





# **FCC C2PC Test Report**

FCC ID : SQG-LWB5PLUS

Equipment : Sterling-LWB5+ WiFi 5 + Bluetooth 5.2 USB

**Adapter PCBA** 

Model No. : Sterling LWB5+

Brand Name : Laird Connectivity

Applicant : Laird Connectivity LLC

Address : W66N220 Commerce Court, Cedarburg, WI

53012 United States Of America

Standard : 47 CFR FCC Part 15.247

Received Date : Nov. 21, 2022

Tested Date : Nov. 28 ~ Dec. 02, 2022

We, International Certification Corporation, would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: Approved by:

Along Chen Assistant Manager Gary Chang / Manager

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**Appendix C. AC Power Line Conducted Emissions** 



## **Release Record**

Report No.	Version	Description	Issued Date
FR061103-09AE	Rev. 01	Initial issue	Dec. 16, 2022

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## **Summary of Test Results**

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	[dBuV]: 2.409MHz 26.02 (Margin -19.98dB) - AV	Pass
15.247(d)	Unwanted Emissions	[dBuV/m at 3m]: 88.18MHz	Pass
15.209	Onwanted Emissions	32.26 (Margin -11.24dB) - PK	F a 3 3
15.247(b)(3)	Conducted Output Power	Power [dBm]: 9.01	Pass

#### **Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

#### **Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

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## 1 General Description

### 1.1 Information

This report is prepared for FCC class II change.

This report is issued as a duplicate report to original ICC report no. FR061103AE. The modification is concerned with following items:

- ♦ Adding a carrier board
- ♦ Changing product name and applicant
- ♦ Changing antenna model name

Therefore, related test items had been performed and presented in the following sections.

### 1.1.1 Specification of the Equipment under Test (EUT)

RF General Information							
Frequency Range (MHz) Bluetooth Ch. Freq. (MHz) Channel Number Data Rate							
2400-2483.5 LE 2402-2480 0-39 [40] 1 Mbps							
Note: Bluetooth LE (Low energy) uses GFSK modulation.							

#### 1.1.2 Antenna Details

Ant. No.	Manufacturer Model		Laird Part Number	Туре	Connector	Antenna Gain (dBi)
1	ACX	AD1608-A2455AA_/LF	NA	Chip Antenna	N/A	1.0

## 1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc

#### 1.1.4 Accessories

N/A

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## 1.1.5 Channel List

	Frequency	band (MHz)			2400~	2483.5	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

## 1.1.6 Test Tool and Duty Cycle

Test Tool	Blue tool, Version: 1.9.8.6				
Modulation Mode	Duty Cycle Of Test Signal (%) Duty Factor (dB)				
BT-LE(1Mbps)	63.89%	1.95			

## 1.1.7 Power Index of Test Tool

Modulation Mode		Test Frequency (MHz)	
Wodulation Wode	2402	2440	2480
BT-LE(1Mbps)	9	9	9

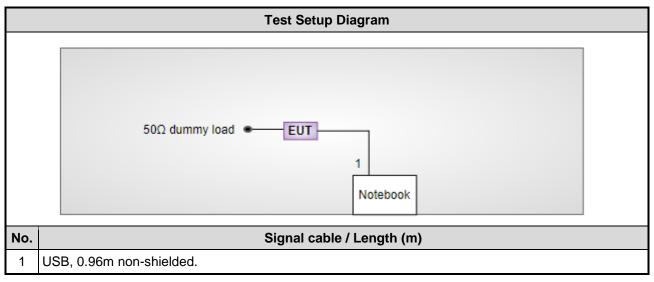
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## 1.2 Local Support Equipment List

Support Equipment List							
No.	Equipment	Brand	Model	FCC ID	Remarks		
1	Notebook	DELL	Latitude 5400	DoC			
2	50Ω terminator						

## 1.3 Test Setup Chart



Note: The notebook is disconnected from EUT and removed from test table when EUT is set to transmit continuously.

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## 1.4 Test Equipment List and Calibration Data

Test Item	Conducted Emission							
Test Site	Conduction room 1 / (CO01-WS)							
Tested Date	Dec. 01, 2022							
Instrument	Brand Model No. Serial No. Calibration Date Calibration Until							
Receiver	Feb. 16, 2022	Feb. 15, 2023						
LISN	R&S	ENV216	101579	Apr. 21, 2022	Apr. 20, 2023			
LISN (Support Unit)	SCHWARZBECK	Schwarzbeck 8127	8127667	Jan .07, 2022	Jan .06, 2023			
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 17, 2022	Oct. 16, 2023			
50 ohm terminal (Support Unit) NA 50 01 May 10, 2022 May 09								
Measurement Software	MANUAL ALIDIX I E3 I 6 120210k I NA I NA							
Note: Calibration Inter	rval of instruments liste	d above is one year.						

Test Item	Radiated Emission							
Test Site	966 chamber1 / (03Cl	H01-WS)						
Tested Date	Nov. 28, 2022							
Instrument	Brand Model No. Serial No. Calibration Date Calibration Ur							
Receiver	R&S	ESR3	101657	Mar. 15, 2022	Mar. 14, 2023			
Spectrum Analyzer	R&S	FSV40	101498	Nov. 21, 2022	Nov. 20, 2023			
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 01, 2022	Oct. 31, 2023			
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Aug. 03, 2022	Aug. 02, 2023			
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1095	Sep. 16, 2022	Sep. 15, 2023			
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Oct. 27, 2022	Oct. 26, 2023			
Preamplifier	EMC	EMC02325	980225	Jun. 28, 2022	Jun. 27, 2023			
Preamplifier	EMC	EMC118A45SE	980898	Jul. 16, 2022	Jul. 15, 2023			
Preamplifier	EMC	EMC184045SE	980903	Jul. 16, 2022	Jul. 15, 2023			
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 04, 2022	Oct. 03, 2023			
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 04, 2022	Oct. 03, 2023			
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 04, 2022	Oct. 03, 2023			
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 04, 2022	Oct. 03, 2023			
RF Cable	EMC	EMC104-35M-35M- 8000	210920	Oct. 04, 2022	Oct. 03, 2023			
RF Cable	EMC	EMC104-35M-35M- 3000	210922	Oct. 04, 2022	Oct. 03, 2023			
Measurement Software	AUDIX	e3	6.120210g	NA	NA			

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Test Item	RF Conducted						
Test Site	(TH01-WS)	(TH01-WS)					
Tested Date	Dec. 02, 2022						
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until		
Spectrum Analyzer	R&S	FSV40	101910	Apr. 08, 2022	Apr. 07, 2023		
Power Meter	Anritsu	ML2495A	1241002	Nov. 23, 2022	Nov. 22, 2023		
Power Sensor	Anritsu	MA2411B	1207366	Nov. 23, 2022	Nov. 22, 2023		
Measurement Software	Sporton	SENSE-15247_DTS	V5.10.8.7.3	NA	NA		
Note: Calibration Inte	rval of instruments list	ted above is one year.		·			

### 1.5 Test Standards

47 CFR FCC Part 15.247 ANSI C63.10-2013

### 1.6 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

## 1.7 Deviation from Test Standard and Measurement Procedure

None

## 1.8 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

Measurement Uncertainty				
Parameters	Uncertainty			
Bandwidth	±34.130 Hz			
Conducted power	±0.808 dB			
Power density	±0.583 dB			
Conducted emission	±2.715 dB			
AC conducted emission	±2.92 dB			
Unwanted Emission ≤ 1GHz	±3.41 dB			
Unwanted Emission > 1GHz	±4.59 dB			

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## 2 Test Configuration

## 2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	CO01-WS, 03CH01-WS, TH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

FCC Designation No.: TW2732FCC site registration No.: 181692

➤ ISED#: 10807A

➤ CAB identifier: TW2732

## 2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Test Configuration
AC Power Line Conducted Emissions	BT-LE(1Mbps)	2402	
Unwanted Emissions ≤ 1GHz	BT-LE(1Mbps)	2402	
Unwanted Emissions > 1GHz	BT-LE(1Mbps)	2402	
Conducted Output Power	BT-LE(1Mbps)	2402, 2440, 2480	

#### NOTE:

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<sup>1.</sup> The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Y-plane** results were found as the worst case and were shown in this report.

<sup>2.</sup>  $50\Omega$  terminator was connected to antenna port of EUT for radiated emission measurement.



## 3 Transmitter Test Results

## 3.1 Conducted Output Power

### 3.1.1 Limit of Conducted Output Power

Conducted power shall not exceed 1Watt.

Antenna gain <= 6dBi, no any corresponding reduction is in output power limit.

#### 3.1.2 Test Procedures

A broadband RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

#### 3.1.3 Test Setup



#### 3.1.4 Test Results

<b>Ambient Condition</b>	25°C / 67%	Tested By	Roger Lu
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Refer to Appendix A.

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### 3.2 Unwanted Emissions in Restricted Frequency Bands

#### 3.2.1 Limit of Unwanted Emissions in Restricted Frequency Bands

Restricted Band Emissions Limit						
Frequency Range (MHz)   Field Strength (uV/m)   Field Strength (dBuV/m)			Measure Distance (m)			
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300			
0.490~1.705	24000/F(kHz)	33.8 - 23	30			
1.705~30.0	30	29	30			
30~88	100	40	3			
88~216	150	43.5	3			
216~960	200	46	3			
Above 960	500	54	3			

#### Note 1:

Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit **Note 2:** 

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

#### 3.2.2 Test Procedures

- 1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
- 2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
- 3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

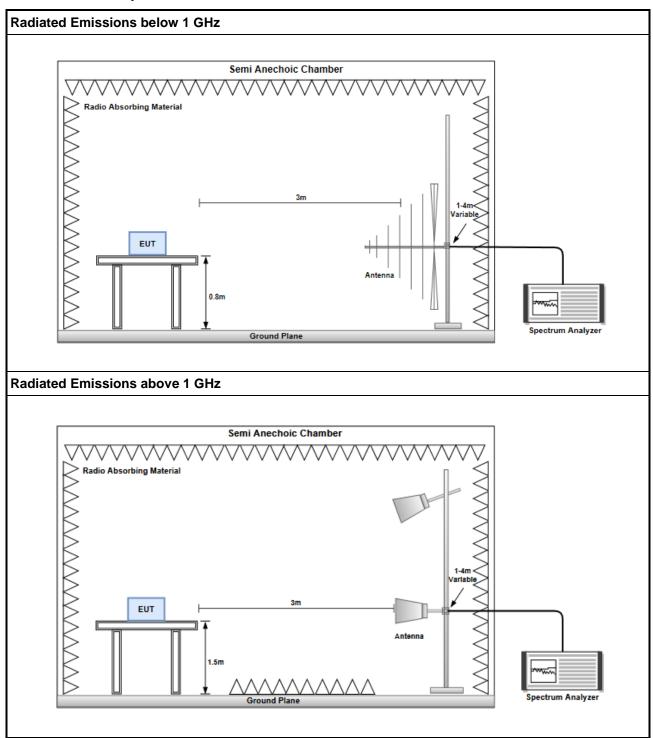
#### Note:

- 1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
- 2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
- RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

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## 3.2.3 Test Setup



### 3.2.4 Test Results

Refer to Appendix B.

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#### 3.3 AC Power Line Conducted Emissions

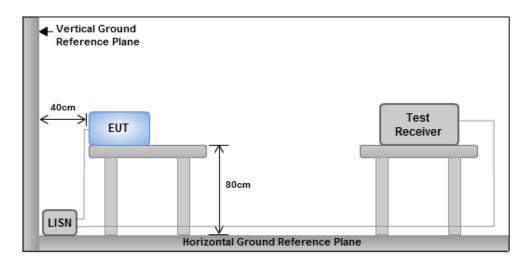
#### 3.3.1 Limit of AC Power Line Conducted Emissions

Conducted Emissions Limit					
Frequency Emission (MHz) Quasi-Peak Average					
66 - 56 *	56 - 46 *				
56	46				
5-30 60 50					
	66 - 56 * 56				

#### 3.3.2 Test Procedures

- 1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
- 2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50  $\Omega$  LISN port.
- 3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
- 4. This measurement was performed with AC 120V/60Hz

#### 3.3.3 Test Setup



Note: 1. Support units were connected to second LISN.

Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

#### 3.3.4 Test Results

Refer to Appendix C.

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## 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corporation (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <a href="http://www.icertifi.com.tw">http://www.icertifi.com.tw</a>.

#### Linkou

Tel: 886-2-2601-1640 No.30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan (R.O.C.)

#### Kwei Shan

Tel: 886-3-271-8666

No.3-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

No.2-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

### Kwei Shan Site II Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 333, Taiwan (R.O.C.)

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666 Fax: 886-3-318-0155

Email: ICC\_Service@icertifi.com.tw

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## Conducted Output Power (Peak)

Appendix A

Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	9.01	0.00796

### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	1.00	9.01	30.00
2440MHz	Pass	1.00	8.52	30.00
2480MHz	Pass	1.00	7.67	30.00



## Conducted Output Power (Average)

Appendix A

Summary

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	8.87	0.00771

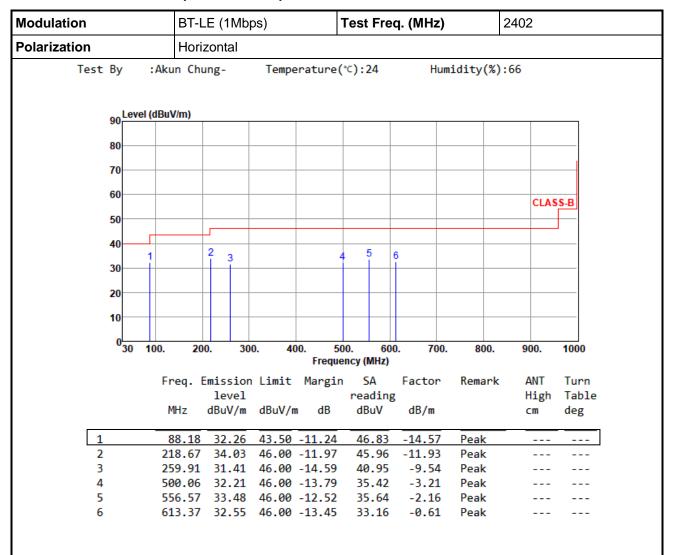
### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	1.00	8.87	-
2440MHz	Pass	1.00	8.37	-
2480MHz	Pass	1.00	7.50	-

Note: Average power is for reference only.



### **Unwanted Emissions (Below 1GHz)**



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

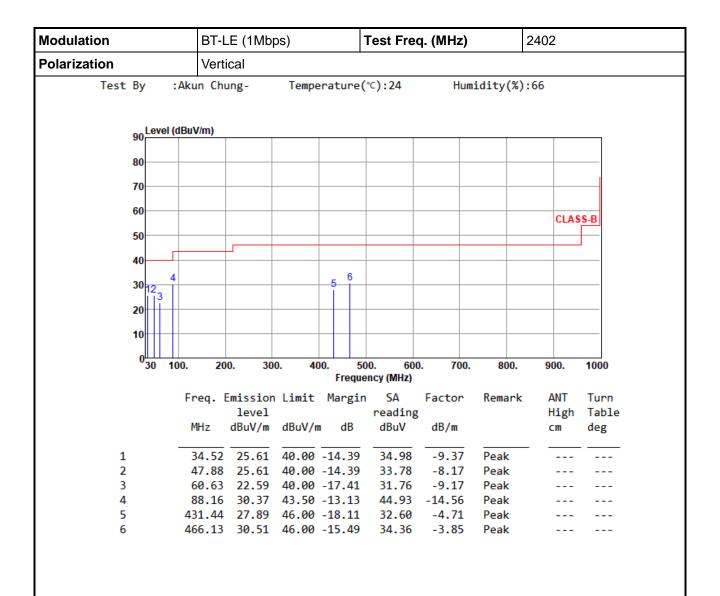
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

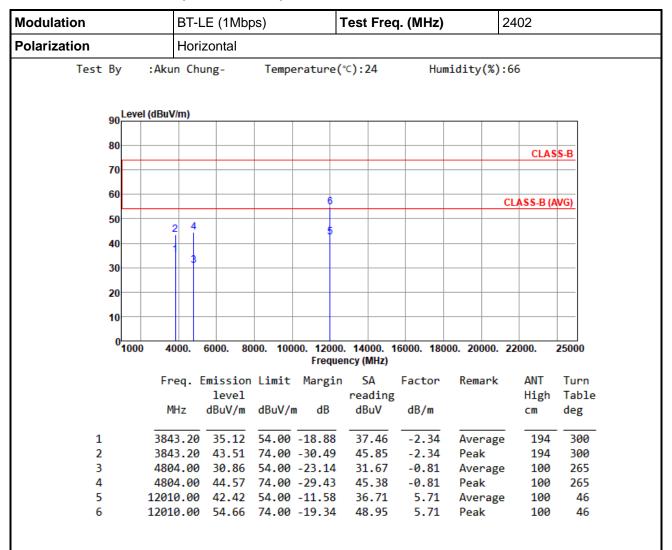
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.



### **Unwanted Emissions (Above 1GHz)**

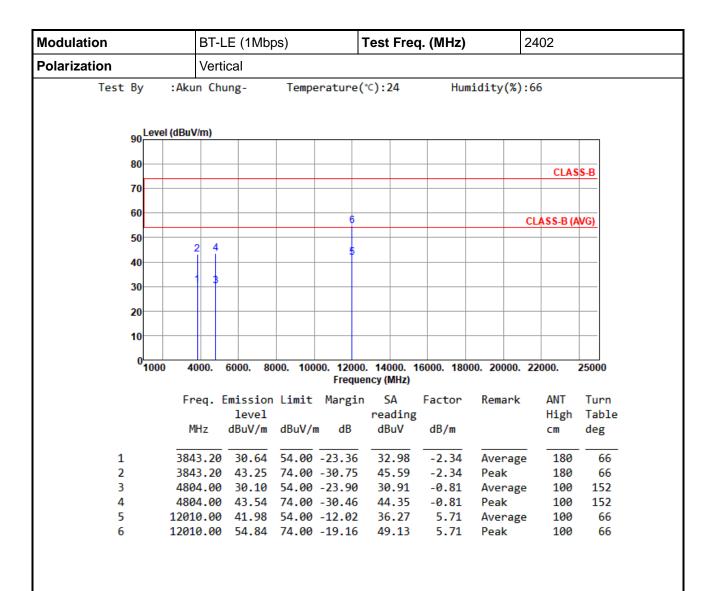


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).





Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



