

TEST REPORT



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2019-02770
Page (1) / (24) Pages

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

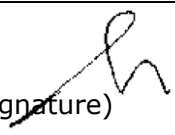
5. Date of Test : 2019-06-28 to 2019-07-11

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.225 RSS-Gen Issue 5, RSS-210 Issue 9

7. Testing Environment: Temp.: (23 ± 1) °C, 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	Technical Manager
	Bong-seok Kim: (Signature) 	Young-taek Lee: (Signature) 

2019-07-19

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



CTK Co., Ltd.
(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
Tel: +82-31-339-9970
Fax: +82-31-624-9501

Report No.:
CTK-2019-02770
Page (2) / (24) Pages

REPORT REVISION HISTORY

Date	Revision	Page No
2019-07-19	Issued (CTK-2019-02770)	all

This report shall not be reproduced except in full, without the written approval of CTK Co., Ltd. This document may be altered or revised by CTK Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by CTK Co., Ltd. will constitute fraud and shall nullify the document.

CONTENTS

1. General Product Description	4
1.1 Client Information	4
1.2 Product Information.....	4
1.3 Antenna Information.....	4
2. Facility and Accreditations.....	5
2.1 Test Facility.....	5
2.2 Laboratory Accreditations and Listings	5
2.3 Calibration Details of Equipment Used for Measurement	5
3. Test Specifications	6
3.1 Standards.....	6
3.2 Mode of operation during the test.....	7
3.3 Peripheral Devices	7
3.4 Maximum Measurement Uncertainty	8
4. Technical Characteristic Test.....	9
4.1 Emission Bandwidth.....	9
4.2 Radiated emissions.....	11
4.3 AC Power line Conducted Emissions	21
APPENDIX A – Test Equipment Used For Tests	24

 CTK Co., Ltd. The Power Leader of Global Regulatory Certification	CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501	Report No.: CTK-2019-02770 Page (4) / (24) Pages	
--	---	--	--

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
IC	3109A-SYECNWPC199
Product Description	Wireless Charging System
Model name	SYECNWPC1909
Variant Model name	-
FVIN	-
Operating Frequency Range	13.56 MHz
RF Output Power	62.1 dBuV/m @ 3 m
Antenna Type	PCB antenna(Loop antenna)
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

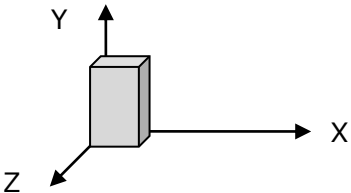
FCC Part Section(s)	RSS Section(s)	Requirement(s)	Status (Note 1)	Report Clause
15.203	RSS-Gen 6.8	Antenna Requirement	C	1.3
15.215(c)	RSS-Gen 6.7	Emission Bandwidth	C	4.1
15.225 (a)(b)(c)(d)	RSS-210 Annex B.6 (a)(b)(c)(d)	Field strength emissions	C	4.2
15.225(e)	RSS-210 Annex B.6	Frequency tolerance	C	4.3
15.207	RSS-Gen 8.8	AC Power line Conducted Emissions	C	4.4
<u>Note 1:</u> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
<u>Note 2:</u> The data in this test report are traceable to the national or international standards.				
<u>Note 3:</u> 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.

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

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

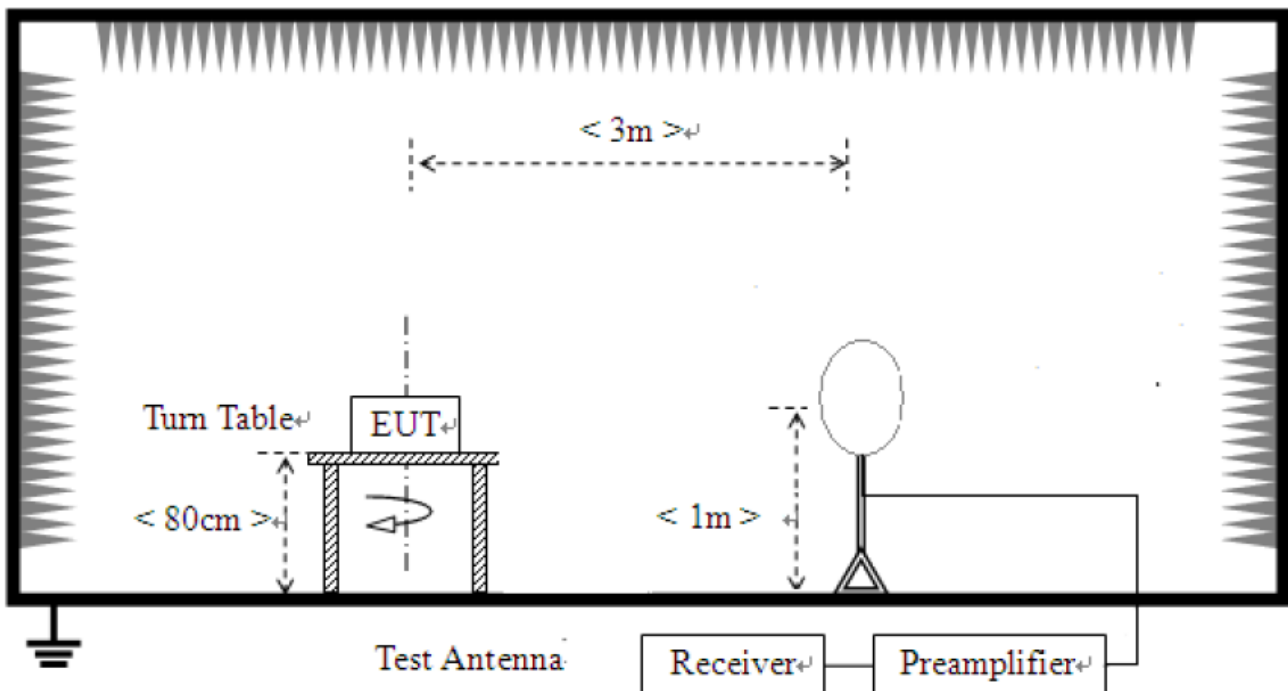
Requirement

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).

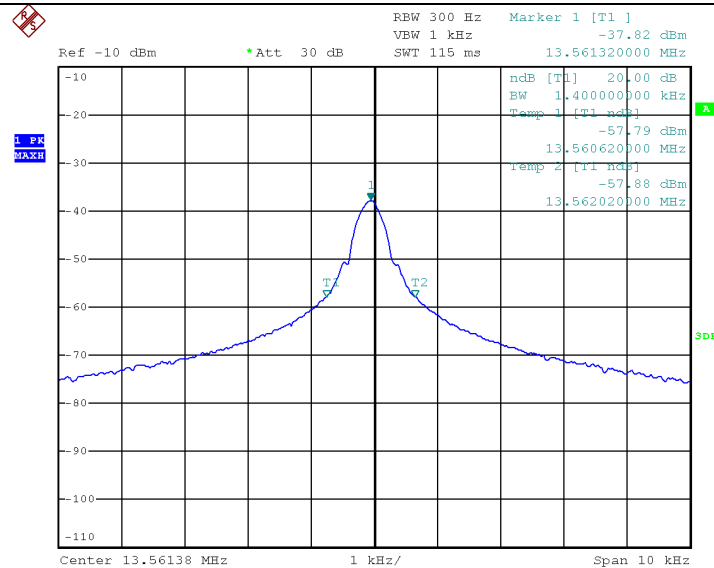
Test Setup



Test results

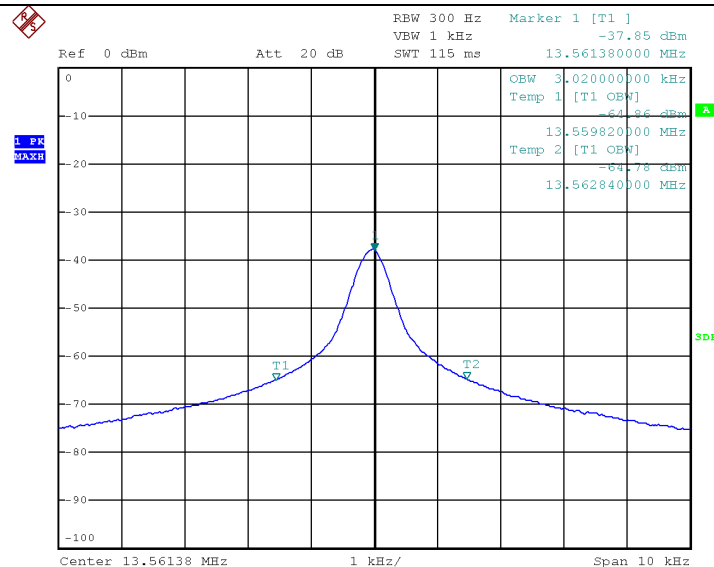
Emission Bandwidth	Result	Limit
20dB Bandwidth	1.40 kHz (F _L : 13.56062 MHz, F _H : 13.56202 MHz)	N/A
99% Bandwidth	3.02 kHz	N/A

Emission Bandwidth Plot 20dB Bandwidth



Date: 11.JUL.2019 21:57:41

Emission Bandwidth Plot 99% Bandwidth



Date: 11.JUL.2019 21:56:13

4.2 Field strength emissions

Requirement

- (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Frequency(MHz)	Field Strength uV/m@30m	Field Strength dBuV/m@30m	Field Strength dBuV/m@3m
13.553-13.567	15,848	84.0	124.0

- (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Frequency(MHz)	Field Strength uV/m@30m	Field Strength dBuV/m@30m	Field Strength dBuV/m@3m
13.410-13.553	334	50.5	90.5
13.567-13.710	334	50.5	90.5

- (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

Frequency(MHz)	Field Strength uV/m@30m	Field Strength dBuV/m@30m	Field Strength dBuV/m@3m
13.110-13.410	106	40.5	80.5
13.710-14.010	106	40.5	80.5

- (d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

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)

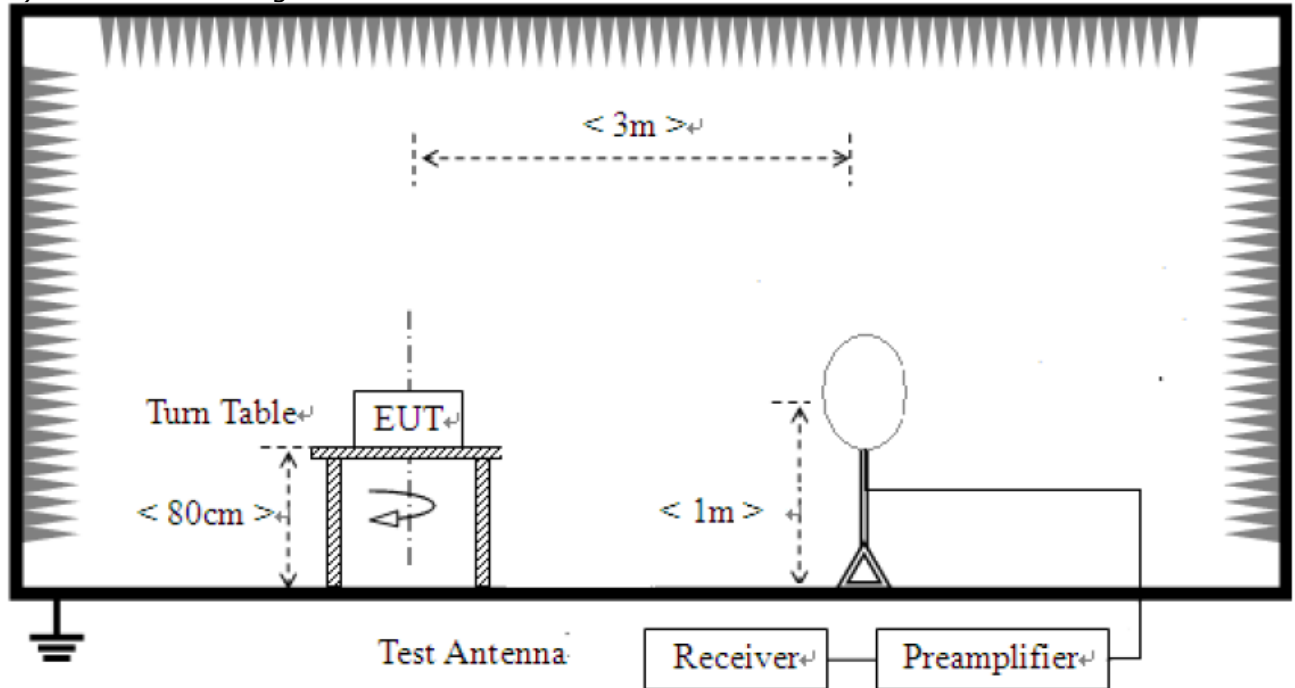
Test Procedures

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 range 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.

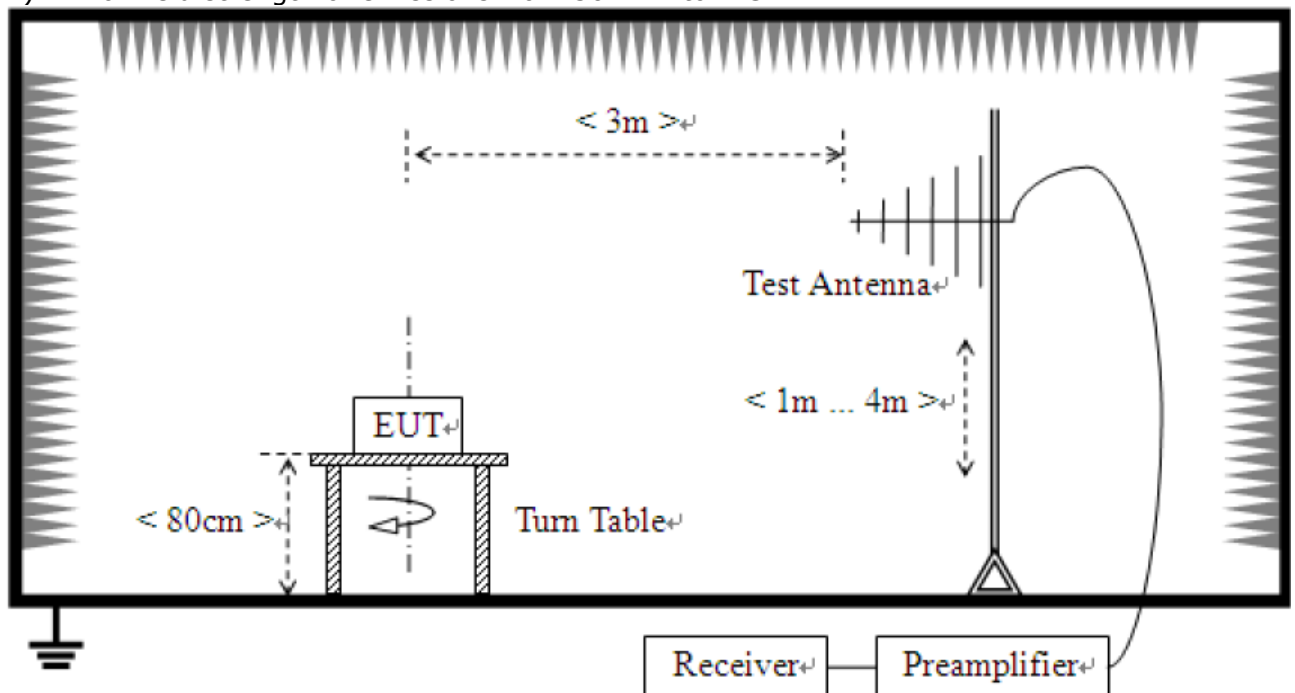
Measuring instrument Settings	
Frequency Range	9 kHz – 1 000 MHz
RBW	200 Hz (9 kHz – 150 kHz) 9 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1 000 MHz)
VBW	≥ RBW
Sweep time	auto couple
Detector function	CISPR quasi-peak(below 1 000 MHz)

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

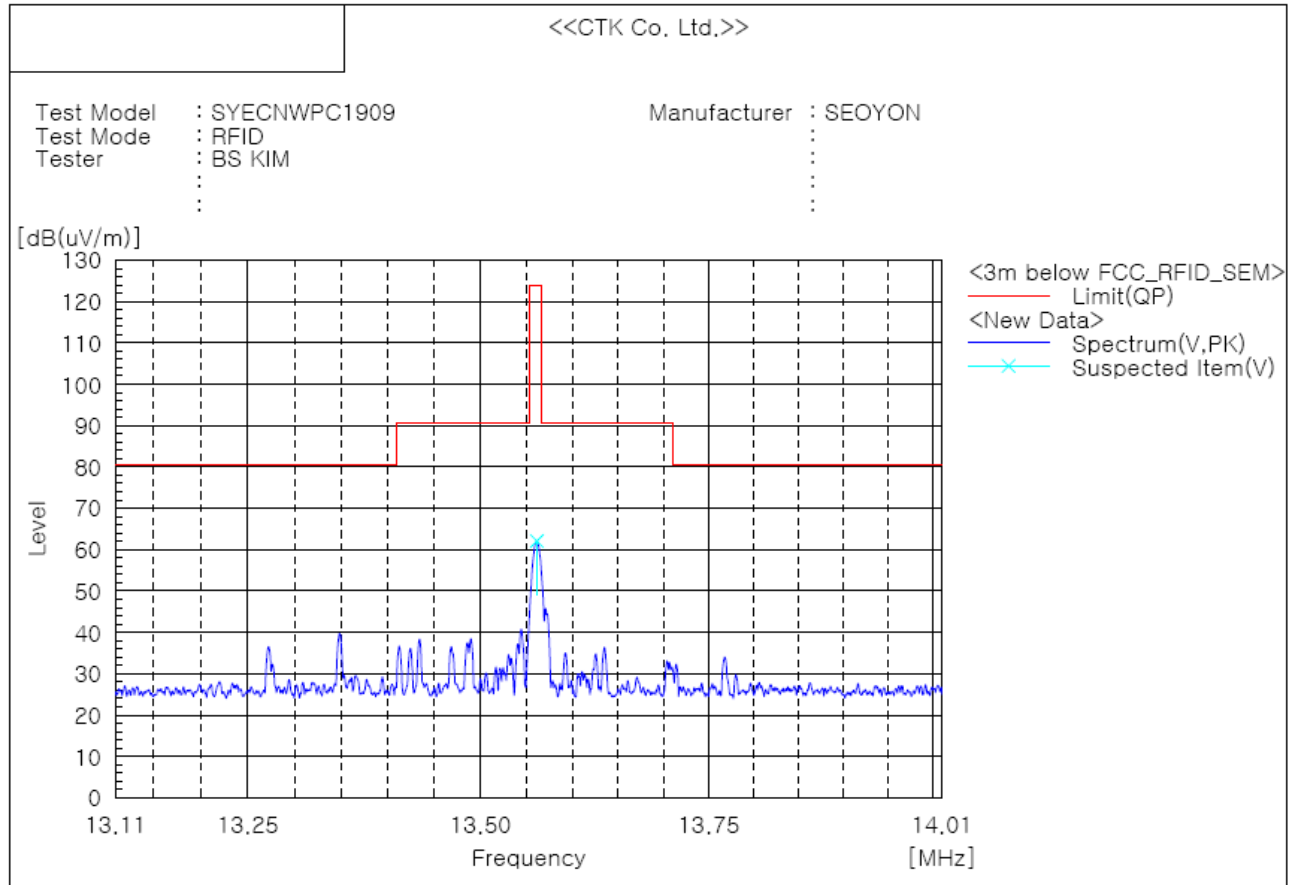


Test results

1) Radiated emissions within the band 13.110-14.010 MHz

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	13.561	36.3	25.8	62.1	124.0	61.9	101.0	339.0

Remark :

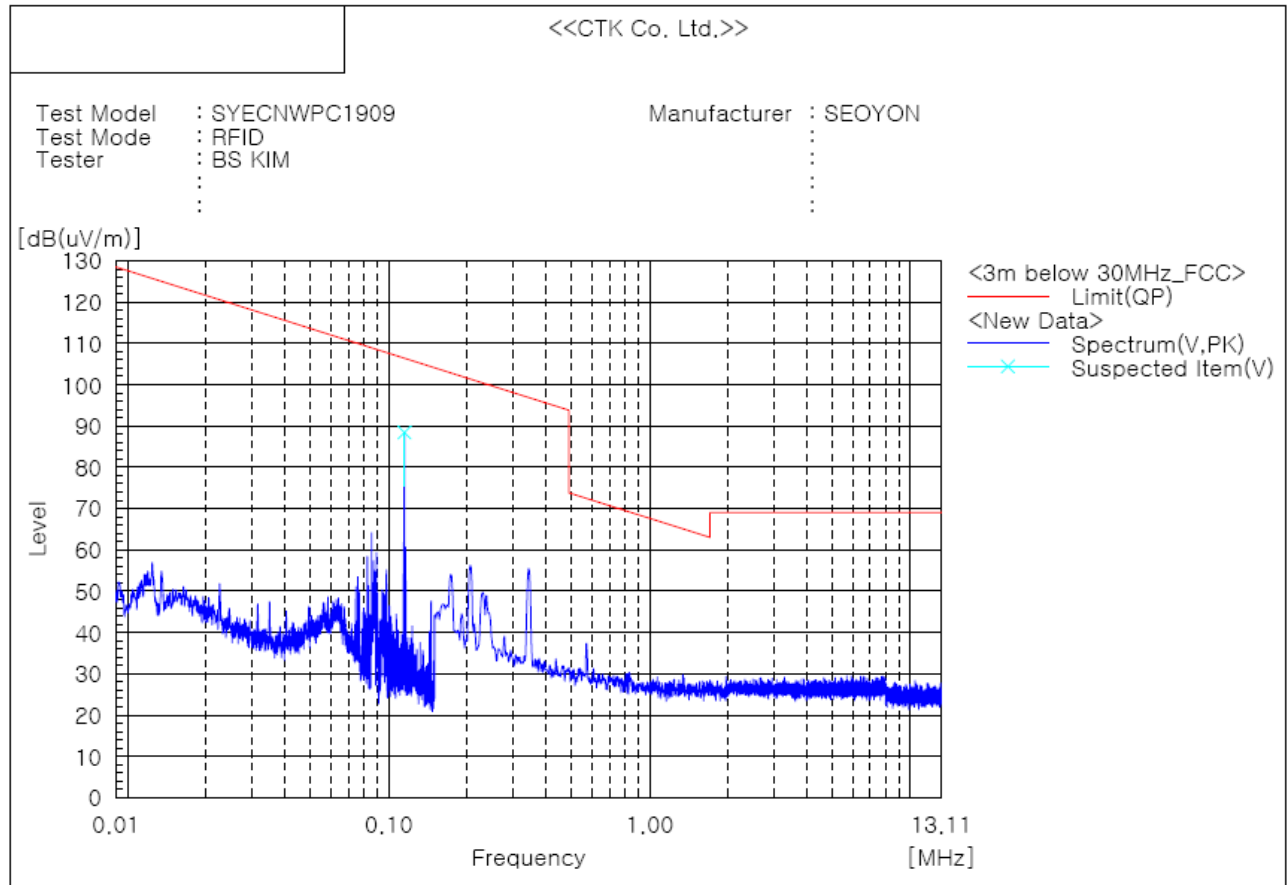
1. Result = Reading + c.f(correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator
3. The test result in peak detector is less than quasi-peak limit.

2) Field strength of any emissions appearing outside of the 13.110-14.010 MHz

Frequency range : 9 kHz – 13.110 MHz

The requirements are:

☒ Complies



Spectrum Selection

No.	Frequency (P)	Reading	c.f	Result	Limit	Margin	Height	Angle
	[MHz]	[dB(uV)]	[dB(1/m)]	PK [dB(uV/m)]	QP [dB(uV/m)]	QP [dB]	[cm]	[deg]
1	0.115	V 63.2	25.2	88.4	106.4	18.0	101.0	315.0

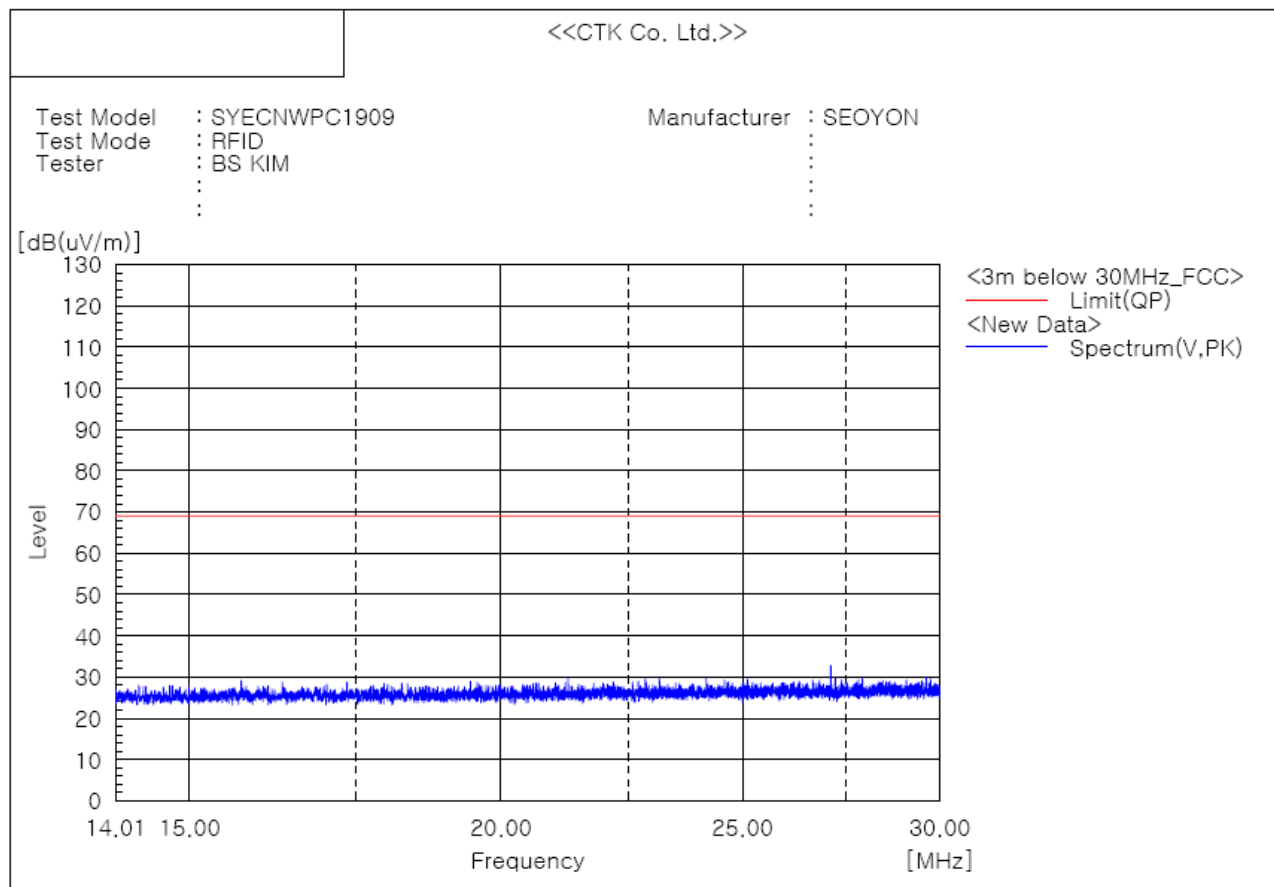
Remark :

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 WPT(Wireless Power Transfer) frequency.

Frequency range : 14.010 MHz – 30 MHz

The requirements are:

☒ Complies



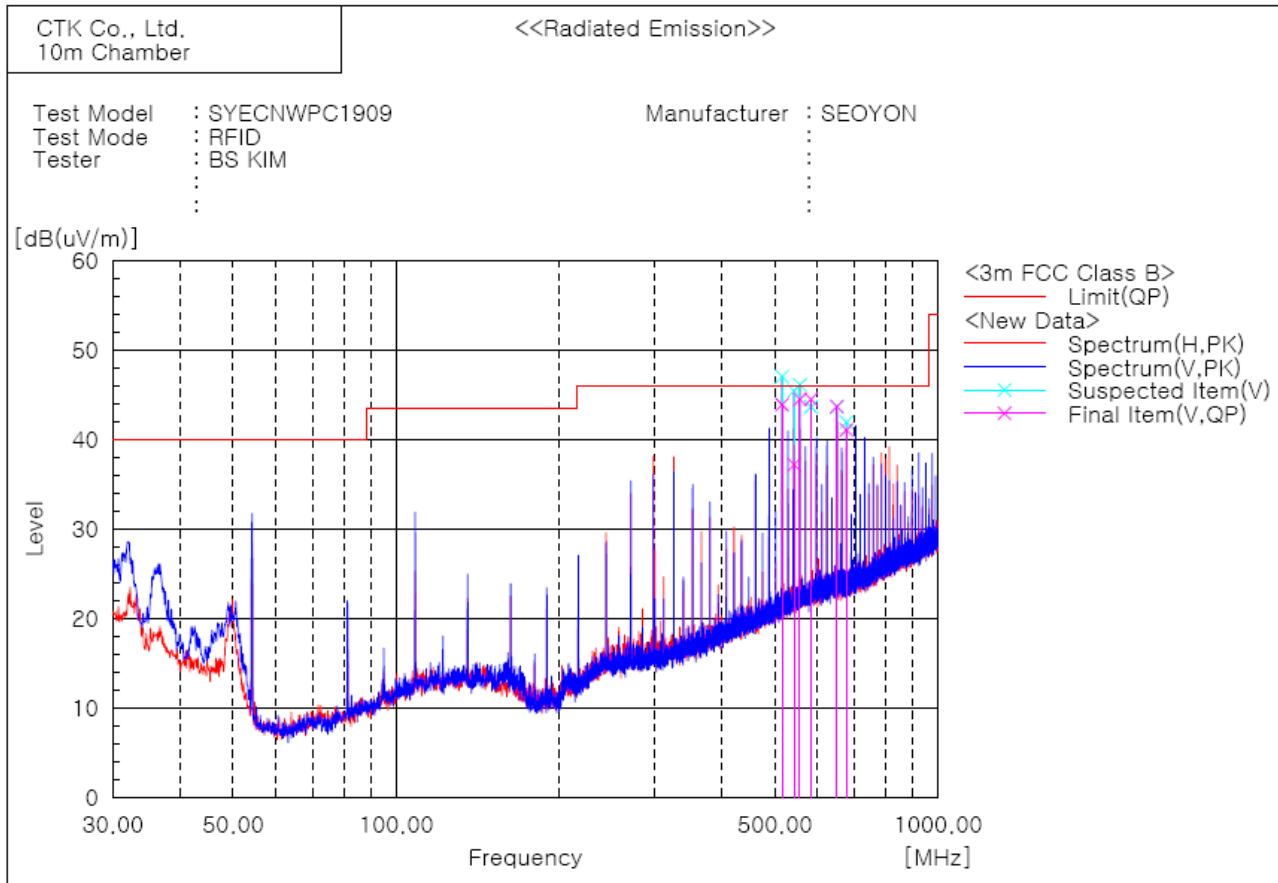
Remark :

1. Result = Reading + c.f(correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator
3. Emissions more than 20 dB below the limit do not need to be reported.

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

The requirements are:

☒ Complies



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	515.364	V	46.1	-2.2	43.9	46.0	2.1	101.0	40.0
2	542.524	V	38.7	-1.5	37.2	46.0	8.8	101.0	359.0
3	555.983	V	45.6	-1.1	44.5	46.0	1.5	101.0	40.0
4	583.143	V	45.0	-0.5	44.5	46.0	1.5	101.0	40.0
5	650.921	V	43.3	0.4	43.7	46.0	2.3	101.0	359.0
6	678.081	V	40.5	0.6	41.1	46.0	4.9	101.0	359.0

Remark :

1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain

4.3 Frequency Stability

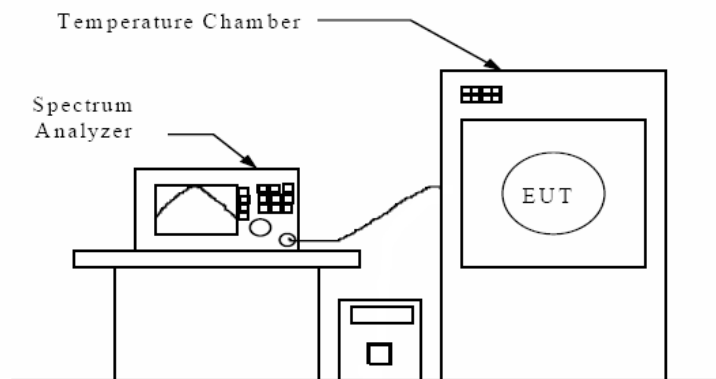
Requirement

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Test Procedures

For the emission bandwidth refer ANSI C63.10-2013, clause 6.8(Frequency stability tests).

Test Setup



Test Results

The requirements are:

☒ Complies

Condition	Measurement Frequency (MHz)				Frequency Stability (ppm)			
	Startup	2 min	5 min	10 min	Start-up	2 min	5 min	10 min
Temp. 50℃	13.561284	13.561288	13.561288	13.561288	-10.62	-10.32	-10.32	-10.32
Temp. 40℃	13.561288	13.561284	13.561288	13.561288	-10.32	-10.62	-10.32	-10.32
Temp. 30℃	13.561360	13.561360	13.561360	13.561360	-5.01	-5.01	-5.01	-5.01
Temp. 20℃	13.561424	13.561424	13.561428	13.561428	-0.29	-0.29	0	0
Temp. 10℃	13.561468	13.561468	13.561468	13.561468	2.95	2.95	2.95	2.95
Temp. 0℃	13.561532	13.561536	13.561536	13.561536	7.67	7.96	7.96	7.96
Temp. -10℃	13.561568	13.561568	13.561568	13.561568	10.32	10.32	10.32	10.32
Temp. -20℃	13.561584	13.561588	13.561588	13.561588	11.50	11.80	11.80	11.80
Voltage 85%	13.561412	13.561412	13.561412	13.561412	-1.18	-1.18	-1.18	-1.18
Voltage 115%	13.561412	13.561408	13.561408	13.561408	-1.18	-1.47	-1.47	-1.47
Limit(ppm)	-				100			

4.4 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 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.

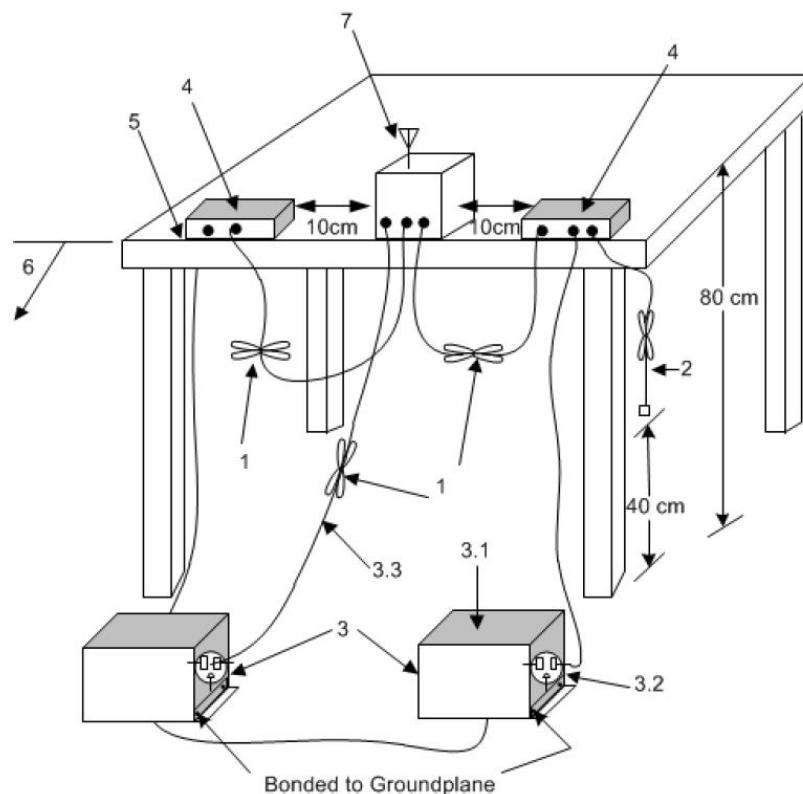
Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* 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



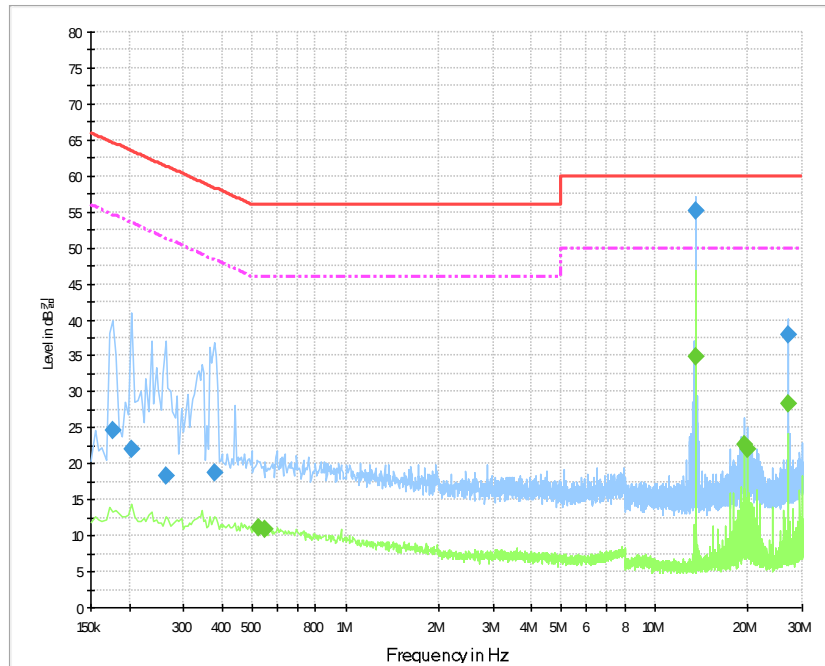
Test Results

The requirements are:

☒ Complies

[LINE]

Class B_L1



Final Result 1

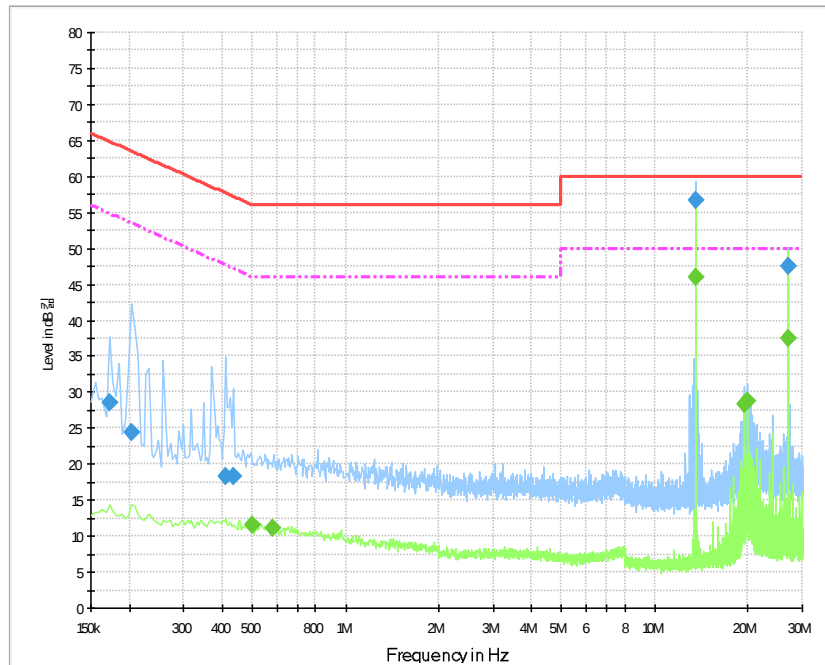
Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.177000	24.5	1000.0	9.000	On	L1	10.3	40.1	64.6
0.204000	22.1	1000.0	9.000	On	L1	10.1	41.3	63.4
0.262500	18.3	1000.0	9.000	On	L1	10.0	43.1	61.4
0.375000	18.8	1000.0	9.000	On	L1	10.1	39.6	58.4
13.560000	55.1	1000.0	9.000	On	L1	10.2	4.9	60.0
27.118500	37.9	1000.0	9.000	On	L1	10.3	22.1	60.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.523500	11.0	1000.0	9.000	On	L1	10.2	35.0	46.0
0.546000	10.9	1000.0	9.000	On	L1	10.2	35.1	46.0
13.555500	34.8	1000.0	9.000	On	L1	10.2	15.2	50.0
19.482000	22.7	1000.0	9.000	On	L1	10.3	27.3	50.0
19.981500	22.1	1000.0	9.000	On	L1	10.3	27.9	50.0
27.118500	28.3	1000.0	9.000	On	L1	10.3	21.7	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)
0.172500	28.6	1000.0	9.000	On	N	10.6	36.2	64.8
0.204000	24.4	1000.0	9.000	On	N	10.4	39.0	63.4
0.411000	18.2	1000.0	9.000	On	N	10.5	39.4	57.6
0.433500	18.3	1000.0	9.000	On	N	10.5	38.9	57.2
13.560000	56.7	1000.0	9.000	On	N	10.6	3.3	60.0
27.123000	47.5	1000.0	9.000	On	N	10.7	12.5	60.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.501000	11.5	1000.0	9.000	On	N	10.6	34.5	46.0
0.582000	11.2	1000.0	9.000	On	N	10.6	34.8	46.0
13.560000	46.1	1000.0	9.000	On	N	10.6	3.9	50.0
19.482000	28.4	1000.0	9.000	On	N	10.7	21.6	50.0
19.981500	28.7	1000.0	9.000	On	N	10.7	21.3	50.0
27.123000	37.4	1000.0	9.000	On	N	10.7	12.6	50.0

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

Cable

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Check Date
1	Cable	CANARE	3m loop	N/A	2019-01-28
2	Cable	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2019-01-28
3	Cable	CANARE	10m 1G below-1	N/A	2019-01-28
4	Cable	CANARE	10m 1G below-2	N/A	2019-01-28
5	Cable	CANARE	AC power line	N/A	2019-01-28