



CTC Laboratories, Inc.

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TEST REPORT

Report No.: **CTC20192113E06**

FCC ID.....: **XRH-NPE107**

Applicant.....: **North Pole Engineering**

Address.....: 221 North First Street, Suite 310 Minneapolis, MN 55401, United States

Manufacturer.....: North Pole Engineering

Address.....: 221 North First Street, Suite 310 Minneapolis, MN 55401, United States

Product Name.....: **AWE Charger**

Trade Mark.....: N/A

Model/Type reference.....: AWEC01

Listed Model(s): OTbeat Link Charging Case

Standard.....: **47 CFR FCC Part 18**

Date of receipt of test sample...: Oct. 24, 2019

Date of testing.....: Oct. 25, 2019 to Nov. 12, 2019

Date of issue.....: Nov. 13, 2019

Result.....: **PASS**

Compiled by:
(Printed name+signature) Terry Su

Supervised by:
(Printed name+signature) Miller Ma

Approved by:
(Printed name+signature) Walter Chen

Testing Laboratory Name.....: **CTC Laboratories, Inc.**

Address.....: 2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China

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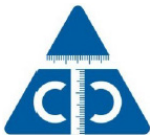


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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

[47 CFR FCC Part 18](#): Industrial, Scientific, and Medical Equipment Unintentional Radiators.

[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 40GHz.

1.2. Report version

Revised No.	Date of issue	Description
01	Nov. 13, 2019	Original



1.3. Test Description

FCC CFR Title 47 FCC Part 18			
Test Item	Standard Section	Result	Test Engineer
Conducted Emissions Test	18.307(b)	Pass	Terry Su
Radiated Emission Test	18.305(b),(c)	Pass	Terry Su

Note: "N/A" is no application.
The measurement uncertainty is not included in the test result.



1.4. Test Facility

Address of the report laboratory

CTC Laboratories, Inc.

Add: 2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China

Laboratory accreditation

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

CNAS-Lab Code: L5365

CTC Laboratories, Inc. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation. Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 951311, Aug 26, 2017.

1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.



Test Items	Measurement Uncertainty	Notes
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)

Note: (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=1.96$.

1.6. Environmental conditions

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

Normal Temperature:	25°C
Relative Humidity	55 %
Air Pressure	101kPa



2. GENERAL INFORMATION

2.1. Client Information

Applicant:	North Pole Engineering
Address:	221 North First Street, Suite 310 Minneapolis, MN 55401, United States
Manufacturer:	North Pole Engineering
Address:	221 North First Street, Suite 310 Minneapolis, MN 55401, United States

2.2. General Description of EUT

Product Name:	AWE Charger
Marketing Name:	N/A
Model/Type reference:	AWEC01
Listed Model(s):	OTbeat Link Charging Case
Model Difference:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is model name.
Power supply:	5Vdc from External adapter 3.7Vdc from 230mAh Li-ion Battery
Hardware version:	N/A
Software version:	N/A
Wireless Charger	
Operation Frequency Range:	760kHz~840kHz
Operation Frequency:	800kHz



2.3. Accessory Equipment information

Equipment Information			
Name	Model	S/N	Manufacturer
AWE	AWE01	---	North Pole Engineering
AC/DC Adapter	PSA05F-050QAL6	PJ23006448A1	PHIHONG
Cable Information			
Name	Shielded Type	Ferrite Core	Length
USB Cable	YES	NO	2M

2.4. Description of Test Modes

Test mode	Charging	Wireless charging to AEW
1	■	
2		■

Note: ■ is operation mode.

Pre-scan above all test mode, found below test mode which it was worse case mode, so only show the test data for worse case mode on the test report.

Test item	Test mode
Conducted emission	1
Radiated emission	2



2.5. Measurement Instruments List

Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	R&S	ENV216	101112	Dec. 28, 2019
2	LISN	R&S	ENV216	101113	Dec. 28, 2019
3	EMI Test Receiver	R&S	ESCI	100920	Dec. 28, 2019
4	UNIVERSAL RADIO COMMUNICATION	Rohde & Schwarz	CMU200	114694	Dec. 28, 2019

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	EMI Test Receiver	Rohde & Schwarz	ESCI	100658	Dec. 28, 2019
2	High pass filter	micro-tranics	HPM50111	142	Dec. 28, 2019
3	Log-Bicon Antenna	Schwarzbeck	CBL6141A	4180	Dec. 28, 2019
4	Ultra-Broadband Antenna	SchwarzBeck	BBHA9170	25841	Dec. 28, 2019
5	Loop Antenna	LAPLAC	RF300	9138	Dec. 28, 2019
6	Loop Antenna	ETS	6507	146	Dec. 28, 2019
7	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec. 28, 2019
8	Horn Antenna	Schwarzbeck	BBHA 9120D	647	Dec. 28, 2019
9	Pre-Amplifier	HP	8447D	1937A03050	Dec. 28, 2019
10	Pre-Amplifier	EMCI	EMC051835	980075	Dec. 28, 2019
11	Antenna Mast	UC	UC3000	N/A	N/A
12	Turn Table	UC	UC3000	N/A	N/A
13	Cable Below 1GHz	Schwarzbeck	AK9515E	33155	Dec. 28, 2019
14	Cable Above 1GHz	Hubersuhner	SUCOFLEX102	DA1580	Dec. 28, 2019
15	Splitter	Mini-Circuit	ZAPD-4	400059	Dec. 28, 2019
16	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	Dec. 28, 2019
17	RF Connection Cable	Chengdu E-Microwave	---	---	Dec. 28, 2019
18	High pass filter	Compliance Direction systems	BSU-6	34202	Dec. 28, 2019
19	Attenuator	Chengdu E-Microwave	EMCAXX-10RN Z-3	---	Dec. 28, 2019

Note: The Cal. Interval was one year.



3. EMC EMISSION TEST

3.1. Radiated Emission

LIMIT

FCC CFR Title 47 Part 18 Section 18.305(b):

Equipment	Operating frequency	RF Power generated by equipment (watts)	Field strength limit (uV/m)	Distance (meters)
Any type unless otherwise specified (miscellaneous)	Any ISM frequency	Below 500	25	300
		500 or more	$25 \times \text{SQRT}(\text{power}/500)$	1300
	Any non-ISM frequency	Below 500	15	300
		500 or more	$15 \times \text{SQRT}(\text{power}/500)$	1300
Industrial heaters and RF stabilized arc welders	On or below 5,725 MHz Above 5,725 MHz	Any Any	10 (²)	1,600 (²)
Medical diathermy	Any ISM frequency Any non-ISM frequency	Any Any	25 15	300 300
Ultrasonic	Below 490 kHz	Below 500	2,400/F(kHz)	300
		500 or more	$2,400/\text{F}(\text{kHz}) \times \text{SQRT}(\text{power}/500)$	3300
	490 to 1,600 kHz	Any	24,000/F(kHz)	30
	Above 1,600 kHz	Any	15	30
Induction cooking ranges	Below 90 kHz	Any	1,500	430
	On or above 90 kHz	Any	300	430

¹Field strength may not exceed 10 $\mu\text{V}/\text{m}$ at 1600 meters. Consumer equipment operating below 1000 MHz is not permitted the increase in field strength otherwise permitted here for power over 500 watts.

²Reduced to the greatest extent possible.

³Field strength may not exceed 10 $\mu\text{V}/\text{m}$ at 1600 meters. Consumer equipment is not permitted the increase in field strength otherwise permitted here for over 500 watts.

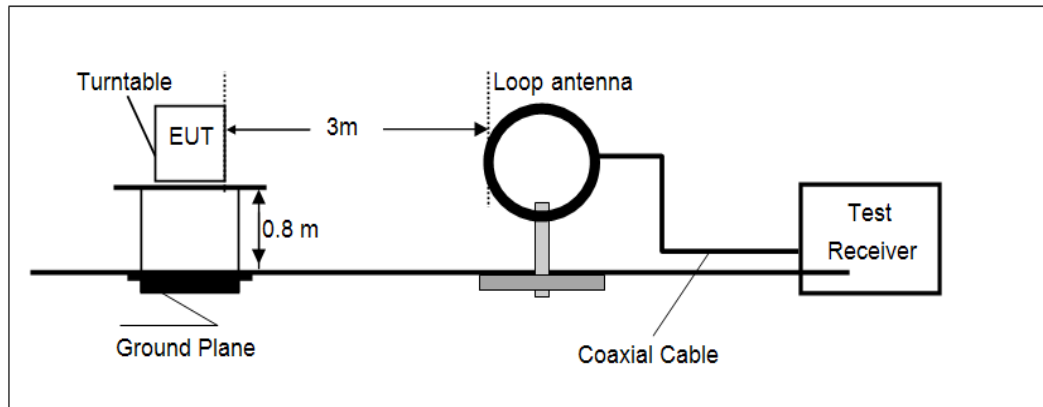
⁴Induction cooking ranges manufactured prior to February 1, 1980, shall be subject to the field strength limits for miscellaneous ISM equipment.

1. This product belongs to non-ISM equipment, the field strength limit is 15uV/m at 300 meter distance.

2. Limit: $20\log^{(15\text{uV/m})} + 40\log^{(300/3)} = 23.52 + 80 = 103.52\text{dBuV/m}$ at 3 meters distance

TEST CONFIGURATION

Radiated Emission Test Set-Up Frequency below 30MHz



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.4:2014.
2. The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna.
5. Use the following spectrum analyzer settings
Span shall wide enough to fully capture the emission being measured;
1) 9kHz – 150kHz, RBW=200Hz, Sweep=auto, Detector function=peak, Trace=max hold;
2) 150kHz – 30MHz, RBW=9kHz, Sweep=auto, Detector function=peak, Trace=max hold; If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

TEST MODE:

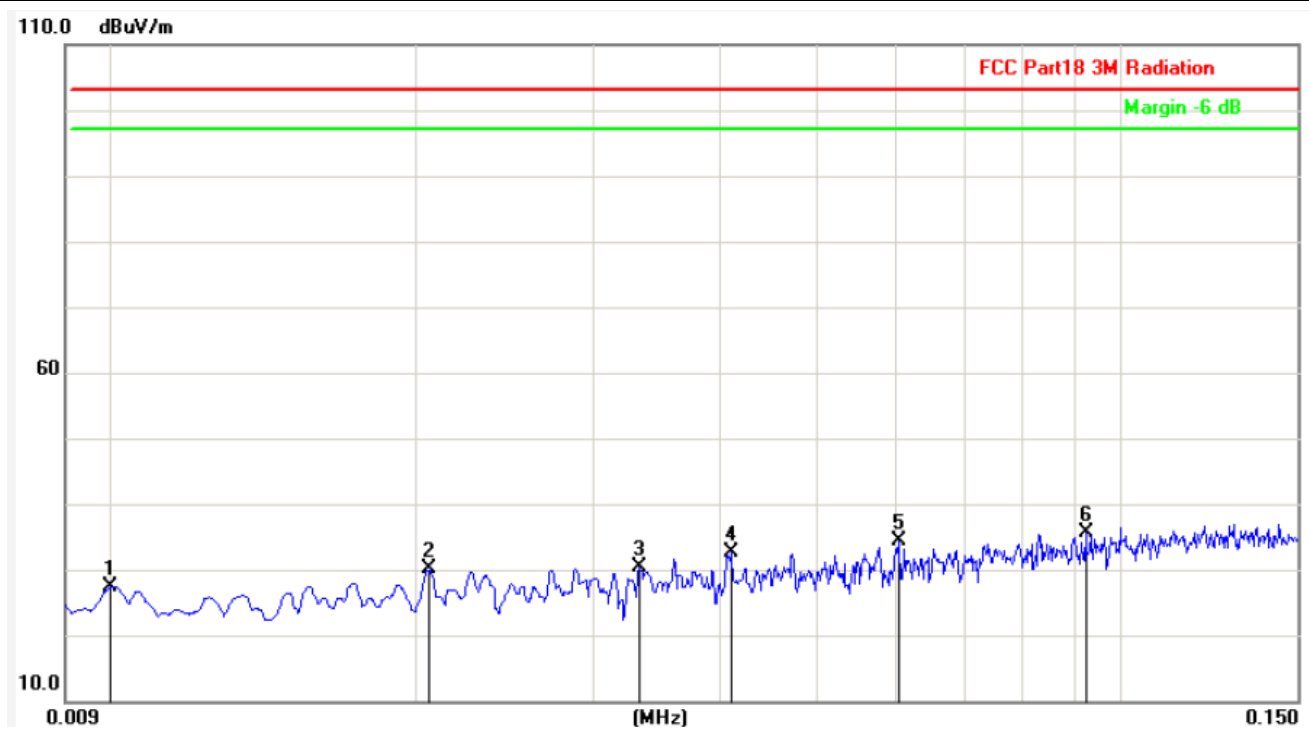
Please refer to the clause 2.4.

TEST RESULTS



9kHz – 150kHz

Test mode	2	Polarization	0°
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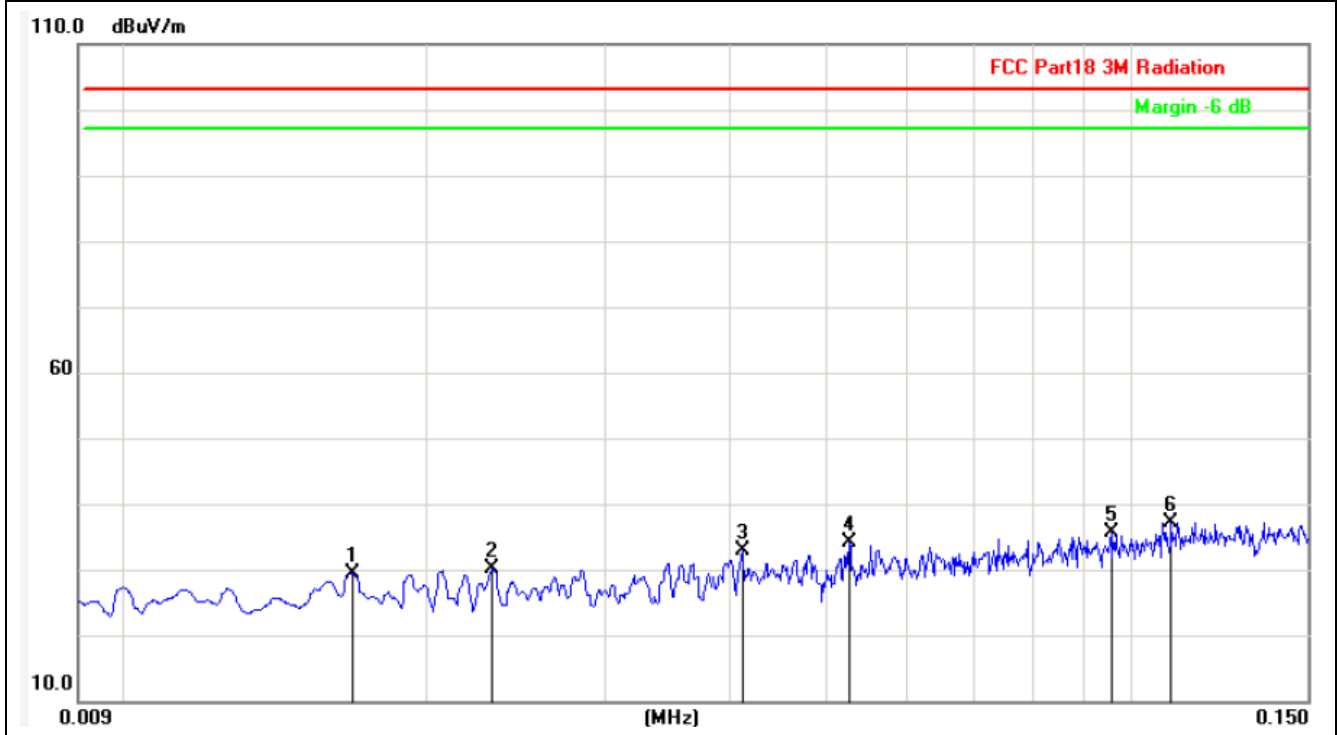


No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.0100	24.51	2.88	27.39	103.25	-75.86	QP
2	0.0206	21.83	8.18	30.01	103.25	-73.24	QP
3	0.0334	19.37	11.03	30.40	103.25	-72.85	QP
4	0.0411	19.06	13.49	32.55	103.25	-70.70	QP
5	0.0603	18.66	15.63	34.29	103.25	-68.96	QP
6	0.0925	16.44	19.19	35.63	103.25	-67.62	QP

Remark:
 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
 2. Margin value = Level -Limit value



Test mode	2	Polarization	90°
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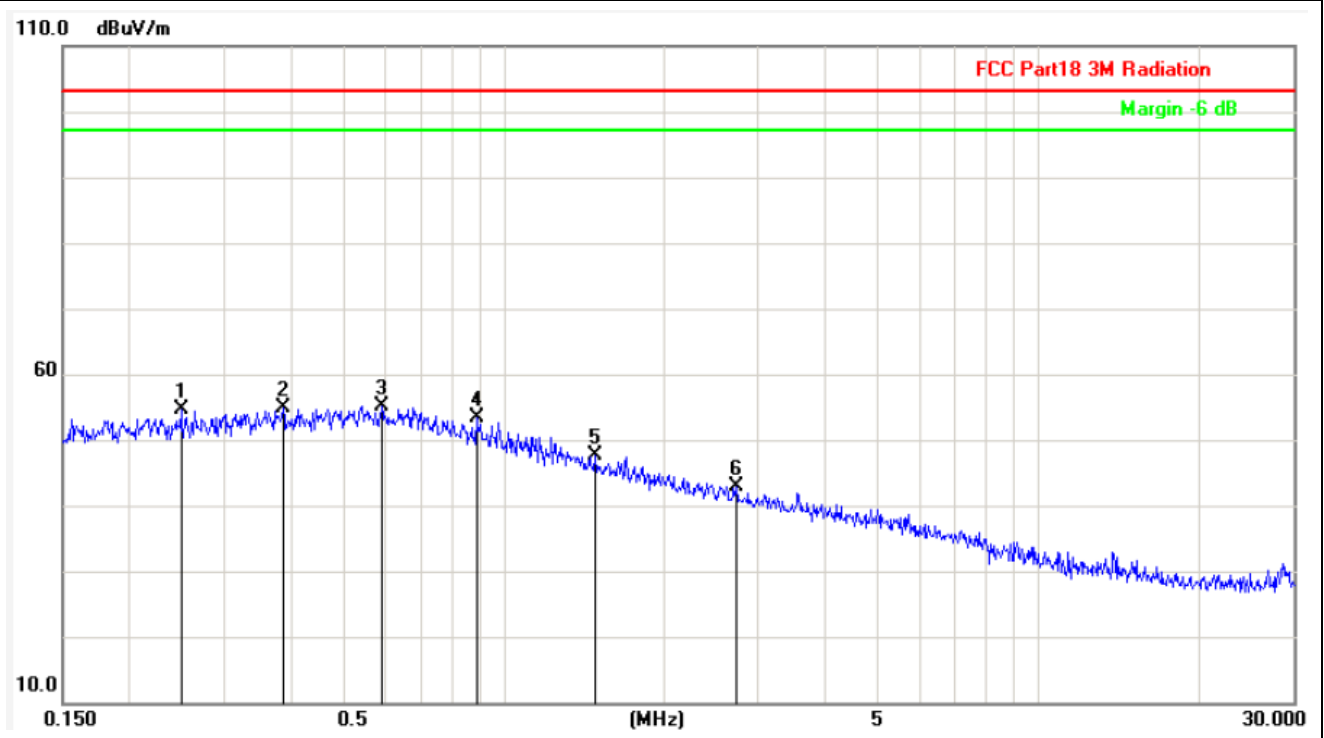
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.0169	22.77	6.70	29.47	103.25	-73.78	QP
2	0.0232	21.18	8.83	30.01	103.25	-73.24	QP
3	0.0411	19.06	13.86	32.92	103.25	-70.33	QP
4	0.0526	18.70	15.54	34.24	103.25	-69.01	QP
5	0.0957	16.47	19.13	35.60	103.25	-67.65	QP
6	0.1100	16.61	20.61	37.22	103.25	-66.03	QP

Remark:
 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
 2. Margin value = Level -Limit value



150kHz – 30MHz

Test mode	2	Polarization	0°
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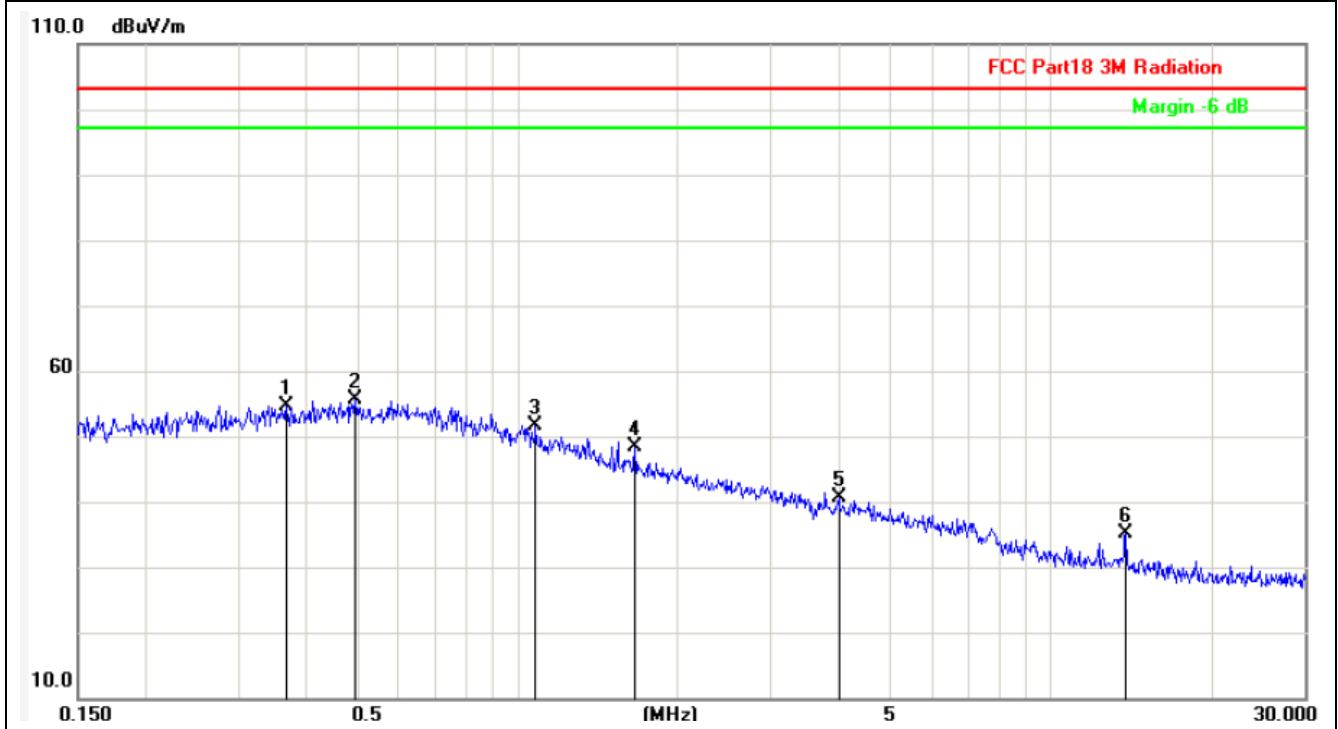


No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.2495	16.58	37.95	54.53	103.25	-48.72	QP
2	0.3871	16.54	38.29	54.83	103.25	-48.42	QP
3	0.5916	16.52	38.73	55.25	103.25	-48.00	QP
4	0.8897	16.60	36.67	53.27	103.25	-49.98	QP
5	1.4874	16.58	31.12	47.70	103.25	-55.55	QP
6	2.7212	16.50	26.43	42.93	103.25	-60.32	QP

Remark:
 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
 2. Margin value = Level -Limit value



Test mode	2	Polarization	90°
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No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	0.3692	16.55	38.09	54.64	103.25	-48.61	QP
2	0.4967	16.50	39.02	55.52	103.25	-47.73	QP
3	1.0824	16.63	34.97	51.60	103.25	-51.65	QP
4	1.6625	16.57	31.91	48.48	103.25	-54.77	QP
5	4.0062	16.64	23.95	40.59	103.25	-62.66	QP
6	13.8411	16.60	18.42	35.02	103.25	-68.23	QP

Remark:
 1. Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
 2. Margin value = Level -Limit value

3.2. Conducted Emission (AC Mains)

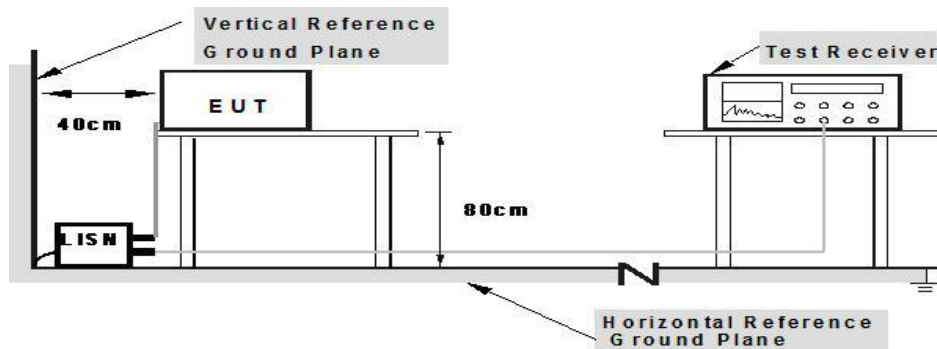
LIMIT

FCC CFR Title 47 Part 18 Section 18.307(b):

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



**Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes**

TEST PROCEDURE

1. The EUT was setup according to ANSI C63.4-2014.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

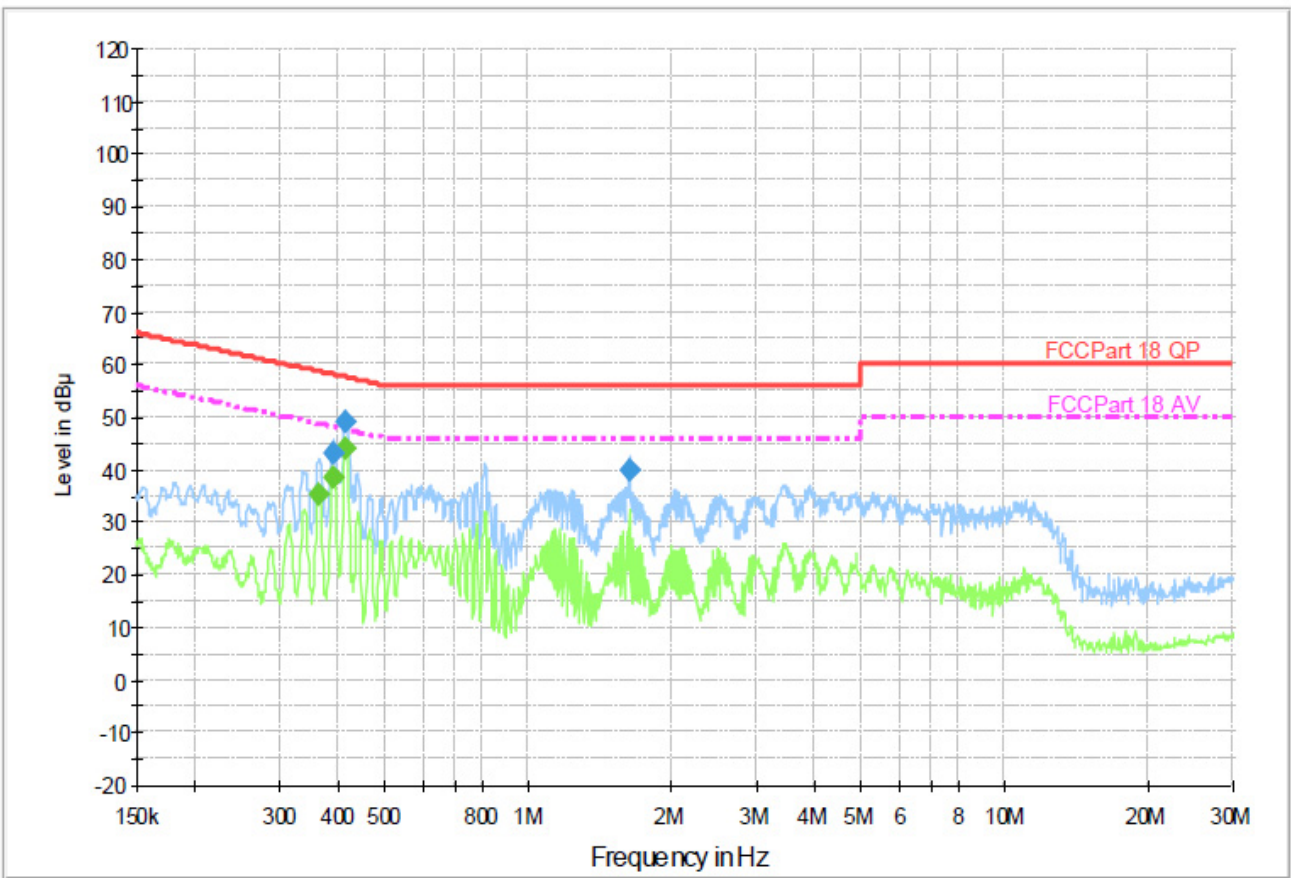
TEST MODE

Please refer to the clause 2.4.

TEST RESULTS



Test mode	1	Terminal	Line
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Final Measurement Detector 1

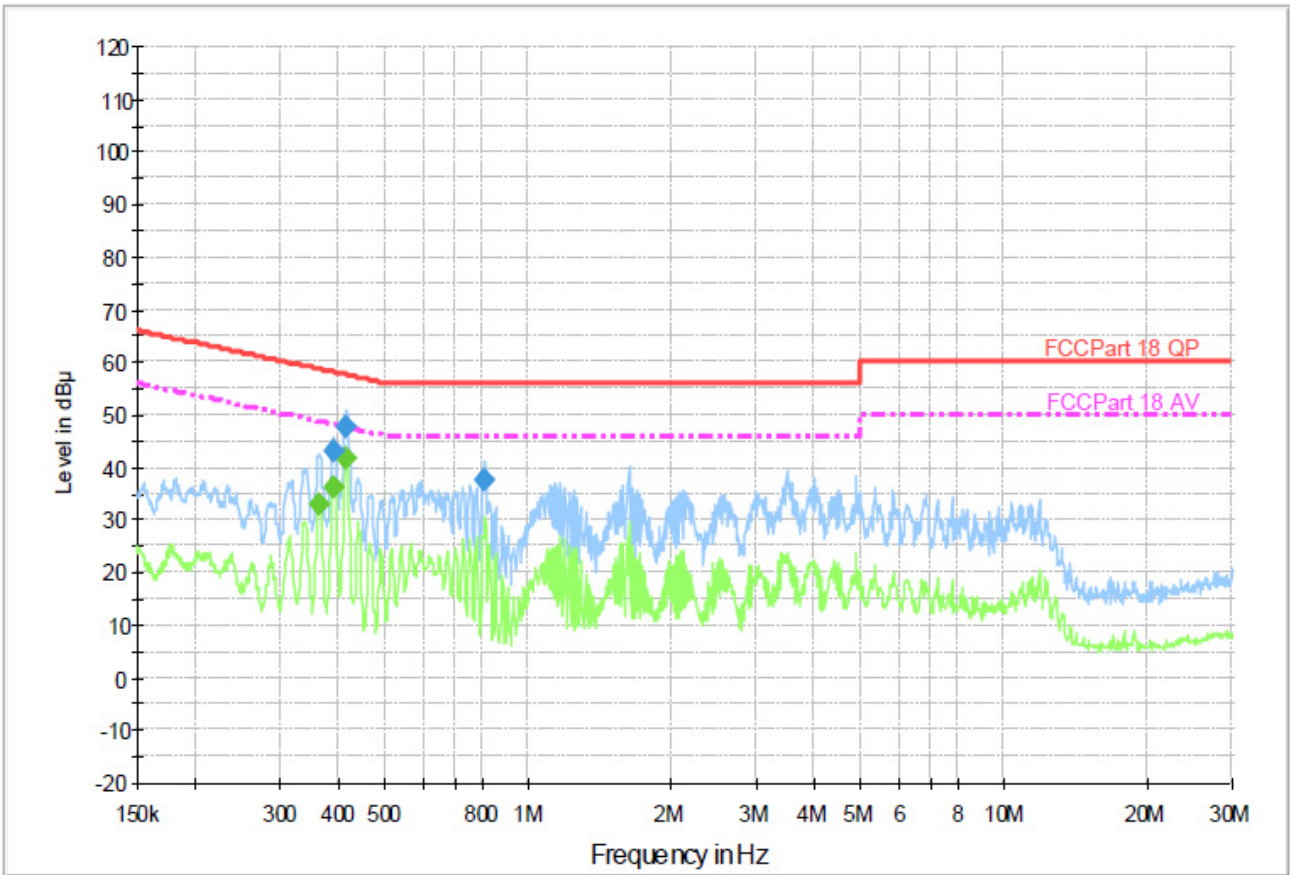
Frequency (MHz)	QuasiPeak (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)	Comment
0.389450	42.9	1000.00	9.000	On	L1	9.4	15.2	58.1	
0.410190	48.9	1000.00	9.000	On	L1	9.4	8.7	57.6	
1.619510	39.7	1000.00	9.000	On	L1	9.5	16.3	56.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)	Comment
0.362440	35.4	1000.00	9.000	On	L1	9.4	13.3	48.7	
0.387900	38.6	1000.00	9.000	On	L1	9.4	9.5	48.1	
0.413480	44.2	1000.00	9.000	On	L1	9.4	3.4	47.6	



Test mode	1	Terminal	Neutral
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Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)	Comment
0.387900	43.1	1000.00	9.000	On	N	9.4	15.0	58.1	
0.413480	47.7	1000.00	9.000	On	N	9.4	9.9	57.6	
0.808570	37.4	1000.00	9.000	On	N	9.4	18.6	56.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)	Comment
0.362440	33.0	1000.00	9.000	On	N	9.4	15.7	48.7	
0.387900	36.3	1000.00	9.000	On	N	9.4	11.8	48.1	
0.411830	41.8	1000.00	9.000	On	N	9.4	5.8	47.6	