



MEASUREMENT REPORT

FCC PART 15.225 / NFC

FCC ID: 2ATJC-95560ANFC

Applicant: Aptiv Electrical Centers (Shanghai) Co.,Ltd

Application Type: Certification

Product: WIRELESS CHARGER

Model No.: Wireless Charging With NFC

Brand Name: Aptiv

FCC Classification: Part 15 Low Power Communication Device Transmitter (DXX)

FCC Rule Part(s): Part 15 Subpart C (Section 15.225)

Test Procedure(s): ANSI C63.10-2013

Test Date: October 17 ~ December 31, 2021

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. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2109RSU066-U3	Rev. 01	Initial Report	01-29-2022	Valid

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1. GENERAL INFORMATION

1.1. Applicant

Aptiv Electrical Centers (Shanghai) Co.,Ltd

Zone A, Building 7, No.60, Yuanguo Road, Anting Town, Jiading District, Shanghai, China

1.2. Manufacturer

Aptiv Electrical Centers (Shanghai) Co.,Ltd

Zone A, Building 7, No.60, Yuanguo Road, Anting Town, Jiading District, Shanghai, China

1.3. Testing Facility

<input checked="" type="checkbox"/>	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:	<input type="checkbox"/> R-20025	<input type="checkbox"/> G-20034	<input type="checkbox"/> C-20020	<input type="checkbox"/> T-20020	
	<input type="checkbox"/> R-20141	<input type="checkbox"/> G-20134	<input type="checkbox"/> C-20103	<input type="checkbox"/> T-20104	
<input type="checkbox"/>	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		
<input type="checkbox"/>	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	WIRELESS CHARGER
Model No.	Wireless Charging With NFC
Brand Name	Aptiv
Test Device S/N	A003135528-001
Wireless Charging Specification	127.7kHz
NFC Specification	13.56MHz
Power Type	DC 12V
Remark: 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

Frequency Range	13.56MHz
Channel Number	1
Type of modulation	ASK
Antenna Type	Loop Antenna

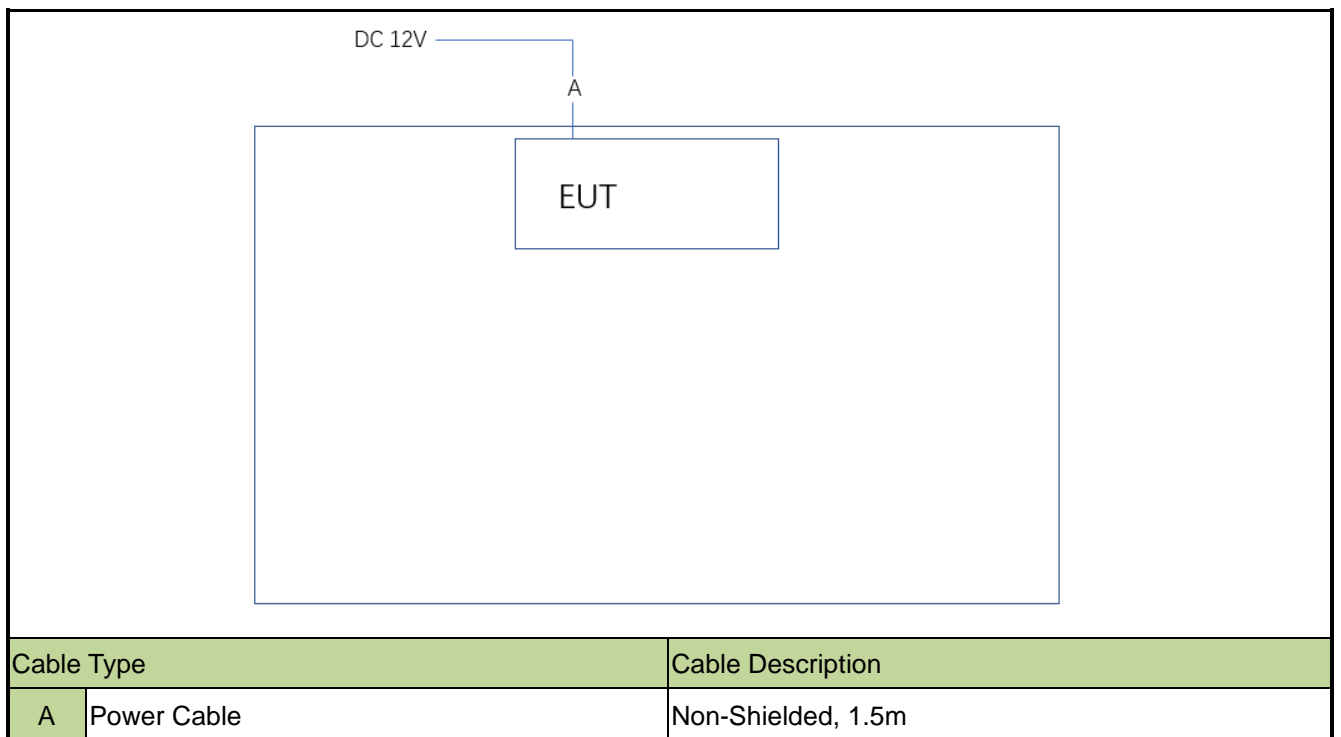
2. TEST FIGURATION

2.1. Test Mode

Test Mode
Mode 1: Transmit by NFC

2.2. Test System Connection Diagram

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.



2.3. 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 the unit is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. TEST EQUIPMENT CALIBRATION DATE

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2022/01/04	WZ-AC1
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2022/06/24	WZ-AC1
EXA Signal Analyzer	Keysight	N9020A	MRTSUE06106	1 year	2022/04/13	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2022/10/28	WZ-AC1
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2022/08/05	WZ-AC1
Thermal Hygrometer	testo	608-H1	MRTSUE06403	1 year	2022/06/28	WZ-AC1
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2022/04/29	WZ-AC1
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2022/04/13	WZ-TR3
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2022/01/07	WZ-TR3
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2022/04/13	WZ-TR3
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A	WZ-TR3
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2022/10/10	WZ-TR3
Thermal Hygrometer	testo	608-H1	MRTSUE06401	1 year	2022/06/28	WZ-TR3

Software	Version	Function
EMI Software	V3	EMI Test Software

5. 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: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 9kHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 9kHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.13dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 0.28%

6. TEST RESULT

6.1. Summary

FCC Part Section(s)	Test Description	Test Condition	Test Result
15.225 (a), (b), (c)	In-Band Emission	Radiated	Pass
15.225(d)	Out-Band Emission		Pass
2.1049	20dB Bandwidth		Pass
15.225(e)	Frequency Stability Tolerance		Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	N/A

Notes:

- 1) All modes of operation and data rates were investigated. 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) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

6.2. In-band Emission

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
<p>Note 1: The lower limit shall apply at the transition frequency.</p> <p>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.</p> <p>Note 3: E field strength (dBμV/m) = 20 log E field strength (μV/m)</p>		

6.2.2. Test Procedure Used

ANSI C63.10-2013 - Section 6.3

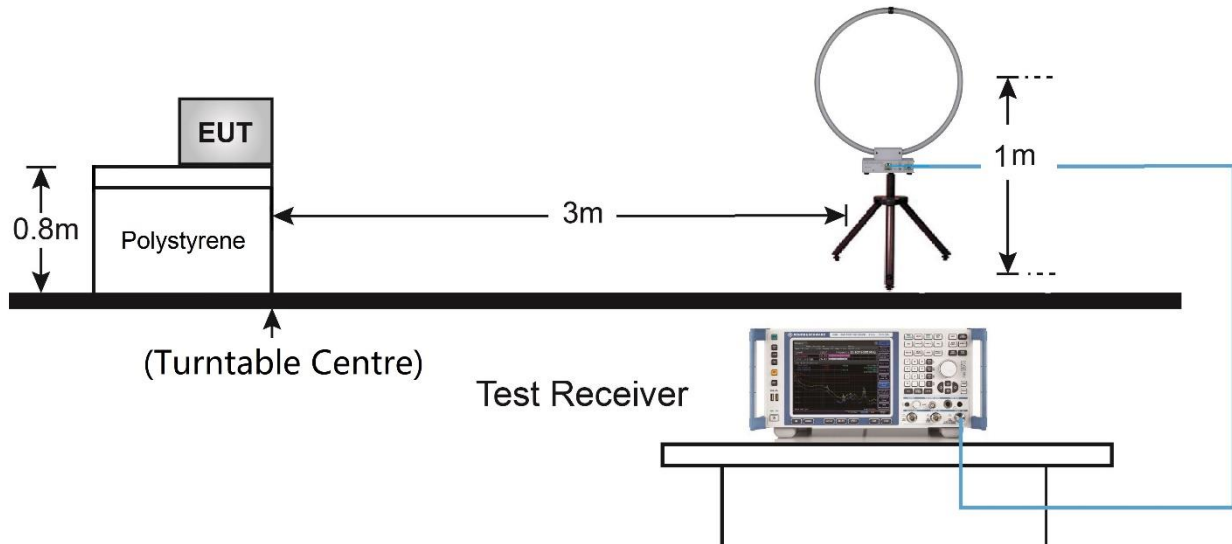
ANSI C63.10-2013 - Section 6.4

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

Test Engineer	Tommy Tang	Test Date	2021/10/31
Test Mode	Mode1	Test Site	WZ-AC1

Frequency (MHz)	Reading Level (dBμV/m)	Factor (dB)	Measure Level (dBμV/m)	Limit (@3m) (dBμV/m)	Margin (dB)
Face On					
13.349	25.2	17.0	42.2	80.5	-38.3
13.482	27.0	17.0	44.0	90.5	-46.5
13.56	48.5	17.0	65.5	124.0	-58.5
13.639	28.5	17.0	45.5	90.5	-45.0
13.774	28.1	17.0	45.1	80.5	-35.4
Face Off					
13.349	26.6	17.0	43.6	80.5	-36.9
13.481	28.6	17.0	45.6	90.5	-44.9
13.561	50.0	17.0	67.0	124.0	-57.0
13.642	29.0	17.0	46.0	90.5	-44.5
13.771	27.9	17.0	44.9	80.5	-35.6

Note 1: 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 = $20 \cdot \log(30/3)^2 = 40$ dB

For example, Limit (@3m) = $20 \cdot \log(106) + 40 = 80.5$ dBμV/m

Note 2: All measurements were recorded using an EMI test receiver employing a peak detector.

Note 3: Measure Level (dBμV/m) = Reading Level (dBμV/m) + Factor (dB)

6.3. Out-band Emission

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 Used

ANSI C63.10-2013 - Section 6.3

ANSI C63.10-2013 - Section 6.4

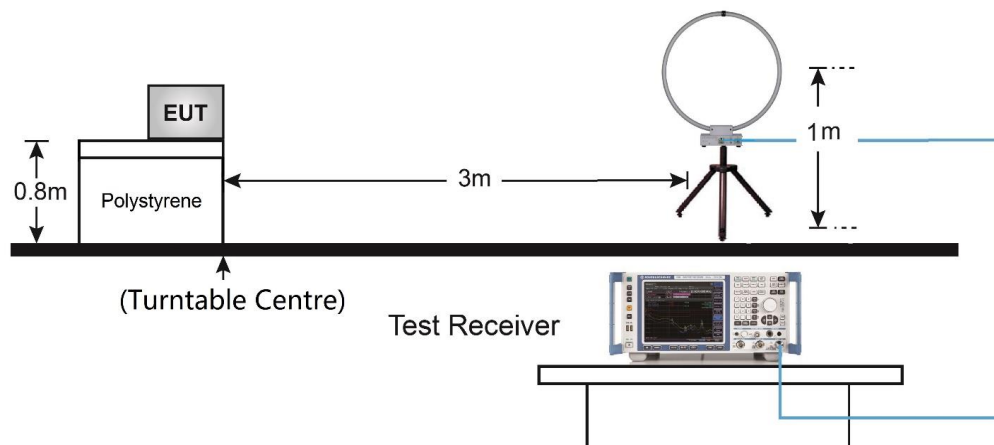
ANSI C63.10-2013 - Section 6.5

6.3.3. Test Setting

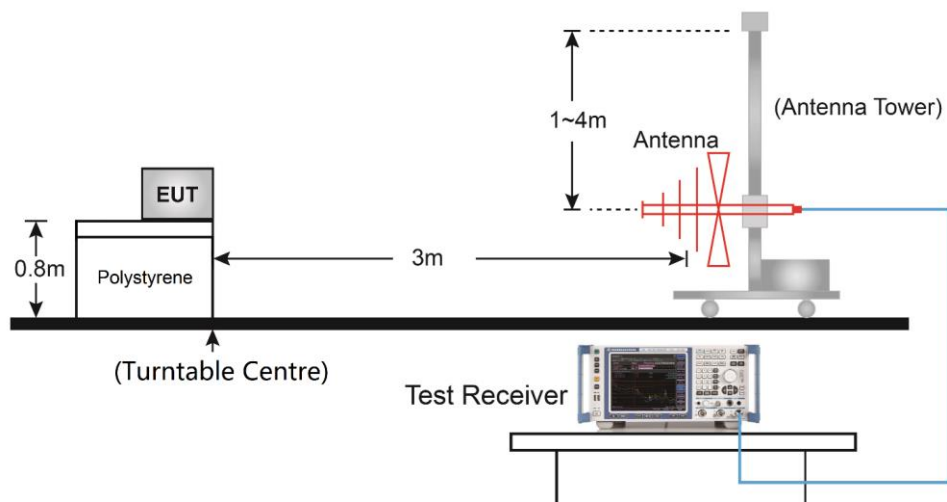
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 9kHz for emission below 30MHz and 100kHz for emission between 30MHz and 1GHz
3. VBW = 3 * RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize

6.3.4. Test Setup

9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



6.3.5. Test Result

Test Engineer	Tommy Tang	Test Date	2021/10/31
Test Mode	Mode1	Test Site	WZ-AC1

Out-Band Emission Below 30MHz						
Frequency (MHz)	Reading Level (dBμV/m)	Factor (dB)	Measure Level (dBμV/m)	Limit (@3m) (dBμV/m)	Margin (dB)	Detector
Face On						
0.598	35.6	17.4	53.0	72.1	-19.1	Peak
Face Off						
0.598	34.1	17.4	51.5	72.1	-20.6	Peak

Out-Band Emission Above 30MHz							
Polarization	Frequency (MHz)	Reading Level (dBμV/m)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
H	40.67	10.6	17.8	28.4	40.0	-11.6	Peak
H	47.46	7.6	18.8	26.4	40.0	-13.6	Peak
H	149.795	7.1	18.1	25.2	43.5	-18.3	Peak
H	214.3	9.1	14.4	23.5	43.5	-20.0	Peak
H	266.68	6.4	17.0	23.4	46.0	-22.6	Peak
H	617.335	2.0	26.0	28.0	46.0	-18.0	Peak
V	40.67	17.0	17.8	34.8	40.0	-5.2	Peak
V	49.885	17.4	18.6	36.0	40.0	-4.0	Peak
V	60.07	10.5	17.7	28.2	40.0	-11.8	Peak
V	113.42	10.5	14.7	25.2	43.5	-18.3	Peak
V	147.855	6.7	18.0	24.7	43.5	-18.8	Peak
V	527.61	2.6	23.7	26.3	46.0	-19.7	Peak

Note 1: 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 = $40 \times \log(30/3) = 40$ dB

For example, Limit (@3m) = $20 \times \log(30) + 40 = 69.54$ dBμV/m

Note 2: All measurements were recorded using an EMI test receiver employing a peak detector.

Note 3: Measure Level (dBμV/m) = Reading Level (dBμV/m) + Factor (dB)

6.4. 20dB Spectrum Bandwidth Measurement

6.4.1. Test Limit

N/A

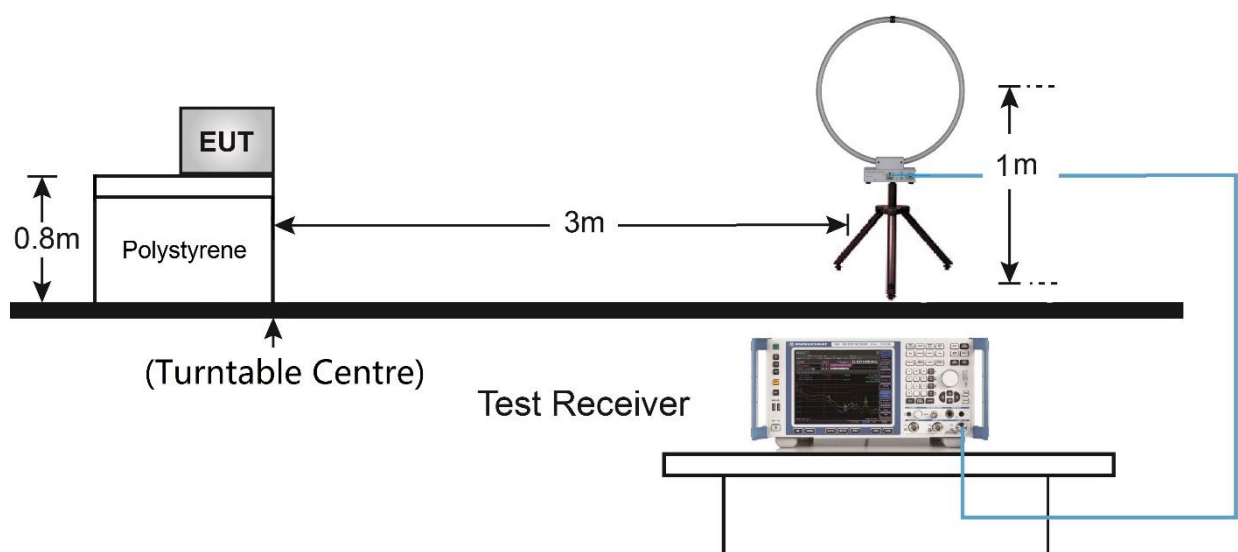
6.4.2. Test Procedure Used

ANSI C63.10-2013 - Section 6.9.2

6.4.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 20dB bandwidth measurement. The "X" dB bandwidth parameter was set to $X = 20$. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set the spectrum span range to overlap the nominal center frequency
3. Set RBW = 1% ~ 5% of the OBW
4. $VBW \geq 3 \times RBW$
5. Detector = Peak
6. Trace mode = max hold
7. Sweep = auto couple
8. Allow the trace to stabilize.

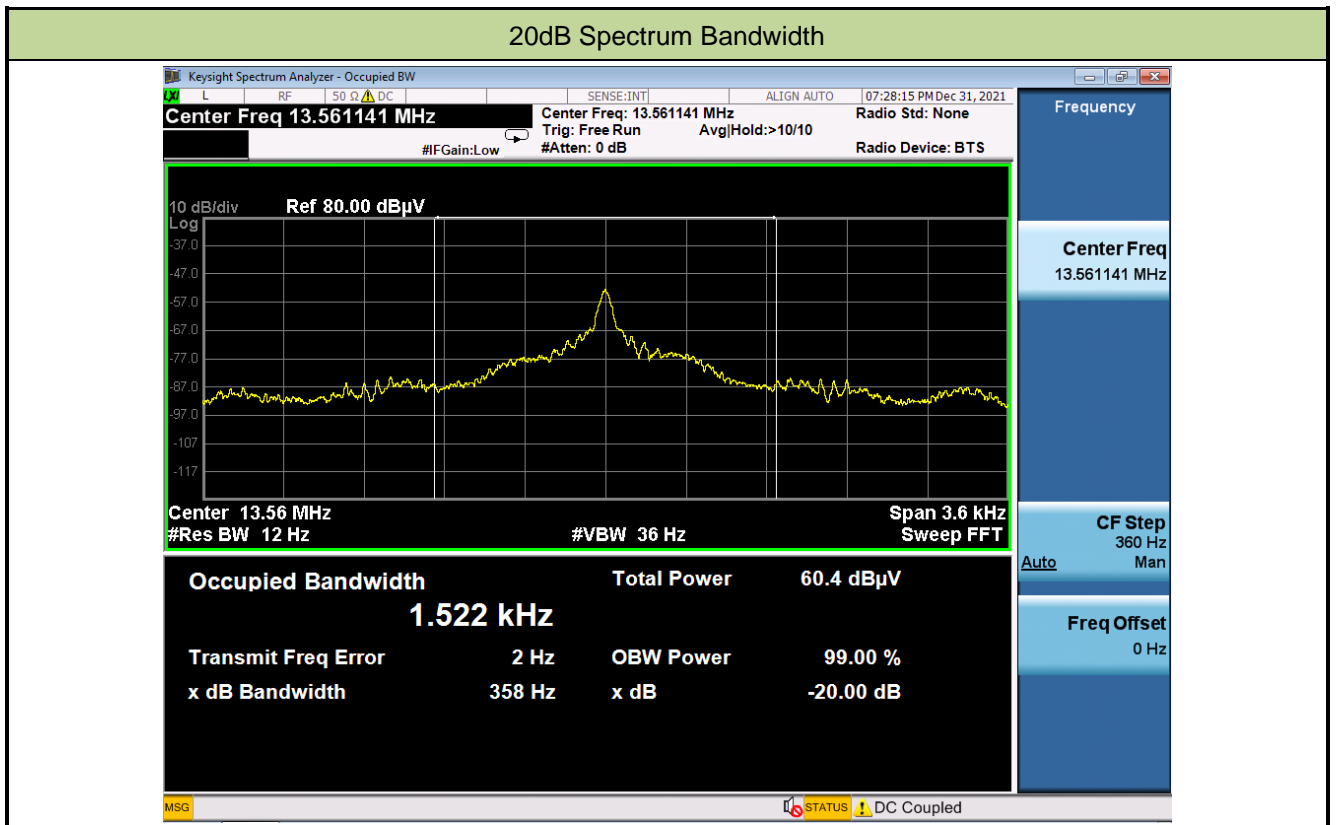
6.4.4. Test Setup



6.4.5. Test Result

Test Engineer	Tommy Tang	Test Date	2021/10/31
Test Mode	Mode1	Test Site	WZ-AC1

Frequency (MHz)	20dB Occupied Bandwidth (Hz)
13.56	358



6.5. Frequency Tolerance

6.5.1. Test Limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency.

6.5.2. Test Procedure Used

ANSI C63.10-2013 - Section 6.8

6.5.3. Test Setting

Frequency Stability Under Temperature Variations:

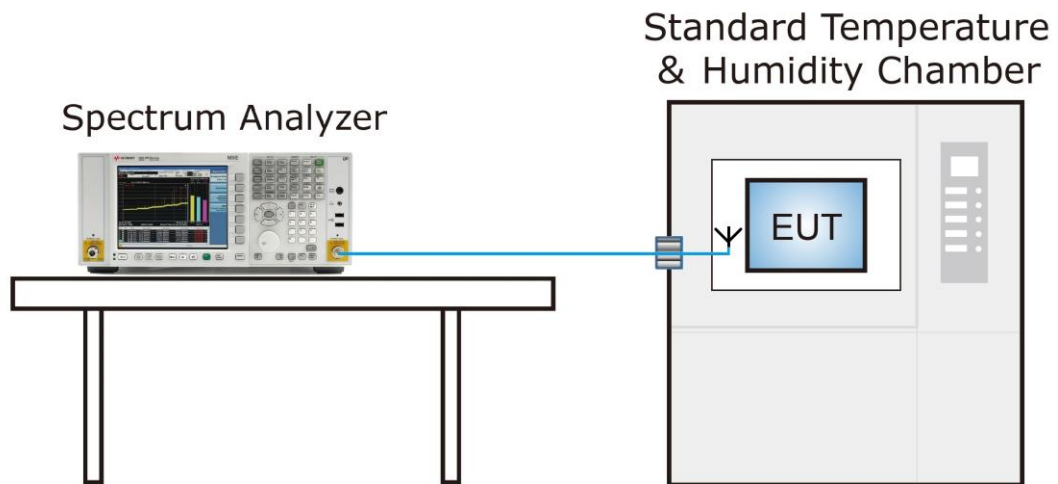
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C 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°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. 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 ($\pm 15\%$) 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

Test Engineer	Tommy Tang	Test Date	2021/10/17
Test Mode	Mode1	Test Site	WZ-TR3

Reference Voltage: 12Vdc						
Deviation Limit: $\pm 0.01\%$ * Operating frequency = $\pm 1356\text{Hz}$						
Voltage (%)	Voltage (VDC)	Temp (°C)	Freq. (Hz)	Freq. Dev. (Hz)	Limit (Hz)	Result
100	12	-20	13560994	994	-1356 ~ +1356	Pass
		-10	13560132	132	-1356 ~ +1356	Pass
		0	13560324	324	-1356 ~ +1356	Pass
		+10	13560306	306	-1356 ~ +1356	Pass
		+20	13560337	337	-1356 ~ +1356	Pass
		+30	13560140	140	-1356 ~ +1356	Pass
		+40	13560276	276	-1356 ~ +1356	Pass
		+50	13560336	336	-1356 ~ +1356	Pass
85%	10.2	+ 20	13560364	364	-1356 ~ +1356	Pass
115%	13.8	+ 20	13560375	375	-1356 ~ +1356	Pass
Note: Frequency Deviation = Frequency – Operating Frequency						

6.6. AC Conducted Emissions Measurement

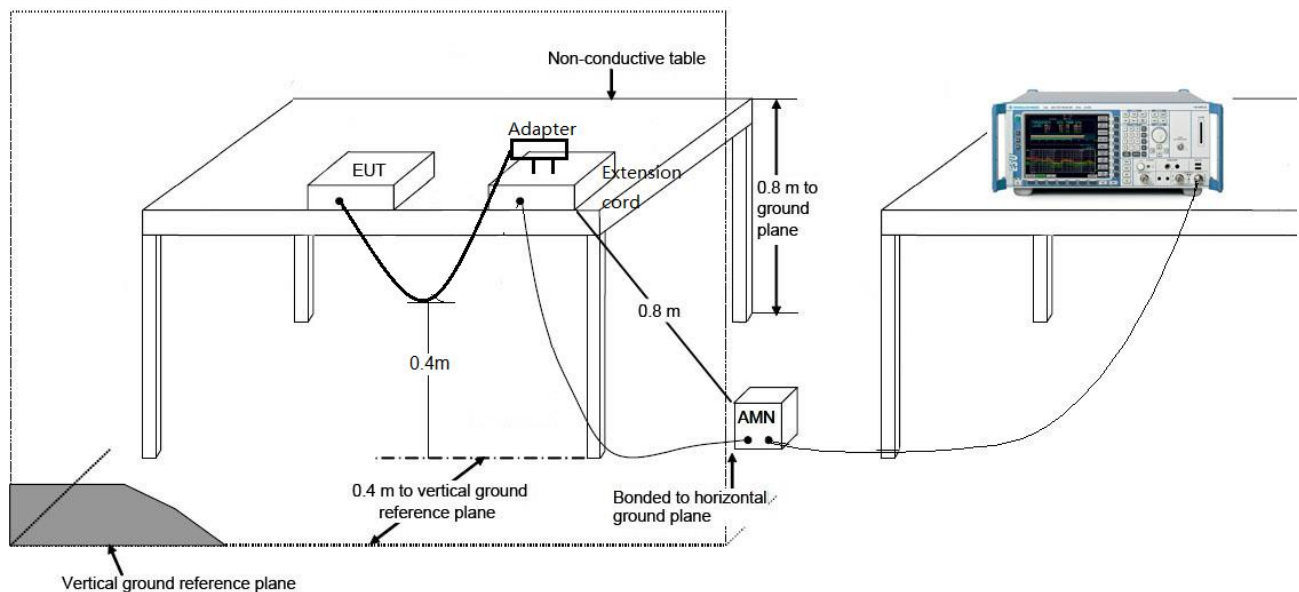
6.6.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
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

The EUT is powered by external DC 12V, so the item is not applicable.

7. CONCLUSION

The data collected relate only the item(s) tested and show that the device is compliance with Part 15C of the FCC Rules.

The End

Appendix A - Test Setup Photograph

Refer to "2109RSU066-UT" file.

Appendix B - EUT Photograph

Refer to "2109RSU066-UE" file.