

FCC TEST REPORT

Product Name: Handheld Smart Terminal

Trade Mark:



or RHINO

Model No.: T5se

Add. Model No.: N/A

Report Number: 220412017EMC-1

Test Standards: FCC 47 CFR Part 15 Subpart B

FCC ID: 2AUOUT5SE

Test Result: PASS

Date of Issue: July 27, 2022

Prepared for:

Rhino Mobility LLC

8 The Green, Suite A, Dover, Delaware, 19901, USA

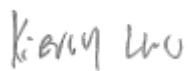
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July 27, 2022

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Version

Version No.	Date	Description
V1.0	July 27, 2022	Original



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UTTR-EMC-FCCPART15B-V1.1

CONTENTS

1. GENERAL INFORMATION	4
1.1 CLIENT INFORMATION	4
1.2 EUT INFORMATION	4
1.2.1 GENERAL DESCRIPTION OF EUT	4
1.2.2 DESCRIPTION OF ACCESSORIES.....	5
1.3 DESCRIPTION OF SUPPORT UNITS	6
1.4 TEST LOCATION.....	6
1.5 TEST FACILITY.....	6
1.6 DEVIATION FROM STANDARDS.....	6
1.7 ABNORMALITIES FROM STANDARD CONDITIONS.....	6
1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER	7
1.9 MEASUREMENT UNCERTAINTY	7
2. TEST SUMMARY	8
3. EQUIPMENT LIST	9
4. TEST CONFIGURATION	10
4.1 ENVIRONMENTAL CONDITIONS FOR TESTING.....	10
4.1.1 NORMAL OR EXTREME TEST CONDITIONS	10
4.1.2 RECORD OF NORMAL ENVIRONMENT.....	10
4.2 TEST MODES.....	10
4.3 TEST SETUP	11
4.3.1 FOR RADIATED EMISSIONS TEST SETUP	11
4.3.2 FOR CONDUCTED EMISSIONS TEST SETUP	12
4.4 SYSTEM TEST CONFIGURATION.....	12
5. REFERENCE DOCUMENTS FOR TESTING.....	13
6. EMC REQUIREMENTS SPECIFICATION	13
6.1 RADIATED EMISSION.....	13
6.2 CONDUCTED EMISSION	18
APPENDIX 1 PHOTOS OF TEST SETUP	21
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS.....	21

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Rhino Mobility LLC
Address of Applicant:	8 The Green, Suite A, Dover, Delaware,19901, USA
Manufacturer:	Rhino Mobility LLC
Address of Manufacturer:	8 The Green, Suite A, Dover, Delaware,19901, USA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Handheld Smart Terminal
Model No.:	T5se
Add. Model No.:	N/A
Trade Mark:	 or RHINO
DUT Stage:	Identical Prototype
Rated Voltage:	☒ Powered by USB port (5Vdc) ☒ 100-240V~50/60Hz, 0.5A and/or 3.85Vdc (1x3.85V Li-ion Rechargeable battery)
Classification of digital devices:	Class B
Highest Internal Frequency:	5.825 GHz
Software Version:	T5se(001)_20220624 (Provided by the customer)
Hardware Version:	AL_Z06_MB_V12 (Provided by the customer)
Sample Received Date:	April 13, 2022
Sample Tested Date:	May 6, 2022 to June 2, 2022
Note: The T5se have two LCD modules from different vendors. This report has evaluated and pre-testing of two batches of LCD modules, with only the worst data recorded in the report.	

1.2.2 Description of Accessories

Adapter	
Model No.:	XY-PP018U1
Input:	100-240 V~50/60 Hz 0.5A
Output:	3.6-6.0 V $\Rightarrow$ 3.0A, 6.0-9.0 V $\Rightarrow$ 2.0A, 9.0-12.0 V $\Rightarrow$ 1.5A
AC Cable:	N/A
DC Cable:	N/A

Internal Battery	
Model No.:	BPT5se
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.85 Vdc
Limited Charge Voltage:	4.4 Vdc
Rated Capacity:	3000 mAh

External Battery Pack	
Model No.:	T5SE-EBAT-3K-BLK
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.85 Vdc
Limited Charge Voltage:	4.4 Vdc
Rated Capacity:	3030 mAh

Cable	
Description:	USB Type-C Plug Cable
Cable Type:	Shielded without ferrite
Length:	1 Meter

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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	Lenovo	TP00067A	N/A	UnionTrust
Mouse	DELL	MS111	N/A	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
--	--	--	--	--

1.4 TEST LOCATION

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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.

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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 Chamber & Accessory Equipment	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☒	Receiver	R&S	ESIB26	100114	5-Nov-2021	4-Nov-2022
☐	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	15-Apr-2022	14-Apr-2023
☐	Loop Antenna	ETS-LINDGREN	6502	00202525	11-Nov-2021	10-Nov-2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	11-Nov-2021	10-Nov-2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	11-Nov-2021	10-Nov-2023
☒	Preamplifier	HP	8447F	2805A02960	5-Nov-2021	4-Nov-2022
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	17-Apr-2022	16-Apr-2024
☒	Pre-amplifier	ETS-LINDGREN	00118385	00201874	6-Nov-2021	5-Nov-2022
☐	Horn Antenna	ETS-LINDGREN	3116C	00200180	17-Apr-2022	16-Apr-2024
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	14-Nov-2020	13-Nov-2022
☒	Pre-amplifier	ETS-LINDGREN	00118384	00202652	17-Nov-2020	16-Nov-2022
☒	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	5-Nov-2021	4-Nov-2022
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	5-Nov-2021	4-Nov-2022
☒	LISN	R&S	ESH2-Z5	860014/024	5-Nov-2021	4-Nov-2022
☐	LISN	ETS-Lindgren	3816/2SH	00201088	5-Nov-2021	4-Nov-2022
☒	Test Software	Audix	e3	Software Version: 9 20151119i		

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	Relative Humidity (%)
NT/NV	+15 to +35	1. 120V~60Hz and/or Battery 2. 240V~50Hz and/or Battery	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment

Test Item	Temp. (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
Conducted Emission	24.5	49	101.1	220412020-A06/17	David Zhang
	24.8	48	101.1	220526002-B03/5	David Zhang
Radiated Emission	21.5	52	100.3	220412020-A06/17	Asia Yan
	23.2	51	100.0	220526002-B03/5	Asia Yan

4.2 TEST MODES

Test Item	EMI Test Modes
Radiated Emission	Test Mode 1: Charging from 120 Vac (with adapter 1) + Battery 1 + MP4 playing + LTE B17 idle + GPS
	Test Mode 2: Charging from 120 Vac (with adapter 1) + Battery 1 + Camera (Front) + WCDMA Band V idle
	Test Mode 3: Charging from 120 Vac (with adapter 1) + Battery 1 + Camera (Back) + LTE B5 idle
	Test Mode 4: Charging from 120 Vac (with adapter 1) + Battery 1 + Scan + LTE B12 idle
	Test Mode 5: Charging from 240 Vac (with adapter 1) + Battery 1(<50%) + Battery 2+ Worse from mode 1~4 + LTE B13 idle
	Test Mode 6: Battery 1(> 90%) + Battery 2 + Worse from mode 1~5 + LTE B14 idle
	Test Mode 7: Battery 1 + LTE B71 idle + USB Cable (data transfer with notebook)
	Test Mode 8: Worse from mode 1~7 + LCD module 2
Conducted Emission	Test Mode 1: Charging from 120 Vac (with adapter 1) + Battery 1 + MP4 playing + LTE B17 idle + GPS
	Test Mode 2: Charging from 120 Vac (with adapter 1) + Battery 1 + Camera (Front) + WCDMA Band V idle
	Test Mode 3: Charging from 120 Vac (with adapter 1) + Battery 1 + Camera (Back) + LTE B5 idle
	Test Mode 4: Charging from 120 Vac (with adapter 1) + Battery 1 + Scan + LTE B12 idle
	Test Mode 5: Charging from 240 Vac (with adapter 1) + Battery 1(<50%) + Battery 2 + LTE B13 idle + Worse from mode 1~4
	Test Mode 6: Battery 1(> 90%) + Battery 2 + LTE B14 idle + Worse from mode 1~5
	Test Mode 7: Battery 1 + LTE B71 idle + USB Cable (data transfer with notebook)
	Test Mode 8: Worse from mode 1~7 + LCD module 2

4.3 TEST SETUP

4.3.1 For Radiated Emissions test setup

Figure 1. 30MHz to 1GHz

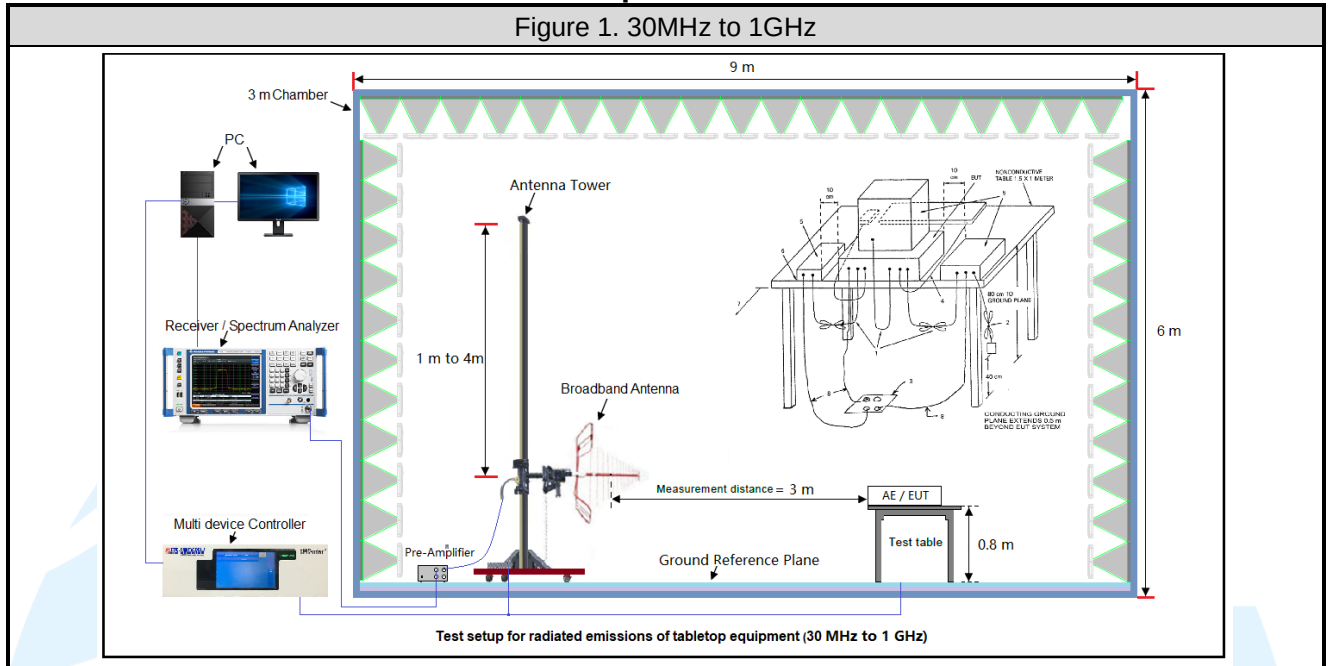
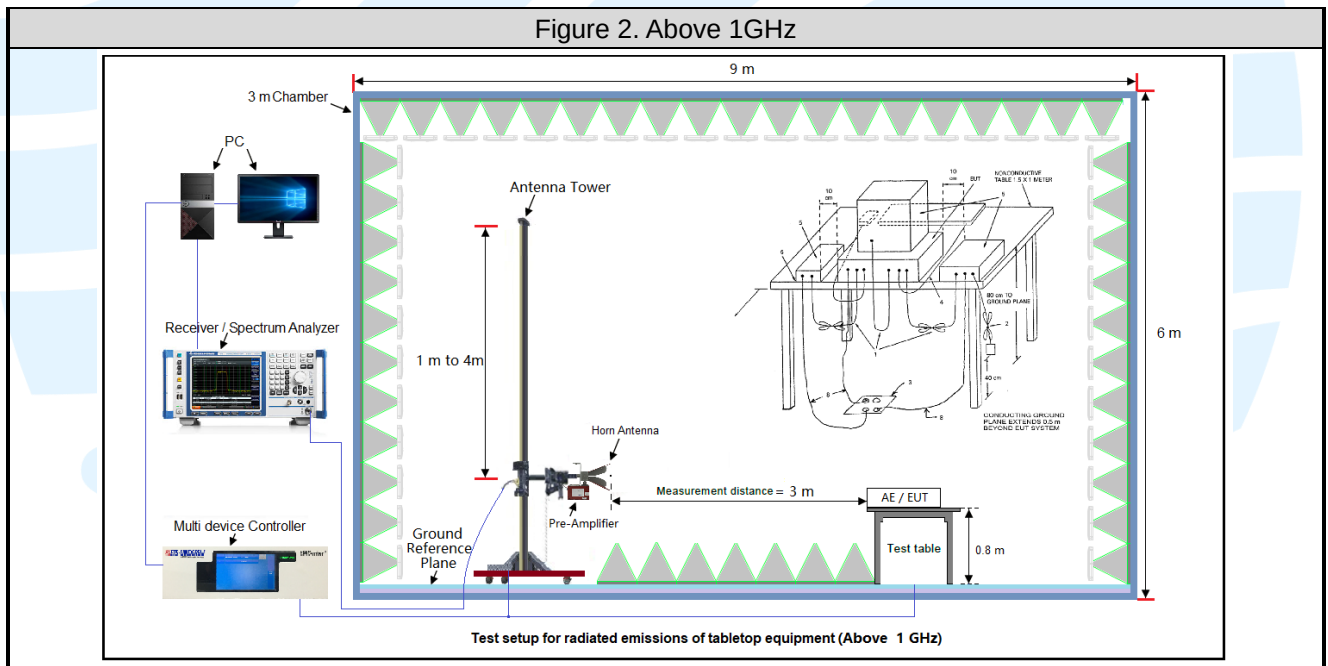
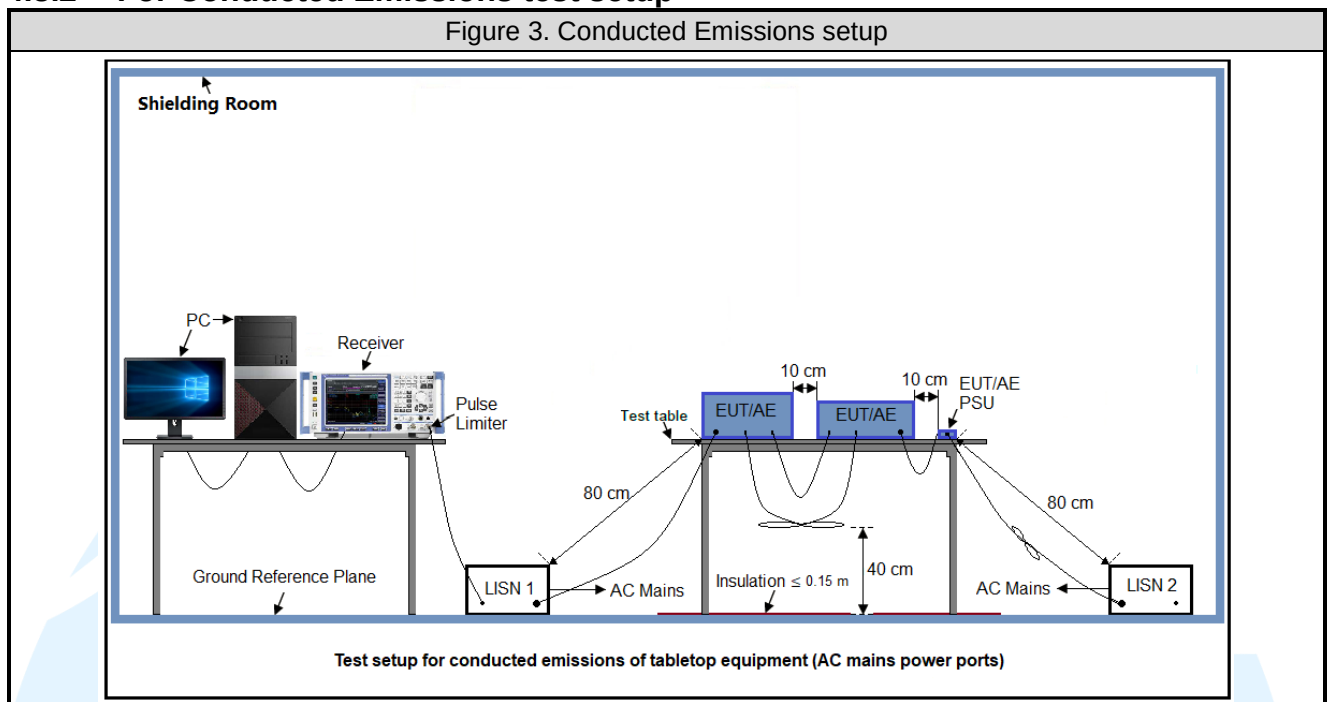


Figure 2. Above 1GHz



4.3.2 For Conducted Emissions test setup



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
$30 \leq f \leq 1\,000$	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

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

Remark:

- The lower limit shall apply at the transition frequencies.
- Emission level (dB μ V/m) = 20 log Emission level (μ V/m).
- 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:

- From 30 MHz to 1GHz test procedure as below:

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- 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.

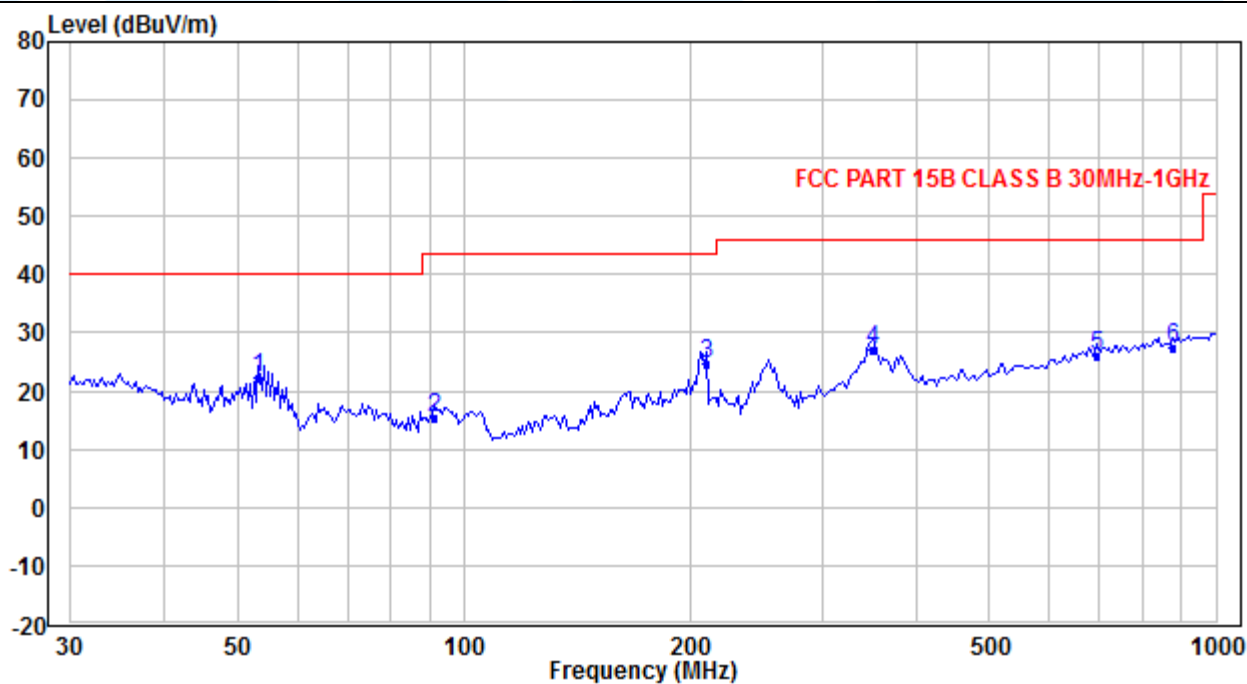
Test Result: Pass

The worst measurement data as follows:

Below 1GHz (Quasi Peak):

Test Mode 4

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	53.379	38.94	-16.54	22.40	40.00	-17.60	QP
2	91.057	31.63	-16.09	15.54	43.50	-27.96	QP
3	210.129	35.77	-10.95	24.82	43.50	-18.68	QP
4	348.514	32.12	-5.19	26.93	46.00	-19.07	QP
5	693.910	24.66	1.36	26.02	46.00	-19.98	QP
6	875.013	23.39	3.87	27.26	46.00	-18.74	QP

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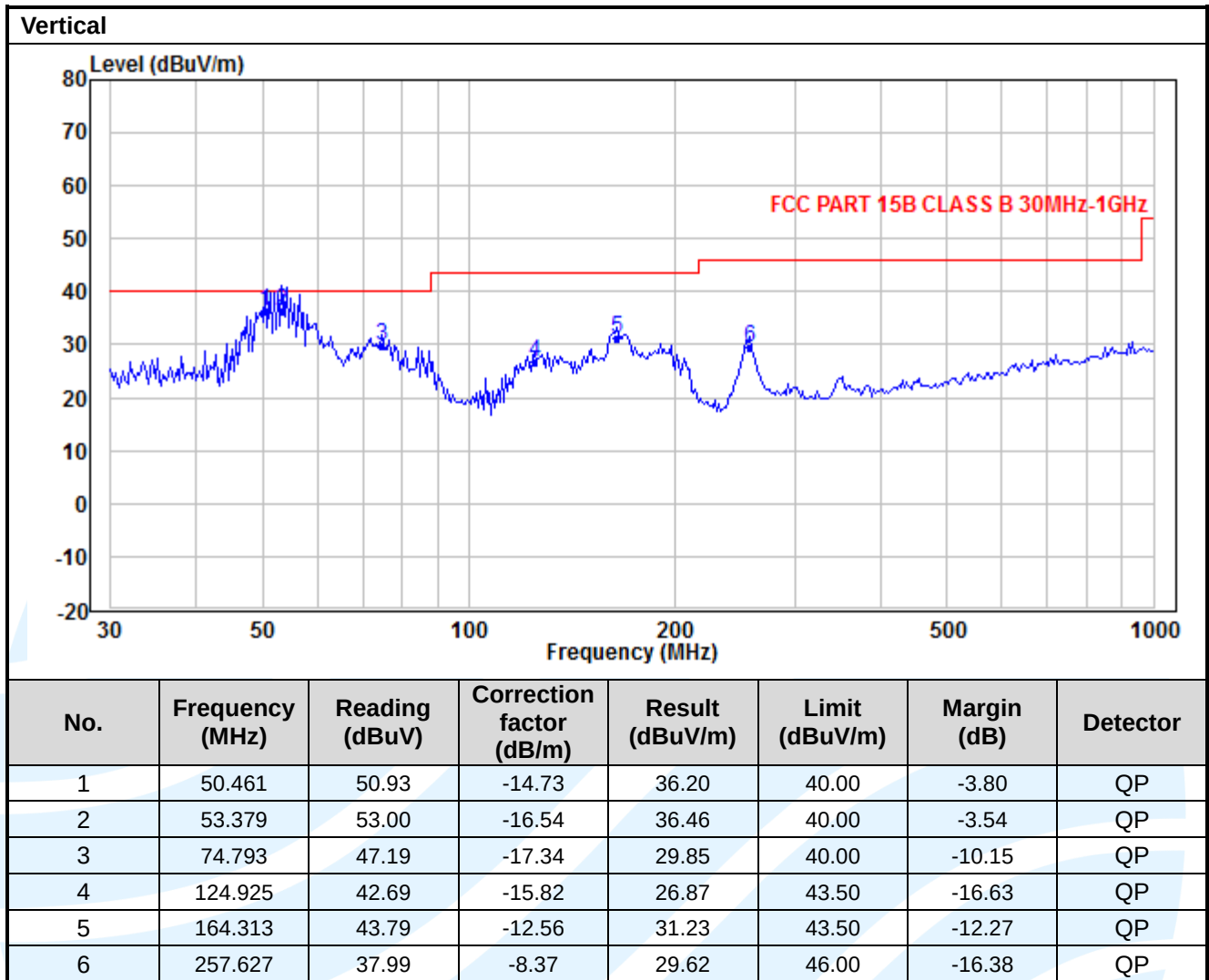
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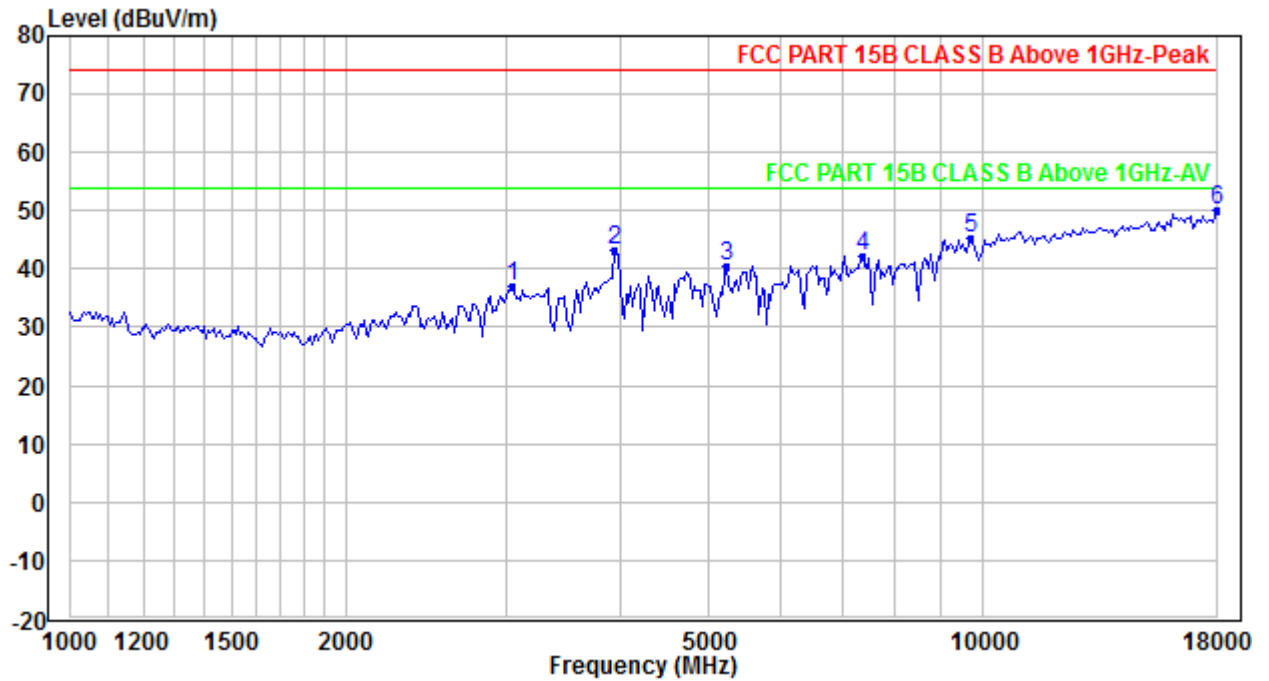
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Above 1GHz (Peak & Average)
Test Mode 1
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	3040.819	43.55	-6.56	36.99	74.00	-37.01	Peak
2	3946.313	46.57	-3.29	43.28	74.00	-30.72	Peak
3	5241.490	41.91	-1.27	40.64	74.00	-33.36	Peak
4	7376.898	40.64	1.70	42.34	74.00	-31.66	Peak
5	9685.139	39.86	5.57	45.43	74.00	-28.57	Peak
6	18000.000	35.29	14.71	50.00	74.00	-24.00	Peak

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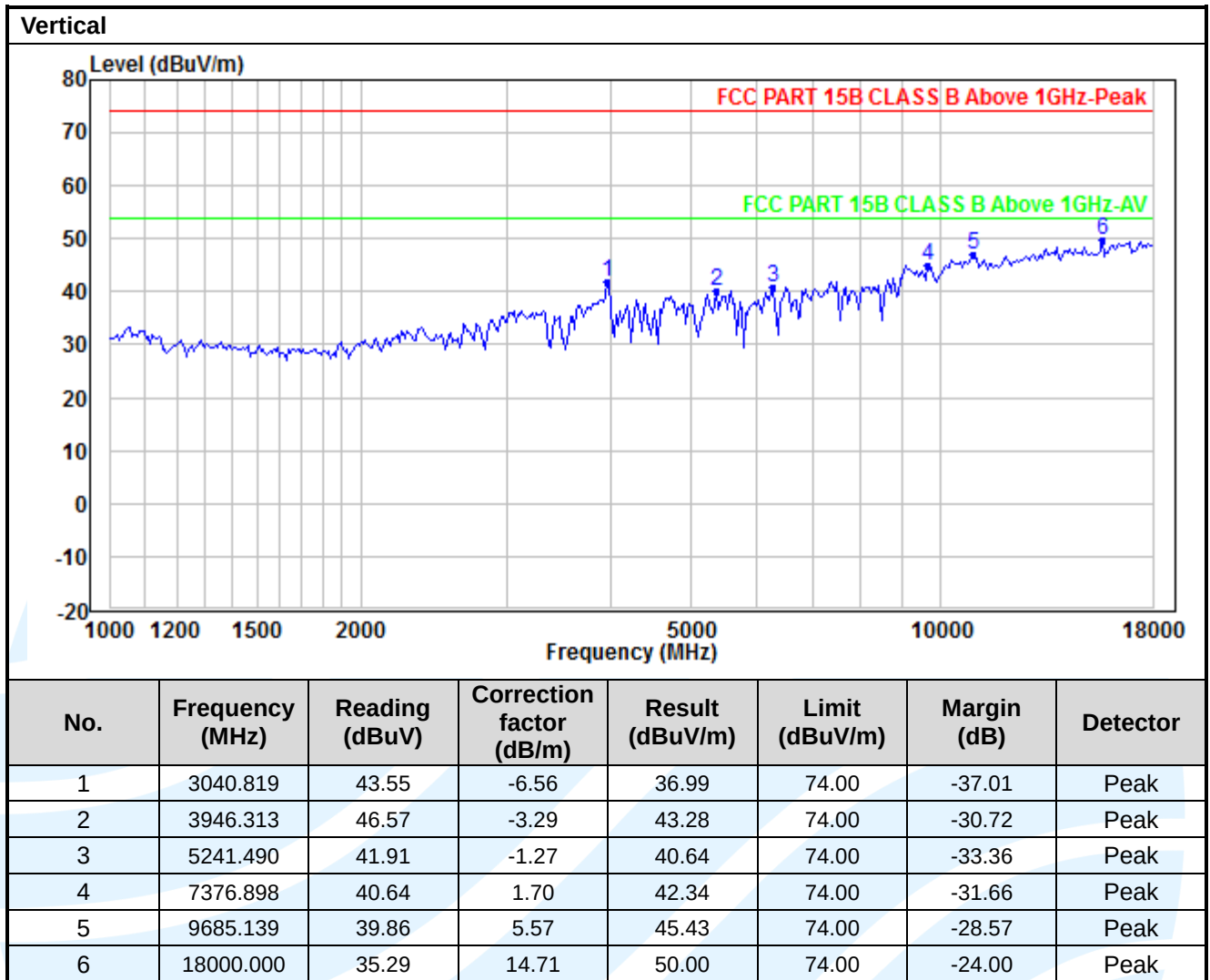
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Remark:

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. All possible modes of operation were investigated, and testing at two nominal voltages of 240V~50Hz and 120V~60Hz, only the worst case emissions reported.
5. For Radiated Emission above 18GHz, there was not any unwanted emission detected.
6. 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.

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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.

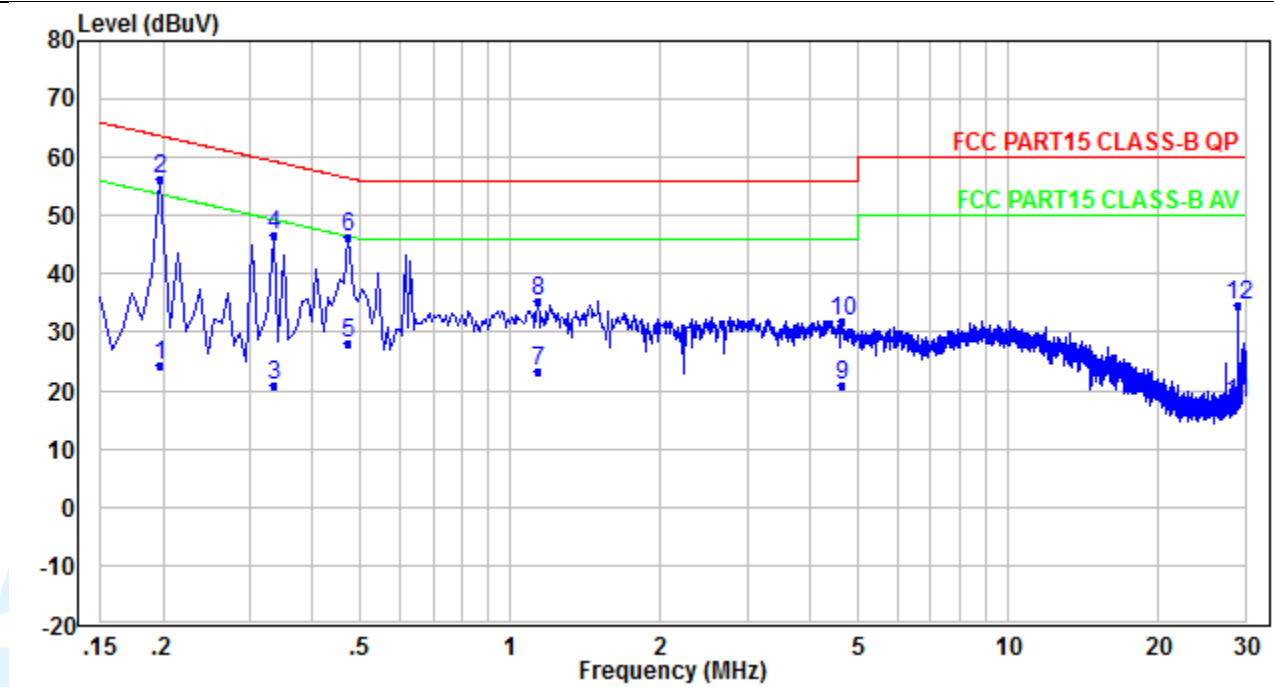
Test Result: Pass

The worst measurement data as follows:

Quasi Peak and Average:

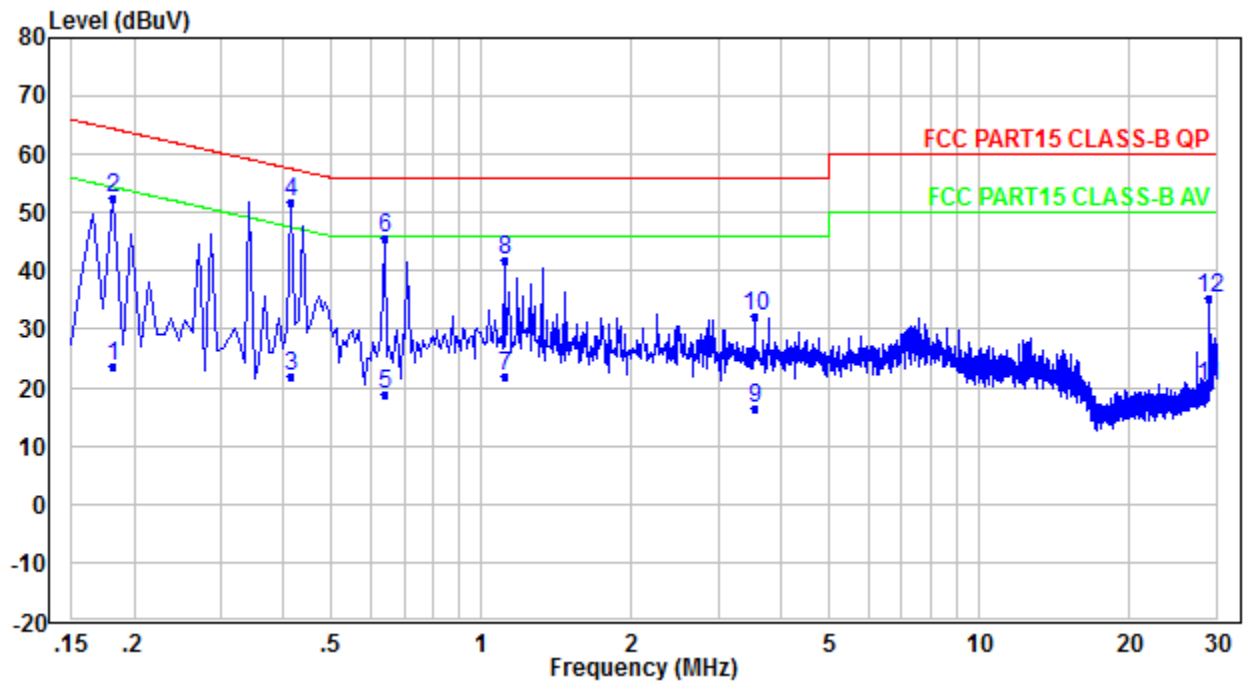
Test Mode 4

Live Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.198	14.05	10.12	24.17	53.69	-29.52	Average
2	0.198	46.05	10.12	56.17	63.69	-7.52	QP
3	0.334	10.64	10.13	20.77	49.35	-28.58	Average
4	0.334	36.64	10.13	46.77	59.35	-12.58	QP
5	0.470	18.12	10.15	28.27	46.52	-18.25	Average
6	0.470	36.12	10.15	46.27	56.52	-10.25	QP
7	1.134	12.99	10.22	23.21	46.00	-22.79	Average
8	1.134	24.99	10.22	35.21	56.00	-20.79	QP
9	4.645	10.71	10.31	21.02	46.00	-24.98	Average
10	4.645	21.71	10.31	32.02	56.00	-23.98	QP
11	29.040	6.70	10.94	17.64	50.00	-32.36	Average
12	29.040	23.70	10.94	34.64	60.00	-25.36	QP

Neutral Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.182	13.56	10.11	23.67	54.39	-30.72	Average
2	0.182	42.56	10.11	52.67	64.39	-11.72	QP
3	0.414	11.67	10.12	21.79	47.57	-25.78	Average
4	0.414	41.67	10.12	51.79	57.57	-5.78	QP
5	0.638	8.53	10.14	18.67	46.00	-27.33	Average
6	0.638	35.53	10.14	45.67	56.00	-10.33	QP
7	1.110	11.87	10.15	22.02	46.00	-23.98	Average
8	1.110	31.87	10.15	42.02	56.00	-13.98	QP
9	3.541	5.97	10.30	16.27	46.00	-29.73	Average
10	3.541	21.97	10.30	32.27	56.00	-23.73	QP
11	29.040	9.36	10.91	20.27	50.00	-29.73	Average
12	29.040	24.36	10.91	35.27	60.00	-24.73	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.
5. All possible modes of operation were investigated, and testing at two nominal voltages of 240V~50Hz and 120V~60Hz, only the worst case emissions reported.

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UTTR-EMC-FCCPART15B-V1.1

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.
