FCC CO-LOCATION RADIO TEST REPORT

FCC ID	**:**	**APYHRO00303**
Equipment	**:**	**Smart phone**
Brand Name	**:**	**SHARP**
Model Name	**:**	**APYHRO00303**
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. 13, 2021 and testing was started from Sep. 30, 2021 and completed on Oct. 13, 2021. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. 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
FR190730F	01	Initial issue of report	Oct. 28, 2021
FR190730F	02	Revise applicant information	Nov. 01, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(b)	Unwanted Emissions	Pass	Under limit 0.57 dB at 5459.920 MHz
3.2	15.203 15.407(a)	Antenna Requirement	Pass	-

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: Lucy Wu

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

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. 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

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

FCC designation No.: 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 Part 15 Subpart E
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- 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). 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.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz	
Bluetooth - LE	
Channel	Freq. (MHz)
39	2480

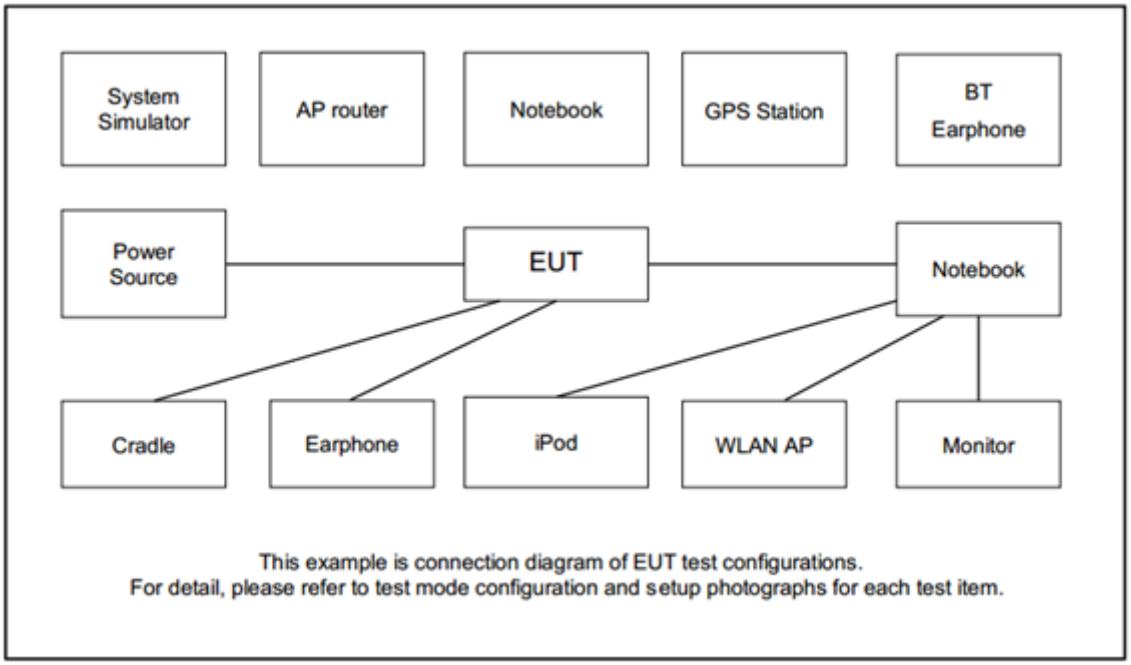
2400-2483.5 MHz		5470-5725 MHz	
802.11n HT20		802.11ac VHT80	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	2412	106	5530

Remark: During the Radiated Spurious Emission test, the EUT turn on the WWAN functions simultaneously.

<Co-Location>

Modulation	Plane	Data Rate
2.4GHz 802.11n HT20 + LTE Band 7	X	MCS0 + QPSK
Bluetooth -LE + 5GHz 802.11ac VHT80 + LTE Band 7	Z	GFSK + MCS0 + QPSK

2.2 Connection Diagram of Test System



2.3 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	N/A	Unshielded ,1.5m	N/A

2.4 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 Unwanted Emissions Measurement

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

3.1.1 Limit of Unwanted Emissions

(1) 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

(2) 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.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 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

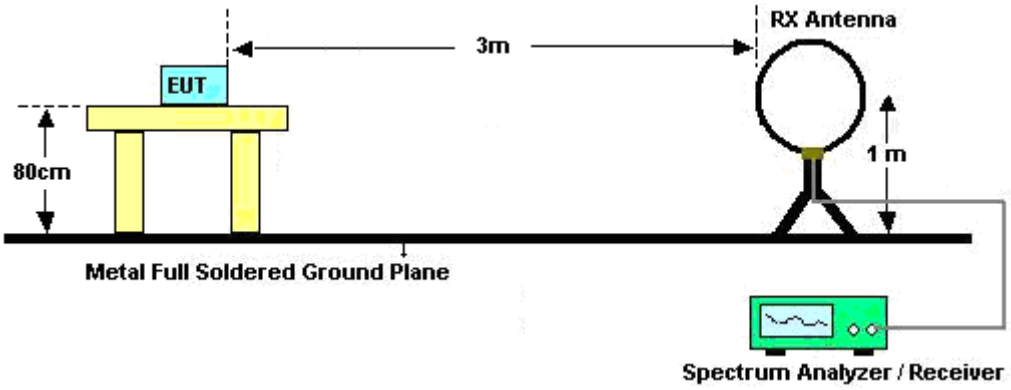
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

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 "-".

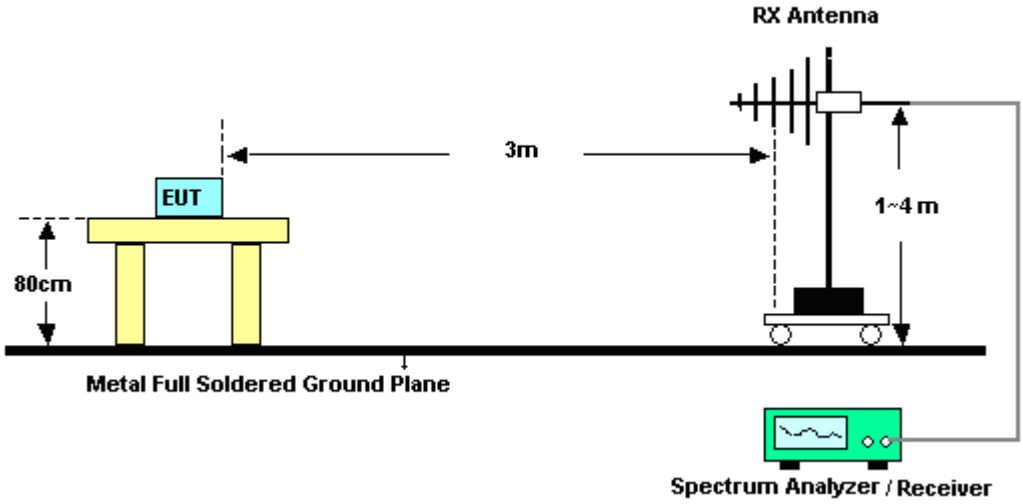
7. Radiated testing above 1GHz was performed by adjusting the antenna tower from 1m to 4m and by rotating the turn table from 0degree to 360 degree to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6dB margin against average limit line, the position is marked as "-".

3.1.4 Test Setup

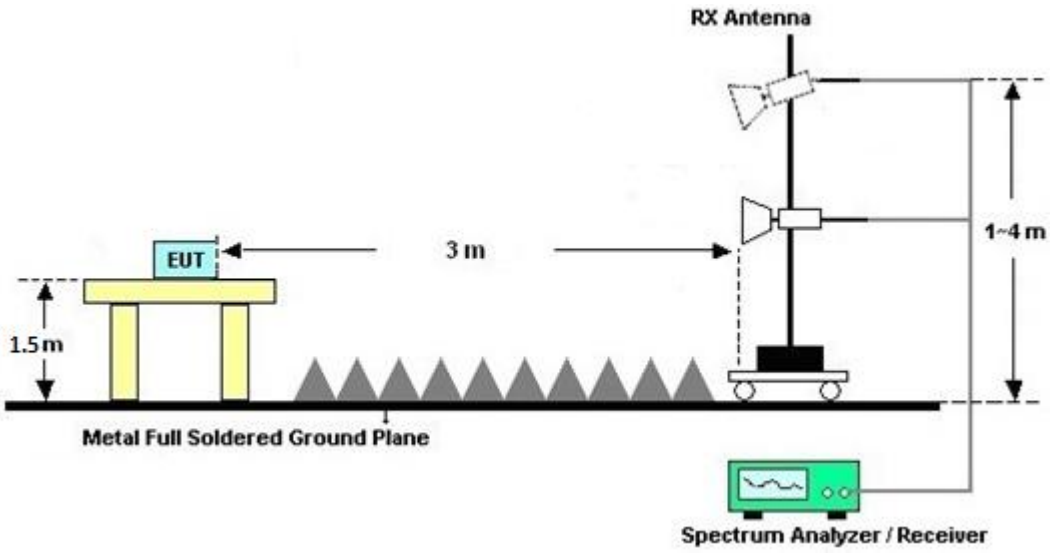
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated test above 1GHz



3.1.5 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.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

3.1.8 Test Result of Radiated Spurious Emissions

Please refer to Appendix A and B.

3.2 Antenna Requirements

3.2.1 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.

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 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 Receicver	Keysight	N9010B	MY60240520	10Hz~44GHz	Dec. 02, 2020	Sep. 30, 2021~ Oct. 13, 2021	Dec. 01, 2021	Radiation (03CH20-HY)
Preamplifier	COM-POWER	PAM-103	18020201	1MHz-1000MHz	Jan. 04, 2021	Sep. 30, 2021~ Oct. 13, 2021	Jan. 03, 2022	Radiation (03CH20-HY)
Amplifier	EMCI	EMC118A45SE	980792	N/A	Nov. 16, 2020	Sep. 30, 2021~ Oct. 13, 2021	Nov. 15, 2021	Radiation (03CH20-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 11, 2020	Sep. 30, 2021~ Oct. 13, 2021	Dec. 10, 2021	Radiation (03CH20-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Sep. 30, 2021~ Oct. 13, 2021	Jan. 03, 2022	Radiation (03CH20-HY)
Bilog Antenna	TESEQ	CBL 6111D&00802 N1D01N-06	55606 & 08	30MHz~1GHz	Oct. 22, 2020	Sep. 30, 2021~ Oct. 13, 2021	Oct. 21, 2021	Radiation (03CH20-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	002360	1GHz-18GHz	Nov. 03, 2020	Sep. 30, 2021~ Oct. 13, 2021	Nov. 02, 2021	Radiation (03CH20-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	009910	18GHz-40GHz	May 12, 2021	Sep. 30, 2021~ Oct. 13, 2021	May 11, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN27	1.53GHz Low Pass Filter	May 25, 2021	Sep. 30, 2021~ Oct. 13, 2021	May 24, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN8	N/A	Mar. 26, 2021	Sep. 30, 2021~ Oct. 13, 2021	Mar. 25, 2022	Radiation (03CH20-HY)
Filter	Wainwright	WHKX8-6090-7000-18000-40SS	SN99	N/A	Nov. 05, 2020	Sep. 30, 2021~ Oct. 13, 2021	Nov. 04, 2021	Radiation (03CH20-HY)
Notch Filter	ST1	STI15_9935_5150-5850	NA	N/A	Apr. 08, 2021	Sep. 30, 2021~ Oct. 13, 2021	Apr. 07, 2022	Radiation (03CH20-HY)
Notch Filter	Marvelous Microwave Inc	MFN_2400.2485.S5	40009N	N/A	Apr. 16, 2021	Sep. 30, 2021~ Oct. 13, 2021	Apr. 15, 2022	Radiation (03CH20-HY)
Hygrometer	TECPEL	DTM-303B	TP200728	N/A	Mar. 09, 2021	Sep. 30, 2021~ Oct. 13, 2021	Mar. 08, 2022	Radiation (03CH20-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519229/2,804015/2,804027/2	N/A	Jan. 20, 2021	Sep. 30, 2021~ Oct. 13, 2021	Jan. 19, 2022	Radiation (03CH20-HY)
Software	Audix	E3 6.2009-8-24	RK-002156	N/A	N/A	Sep. 30, 2021~ Oct. 13, 2021	N/A	Radiation (03CH20-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Sep. 30, 2021~ Oct. 13, 2021	N/A	Radiation (03CH20-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Sep. 30, 2021~ Oct. 13, 2021	N/A	Radiation (03CH20-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Sep. 30, 2021~ Oct. 13, 2021	N/A	Radiation (03CH20-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**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.8 dB**

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

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

Appendix A. Radiated Spurious Emission

Test Engineer :	Troye Hsieh and JC Liang	Temperature :	20~21.5°C
		Relative Humidity :	60.3~66.1%

WLAN 802.11n HT20_Tx_CH01 + LTE Band 7 CH20850

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Chain	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
4		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		2390	57.38	-16.62	74	47.89	27.26	18.42	36.19	400	57	P	H
		2390	46.28	-7.72	54	36.79	27.26	18.42	36.19	400	57	A	H
	*	2412	100.45	-	-	90.84	27.35	18.46	36.2	400	57	P	H
	*	2412	93.47	-	-	83.86	27.35	18.46	36.2	400	57	A	H
802.11n													H
HT20													H
CH01		2390	62.31	-11.69	74	52.82	27.26	18.42	36.19	196	163	P	V
2412MHz		2390	50.95	-3.05	54	41.46	27.26	18.42	36.19	196	163	A	V
	*	2412	104.3	-	-	94.69	27.35	18.46	36.2	196	163	P	V
	*	2412	96.94	-	-	87.33	27.35	18.46	36.2	196	163	A	V
													V
													V

WLAN 802.11n HT20_Tx_CH01 + LTE Band 7 CH20850

(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)	Chain Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 Ch01 + LTE Band 7 CH20850		4824	50.22	-23.78	74	42.79	32.14	12.73	37.44	264	15	P	H
		4824	37.85	-16.15	54	30.42	32.14	12.73	37.44	264	15	A	H
													H
													H
													H
													H
													H
													H
		4824	44.56	-29.44	74	37.13	32.14	12.73	37.44	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
Remark	1. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

WLAN 802.11n HT20_Tx_CH01 + LTE Band 7 CH20850

Emission below 1GHz (LF@ 3m)

	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT20 Ch01 + LTE Band 7 CH20850		30.97	22.68	-17.32	40	33.3	24.13	0.97	35.72	-	-	P	H
		80.44	27	-13	40	47.59	13.55	1.54	35.68	-	-	P	H
		129.91	21.88	-21.62	43.5	37.98	17.52	1.98	35.6	-	-	P	H
		729.37	37.53	-8.47	46	39.05	27.68	4.76	33.96	-	-	P	H
		741.98	35.9	-10.1	46	36.95	28.07	4.8	33.92	-	-	P	H
		915.61	34.64	-11.36	46	33.01	29.4	5.52	33.29	-	-	P	H
													H
													H
													H
													H
													H
													H
		30.97	23.26	-16.74	40	33.88	24.13	0.97	35.72	-	-	P	V
		80.44	30.46	-9.54	40	51.05	13.55	1.54	35.68	-	-	P	V
		637.22	29.82	-16.18	46	33.25	26.42	4.43	34.28	-	-	P	V
		729.37	37.6	-8.4	46	39.12	27.68	4.76	33.96	-	-	P	V
		857.41	32.93	-13.07	46	31.95	29.18	5.3	33.5	-	-	P	V
		955.38	35.35	-10.65	46	31.84	31.01	5.63	33.13	-	-	P	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.

BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Chain Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 39 2480MHz	*	2480	100.48	-	-	90.5	27.62	18.58	36.22	141	61	P	H
	*	2480	98.9	-	-	88.92	27.62	18.58	36.22	141	61	A	H
		2483.64	51.57	-22.43	74	41.57	27.63	18.59	36.22	141	61	P	H
		2483.96	41.43	-12.57	54	31.42	27.64	18.59	36.22	141	61	A	H
													H
													H
	*	2480	100.88	-	-	90.9	27.62	18.58	36.22	100	116	P	V
	*	2480	99.07	-	-	89.09	27.62	18.58	36.22	100	116	A	V
		2483.64	52.85	-21.15	74	42.85	27.63	18.59	36.22	100	116	P	V
		2490.84	41.26	-12.74	54	31.23	27.66	18.6	36.23	100	116	A	V
													V
													V

Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Chain	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		5457.04	58.06	-15.94	74	50.28	32.7	12.89	37.81	100	114	P	H
		5469.04	59.42	-8.78	68.2	51.63	32.7	12.9	37.81	100	114	P	H
		5458.96	48.63	-5.37	54	40.85	32.7	12.89	37.81	100	114	A	H
	*	5530	95.33	-	-	87.54	32.64	12.98	37.83	100	114	P	H
802. 11ac	*	5530	86.93	-	-	79.14	32.64	12.98	37.83	100	114	A	H
VHT80		5727.83	45.85	-22.35	68.2	37.01	33.47	13.2	37.83	100	114	P	H
CH 106		5458.48	61.84	-12.16	74	54.06	32.7	12.89	37.81	100	294	P	V
5530MHz		5460.4	65.02	-3.18	68.2	57.24	32.7	12.89	37.81	100	294	P	V
		5459.92	53.43	-0.57	54	45.65	32.7	12.89	37.81	100	294	A	V
	*	5530	99.71	-	-	91.92	32.64	12.98	37.83	100	294	P	V
	*	5530	91.4	-	-	83.61	32.64	12.98	37.83	100	294	A	V
		5758.07	45.18	-23.02	68.2	36.17	33.62	13.23	37.84	100	294	P	V

BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350

(Harmonic @ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Chain	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE_CH39 + 802.11 ac VHT80 CH106 + LTE Band 7 CH21350		4960	41.88	-32.12	74	34.34	32.74	12.35	37.55	-	-	P	H
		7440	46.51	-27.49	74	32.88	36.32	15.76	38.45	-	-	P	H
		11060	49.1	-24.9	74	32.74	38.9	19.31	41.85	100	127	P	H
		11060	39.84	-14.16	54	23.48	38.9	19.31	41.85	100	127	A	H
		16590	52.61	-15.59	68.2	34.19	38.49	24.06	44.13	-	-	P	H
													H
													H
													H
		4960	41.92	-32.08	74	34.38	32.74	12.35	37.55	-	-	P	V
		7440	47.11	-26.89	74	33.48	36.32	15.76	38.45	-	-	P	V
		11060	50.22	-23.78	74	33.86	38.9	19.31	41.85	100	43	P	V
		11060	39.81	-14.19	54	23.45	38.9	19.31	41.85	100	43	A	V
		16590	51.73	-16.47	68.2	33.31	38.49	24.06	44.13	-	-	P	V
													V
													V
													V
Remark	1. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350

Emission below 1GHz (LF@ 3m)

	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE_CH39+ 802.11 ac VHT80 CH106 + LTE Band 7 CH21350		30.97	22.89	-17.11	40	33.51	24.13	0.97	35.72	-	-	P	H
		80.44	22.71	-17.29	40	43.3	13.55	1.54	35.68	-	-	P	H
		96.93	20.8	-22.7	43.5	39.05	15.7	1.7	35.65	-	-	P	H
		263.77	21	-25	46	33.35	20.15	2.83	35.33	-	-	P	H
		729.37	37.76	-8.24	46	39.28	27.68	4.76	33.96	-	-	P	H
		955.38	35.16	-10.84	46	31.65	31.01	5.63	33.13	-	-	P	H
													H
													H
													H
													H
													H
													H
		43.58	23.51	-16.49	40	40.89	17.23	1.11	35.72	-	-	P	V
		80.44	25.24	-14.76	40	45.83	13.55	1.54	35.68	-	-	P	V
		98.87	19.81	-23.69	43.5	37.74	15.99	1.73	35.65	-	-	P	V
		729.37	37.93	-8.07	46	39.45	27.68	4.76	33.96	-	-	P	V
		746.83	34.67	-11.33	46	35.66	28.09	4.82	33.9	-	-	P	V
		954.41	34.86	-11.14	46	31.4	30.97	5.62	33.13	-	-	P	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.

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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Chain	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(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 B. Radiated Spurious Emission

Test Engineer :	Troye Hsieh and JC Liang	**Temperature :**	20~21.5°C
		Relative Humidity :	60.3~66.1%

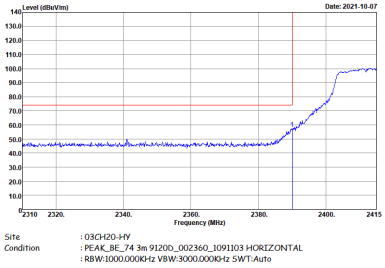
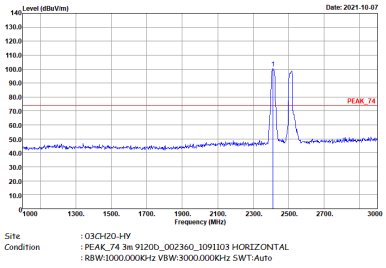
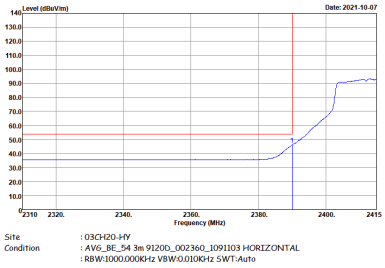
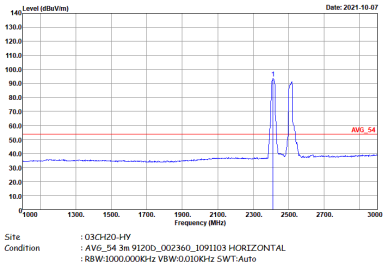
Note symbol

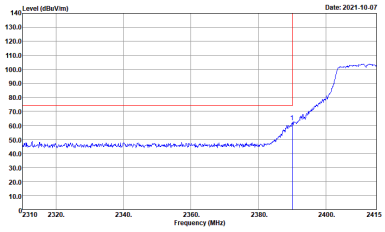
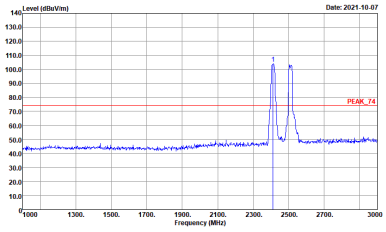
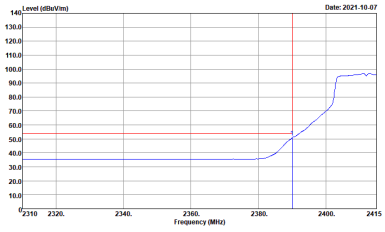
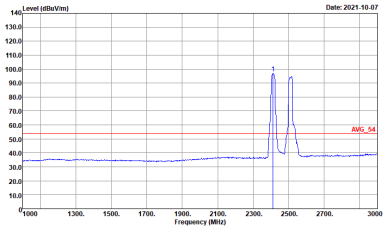
-L	**Low channel location**
-R	**High channel location**

WLAN 802.11n HT20_Tx_CH01 + LTE Band 7 CH20850

2.4GHz 2400~2483.5MHz

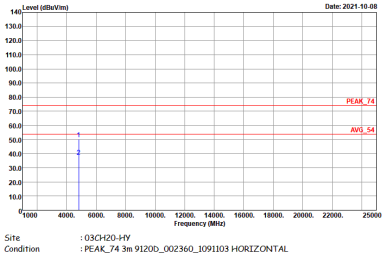
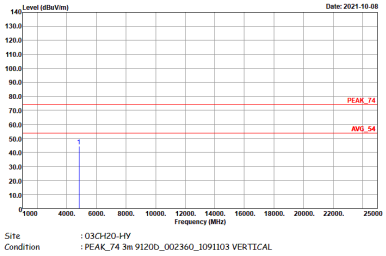
WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
Ant	802.11n HT20 CH01 2412MHz	
4	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
Ant	802.11n HT20 CH01 2412MHz	
4	Vertical	Fundamental
Peak	 Site : 03CH20-HY Condition : PEAK_BE_74 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH20-HY Condition : PEAK_74 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH20-HY Condition : AVG_BE_54 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH20-HY Condition : AVG_54 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

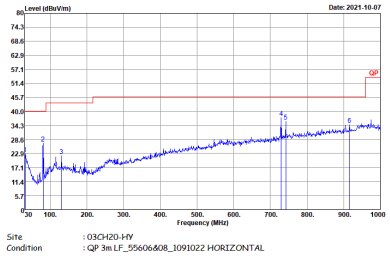
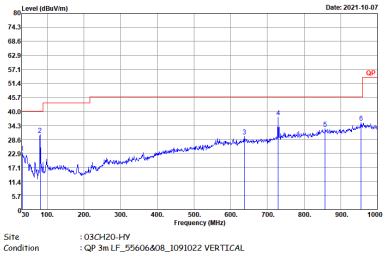
WLAN 802.11n HT20_Tx_CH01 + LTE Band 7 CH20850

(Harmonic @ 3m)

Ant	802.11n HT20_Tx_CH01 + LTE Band 7 CH20850	
4	Horizontal	Vertical
Peak Avg.		

WLAN 802.11n HT20_Tx_CH01 + LTE Band 7 CH20850

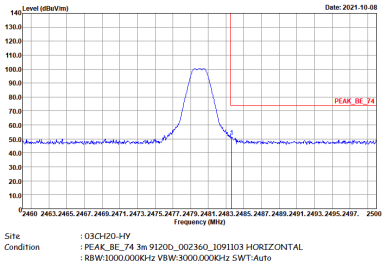
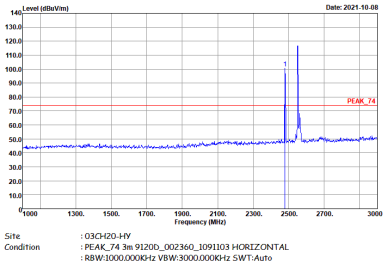
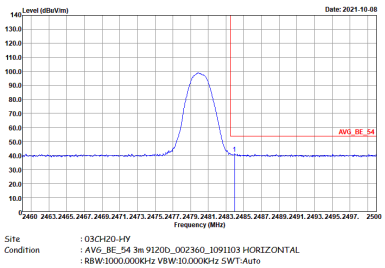
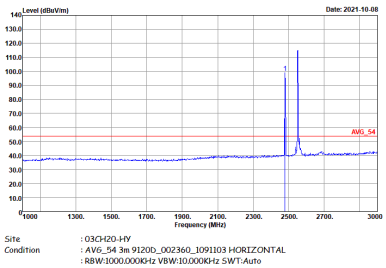
Emission below 1GHz (LF@ 3m)

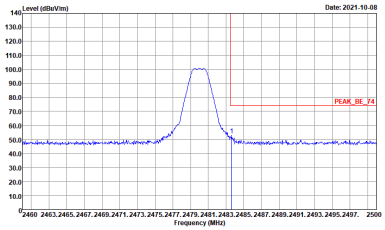
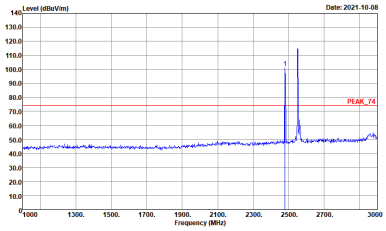
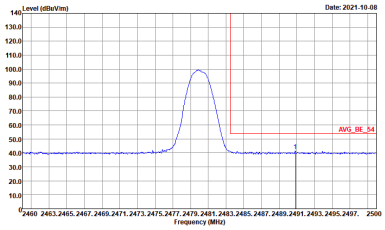
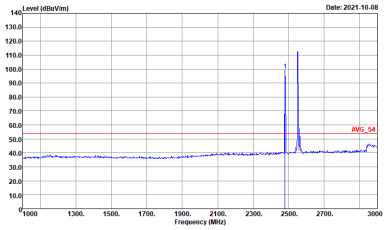
WIFI	802.11n HT20_Tx_CH01 + LTE Band 7 CH20850	
Ant	(LF@ 3m)	
4	Horizontal	Vertical
QP / Peak		

BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350

2.4GHz 2400~2483.5MHz

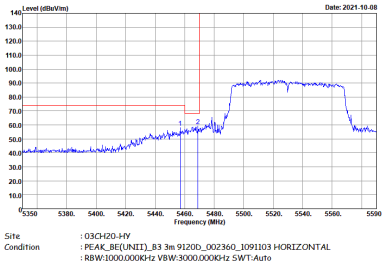
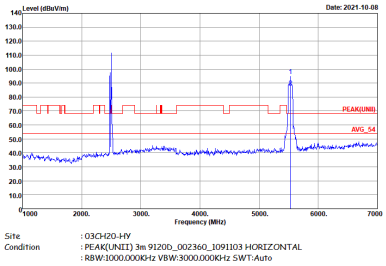
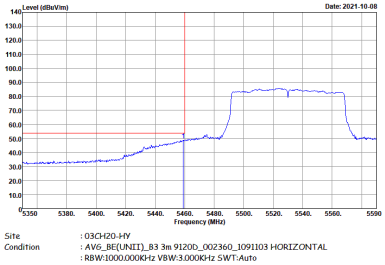
BLE (Band Edge @ 3m)

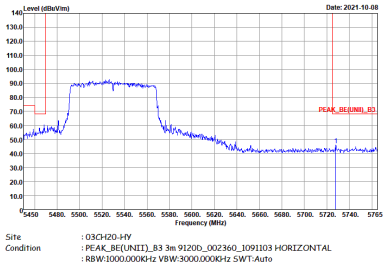
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Fundamental
Peak		
Avg.		

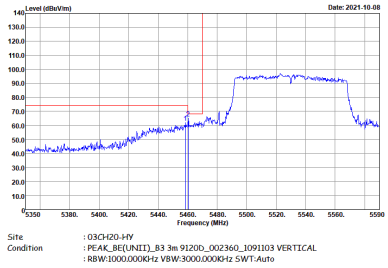
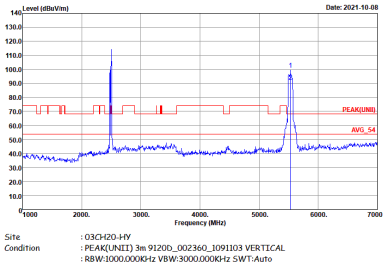
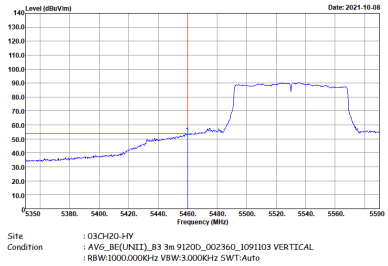
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Vertical	Fundamental
Peak	 Site : 03CH20-HY Condition : PEAK_BE_74 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH20-HY Condition : PEAK_74 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH20-HY Condition : AVG_BE_54 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto	 Site : 03CH20-HY Condition : AVG_54 3m 9120D_002360_1091103 VERTICAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto

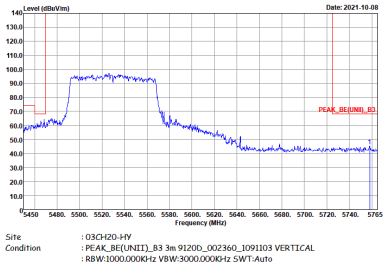
Band 3 - 5470~5725MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

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

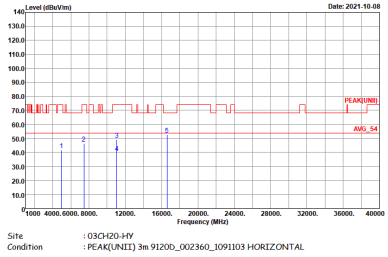
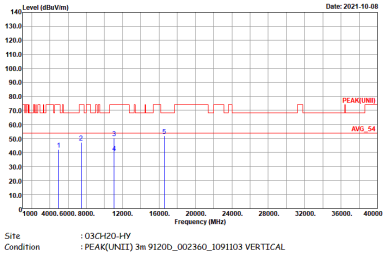
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
Ant	802.11ac VHT80 CH106 5530MHz - R	
4	Horizontal	Fundamental
Peak	 Site : 03CH20-HY Condition : PEAK_BE(UNII)_B3 3m 9120D_002360_1091103 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

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	
1	Vertical	Fundamental
Peak		Left blank

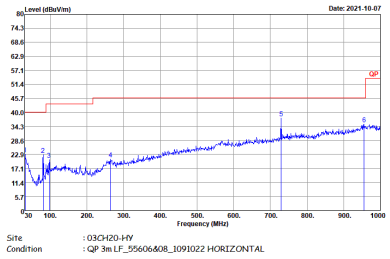
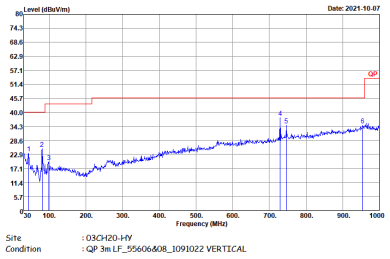
BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350

(Harmonic @ 3m)

ANT	BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350	
4	Horizontal	Vertical
Peak Avg.		

BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350

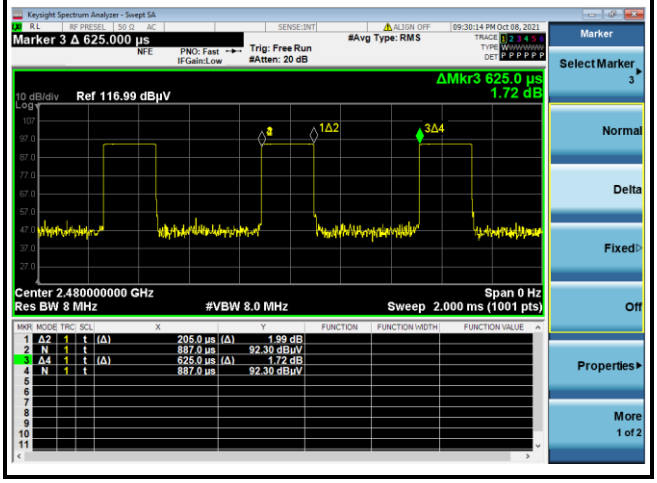
Emission below 1GHz (LF@ 3m)

WIFI	BLE (2M)_Tx_CH39 + 802.11ac VHT80_Tx_CH106 + LTE Band 7 CH21350	
ANT	(LF@ 3m)	
4	Horizontal	Vertical
QP / Peak		

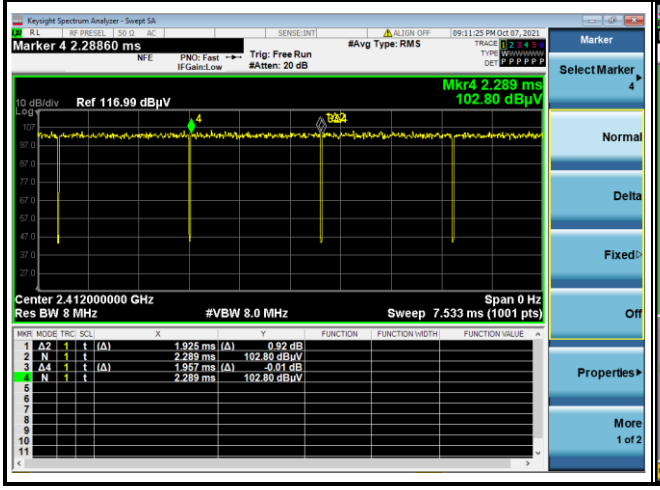
Appendix C. Duty Cycle Plots

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth –LE for 2Mbps	32.80	205.0	4.88	10kHz
2.4GHz 802.11n HT20	98.36	-	-	10Hz
5GHz 802.11ac VHT80	92.79	463.9	2.16	3kHz

Bluetooth – LE for 2Mbps



2.4GHz 802.11n HT20



802.11ac VHT80