TEST REPORT

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Suwon-si, Gyeonggi-do, 16677, Korea
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KCTL

1. Client

- Name : SUPREMA INC
- Address : 17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)
- Date of Receipt : 2020-07-01

2. Use of Report : Certification

3. Name of Product / Model : BioEntry W2 / BEW2-OAPB

4. Manufacturer / Country of Origin : SUPREMA INC / Korea

5. FCC ID : TKWBEW2-OAPB

6. IC Certificate No. : 23080-BEW2OAPB

7. Date of Test : 2020-09-14 to 2020-09-23

8. Location of Test : ■ Permanent Testing Lab □ On Site Testing (Address: Address of testing location)

9. Test method used : FCC Part 15 Subpart C, 15.225
RSS-210 Issue 9 August 2016
RSS-Gen Issue 5 March 2019

10. Test Result : Refer to the test result in the test report

Affirmation	Tested by Name : Jungwon Seo (Signature)	Technical Manager Name : Heesu Ahn (Signature)

2020-10-28

KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2020-09-29	Originally issued	-
2020-10-27	Updated	5,14,21~24,27
2020-10-28	Updated	22

Note. The report No. KR20-SRF0249-A is superseded by the report No. KR20-SRF0249-B.

General remarks for test reports

Nothing significant to report.

CONTENTS

1. General information

Client	:	SUPREMA INC
Address	:	17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)
Manufacturer	:	SUPREMA INC
Address	:	17F-5, Parkview officetower,, 248, Jeongjail-ro, Bundang-gu, Seongnam-si, Gyeonggi-do 13554 Korea (Republic Of)
Laboratory	:	KCTL Inc.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	FCC Site Designation No: KR0040, FCC Site Registration No: 687132
		VCCI Registration No. : R-20080, G-20078, C-20059, T-20056
		Industry Canada Registration No. : 8035A
		KOLAS No.: KT231

2. Device information

Equipment under test	:	BioEntry W2
Model	:	BEW2-OAPB
Derivative model	:	BEW2-ODPB , BEW2-OHPB, BC-LRE-BFI
Frequency range	:	2 402 ㎒ ~ 2 480 ㎒ (Bluetooth Low Energy)
		13.56 ㎒ (NFC)
		125 ㎑ (RFID)
Modulation technique	:	GFSK(Bluetooth Low Energy), ASK (NFC,RFID)
Number of channels	:	40 ch (Bluetooth Low Energy), 1 ch (NFC)
Power source	:	DC 12 Ⅴ, PoE 48 Ⅴ
Antenna specification	:	PCB Loop Antenna (NFC)
		PCB Pattern Antenna (Bluetooth Low Energy)
		Coil Antenna (RFID)
Antenna gain	:	3.00 ㏈i (Bluetooth Low Energy)
Software version	:	V1.6.0
Hardware version	:	V1.0
Test device serial No.	:	N/A
Operation temperature	:	-20 ℃ ~ 50 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source	Note.
GIGABIT PoE SWITCH	IDIS Co., Ltd.	DH2212PF	14377716100013	100-240 V	N/A

2.2. Information about derivative model

The difference between basic model and derivative models is:

Based on the base model, derivative models remove the SAM IC to support a specific card. Customer's model based on the BEW2-OAPB with customer's mark, label and etc.

- BEW2-ODPB : Removed SAM IC
- BEW2-OHPB : Removed SAM IC, add HID s/w license.
- BC-LRE-BFI: BEW2-OAPB with customer's mark & label

Each models are the same functionality except for the SAM function.

2.3. Frequency/channel operations

This device contains the following capabilities:
NFC, 125 ㎑ (RFID), Bluetooth Low Energy

Ch.	Frequency (㎒)
01	13.56

Table 2.3.1. NFC

3. Antenna requirement

Requirement of FCC part section 15.203:

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.

Requirement of RSS-Gen Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

- The transmitter has permanently attached PCB Loop Antenna (internal antenna) on board.

4. Summary of tests

FCC Part section(s)	IC Rule reference	Parameter	Test Condition	Test results
15.225(a)	RSS-210 B.6 (Ⅰ)	In-band Fundamental Emission	Radiated	Pass
15.225(b), (c)	RSS-210 B.6 (Ⅱ), (Ⅲ)	In-band Spurious Emission		Pass
15.225(d) 15.209 15.225(e)	RSS-210 B.6 (Ⅳ) RSS-Gen Issue 9 (8.9)	Out-of-band Spurious Emission		Pass
	RSS-210 B.6 (b)	Frequency Stability Tolerance	Conducted	Pass
15.215(c)	-	20 dB Bandwidth		Pass
-	RSS-Gen Issue 5 (6.7)	Occupied Bandwidth		Pass
15.207(a)	RSS-Gen Issue 5 (8.8)	AC Conducted emissions		Pass

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. 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.
3. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **Y** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **Y** orientation
4. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
5. The radiated test was performed with and without passive tag. The test results shown in the following sections represent the worst case emissions.
   - Worst Case : Without passive tag

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

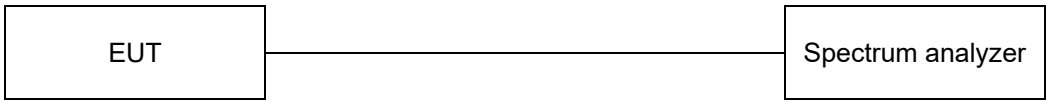
All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded uncertainty (±)	
Radiated spurious emissions	9 ㎑ ~ 30 ㎒:	2.3 dB
	30 ㎒ ~ 300 ㎒	5.4 dB
	300 ㎒ ~ 1 000 ㎒	5.5 dB
Conducted emissions	9 ㎑ ~ 150 ㎑	3.7 dB
	150 ㎑ ~ 30 ㎒	3.3 dB

6. Test results

6.1. 20 dB Bandwidth & 99% Bandwidth

Test setup



Limit

According to §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.

According to RSS-Gen Issue 5 (6.7) The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

Test procedure

ANSI C63.10 - Section 6.9.2

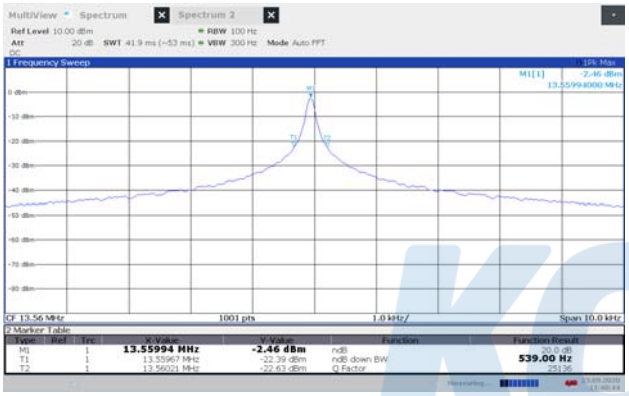
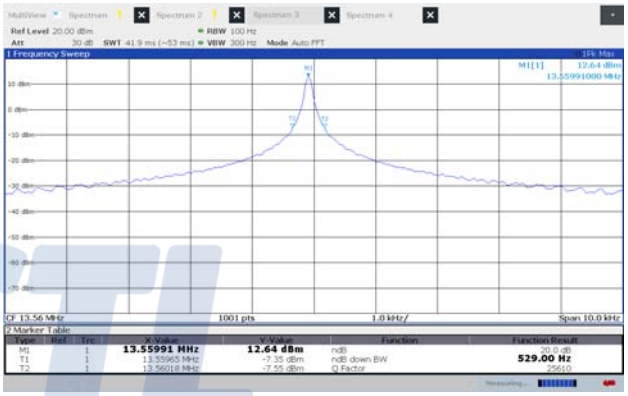
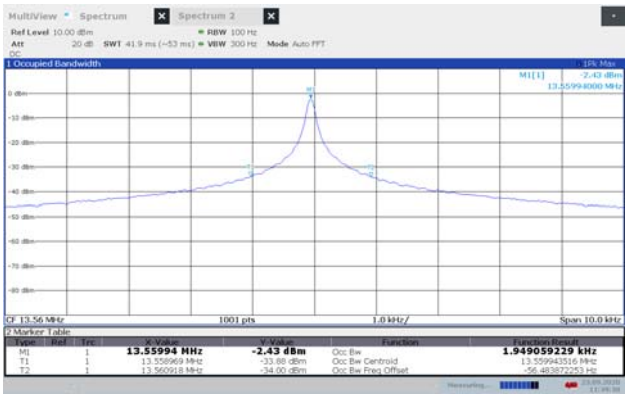
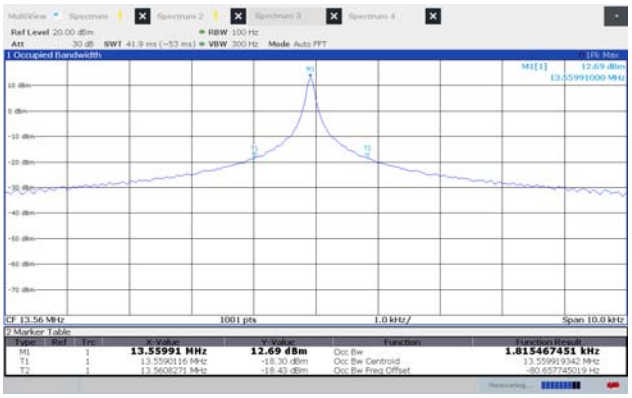
Test settings

The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are −6 dB, −20 dB, and −26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this subclause, the ratio is designated by "−xx dB." The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the "−xx dB" bandwidth; other requirements might specify that the "−xx dB" bandwidth be entirely contained within the authorized or designated frequency band.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.
b)Span: Two times and five times the OBW.
c) RBW = 1 % to 5 % of the OBW and VBW ≥ 3 x RBW
d) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation.
e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
f) Detector: peak
g) Trace mode: max hold.
h) Allow the trace to stabilize.
i) Determine the "−xx dB down amplitude" using ((reference value) − xx). Alternatively, this calculation may be made by using the marker-delta function of the instrument.
j) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
k) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "−xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "−xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.

Test results

Voltage	Frequency [㎒]	20 dB Bandwidth [㎒]		Limit [㎒]	Occupied Bandwidth (99 % BW) [㎑]
12 V	13.56	Lowest Frequency	13.559 670	13.110 000	1.949
		Highest Frequency	13.560 210	14.010 000	
48 V		Lowest Frequency	13.559 650	13.110 000	1.815
		Highest Frequency	13.560 180	14.010 000	

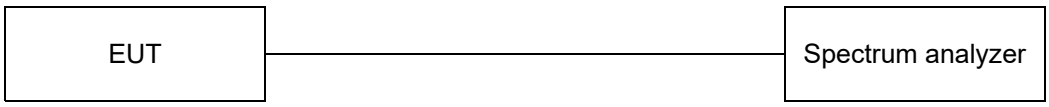
12 V	48 V
20 dB Bandwidth	20 dB Bandwidth
	
Occupied Bandwidth	Occupied Bandwidth
	

Note:

Because the measured signal is CW/CW-like, adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be aproximately twice the RBW

6.2. Frequency tolerance

Test setup



Limit

According to 15.225 (e) and RSS-210 B.6, the frequency tolerance of the carrier signal shall be maintained within ±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. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test procedure

ANSI C63.10 - Section 6.8.1

Test results

12 V

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[℃]		[㎐]	[㎐]	[%]
100	12.00	20(Ref.)	Startup	13 559 927	73.3	-0.000 54
			2 minutes	13 559 926	73.8	-0.000 55
			5 minutes	13 559 940	60.4	-0.000 45
			10 minutes	13 559 933	66.7	-0.000 49
		-20.00	Startup	13 559 934	65.7	-0.000 49
			2 minutes	13 559 928	71.9	-0.000 53
			5 minutes	13 559 927	72.7	-0.000 54
			10 minutes	13 559 923	76.7	-0.000 57
		-10.00	Startup	13 559 927	73.5	-0.000 54
			2 minutes	13 559 927	72.6	-0.000 54
			5 minutes	13 559 924	75.6	-0.000 56
			10 minutes	13 559 926	74.0	-0.000 55
		0.00	Startup	13 559 937	63.3	-0.000 47
			2 minutes	13 559 932	67.7	-0.000 50
			5 minutes	13 559 940	60.3	-0.000 45
			10 minutes	13 559 927	73.1	-0.000 54
		10.00	Startup	13 559 922	77.6	-0.000 57
			2 minutes	13 559 923	76.8	-0.000 57
			5 minutes	13 559 939	60.6	-0.000 45
			10 minutes	13 559 932	67.9	-0.000 50
		25.00	Startup	13 559 937	63.5	-0.000 47
			2 minutes	13 559 934	65.9	-0.000 49
			5 minutes	13 559 926	74.3	-0.000 55
			10 minutes	13 559 939	60.6	-0.000 45
		30.00	Startup	13 559 939	61.0	-0.000 45
			2 minutes	13 559 932	68.5	-0.000 51
			5 minutes	13 559 921	78.9	-0.000 58
			10 minutes	13 559 936	64.3	-0.000 47
		40.00	Startup	13 559 936	63.6	-0.000 47
			2 minutes	13 559 939	60.9	-0.000 45
			5 minutes	13 559 934	65.6	-0.000 48
			10 minutes	13 559 935	64.6	-0.000 48
		50.00	Startup	13 559 934	65.8	-0.000 49
			2 minutes	13 559 927	72.7	-0.000 54
			5 minutes	13 559 933	66.9	-0.000 49
			10 minutes	13 559 938	61.8	-0.000 46
85	10.20	20	Startup	13 559 933	67.1	-0.000 50
			2 minutes	13 559 923	76.5	-0.000 56
			5 minutes	13 559 933	66.7	-0.000 49
			10 minutes	13 559 922	78.1	-0.000 58
115	13.80	20	Startup	13 559 926	73.5	-0.000 54
			2 minutes	13 559 929	71.0	-0.000 52
			5 minutes	13 559 940	60.4	-0.000 45
			10 minutes	13 559 924	76.0	-0.000 56

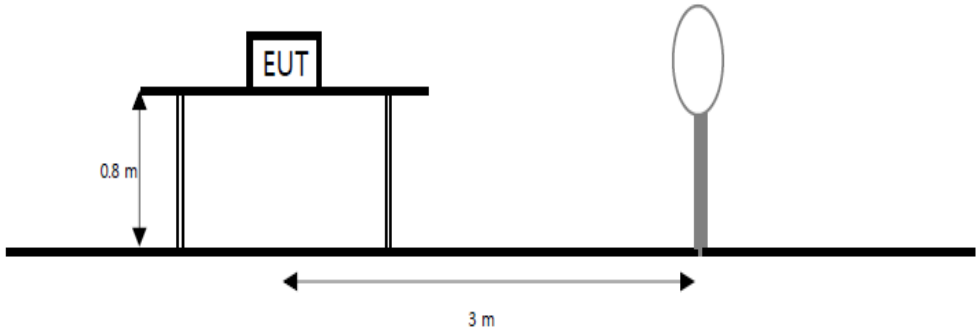
48 V

Voltage	Voltage	TEMP	Maintaining time	Measure frequency	Frequency deviation	Deviation
[%]	[V]	[℃]		[㎐]	[㎐]	[%]
100	48.00	20(Ref.)	Startup	13 559 940	60.0	-0.000 44
			2 minutes	13 559 918	81.6	-0.000 60
			5 minutes	13 559 962	38.3	-0.000 28
			10 minutes	13 559 948	51.7	-0.000 38
		-20.00	Startup	13 559 914	86.5	-0.000 64
			2 minutes	13 559 947	53.3	-0.000 39
			5 minutes	13 559 947	52.5	-0.000 39
			10 minutes	13 559 976	23.9	-0.000 18
		-10.00	Startup	13 559 938	61.8	-0.000 46
			2 minutes	13 559 946	53.7	-0.000 40
			5 minutes	13 559 961	38.7	-0.000 29
			10 minutes	13 559 957	43.5	-0.000 32
		0.00	Startup	13 559 926	74.3	-0.000 55
			2 minutes	13 559 935	64.8	-0.000 48
			5 minutes	13 559 955	45.0	-0.000 33
			10 minutes	13 559 977	23.4	-0.000 17
		10.00	Startup	13 559 945	55.3	-0.000 41
			2 minutes	13 559 954	45.6	-0.000 34
			5 minutes	13 559 922	77.5	-0.000 57
			10 minutes	13 559 946	53.7	-0.000 40
		25.00	Startup	13 559 903	97.2	-0.000 72
			2 minutes	13 559 915	85.4	-0.000 63
			5 minutes	13 559 935	65.0	-0.000 48
			10 minutes	13 559 953	46.7	-0.000 34
		30.00	Startup	13 559 926	74.2	-0.000 55
			2 minutes	13 559 911	89.3	-0.000 66
			5 minutes	13 559 959	41.0	-0.000 30
			10 minutes	13 559 970	30.4	-0.000 22
		40.00	Startup	13 559 937	63.0	-0.000 47
			2 minutes	13 559 912	88.4	-0.000 65
			5 minutes	13 559 959	41.4	-0.000 31
			10 minutes	13 559 964	36.0	-0.000 27
		50.00	Startup	13 559 935	65.2	-0.000 48
			2 minutes	13 559 931	68.8	-0.000 51
			5 minutes	13 559 942	58.4	-0.000 43
			10 minutes	13 559 979	21.3	-0.000 16
85	40.80	20	Startup	13 559 947	52.8	-0.000 39
			2 minutes	13 559 955	44.9	-0.000 33
			5 minutes	13 559 968	32.2	-0.000 24
			10 minutes	13 559 957	43.2	-0.000 32
115	55.20	20	Startup	13 559 935	64.5	-0.000 48
			2 minutes	13 559 924	75.6	-0.000 56
			5 minutes	13 559 926	74.3	-0.000 55
			10 minutes	13 559 930	69.8	-0.000 52

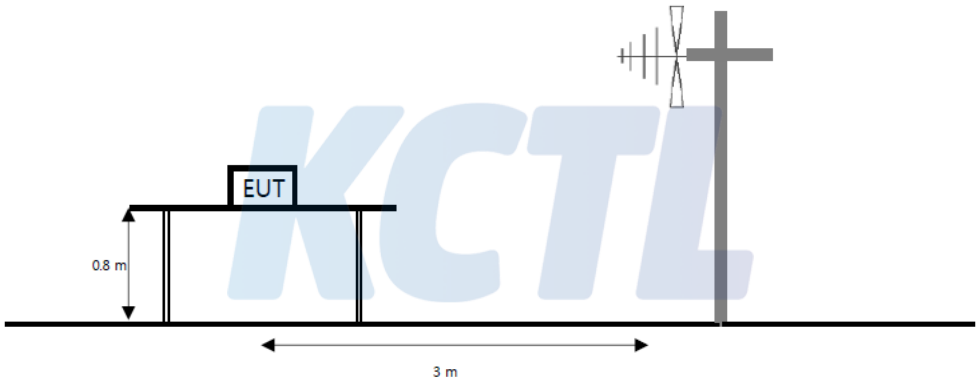
6.3. Radiated spurious emissions

Test setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



Limit

15.225 (a), RSS-210 B.6 (a) The field strength of any emission within the band 13.553-13.567 ㎒ shall not exceed 15, 848 microvolts/meter at 30 meters.

15.225 (b), RSS-210 B.6 (b) With in the bands 13.410-13.553 ㎒ and 13.567-13.710 ㎒, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

15.225 (c), RSS-210 B.6 (c) With in the bands 13.110-13.410 ㎒ and 13.710-14.010 ㎒, the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

15.225 (d), RSS-210 B.6 (d), RSS-Gen Issue 9 (8.9) The Field Strength of any emissions appearing outside of the 13.110-14.010 ㎒ band shall not exceed the general radiated emission limits in 15.209.

Frequency (㎒)	Field Strength (㎶/m)	Measurement distance (meters)
0.009-0.490	2400/F(㎑)	300
0.490-1.705	24000/F(㎑)	30
1.705-30.0	30(29.54 dB㎶/m)	30
30.0-88.0	100(40 dB㎶/m)	3
88-216	150(43.5 dB㎶/m)	3
216-960	200 (46 dB㎶/m)	3
Above 960	500 (53.98 dB㎶/m)	3

Test procedure
ANSI C63.10-2013 - Section 6.4, 6.5

Test settings

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW ≥ 3 x RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Table. RBW as a function of frequency

Frequency	RBW
9 ㎑ to 150 ㎑	200 ㎐ to 300 ㎐
0.15 ㎒ to 30 ㎒	9 ㎑ to 10 ㎑
30 ㎒ to 1 000 ㎒	100 ㎑ to 120 ㎑
> 1 000 ㎒	1 ㎒

Notes:

1. *f* <30 ㎒, extrapolation factor of 40 dB/decade of distance. F_d = 40log(D_m/Ds)
   f ≥30 ㎒, extrapolation factor of 20 dB/decade of distance. F_d = 20log(D_m/Ds)
   Where:
   F_d= Distance factor in dB
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
2. Measurements were performed at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in § 15.31(f)(2). Extrapolation Factor = 40 log10(30/3) = 40 dB.
3. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or F_d(dB)
4. Result = Reading + Cable loss + Amp gain + Ant. factor - Distance factor
5. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
6. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.
7. Below 30 ㎒ frequency range, all orientations about parallel, perpendicular, and ground-parallel were investigated then reported and the worse orientations of Face-on and Face-off were set for final test.
8. Face-on = Parallel, Face-off = Perpendicular

Test results for fundamental
15.225 (a) 13.553-13.567 ㎒

12 V

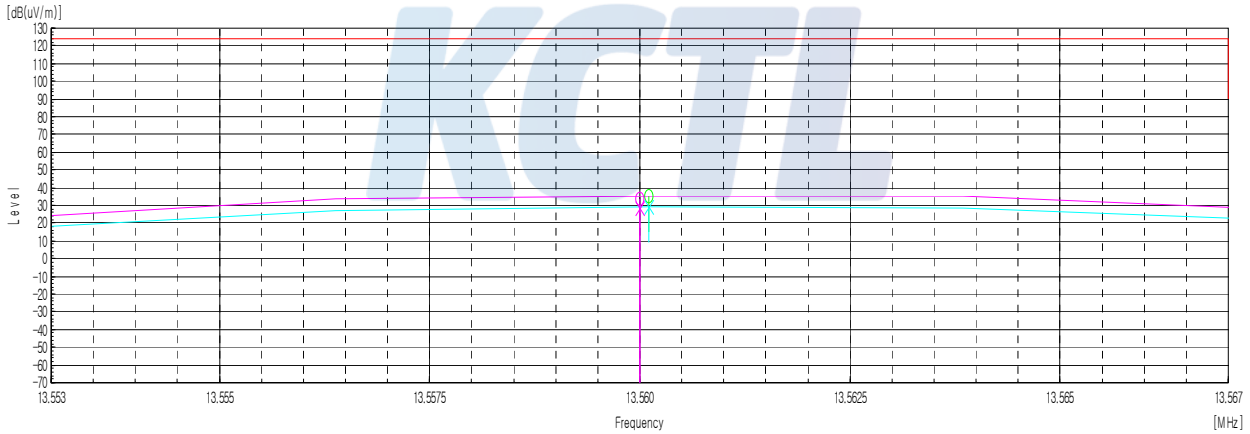
[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.56	85.20	20.20	-31.33	40.00	33.97	84.00	50.03

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.56	79.60	20.2	-31.33	40.00	28.47	84.00	55.53

Face-on/Face-off



48 V

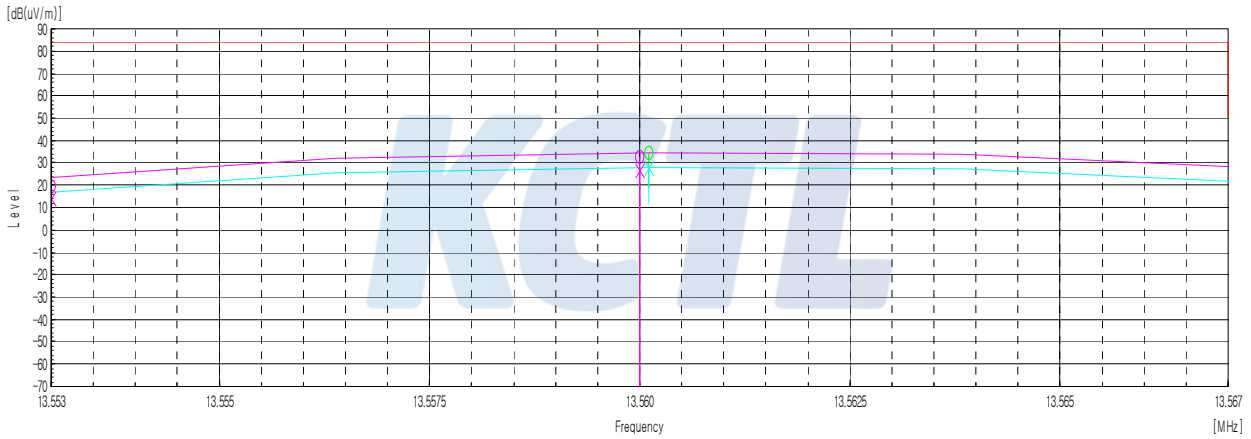
[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.56	83.60	20.2	-31.12	40.00	32.68	84.00	51.32

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.56	78.10	20.2	-31.12	40.00	27.18	84.00	56.82

Face-on/Face-off



Test results for in-band & out-band (9 ㎑ to 30 ㎒)

15.225 (b,c) 13.110-14.010 ㎒

12 V

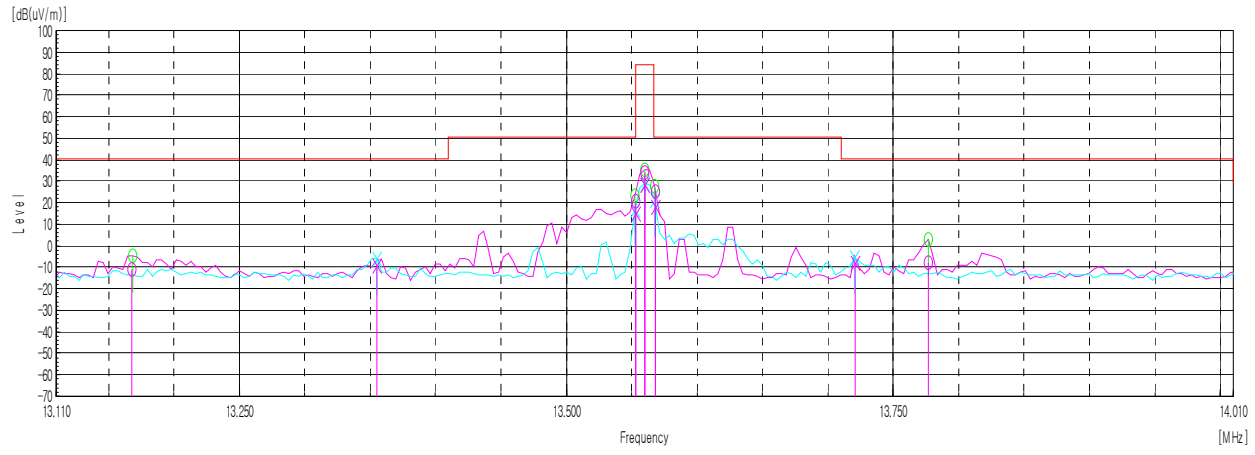
[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.17	40.40	20.20	-31.34	40.00	-10.74	40.50	51.24
13.55	71.90	20.20	-31.33	40.00	20.77	50.50	29.73
13.57	76.40	20.20	-31.33	40.00	25.27	50.50	25.23
13.78	43.20	20.20	-31.32	40.00	-7.92	40.50	48.42

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.36	41.90	20.20	-31.34	40.00	-9.24	40.50	49.74
13.55	66.40	20.20	-31.33	40.00	15.27	50.50	35.23
13.57	69.10	20.20	-31.33	40.00	17.97	50.50	32.53
13.72	43.20	20.20	-31.33	40.00	-7.93	40.50	48.43

Face-on/Face-off



Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

48 V

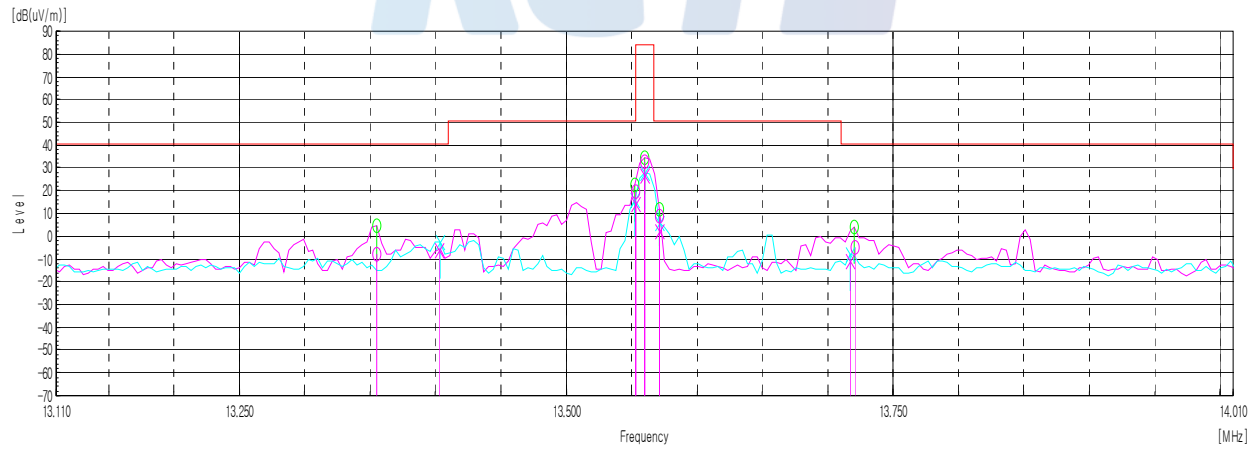
[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.36	43.30	20.20	-31.13	40.00	-7.63	40.50	48.13
13.55	70.80	20.20	-31.12	40.00	19.88	50.50	30.62
13.57	60.20	20.20	-31.12	40.00	9.28	50.50	41.22
13.72	45.90	20.20	-31.12	40.00	-5.02	40.50	45.52

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
13.40	44.90	20.20	-31.12	40.00	-6.02	40.50	46.52
13.55	65.20	20.20	-31.12	40.00	14.28	50.50	36.22
13.57	53.30	20.20	-31.12	40.00	2.38	50.50	48.12
13.72	40.10	20.20	-31.12	40.00	-10.82	40.50	51.32

Face-on/Face-off



Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

Test results (9 ㎑ to 30 ㎒)

15.225 (d) 0.009-30 ㎒

12 V

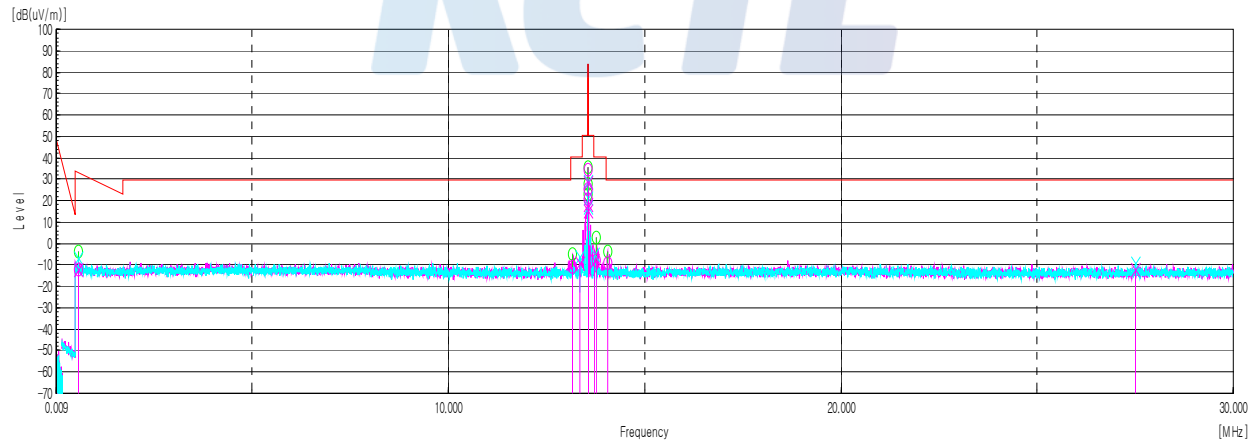
[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
0.58	40.40	19.90	-32.35	40.00	-12.05	32.34	44.39
14.05	42.20	20.20	-31.32	40.00	-8.92	29.54	38.46

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
0.58	40.10	19.90	-32.35	40.00	-12.35	32.34	44.69
27.50	37.70	20.45	-30.87	40.00	-12.72	29.54	42.26

Face-on/Face-off



Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

48 V

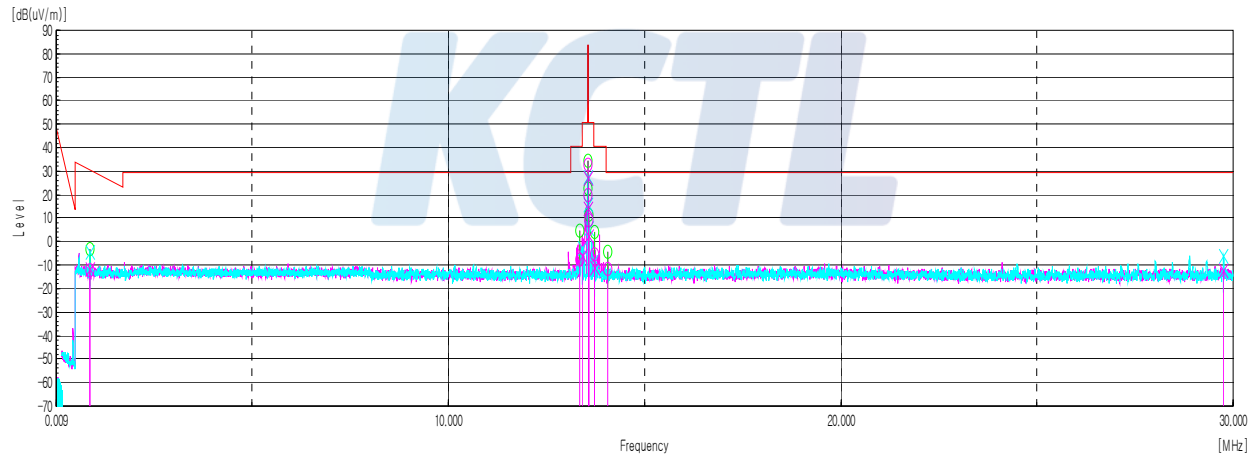
[Face-on]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
0.87	40.10	19.90	-32.28	40.00	-12.28	28.81	41.09
14.07	39.30	20.20	-31.10	40.00	-11.60	29.54	41.14

[Face-off]

Frequency	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data							
0.87	40.80	19.90	-32.28	40.00	-11.58	28.81	40.39
29.76	38.20	20.45	-30.46	40.00	-11.81	29.54	41.35

Face-on/Face-off



Note. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to the 15.209(a) limit.

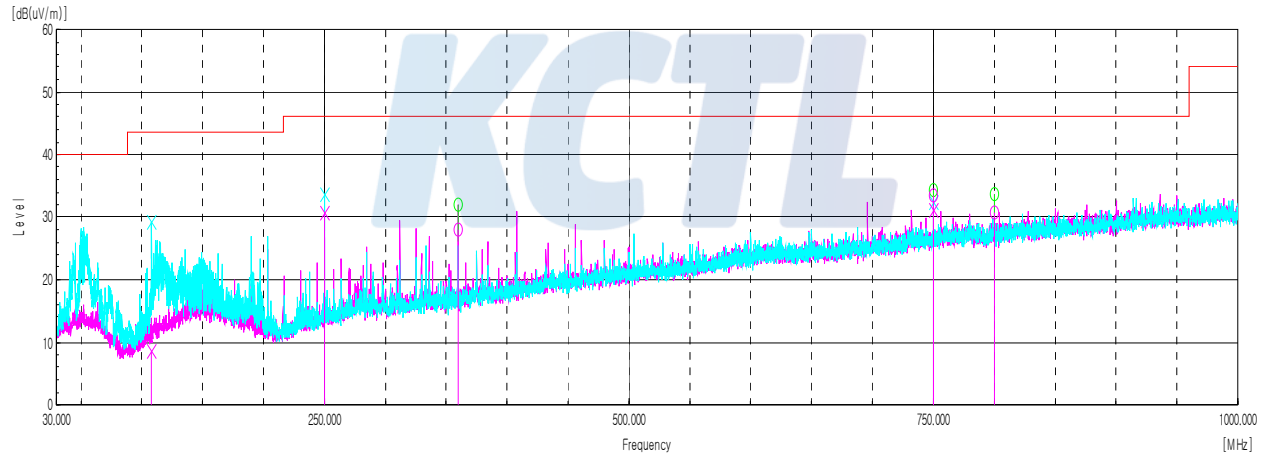
Test results (Below 1 000 ㎒)

15.225 (d) 30-1000 ㎒

12 V

Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
108.21	V	21.80	15.63	-28.65	-	8.78	43.50	34.72
249.95	V	40.50	17.70	-26.45	-	31.75	46.00	14.25
360.04	H	33.80	20.62	-26.3	-	28.12	46.00	17.88
749.98	H	28.60	27.60	-23.04	-	33.16	46.00	12.84
749.98	V	26.20	27.60	-23.04	-	30.76	46.00	15.24
800.06	H	25.10	28.30	-22.61	-	30.79	46.00	15.21

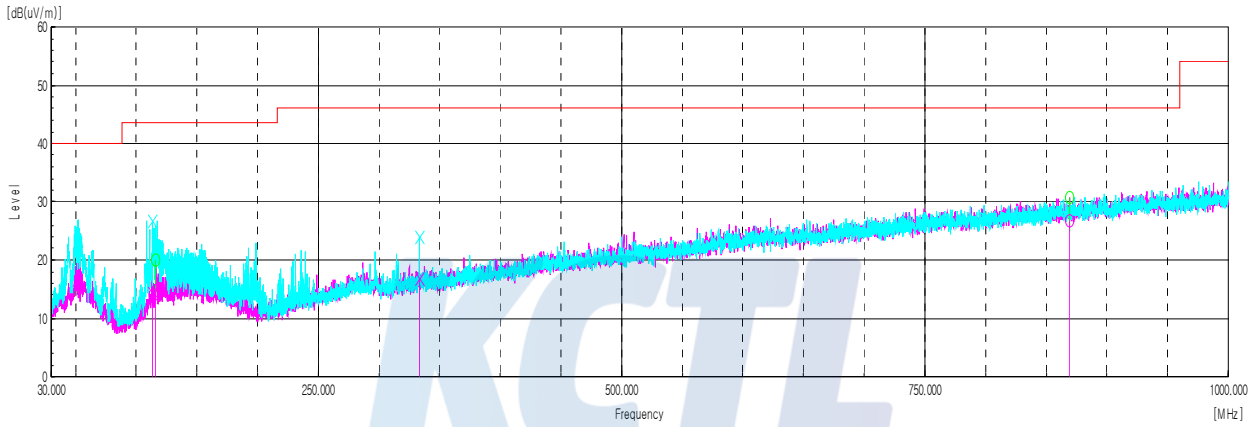
Horizontal/Vertical



48 V

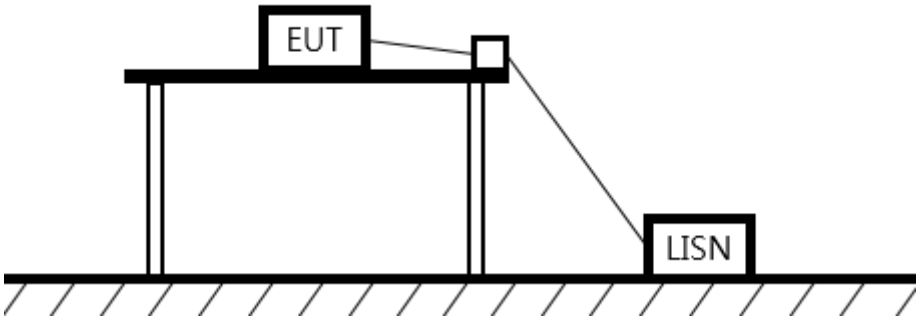
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	Distance Factor	Result	Limit	Margin
(㎒)	(V/H)	(dB(㎶))	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
Quasi peak data								
113.54	V	26.90	16.29	-29.18	-	14.01	43.50	29.49
116.21	H	27.00	16.63	-29.14	-	14.49	43.50	29.01
333.37	V	23.30	20.03	-26.54	-	16.79	46.00	29.21
869.41	H	19.40	29.06	-21.78	-	26.68	46.00	19.32

Horizontal/Vertical



6.4. AC Conducted emission

Test setup



Limit

According to 15.207(a), RSS-Gen Issue 5 (8.8) 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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

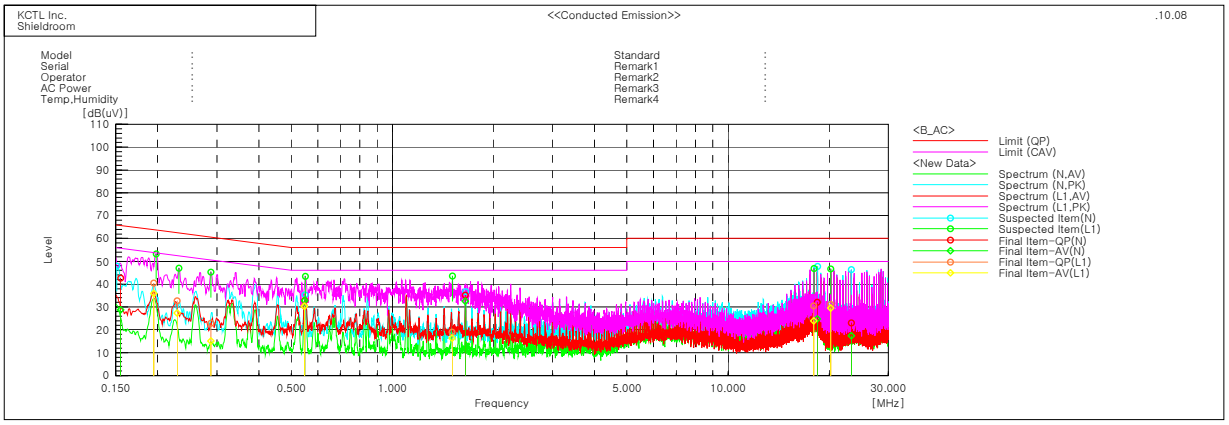
Frequency of Emission (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 ㎝ in which is located 40 ㎝ away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity ㅡ Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 ㎒ to 30 ㎒.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 ㎑ or to quasi-peak and average within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

Test results

48 V



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.15529	32.8	18.9	9.9	42.7	28.8	65.7	55.7	23.0	26.9
2	0.54789	23.0	23.0	9.8	32.8	32.8	56.0	46.0	23.2	13.2
3	1.64938	25.5	22.8	9.7	35.2	32.5	56.0	46.0	20.8	13.5
4	18.4488	22.2	14.9	9.9	32.1	24.8	60.0	50.0	27.9	25.2
5	23.28416	13.1	7.6	9.9	23.0	17.5	60.0	50.0	37.0	32.5

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.19483	30.4	26.0	10.0	40.4	36.0	63.8	53.8	23.4	17.8
2	0.22846	22.9	17.6	9.7	32.6	27.3	62.5	52.5	29.9	25.2
3	0.28808	13.2	5.4	9.7	22.9	15.1	60.6	50.6	37.7	35.5
4	0.54626	20.6	20.5	9.9	30.5	30.4	56.0	46.0	25.5	15.6
5	1.50666	9.3	6.7	9.7	19.0	16.4	56.0	46.0	37.0	29.6
6	18.00636	20.5	14.0	10.0	30.5	24.0	60.0	50.0	29.5	26.0
7	20.2025	21.0	19.4	10.1	31.1	29.5	60.0	50.0	28.9	20.5

Note. 12 V mode test is not applicable because the EUT in 12 V mode only connects DC power line.

7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Vector Signal Generator	R&S	SMBV100A	257566	21.07.13
Signal Generator	R&S	SMB100A	176206	21.01.21
Spectrum Analyzer	R&S	FSW50	101013	21.07.13
DC Power Supply	AGILENT	E3632A	MY40008800	21.07.28
Temp & Humid Chamber	Myeongseong R&P	CTHC-50P-DT	20150824-2	21.07.28
Amplifier	L-3 Narda-MITEQ	AFS5-00101800-25-S-5	2054570	21.05.22
EMI TEST RECIEVER	R&S	ESCI7	100732	21.03.04
Bilog Antenna	Teseq GmbH	CBL6112D	37876	22.09.02
Loop Antenna	R&S	HFH2-Z2	100355	22.08.21
Attenuator	AGILENT	8491B-006	MY37270292	21.05.15
Amplifier	SONOMA	310N	284608	21.08.20
Antenna Mast	Innco Systems	MA4000-EP	303	N/A
Turn Table	Innco Systems	DT2000	79	N/A
TWO-LINE V - NETWORK	R&S	ENV216	101584	21.04.06
EMI TEST RECEIVER	R&S	ESCI	101408	21.08.20

End of test report