



REPORT No.: SZ19100195W01

TEST REPORT

APPLICANT : BDE Technology Co., Ltd

PRODUCT NAME : BDE Low Power, Long Range Sub-1G Module

MODEL NAME : BDE-RFM216

BRAND NAME : BDE

FCC ID : 2ABRUBDRFM216

STANDARD(S) : 47 CFR Part 15 Subpart C

RECEIPT DATE : 2019-11-27

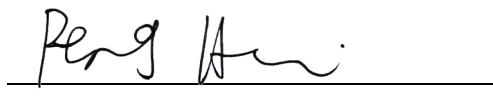
TEST DATE : 2019-12-04 to 2019-12-05

ISSUE DATE : 2019-12-16

Edited by:


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Change History		
Version	Date	Reason for change
1.0	2019-12-16	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	BDE Technology Co., Ltd
Applicant Address:	Innovation Building C1-1105, 182 Science Ave, Science City, Guangzhou, China
Manufacturer:	BDE Technology Co., Ltd
Manufacturer Address:	Innovation Building C1-1105, 182 Science Ave, Science City, Guangzhou, China

1.2. Equipment Under Test (EUT) Description

Product Name:	BDE Low Power, Long Range Sub-1G Module
Serial No:	(N/A, marked #1 by test site)
Equipment Type:	WB-DSSS
Modulation Type:	2-GFSK
Data Rate:	240kbps, 120kbps, 60kps, 30kbps
Operating Frequency Range:	903MHz-927MHz

Note 1: This is a Class II permissive change report for FCC ID: 2ABRUBDRFM216, we tested and recorded the test results for below test items.

1. Conducted Emission
2. Radiated Emission

Note 2: All data rates supported by the EUT has been evaluated, but only the worst case(30kbps) is presented in this report.

Note 3: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



1.3.Host Information

Product Name:	BDE Low Power, Long Range Sub-1G USB Dongle
Model Name:	BDE-USB216
Brand Name:	BDE
Hardware Version:	2.2
Software Version:	1.0
Antenna Type:	Helical Antenna
Antenna Gain:	4.37dBi

1.4.The Channel Number and Frequency

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	903	10	913	20	923
1	904	11	914	21	924
2	905	12	915	22	925
3	906	13	916	23	926
4	907	14	917	24	927
5	908	15	918		
6	909	16	919		
7	910	17	920		
8	911	18	921		
9	912	19	922		

Note: The lowest channel 0, middle channel 12 and highest channel 24 were selected for test in the report.



1.5. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

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	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	N/A	N/A
2	N/A	Duty Cycle Of Test Signal	N/A	N/A	N/A	N/A
3	15.247(b)	Maximum Peak Conducted Output Power	N/A	N/A	N/A	N/A
4	15.247(b)	Maximum Average Conducted Output Power	N/A	N/A	N/A	N/A
5	15.247(a)	Bandwidth	N/A	N/A	N/A	N/A
6	15.247(d)	Conducted Spurious Emission and Band Edge	N/A	N/A	N/A	N/A
7	15.247(e)	Power spectral density (PSD)	N/A	N/A	N/A	N/A
8	15.207	Conducted Emission	Dec 04, 2019	Lin Jiayong	PASS	No deviation
9	15.209, 15.247(d)	Radiated Emission	Dec 05, 2019	Gao Jianrou	PASS	No deviation

Note 1: The tests were performed according to the method of measurements prescribed in ANSIC63.10-2013.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.



1.6. Environmental Conditions

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

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

2. 47 CFR Part 15C Requirements

2.1. Conducted Emission

2.1.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, 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).

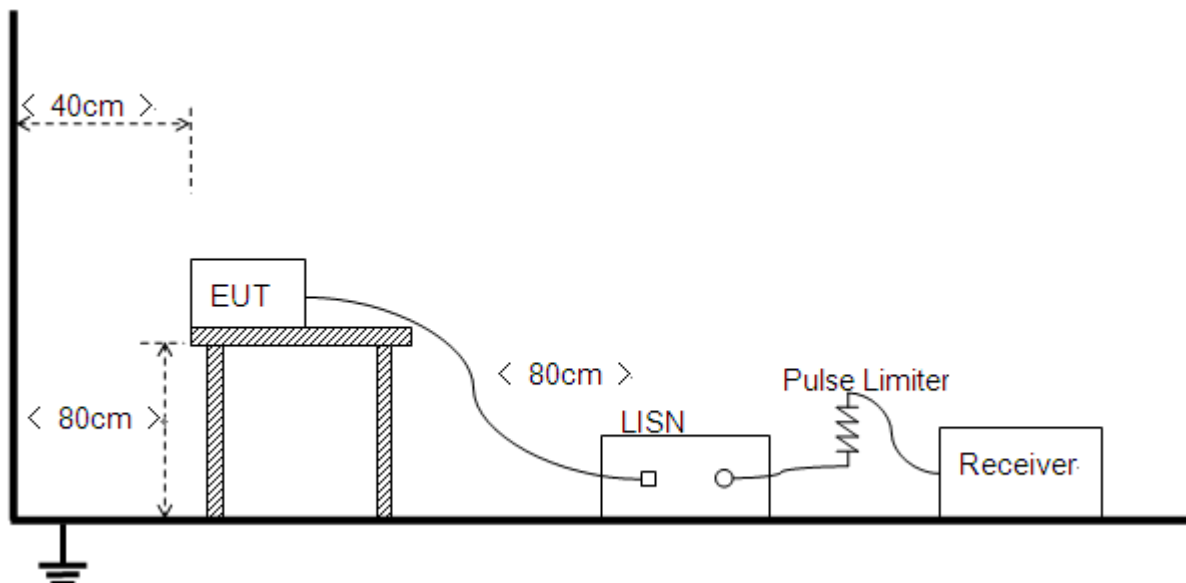
Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.1.2. Test Description

Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference



Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

2.1.3. Test Result

The maximum conducted interference is searched using Peak (PK), if 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. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

Test Setup:

Test Mode: EUT+PC+ + Adapter+915M TX

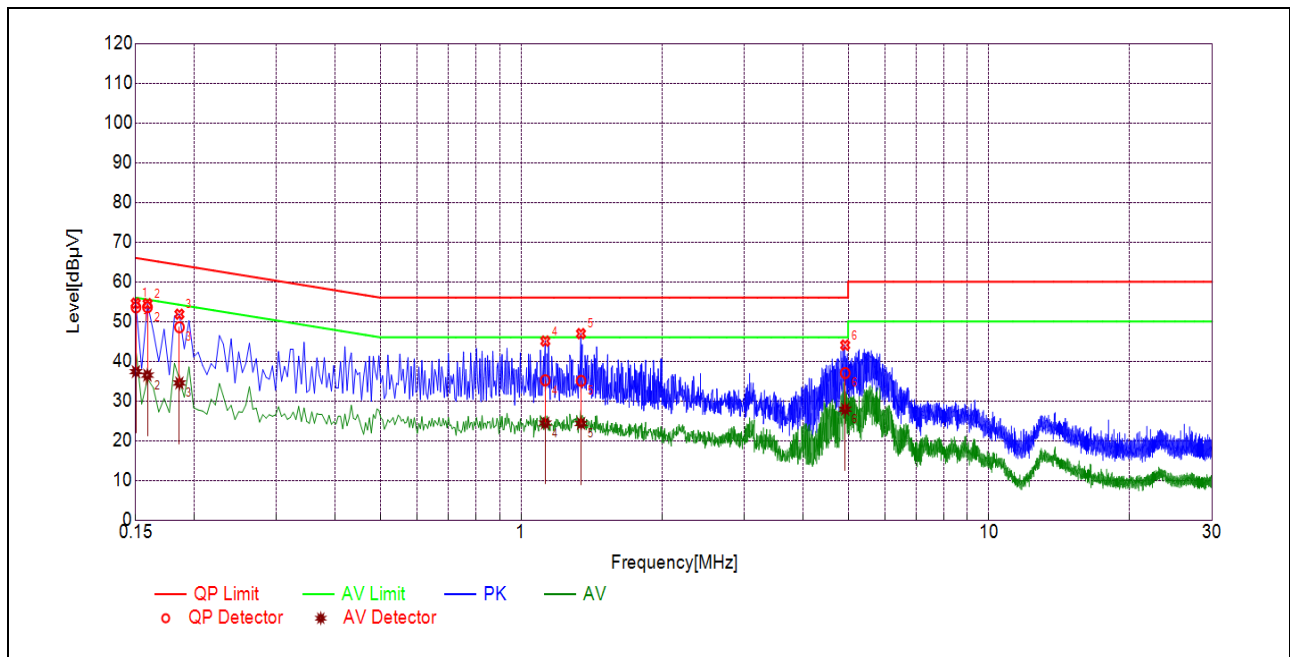
Test voltage: AC 120V/60Hz

The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V]} = U_R + L_{\text{Cable loss [dB]} + A_{\text{Factor}}$$

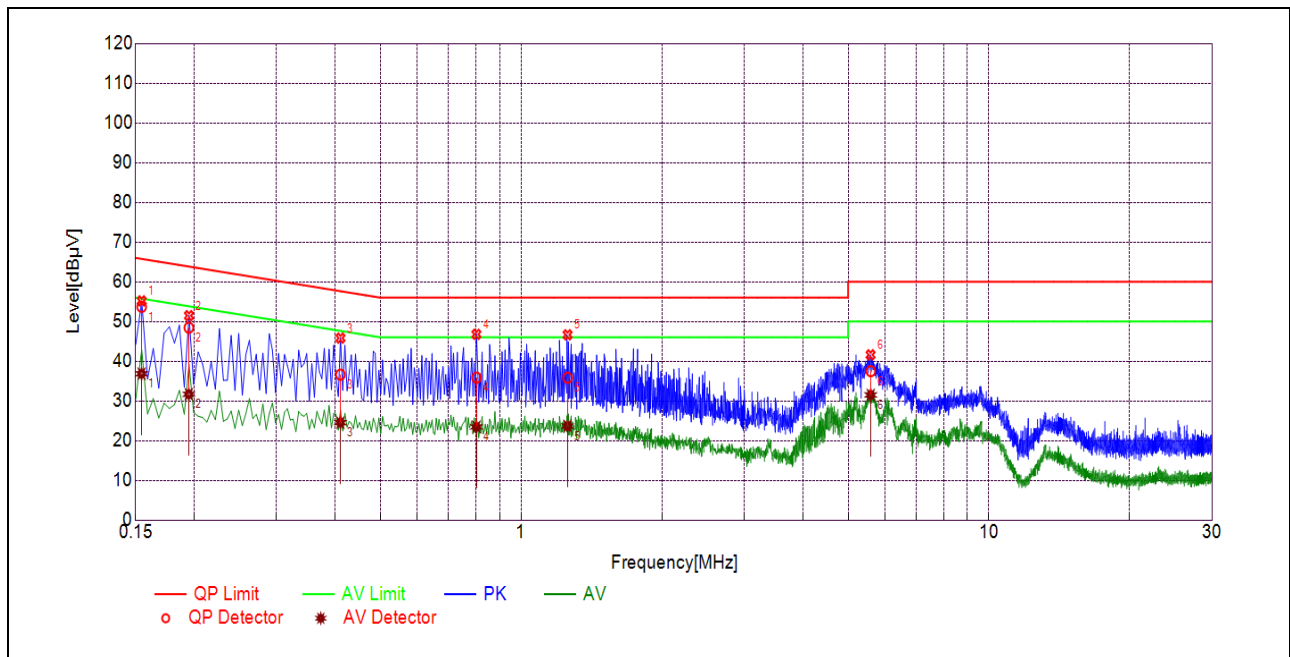
U_R : Receiver Reading

A_{Factor} : Voltage division factor of LISN



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1502	53.56	37.37	65.99	55.99	Line	PASS
2	0.1589	53.59	36.48	65.52	55.52		PASS
3	0.1860	48.56	34.51	64.21	54.21		PASS
4	1.1256	35.20	24.41	56.00	46.00		PASS
5	1.3433	35.05	24.33	56.00	46.00		PASS
6	4.9283	37.02	27.91	56.00	46.00		PASS



(N Phase)

NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1544	53.68	36.83	65.76	55.76	Neutral	PASS
2	0.1948	48.45	31.67	63.83	53.83		PASS
3	0.4108	36.61	24.52	57.63	47.63		PASS
4	0.8026	35.85	23.45	56.00	46.00		PASS
5	1.2569	35.83	23.66	56.00	46.00		PASS
6	5.5900	37.48	31.50	60.00	50.00		PASS



2.2. Radiated Emission

2.2.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

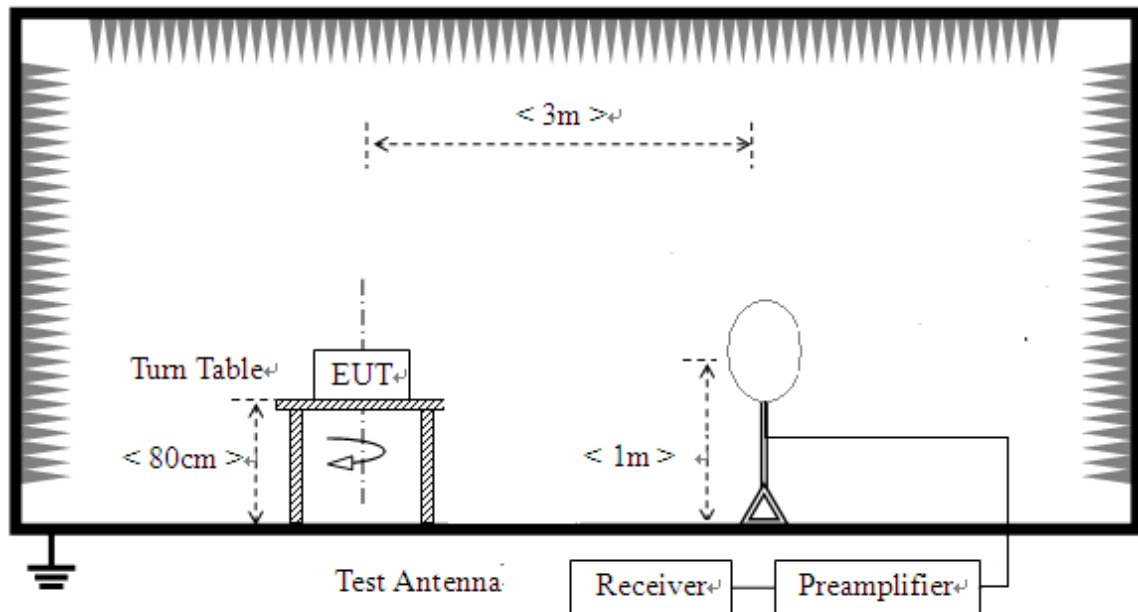
Note 1: For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.

Note 2: For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK). In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

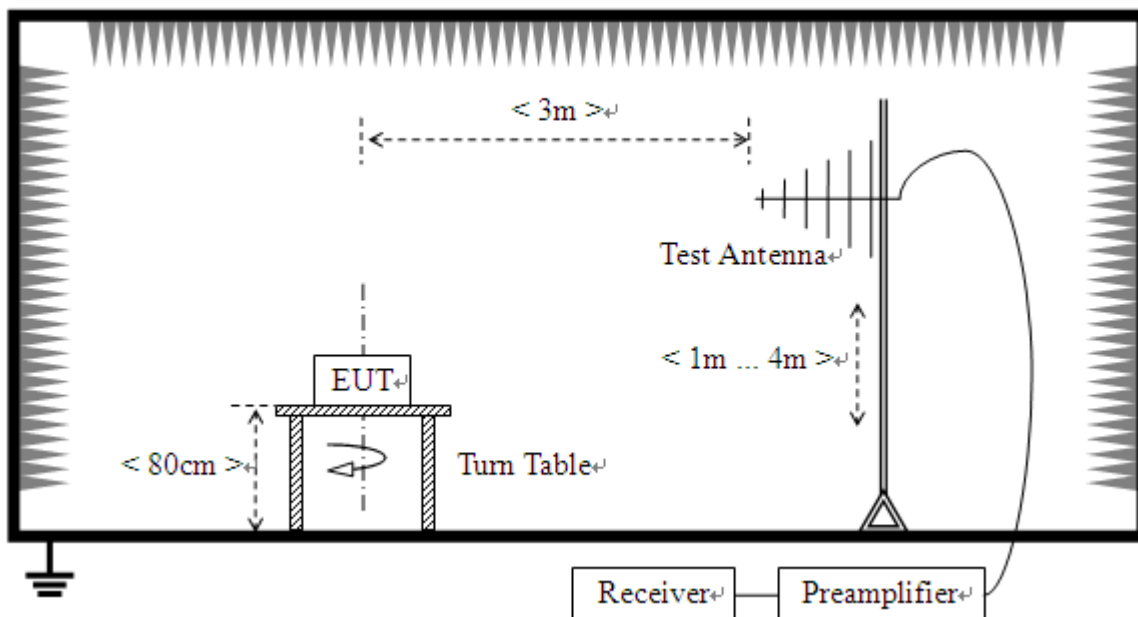
2.2.2. Test Description

Test Setup:

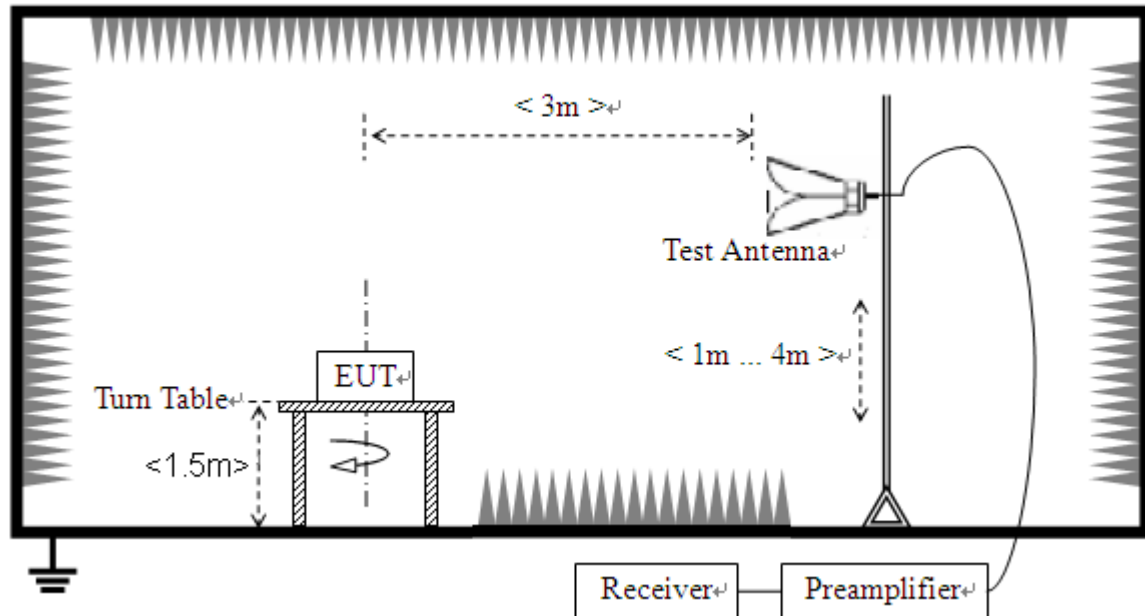
- 1) For radiated emissions from 9kHz to 30MHz



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



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10:2013. For radiated emissions below or equal to 1GHz, The EUT was set-up on insulator 80cm above the Ground Plane, for radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10:2013.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.

(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The test antenna may have to be



higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

2.2.3. Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V/m]} = U_R + A_T + A_{\text{Factor}} \text{ [dB]}; A_T = L_{\text{Cable loss}} \text{ [dB]} - G_{\text{preamp}} \text{ [dB]}$$

A_T : Total correction Factor except Antenna

U_R : Receiver Reading

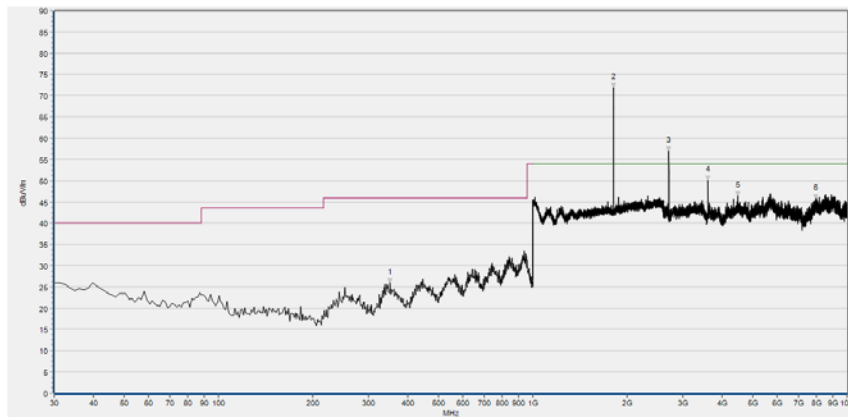
G_{preamp} : Preamplifier Gain

A_{Factor} : Antenna Factor at 3m

During the test, the total correction Factor A_T and A_{Factor} were built in test software.

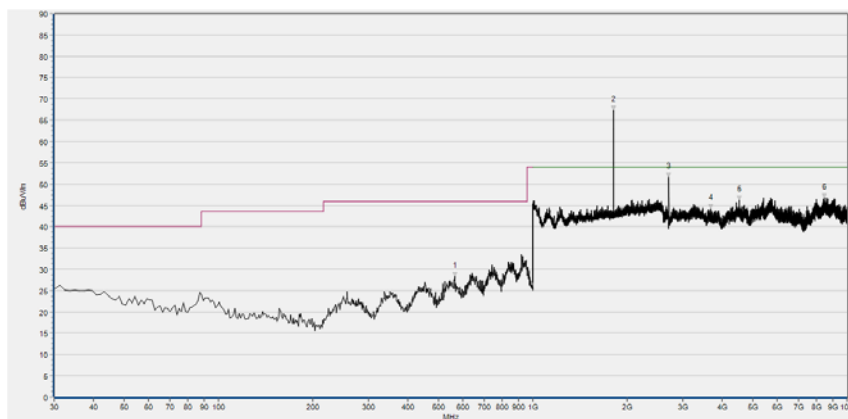
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note2: For the frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

**Plot for Channel = 0**

Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
351.715	25.90	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1805.700	72.44	N/A	40.92	74.00	N/A	54.00	Horizontal	PASS
2708.400	56.89	N/A	31.72	74.00	N/A	54.00	Horizontal	PASS
3611.966	50.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4485.325	46.38	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
7942.426	45.83	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

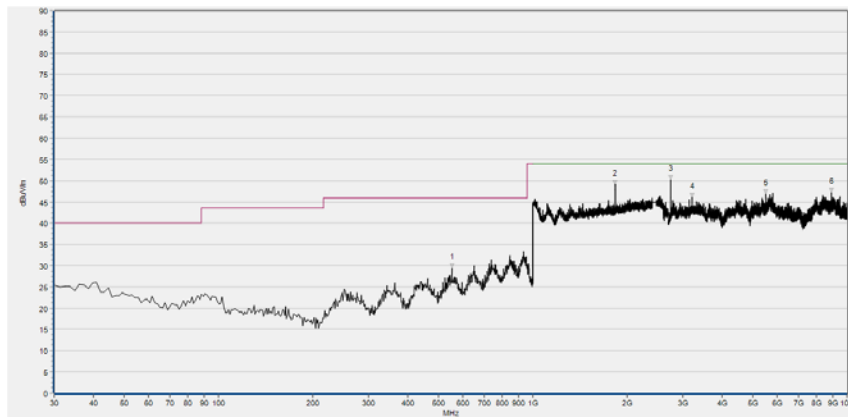
(Antenna Horizontal, 30MHz to 10GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
564.168	28.38	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1805.600	67.39	N/A	40.13	74.00	N/A	54.00	Vertical	PASS
2709.600	51.12	N/A	31.06	74.00	N/A	54.00	Vertical	PASS
3683.288	44.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4532.424	46.23	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8467.249	46.75	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

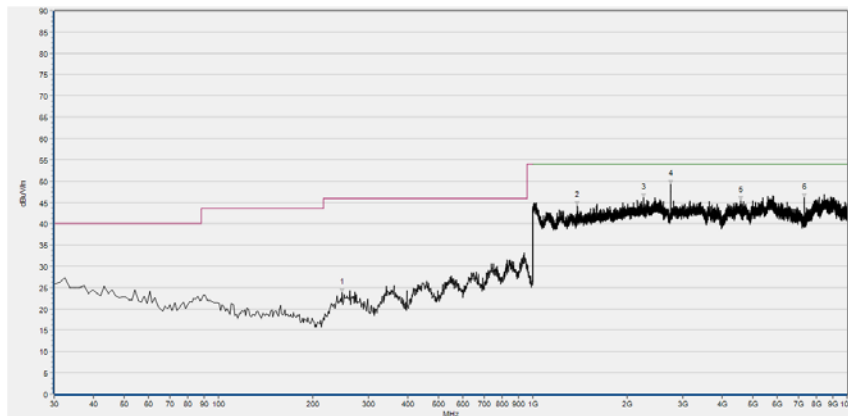
(Antenna Vertical, 30MHz to 10GHz)

Plot for Channel = 12



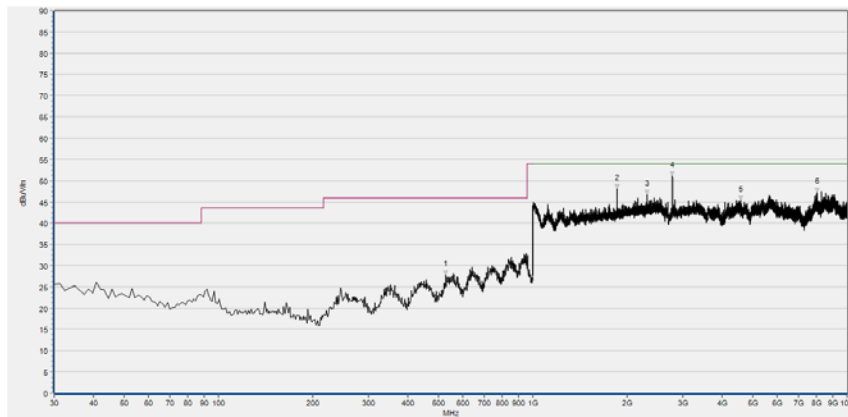
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
553.242	29.44	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1829.772	49.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2745.336	50.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3216.330	46.07	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5517.476	46.95	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8916.712	47.31	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 10GHz)



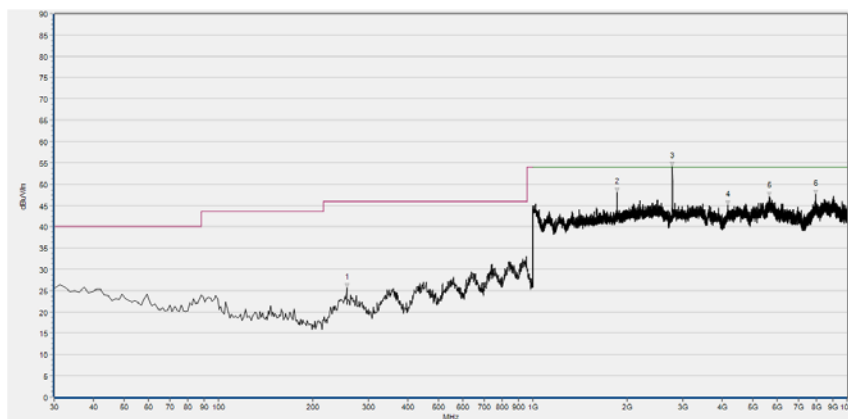
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
247.309	23.73	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1386.715	44.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2249.780	46.16	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2745.336	49.33	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4597.018	45.41	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7296.490	46.14	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 10GHz)

**Plot for Channel = 24**

Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
528.961	27.79	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1853.461	48.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2306.763	46.82	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2781.600	51.24	N/A	33.17	74.00	N/A	54.00	Horizontal	PASS
4574.141	45.36	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8028.551	47.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 10GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
255.807	25.62	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1854.102	48.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2781.600	54.01	N/A	33.38	74.00	N/A	54.00	Vertical	PASS
4170.431	45.02	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5657.429	47.04	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7938.389	47.52	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 10GHz)



Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
Radiated Emission	$\pm 2.95\text{dB}$
Conducted Emission	$\pm 2.44\text{dB}$

This uncertainty represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$



Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.



4. Test Equipments Utilized

4.1 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2019.05.08	2020.05.09
LISN	812744	NSLK 8127	Schwarzbeck	2019.05.08	2020.05.09
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2019.05.08	2020.05.09
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
PC	OB68192 JS	T430i	Lenovo	NA	NA
Adapter	NA	ADLX90N CT3A	Lenovo	NA	NA

4.2 List of Software Used

Description	Manufacturer	Software Version
MORLAB EMCR V1.2	MORLAB	V1.0

**4.3 Radiated Test Equipments**

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2019.07.26	2020.07.25
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2019.05.08	2020.05.09
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.15	2020.02.14
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2020.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.07.26	2020.07.25
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2018.12.01	2019.11.30
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

————— END OF REPORT —————