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TEST REPORT

Eurofins KCTL Co.,Ltd.
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Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-70-5008-1021 FAX: 82-505-299-8311
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eurofins | KCTL

1. Client

- Name : KOREIT CO.,LTD.
- Address : 103, Chungjusandan 3-ro, Chungju-si, Chungcheongbuk-do, Republic of Korea
- Date of Receipt : 2023-12-14

2. Use of Report : Certification

3. Name of Product / Model : EM EAS-System / Evolve-K4300 System

4. Manufacturer / Country of Origin : KOREIT CO.,LTD. / Korea

5. FCC ID : 2BEFN-EVOLVE-K4300

6. Date of Test : 2023-12-28 to 2024-01-24

7. Location of Test : ■ Permanent Testing Lab ☐ On Site Testing
(Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

8. Test method used : FCC Part 15 Subpart C, 15.209

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

Affirmation	Tested by Name : Minki Kim (Signature)	Technical Manager Name : Heesu Ahn (Signature)

2024-03-12

Eurofins KCTL Co.,Ltd.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by Eurofins KCTL Co.,Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2024-03-06	Originally issued	-
2024-03-12	Updated	3, 7, 11, 12-16

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Note. The report No. KR24-SRF0015 is superseded by the report No. KR24-SRF0015-A.

General remarks for test reports

Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

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1. General information

Client	:	KOREIT CO.,LTD.
Address	:	103, Chungjusandan 3-ro, Chungju-si, Chungcheongbuk-do, Republic of Korea
Manufacturer	:	KOREIT CO.,LTD.
Address	:	103, Chungjusandan 3-ro, Chungju-si, Chungcheongbuk-do, Republic of Korea
Laboratory	:	Eurofins KCTL Co.,Ltd.
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
		CAB Identifier: KR0040
		ISED Number: 8035A
		KOLAS No.: KT231

2. Device information

Equipment under test	:	EM EAS-System
Model	:	Evolve-K4300 System
Modulation technique	:	ASK
Frequency range	:	12.5 ㎑
Power source	:	AC 115 ~ 220 V
Antenna specification	:	Coil Loop Antenna
Software version	:	FT3.110
Hardware version	:	MONO-ELECTRONIC REV.E
Test device serial No.	:	09103848 01E 363 3 001
Operation temperature	:	0 ℃ ~ 85 ℃

2.1. Companion device information

Equipment	Manufacturer	Model	Serial No.
Tag System	EM EAS-System	N/A	N/A

2.2. Frequency/channel operations

This device contains the following capabilities:

Frequency (㎑)
12.5

Table 2.2.1. 12.5 ㎑

2.3. Normal and extreme test conditions

- Ambient Conditions

Item	Temperature [℃]	Relative humidity [%]
Requirement for tests	15 to 35	20 to 75
Ambient Conditions	21	51

- Test Conditions

Test Condition	Temperature [℃]	Voltage [V]
NTNV	21	AC 115 ~ 220

Note 1 : N:Normal T:Temperature V:Voltage

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.

4. Summary of tests

FCC Part Section(s)	Parameter	Test Results
15.209	Field Strength of Fundamental and Spurious Emission	Pass
15.203	Antenna requirement	Pass
2.1049	20dB Bandwidth	Pass
15.207	AC Conducted Emission	Pass

Notes:

1. The test results shown in the following sections represent the worst case emissions.
2. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.
3. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
4. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.
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 : Passive tag
6. This product consists of a Stand Ant (2EA) and a Floor Ant (1EA), and the product operates only in simultaneous operation.

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.

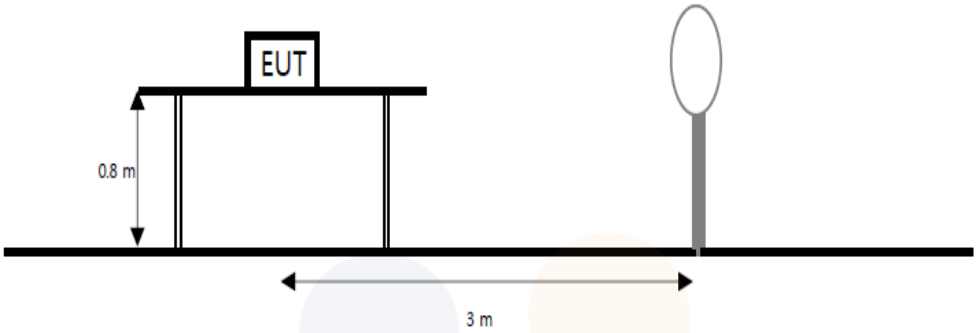
Parameter	Expanded Uncertainty (±)	
Radiated Emissions	Below 30 MHz	2.3 dB
	30 MHz to 1 000 MHz	2.5 dB
Conduced Emissions	150 kHz ~ 30 MHz	2.8 dB

6. Test Results

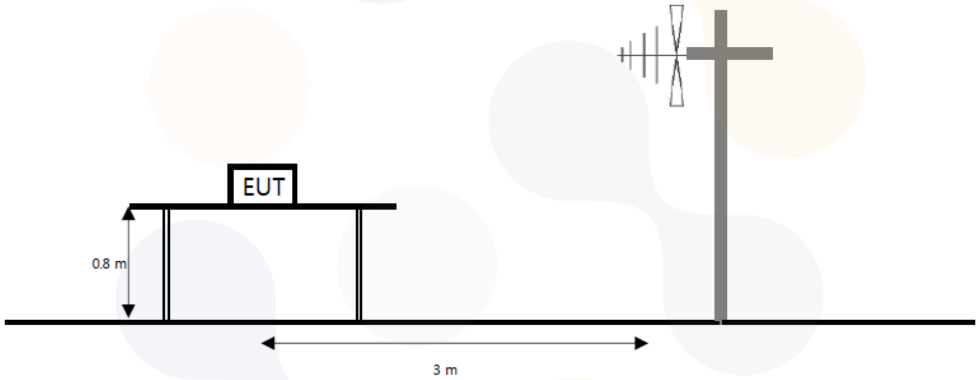
6.1. Field Strength of Fundamental and Spurious Emission

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

According to section 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 (㎒)	Field strength (㎶/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	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 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section15.231 and 15.241.

Test Procedure

ANSI C63.10-2013

Test Settings

Test Procedures for emission from 9 ㎑ to 30 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.

c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.

d. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode.

e. 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.

- Face-on = Parallel, Face-off = Perpendicular

Notes:

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/D_s)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
2. The test measurement distance is 3 meter
3. 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 : passive tag
4. Limit (㏈(㎶/m)) = For 0.009 ㎒ - 0.490 ㎒, 20*log(2 400/F(㎑)) ㏈(㎶/m)
   For 0.490 ㎒ - 1.705 ㎒, 20*log(24 000/F(㎑)) ㏈(㎶/m)
   For 1.705 ㎒ - 30 ㎒, 20*log(30) = 29.54 ㏈(㎶/m)

Test Results

FCC Radiated Emissions Fundamental & 9 ㎑ to 30 ㎒

[Face-on]

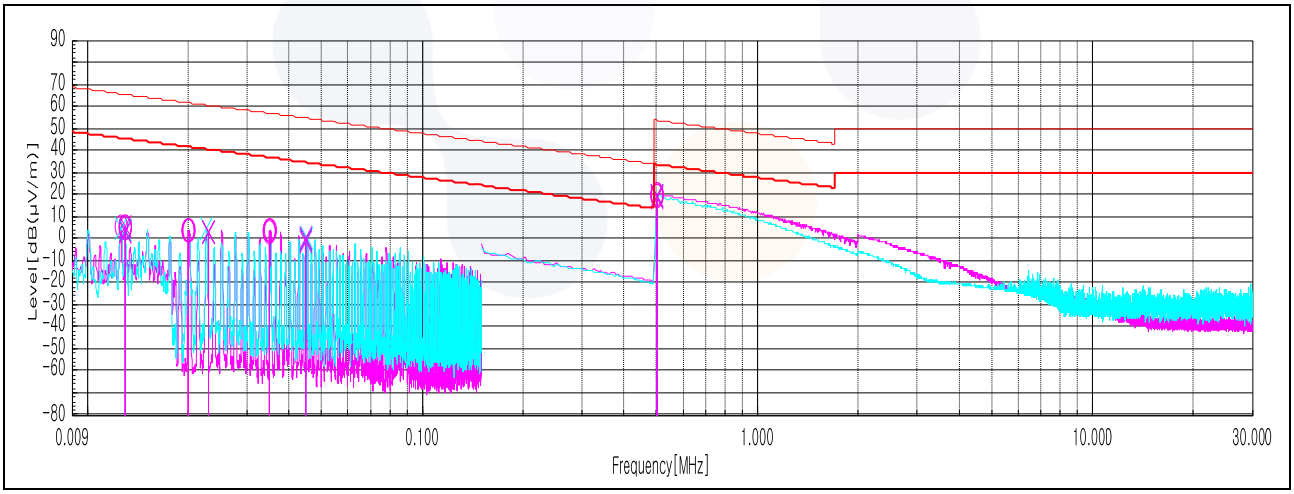
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Result	Limit	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.013	95.40	AV	20.88	-31.42	80.00	4.86	45.33	40.47
0.020	95.10	AV	20.60	-31.55	80.00	4.15	41.58	37.43
0.035	94.90	AV	20.18	-31.84	80.00	3.24	36.72	33.48
0.501	71.90	QP	19.90	-32.08	40.00	19.72	33.61	13.89

[Face-off]

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Result	Limit	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.013	93.70	AV	20.88	-31.42	80.00	3.16	45.33	42.17
0.023	93.90	AV	20.48	-31.61	80.00	2.77	40.37	37.60
0.045	90.70	AV	20.13	-32.03	80.00	-1.20	34.54	35.74
0.501	71.40	QP	19.90	-32.08	40.00	19.22	33.61	14.39

Note.

1) 80 is distance factor = 40*log(3/300), 40 is distance factor = 40*log(3/30)



FCC Radiated Emissions Fundamental & 30 ㎒ to 1 ㎓

[Face-on]

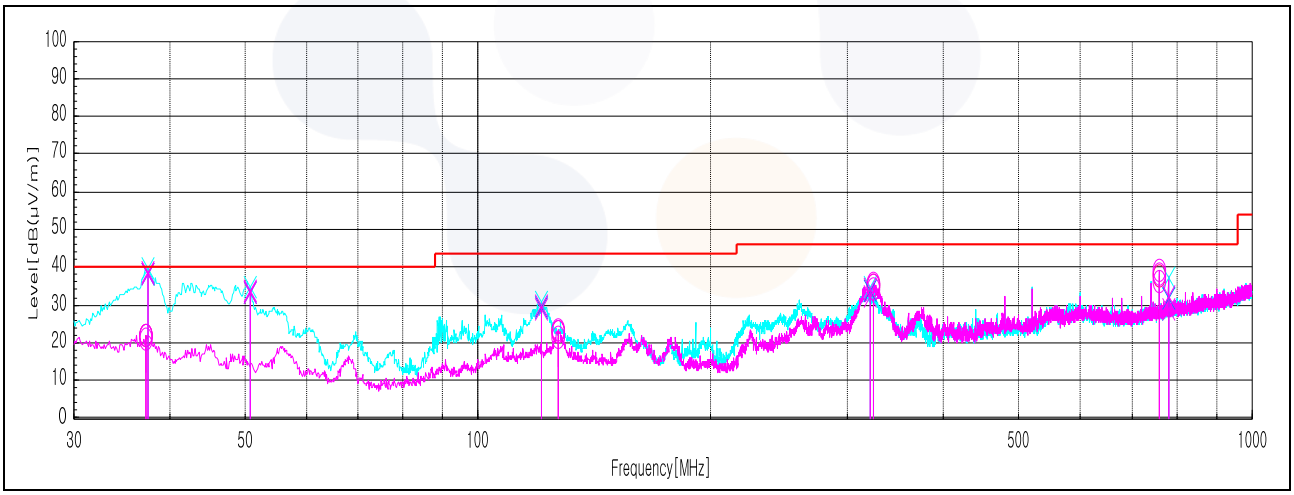
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Result	Limit	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
37.28	31.50	QP	20.88	-30.80	-	21.58	40.00	18.42
127.00	33.90	QP	17.53	-29.01	-	22.42	43.50	21.08
324.76	41.70	QP	19.49	-26.32	-	34.87	46.00	11.13
760.05	34.80	QP	24.94	-22.39	-	37.35	46.00	8.65

[Face-off]

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Result	Limit	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB)
37.52	48.40	QP	20.74	-30.79	-	38.35	40.00	1.65
50.73	50.30	QP	13.86	-30.52	-	33.64	40.00	6.36
120.82	40.90	QP	17.68	-29.11	-	29.47	43.50	14.03
321.61	40.30	QP	19.42	-26.37	-	33.35	46.00	12.65
780.05	28.50	QP	25.12	-21.95	-	31.67	46.00	14.33

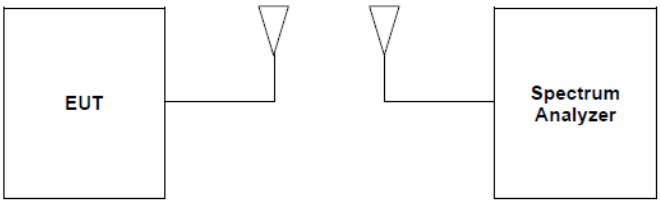
Note.

1) 80 is distance factor = 40*log(3/300), 40 is distance factor = 40*log(3/30)



6.2. 20dB Bandwidth

Test Setup



Limit

For reporting purpose only

Test Settings

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

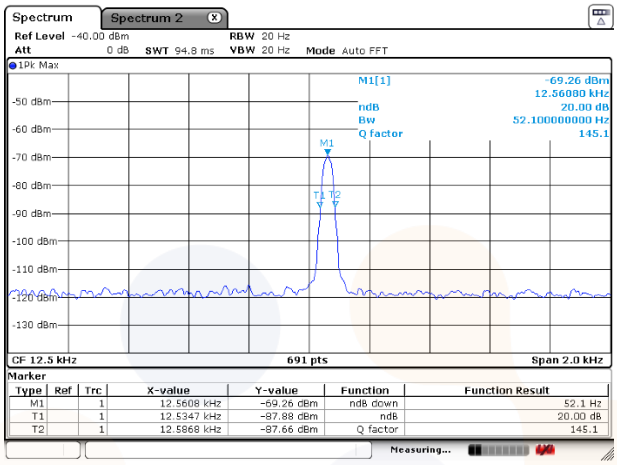
The difference between the two recorded frequencies is the 99% occupied bandwidth.

Test Results

Frequency (㎑)	20㏈ Bandwidth (㎑)	Limit
12.50	0.05	Reporting purpose only

Test Plots

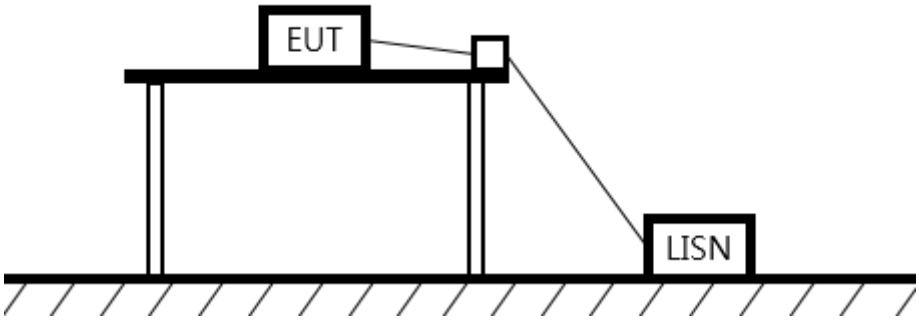
20㏈ Bandwidth



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 approximately twice the RBW.

6.3. AC Conducted emission

Test Setup



Limit

According to 15.207(a) and RSS-Gen(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.

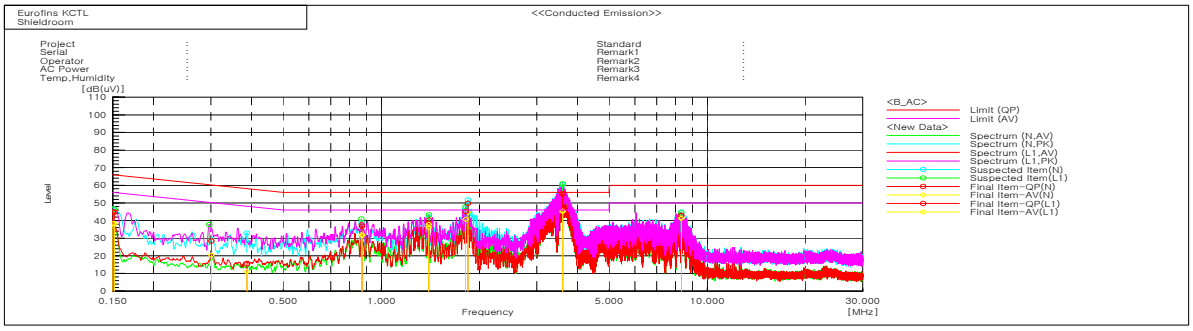
Frequency of Emission (㎒)	Conducted limit (dBμV/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

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 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

[AC 115 V]



Final Result

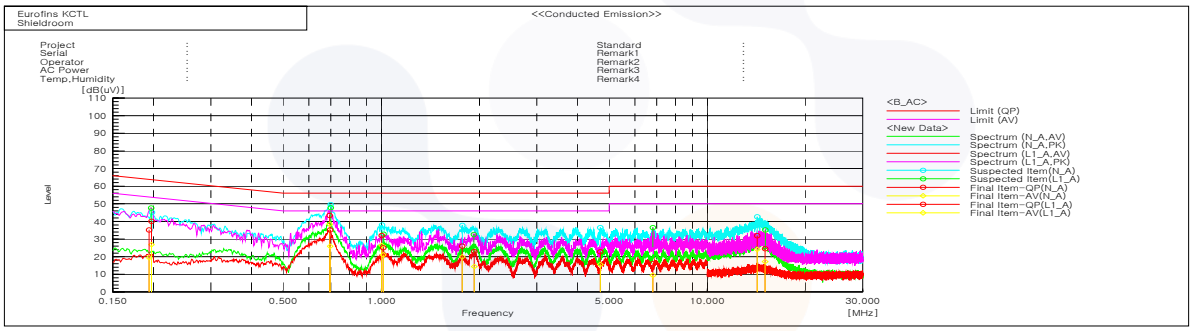
--- N_Phase ---

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	0.15201	35.0	28.3	9.8	44.8	38.1	65.9	55.9	21.1	17.8
2	0.38704	5.7	1.1	9.8	15.5	10.9	58.1	48.1	42.6	37.2
3	0.87148	27.8	22.3	9.8	37.6	32.1	56.0	46.0	18.4	13.9
4	1.39619	28.7	26.5	9.7	38.4	36.2	56.0	46.0	17.6	9.8
5	1.8451	40.1	35.0	9.7	49.8	44.7	56.0	46.0	6.2	1.3
6	3.59752	45.7	35.4	9.7	55.4	45.1	56.0	46.0	0.6	0.9
7	8.31881	33.2	31.7	9.8	43.0	41.5	60.0	50.0	17.0	8.5

--- 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	0.15014	35.1	28.4	9.8	44.9	38.2	66.0	56.0	21.1	17.8
2	0.30102	18.8	10.9	9.6	28.4	20.5	60.2	50.2	31.8	29.7
3	0.87336	27.1	21.8	9.7	36.8	31.5	56.0	46.0	19.2	14.5
4	1.39932	30.6	28.2	9.7	40.3	37.9	56.0	46.0	15.7	8.1
5	1.81611	35.5	31.1	9.6	45.1	40.7	56.0	46.0	10.9	5.3
6	3.60209	45.6	35.8	9.6	55.2	45.4	56.0	46.0	0.8	0.6
7	8.31983	33.0	31.4	9.8	42.8	41.2	60.0	50.0	17.2	8.8

[AC 220 V]



Final Result

--- N_A 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	0.19719	30.0	16.9	10.0	40.0	26.9	63.7	53.7	23.7	26.8
2	0.69443	33.5	28.5	9.9	43.4	38.4	56.0	46.0	12.6	7.6
3	1.00296	22.2	16.6	9.8	32.0	26.4	56.0	46.0	24.0	19.6
4	1.77192	16.2	10.1	9.8	26.0	19.9	56.0	46.0	30.0	26.1
5	4.69711	12.9	5.7	9.9	22.8	15.6	56.0	46.0	33.2	30.4
6	14.24172	21.2	13.4	10.7	31.9	24.1	60.0	50.0	28.1	25.9

--- L1_A 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	0.19401	25.1	9.4	10.1	35.2	19.5	63.9	53.9	28.7	34.4
2	0.69717	25.3	16.0	9.9	35.2	25.9	56.0	46.0	20.8	20.1
3	1.01377	15.3	11.2	9.8	25.1	21.0	56.0	46.0	30.9	25.0
4	1.92842	13.0	4.6	9.8	22.8	14.4	56.0	46.0	33.2	31.6
5	6.81383	6.2	-0.5	9.9	16.1	9.4	60.0	50.0	43.9	40.6
6	15.06141	13.7	6.4	10.8	24.5	17.2	60.0	50.0	35.5	32.8

7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Signal Generator	R&S	SMB100A	176206	25.01.18
Loop Antenna	R&S	HFH2-Z2	100355	24.08.10
EMI TEST RECEIVER	R&S	ESCI7	100732	24.03.03*
ATTENUATOR	KEYSIGHT	8491B-6dB	MY39271082	25.05.25
AMPLIFIER	SONOMA INSTRUMENT	310N	284608	24.08.18
Bilog Antenna	TESEQ	CBL 6112D	62438	25.05.25
EMI TEST RECEIVER	R&S	ESCI	101408	24.08.18
TWO-LINE V-NETWORK	R&S	ENV216	101358	24.09.27
TWO-LINE V-NETWORK	R&S	ENV216	101352	24.03.28
Antenna Mast	Innco Systems	MA4640/800-XP-ET	-	-
Turn Table	Innco Systems	DT2000	79	-

* The equipment was used finished calibration.

End of test report