

# FCC Co-Location Test Report

**FCC ID** : 2AXXQMLBADA  
**Equipment** : Location Bridge  
**Model No.** : MLB-AD-A  
**Brand Name** : MACHINEQ  
**Applicant** : Humax Networks, INC.  
**Address** : 216, Hwangsaеul-ro, Bundang-gu,  
Seongnam-si, South Korea  
**Standard** : 47 CFR FCC Part 15.247  
**Received Date** : Dec. 28, 2020  
**Tested Date** : Jan. 23 ~ Jan. 26, 2021

We, International Certification Corp., 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 may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:



Along Chen / Assistant Manager

Approved by:



Gary Chang / Manager



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## Release Record

Report No.	Version	Description	Issued Date
FR0D2803CO	Rev. 01	Initial issue	Feb. 03, 2021

## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 3304.30MHz 51.23 (Margin -2.77dB) - AV	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.

# 1 General Description

## 1.1 Information

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

LoRa	
Operating Frequency	902.3 ~ 914.9 MHz 903 ~ 914.2 MHz
Modulation Type	CSS
BT	
Operating Frequency	2402 MHz ~ 2480 MHz
Modulation Type	Bluetooth 5.0 LE: GFSK

### 1.1.2 Antenna Details

#### For BT

Ant. No.	Type	Connector	Gain (dBi)	Remarks
1	DIPOLE	MHF IPEX	6.14	V02
2	DIPOLE	MHF IPEX	6.96	V03

#### For LoRa

Ant. No.	Type	Connector	Gain (dBi)	Remarks
1	PIFA	N/A	2.18	---

### 1.1.3 Accessories

N/A

## 1.2 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2020	Dec. 03, 2021
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 10, 2020	Jul. 09, 2021
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 11, 2020	Dec. 10, 2021
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 06, 2020	Nov. 05, 2021
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 17, 2020	Nov. 16, 2021
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 06, 2020	Oct. 05, 2021
Preamplifier	EMC	EMC02325	980225	Jul. 03, 2020	Jul. 02, 2021
Preamplifier	Agilent	83017A	MY39501308	Sep. 26, 2020	Sep. 25, 2021
Preamplifier	EMC	EMC184045B	980192	Jul. 21, 2020	Jul. 20, 2021
RF Cable	EMC	EMC104-SM-SM-80 00	181106	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 06, 2020	Oct. 05, 2021
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 06, 2020	Oct. 05, 2021
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 06, 2020	Oct. 05, 2021
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 06, 2020	Oct. 05, 2021
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

### 1.3 Test Standards

47 CFR FCC Part 15.247

ANSI C63.10-2013

### 1.4 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

### 1.5 Deviation from Test Standard and Measurement Procedure

None

### 1.6 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
Radiated emission $\leq$ 1GHz	$\pm 3.41$ dB
Radiated emission $>$ 1GHz	$\pm 4.59$ dB

## 2 Test Configuration

### 2.1 Testing Facility

<b>Test Laboratory</b>	International Certification Corp.
<b>Test Site</b>	03CH01-WS
<b>Address of Test Site</b>	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- ISED#: 10807A
- CAB identifier: TW2732

### 2.2 The Worst Test Modes and Channel Details

Test item	Test Mode	Test Configuration
Radiated Emissions ≤ 1GHz	LoRa 125k 902.3 MHz + BLE 2402MHz	1, 2
Radiated Emissions > 1GHz	LoRa 125k 902.3 MHz + BLE 2402MHz	1

Note:

1. The selected channel is the maximum power channel of each BT and LoRa module.
2. The test configurations are listed as follows:
  - Configuration 1: POE Mode
  - Configuration 2 : Adapter Mode



## 3 Transmitter Test Results

### 3.1 Unwanted Emissions into Restricted Frequency Bands

#### 3.1.1 Limit of Unwanted Emissions into 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.

#### 3.1.2 Test Procedures

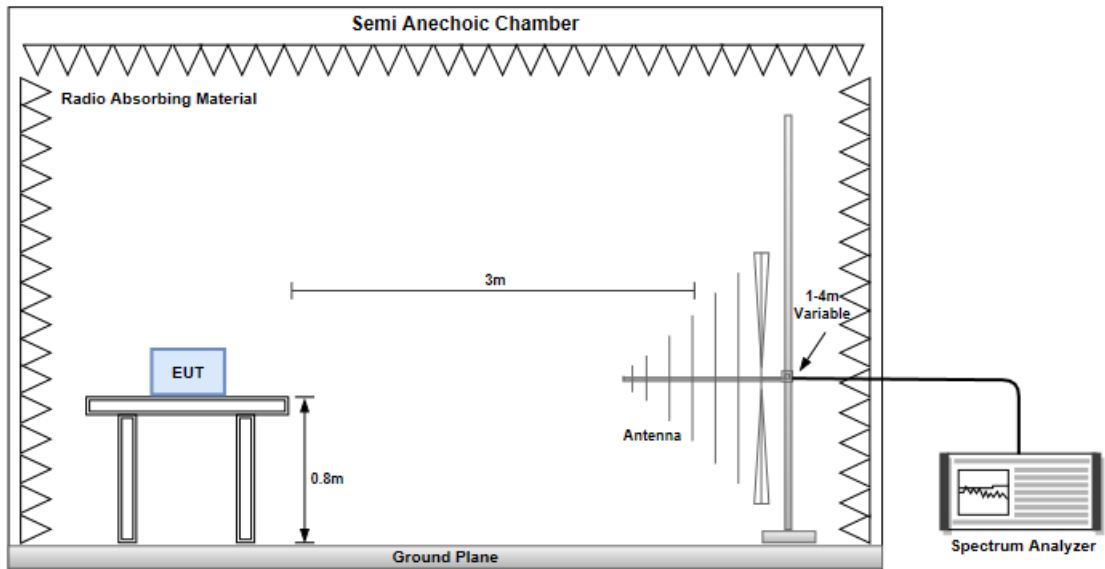
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission 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:**

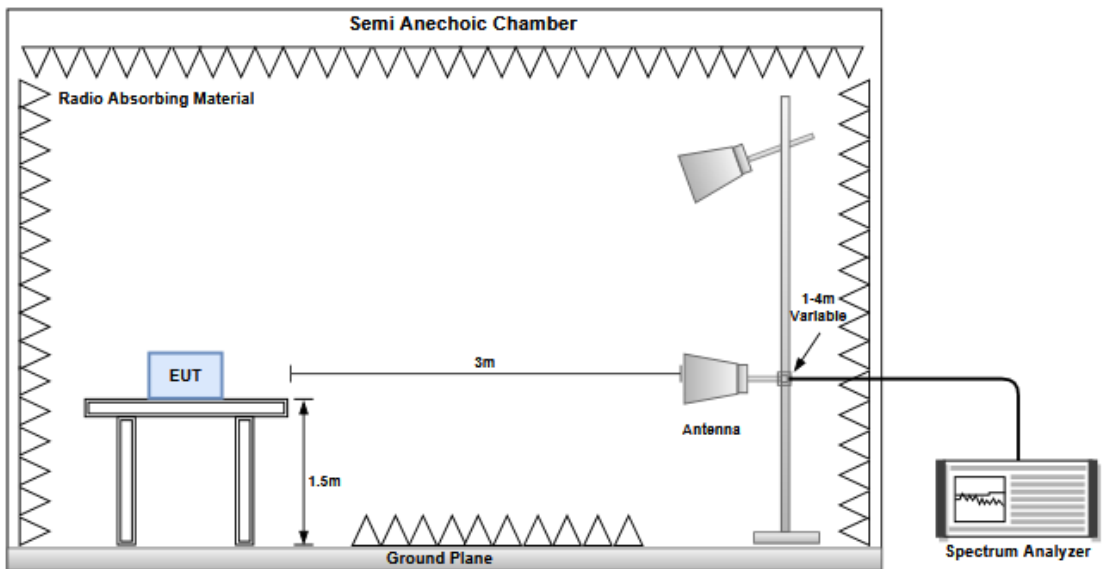
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

### 3.1.3 Test Setup

#### Radiated Emissions below 1 GHz

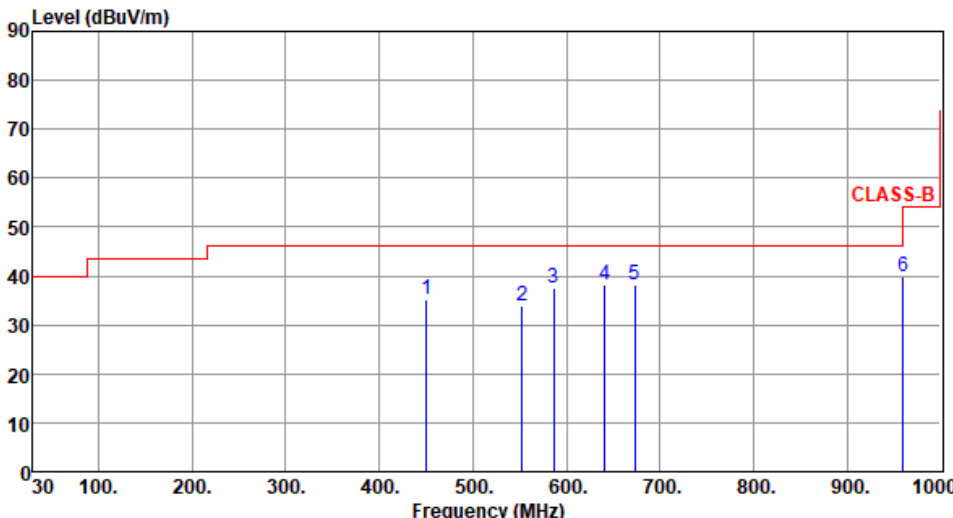


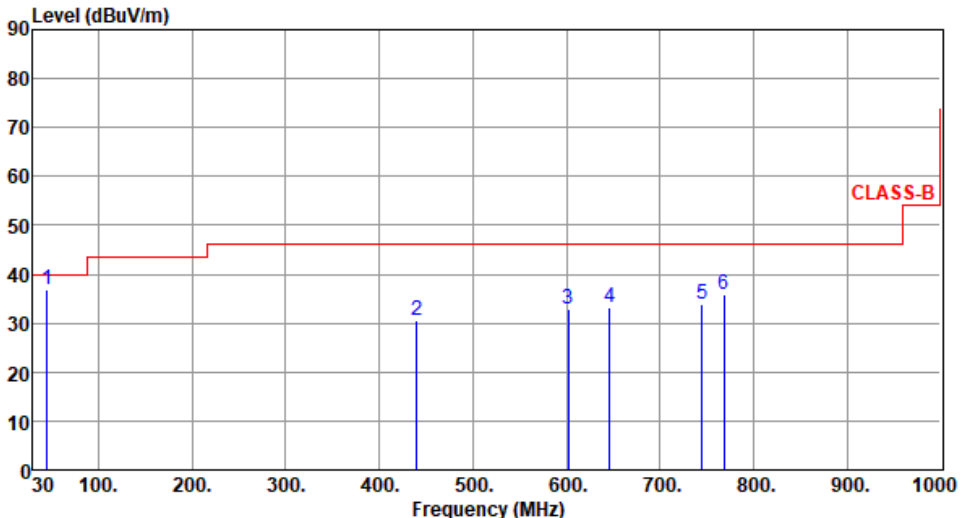
#### Radiated Emissions above 1 GHz



## Configuration 1 : POE Mode

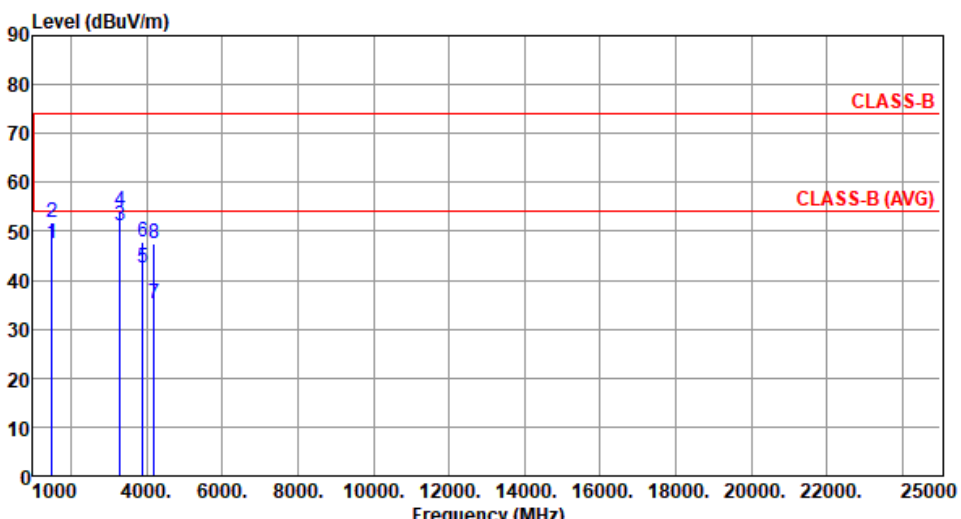
### 3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

<b>Test Mode</b>	LoRa 125k 902.3 MHz + BLE 2402MHz									
<b>Polarization</b>	Horizontal									
Test By : Akun Chung			Temperature(°C): 25			Humidity(%): 64				
 <p>The graph displays the emission level in dBuV/m on the y-axis (0 to 90) against frequency in MHz on the x-axis (30 to 1000). A red line represents the CLASS-B limit, which is constant at 46 dBuV/m from 100 MHz to 1000 MHz. Six blue vertical lines indicate measured peaks at various frequencies: 1 (450.40 MHz), 2 (552.80 MHz), 3 (586.40 MHz), 4 (640.80 MHz), 5 (672.80 MHz), and 6 (960.00 MHz). The emission levels for these peaks are 35.25, 33.77, 37.66, 38.04, 38.28, and 39.88 dBuV/m, respectively. The margin between the emission level and the limit is shown in the table below.</p>										
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High cm	Turn Table deg	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB				
1	450.40	35.25	46.00	-10.75	39.47	-4.22	Peak	---	---	
2	552.80	33.77	46.00	-12.23	36.04	-2.27	Peak	---	---	
3	586.40	37.66	46.00	-8.34	39.04	-1.38	Peak	---	---	
4	640.80	38.04	46.00	-7.96	38.30	-0.26	Peak	---	---	
5	672.80	38.28	46.00	-7.72	38.54	-0.26	Peak	---	---	
6	960.00	39.88	46.00	-6.12	35.11	4.77	Peak	---	---	
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)            *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.</p>										

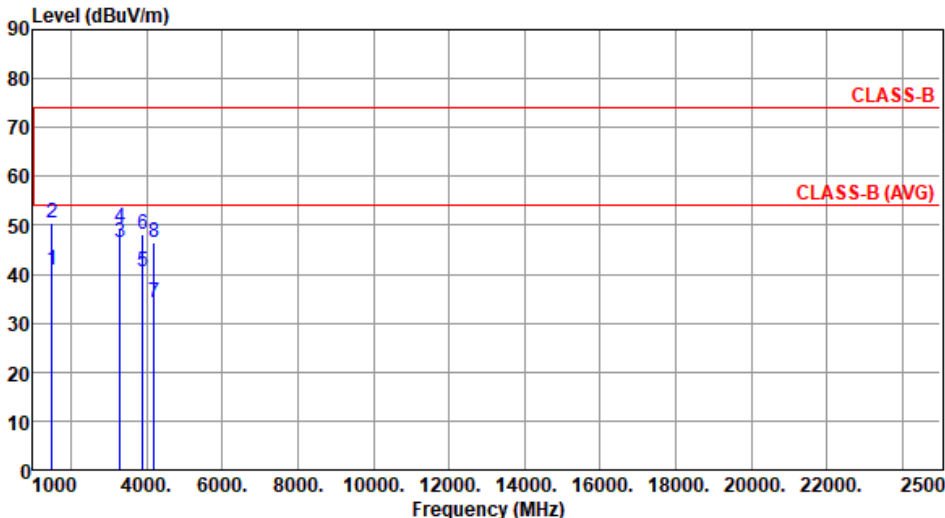
<b>Test Mode</b>	LoRa 125k 902.3 MHz + BLE 2402MHz									
<b>Polarization</b>	Vertical									
Test By : Akun Chung			Temperature(°C): 25			Humidity(%): 64				
										
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg	
1	45.30	36.80	40.00	-3.20	45.07	-8.27	Peak	---	---	
2	440.31	30.44	46.00	-15.56	35.01	-4.57	Peak	---	---	
3	602.30	32.74	46.00	-13.26	33.78	-1.04	Peak	---	---	
4	645.95	33.27	46.00	-12.73	33.50	-0.23	Peak	---	---	
5	744.89	33.87	46.00	-12.13	32.33	1.54	Peak	---	---	
6	768.17	35.75	46.00	-10.25	33.85	1.90	Peak	---	---	

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

### 3.1.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

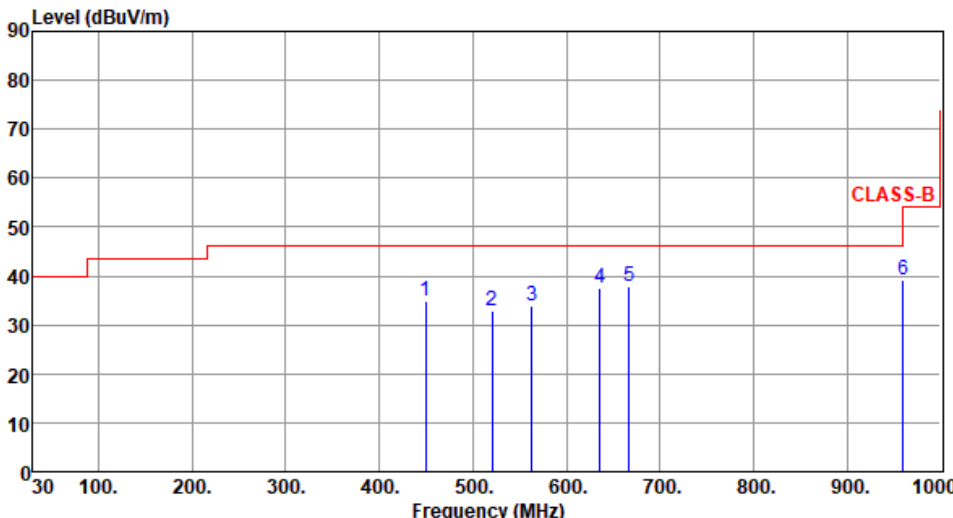
<b>Test Mode</b>	LoRa 125k 902.3 MHz + BLE 2402MHz									
<b>Polarization</b>	Horizontal									
Test By : Akun Chung			Temperature(°C): 24			Humidity(%): 66				
										
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg	
1	1499.70	47.40	54.00	-6.60	53.95	-6.55	Average	192	322	
2	1499.70	51.85	74.00	-22.15	58.40	-6.55	Peak	192	322	
3	3304.30	51.23	54.00	-2.77	52.26	-1.03	Average	314	163	
4	3304.30	54.00	74.00	-20.00	55.03	-1.03	Peak	314	163	
5	3901.70	42.40	54.00	-11.60	41.63	0.77	Average	354	339	
6	3901.70	47.96	74.00	-26.04	47.19	0.77	Peak	354	339	
7	4206.60	35.29	54.00	-18.71	33.68	1.61	Average	380	324	
8	4206.60	47.46	74.00	-26.54	45.85	1.61	Peak	380	324	

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB)  
\*Factor includes antenna factor , cable loss and amplifier gain  
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

<b>Test Mode</b>	LoRa 125k 902.3 MHz + BLE 2402MHz								
<b>Polarization</b>	Vertical								
Test By	:Akun Chung	Temperature(°C)	:24	Humidity(%)	:66				
									
	Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn
	MHz	level	dBuV/m	dB	reading	dB		High	Table
		dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg
1	1499.70	40.97	54.00	-13.03	47.52	-6.55	Average	355	130
2	1499.70	50.33	74.00	-23.67	56.88	-6.55	Peak	355	130
3	3304.30	46.46	54.00	-7.54	47.49	-1.03	Average	383	101
4	3304.30	49.57	74.00	-24.43	50.60	-1.03	Peak	383	101
5	3901.70	40.49	54.00	-13.51	39.72	0.77	Average	323	121
6	3901.70	48.10	74.00	-25.90	47.33	0.77	Peak	323	121
7	4206.60	34.19	54.00	-19.81	32.58	1.61	Average	380	125
8	4206.60	46.49	74.00	-27.51	44.88	1.61	Peak	380	125
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)  *Factor includes antenna factor , cable loss and amplifier gain  Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>									

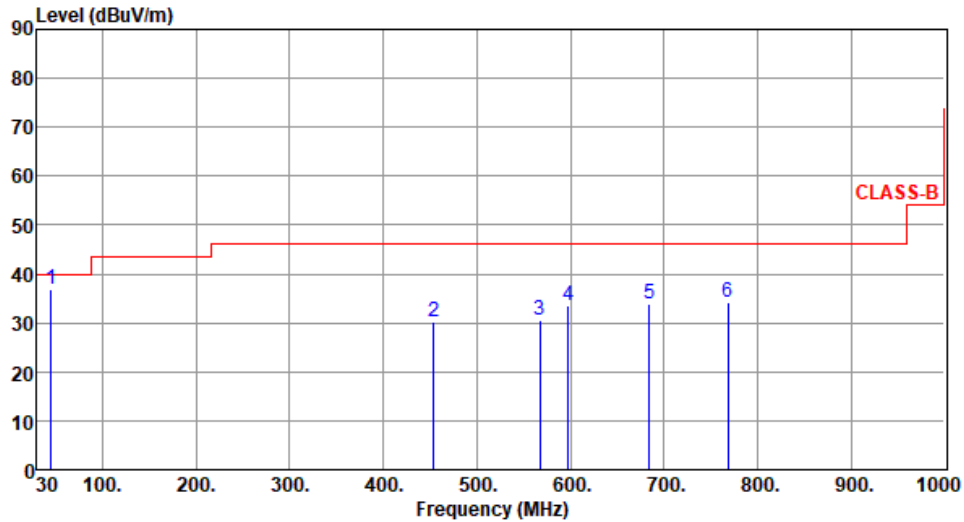
## Configuration 2 : Adapter Mode

### 3.1.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

<b>Test Mode</b>	LoRa 125k 902.3 MHz + BLE 2402MHz									
<b>Polarization</b>	Horizontal									
Test By : Akun Chung			Temperature(°C): 25			Humidity(%): 64				
 <p>The graph displays the radiated unwanted emissions. The y-axis represents Level (dBuV/m) from 0 to 90, and the x-axis represents Frequency (MHz) from 30 to 1000. A red line indicates the CLASS-B limit, which is constant at 46 dBuV/m from 100 MHz to 1000 MHz. Six peaks are identified with blue vertical lines and numbered 1 through 6. Peak 1 is at 450.01 MHz, peak 2 at 520.82 MHz, peak 3 at 563.50 MHz, peak 4 at 636.25 MHz, peak 5 at 667.29 MHz, and peak 6 at 960.00 MHz. All peaks are below the 46 dBuV/m limit.</p>										
	Freq.	Emission	Limit	Margin	SA	Factor	Remark	ANT	Turn	
	MHz	level	dBuV/m	dB	reading	dB		High	Table	
		dBuV/m			dBuV			cm	deg	
1	450.01	34.88	46.00	-11.12	39.11	-4.23	Peak	---	---	
2	520.82	32.86	46.00	-13.14	35.65	-2.79	Peak	---	---	
3	563.50	33.91	46.00	-12.09	35.96	-2.05	Peak	---	---	
4	636.25	37.46	46.00	-8.54	37.80	-0.34	Peak	---	---	
5	667.29	37.75	46.00	-8.25	37.92	-0.17	Peak	---	---	
6	960.00	39.08	46.00	-6.92	34.31	4.77	Peak	---	---	
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)            *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.</p>										

<b>Test Mode</b>	LoRa 125k 902.3 MHz + BLE 2402MHz
<b>Polarization</b>	Vertical

Test By :Akun Chung      Temperature(°C):25      Humidity(%):64



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	45.30	36.70	40.00	-3.30	44.97	-8.27	Peak	---	---
2	453.89	30.19	46.00	-15.81	34.33	-4.14	Peak	---	---
3	567.38	30.48	46.00	-15.52	32.45	-1.97	Peak	---	---
4	597.45	33.57	46.00	-12.43	34.72	-1.15	Peak	---	---
5	684.75	33.92	46.00	-12.08	33.93	-0.01	Peak	---	---
6	768.17	34.30	46.00	-11.70	32.40	1.90	Peak	---	---

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

\*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.



## 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 Corp (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 <http://www.icertifi.com.tw>.

### **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 District, Tao Yuan City  
333, Taiwan, R.O.C.

### **Kwei Shan Site II**

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd  
St., Kwei Shan District, 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

==END==