MEASUREMENT REPORT

FCC Part 15 Subpart B / ICES-003

Applicant:	Aptiv Electrical Centers (Shanghai) Co.,Ltd
Address:	Zone A, Building 7, No.60, Yuanguo Road, Anting Town, Jiading District, Shanghai, China
Model No.:	Wireless Charging with NFC
Product:	Wireless Charging
Brand Name:	Aptiv
FCC Rule Part(s):	FCC Part 15 Subpart B: 2020
IC Rule Part(s):	ICES-003 Issue 6 Class B
Test Procedure(s):	ANSI C63.4: 2014
Result:	Complies
Test Date:	February 28~March 10, 2020

Reviewed By: oscar shi
(Oscar Shi)

Approved By: Robin Wu
(Robin Wu)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

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 C63.4-2014. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
2001WSU016-U3	Rev. 01	Initial Report	03-16-2020	Valid

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Description Page

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 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.**

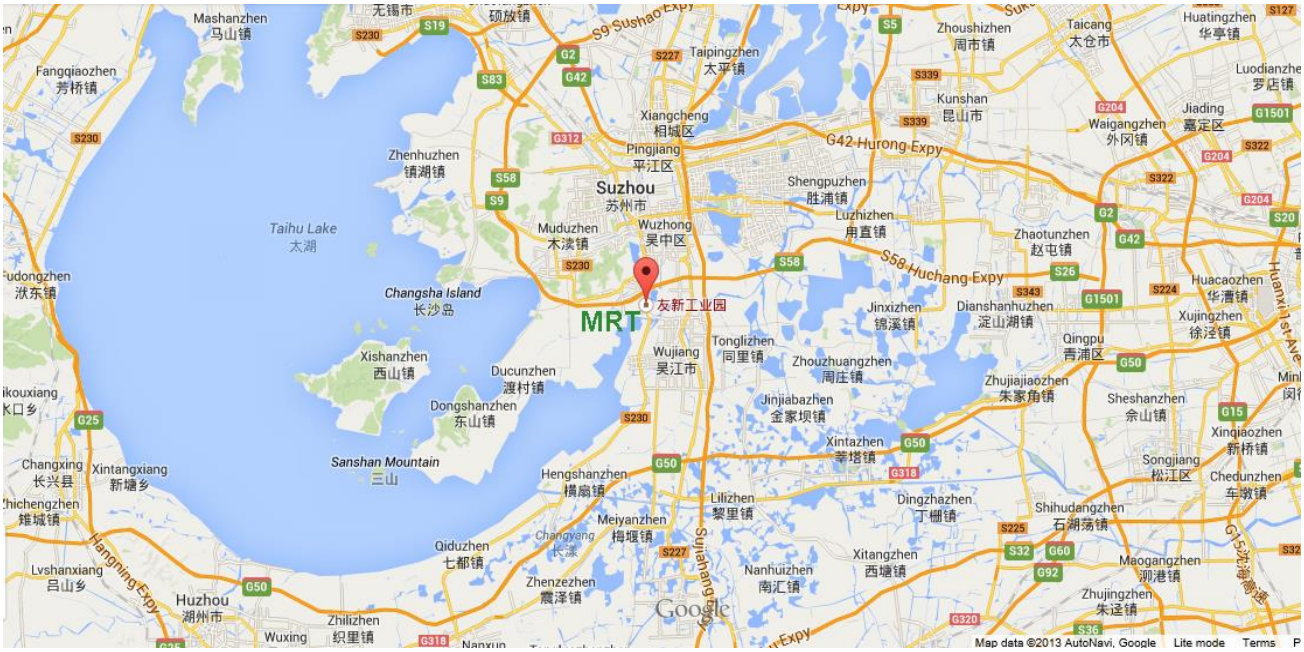
1. INTRODUCTION

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. Equipment Description

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

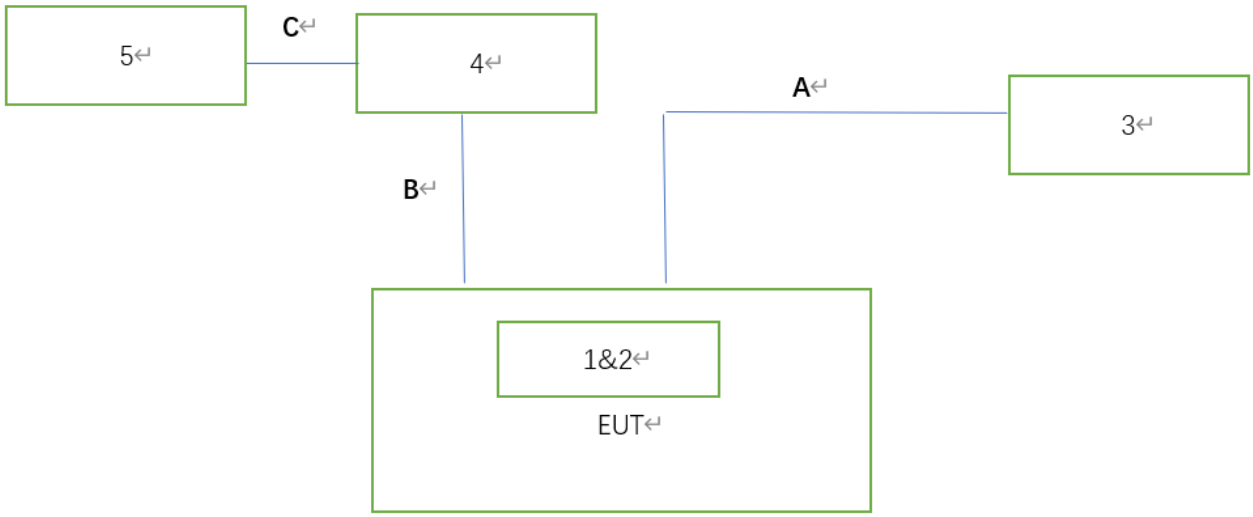
2.2. Test Mode

Final Test Mode:	Mode 1: Charging for Android smart phone with EUT
	Mode 2: Charging for IOS smart phone with EUT
	Mode 3: EUT through CAN device to connect to PC to transmit at 13.56MHz

2.3. Configuration of Tested System

The EUT was tested per the guidance FCC Part 15 Subpart B: 2020 & ICES-003 Issue 6 Class B and ANSI C63.4: 2014 was used to reference the appropriate EUT setup for radiated testing and AC line conducted testing.

Connection Diagram (Mode 1 & 2& 3)



Signal Cable Type		Signal Cable Description
A	Power Cable	Non-Shielded, 0.8m
B	Automotive wiring harness	Non-Shielded, 1.5m
C	USB cable	Non-Shielded, 0.8m

2.4. 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
2	Smart Phone	Apple	A2217	N/A	N/A
3	DC Power Supply	GWINSTEK	DPS-3303C	EM913553	N/A
4	Can device	Peak-system	N/A	N/A	N/A
5	Notebook	Shineion	QTJ507	X2001H03651861	N/A

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

2.5. Test Software

1	Setup the EUT and simulators as shown on above.
2	a. Charging for Android smart phone with EUT b. Charging for IOS smart phone with EUT c. Transmit with NFC
3	Make the EUT working on each mode, and turn to test

2.6. EMI Suppression Device(s)/Modifications

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

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical Equipment in the Range of 9kHz to 18GHz (ANSI C63.4-2014) was used in the measurement of the Equipment under test.

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. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to 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 150 kHz to 30 MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9 kHz. 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 resolution, clock or data exchange speed, scrolling H pattern to the EUT and/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 are used for final measurements on the same test site.

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. An 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 30 MHz 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 30 MHz, 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 was placed on top of the 0.8 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, mode of operation, 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. 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

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.

Conducted Emission Measurement - SR2
The maximum measurement uncertainty is evaluated as: 9kHz~150kHz: 3.84dB 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
The maximum measurement uncertainty is evaluated as: 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
The maximum measurement uncertainty is evaluated as: 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

6. TEST RESULT

6.1. Summary

FCC Part Section(s)	IC Part Section(s)	Test Description	Test Result
15.107	ICES-003 Issue 6 - 6.1	Conducted Emissions	N/A
15.109	ICES-003 Issue 6 - 6.2	Radiated Emissions	Pass

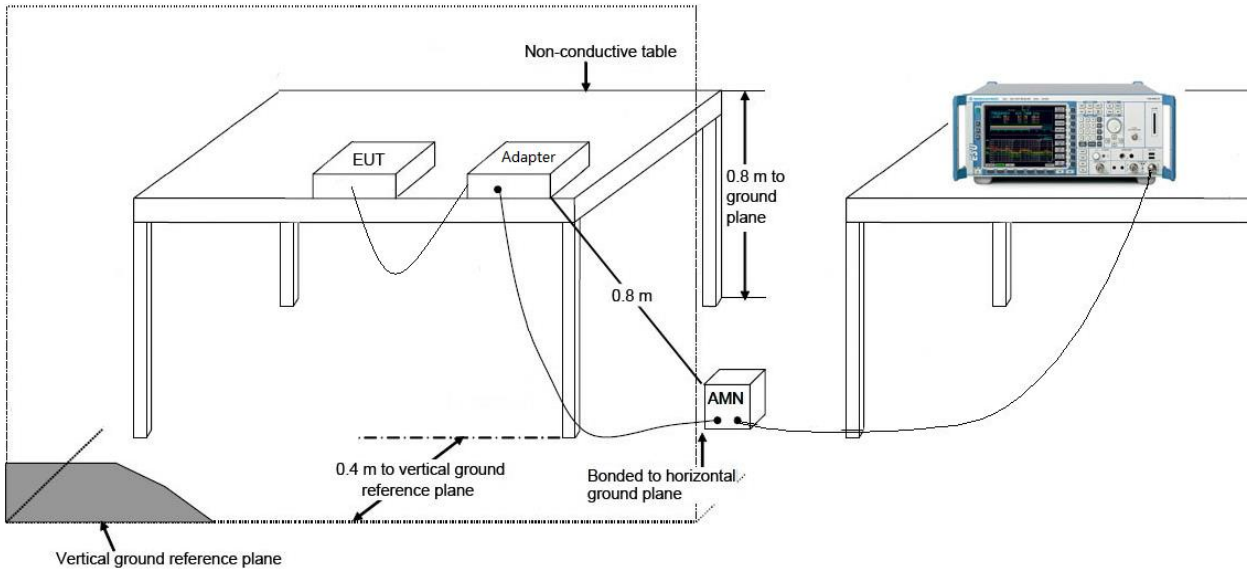
Note: “N/A” means that the test item is not applicable, and the detailed information refers to relevant section.

6.2. Conducted Emission Measurement

6.2.1.Test Limit

FCC 15.107 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.		

6.2.2.Test Setup



6.2.3.Test Result

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

6.3. Radiated Emission Measurement

6.3.1.Test Limit

FCC Part 15.109 & ICES-003 Issue 6 6.2 Limits		
Frequency (MHz)	Distance (m)	Level (dBμV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

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 (uV/m)

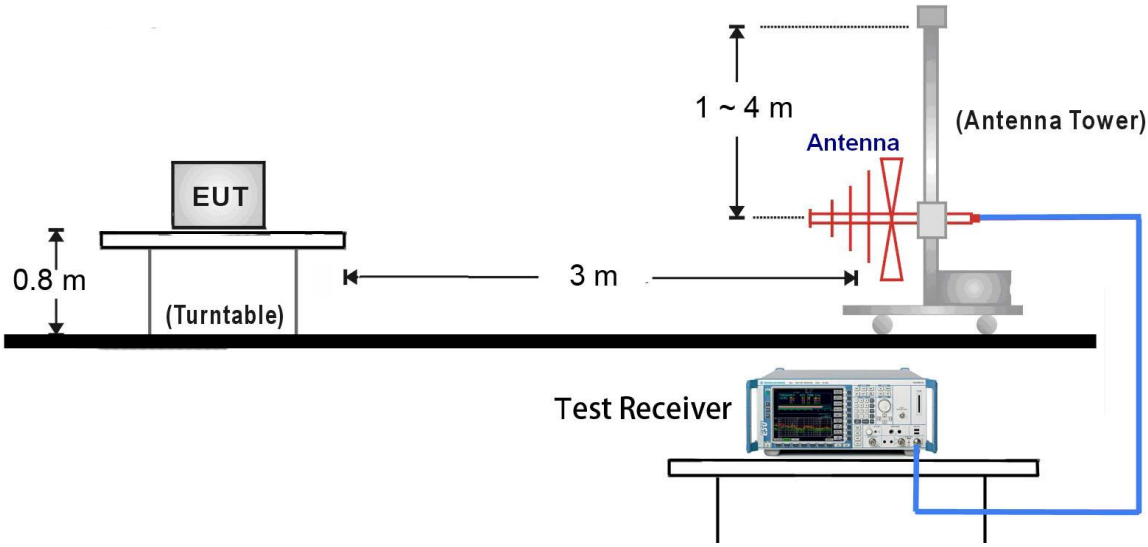
6.3.2.Test Frequency selected

For an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

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(Note)
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

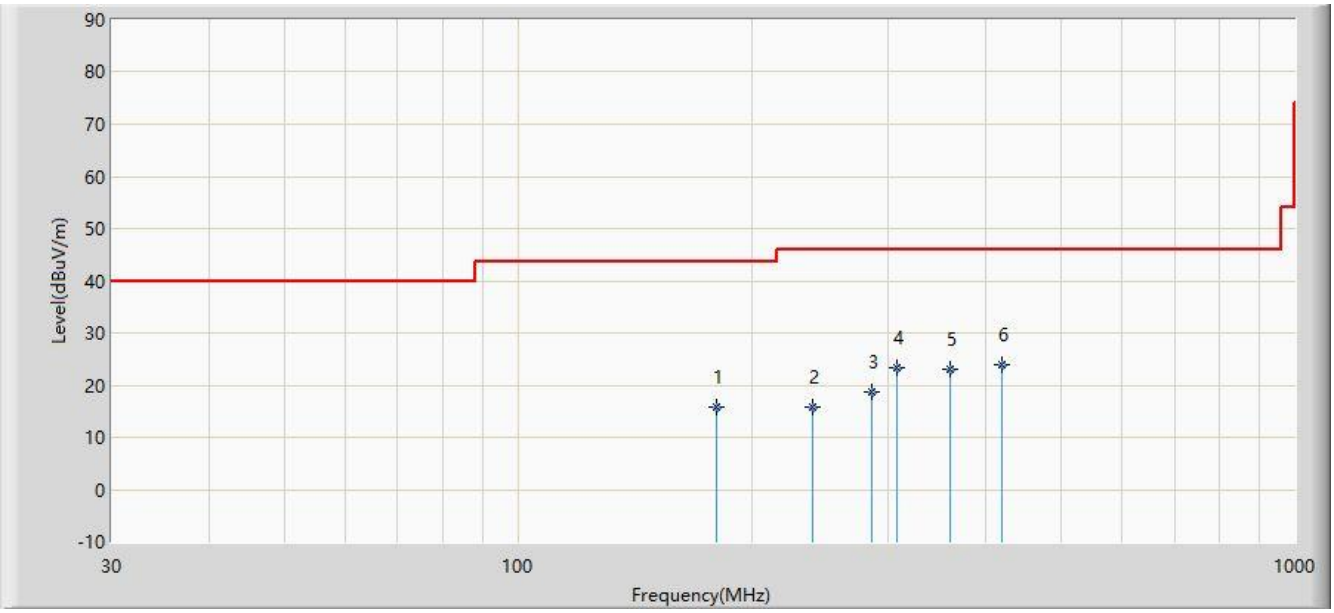
Note: Below 1.705MHz no radiated testing required for ICES-003 Issue 6.

6.3.3.Test Setup



6.3.4.Test Result

Site: AC1	Time: 2020/02/28 - 14:11
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Snake Ni
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Wireless Charging	Power: DC 12V
Test Mode 1	

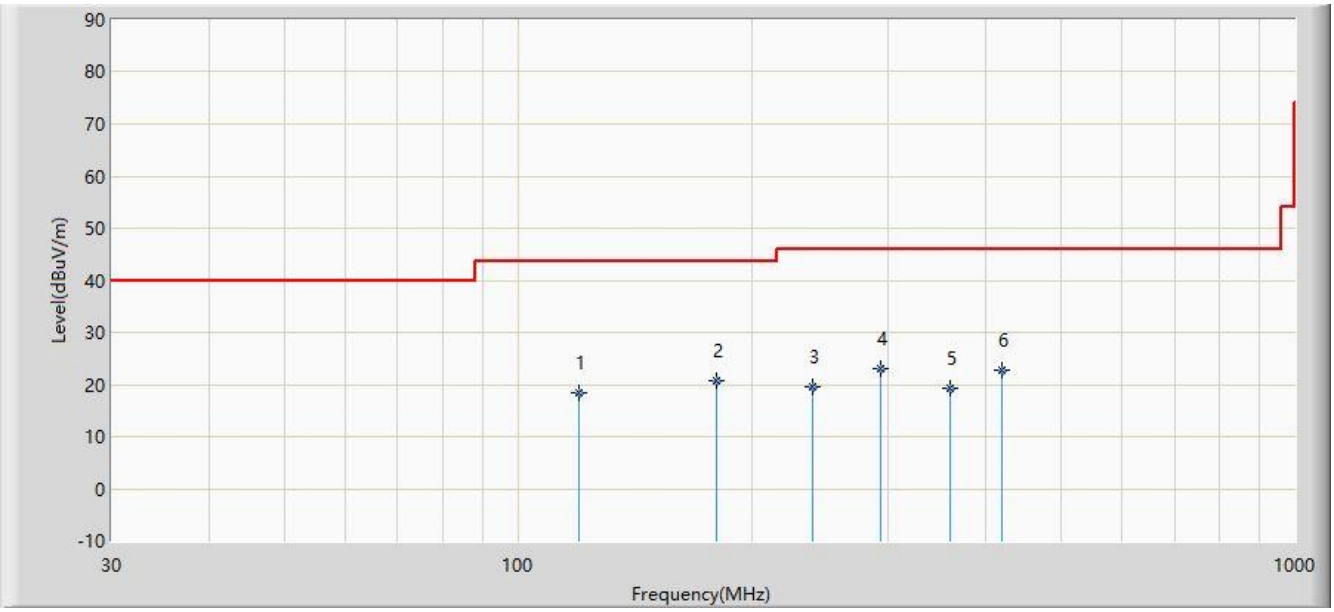


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			179.865	15.697	2.800	-27.803	43.500	12.897	QP
2			240.005	15.730	2.900	-30.270	46.000	12.830	QP
3			285.110	18.690	4.710	-27.310	46.000	13.981	QP
4			307.905	23.234	8.680	-22.766	46.000	14.553	QP
5			360.285	22.985	7.270	-23.015	46.000	15.716	QP
6		*	420.425	24.010	6.920	-21.990	46.000	17.090	QP

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

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

Site: AC1	Time: 2020/02/28 - 14:11
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Snake Ni
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Wireless Charging	Power: DC 12V
Test Mode 1	

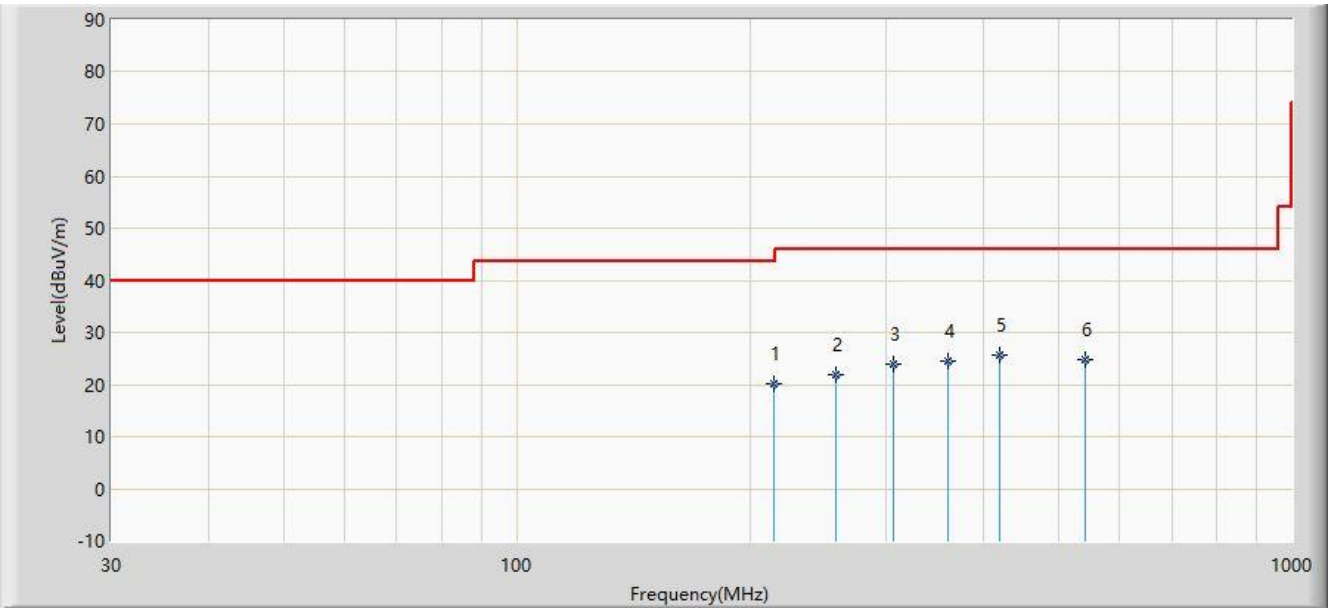


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			119.725	18.420	5.270	-25.080	43.500	13.150	QP
2		*	179.865	20.677	7.780	-22.823	43.500	12.897	QP
3			240.005	19.510	6.680	-26.490	46.000	12.830	QP
4			293.355	23.020	8.850	-22.980	46.000	14.170	QP
5			360.285	19.295	3.580	-26.705	46.000	15.716	QP
6			420.425	22.740	5.650	-23.260	46.000	17.090	QP

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

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

Site: AC1	Time: 2020/02/28 - 14:11
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Snake Ni
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Wireless Charging	Power: DC 12V
Test Mode 2	

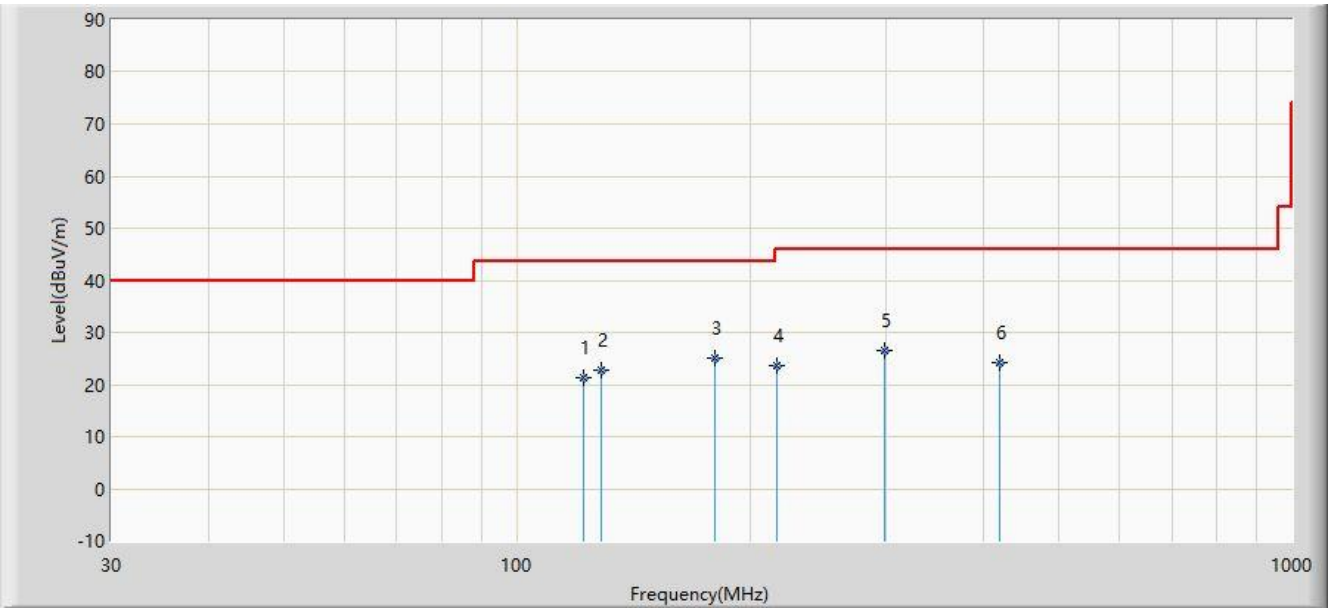


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			214.785	20.112	8.470	-23.388	43.500	11.642	QP
2			258.435	22.005	8.850	-23.995	46.000	13.155	QP
3			305.965	23.996	9.500	-22.004	46.000	14.496	QP
4			360.285	24.505	8.790	-21.495	46.000	15.716	QP
5		*	420.425	25.760	8.670	-20.240	46.000	17.090	QP
6			540.705	24.848	5.460	-21.152	46.000	19.388	QP

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

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

Site: AC1	Time: 2020/02/28 - 14:11
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Snake Ni
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Wireless Charging	Power: DC 12V
Test Mode 2	

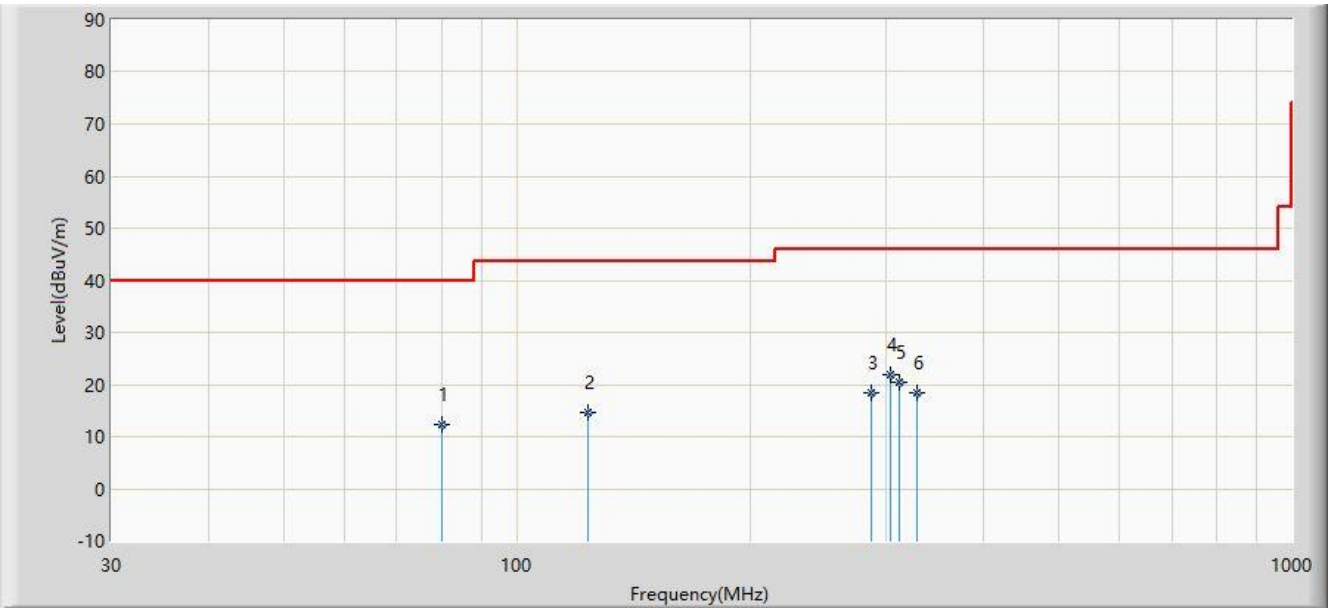


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			122.150	21.258	7.930	-22.242	43.500	13.327	QP
2			128.455	22.753	9.050	-20.747	43.500	13.704	QP
3		*	179.865	25.197	12.300	-18.303	43.500	12.897	QP
4			216.240	23.484	11.750	-22.516	46.000	11.734	QP
5			297.720	26.639	12.360	-19.361	46.000	14.279	QP
6			420.425	24.110	7.020	-21.890	46.000	17.090	QP

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

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

Site: AC1	Time: 2020/03/10 - 11:11
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Snake Ni
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Wireless Charging	Power: DC 12V
Test Mode 3	

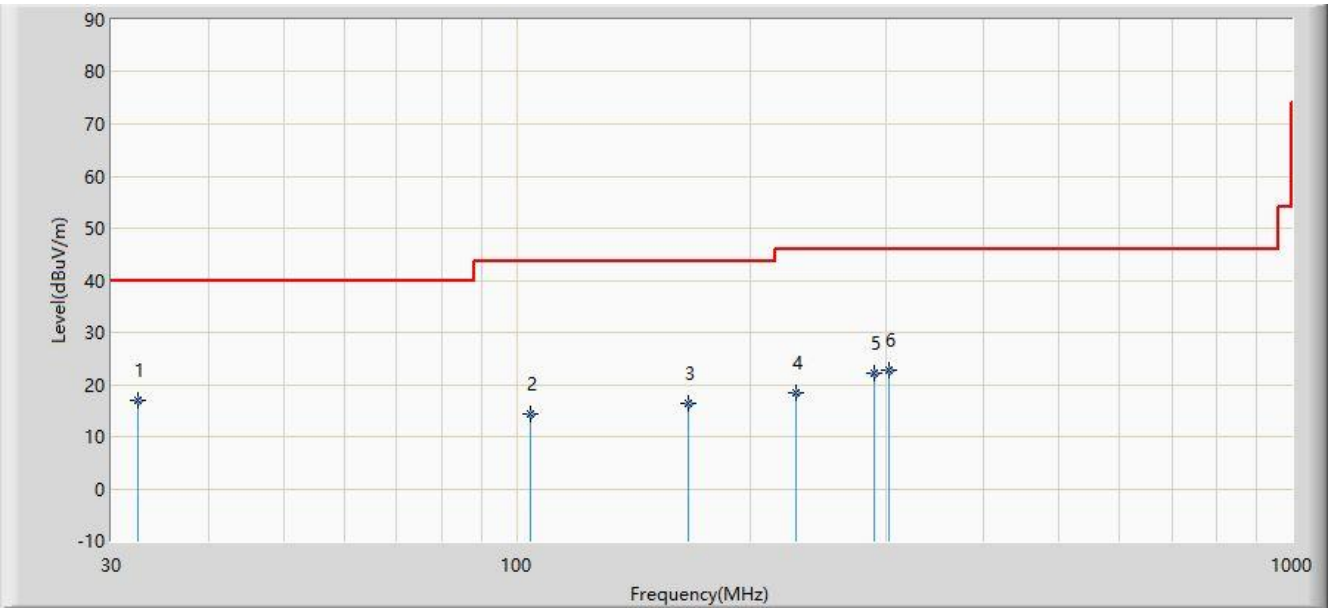


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			79.955	12.405	2.270	-27.595	40.000	10.135	QP
2			123.605	14.558	1.140	-28.942	43.500	13.419	QP
3			287.050	18.431	4.400	-27.569	46.000	14.032	QP
4		*	303.540	21.832	7.400	-24.168	46.000	14.432	QP
5			311.785	20.558	5.900	-25.442	46.000	14.657	QP
6			328.275	18.263	3.180	-27.737	46.000	15.083	QP

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

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

Site: AC1	Time: 2020/03/10 - 11:12
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Snake Ni
Probe: AC1_VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Wireless Charging	Power: DC 12V
Test Mode 3	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	32.425	16.991	3.200	-23.009	40.000	13.790	QP
2			104.205	14.226	2.770	-29.274	43.500	11.456	QP
3			166.285	16.377	1.700	-27.123	43.500	14.678	QP
4			229.335	18.333	5.810	-27.667	46.000	12.524	QP
5			288.990	22.311	8.250	-23.689	46.000	14.061	QP
6			301.600	22.798	8.420	-23.202	46.000	14.378	QP

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

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

7. CONCLUSION

The data collected relate only the item(s) tested and show that the unit has been tested to comply with the requirements specified in §15.107 / §15.109 of the FCC Rules and ICES-003 Rules.

The End

Appendix A - Test Setup Photograph

Refer to “2001WSU016-UT” file.

Appendix B - EUT Photograph

Refer to “ 2001WSU016-UE” file.