



FCC CO-LOCATION RADIO TEST REPORT

FCC ID : 2AW3A-1NAC21ACUCM
Equipment : EV Charger
Brand Name : RIVIAN
Model Name : PT00057322
PT00261633
PT00401761
PT00340197
Marketing Name : RIVIAN WAYPOINTS CHARGER
RIVIAN FLEET AC DISPENSER
Applicant : Rivian Automotive LLC.
607 Hansen Way, Palo Alto, CA 94304
Manufacturer : Lite-On Technology Corporation
15F , No.555, Siyuan Rd., Xinzhuang
Dist., New Taipei City, Taiwan (R.O.C.)
Standard : FCC Part 15 Subpart E §15.407

The product was received on Mar. 25, 2022 and testing was performed from Apr. 22, 2022 to May 17, 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 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
FR230116B	01	Initial issue of report	Sep. 14, 2022
FR230116B	02	Revise Antenna information	Sep. 27, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	8.72 dB under the limit at 2497.200 MHz
3.2	15.203 & 15.247(b)	Antenna Requirement	Pass	-

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: Yun Huang

Report Producer: Ruby Zou

1 General Description

1.1 Product Feature of Equipment Under Test

GSM/LTE, Bluetooth - LE, Wi-Fi 2.4GHz 802.11b/g/n and NFC.

Product Feature	
Sample 1	SKU 1
Sample 2	SKU 2
Sample 3	SKU 3
Sample 4	SKU 4
Antenna Type	WWAN: Fixed External Antenna WLAN: FPC Antenna Bluetooth-LE: Internal Antenna NFC: PCB Loop Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	Bluetooth-LE: 0.5 WLAN (2.4GHz): 2.2

Remark: The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

	SKU 1	SKU 2	SKU 3	SKU 4
	Public	Fleet	Fleet	Fleet
	LITEON: W1-UC166-0TH1ER	LITEON: W1-UC16A-00H1ER	LITEON: W1-UC168-00H1ER	LITEON: W1-UC166-00H1ER
	RIVIAN: PT00057322	RIVIAN:PT00261633	RIVIAN: PT00340197	RIVIAN:PT00401761
LCD Panel	Yes	NO	NO	NO
Charge Plug	25ft	32ft	25ft	18ft
LTE module	YES	YES	YES	YES
BLE module	YES	YES	YES	YES
Wi-Fi module	YES	YES	YES	YES
RFID module	YES	YES	YES	YES
Holster	YES	NO	NO	NO
Holster cover	YES	YES	YES	YES

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. 03CH11-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 KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ ANSI C63.10-2013
- ♦ ANSI C63.26-2015

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

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).

2.1 Carrier Frequency and Channel

2400-2483.5 MHz		2400-2483.5 MHz	
Bluetooth – LE for 2Mbps		802.11b	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
39	2480	6	2437

2.2 Test Mode

The final test modes consider the modulation and the worst data rates as shown in the table below.

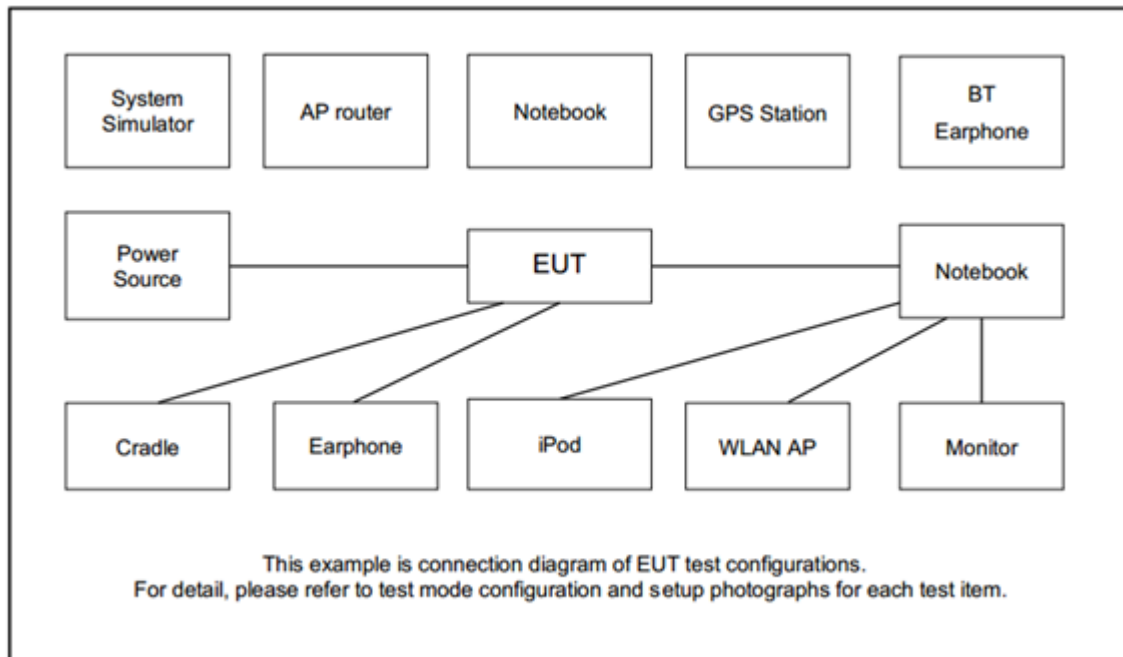
<Co-Location>

Modulation	Data Rate
Bluetooth-LE + WLAN 2.4GHz 802.11b + LTE Cat-M1 Band 25	2Mbps + MCS0 + QPSK

Remark:

1. During the Radiated Spurious Emission test, the EUT turn on the WWAN functions simultaneously.
2. For Radiated Test Cases, the tests were performed with Sample 1.

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

For Bluetooth – LE function, the RF test items, utility “nRF Connect V3.10.0.0” was installed in EUT 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.

For WLAN function, the RF test items, utility “Tera Term V4.95 and Dut Wlan BT Labtool V2.0.0.92” was installed in EUT 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 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Unwanted Emissions

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

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

3.1.2 Measuring Instruments

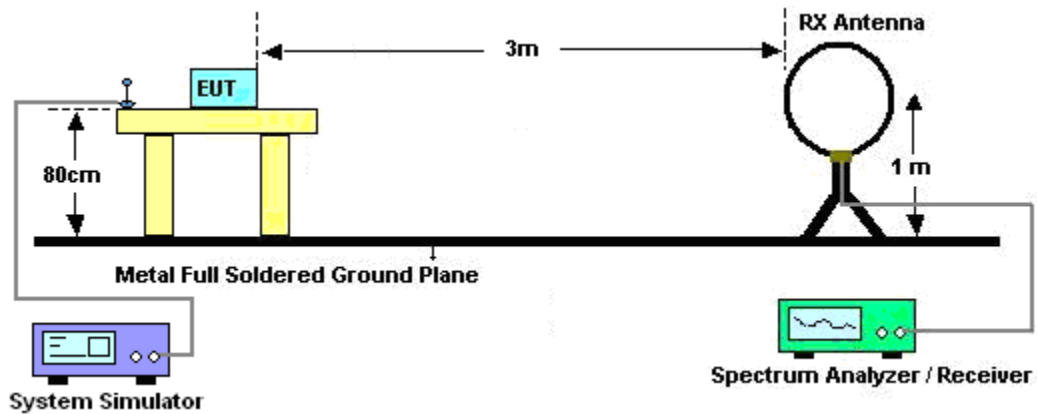
See list of measuring equipment of this test report.

3.1.3 Test Procedures

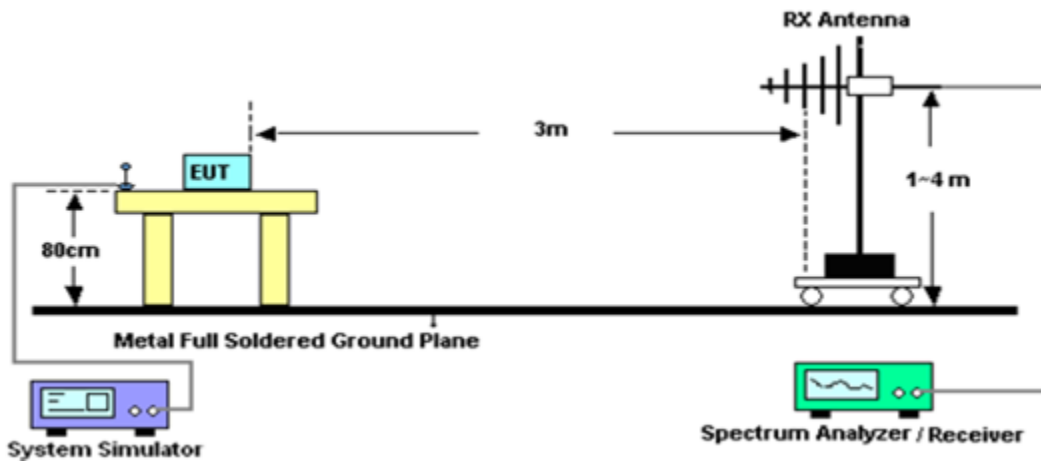
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 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 “-”.
7. 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 “-”.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW = 100 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3 MHz for $f \geq 1$ GHz for peak measurement.
For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.1.4 Test Setup

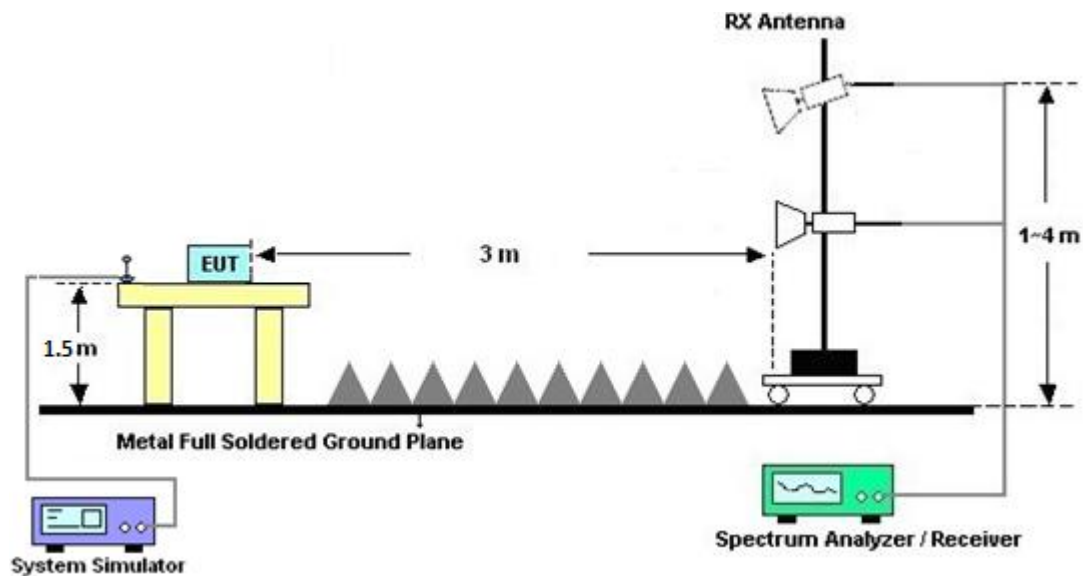
For radiated emissions below 30MHz



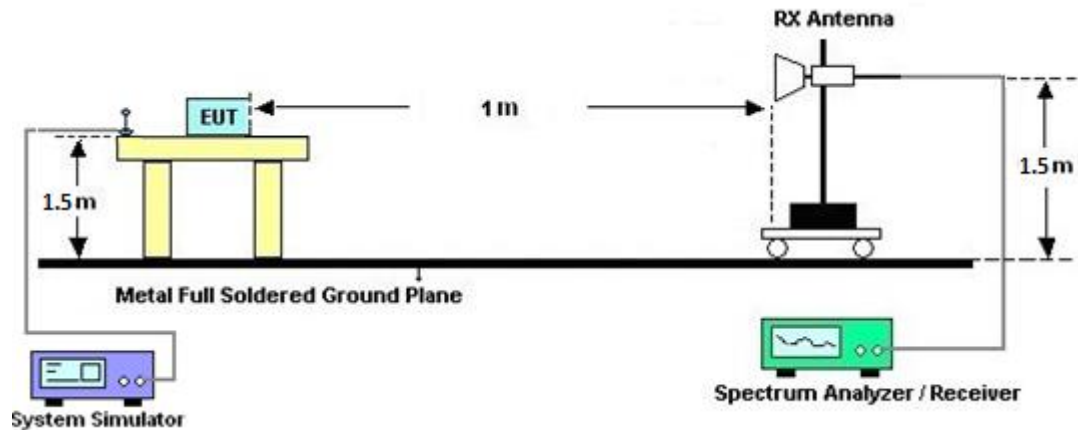
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.1.5 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.

3.1.6 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 (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.



3.2 Antenna Requirements

3.2.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power and the peak power spectral density shall be reduced by the same level in dB comparing to gain minus 6dBi. 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.

3.2.2 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
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	Apr. 22, 2022~ May 17, 2022	Jan. 06, 2023	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 09, 2021	Apr. 22, 2022~ May 17, 2022	Oct. 08, 2022	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1212	1GHz ~ 18GHz	Mar. 10, 2022	Apr. 22, 2022~ May 17, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA9170	00993	18GHz~40GHz	Nov. 30, 2021	Apr. 22, 2022~ May 17, 2022	Nov. 29, 2022	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 10, 2021	Apr. 22, 2022~ May 17, 2022	Dec. 09, 2022	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2021	Apr. 22, 2022~ May 17, 2022	Nov. 09, 2022	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03	1710001800055 007	1GHz~18GHz	Jun. 16, 2021	Apr. 22, 2022~ May 17, 2022	Jun. 15, 2022	Radiation (03CH11-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	Jun. 22, 2021	Apr. 22, 2022~ May 17, 2022	Jun. 21, 2022	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 15, 2021	Apr. 22, 2022~ May 17, 2022	Oct. 14, 2022	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY55420170	20MHz~8.4GHz	Jul. 15, 2021	Apr. 22, 2022~ May 17, 2022	Jul. 14, 2022	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Apr. 22, 2022~ May 17, 2022	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1~4m	N/A	Apr. 22, 2022~ May 17, 2022	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Apr. 22, 2022~ May 17, 2022	N/A	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Apr. 22, 2022~ May 17, 2022	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 10, 2022	Apr. 22, 2022~ May 17, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz-30MHz	Mar. 10, 2022	Apr. 22, 2022~ May 17, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	30MHz-18GHz	Mar. 10, 2022	Apr. 22, 2022~ May 17, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	811852/4	30MHz-18GHz	Mar. 10, 2022	Apr. 22, 2022~ May 17, 2022	Mar. 09, 2023	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-1 530-8000-40S S	SN11	1.53G Low Pass	Sep. 13, 2021	Apr. 22, 2022~ May 17, 2022	Sep. 12, 2022	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-270 0-3000-18000 -60SS	SN3	3GHz High Pass Filter	Sep. 13, 2021	Apr. 22, 2022~ May 17, 2022	Sep. 12, 2022	Radiation (03CH11-HY)
Filter	Wainwright	WHKX8-5872. 5-6750-18000 -40SS	SN3	6.75GHz High Pass Filter	Sep. 13, 2021	Apr. 22, 2022~ May 17, 2022	Sep. 12, 2022	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-900- 1000-15000-6 0SS	SN12	1GHz High Pass Filter	Nov. 04, 2021	Apr. 22, 2022~ May 17, 2022	Nov. 03, 2022	Radiation (03CH11-HY)
Hygrometer	TECEPIL	DTM-303B	TP140325	N/A	Nov. 26, 2021	Apr. 22, 2022~ May 17, 2022	Nov. 25, 2022	Radiation (03CH11-HY)
Hygrometer	TECEPIL	DTM-303B	TP200880	N/A	Sep. 30, 2021	Apr. 22, 2022~ May 17, 2022	Sep. 29, 2022	Radiation (03CH11-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
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.4 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.9 dB
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Appendix A. Radiated Spurious Emission

Test Engineer :	Theodore Huang, Fu Chen and Troye Hsieh	Temperature :	20.1~21.7°C
		Relative Humidity :	56.1~67.5%

802.11b Ch06 + BLE 2M Ch39 + LTE Cat-M1 Band 25 Link

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 06 2437MHz		2371.76	52.31	-21.69	74	41.61	27.39	17.26	33.95	262	342	P	H
		2389.36	41.44	-12.56	54	30.64	27.46	17.29	33.95	262	342	A	H
	*	2437	108.22	-	-	97.15	27.65	17.36	33.94	262	342	P	H
	*	2437	104.39	-	-	93.32	27.65	17.36	33.94	262	342	A	H
		2495.6	53.2	-20.8	74	41.89	27.79	17.44	33.92	262	342	P	H
		2494.8	42.23	-11.77	54	30.92	27.79	17.44	33.92	262	342	A	H
													H
													H
													H
													H
		2372.88	52.78	-21.22	74	42.08	27.39	17.26	33.95	125	54	P	V
		2388.08	41.33	-12.67	54	30.55	27.45	17.28	33.95	125	54	A	V
	*	2437	100.76	-	-	89.69	27.65	17.36	33.94	125	54	P	V
	*	2437	97.64	-	-	86.57	27.65	17.36	33.94	125	54	A	V
		2498.72	52.74	-21.26	74	41.41	27.8	17.45	33.92	125	54	P	V
		2496	41.97	-12.03	54	30.66	27.79	17.44	33.92	125	54	A	V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



BLE 2M (Band Edge @ 3m)

BLE	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)
BLE 2M CH 39 2480MHz	*	2480	84.33	-	-	73.08	27.76	17.42	33.93	350	5	P	H
	*	2480	83.09	-	-	71.84	27.76	17.42	33.93	350	5	A	H
		2483.8	52.98	-21.02	74	41.7	27.77	17.43	33.92	350	5	P	H
		2497.2	45.28	-8.72	54	33.96	27.79	17.45	33.92	350	5	A	H
													H
													H
	*	2480	81.6	-	-	70.35	27.76	17.42	33.93	250	73	P	V
	*	2480	80.39	-	-	69.14	27.76	17.42	33.93	250	73	A	V
		2485.96	53.31	-20.69	74	42.03	27.77	17.43	33.92	250	73	P	V
		2494.16	45.1	-8.9	54	33.79	27.79	17.44	33.92	250	73	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



802.11b Ch06 + BLE 2M Ch39 + LTE Cat-M1 Band 25 Link

WIFI 802.11b + BLE 2M (Harmonic @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant. Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	Avg. (P/A)	(H/V)
WIFI 802.11b Ch06 2437MHz + BLE 2M Ch39 2480MHz		4874	50.22	-23.78	74	64.46	32.6	11.63	58.47	150	67	P	H
		4874	37.16	-16.84	54	51.4	32.6	11.63	58.47	150	67	A	H
		4960	43.05	-30.95	74	56.63	33.02	11.89	58.49	-	-	P	H
		7311	44.09	-29.91	74	52.8	37.06	13.41	59.18	-	-	P	H
		7440	42.66	-31.34	74	51.59	36.44	13.75	59.12	-	-	P	H
													H
		4874	50.81	-23.19	74	65.05	32.6	11.63	58.47	150	260	P	V
		4874	37.18	-16.82	54	51.42	32.6	11.63	58.47	150	260	A	V
		4960	44.71	-29.29	74	58.29	33.02	11.89	58.49	-	-	P	V
		7311	44.56	-29.44	74	53.27	37.06	13.41	59.18	-	-	P	V
		7440	42.43	-31.57	74	51.36	36.44	13.75	59.12	-	-	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												



Emission above 18GHz

WIFI 802.11b + BLE 2M (SHF @ 1m)

WIFI Ant.	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)
Simultaneously		22403	37	-37	74	57.13	38.26	-3.85	54.54	-	-	P	H
WIFI 802.11b + BLE 2M SHF													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		23817	37.66	-36.34	74	54.89	38.8	-2.22	53.81	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Emission below 1GHz

WIFI 802.11b + BLE 2M (LF)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
WIFI 802.11b + BLE 2M LF		53.28	28.2	-11.8	40	46.88	12.7	1.1	32.48	-	-	P	H
		206.54	33.96	-9.54	43.5	49.3	14.94	2.22	32.5	-	-	P	H
		263.77	35.84	-10.16	46	45.96	19.6	2.52	32.24	-	-	P	H
		479.11	36.92	-9.08	46	42.13	23.5	3.34	32.05	-	-	P	H
		875.84	29.93	-16.07	46	27.73	28.98	4.58	31.36	-	-	P	H
		955.38	32.19	-13.81	46	27.6	30.66	4.79	30.86	-	-	P	H
													H
													H
													H
													H
													H
													H
		53.28	30.56	-9.44	40	49.24	12.7	1.1	32.48	-	-	P	V
		143.49	34.56	-8.94	43.5	48.01	17.13	1.87	32.45	-	-	P	V
		399.57	34.25	-11.75	46	41.23	21.66	3.06	31.7	-	-	P	V
		479.11	36.19	-9.81	46	41.4	23.5	3.34	32.05	-	-	P	V
		929.19	29.85	-16.15	46	26.8	29.35	4.73	31.03	-	-	P	V
		947.62	31.45	-14.55	46	27.31	30.28	4.77	30.91	-	-	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:

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+2		(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 :	Theodore Huang, Fu Chen and Troye Hsieh	Temperature :	20.1~21.7°C
		Relative Humidity :	56.1~67.5%

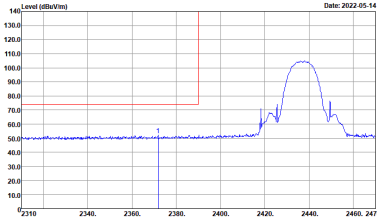
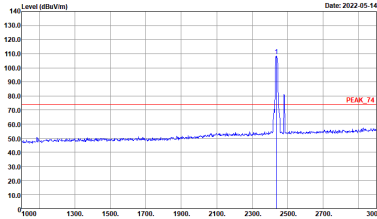
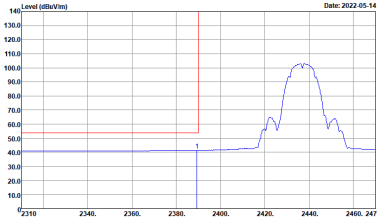
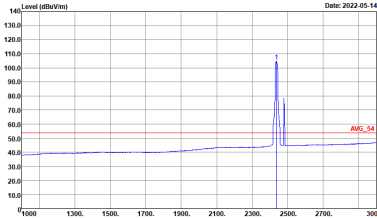
Note symbol

-L	Low channel location
-R	High channel location

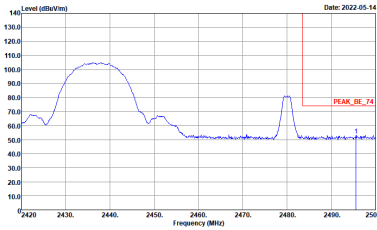
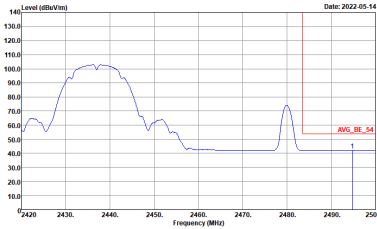


802.11b Ch06 + BLE 2M Ch39 + LTE Cat-M1 Band 25 Link

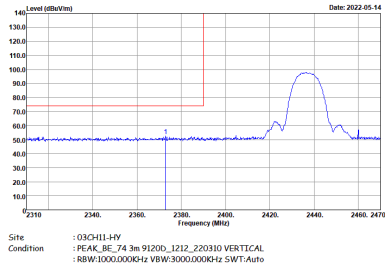
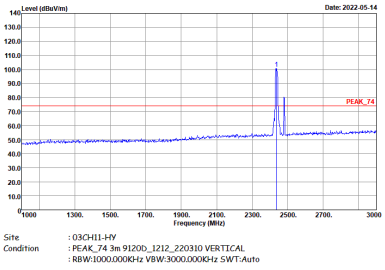
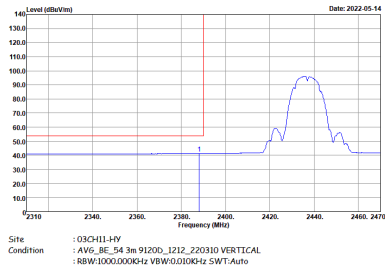
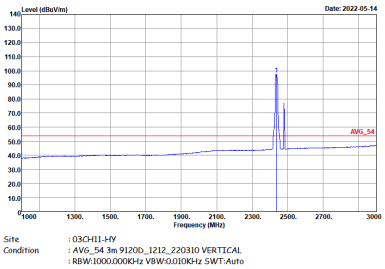
WIFI 802.11b (Band Edge @ 3m)

WIFI	Wifi 802.11b Band Edge @ 3m	
ANT	802.11b Ch06 2437MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH11-HY Condition : PEAK_74 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH11-HY Condition : AVG_54 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

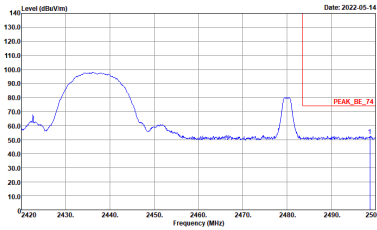
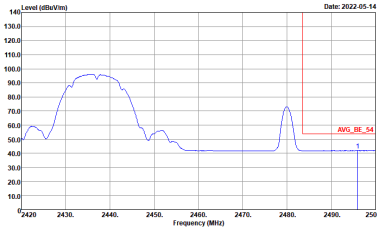


WIFI	Wifi 802.11b Band Edge @ 3m	
ANT	802.11b Ch06 2437MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m 91200_1212_220310 HORIZONTAL RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto	Left blank
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m 91200_1212_220310 HORIZONTAL RBW:1000.0000Hz VBW:0.0100Hz SWT:Auto	Left blank



WIFI	Wifi 802.11b Band Edge @ 3m	
ANT	802.11b Ch06 2437MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m 91200_1212_220310 VERTICAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto	 Site : 03CH11-HY Condition : PEAK_74 3m 91200_1212_220310 VERTICAL : RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m 91200_1212_220310 VERTICAL : RBW:1000.0000Hz VBW:0.0100Hz SWT:Auto	 Site : 03CH11-HY Condition : AVG_54 3m 91200_1212_220310 VERTICAL : RBW:1000.0000Hz VBW:0.0100Hz SWT:Auto



WIFI	Wifi 802.11b Band Edge @ 3m	
ANT	802.11b Ch06 2437MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m 91200_1212_220310 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m 91200_1212_220310 VERTICAL RBW:1000.000KHz VBW:0.010KHz SWT:Auto	Left blank



BLE 2M (Band Edge @ 3m)

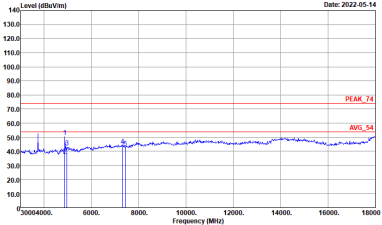
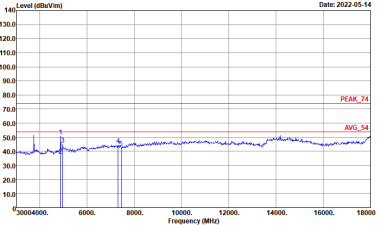
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Fundamental
Peak	Site : 03CH11-HY Condition : PEAK_BE_74 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Site : 03CH11-HY Condition : PEAK_74 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	Site : 03CH11-HY Condition : AVG_BE_54 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto	Site : 03CH11-HY Condition : AVG_54 3m 91200_1212_220310 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto



BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2M Ch39 2480Mhz	
	Vertical	Fundamental
Peak	Site : 03CH11-HY Condition : PEAK_BE_74 3m 91200_1212_220310 VERTICAL RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto	Site : 03CH11-HY Condition : PEAK_74 3m 91200_1212_220310 VERTICAL RBW:1000.0000Hz VBW:3000.0000Hz SWT:Auto
Avg.	Site : 03CH11-HY Condition : AVG_BE_54 3m 91200_1212_220310 VERTICAL RBW:1000.0000Hz VBW:10.0000Hz SWT:Auto	Site : 03CH11-HY Condition : AVG_54 3m 91200_1212_220310 VERTICAL RBW:1000.0000Hz VBW:10.0000Hz SWT:Auto

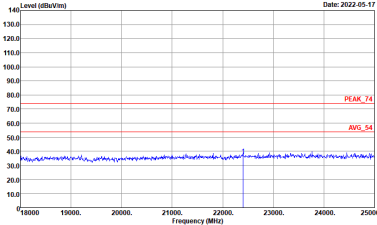
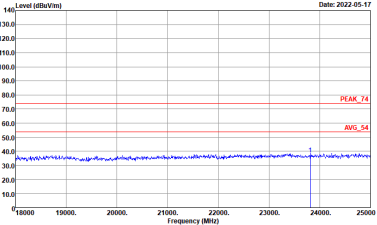


802.11b Ch06 + BLE 2M Ch39 + LTE Cat-M1 Band 25 Link
WIFI 802.11b + BLE 2M (Harmonic @ 3m)

Ant.	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
Simultaneously	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m 91200_1212_220310 HORIZONTAL Detector : Peak	 Site : 03CH11-HY Condition : PEAK_74 3m 91200_1212_220310 VERTICAL Detector : Peak

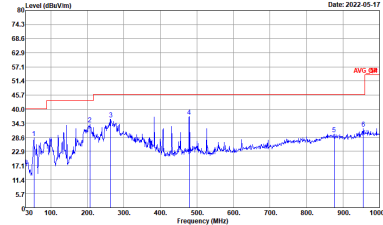
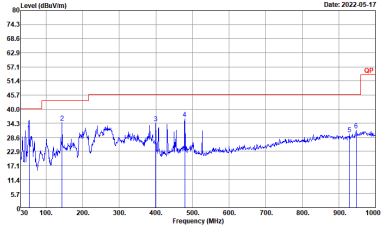


Emission above 18GHz
WIFI 802.11b + BLE 2M (SHF@1m)

Ant.	2.4GHz 2400~2483.5MHz SHF	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HY Condition : PEAK_74 1m SHF ANT_9170_00993 HORIZONTAL Detector : Peak	 Site : 03CH11-HY Condition : PEAK_74 1m SHF ANT_9170_00993 VERTICAL Detector : Peak



Emission below 1GHz
2.4GHz WIFI 802.11b + BLE 2M (LF)

Ant.	2.4GHz 2400~2483.5MHz LF	
Simultaneously	Horizontal	Vertical
QP / Peak	 Site : 03CH11-HV Condition : QP 3m BI-LOG 35414-211009 HORIZONTAL Detector : Peak	 Site : 03CH11-HV Condition : QP 3m BI-LOG 35414-211009 VERTICAL Detector : Peak



Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth – LE for 2Mbps	33.01	206	4.85	10kHz
802.11b	100.00	-	-	10Hz

