



MEASUREMENT REPORT

FCC PART 15.209

FCC ID: 2ATJC-95560NFC
APPLICANT: Aptiv Electrical Centers (Shanghai) Co.,Ltd
Application Type: Certification
Product: Wireless Charging
Model No.: Wireless Charging with NFC
Band name: Aptiv
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: March 01~02, 2020

Reviewed By:

oscar shi

(Oscar Shi)

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
2001WSU016-U1	Rev. 01	Initial Report	03-16-2020	Valid

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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 Device Serial No.:	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

Test Facility / Accreditations

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

- MRT facility is a FCC accredited (MRT Designation No. CN1166) 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 Innovation, Science and Economic Development Canada and 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 with NFC
Working Center Frequency:	120KHz for android 127.7KHz for IOS 13.56 MHz for NFC
Working Voltage:	DC 12V

2.2. Product Specification Subjective to this Report

Frequency Range:	110~205KHz
Type of Modulation:	FSK

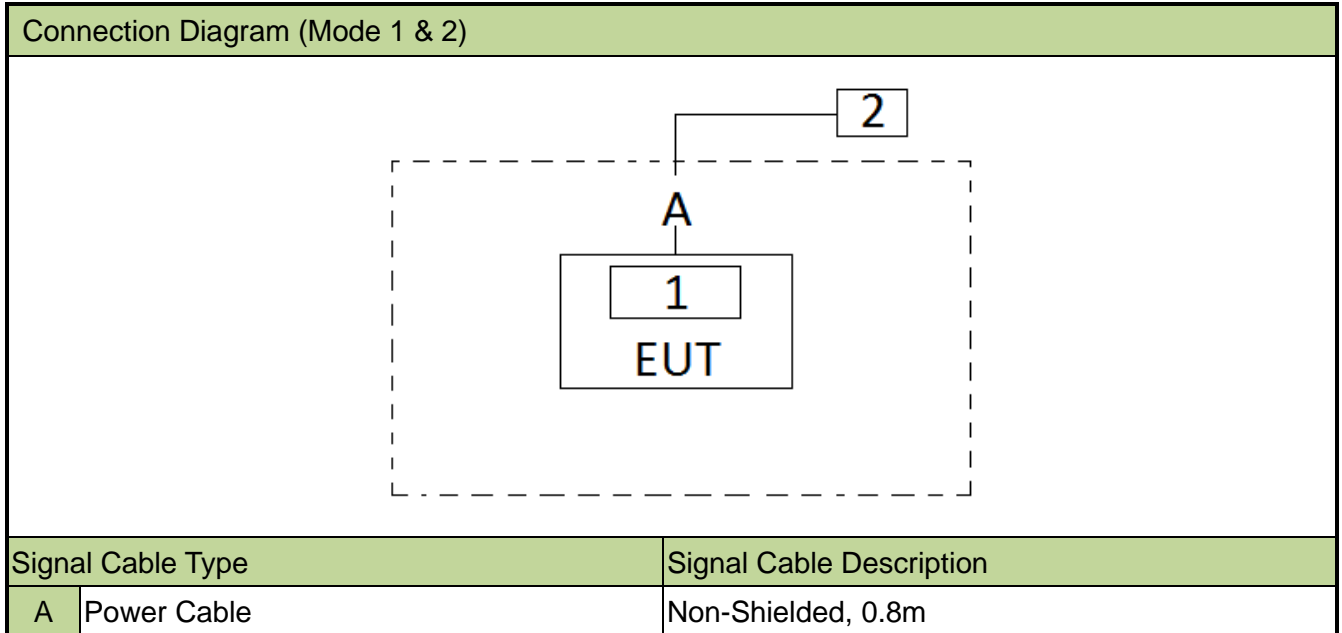
Note: For other features of this EUT, test report will be issued separately.

2.3. Test Mode

Test Mode	Mode 1: Transmit at 120KHz
	Mode 2: Transmit at 127.7KHz

2.4. Configuration of Tested System

The device was tested per the guidance FCC Part 15.209 and ANSI C63.10: 2013 which used to reference the appropriate EUT setup for radiated and AC line conducted testing.



2.5. Test System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	Wireless charging coil Receiver	APTIV	N/A	N/A	N/A
	Mobile Phone	Apple	iphone 11 Pro	N/A	N/A
2	DC Power Supply	GWINSTEK	DPS-3303C	EM913553	N/A

Note: The Wireless charging coil Receiver is provided by the manufacturer which can Simulate android Phone 120KHz charging.

2.6. EMI Suppression Device(s)/Modifications

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

2.7. 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 device 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	2020/08/08
Shielding Room	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	2020/08/01
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2020/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2020/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2020/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2021/02/23
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2020/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	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	2020/08/01
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2020/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2020/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2021/02/23
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2020/12/15
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2020/04/30

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2020/04/15
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2020/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2020/04/15
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2020/11/18
USB wideband power sensor	Keysight	U2021XA	MRTSUE06446	1 year	2020/06/30
USB wideband power sensor	Keysight	U2021XA	MRTSUE06447	1 year	2020/06/30
Bluetooth Test Set	Anritsu	MT8852B-042	MRTSUE06389	1 year	2020/06/13
Audio Analyzer	Agilent	U8903B	MRTSUE06143	1 year	2020/06/13
Modulation Analyzer	HP	8901A	MRTSUE06098	1 year	2020/10/10
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2020/11/07
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2020/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2020/08/08

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

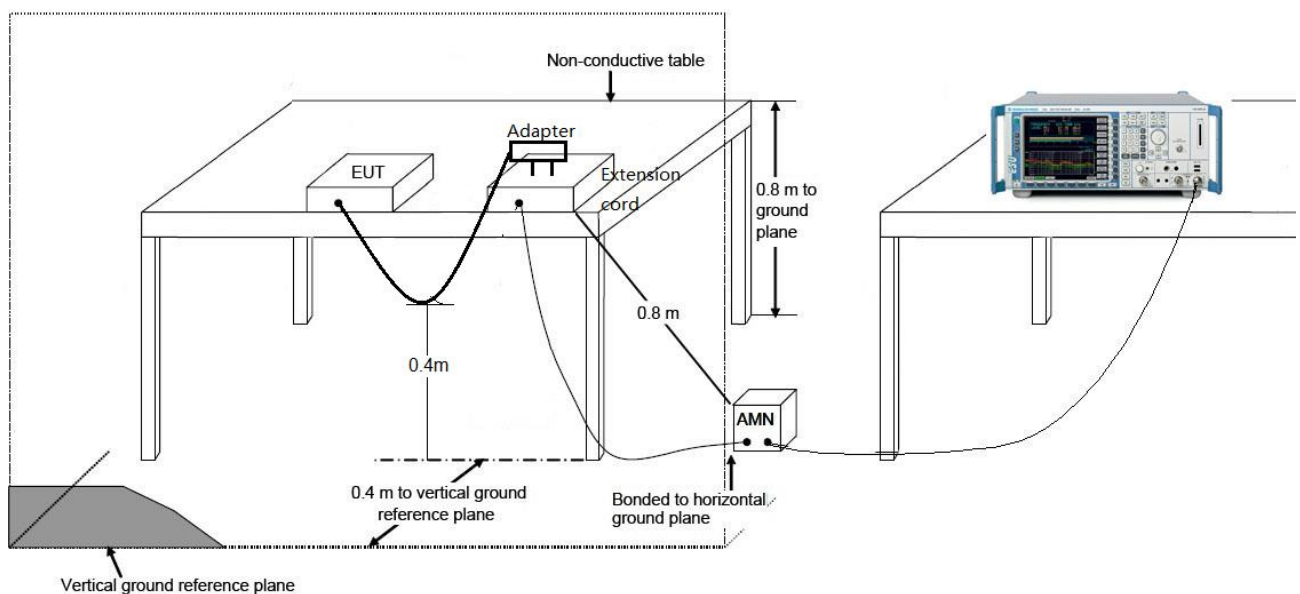
7.2.1. Test Limit

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 item 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

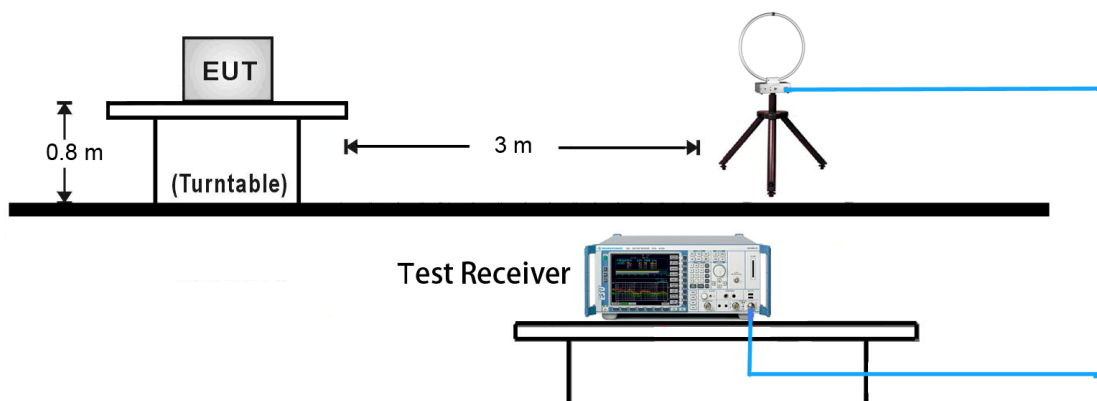
ANSI C63.10 - Section 6.3 (General Requirements)

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

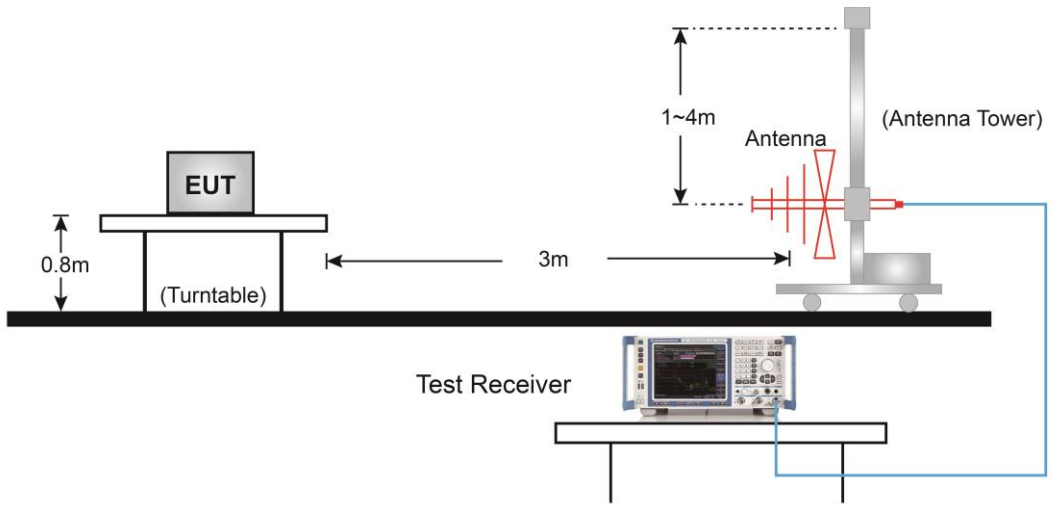
ANSI C63.10 - Section 6.5 (Standard test method above 30MHz to 1GHz)

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	Dillon Diao	Relative Humidity	52%
Test Site	AC1	Test Date	2020/03/01
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	72.123	20.188	92.311	106.021	-13.710	Peak	Face On
0.120	66.900	20.188	87.088	106.021	-18.933	Peak	Face Off
Radiated Spurious Emission							
0.019	39.700	21.294	60.994	122.029	-61.035	Peak	Face On
0.240	34.820	20.251	55.071	100	-44.929	Peak	Face On
1.553	21.300	20.455	41.755	63.781	-22.026	Peak	Face On
0.019	40.200	21.294	61.494	122.029	-60.535	Peak	Face Off
0.240	31.300	20.251	51.551	100	-48.449	Peak	Face Off
0.866	21.270	20.568	41.838	68.854	-27.016	Peak	Face Off
179.865	8.960	12.897	21.857	43.500	-21.643	QP	Horizontal
240.005	15.850	12.830	28.680	46.000	-17.320	QP	Horizontal
303.540	14.380	14.432	28.812	46.000	-17.188	QP	Horizontal
340.885	4.050	15.321	19.371	46.000	-26.629	QP	Horizontal
360.285	8.940	15.716	24.655	46.000	-21.345	QP	Horizontal
420.425	7.860	17.090	24.950	46.000	-21.050	QP	Horizontal
42.610	8.180	14.410	22.591	40.000	-17.409	QP	Vertical
46.975	9.230	14.189	23.418	40.000	-16.582	QP	Vertical
125.060	8.100	13.502	21.602	43.500	-21.898	QP	Vertical
179.865	10.510	12.897	23.407	43.500	-20.093	QP	Vertical
303.540	7.210	14.432	21.642	46.000	-24.358	QP	Vertical
832.190	8.250	23.544	31.794	46.000	-14.206	QP	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB) Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)							

Product	Wireless Charging	Temperature	25°C
Test Engineer	Dillon Diao	Relative Humidity	56%
Test Site	AC1	Test Date	2020/03/01
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							
0.127	60.100	20.188	80.288	105.528	-25.240	Peak	Face On
0.127	49.221	20.188	69.409	105.528	-36.119	Peak	Face Off
Radiated Spurious Emission							
0.019	38.600	21.294	59.894	122.029	-62.135	Peak	Face On
0.866	17.670	20.568	38.238	68.656	-30.418	Peak	Face On
1.911	15.340	20.406	35.745	69.542	-33.797	Peak	Face On
0.024	30.540	21.171	51.711	120.000	-68.289	Peak	Face Off
0.956	19.870	20.552	40.421	67.995	-27.574	Peak	Face Off
3.672	15.930	20.443	36.372	69.542	-33.170	Peak	Face Off
179.865	11.100	12.897	23.997	43.500	-19.503	QP	Horizontal
240.005	15.230	12.830	28.060	46.000	-17.940	QP	Horizontal
305.480	13.870	14.483	28.353	46.000	-17.647	QP	Horizontal
360.285	8.560	15.716	24.275	46.000	-21.725	QP	Horizontal
420.425	7.460	17.090	24.550	46.000	-21.450	QP	Horizontal
827.340	8.520	23.517	32.037	46.000	-13.963	QP	Horizontal
42.610	8.790	14.410	23.201	40.000	-16.799	QP	Vertical
46.005	8.780	14.209	22.989	40.000	-17.011	QP	Vertical
159.980	3.260	15.224	18.484	43.500	-25.016	QP	Vertical
179.865	10.320	12.897	23.217	43.500	-20.283	QP	Vertical
240.005	6.720	12.830	19.550	46.000	-26.450	QP	Vertical
303.540	8.860	14.432	23.292	46.000	-22.708	QP	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB) Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)							

7.4. 20dB Spectrum Bandwidth Measurement

7.4.1. Test Limit

N/A

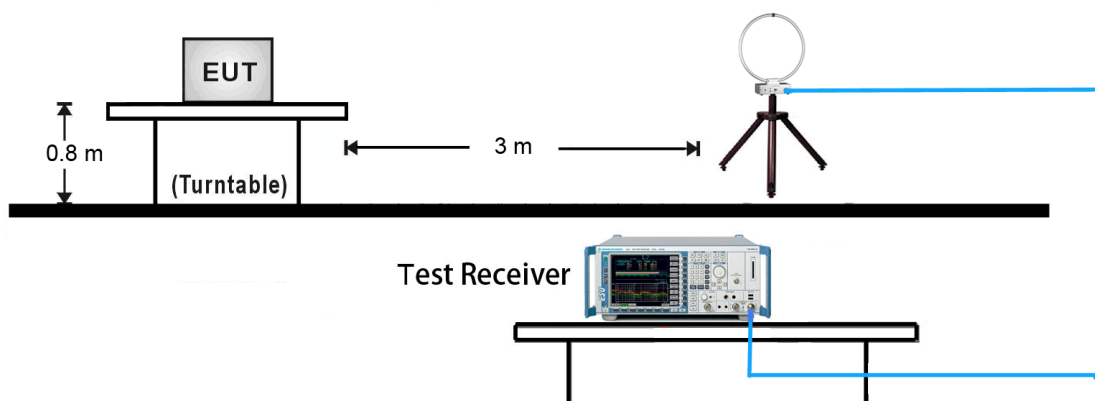
7.4.2. Test Procedure Used

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 = 1% to 5% OBW
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.

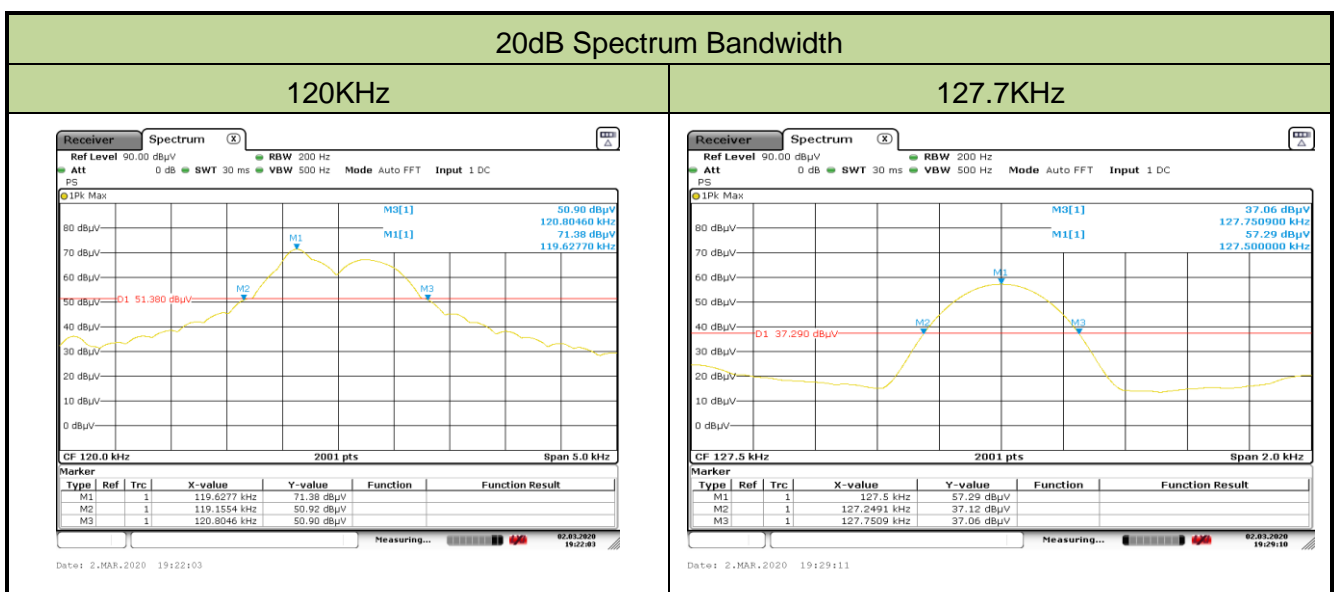
7.4.4. Test Setup



7.4.5. Test Result

Product	Wireless Charging	Temperature	25 °C
Test Engineer	Snake Ni	Relative Humidity	56%
Test Site	AC1	Test Date	2020/03/02

Test Mode	Low Frequency (KHz)	High Frequency (KHz)	20dB Bandwidth (KHz)	Result
Mode 1 (120KHz)	119.1554	120.8046	1.6492	Pass
Mode 2 (127.7KHz)	127.2491	127.7509	0.5018	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 "2001WSU016-UT" file.

Appendix B - EUT Photograph

Refer to "2001WSU016-UE" file.