






TEST REPORT

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<p>1. Client</p>		
<p>◦ Name : Mobee-K Co., LTD ◦ Address : 10, Seongnam-daro 926beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea ◦ Date of Receipt : 2020-07-01</p>		
<p>2. Use of Report : Certification</p>		
<p>3. Name of Product / Model : Smart Watch Wireless Charger / MS230</p>		
<p>4. Manufacturer / Country of Origin : Mobee-K Co., LTD / Korea</p>		
<p>5. FCC ID : 2AUP9MS230</p>		
<p>6. Date of Test : 2020-09-03 to 2020-09-10</p>		
<p>7. Location of Test : <input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing (Address: Address of testing location)</p>		
<p>8. Test method used : FCC Part 15 Subpart C, 15.209</p>		
<p>9. Test Results : Refer to the test result in the test report</p>		
<p>Affirmation</p>	<p>Tested by Name : Hosung Lee  (Signature)</p>	<p>Technical Manager Name : Heesu Ahn  (Signature)</p>
<p>2020-11-20</p>		
<p>KCTL Inc.</p>		
<p>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 KCTL Inc.</p>		

REPORT REVISION HISTORY

Date	Revision	Page No
2020-11-20	Originally issued	-

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General remarks for test reports

Nothing significant to report.

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1. General information

Client : Mobee-K Co., LTD
 Address : 10, Seongnam-daro 926beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
 Manufacturer : Mobee-K Co., LTD
 Address : 10, Seongnam-daro 926beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
 Factory : KO-MTECH
 Address : 19, Dongsan-ro 27beon-gil, Danwon-gu, Ansan-si, Gyeonggi-do, Republic of Korea
 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 : Smart Watch Wireless Charger
 Model : MS230
 Frequency range : 2 402 MHz ~ 2 480 MHz (Bluetooth Low Energy)
 110 kHz ~ 129 kHz(WPT)
 Modulation technique : GFSK(Bluetooth Low Energy)
 FSK(WPT)
 Number of channels : 40 ch(Bluetooth Low Energy)
 Power source : DC 5.0 V
 Antenna specification : Pattern Antenna(Bluetooth Low Energy)
 Loop Coil Antenna(WPT)
 Antenna gain : -28.747 dBi (Bluetooth Low Energy)
 Software version : 1.0
 Hardware version : 1.0
 Test device serial No. : N/A
 Operation temperature : -10 °C ~ 50 °C

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
N/A	-	-	-	-

2.2. Frequency/channel operations

This device contains the following capabilities:

Bluetooth Low Energy, WPT

Frequency (kHz)
110 ~ 129

Table 2.2.1. WPT

2.3. Simultaneously transmission condition

Technology	Modulation	Test mode	Test channel
Wireless Power Transfer	FSK	Charging	-

Note.

The emission of the operation have been evaluated and the test results of the worst case was recorded.

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.

- The transmitter has permanently attached Coil antenna(Internal antenna) on board.

4. Summary of tests

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

Notes:

- 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.
- The test procedure(s) in this report were performed in accordance as following.
 - ◆ ANSI C63.10-2013
- The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

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 or 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.

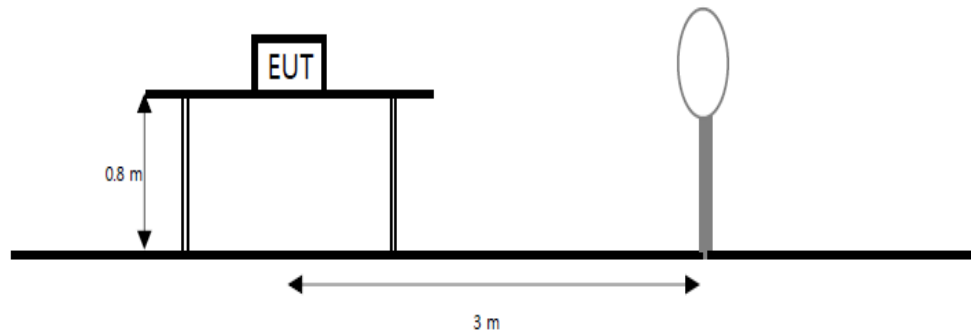
Parameter	Expanded uncertainty (\pm)	
Radiated spurious emissions	9 kHz ~ 30 MHz	2.3 dB
Conducted emissions	9 kHz ~ 150 kHz	3.7 dB
	150 kHz ~ 30 MHz	3.3 dB

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 kHz to 30 MHz 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 (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Measurement distance (m)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/F(kHz)	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 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., Section 15.231 and 15.241.

Test procedure

ANSI C63.10-2013

Test settings**Test Procedures for emission from 9 kHz to 30 MHz**

- 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 MHz 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. $f < 30$ MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40 \log(D_m/D_s)$

Where:

- F_d = Distance factor in dB
 D_m = Measurement distance in meters
 D_s = Specification distance in meters

2. The test measurement distance is 3 meter
3. Limit (dB(μ V/m)) =

For 0.009 MHz - 0.490 MHz,	$20 \cdot \log(2400/F(\text{kHz}))$ dB(μ V/m)
For 0.490 MHz - 1.705 MHz,	$20 \cdot \log(24000/F(\text{kHz}))$ dB(μ V/m)
For 1.705 MHz - 30 MHz,	$20 \cdot \log(30) = 29.54$ dB(μ V/m)

Test results**Radiated Emissions Fundamental & 9 kHz to 30 MHz**

[Face-on]

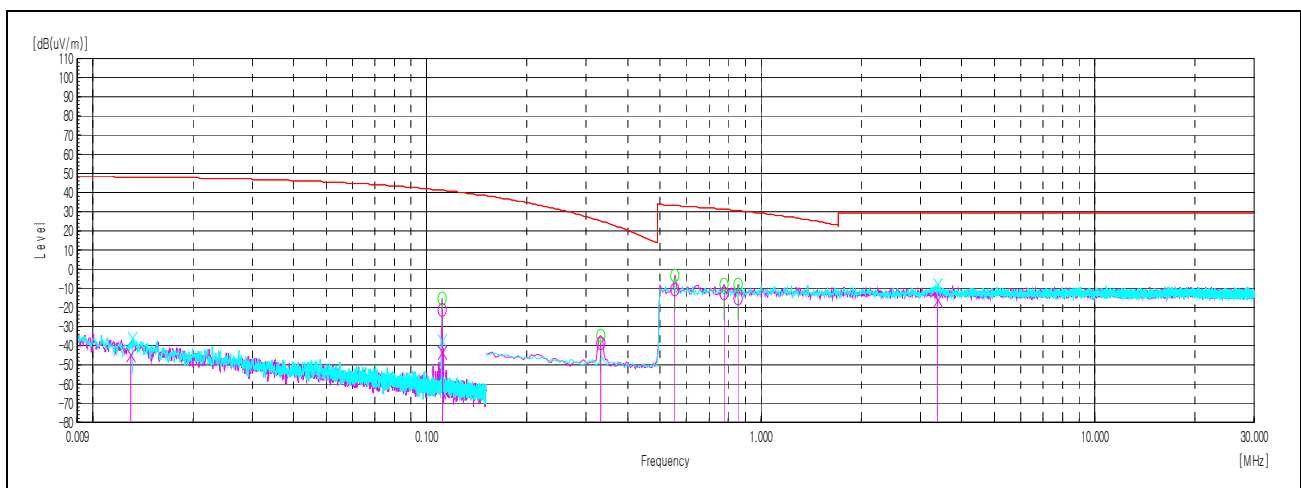
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result	Limit	Margin
(MHz)	(dB(μV))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
0.111	71.30	AV	19.99	-32.41	80.00	67.58	-21.12	41.20	62.32
0.330	53.90	AV	19.92	-32.27	80.00	67.65	-38.45	25.10	63.55
0.550	41.80	QP	20.00	-32.21	40.00	27.79	-10.41	33.20	43.61
0.780	39.60	QP	20.00	-32.20	40.00	27.80	-12.60	31.20	43.80
0.860	37.20	QP	20.00	-32.20	40.00	27.80	-15.00	30.50	45.50

[Face-off]

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result	Limit	Margin
(MHz)	(dB(μV))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(μV/m))	(dB(μV/m))	(dB)
0.013	45.60	AV	20.80	-31.24	80.00	69.56	-44.84	48.20	93.04
0.111	49.40	AV	19.99	-32.41	80.00	67.58	-43.02	41.20	84.22
3.390	36.00	QP	20.14	-31.85	40.00	28.29	-15.71	29.50	45.21

Note.

- 1) Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss + distance factor(dB)
- 2) -80 is distance factor = $40 \cdot \log(3/300)$, -40 is distance factor = $40 \cdot \log(3/30)$



Radiated Emissions Fundamental & 9 kHz to 30 MHz

[Face-on]

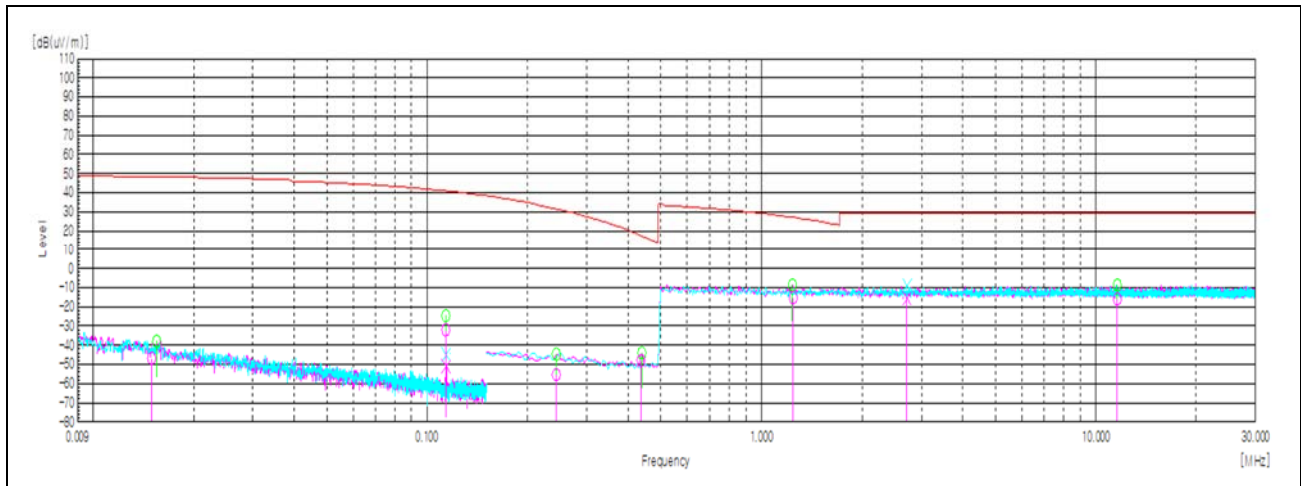
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result	Limit	Margin
(MHz)	(dB($\mu V/m$))	Mode	(dB)	(dB)	(dB)	(dB)	(dB($\mu V/m$))	(dB($\mu V/m$))	(dB)
0.015	43.90	AV	20.73	-31.30	80.00	69.43	-46.67	48.10	94.77
0.119	60.40	AV	19.99	-32.40	80.00	67.59	-32.01	38.60	70.61
0.243	36.90	AV	19.93	-32.29	80.00	67.64	-55.46	31.60	87.06
0.437	44.00	AV	19.97	-32.23	80.00	67.74	-48.26	17.60	65.86
1.240	36.90	QP	20.01	-32.14	40.00	27.87	-15.23	27.10	42.33
11.568	35.30	QP	20.23	-31.21	40.00	29.02	-15.68	29.50	45.18

[Face-off]

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result	Limit	Margin
(MHz)	(dB($\mu V/m$))	Mode	(dB)	(dB)	(dB)	(dB)	(dB($\mu V/m$))	(dB($\mu V/m$))	(dB)
0.119	41.50	AV	19.99	-32.40	80.00	67.59	-50.91	38.60	89.51
2.713	36.50	QP	20.09	-31.93	40.00	28.16	-15.34	29.50	44.84

Note.

- Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss + distance factor(dB)
- 80 is distance factor = $40 \cdot \log(3/300)$, -40 is distance factor = $40 \cdot \log(3/30)$



Radiated Emissions Fundamental & 9 kHz to 30 MHz

[Face-on]

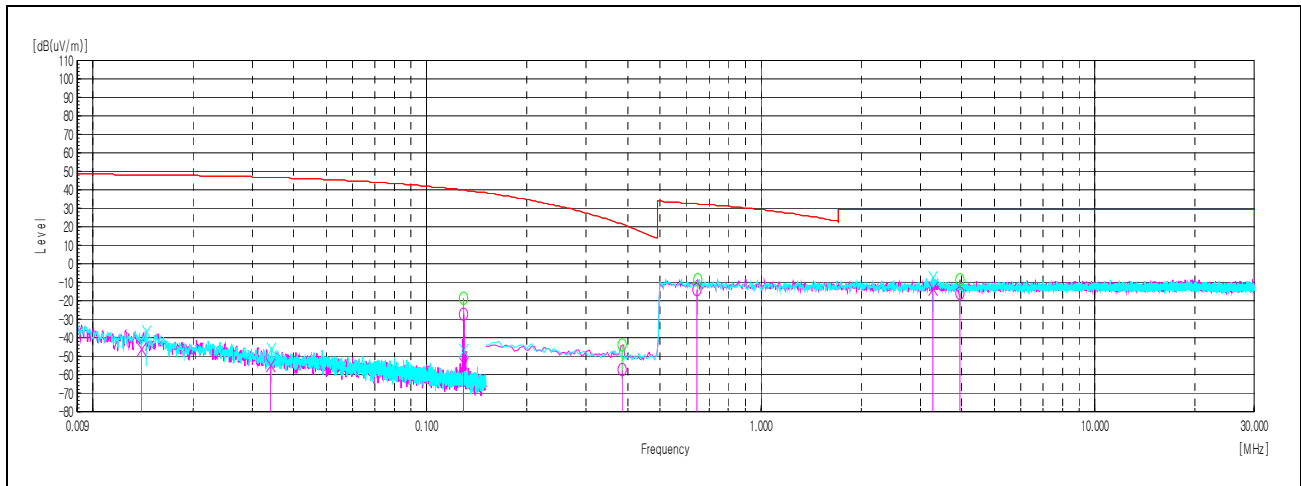
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result	Limit	Margin
(MHz)	(dB(μ V))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
0.130	65.10	AV	19.99	-32.40	80.00	67.59	-27.31	39.90	67.21
0.390	34.90	AV	19.94	-32.25	80.00	67.69	-57.41	21.40	78.81
0.650	37.90	QP	20.00	-32.19	40.00	27.81	-14.29	32.40	46.69
3.950	35.80	QP	20.20	-31.81	40.00	28.39	-15.81	29.50	45.31

[Face-off]

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result	Limit	Margin
(MHz)	(dB(μ V))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(μ V/m))	(dB(μ V/m))	(dB)
0.014	44.20	AV	20.76	-31.27	80.00	69.49	-46.31	48.20	94.51
0.034	37.00	AV	20.18	-31.90	80.00	68.28	-54.72	46.70	101.42
0.129	38.60	AV	19.99	-32.40	80.00	67.59	-53.81	39.90	93.71
3.280	38.30	QP	20.13	-31.86	40.00	28.27	-13.43	29.50	42.93

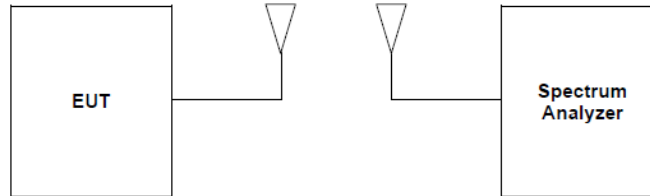
Note.

- Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss + distance factor(dB)
- 80 is distance factor = $40 \cdot \log(3/300)$, -40 is distance factor = $40 \cdot \log(3/30)$



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.

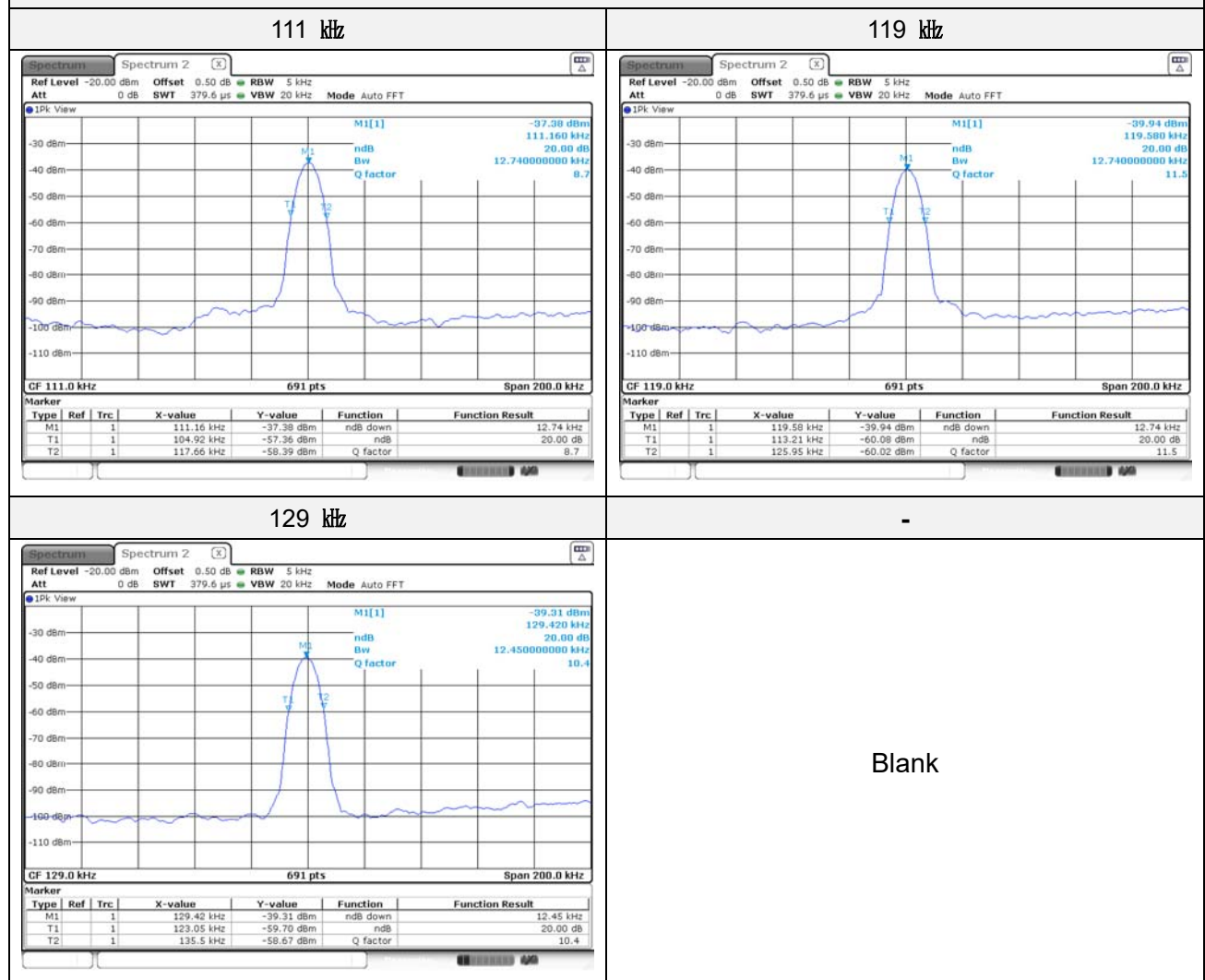
Test results

20dB Bandwidth

Frequency (kHz)	20dB Bandwidth (kHz)	Limit
111	12.74	Reporting purpose only
119	12.74	
129	12.54	

Test Plots

20dB Bandwidth

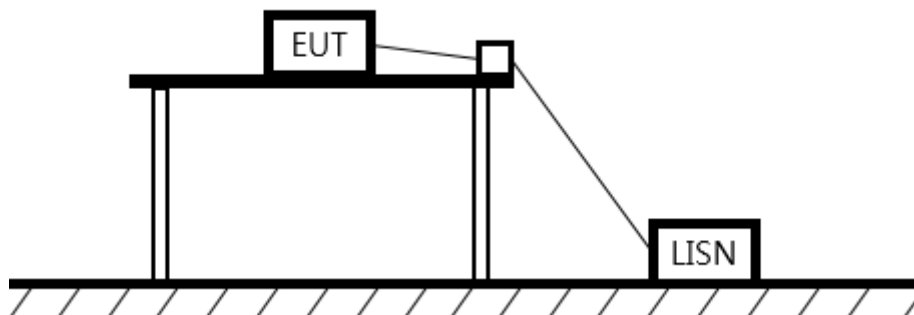


Note:

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

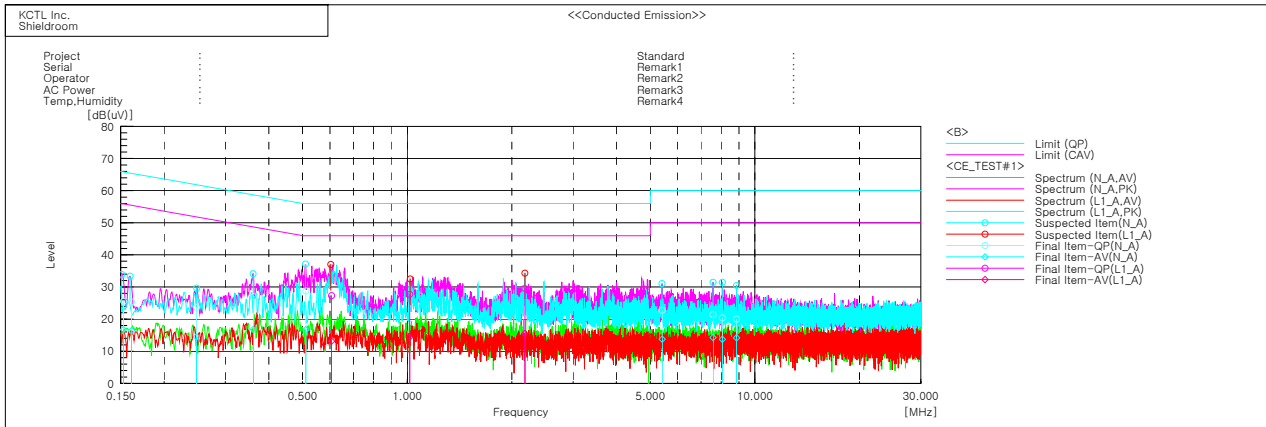
According to 15.207(a), For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 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 (MHz)	Conducted limit (dB μ V/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 cm in which is located 40 cm 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 50 Ω /50 μ H 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 MHz to 30 MHz.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 kHz or to quasi-peak and average within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

Test results



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	0.15275	15.6	6.8	10.0	25.6	16.8	65.8	55.8	40.2	39.0
2	0.16105	15.2	6.2	10.2	25.4	16.4	65.4	55.4	40.0	39.0
3	0.24787	13.8	4.6	9.9	23.7	14.5	61.8	51.8	38.1	37.3
4	0.36076	16.9	6.8	10.1	27.0	16.9	58.7	48.7	31.7	31.8
5	0.51141	18.6	6.5	10.2	28.8	16.7	56.0	46.0	27.2	29.3
6	5.4117	12.6	3.7	10.1	22.7	13.8	60.0	50.0	37.3	36.2
7	7.57967	11.2	4.1	10.2	21.4	14.3	60.0	50.0	38.6	35.7
8	8.0656	10.2	3.5	10.2	20.4	13.7	60.0	50.0	39.6	36.3
9	8.86244	9.7	3.9	10.3	20.0	14.2	60.0	50.0	40.0	35.8

--- 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	0.60628	17.4	3.2	9.9	27.3	13.1	56.0	46.0	28.7	32.9
2	1.01686	17.8	4.5	9.9	27.7	14.4	56.0	46.0	28.3	31.6
3	2.18059	19.7	5.6	9.9	29.6	15.5	56.0	46.0	26.4	30.5

7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV30	100808	21.07.29
EMI TEST RECEIVER	R&S	ESCI7	100732	21.03.04
Amplifier	SONOMA INSTRUMENT	310N	186280	21.04.03
LOOP Antenna	R&S	HFH2-Z2	100355	22.08.21
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	DT2000	79	-
TWO-LINE V - NETWORK	R&S	ENV216	101358	21.09.29
EMI TEST RECEIVER	R&S	ESCI	100001	21.08.20
Vector Signal Generator	R&S	SMBV100A	257566	21.07.13
Signal Generator	R&S	SMR40	100007	21.04.08

End of test report