FCC EMC Test Report

Applicant:	Hangzhou Roombanker Technology Co., Ltd.
Address of Applicant:	A#801 Wantong center, Hangzhou, China
Equipment Under Test (EUT)	
Product Name:	Multi Protocol Host Gateway
Model No.:	DSGW-291, DSGW-291-X (X:1~18)
FCC ID:	2AUXBDSGW-291
Applicable Standards:	FCC CFR Title 47 Part 15B
Date of Sample Receipt:	27 Feb., 2023
Date of Test:	28 Feb., to 26 May, 2023
Date of report Issued:	29 May, 2023
Test Result:	PASS

Tested by:	June Li ***Test Engineer***	***Date:***	*29 May, 2023*
Reviewed by:	Janet Wu ***Project Engineer***	***Date:***	*29 May, 2023*
Approved by:	Marc Zhang ***Manager***	***Date:***	*29 May, 2023*

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in above the application standard version. Test results reported herein relate only to the item(s) tested.

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1 Version

Version No.	Date	Description
00	*29 May, 2023*	*Original*

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3 General Information

3.1 Client Information

Applicant:	Hangzhou Roombanker Technology Co., Ltd.
Address:	A#801 Wantong center, Hangzhou, China
Manufacturer:	Hangzhou Roombanker Technology Co., Ltd.
Address:	A#801 Wantong center, Hangzhou, China

3.2 General Description of E.U.T.

Product Name:	Multi Protocol Host Gateway
Model No.:	DSGW-291, DSGW-291-X (X:1~18)
Power Supply:	DC 12V, 3A
Test Sample Condition:	The test samples were provided in good working order with no visible defects.
Remark:	DSGW-291, DSGW-291-X (X:1~18) were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name.

3.3 Test Mode

Operating Mode	Detail Description
Power on+Working mode	Keep the EUT in Downloading mode(Worst case)
Power on +LAN mode	Keep the EUT in Charging+Recording mode
The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

3.4 Description of Test Auxiliary Equipment

Manufacturer	Description	Model	S/N	FCC ID/DoC
Lenovo	Laptop	ThinkPad T14 Gen 1	SL10Z47277	DoC
Lenovo	Keyboard	MK11	/	DoC
Lenovo	Mouse	MK11	/	DoC
PHILIPS	Screen	276E8V	UKC2020003998	DoC
JYTSZ	Earphone	/	/	/

3.5 Description of Cable Used

Cable Type	Description	Length	From	To
Detached USB Cable	Shielding	1.0m	EUT	PC/Adapter
Detached Network Cable	Shielding	1.5m	EUT	PC

3.6 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 10MHz)	1.9 dB
Conducted Emission for LISN (10MHz ~ 30MHz)	2.6 dB
Radiated Emission (30MHz ~ 1GHz) (3m SAC)	3.8 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	3.6 dB
Radiated Emission (30MHz ~ 1GHz) (10m SAC)	3.7 dB

Note: *All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.*

3.7 Additions to, Deviations, or Exclusions from the Method

No

3.8 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

3.9 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info-JYTee@lets.com, Website: http://jyt.lets.com

3.10 Test Instruments List

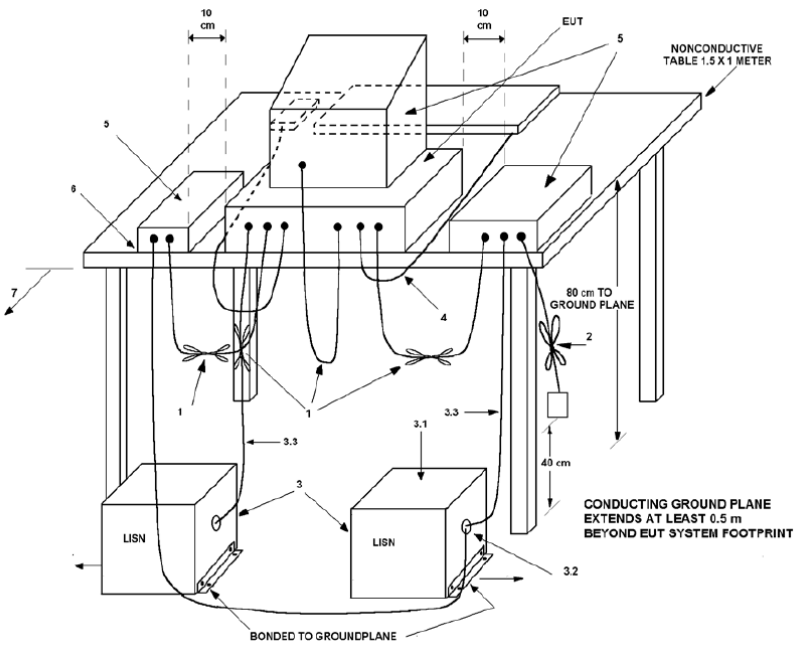
Radiated Emission(3m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	02-09-2023	02-08-2024
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	02-09-2023	02-08-2024
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-10-2023	01-09-2024
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	01-10-2023	01-09-2024
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	01-11-2023	01-10-2024
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-10-2023	01-09-2024
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-18-2023	01-17-2024
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-18-2023	01-17-2024
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

Conducted Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
EMI Test Receiver	Rohde & Schwarz	ESR3	WXJ003-2	07-12-2022	07-11-2023
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	01-10-2023	01-09-2024
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	01-11-2023	01-10-2024
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	01-18-2023	01-17-2024
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

4 Measurement Setup and Procedure

4.1 Test Setup

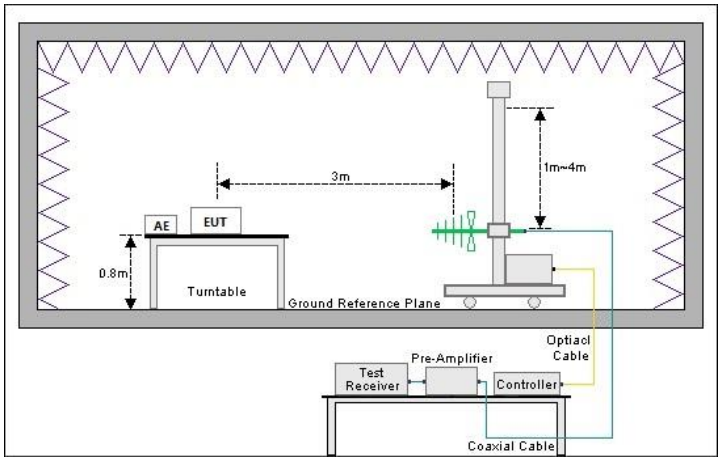
1) Conducted emission measurement:



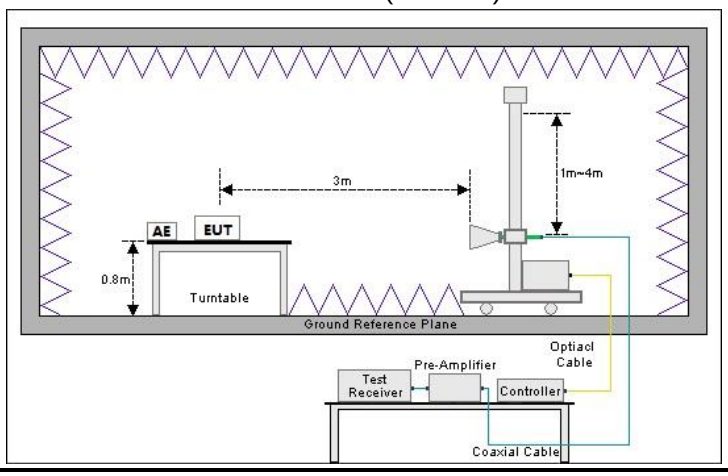
Note: The detailed descriptions please refer to Figure 8 of ANSI C63.4:2014.

2) Radiated emission measurement:

Below 1GHz (3m SAC)



Above 1GHz (3m SAC)



4.2 Test Procedure

Test method	Test step
Conducted emission	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement.
Radiated emission	**For below 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data. **For above 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.

5 Test Results

5.1 Summary

5.1.1 Clause and data summary

Test items	Standard clause	Test data	Result
Conducted Emission	Part 15.107	See Section 5.2	Pass
Radiated Emission	Part 15.109	See Section 5.3	Pass

Remark:

1. *The EUT is a **Class B** digital device.*
2. *Pass: The EUT complies with the essential requirements in the standard.*
3. *N/A: Not Applicable.*

Test Method:	*ANSI C63.4:2014*

5.1.2 Test Limit

Test items	Limit
Conducted Emission	
Radiated Emission	

Frequency (MHz)	Class A Limit (dBμV)		Class B Limit (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15 – 0.5	79	66	66 to 56 Note 1	56 to 46 Note 1
0.5 – 5	73	60	56	46
5 – 30	73	60	60	50

Note 1: The limit level in dBμV decreases linearly with the logarithm of frequency.
Note 2: The more stringent limit applies at transition frequencies.

Frequency (MHz)	Class A Limit (dBμV/m)		Class B Limit (dBμV/m)	
	Quasi-Peak @ 3m	Quasi-Peak @ 10m	Quasi-Peak @ 3m	Quasi-Peak @ 10m
30 – 88	49.0	39.0	40.0	30.0
88 – 216	53.5	43.5	43.5	33.5
216 – 960	56.0	46.0	46.0	36.0
960 – 1000	60.0	50.0	54.0	44.0

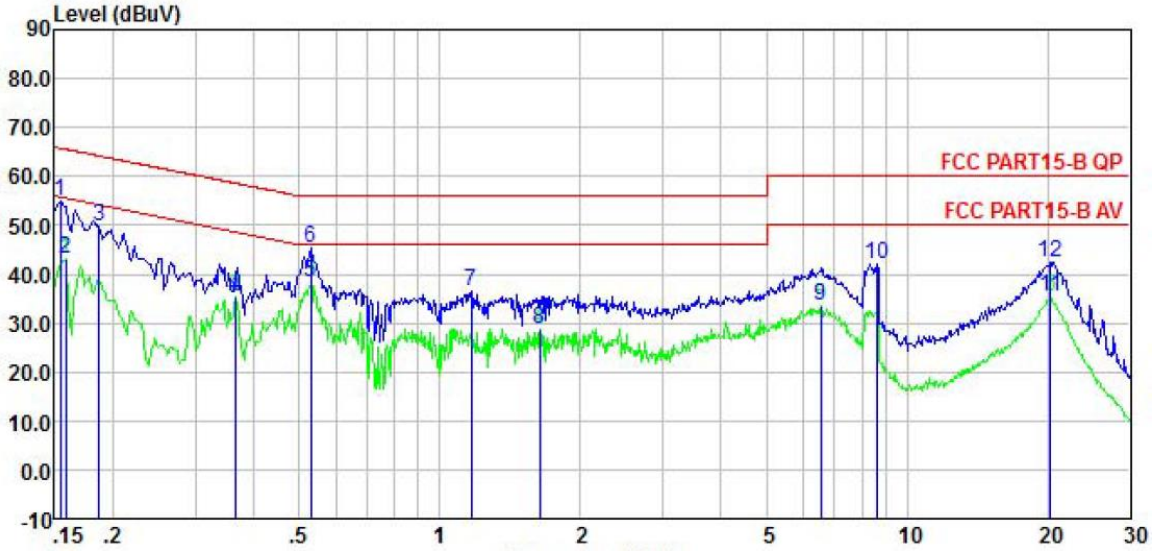
Note: The more stringent limit applies at transition frequencies.

Frequency	Class A Limit (dBμV/m) @ 3m		Class B Limit (dBμV/m) @ 3m	
	Average	Peake	Average	Peake
Above 1 GHz	60.0	80.0	54.0	74.0

Note: The measurement bandwidth shall be 1 MHz or greater.

5.2 Conducted Emission

Product name:	Multi Protocol Host Gateway	**Product model:**	DSGW-291-X (X:1~18)
Test by:	June	**Test mode:**	Power on+Working mode
Test frequency:	150 kHz ~ 30 MHz	**Phase:**	Line
Test voltage:	AC 120 V/60 Hz		

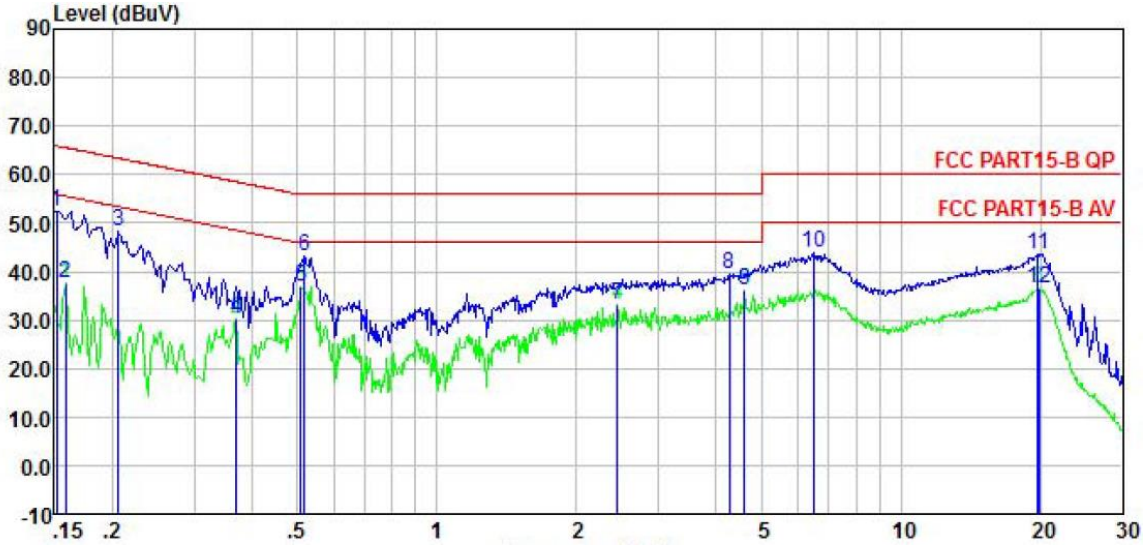


	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.154	44.43	0.04	10.50	0.01	54.98	65.78	-10.80	QP
2	0.158	32.50	0.04	10.50	0.01	43.05	55.56	-12.51	Average
3	0.186	39.08	0.05	10.50	0.02	49.65	64.20	-14.55	QP
4	0.365	24.80	0.06	10.50	0.03	35.39	48.61	-13.22	Average
5	0.529	27.88	0.05	10.50	0.03	38.46	46.00	-7.54	Average
6	0.529	34.67	0.05	10.50	0.03	45.25	56.00	-10.75	QP
7	1.166	25.71	0.07	10.50	0.09	36.37	56.00	-19.63	QP
8	1.636	18.19	0.08	10.50	0.16	28.93	46.00	-17.07	Average
9	6.523	22.87	0.16	10.50	0.10	33.63	50.00	-16.37	Average
10	8.592	31.39	0.20	10.50	0.11	42.20	60.00	-17.80	QP
11	20.270	24.49	0.34	10.50	0.19	35.52	50.00	-14.48	Average
12	20.270	31.51	0.34	10.50	0.19	42.54	60.00	-17.46	QP

Remark:

1. Level = Read level + LISN Factor + Cable Loss.

Product name:	Multi Protocol Host Gateway	Product model:	DSGW-291-X (X:1~18)
Test by:	June	Test mode:	Power on+Working mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz		



	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.152	41.79	0.06	10.50	0.01	52.36	65.91	-13.55	QP
2	0.158	27.19	0.06	10.50	0.01	37.76	55.56	-17.80	Average
3	0.206	37.75	0.05	10.50	0.04	48.34	63.36	-15.02	QP
4	0.369	19.82	0.05	10.50	0.03	30.40	48.52	-18.12	Average
5	0.510	26.44	0.04	10.50	0.03	37.01	46.00	-8.99	Average
6	0.518	32.70	0.04	10.50	0.03	43.27	56.00	-12.73	QP
7	2.448	22.32	0.08	10.50	0.14	33.04	46.00	-12.96	Average
8	4.269	28.94	0.10	10.50	0.08	39.62	56.00	-16.38	QP
9	4.598	25.57	0.11	10.50	0.09	36.27	46.00	-9.73	Average
10	6.488	33.17	0.15	10.50	0.09	43.91	60.00	-16.09	QP
11	19.740	32.70	0.33	10.50	0.15	43.68	60.00	-16.32	QP
12	19.845	25.35	0.33	10.50	0.15	36.33	50.00	-13.67	Average

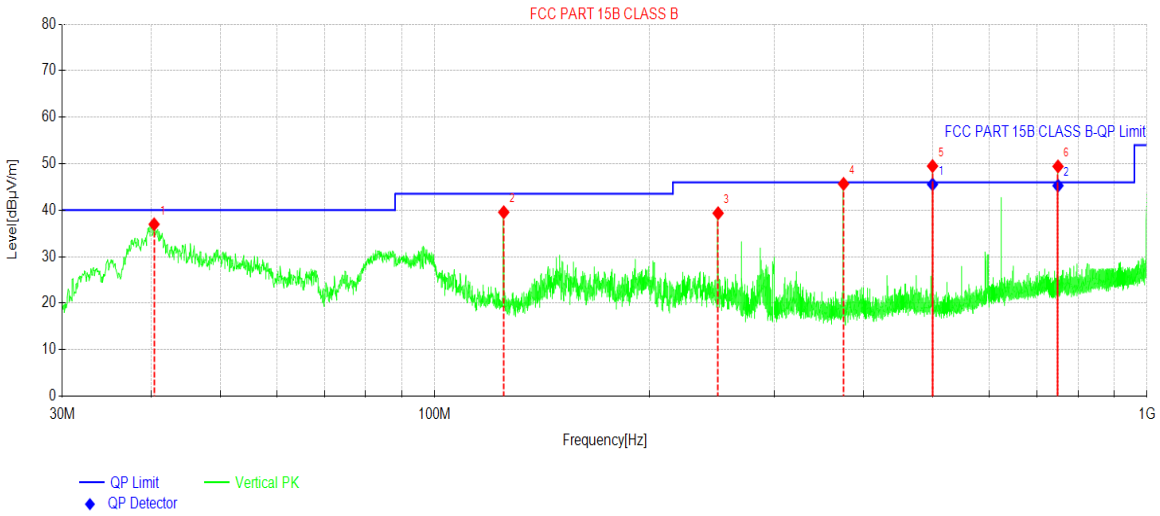
Remark:

1. Level = Read level + LISN Factor + Cable Loss.

5.3 Radiated Emission

Below 1GHz:

Product Name:	Multi Protocol Host Gateway	**Product Model:**	DSGW-291-X (X:1~18)
Test By:	June	**Test mode:**	Power on+Working mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	AC 120V/60Hz		



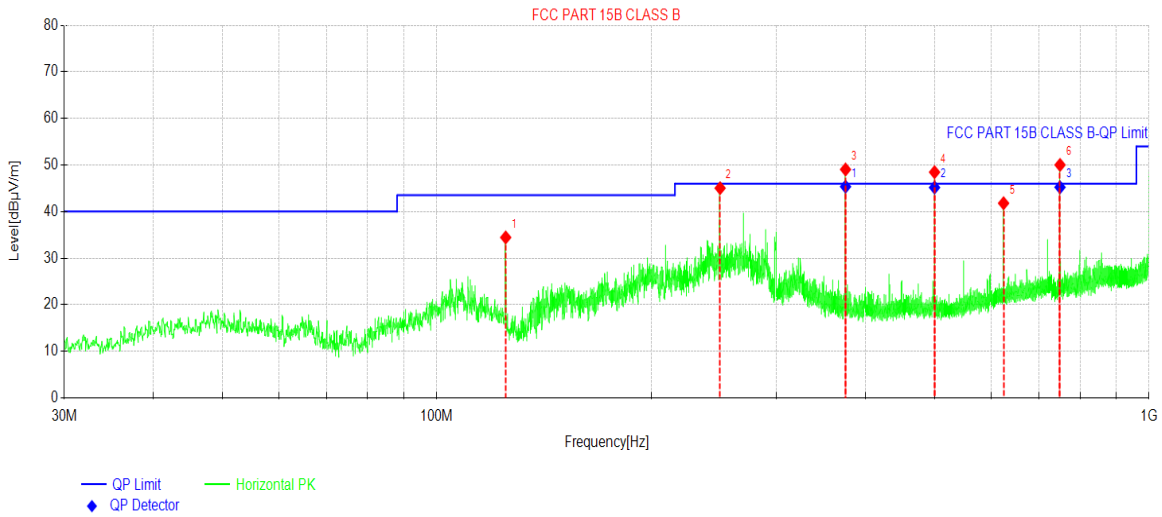
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	40.3790	50.56	36.96	-13.60	40.00	3.04	PK	Vertical
2	125.011	57.12	39.56	-17.56	43.50	3.94	PK	Vertical
3	249.996	52.83	39.34	-13.49	46.00	6.66	PK	Vertical
4	374.980	56.43	45.65	-10.78	46.00	0.35	PK	Vertical
5	499.965	58.44	49.48	-8.96	46.00	-3.48	PK	Vertical
6	750.031	53.35	49.41	-3.94	46.00	-3.41	PK	Vertical

Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	QP Reading [dBµV/m]	Angle [°]	Verdict
1	499.965	-8.96	45.54	46.00	0.46	54.5	195	PASS
2	750.031	-3.94	45.26	46.00	0.74	49.2	226	PASS

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Multi Protocol Host Gateway	**Product Model:**	DSGW-291-X (X:1~18)
Test By:	June	**Test mode:**	Power on+Working mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Horizontal
Test Voltage:	AC 120V/60Hz		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB	Trace	Polarity
1	125.011	52.00	34.44	-17.56	43.50	9.06	PK	Horizontal
2	249.996	58.52	45.03	-13.49	46.00	0.97	PK	Horizontal
3	374.980	59.82	49.04	-10.78	46.00	-3.04	PK	Horizontal
4	499.965	57.42	48.46	-8.96	46.00	-2.46	PK	Horizontal
5	624.998	48.01	41.79	-6.22	46.00	4.21	PK	Horizontal
6	750.079	53.95	50.01	-3.94	46.00	-4.01	PK	Horizontal

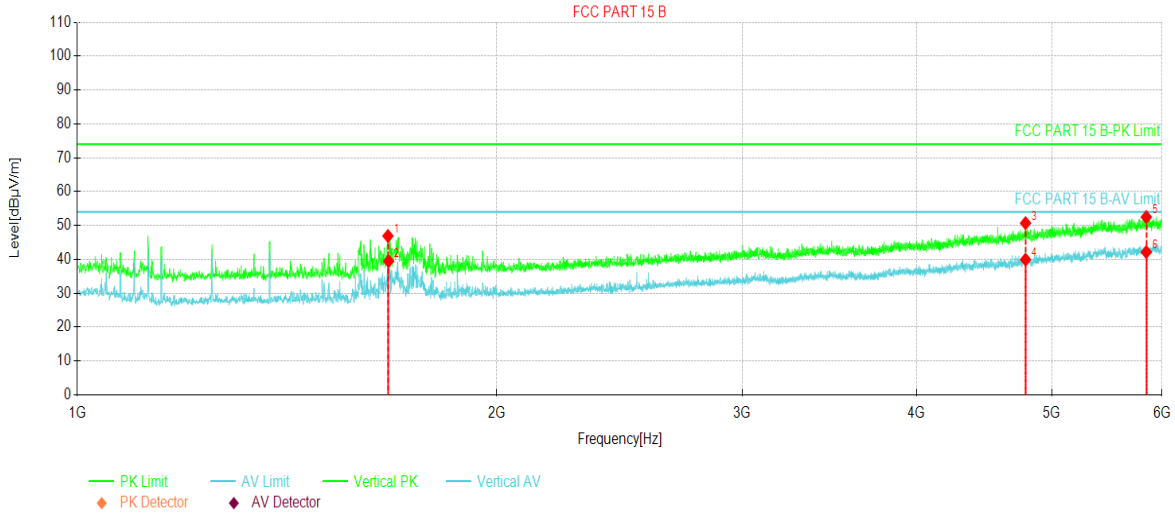
Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	QP Reading [dBµV/m]	Angle [°]	Verdict
1	374.980	-10.78	45.35	46.00	0.65	56.13	26	PASS
2	499.965	-8.96	45.17	46.00	0.83	54.13	38	PASS
3	750.079	-3.94	45.22	46.00	0.78	49.16	139	PASS

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Above 1GHz:

Product Name:	Multi Protocol Host Gateway	**Product Model:**	DSGW-291-X (X:1~18)
Test By:	June	**Test mode:**	Power on+Working mode
Test Frequency:	1000 MHz ~ 6000 MHz	**Polarization:**	Vertical
Test Voltage:	AC 120V/60Hz		

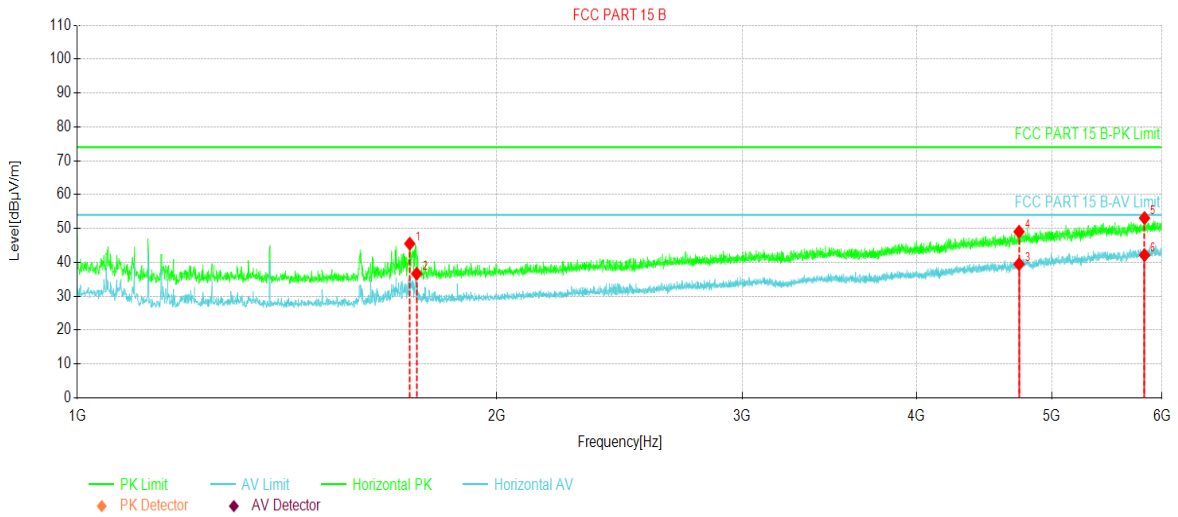


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1670.62	69.16	-22.25	46.91	74.00	27.09	PK	Vertical
2	1672.50	61.74	-22.24	39.50	54.00	14.50	AV	Vertical
3	4789.37	59.45	-8.75	50.70	74.00	23.30	PK	Vertical
4	4789.37	48.67	-8.75	39.92	54.00	14.08	AV	Vertical
5	5846.25	57.06	-4.56	52.50	74.00	21.50	PK	Vertical
6	5846.25	46.71	-4.56	42.15	54.00	11.85	AV	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Multi Protocol Host Gateway	**Product Model:**	DSGW-291-X (X:1~18)
Test By:	June	**Test mode:**	Power on+Working mode
Test Frequency:	1000 MHz ~ 6000 MHz	**Polarization:**	Horizontal
Test Voltage:	AC 120V/60Hz		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1731.87	67.60	-22.08	45.52	74.00	28.48	PK	Horizontal
2	1751.87	58.68	-22.03	36.65	54.00	17.35	AV	Horizontal
3	4738.12	48.46	-8.97	39.49	54.00	14.51	AV	Horizontal
4	4738.12	58.02	-8.97	49.05	74.00	24.95	PK	Horizontal
5	5829.37	57.73	-4.65	53.08	74.00	20.92	PK	Horizontal
6	5829.37	46.80	-4.65	42.15	54.00	11.85	AV	Horizontal

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

------End of report------