



Certificate #4312.01

TEST REPORT

Product Name: Multi-WAN Gigabit VPN Router
Trade Mark: GRANDSTREAM
Model No.: GWN7002
Report Number: 2211072480EMC-1
Test Standards: FCC 47 CFR Part 15 Subpart B
ICES-003 Issue 7
FCC ID: YZZGWN7002
Test Result: PASS
Date of Issue: December 1, 2022

Prepared for:

Grandstream Networks, Inc.
126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and
technology park, Longhua district, Shenzhen, China
TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Prepared by:

Kieron Luo
Project Engineer

Reviewed by:

Henry Lu
Team Leader

Approved by:

Kevin Liang
Assistant Manager

Date:

December 1, 2022

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com<http://www.uttlab.com>UTTR-EMC-ICES003-V1.2

Version

Version No.	Date	Description
V1.0	December 1, 2022	Original

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com<http://www.uttlab.com>UTTR-EMC-ICES003-V1.2

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Grandstream Networks, Inc.
Address of Applicant:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA
Manufacturer:	Grandstream Networks, Inc.
Address of Manufacturer:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Multi-WAN Gigabit VPN Router
Model No.:	GWN7002
Trade Mark:	GRANDSTREAM
DUT Stage:	Identical Prototype
Rated Voltage:	☒ Powered by DC port 12-24V ☒ Powered by POE port
Classification of digital devices:	Class B
Highest Internal Frequency:	1.0 GHz
Sample Received Date:	November 7, 2022
Sample Tested Date:	November 17, 2022 November 18, 2022
Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.	

1.2.2 Description of Accessories

Adapter (1)	
Model No.:	GQ36-240150-AU
Input:	100-240 V~50/60 Hz 1.0 A Max
Output:	24.0 V $\equiv$ 1.5 A
DC Cable:	2.5 Meter, Unshielded without ferrite

Adapter (2)	
Model No.:	GQ24-240100-AU
Input:	100-240 V~50/60 Hz 1.0 A Max
Output:	24.0 V $\equiv$ 1.0 A
DC Cable:	2.5 Meter, Unshielded without ferrite

Adapter (3)	
Model No.:	ADS-25FSG-19 24024EPCU
Input:	100-240 V~50/60 Hz 0.7 A Max
Output:	24.0 V $\equiv$ 1.0 A
DC Cable:	2.5 Meter, Unshielded without ferrite

Adapter (4)	
Model No.:	RA040-2401000US
Input:	100-240 V~50/60 Hz 0.6 A Max
Output:	24.0 V $\equiv$ 1.0 A 24.0W

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DC Cable:	1.2 Meter, Unshielded without ferrite
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Cable	
Connector:	Ethernet Cable
Cable Type:	Unshielded without ferrite
Length:	1.5 Meter

1.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	DELL	Latitude 3400	16238087894	UnionTrust
Mouse	DELL	MS111	CN-011D3V-73826-62N-0LK	UnionTrust
Notebook	DELL	Latitude 3400	14061305558	UnionTrust
Mouse	DELL	MS111	M312090506256	UnionTrust
Network tester	KYLAND	Opal10G-2GX8GE-LV-LV	N/A	UnionTrust
Gigabit port electrical modules	SAMZHE	SZ-QGE	SZ000001237332	UnionTrust
Gigabit port electrical modules	SAMZHE	SZ-QGE	SZ000001237308	UnionTrust
IP Phone	GRANDSTREAM	GRP2650	N/A	Applicant
IP Phone	GRANDSTREAM	GRP2615	N/A	Applicant

Support Cable

Cable No.	Description	Connector	Length(Meter)	Supplied by
1	Ethernet Cable	RJ45	1.5 Unshielded without ferrite	UnionTrust
2	Ethernet Cable	RJ45	2.0 Unshielded without ferrite	UnionTrust
3	Ethernet Cable	RJ45	5.0 Unshielded without ferrite	UnionTrust
4	Optic fiber Cable*2	ST	1.0 Unshielded without ferrite	UnionTrust

1.4 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Telephone: +86 (0) 755 2823 0888

Fax: +86 (0) 755 2823 0886

1.5 TEST FACILITY

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

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CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.6 DEVIATION FROM STANDARDS

None.

1.7 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.9 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.6 dB
5	Radiated emission 1GHz-18GHz	± 4.4 dB
6	Radiated emission 18GHz-26GHz	± 4.6 dB
7	Radiated emission 26GHz-40GHz	± 4.6 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart B Test Cases			
Test Item	Test Requirement	Test Method	Result
Conducted Emission	FCC 47 CFR Part 15.107 ICES-003 Issue 7 Section 3.2.1	ANSI C63.4-2014	PASS
Radiated Emission	FCC 47 CFR Part 15.109 ICES-003 Issue 7 Section 3.2.2	ANSI C63.4-2014	PASS



3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3m SAC	ETS-LINDGREN	3m	Euroshiedpn-CT001270-1317	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 03, 2022	Nov. 02, 2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 11, 2021	Nov. 10, 2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 11, 2021	Nov. 10, 2023
☒	Preamplifier	HP	8447F	2805A02960	Nov. 01, 2022	Oct. 31, 2023
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	Apr. 17, 2022	Apr. 16, 2024
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	Nov. 01, 2022	Oct. 31, 2023
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Nov. 01, 2022	Oct. 31, 2023
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 01, 2022	Oct. 31, 2023
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 01, 2022	Oct. 31, 2023
☒	LISN	ETS-Lindgren	3816/2SH	00201088	Nov. 01, 2022	Oct. 31, 2023
☒	Test Software	Audix	e3	Software Version: 9.160323		

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NV/NT	+15 to +35	Powered by POE Port or Powered by Adaptor	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test sample

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
Conducted Emission	25.7	57.7	99.95	S20221107770-ZJA01/2	Davin Zhang
Radiated Emission	27.0	55.4	99.7		Andy Lin

4.2 TEST MODES

Test Item	EMI Test Modes
Radiated Emission	Test Mode 1: AC120V/60Hz (Adaptor1) + LAN Port4 & SFP Port2 Loop transmission+ PoE OUT + USB OUT Test Mode 2: AC120V/60Hz (Adaptor1) + SFP Port1 & SFP Port2 Loop transmission+ PoE OUT + USB OUT Test Mode 3: AC120V/60Hz (Adaptor1) + WAN Port3 & LAN Port4 Loop transmission+ PoE OUT + USB OUT Test Mode 4: AC240V/50Hz (Adaptor1) +Worse from mode 1~3 Test Mode 5: Worse from mode 1~4(Adaptor2) Test Mode 6: Worse from mode 1~4(Adaptor3) Test Mode 7: Worse from mode 1~4(Adaptor4) Test Mode 8: Worse from mode 1~3(POE)
Conducted Emission	Test Mode 1: AC120V/60Hz (Adaptor1) + LAN Port4 & SFP Port2 Loop transmission+ PoE OUT + USB OUT Test Mode 2: AC120V/60Hz (Adaptor1) + SFP Port1 & SFP Port2 Loop transmission+ PoE OUT + USB OUT Test Mode 3: AC120V/60Hz (Adaptor1) + WAN Port3 & LAN Port4 Loop transmission+ PoE OUT + USB OUT Test Mode 4: AC240V/50Hz (Adaptor1) +Worse from mode 1~3 Test Mode 5: Worse from mode 1~4(Adaptor2) Test Mode 6: Worse from mode 1~4(Adaptor3) Test Mode 7: Worse from mode 1~4(Adaptor4) Test Mode 8: Worse from mode 1~3(POE)
Remark: The above test modes in boldface were the worst cases.	

4.3 TEST SETUP

4.3.1 For Radiated Emissions test setup

Figure 1. 30MHz to 1GHz

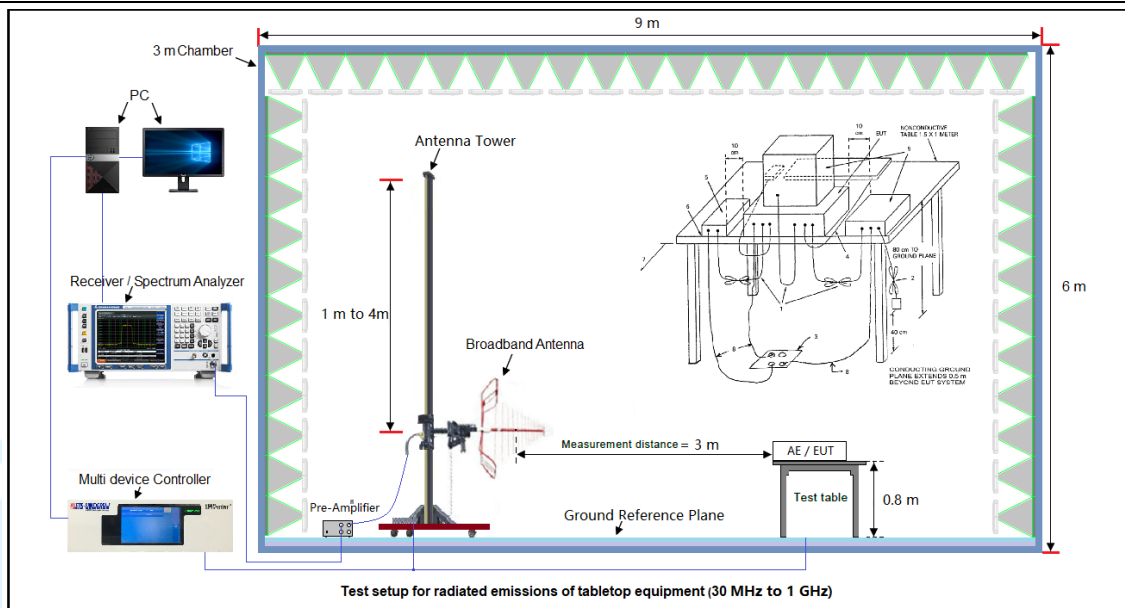
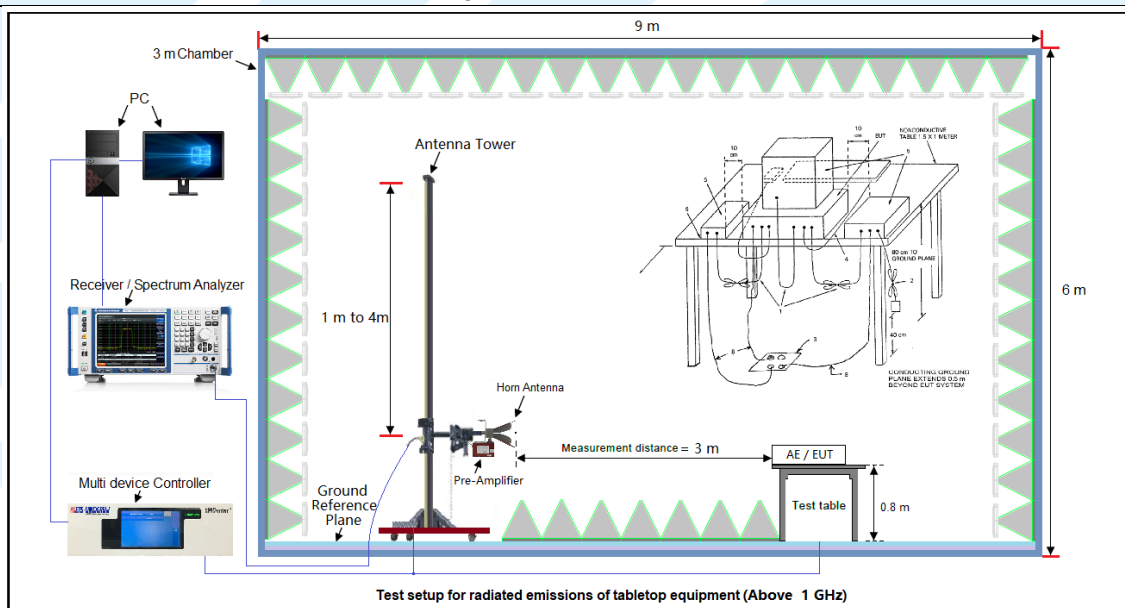
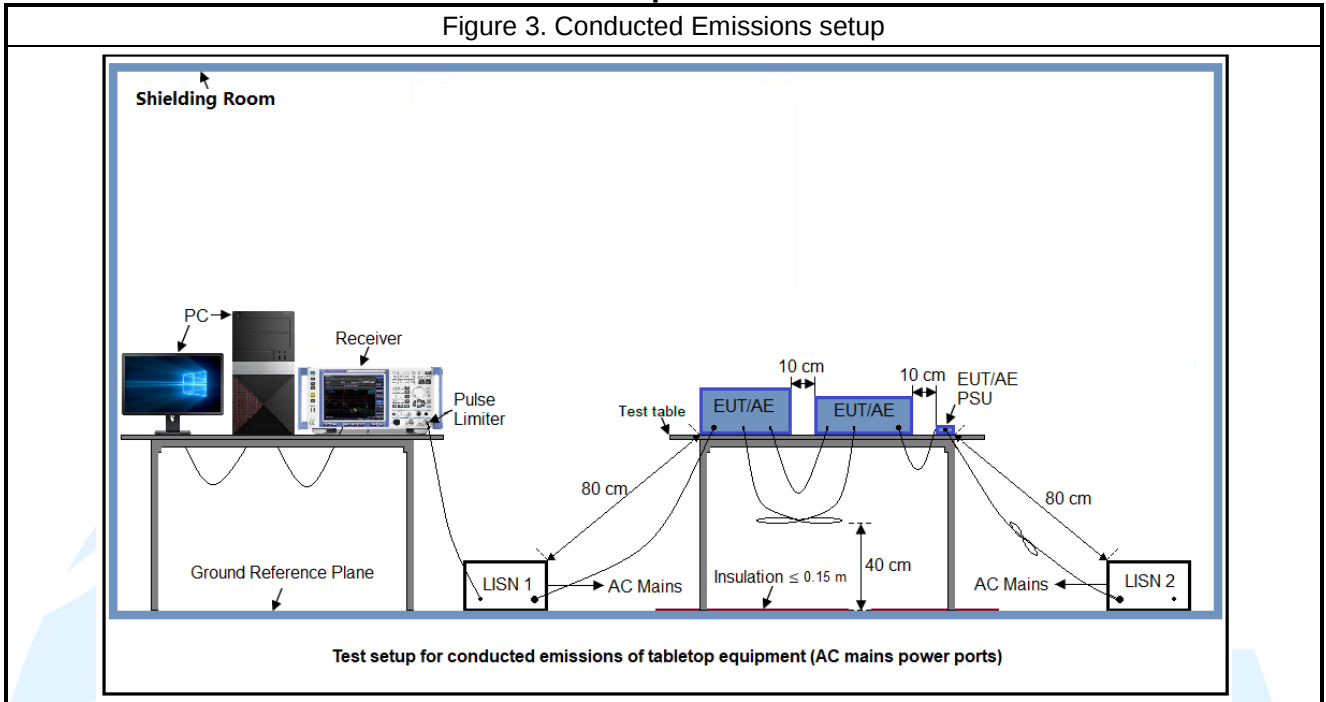


Figure 2. Above 1GHz



4.3.2 For Conducted Emissions test setup

Figure 3. Conducted Emissions setup



4.4 SYSTEM TEST CONFIGURATION

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic (according to KDB 896810 D02 SDoC FAQ v01r01) of the highest fundamental frequency or to 40 GHz, whichever is lower.

5. REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part15 Subpart B	Unintentional Radiators
2	ICES-003 Issue 7	Information Technology Equipment (Including Digital Apparatus)
3	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
4	KDB 174176 D01 Line Conducted FAQ v01r01	AC power-line conducted emission frequency asked questions
5	KDB 896810 D02 SDoC FAQ v01r02	Supplier's Declaration of Conformity frequency asked questions

6. EMC REQUIREMENTS SPECIFICATION

6.1 RADIATED EMISSION

Test Requirement: FCC 47 CFR Part 15.109
ICES-003 Issue 7 Clause 3.2.2

Test Method: ANSI C63.4-2014

Receiver Setup:

Frequency: (f) (MHz)	Detector type	Measurement receiver bandwidth	
		RBW	VBW
$30 \leq f \leq 1\,000$	Quasi Peak	120 kHz	300 kHz
$f \geq 1000$	Peak	1 MHz	3 MHz
	Average	1 MHz	3 MHz

Measured frequency range

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.

Limits:

Limits for Class B devices

FCC 47 CFR Part 15 Subpart B

Frequency (MHz)	limits at 3m (dBμV/m)		
	QP Detector	PK Detector	AV Detector
30 – 88	40.0	--	--
88 – 216	43.5	--	--
216 – 960	46.0		
960 – 1000	54.0	--	--
Above 1000	--	74.0	54.0

ICES-003 Issue 7

Frequency (MHz)	limits at 3m (dBμV/m)		
	QP Detector	PK Detector	AV Detector
30 – 88	40.0	--	--
88 – 216	43.5	--	--
216 – 230	46.0		

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230 – 960	47.0	--	--
960 – 1000	54.0	--	--
Above 1000	--	74.0	54.0

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dB μ V/m) = 20 log Emission level (μ V/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.3.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:
 - 1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
 - 2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
 - 3) For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.
2. Above 1GHz test procedure as below:
 - 1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
 - 2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
 - 3) For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

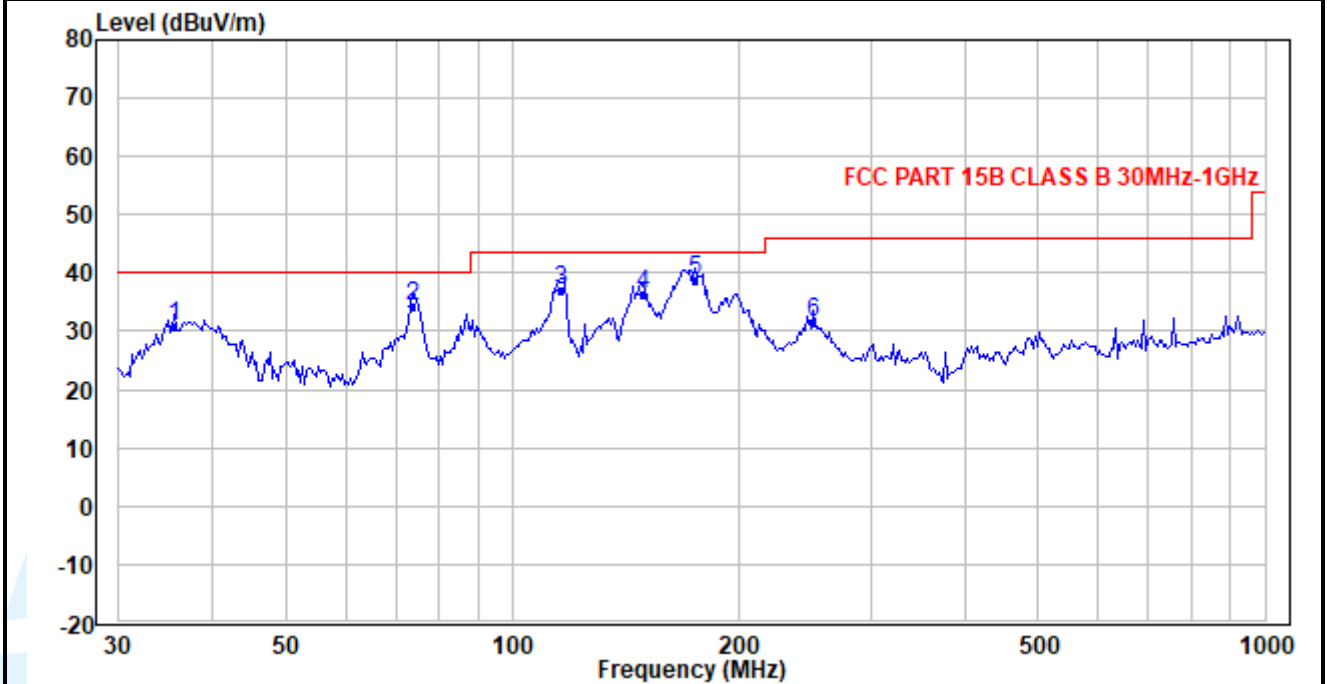
The measurement data as follows:

The measurement data for FCC 47 CFR Part 15 Subpart B as follows:

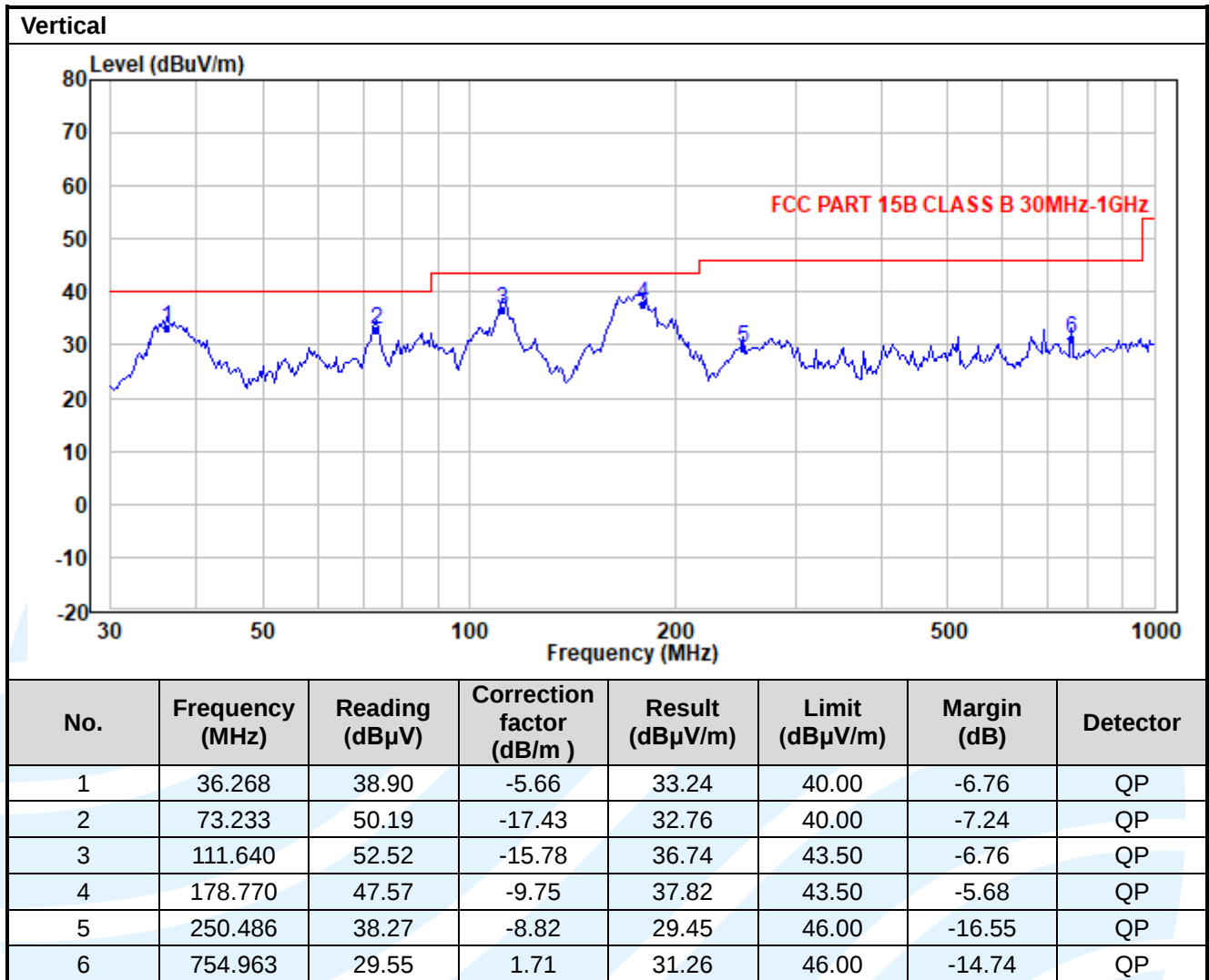
Below 1GHz(Quasi Peak):

Test Mode2

Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	35.511	35.65	-4.86	30.79	40.00	-9.21	QP
2	73.750	51.75	-17.48	34.27	40.00	-5.73	QP
3	115.632	52.95	-15.74	37.21	43.50	-6.29	QP
4	148.917	51.74	-15.30	36.44	43.50	-7.06	QP
5	175.040	49.52	-10.68	38.84	43.50	-4.66	QP
6	250.486	40.32	-8.82	31.50	46.00	-14.50	QP



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Tel: +86-755-28230888

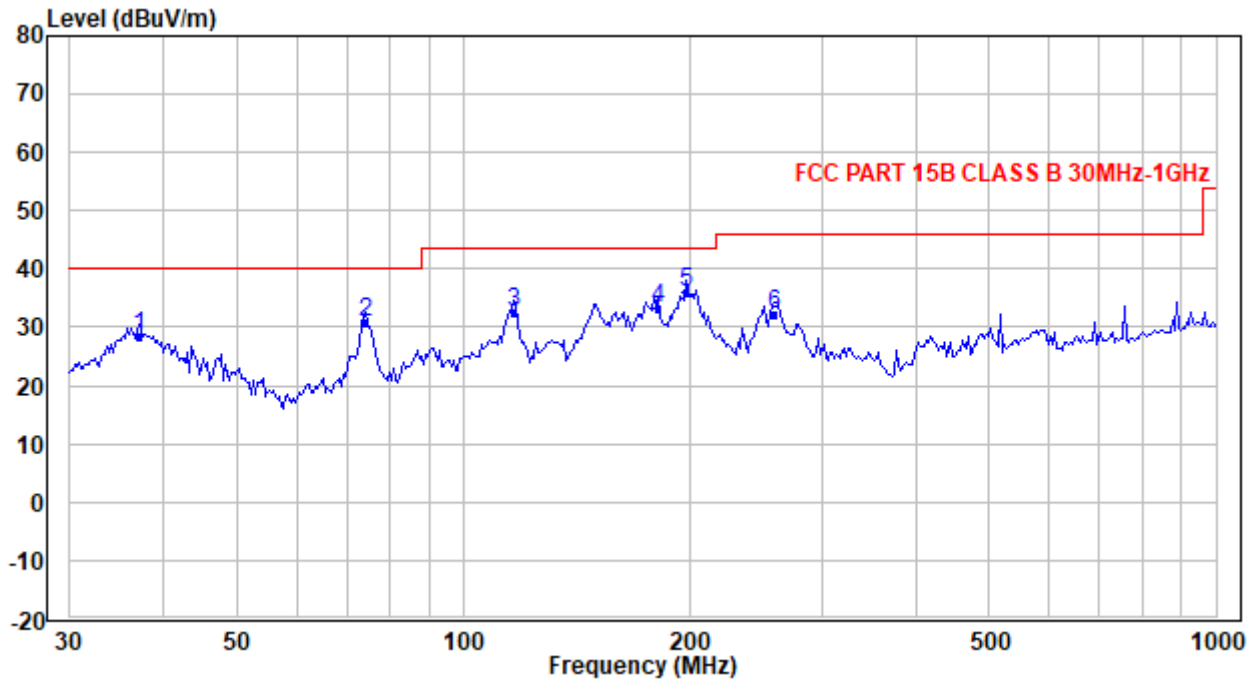
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Below 1GHz(Quasi Peak):
Test Mode5:
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	37.041	34.72	-6.31	28.41	40.00	-11.59	QP
2	74.270	48.18	-17.45	30.73	40.00	-9.27	QP
3	116.448	48.50	-15.87	32.63	43.50	-10.87	QP
4	181.300	43.33	-10.14	33.19	43.50	-10.31	QP
5	197.251	46.54	-10.61	35.93	43.50	-7.57	QP
6	259.443	40.72	-8.33	32.39	46.00	-13.61	QP

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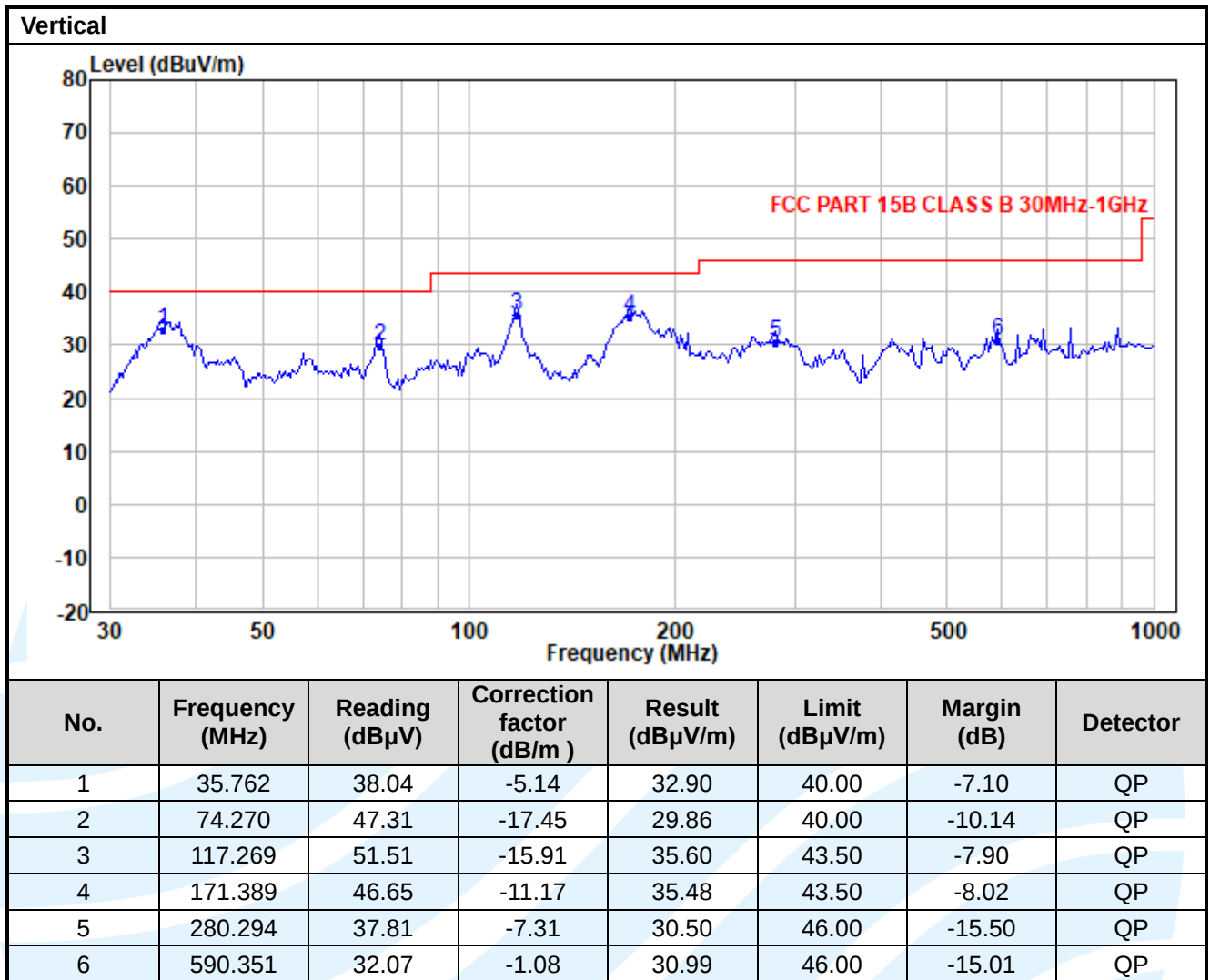
Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

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Shenzhen UnionTrust Quality and Technology Co., Ltd.

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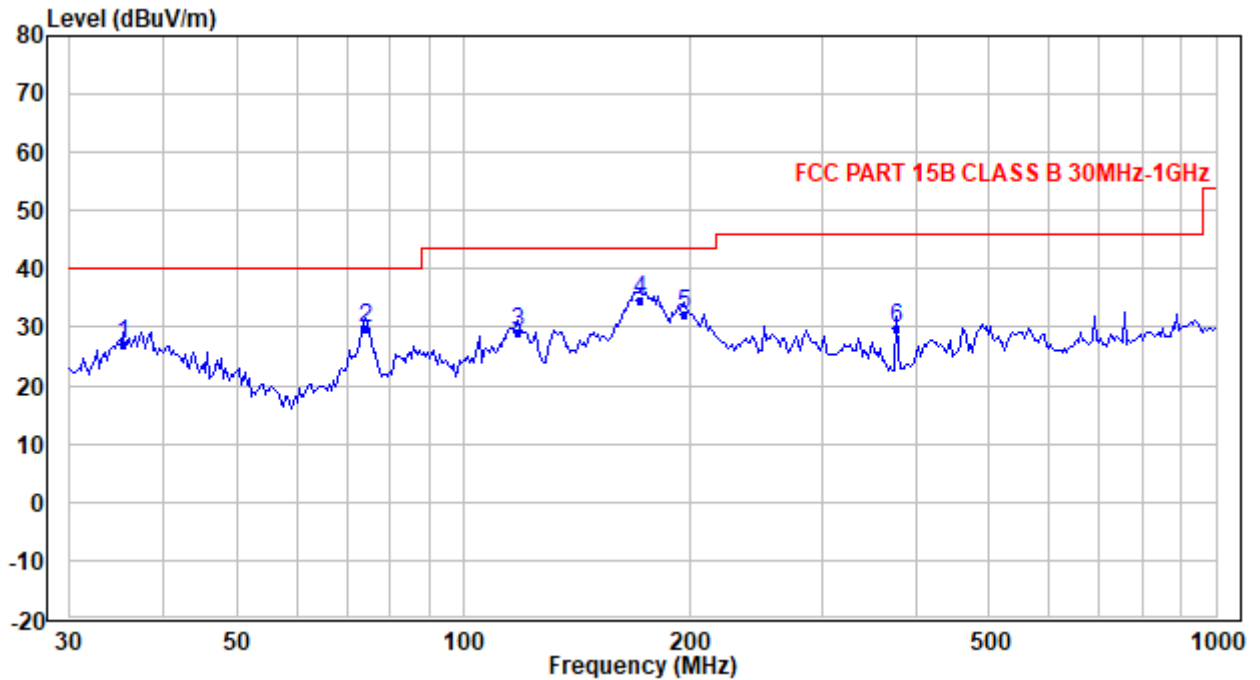
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Below 1GHz(Quasi Peak):
Test Mode6:
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	35.263	31.67	-4.57	27.10	40.00	-12.90	QP
2	74.270	47.16	-17.45	29.71	40.00	-10.29	QP
3	118.096	44.85	-15.75	29.10	43.50	-14.40	QP
4	171.389	45.65	-11.17	34.48	43.50	-9.02	QP
5	195.870	42.78	-10.53	32.25	43.50	-11.25	QP
6	376.523	35.03	-5.26	29.77	46.00	-16.23	QP

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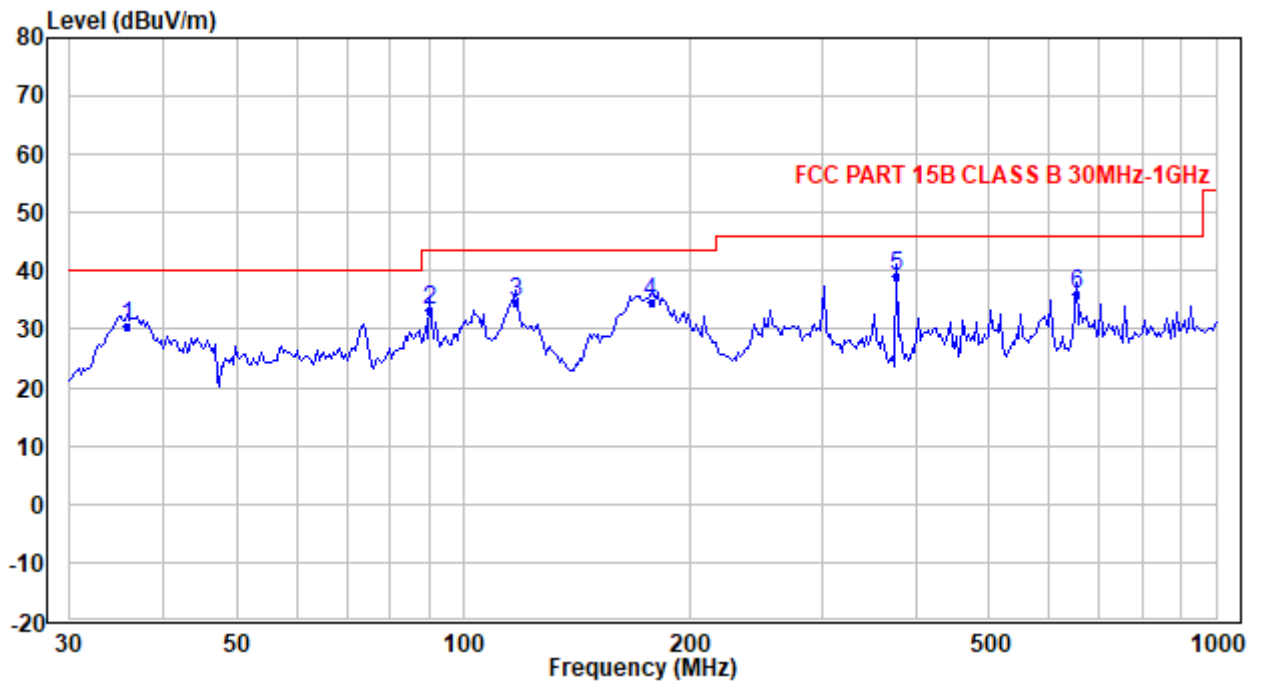
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Vertical



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	35.762	35.66	-5.14	30.52	40.00	-9.48	QP
2	90.420	49.43	-16.14	33.29	43.50	-10.21	QP
3	117.269	50.48	-15.91	34.57	43.50	-8.93	QP
4	177.518	44.61	-10.13	34.48	43.50	-9.02	QP
5	376.523	44.35	-5.26	39.09	46.00	-6.91	QP
6	651.383	35.75	0.37	36.12	46.00	-9.88	QP

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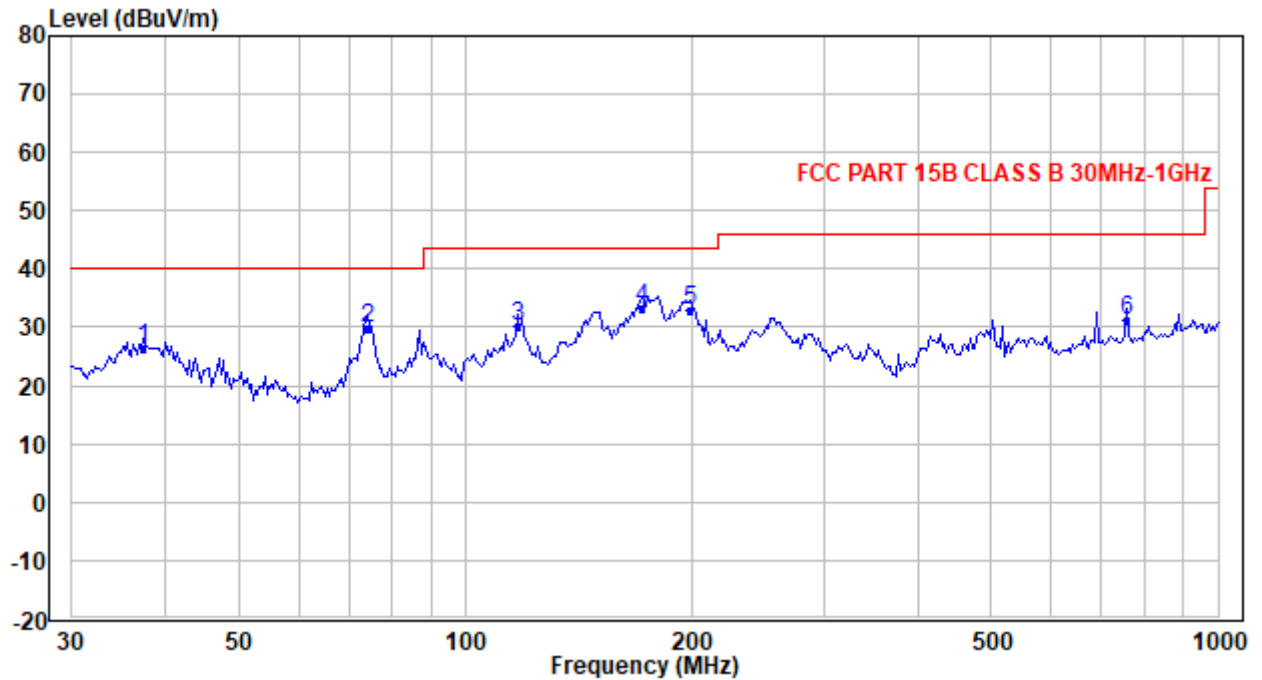
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UTTR-EMC-ICES003-V1.2

Below 1GHz(Quasi Peak):
Test Mode7:
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	37.302	32.63	-6.38	26.25	40.00	-13.75	QP
2	74.270	47.41	-17.45	29.96	40.00	-10.04	QP
3	117.269	46.07	-15.91	30.16	43.50	-13.34	QP
4	171.389	44.57	-11.17	33.40	43.50	-10.10	QP
5	198.642	43.26	-10.48	32.78	43.50	-10.72	QP
6	754.963	29.51	1.71	31.22	46.00	-14.78	QP

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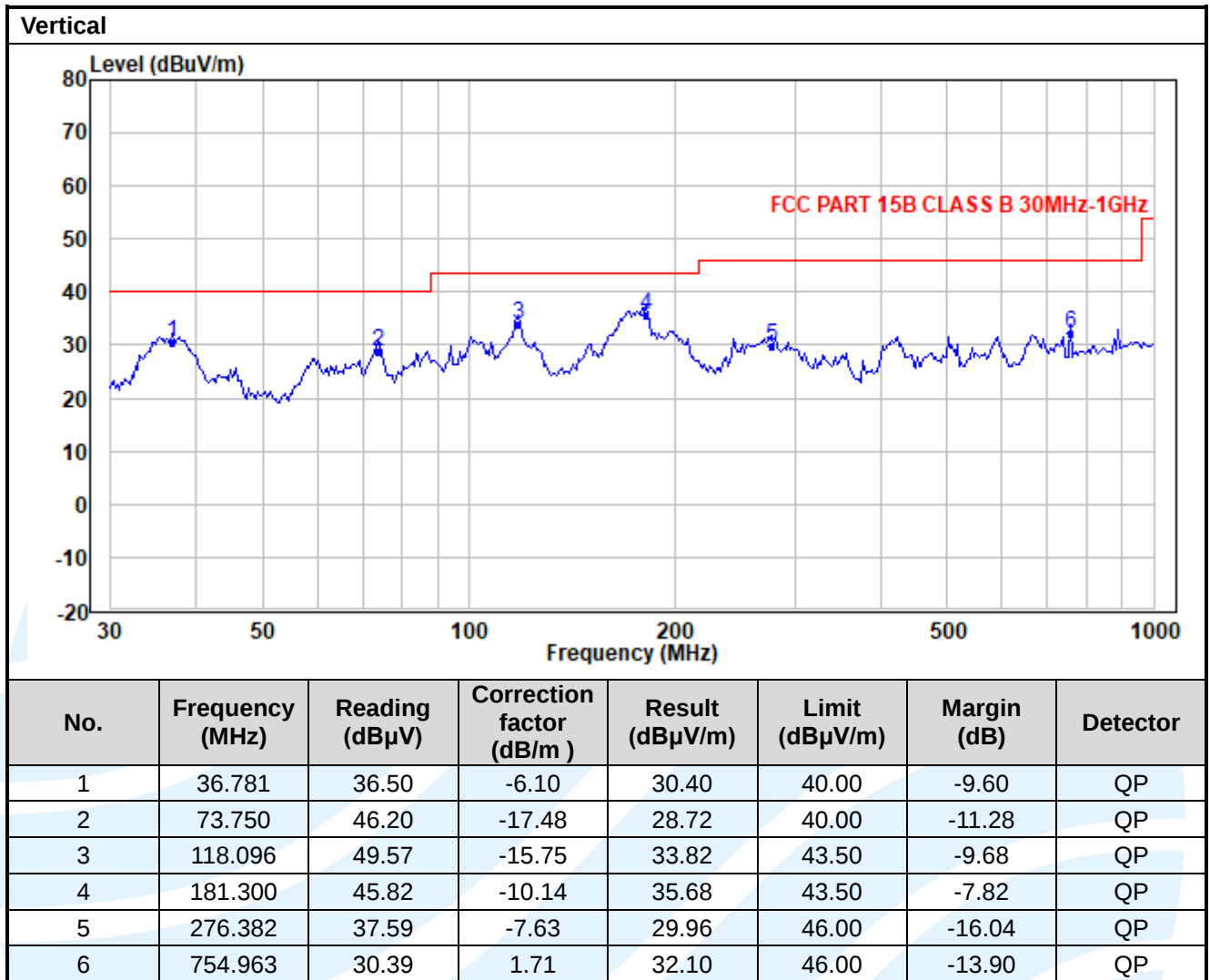
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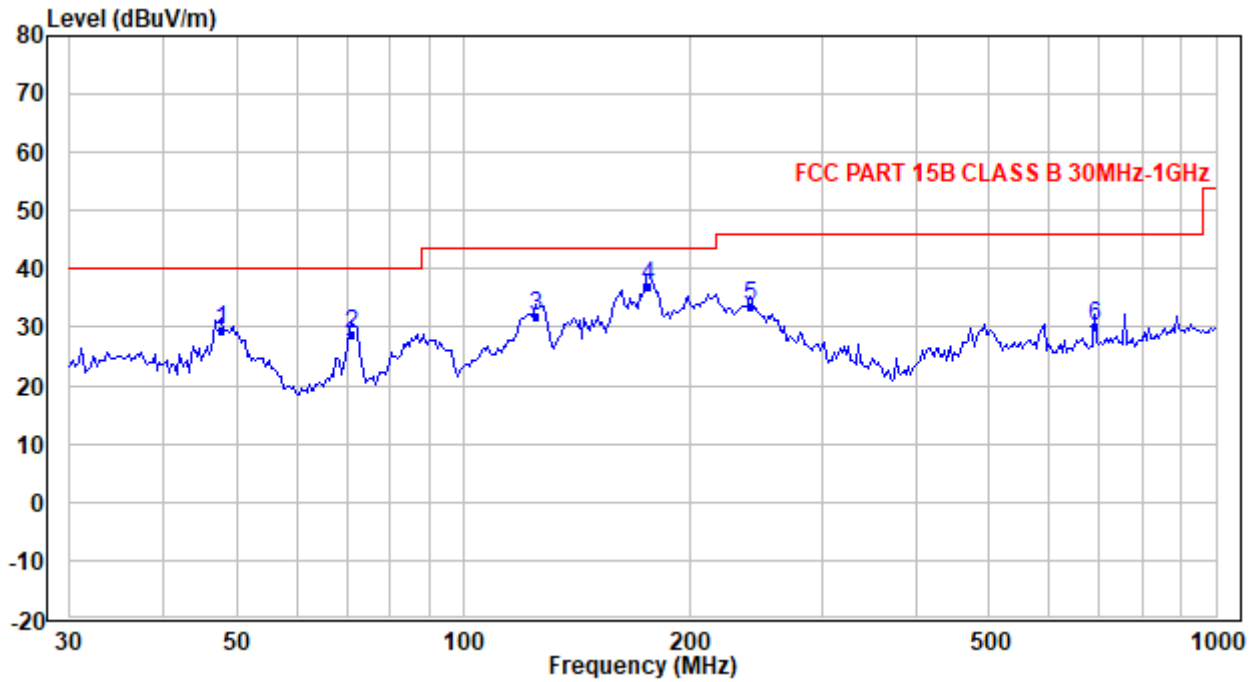
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Below 1GHz(Quasi Peak):
Test Mode8:
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	47.703	42.49	-13.04	29.45	40.00	-10.55	QP
2	71.203	46.15	-17.29	28.86	40.00	-11.14	QP
3	124.925	47.69	-15.82	31.87	43.50	-11.63	QP
4	176.275	47.49	-10.33	37.16	43.50	-6.34	QP
5	240.144	42.56	-9.09	33.47	46.00	-12.53	QP
6	689.051	28.91	1.23	30.14	46.00	-15.86	QP

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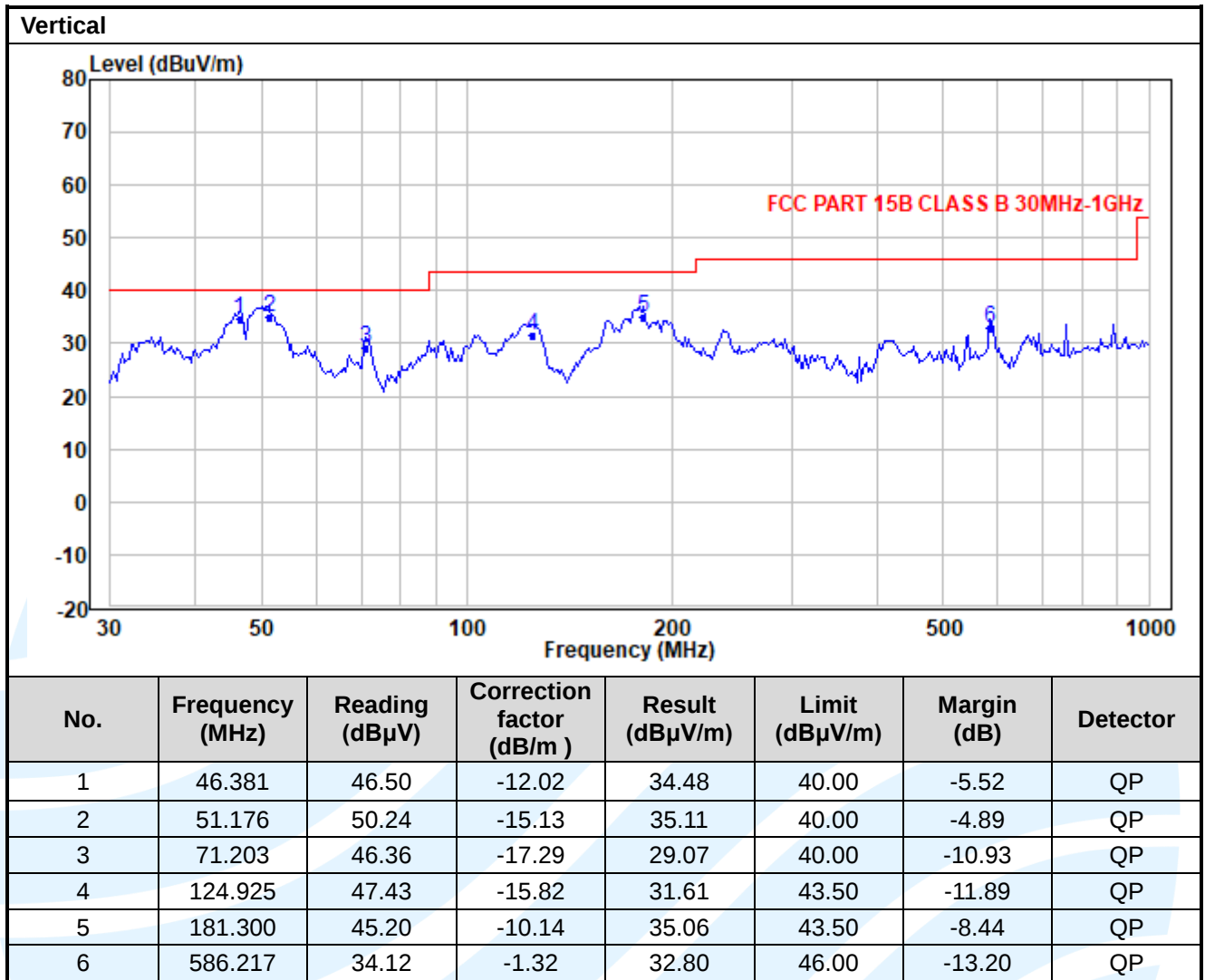
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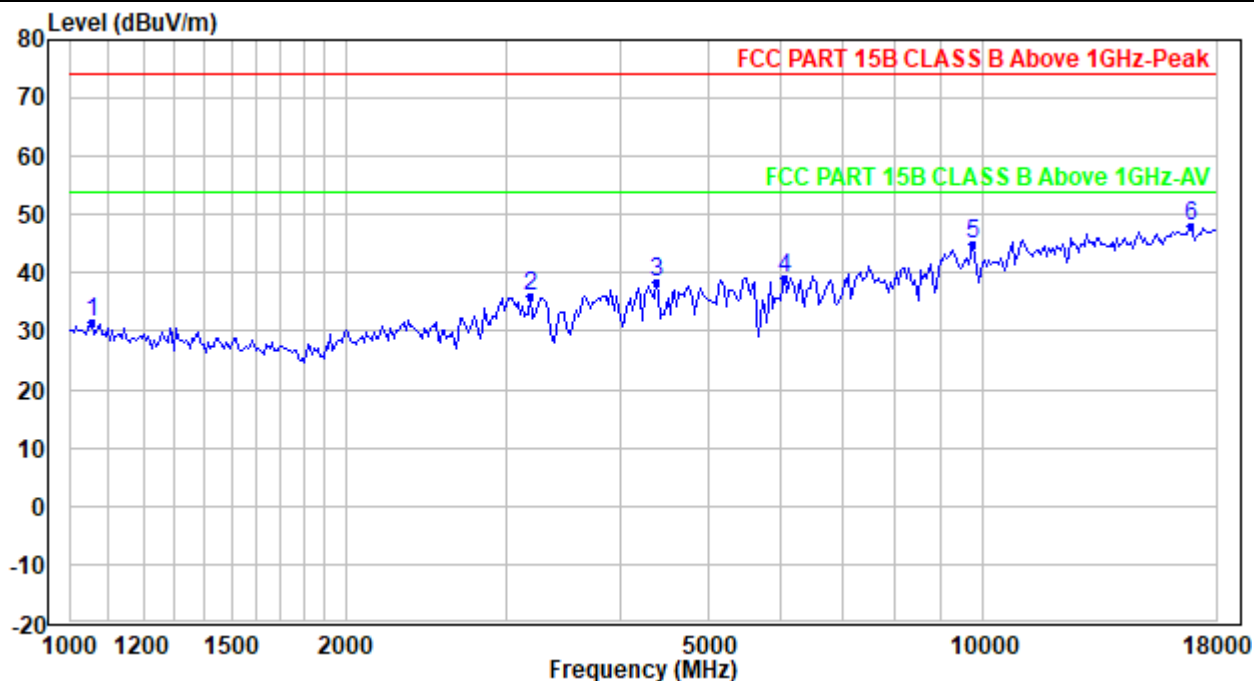
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Above 1GHz(Peak & Average)

Test Mode2:

Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	1053.514	44.92	-13.42	31.50	74.00	-42.50	Peak
2	3185.042	42.03	-6.05	35.98	74.00	-38.02	Peak
3	4379.978	41.05	-2.61	38.44	74.00	-35.56	Peak
4	6058.208	39.65	-0.38	39.27	74.00	-34.73	Peak
5	9741.401	39.25	5.65	44.90	74.00	-29.10	Peak
6	16888.890	35.34	12.68	48.02	74.00	-25.98	Peak

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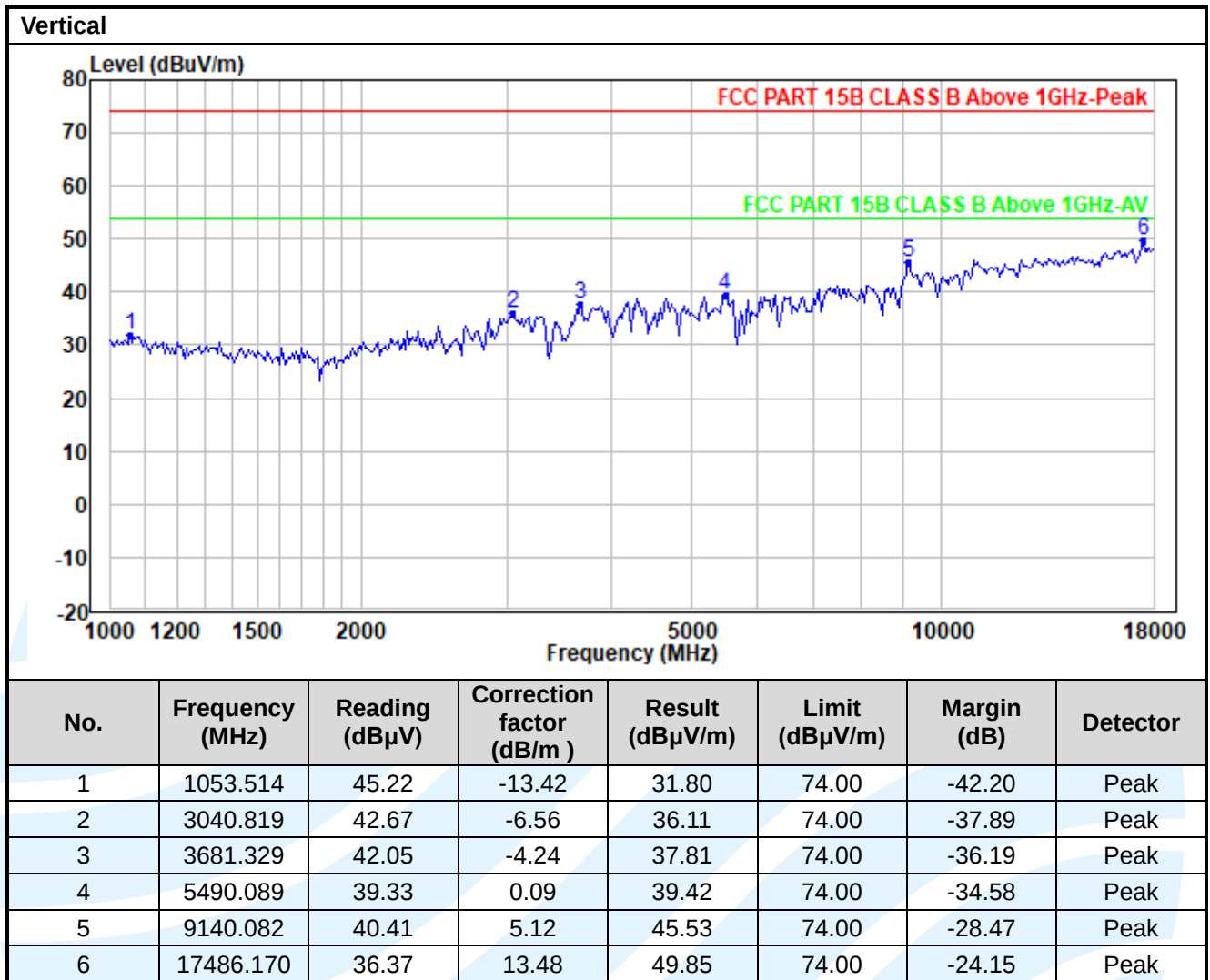
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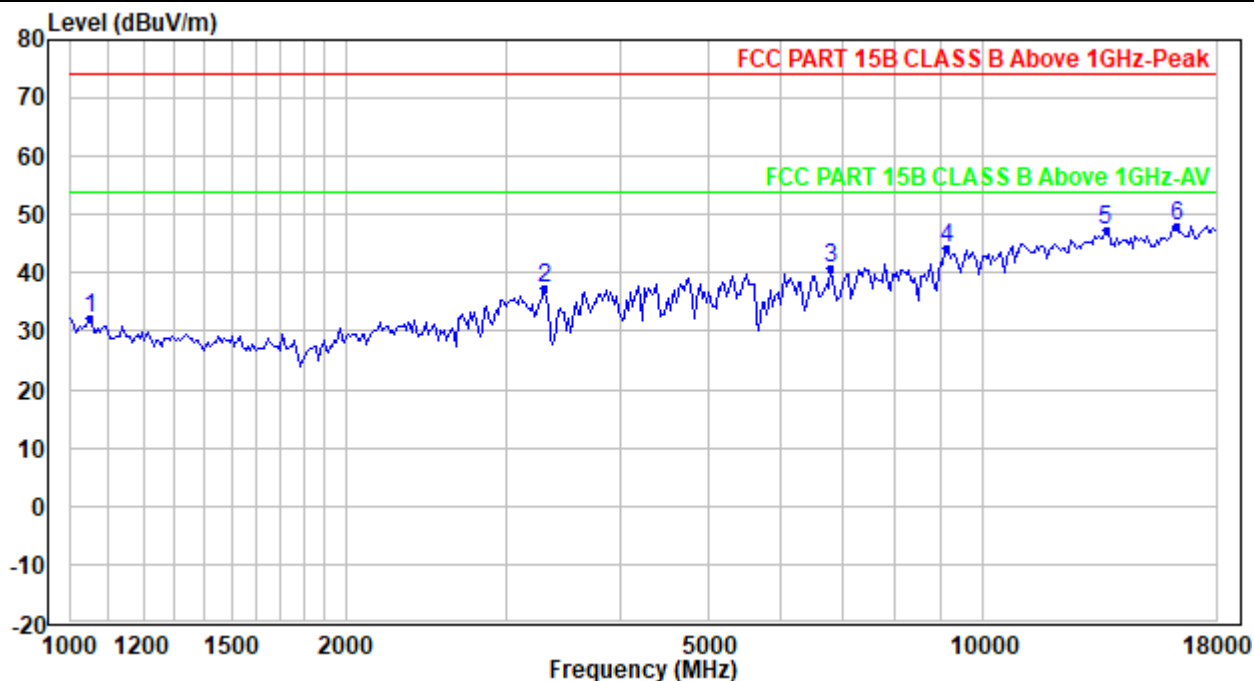
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Above 1GHz(Peak & Average)

Test Mode5:

Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	1047.429	45.54	-13.42	32.12	74.00	-41.88	Peak
2	3297.681	43.17	-5.69	37.48	74.00	-36.52	Peak
3	6802.299	39.73	0.93	40.66	74.00	-33.34	Peak
4	9140.082	39.06	5.12	44.18	74.00	-29.82	Peak
5	13630.910	35.78	11.53	47.31	74.00	-26.69	Peak
6	16312.020	36.01	12.15	48.16	74.00	-25.84	Peak

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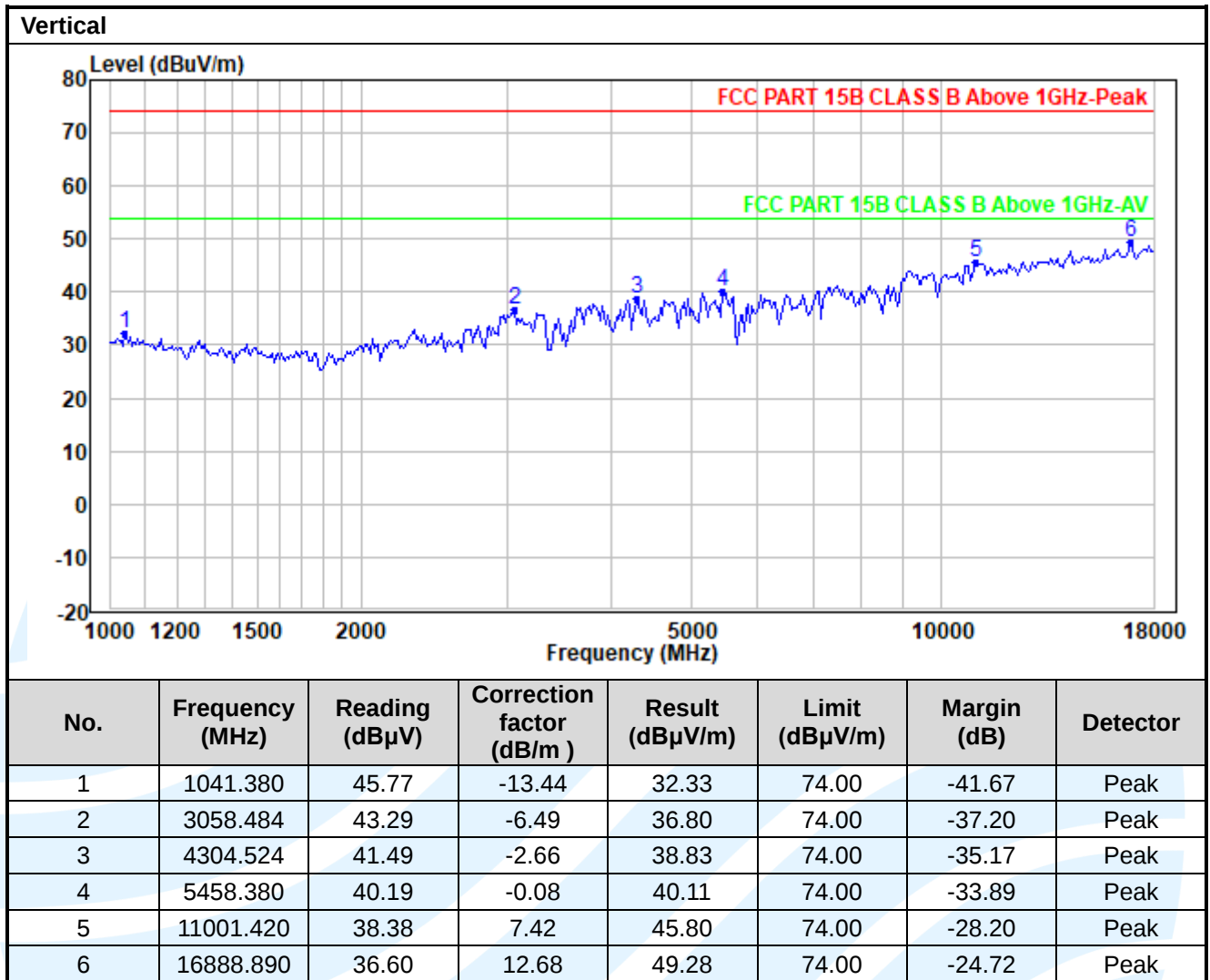
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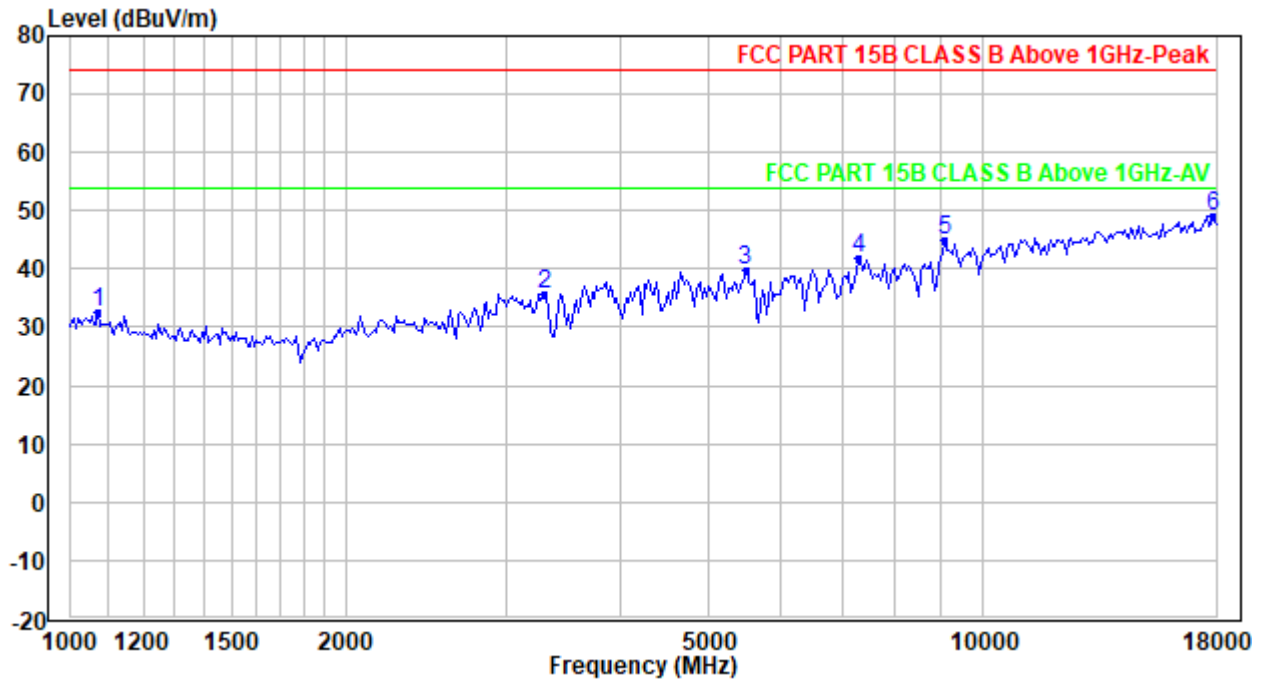
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Above 1GHz(Peak & Average)
Test Mode6:
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	1071.981	45.84	-13.38	32.46	74.00	-41.54	Peak
2	3297.681	41.50	-5.69	35.81	74.00	-38.19	Peak
3	5490.089	39.54	0.09	39.63	74.00	-34.37	Peak
4	7291.932	40.38	1.56	41.94	74.00	-32.06	Peak
5	9087.293	39.95	5.09	45.04	74.00	-28.96	Peak
6	17896.040	34.57	14.46	49.03	74.00	-24.97	Peak

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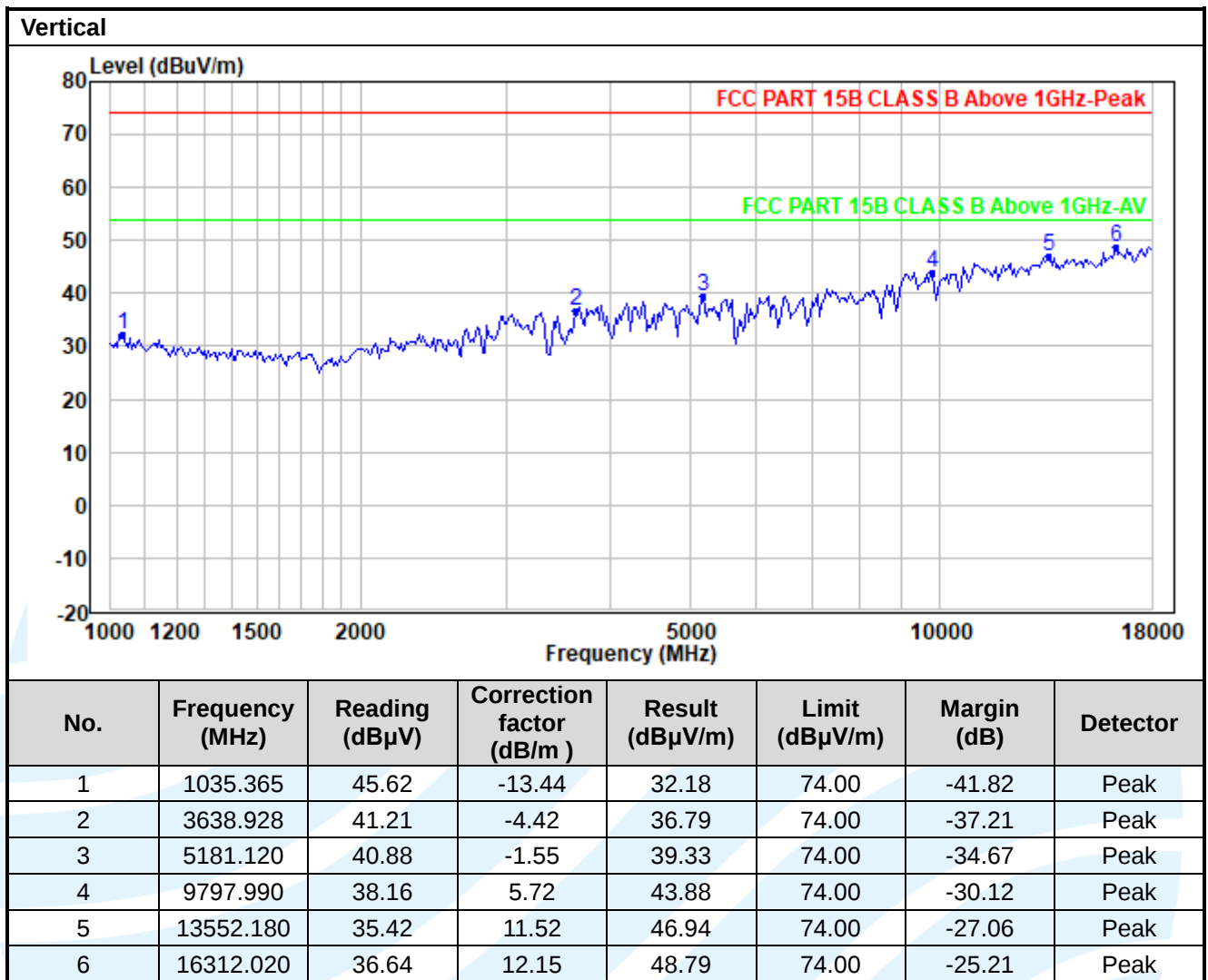
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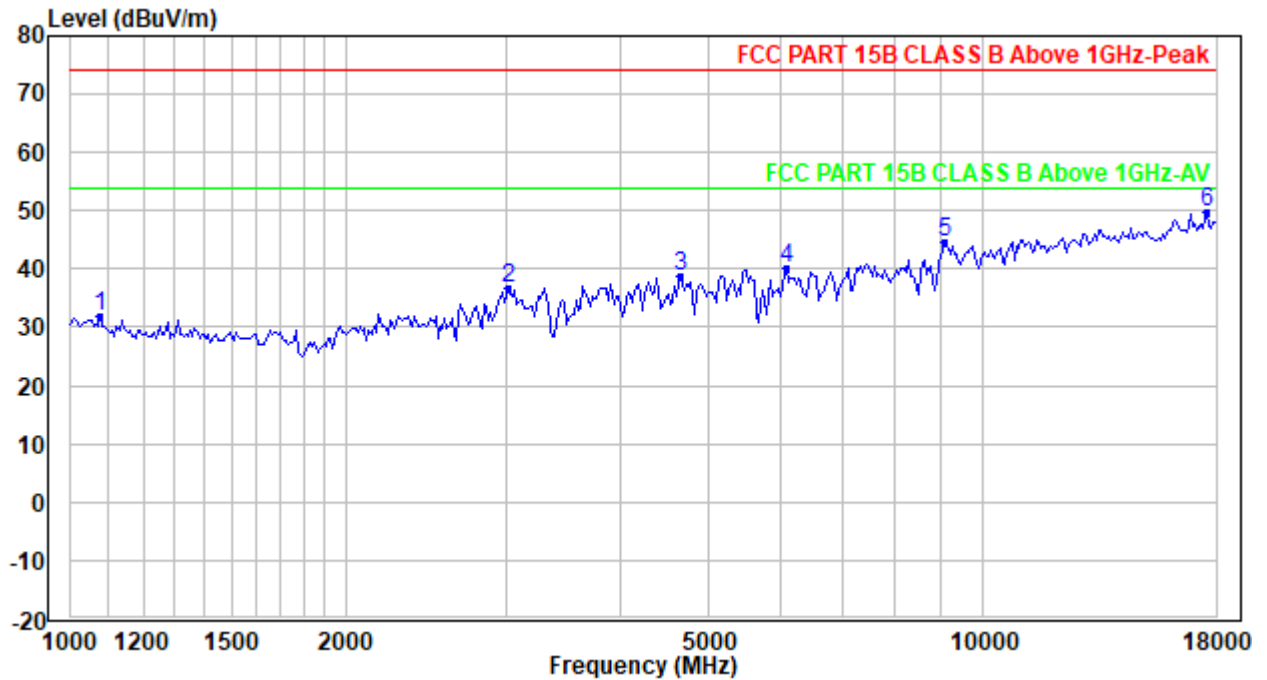
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Above 1GHz(Peak & Average)
Test Mode7:
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	1078.208	45.22	-13.36	31.86	74.00	-42.14	Peak
2	3023.257	43.38	-6.62	36.76	74.00	-37.24	Peak
3	4668.133	41.29	-2.43	38.86	74.00	-35.14	Peak
4	6093.401	40.28	-0.30	39.98	74.00	-34.02	Peak
5	9087.293	39.66	5.09	44.75	74.00	-29.25	Peak
6	17587.750	36.10	13.71	49.81	74.00	-24.19	Peak

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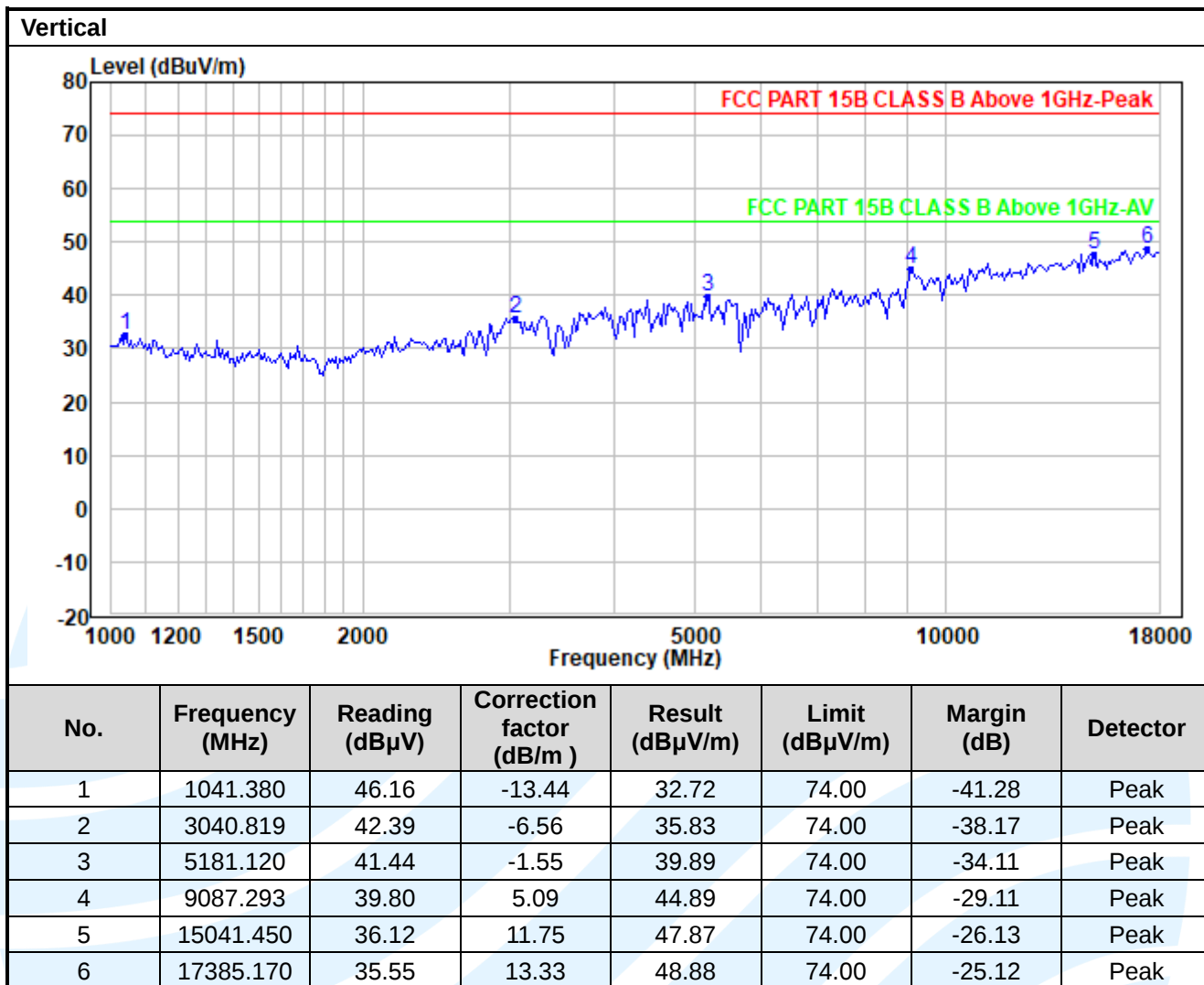
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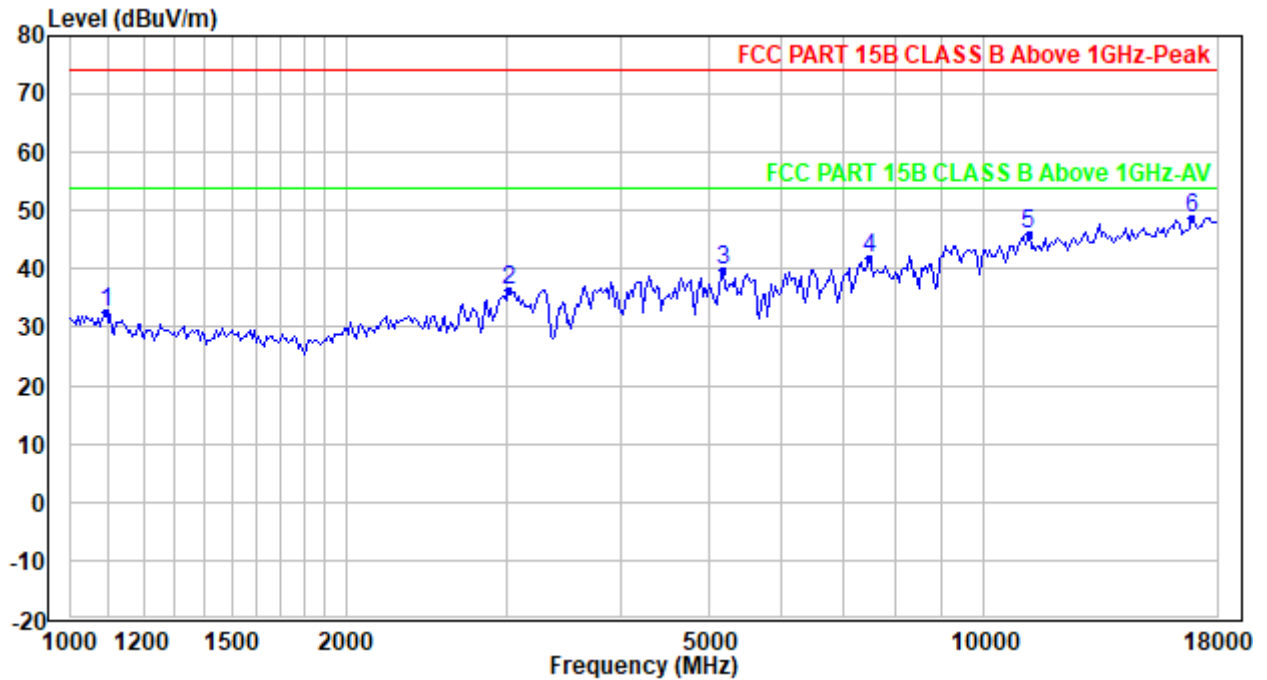
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Above 1GHz(Peak & Average)
Test Mode8:
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	1090.771	46.04	-13.34	32.70	74.00	-41.30	Peak
2	3023.257	43.02	-6.62	36.40	74.00	-37.60	Peak
3	5181.120	41.49	-1.55	39.94	74.00	-34.06	Peak
4	7506.207	39.93	1.92	41.85	74.00	-32.15	Peak
5	11194.260	38.54	7.29	45.83	74.00	-28.17	Peak
6	16888.890	36.09	12.68	48.77	74.00	-25.23	Peak

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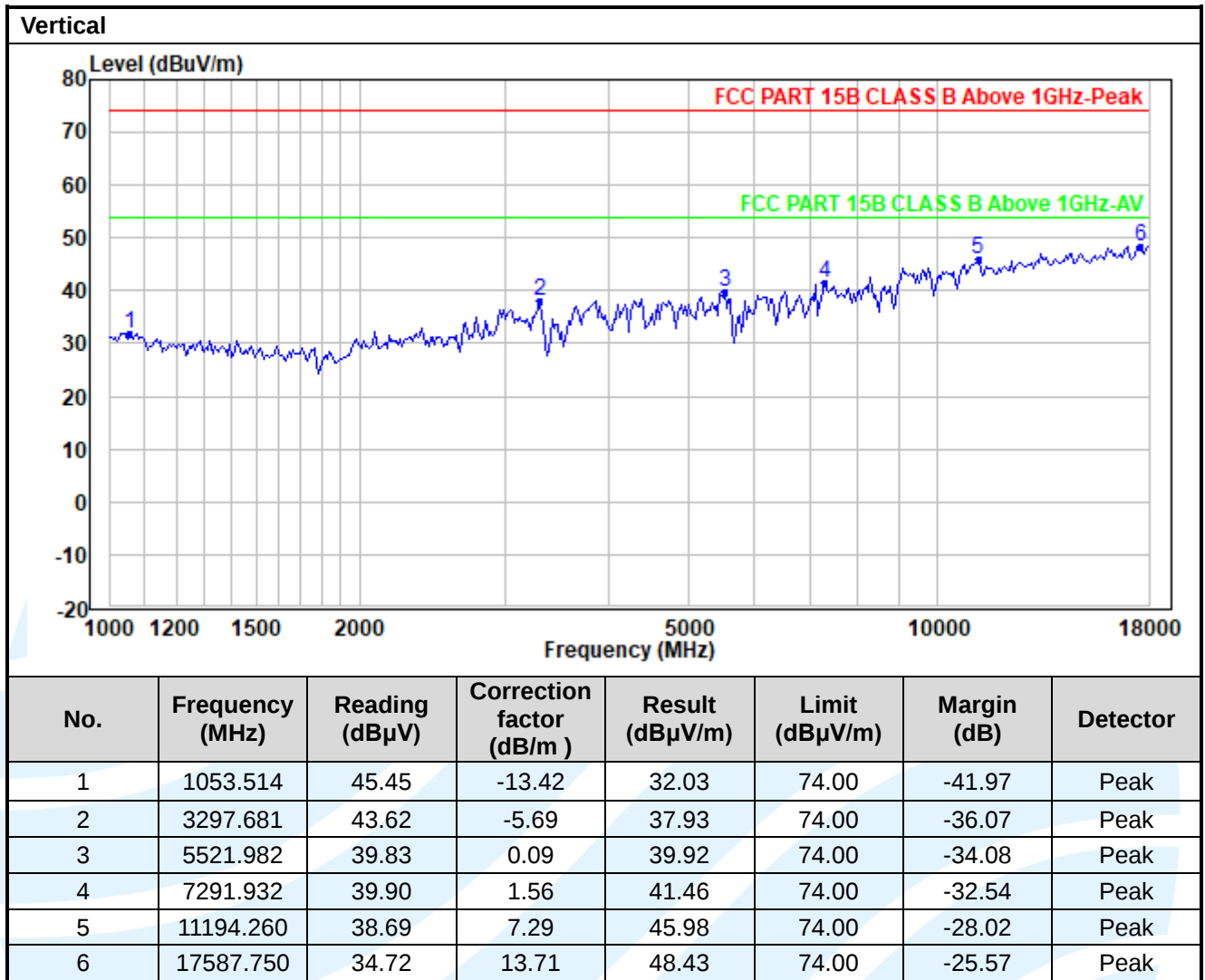
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Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit
4. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.
5. The limit of ICES-003 in the 230MHz to 960MHz band is higher than that of FCC Part 15B, so the radiation emission test data conform to the limit of ICES-003.

6.2 CONDUCTED EMISSION

Test Requirement: FCC 47 CFR Part 15.107
ICES-003 Issue 7 Section 3.2.1

Test Method: ANSI C63.4-2014

Limits:

Limits for Class B devices

Frequency range (MHz)	Limits (dB(μV))	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.3.2 for details.

Test Procedures:

- 1) The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
- 2) The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
- 3) For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

Equipment Used: Refer to section 3 for details.

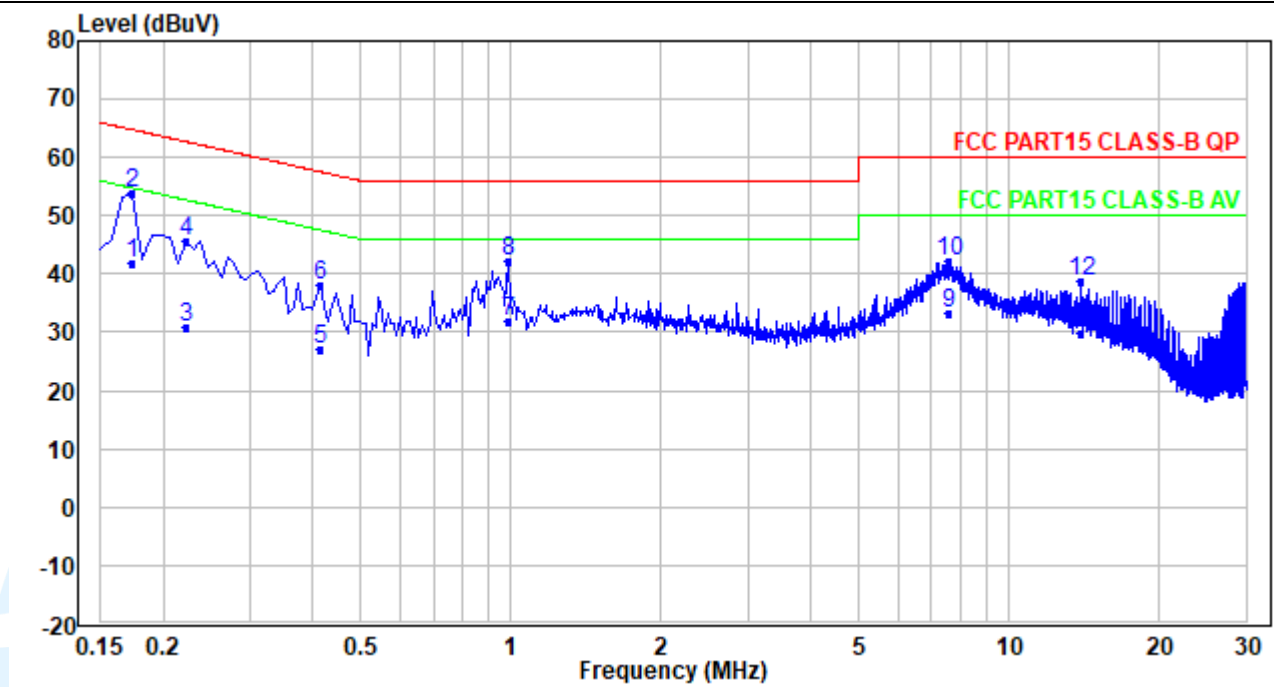
Test Result: Pass

The measurement data as follows:

Quasi Peak and Average:

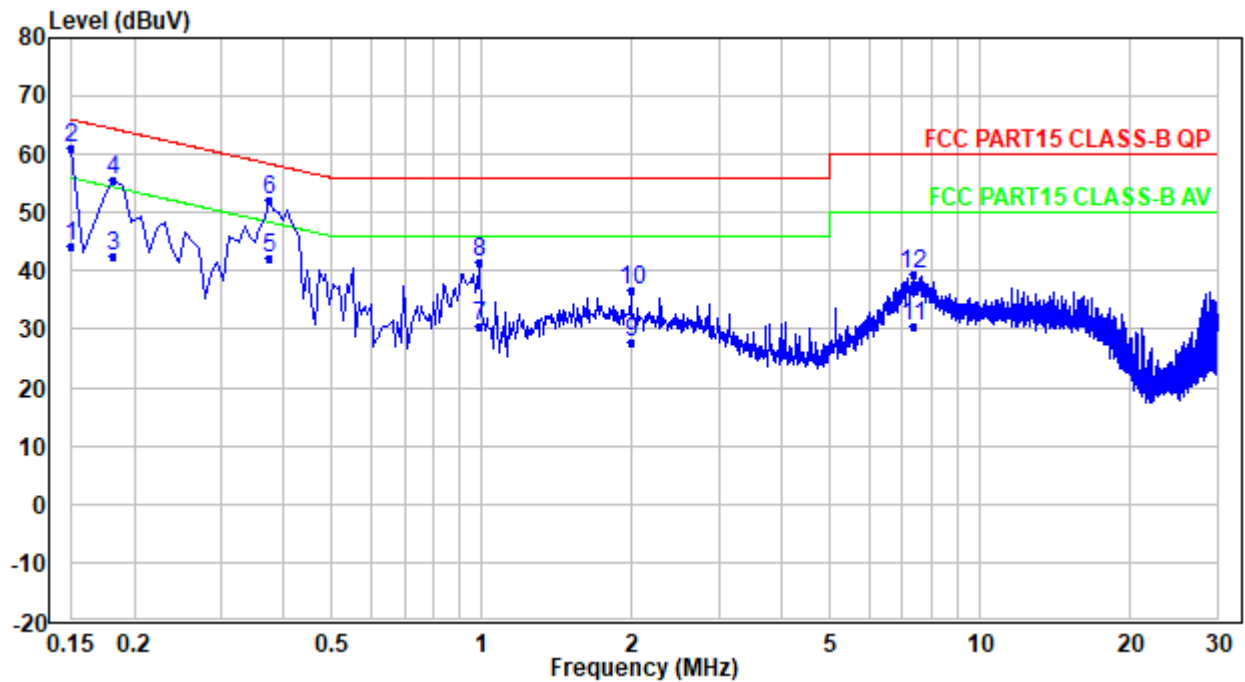
Test Mode1:

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.174	31.77	10.13	41.90	54.77	-12.87	Average
2	0.174	43.77	10.13	53.90	64.77	-10.87	QP
3	0.222	20.69	10.12	30.81	52.74	-21.93	Average
4	0.222	35.69	10.12	45.81	62.74	-16.93	QP
5	0.414	16.92	10.13	27.05	47.57	-20.52	Average
6	0.414	27.92	10.13	38.05	57.57	-19.52	QP
7	0.990	21.81	10.22	32.03	46.00	-13.97	Average
8	0.990	31.81	10.22	42.03	56.00	-13.97	QP
9	7.613	22.79	10.48	33.27	50.00	-16.73	Average
10	7.613	31.79	10.48	42.27	60.00	-17.73	QP
11	13.947	18.86	10.82	29.68	50.00	-20.32	Average
12	13.947	27.86	10.82	38.68	60.00	-21.32	QP

Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.150	34.08	10.11	44.19	56.00	-11.81	Average
2	0.150	51.08	10.11	61.19	66.00	-4.81	QP
3	0.182	32.40	10.11	42.51	54.39	-11.88	Average
4	0.182	45.40	10.11	55.51	64.39	-8.88	QP
5	0.374	31.99	10.12	42.11	48.41	-6.30	Average
6	0.374	41.99	10.12	52.11	58.41	-6.30	QP
7	0.990	20.40	10.15	30.55	46.00	-15.45	Average
8	0.990	31.40	10.15	41.55	56.00	-14.45	QP
9	1.998	17.42	10.18	27.60	46.00	-18.40	Average
10	1.998	26.42	10.18	36.60	56.00	-19.40	QP
11	7.341	20.09	10.49	30.58	50.00	-19.42	Average
12	7.341	29.09	10.49	39.58	60.00	-20.42	QP

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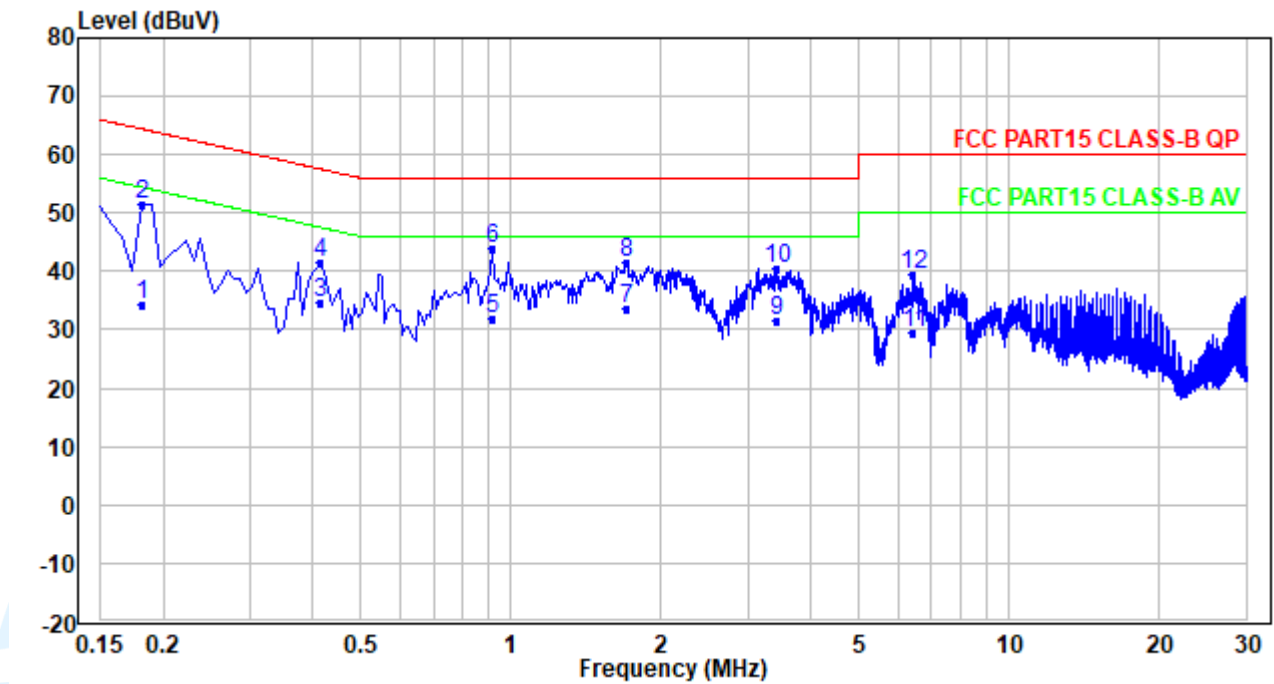
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Quasi Peak and Average:
Test Mode5:

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.182	24.27	10.12	34.39	54.39	-20.00	Average
2	0.182	41.27	10.12	51.39	64.39	-13.00	QP
3	0.414	24.46	10.13	34.59	47.57	-12.98	Average
4	0.414	31.46	10.13	41.59	57.57	-15.98	QP
5	0.918	21.58	10.21	31.79	46.00	-14.21	Average
6	0.918	33.58	10.21	43.79	56.00	-12.21	QP
7	1.702	23.35	10.24	33.59	46.00	-12.41	Average
8	1.702	31.35	10.24	41.59	56.00	-14.41	QP
9	3.413	21.29	10.28	31.57	46.00	-14.43	Average
10	3.413	30.29	10.28	40.57	56.00	-15.43	QP
11	6.437	18.93	10.42	29.35	50.00	-20.65	Average
12	6.437	28.93	10.42	39.35	60.00	-20.65	QP

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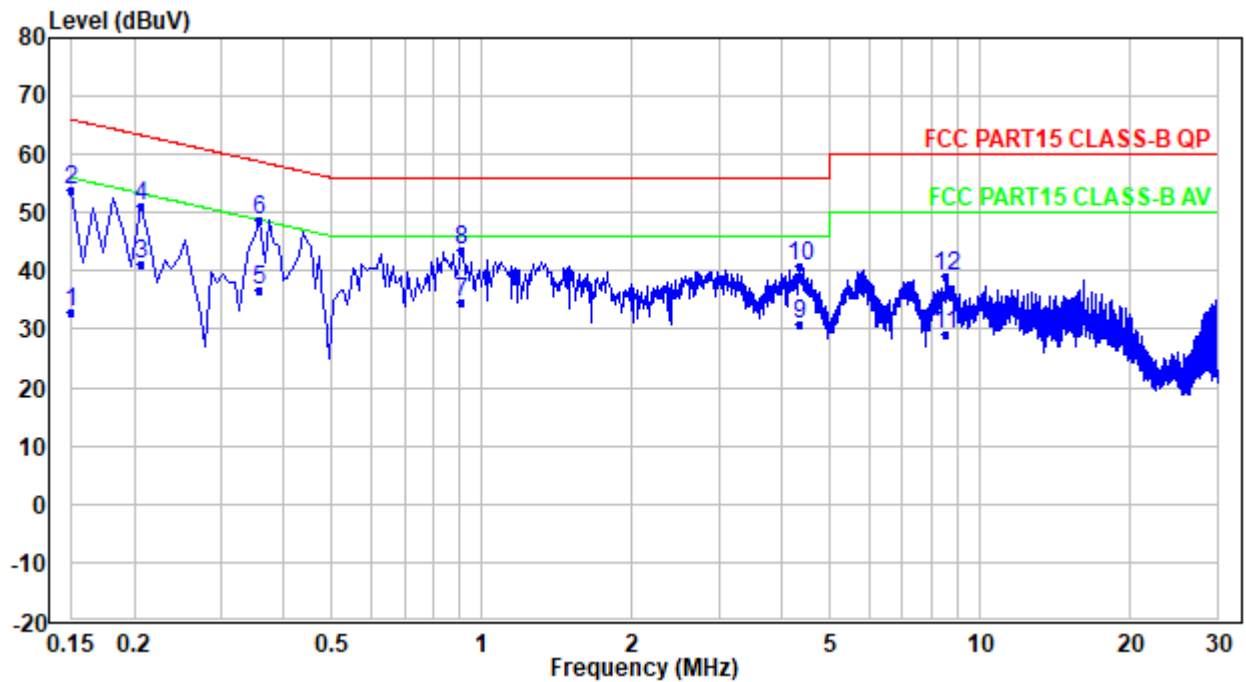
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Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.150	22.81	10.11	32.92	56.00	-23.08	Average
2	0.150	43.81	10.11	53.92	66.00	-12.08	QP
3	0.206	30.95	10.11	41.06	53.37	-12.31	Average
4	0.206	40.95	10.11	51.06	63.37	-12.31	QP
5	0.358	26.48	10.11	36.59	48.78	-12.19	Average
6	0.358	38.48	10.11	48.59	58.78	-10.19	QP
7	0.910	24.48	10.15	34.63	46.00	-11.37	Average
8	0.910	33.48	10.15	43.63	56.00	-12.37	QP
9	4.349	20.57	10.33	30.90	46.00	-15.10	Average
10	4.349	30.57	10.33	40.90	56.00	-15.10	QP
11	8.556	18.50	10.55	29.05	50.00	-20.95	Average
12	8.556	28.50	10.55	39.05	60.00	-20.95	QP

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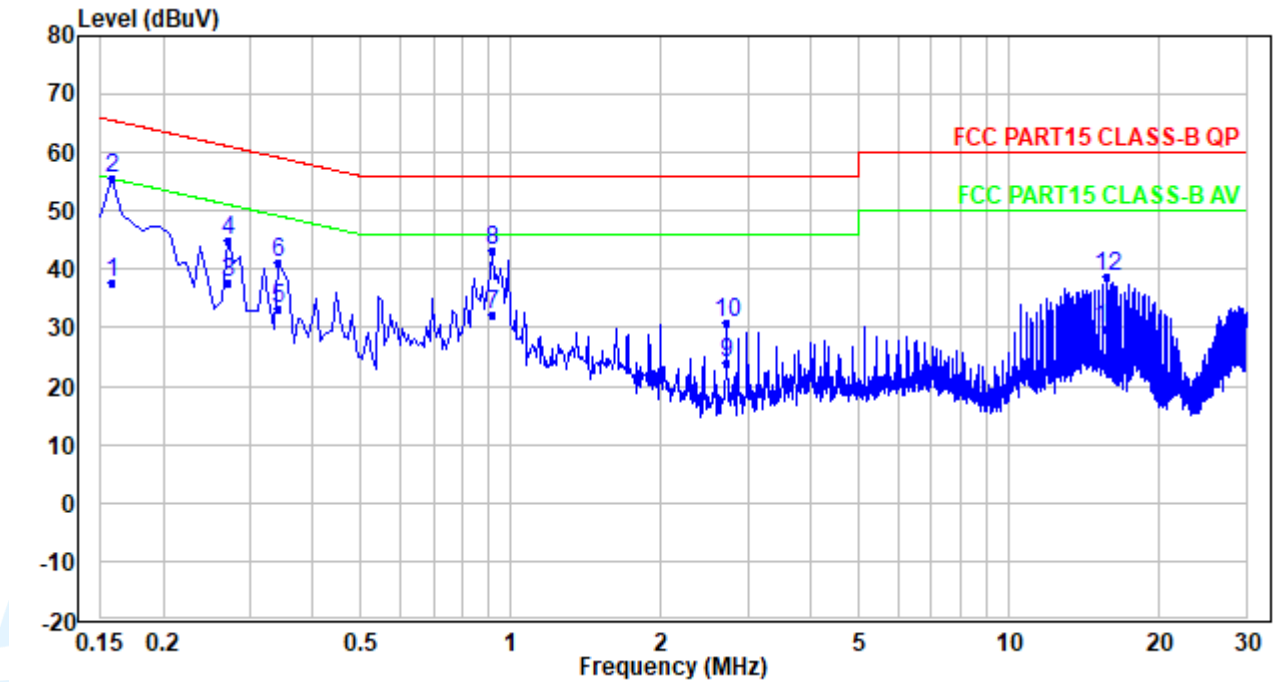
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Quasi Peak and Average:
Test Mode6:

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.158	27.61	10.13	37.74	55.57	-17.83	Average
2	0.158	45.61	10.13	55.74	65.57	-9.83	QP
3	0.270	27.75	10.13	37.88	51.12	-13.24	Average
4	0.270	34.75	10.13	44.88	61.12	-16.24	QP
5	0.342	23.18	10.13	33.31	49.16	-15.85	Average
6	0.342	31.18	10.13	41.31	59.16	-17.85	QP
7	0.918	21.86	10.21	32.07	46.00	-13.93	Average
8	0.918	32.86	10.21	43.07	56.00	-12.93	QP
9	2.709	13.58	10.26	23.84	46.00	-22.16	Average
10	2.709	20.58	10.26	30.84	56.00	-25.16	QP
11	15.707	18.91	10.89	29.80	50.00	-20.20	Average
12	15.707	27.91	10.89	38.80	60.00	-21.20	QP

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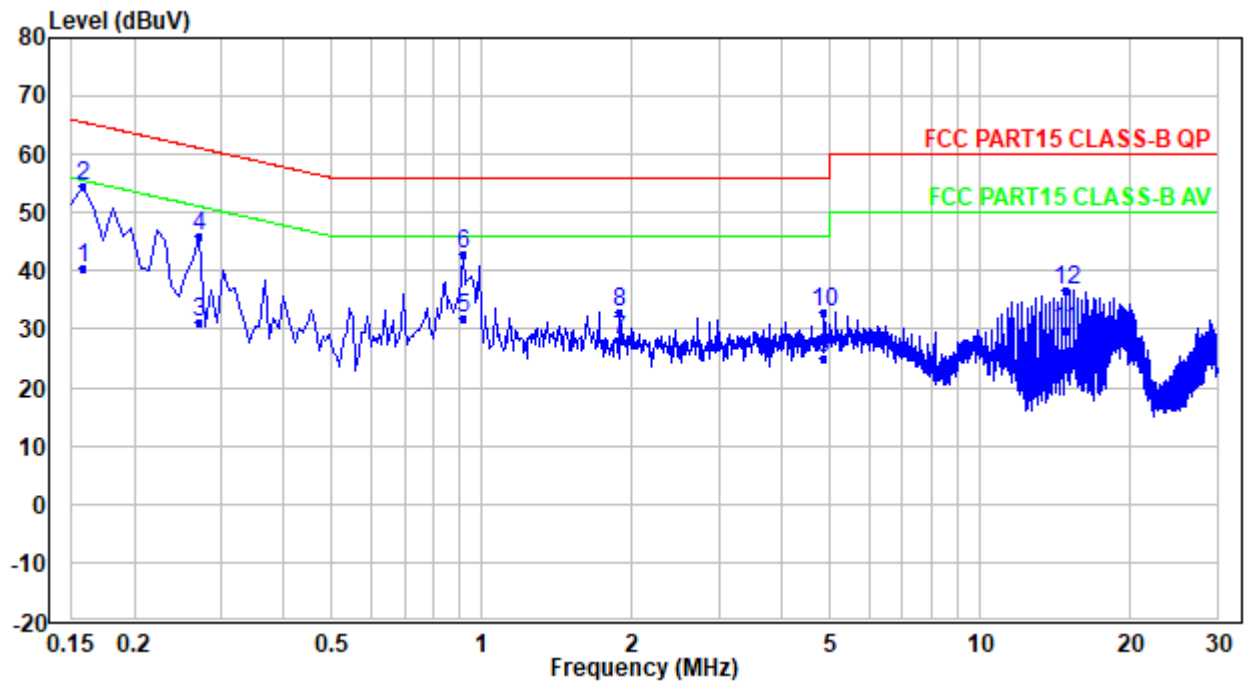
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Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.158	30.45	10.12	40.57	55.57	-15.00	Average
2	0.158	44.45	10.12	54.57	65.57	-11.00	QP
3	0.270	21.01	10.11	31.12	51.12	-20.00	Average
4	0.270	36.01	10.11	46.12	61.12	-15.00	QP
5	0.918	21.64	10.15	31.79	46.00	-14.21	Average
6	0.918	32.64	10.15	42.79	56.00	-13.21	QP
7	1.894	17.79	10.17	27.96	46.00	-18.04	Average
8	1.894	22.79	10.17	32.96	56.00	-23.04	QP
9	4.877	14.55	10.35	24.90	46.00	-21.10	Average
10	4.877	22.55	10.35	32.90	56.00	-23.10	QP
11	14.899	18.84	10.83	29.67	50.00	-20.33	Average
12	14.899	25.84	10.83	36.67	60.00	-23.33	QP

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Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

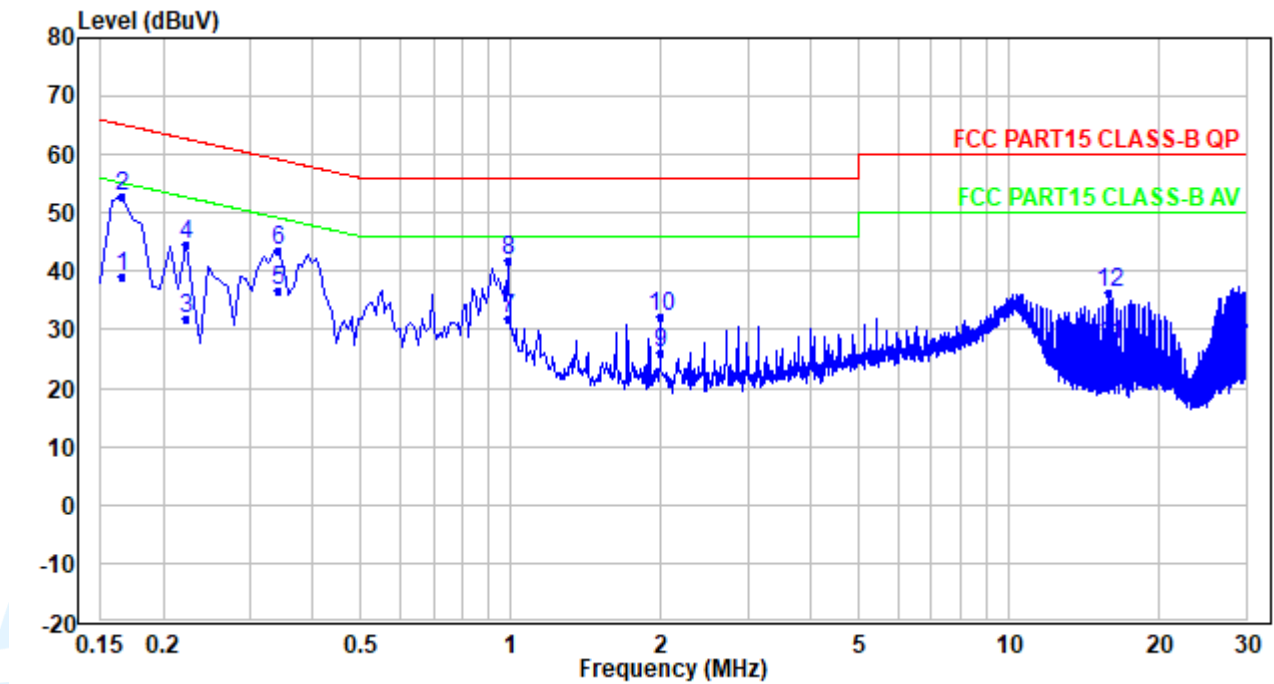
E-mail: info@uttlab.com

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Quasi Peak and Average:
Test Mode7:

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.166	28.81	10.13	38.94	55.16	-16.22	Average
2	0.166	42.81	10.13	52.94	65.16	-12.22	QP
3	0.222	21.62	10.12	31.74	52.74	-21.00	Average
4	0.222	34.62	10.12	44.74	62.74	-18.00	QP
5	0.342	26.46	10.13	36.59	49.16	-12.57	Average
6	0.342	33.46	10.13	43.59	59.16	-15.57	QP
7	0.990	21.51	10.22	31.73	46.00	-14.27	Average
8	0.990	31.51	10.22	41.73	56.00	-14.27	QP
9	1.998	15.83	10.24	26.07	46.00	-19.93	Average
10	1.998	21.83	10.24	32.07	56.00	-23.93	QP
11	15.971	16.47	10.89	27.36	50.00	-22.64	Average
12	15.971	25.47	10.89	36.36	60.00	-23.64	QP

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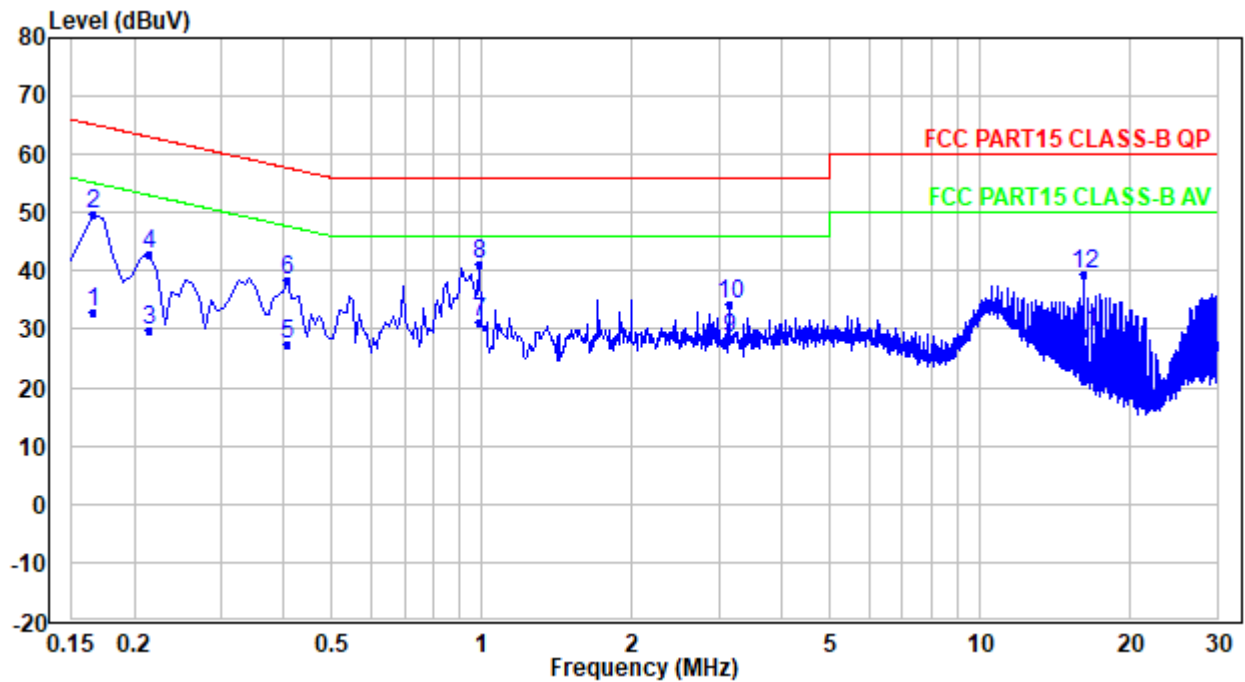
Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

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Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.166	22.81	10.12	32.93	55.16	-22.23	Average
2	0.166	39.81	10.12	49.93	65.16	-15.23	QP
3	0.214	19.73	10.11	29.84	53.05	-23.21	Average
4	0.214	32.73	10.11	42.84	63.05	-20.21	QP
5	0.406	17.15	10.12	27.27	47.73	-20.46	Average
6	0.406	28.15	10.12	38.27	57.73	-19.46	QP
7	0.990	21.14	10.15	31.29	46.00	-14.71	Average
8	0.990	31.14	10.15	41.29	56.00	-14.71	QP
9	3.133	18.15	10.27	28.42	46.00	-17.58	Average
10	3.133	24.15	10.27	34.42	56.00	-21.58	QP
11	16.243	18.65	10.86	29.51	50.00	-20.49	Average
12	16.243	28.65	10.86	39.51	60.00	-20.49	QP

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Fax: +86-755-28230886

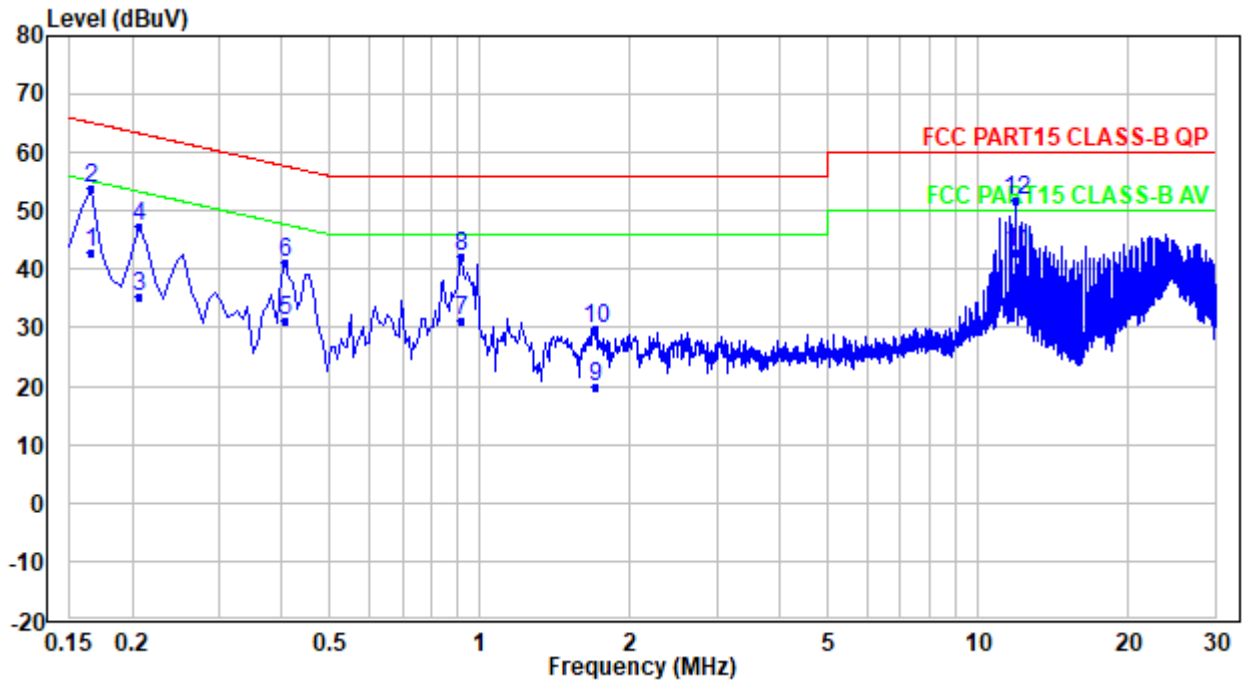
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Quasi Peak and Average:
Test Mode8:

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.166	32.74	10.13	42.87	55.16	-12.29	Average
2	0.166	43.74	10.13	53.87	65.16	-11.29	QP
3	0.206	25.21	10.12	35.33	53.37	-18.04	Average
4	0.206	37.21	10.12	47.33	63.37	-16.04	QP
5	0.406	20.99	10.12	31.11	47.73	-16.62	Average
6	0.406	30.99	10.12	41.11	57.73	-16.62	QP
7	0.918	21.05	10.21	31.26	46.00	-14.74	Average
8	0.918	32.05	10.21	42.26	56.00	-13.74	QP
9	1.710	9.69	10.24	19.93	46.00	-26.07	Average
10	1.710	19.69	10.24	29.93	56.00	-26.07	QP
11	11.964	32.17	10.70	42.87	50.00	-7.13	Average
12	11.964	41.17	10.70	51.87	60.00	-8.13	QP

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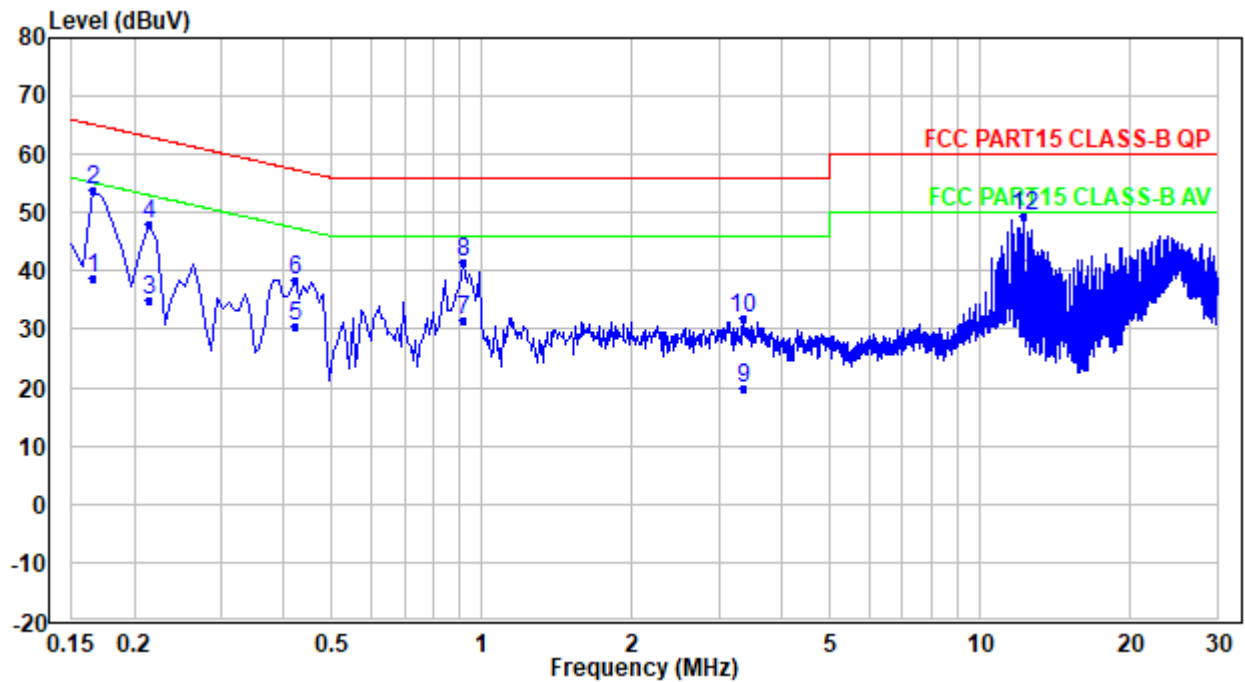
Fax: +86-755-28230886

E-mail: info@uttlab.com

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Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.166	28.81	10.12	38.93	55.16	-16.23	Average
2	0.166	43.81	10.12	53.93	65.16	-11.23	QP
3	0.214	24.90	10.11	35.01	53.05	-18.04	Average
4	0.214	37.90	10.11	48.01	63.05	-15.04	QP
5	0.422	20.25	10.12	30.37	47.41	-17.04	Average
6	0.422	28.25	10.12	38.37	57.41	-19.04	QP
7	0.918	21.44	10.15	31.59	46.00	-14.41	Average
8	0.918	31.44	10.15	41.59	56.00	-14.41	QP
9	3.341	9.46	10.28	19.74	46.00	-26.26	Average
10	3.341	21.46	10.28	31.74	56.00	-24.26	QP
11	12.276	27.73	10.71	38.44	50.00	-11.56	Average
12	12.276	38.73	10.71	49.44	60.00	-10.56	QP

Remark:

1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result - Limit
4. An initial pre-scan was performed on the Phase and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

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APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

***** End of Report *****

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