

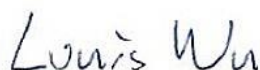


FCC RADIO TEST REPORT

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 C §15.247

The product was received on Sep. 14, 2021 and testing was started from Oct. 09, 2021 and completed on Oct. 14, 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.



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
FR190730-01C	01	Initial issue of report	Oct. 28, 2021
FR190730-01C	02	Revise applicant information	Nov. 01, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.247(a)(2)	6dB Bandwidth	-	See Note
-	2.1049	99% Occupied Bandwidth	-	See Note
3.1	15.247(b)	Power Output Measurement	Pass	-
-	15.247(e)	Power Spectral Density	-	See Note
-	15.247(d)	Conducted Band Edges	-	See Note
		Conducted Spurious Emission	-	See Note
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 3.58 dB at 4824.000 MHz
-	15.207	AC Conducted Emission	-	See Note
3.3	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Note:

1. This is a variant report by differences between support of WWAN Bands. All the test cases were performed on original report which can be referred to Sporton Report Number FR190730C. Based on the original report, the test cases were verified.
2. 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: Amy Chen

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		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	-1.36

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. 03CH20-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 C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ 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

- 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: 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)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Test Mode

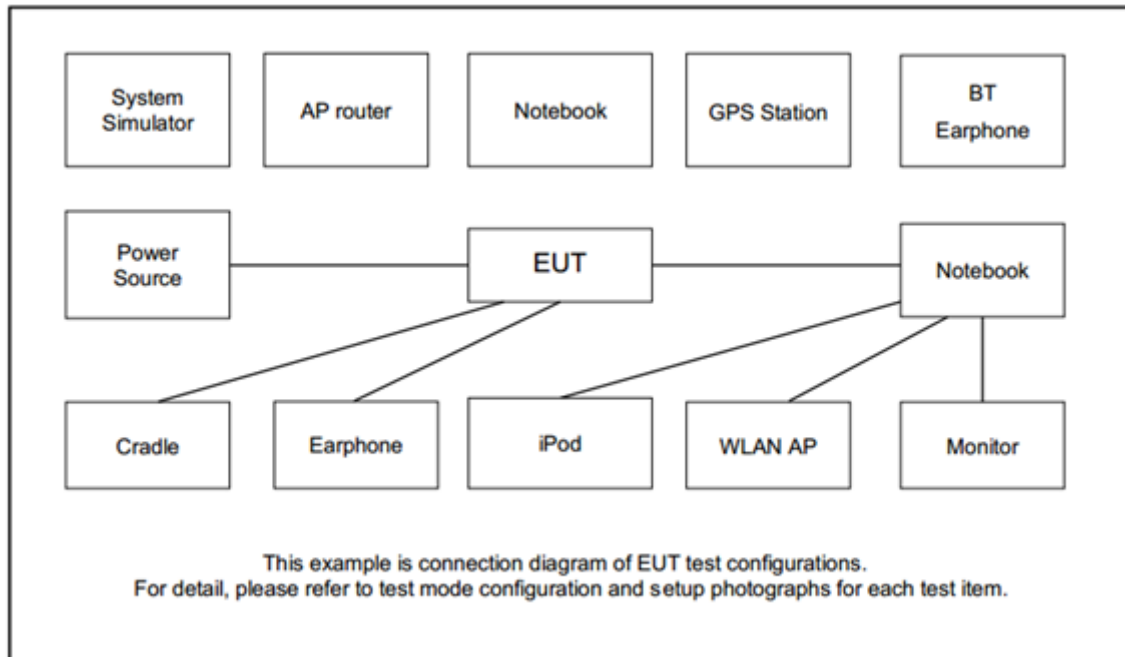
Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0

Ch. #	2400-2483.5 MHz		
	802.11b	802.11n HT20	802.11n HT40
Low	01	01	-
Middle	-	-	06
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 V4.0.00158.0" 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 Output Power Measurement

3.1.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna with directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

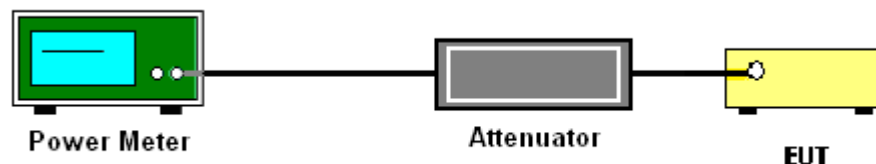
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. For Peak Power, the testing follows ANSI C63.10 Section 11.9.1.3 PKPM1
2. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
3. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Measure the conducted output power and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.1.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

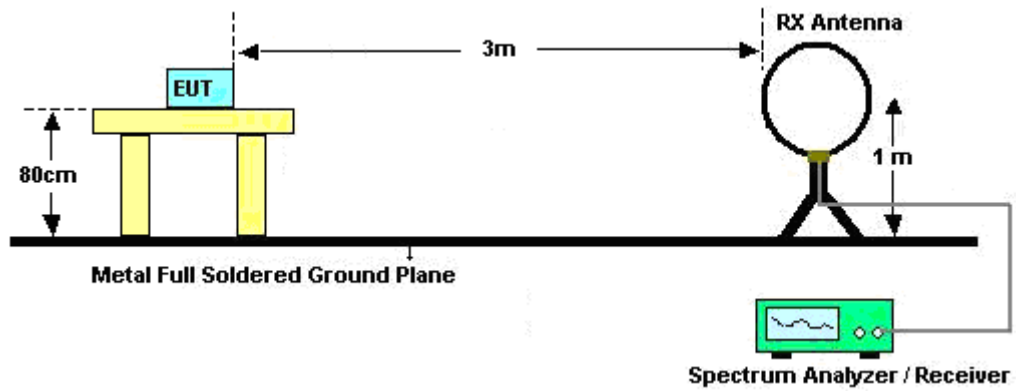


3.2.3 Test Procedures

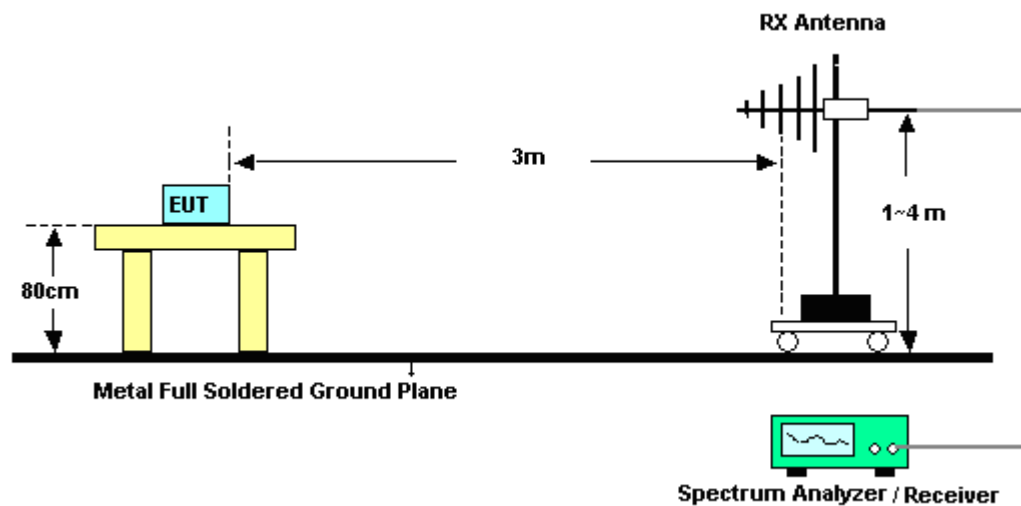
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT 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.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 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 “-”.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW = 100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3 MHz for $f \geq 1$ GHz for peak measurement.For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.2.4 Test Setup

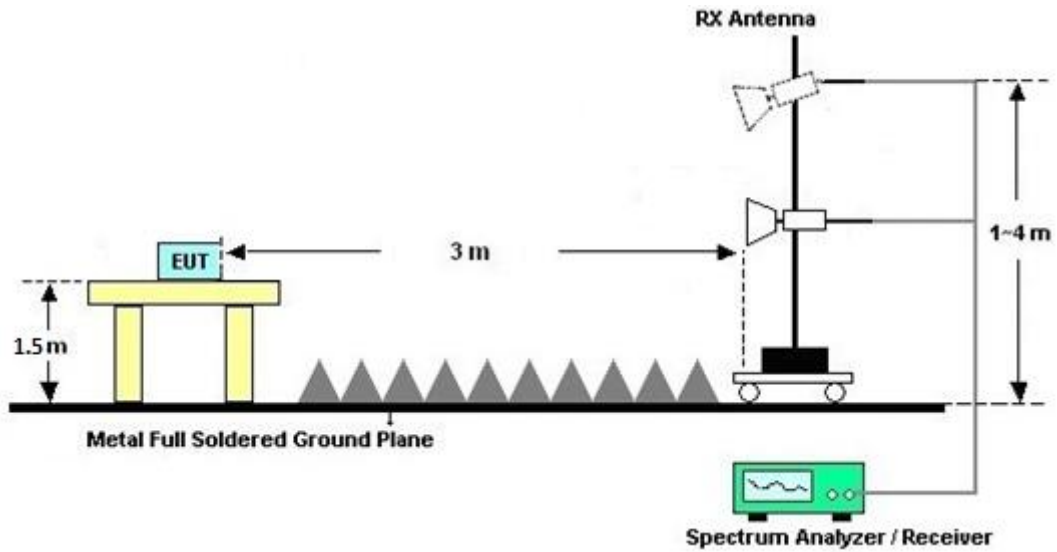
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated test above 1GHz



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

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 Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B and C.



3.3 Antenna Requirements

3.3.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.3.2 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
EMI Test Receiver	Keysight	N9010B	MY60240520	10Hz~44GHz	Dec. 02, 2020	Oct. 12, 2021~ Oct. 14, 2021	Dec. 01, 2021	Radiation (03CH20-HY)
Preamplifier	COM-POWER	PAM-103	18020201	1MHz-1000MHz	Jan. 04, 2021	Oct. 12, 2021~ Oct. 14, 2021	Jan. 03, 2022	Radiation (03CH20-HY)
Amplifier	EMCI	EMC118A45SE	980792	N/A	Nov. 16, 2020	Oct. 12, 2021~ Oct. 14, 2021	Nov. 15, 2021	Radiation (03CH20-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 11, 2020	Oct. 12, 2021~ Oct. 14, 2021	Dec. 10, 2021	Radiation (03CH20-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Oct. 12, 2021~ Oct. 14, 2021	Jan. 03, 2022	Radiation (03CH20-HY)
Bilog Antenna	TESEQ	CBL 6111D&00802 N1D01N-06	55606 & 08	30MHz~1GHz	Oct. 22, 2020	Oct. 12, 2021~ Oct. 14, 2021	Oct. 21, 2021	Radiation (03CH20-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	002360	1GHz-18GHz	Nov. 03, 2020	Oct. 12, 2021~ Oct. 14, 2021	Nov. 02, 2021	Radiation (03CH20-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00991	18GHz-40GHz	May 12, 2021	Oct. 12, 2021~ Oct. 14, 2021	May 11, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WLK4-1000-15 30-8000-40SS	SN27	1.53GHz Low Pass Filter	May 25, 2021	Oct. 12, 2021~ Oct. 14, 2021	May 24, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 OST	SN8	N/A	Mar. 26, 2021	Oct. 12, 2021~ Oct. 14, 2021	Mar. 25, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WHKX8-6090- 7000-18000-40 SS	SN99	N/A	Nov. 05, 2020	Oct. 12, 2021~ Oct. 14, 2021	Nov. 04, 2021	Radiation (03CH20-HY)
Hygrometer	TECEPIL	DTM-303B	TP200728	N/A	Mar. 09, 2021	Oct. 12, 2021~ Oct. 14, 2021	Mar. 08, 2022	Radiation (03CH20-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519229/2,804 015/2,804027 /2	N/A	Jan. 20, 2021	Oct. 12, 2021~ Oct. 14, 2021	Jan. 19, 2022	Radiation (03CH20-HY)
Software	Audix	E3 6.2009-8-24	RK-002156	N/A	N/A	Oct. 12, 2021~ Oct. 14, 2021	N/A	Radiation (03CH20-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Oct. 12, 2021~ Oct. 14, 2021	N/A	Radiation (03CH20-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Oct. 12, 2021~ Oct. 14, 2021	N/A	Radiation (03CH20-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Oct. 12, 2021~ Oct. 14, 2021	N/A	Radiation (03CH20-HY)
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 01, 2021	Oct. 09, 2021	Feb. 28, 2022	Conducted (TH02-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO 12	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% ($U = 2Uc(y)$)	3.9 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.8 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

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

TEST RESULTS DATA
Average Output Power
(Reporting Only)

2.4GHz Band Single Antenna																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant4	Ant2	SUM	Ant4	Ant2	Ant4	Ant2	Ant4	Ant2	Ant4	Ant2	
11b	1Mbps	1	1	2412	18.90	-		30.00	-	-1.36	-	17.54	-	36.00	-	Pass
11b	1Mbps	1	6	2437	18.60	-		30.00	-	-1.36	-	17.24	-	36.00	-	Pass
11b	1Mbps	1	11	2462	18.80	-		30.00	-	-1.36	-	17.44	-	36.00	-	Pass
11g	6Mbps	1	1	2412	18.90	-		30.00	-	-1.36	-	17.54	-	36.00	-	Pass
11g	6Mbps	1	6	2437	18.50	-		30.00	-	-1.36	-	17.14	-	36.00	-	Pass
11g	6Mbps	1	11	2462	18.30	-		30.00	-	-1.36	-	16.94	-	36.00	-	Pass
HT20	MCS0	1	1	2412	18.20	-		30.00	-	-1.36	-	16.84	-	36.00	-	Pass
HT20	MCS0	1	6	2437	18.50	-		30.00	-	-1.36	-	17.14	-	36.00	-	Pass
HT20	MCS0	1	11	2462	17.80	-		30.00	-	-1.36	-	16.44	-	36.00	-	Pass
HT40	MCS0	1	3	2422	16.80	-		30.00	-	-1.36	-	15.44	-	36.00	-	Pass
HT40	MCS0	1	6	2437	17.70	-		30.00	-	-1.36	-	16.34	-	36.00	-	Pass
HT40	MCS0	1	9	2452	16.10	-		30.00	-	-1.36	-	14.74	-	36.00	-	Pass
VHT20	MCS0	1	1	2412	18.10	-		30.00	-	-1.36	-	16.74	-	36.00	-	Pass
VHT20	MCS0	1	6	2437	18.40	-		30.00	-	-1.36	-	17.04	-	36.00	-	Pass
VHT20	MCS0	1	11	2462	17.70	-		30.00	-	-1.36	-	16.34	-	36.00	-	Pass
VHT40	MCS0	1	3	2422	16.70	-		30.00	-	-1.36	-	15.34	-	36.00	-	Pass
VHT40	MCS0	1	6	2437	17.60	-		30.00	-	-1.36	-	16.24	-	36.00	-	Pass
VHT40	MCS0	1	9	2452	16.00	-		30.00	-	-1.36	-	14.64	-	36.00	-	Pass

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

TEST RESULTS DATA
Peak Output Power

2.4GHz Band Single Antenna																
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant4	Ant2	SUM	Ant4	Ant2	Ant4	Ant2	Ant4	Ant2	Ant4	Ant2	
11b	1Mbps	1	1	2412	20.82	-		30.00	-	-1.36	-	19.46	-	36.00	-	Pass
11b	1Mbps	1	6	2437	20.61	-		30.00	-	-1.36	-	19.25	-	36.00	-	Pass
11b	1Mbps	1	11	2462	20.86	-		30.00	-	-1.36	-	19.50	-	36.00	-	Pass
11g	6Mbps	1	1	2412	22.75	-		30.00	-	-1.36	-	21.39	-	36.00	-	Pass
11g	6Mbps	1	6	2437	22.57	-		30.00	-	-1.36	-	21.21	-	36.00	-	Pass
11g	6Mbps	1	11	2462	22.31	-		30.00	-	-1.36	-	20.95	-	36.00	-	Pass
HT20	MCS0	1	1	2412	22.23	-		30.00	-	-1.36	-	20.87	-	36.00	-	Pass
HT20	MCS0	1	6	2437	22.58	-		30.00	-	-1.36	-	21.22	-	36.00	-	Pass
HT20	MCS0	1	11	2462	21.89	-		30.00	-	-1.36	-	20.53	-	36.00	-	Pass
HT40	MCS0	1	3	2422	22.24	-		30.00	-	-1.36	-	20.88	-	36.00	-	Pass
HT40	MCS0	1	6	2437	22.73	-		30.00	-	-1.36	-	21.37	-	36.00	-	Pass
HT40	MCS0	1	9	2452	21.85	-		30.00	-	-1.36	-	20.49	-	36.00	-	Pass
VHT20	MCS0	1	1	2412	22.14	-		30.00	-	-1.36	-	20.78	-	36.00	-	Pass
VHT20	MCS0	1	6	2437	22.47	-		30.00	-	-1.36	-	21.11	-	36.00	-	Pass
VHT20	MCS0	1	11	2462	21.78	-		30.00	-	-1.36	-	20.42	-	36.00	-	Pass
VHT40	MCS0	1	3	2422	22.12	-		30.00	-	-1.36	-	20.76	-	36.00	-	Pass
VHT40	MCS0	1	6	2437	22.62	-		30.00	-	-1.36	-	21.26	-	36.00	-	Pass
VHT40	MCS0	1	9	2452	21.74	-		30.00	-	-1.36	-	20.38	-	36.00	-	Pass

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



Appendix B. Radiated Spurious Emission

Test Engineer :	JC Liang	Temperature :	20~21°C
		Relative Humidity :	60~67%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2389.905	48.74	-25.26	74	39.25	27.26	18.42	36.19	108	346	P	H
		2388.855	37.54	-16.46	54	28.05	27.26	18.42	36.19	108	346	A	H
	*	2412	105.77	-	-	96.16	27.35	18.46	36.2	108	346	P	H
	*	2412	102.53	-	-	92.92	27.35	18.46	36.2	108	346	A	H
													H
													H
		2384.235	48.54	-25.46	74	39.08	27.24	18.41	36.19	400	66	P	V
		2388.96	36.3	-17.7	54	26.81	27.26	18.42	36.19	400	66	A	V
	*	2412	100.64	-	-	91.03	27.35	18.46	36.2	400	66	P	V
	*	2412	97.49	-	-	87.88	27.35	18.46	36.2	400	66	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 4	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	52.98	-21.02	74	45.55	32.14	12.73	37.44	100	257	P	H
		4824	50.42	-3.58	54	42.99	32.14	12.73	37.44	100	257	A	H
													H
													H
													H
													H
		4824	45.64	-28.36	74	38.21	32.14	12.73	37.44	-	-	P	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.												

**2.4GHz 2400~2483.5MHz****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 01 2412MHz		2389.695	60.53	-13.47	74	51.04	27.26	18.42	36.19	113	343	P	H
		2390	50.31	-3.69	54	40.82	27.26	18.42	36.19	113	343	A	H
	*	2412	106.26	-	-	96.65	27.35	18.46	36.2	113	343	P	H
	*	2412	98.85	-	-	89.24	27.35	18.46	36.2	113	343	A	H
													H
													H
		2389.695	57.17	-16.83	74	47.68	27.26	18.42	36.19	400	54	P	V
		2390	45.51	-8.49	54	36.02	27.26	18.42	36.19	400	54	A	V
	*	2412	102.18	-	-	92.57	27.35	18.46	36.2	400	54	P	V
	*	2412	94.11	-	-	84.5	27.35	18.46	36.2	400	54	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz
WIFI 802.11n 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 01 2412MHz		4824	50.66	-23.34	74	43.23	32.14	12.73	37.44	100	243	P	H
		4824	40.56	-13.44	54	33.13	32.14	12.73	37.44	100	243	A	H
													H
													H
													H
													H
		4824	42.87	-31.13	74	35.44	32.14	12.73	37.44	-	-	P	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.												

**2.4GHz 2400~2483.5MHz****WIFI 802.11n HT40 (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 HT40 CH 06 2437MHz		2389.36	54.47	-19.53	74	44.98	27.26	18.42	36.19	100	345	P	H
		2389.84	44.75	-9.25	54	35.26	27.26	18.42	36.19	100	345	A	H
	*	2437	103.86	-	-	94.12	27.45	18.5	36.21	100	345	P	H
	*	2437	96.83	-	-	87.09	27.45	18.5	36.21	100	345	A	H
		2483.68	60.17	-13.83	74	50.17	27.63	18.59	36.22	100	345	P	H
		2483.84	49.91	-4.09	54	39.9	27.64	18.59	36.22	100	345	A	H
		2386.96	49.17	-24.83	74	39.69	27.25	18.42	36.19	396	53	P	V
		2390	39.95	-14.05	54	30.46	27.26	18.42	36.19	396	53	A	V
	*	2437	101.41	-	-	91.67	27.45	18.5	36.21	396	53	P	V
	*	2437	93.59	-	-	83.85	27.45	18.5	36.21	396	53	A	V
		2483.92	55.84	-18.16	74	45.83	27.64	18.59	36.22	396	53	P	V
		2483.68	46.33	-7.67	54	36.33	27.63	18.59	36.22	396	53	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (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 HT40 CH 06 2437MHz		4874	44.25	-29.75	74	36.66	32.3	12.77	37.48	-	-	P	H
		7311	46.8	-27.2	74	33.01	36.76	15.38	38.35	-	-	P	H
													H
													H
													H
													H
		4874	42.34	-31.66	74	34.75	32.3	12.77	37.48	-	-	P	V
		7311	47.4	-26.6	74	33.61	36.76	15.38	38.35	-	-	P	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.												



Emission below 1GHz
2.4GHz WIFI 802.11b (LF)

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)
2.4GHz 802.11b LF		36.79	24.18	-15.82	40	37.86	20.97	1.07	35.72	-	-	P	H
		107.6	21.19	-22.31	43.5	38	17.03	1.8	35.64	-	-	P	H
		348.16	25.54	-20.46	46	36.99	20.42	3.24	35.11	-	-	P	H
		578.05	28.37	-17.63	46	32.66	25.95	4.24	34.48	-	-	P	H
		739.07	32.59	-13.41	46	33.7	28.03	4.79	33.93	-	-	P	H
		958.29	35.46	-10.54	46	31.86	31.08	5.64	33.12	-	-	P	H
													H
													H
													H
													H
													H
													H
		31.94	24.81	-15.19	40	36.04	23.51	0.98	35.72	-	-	P	V
		67.83	30.87	-9.13	40	52.99	12.19	1.39	35.7	-	-	P	V
		88.2	25.65	-17.85	43.5	45.29	14.41	1.62	35.67	-	-	P	V
		729.37	35.28	-10.72	46	36.8	27.68	4.76	33.96	-	-	P	V
		746.83	37.35	-8.65	46	38.34	28.09	4.82	33.9	-	-	P	V
		959.26	35.04	-10.96	46	31.4	31.1	5.65	33.11	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												



Note symbol

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

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

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



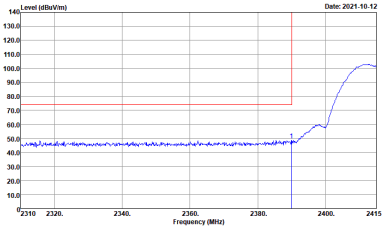
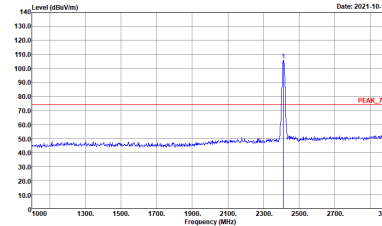
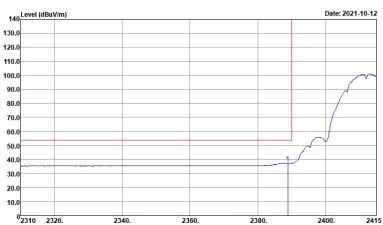
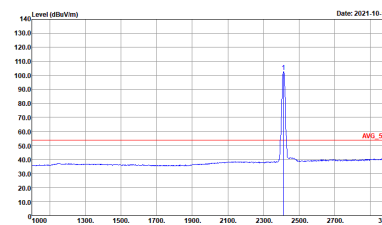
Appendix C. Radiated Spurious Emission Plots

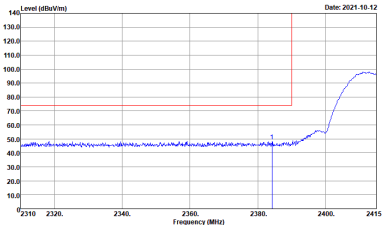
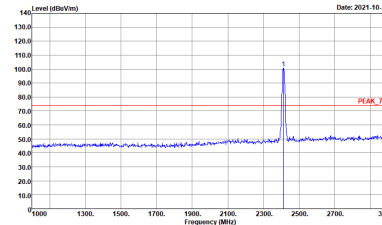
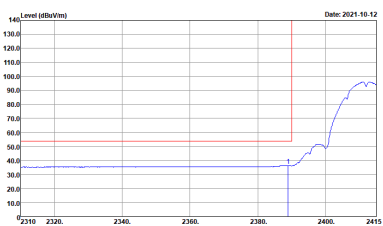
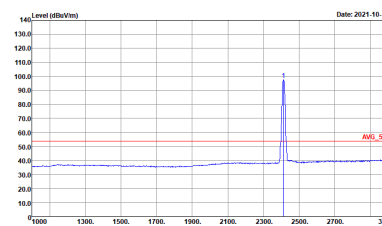
Test Engineer :	JC Liang	Temperature :	20~21°C
		Relative Humidity :	60~67%

Note symbol

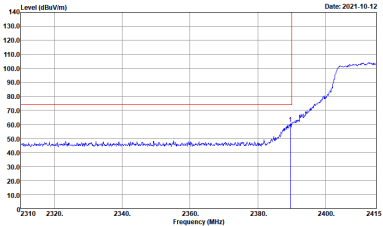
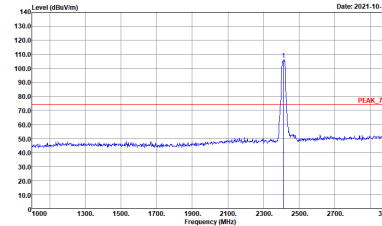
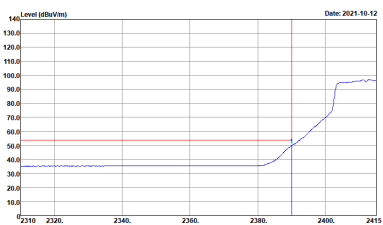
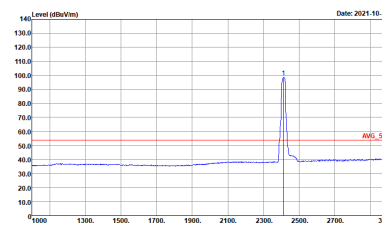
-L	Low channel location
-R	High channel location

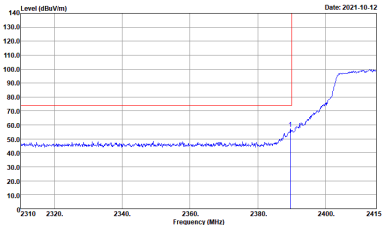
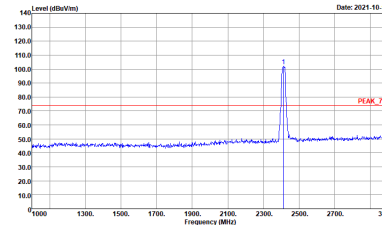
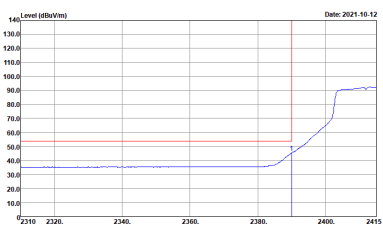
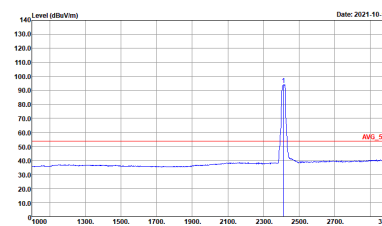
2.4GHz 2400~2483.5MHz
WIFI 802.11b (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
4	Horizontal	Fundamental
Peak	 <p>Site : 03CH20-HY Condition : PEAK_BE_74 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SW1:Auto</p>	 <p>Site : 03CH20-HY Condition : PEAK_74 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SW1:Auto</p>
	 <p>Site : 03CH20-HY Condition : AVG_BE_54 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:0.0100Hz SW1:Auto</p>	 <p>Site : 03CH20-HY Condition : AVG_54 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:0.0100Hz SW1:Auto</p>
Avg.		

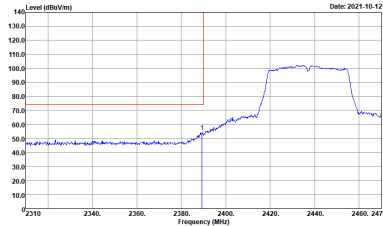
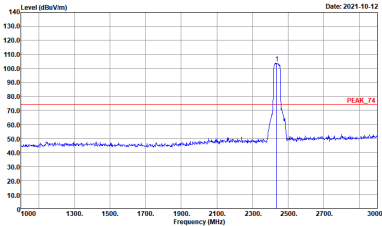
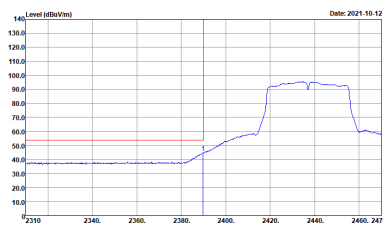
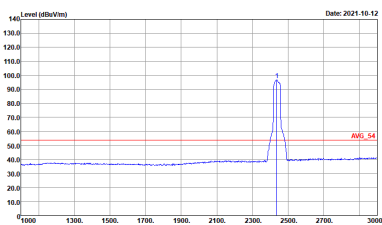
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
4	Vertical	Fundamental
Peak	 <p>Site : 03CH20-HY Condition : PEAK_BE_74 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH20-HY Condition : PEAK_74 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
	 <p>Site : 03CH20-HY Condition : AVG_BE_54 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:0.001KHz SWT:Auto</p>	 <p>Site : 03CH20-HY Condition : AVG_54 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:0.001KHz SWT:Auto</p>
Avg.		

2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Band Edge @ 3m)

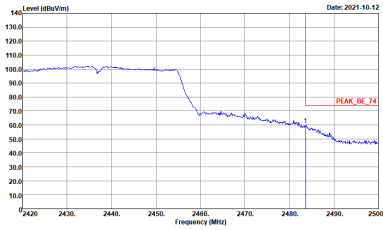
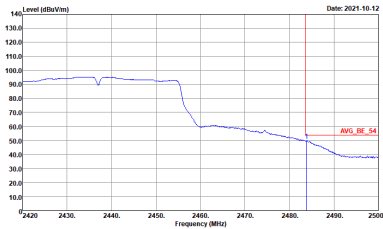
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
4	Horizontal	Fundamental
Peak	 <p>Site : 03CH20-HY Condition : PEAK_BE_74 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>	 <p>Site : 03CH20-HY Condition : PEAK_74 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>
	 <p>Site : 03CH20-HY Condition : AVG_BE_54 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:0.0100Hz SWT:Auto</p>	 <p>Site : 03CH20-HY Condition : AVG_54 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:0.0100Hz SWT:Auto</p>
Avg.		

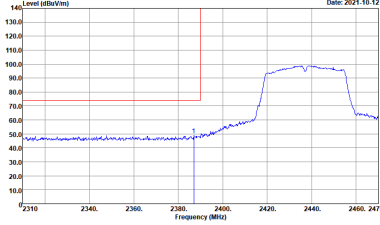
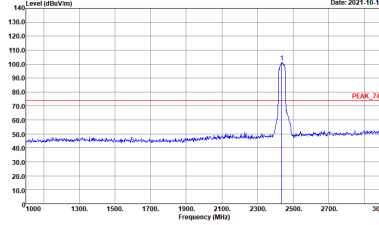
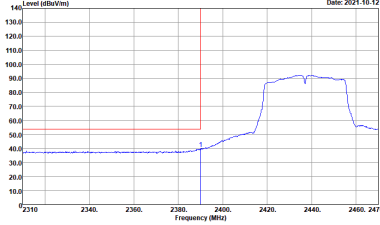
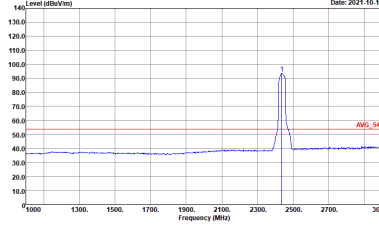
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
4	Vertical	Fundamental
Peak	 <p>Site : 03CH20-1HY Condition : PEAK_BE_74 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH20-1HY Condition : PEAK_74 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
	 <p>Site : 03CH20-1HY Condition : AVG_BE_54 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto</p>	 <p>Site : 03CH20-1HY Condition : AVG_54 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto</p>
Avg.		

2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

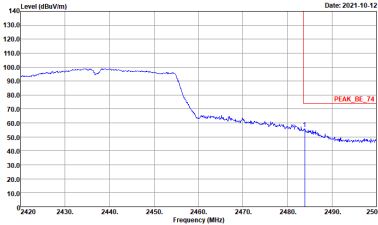
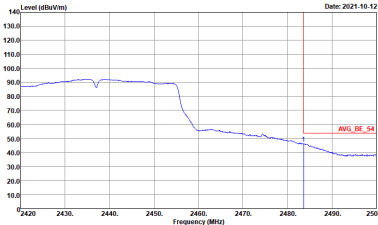
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - L	
4	Horizontal	Fundamental
Peak	 <p>Site : 03CH20-HY Condition : PEAK_BE_74 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>	 <p>Site : 03CH20-HY Condition : PEAK_74 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>
Avg.	 <p>Site : 03CH20-HY Condition : AVG_BE_54 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>	 <p>Site : 03CH20-HY Condition : AVG_54 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto</p>



WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - R	
4	Horizontal	Fundamental
Peak	 <p>Site : 03CH20-HY Condition : PEAK_BE_74 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Site : 03CH20-HY Condition : AVG_BE_54 3m 91200_002360_1091103 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - L	
4	Vertical	Fundamental
Peak	 <p>Site : 03CH20-1HY Condition : PEAK_BE_74 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH20-1HY Condition : PEAK_74 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH20-1HY Condition : AVG_BE_54 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>	 <p>Site : 03CH20-1HY Condition : AVG_54 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p>



WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - R	
4	Vertical	Fundamental
Peak	 <p>Site : 03CH20-HY Condition : PEAK_BE_74 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	Left blank
Avg.	 <p>Site : 03CH20-HY Condition : AVG_BE_54 3m 91200_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	Left blank



2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH01 2412MHz	
4	Horizontal	Vertical
Peak Avg.	<div><p>Site : 03CH20-1FY Condition : PEAK_74 3m 91200_002360_1091103 HORIZONTAL</p></div>	<div><p>Site : 03CH20-1FY Condition : PEAK_74 3m 91200_002360_1091103 VERTICAL</p></div>



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

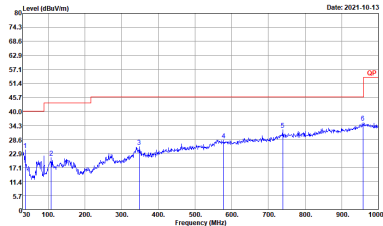
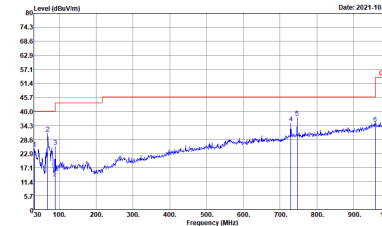
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
4	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH20-1FY Condition : PEAK_74 3m 91200_002360_1091103 HORIZONTAL</p>	<p>Site : 03CH20-1FY Condition : PEAK_74 3m 91200_002360_1091103 VERTICAL</p>



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT40 CH06 2437MHz	
4	Horizontal	Vertical
Peak Avg.	<div><p>Site : 03CH20-4F Condition : PEAK_74 3m 91200_002360_1091103 HORIZONTAL</p></div>	<div><p>Site : 03CH20-4F Condition : PEAK_74 3m 91200_002360_1091103 VERTICAL</p></div>

Emission below 1GHz
2.4GHz WIFI 802.11b (LF)

WIFI	2.4GHz 2400~2483.5MHz	
ANT	802.11b LF	
4	Horizontal	Vertical
QP / Peak	 <p>Site : 03CH20-14Y Condition : QP 3m LF_55606408_1091022 HORIZONTAL</p>	 <p>Site : 03CH20-14Y Condition : QP 3m LF_55606408_1091022 VERTICAL</p>



Appendix D. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
4	802.11b	99.36	-	-	10Hz
4	2.4GHz 802.11n HT20	98.26	-	-	10Hz
4	2.4GHz 802.11n HT40	95.00	950	1.05	3kHz

