



FCC RADIO TEST REPORT

FCC ID : TX2-RTL8822C
Equipment : Module
Brand Name : Realtek
Model Name : RTL8822C
Marketing Name : 11a/b/g/n/ac RTL8822C Combo module
Applicant : Realtek Semiconductor Corp.
No. 2, Innovation Road II, Hsinchu
Science Park, Hsinchu 300, Taiwan
Standard : FCC Part 15 Subpart C §15.247

The product was received on Sep. 01, 2022 and testing was performed from Sep. 26, 2022 to Oct. 26, 2022. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Louis Wu

Sportun 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



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.247(a)(1)	Number of Channels	-	See Note
-	15.247(a)(1)	Hopping Channel Separation	-	See Note
-	15.247(a)(1)	Dwell Time of Each Channel	-	See Note
-	15.247(a)(1)	20dB Bandwidth	-	See Note
-	2.1049	99% Occupied Bandwidth	-	See Note
3.1	15.247(b)(1) 15.247(b)(4)	Peak Output Power	Pass	-
-	15.247(d)	Conducted Band Edges	-	See Note
-	15.247(d)	Conducted Spurious Emission	-	See Note
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	7.71 dB under the limit at 809.600 MHz
3.3	15.207	AC Conducted Emission	Pass	10.83 dB under the limit at 0.177 MHz
3.4	15.203	Antenna Requirement	Pass	-

Note: The module (Model: RTL8822C) makes no difference after verifying output power, this report reuses test data from the module 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 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: Rachel Hsieh



1 General Description

1.1 Product Feature of Equipment Under Test

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

Product Feature	
Installed into the Host	Equipment Name: Steam Deck Brand Name: Valve Model Name: 1010
Sample 1	Host with INPAQ Antenna
Sample 2	Host with AWAN Antenna
Sample 3	Host with HTK Antenna
Antenna Type	WLAN <Main>: PIFA Antenna <Aux.>: PIFA Antenna Bluetooth: PIFA Antenna

Antenna Information		
INPAQ Antenna	Antenna Type	PIFA Antenna
	Part Number	DQ600015300 (WA-P-LE-02-153)
	Peak gain (dBi)	Main Antenna Bluetooth: 1.38
AWAN Antenna	Antenna Type	PIFA Antenna
	Part Number	DQ610001400 (AEP6Y-100014)
	Peak gain (dBi)	Main Antenna Bluetooth: 1.19
HTK Antenna	Antenna Type	PIFA Antenna
	Part Number	DQ60ACQD0E5 (0ACQD022049N)
	Peak gain (dBi)	Main Antenna Bluetooth: -0.44

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	Sportun International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	Sportun Site No. CO05-HY, 03CH07-HY

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

Test Site	Sportun 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.	Sportun Site No. TH05-HY (TAF Code: 3786)
Remark	The RF Conducted Measurement test item subcontracted to Sporton International Inc. Wensan Laboratory.

FCC designation No.: TW1190 and 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 15.247 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.



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	-	-



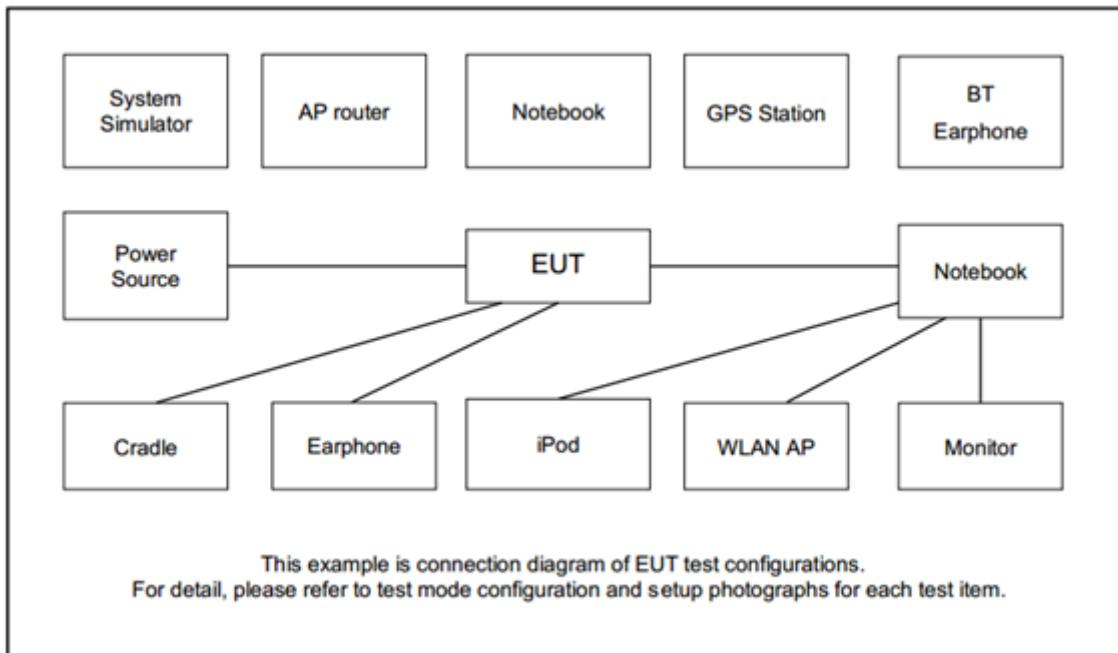
2.2 Test Mode

- 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: conduction emission (150 kHz to 30 MHz), 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 only the worst plane, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

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 EDR 3Mbps 8-DPSK Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz
AC Conducted Emission	Mode 1 :Bluetooth Link + WLAN (2.4GHz) Link + Adapter for Sample 1
Remark:	<ol style="list-style-type: none">1. For Radiated Test Cases, the worst mode data rate 3Mbps 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 3Mbps, and no other significantly frequencies found in conducted spurious emission.2. For Radiated Test Cases, the tests were performed with Sample 1.

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.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
2.	Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	Bluetooth Earphone	Sony Ericsson	MW600	PY700A2029	N/A	N/A
4.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “VTE version 0.60.3” was installed in Host which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3 Test Result

3.1 Output Power Measurement

3.1.1 Limit of Output Power

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.

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.

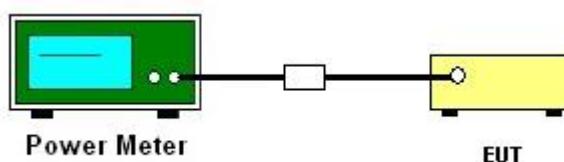
3.1.2 Measuring Instruments

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.



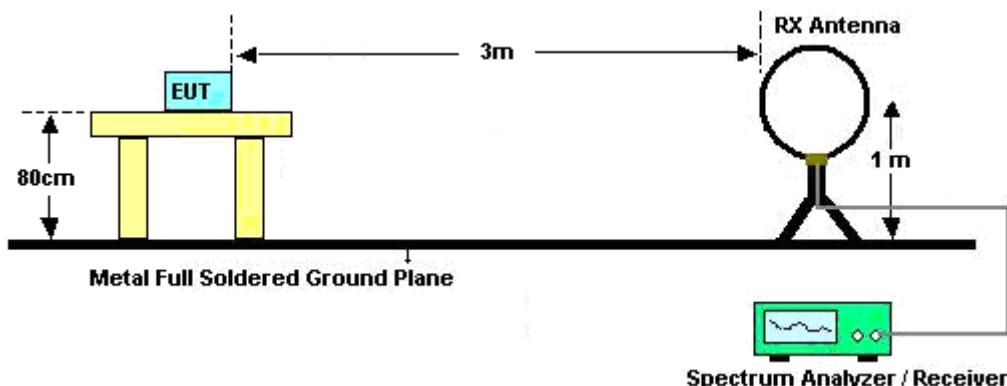
3.2.3 Test Procedures

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 \geq 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 = $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 \cdot \log_{10}$ (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 "-".

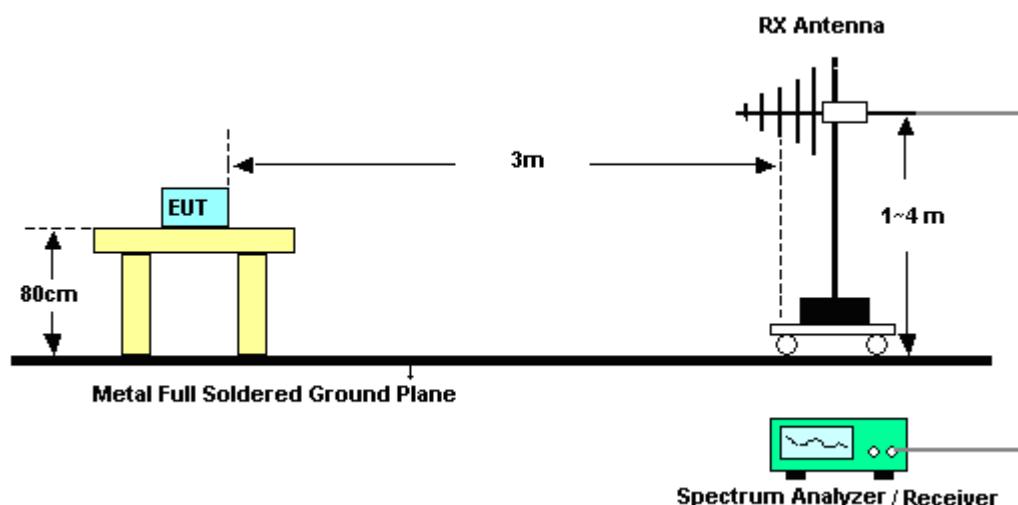
Note: The average levels are calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from $20 \cdot \log_{10}$ (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.2.4 Test Setup

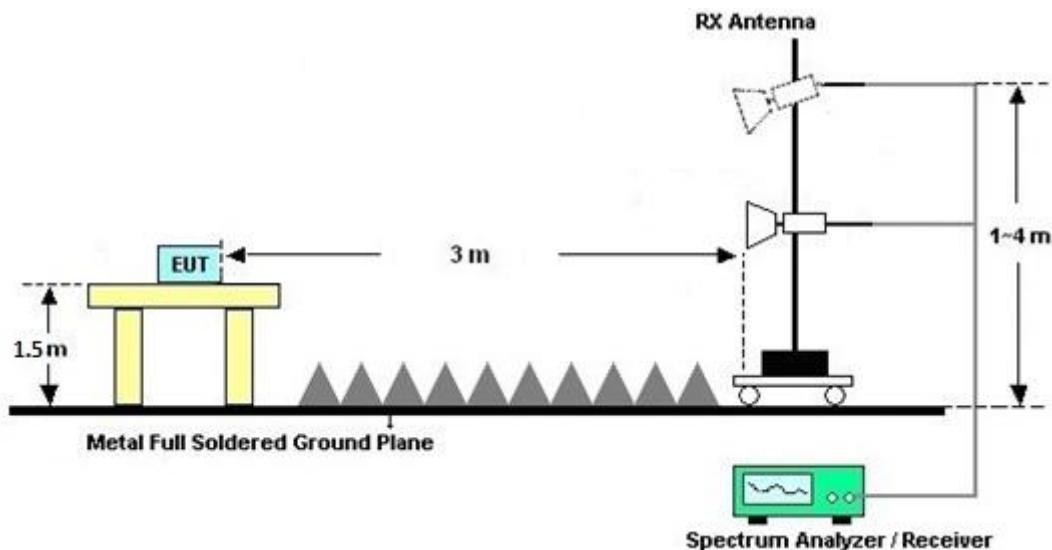
For radiated test below 30MHz



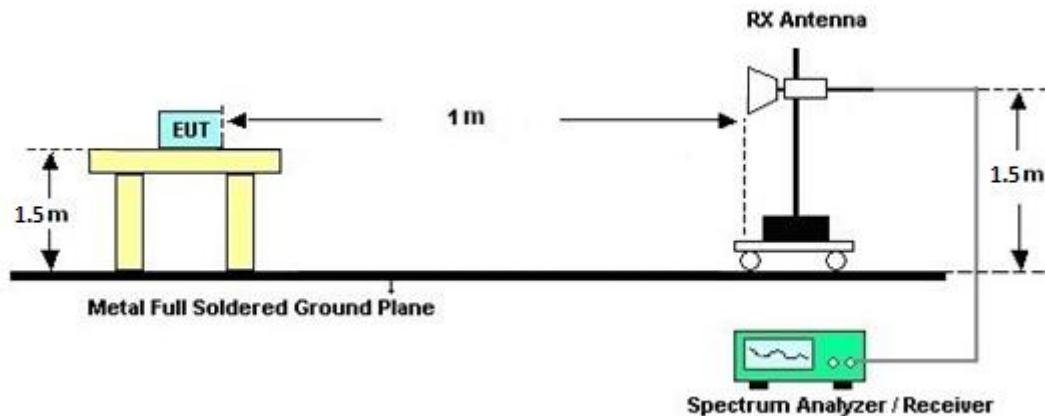
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



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 Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.2.7 Duty Cycle

Please refer to Appendix E.

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

Please refer to Appendix C and D.



3.3 AC Conducted Emission Measurement

3.3.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

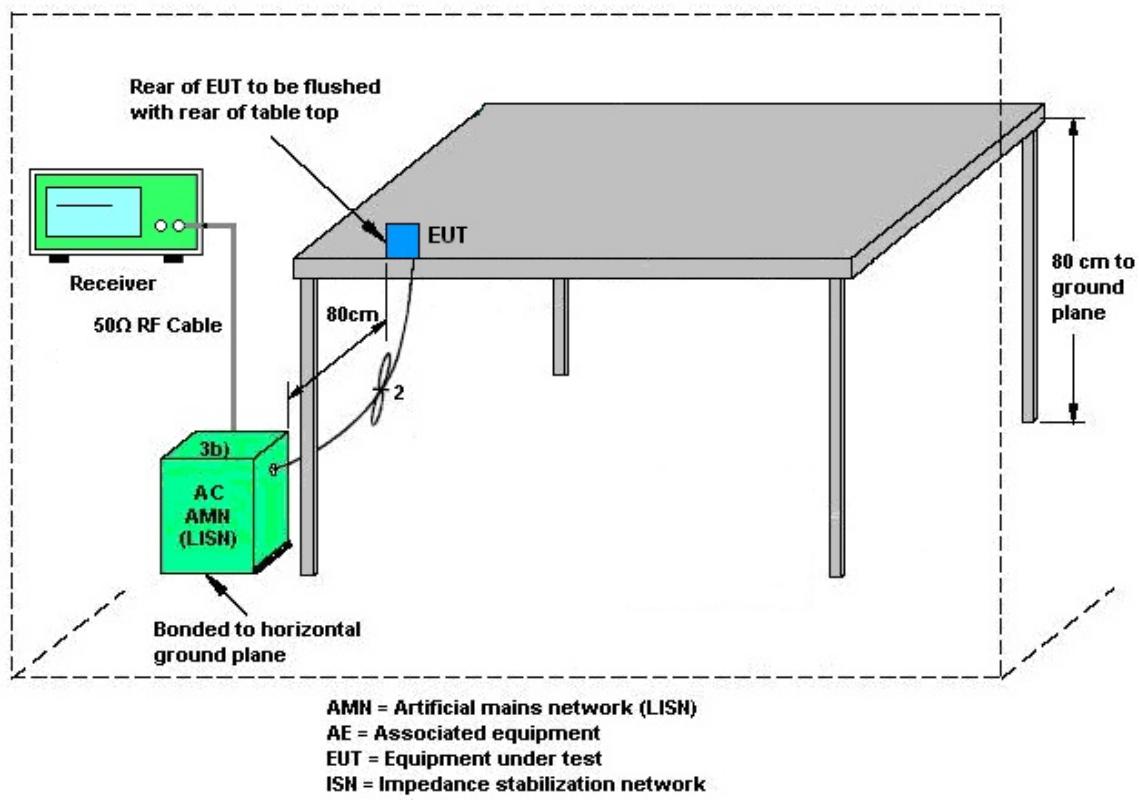
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.3.4 Test Setup



3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.4 Antenna Requirements

3.4.1 Standard Applicable

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.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	35419 & 03	30MHz~1GHz	Apr. 24, 2022	Oct. 21, 2022~Oct. 26, 2022	Apr. 23, 2023	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 03, 2021	Oct. 21, 2022~Oct. 26, 2022	Dec. 02, 2022	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	Oct. 21, 2022~Oct. 26, 2022	Jan. 06, 2023	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101 800-30-10P	1590075	1GHz~18GHz	Apr. 21, 2022	Oct. 21, 2022~Oct. 26, 2022	Apr. 20, 2023	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 03, 2022	Oct. 21, 2022~Oct. 26, 2022	Oct. 02, 2023	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 03, 2022	Oct. 21, 2022~Oct. 26, 2022	Oct. 02, 2023	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 21, 2022	Oct. 21, 2022~Oct. 26, 2022	Jul. 20, 2023	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Jul. 22, 2022	Oct. 21, 2022~Oct. 26, 2022	Jul. 21, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	30MHz to 18GHz	Feb. 23, 2022	Oct. 21, 2022~Oct. 26, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4	9kHz to 18GHz	Feb. 23, 2022	Oct. 21, 2022~Oct. 26, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4	9kHz to 18GHz	Feb. 23, 2022	Oct. 21, 2022~Oct. 26, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 16, 2022	Oct. 21, 2022~Oct. 26, 2022	Sep. 15, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 23, 2022	Oct. 21, 2022~Oct. 26, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	N/A	Oct. 21, 2022~Oct. 26, 2022	N/A	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Oct. 21, 2022~Oct. 26, 2022	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	Oct. 21, 2022~Oct. 26, 2022	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Oct. 21, 2022~Oct. 26, 2022	N/A	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	Oct. 21, 2022~Oct. 26, 2022	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPTEL	TR-32	HE17XB2495	N/A	Mar. 07, 2022	Oct. 21, 2022~Oct. 26, 2022	Mar. 06, 2023	Radiation (03CH07-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290053	20Hz~26.5GHz	May 27, 2022	Oct. 21, 2022~Oct. 26, 2022	May 26, 2023	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Nov. 30, 2021	Oct. 21, 2022~Oct. 26, 2022	Nov. 29, 2022	Radiation (03CH07-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Sep. 26, 2022	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 01, 2021	Sep. 26, 2022	Nov. 30, 2022	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 17, 2021	Sep. 26, 2022	Nov. 16, 2022	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 03, 2021	Sep. 26, 2022	Dec. 02, 2022	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Sep. 26, 2022	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Aug. 01, 2022	Sep. 26, 2022	Jul. 31, 2023	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 30, 2021	Sep. 26, 2022	Dec. 29, 2022	Conduction (CO05-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 16, 2021	Sep. 28, 2022~Sep. 29, 2022	Nov. 15, 2022	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	1036004	N/A	Aug. 08, 2022	Sep. 28, 2022~Sep. 29, 2022	Aug. 07, 2023	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 08, 2022	Sep. 28, 2022~Sep. 29, 2022	Aug. 07, 2023	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101905	10Hz - 40GHz	Aug. 03, 2022	Sep. 28, 2022~Sep. 29, 2022	Aug. 02, 2023	Conducted (TH05-HY)



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	3.1 dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	6.5 dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	4.5 dB
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Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	4.2 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	5.3 dB
-------------------------------------------------------------------------------	--------

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Paul Lin	Temperature:	21~25	°C
Test Date:	2022/9/28~2022/9/29	Relative Humidity:	51~54	%

TEST RESULTS DATA						
Peak Power Table						
DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result	Test Result
DH1	0	1	4.07	20.97	Pass	Default
	39	1	4.70	20.97	Pass	
	78	1	4.72	20.97	Pass	
2DH5	0	1	5.37	20.97	Pass	Default
	39	1	6.48	20.97	Pass	
	78	1	6.51	20.97	Pass	
3DH5	0	1	6.24	20.97	Pass	Default
	39	1	6.77	20.97	Pass	
	78	1	7.02	20.97	Pass	

TEST RESULTS DATA						
Average Power Table						
(Reporting Only)						
DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)	Duty Factor (dB)	
DH1	0	1	3.02	5.10	Default	
	39	1	4.03	5.10		
	78	1	4.09	5.10		
2DH1	0	1	2.87	5.02	Default	
	39	1	3.75	5.02		
	78	1	3.89	5.02		
3DH1	0	1	2.96	5.06	Default	
	39	1	3.93	5.06		
	78	1	4.02	5.06		



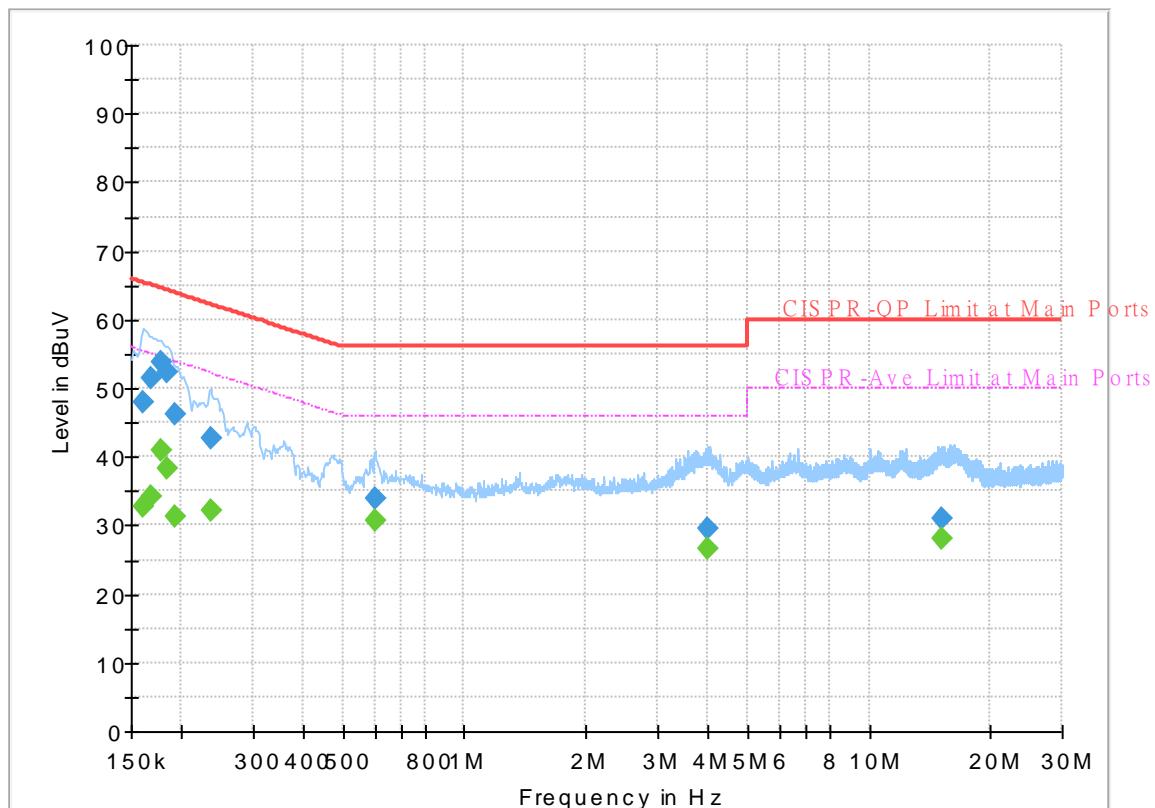
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Calvin Wang	Temperature :	23~26°C
		Relative Humidity :	45~55%

EUT Information

Report NO : 290129
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

Full Spectrum



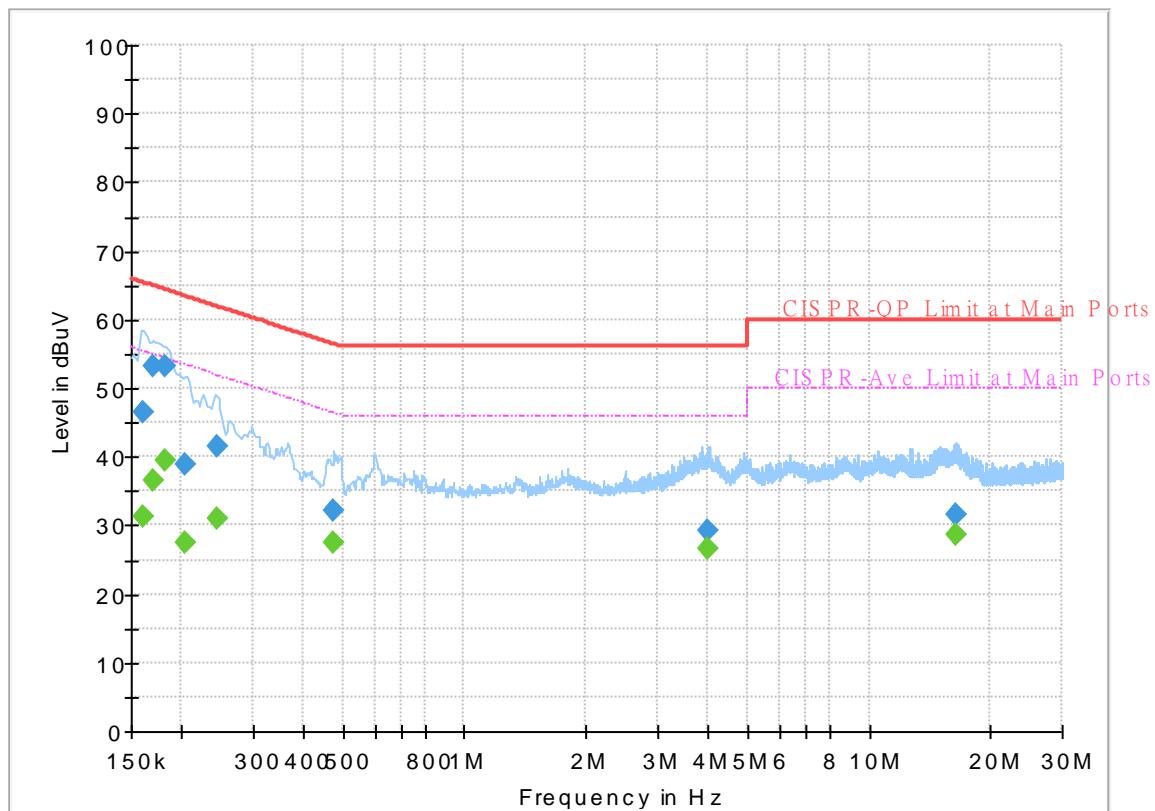
Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.161250	---	32.64	55.40	22.76	L1	OFF	19.8
0.161250	47.85	---	65.40	17.55	L1	OFF	19.8
0.168000	---	34.08	55.06	20.98	L1	OFF	19.8
0.168000	51.46	---	65.06	13.60	L1	OFF	19.8
0.177000	---	41.00	54.63	13.63	L1	OFF	19.8
0.177000	53.80	---	64.63	10.83	L1	OFF	19.8
0.183750	---	38.27	54.31	16.04	L1	OFF	19.8
0.183750	52.40	---	64.31	11.91	L1	OFF	19.8
0.192750	---	31.18	53.92	22.74	L1	OFF	19.8
0.192750	46.18	---	63.92	17.74	L1	OFF	19.8
0.235500	---	32.23	52.25	20.02	L1	OFF	19.8
0.235500	42.79	---	62.25	19.46	L1	OFF	19.8
0.600000	---	30.57	46.00	15.43	L1	OFF	19.8
0.600000	34.03	---	56.00	21.97	L1	OFF	19.8
4.004250	---	26.62	46.00	19.38	L1	OFF	20.0
4.004250	29.64	---	56.00	26.36	L1	OFF	20.0
15.060750	---	27.94	50.00	22.06	L1	OFF	20.4
15.060750	31.05	---	60.00	28.95	L1	OFF	20.4

EUT Information

Report NO : 290129
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Neutral

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.161250	---	31.37	55.40	24.03	N	OFF	19.8
0.161250	46.39	---	65.40	19.01	N	OFF	19.8
0.170250	---	36.46	54.95	18.49	N	OFF	19.8
0.170250	53.15	---	64.95	11.80	N	OFF	19.8
0.181500	---	39.52	54.42	14.90	N	OFF	19.8
0.181500	53.20	---	64.42	11.22	N	OFF	19.8
0.204000	---	27.56	53.45	25.89	N	OFF	19.8
0.204000	38.87	---	63.45	24.58	N	OFF	19.8
0.244500	---	31.11	51.94	20.83	N	OFF	19.8
0.244500	41.50	---	61.94	20.44	N	OFF	19.8
0.476250	---	27.36	46.40	19.04	N	OFF	19.8
0.476250	32.24	---	56.40	24.16	N	OFF	19.8
3.988500	---	26.47	46.00	19.53	N	OFF	20.0
3.988500	29.11	---	56.00	26.89	N	OFF	20.0
16.311750	---	28.59	50.00	21.41	N	OFF	20.5
16.311750	31.70	---	60.00	28.30	N	OFF	20.5



Appendix C. Radiated Spurious Emission

Test Engineer :	Jesse Wang, Stan Hsieh, Ken Wu and Howard Huang	Temperature :		22.6~24.5°C
		Relative Humidity :		58.6~61.3%

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2333.73	43.45	-30.55	74	39.04	31.47	8.25	35.31	202	144	P	H
		2333.73	18.66	-35.34	54	-	-	-	-	-	-	A	H
	*	2402	89.23	-	-	84.7	31.42	8.41	35.3	202	144	P	H
	*	2402	64.44	-	-	-	-	-	-	-	-	A	H
		2380.77	44.24	-29.76	74	39.78	31.4	8.36	35.3	300	300	P	V
		2380.77	19.45	-34.55	54	-	-	-	-	-	-	A	V
	*	2402	89.75	-	-	85.22	31.42	8.41	35.3	300	300	P	V
	*	2402	64.96	-	-	-	-	-	-	-	-	A	V
BT CH 78 2480MHz													V
	*	2480	90.98	-	-	85.75	32.04	8.59	35.4	114	240	P	H
	*	2480	66.19	-	-	-	-	-	-	-	-	A	H
		2492.24	45.31	-28.69	74	39.98	32.14	8.61	35.42	114	240	P	H
		2492.24	20.52	-33.48	54	-	-	-	-	-	-	A	H
	*	2480	90.32	-	-	85.09	32.04	8.59	35.4	358	295	P	V
	*	2480	65.53	-	-	-	-	-	-	-	-	A	V
		2499.24	44.71	-29.29	74	39.32	32.19	8.63	35.43	358	295	P	V
		2499.24	19.92	-34.08	54	-	-	-	-	-	-	A	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 (dB μ V/m)	Margin (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	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 39 2441MHz		4882	39.75	-34.25	74	51.76	34.04	12.8	58.85	-	-	P	H
		4882	14.96	-39.04	54	-	-	-	-	-	-	A	H
		7323	40.64	-33.36	74	47.4	35.69	15.06	57.51	-	-	P	H
		7323	15.85	-38.15	54	-	-	-	-	-	-	A	H
													H
													H
													H
													H
													H
													H
													H
													V
		4882	40.39	-33.61	74	52.4	34.04	12.8	58.85	-	-	P	V
		4882	15.6	-38.4	54	-	-	-	-	-	-	A	V
		7323	42.17	-31.83	74	48.93	35.69	15.06	57.51	-	-	P	V
		7323	17.38	-36.62	54	-	-	-	-	-	-	A	V
													V
													V
													V
													V
													V
	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												



Emission below 1GHz

2.4GHz BT (LF)

**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	Peak or Average
H/V	Horizontal or Vertical



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

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dB μ V/m)	(dB)	(dB μ V/m)	(dB μ V)	(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

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)

2. Level(dB μ V/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

3. Margin(dB) = Level(dB μ V/m) – Limit Line(dB μ V/m)

For Peak Limit @ 2390MHz:

1. Level(dB μ V/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dB μ V) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dB μ V) – 35.86 (dB)

= 55.45 (dB μ V/m)

2. Margin(dB)

= Level(dB μ V/m) – Limit Line(dB μ V/m)

= 55.45(dB μ V/m) – 74(dB μ V/m)

= -18.55(dB)

Peak measured complies with the limit line, so test result is “PASS”.

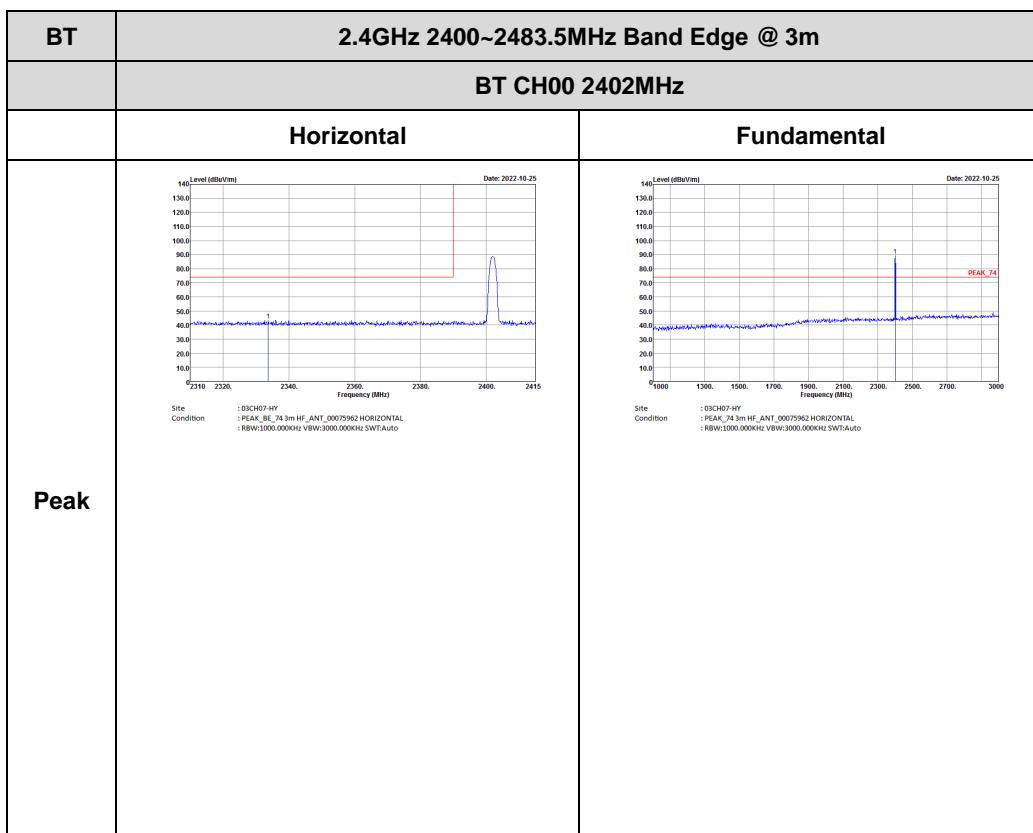


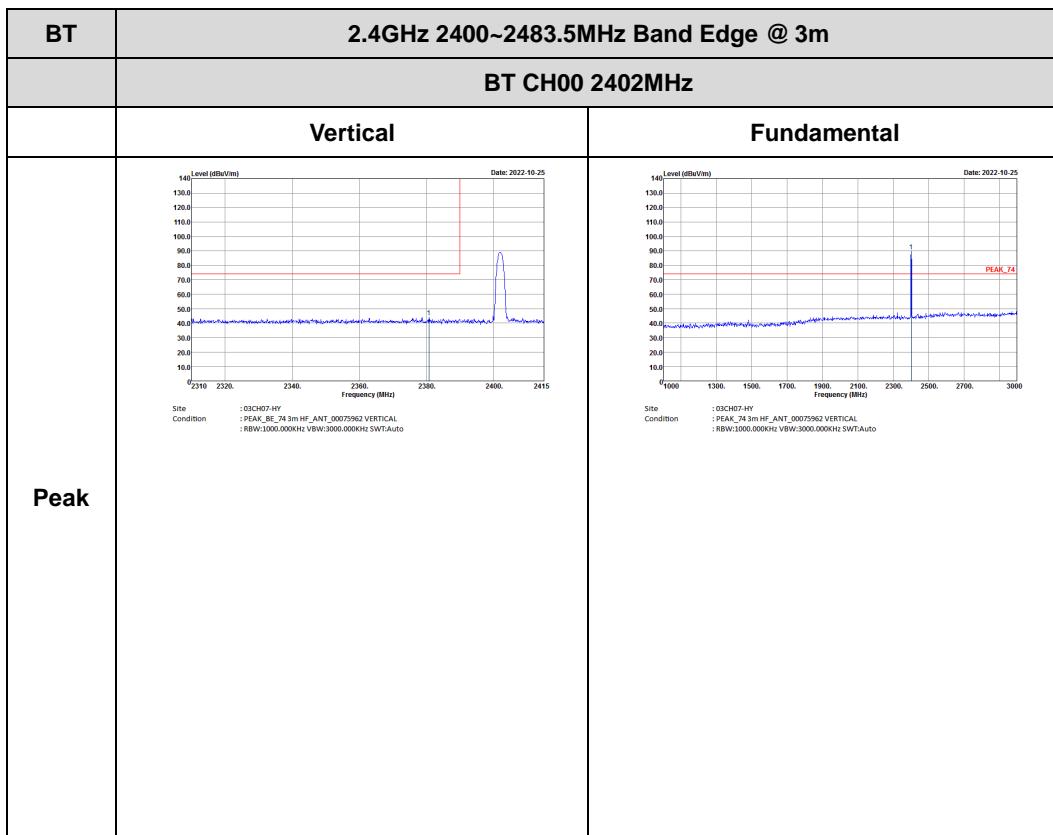
Appendix D. Radiated Spurious Emission Plots

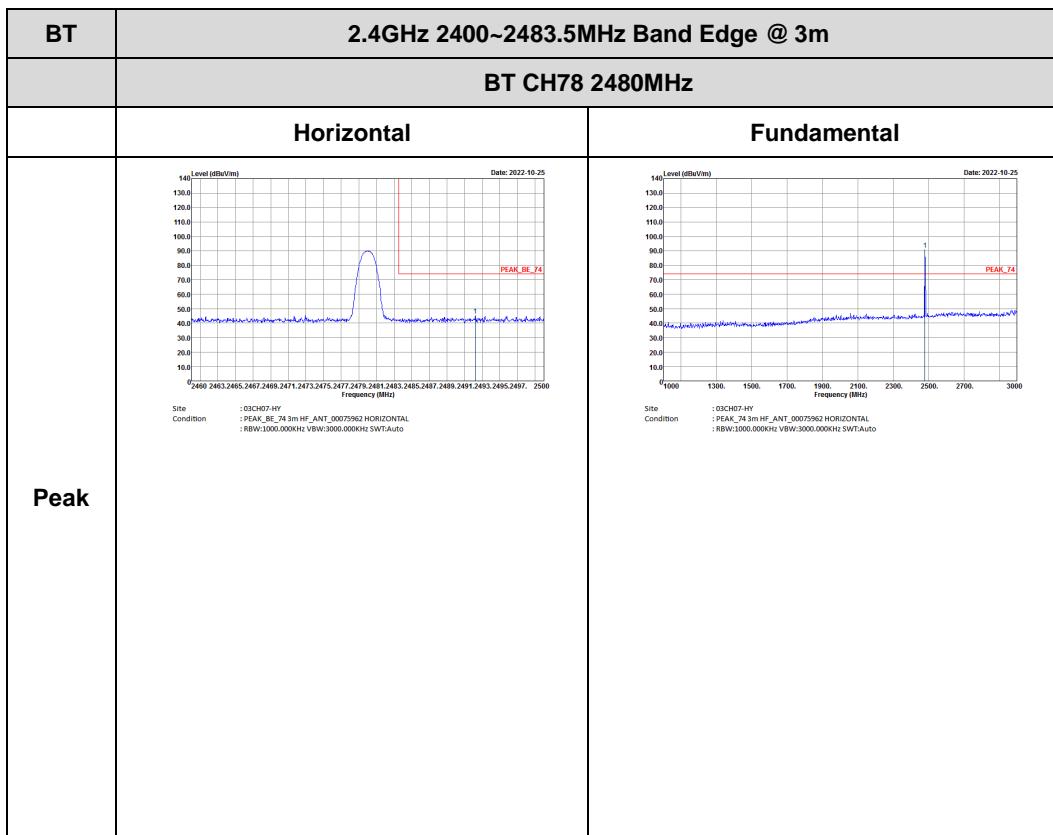
Test Engineer :	Jesse Wang, Stan Hsieh, Ken Wu and Howard Huang	Temperature :	22.6~24.5°C
		Relative Humidity :	58.6~61.3%

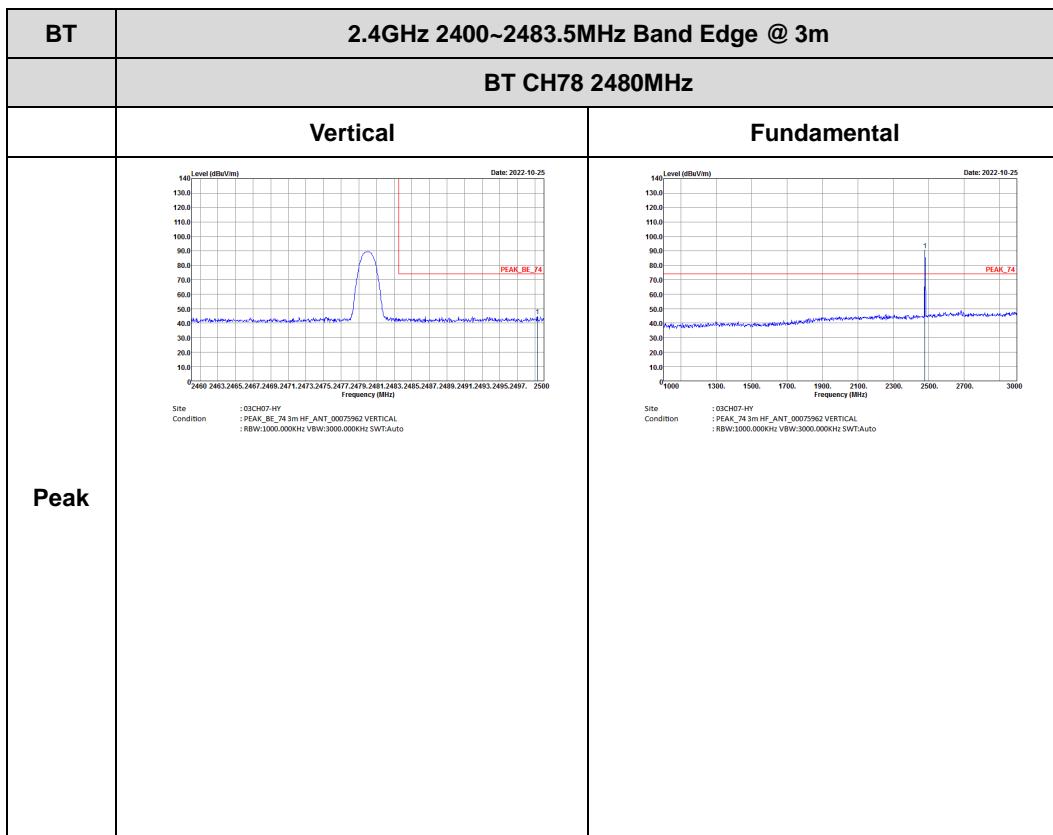
2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)





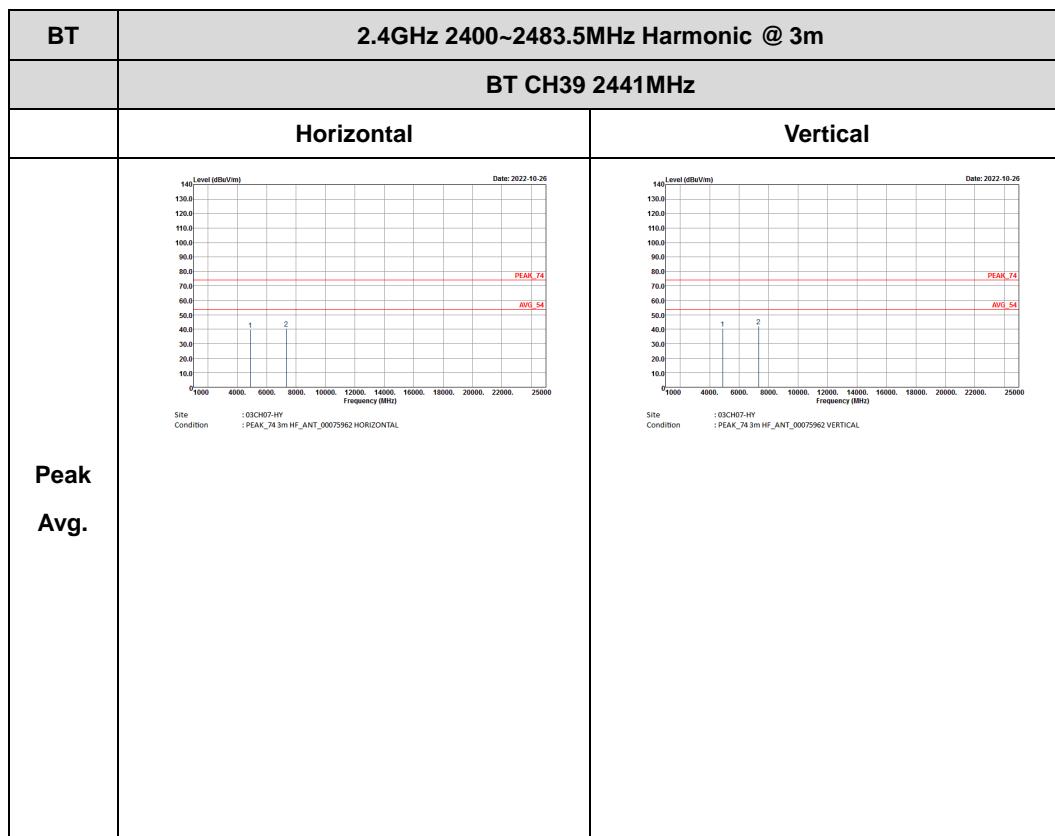






2.4GHz 2400~2483.5MHz

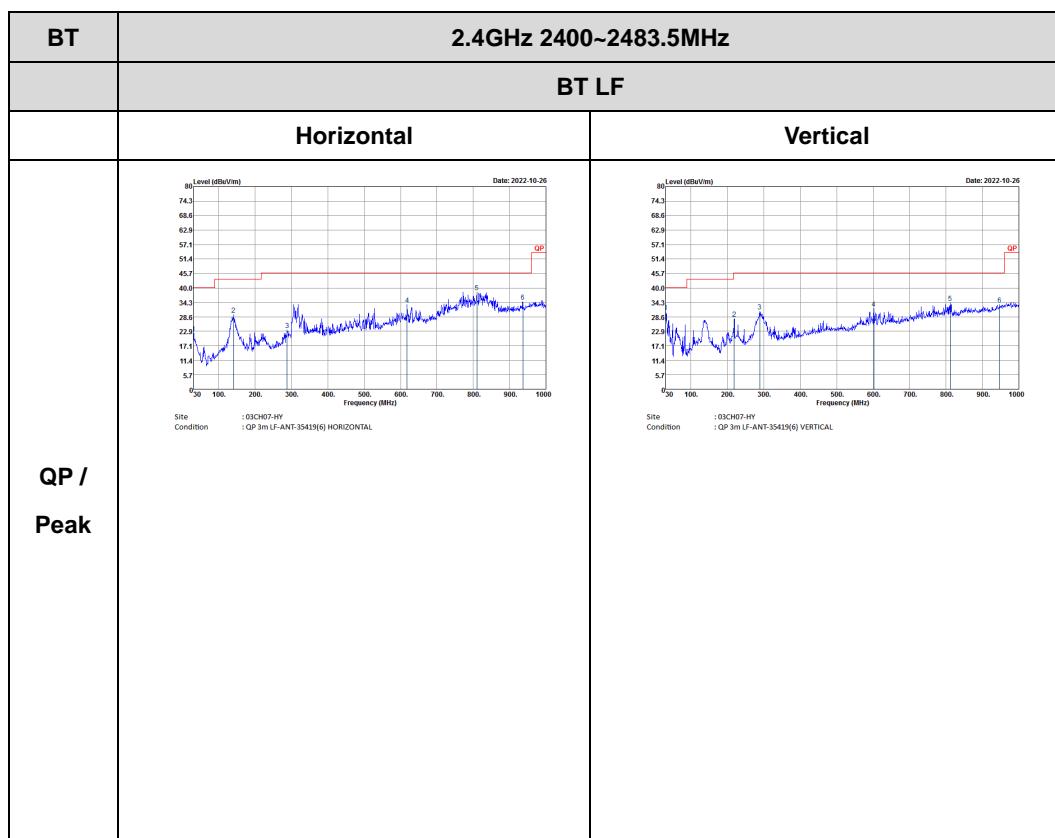
BT (Harmonic @ 3m)





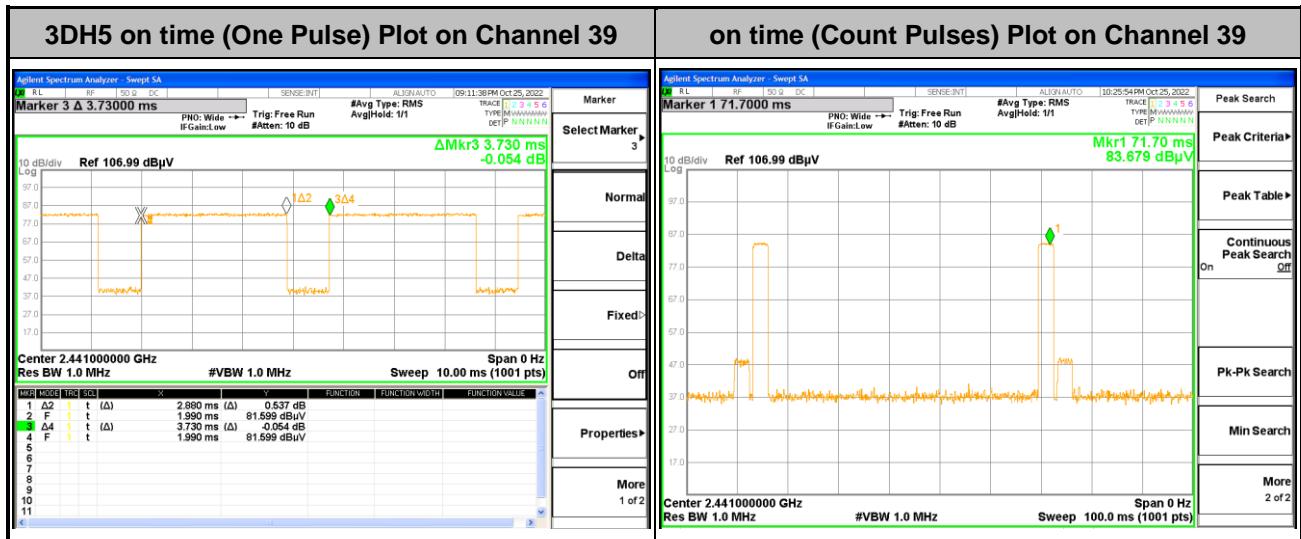
Emission below 1GHz

2.4GHz BT (LF)





Appendix E. Duty Cycle Plots



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. 3DH5 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

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

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. $[100 \text{ ms} / 57.6 \text{ ms}] = 2 \text{ hops}$
Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,
 $20 \times \log(5.76 \text{ ms}/100 \text{ ms}) = -24.79 \text{ dB}$