



MEASUREMENT REPORT

FCC PART 15.209

FCC ID: 2ATJC-95560

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

Application Type: Certification

Product: Wireless Charging

Model No.: Wireless Charging without NFC

FCC Classification: Part 15 Low Power Transmitter Below 1705 kHz (DCD)

FCC Rule Part(s): Part15 Subpart C (Section 15.209)

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

Test Date: June 13 ~ July 05, 2019

Reviewed By: Kevin Guo
(Kevin Guo)

Approved By: Robin Wu
(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.

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
1904WSU019-U1	Rev. 01	Initial Report	08-09-2019	Valid

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§2.1033 General Information

Applicant:	Aptiv Electrical Centers (Shanghai) Co.,Ltd
Applicant Address:	Zone A, Building 7, No.60, Yuanguo Road, Anting Town, Jiading District, Shanghai, China
Manufacturer:	Aptiv Electrical Centers (Shanghai) Co.,Ltd
Manufacturer Address:	Zone A, Building 7, No.60, Yuanguo Road, Anting Town, Jiading District, Shanghai, China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	Wireless Charging
Model No.:	Wireless Charging without NFC
Working Center Frequency:	120KHz for android 127.7KHz for IOS
Modulation Type:	FSK
Working Voltage:	DC 12V

2.2. Test Mode

Test Mode	Transmit at 120KHz
	Transmit at 127.7KHz

2.3. Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013, which is used as the reference of appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.4. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.5. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and were used in the measurement.

Deviation from measurement procedure.....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the Antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable. For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive Antenna height using a broadband Antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn Antennas were used. For frequencies below 30MHz, a calibrated loop Antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband Antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive Antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn Antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive Antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive Antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn Antenna, the horn Antenna should be always directed to the EUT when rising height.

4. 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 **Wireless Charging** is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2020/04/15
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2020/06/13
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2020/06/13
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2019/08/14
Shielding Chamber	MIX-BEP	Chamber-SR2	MRTSUE06215	N/A	N/A

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2019/08/13
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2019/09/25
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/09
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2020/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2019/10/19
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2019/11/16
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2019/08/14
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06213	1 year	2020/04/30

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2019/08/13
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/09
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2019/10/19
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2019/11/09
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2019/11/16
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2019/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2020/04/30

Software	Version	Function
EMI Software	V3	EMI Test Software

6. 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 - SR2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~150kHz: 3.84dB 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 30MHz~300MHz: 4.07dB 300MHz~1GHz: 3.63dB 1GHz~18GHz: 4.16dB Vertical: 30MHz~300MHz: 4.18dB 300MHz~1GHz: 3.60dB 1GHz~18GHz: 4.76dB
Radiated Emission Measurement - AC2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 30MHz~300MHz: 3.75dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.28dB Vertical: 30MHz~300MHz: 3.86dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.33dB

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	N/A	Section 7.2
15.209	General Field Strength Limits	FCC Part 15.209 limits	Radiated	Pass	Section 7.3
15.215(c)	20dB Spectrum Bandwidth	20 dB bandwidth of the emission in the specific band		Pass	Section 7.4

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) "N/A" means that the test item is not applicable, and the detailed information refers to relevant section.

7.2. Conducted Emission

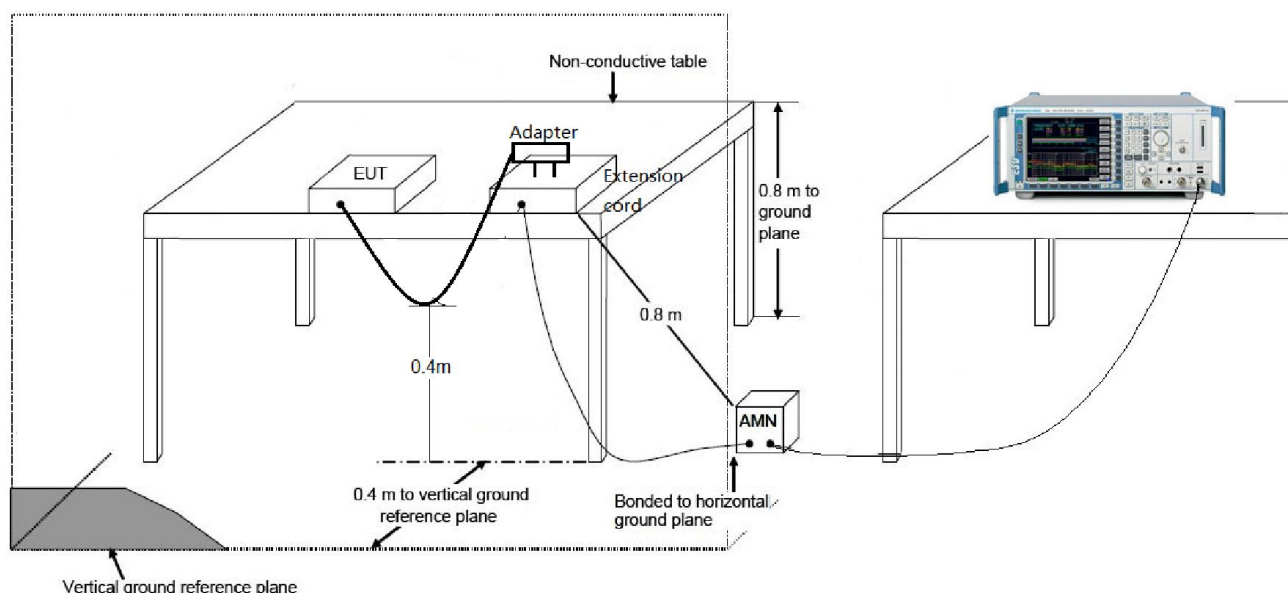
7.2.1. Test Limit

FCC 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
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.

7.2.2. Test Setup



7.2.3. Test Result

The EUT is powered by DC, so this requirement does not apply.

7.3. General Radiated Emission

7.3.1. Test Limit

FCC Part 15.209 Limit		
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 80	100	3
80 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

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 (dBuV/m) = 20 log E field strength (uV/m).

7.3.2. Test Procedure Used

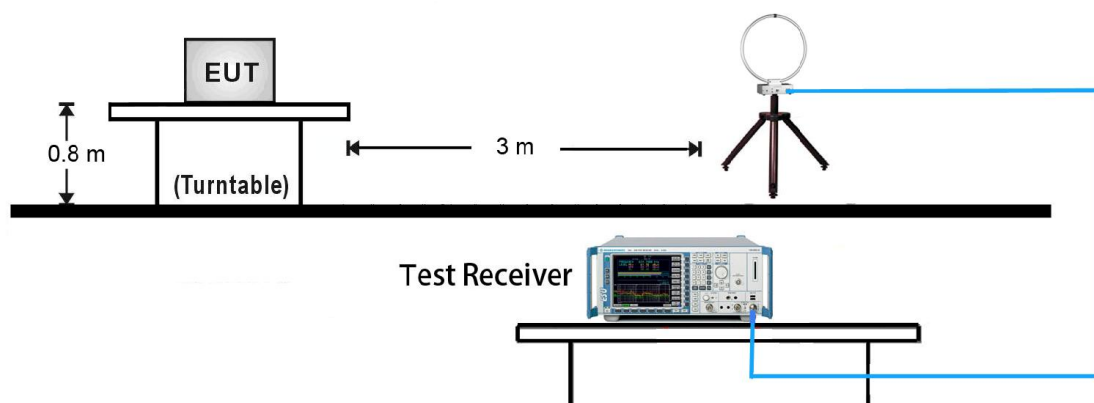
ANSI C63.10 - Section 6.3 (General Requirements)

ANSI C63.10 - Section 6.4 (Standard test method below 30MHz)

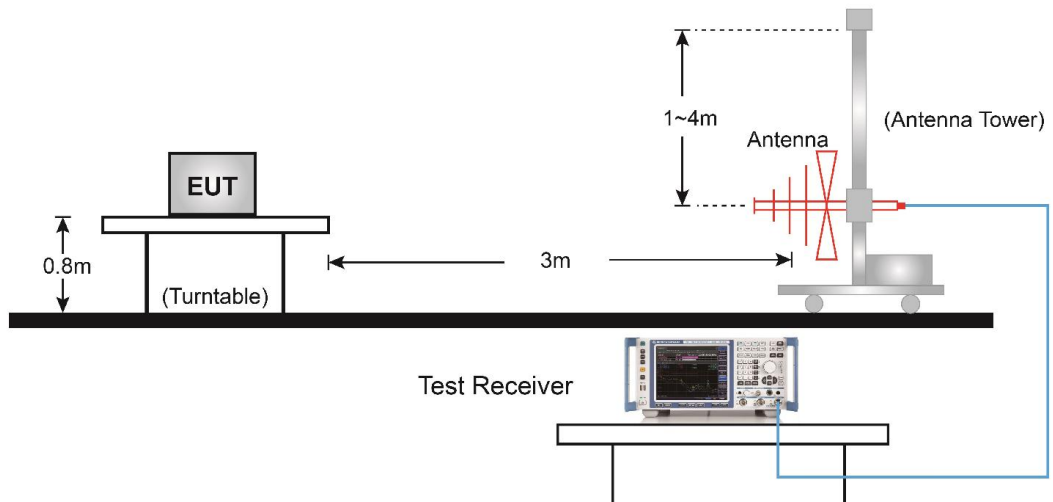
ANSI C63.10 - Section 6.5 (Standard test method above 30MHz to 1GHz)

7.3.3. Test Setup

Below 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



7.3.4. Test Result

Product	Wireless Charging	Temperature	25°C
Test Engineer	Cloud Guo	Relative Humidity	52%
Test Site	AC2	Test Date	2019/06/13
Test Mode	Mode 1		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Fundamental Radiated Emission							
0.120	62.966	20.188	83.154	106.021	-22.867	Peak	Face On
0.120	57.824	20.188	78.012	106.021	-28.009	Peak	Face Off
Radiated Spurious Emission							
0.020	32.778	21.269	54.047	121.584	-67.537	Peak	Face On
0.359	28.771	20.284	49.055	96.502	-47.447	Peak	Face On
2.374	27.570	20.421	47.991	69.542	-21.551	Peak	Face On
0.020	30.246	21.269	51.515	121.584	-70.069	Peak	Face Off
0.210	27.239	20.240	47.479	101.160	-53.681	Peak	Face Off
2.344	27.326	20.415	47.741	69.542	-21.801	Peak	Face Off
73.165	13.682	11.201	24.883	40	-15.117	QP	Horizontal
146.885	4.128	15.176	19.304	43.5	-24.196	QP	Horizontal
186.655	6.984	12.245	19.229	43.5	-24.271	QP	Horizontal
300.630	15.238	14.551	29.790	46	-16.210	QP	Horizontal
328.375	15.408	15.290	30.698	46	-15.302	QP	Horizontal
420.425	8.629	17.301	25.930	46	-20.070	QP	Horizontal
53.765	15.865	13.982	29.847	40	-10.153	QP	Vertical
73.165	16.511	11.201	27.712	40	-12.288	QP	Vertical
124.090	15.584	13.585	29.170	43.5	-14.330	QP	Vertical
153.190	8.767	15.401	24.168	43.5	-19.332	QP	Vertical
204.115	9.001	11.404	20.405	46	-25.595	QP	Vertical
298.690	8.082	14.496	22.578	46	-23.422	QP	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)							
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)							

Product	Wireless Charging	Temperature	24°C
Test Engineer	Messiah Li	Relative Humidity	56%
Test Site	AC2	Test Date	2019/07/05
Test Mode	Mode 2		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Fundamental Radiated Emission							
0.128	59.384	20.188	79.572	105.460	-25.888	Peak	Face On
0.128	55.253	20.188	75.441	105.460	-30.019	Peak	Face Off
Radiated Spurious Emission							
0.019	33.195	21.294	54.489	122.029	-67.540	Peak	Face On
0.374	23.728	20.284	44.012	96.147	-52.135	Peak	Face On
1.657	23.170	20.435	43.605	69.542	-25.937	Peak	Face On
0.040	21.039	20.780	41.819	115.563	-73.744	Peak	Face Off
0.374	21.744	20.284	42.028	96.147	-54.119	Peak	Face Off
1.822	19.483	20.411	39.894	69.542	-29.648	Peak	Face Off
46.050	11.360	18.269	29.629	40	-10.371	QP	Horizontal
57.140	10.240	18.022	28.262	40	-11.738	QP	Horizontal
63.950	8.250	18.022	26.272	40	-13.728	QP	Horizontal
86.540	7.420	18.022	25.442	40	-14.558	QP	Horizontal
298.650	16.350	18.022	34.372	46	-11.628	QP	Horizontal
334.560	15.240	18.022	33.262	46	-12.738	QP	Horizontal
38.250	16.450	19.086	35.536	40	-4.464	QP	Vertical
50.860	12.680	18.022	30.702	40	-9.298	QP	Vertical
61.040	11.820	18.022	29.842	40	-10.158	QP	Vertical
92.540	13.450	18.022	31.472	43.5	-12.028	QP	Vertical
145.650	10.360	18.022	28.382	43.5	-15.118	QP	Vertical
166.350	11.260	18.022	29.282	43.5	-14.218	QP	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)							
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)							

7.4. 20dB Spectrum Bandwidth Measurement

7.4.1. Test Limit

N/A

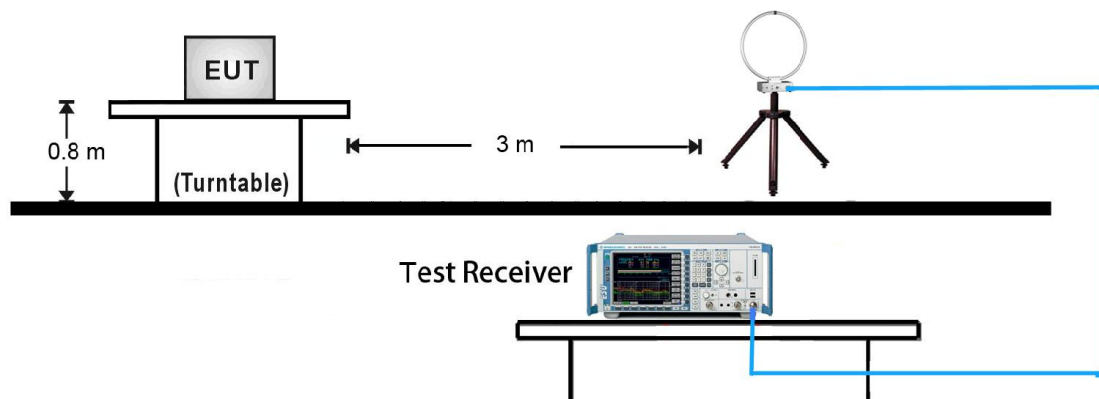
7.4.2. Test Procedure Used

ANSI C63.10 Clause 6.9.2

7.4.3. Test Setting

1. Set the spectrum span range to overlap the nominal center frequency
2. Set RBW = 100 kHz
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize and marker the highest level.
8. Determine the display level (the highest level - 20dB) and place two markers, one at the lowest frequency and the other at the highest frequency.

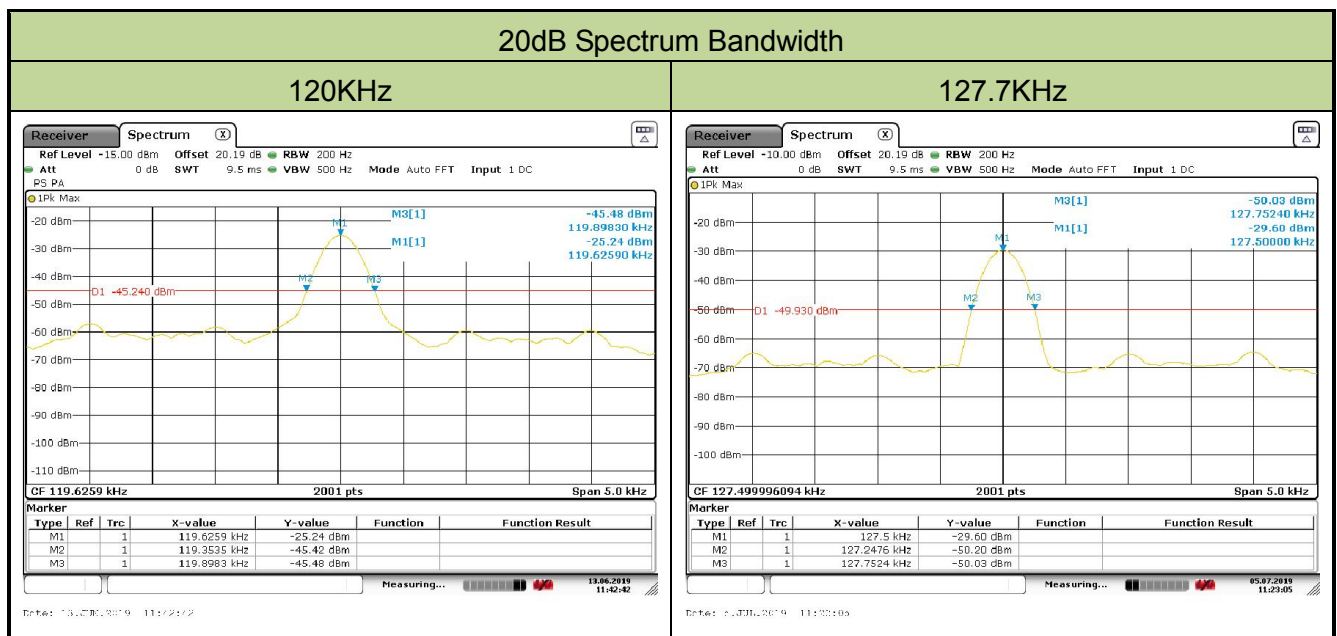
7.4.4. Test Setup



7.4.5. Test Result

Product	Wireless Charging	Temperature	24°C
Test Engineer	Messiah Li	Relative Humidity	56%
Test Site	AC2	Test Date	2019/06/13 ~ 2019/07/05

Test Mode	Low Frequency (KHz)	High Frequency (KHz)	20dB Bandwidth (KHz)	Result
Mode 1 (120KHz)	119.3535	119.8983	0.5448	Pass
Mode 2 (127.7KHz)	127.2476	127.7524	0.5048	Pass



8. CONCLUSION

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

The End

Appendix A - Test Setup Photograph

Refer to "1904WSU019-UT" file.

Appendix B - EUT Photograph

Refer to "1904WSU019-UE" file.