



# FCC CO-LOCATION RADIO TEST REPORT

**FCC ID** : APYHRO00285  
**Equipment** : Smart phone  
**Brand Name** : SHARP  
**Applicant** : SHARP CORPORATION  
2-13-1, HACHIHONMATSU-IIDA,  
HIGASHI-HIROSHIMA-SHI,  
HIROSHIMA PREFECTURE 739-0192, 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 May 04, 2020 and testing was started from May 23, 2020 and completed on May 27, 2020. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

*Louis Wu*

Approved by: Louis Wu

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



## Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
<b>1 General Description .....</b>	<b>5</b>
1.1 Product Feature of Equipment Under Test.....	5
1.2 Modification of EUT .....	5
1.3 Testing Location .....	5
1.4 Applicable Standards.....	5
<b>2 Test Configuration of Equipment Under Test .....</b>	<b>6</b>
2.1 Carrier Frequency and Channel .....	6
2.2 Test Mode.....	6
2.3 Connection Diagram of Test System.....	7
2.4 Support Unit used in test configuration and system .....	7
2.5 EUT Operation Test Setup .....	7
<b>3 Test Result .....</b>	<b>8</b>
3.1 Unwanted Emissions Measurement.....	8
3.2 Antenna Requirements.....	11
<b>4 List of Measuring Equipment.....</b>	<b>12</b>
<b>5 Uncertainty of Evaluation .....</b>	<b>13</b>
<b>Appendix A. Radiated Spurious Emission</b>	
<b>Appendix B. Radiated Spurious Emission Plots</b>	
<b>Appendix C. Duty Cycle Plots</b>	
<b>Appendix D. Setup Photographs</b>	



### History of this test report

Report No.	Version	Description	Issued Date
FR021246-01E	01	Initial issue of report	Jun. 01, 2020



### 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 5.15 dB at 2483.620 MHz
3.2	15.203 15.407(a)	Antenna Requirement	Pass	-

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

Reviewed by: **Wii Chang**  
Report Producer: **Dara Chiu**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Antenna Type	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna GPS/Glonass/BDS: PIFA Antenna

## 1.2 Modification of EUT

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

## 1.3 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	<p style="text-align: center;"><b>Sporton Site No.</b></p> <p style="text-align: center;">03CH15-HY</p>

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

FCC designation No.: TW0007

## 1.4 Applicable Standards

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

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ 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). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane for 2.4GHz; Y Plane for 5GHz) were recorded in this report.

### 2.1 Carrier Frequency and Channel

2400-2483.5 MHz		5470-5725 MHz	
802.11n TH20		802.11ac VTH80	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
11	2462	106	5530

### 2.2 Test Mode

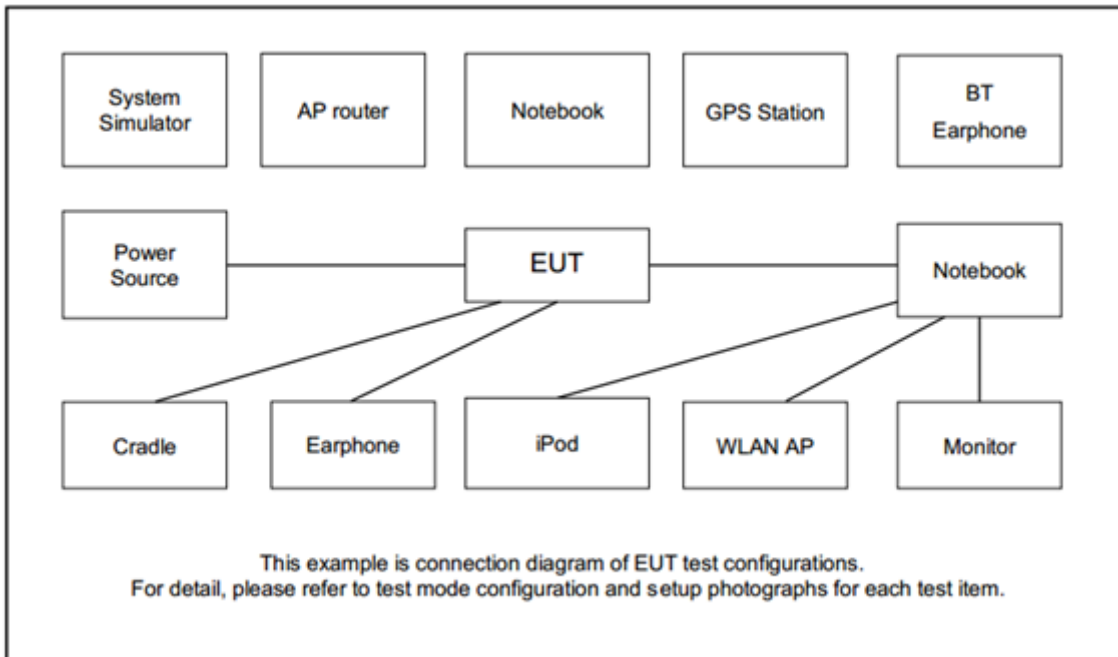
Final test modes are considering the modulation and worse data rates as below table.

<Co-Location>

Modulation	Data Rate
2.4GHz 802.11n HT20 + WCDMA Band VI	MCS0 + QPSK
5GHz 802.11ac VTH80 + LTE Band 2	MCS0 + QPSK

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

### 2.3 Connection Diagram of Test System



### 2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0m	N/A
2.	AC Adapter	DVE	DSA-10PFL-05 FUS 050200 a	N/A	N/A	N/A

### 2.5 EUT Operation Test Setup

The RF test items, utility “QRCT v3.0.303.0” 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.

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

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.

##### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.



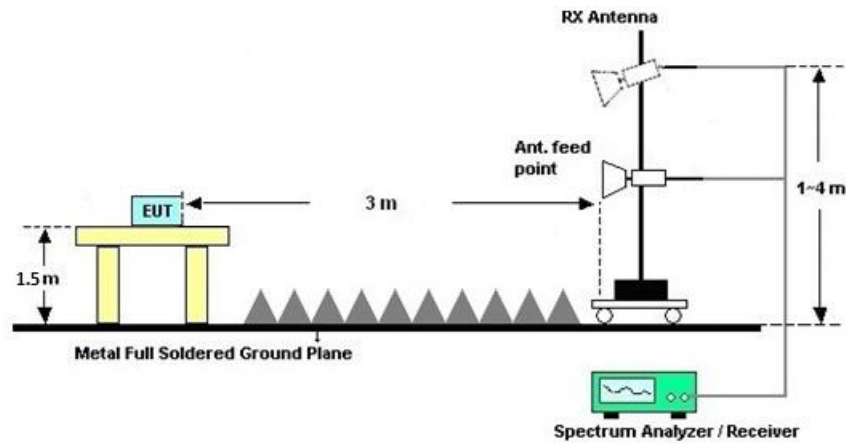


### 3.1.3 Test Procedures

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 1000MHz
    - RBW = 120 kHz
    - VBW = 300 kHz
    - Detector = Peak
    - Trace mode = max hold
  - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
    - RBW = 1 MHz
    - VBW  $\geq$  3 MHz
    - Detector = Peak
    - Sweep time = auto
    - Trace mode = max hold
  - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
    - RBW = 1 MHz
    - VBW = 10 Hz, when duty cycle is no less than 98 percent.
    - VBW  $\geq$  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.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

### 3.1.4 Test Setup

For radiated emissions above 1GHz



### 3.1.5 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

### 3.1.6 Duty Cycle

Please refer to Appendix C.

### 3.1.7 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	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jan. 09, 2020	May 23, 2020~ May 27, 2020	Jan. 08, 2021	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&00 800N1D01N-0 6	41912&05	30MHz to 1GHz	Feb. 09, 2020	May 23, 2020~ May 27, 2020	Feb. 08, 2021	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1620	1-18GHz	Jul. 31, 2019	May 23, 2020~ May 27, 2020	Jul. 30, 2020	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917058 4	18GHz- 40GHz	Dec. 10, 2019	May 23, 2020~ May 27, 2020	Dec. 09, 2020	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 27, 2019	May 23, 2020~ May 27, 2020	Dec. 26, 2020	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-30 3	17100018000 55006	1GHz~18GHz	May 07, 2020	May 23, 2020~ May 27, 2020	May 06, 2021	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	1GHz~26.5GHz	Aug. 23, 2019	May 23, 2020~ May 27, 2020	Aug. 22, 2020	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 13, 2019	May 23, 2020~ May 27, 2020	Dec. 12, 2020	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Nov. 01, 2019	May 23, 2020~ May 27, 2020	Oct. 31, 2020	Radiation (03CH15-HY)
Spectrum Analyzer	Agilent	E4446A	MY50180136	3Hz~44GHz	May 04, 2020	May 23, 2020~ May 27, 2020	May 03, 2021	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	May 23, 2020~ May 27, 2020	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	May 23, 2020~ May 27, 2020	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24 (k5)	RK-000451	N/A	N/A	May 23, 2020~ May 27, 2020	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY36980/4	30M-18G	Apr. 14, 2020	May 23, 2020~ May 27, 2020	Apr. 13, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9838/4PE	30M-18G	Apr. 14, 2020	May 23, 2020~ May 27, 2020	Apr. 13, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY37710/4	30M~18GHz	Apr. 17, 2020	May 23, 2020~ May 27, 2020	Apr. 16, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz-40GHz	Feb. 25, 2020	May 23, 2020~ May 27, 2020	Feb. 24, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 25, 2020	May 23, 2020~ May 27, 2020	Feb. 24, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WLK4-1000-15 30-8000-40SS	SN4	1.53G Low Pass	Jul. 04, 2019	May 23, 2020~ May 27, 2020	Jul. 03, 2020	Radiation (03CH15-HY)
Filter	Wainwright	WHKX8-5872. 5-6750-18000- 40ST	SN6	6.75GHz High Pass Filter	Jul. 02, 2019	May 23, 2020~ May 27, 2020	Jul. 01, 2020	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0ST	SN4	3GHz High Pass Filter	Sep. 17, 2019	May 25, 2020~ May 27, 2020	Sep. 16, 2020	Radiation (03CH15-HY)



## 5 Uncertainty of Evaluation

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

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

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

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

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

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



## Appendix A. Radiated Spurious Emission

Test Engineer :	Leo Lee, Mancy Chou, and Bigshow Wang	Temperature :	22.1~24.7°C
		Relative Humidity :	55~61%

### 802.11n HT20\_Tx\_Ch11 + WCDMA Band 4 Ch1513 (Band Edge @ 3m)

WIFI Ant. Simultaneously	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_Tx Ch11 + WCDMA Band 4 CH1513	*	2462	99.21	-	-	85.26	27.58	7.56	31.11	128	298	P	H	
	*	2462	90.73	-	-	76.78	27.58	7.56	31.11	128	298	A	H	
		2483.89	60.71	-13.29	74	46.76	27.53	7.6	31.1	128	298	P	H	
		2483.62	48.85	-5.15	54	34.9	27.53	7.6	31.1	128	298	A	H	
													P	H
													A	H
	*	2462	97.01	-	-	83.06	27.58	7.56	31.11	280	359	P	V	
	*	2462	89.29	-	-	75.34	27.58	7.56	31.11	280	359	A	V	
		2483.53	58.22	-15.78	74	44.27	27.53	7.6	31.1	280	359	P	V	
		2483.53	48.04	-5.96	54	34.09	27.53	7.6	31.1	280	359	A	V	
													P	V
													A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.													



**802.11n HT20\_Tx\_Ch11 + WCDMA Band4 Ch1513 ((Harmonic @ 3m)**

WIFI Ant. Simultaneously	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_Tx Ch11 + WCDMA Band 4 CH1513		3500.2	49.43	-24.57	74	71.14	28.7	9.19	60.6	100	0	P	H	
		4924	41.06	-32.94	74	58.1	31.34	10.23	59.15	100	0	P	H	
		5257	42.45	-31.55	74	59.04	31.49	10.59	59.25	100	0	P	H	
		7007.7	48.63	-25.37	74	60.07	35.33	11.73	58.99	100	0	P	H	
		7386	44.89	-29.11	74	54.22	36.46	12.16	58.46	100	0	P	H	
														H
			3500.2	47.59	-26.41	74	69.3	28.7	9.19	60.6	100	0	P	V
			4924	40.64	-33.36	74	57.68	31.34	10.23	59.15	100	0	P	V
			5257	42.21	-31.79	74	58.8	31.49	10.59	59.25	100	0	P	V
			7007.7	47.01	-26.99	74	58.45	35.33	11.73	58.99	100	0	P	V
			7386	46.97	-27.03	74	56.3	36.46	12.16	58.46	100	0	P	V
														V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.													



**802.11ac VHT80\_Tx\_Ch106 + LTE Band2 20M CH19100 (Band Edge @ 3m)**

WIFI Ant. Simultaneously	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_Tx Ch106 + LTE Band2 20M CH19100		5459.68	56.18	-17.82	74	43.65	31.76	10.73	30.43	393	307	P	H
		5468.56	57.81	-10.39	68.2	45.22	31.81	10.74	30.43	393	307	P	H
		5459.92	48.46	-5.54	54	35.93	31.76	10.73	30.43	393	307	A	H
	*	5530	99.63	-	-	86.95	31.88	10.81	30.45	393	307	P	H
	*	5530	92.72	-	-	80.04	31.88	10.81	30.45	393	307	A	H
		5745.47	51.79	-16.41	68.2	39.08	32	10.86	30.58	393	307	P	H
		5457.76	54.34	-19.66	74	41.82	31.75	10.73	30.43	301	88	P	V
		5469.28	56.94	-11.26	68.2	44.34	31.82	10.74	30.43	301	88	P	V
		5459.44	47.01	-6.99	54	34.48	31.76	10.73	30.43	301	88	A	V
	*	5530	96.58	-	-	83.9	31.88	10.81	30.45	301	88	P	V
	*	5530	89.89	-	-	77.21	31.88	10.81	30.45	301	88	A	V
		5749.88	51.72	-16.48	68.2	39.01	32	10.86	30.58	301	88	P	V
	<b>Remark</b>	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.											





**802.11ac VHT80\_Tx\_Ch106 + LTE Band2 20M CH19100 ((Harmonic @ 3m)**

WIFI Ant. Simultaneously	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_Tx Ch106 + LTE Band2 20M CH19100		7565	47.65	-26.35	74	56.43	36.5	12.24	58.22	100	0	P	H	
		11060	49.72	-24.28	74	56.03	40.48	13.82	61.08	100	0	P	H	
		15127.2	53.93	-14.27	68.2	60.05	39.96	16.53	63.05	100	0	P	H	
		16590	47.41	-20.79	68.2	49.92	38.89	17.51	59.35	100	0	P	H	
													H	
													H	
			7565	50.15	-23.85	74	58.93	36.5	12.24	58.22	100	0	P	V
			11060	49.4	-24.6	74	55.71	40.48	13.82	61.08	100	0	P	V
			15127.2	53.14	-15.06	68.2	59.26	39.96	16.53	63.05	100	0	P	V
			16590	48.05	-20.15	68.2	50.56	38.89	17.51	59.35	100	0	P	V
													V	
													V	
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.													



**Note symbol**

*	<b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is <b>over limit</b> line.
P/A	<b>Peak</b> or <b>Average</b>
H/V	<b>Horizontal</b> or <b>Vertical</b>



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 B. Radiated Spurious Emission Plots

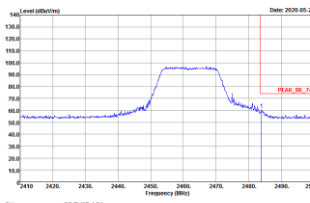
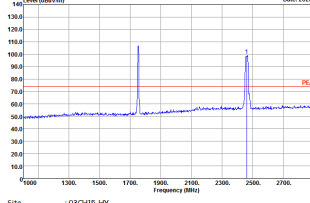
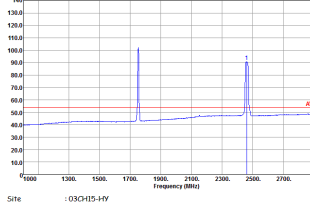
Test Engineer :	Leo Lee, Mancy Chou, and Bigshow Wang	Temperature :	22.1~24.7°C
		Relative Humidity :	55~61%

**Note symbol**

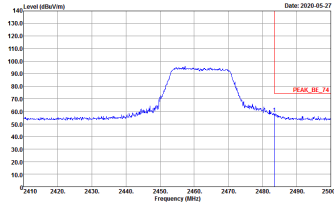
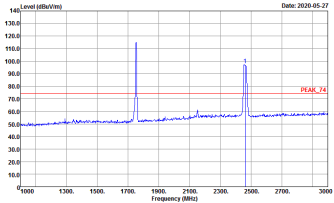
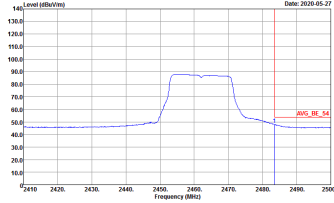
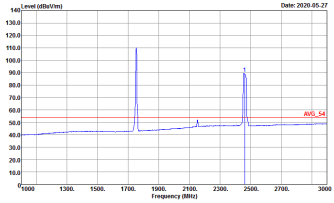
-L	Low channel location
-R	High channel location



802.11n HT20\_Tx\_Ch11 + WCDMA Band 4 CH1513 (Band Edge @ 3m)

ANT	802.11n HT20_Tx_Ch11 + WCDMA Band 4 CH1513	
Simultaneously	Horizontal	Fundamental
<p><b>Peak</b></p>	 <p>Site : 03CH15-HY            Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL            : RBW:10000000Hz VBW:30000000Hz SWT:Auto            Detector : Peak            Project : 021246-01</p>	 <p>Site : 03CH15-HY            Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL            : RBW:10000000Hz VBW:30000000Hz SWT:Auto            Detector : Peak            Project : 021246-01</p>
<p><b>Avg.</b></p>	 <p>Site : 03CH15-HY            Condition : AVG_BE_54 3m 91200_15_1620 HORIZONTAL            : RBW:10000000Hz VBW:100000Hz SWT:Auto            Detector : Peak            Project : 021246-01</p>	 <p>Site : 03CH15-HY            Condition : AVG_54 3m 91200_15_1620 HORIZONTAL            : RBW:10000000Hz VBW:100000Hz SWT:Auto            Detector : Peak            Project : 021246-01</p>



ANT	802.11n HT20_Tx_Ch11 + WCDMA Band 4 CH1513	
Simultaneously	Vertical	Fundamental
<b>Peak</b>	 <p>Site : 03CH15-HY            Condition : PEAK_95_74 3m 91200_15_1620 VERTICAL            : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto            Detector : Peak            Project : 021246-01</p>	 <p>Site : 03CH15-HY            Condition : PEAK_74 3m 91200_15_1620 VERTICAL            : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto            Detector : Peak            Project : 021246-01</p>
<b>Avg.</b>	 <p>Site : 03CH15-HY            Condition : AVG_BE_54 3m 91200_15_1620 VERTICAL            : RBW:1000.000kHz VBW:1.000kHz SWT:Auto            Detector : Peak            Project : 021246-01</p>	 <p>Site : 03CH15-HY            Condition : AVG_54 3m 91200_15_1620 VERTICAL            : RBW:1000.000kHz VBW:1.000kHz SWT:Auto            Detector : Peak            Project : 021246-01</p>

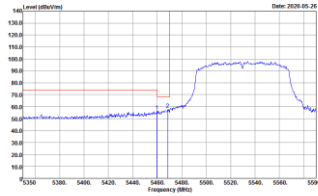
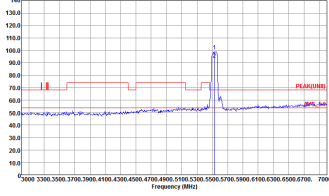
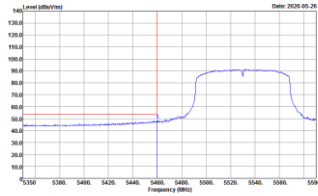


802.11n HT20\_Tx\_Ch11 + WCDMA Band 4 CH1513 (Harmonic @ 3m)

ANT	802.11n HT20_Tx_Ch11 + WCDMA Band 4 CH1513	
Simultaneously	Horizontal	Vertical
Peak Avg.	<p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 021246-01</p>	<p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : Peak Project : 021246-01</p>

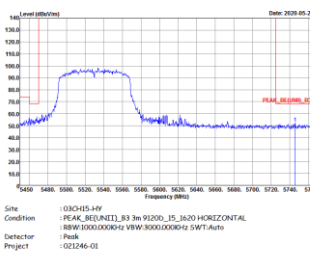


802.11ac VHT80\_Tx\_Ch106 + LTE Band 2 20M CH19100 (Band Edge @ 3m)

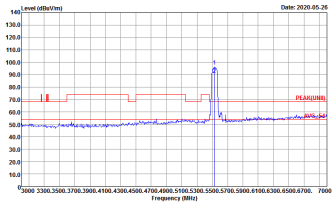
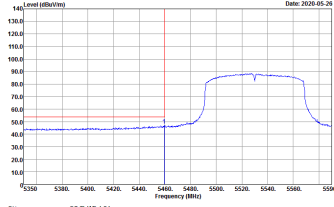
ANT	802.11ac VHT80_Tx_Ch106 + LTE Band 2 20M CH19100	
Simultaneously	Horizontal	Fundamental
<p style="text-align: center;"><b>Peak</b></p>	 <p>Site : 03CH15-HY            Condition : PEAK_BE(LINE1)_83 3m 91200_15_1620 HORIZONTAL            Detector : Peak            Project : 021246-01</p>	 <p>Site : 03CH15-HY            Condition : PEAK(LINE1) 3m 91200_15_1620 HORIZONTAL            Detector : Peak            Project : 021246-01</p>
<p style="text-align: center;"><b>Avg.</b></p>	 <p>Site : 03CH15-HY            Condition : AVG_BE(LINE1)_83 3m 91200_15_1620 HORIZONTAL            Detector : Peak            Project : 021246-01</p>	<p style="text-align: center;"><b>N/A</b></p>





ANT	802.11ac VHT80_Tx_Ch106 + LTE Band 2 20M CH19100	
Simultaneously	Horizontal	Fundamental
<p style="text-align: center;"><b>Peak</b></p>		<p style="text-align: center;"><b>N/A</b></p>
<p style="text-align: center;"><b>Avg.</b></p>	<p style="text-align: center;"><b>N/A</b></p>	<p style="text-align: center;"><b>N/A</b></p>



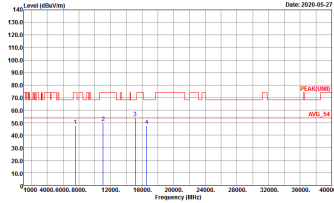
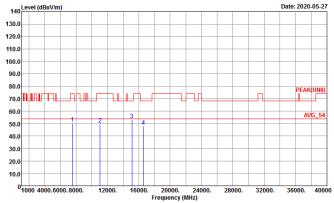
ANT	802.11ac VHT80_Tx_Ch106 + LTE Band 2 20M CH19100	
Simultaneously	Vertical	Fundamental
<b>Peak</b>	 <p>Site : 03CH15-HY            Condition : PEAK_BE(UNIT)_B3 3m 91200_15_1620 VERTICAL            Detector : Peak            Project : 021246-01</p>	 <p>Site : 03CH15-HY            Condition : PEAK_BE(UNIT)_3m 91200_15_1620 VERTICAL            Detector : Peak            Project : 021246-01</p>
<b>Avg.</b>	 <p>Site : 03CH15-HY            Condition : AVG_BE(UNIT)_B3 3m 91200_15_1620 VERTICAL            Detector : Peak            Project : 021246-01</p>	



ANT	802.11ac VHT80_Tx_Ch106 + LTE Band 2 20M CH19100	
Simultaneously	Vertical	Fundamental
<p style="text-align: center;"><b>Peak</b></p>		<p style="text-align: center;"><b>N/A</b></p>
<p style="text-align: center;"><b>Avg.</b></p>	<p style="text-align: center;"><b>N/A</b></p>	<p style="text-align: center;"><b>N/A</b></p>



802.11ac VHT80\_Tx\_Ch106 + LTE Band2 20M CH19100 (Harmonic @ 3m)

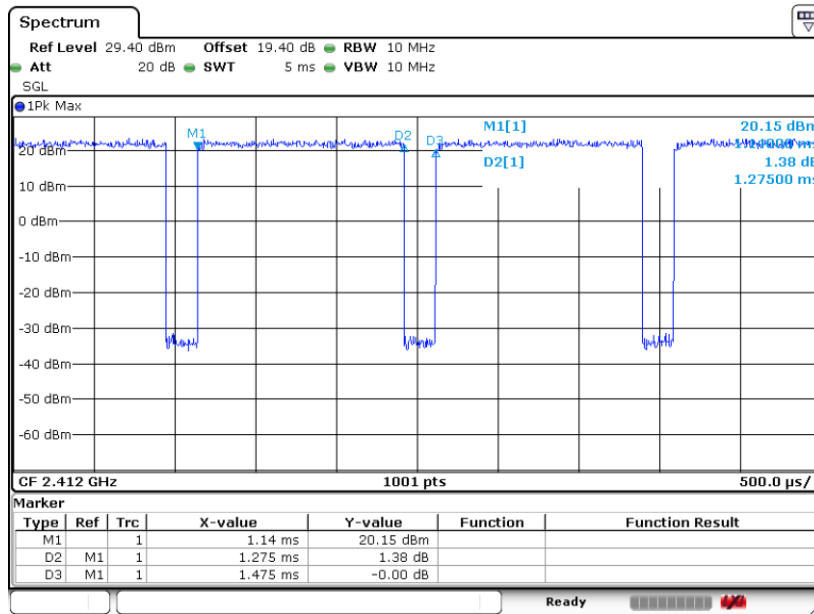
ANT	802.11ac VHT80_Tx_Ch106 + LTE Band 2 20M CH19100	
Simultaneously	Horizontal	Vertical
<p style="text-align: center;"><b>Peak</b> <b>Avg.</b></p>	 <p style="font-size: small;">           Date: 2020-05-27            Site : 03CH15-HY            Condition : PEAK(LINEI) 3m 91200_15_1620 HORIZONTAL            Detector : Peak            Project : 021246-01            Mode : 11ac(80)_Tx_Ch122-82-20M-H Ch 1980 QPSK         </p>	 <p style="font-size: small;">           Date: 2020-05-27            Site : 03CH15-HY            Condition : PEAK(LINEI) 3m 91200_15_1620 VERTICAL            Detector : Peak            Project : 021246-01            Mode : 11ac(80)_Tx_Ch122-82-20M-H Ch 1980 QPSK         </p>



## Appendix C. Duty Cycle Plots

Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor (dB)
2.4GHz 802.11n HT20	86.44	1275	0.78	1kHz	0.63
5GHz 802.11ac VHT80	86.27	248	4.03	10kHz	0.64

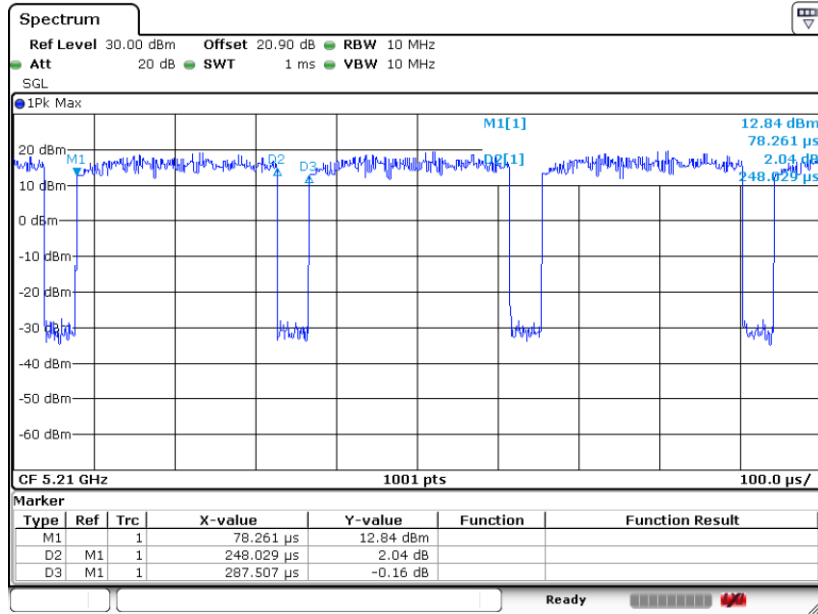
### 802.11n HT20



Date: 7.MAY.2020 18:52:09



802.11ac VHT80



Date: 8.MAY.2020 17:14:28