TEST REPORT

CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
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Report No.: CTK-2019-02659

1. Client

◦ Name : SEOYON ELECTRONICS CO., LTD.

◦ Address : 100, Saneop-ro, 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, South Korea

◦ Date of Receipt : 2019-06-19

2. Manufacturer

◦ Name : SEOYON ELECTRONICS CO., LTD.

◦ Address : 100, Saneop-ro, 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, South Korea

3. Use of Report : For FCC Certification

4. Test Sample / Model : Wireless Charging System / SYECNWPC1909

5. Date of Test : 2019-06-28 to 2019-07-09

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.209

7. Testing Environment: Temp.: (23 ± 1) ℃, Humidity: (48 ± 5) % R.H.

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Bong-seok Kim: (Signature)	Technical Manager Young-taek Lee: (Signature)

2019-07-13

Republic of KOREA **CTK Co., Ltd.**

REPORT REVISION HISTORY

Date	Revision	Page No
2019-07-13	Issued (CTK-2019-02659)	all

CONTENTS

1. General Product Description

1.1 Client Information

Company	SEOYON ELECTRONICS CO., LTD.
Contact Point	100, Saneop-ro, 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, South Korea
Contact Person	Name : Hee tack Ryu E-mail : shadow@seoyonelec.com Tel : +82-31-420-3481

1.2 Product Information

FCC ID	NYOSYECNWPC1909
Product Description	Wireless Charging System
Model name	SYECNWPC1909
Variant Model name	-
Operating Frequency Range	112 kHz - 148 kHz
Charging Frequency	115 kHz
RF Output Power	93.1 dBuV/m @ 3 m
Power Transfer Method	Magnetic induction and only single primary coil coupling secondary coil
Output power from each primary coil	<15W
That may have multiple primary coils	No
Antenna Type	Coil
Charging Method	Directly contact
Power Source	DC 12 V

1.3 Antenna Information

☒	Integral antenna (antenna permanently attached)	
	☐	Temporary RF connector provided
	☒	No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
☐	External antenna (dedicated antennas)	

2. Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3. Test Specifications

3.1 Standards

FCC Part Section(s)	Requirement(s)	Status (Note 1)	Report Clause
15.203	Antenna Requirement	C	1.3
15.215(c)	Emission Bandwidth	C	4.1
15.209	Radiated Emissions	C	4.2
15.207	AC Power line Conducted Emissions	C	4.3
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
Note 2: The data in this test report are traceable to the national or international standards.			
Note 3: The sample was tested according to the following specification: FCC Part 15, ANSI C63.10-2013.			

3.2 Mode of operation during the test

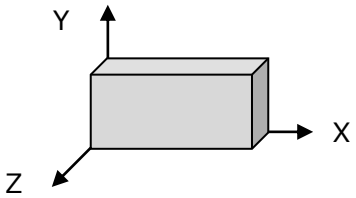
Wireless charger were performed all charging conditions including variable loading and non-charging operation, the worst mode is full charging loading.

Charger Frequency

Charger Frequencies
115 kHz
Wireless charger frequencies are variable frequency range (112 kHz – 148 kHz) and depend on charging loading

The Worst Case Measurement Configuration

Tests Item	AC power line conducted emissions
Condition	AC power line conducted measurement for line and neutral Test Voltage : 120 Vac/60 Hz
Operating Mode	DC Power supply mode

Tests Item	Transmitter Radiated Emissions, Emission Bandwidth
Condition	Radiated measurement
User Position	☐ EUT will be placed in fixed position.
	☒ EUT will be placed in mobile position and operating multiple positions.
	☐ EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions.
Operating Mode	DC Power supply mode
EUT faces identified relative to view from receiving antenna	

3.3 Peripheral Devices

No.	Device	Manufacturer	Model No.	Serial No.
1	DC Power Supply	Topward Electric Instruments	6303D	711196
2	WPT Load	-	-	-

Note : WPT load was provided by manufacturer.

3.4 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor k = 2, Confidence levels of 95 %

Test Item	Uncertainty
AC power-line conducted emissions	2.26 dB
Radiated emissions	4.38 dB

4. Technical Characteristic Test

4.1 Emission Bandwidth

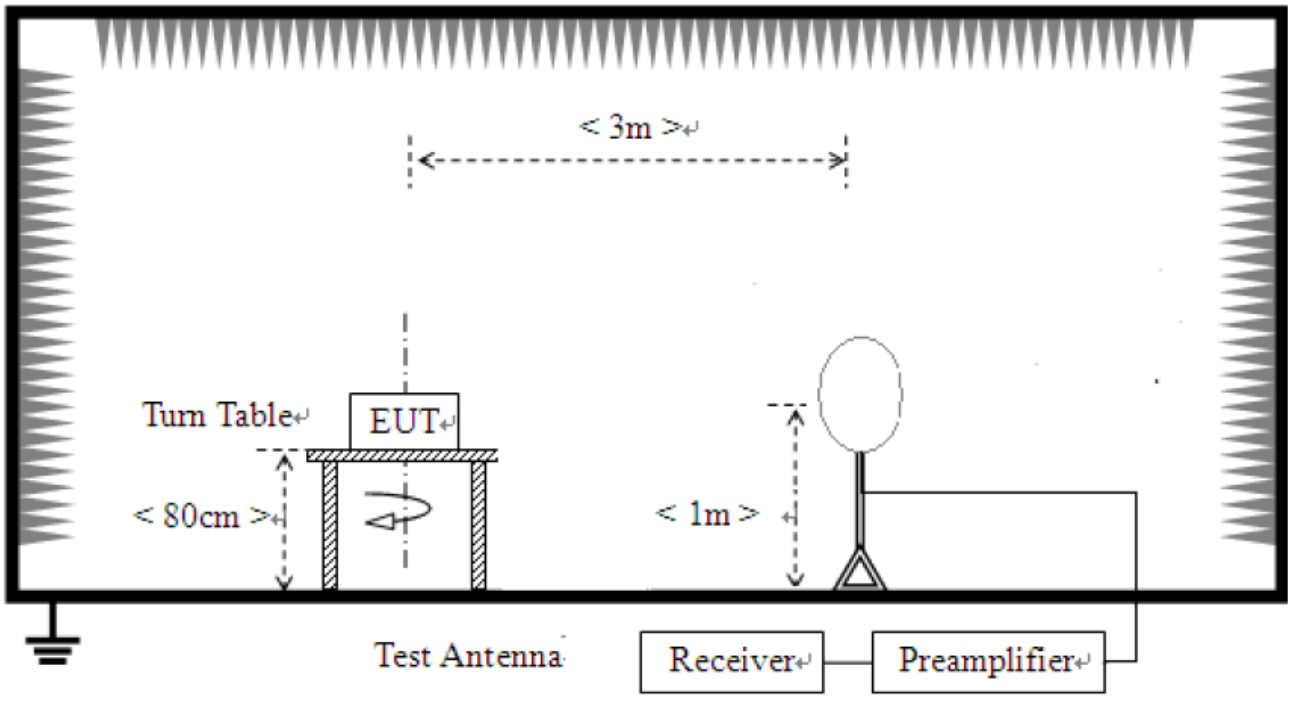
Requirement

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 Procedures

For the emission bandwidth refer ANSI C63.10-2013, clause 6.9(Occupied bandwidth).

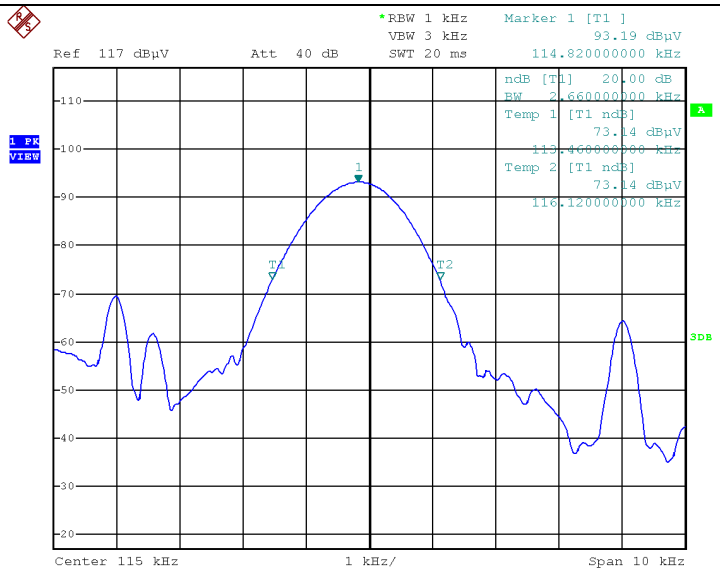
Test Setup



Test results

Emission Bandwidth	Result	Limit
20dB Bandwidth	2.66	N/A
99% Bandwidth	2.30	N/A

Emission Bandwidth Plot 20dB Bandwidth



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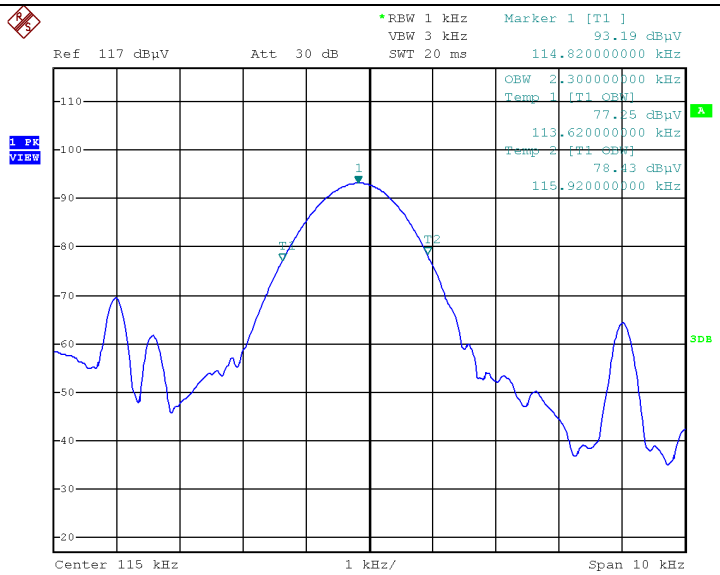
Emission Bandwidth Plot 99% Bandwidth



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4.2 Radiated emissions

Requirement

FCC Part 15 § 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 uV/m@3m	Field Strength dBuV/m@3m	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	48.5 – 13.8	300
0.490-1.705	24000/F(kHz)	33.8 – 23	30
1.705-30	30	29.5	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note : The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Location

☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)

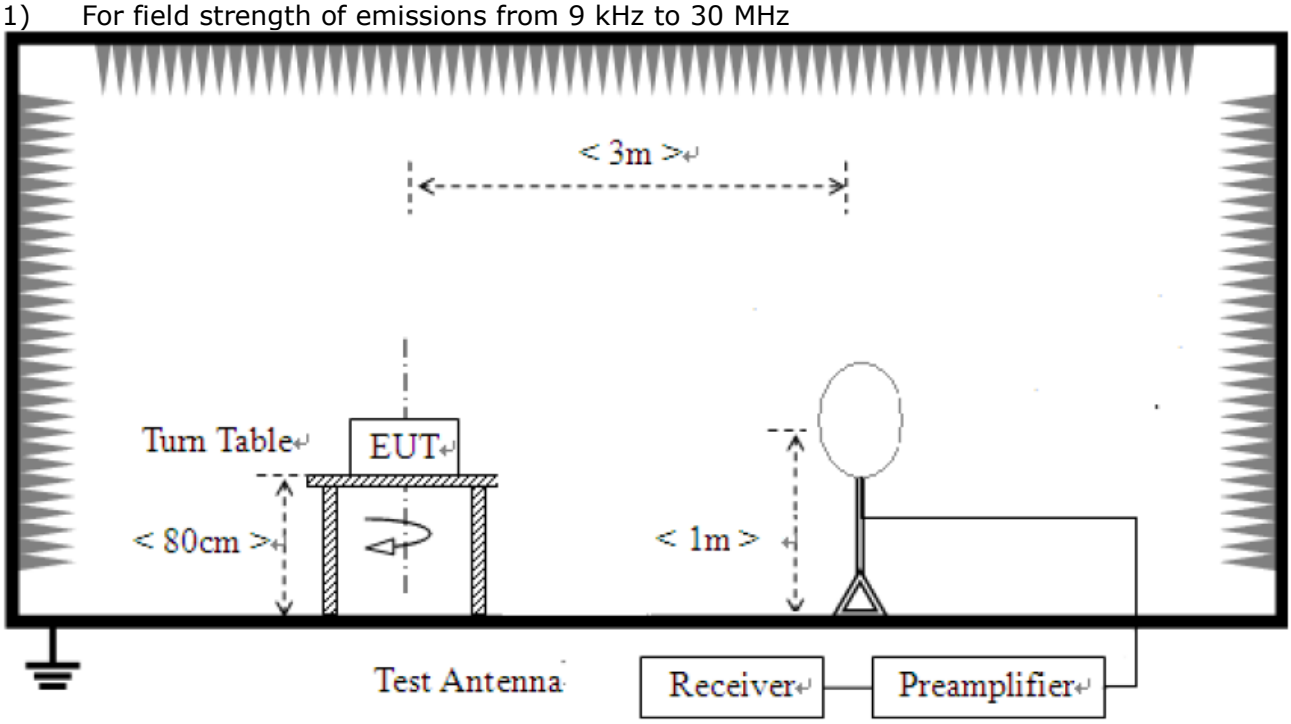
Test Procedures

Test Method	
☒	Refer as ANSI C63.10-2013, clause 6.4(Radiated emissions from unlicensed wireless devices below 30 MHz).
☒	Radiated emission tests shall be performed in the frequency range of 9 kHz to 30 MHz, using a calibrated loop antenna. When perpendicular to the ground plane, the lowest height of the magnetic antenna shall be 1 m above the ground and shall be positioned at the specified distance from the EUT. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
	☒ The results shall be by using the square of an inverse linear distance extrapolation factor(40 dB/decade).
☒	Refer as ANSI C63.10-2013, clause 6.5(Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz).
☒	In the frequency rage above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) is used. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.
☒	Emissions more than 20 dB below the limit do not need to be reported.

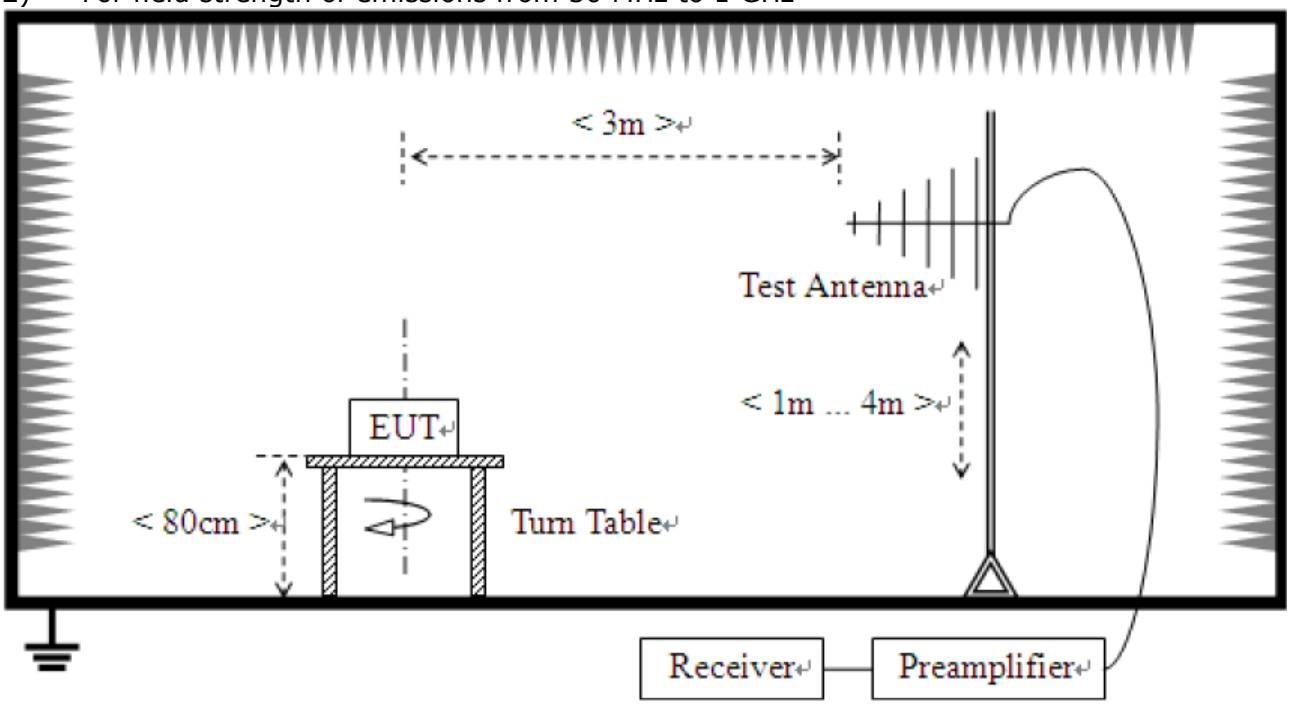
Measuring instrument Settings	
Frequency Range	9 kHz – 1 000 MHz
RBW	200 Hz (9 kHz – 150 kHz) 9 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1 000 MHz)
VBW	≥ RBW
Sweep time	auto couple
Detector function	CISPR quasi-peak(below 1 000 MHz)

Test Setup

1) For field strength of emissions from 9 kHz to 30 MHz



2) For field strength of emissions from 30 MHz to 1 GHz



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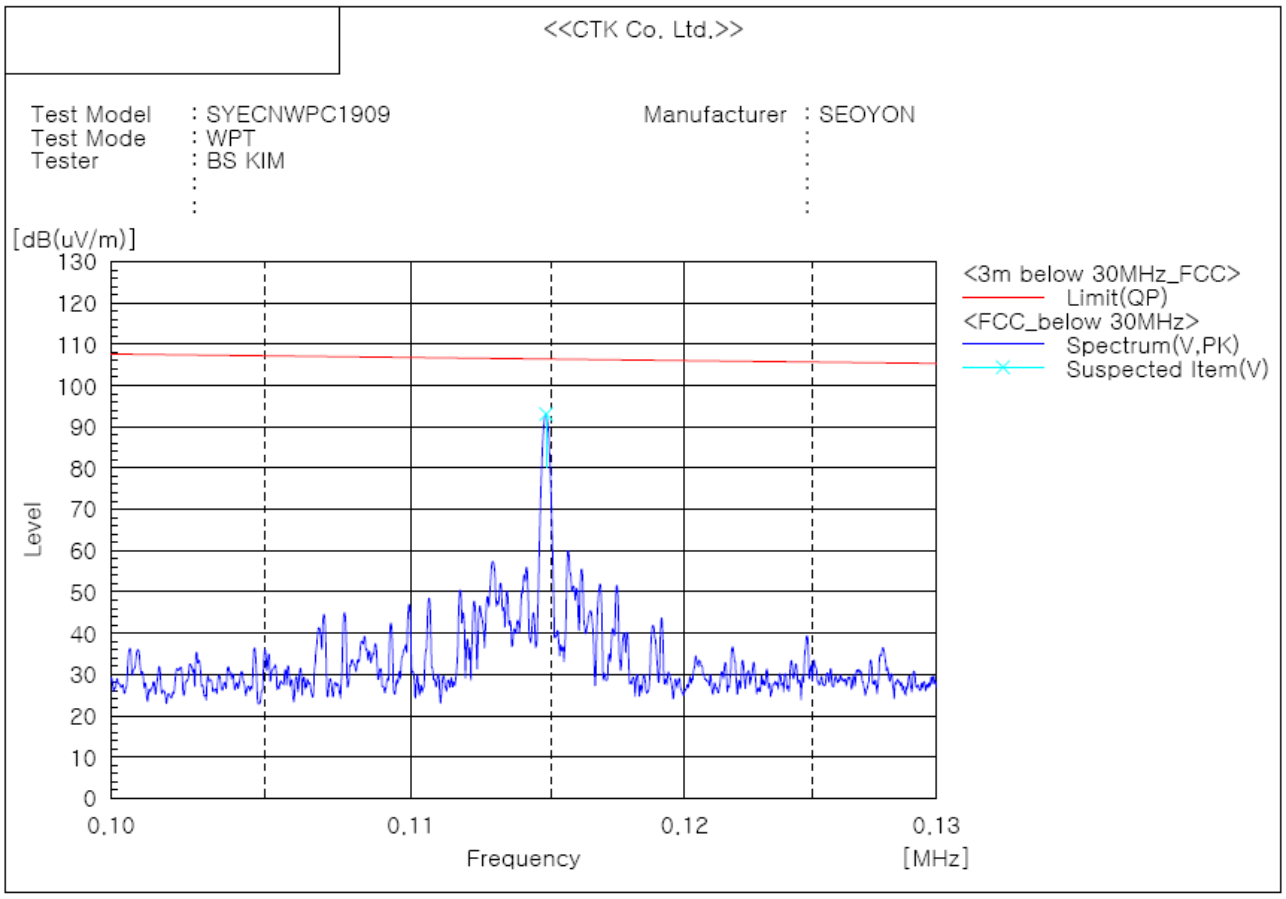
Test results

1) Radiated emissions of fundamental frequency

The requirements are:
☒ Complies



Spectrum Selection

No.	Frequency	(P)	Reading	c.f	Result PK	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(uV)]	[dB(1/m)]	[dB(uV/m)]	[dB(uV/m)]	[dB]	[cm]	[deg]
1	0.115	V	67.9	25.2	93.1	106.4	13.3	100.0	85.0

Remark :

1. Result = Reading + c.f(correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator
3. Limit : 20log(2400/115) + 40log(300/3) = 106.4 dBuV/m
4. The test result in peak detector is less than quasi-peak limit.

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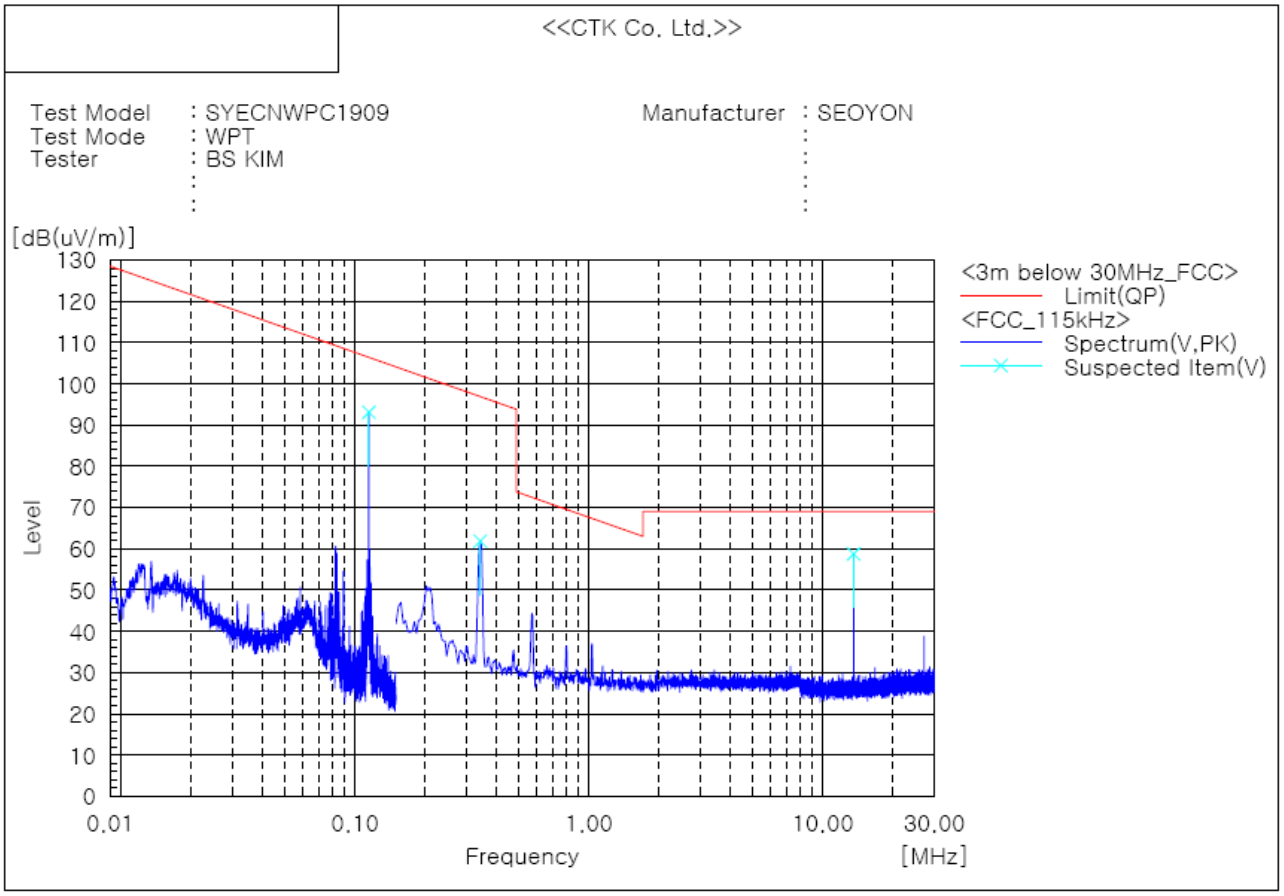
2) Radiated emissions in the frequency range of 9 kHz to 30 MHz

The requirements are:
☒ Complies



Spectrum Selection

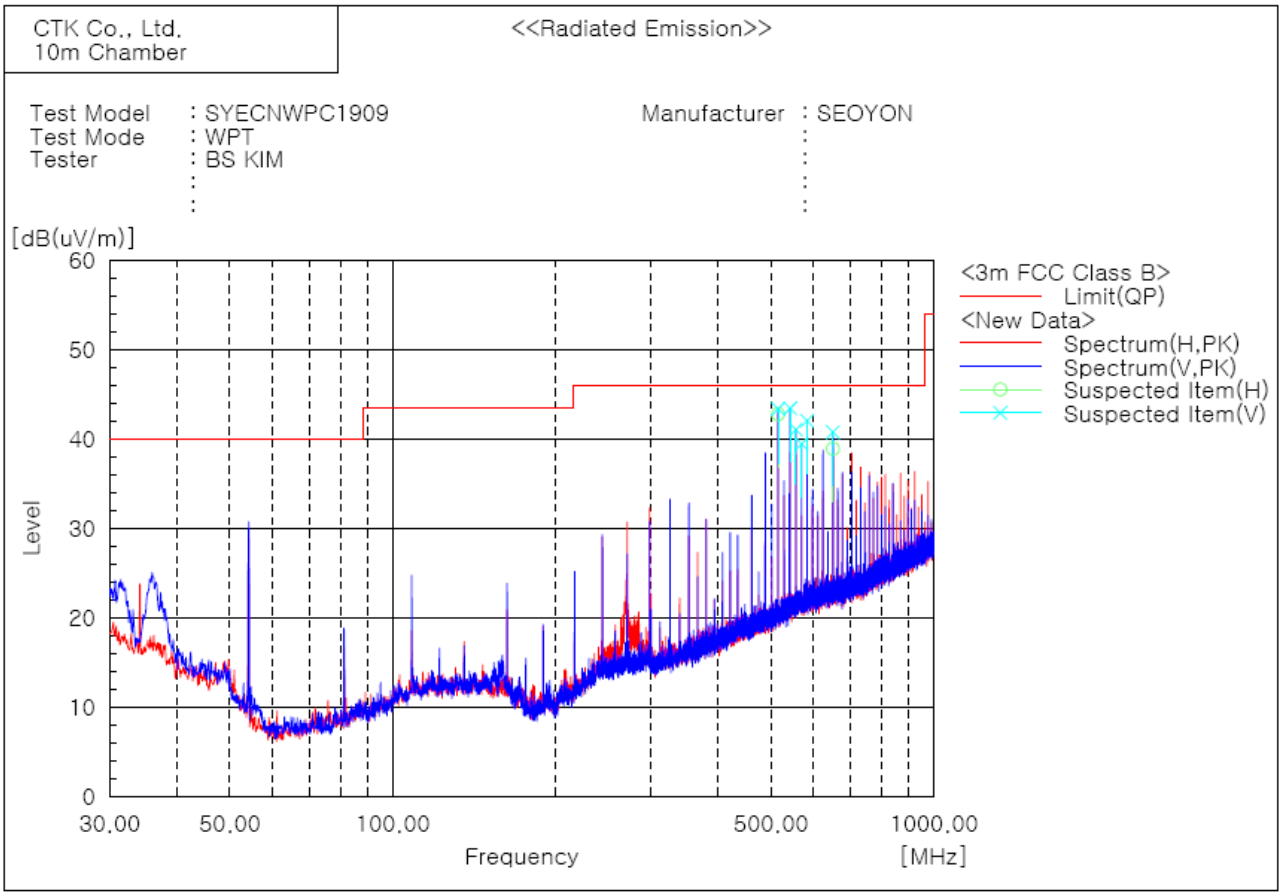
No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	0.115	V	67.9	25.2	93.1	106.4	13.3	100.0	85.0
2	0.344	V	36.8	25.1	61.9	96.9	35.0	100.0	114.0
3	13.564	V	32.9	25.8	58.7	69.0	10.3	100.0	0.0

Remark :

1. Result = Reading + c.f(correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator
3. The test result in peak detector is less than quasi-peak limit.
4. No.1 is the fundamental frequency.
5. No.3 is the RFID frequency.

3) Radiated emissions in the frequency range of 30 MHz to 1 000 MHz

The requirements are:
☒ Complies



Spectrum Selection

No.	Frequency [MHz]	(P)	Reading [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	515.364	V	45.6	-2.2	43.4	46.0	2.6	101.0	0.0
2	515.364	H	45.0	-2.2	42.8	46.0	3.2	100.0	315.0
3	542.524	V	44.9	-1.5	43.4	46.0	2.6	101.0	41.0
4	555.983	V	42.2	-1.1	41.1	46.0	4.9	200.0	266.0
5	569.563	V	40.3	-0.8	39.5	46.0	6.5	200.0	240.0
6	583.143	V	42.6	-0.5	42.1	46.0	3.9	200.0	240.0
7	650.921	V	40.4	0.4	40.8	46.0	5.2	101.0	0.0

Remark :
1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain
3. The test result in peak detector is less than quasi-peak limit.

4.3 AC Power line Conducted Emissions

Requirement

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 μH/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.

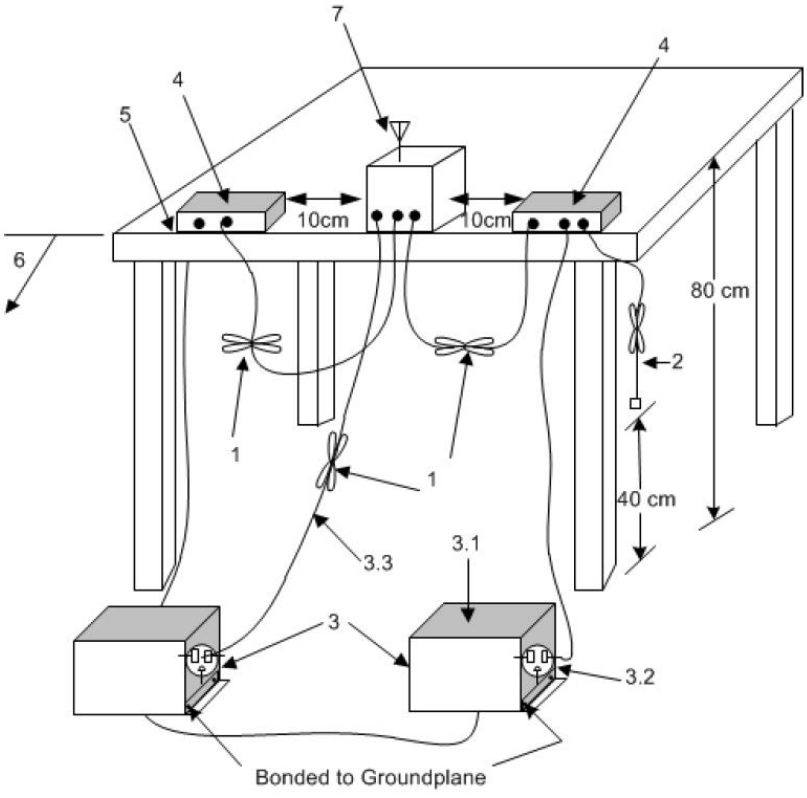
Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

Test Procedures

Refer as ANSI C63.10-2013, clause 6.2(Standard test method for ac power-line conducted emissions from unlicensed wireless devices).

Test Setup



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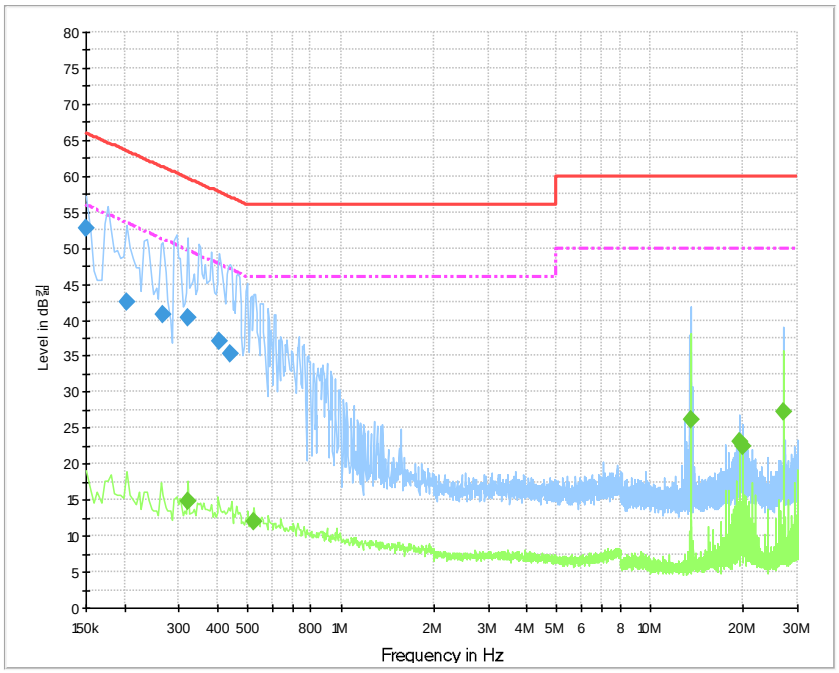
Test Results

The requirements are:
☒ Complies

[LINE]

Class B_L1



Final Result 1

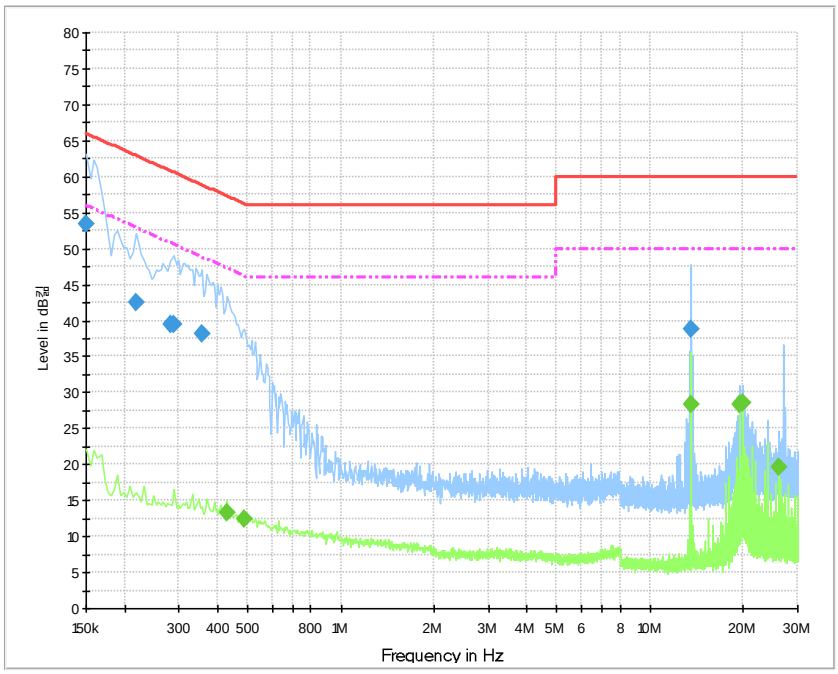
Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	52.8	1000.0	9.000	On	L1	10.0	13.2	66.0
0.204000	42.4	1000.0	9.000	On	L1	10.1	21.0	63.4
0.267000	40.8	1000.0	9.000	On	L1	10.0	20.5	61.2
0.321000	40.4	1000.0	9.000	On	L1	10.1	19.2	59.7
0.406500	37.1	1000.0	9.000	On	L1	10.1	20.7	57.7
0.438000	35.2	1000.0	9.000	On	L1	10.1	21.9	57.1

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.321000	14.9	1000.0	9.000	On	L1	10.1	34.8	49.7
0.523500	12.0	1000.0	9.000	On	L1	10.2	34.0	46.0
13.569000	26.1	1000.0	9.000	On	L1	10.2	23.9	50.0
19.482000	23.2	1000.0	9.000	On	L1	10.3	26.8	50.0
19.981500	22.4	1000.0	9.000	On	L1	10.3	27.6	50.0
27.118500	27.2	1000.0	9.000	On	L1	10.3	22.8	50.0

[NEUTRAL]

Class B_N



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	53.4	1000.0	9.000	On	N	10.3	12.6	66.0
0.217500	42.6	1000.0	9.000	On	N	10.4	20.3	62.9
0.280500	39.6	1000.0	9.000	On	N	10.3	21.2	60.8
0.289500	39.5	1000.0	9.000	On	N	10.3	21.1	60.5
0.357000	38.1	1000.0	9.000	On	N	10.5	20.7	58.8
13.569000	38.9	1000.0	9.000	On	N	10.6	21.1	60.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.429000	13.3	1000.0	9.000	On	N	10.5	34.0	47.3
0.487500	12.4	1000.0	9.000	On	N	10.5	33.8	46.2
13.569000	28.2	1000.0	9.000	On	N	10.6	21.8	50.0
19.482000	28.4	1000.0	9.000	On	N	10.7	21.6	50.0
19.981500	28.6	1000.0	9.000	On	N	10.7	21.4	50.0
25.975500	19.6	1000.0	9.000	On	N	10.7	30.4	50.0

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APPENDIX A – Test Equipment Used For Tests

Instrument for Radiated emission

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2018-10-25	2019-10-25
2	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2018-05-27	2020-05-27
3	Bilog Antenna	Schaffner	CBL6111C	2551	2018-05-10	2020-05-10
4	AMPLIFIER	SONOMA	310	291721	2019-01-28	2020-01-28
5	6dB Attenuator	R&S	DNF	272.4110.50-2	2018-10-25	2019-10-25
6	Spectrum Analyzer	R&S	FSP-30	100994	2018-10-25	2019-10-25

Instrument for AC power line conducted emission

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	LISN	Rohde & Schwarz	ENV216	101760	2019-01-29	2020-01-29
2	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2019-01-29	2020-01-29