FCC RADIO TEST REPORT

FCC ID	:	**APYHRO00310**
Equipment	:	**Smart phone**
Brand Name	:	**SHARP**
Model Name	:	**APYHRO00310**
Applicant	:	**SHARP CORPORATION** **1 Takumi-cho, Sakai-ku, Sakai City Osaka, Japan 590-8522**
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 Jan. 17, 2022 and testing was performed from Feb. 25, 2022 to Mar. 11, 2022. 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 variant report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR211502-01A	01	Initial issue of report	Mar. 18, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.247(a)(1)	Number of Channels	Not Required	-
-	15.247(a)(1)	Hopping Channel Separation	Not Required	-
-	15.247(a)(1)	Dwell Time of Each Channel	Not Required	-
-	15.247(a)(1)	20dB Bandwidth	Not Required	-
-	2.1049	99% Occupied Bandwidth	Not Required	-
3.1	15.247(b)(1)	Peak Output Power	Pass	-
-	15.247(d)	Conducted Band Edges	Not Required	-
-	15.247(d)	Conducted Spurious Emission	Not Required	-
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	9.23 dB under the limit at 33.880 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.3	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Note:
1. Not required means after assessing, test items are not necessary to carry out.
2. The RF circuit, output power level and antenna performance is the same in Bluetooth function across all two FCC ID APYHRO00309 and APYHRO00310, 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:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

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 Feature	
Antenna Type	WWAN <Ant. 0>: Monopole Antenna <Ant. 1>: PIFA Antenna <Ant. 2>: Monopole 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 EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

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.**
	TH05-HY, 03CH16-HY

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

FCC designation No.: TW3786

1.4 Applicable Standards

According to the specifications declared by 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 the test items were validated and recorded in accordance with the standards without any modification during the testing.
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

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-

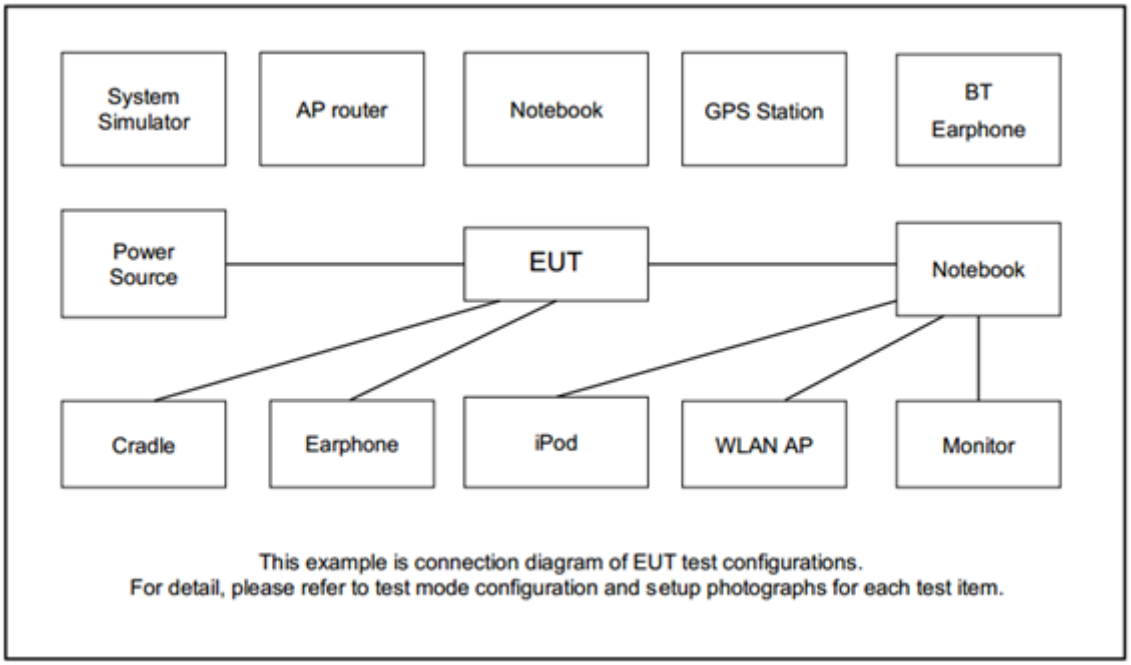
2.2 Test Mode

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, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
Radiated Test Cases	**Bluetooth BR 1Mbps GFSK**
	Mode 1: CH78_2480 MHz
Remark: For Radiated Test Cases, the worst mode data rate 1Mbps was reported only since the highest RF output power in the preliminary tests. The conducted spurious emissions and conducted band edge measurement for other data rates were not worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.	

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.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT Version 4.0.194.0” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to contact with base station 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

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

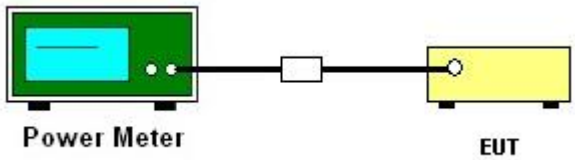
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
1. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
2. Set the maximum power setting and enable the EUT to transmit continuously.
3. Measure the conducted output power with cable loss and record the results in the test report.
4. Measure 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 Edges and Spurious Emission

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. 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

Please refer to the measuring equipment list in this test report.

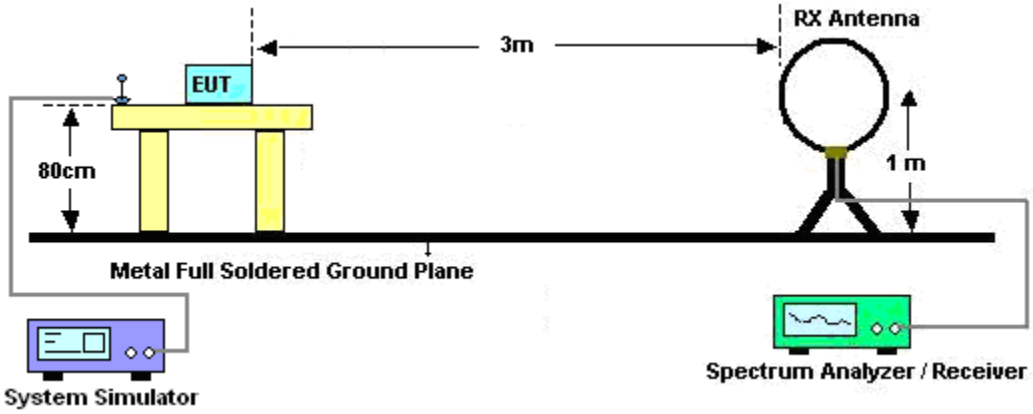
3.2.3 Test Procedures

1. The EUT is 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.
2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT is 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 to comply with the guidelines.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. 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, RBW = 1 MHz for f>1 GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log (Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".
8. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees 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 6 dB margin against average limit line, the position is marked as "-".

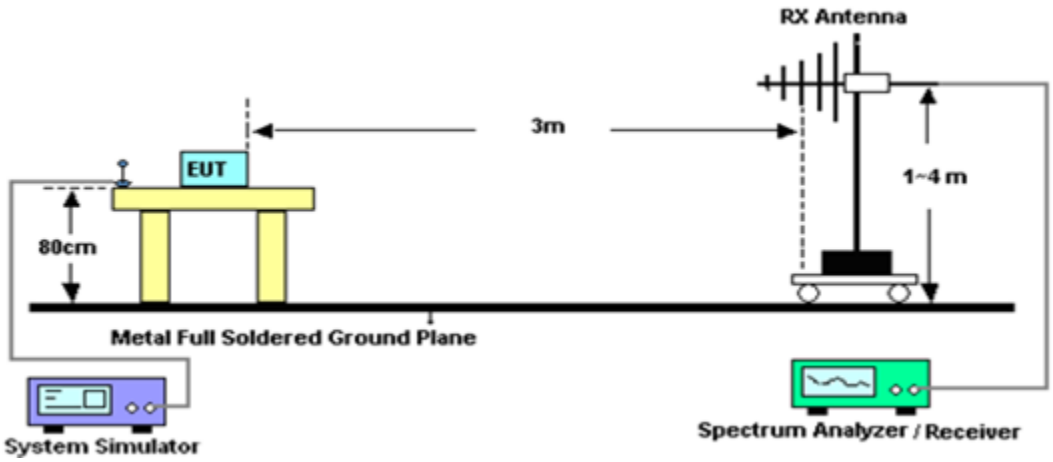
Note: The average levels are calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.2.4 Test Setup

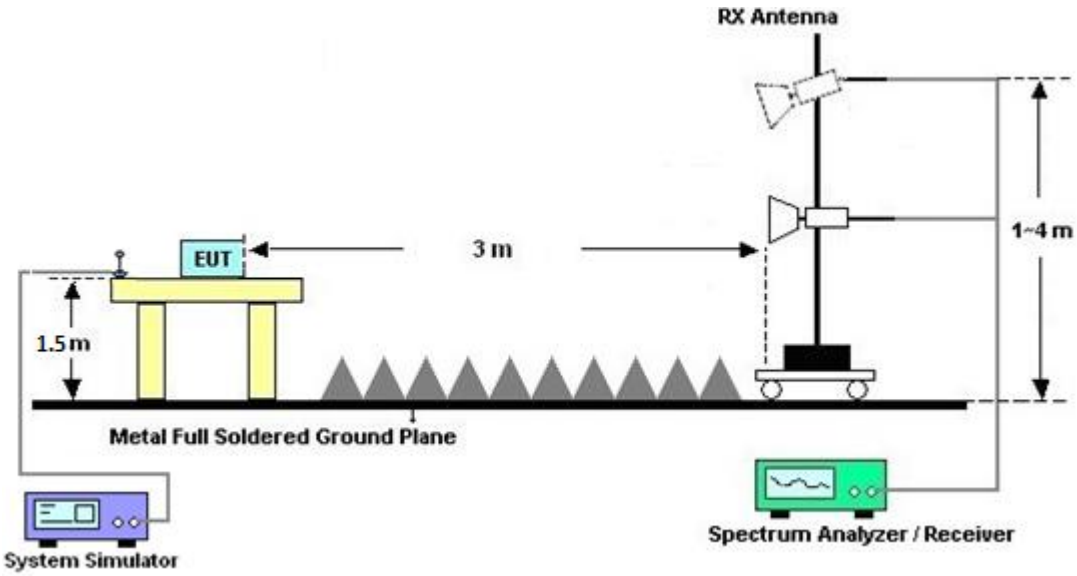
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



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

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is 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 comes out very similar.

3.2.6 Test Results of Radiated Spurious Emissions (above 18GHz)

For frequency above 18GHz, the pre-scanned result is 20dB lower than the limit line is not reported.

3.2.7 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.2.8 Duty Cycle

Please refer to Appendix D.

3.2.9 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
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 07, 2021	Mar. 04, 2022~ Mar. 11, 2022	Sep. 06, 2022	Radiation (03CH16-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00802N1D01N -06	47020 & 06	30MHz to 1GHz	Oct. 09, 2021	Mar. 04, 2022~ Mar. 11, 2022	Oct. 08, 2022	Radiation (03CH16-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02114	1G~18GHz	Aug. 04, 2021	Mar. 04, 2022~ Mar. 11, 2022	Aug. 03, 2022	Radiation (03CH16-HY)
Amplifier	SONOMA	310N	371607	9kHz~1G	Jul. 05, 2021	Mar. 04, 2022~ Mar. 11, 2022	Jul. 04, 2022	Radiation (03CH16-HY)
Amplifier	EMCI	EMC051845SE	980729	1-18GHz	Jul. 09, 2021	Mar. 04, 2022~ Mar. 11, 2022	Jul. 08, 2022	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 09, 2021	Mar. 04, 2022~ Mar. 11, 2022	Dec. 08, 2022	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY57290111	3Hz~26.5GHz	Dec. 15, 2021	Mar. 04, 2022~ Mar. 11, 2022	Dec. 14, 2022	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11680/4PE	NA	Aug. 28, 2021	Mar. 04, 2022~ Mar. 11, 2022	Aug. 27, 2022	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11688/4PE	NA	Aug. 28, 2021	Mar. 04, 2022~ Mar. 11, 2022	Aug. 27, 2022	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	EC-A5-300-5757	NA	Aug. 28, 2021	Mar. 04, 2022~ Mar. 11, 2022	Aug. 27, 2022	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Mar. 04, 2022~ Mar. 11, 2022	N/A	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Mar. 04, 2022~ Mar. 11, 2022	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Mar. 04, 2022~ Mar. 11, 2022	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Mar. 04, 2022~ Mar. 11, 2022	N/A	Radiation (03CH16-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 16, 2021	Feb. 25, 2022	Nov. 15, 2022	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	1036004	N/A	Aug. 01, 2021	Feb. 25, 2022	Jul. 31, 2022	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 01, 2021	Feb. 25, 2022	Jul .31, 2022	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Feb. 25, 2022	Aug. 29, 2022	Conducted (TH05-HY)
BT Base Station (Measure)	Rohde & Schwarz	CBT	101136	BT 3.0	Oct. 17, 2021	Feb. 25, 2022	Oct. 16, 2022	Conducted (TH05-HY)
Switch Control Manframe	E-IUSTRUMENT	ETF-1405-0	EC1900067 (BOX7)	N/A	Aug. 12, 2021	Feb. 25, 2022	Aug. 11, 2022	Conducted (TH05-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))	**5.8 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.2 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Hank Hsu	Temperature:	21~25	°C
Test Date:	2022/2/25	Relative Humidity:	51~54	%

TEST RESULTS DATA
Peak Power Table

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH1	0	1	11.07	20.97	Pass
	39	1	**11.69**	20.97	Pass
	78	1	11.38	20.97	Pass
2DH1	0	1	10.55	20.97	Pass
	39	1	**11.12**	20.97	Pass
	78	1	10.95	20.97	Pass
3DH1	0	1	10.78	20.97	Pass
	39	1	**11.38**	20.97	Pass
	78	1	11.12	20.97	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
DH1	0	1	10.95	5.15
	39	1	**11.51**	5.15
	78	1	11.25	5.15
2DH1	0	1	9.23	5.12
	39	1	9.42	5.12
	78	1	**9.60**	5.12
3DH1	0	1	9.27	5.12
	39	1	9.44	5.12
	78	1	**9.72**	5.12

Appendix B. Radiated Spurious Emission

Test Engineer :	Andy Yang, Karl Hou, and Wilson Wu	Temperature :	20~25°C
		Relative Humidity :	50~60%

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	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)
BT CH 78 2480MHz	*	2480	103.85	-	-	97.66	27.78	8.46	30.05	356	348	P	H
	*	2480	79.06	-	-	-	-	-	-	-	-	A	H
		2483.64	53.15	-20.85	74	46.92	27.8	8.47	30.04	356	348	P	H
		2483.64	28.36	-25.64	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	100.26	-	-	94.07	27.78	8.46	30.05	366	79	P	V
	*	2480	75.47	-	-	-	-	-	-	-	-	A	V
		2484.12	49.96	-24.04	74	43.73	27.8	8.47	30.04	366	79	P	V
		2484.12	25.17	-28.83	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

BT (Harmonic @ 3m)

BT	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)
BT CH 78 2480MHz		4960	39.84	-34.16	74	49.98	33.02	12.28	55.44	-	-	P	H
		4960	15.05	-38.95	54	-	-	-	-	-	-	A	H
		7440	46.49	-27.51	74	49.74	36.22	16.2	55.67	-	-	P	H
		7440	21.7	-32.3	54	-	-	-	-	-	-	A	H
		10950	50.09	-23.91	74	47.13	38.85	19.49	55.38	-	-	P	H
		10950	25.3	-28.7	54	-	-	-	-	-	-	A	H
		14475	48.37	-25.63	74	40.29	40.4	22	54.32	-	-	P	H
		14475	23.58	-30.42	54	-	-	-	-	-	-	A	H
		17970	53.28	-20.72	74	42.07	42.76	25.03	56.58	-	-	P	H
		17970	28.49	-25.51	54	-	-	-	-	-	-	A	H
													H
													H
		4960	39.38	-34.62	74	49.52	33.02	12.28	55.44	-	-	P	V
		4960	14.59	-39.41	54	-	-	-	-	-	-	A	V
		7440	51.3	-22.7	74	54.55	36.22	16.2	55.67	100	241	P	V
		7440	26.51	-27.49	54	-	-	-	-	-	-	A	V
		11655	49.28	-24.72	74	45.28	38.69	20.26	54.95	-	-	P	V
		11655	24.49	-29.51	54	-	-	-	-	-	-	A	V
		14505	49.67	-24.33	74	41.59	40.39	22.02	54.33	-	-	P	V
		14505	24.88	-29.12	54	-	-	-	-	-	-	A	V
		17880	53.51	-20.49	74	43.05	41.96	25.02	56.52	-	-	P	V
		17880	28.72	-25.28	54	-	-	-	-			A	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.
4. The emission level close to 18GHz is checked that the average emission level is noise floor only.

Emission below 1GHz

2.4GHz BT (LF)

BT	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)
2.4GHz BT LF		157.07	22.29	-21.21	43.5	35.4	16.78	2.36	32.25	-	-	P	H
		264.74	21.94	-24.06	46	31.3	19.95	2.94	32.25	-	-	P	H
		320.03	22.3	-23.7	46	31.81	19.61	3.15	32.27	-	-	P	H
		483.96	26.43	-19.57	46	31.23	23.74	3.84	32.38	-	-	P	H
		658.56	28.41	-17.59	46	30.23	26.2	4.45	32.47	-	-	P	H
		783.69	32.74	-13.26	46	32.14	28.04	4.84	32.28	-	-	P	H
													H
													H
													H
													H
													H
													H
		61.04	25.54	-14.46	40	44.5	11.93	1.4	32.29	-	-	P	V
		184.23	20.98	-22.52	43.5	35.92	14.88	2.41	32.23	-	-	P	V
		312.27	20.4	-25.6	46	30.1	19.45	3.13	32.28	-	-	P	V
		393.75	22.46	-23.54	46	29.57	21.81	3.45	32.37	-	-	P	V
		551.86	26.5	-19.5	46	29.33	25.46	4.12	32.41	-	-	P	V
		796.3	32.92	-13.08	46	32.32	27.97	4.89	32.26	-	-	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 and emission level has at least 6dB margin against limit or emission is 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:

BT	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)
BT CH 00 2402MHz		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)

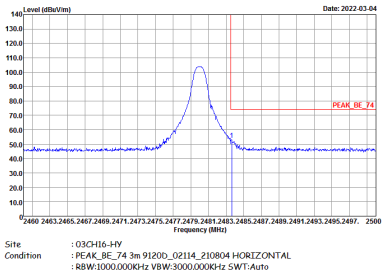
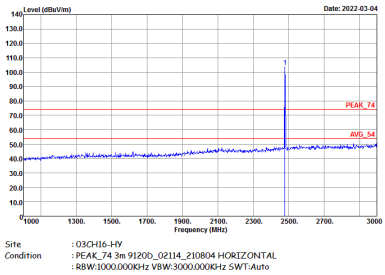
Both peak and average measured complies with the limit line, so test result is “PASS”.

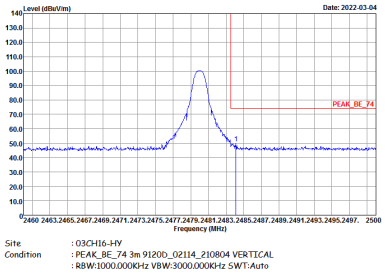
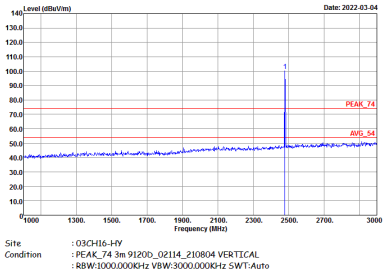
Appendix C. Radiated Spurious Emission Plots

Test Engineer :	Andy Yang, Karl Hou, and Wilson Wu	Temperature :	20~25°C
		Relative Humidity :	50~60%

2.4GHz 2400~2483.5MHz

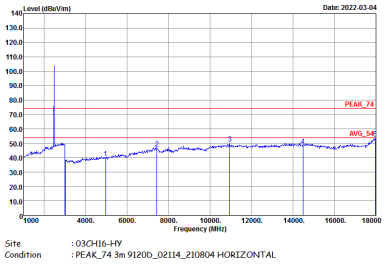
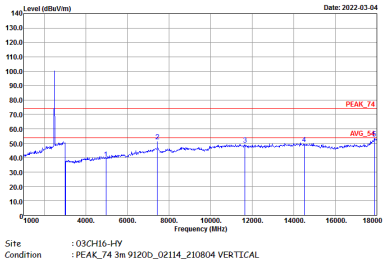
BT (Band Edge @ 3m)

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

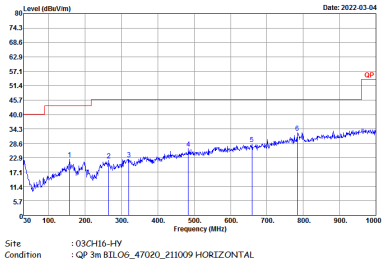
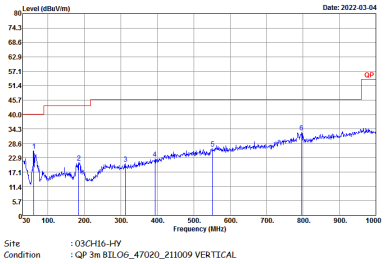
2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

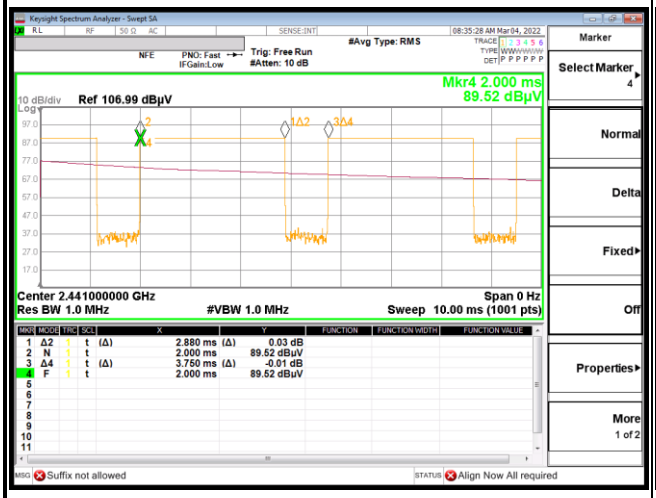
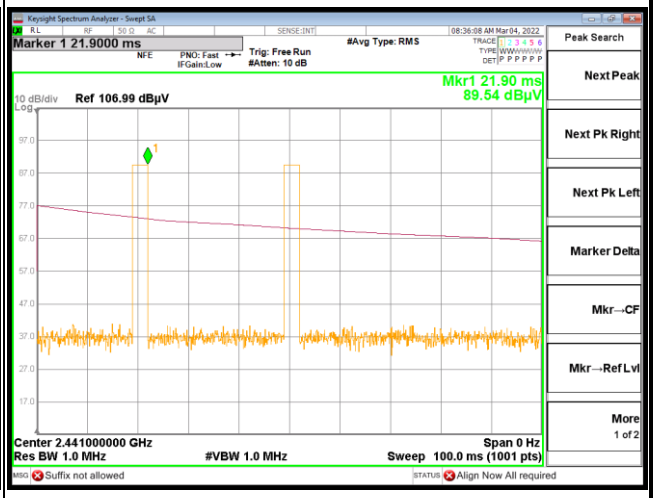
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

2.4GHz BT (LF)

BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak		

Appendix D. Duty Cycle Plots

DH5 on time (One Pulse) Plot on Channel 39	on time (Count Pulses) Plot on Channel 39
	

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.88 / 100 = 5.76 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.79 dB
3. **DH5** has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the on time period to have DH5 packet completing one hopping sequence is

2.88 ms x 20 channels = 57.6 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.6 ms] = 2 hops

Thus, the maximum possible ON time:

2.88 ms x 2 = 5.76 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

20 x log(5.76 ms/100 ms) = -24.79 dB