RF MEASUREMENT REPORT

FCC ID:	2ALS8-SS0005
Applicant:	Ninebot (Changzhou) Tech Co., Ltd.
Product:	ninebot smart dashboard
Model No.:	WF-200
FCC Classification:	Part 15 Low Power Communication Device Transmitter (DXX)
FCC Rule Part(s):	Part 15 Subpart C (Section 15.225)
Result:	Complies
Receive Date:	2023-01-04
Test Date:	2023-01-11 ~ 2023-01-16

Reviewed By: Vincent Yu

Approved By: Robin Wu

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
2301RSU007-U1	V01	Initial Report	2023-01-30	Valid

CONTENTS

1. General Information

1.1. Applicant

Ninebot (Changzhou) Tech Co., Ltd.

16F-17F, Block A, Building 3, Changwu Mid Road 18#, Wujin Dist., Changzhou, Jiangsu, China

1.2. Manufacturer

Ninebot (Changzhou) Tech Co., Ltd.

16F-17F, Block A, Building 3, Changwu Mid Road 18#, Wujin Dist., Changzhou, Jiangsu, China

1.3. Testing Facility

☒	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong)				
	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China				
	Laboratory Location (Suzhou - SIP)				
	4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China				
	Laboratory Accreditations				
	A2LA: 3628.01		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐R-20025	☐G-20034	☐C-20020	☐T-20020
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen)				
	1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan)				
	No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: L3261-190725				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product Name	ninebot smart dashboard
Model No.	WF-200
EUT Identification No.	20230104Sample#11
NFC Specification	13.56MHz
WPT Specification	115 ~ 145kHz
Power Supply	18VDC / 1.5A
Output	15W (Max)
Operating Temp.	0 ~ 40°C
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

NFC Specification	13.56MHz
Type of modulation	ASK
Antenna Type	Coil Antenna

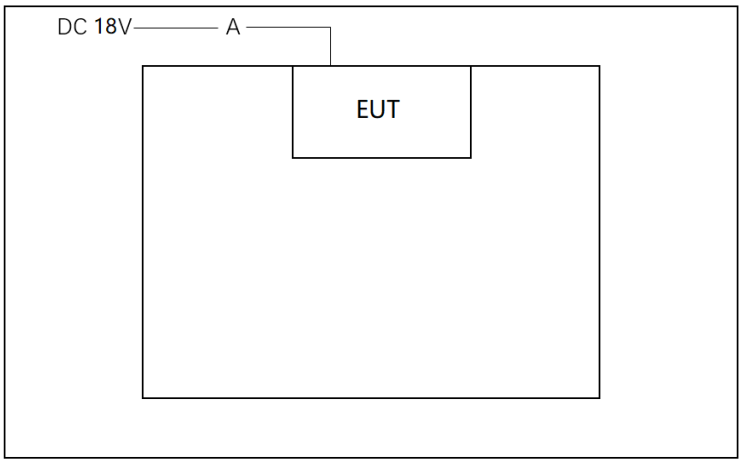
2. Test Configuration

2.1. Test Mode

Test Mode
Mode 1: Transmit by NFC

2.2. Test Configuration and Software

The device was tested per the guidance ANSI C63.10-2013 that was used to reference the appropriate EUT setup for radiated spurious emissions and AC line conducted emission testing.



Cable Type		Cable Spec.	Length
A	Power Cable	Non-Shielded	>10.0m

2.3. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.225
- ANSI C63.10-2013

2.4. Test Environment Condition

Ambient Temperature	15 ~ 35 °C
Relative Humidity	20 ~ 75 %RH

3. Antenna Requirements

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of this device is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument Name	Manufacturer	Model No.	Asset No.	Cali. Interval	Cal. Due Date	Test Site
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2023-12-28	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2023-06-21	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2023-04-21	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2023-06-06	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2023-12-28	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11039	1 year	2023-11-01	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC1
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2023-10-08	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2023-06-06	WZ-TR3
Signal Analyzer	Keysight	N9010B	MRTSUE07027	1 year	2023-11-25	WZ-TR3

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	2.03C	RE Antenna & Turntable

5. Decision Rules and Measurement Uncertainty

5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.2. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT 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.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): Horizontal: 30MHz~200MHz: 3.85dB 200MHz~1GHz: 4.36dB 1GHz~6GHz: 4.98dB Vertical: 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.28dB 1GHz~6GHz: 4.91dB

6. Test Result

6.1. Summary

FCC Part Section(s)	Test Description	Test Condition	Verdict
15.225 (a), (b), (c)	In-Band Emission	Radiated	Pass
15.225(d)	Out-Band Emission		Pass
15.215 (c)	20dB Bandwidth		Pass
15.225(e)	Frequency Stability Tolerance		Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	N/A

Remark:

1. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
2. “N/A” means not applicable.

6.2. In-band Emission Measurement

6.2.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.225		
Frequency (MHz)	Distance (m)	Level (μV/m)
13.553 ~13.567	30	15848
13.410 ~13.553, 13.567 ~13.710	30	334
13.110 ~13.410, 13.710 ~14.010	30	106
Note 1: The lower limit shall apply at the transition frequency. Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system. Note 3: E field strength (dBμV/m) = 20 log E field strength (μV/m)		

6.2.2. Test Procedure

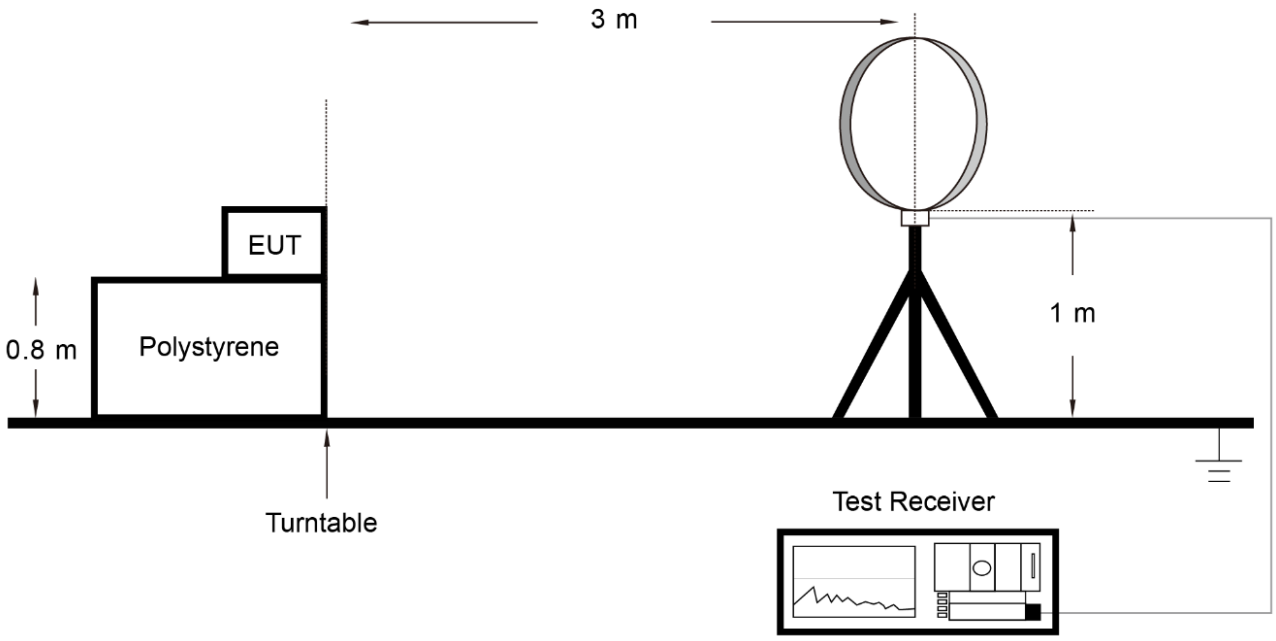
ANSI C63.10-2013 - Section 6.4.7

6.2.3. Test Setting

1. RBW = 9kHz
2. VBW = 3 * RBW
3. Detector = Peak
4. Trace mode = Max hold
5. Sweep = Auto couple
6. Allow the trace to stabilize

6.2.4. Test Setup

9kHz ~ 30MHz Test Setup:



6.2.5. Test Result

Refer to Appendix A.1.

6.3. Out-band Emission Measurement

6.3.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (μV/m)
0.009 - 0.490	300	2400/F (kHz)
0.490 - 1.705	30	24000/F (kHz)
1.705 - 30	30	30
30 - 88	3	100
88 - 216	3	150
216 - 960	3	200
Above 960	3	500
Note 1: The lower limit shall apply at the transition frequency. Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system. Note 3: E field strength (dBμV/m) = 20 log E field strength (μV/m)		

6.3.2. Test Procedure

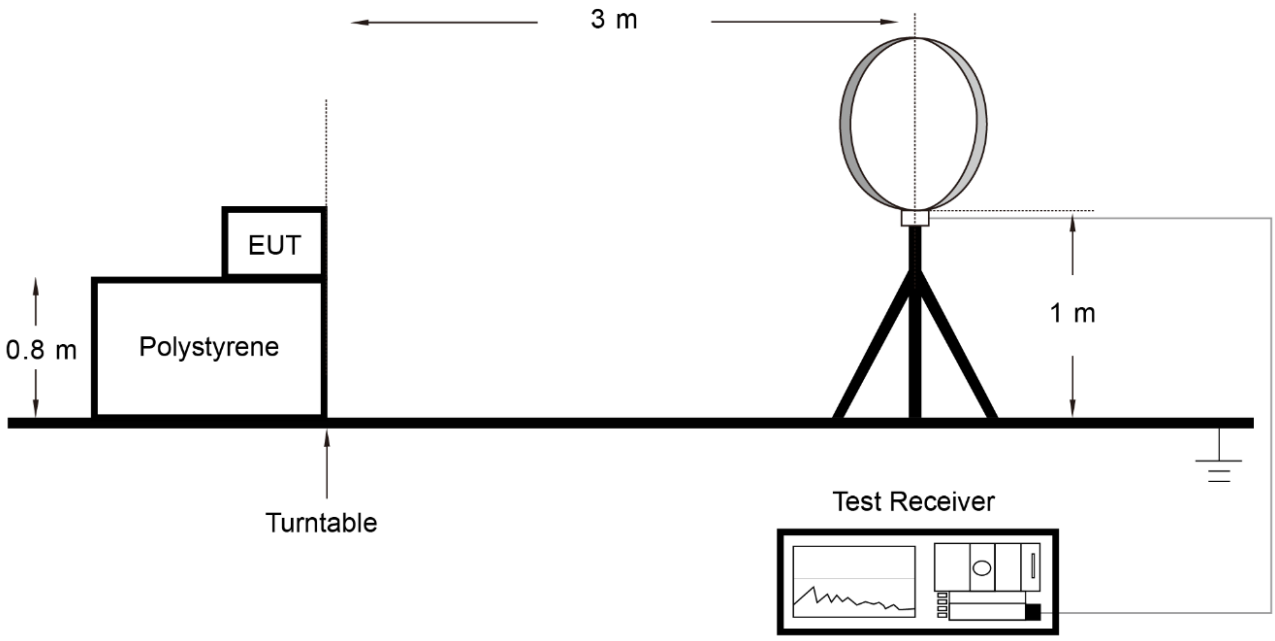
ANSI C63.10-2013 - Section 6.5.4

6.3.3. Test Setting

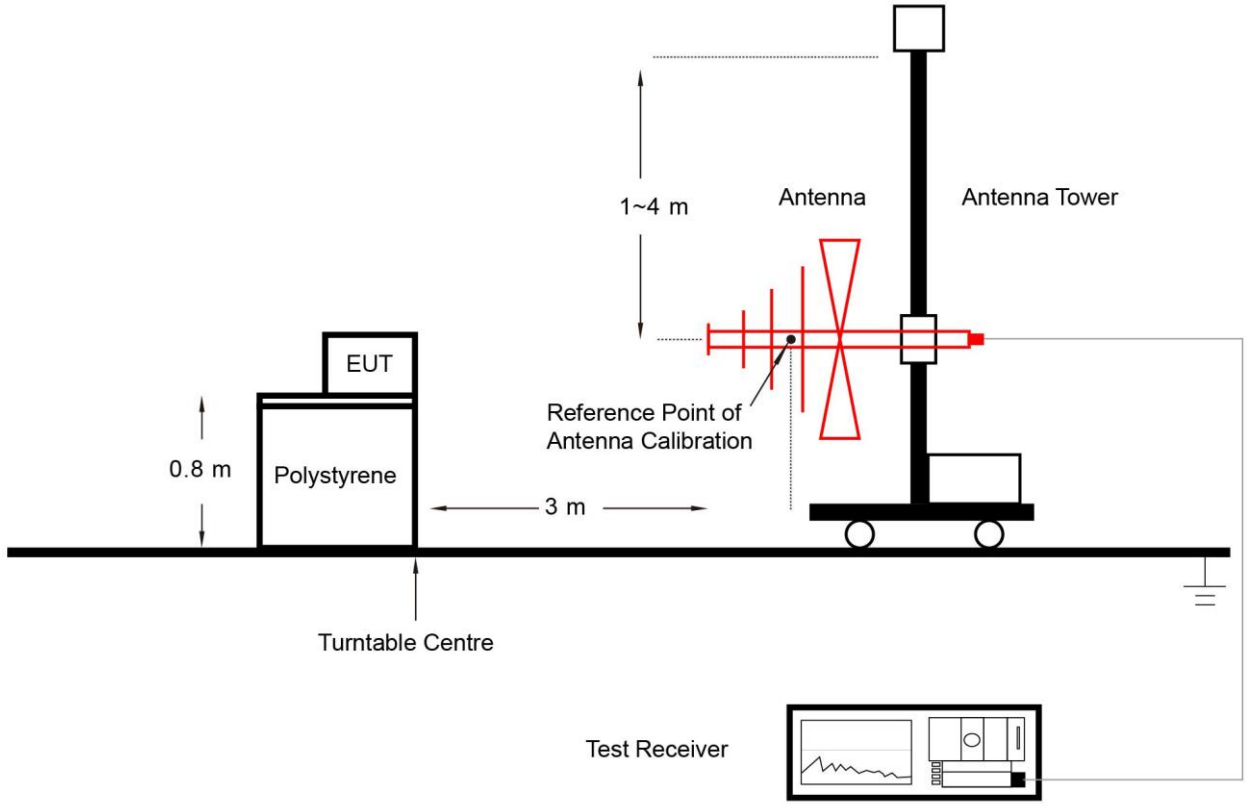
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 9kHz for emission below 30MHz and 100kHz for emission between 30MHz and 1GHz
3. VBW = 3 * RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize

6.3.4. Test Setup

9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



6.3.5. Test Result

Refer to Appendix A.2.

6.4. Occupied Bandwidth Measurement

6.4.1. Test Limit

Within the operating frequency band (13.110 ~ 14.010 MHz).

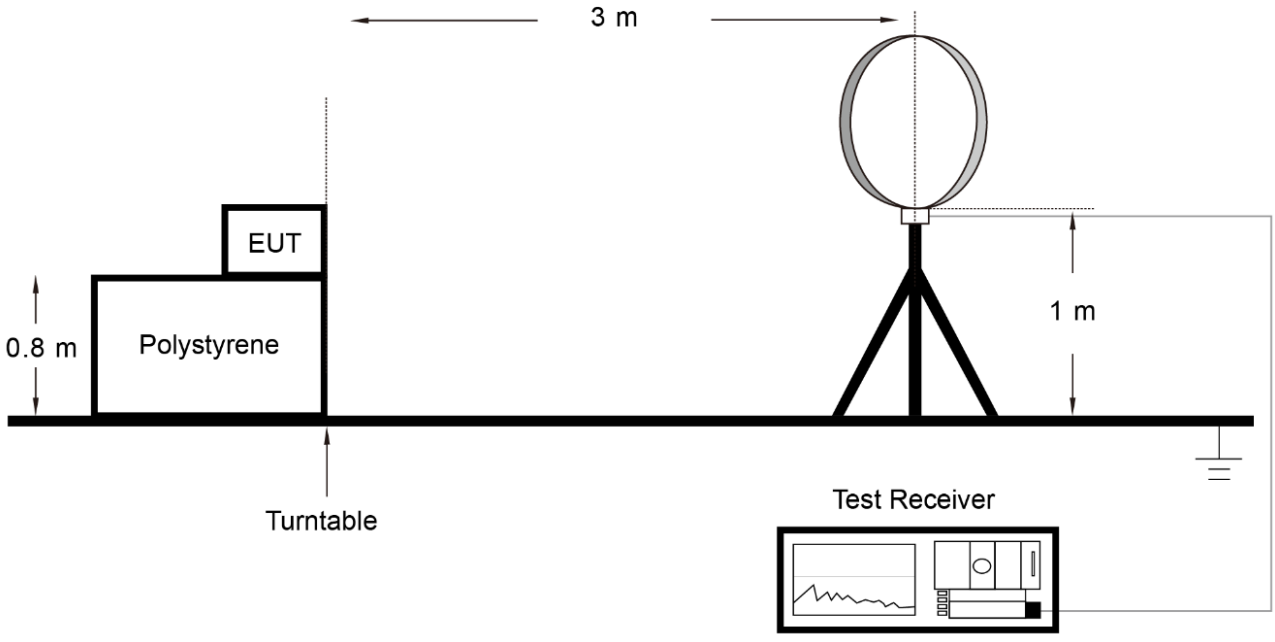
6.4.2. Test Procedure

ANSI C63.10-2013 - Section 6.9.2

6.4.3. Test Setting

1. Set RBW ≥ 1% to 5% of the 20dB bandwidth
2. VBW = approximately three times RBW
3. Span = approximately 2 to 5 times the 20dB bandwidth
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.3.

6.5. Frequency Tolerence Measurement

6.5.1. Test Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency.

6.5.2. Test Procedure

ANSI C63.10-2013 - Section 6.8

6.5.3. Test Setting

Frequency Stability Under Temperature Variations:

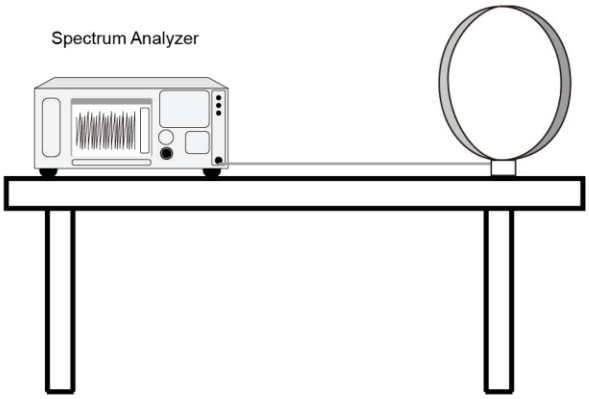
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20℃ operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10℃ decreased per stage until the lowest temperature reached.

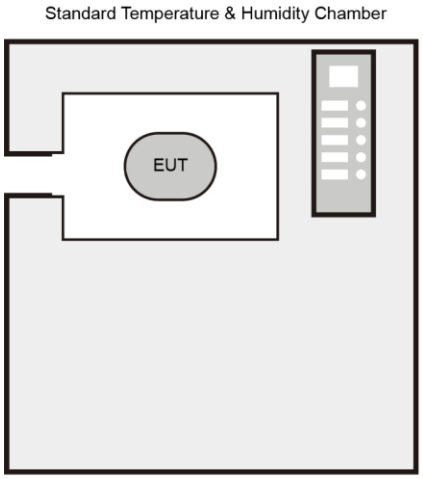
Frequency Stability Under Voltage Variations:

Set chamber temperature to 20℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change. For hand-carried battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

6.5.4. Test Setup





6.5.5. Test Result

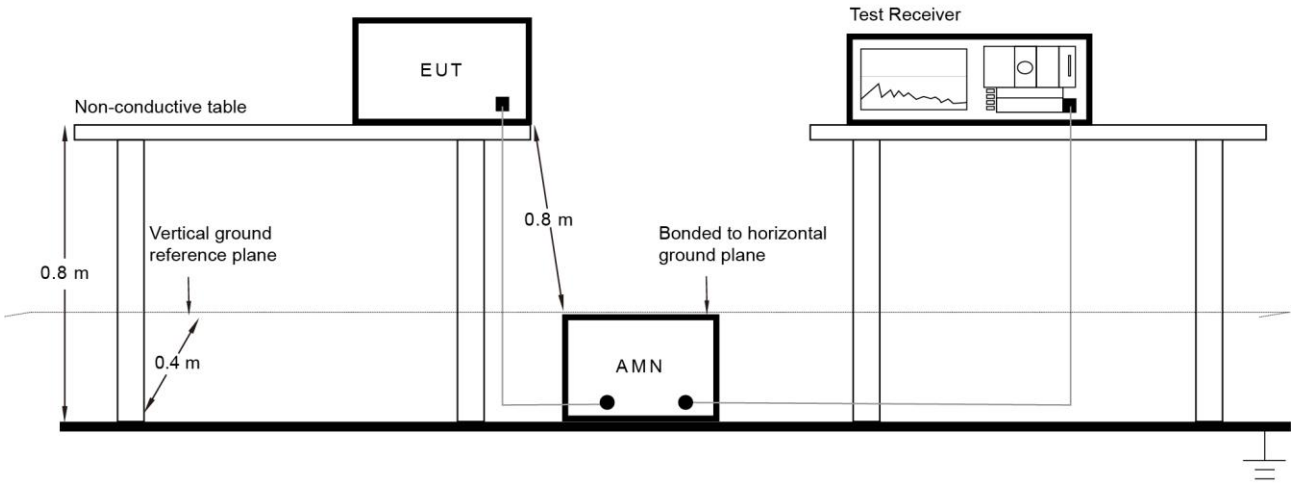
Refer to Appendix A.4.

6.6. AC Conducted Emissions Measurement

6.6.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207		
Frequency (MHz)	QP (dBμV)	AV (dBμV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50
Note 1: The lower limit shall apply at the transition frequencies. Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.		

6.6.2. Test Setup



6.6.3. Test Result

Refer to Appendix A.5.

Appendix A - Test Result

A.1 In-band Emission Test Result

Test Engineer	Ajin Fan	Test Date	2023-01-11
Test Mode	Mode 1	Test Site	WZ-AC1

Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level @3m (dBμV/m)	Measure Level @30m (dBμV/m)	Limit @30m (dBμV/m)	Margin [dB]
Coaxial						
13.110	8.243	17.153	25.396	-14.604	40.506	-55.110
13.346	20.875	17.150	38.025	-1.975	40.506	-42.481
13.410	13.335	17.149	30.484	-9.516	40.506	-50.022
13.553	31.746	17.147	48.893	8.893	50.475	-41.582
13.560	39.675	17.147	56.822	16.822	83.999	-67.177
13.567	34.884	17.147	52.031	12.031	50.475	-38.444
13.710	12.021	17.145	29.166	-10.834	40.506	-51.340
13.773	20.804	17.145	37.949	-2.051	40.506	-42.557
14.010	7.592	17.142	24.734	-15.266	40.506	-55.772
Coplanar						
13.110	6.465	17.153	23.618	-16.382	40.506	-56.888
13.349	19.362	17.150	36.512	-3.488	40.506	-43.994
13.410	11.448	17.149	28.597	-11.403	40.506	-51.909
13.553	29.676	17.147	46.823	6.823	50.475	-43.652
13.560	37.620	17.147	54.767	14.767	83.999	-69.232
13.567	32.744	17.147	49.891	9.891	50.475	-40.584
13.710	10.392	17.145	27.537	-12.463	40.506	-52.969
13.775	16.045	17.145	33.190	-6.810	40.506	-47.316
14.010	8.128	17.142	25.270	-14.730	40.506	-55.236

Note:

1. Measure Level @3m (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)
   Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)
2. Measurements were tested at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear extrapolation factor (40 dB/decade) as specified in &15.31(f)(2).
   Extrapolation Factor = 40*Log (30/3) = 40 dB.
   Measure Level @30m (dBμV/m) = Measure Level @3m (dBμV/m) - 40 dB
3. All measurements were recorded using an EMI test receiver employing a peak detector.

A.2 Out-Band Emission Test Result

Test Engineer	Ajin Fan	Test Date	2023-01-11
Test Mode	Mode 1	Test Site	WZ-AC1
Remark	9kHz ~ 490kHz		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level @3m (dBμV/m)	Measure Level @300m (dBμV/m)	Limit @300m (dBμV/m)	Margin (dB)
Coaxial						
0.140	71.135	17.380	88.516	8.516	24.682	-16.166
0.150	69.530	17.376	86.906	6.906	24.082	-17.176
0.419	44.889	17.507	62.396	-17.604	15.160	-32.764
Coplanar						
0.140	65.883	17.380	83.264	3.264	24.682	-21.418
0.150	65.014	17.376	82.390	2.390	24.082	-21.692
0.419	40.329	17.507	57.836	-22.164	15.160	-37.324

Note

1. Measure Level @3m (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)
   Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)
2. Measurements were tested at 3m and the data was extrapolated to the specified measurement distance of 300m using the square of an inverse linear extrapolation factor (40 dB/decade) as specified in 15.31(f)(2).
   Extrapolation Factor = 40*Log (300/3) = 80 dB.
   Measure Level @300m (dBμV/m) = Measure Level @3m (dBμV/m) - 80 dB
3. All measurements were recorded using an EMI test receiver employing a peak detector.

Test Engineer	Ajin Fan	Test Date	2023-01-11
Test Mode	Mode 1	Test Site	WZ-AC1
Remark	490kHz ~ 30MHz		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level @3m (dBμV/m)	Measure Level @30m (dBμV/m)	Limit @30m (dBμV/m)	Margin (dB)
Coaxial						
0.702	35.602	17.666	53.268	13.268	30.677	-17.409
0.986	29.915	17.683	47.598	7.598	27.727	-20.129
1.254	25.312	17.655	42.967	2.967	25.638	-22.671
Coplanar						
0.568	30.473	17.613	48.087	8.087	32.517	-24.430
0.702	31.122	17.666	48.788	8.788	30.677	-21.889
0.986	25.991	17.683	43.674	3.674	27.727	-24.053

Note

1. Measure Level @3m (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)
   Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)
2. Measurements were tested at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear extrapolation factor (40 dB/decade) as specified in &15.31(f)(2).
   Extrapolation Factor = 40*Log (30/3) = 40 dB.
   Measure Level @30m (dBμV/m) = Measure Level @3m (dBμV/m) - 40 dB
3. All measurements were recorded using an EMI test receiver employing a peak detector.

Test Engineer	Ajin Fan	Test Date	2023-01-11
Test Mode	Mode 1	Test Site	WZ-AC1
Remark	30MHz ~ 1GHz		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
40.670	8.792	18.261	27.053	40.000	-12.947	Peak	Horizontal
67.830	5.663	16.528	22.191	40.000	-17.809	Peak	Horizontal
159.980	2.483	18.156	20.639	43.500	-22.861	Peak	Horizontal
326.335	4.025	19.275	23.301	46.000	-22.699	Peak	Horizontal
648.860	4.325	26.228	30.553	46.000	-15.447	Peak	Horizontal
759.440	3.906	28.246	32.152	46.000	-13.848	Peak	Horizontal
40.700	17.670	18.262	35.933	40.000	-4.067	QP	Vertical
54.250	10.941	17.942	28.883	40.000	-11.117	Peak	Vertical
67.830	13.960	16.528	30.488	40.000	-9.512	Peak	Vertical
176.470	7.495	17.069	24.564	43.500	-18.936	Peak	Vertical
243.885	7.906	16.465	24.371	46.000	-21.629	Peak	Vertical
434.005	11.372	21.873	33.246	46.000	-12.754	Peak	Vertical

Note:

Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)

A.3 Occupied Bandwidth Test Result

Test Engineer	Charles Zhang	Test Date	2023-01-14
Test Mode	Mode 1	Test Site	WZ-AC1

Frequency (F_C) (MHz)	20dB Occupied Bandwidth (Hz)
13.56	55

Note:

$F_L = F_C - F_{Lower\ Boundary} = 13.560735\ MHz > 13.110MHz$

$F_H = F_C + F_{Upper\ Boundary} = 13.560790\ MHz < 14.010MHz$

20dB Occupied Bandwidth

A.4 Frequency Stability Tolerance Test Result

Test Engineer	Hunk Li	Test Date	2023-01-16
Test Mode	Mode 1	Test Site	WZ-TR3

Frequency (MHz)	Voltage (%)	Voltage (V_{dc})	Temperature (°C)	Frequency Deviation (Hz)	Tolerance (%)	Limit (%)
13.56	100%	18V	50	720	0.005308	-0.01 ~ +0.01
			40	698	0.005150	-0.01 ~ +0.01
			30	657	0.004846	-0.01 ~ +0.01
			20	476	0.003511	-0.01 ~ +0.01
			10	824	0.006074	-0.01 ~ +0.01
			0	922	0.006797	-0.01 ~ +0.01
			-10	818	0.006029	-0.01 ~ +0.01
			-20	859	0.006333	-0.01 ~ +0.01
	85%	15.3V	20	113	0.000831	-0.01 ~ +0.01
	115%	20.7V	20	1068	0.007873	-0.01 ~ +0.01

Note: Tolerance = Frequency Deviation (Hz) / Frequency (Hz) * 100%

A.5 AC Conducted Emissions Test Result

This device is powered by external DC source, so the item is not applicable.

Appendix B - Test Setup Photograph

Refer to “ 2301RSU007-UT” file.

Appendix C - EUT Photograph

Refer to “ 2301RSU007-UE” file.

The End