FCC TEST REPORT

Product Name:	Wireless Microphone
Trade Mark:	North GEMS
Model No.:	K81
Report Number:	2402019154EMC-1
Test Standards:	FCC 47 CFR Part 15 Subpart B
FCC ID:	2AO23-K81M
Test Result:	PASS
Date of Issue:	April 7, 2024

Prepared for:

Chug Inc.
7157 Shady Oak Road, Eden Prairie, MN 55344, USA

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
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Date: April 7, 2024

Version

Version No.	Date	Description
V1.0	April 7, 2024	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Chug Inc.
Address of Applicant:	7157 Shady Oak Road, Eden Prairie, MN 55344, USA
Manufacturer:	Star Wave technology co.,ltd
Address of Manufacturer:	15/F,HUAIDE INTERNATIONAL BUILDING,NO.73 GUANGSHEN ROAD,FUYONG STREET, SHENZHEN, 518103 CHINA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Wireless Microphone
Model No.:	K81
Trade Mark:	North GEMS
DUT Stage:	Production Unit
Rated Voltage:	☒ Powered by USB port (5Vdc)
	☒ 3.7Vdc (1x3.7V button Battery)
Classification of digital devices:	Class B
Highest Internal Frequency:	2480 MHz
Software Version:	M9-TX-v4.1 (Provided by the customer)
Hardware Version:	V-1042F_TX_AD6976D_230621_FD163EEC (Provided by the customer)
Sample Received Date:	February 1, 2024
Sample Tested Date:	February 21, 2024 to February 23, 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

Charging Case	
Connector:	USB-C
USB-C Input:	5V ⎓ 300mA
Pogo pin Output:	5V ⎓ 150mA
Case Battery Capatity:	3.7V/300mAh/1.11Wh

Cable	
Connector:	USB Cable
Cable Type:	Unshielded without ferrite
Length:	0.2 Meter

Battery	
Battery Type:	Button Battery
Rated Voltage:	3.7 Vdc
Typical Capacity:	60 mAh
Rated Capacity:	60 mAh

Receiver	
Connector:	USB-C
USB-C Input:	5V ⎓ 1A

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-738	UnionTrust
Adapter	HUAWEI	HW-050200C01	B78578GBT02395	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
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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, China 518109
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-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

Test Equipment of Radiated emissions					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal.Date**	**Cal.Due Date**
3 m SAC	ETS-Lindgren	3 m	Euroshiedpn-CT001270-1317	11-Nov-2023	10-Nov-2026
Broadband Antenna	ETS-Lindgren	3142E	00201566	30-Oct-2023	29-Oct-2024
Double-Ridged Waveguide Horn Antenna(Pre-amplifier)	ETS-Lindgren	3117-PA	00201541	16- Apr-2022	15- Apr-2024
Pre-amplifier	ETS-Lindgren	00118385	00201874	31-Oct-2023	30-Oct-2024
Receiver	ROHDE & SCHWARZ	ESIB26	100114	27-Oct-2023	26-Oct-2024
Pre-amplifier	HP	8447F	2805A02960	31-Oct-2023	30-Oct-2024
6dB Attenuator	Talent	RA6A5-N-18	18103001	30-Oct-2023	29-Oct-2024
Test Software	Audix	e3	Software Version: 19815(V9)		

Test Equipment of Conducted emissions					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal.Date**	**Cal.Due Date**
LISN Artifical Mains Network	ROHDE & SCHWARZ	ESH2-Z5	860014/024	27-Oct-2023	26-Oct-2024
LISN Artifical Mains Network	ETS-Lindgren	3816/2SH	00201088	27-Oct-2023	26-Oct-2024
Receiver	ROHDE & SCHWARZ	ESR7	101181	27-Oct-2023	26-Oct-2024
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	0357.8810.54	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 (%)
NT/NV	+15 to +35	5V DC or/and 3.7 V Battery	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temp. (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
Radiated Emission	24.4	53.2	100.1	S202402012700-ZJA05/6	Yana Zeng
Conducted Emission	24.5	60.0	100.5		Linson Xie

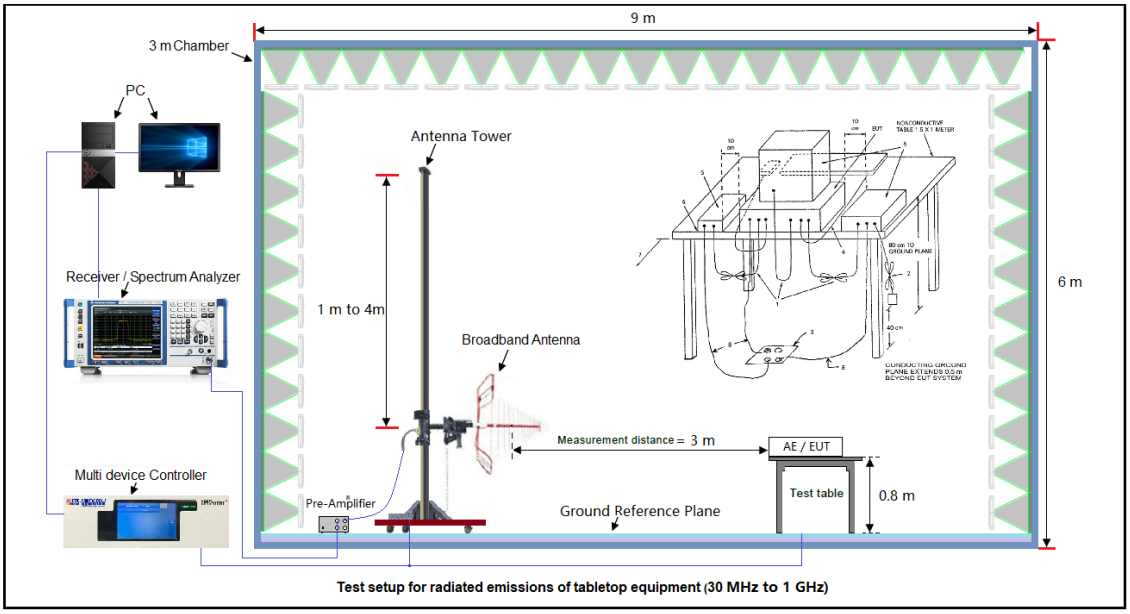
4.2 TEST MODES

Test Item	EMI Test Modes
Radiated Emission	Test Mode 1: Charging from 120 Vac + Charging case Test Mode 2: Charging from 120 Vac + microphone Test Mode 3: Charging from 120 Vac + Charging case + microphone Test Mode 4: BT link
Conducted Emission	Test Mode 1: Charging from 120 Vac + Charging case Test Mode 2: Charging from 120 Vac + microphone Test Mode 3: Charging from 120 Vac + Charging case + microphone
Remark: The above test modes in boldface were the worst cases, only the test data of these modes were reported.	

4.3 TEST SETUP

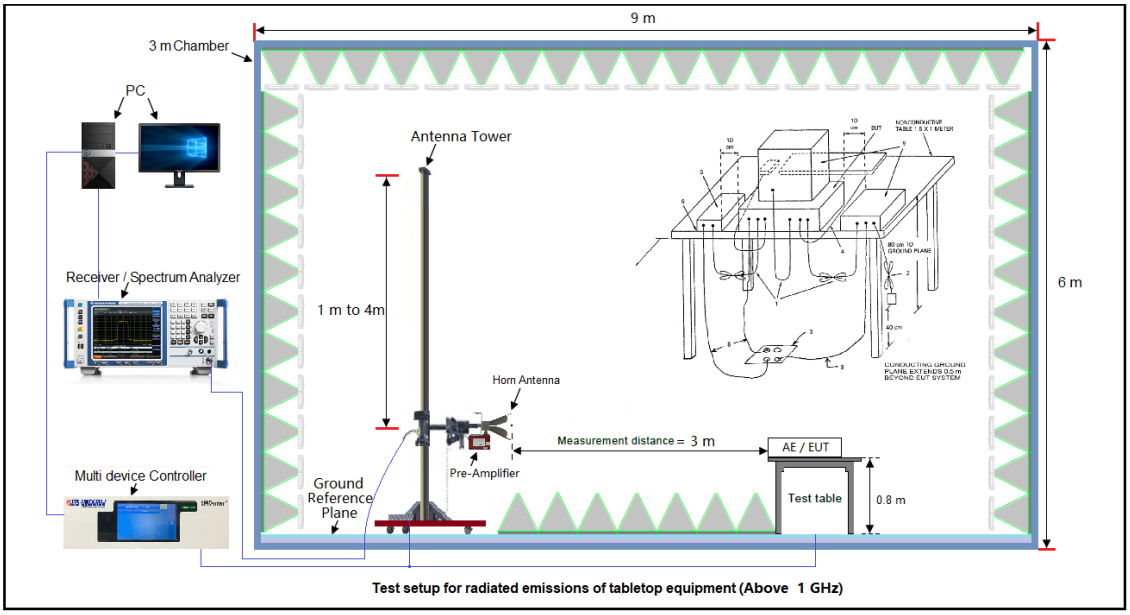
4.3.1 For Radiated Emissions test setup

Figure 1. 30MHz to 1GHz



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

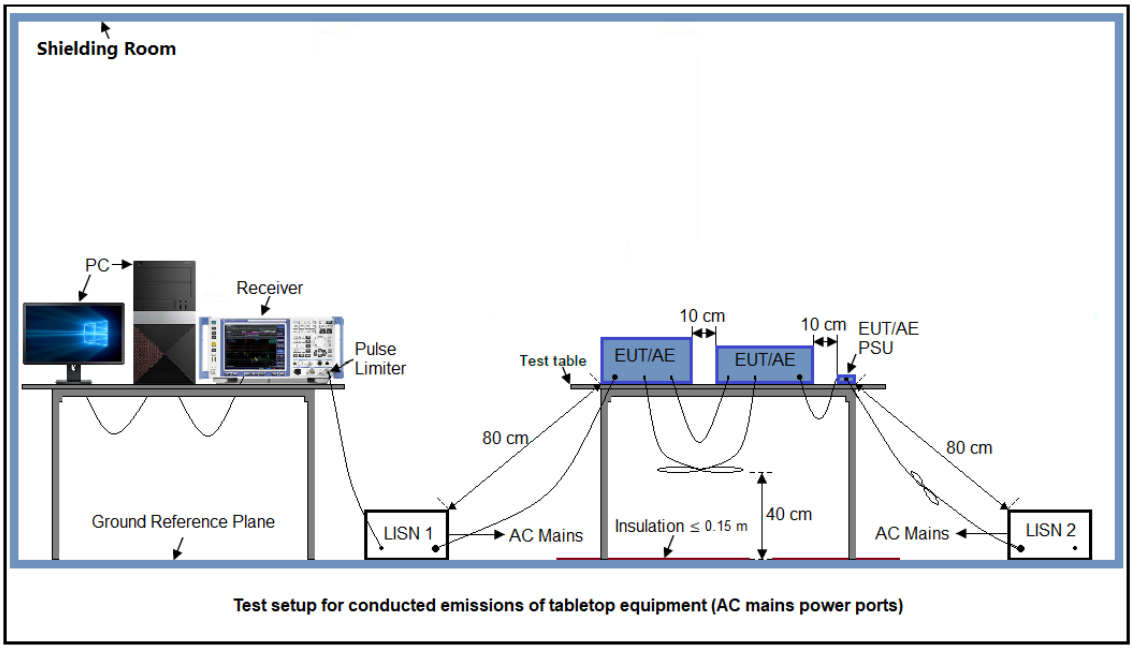
Figure 2. Above 1GHz



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

4.3.2 For Conducted Emissions test setup

Figure 3. Conducted Emissions setup



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

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 to 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.

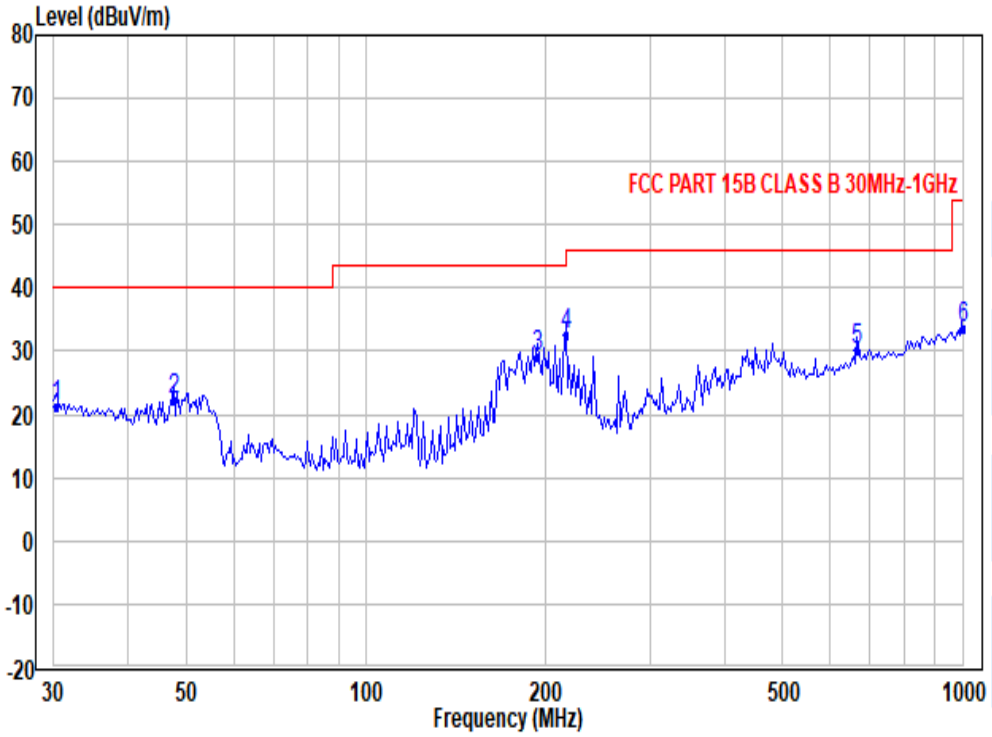
3) For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

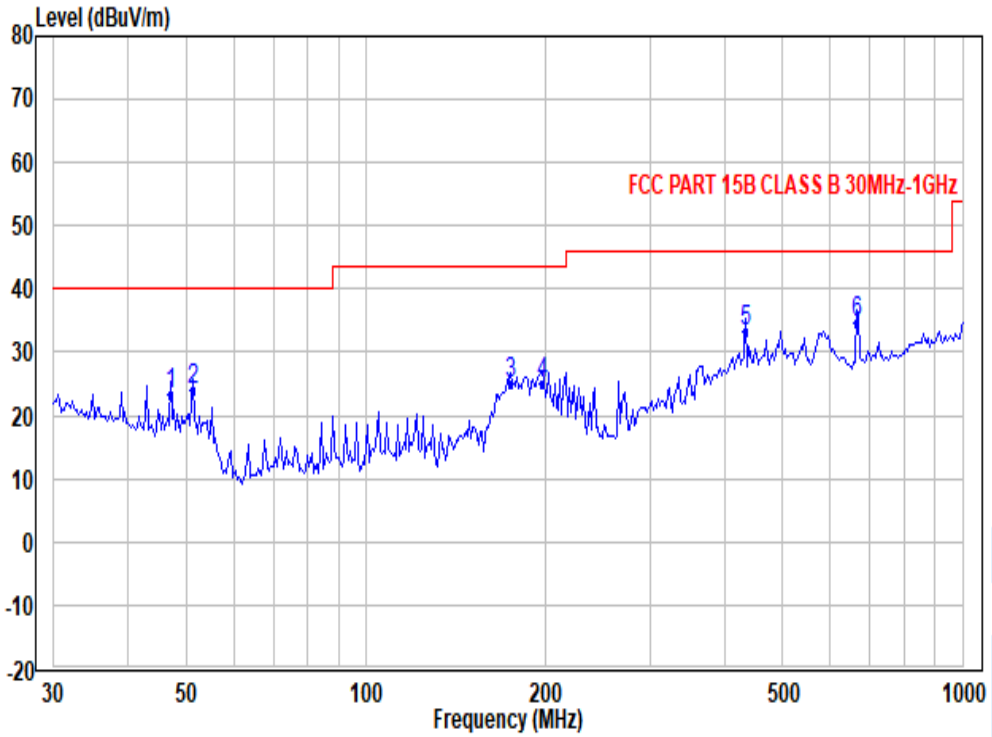
The worst measurement data as follows:

Below 1GHz (Quasi Peak):
Test Mode4
Horizontal



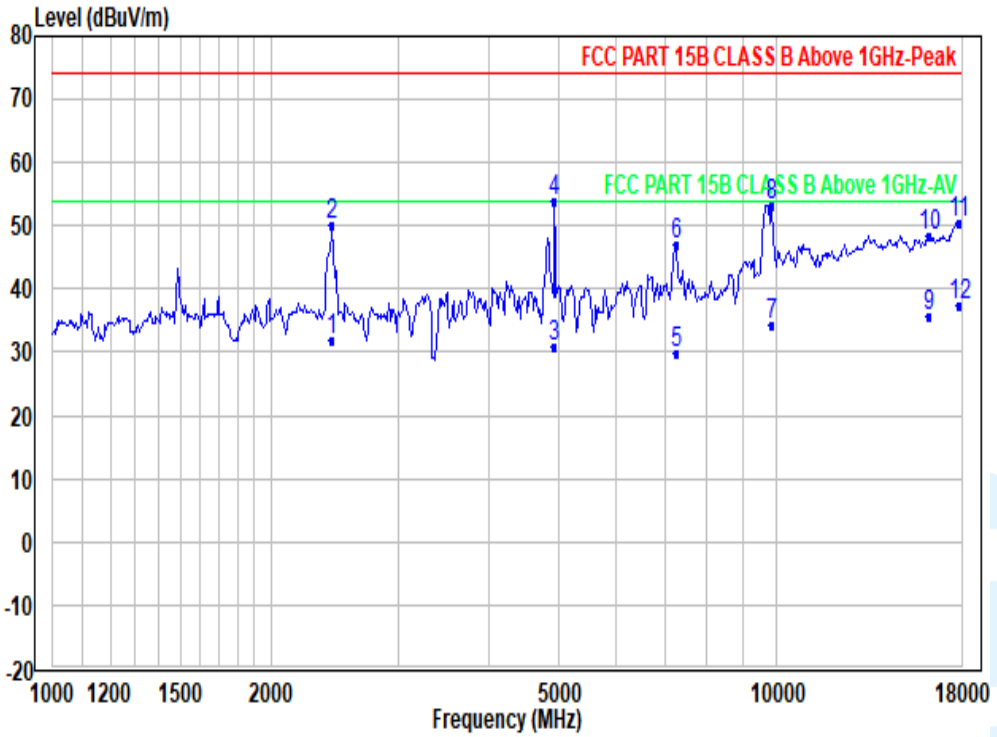
No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.212	25.80	-4.47	21.33	40.00	-18.67	QP
2	47.703	35.34	-13.10	22.24	40.00	-17.76	QP
3	194.499	40.39	-11.18	29.21	43.50	-14.29	QP
4	216.120	43.58	-10.93	32.65	46.00	-13.35	QP
5	665.261	29.77	0.55	30.32	46.00	-15.68	QP
6	1000.000	27.45	6.01	33.46	54.00	-20.54	QP

Vertical



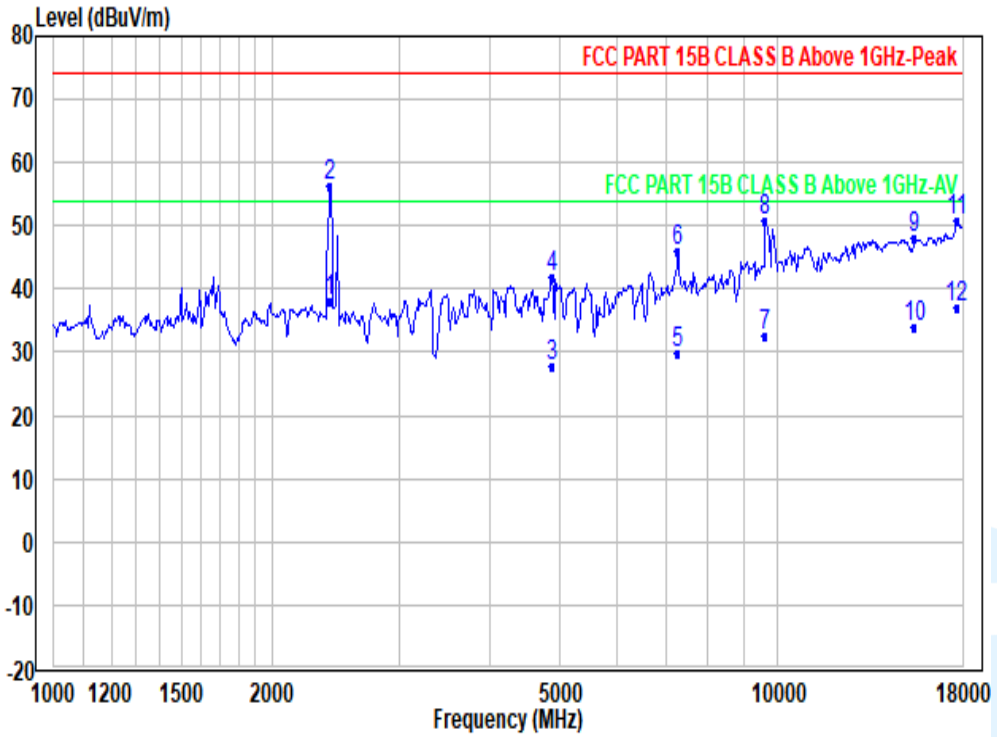
No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	47.037	36.33	-12.89	23.44	40.00	-16.56	QP
2	51.176	37.85	-14.01	23.84	40.00	-16.16	QP
3	175.040	36.30	-11.44	24.86	43.50	-18.64	QP
4	197.251	36.06	-11.21	24.85	43.50	-18.65	QP
5	433.340	37.11	-3.90	33.21	46.00	-12.79	QP
6	665.261	34.15	0.55	34.70	46.00	-11.30	QP

Above 1GHz (Peak & Average)
Test Mode4
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2432.993	39.94	-7.96	31.98	54.00	-22.02	Average
2	2432.993	57.94	-7.96	49.98	74.00	-24.02	Peak
3	4932.206	32.26	-1.41	30.85	54.00	-23.15	Average
4	4932.206	55.26	-1.41	53.85	74.00	-20.15	Peak
5	7249.817	27.70	2.29	29.99	54.00	-24.01	Average
6	7249.817	44.70	2.29	46.99	74.00	-27.01	Peak
7	9826.408	27.68	6.64	34.32	54.00	-19.68	Average
8	9826.408	46.68	6.64	53.32	74.00	-20.68	Peak
9	16264.840	23.10	12.41	35.51	54.00	-18.49	Average
10	16264.840	36.10	12.41	48.51	74.00	-25.49	Peak
11	17844.290	34.58	15.78	50.36	74.00	-23.64	Peak
12	17844.290	21.58	15.78	37.36	54.00	-16.64	Average

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2404.971	46.25	-8.13	38.12	54.00	-15.88	Average
2	2404.971	64.25	-8.13	56.12	74.00	-17.88	Peak
3	4875.398	29.17	-1.47	27.70	54.00	-26.30	Average
4	4875.398	43.17	-1.47	41.70	74.00	-32.30	Peak
5	7270.844	27.64	2.30	29.94	54.00	-24.06	Average
6	7270.844	43.64	2.30	45.94	74.00	-28.06	Peak
7	9601.354	26.55	6.10	32.65	54.00	-21.35	Average
8	9601.354	44.55	6.10	50.65	74.00	-23.35	Peak
9	15438.670	35.91	11.98	47.89	74.00	-26.11	Peak
10	15438.670	21.91	11.98	33.89	54.00	-20.11	Average
11	17638.760	35.96	14.95	50.91	74.00	-23.09	Peak
12	17638.760	21.96	14.95	36.91	54.00	-17.09	Average

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, only the worst case emissions reported.
5. 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:

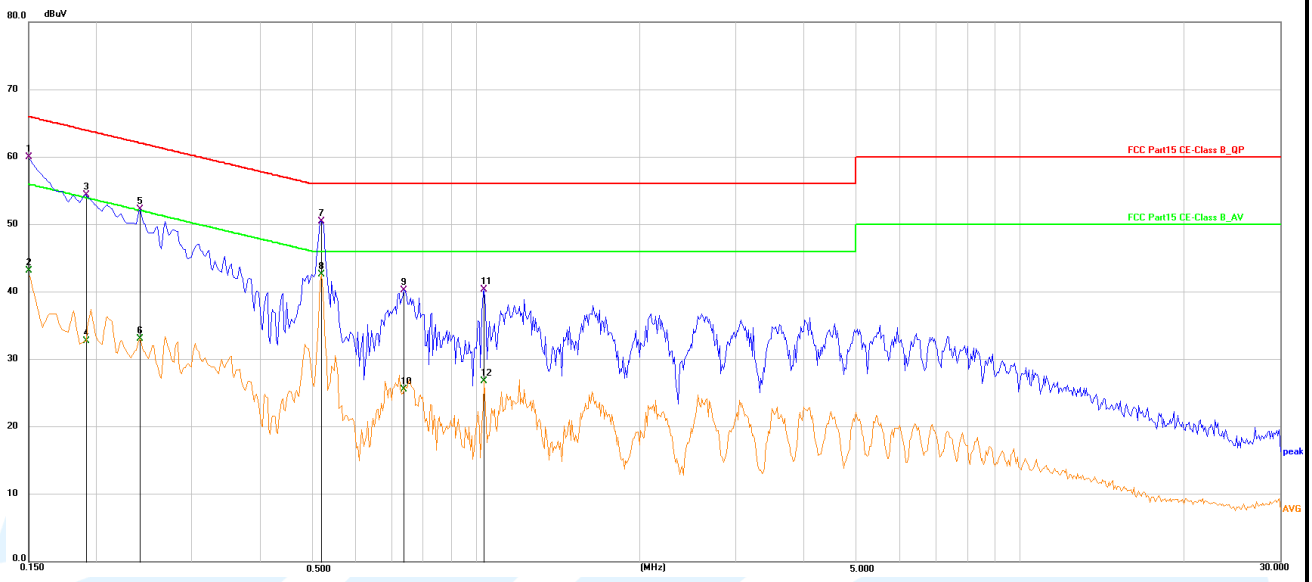
1) The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
2) The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak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

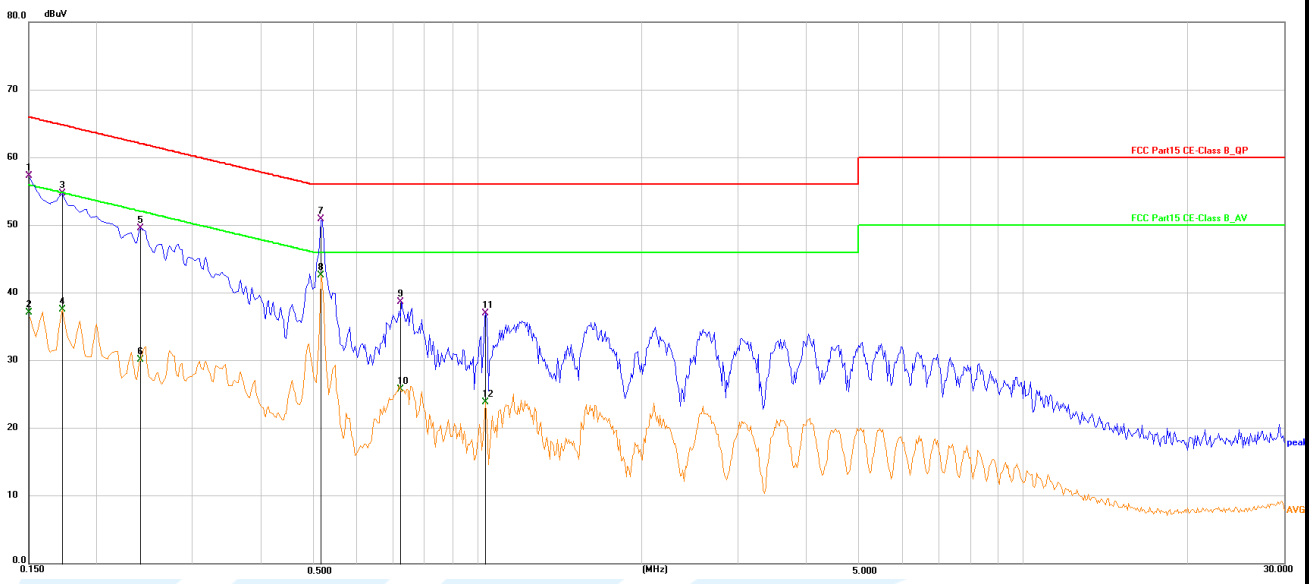
The worst measurement data as follows:
Quasi Peak and Average:
Test Mode3

Live Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1500	49.76	10.20	59.96	66.00	-6.04	QP
2	0.1500	32.90	10.20	43.10	56.00	-12.90	AVG
3	0.1905	44.24	10.16	54.40	64.01	-9.61	QP
4	0.1905	22.54	10.16	32.70	54.01	-21.31	AVG
5	0.2400	41.99	10.19	52.18	62.10	-9.92	QP
6	0.2400	22.86	10.19	33.05	52.10	-19.05	AVG
7	0.5190	40.30	10.19	50.49	56.00	-5.51	QP
8	0.5190	32.38	10.19	42.57	46.00	-3.43	AVG
9	0.7350	30.01	10.22	40.23	56.00	-15.77	QP
10	0.7350	15.31	10.22	25.53	46.00	-20.47	AVG
11	1.0363	29.97	10.34	40.31	56.00	-15.69	QP
12	1.0363	16.46	10.34	26.80	46.00	-19.20	AVG

Neutral Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1500	47.12	10.19	57.31	66.00	-8.69	QP
2	0.1500	26.87	10.19	37.06	56.00	-18.94	AVG
3	0.1725	44.52	10.14	54.66	64.84	-10.18	QP
4	0.1725	27.34	10.14	37.48	54.84	-17.36	AVG
5	0.2400	39.51	10.08	49.59	62.10	-12.51	QP
6	0.2400	20.06	10.08	30.14	52.10	-21.96	AVG
7	0.5144	40.56	10.27	50.83	56.00	-5.17	QP
8	0.5144	32.31	10.27	42.58	46.00	-3.42	AVG
9	0.7215	28.38	10.24	38.62	56.00	-17.38	QP
10	0.7215	15.54	10.24	25.78	46.00	-20.22	AVG
11	1.0365	26.85	10.16	37.01	56.00	-18.99	QP
12	1.0365	13.73	10.16	23.89	46.00	-22.11	AVG

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, only the worst case emissions reported.

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 **********
