FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**2AW3A-2NAC24ACUCM**
Equipment	:	**EV Charger**
Brand Name	:	**RIVIAN**
Model Name	:	**2NAC24ACUCM**
Marketing Name	:	**RIVIAN WAYPOINTS CHARGER**
Applicant	:	**Rivian Automotive LLC. 14600 Myford Road, Irvine Irvine CA, 92606**
Manufacturer	:	**Lite-On Technology Corporation 29F , No.555, Siyuan Rd., Xinzhuang Dist., New Taipei City, Taiwan (R.O.C.)**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Mar. 27, 2024 and testing was performed from Jul. 01, 2024 to Jul. 02, 2024. 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
FR432616D	01	Initial issue of report	Jul. 30, 2024
FR432616D	02	Revise Antenna Type This report is an updated version, replacing the report issued on Jul. 30, 2024.	Aug. 21, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(b)	Unwanted Emissions	Pass	1.29 dB under the limit at 60.24 MHz
3.2	15.203	Antenna Requirement	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”.

Disclaimer:

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

Reviewed by: Danny Lee

Report Producer: Ming Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
General Specs GSM/LTE, Bluetooth - LE, Wi-Fi 2.4GHz 802.11b/g/n, and NFC. **Antenna Type** WWAN: FPC Antenna WLAN: FPC Antenna Bluetooth-LE: Internal Antenna NFC: Loop Antenna	
Antenna Gain	LTE Band 13 : 2.8 Bluetooth LE: 0.5 WLAN 2.4GHz: 2.2

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

1.2 Modification of EUT

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

1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010 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 47 CFR Part 2, 22(H), 24(E), 27
- FCC Part 15 Subpart C §15.247
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013
- ANSI C63.26-2015

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.

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	
Bluetooth-LE	
Channel	Freq. (MHz)
39	2480

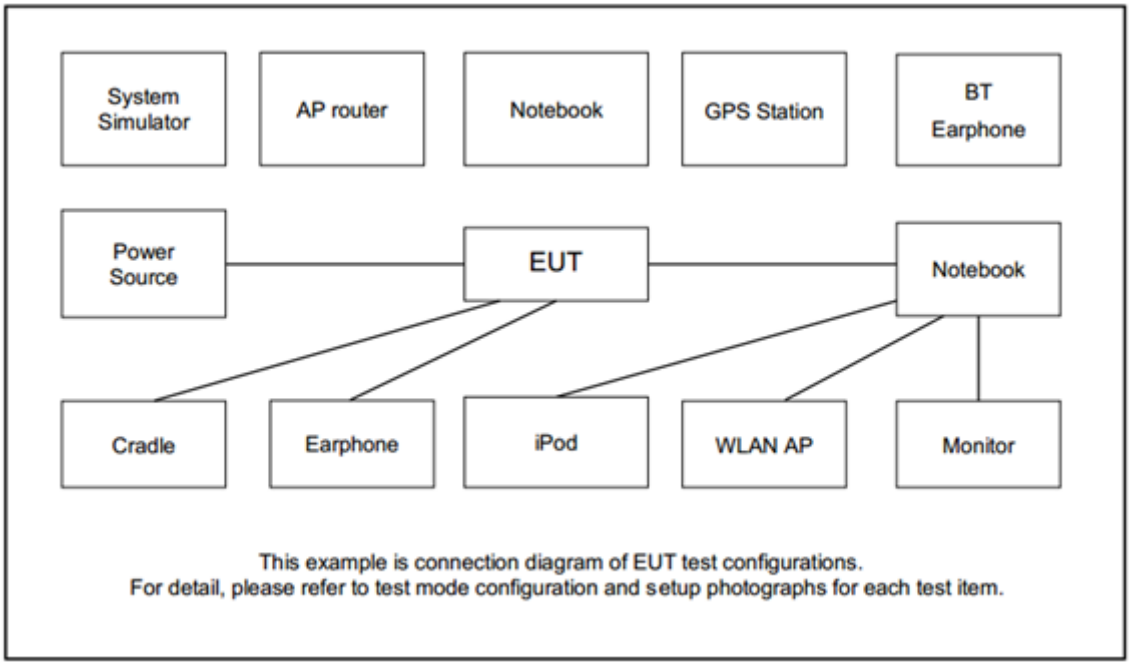
2400-2483.5 MHz	
802.11b	
Channel	Freq. (MHz)
01	2412

2.2 Test Mode

<Co-Location>

Test Mode	Modulation	Data Rate
Mode 1	Bluetooth-LE 2Mbps + WLAN 2.4GHz 802.11b + LTE NB-IoT Band 13	2Mbps + 6Mbps + QPSK

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.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8 m
2.	Notebook	DELL	Latitude 3400	N/A	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “Tera Term / Dut Labtool / nRF Connect” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3 Test Result

3.1 Unwanted Emissions Measurement

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

3.1.1 Limit of Unwanted Emissions

(1) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table:

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

Note: The following formula is used to convert the EIRP to field strength.

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

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(2) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of −27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.1.2 Measuring Instruments

Please refer to the measuring equipment list in 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 ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

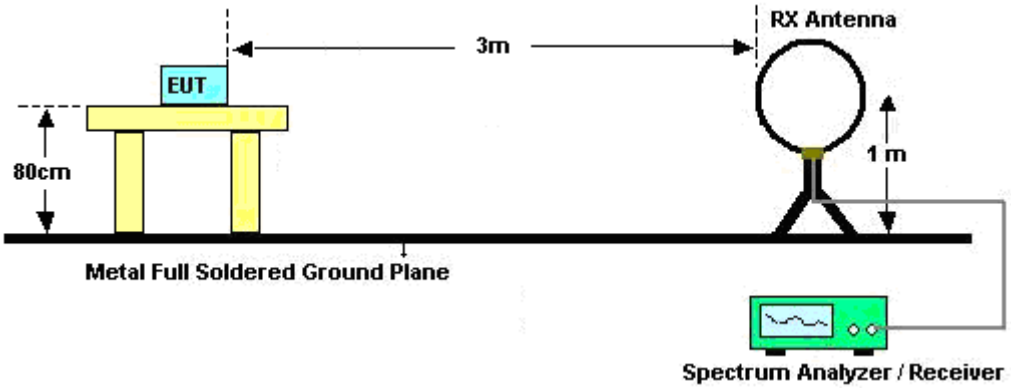
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 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.

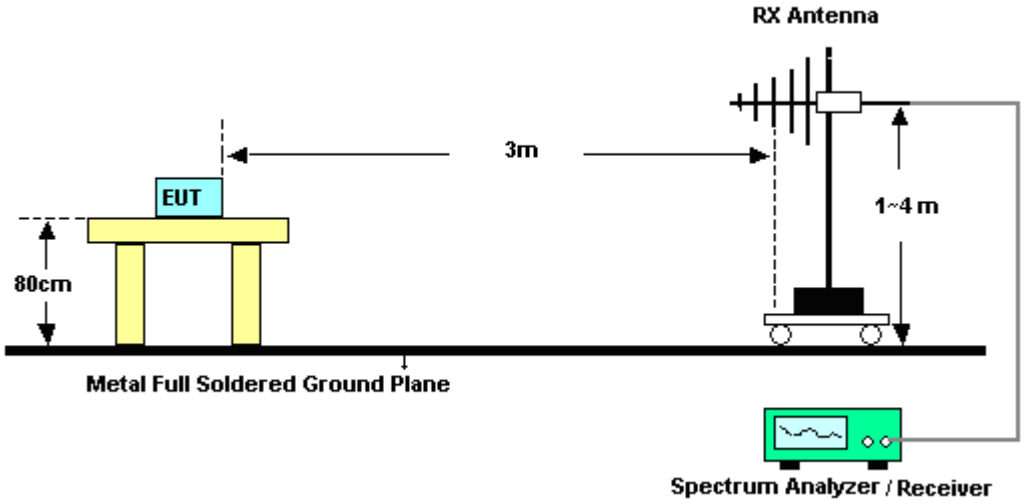
2. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT is set 3 meters away from the receiving antenna which is mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna 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 is arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Radiated testing below 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 “-“.

3.1.4 Test Setup

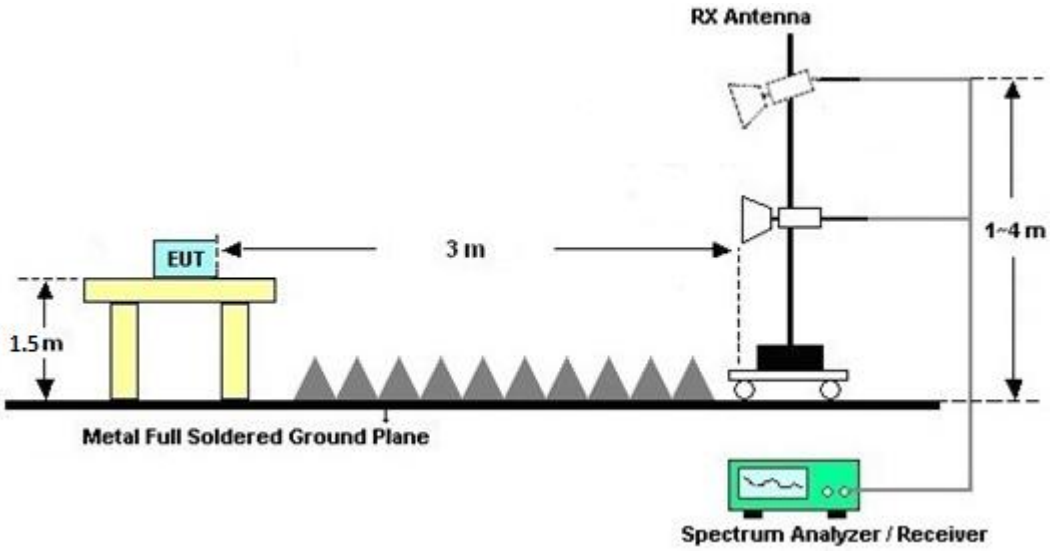
For radiated emissions below 30MHz



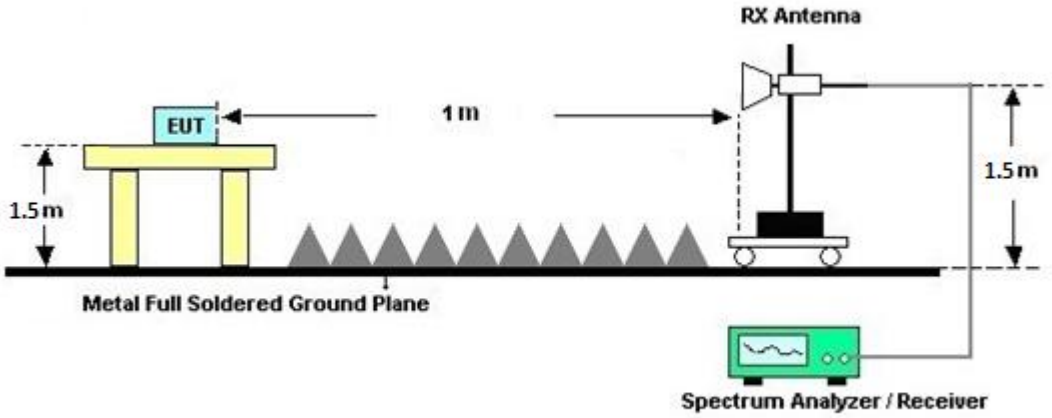
For radiated emissions from 30MHz to 1GHz



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 came out very similar.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

3.1.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.

3.2 Antenna Requirements

3.2.1 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.

3.2.2 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
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 07, 2023	Jul. 01, 2024~ Jul. 02, 2024	Oct. 06, 2024	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 12, 2023	Jul. 01, 2024~ Jul. 02, 2024	Sep. 11, 2024	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-01620	1GHz~18GHz	Aug. 17, 2023	Jul. 01, 2024~ Jul. 02, 2024	Aug. 16, 2024	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz~40GHz	Nov. 24, 2023	Jul. 01, 2024~ Jul. 02, 2024	Nov. 23, 2024	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 08, 2023	Jul. 01, 2024~ Jul. 02, 2024	Dec. 07, 2024	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Mar. 25, 2024	Jul. 01, 2024~ Jul. 02, 2024	Mar. 24, 2025	Radiation (03CH11-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055007	1GHz~18GHz	Jun. 13, 2024	Jul. 01, 2024~ Jul. 02, 2024	Jun. 12, 2025	Radiation (03CH11-HY)
Preamplifier	EMEC	EM18G40G	060871	18GHz~40GHz	Aug. 30, 2024	Jul. 01, 2024~ Jul. 02, 2024	Aug. 29, 2025	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 05, 2023	Jul. 01, 2024~ Jul. 02, 2024	Oct. 04, 2024	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Oct. 06, 2023	Jul. 01, 2024~ Jul. 02, 2024	Oct. 05, 2024	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Jul. 01, 2024~ Jul. 02, 2024	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jul. 01, 2024~ Jul. 02, 2024	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jul. 01, 2024~ Jul. 02, 2024	N/A	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Jul. 01, 2024~ Jul. 02, 2024	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz~40GHz	Mar. 06, 2024	Jul. 01, 2024~ Jul. 02, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804013/2	30M~40G	May 23, 2024	Jul. 01, 2024~ Jul. 02, 2024	May 22, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	9K~30M	Mar. 06, 2024	Jul. 01, 2024~ Jul. 02, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	30M~40G	Mar. 06, 2024	Jul. 01, 2024~ Jul. 02, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN11	1.53G Low Pass	Sep. 11, 2023	Jul. 01, 2024~ Jul. 02, 2024	Sep. 10, 2024	Radiation (03CH11-HY)

5 Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.10 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.30 dB

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.30 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.30 dB

Appendix A. Radiated Spurious Emission

Test Engineer :	Yuan Lee, Fu Chen and Troye Hsieh	Temperature :	20.2~20.9°C
		Relative Humidity :	52.3~65.4%

BLE 2Mbps CH39+ BLE 802.11b CH01+ LTE NB-IoT Band 13 Link

BLE 2Mbps (Band Edge @ 3m)

BLE Ant.	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH39 2480MHz	*	2480	87.73	-	-	76.47	27.7	16.84	33.28	321	74	P	H
	*	2480	86.34	-	-	75.08	27.7	16.84	33.28	321	74	A	H
		2491.44	53.85	-20.15	74	42.58	27.7	16.85	33.28	321	74	P	H
		2493.04	44.61	-9.39	54	33.33	27.7	16.85	33.27	321	74	A	H
													H
													H
	*	2480	87.44	-	-	76.18	27.7	16.84	33.28	190	239	P	V
	*	2480	86.04	-	-	74.78	27.7	16.84	33.28	190	239	A	V
		2497.08	53.76	-20.24	74	42.47	27.7	16.86	33.27	190	239	P	V
		2499.76	44.76	-9.24	54	33.47	27.7	16.86	33.27	190	239	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

BLE 802.11b (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					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 CH01 2412MHz		2360.505	54.67	-19.33	74	44.04	27.3	16.69	33.36	199	203	P	H
		2360.505	48.63	-5.37	54	38	27.3	16.69	33.36	199	203	A	H
	*	2412	108.97	-	-	98.05	27.5	16.74	33.32	199	203	P	H
	*	2412	105.8	-	-	94.88	27.5	16.74	33.32	199	203	A	H
													H
													H
		2360.4	56.45	-17.55	74	45.82	27.3	16.69	33.36	114	281	P	V
		2360.505	51.51	-2.49	54	40.88	27.3	16.69	33.36	114	281	A	V
	*	2412	105.25	-	-	94.33	27.5	16.74	33.32	114	281	P	V
	*	2412	102.26	-	-	91.34	27.5	16.74	33.32	114	281	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

BLE 2Mbps CH39+ BLE 802.11b CH01+ LTE NB-IoT Band 13

BLE 2Mbps+ BLE 802.11b (Harmonic @ 3m)

Ant. Simultaneously	Note	Frequency (MHz)	Level (dBµV/m)	Margin (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 CH39 2480MHz + 802.11b CH01 2412MHz		4824	53.81	-20.19	74	67.69	32.54	12.12	58.54	125	360	P	H
		4824	52.16	-1.84	54	66.04	32.54	12.12	58.54	125	360	A	H
		4960	44.08	-29.92	74	57.53	33.04	12.15	58.64	400	81	P	H
		4960	36.46	-17.54	54	49.91	33.04	12.15	58.64	400	81	A	H
		7440	43.11	-30.89	74	50.34	36.32	15.35	58.9	-	-	P	H
													H
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													H
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													H
		4824	48.24	-25.76	74	62.12	32.54	12.12	58.54	279	81	P	V
		4824	45.49	-8.51	54	59.37	32.54	12.12	58.54	279	81	A	V
		4960	45.19	-28.81	74	58.64	33.04	12.15	58.64	251	129	P	V
		4960	39.13	-14.87	54	52.58	33.04	12.15	58.64	251	129	A	V
		7440	42.82	-31.18	74	50.05	36.32	15.35	58.9	-	-	P	V
													V
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													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

BLE + BLE 802.11b + LTE NB-IoT Band 13 (SHF)

	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH39 2480MHz + 802.11b CH01 2412MHz		24510	35.09	-38.91	74	38.22	39.1	18.17	60.4	-	-	P	H
													H
													H
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													H
		24657	34.34	-39.66	74	37.11	39.21	18.39	60.37	-	-	P	V
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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 below 1GHz

BLE 2Mbps + BLE 802.11b + LTE NB-IoT Band 13 (LF)

	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH39 2480MHz + 802.11b CH01 2412MHz		60.24	38.71	-1.29	40	58.22	11.79	0.81	32.11	250	358	QP	H
		72.12	38.25	-1.75	40	57.12	12.29	1.04	32.2	250	70	QP	H
		76.98	32.84	-7.16	40	51.2	12.83	1.09	32.28	250	55	QP	H
		84.27	33.08	-6.92	40	50.52	13.78	1.15	32.37	250	249	QP	H
		96.15	31.39	-12.11	43.5	47.12	15.41	1.26	32.4	200	236	QP	H
		107.49	33.38	-10.12	43.5	47.68	16.63	1.3	32.23	250	242	QP	H
		120.18	31.76	-11.74	43.5	45.11	17.33	1.36	32.04	150	248	QP	H
		132.33	33.27	-10.23	43.5	46.56	17.44	1.49	32.22	250	305	QP	H
		168.24	39.29	-4.21	43.5	54.15	15.52	1.71	32.09	150	325	QP	H
		180.12	38.64	-4.86	43.5	54.17	14.69	1.75	31.97	150	315	QP	H
		200.64	36.67	-6.83	43.5	52.32	14.82	1.89	32.36	100	286	QP	H
		215.22	36.59	-6.91	43.5	52.19	14.74	1.96	32.3	200	83	QP	H
		664	38.76	-7.24	46	40.59	26.35	3.66	31.84	100	324	QP	H
		810.3	36.38	-9.62	46	35.86	27.94	4.12	31.54	200	287	QP	H
		960	39.62	-6.38	46	34.97	30.97	4.56	30.88	250	81	QP	H
		59.97	35.78	-4.22	40	55.29	11.79	0.81	32.11	250	291	QP	V
		119.64	31.82	-11.68	43.5	45.23	17.28	1.36	32.05	250	231	QP	V
		132.33	32.52	-10.98	43.5	45.81	17.44	1.49	32.22	250	305	QP	V
		168.51	39.21	-4.29	43.5	54.08	15.5	1.72	32.09	100	258	QP	V
		179.31	37.69	-5.81	43.5	53.2	14.72	1.75	31.98	100	270	QP	V

Ant. Simultaneously	Note	Frequency (MHz)	Level (dBµV/m)	Margin (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 CH39 2480MHz + 802.11b CH01 2412MHz		192.27	35.39	-8.11	43.5	51.22	14.55	1.83	32.21	100	312	QP	V
		200.91	32.75	-10.75	43.5	48.4	14.82	1.89	32.36	100	286	QP	V
		204.69	35.27	-8.23	43.5	50.78	14.91	1.92	32.34	200	317	QP	V
		215.49	33.31	-10.19	43.5	48.91	14.74	1.96	32.3	250	169	QP	V
		666.8	37.95	-8.05	46	39.73	26.38	3.67	31.83	200	173	QP	V
		810.3	39.74	-6.26	46	39.22	27.94	4.12	31.54	200	358	QP	V
		869.8	40.74	-5.26	46	39	29.11	4.21	31.58	100	194	QP	V
		886.6	37.56	-8.44	46	35.8	29	4.3	31.54	100	360	QP	V
		930	39.9	-6.1	46	37.14	29.49	4.47	31.2	100	176	QP	V
		960	40.38	-5.62	46	35.73	30.97	4.56	30.88	100	219	QP	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

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 **Margin** 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:

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					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)
802.11a CH 36 5180MHz		5150	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		5150	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. Margin (dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 5150MHz:

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. Margin (dB)

= Leve(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 5150MHz:

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. Margin (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

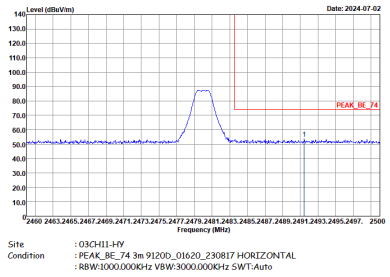
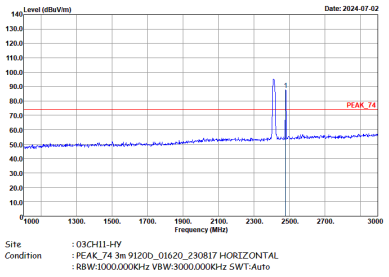
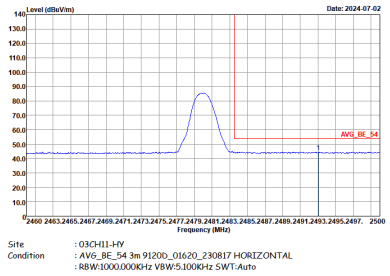
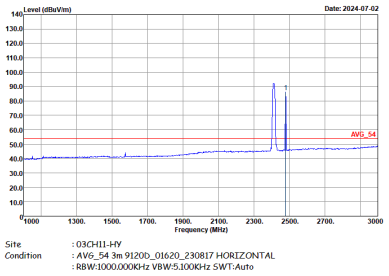
Test Engineer :	Yuan Lee, Fu Chen and Troye Hsieh	**Temperature :**	20.2~20.9°C
		Relative Humidity :	52.3~65.4%

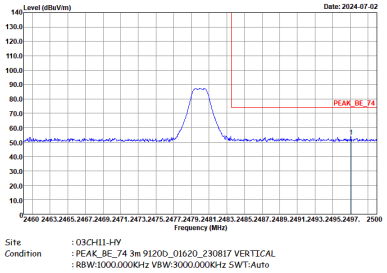
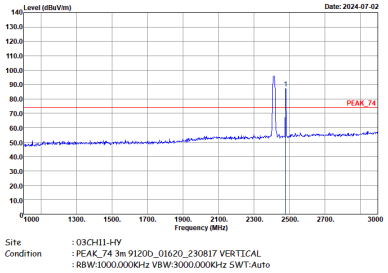
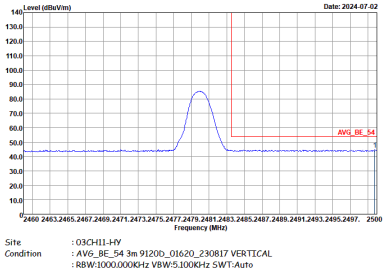
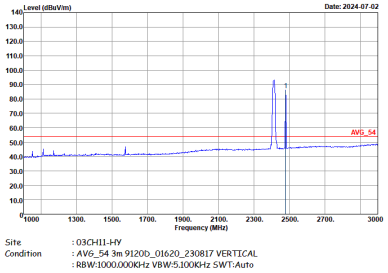
Note symbol

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

BLE 2Mbps CH39 + 802.11b CH06 + LTE NB-IoT Band 13 Link

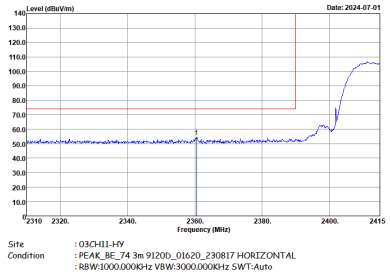
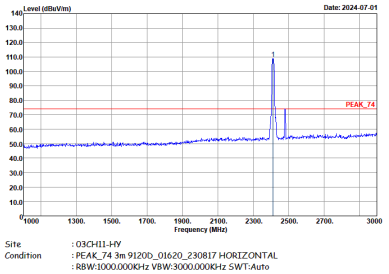
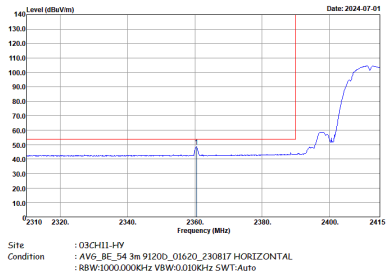
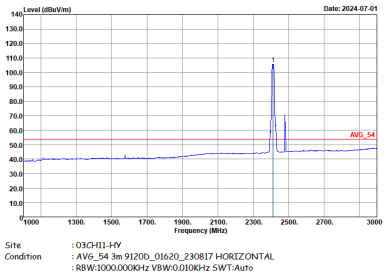
BLE (Band Edge @ 3m)

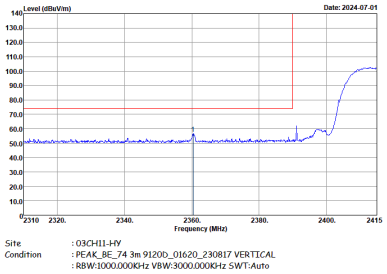
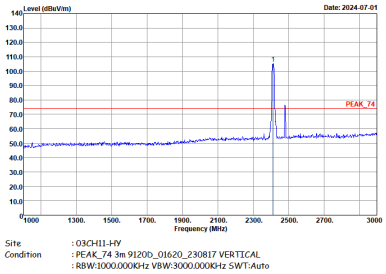
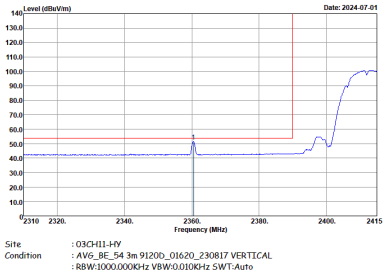
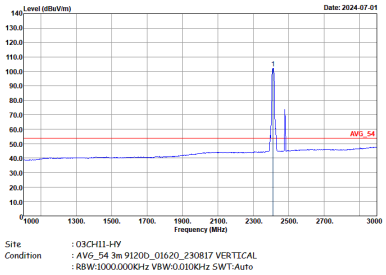
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
Ant.	BLE CH39 2480MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
Ant.	BLE CH39 2480MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m 9120D_01620_230817 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH11-HY Condition : PEAK_74 3m 9120D_01620_230817 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m 9120D_01620_230817 VERTICAL : RBW:1000.000KHz VBW:5.100KHz SWT:Auto	 Site : 03CH11-HY Condition : AVG_54 3m 9120D_01620_230817 VERTICAL : RBW:1000.000KHz VBW:5.100KHz SWT:Auto

2.4GHz 2400~2483.5MHz

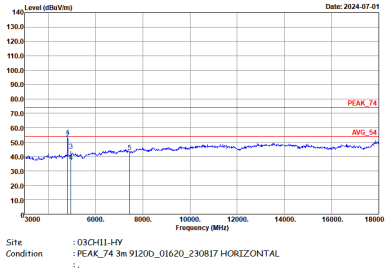
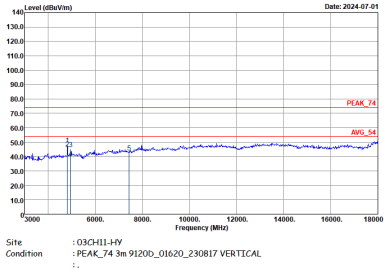
WIFI 802.11b (Band Edge @ 3m)

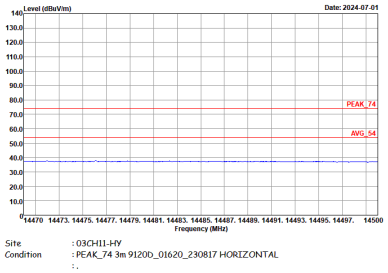
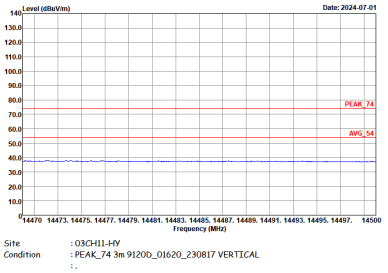
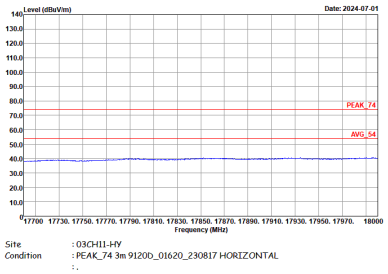
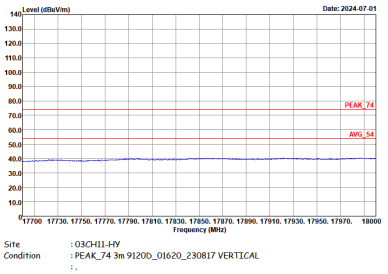
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
Ant.	802.11b CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

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

BLE 2Mbps CH39 + 802.11b CH06 + LTE NB-IoT Band 13 Link

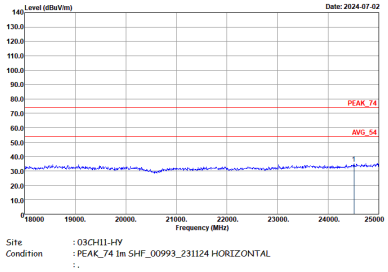
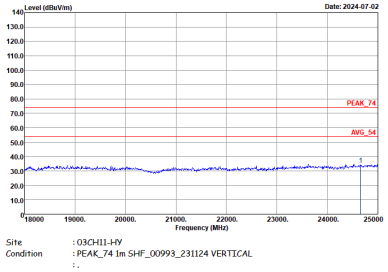
BLE 2Mbps + WIFI 802.11b (Harmonic @ 3m)

	Harmonic @ 3m	
Ant.	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
Simultaneously	Horizontal	Vertical
Peak Avg.		

	Harmonic @ 3m	
Ant.	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
Simultaneously	Horizontal	Vertical
14.47G ~14.5G Avg.		
17.7G ~18G Avg.		

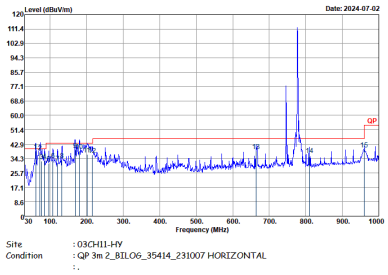
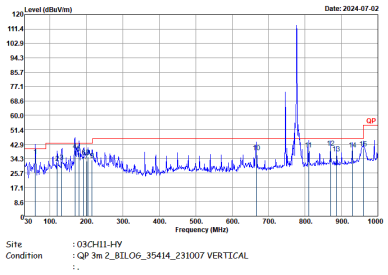
Emission above 18GHz

BLE + WIFI 802.11b + LTE NB-IoT Band 13 (SHF)

	SHF	
Ant.	2.4GHz 2400~2483.5MHz	
Simultaneously	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

BLE 2Mbps CH39 + 802.11b CH06 + LTE NB-IoT Band 13 Link (LF)

	LF	
Ant.	**2.4GHz 2400~2483.5MHz**	
Simultaneously	**Horizontal**	**Vertical**
QP / Peak		

Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth - LE for 2Mbps	32.69	204	4.902	5.1KHz
802.11b	100.00	-	-	10Hz

Bluetooth - LE for 1Mbps	802.11b