FCC Co-Location Test Report

FCC ID	:	**O6ZHXQX1AM0S**
Equipment	:	**8-Channel LoRa Module**
Model No.	:	**HXQX1AM0S**
Brand Name	:	**machineQ**
Applicant	:	**Humax Co., Ltd.**
Address	:	**HUMAX BLDG., 2, HUMAX BLDG., 2, Yeongmun-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, South Korea, 17040**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Nov. 13, 2018**
Tested Date	:	**Dec. 11, 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
FR782401-07CO	Rev. 01	Initial issue	Dec. 26, 2018

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 1513.70MHz 52.85 (Margin -1.15dB) - 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 values of gain for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of the gain.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

Operating Frequency	902 MHz ~ 928 MHz
Modulaton Type	CSS

1.1.2 Information of Host

Brand Name	machineQ
Product name	8-Channel LoRa Gateway
Model name	HXQX1AM0S
FCC ID	O6ZHLC0000

1.1.2.1 Antenna of Host

Ant. No.	Model	Type	Gain (dBi)	Connector	Remark
1	CON 1	PIFA	3.76	UFL	Wi-Fi Antenna
2	CON 2	PIFA	3.86	UFL	Wi-Fi Antenna
3	LoRa antenna (External)	Dipole	0.96	SMA	Lora Antenna
4	LoRa antenna (Internal)	Monopole	1.02	UFL	Lora Antenna

1.2 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber3 / (03CH03-WS)				
Tested Date	Dec. 11, 2018				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101499	Jan. 03, 2018	Jan. 02, 2019
Receiver	R&S	ESR3	101657	Jan. 05, 2018	Jan. 04, 2019
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 19, 2018	Apr. 18, 2019
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Jan. 18, 2018	Jan. 17, 2019
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019
Preamplifier	EMC	EMC02325	980187	Aug. 24, 2018	Aug. 23, 2019
Preamplifier	Agilent	83017A	MY53270014	Aug. 09, 2018	Aug. 08, 2019
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019
RF cable-3M	EMC	EMC104-SM-SM-8000	181107	Oct. 30, 2018	Oct. 29, 2019
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY32487/4	Oct. 30, 2018	Oct. 29, 2019
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Oct. 30, 2018	Oct. 29, 2019
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Oct. 30, 2018	Oct. 29, 2019
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Oct. 30, 2018	Oct. 29, 2019
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Oct. 30, 2018	Oct. 29, 2019
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 15.247 Meas Guidance v05
FCC KDB 662911 D01 Multiple Transmitter Output v02r01

1.4 Deviation from Test Standard and Measurement Procedure

None

1.5 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	03CH03-WS	24°C / 65%	Roger Lu Aska Huang

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- IC site registration No.: 10807C-1

2.2 The Worst Test Modes and Channel Details

Test item	Test Mode	Test mode
Radiated Emissions	2.4G HT20 ch6 + LoRa 923.3MHz	1, 2

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

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

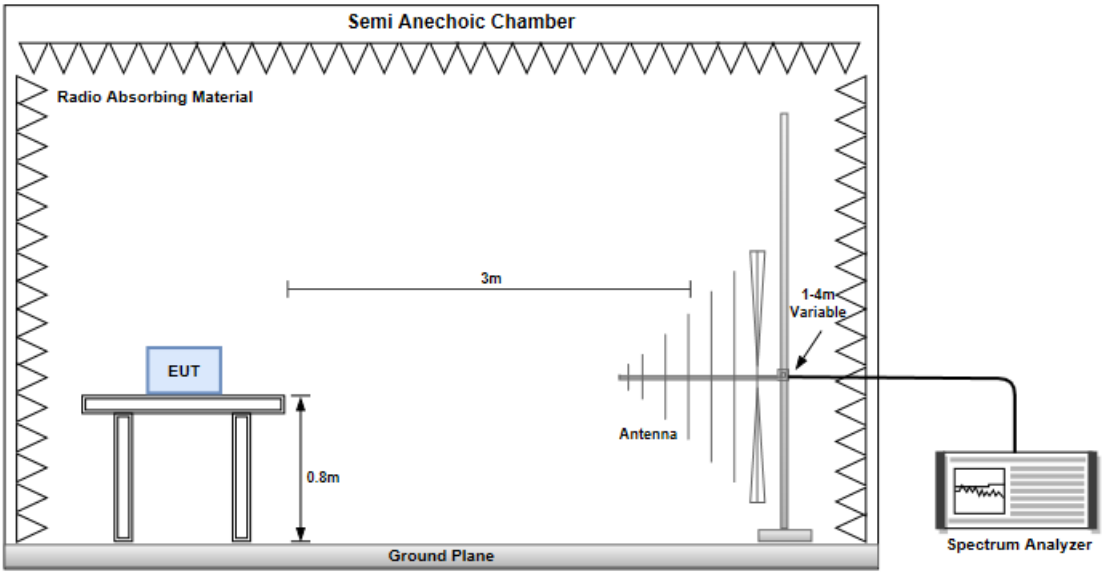
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

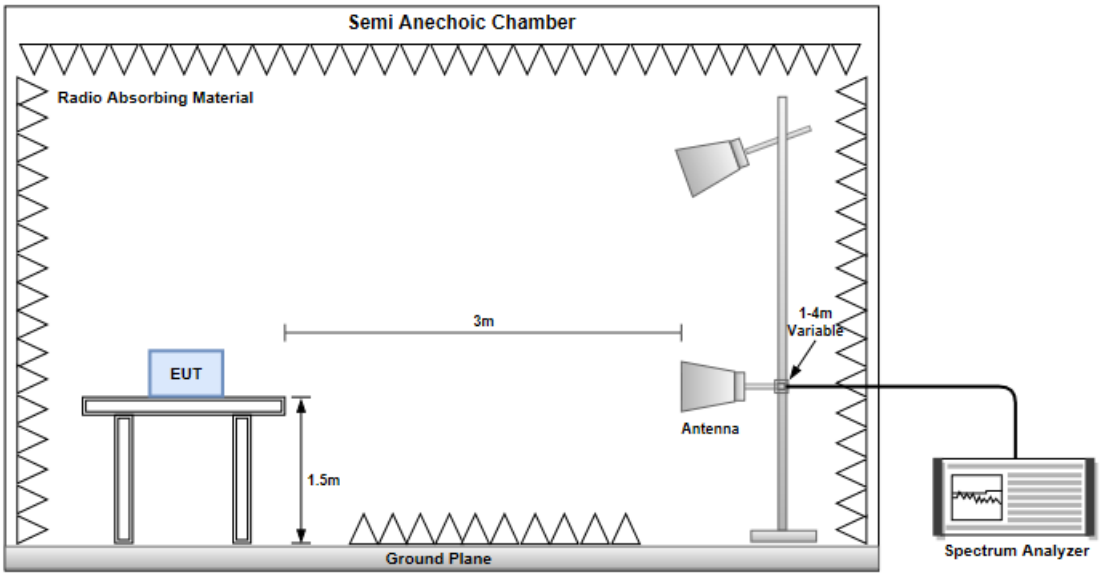
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.1.3 Test Setup

Radiated Emissions below 1 GHz



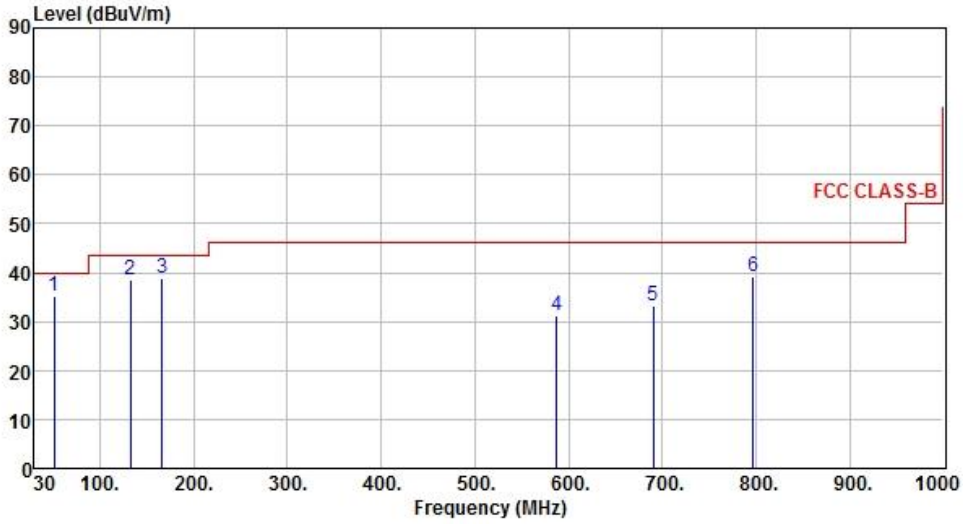
Radiated Emissions above 1 GHz



Configuration 1: Wifi module + LoRa module with external antenna

3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

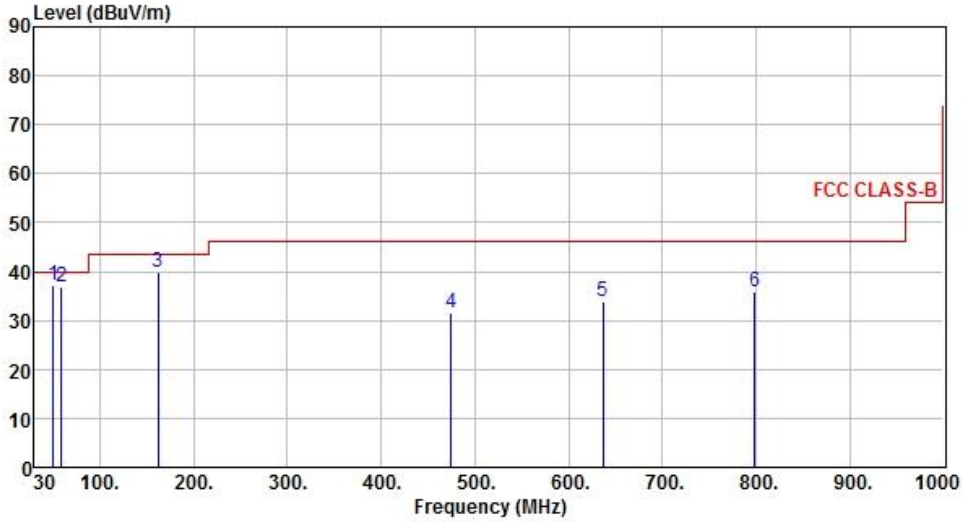
Test Mode	2.4G HT20 ch6 + LoRa 923.3MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	50.74	35.22	40.00	-4.78	43.16	-7.94	QP	132	145
2	132.51	38.60	43.50	-4.90	48.12	-9.52	Peak	---	---
3	166.51	38.91	43.50	-4.59	47.39	-8.48	Peak	---	---
4	587.20	31.14	46.00	-14.86	31.83	-0.69	Peak	---	---
5	690.40	33.21	46.00	-12.79	32.15	1.06	Peak	---	---
6	796.80	39.17	46.00	-6.83	35.92	3.25	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	2.4G HT20 ch6 + LoRa 923.3MHz
Polarization	Vertical

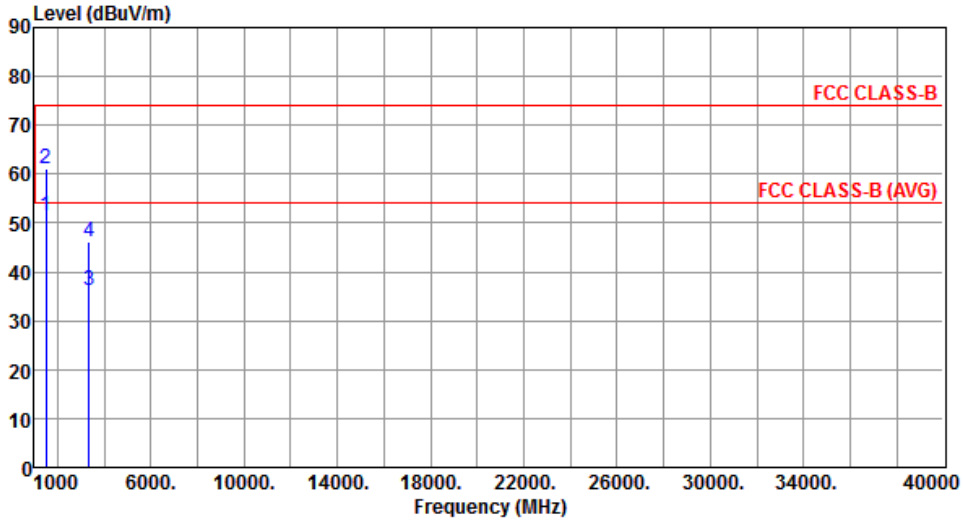


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	50.23	37.11	40.00	-2.89	45.00	-7.89	QP	149	331
2	58.56	36.95	40.00	-3.05	45.52	-8.57	QP	150	333
3	162.09	39.78	43.50	-3.72	48.14	-8.36	Peak	---	---
4	474.40	31.63	46.00	-14.37	34.86	-3.23	Peak	---	---
5	636.80	33.99	46.00	-12.01	33.76	0.23	Peak	---	---
6	798.40	36.00	46.00	-10.00	32.73	3.27	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)

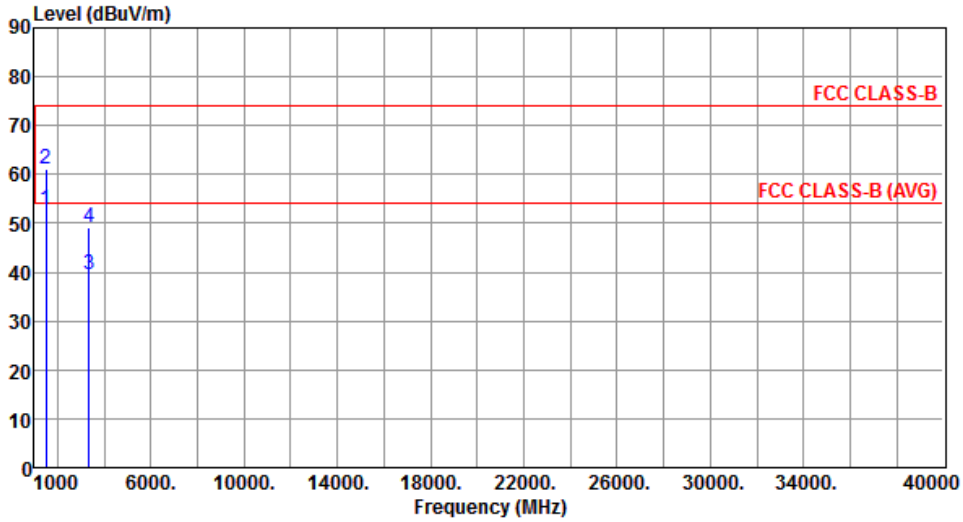
Test Mode	2.4G HT20 ch6 + LoRa 923.3MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1513.70	51.34	54.00	-2.66	56.18	-4.84	Average	116	325
2	1513.70	61.24	74.00	-12.76	66.08	-4.84	Peak	116	325
3	3360.30	36.06	54.00	-17.94	35.12	0.94	Average	100	50
4	3360.30	46.26	74.00	-27.74	45.32	0.94	Peak	100	50

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	2.4G HT20 ch6 + LoRa 923.3MHz
Polarization	Vertical



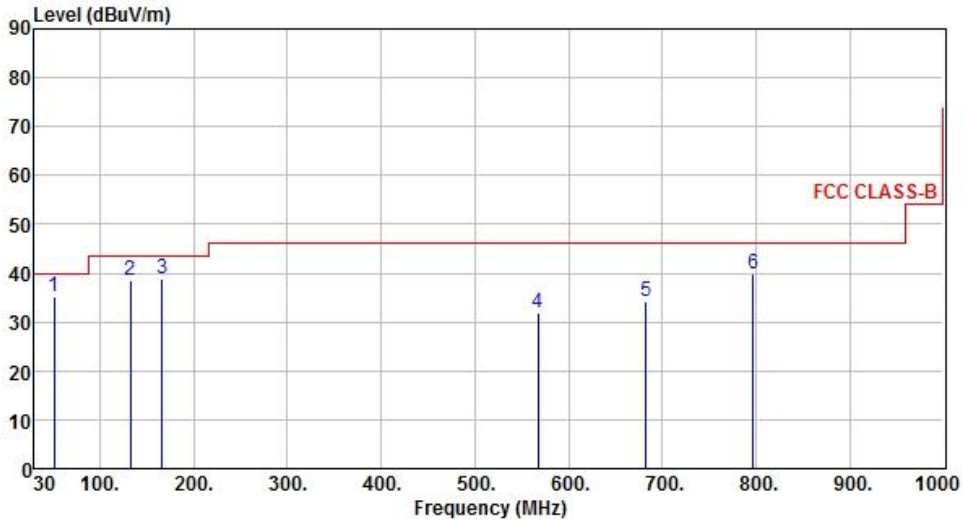
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1513.70	52.85	54.00	-1.15	57.69	-4.84	Average	328	43
2	1513.70	61.14	74.00	-12.86	65.98	-4.84	Peak	328	43
3	3360.30	39.39	54.00	-14.61	38.45	0.94	Average	300	5
4	3360.30	49.15	74.00	-24.85	48.21	0.94	Peak	300	5

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).

Configuration 2: Wifi module + LoRa module with internal antenna

3.1.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

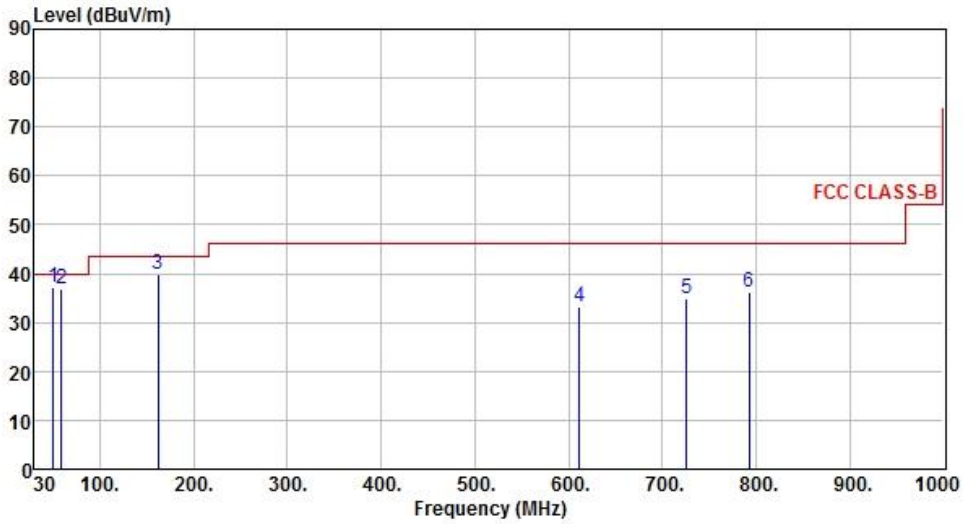
Test Mode	2.4G HT20 ch6 + LoRa 923.3MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	50.74	35.22	40.00	-4.78	43.16	-7.94	QP	132	145
2	132.51	38.60	43.50	-4.90	48.12	-9.52	Peak	---	---
3	166.51	38.91	43.50	-4.59	47.39	-8.48	Peak	---	---
4	567.20	31.90	46.00	-14.10	33.18	-1.28	Peak	---	---
5	682.40	34.16	46.00	-11.84	33.22	0.94	Peak	---	---
6	796.80	39.96	46.00	-6.04	36.71	3.25	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	2.4G HT20 ch6 + LoRa 923.3MHz
Polarization	Vertical

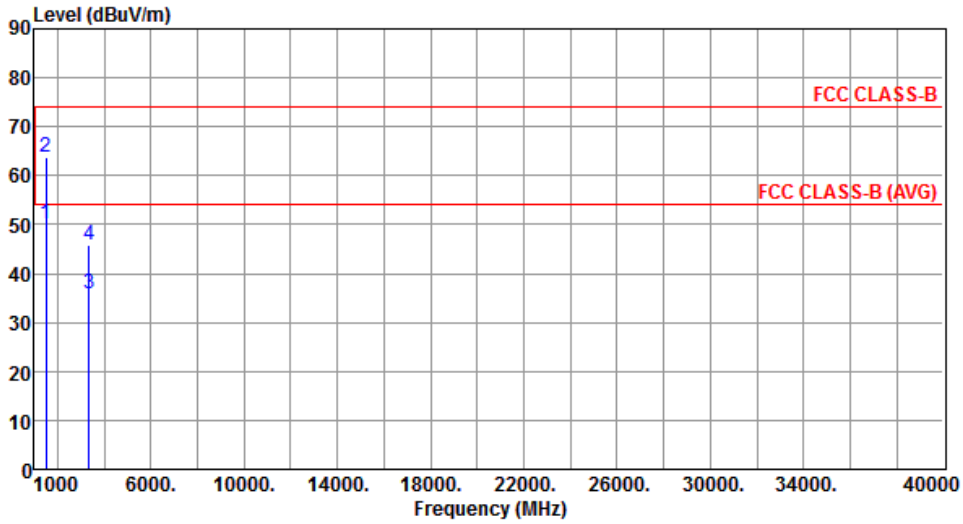


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	50.23	37.11	40.00	-2.89	45.00	-7.89	QP	149	331
2	58.56	36.95	40.00	-3.05	45.52	-8.57	QP	150	333
3	162.09	39.78	43.50	-3.72	48.14	-8.36	Peak	---	---
4	611.20	33.12	46.00	-12.88	33.27	-0.15	Peak	---	---
5	725.60	34.78	46.00	-11.22	32.83	1.95	Peak	---	---
6	792.80	36.08	46.00	-9.92	32.88	3.20	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)

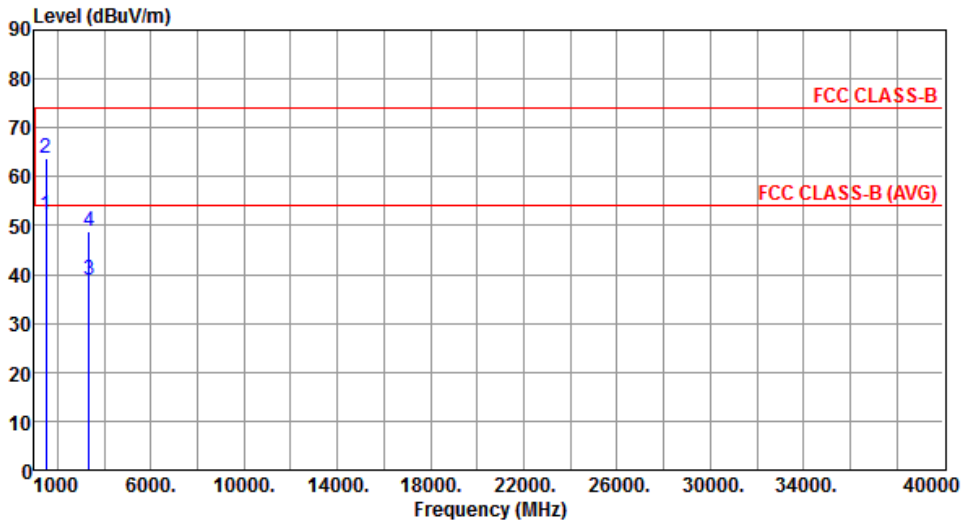
Test Mode	2.4G HT20 ch6 + LoRa 923.3MHz
Polarization	Horizontal



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1513.70	50.20	54.00	-3.80	55.04	-4.84	Average	218	314
2	1513.70	63.72	74.00	-10.28	68.56	-4.84	Peak	218	314
3	3360.30	35.86	54.00	-18.14	34.92	0.94	Average	100	49
4	3360.30	45.81	74.00	-28.19	44.87	0.94	Peak	100	49

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	2.4G HT20 ch6 + LoRa 923.3MHz
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	1513.70	52.21	54.00	-1.79	57.05	-4.84	Average	233	330
2	1513.70	63.86	74.00	-10.14	68.70	-4.84	Peak	233	330
3	3360.30	38.96	54.00	-15.04	38.02	0.94	Average	295	6
4	3360.30	48.86	74.00	-25.14	47.92	0.94	Peak	295	6

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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