FCC Co-Location Test Report

FCC ID	:	**MXF-WSMS-140**
Equipment	:	**Telemetry Unit**
Model No.	:	**WSMS-140_C** **(Refer to item 1.1.1 for more details.)**
Brand Name	:	**Gemtek/Linde**
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	:	**Jul. 09, 2018**
Tested Date	:	**Aug. 06, 2018**

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: **Approved by:**

Along Chen / Assistant Manager **Gary Chang / Manager**

Testing Laboratory 2732

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Release Record

Report No.	Version	Description	Issued Date
FR870901CO	Rev. 01	Initial issue	Aug. 21, 2018

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 43.58MHz 33.54 (Margin -6.46dB) - PK	Pass

1 General Description

1.1 Information

1.1.1 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description
Gemtek/Linde	WSMS-140_C	Telemetry Unit	4-20mA current sense
	WSMS-140_B		Modbus RS-485 communication
	WSMS-140_G		Hall sensor for magnet sense

1.1.2 Specification of the Equipment under Test (EUT)

RF General Information					
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel Number	Physical bit rate (bit/s)	Spread Factor	Channel Bandwidth (kHz)
902 ~ 928	902.3 ~ 914.9	1-64 [64]	11000 ~ 980	7 ~ 10	125
Note 1: The device uses Lora modulation. Note 2: The device supports hybrid mode.					

RF General Information				
Frequency Range (MHz)	Bluetooth Mode	Ch. Freq. (MHz)	Channel Number	Data Rate
2400-2483.5	V4.2 LE	2402 ~ 2480	0-39 [40]	1 Mbps
Note 1: Bluetooth LE (Low energy) uses GFSK modulation.				

1.1.3 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)	Remarks
1	PCB	MMCX	3.5	For BT LE
2	Omni-directional fiberglass pipe	N type	0	For LoRa

1.1.4 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc

1.2 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2017	Dec. 03, 2018
Receiver	R&S	ESR3	101658	Nov. 20, 2017	Nov. 19, 2018
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-523	Nov. 10, 2017	Nov. 09, 2018
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 20, 2017	Dec. 19, 2018
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 23, 2017	Nov. 22, 2018
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2017	Nov. 12, 2018
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 07, 2017	Dec. 06, 2018
Preamplifier	EMC	EMC02325	980194	Sep. 25, 2017	Sep. 24, 2018
Preamplifier	Agilent	83017A	MY39501308	Oct. 06, 2017	Oct. 05, 2018
Preamplifier	EMC	EMC184045B	980192	Aug. 22, 2017	Aug. 21, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16140/4	May 09, 2018	May 08, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Dec. 07, 2017	Dec. 06, 2018
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16139/4	Dec. 07, 2017	Dec. 06, 2018
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	16052	Dec. 07, 2017	Dec. 06, 2018
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Dec. 07, 2017	Dec. 06, 2018
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Dec. 07, 2017	Dec. 06, 2018
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.3 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247
ANSI C63.10-2013
FCC KDB 558074 D01 DTS Meas Guidance v04

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. 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 ≤ 1GHz	±3.66 dB
Radiated emission > 1GHz	±5.63 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH01-WS	26°C / 63%	Akun Chung

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Test Mode	Test Configuration
Radiated Emissions ≤ 1GHz	LORA 902.3MHz + BLE 2480MHz	1, 2, 3
Radiated Emissions > 1GHz	LORA 902.3MHz + BLE 2480MHz	3

NOTE:

1. Test Configurations are listed as follows:
   1) Test Configuration 1: For model: WSMS-140_C
   2) Test Configuration 2: For model: WSMS-140_B
   3) Test Configuration 3: For model: WSMS-140_G

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

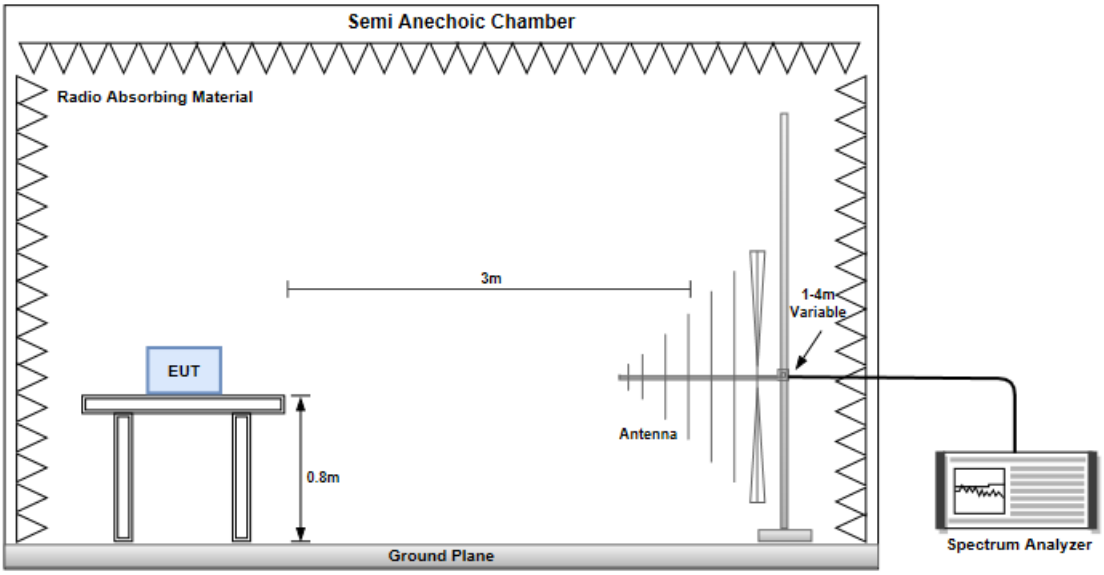
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

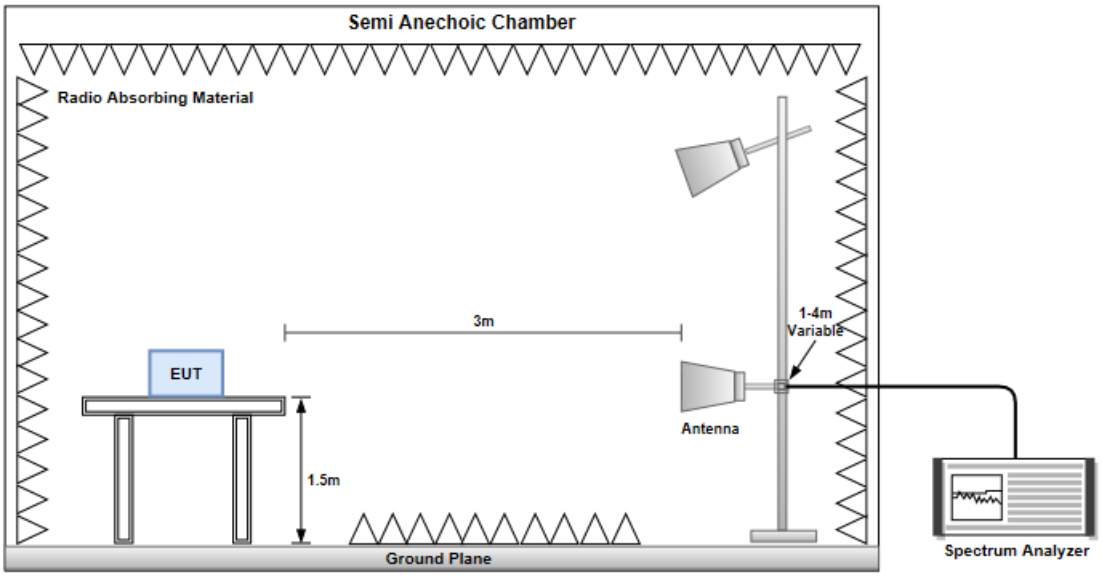
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.1.3 Test Setup

Radiated Emissions below 1 GHz



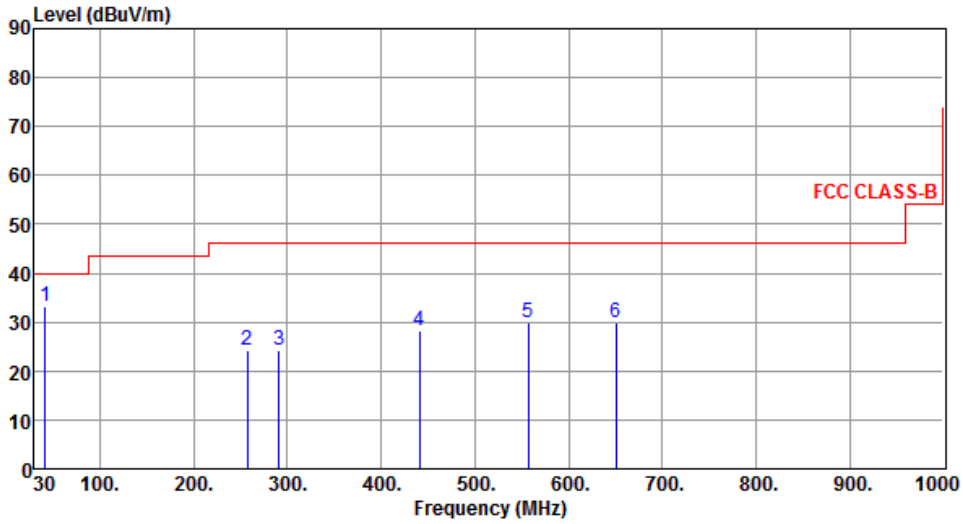
Radiated Emissions above 1 GHz



Test Configuration 1: For model: WSMS-140_C

3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

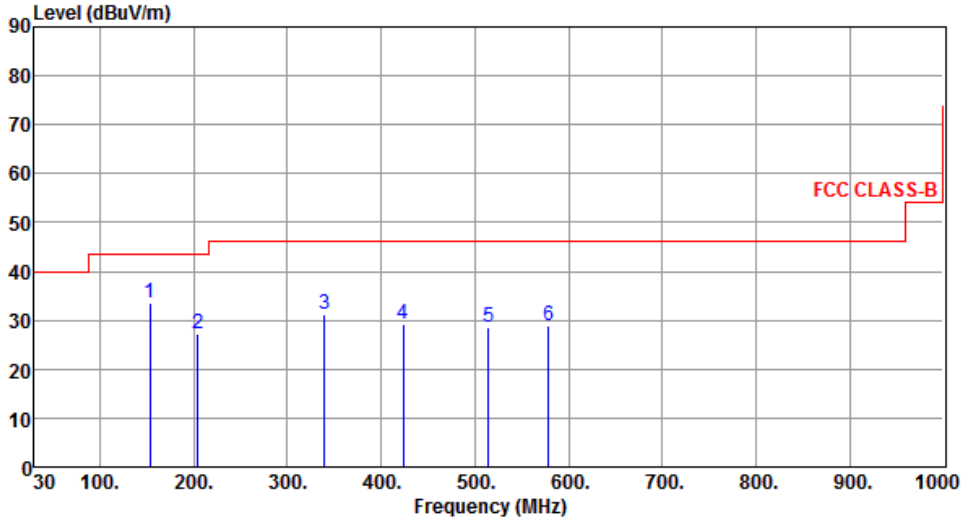
Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	41.99	33.14	40.00	-6.86	41.31	-8.17	Peak	---	---
2	257.64	24.11	46.00	-21.89	33.31	-9.20	Peak	---	---
3	291.11	24.17	46.00	-21.83	32.32	-8.15	Peak	---	---
4	441.23	28.32	46.00	-17.68	32.71	-4.39	Peak	---	---
5	557.14	29.99	46.00	-16.01	31.76	-1.77	Peak	---	---
6	650.47	29.87	46.00	-16.13	30.20	-0.33	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.

Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Vertical



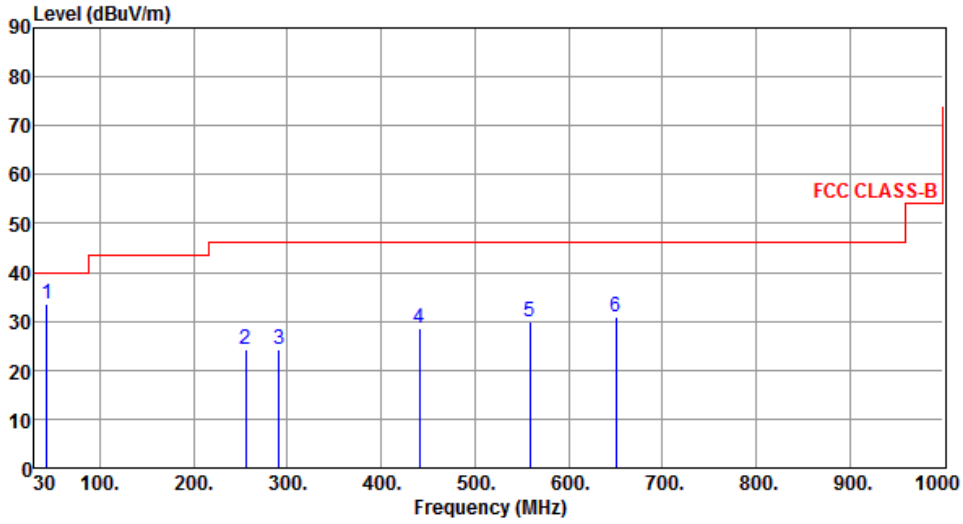
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	153.57	33.44	43.50	-10.06	41.84	-8.40	Peak	---	---
2	204.58	27.11	43.50	-16.39	38.16	-11.05	Peak	---	---
3	339.58	31.11	46.00	-14.89	37.99	-6.88	Peak	---	---
4	423.69	29.13	46.00	-16.87	33.82	-4.69	Peak	---	---
5	514.66	28.57	46.00	-17.43	31.26	-2.69	Peak	---	---
6	578.58	28.91	46.00	-17.09	30.35	-1.44	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.

Test Configuration 2: For model: WSMS-140_B

3.1.5 Transmitter Radiated Unwanted Emissions (Below 1GHz)

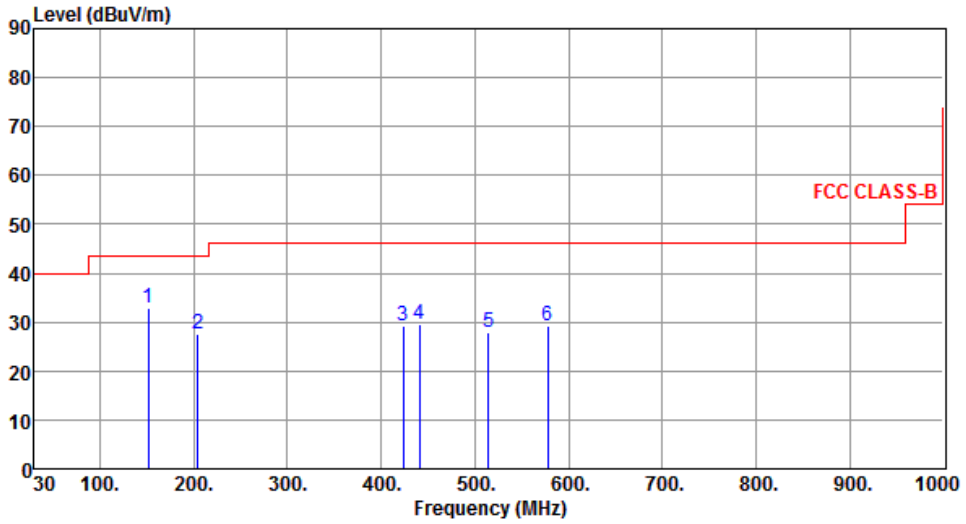
Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	43.58	33.54	40.00	-6.46	41.56	-8.02	Peak	---	---
2	255.69	24.36	46.00	-21.64	33.61	-9.25	Peak	---	---
3	291.14	24.36	46.00	-21.64	32.51	-8.15	Peak	---	---
4	441.31	28.41	46.00	-17.59	32.79	-4.38	Peak	---	---
5	559.17	29.85	46.00	-16.15	31.62	-1.77	Peak	---	---
6	650.57	30.87	46.00	-15.13	31.20	-0.33	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.

Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Vertical



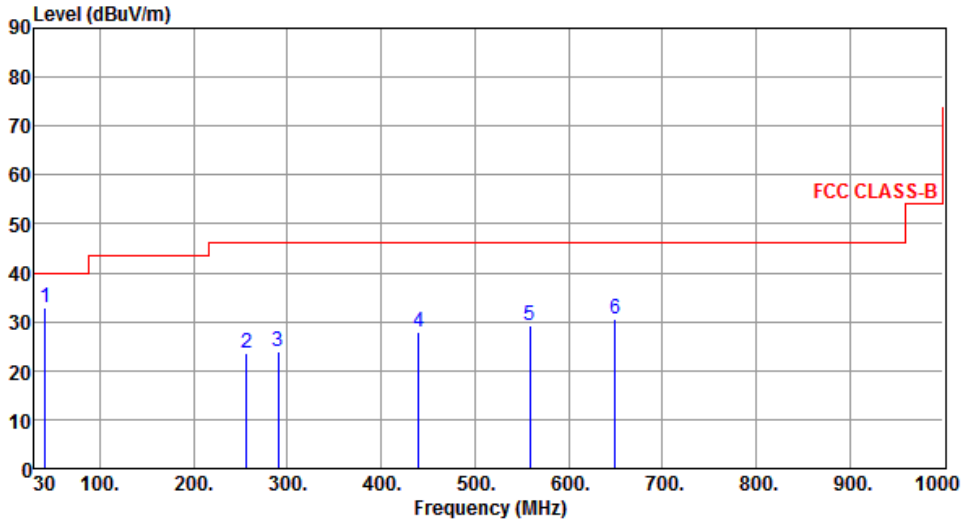
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	151.21	32.77	43.50	-10.73	41.23	-8.46	Peak	---	---
2	204.34	27.57	43.50	-15.93	38.62	-11.05	Peak	---	---
3	423.88	29.36	46.00	-16.64	34.04	-4.68	Peak	---	---
4	441.36	29.57	46.00	-16.43	33.95	-4.38	Peak	---	---
5	514.57	27.88	46.00	-18.12	30.57	-2.69	Peak	---	---
6	577.88	29.36	46.00	-16.64	30.81	-1.45	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.

Test Configuration 3: For model: WSMS-140_G

3.1.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

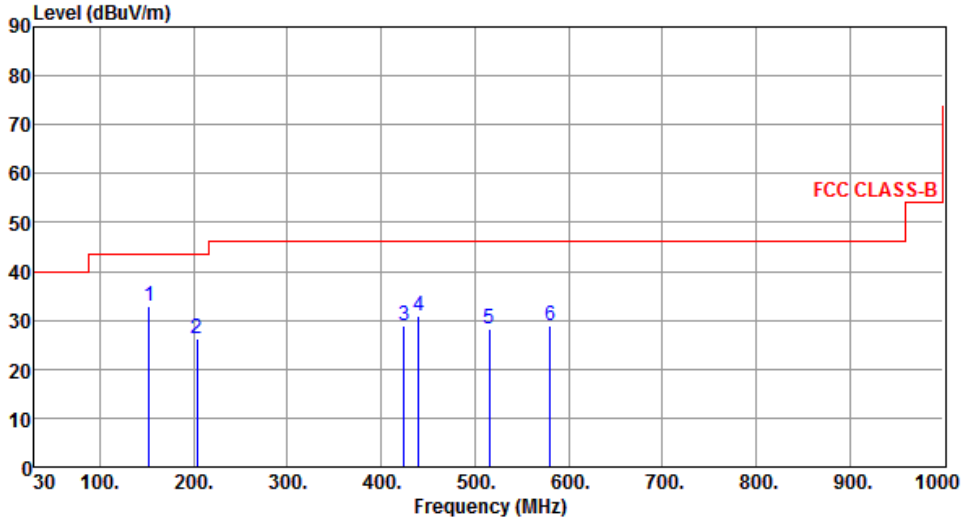
Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	41.64	32.85	40.00	-7.15	41.03	-8.18	Peak	---	---
2	256.00	23.70	46.00	-22.30	32.94	-9.24	Peak	---	---
3	290.40	23.98	46.00	-22.02	32.14	-8.16	Peak	---	---
4	440.00	27.91	46.00	-18.09	32.32	-4.41	Peak	---	---
5	558.40	29.34	46.00	-16.66	31.11	-1.77	Peak	---	---
6	649.60	30.41	46.00	-15.59	30.74	-0.33	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.

Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Vertical

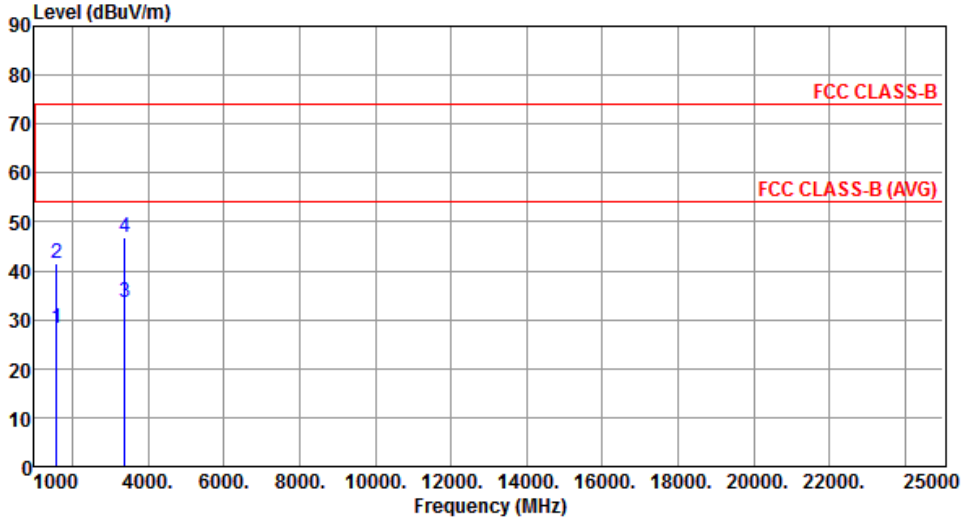


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	152.22	32.91	43.50	-10.59	41.37	-8.46	Peak	---	---
2	203.20	26.35	43.50	-17.15	37.37	-11.02	Peak	---	---
3	424.80	29.00	46.00	-17.00	33.66	-4.66	Peak	---	---
4	440.00	30.91	46.00	-15.09	35.32	-4.41	Peak	---	---
5	515.20	28.08	46.00	-17.92	30.76	-2.68	Peak	---	---
6	580.00	28.85	46.00	-17.15	30.26	-1.41	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.

3.1.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)

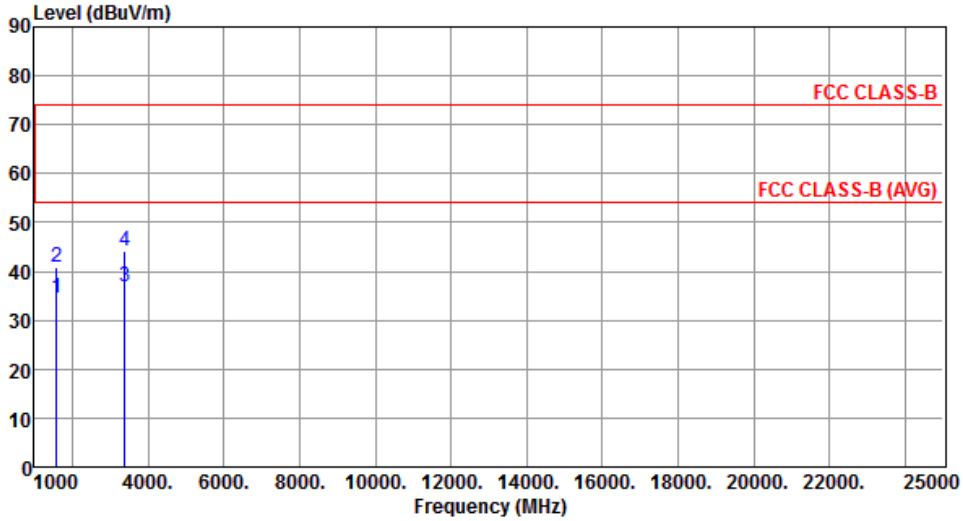
Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1577.70	28.37	54.00	-25.63	35.10	-6.73	Average	100	292
2	1577.70	41.51	74.00	-32.49	48.24	-6.73	Peak	100	292
3	3382.30	33.51	54.00	-20.49	34.12	-0.61	Average	100	296
4	3382.30	46.88	74.00	-27.12	47.49	-0.61	Peak	100	296

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).

Test mode	LORA 902.3MHz + BLE 2402MHz
Polarization	Vertical



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1577.70	34.59	54.00	-19.41	41.32	-6.73	Average	100	199
2	1577.70	40.93	74.00	-33.07	47.66	-6.73	Peak	100	199
3	3382.30	36.77	54.00	-17.23	37.38	-0.61	Average	158	338
4	3382.30	44.33	74.00	-29.67	44.94	-0.61	Peak	158	338

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).

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	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	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

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