Certificate #4312.01

TEST REPORT

Product Name:	Long-Range Enterprise Wi-Fi 6 Access Point
Trade Mark:	GRANDSTREAM
Model No.:	GWN7660ELR
Report Number:	2311037676EMC-1
Test Standards:	FCC 47 CFR Part 15 Subpart B
FCC ID:	YZZGWN7660ELR
Test Result:	PASS
Date of Issue:	February 21, 2024

Prepared for:

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

Prepared by:

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Date: February 21, 2024

Version

Version No.	Date	Description
V1.0	February 21, 2024	Original

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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:	Long-Range Enterprise Wi-Fi 6 Access Point
Model No.:	GWN7660ELR
Trade Mark:	GRANDSTREAM
DUT Stage:	Identical Prototype
Rated Voltage:	48Vdc
Classification of digital devices:	Class B
Highest Internal Frequency:	5825 MHz
Sample Received Date:	November 3, 2023
Sample Tested Date:	November 23, 2023 January 5, 2024
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

Others
1x Mounting Bracket, 1x Base Bracket

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
POE	CISCO	MA-INJ-4	QS-6593-01N A02	UnionTrust
Wireless Router	ASUA	RT-AC2200	2019AJ4850	UnionTrust
Notebook	Lenovo	Lenovo B40-80	MP12NEQ6	UnionTrust
Notebook	Lenovo	TP00067A	PN-0FZDEU 16\02	UnionTrust
Mouse	DELL	MS111	CN-011D3V-73826-6 2N-0LK	UnionTrust
Mouse	DELL	MS111	CN-011D3V-73826-6 2N-0CUT	UnionTrust
Mobile Phone	MI	MDG1	461cceef7d24	UnionTrust

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

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:

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	ANSI C63.4-2014	PASS
Radiated Emission	FCC 47 CFR Part 15.109	ANSI C63.4-2014	PASS

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	3m SAC	ETS-LINDGREN	3m	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☒	Receiver	R&S	ESIB26	100114	27-Oct-2023	26-Oct-2024
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	30-Oct-2023	29-Oct-2024
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	30-Oct-2023	29-Oct-2024
☒	Preamplifier	HP	8447F	2805A02960	31-Oct-2023	30-Oct-2024
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	16-Apr-2023	15-Apr-2025
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	31-Oct-2023	30-Oct-2024
☒	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**	**Cal. Due date**
☒	Receiver	R&S	ESR7	101181	27-Oct-2023	26-Oct-2024
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	27-Oct-2023	26-Oct-2024
☒	LISN	R&S	ESH2-Z5	860014/024	27-Oct-2023	26-Oct-2024
☒	LISN	ETS-Lindgren	3816/2SH	00201088	27-Oct-2023	26-Oct-2024
☒	Shielding room	ETS-Lindgren	843	Euroshiedpn-CT001270-1246	5-Nov-2021	4-Nov-2024
☒	Test Software	EZ-EMC	EZ-CON	Software Version: EMC-CON 3A1.1		

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	48	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	24.8	62.1	99.8	S202311032347-ZJA02/4	Linson Xie
Radiated Emission	25.3	61.2	100.0		Fire Huo

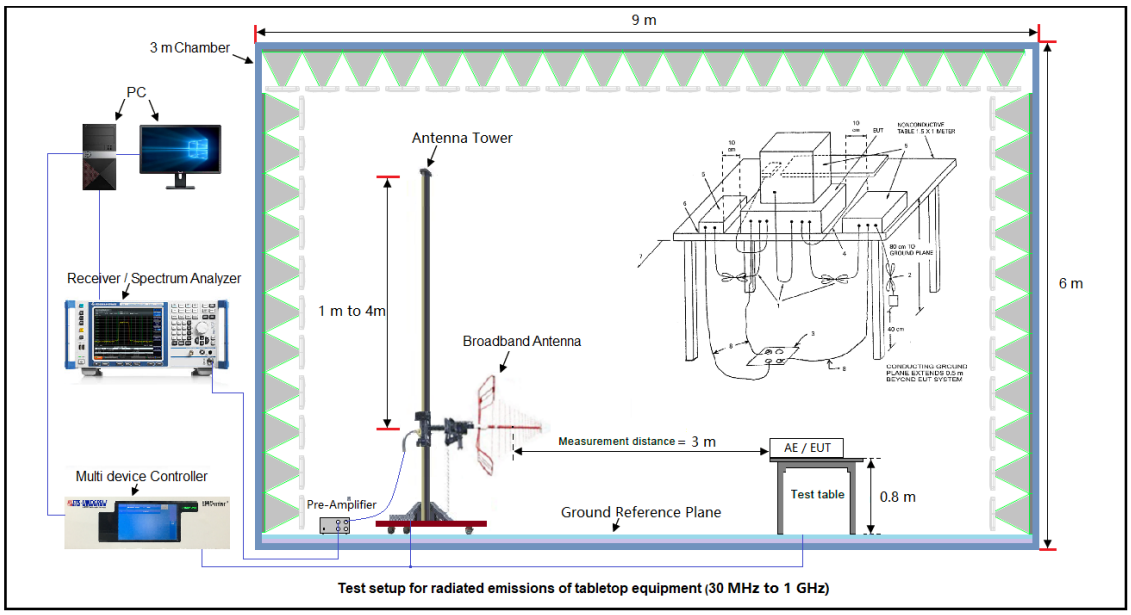
4.2 TEST MODES

Test Item	EMI Test Modes
Radiated Emission	Test Mode1: Powered by NET/POE port + WIFI Link +RJ45 data transmitting + SFP data transmitting
Conducted Emission	Test Mode1: Powered by NET/POE port + WIFI Link +RJ45 data transmitting + SFP data transmitting

4.3 TEST SETUP

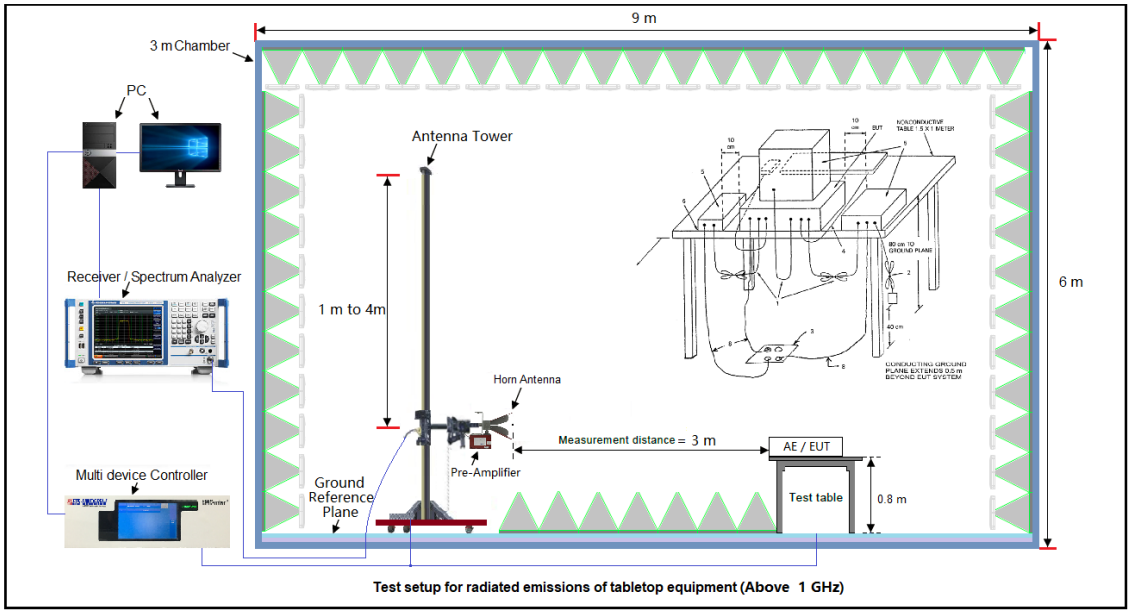
4.3.1 For Radiated Emissions test setup

Figure 1. 30MHz to 1GHz



Test setup for radiated emissions of tabletop equipment (30 MHz to 1 GHz)

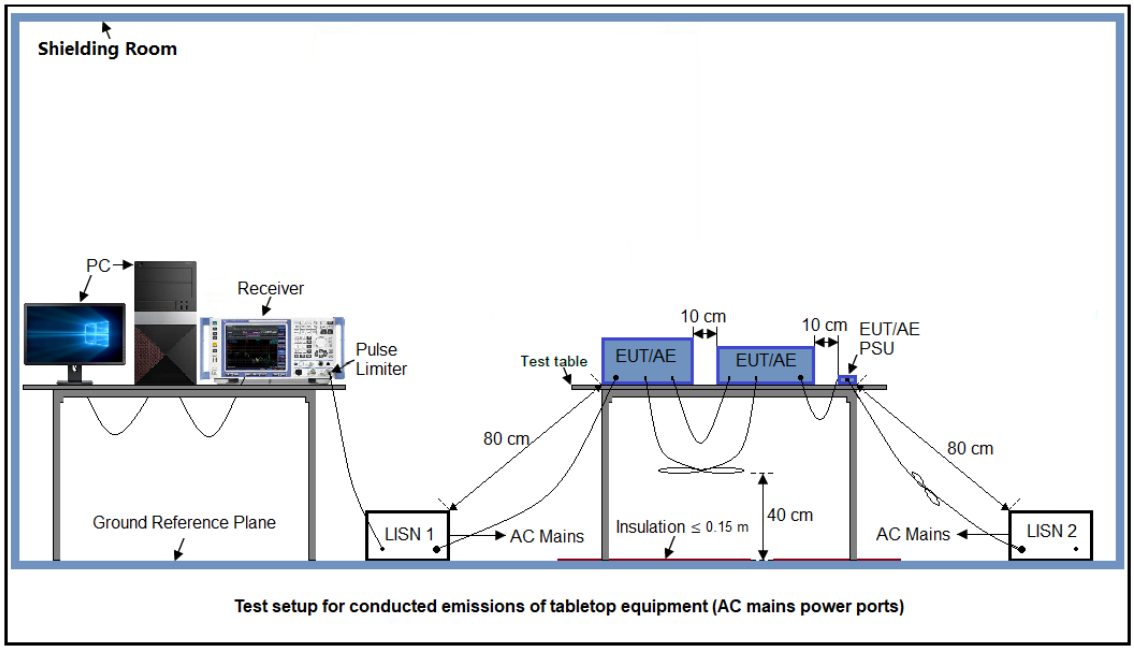
Figure 2. Above 1GHz



Test setup for radiated emissions of tabletop equipment (Above 1 GHz)

4.3.2 For Conducted Emissions test setup

Figure 3. Conducted Emissions setup



Test setup for conducted emissions of tabletop equipment (AC mains power ports)

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	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
3	KDB 174176 D01 Line Conducted FAQ v01r01	AC power-line conducted emission frequency asked questions
4	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

Test Method: ANSI C63.4-2014

Receiver Setup:

Frequency: (f) (MHz)	Detector type	Measurement receiver bandwidth	
		RBW	VBW
30 ≤ f ≤ 1 000	Quasi Peak	120 kHz	300 kHz
f ≥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

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (μV/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:

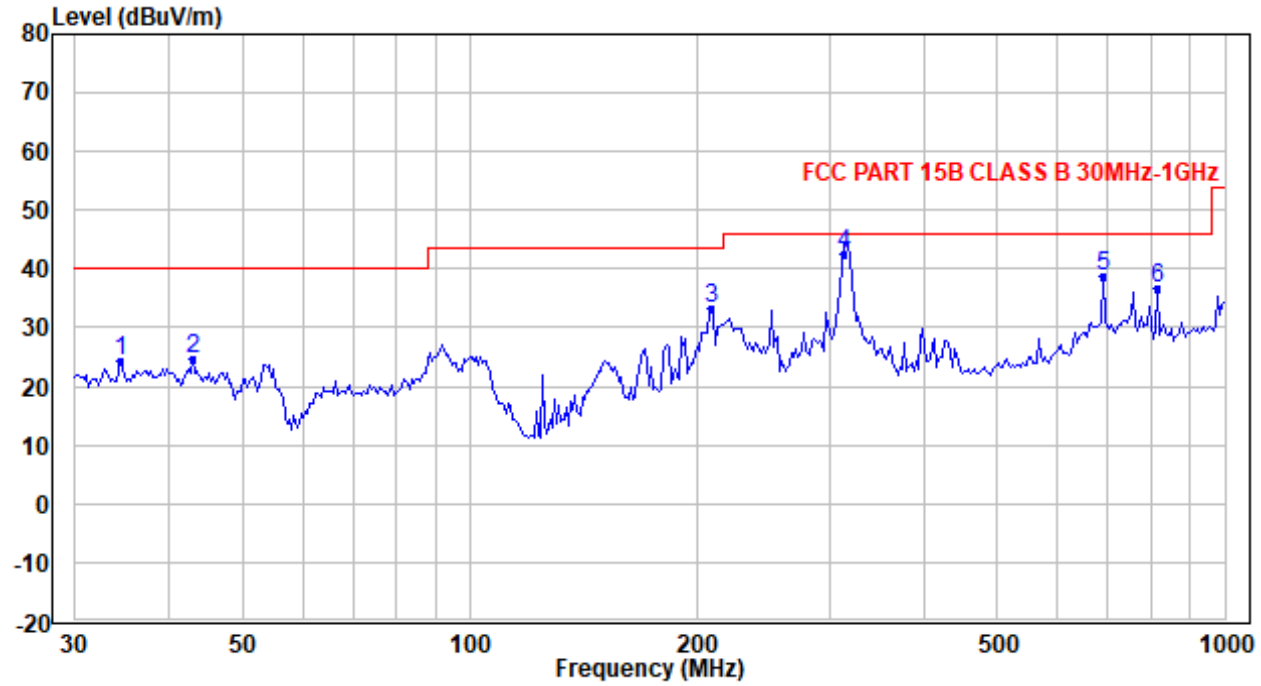
1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal 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

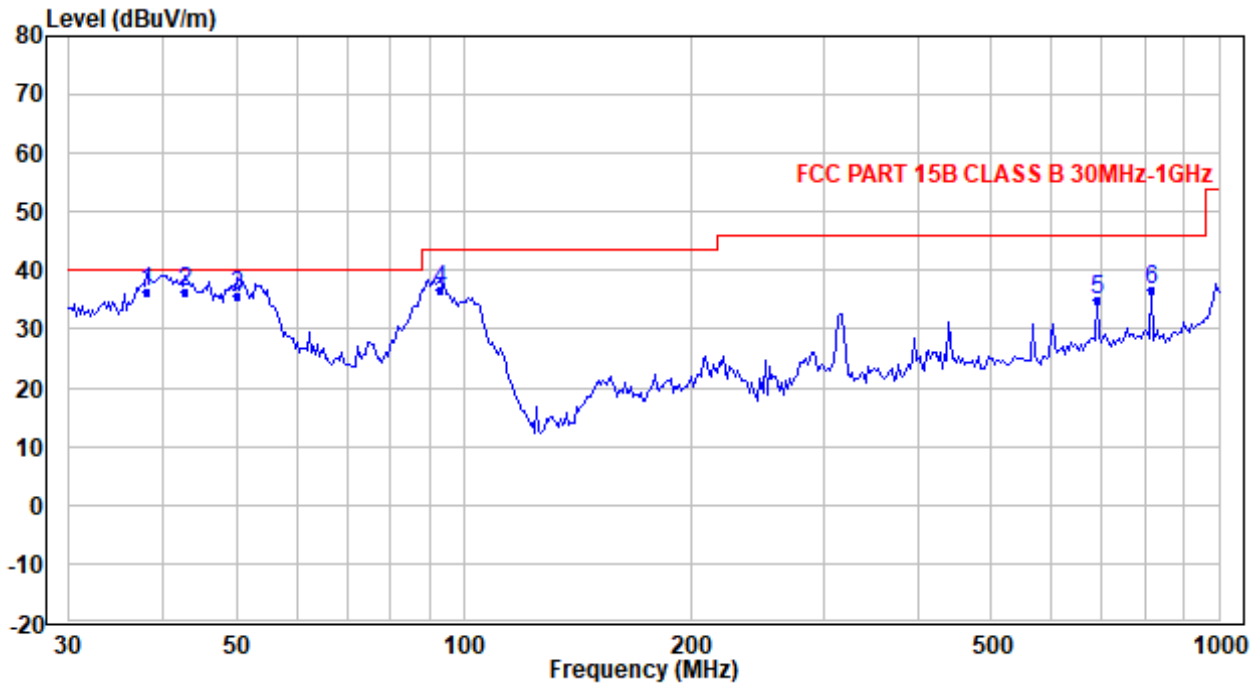
The measurement data as follows:

Below 1GHz(Quasi Peak):
Test Mode1
Horizontal



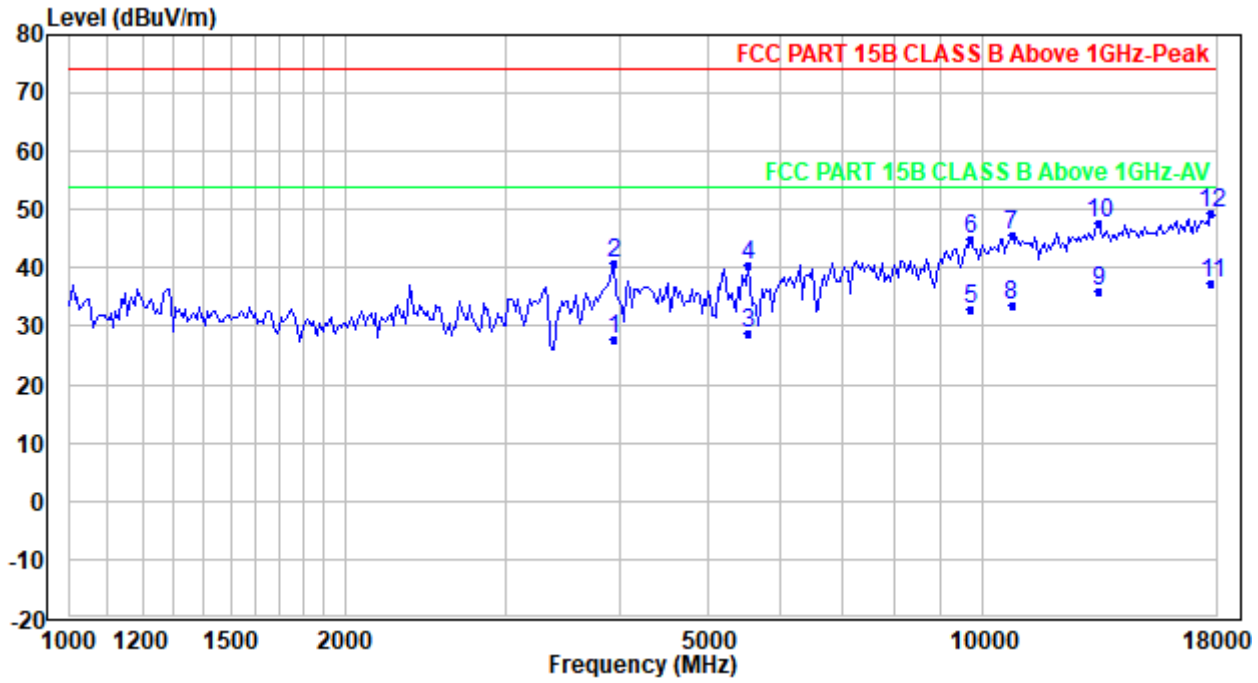
No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	34.527	29.71	-5.42	24.29	40.00	-15.71	QP
2	42.931	34.19	-9.35	24.84	40.00	-15.16	QP
3	208.658	43.96	-10.69	33.27	43.50	-10.23	QP
4	313.648	48.12	-5.71	42.41	46.00	-3.59	QP
5	689.051	36.84	2.00	38.84	46.00	-7.16	QP
6	815.635	33.72	3.14	36.86	46.00	-9.14	QP

Vertical



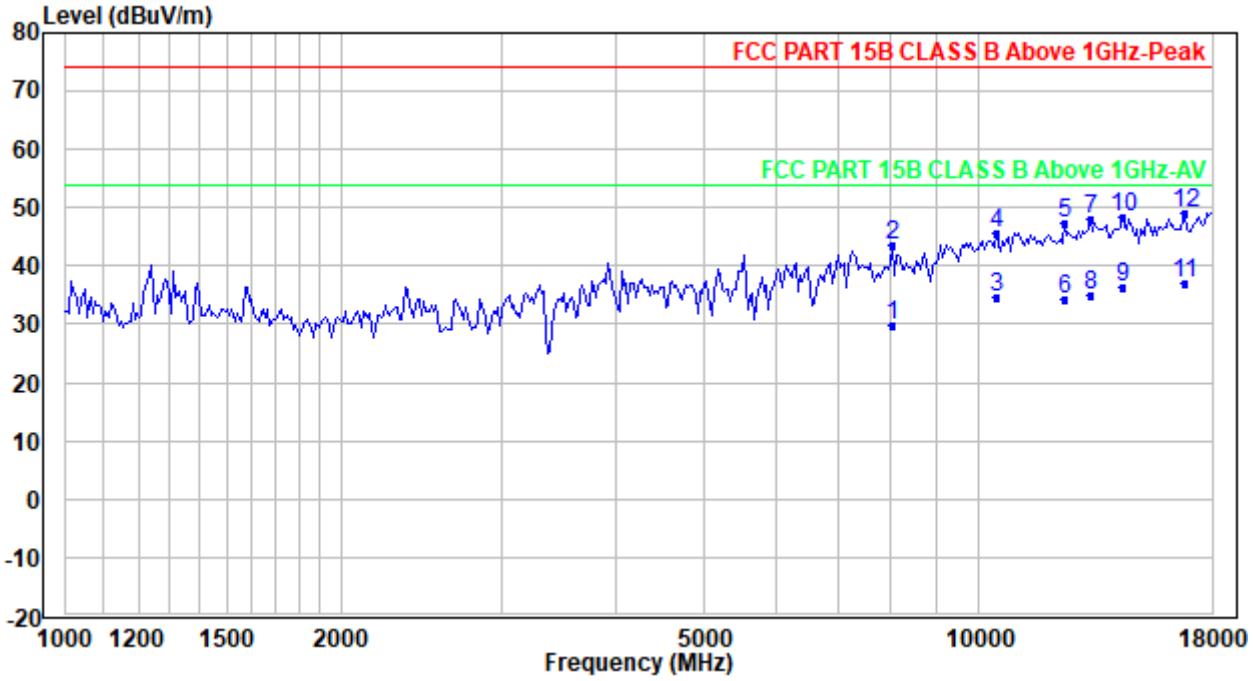
No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	38.096	42.85	-6.50	36.35	40.00	-3.65	QP
2	42.630	45.41	-9.16	36.25	40.00	-3.75	QP
3	50.108	50.53	-14.84	35.69	40.00	-4.31	QP
4	92.997	52.25	-15.69	36.56	43.50	-6.94	QP
5	689.051	33.10	2.00	35.10	46.00	-10.90	QP
6	815.635	33.55	3.14	36.69	46.00	-9.31	QP

Above 1GHz(Peak & Average)
Test Mode1:
Horizontal



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	3946.313	30.34	-2.44	27.90	54.00	-26.10	Average
2	3946.313	43.34	-2.44	40.90	74.00	-33.10	Peak
3	5521.982	28.24	0.41	28.65	54.00	-25.35	Average
4	5521.982	40.24	0.41	40.65	74.00	-33.35	Peak
5	9685.139	26.80	6.29	33.09	54.00	-20.91	Average
6	9685.139	38.80	6.29	45.09	74.00	-28.91	Peak
7	10749.450	37.97	7.73	45.70	74.00	-28.30	Average
8	10749.450	25.97	7.73	33.70	54.00	-20.30	Peak
9	13396.090	23.47	12.38	35.85	54.00	-18.15	Average
10	13396.090	35.47	12.38	47.85	74.00	-26.15	Peak
11	17792.680	21.95	15.57	37.52	54.00	-16.48	Average
12	17792.680	33.95	15.57	49.52	74.00	-24.48	Peak

Vertical



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	8046.507	26.22	3.49	29.71	54.00	-24.29	Average
2	8046.507	40.22	3.49	43.71	74.00	-30.29	Peak
3	10442.590	27.56	7.23	34.79	54.00	-19.21	Average
4	10442.590	38.56	7.23	45.79	74.00	-28.21	Peak
5	12424.410	38.23	9.12	47.35	74.00	-26.65	Peak
6	12424.410	25.23	9.12	34.35	54.00	-19.65	Average
7	13241.800	36.03	11.90	47.93	74.00	-26.07	Peak
8	13241.800	23.03	11.90	34.93	54.00	-19.07	Average
9	14360.350	23.65	12.83	36.48	54.00	-17.52	Average
10	14360.350	35.65	12.83	48.48	74.00	-25.52	Peak
11	16791.350	24.18	12.89	37.07	54.00	-16.93	Average
12	16791.350	36.18	12.89	49.07	74.00	-24.93	Peak

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. For Radiated Emission above 18GHz, there was not any unwanted emission detected.

6.2 CONDUCTED EMISSION

Test Requirement: FCC 47 CFR Part 15.107

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:

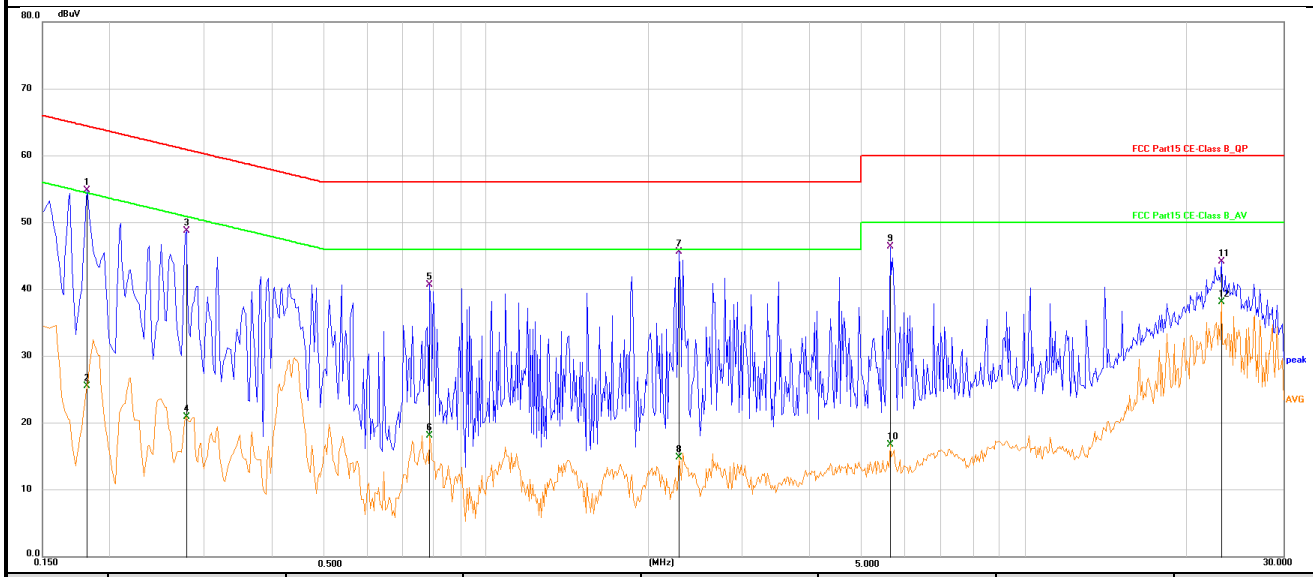
1) The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
2) The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak 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

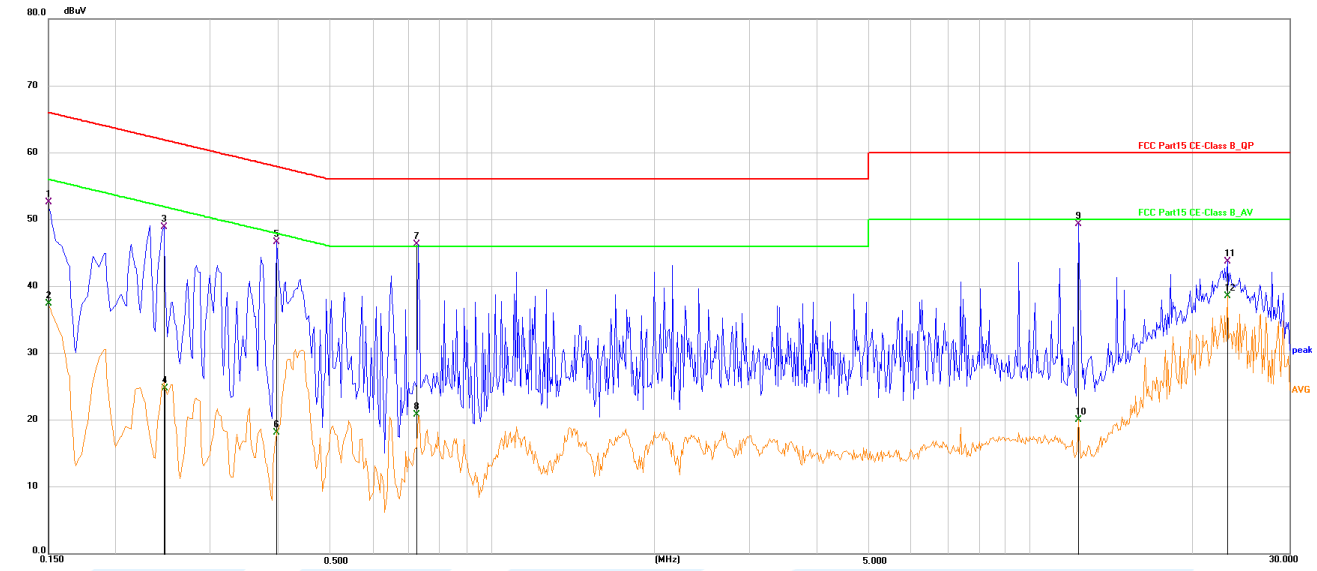
The measurement data as follows:
Quasi Peak and Average:
Test Mode1:

Live Line



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)	Detector
1	0.1814	44.82	10.02	54.84	64.42	-9.58	QP
2	0.1814	15.45	10.02	25.47	54.42	-28.95	Average
3	0.2760	38.76	10.01	48.77	60.94	-12.17	QP
4	0.2760	10.93	10.01	20.94	50.94	-30.00	Average
5	0.7844	30.69	10.03	40.72	56.00	-15.28	QP
6	0.7844	8.10	10.03	18.13	46.00	-27.87	Average
7	2.2785	35.56	10.08	45.64	56.00	-10.36	QP
8	2.2785	4.78	10.08	14.86	46.00	-31.14	Average
9	5.6130	36.11	10.23	46.34	60.00	-13.66	QP
10	5.6130	6.50	10.23	16.73	50.00	-33.27	Average
11	23.1270	32.89	11.26	44.15	60.00	-15.85	QP
12	23.1270	26.84	11.26	38.10	50.00	-11.90	Average

Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1500	42.60	10.02	52.62	66.00	-13.38	QP
2	0.1500	27.40	10.02	37.42	56.00	-18.58	Average
3	0.2445	38.85	10.00	48.85	61.94	-13.09	QP
4	0.2468	14.72	10.00	24.72	51.86	-27.14	Average
5	0.3975	36.65	10.01	46.66	57.91	-11.25	QP
6	0.3975	8.07	10.01	18.08	47.91	-29.83	Average
7	0.7304	36.21	10.02	46.23	56.00	-9.77	QP
8	0.7304	10.74	10.02	20.76	46.00	-25.24	Average
9	12.1965	38.83	10.51	49.34	60.00	-10.66	QP
10	12.1965	9.52	10.51	20.03	50.00	-29.97	Average
11	23.1270	32.48	11.18	43.66	60.00	-16.34	QP
12	23.1270	27.41	11.18	38.59	50.00	-11.41	Average

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.

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 **********

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.