

FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Wireless Charging System

Model: SYECLWPC1801

Trade Name: HYUNDAI, KIA

Issued to

**SEOYON ELECTRONICS Co.,Ltd
100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do,
Korea 16648**

Issued by

**Compliance Certification Services Inc.
Tainan Laboratory
No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)
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Issued Date: October 19, 2017**



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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	October 19, 2017	Initial Issue	ALL	Allison Chen
01	November 16, 2017	1. Modify frequency band. 2. Modify 9 kHz - 490 kHz test data.	P.5, P.19	Angel Cheng

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1. TEST RESULT CERTIFICATION

Applicant: SEOYON ELECTRONICS Co.,Ltd
 100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si,
 Gyeonggi-do, Korea 16648

Equipment Under Test: Wireless Charging System

Trade Name: HYUNDAI, KIA

Model: SYECLWPC1801

Date of Test: October 12 ~ October 18, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15.209	No non-compliance noted

We hereby certify that:

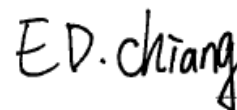
All test results conform to above mentioned standards.

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part15.203, Part15.207,Part15.209.Part15.215.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Tested by:

Jeter Wu
 Assistant Manager
 Compliance Certification Services Inc.

ED Chiang
 Engineer
 Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	Wireless Charging System
Trade Name	HYUNDAI, KIA
Model Number	SYECLWPC1801
Model Discrepancy	N/A
Received Date	September 30, 2017
Power Supply	Power form host device. (DC: 9 – 16 V)
Frequency Band	110 KHz ~ 115 KHz
Antenna Designation	Coli Antenna

Remark:

1. *The sample selected for test was production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: **NYOSYECLWPC1801** filing to comply with Section 15.203, 15.207, 15.209 and 15.215 of the FCC Part 15, Subpart C Rules.*

3. TEST SUMMERY

Standard Sec.	Chapter	Test Item	Result
15.215	8.1	20dB Bandwidth	Pass
15.209	8.2	Transmitter Radiated Emission	Pass
15.207	8.3	AC Power-line Conducted Emission	--
15.203	8.4	Antenna Requirement	Pass

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 , ANSI 63.4 2014 and FCC CFR 47 Part 15.203, 15.207.15.209,15.215.

4.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.207.15.209, 15.215 under the FCC Rules Part 15 Subpart C and ANSI C63.10: 2013.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in ANSI C63.10: 2013, Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz was using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. The EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10: 2013.

4.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in other rules, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

(b) Except as provided by other rules, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

4.5 DESCRIPTION OF TEST MODES

The EUT (model: SYECLWPC1801) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed. The worst case data rate is determined as the data rate with highest output power.

After verification, all tests were carried out with the worst case test modes as shown below.

Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Voltage/Hz	DC 12V
Test Mode	Mode 1:EUT power by DC Power Source.
Worst Mode	<input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4

Remark:

1. *The worst mode was record in this test report.*
2. *EUT pre-scanned in three axis ,X, Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case(X-Plane and Horizontal) were recorded in this report*
3. *For below 1G, AC power line conducted emission and radiation emission were performed the EUT transmit at the highest output power channel as worse case.*

5. INSTRUMENT CALIBRATION

5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: Each piece of equipment is scheduled for calibration once a year and Loop Antenna is scheduled for calibration once three years.

RF Conducted Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
BNC Coaxial Cable	CCS	BNC50	11	01/13/2017	01/12/2018
EMI Test Receiver	R&S	ESCS 30	100348	12/12/2016	12/11/2017
LISN	SCHWARZBECK	NNLK8130	8130124	11/08/2016	11/07/2017
LISN	FCC	FCC-LISN-50-32-2	08009	05/08/2017	05/07/2018
Pulse Limiter	R&S	ESH3-Z2	100116	01/13/2017	01/12/2018
BNC Coaxial Cable	CCS	BNC50	11	01/13/2017	01/12/2018
Software	e-3 (5.04211j)				

3M 966 Chamber Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	07/20/2017	07/19/2019
Amplifier	HP	8447F	2443A01671	01/18/2017	01/17/2018
Bi-Log Antenna	Sunol	JB1	A070506-2	07/22/2017	07/21/2018
Cable	HUBER+SUHNER	SUCOFLEX 104PEA	SN25737 /4PEA	01/18/2017	01/17/2018
Double Ridged Guide Horn Antenna	ETS-LINDGREN	3116	00078900	03/20/2017	03/19/2019
EMI Test Receiver	R&S	ESCS 30	100294	12/02/2016	12/01/2017
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/09/2017	05/08/2018
Horn Antenna	Com-Power	AH-118	071032	02/09/2017	02/08/2018
Pre-Amplifier	EMCI	EMC012645	980098	01/17/2017	01/16/2018
Software	Excel				

5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	N/A
Emission bandwidth, 6dB bandwidth	+/- 1.4003
RF output power, conducted	+/- 1.1372
Power density, conducted	+/- 1.4003
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

- No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029
- No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)
Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721
- No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)
Tel: 886-6-580-2201 / Fax: 886-6-580-2202

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

7.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Cable length & Type Describe
1.	DC Power Source	GWINSTEK	SPS-3610	N/A	N/A	DC Cable 1.5m shielding

Remark:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

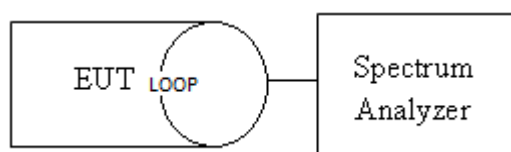
8. TEST REQUIREMENTS

8.1 20DB BANDWIDTH

Definition

According to FCC Part 15.215 (c) ,Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Configuration



TEST PROCEDURE

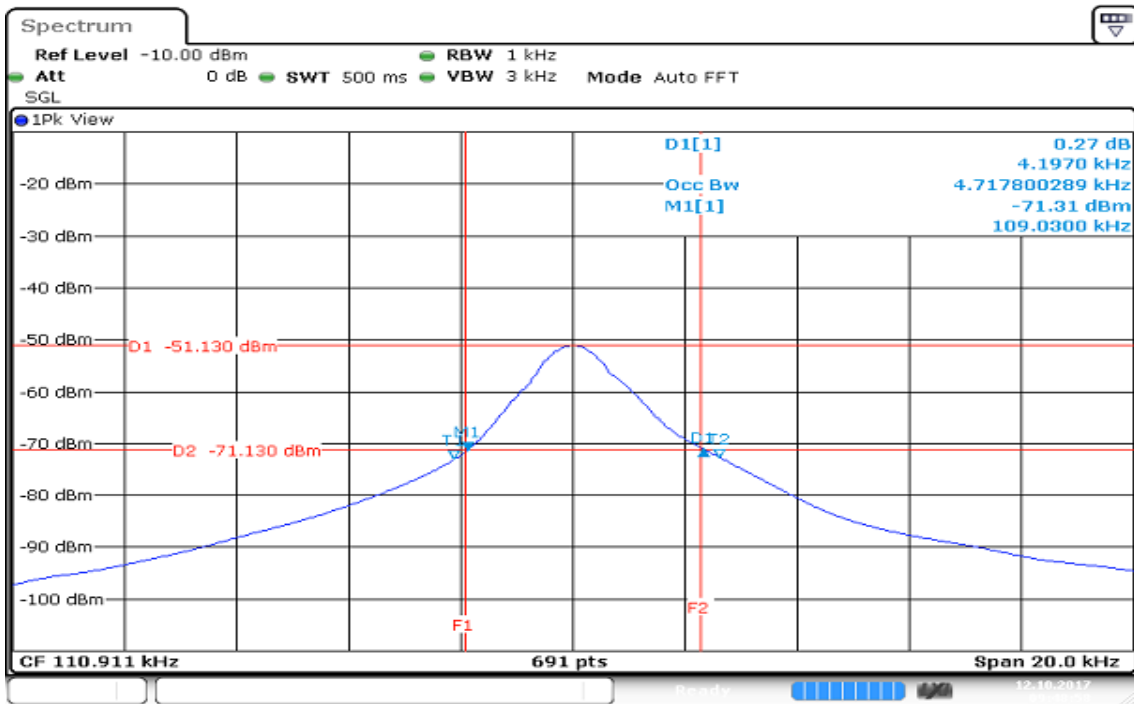
The Loop antenna connected to the spectrum analyzer, was touching to the transmitter antenna. Set the RBW=1KHz, VBW ≥ 3 x RBW, Detector = Peak, Trace mode = Max hold, Sweep = 500ms.Measure the maximum width of the emission that is constrained by the frequencies associated with the Occupied Bandwidth.

TEST RESULTS

No non-compliance noted

Test Condition	Frequency(kHz)	Occupied Bandwidth (kHz)	F _L at 20dB BW (kHz)	F _H at 20dB BW (kHz)	20dB Bandwidth (kHz)	Limit
Charging mode	110.911	4.197	109.03	113.227	4.7178	N/A

Test Data



Date: 12 OCT 2017 09:46:58

8.2 TRANSMITTER RADIATED EMISSION

LIMIT

1. According to FCC PART 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (µV/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
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: Except as provided in other rules, fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

2. In the above emission table, the tighter limit applies at the band edges.

Below 30MHz

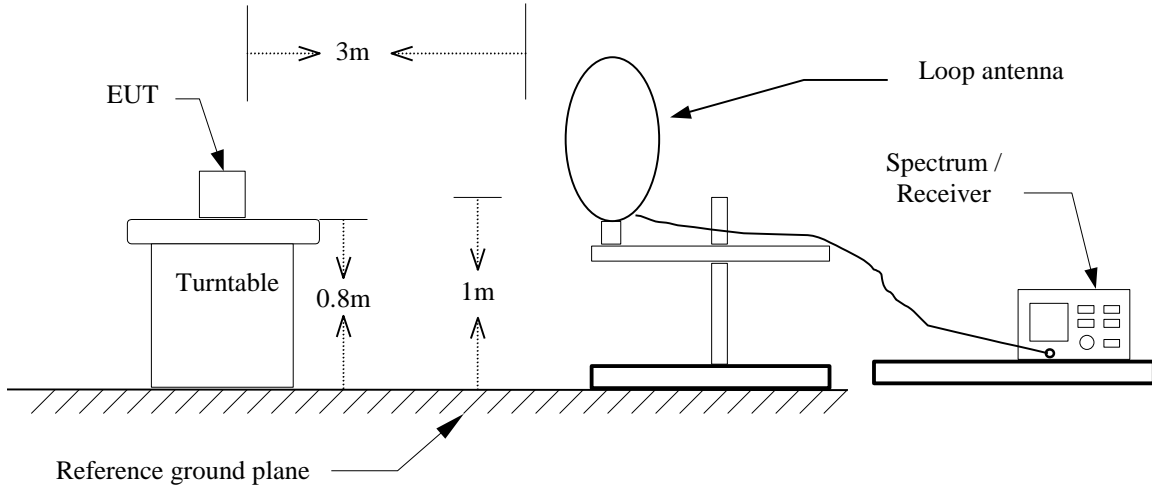
Frequency (MHz)	Field Strength				
	(µV/m)	(dBµV/m)	Measurement Distance (meter)	(dBµV/m)	Measurement Distance (meter)
0.009 - 0.490	2400/F(kHz)	48.52 – 13.80	300	128.52–104.84	3
0.490 - 1.705	24000/F(kHz)	33.80 – 22.97	30	73.80– 62.97	3
1.705 – 30.0	30	29.54	30	69.54	3

Above 30MHz

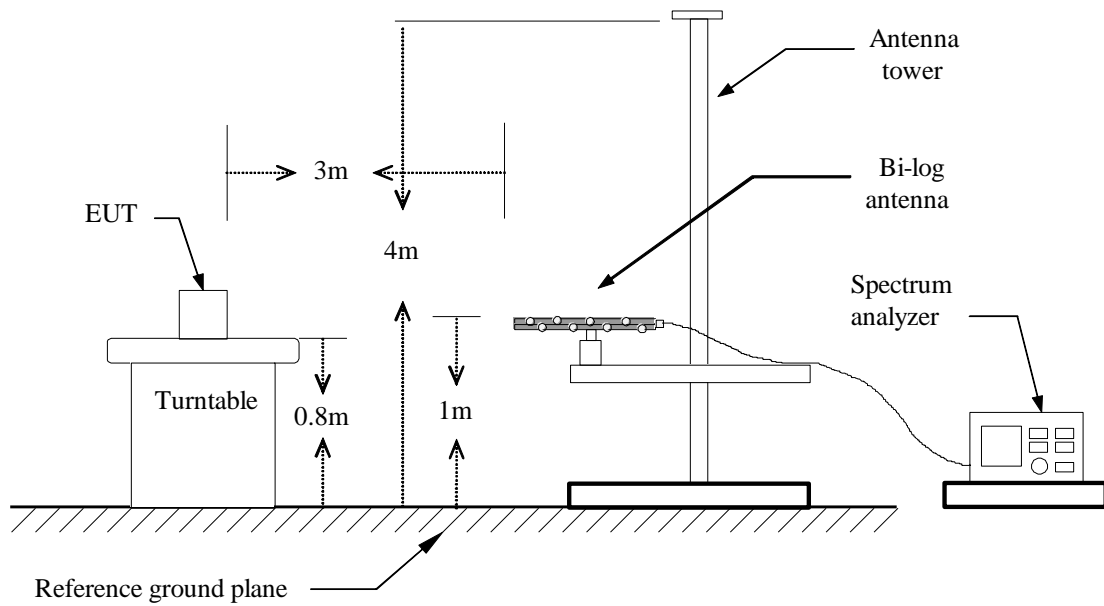
Frequency (MHz)	Field Strength		Measurement Distance (meter)
	(µV/m)	(dBµV/m)	
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Test Configuration

9kHz ~ 30MHz



30MHz ~ 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
Below 1GHz:
 $RBW=100kHz / VBW=300kHz / Sweep=AUTO$
7. Repeat above procedures until the measurements for all frequencies are complete.
8. Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

9 kHz - 490 kHz

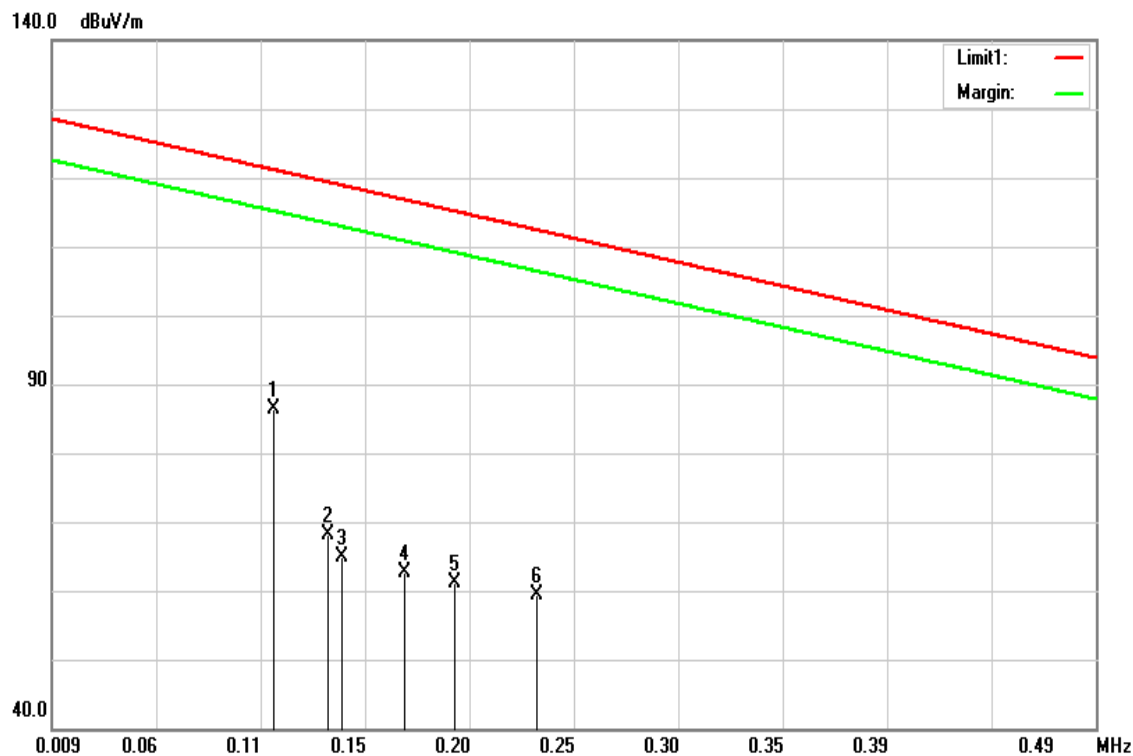
Operation Mode: Charge mode

Test Date: October 12, 2017

Temperature: 24°C

Tested by: ED Chiang

Humidity: 33% RH



Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
0.1115	72.05	14.29	86.34	126.66	-40.32	peak
0.1365	53.82	14.28	68.10	124.90	-56.80	peak
0.1427	50.57	14.28	64.85	124.52	-59.67	peak
0.1716	48.26	14.26	62.52	122.91	-60.39	peak
0.1947	46.82	14.26	61.08	121.82	-60.74	peak
0.2322	45.13	14.24	59.37	120.29	-60.92	peak

Remark:

1. the frequency bands 9-90 kHz, 110-490 kHz measurements employing an average detector and other below 1GHz measurements employing a CISPR quasi-peak detector.

490 kHz - 30 MHz

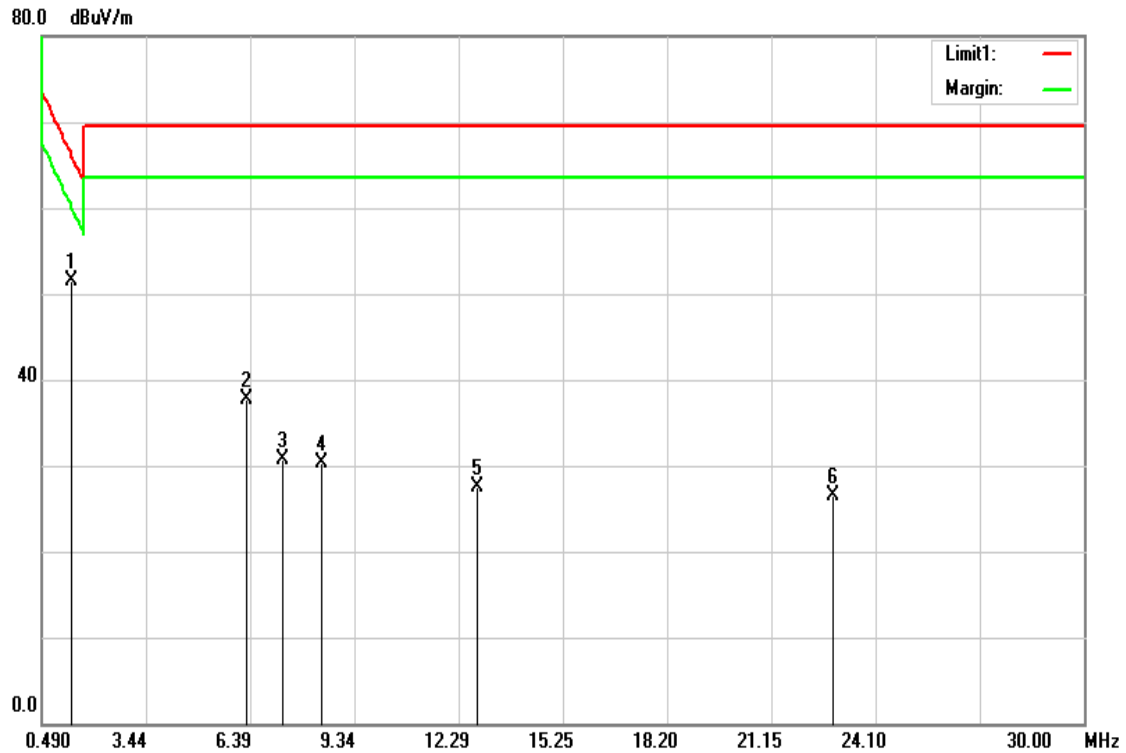
Operation Mode: Charge mode

Test Date: October 12, 2017

Temperature: 24°C

Tested by: ED Chiang

Humidity: 33% RH



Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1.3458	36.77	14.67	51.44	66.16	-14.72	peak
6.3035	22.73	14.89	37.62	69.50	-31.88	peak
7.3068	15.79	14.95	30.74	69.50	-38.76	peak
8.4282	15.24	15.04	30.28	69.50	-39.22	peak
12.8252	12.33	15.20	27.53	69.50	-41.97	peak
22.8881	11.79	14.80	26.59	69.50	-42.91	peak

Below 1 GHz

Operation Mode: Charge mode

Test Date: October 18, 2017

Temperature: 24°C

Tested by: ED Chiang

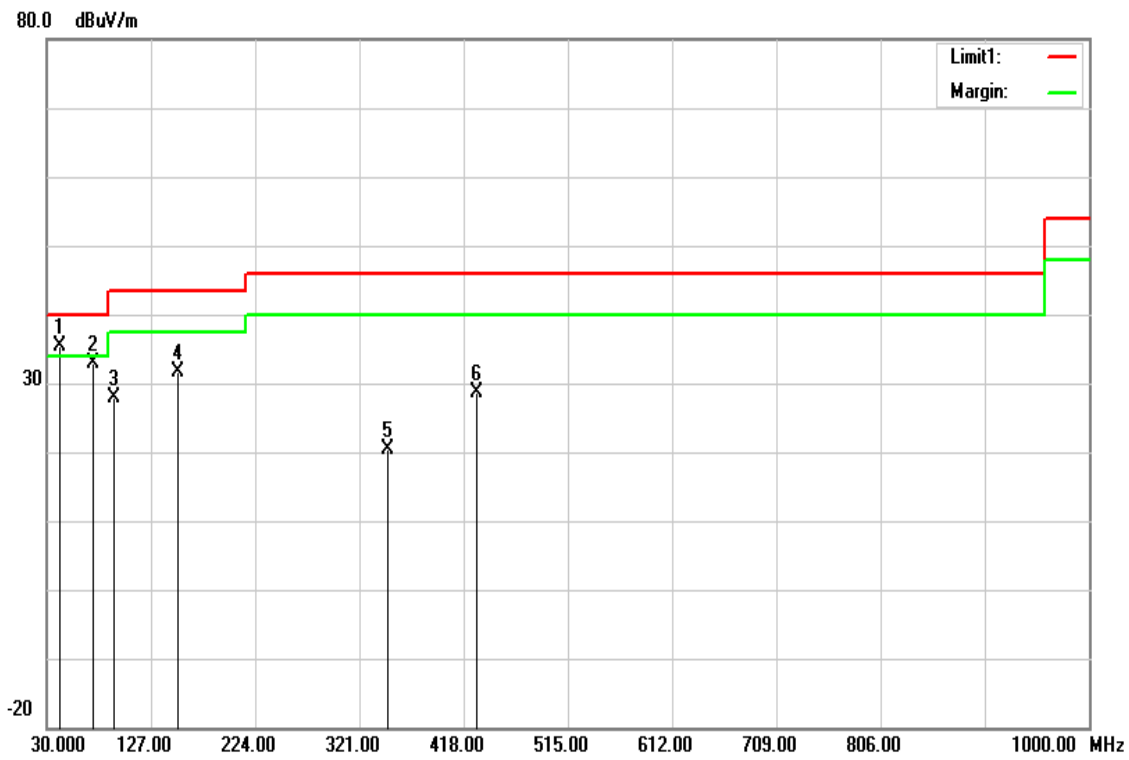
Humidity: 33% RH

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
41.6400	52.17	-16.89	35.28	40.00	-4.72	QP	V
72.6800	54.17	-21.31	32.86	40.00	-7.14	QP	V
92.0800	48.60	-20.69	27.91	43.50	-15.59	peak	V
152.2200	47.35	-15.80	31.55	43.50	-11.95	peak	V
347.1900	33.37	-13.03	20.34	46.00	-25.66	peak	V
429.6400	39.02	-10.33	28.69	46.00	-17.31	peak	V
73.6500	53.10	-21.34	31.76	40.00	-8.24	QP	H
143.4900	52.15	-15.61	36.54	43.50	-6.96	QP	H
188.1100	50.12	-16.40	33.72	43.50	-9.78	peak	H
206.5400	46.21	-15.97	30.24	43.50	-13.26	peak	H
321.0000	35.85	-13.60	22.25	46.00	-23.75	peak	H
778.8400	27.87	-3.76	24.11	46.00	-21.89	peak	H

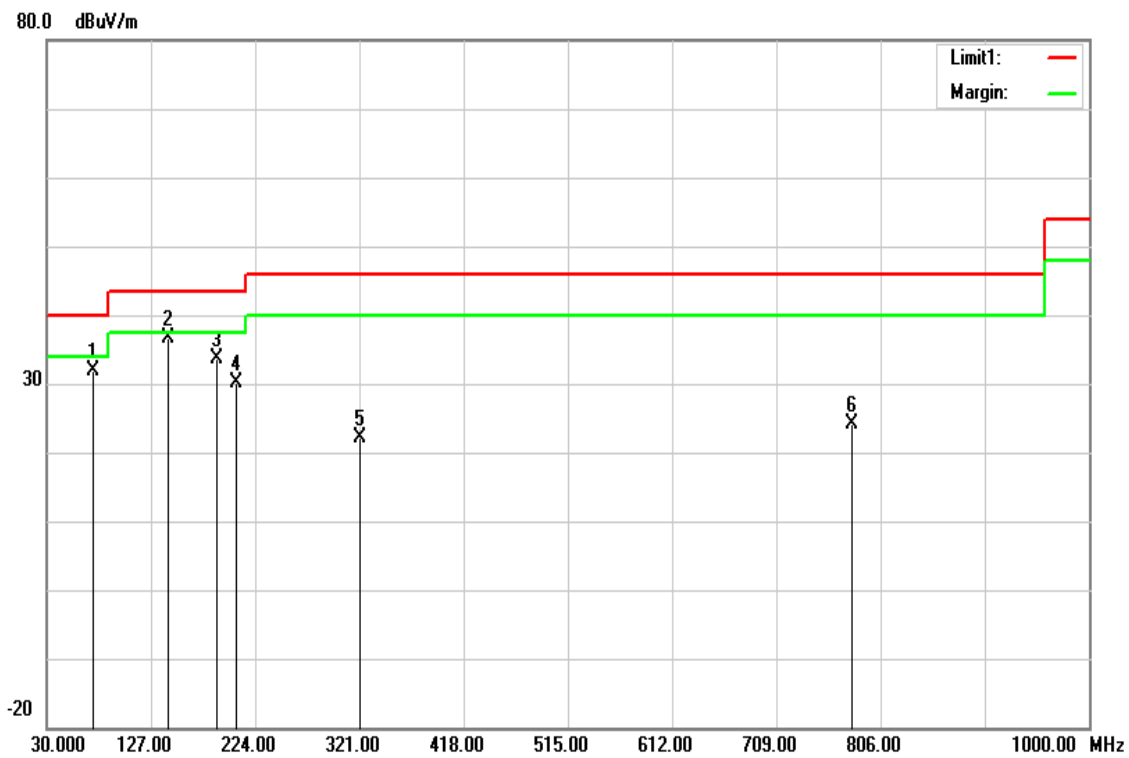
Remark:

1. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
2. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
3. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
4. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

Polarity : Vertical



Polarity : Horizontal



8.3 AC CONDUCTED EMISSION

LIMIT

According to §15.207(a) , for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

Test Configuration

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete
4. For conduction test, adapter1(Delta) and adapter2(AcBel) were pretest. The worst case was adapter2 in this test report.

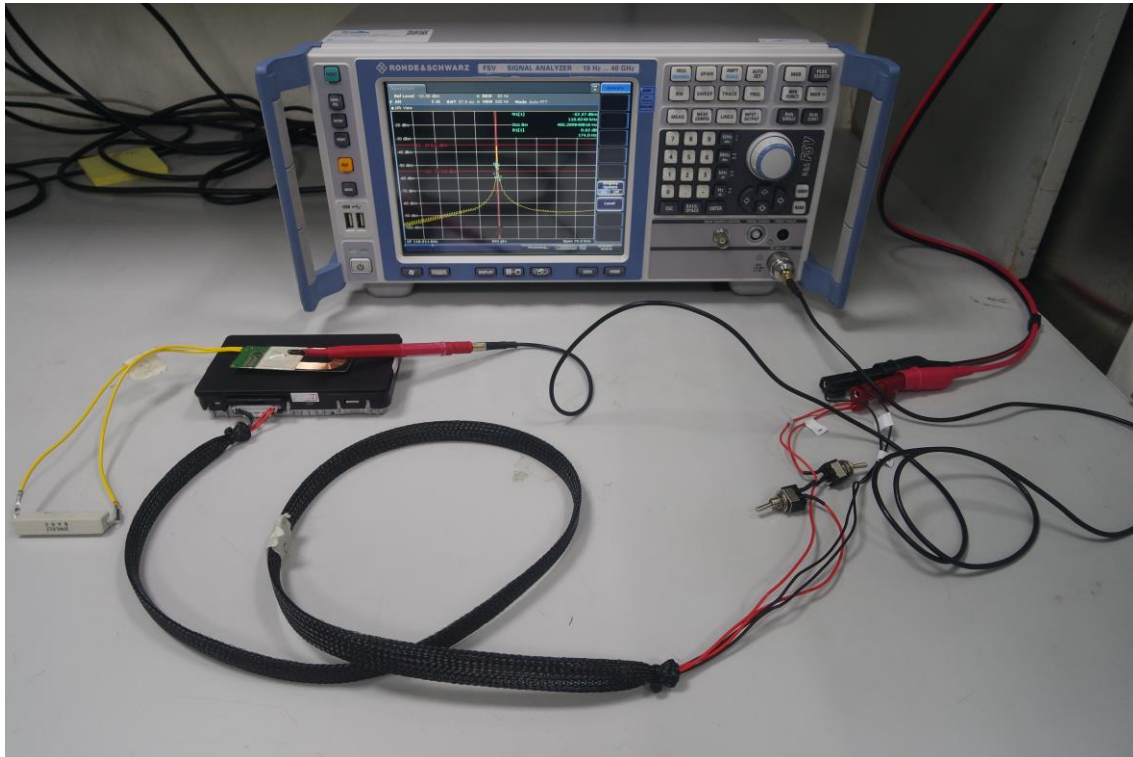
TEST RESULTS

Not applicable, because EUT not connect to AC Main Source direct.

8.4 ANTENNA REQUIREMENT

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

APPENDIX I PHOTOGRAPHS OF TEST SETUP RF Conducted Emission Setup Photo



RADIATED EMISSION SETUP PHOTOS

9 kHz - 30 MHz



Below 1G

