



REPORT No. : KH18110035E01

TEST REPORT

APPLICANT : Xiamen Four-Faith Communication Technology Co., Ltd.

PRODUCT NAME : F8L10GW LoRa Gateway

MODEL NAME : F8L10GW

BRAND NAME : Four-Faith

FCC ID : 2ALUW-F8L10GW

STANDARD(S) : 47 CFR Part 15 Subpart B

TEST DATE : 2018-11-18 to 2018-11-20

ISSUE DATE : 2018-11-21

Prepared by:

A handwritten signature in black ink, appearing to read "Yue Meng".

Yue Meng (Project engineer)

Approved by:

A handwritten signature in black ink, appearing to read "Anne Liu".

Anne Liu (Supervisor)

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Change History		
Issue	Date	Reason for change
1.0	2018-11-21	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Xiamen Four-Faith Communication Technology Co., Ltd.
Applicant Address:	11th Floor, A-06 Area, No.370, Chengyi Street, Jimei, Xiamen, Fujian, China.
Manufacturer:	Xiamen Four-Faith Communication Technology Co., Ltd.
Manufacturer Address:	11th Floor, A-06 Area, No.370, Chengyi Street, Jimei, Xiamen, Fujian, China.

1.2. Equipment Under Test (EUT) Description

EUT Type:	F8L10GW LoRa Gateway
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	V1.3
Software Version:	20180927

Note:

1. For a more detailed description, please refer to specification or user's manual supplied by the applicant and/or manufacturer

1.3. Related Submittal(s)/Grant(s)

FCC Part 15.249 DXX submissions with FCC ID: 2ALUW-F8L10GW

FCC Part 15.247 DTS submissions with FCC ID: 2ALUW-F8L10GW



2. Test Results

2.1. Applied Reference Documents

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart B:

No.	Identity	Document Title
1	47 CFR Part 15	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result
1	15.107	Conducted Emission	2018.11.18	Jinxin Huang	PASS
2	15.109	Radiated Emission	2018.11.20	Jinxin Huang	PASS

NOTE: The tests were performed according to the method of measurements prescribed in ANSI C63.4-2014.

2.2. EUT Setup and Operating Conditions

Frequency range was investigated: Conducted emission test: from 150KHz to 30MHz; Radiated emission test: from 30MHz to 6000MHz.

Test Item	
Mode 1 :	EUT + PC WAN Link Note: EUT connects with the PC network port through the network(RJ45) cable, opens the data link of data packet transmission test software "TFGen", and opens the Windows command window to input the ping instruction.

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 - 60
Atmospheric Pressure (kPa):	86 - 106

3. 47 CFR Part 15B Requirements

3.1. Conducted Emission

3.1.1. Requirement

According to FCC section 15.107, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

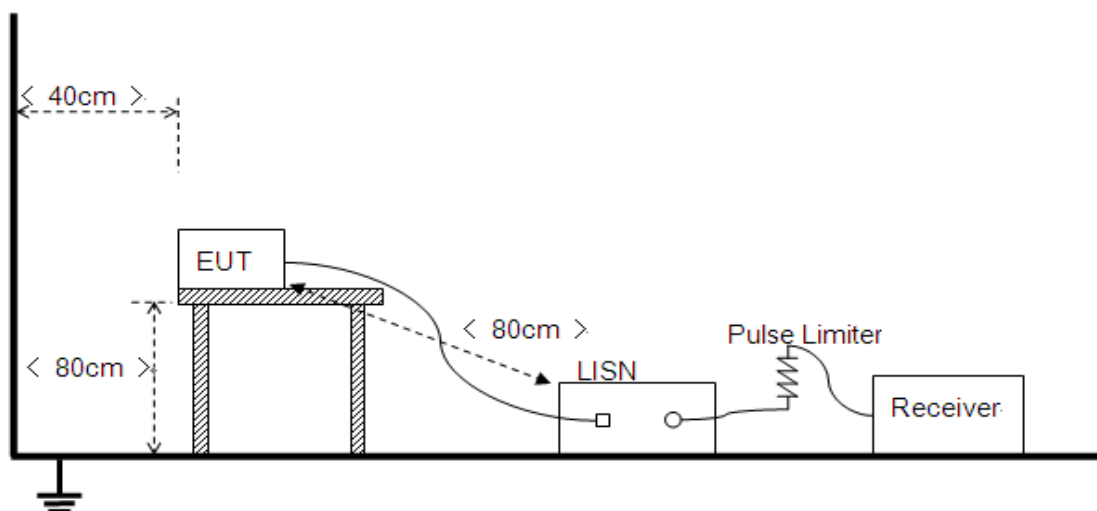
Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- The limit subjects to the Class B digital device.
- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

3.1.2. Test Setup

Please refer to Annex A for the photographs of the Test Configuration.



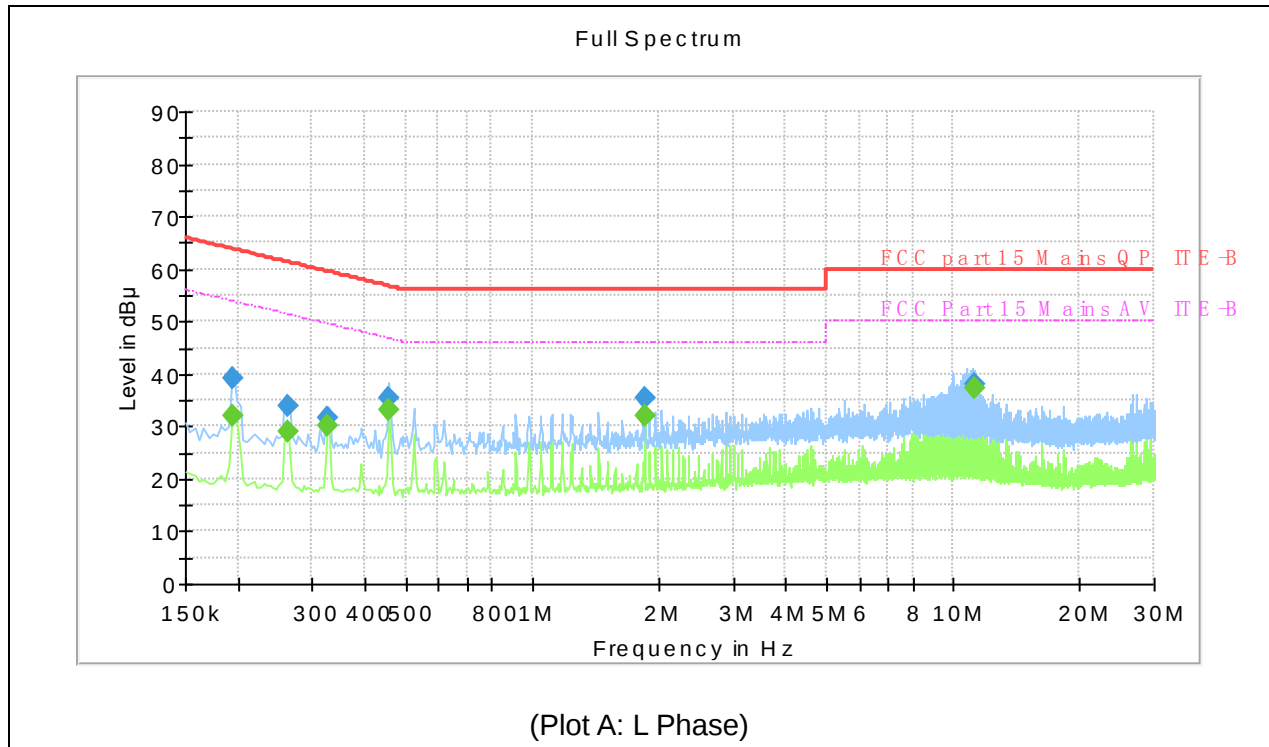


The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides $50\Omega/50\mu\text{H}$ of coupling impedance for the measuring instrument. A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

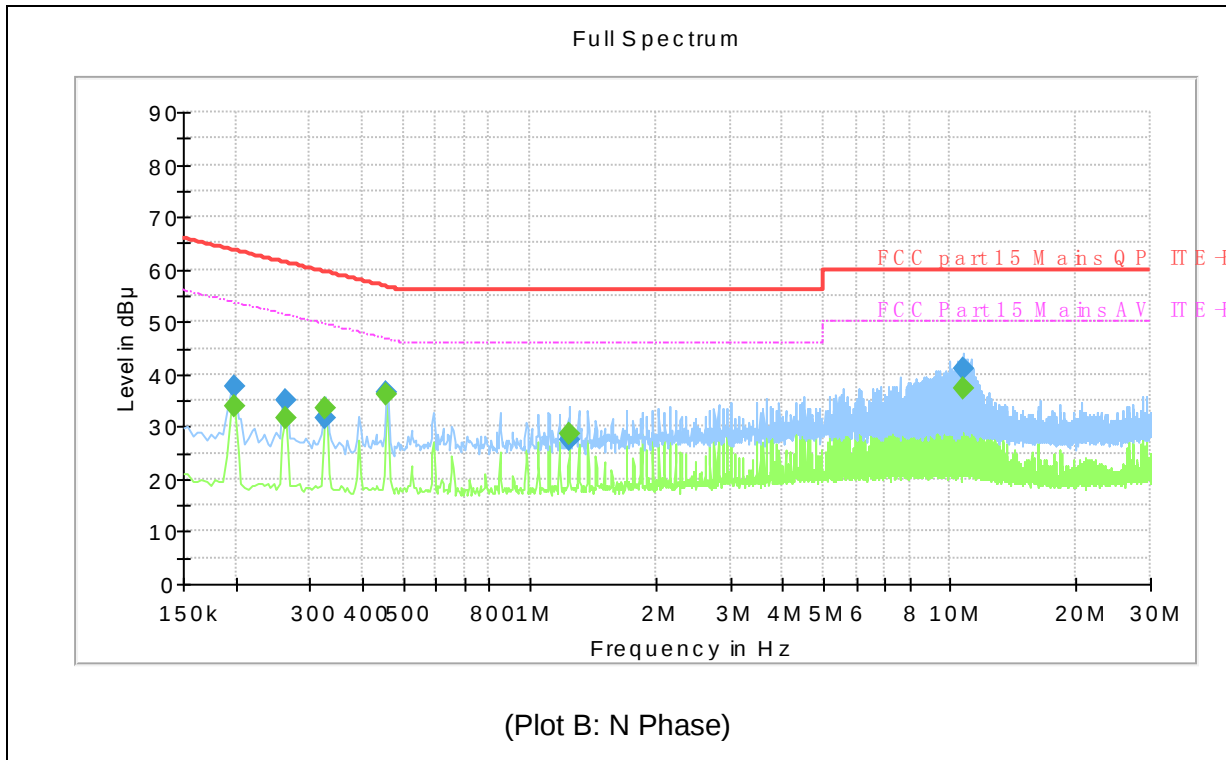
The power strip or extension cord has been investigated to make sure that the LISN integrity is maintained with respect to the impedance characteristics as prescribed in ANSI C63.4-2014 at Clause 4.3.

3.1.3. Test Result

The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. All test modes are considered, refer to recorded points and plots below.

**A. Test Plot and Suspicious Points:**

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)	Verdict
0.194000	---	31.91	53.86	21.95	L1	10.2	PASS
0.194000	39.17	---	63.86	24.70	L1	10.2	PASS
0.262000	---	28.92	51.37	22.45	L1	10.2	PASS
0.262000	34.06	---	61.37	27.31	L1	10.2	PASS
0.326000	---	29.94	49.55	19.61	L1	10.2	PASS
0.326000	31.81	---	59.55	27.74	L1	10.2	PASS
0.458000	35.27	---	56.73	21.46	L1	10.2	PASS
0.458000	---	33.22	46.73	13.51	L1	10.2	PASS
1.850000	35.39	---	56.00	10.61	L1	10.3	PASS
1.850000	---	32.19	46.00	13.81	L1	10.3	PASS
11.182000	---	37.16	50.00	12.84	L1	10.7	PASS
11.182000	38.19	---	60.00	21.81	L1	10.7	PASS



Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)	Verdict
0.198000	---	33.84	53.69	19.85	N	10.2	PASS
0.198000	37.65	---	63.69	26.04	N	10.2	PASS
0.262000	---	31.69	51.37	19.68	N	10.2	PASS
0.262000	34.94	---	61.37	26.43	N	10.2	PASS
0.326000	---	33.62	49.55	15.93	N	10.2	PASS
0.326000	31.79	---	59.55	27.76	N	10.2	PASS
0.458000	36.39	---	56.73	20.34	N	10.2	PASS
0.458000	---	35.97	46.73	10.76	N	10.2	PASS
1.242000	27.41	---	56.00	28.59	N	10.3	PASS
1.242000	---	28.79	46.00	17.21	N	10.3	PASS
10.790000	---	37.15	50.00	12.85	N	10.6	PASS
10.790000	41.09	---	60.00	18.91	N	10.6	PASS



3.2. Radiated Disturbance

3.2.1. Requirement

According to FCC section 15.109 (a), the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency range (MHz)	Field Strength Limitation at 3m Measurement Distance	
	($\mu\text{V/m}$)	(dB $\mu\text{V/m}$)
30.0 - 88.0	100	20log 100
88.0 - 216.0	150	20log 150
216.0 - 960.0	200	20log 200
Above 960.0	500	20log 500

As shown in FCC section 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector. When average radiated emission measurements are specified in this part, including emission measurements below 1000MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

Note:

- 1) The tighter limit shall apply at the boundary between two frequency range.
- 2) Limitation expressed in dB $\mu\text{V/m}$ is calculated by $20\log$ Emission Level($\mu\text{V/m}$).

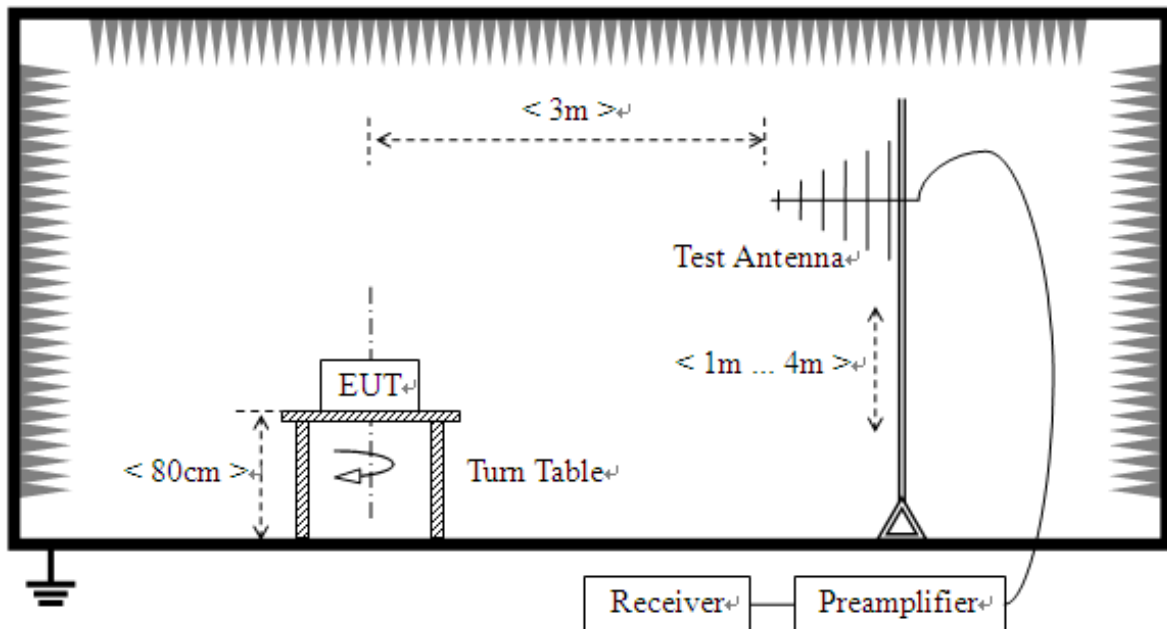
3.2.2. Frequency range of measurement

According to 15.33(b)(1), the frequency range of radiated measurement for the EUT is listed in the following table:

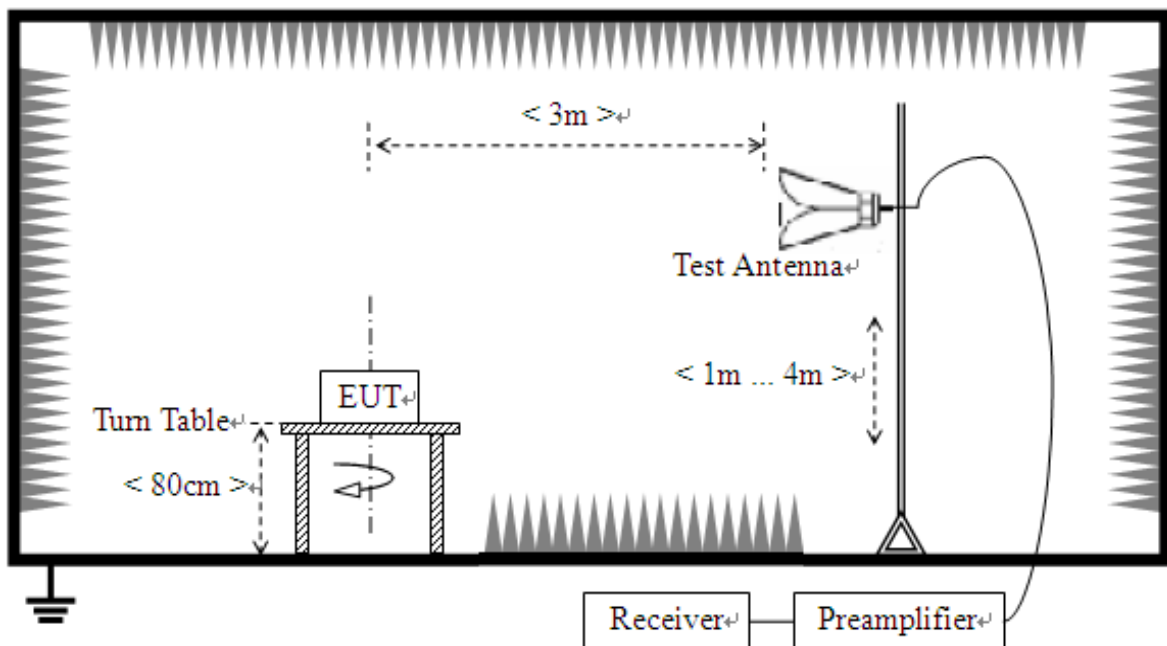
Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

3.2.3. Test Setup

- 1) For radiated emissions from 30MHz to 1GHz



- 2) For radiated emissions above 1GHz





The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.

For the test Antenna:

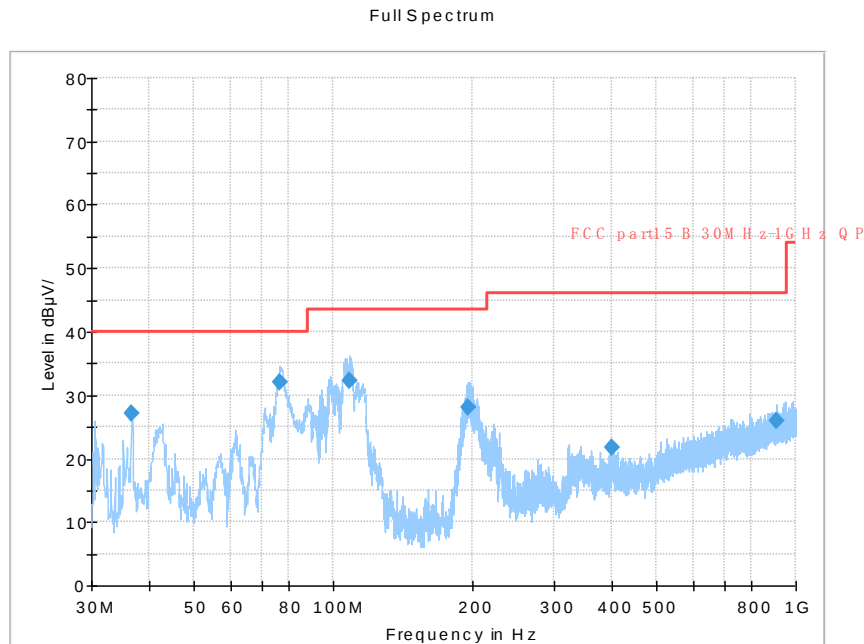
In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

3.2.4. Test Result

The maximum radiated emission is searched using PK, QP and AV detectors; the emission levels more than the limits, and that have narrow margins from the limits will be re-measured with AV and QP detectors. Both the vertical and the horizontal polarizations of the Test Antenna are considered to perform the tests. All test modes are considered, refer to recorded points and plots below.

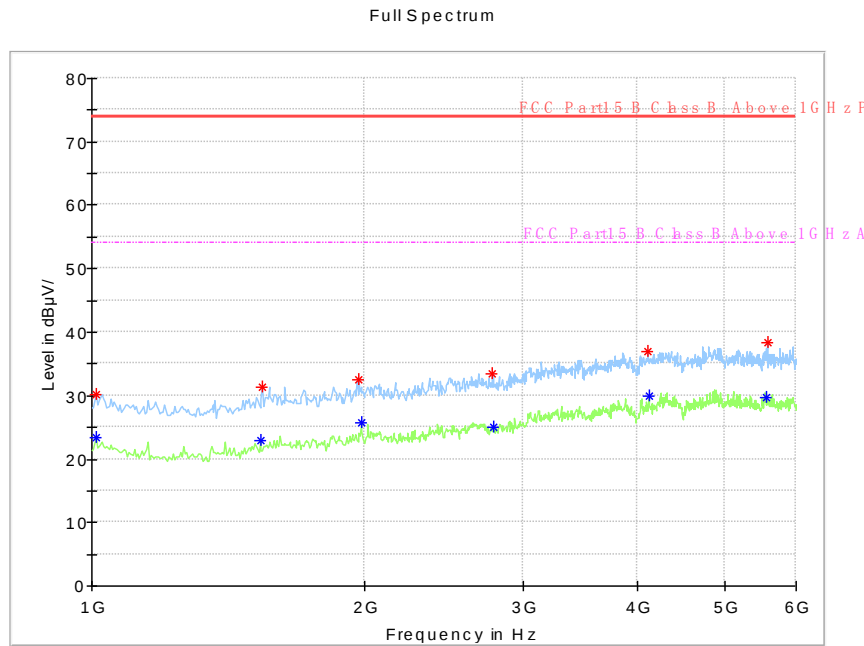
The amplitude of emissions (6GHz-12.5GHz) which are attenuated more than 20 dB below the permissible value need not be reported.

Note: All radiated emission tests were performed in X, Y, Z axis direction, and only the worst axis test condition was recorded in this test report.



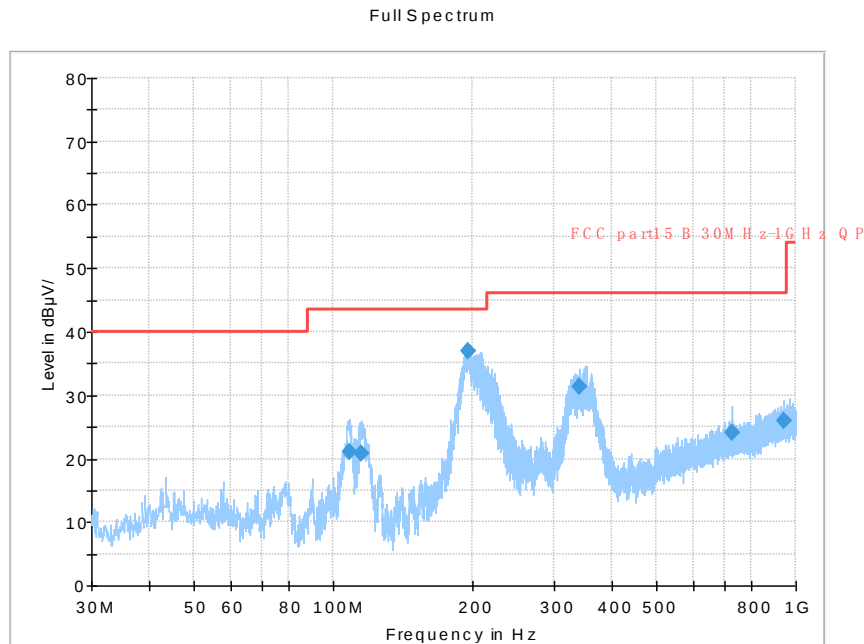
(Plot A: ANT-Vertical,30MHz - 1GHz)

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)	Verdict
36.574444	27.17	40.00	12.83	V	13.4	PASS
76.560000	32.00	40.00	8.00	V	9.6	PASS
108.785556	32.28	43.50	11.22	V	14.8	PASS
196.031667	28.11	43.50	15.39	V	13.5	PASS
399.516111	21.68	46.00	24.32	V	19.7	PASS
906.071667	25.93	46.00	20.07	V	28.1	PASS



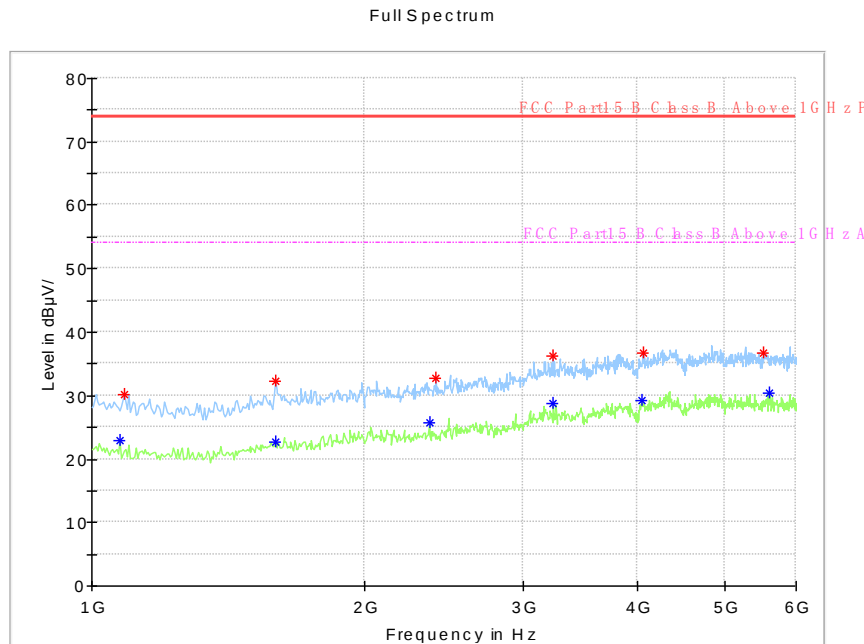
(Plot C: ANT- Vertical, 1GHz - 6GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)	Verdict
1010.0000	30.12	---	74.00	43.88	V	-16.6	PASS
1010.0000	---	23.42	54.00	30.58	V	-16.6	PASS
1535.0000	---	22.83	54.00	31.17	V	-15.6	PASS
1545.0000	31.42	---	74.00	42.58	V	-15.4	PASS
1975.0000	32.49	---	74.00	41.51	V	-13.1	PASS
1985.0000	---	25.67	54.00	28.33	V	-12.7	PASS
2770.0000	33.54	---	74.00	40.46	V	-11.0	PASS
2775.0000	---	25.09	54.00	28.91	V	-11.0	PASS
4115.0000	36.97	---	74.00	37.03	V	-6.0	PASS
4125.0000	---	29.90	54.00	24.10	V	-5.9	PASS
5570.0000	---	29.79	54.00	24.21	V	-3.2	PASS
5575.0000	38.32	---	74.00	35.68	V	-3.3	PASS



(Plot B: ANT- Horizontal, 30MHz - 1GHz)

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)	Verdict
108.300556	20.97	43.50	22.53	H	14.7	PASS
114.928889	20.83	43.50	22.67	H	13.0	PASS
196.193333	36.94	43.50	6.56	H	13.6	PASS
339.322222	31.25	46.00	14.75	H	18.2	PASS
729.154444	24.18	46.00	21.82	H	25.3	PASS
942.770000	25.98	46.00	20.02	H	28.4	PASS



(Plot D: ANT- Horizontal, 1GHz - 6GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)	Verdict
1075.0000	---	22.82	54.00	31.18	H	-16.8	PASS
1085.0000	30.23	---	74.00	43.77	H	-16.9	PASS
1595.0000	---	22.72	54.00	31.28	H	-14.9	PASS
1595.0000	32.23	---	74.00	41.77	H	-14.9	PASS
2360.0000	---	25.78	54.00	28.22	H	-11.8	PASS
2400.0000	32.80	---	74.00	41.20	H	-12.2	PASS
3235.0000	36.19	---	74.00	37.81	H	-8.4	PASS
3235.0000	---	28.69	54.00	25.31	H	-8.4	PASS
4060.0000	---	29.20	54.00	24.80	H	-5.3	PASS
4065.0000	36.65	---	74.00	37.35	H	-5.3	PASS
5530.0000	36.74	---	74.00	37.26	H	-3.7	PASS
5615.0000	---	30.46	54.00	23.54	H	-3.7	PASS



Annex A Test Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission Measurement

Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))	9kHz-150kHz	3.10 dB
	150kHz-30MHz	2.61dB

Uncertainty of Radiated Emission Measurement

Measuring Uncertainty for a Level of Confidence of 95%(U=2Uc(y))	30MHz-200MHz	3.87dB
	200MHz-1000MHz	4.07dB
	1GHz-6GHz	4.25dB
	6GHz-18GHz	5.00dB



Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Company Name:	Kehu-Morlab Test Laboratory
Address:	Unit 101, No.1732 Gangzhong Road, Xiamen Area, Pilot Free Trade Zone (Fujian) China
Responsible Test Lab Manager:	Mr. Di Dehai
Telephone:	+86-0592-5612050
Facsimile:	+86-0592-5612095

2. Identification of the Responsible Testing Location

Name:	Kehu-Morlab Test Laboratory
Address:	Unit 101, No.1732 Gangzhong Road, Xiamen Area, Pilot Free Trade Zone (Fujian) China

3. Accreditation Certificate

Accredited Testing Laboratory:	The FCC designation number is CN1249. (Kehu-Morlab Test Laboratory)
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4. Test Software Utilized

No.	Model	Version Number	Producer	Test Item
1	EMC32	V10.00.00	Rode&Schwarz	RE
2	EMC32	V10.20.01	Rode&Schwarz	CE

5. Conducted Emission Test Equipments

No.	Equipment Name	Serial No.	Model No.	Manufacturer	Cal.Date	Cal.Due Date
1	EMI Receiver	102174	ESR3	ESR3	2017.11.27	2018.11.26
2	LISN	101338	ENV432	ENV432	2017.11.27	2018.11.26
3	Pulse Limiter (10dB)	317	VTSD 9561 F	VTSD 9561 F	2017.11.27	2018.11.26
4	Coaxial cable(BNC) (30MHz-3GHz)	EMC01	N/A	Morlab	N/A	N/A

**6. Radiated Test Equipments**

No.	Equipment Name	Serial No.	Model No.	Manufacturer	Cal. Date	Cal.Due Date
1	Anechoic Chamber	N/A	9m*6m*6m	ETS-Lindgren	2017.11.27	2018.11.26
2	Signal Analyzer	101294	FSV40	R&S	2017.12.01	2018.11.30
3	Active Ring Antenna	FMZB 1513 #269	FMZB 1513	Schwarzbeck	2017.11.26	2018.11.25
4	Linear Log Periodic Broad Band Antenna	949	VULB 9163	Schwarzbeck	2017.12.03	2018.12.02
5	Ultra-Wideband Horn Antenna	102615	HF907	R&S	2017.12.03	2018.12.02
6	Coaxial cable (N male) (9kHz -3GHz)	EMC02	N/A	Morlab	N/A	N/A
7	Coaxial cable (N male) (9kHz -3GHz)	EMC03	N/A	Morlab	N/A	N/A
8	Coaxial cable (N male) (1GHz-26.5GHz)	EMC04	N/A	Morlab	N/A	N/A
9	Coaxial cable (N male) (1GHz-26.5GHz)	EMC05	N/A	Morlab	N/A	N/A
10	Pre-amplifier (1GHz-18GHz)	8810011	PAP-1G18	CDSI	2017.11.27	2018.11.26

————— END OF REPORT —————