RF Test Report
125 kHz RFID

Report No.	:	FCCBVCI-WAY-P22090077R1
Customer	:	LG Electronics Inc.
Customer Address	:	222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do 451-713 Korea.
Manufacturer	:	LG Electronics Nanjing New Technology Co., Ltd
Manufacturer Address:		346, Yaoxin Road, Economic & Technical Development Zone, 210038 Nanjing, China
Use of Report	:	Certification
Model Name (FCC)	:	24CR670N
Model Name (IC)	:	24CR670IK
FCC ID	:	BEJNT-24CR670
IC	:	2703H-24CR670
Date of Test	:	2022.09.30 to 2022.10.26
Test Method Used	:	FCC 47 CFR PART 15 Subpart C (Section §15.207) FCC 47 CFR PART 15 Subpart C (Section §15.209) RSS-Gen Issue 5, April 2018
Testing Environment	:	Refer to the Test Condition

Test Result : ☒ **Pass** ☐ **Fail**

ISSUED BY:	BV CPS ADT Korea Ltd., EMC/RF Laboratory
ADDRESS:	Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea 16675
TEST LOCATION:	HeungAn-daero 49, DongAn-gu, Anyang-si, Gyeonggi-do, Korea, 14119

Tested by

Name : Donghwa Shin (Signature)

Technical Manager

Name : Jungwoo Kim (Signature)

2022. 12. 12

BV CPS ADT Korea Ltd.

RELEASE CONTROL RECORD

REPORT NO.	REASON FOR CHANGE	DATE ISSUED
FCCBVCI-WAY-P22090077	Original release	2022.10.31
FCCBVCI-WAY-P22090077R1	Family Series add note (page 6)	2022.12.12

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1 Summary of Test Results

The EUT has been tested according to the following specifications

Applied Standard : FCC Part 15, Subpart C 15.207/15.209), RSS-Gen Issue 5					
FCC Part Section(s)	**RSS Section(s)**	**Test Description**	**Limit**	**Test Result**	**Reference**
15.207	RSS- Gen [8.8]	AC Conducted Emissions (150 kHz – 30 MHz)	< FCC 15.207 limits	PASS	Section 3.4
-	RSS-Gen [6.7]	Occupied Bandwidth (99 % Bandwidth)	N/A	PASS	Section 3.2
15.209	RSS-Gen	Transmitter Radiated Emission	Emissions in Restricted bands must meet the radiated limits detailed in 15.209	PASS	Section 3.3
15.203	RSS-Gen	Antenna Requirement	< FCC 15.207 limits	PASS	Section 3.1

NOTES

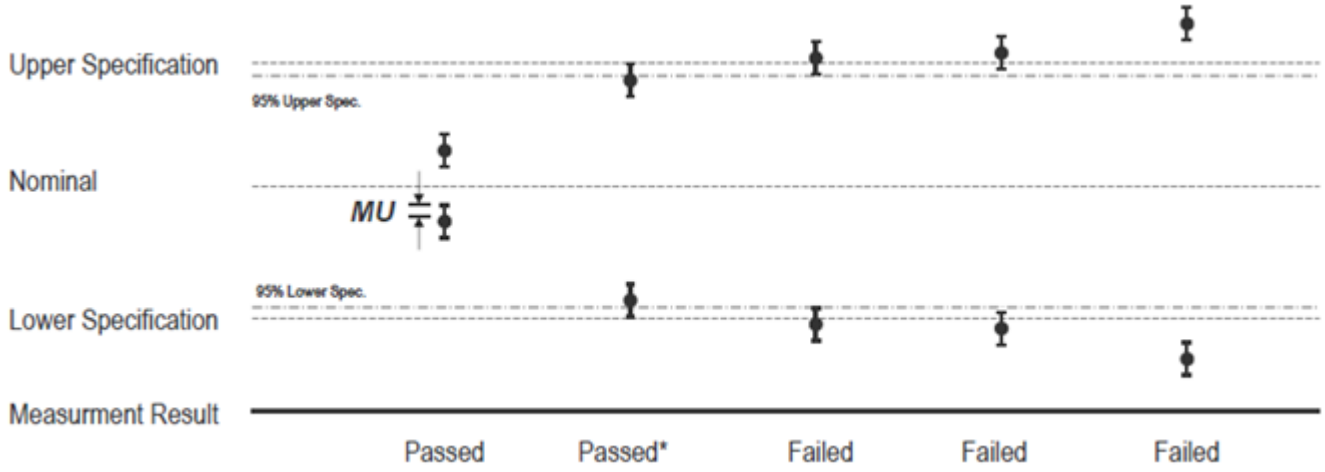
1) The general test methods used to test on this devices are ANSI C63.10.

2) Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

3) According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒.

Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

1.1 Decision Rules for Statement of Conformity



QUA-52 Decision Rule(QA Document) was applied.

Step 1) : Reference Check, Daily Check, Peripheral device Check

Step 2) : Re-test Procedure (Repeat the test maximum 3 times, Different Test Engineer)

1) If the original test results are subject to retesting and the judgement is unclear, the retest is carried out.
2) If the result of the first retest is the same as the initial test, the judgement is made based on the value.
3) If the result of the first retest differ from the results of the initial test, the second re-test is carried out.
4) After completion of the second retest, the average of the three test results is determined as the final result. However, if the deviation of the three test values is more than 5 % of the reference value, the technical manager should review the reproducibility of the test from the beginning.

1.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2

Measurement Items	Frequency Range	Expanded Uncertainty U = *k*Uc (*k* = 2)
Conducted Emissions at main ports	150 kHz – 30 MHz	2.99
Radiated Spurious Emissions	9 kHz – 30 MHz	1.92
	30 MHz – 1 GHz	4.00

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

2 General Information

2.1 General Description of EUT

Product	All-in-One Thin Client
Brand	LG Electronics Inc.
Factory	**LG Electronics Inc.** 168, Suchul-daero, Gumi-si, Gyeongsangbuk-do, 39368 Republic of Korea
	LG Electronics Nanjing New Technology Co.,Ltd. No. 346, Yaoxin Road, Economic & Technical Development Zone Nanjing 210038, P.R. China
	LG Electronics Inc. 77, Sanho-daero Gumi-si, Gyeongsangbuk-do, 39381, Republic of Korea
FCC Model	24CR670N
IC Model	24CR670IK
Identification No. of EUT	207NTHME4201
FCC Series Model	24CR670N, 24CR670NK, 24CR670W, 24CR671N, 24CR671NK, 24CR671W, 24CR671WK, 24CR670I, 24CR670IK, 24CR671I, 24CR671IK, 24CR670WK
Model Difference	Model difference based on CPU, OS, keyboard and mouse
HVIN	24CR670IK
FVIN	-
Power Supply	DC 19 V, Adaptor (Input: AC 100-240 V, 50/60 Hz, Output: DC 19 V)
Modulation Type	ASK
Transfer Rate	-
Operating Frequency	125 ㎑
Number of Channel	1
Output Power	-4.05 dBμV
Antenna Type	Loop Coil Antenna
Antenna Connector	Internal
H/W Version	V1.3
S/W Version	V2.0

NOTES

1) The above equipment has been tested by **Bureau Veritas Consumer Products Services ADT Korea**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2) These differences do not degrade the radio.

3) The following antennas were provided to the EUT.

Antenna	Type	Connector	Peak Gain (dBi)
			125 kHz
RFID	Loop Coil Antenna	Internal	-

4) **List of Accessories**

Accessories	Brand	Model	Manufacturer	Specification
-	-	-	-	-

5) **Auxiliary test equipment**

Accessories	Brand	Model	Manufacturer	Specification
-	-	-	-	-

2.2 Description of Test Mode

[Test Channel of EUT]

Channel	Frequency [MHz]
1	0.125

2.2.1 Test Mode Applicability and Tested Channel Details

Following channel(s) was(were) selected for the final test as listed below :

EUT Configure mode	Applicable to					Description
	RE < 1G	RE ≥ 1G	PLC	FS	EB	
A	√	√	√	-	-	Powered by Adaptor
B	-	-	-	-	-	Powered by DC Power Supply

Where RE ≥ 1 G : Radiated Emission above 1 GHz
RE < 1 G : Radiated Emission below 1 GHz
PLC : Power Line Conducted Emission
FS : Antenna Port Conducted Measurement
EB : 20 dB Bandwidth

Radiated Emission Test (Below 1 GHz)

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1	1	ASK

Radiated Emission Test (Above 1 GHz)

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1	1	ASK

Power line Conducted Emission Test

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1	1	ASK

Test Condition

Applicable to	Environmental Conditions	Test Voltage	Tested by
RE < 1G	(21.9 ± 2) °C, (46.5 ± 3) % R.H.	AC 230 V, 60 Hz	Donghwa Shin
RE ≥ 1G	(21.9 ± 2) °C, (46.5 ± 3) % R.H.	AC 230 V, 60 Hz	Donghwa Shin
PLC	(21.9 ± 2) °C, (46.5 ± 3) % R.H.	AC 230 V, 60 Hz	Donghwa Shin
FS	N/A	N/A	N/A
EB	N/A	N/A	N/A

2.3 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards.

FCC CFR 47 Part 15, Subpart C (§15.207)
FCC CFR 47 Part 15, Subpart C (§15.209)
ANSI C63.10-2013
RSS-GEN Issue 5

All test items in this test report have been performed and recorded as per the above standards.

2.4 Test Equipment

Test Equipment is traceable to the National Institute of Standards and Technology (NIST). Measurement antenna used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

	Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
■	Temperature & Humidity Chamber	Espec	PL-2J	15015910	2023-06-03
■	True-RMS Digital Multimeter	Fluke	177	43240434	2023-06-03
■	Termination	Warison	WTER-18S2	1	2022-11-24
■	VUBA 9117 Biconical VHF-UHF Broadband Antenna	Schwarzbeck	VUBA 9117	403	2023-12-22
■	Signal Conditioning Unit	R&S	SCU08F2	08400015	2022-11-23
■	Active Loop Antenna	R&S	HFH2-Z2E	349806	2023-02-18
■	Trilog Antenna (with 6 dB ATT.)	Schwarzbeck	VULB 9163	01199	2023-02-22
■	EMI Test Receiver	R&S	ESW8	101170	2022-11-24
■	EMI Test Receiver	R&S	ESW44	101812	2022-11-25
■	Spectrum Analyzer	R&S	FSV30	103017	2022-11-22

3 Test Results

3.1 Antenna Requirement

Except 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 the section.

- The antenna(s) of the EUT are Permanently attached.
- There are no provisions for connection to an external antenna.

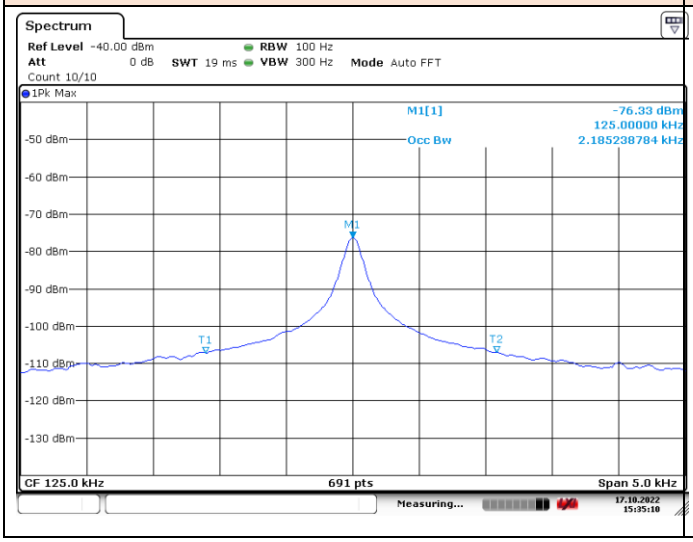
Result

The EUT complies with the requirement of §15.203

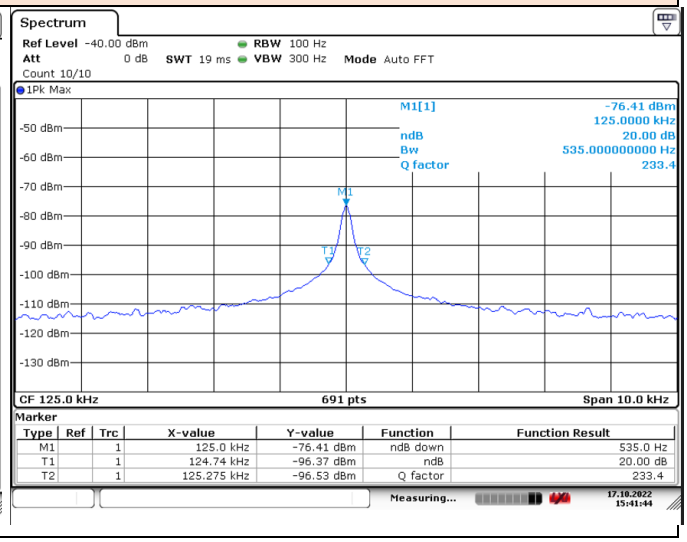
3.2 Occupied Bandwidth

Frequency (kHz)	99% Bandwidth (kHz)	20 dB Bandwidth (kHz)	Limit(kHz)	Pass/Fail
125	2.185	0.535	N/A	Pass

125 kHz 99% Bandwidth



125 kHz 20 dB Bandwidth



3.3 Transmitter Radiated Emission

3.3.1 Regulation

§15.247(d) : In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

§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 (microvolts/meter)	Measurement distance (meters)
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

**Except as provided in paragraph (g), 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., §§15.231 and 15.241.

3.3.2 Test Procedure

Spurious Radiated Emissions

1. The preliminary radiated measurement were performed to determine the frequency producing the maximum emissions in an semi-anechoic chamber at a distance of 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360^{O}.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1000 MHz using the Bi-Log antenna, and from 1000 MHz to 26500 MHz using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 x 4 meter in an semi-anechoic chamber. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector fuction with specified bandwidth.
6. The 0.8 m height is for below 1 GHz testing, and 1.5 m is for above 1GHz testing.

- Procedure for unwanted emissions measurements below 1 000 MHz

The procedure for unwanted emissions measurements below 1 000 MHz is as follows:

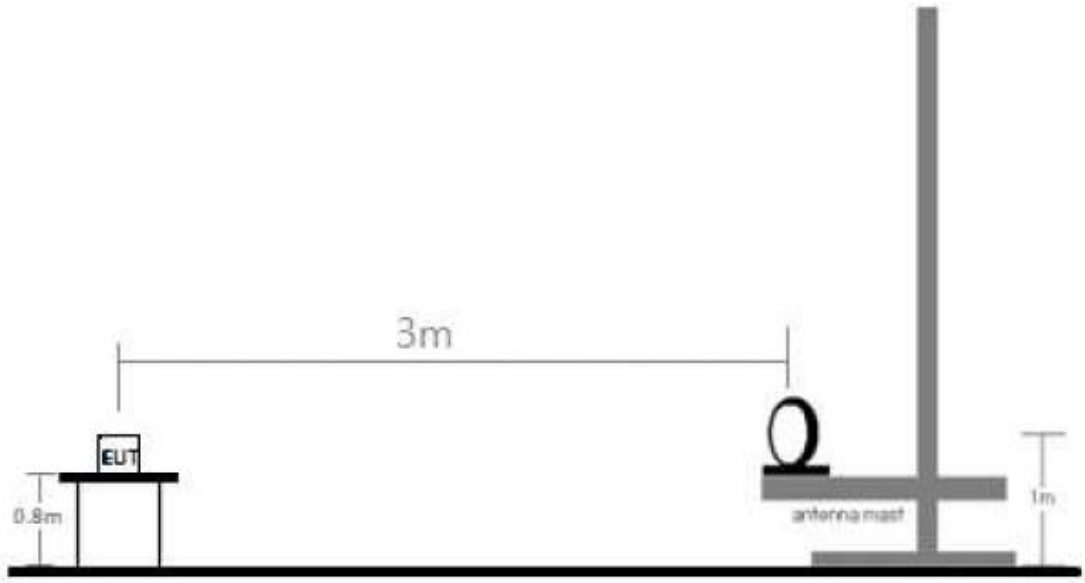
a) Follow the requirements in 12.7.4.

b) Compliance shall be determined using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

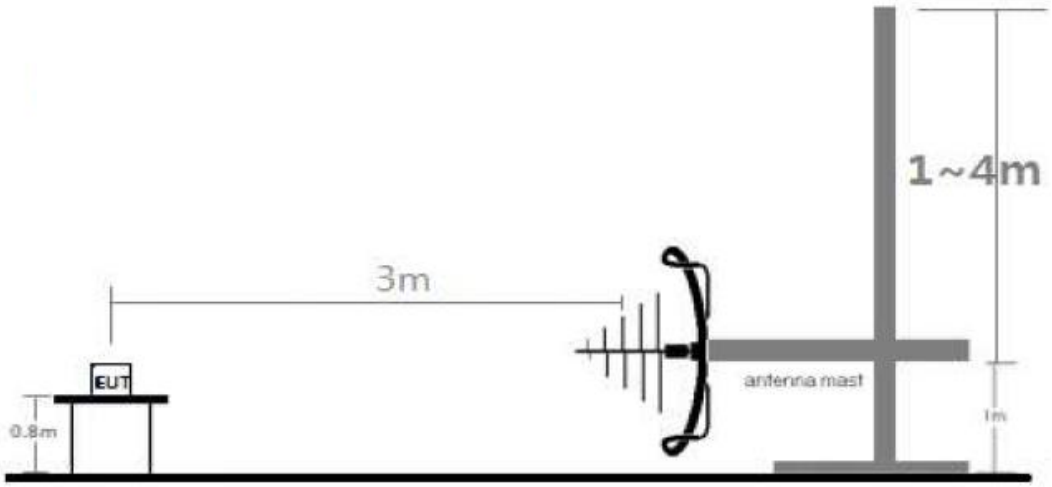
3.3.3 Deviation from Test Standard

No deviation.

3.3.4 Test Setup



[Radiated Emission Test Setup Below 30 MHz]

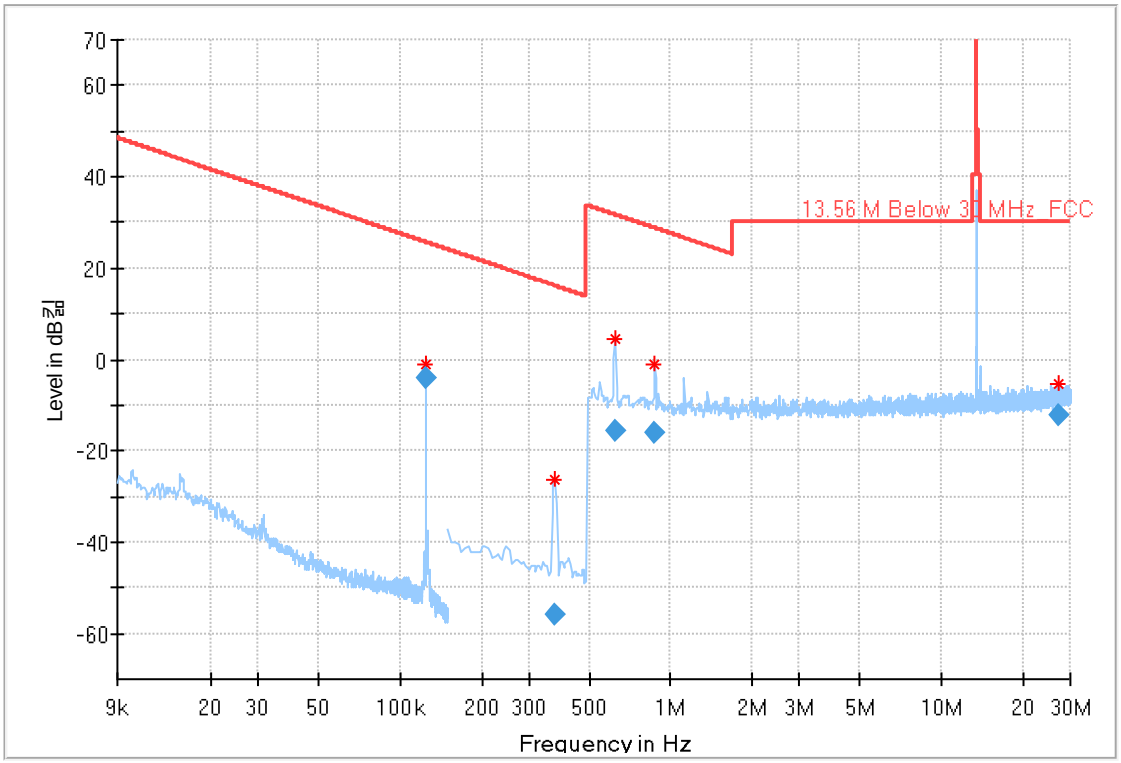


[Radiated Emission Test Setup Below 1 GHz]

3.3.5 Test Result of Radiated Spurious Emission

3.3.5.1 Radiated Emissions (Below 30 MHz)

125 kHz_Horizontal



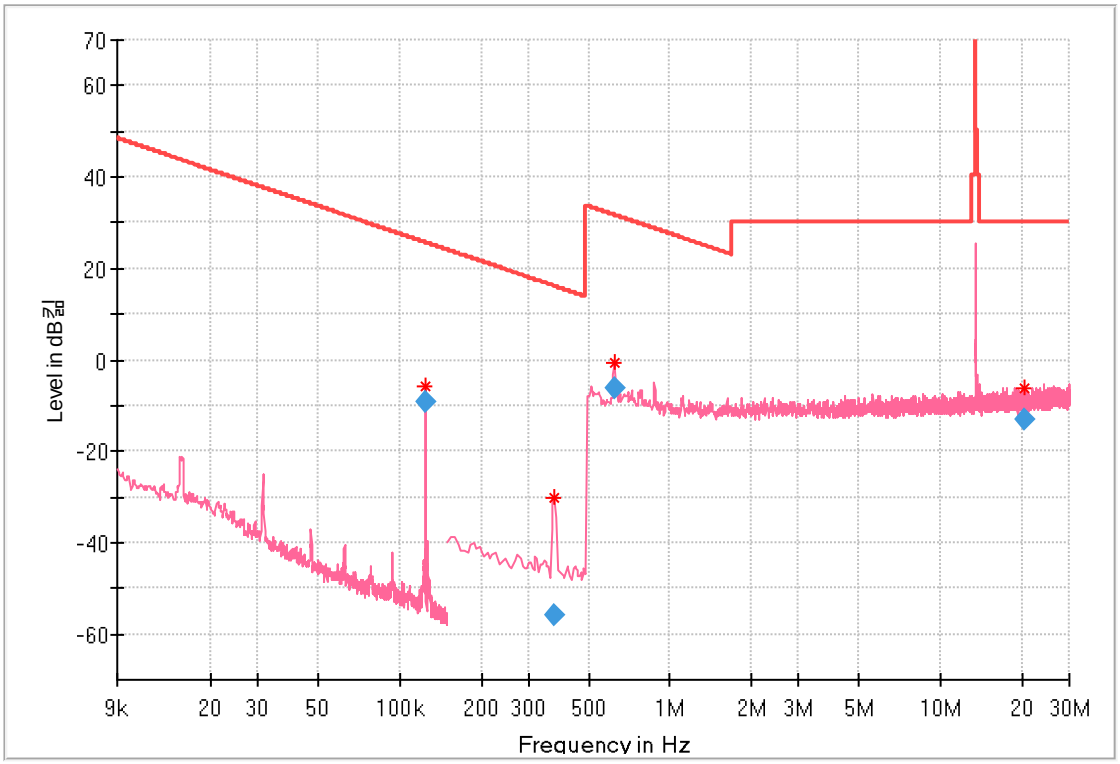
FCC

Frequency [MHz]	QuasiPeak [dBuV/m]	Distance Correction Factor [dB]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB/m]
0.13	-4.05	-80.00	25.66	29.71	100.00	Parallel	0.00	-59.40
0.37	-56.06	-80.00	16.15	72.21	100.00	Parallel	0.00	-59.30
0.62	-15.62	-40.00	31.74	47.36	100.00	Parallel	356.00	-19.20
0.87	-15.88	-40.00	28.78	44.66	100.00	Parallel	356.00	-19.20
27.22	-12.05	-40.00	30.00	42.05	100.00	Parallel	165.00	-16.50

ISED

Frequency [MHz]	QuasiPeak [dBuA/m]	Distance Correction Factor [dB]	Limit [dBuA/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB/m]
0.13	-55.55	-80.00	-25.84	29.71	100.00	Parallel	0.00	-59.40
0.37	-107.56	-80.00	-35.35	72.21	100.00	Parallel	0.00	-59.30
0.62	-67.12	-40.00	-19.76	47.36	100.00	Parallel	356.00	-19.20
0.87	-67.38	-40.00	-22.72	44.66	100.00	Parallel	356.00	-19.20
27.22	-63.55	-40.00	-21.50	42.05	100.00	Parallel	165.00	-16.50

125 kHz_Vertical



FCC

Frequency [MHz]	QuasiPeak [dBuV/m]	Distance Correction Factor [dB]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB/m]
0.13	-9.34	-80.00	25.66	35.00	100.00	Perpendicular	72.00	-59.40
0.37	-56.05	-80.00	16.15	72.20	100.00	Perpendicular	83.00	-59.30
0.62	-6.02	-40.00	31.74	37.76	100.00	Perpendicular	53.00	-19.20
20.35	-13.00	-40.00	30.00	43.00	100.00	Perpendicular	190.00	-17.00

ISED

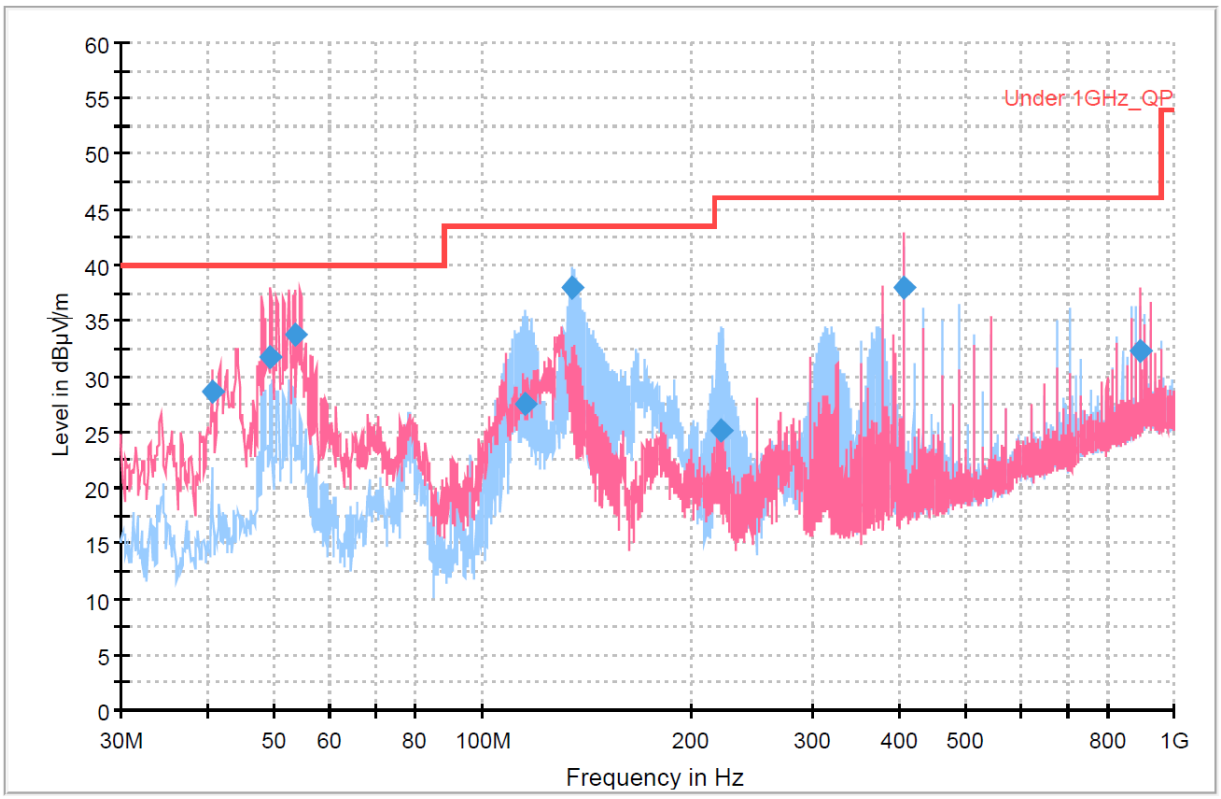
Frequency [MHz]	QuasiPeak [dBuA/m]	Distance Correction Factor [dB]	Limit [dBuA/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB/m]
0.13	-60.84	-80.00	-25.84	35.00	100.00	Perpendicular	72.00	-59.40
0.37	-107.55	-80.00	-35.35	72.20	100.00	Perpendicular	83.00	-59.30
0.62	-57.52	-40.00	-19.76	37.76	100.00	Perpendicular	53.00	-19.20
20.35	-64.50	-40.00	-21.50	43.00	100.00	Perpendicular	190.00	-17.00

Remarks

1. QuasiPeak(dBuV/m) = QuasiPeak Reading Value(dBµV/m) + Correction Factor(dB) + Distance Factor(dB)
2. Correction Factor(dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin(dB) = (Quasi Peak) Limit (dBµV/m) – (Quasi Peak) Result (dBµV/m)
4. dBuA/m = dBuV/m – 51.5 dB
5. We tested three kind of Antenna Pol (Parallel, Perpendicular, Ground parallel) and reported worst case antenna Pol.

3.3.5.2 Radiated Emissions (Below 1 GHz)

125 kHz



Frequency [MHz]	Quasi Peak [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Pol	Azimuth [deg]	Correction Factor [dB/m]
40.67	28.68	40.00	11.32	100	V	358	-18.70
49.40	31.69	40.00	8.31	104	V	358	-18.40
53.57	33.69	40.00	6.31	100	V	232	-18.90
115.36	27.47	43.52	16.05	250	H	124	-22.10
134.76	37.97	43.52	5.55	154	H	150	-24.40
221.28	25.07	46.02	20.95	104	H	108	-21.20
406.75	38.02	46.02	8.00	104	V	234	-15.60

Remarks
1. Quasi Peak(dBµV/m) = Quasi Peak Reading Value(dBµV/m) + Correction Factor(dB)
2. Correction Factor(dB) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin(dB) = (Quasi Peak) Limit (dBµV/m) – (Quasi Peak) Result (dBµV/m)

3.4 AC Conducted Emissions (150 kHz to 30 MHz)

3.4.1 Regulation

§15.207(a) : Except as shown in paragraphs (b) and (c) of this section, 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.

	Conducted limit (dBµV)	
Frequency of emission (MHz)	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.

3.4.2 Test Procedure

a) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm / 50 µH of coupling impedance for the measuring instrument.

b) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

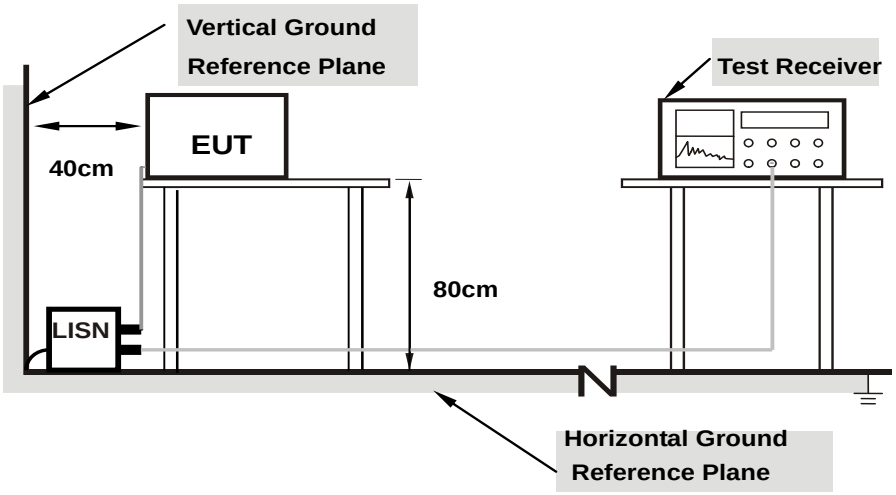
c) The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Remark : The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz – 30 MHz.

3.4.3 Deviation from Test Standard

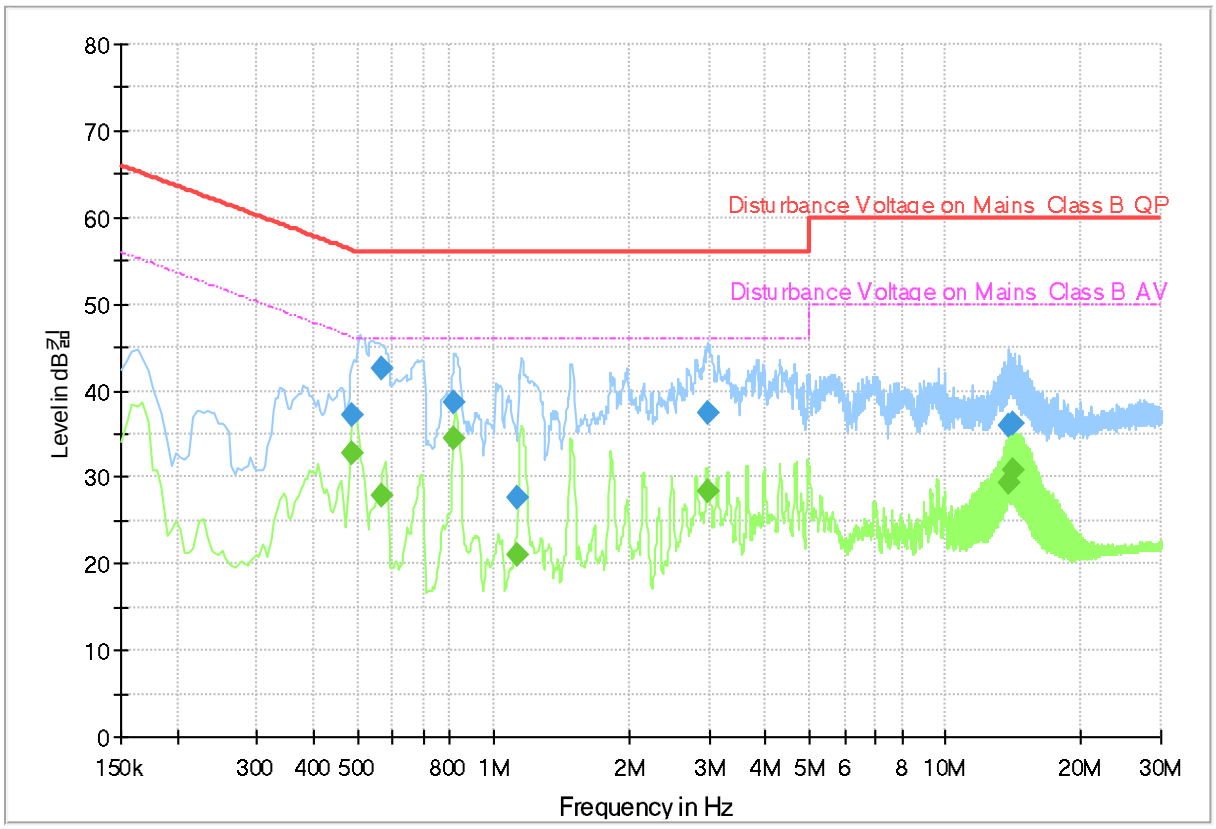
No deviation.

3.4.4 Test Setup



3.4.5 Test Result

125 kHz



Frequency [MHz]	Quasi Peak Reading Value [dBuV]	Quasi Peak Result [dBuV]	CAV Reading Value [dBuV]	CAV Result [dBuV]	Line	Correction Factor [dB/m]	Quasi Peak Margin [dBuV]	Quasi Peak Limit [dBuV]	CAV Margin [dBuV]	CAV Limit [dBuV]
0.49	27.31	37.31	---	---	L1	10.00	18.88	56.19	---	---
0.49	---	---	22.74	32.74	L1	10.00	---	---	13.45	46.19
0.56	32.63	42.53	---	---	L1	9.90	13.47	56.00	---	---
0.56	---	---	18.04	27.94	L1	9.90	---	---	18.06	46.00
0.82	28.82	38.62	---	---	N	9.80	17.38	56.00	---	---
0.82	---	---	24.59	34.39	N	9.80	---	---	11.61	46.00
1.13	17.89	27.69	---	---	N	9.80	28.31	56.00	---	---
1.13	---	---	11.16	20.96	N	9.80	---	---	25.04	46.00
2.96	27.75	37.45	---	---	L1	9.70	18.55	56.00	---	---
2.96	---	---	18.69	28.39	L1	9.70	---	---	17.61	46.00
13.77	25.95	35.95	---	---	N	10.00	24.05	60.00	---	---
13.77	---	---	19.28	29.28	N	10.00	---	---	20.72	50.00
14.10	26.10	36.10	---	---	N	10.00	23.90	60.00	---	---
14.10	---	---	20.88	30.88	N	10.00	---	---	19.12	50.00

Remarks
1. Final Value (QP and/or CAV) = Reading Value (QP and/or CAV) + Corr. (LISN Insertion Loss + Cable Loss)
Margin (QP and/or CAV) = Limit – Final Value (QP and/or CAV)
QP = Quasi-Peak, CAV = CISPR-Average, Corr. = Correction Factor
2. Two graphs measured for both Live (L1) and Neutral (N) of the LISN are combined into one graph.

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services Korea. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

Test Firm Name : BV CPS ADT Korea Ltd.

Main Address :Innoplex No.2 106, Sinwon-ro 306, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675 KOREA

Satellite Address : Bureau Veritas Bldg, HeungAn-daero 49, DongAn-gu, Anyang-si, Gyeonggi-do, 14119, KOREA

FCC

Designation Number : KR0158
Test Firm Registration Number : 666061

ISED

Designation Number : KR0158
Test Firm Registration Number : 25944 (Main)
Test Firm Registration Number : 26316 (Satellite)

If you have any comments, please feel free to contact us at the following:

Email: Meyer.Shin@bureauveritas.com
Web Site: www.bureauveritas.co.kr/cps/eaw

The address and road map of all our labs can be found in our web site also.

- End of report -