FCC Test Report

FCC ID	:	**2AX22-VNC0100201**
Equipment	:	**Cattle Rider**
Model No.	:	**VNC-01-00201**
Brand Name	:	**Vence**
Applicant	:	**Vence Corp**
Address	:	**16885 West Bernardo Drive, San Diego, CA 92127**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Nov. 06, 2020**
Tested Date	:	**Dec. 01, 2020 ~ Jan. 07, 2021**

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 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:
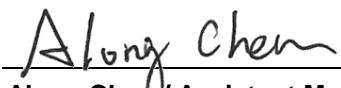
Along Chen / Assistant Manager

Approved by:

Gary Chang / Manager

ilac-MRA

TAF
Testing Laboratory
2732

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Release Record

Report No.	Version	Description	Issued Date
FR0N0603-1AH	Rev. 01	Initial issue	Mar. 26, 2021

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	Note	N/A
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2706.90MHz 48.57 (Margin -5.43dB) - AV	Pass
15.247(d)	Band Edge	Meet the requirement of limit	Pass
15.247(b)(2)(3)	Conducted Output Power	Power [dBm]: 21.24	Pass
15.247(a)(1)(i)	Number of Hopping Channels	Meet the requirement of limit	Pass
15.247(a)(1)	Hopping Channel Separation	Meet the requirement of limit	Pass
15.247(f)	Dwell Time	Meet the requirement of limit	Pass
15.247(f)	Power spectral density	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass
Note: The EUT consumes power from battery, so the test is not required.			

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)

RF General Information					
Frequency Range (MHz)	Ch. Freq. (MHz)	Channel Number	Physical bit rate (bit/sec)	Spread Factor	Channel Bandwidth (kHz)
902 ~ 928	902.3 ~ 914.9	1-64 [64]	1760	SF9	125
Note 1: RF output power specifies that Maximum Conducted (Average) Output Power. Note 2: The device uses Lora modulation. Note 3: The device supports hybrid mode.					

1.1.2   Antenna Details

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	Pulse	Larsen W3012	Chip	N/A	-1.1

1.1.3   Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.6Vdc

1.1.4   Accessories

N/A

1.1.5 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.3	17	905.5	33	908.7	49	911.9
2	902.5	18	905.7	34	908.9	50	912.1
3	902.7	19	905.9	35	909.1	51	912.3
4	902.9	20	906.1	36	909.3	52	912.5
5	903.1	21	906.3	37	909.5	53	912.7
6	903.3	22	906.5	38	909.7	54	912.9
7	903.5	23	906.7	39	909.9	55	913.1
8	903.7	24	906.9	40	910.1	56	913.3
9	903.9	25	907.1	41	910.3	57	913.5
10	904.1	26	907.3	42	910.5	58	913.7
11	904.3	27	907.5	43	910.7	59	913.9
12	904.5	28	907.7	44	910.9	60	914.1
13	904.7	29	907.9	45	911.1	61	914.3
14	904.9	30	908.1	46	911.3	62	914.5
15	905.1	31	908.3	47	911.5	63	914.7
16	905.3	32	908.5	48	911.7	64	914.9

1.1.6 Test Tool and Duty Cycle

Test Tool	cmd, version: 6.1.7601.17514
Duty cycle	100 %

1.1.7 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	902.3	**908.5**	**914.9**
LORA	22	22	22

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	Notebook	DELL	Latitude E5470	DoC	---
2	USB console	FTDI	TTL-232R-3V3	---	Provided by applicant.

1.3 Test Setup Chart

Test Setup Diagram
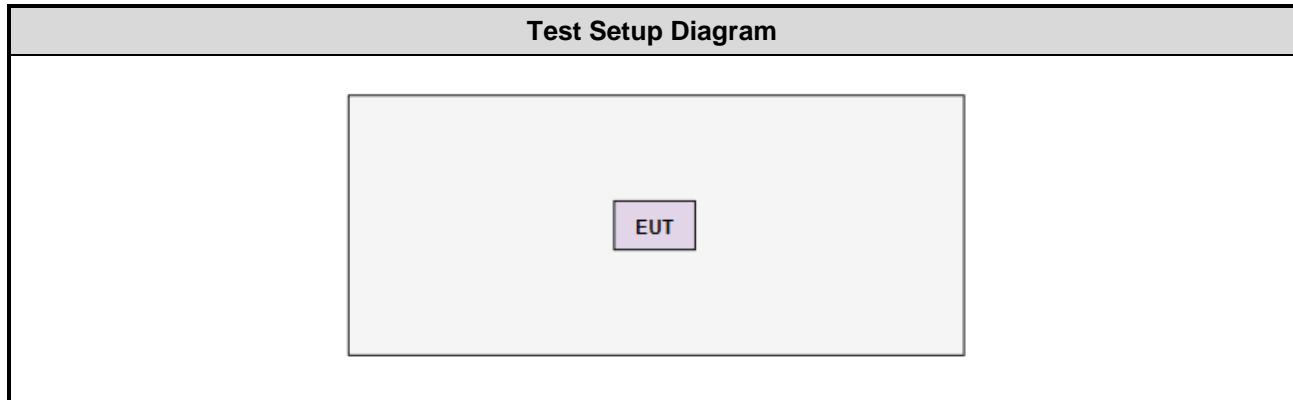
Note: The notebook & USB console are disconnected from EUT and removed from test table after sending command from notebook to control EUT to transmit continuously.

1.4 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber 3 / (03CH03-WS)				
Tested Date	Dec. 01, 2020				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101499	Jan. 09, 2020	Jan. 08, 2021
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 29, 2020	Apr. 28, 2021
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1095	Sep. 25, 2020	Sep. 24, 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	980187	Aug. 05, 2020	Aug. 04, 2021
Preamplifier	Agilent	83017A	MY39501309	Sep. 02, 2020	Sep. 01, 2021
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/**4**	Sep. 26, 2020	Sep. 25, 2021
RF cable-8M	EMC	EMC104-SM-SM-8000	181107	Sep. 26, 2020	Sep. 25, 2021
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Sep. 26, 2020	Sep. 25, 2021
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 26, 2020	Sep. 25, 2021
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 26, 2020	Sep. 25, 2021
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 26, 2020	Sep. 25, 2021
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Tested Date	Jan. 07, 2021				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101063	Apr. 30, 2020	Apr. 29, 2021
Spectrum Analyzer	R&**S**	FSV40	101499	Jan. 09, 2020	Jan. 08, 2021
TEMP&HUMIDITY CHAMBER	GIANT FORCE	GCT-225-40-SP-SD	MAF1212-002	May. 06, 2020	May. 05, 2021
Power Meter	Anritsu	ML2495A	1241002	Nov. 04, 2020	Nov. 03, 2021
Power Sensor	Anritsu	MA2411B	1207366	Nov. 04, 2020	Nov. 03, 2021
Signal Generator	R&S	SMB100A	175727	Jan. 07, 2021	Jan. 06, 2022
DC POWER SOURCE	GW INSTEK	GPC-6030D	GES855395	Nov. 09, 2020	Nov. 08, 2021
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed 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
Radiated emission ≤ 1GHz	±3.96 dB
Radiated emission ˃ 1GHz	±4.51 dB

2   Test Configuration

2.1   Testing Facility

Test Laboratory	International Certification Corporation
Test Site	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.)
Test Site	03CH03-WS
Address of Test Site	No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 333, Taiwan (R.O.C.)

➢ FCC Designation No.:   TW0009

➢ FCC site registration No.:   207696

➢ ISED#:   10807A

➢ CAB identifier: TW2732

2.2   The Worst Test Modes and Channel Details

Test item	Test Frequency (MHz)	Channel Bandwidth (kHz)	Modulation / SF	Test Configuration
Conducted Emissions Radiated Emissions > 1GHz Conducted Output Power Hopping Channel Separation 20dB and Occupied bandwidth Power Spectral Density	902.3 / 908.5 / 914.9	125	Lora / 9	---
Radiated Emissions ≤ 1GHz	902.3 / 908.5 / 914.9	125	Lora / 9	---
Number of Hopping Channels	902.3 ~ 914.9	125	Lora / 9	---
Dwell Time	902.3	125	Lora / 9	---
NOTE: 1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **X-plane** result was found as the worst case and was shown in this report.				

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
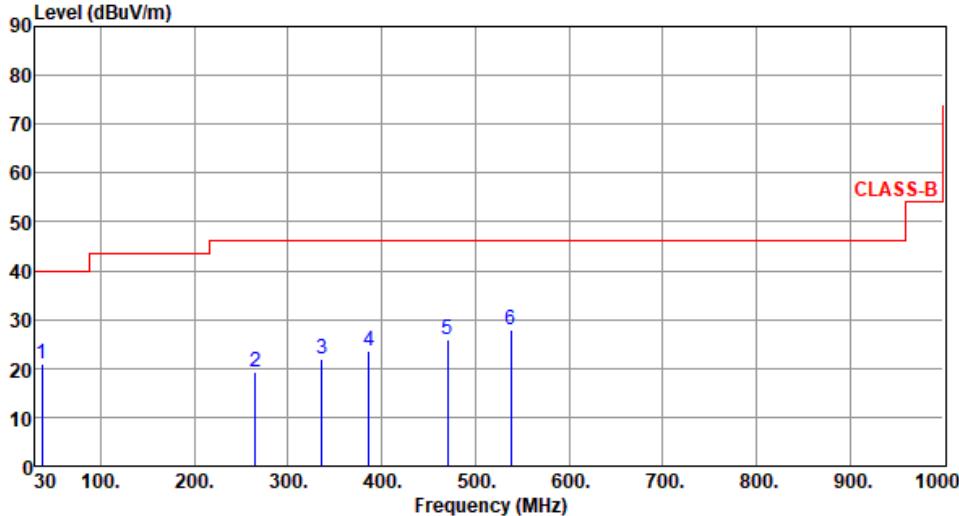
Radiated Emissions below 1 GHz
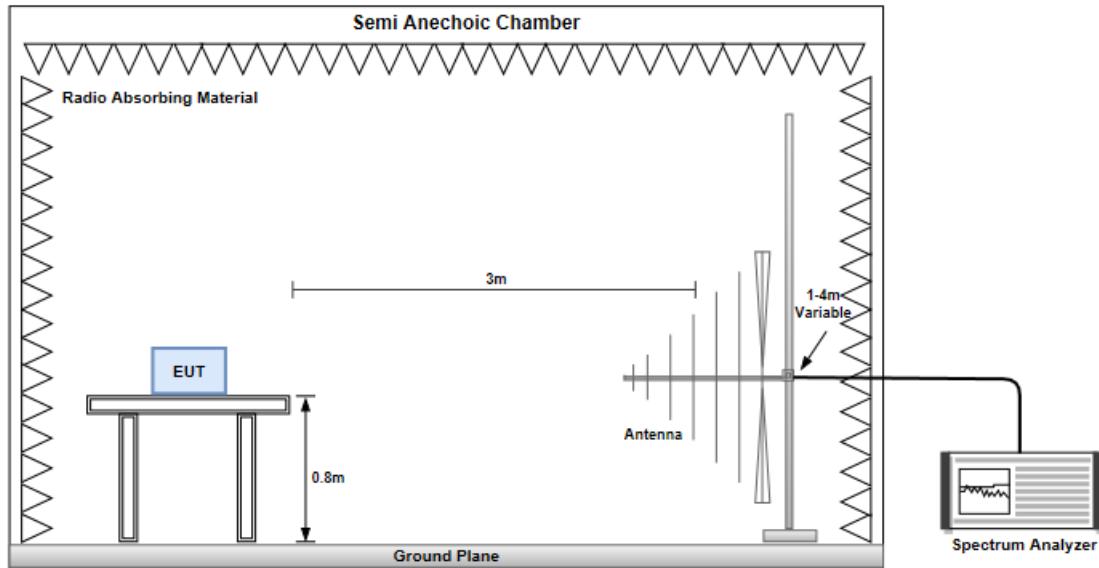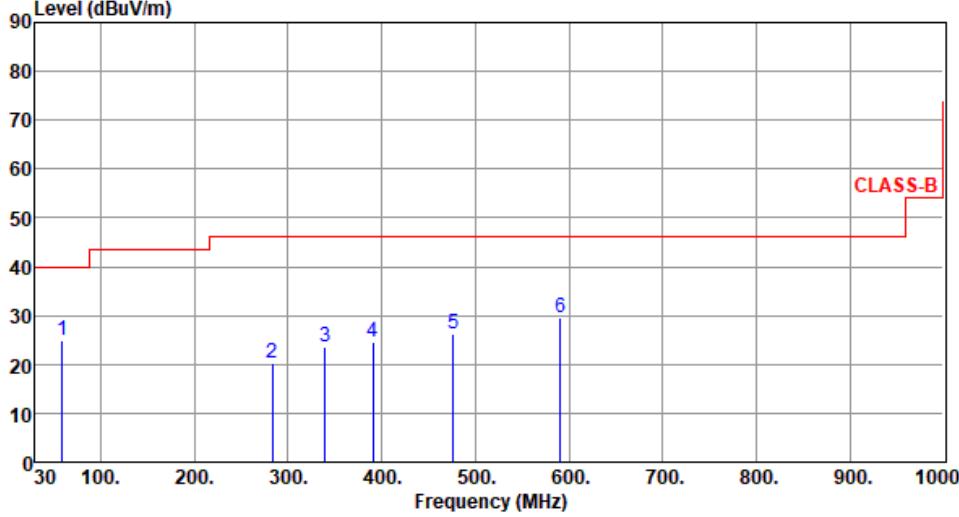
Radiated Emissions above 1 GHz
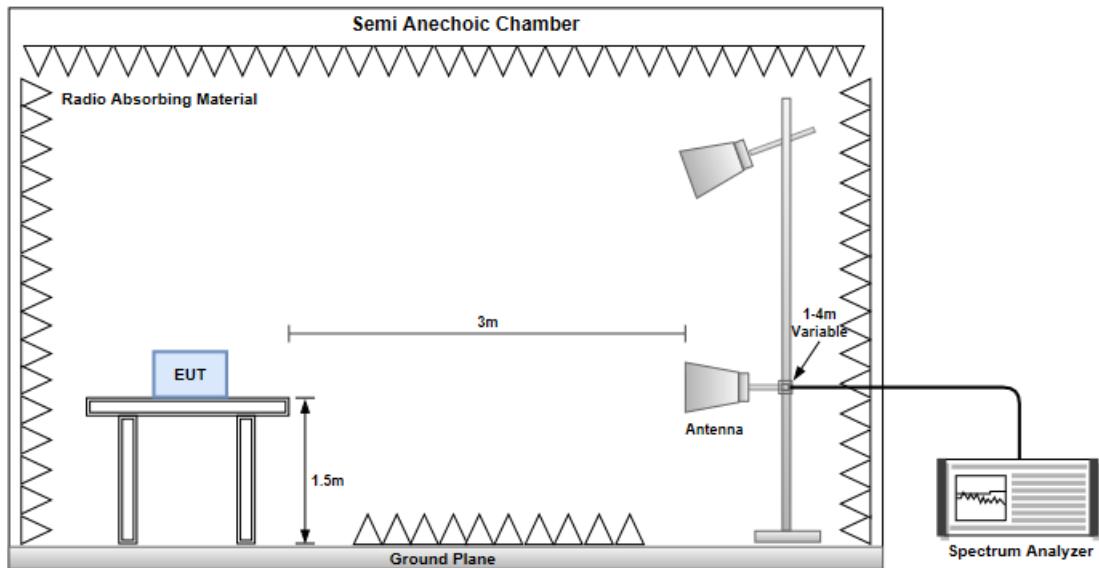
3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation / SF	Lora / 9	Test Freq. (MHz)	902.3
Polarization	Horizontal		

Test By   :BRAD WU   Temperature(℃):22   Humidity(%):65

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	36.85	20.84	40.00	-19.16	30.54	-9.70	Peak	---	---
2	264.80	19.18	46.00	-26.82	28.94	-9.76	Peak	---	---
3	336.00	21.98	46.00	-24.02	29.28	-7.30	Peak	---	---
4	386.40	23.62	46.00	-22.38	29.75	-6.13	Peak	---	---
5	470.40	26.03	46.00	-19.97	29.68	-3.65	Peak	---	---
6	537.60	27.80	46.00	-18.20	30.47	-2.67	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.

Modulation / SF	Lora / 9	Test Freq. (MHz)	902.3
Polarization	Vertical		

Test By   :BRAD WU   Temperature(℃):22   Humidity(%):65

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	59.26	24.94	40.00	-15.06	34.14	-9.20	Peak	---	---
2	283.20	20.25	46.00	-25.75	29.28	-9.03	Peak	---	---
3	339.20	23.44	46.00	-22.56	30.71	-7.27	Peak	---	---
4	390.40	24.68	46.00	-21.32	30.72	-6.04	Peak	---	---
5	476.80	26.38	46.00	-19.62	29.97	-3.59	Peak	---	---
6	590.40	29.50	46.00	-16.50	30.46	-0.96	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.

Modulation / SF	Lora / 9	Test Freq. (MHz)	908.5
Polarization	Horizontal		

Test By   :BRAD WU   Temperature(°C):22   Humidity(%):65

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	36.11	20.65	40.00	-19.35	30.28	-9.63	Peak	---	---
2	239.20	19.81	46.00	-26.19	30.47	-10.66	Peak	---	---
3	332.00	22.84	46.00	-23.16	30.23	-7.39	Peak	---	---
4	391.20	24.14	46.00	-21.86	30.16	-6.02	Peak	---	---
5	449.60	25.89	46.00	-20.11	29.96	-4.07	Peak	---	---
6	548.80	28.60	46.00	-17.40	31.12	-2.52	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.

Modulation / SF	Lora / 9	Test Freq. (MHz)	908.5
Polarization	Vertical		

Test By   :BRAD WU   Temperature(°C):22   Humidity(%):65

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	59.84	25.26	40.00	-14.74	34.45	-9.19	Peak	---	---
2	257.60	19.27	46.00	-26.73	29.28	-10.01	Peak	---	---
3	329.60	21.72	46.00	-24.28	29.19	-7.47	Peak	---	---
4	388.00	24.18	46.00	-21.82	30.28	-6.10	Peak	---	---
5	486.40	26.38	46.00	-19.62	29.89	-3.51	Peak	---	---
6	599.20	29.06	46.00	-16.94	29.78	-0.72	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.
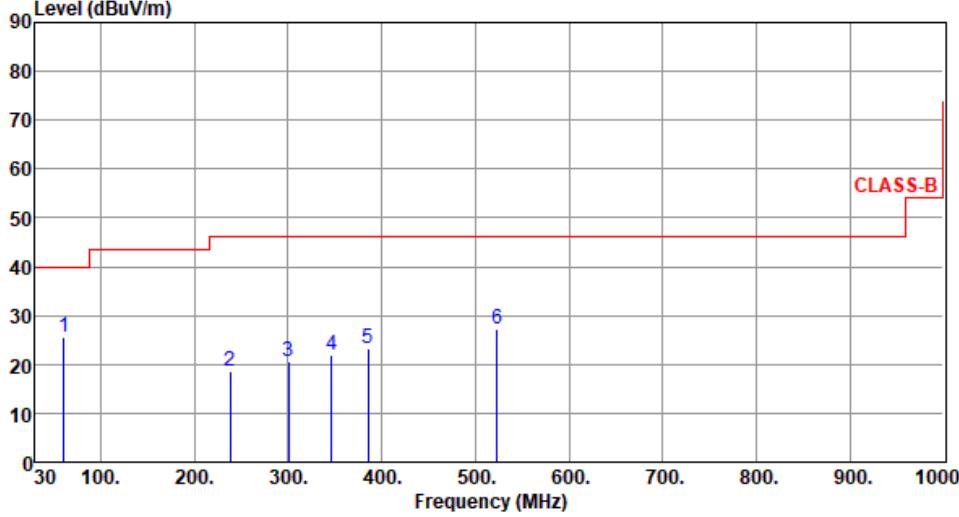
Modulation / SF	Lora / 9	Test Freq. (MHz)	914.9
Polarization	Horizontal		

Test By   :BRAD WU   Temperature(°C):22   Humidity(%):65

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	35.96	20.48	40.00	-19.52	30.10	-9.62	Peak	---	---
2	245.60	20.07	46.00	-25.93	30.42	-10.35	Peak	---	---
3	341.60	21.92	46.00	-24.08	29.20	-7.28	Peak	---	---
4	406.40	24.29	46.00	-21.71	29.94	-5.65	Peak	---	---
5	494.40	26.83	46.00	-19.17	30.23	-3.40	Peak	---	---
6	525.60	28.20	46.00	-17.80	30.93	-2.73	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.

Modulation / SF	Lora / 9	Test Freq. (MHz)	914.9
Polarization	Vertical		

Test By   :BRAD WU   Temperature(°C):22   Humidity(%):65

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	60.24	25.45	40.00	-14.55	34.71	-9.26	Peak	---	---
2	238.40	18.69	46.00	-27.31	29.42	-10.73	Peak	---	---
3	300.80	20.46	46.00	-25.54	29.04	-8.58	Peak	---	---
4	346.40	21.91	46.00	-24.09	29.22	-7.31	Peak	---	---
5	385.60	23.39	46.00	-22.61	29.54	-6.15	Peak	---	---
6	523.20	27.08	46.00	-18.92	29.82	-2.74	Peak	---	---
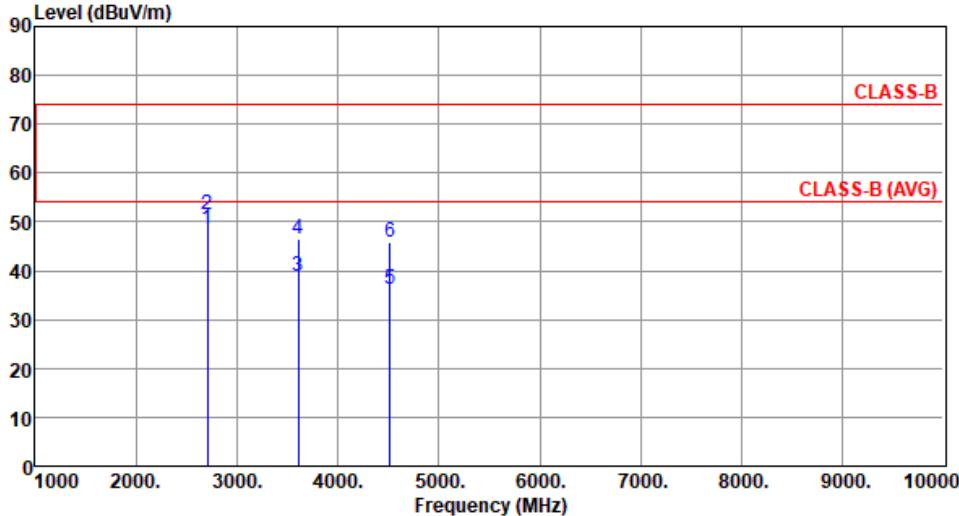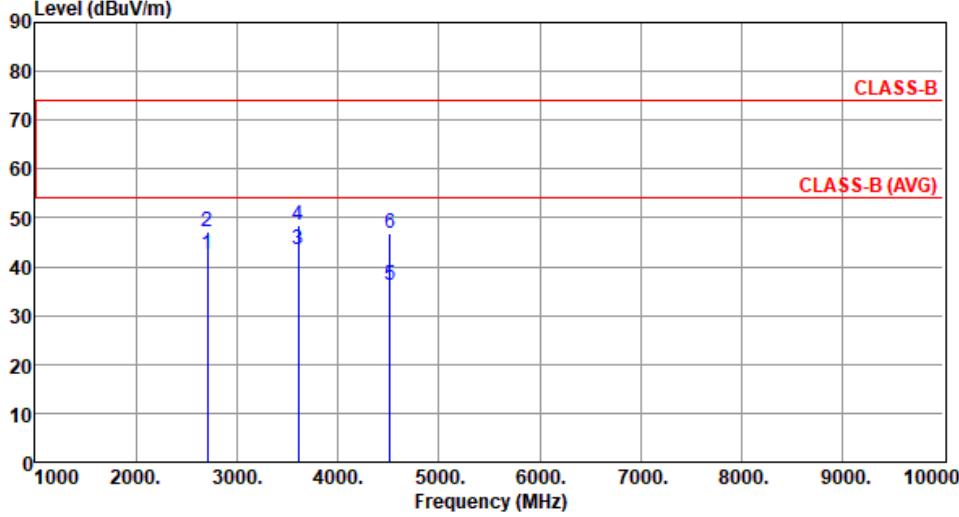
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
      *Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.1.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation / SF	Lora / 9	Test Freq. (MHz)	902.3
Polarization	Horizontal		

Test By   :BRAD WU   Temperature(℃):23   Humidity(%):66

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2706.90	48.57	54.00	-5.43	49.72	-1.15	Average	124	235
2	2706.90	51.53	74.00	-22.47	52.68	-1.15	Peak	124	235
3	3609.20	38.72	54.00	-15.28	37.06	1.66	Average	184	247
4	3609.20	46.64	74.00	-27.36	44.98	1.66	Peak	184	247
5	4511.50	36.26	54.00	-17.74	32.01	4.25	Average	100	231
6	4511.50	45.90	74.00	-28.10	41.65	4.25	Peak	100	231

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).

Modulation / SF	Lora / 9	Test Freq. (MHz)	902.3
Polarization	Vertical		

Test By :BRAD WU   Temperature(°C):23   Humidity(%):66

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2706.90	42.55	54.00	-11.45	43.70	-1.15	Average	151	321
2	2706.90	47.06	74.00	-26.94	48.21	-1.15	Peak	151	321
3	3609.20	43.50	54.00	-10.50	41.84	1.66	Average	163	154
4	3609.20	48.43	74.00	-25.57	46.77	1.66	Peak	163	154
5	4511.50	36.21	54.00	-17.79	31.96	4.25	Average	108	166
6	4511.50	46.76	74.00	-27.24	42.51	4.25	Peak	108	166

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).

Modulation / SF	Lora / 9	Test Freq. (MHz)	908.5
Polarization	Horizontal		

Test By   :BRAD WU   Temperature(°C):23   Humidity(%):66

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2725.50	36.09	54.00	-17.91	37.21	-1.12	Average	136	277
2	2725.50	41.77	74.00	-32.23	42.89	-1.12	Peak	136	277
3	3634.00	39.07	54.00	-14.93	37.37	1.70	Average	215	230
4	3634.00	45.26	74.00	-28.74	43.56	1.70	Peak	215	230
5	4542.50	33.86	54.00	-20.14	29.47	4.39	Average	100	58
6	4542.50	45.26	74.00	-28.74	40.87	4.39	Peak	100	58

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).

Modulation / SF	Lora / 9	Test Freq. (MHz)	908.5
Polarization	Vertical		

Test By   :BRAD WU   Temperature(℃):23   Humidity(%):66

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2725.50	38.56	54.00	-15.44	39.68	-1.12	Average	129	300
2	2725.50	44.73	74.00	-29.27	45.85	-1.12	Peak	129	300
3	3634.00	41.32	54.00	-12.68	39.62	1.70	Average	282	162
4	3634.00	46.56	74.00	-27.44	44.86	1.70	Peak	282	162
5	4542.50	35.99	54.00	-18.01	31.60	4.39	Average	119	166
6	4542.50	45.92	74.00	-28.08	41.53	4.39	Peak	119	166

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).

Modulation / SF	Lora / 9	Test Freq. (MHz)	914.9
Polarization	Horizontal		

```
Test By    :BRAD WU        Temperature(℃):22      Humidity(%):65
```



```
           Freq.  Emission Limit   Margin   SA      Factor   Remark    ANT    Turn
                  level                      reading                    High   Table
           MHz    dBuV/m   dBuV/m  dB       dBuV     dB                  cm     deg
    ───────────────────────────────────────────────────────────────────────────────
    1      2744.70 36.84   54.00   -17.16   37.92    -1.08    Average    126    234
    2      2744.70 43.98   74.00   -30.02   45.06    -1.08    Peak       126    234
    3      3659.60 41.70   54.00   -12.30   39.95     1.75    Average    113    231
    4      3659.60 47.47   74.00   -26.53   45.72     1.75    Peak       113    231
    5      4574.50 33.69   54.00   -20.31   29.19     4.50    Average    100     62
    6      4574.50 45.12   74.00   -28.88   40.62     4.50    Peak       100     62
```

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).

Modulation / SF	Lora / 9	Test Freq. (MHz)	914.9
Polarization	Vertical		

Test By   :BRAD WU   Temperature(°C):22   Humidity(%):65

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2744.70	35.92	54.00	-18.08	37.00	-1.08	Average	153	282
2	2744.70	43.18	74.00	-30.82	44.26	-1.08	Peak	153	282
3	3659.60	42.57	54.00	-11.43	40.82	1.75	Average	235	160
4	3659.60	47.58	74.00	-26.42	45.83	1.75	Peak	235	160
5	4574.50	35.31	54.00	-18.69	30.81	4.50	Average	100	169
6	4574.50	45.96	74.00	-28.04	41.46	4.50	Peak	100	169

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).

3.2 Unwanted Emissions into Non-Restricted Frequency Bands

3.2.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.2.2 Test Procedures

Reference Level Measurement

1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Set Sweep time = auto couple, Trace mode = max hold.
3. Allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

Unwanted Emissions Level Measurement

1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

3.2.3 Test Setup
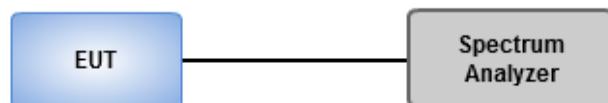
3.2.4 Unwanted Emissions into Non-Restricted Frequency Bands

Ambient Condition	22°C / 65%	Tested By	Brad Wu

Hopping on
TX Frequency 902.3~914.9 MHz / 30MHz~10GHz (down 30dBc)
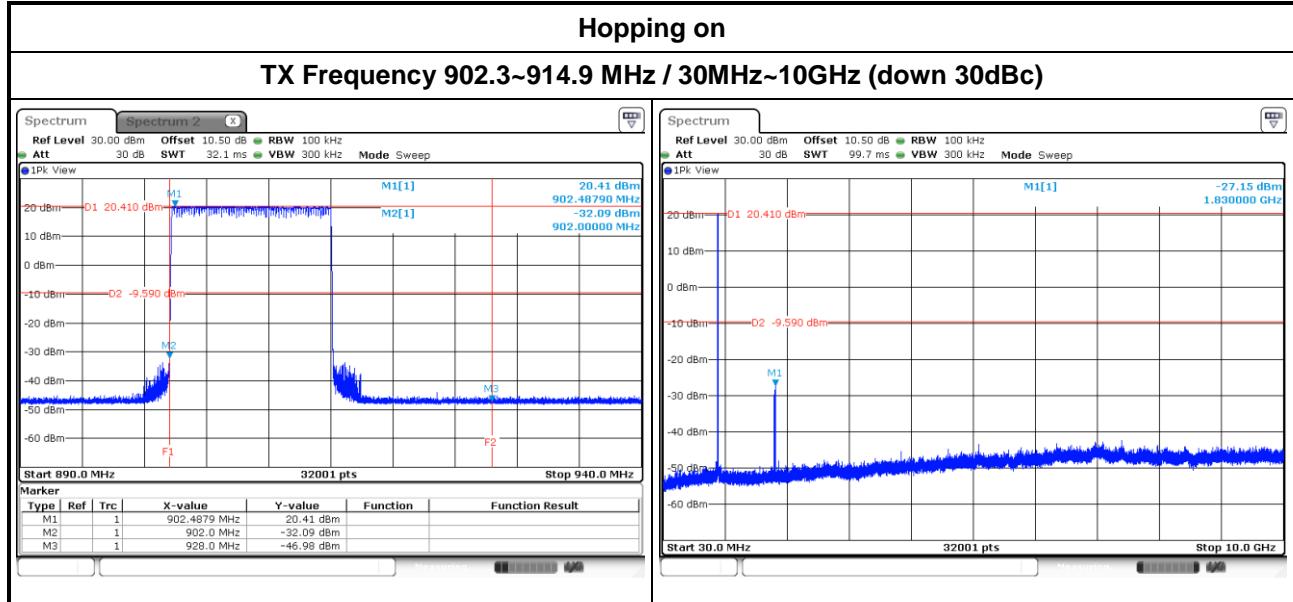
Hopping off

TX Frequency 902.3MHz / 30MHz~10GHz (down 30dBc)
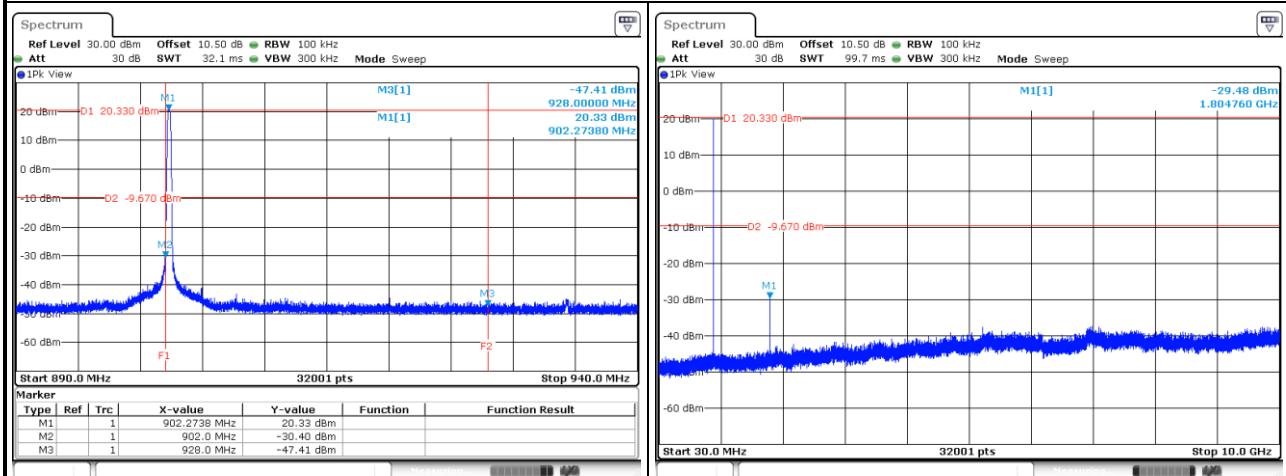
TX Frequency 908.5MHz / 30MHz~10GHz (down 30dBc)
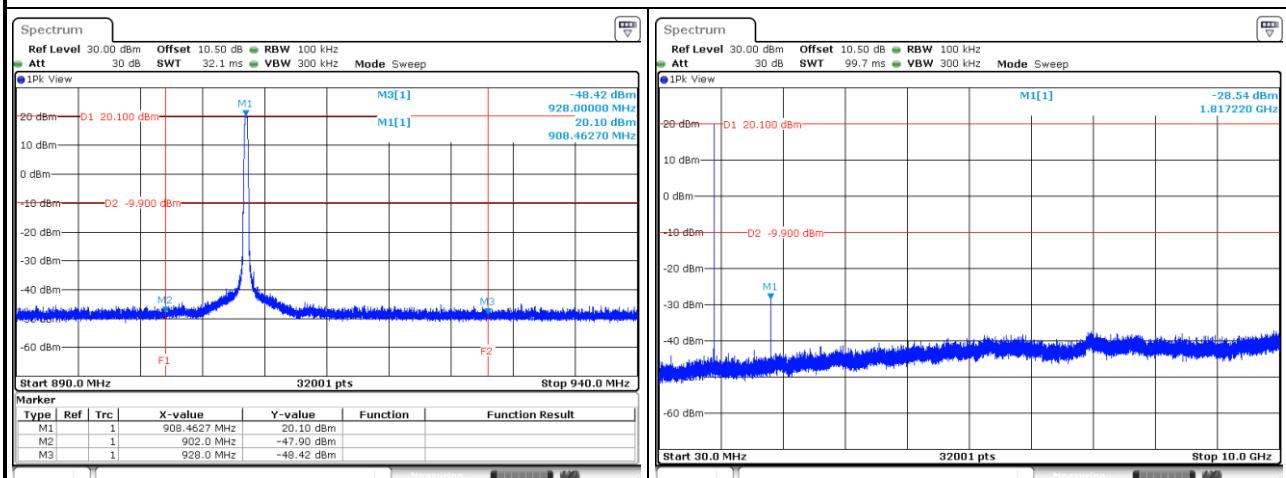
TX Frequency 914.9MHz / 30MHz~10GHz (down 30dBc)
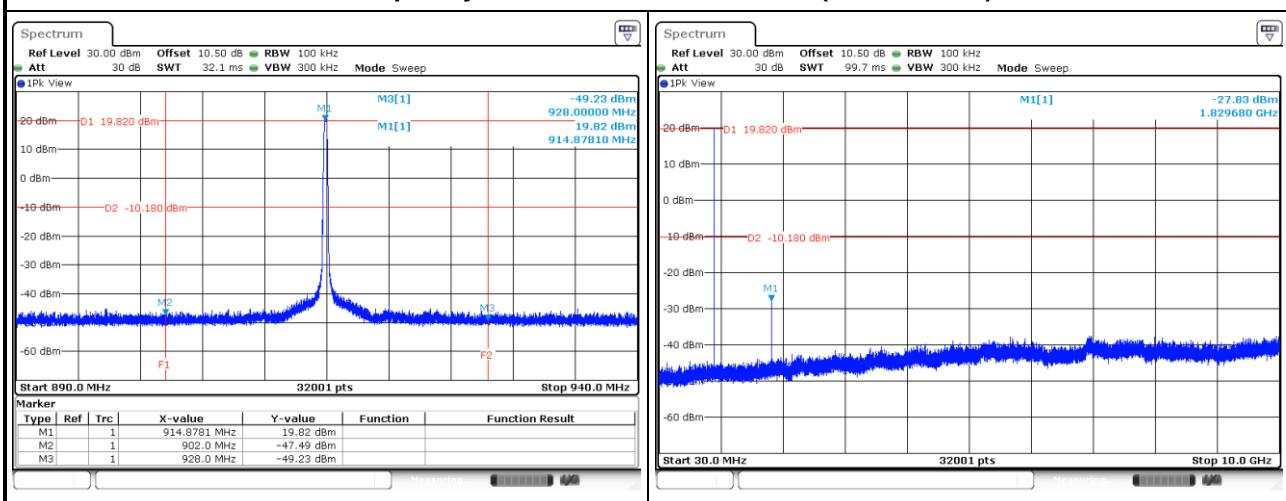
3.3　Conducted Output Power

3.3.1　Limit of Conducted Output Power

☒　1 Watt, systems employing at least 50 hopping channels;

☐　0.25 Watt, for systems employing less than 50 hopping channels, but at least 25 hopping channels,

3.3.2　Test Procedures

1.　A wideband power meter is used for power measurement. Bandwidth of power senor and meter is 50MHz

2　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

3.3.3　Test Setup

3.3.4　Test Result of Conducted Output Power

Ambient Condition	22°C / 65%	Tested By		Brad Wu

Modulation / SF	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (W)
Lora / 9	902.3	133.05	21.24	1
Lora / 9	908.5	128.82	21.10	1
Lora / 9	914.9	124.45	20.95	1

3.4 Number of Hopping Frequency

3.4.1 Limit of Number of Hopping Frequency

Number of Hopping Frequencies Limit for Frequency Hopping Systems
☒   902-928 MHz Band:
☐   N ≥ 50, 20 dB bandwidth of the hopping channel is less than 250 kHz
☐   N ≥ 25, 20 dB bandwidth of the hopping channel is 250 kHz or greater
☒   Hybrid mode, No minimum number of hopping channels associated with hybrid system.
N: Number of Hopping Frequencies

3.4.2 Test Procedures

1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
2. Allow trace to stabilize.

3.4.3 Test Setup
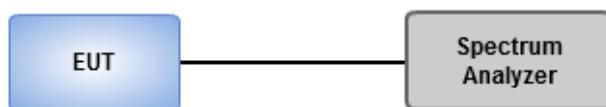
3.4.4 Test Result of Number of Hopping Frequency

Ambient Condition	22°C / 65%	Tested By	Brad Wu

<table>
<tr><td colspan="2">TX Frequency 902.3~914.9MHz</td></tr>
</table>
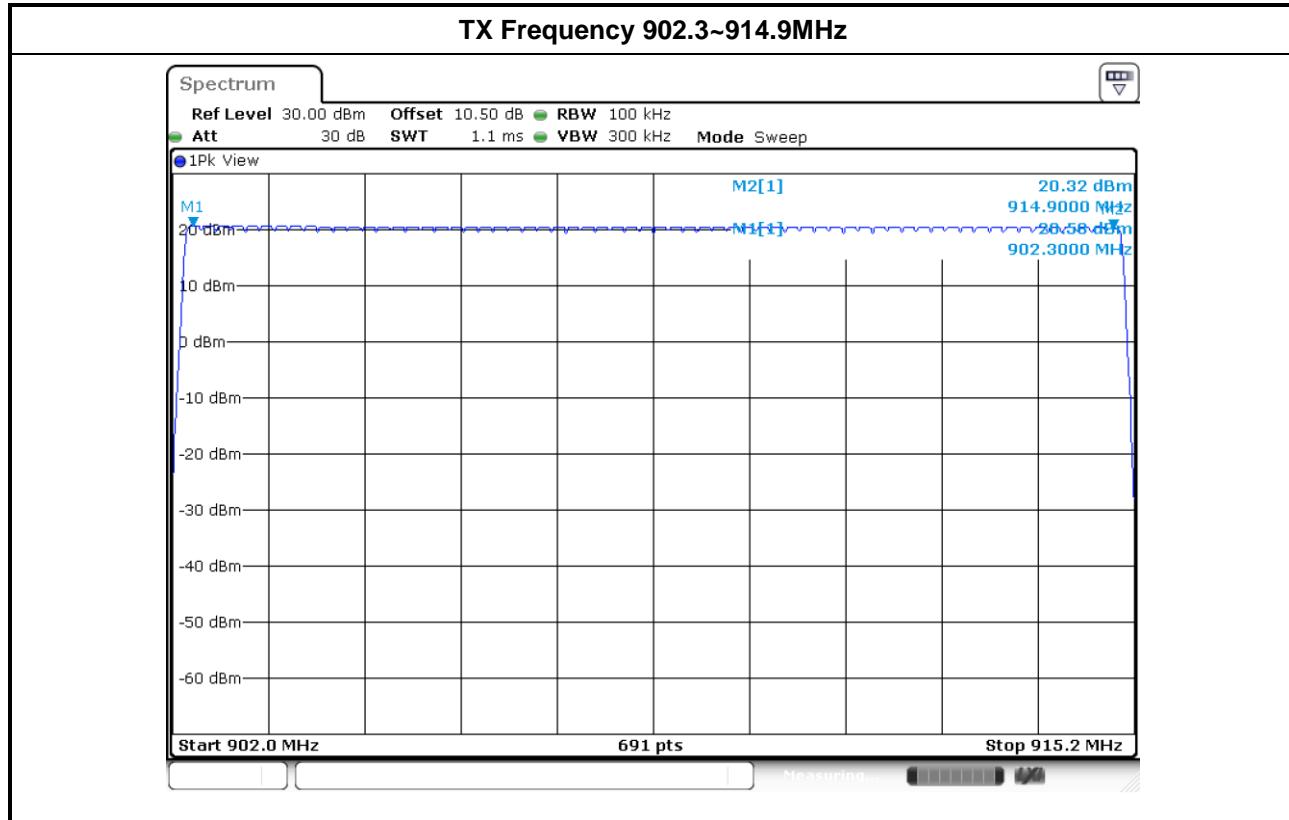
3.5 20dB and Occupied Bandwidth

3.5.1 Test Procedures

20dB Bandwidth

1. Set RBW=3kHz, VBW=10kHz, Sweep time=Auto, Detector=Peak Trace max hold.

2 Allow trace to stabilize.

3 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

1. Set RBW=3kHz, VBW=10kHz,Sweep time = Auto, Detector=Sample, Trace max hold

2 Allow trace to stabilize

3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.5.2 Test Setup
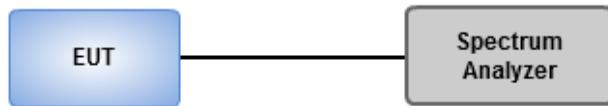
3.5.3 Test result of 20dB and Occupied Bandwidth

Ambient Condition	22°C / 65%	Tested By	Brad Wu

Modulation / SF	Freq. (MHz)	20dB Bandwidth (kHz)	Occupied Bandwidth (kHz)
Lora / 9	902.3	140.23	125.90
Lora / 9	908.5	139.80	125.90
Lora / 9	914.9	140.67	126.34

Worst Plot
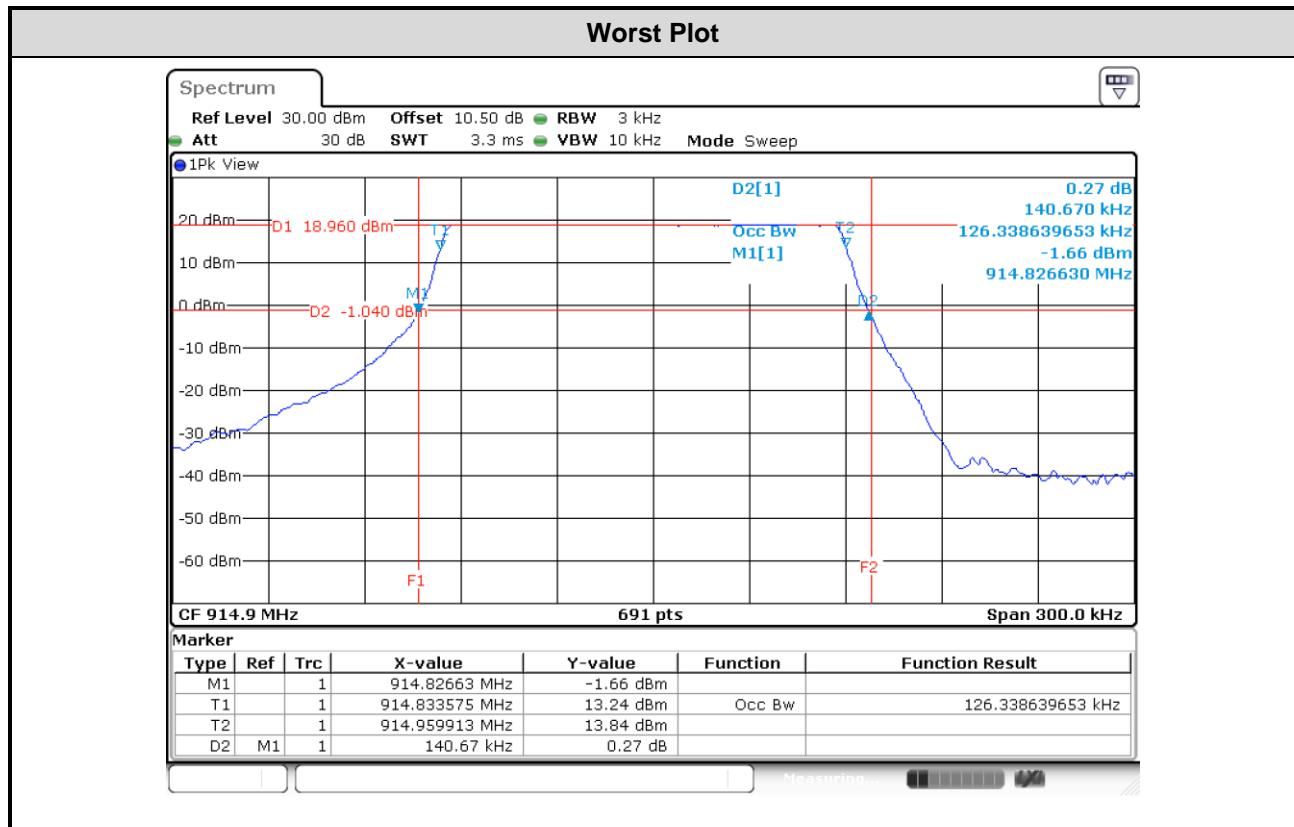
3.6   Channel Separation

3.6.1   Limit of Channel Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

3.6.2   Test Procedures

1.   Set RBW=10kHz, VBW=30kHz, Sweep time=Auto, Detector=Peak Trace max hold.

2   Allow trace to stabilize.

3   Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

3.6.3   Test Setup
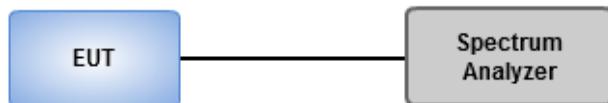
3.6.4 Test result of Channel Separation

Ambient Condition	22°C / 65%	Tested By	Brad Wu

Modulation / SF	Freq. (MHz)	Adjacent Channel Separation (kHz)	20dB Bandwidth (kHz)	Pass/Fail
Lora / 9	902.3	200.80	140.23	Pass
Lora / 9	908.5	200.80	139.80	Pass
Lora / 9	914.9	200.80	140.67	Pass

Worst Plot
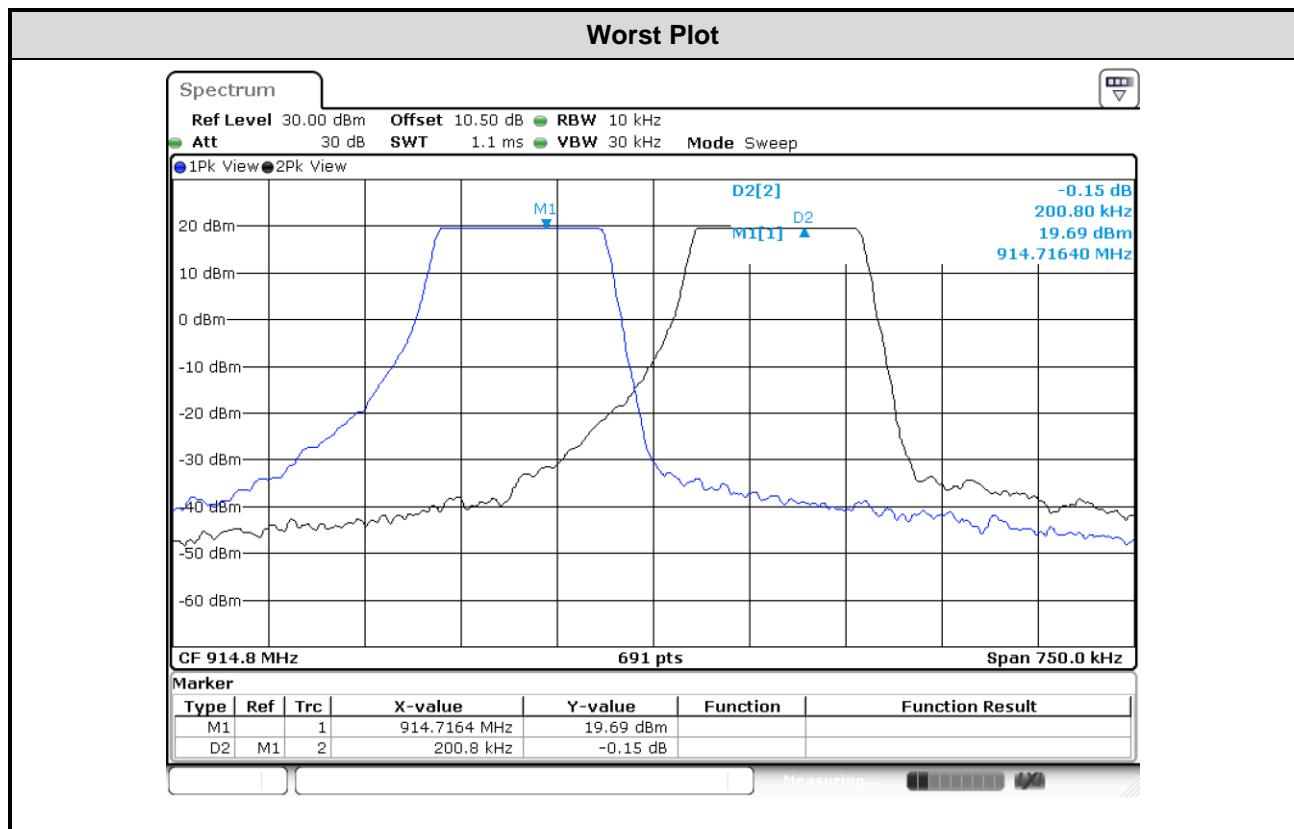
3.7 Number of Dwell Time

3.7.1 Limit of Dwell time

Time of Occupancy (Dwell Time) Limit for Frequency Hopping Systems		
☒	902-928 MHz Band:	
	☐	≤ 0.4 second within a 20 second period, 20 dB bandwidth of the hopping channel is less than 250 kHz
	☐	≤ 0.4 second within a 10 second period, 20 dB bandwidth of the hopping channel is 250 kHz or greater
	☒	Hybrid mode ,an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

3.7.2 Test Procedures

1. Set RBW=200kHz, VBW=1000kHz, Sweep time=25.6s / 500ms, Detector=Peak, Span=0Hz, Trace max hold.
2. Measure and record the burst on time.

3.7.3 Test Setup
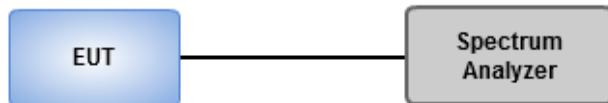
3.7.4 Test Result of Dwell Time

Ambient Condition	22°C / 65%	Tested By	Brad Wu

Modulation / SF	Freq. (MHz)	Length of Transmission Time (sec)	Number of Transmission in a 25.6 s (64 Hopping channels *0.4s)	Result (s)	Limit (s)
Lora / 9	902.3	0.371457	1	0.371457	0.4

SF 9
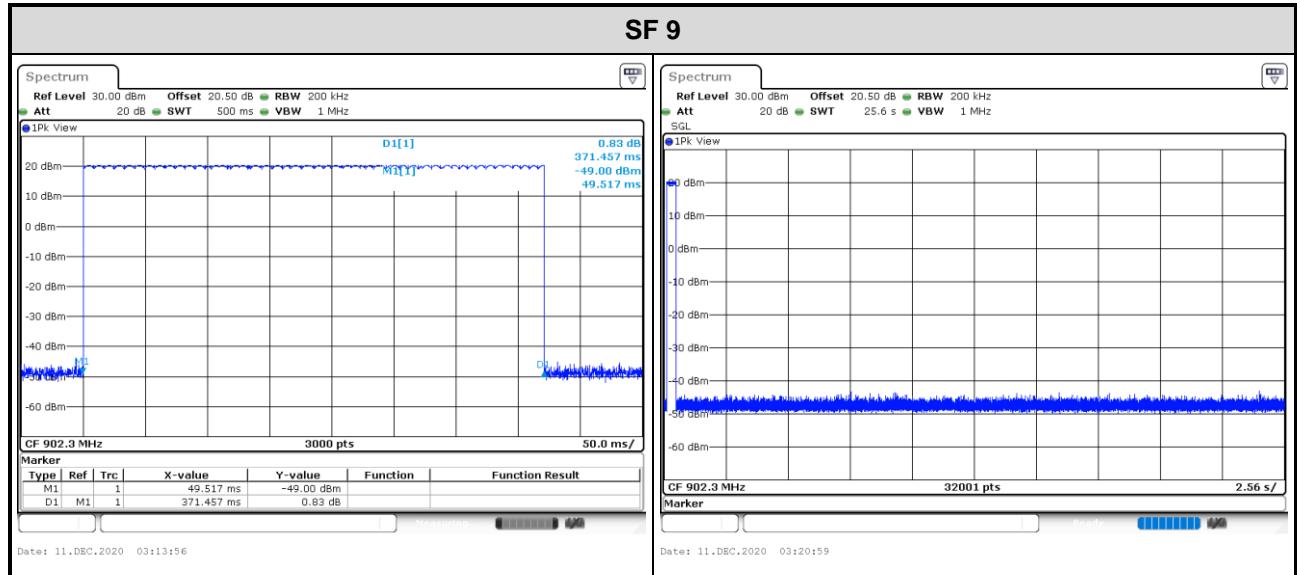
3.8 Power Spectral Density

3.8.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band. This item is for Hybrid mode.

3.8.2 Test Procedures

1. Set the RBW = 3kHz, VBW = 10 kHz.

2. Detector = RMS, Sweep time = auto couple.

3. Employ trace averaging (RMS) mode over a minimum of 100 traces

4. Use the peak marker function to determine the maximum amplitude level.

3.8.3 Test Setup
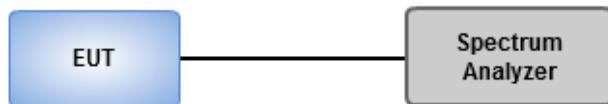
3.8.4 Test Result of Power Spectral Density

Ambient Condition	22°C / 65%	Tested By	Brad Wu

Modulation / SF	Freq. (MHz)	Total Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Lora / 9	902.3	5.54	8.00
Lora / 9	908.5	5.06	8.00
Lora / 9	914.9	5.35	8.00

Worst Plot
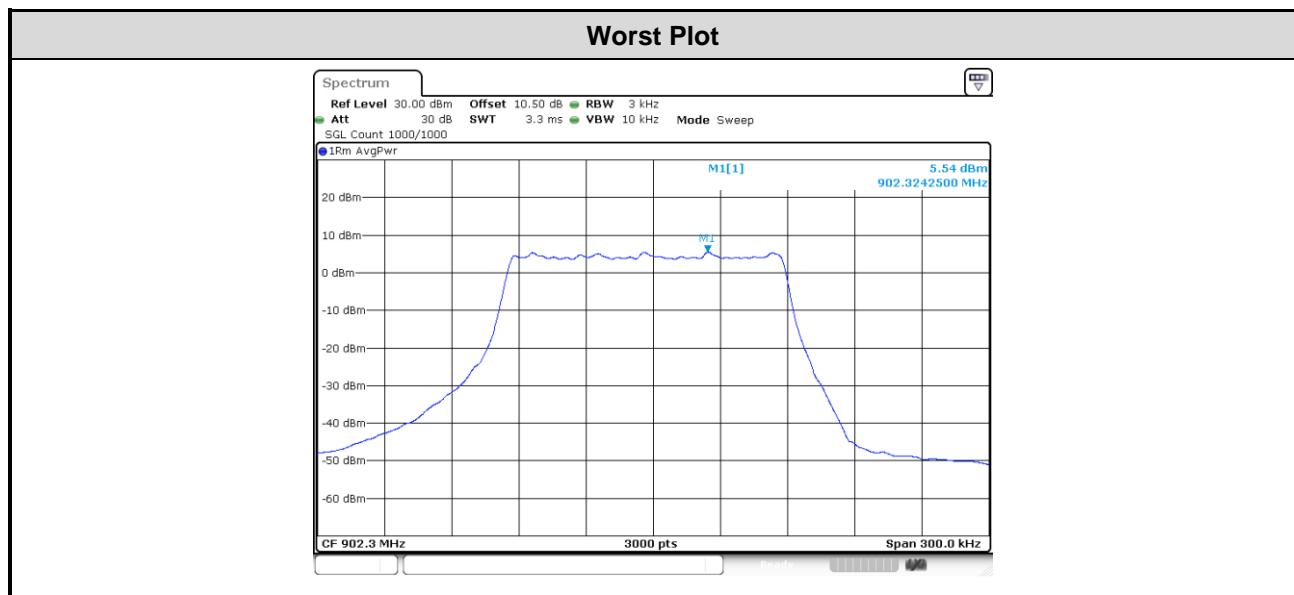
4 Test laboratory information

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	**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 Dist., Tao Yuan City 33381, Taiwan (R.O.C.)	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
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Email: ICC_Service@icertifi.com.tw

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