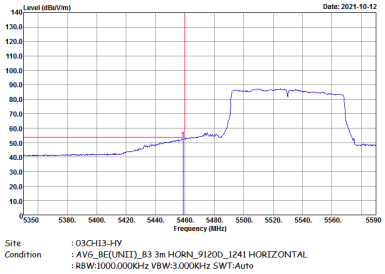
Band 2 - 5250~5350MHz

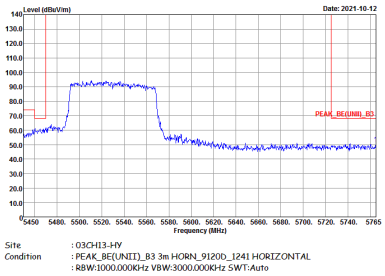
WIFI 802.11ac VHT80 (Harmonic @ 3m)

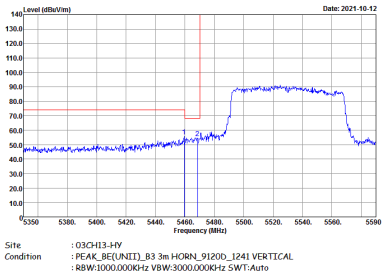
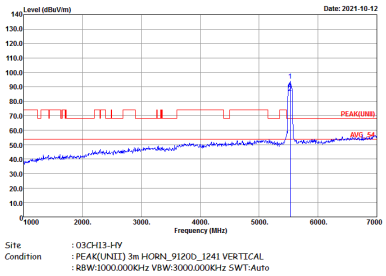
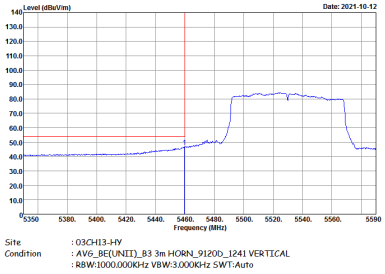
WIFI	Band 2 5250~5350MHz Harmonic @ 3m	
ANT	802.11ac VHT80 CH58 5290MHz	
4	Horizontal	Vertical
Peak Avg.		

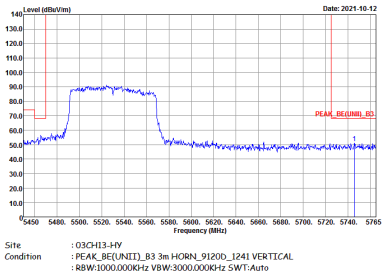
Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - L	
4	Horizontal	Fundamental
Peak		
Avg.		Left blank

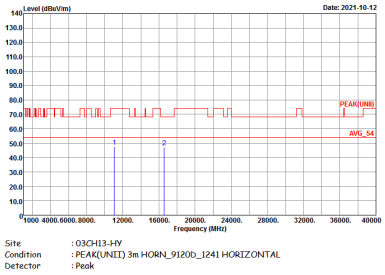
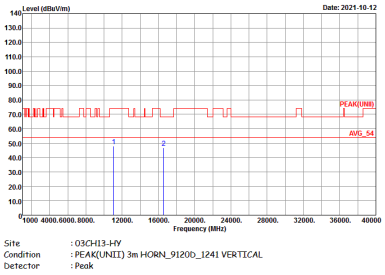
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - R	
4	Horizontal	Fundamental
Peak		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - L	
4	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz - R	
4	Vertical	Fundamental
Peak		Left blank

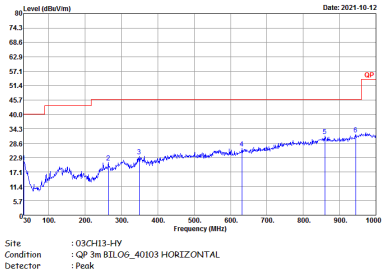
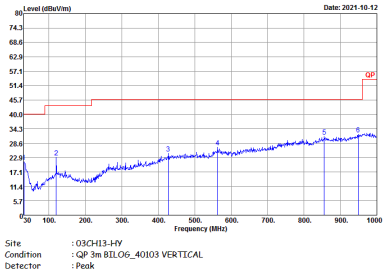
Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI	Band 3 5470~5725MHz Harmonic @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz	
4	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

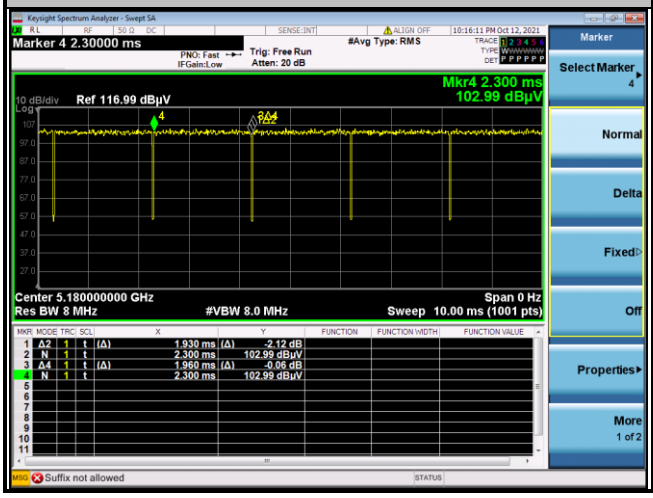
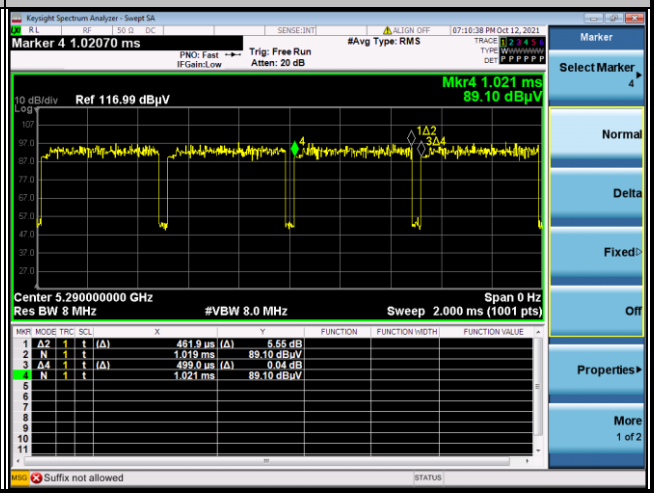
5GHz WIFI 802.11ac VHT80 (LF)

WIFI	5GHz WIFI	
ANT	802.11ac VHT80 LF	
4	Horizontal	Vertical
QP / Peak		

Appendix D. Duty Cycle Plots

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting
5GHz 802.11n HT20	98.47	-	-	10Hz
5GHz 802.11ac VHT80	92.38	461.9	2.17	3kHz

802.11n HT20



802.11ac VHT80