FCC Co-Location Test Report

FCC ID	:	**MXF-WLRGFM100**
Equipment	:	**IOT Femto Gateway**
Model No.	:	**WLRGFM-100**
Brand Name	:	**Browan**
Applicant	:	**Gemtek Technology Co., Ltd.**
Address	:	**No. 15-1 Zhonghua Road, Hsinchu Industrial Park, Hukou, Hsinchu, Taiwan, 30352.**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**May 17, 2022**
Tested Date	:	**May 27 ~ May 30, 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**

Table of Contents

1 GENERAL DESCRIPTION 5

1.1 Information 5

1.2 The Equipment List 7

1.3 Test Standards 7

1.4 Reference Guidance 7

1.5 Deviation from Test Standard and Measurement Procedure 7

1.6 Measurement Uncertainty 8

2 TEST CONFIGURATION 9

2.1 Testing Facility 9

2.2 The Worst Test Modes and Channel Details 9

3 TRANSMITTER TEST RESULTS 10

3.1 Unwanted Emissions into Restricted Frequency Bands 10

4 TEST LABORATORY INFORMATION 11

Appendix A. Unwanted Emissions Into Restricted Frequency Bands

Release Record

Report No.	Version	Description	Issued Date
FR741001-04CO	Rev. 01	Initial issue	Jun. 29, 2022

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 58.69MHz 35.81 (Margin -4.19dB) - QP	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

This is a Class II Permissive Change report (C2PC).

This report is issued as a supplementary report to original report no. FR741001CO. The modifications are listed as table below:

Changing list

Report No.	Description of the change	Description
FR741001CO	V01	Original report.
FR741001-02CO	V02	C1PC
FR741001-04CO	V02A	C2PC

Item	V01	V02
Pin Direction of LED1,2,3,4	Same	LED 1 / 3: Horizontal LED 2 / 4: Vertical
Pad size for Antenna card	Original design	Modified to bigger size
Location of R116A, R105, R103, R116	Original design	Downward 2~3 mm Direction of R116A is rotated 90o
Lora RF cable connector	I-PEX	MMCX

Item	V02	V02A
MB-PCB version	V02	V02A
RF card connector	MMCX	Ipex
RF cable	MMCX, 120mm	MMCX to Ipex, 95mm

1.1.1 Specification of the Equipment under Test (EUT)

WLAN	
Operating Frequency	802.11b/g/n: 2412 MHz ~ 2462 MHz
Modulation Type	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
LoRa	
Operating Frequency	923.3 MHz ~ 927.5 MHz
Modulaton Type	CSS

1.1.2 Antenna Details

For WLAN

Ant. No.	Type	Connector	Gain (dBi)	Remark
1	Monopole	No	3.60	---
2	Monopole	No	3.42	---

For LoRa

Ant. No.	Type	Connector	Gain (dBi)	Remark
1	Dipole	SMA	0.28	External antenna
2	Printed	I-PEX	-0.39	Internal antenna

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from adapter

1.2 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Tested Date	May 27 ~ May 30, 2022				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Receiver	R&S	ESR3	101657	Mar. 15, 2022	Mar. 14, 2023
Spectrum Analyzer	R&S	FSV40	101498	Nov. 29, 2021	Nov. 28, 2022
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 08, 2021	Nov. 07, 2022
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jun. 30, 2021	Jun. 29, 2022
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 03, 2021	Dec. 02, 2022
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Jan. 11, 2022	Jan. 10, 2023
Preamplifier	EMC	EMC02325	980225	Jun. 29, 2021	Jun. 28, 2022
Preamplifier	Agilent	83017A	MY39501308	Sep. 28, 2021	Sep. 27, 2022
Preamplifier	EMC	EMC184045B	980192	Jul. 14, 2021	Jul. 13, 2022
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 05, 2021	Oct. 04, 2022
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 05, 2021	Oct. 04, 2022
LF cable 11M	EMC	EMCCFD400-NW-NW-11000	200801	Oct. 05, 2021	Oct. 04, 2022
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	160502	Oct. 05, 2021	Oct. 04, 2022
RF Cable	EMC	EMC104-35M-35M-8000	210920	Oct. 05, 2021	Oct. 04, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 05, 2021	Oct. 04, 2022
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**
Unwanted Emission ≤ 1GHz	±3.41 dB
Unwanted Emission > 1GHz	±4.59 dB

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	03CH01-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.: TW2732
- FCC site registration No.: 181692
- ISED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode
Unwanted Emissions	2.4G 11g ch6 + LoRa 927.5MHz

Note:

1. Test configuration are listed as listed as follows:
   Test Configuration 1: Wifi module + LoRa module with external antenna
   Test Configuration 2: Wifi module + LoRa module with internal antenna
2. The selected channel is the maximum power channel of Wifi & LoRa module

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

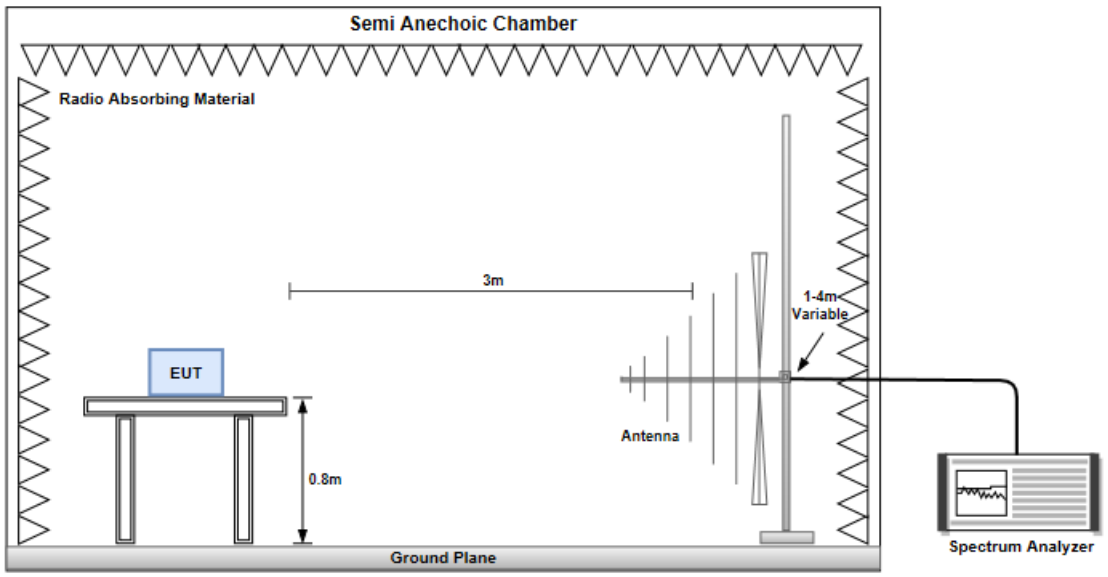
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

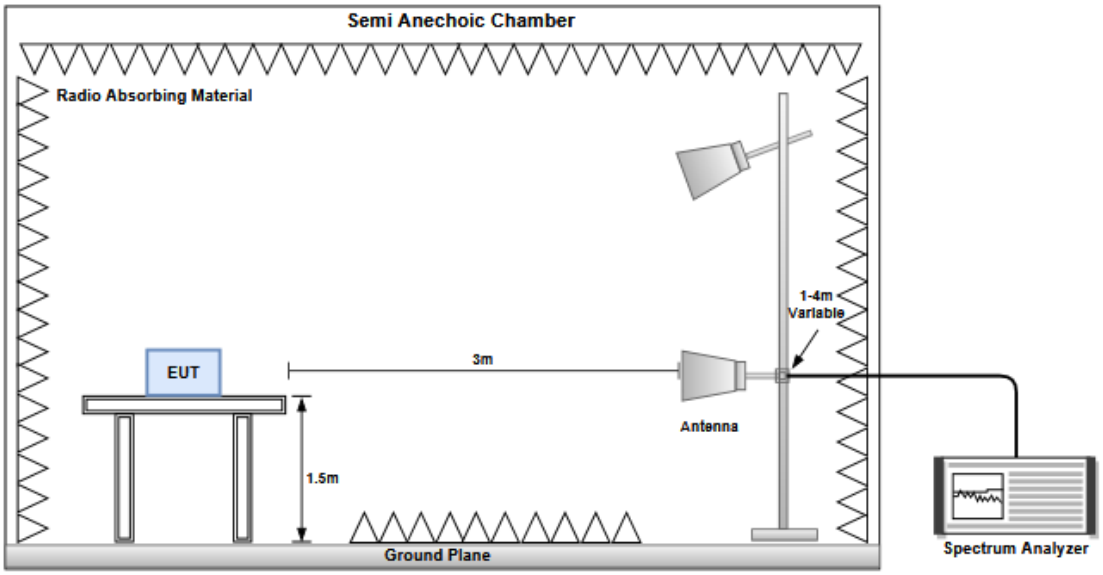
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.1.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



3.1.4 Test Results

Refer to Appendix A.

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 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 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: 886-3-318-0345
Email: ICC_Service@icertifi.com.tw

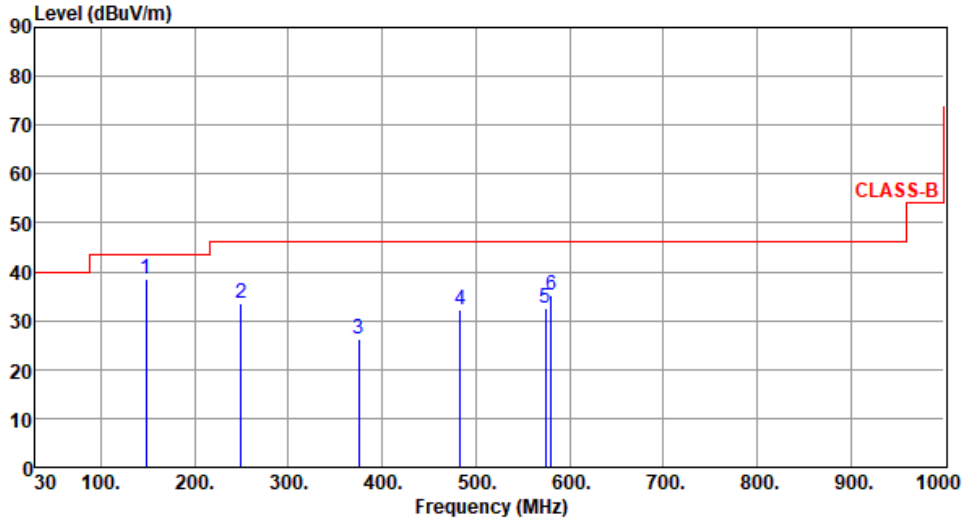
==END==

Test Configuration 1: Wifi module + LoRa module with external antenna

Unwanted Emissions (Below 1GHz)

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Horizontal

Test By :Roger Lu Temperature(℃):25 Humidity(%):66

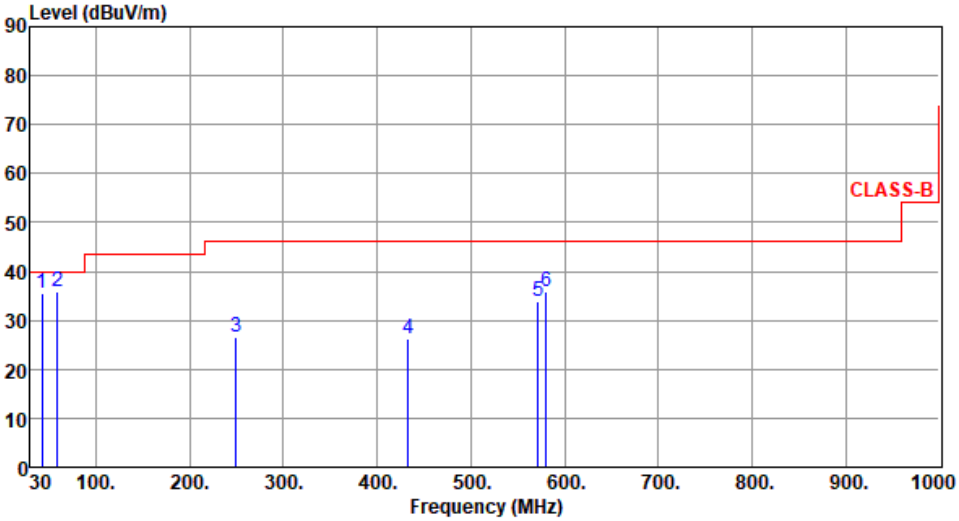


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	148.56	38.66	43.50	-4.84	47.68	-9.02	Peak	---	---
2	249.60	33.47	46.00	-12.53	43.54	-10.07	Peak	---	---
3	375.20	26.36	46.00	-19.64	32.69	-6.33	Peak	---	---
4	483.20	32.29	46.00	-13.71	36.03	-3.74	Peak	---	---
5	574.40	32.44	46.00	-13.56	34.24	-1.80	Peak	---	---
6	580.00	35.20	46.00	-10.80	36.86	-1.66	Peak	---	---

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.

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Vertical

Test By :Roger Lu Temperature(℃):25 Humidity(%):66



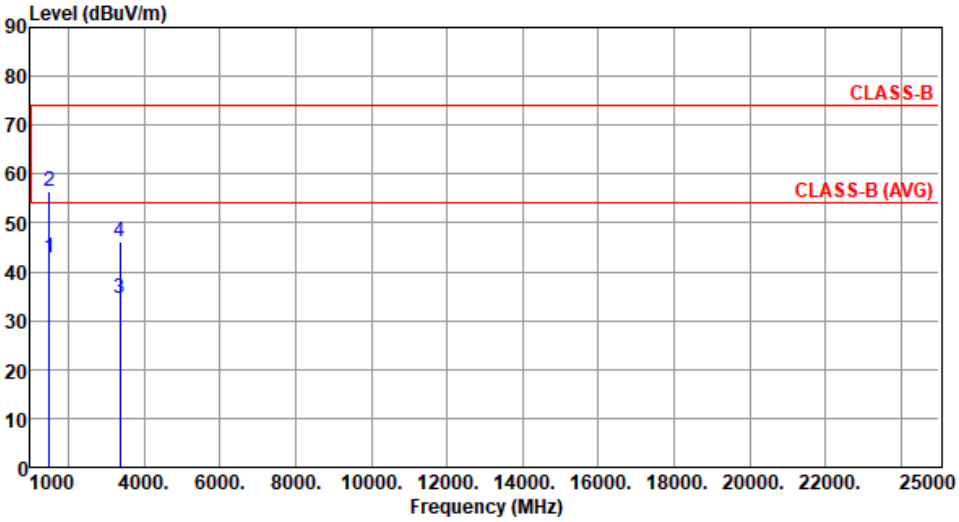
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	42.58	35.66	40.00	-4.34	44.11	-8.45	Peak	---	---
2	58.69	35.81	40.00	-4.19	45.12	-9.31	QP	100	268
3	249.60	26.51	46.00	-19.49	36.58	-10.07	Peak	---	---
4	432.80	26.37	46.00	-19.63	31.10	-4.73	Peak	---	---
5	572.00	33.95	46.00	-12.05	35.80	-1.85	Peak	---	---
6	580.00	35.72	46.00	-10.28	37.38	-1.66	Peak	---	---

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)

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Horizontal

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

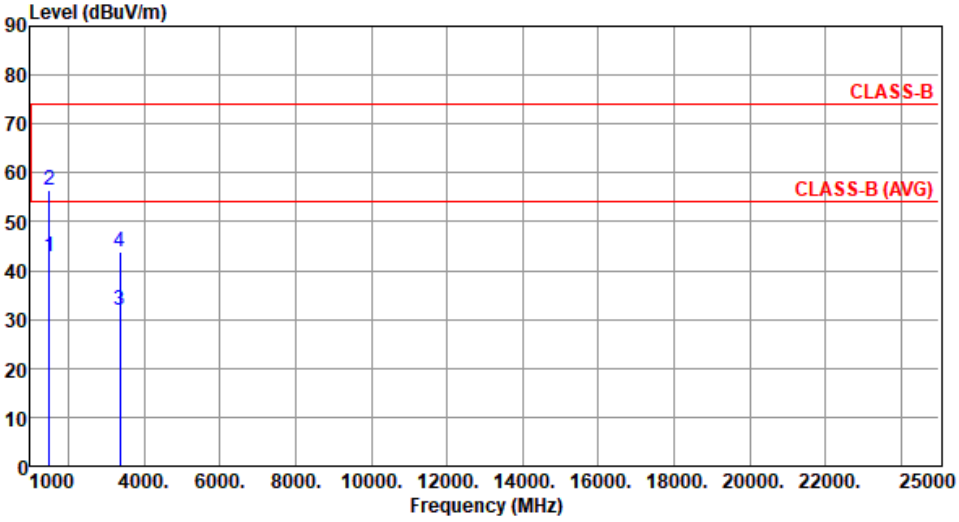


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	1509.50	42.97	54.00	-11.03	49.25	-6.28	Average	149	30
2	1509.50	56.30	74.00	-17.70	62.58	-6.28	Peak	149	30
3	3364.50	34.68	54.00	-19.32	35.51	-0.83	Average	100	20
4	3364.50	46.00	74.00	-28.00	46.83	-0.83	Peak	100	20

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).

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Vertical

Test By :Roger Lu Temperature(℃):25 Humidity(%):68



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	1509.50	42.82	54.00	-11.18	49.10	-6.28	Average	183	316
2	1509.50	56.35	74.00	-17.65	62.63	-6.28	Peak	183	316
3	3364.50	31.74	54.00	-22.26	32.57	-0.83	Average	213	113
4	3364.50	43.93	74.00	-30.07	44.76	-0.83	Peak	213	113

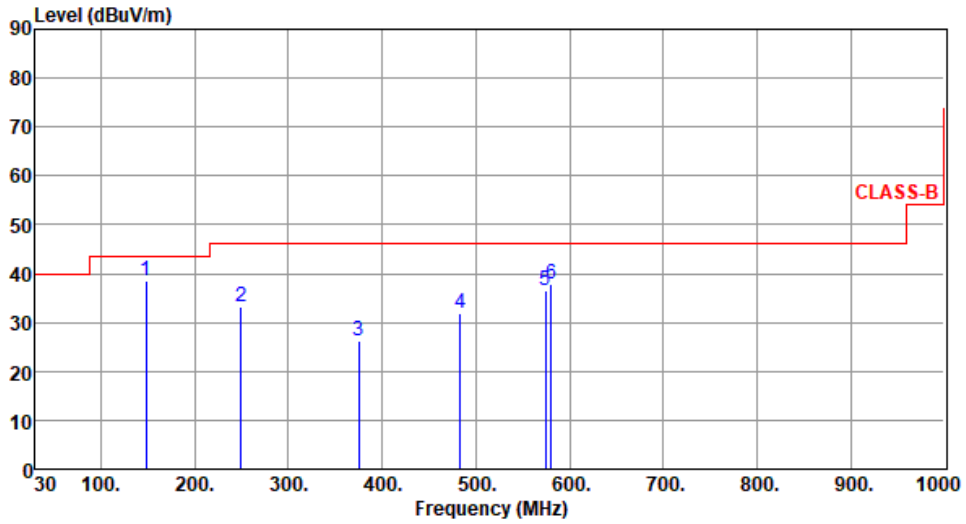
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor* (dB/m)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Test Configuration 2: Wifi module + LoRa module with internal antenna

Unwanted Emissions (Below 1GHz)

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Horizontal

Test By :Roger Lu Temperature(℃):25 Humidity(%):66

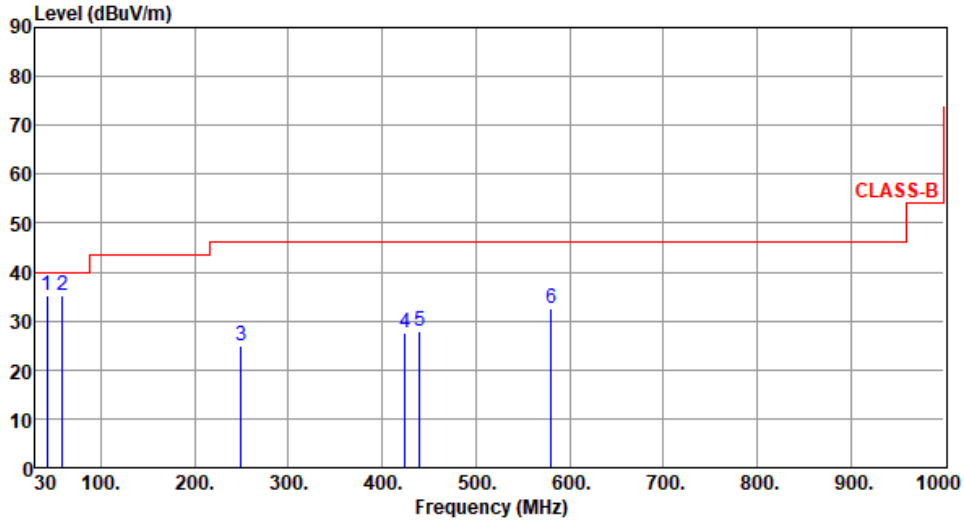


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	148.56	38.69	43.50	-4.81	47.71	-9.02	Peak	---	---
2	249.60	33.08	46.00	-12.92	43.15	-10.07	Peak	---	---
3	375.20	26.25	46.00	-19.75	32.58	-6.33	Peak	---	---
4	483.20	32.03	46.00	-13.97	35.77	-3.74	Peak	---	---
5	574.40	36.64	46.00	-9.36	38.44	-1.80	Peak	---	---
6	580.00	38.01	46.00	-7.99	39.67	-1.66	Peak	---	---

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.

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Vertical

Test By :Roger Lu Temperature(℃):25 Humidity(%):66



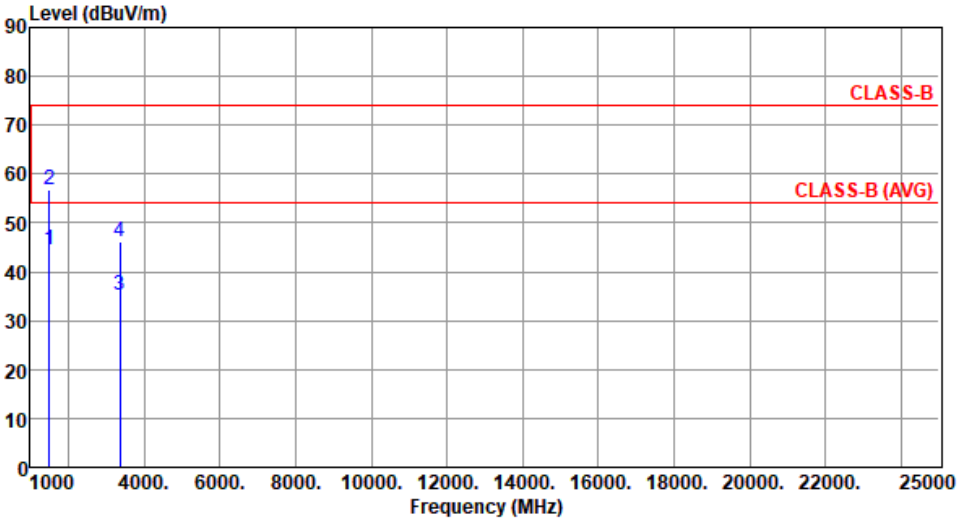
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	42.56	35.21	40.00	-4.79	43.66	-8.45	Peak	---	---
2	58.66	35.35	40.00	-4.65	44.65	-9.30	QP	100	266
3	249.60	25.05	46.00	-20.95	35.12	-10.07	Peak	---	---
4	424.80	27.66	46.00	-18.34	32.68	-5.02	Peak	---	---
5	440.00	27.89	46.00	-18.11	32.46	-4.57	Peak	---	---
6	580.00	32.56	46.00	-13.44	34.22	-1.66	Peak	---	---

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)

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Horizontal

Test By :Roger Lu Temperature(℃):25 Humidity(%):68

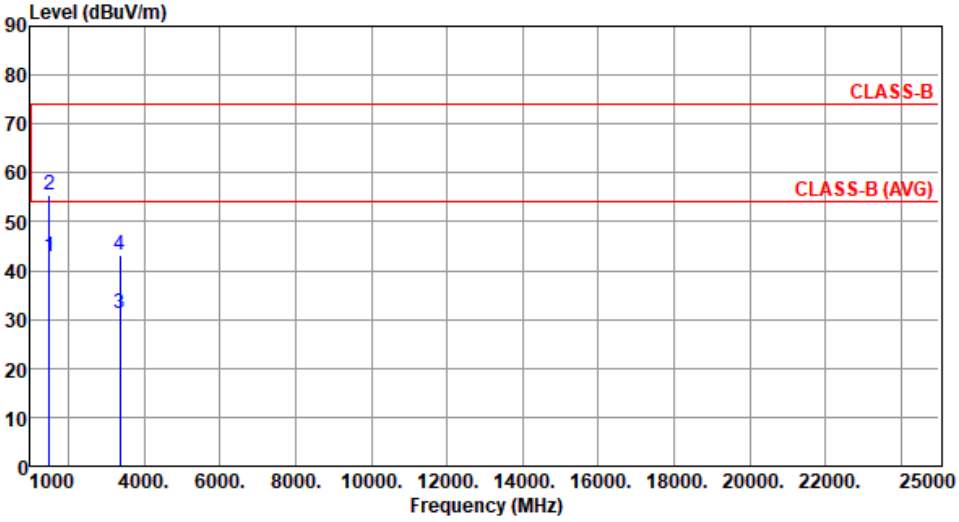


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	1509.50	44.61	54.00	-9.39	50.89	-6.28	Average	189	175
2	1509.50	56.82	74.00	-17.18	63.10	-6.28	Peak	189	175
3	3364.50	35.08	54.00	-18.92	35.91	-0.83	Average	156	44
4	3364.50	46.13	74.00	-27.87	46.96	-0.83	Peak	156	44

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).

Test Mode	2.4G 11g ch6 + LoRa 927.5MHz
Polarization	Vertical

Test By :Roger Lu Temperature(℃):25 Humidity(%):68



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	1509.50	42.75	54.00	-11.25	49.03	-6.28	Average	100	60
2	1509.50	55.48	74.00	-18.52	61.76	-6.28	Peak	100	60
3	3364.50	31.25	54.00	-22.75	32.08	-0.83	Average	100	215
4	3364.50	43.11	74.00	-30.89	43.94	-0.83	Peak	100	215

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).