TEST REPORT

FCC Part 15C

Equipment under test	UTS-1 Wireless Charger
Model name	UTS-1
FCC ID	2AWLH-UTS-1
Applicant	Hana Technologies Inc.
Manufacturer	1. Hana Technologies Inc. 2. Hana Microelectronics Public Co.,Ltd. 3. Hana Microelectronics (Cambodia) Co., Ltd.
Date of test(s)	2020.05.20 ~ 2020.06.10
Date of issue	2020.06.15

Issued to

Hana Technologies Inc.
2061 Case Parkway South, Unit # 6, Twinsburg, OH 44087, U.S.A.
Tel: +1 330-405-4600 / Fax: +1-330-405-3448

Issued by

KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, 14057, Korea
473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	**Report approval by :**
	
Yeong-Jun Cho Test engineer	Young-Jin, Lee Technical manager

Revision history

Revision	Date of issue	Test report No.	Description
-	2020.06.15	KES-RF-20T0094	Initial

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1. General information

Applicant	Hana Technologies Inc.
Applicant address	2061 Case Parkway South, Unit # 6, Twinsburg, OH 44087, U.S.A.
Test site	KES Co., Ltd.
Test site address	3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s):	Part 15C
FCC ID:	2AWLH-UTS-1
Test device serial No.	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	UTS-1 Wireless Charger
Frequency	0.1238 ~ 0.1467 ㎒
Inductive charging technique	Magnetic Induction
Model:	UTS-1
Antenna specification	Internal type(Coil antenna)
Power source	AC 120 V(Adapter DC output 12 V)
S/W Version	Rev 1.0
H/W version	Rev 1.0

1.2. Test configuration

The **Hana Technologies Inc. UTS-1 Wireless Charger FCC ID: 2AWLH-UTS-1**was tested according to the specification of EUT, the EUT must comply with following standards.

FCC Part 15C
ANSI C63.10-2013

1.3. Test frequency

		Frequency Range
Power source	AC 120 V (Adapter DC output 12 V)	0.1238 ~ 0.1467 ㎒

1.4. Test mode

Mode	Charging current	Description
Charging mode With load	90%	Using Max load
	50%	Using Mid load
	10%	Using Min load

1.5. Information about derivative model

N/A

1.6. Device modifications

N/A

1.7. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
AC/DC Adapter	SHENZHEN YINGHUI YUAN ELECTRONICS CO.,LTD	YHY-12003000	-	Output : DC 12 V, 3A

1.8. Measurement Uncertainty`

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.62 dB
Uncertainty for Radiation emission test (include Fundamental emission)	9㎑ - 30㎒	4.54 dB
	30㎒ - 1㎓	4.36 dB
	Above 1㎓	5.00 dB
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

2. Summary of tests

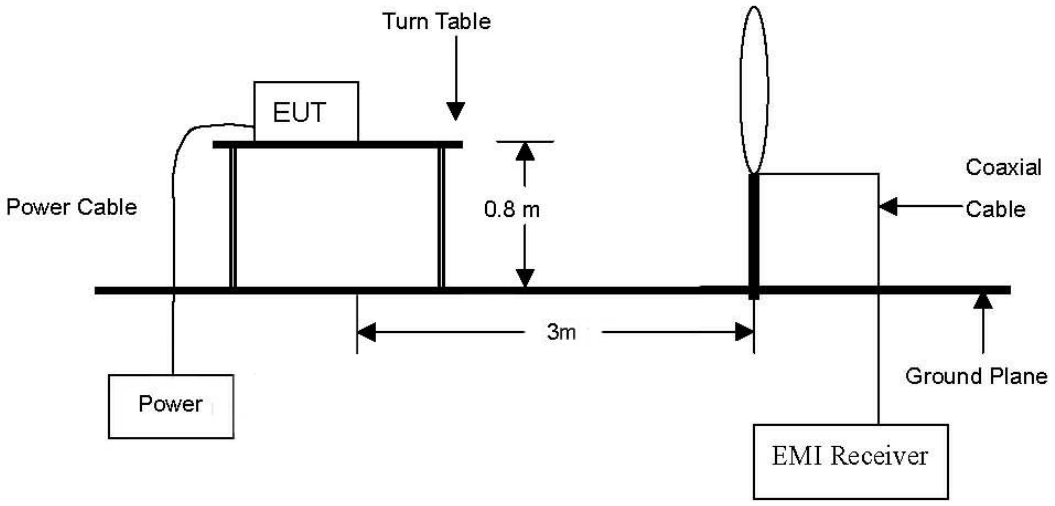
FCC Part Sections	Parameter	Test results
15.209	Radiated spurious emission	Pass
2.1049	20dB Bandwidth	Pass
15.207	AC conducted emissions	Pass

3. Test results

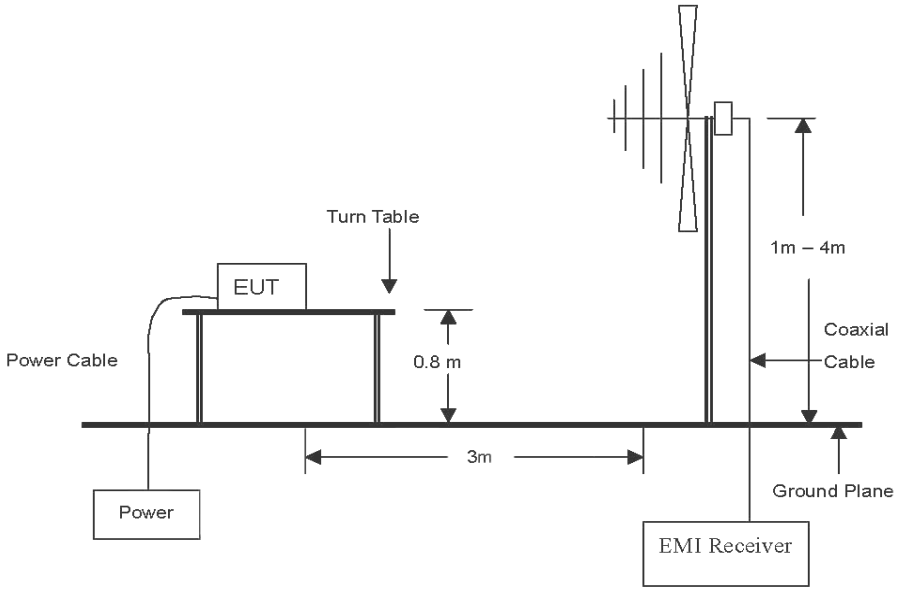
3.1. Radiated spurious emission

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.



Test procedure

[9 ㎑ to 30 ㎒]

The EUT was placed on the top of a rotating table 0.8 meter 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. 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 and ground parallel of the antenna are set to make the measurement. 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. The test-receiver system was set to Quasi-peak function and specified bandwidth with maximum hold mode.

[30 ㎒ to 1 ㎓]

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.

The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

Note:

1. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test 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.
2. Measurement distance : 3 m.
3. Field strength = Level + Correction factor + F_d
4. $F_d = 40\log(D_m / D_s)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
   For 300m: 40log(300/3) = 80 dB for frequency band 0.009 ㎒ to 0.490 ㎒
   For 30m: 40log(30/3) = 40 dB for frequency band 0.490 ㎒ to 30 ㎒
5. No significant emissions were found in the 90 - 110㎑ restricted band.

Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400 / F(㎑)
0.490 ~ 1.705	30	24000 / F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

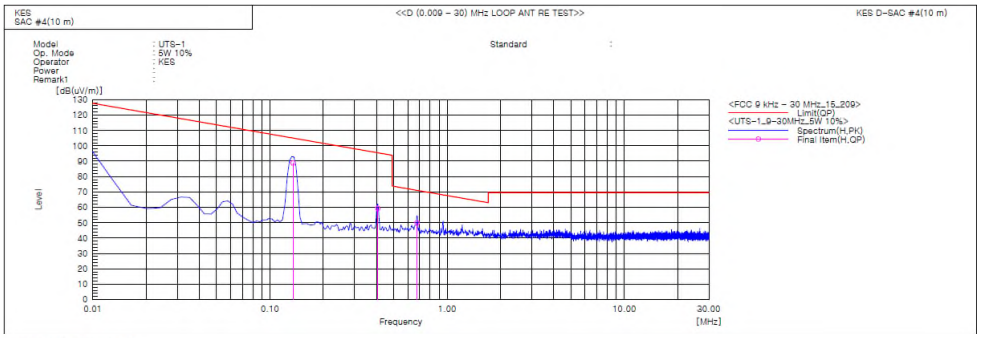
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 ㎒, 76 ~ 88 ㎒, 174 ~ 216 ㎒ or 470 ~ 806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

Test results (Below 30 ㎒)

Mode: 5W // 10 % charger

Distance of measurement: 3 meter

Parallel



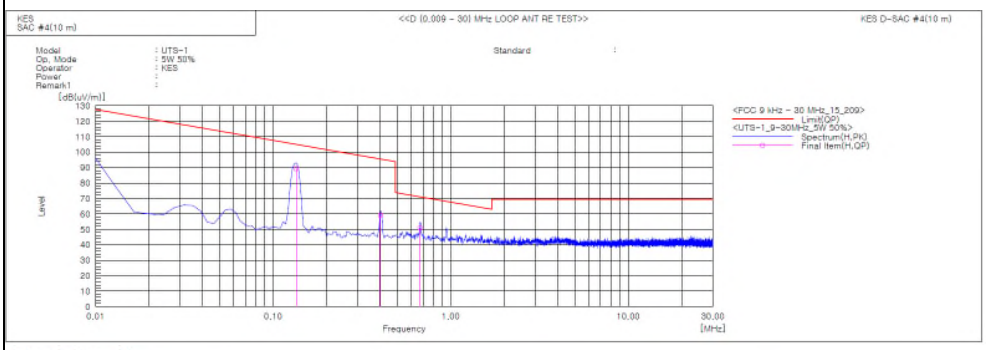
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.135	H	68.9	19.9	88.8	105.0	16.2	100.0	64.0	
2	0.406	H	38.8	20.5	59.3	95.4	36.1	100.0	41.0	
3	0.676	H	28.7	21.1	49.8	71.0	21.2	100.0	25.0	

Mode: 5W // 50 % charger

Distance of measurement: 3 meter

Parallel



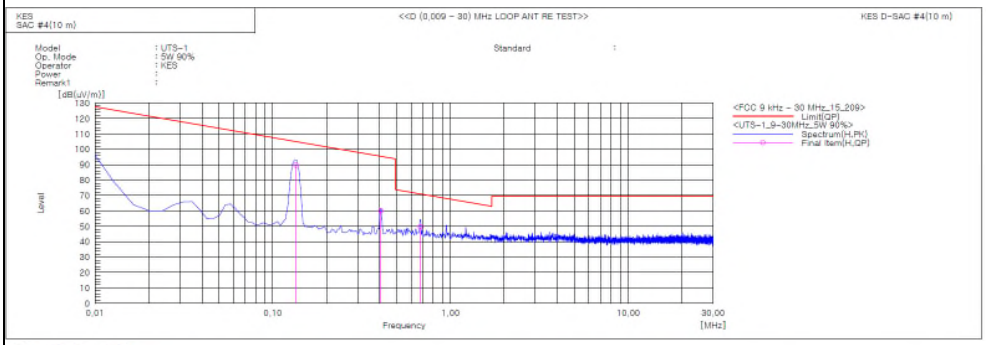
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.135	H	69.5	19.9	89.4	105.0	15.6	100.0	18.0	
2	0.403	H	38.6	20.5	59.1	95.5	36.4	100.0	334.0	
3	0.673	H	29.9	21.1	51.0	71.1	20.1	100.0	70.0	

Mode: 5W // 90 % charge

Distance of measurement: 3 meter

Parallel



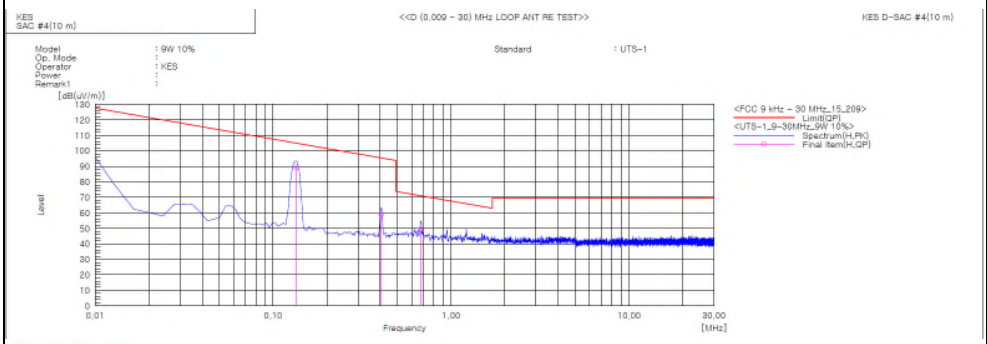
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.135	H	69.7	19.9	89.6	105.0	15.4	100.0	49.0	
2	0.406	H	39.6	20.5	60.1	95.4	35.3	100.0	26.0	
3	0.676	H	28.6	21.1	49.7	71.0	21.3	100.0	359.0	

Mode: 9W // 10 % charger

Distance of measurement: 3 meter

Parallel



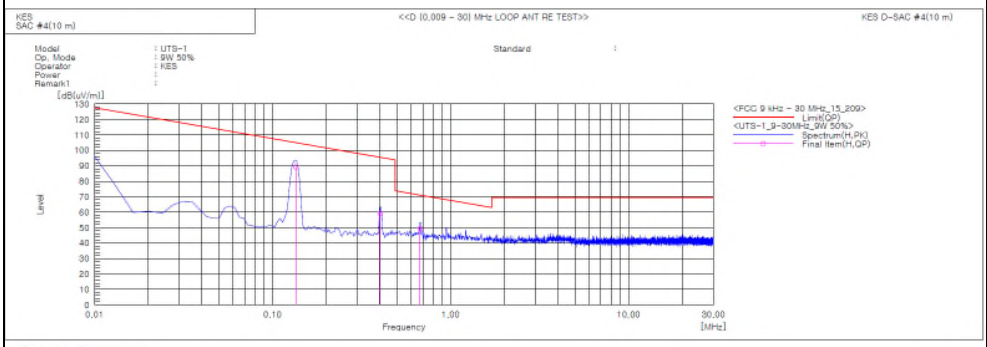
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.135	H	69.6	19.9	89.5	105.0	15.5	100.0	124.0	
2	0.406	H	38.4	20.5	58.9	95.4	36.5	100.0	124.0	
3	0.673	H	28.2	21.1	49.3	71.1	21.8	100.0	69.0	

Mode: 9W // 50 % charger

Distance of measurement: 3 meter

Parallel



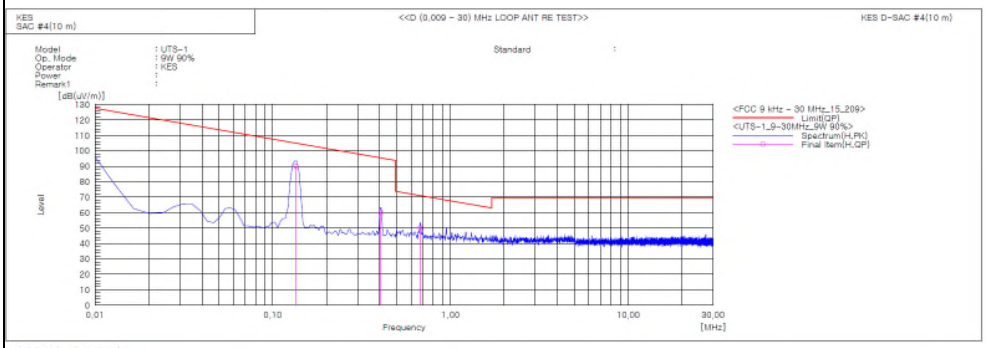
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.135	H	69.3	19.9	89.2	105.0	15.8	100.0	127.0	
2	0.403	H	38.6	20.5	59.1	95.5	36.4	100.0	119.0	
3	0.676	H	28.4	21.1	49.5	71.0	21.5	100.0	73.0	

Mode: 9W // 90 % charge

Distance of measurement: 3 meter

Parallel



Final Result

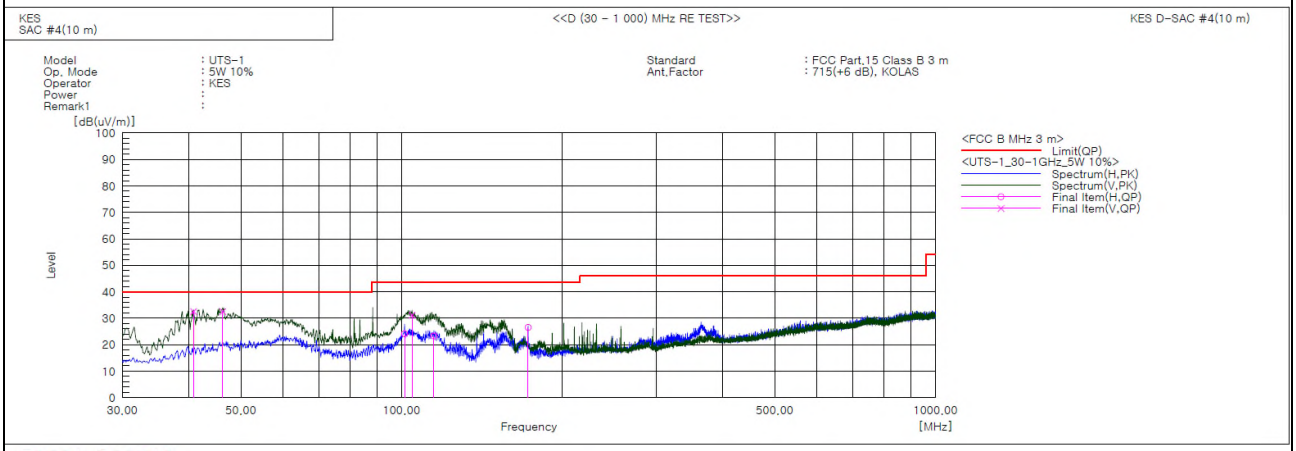
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	0.135	H	70.1	19.9	90.0	105.0	15.0	100.0	124.0	
2	0.406	H	39.5	20.5	60.0	95.4	35.4	100.0	139.0	
3	0.676	H	29.1	21.1	50.2	71.0	20.8	100.0	295.0	

Test results (Below 1 000 ㎒)

Mode: 5W // 10 % charge

Distance of measurement: 3 meter

Horizontal // Vertical



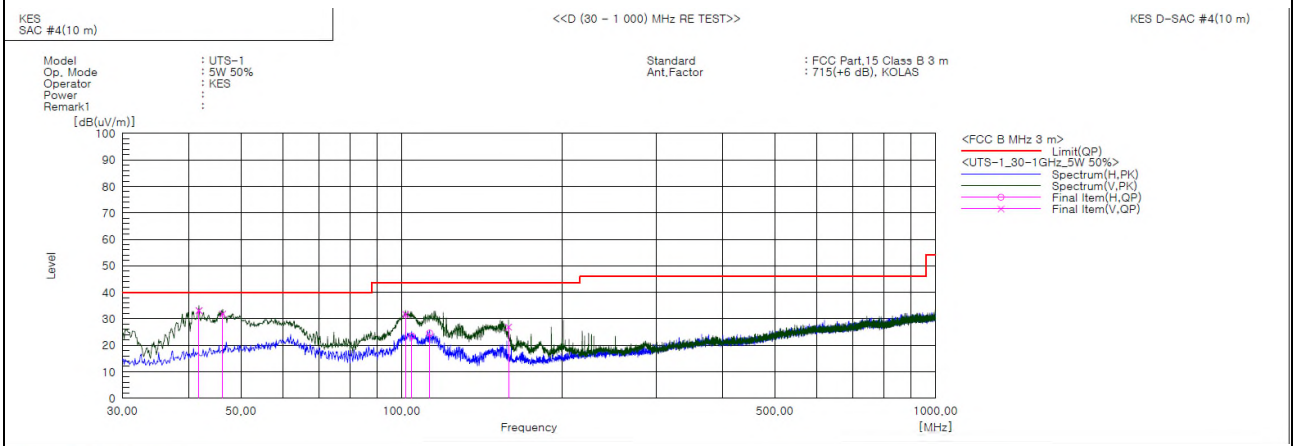
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	40.791	V	55.7	-23.2	32.5	40.0	7.5	142.0	149.0	
2	46.248	V	54.8	-22.3	32.5	40.0	7.5	211.0	153.0	
3	101.295	H	47.3	-23.2	24.1	43.5	19.4	344.0	287.0	
4	104.690	V	54.3	-23.2	31.1	43.5	12.4	155.0	188.0	
5	114.996	H	47.3	-24.0	23.3	43.5	20.2	196.0	211.0	
6	172.711	H	51.8	-25.3	26.5	43.5	17.0	100.0	296.0	

Mode: 5W // 50 % charge

Distance of measurement: 3 meter

Horizontal // Vertical



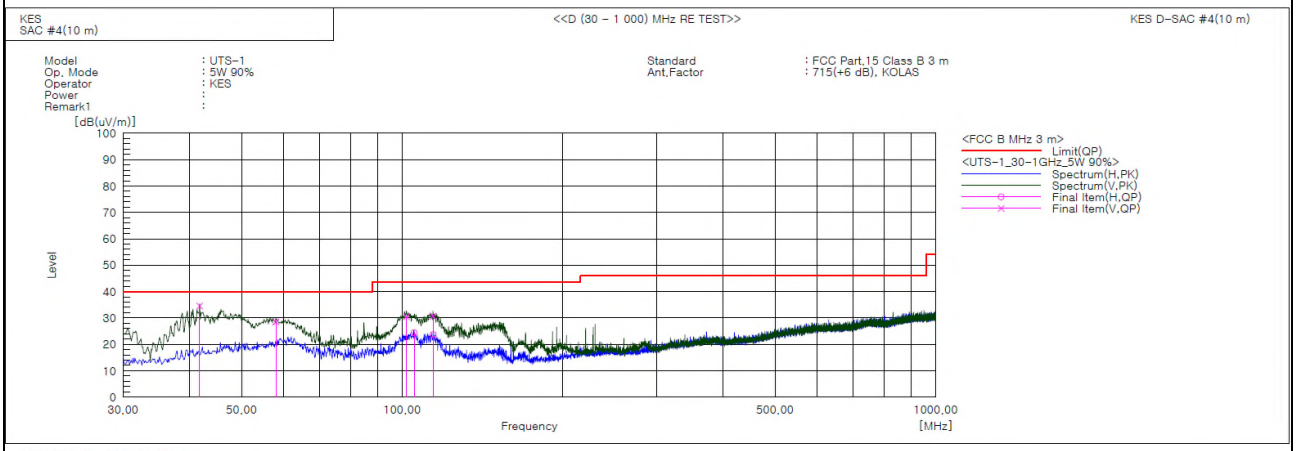
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	41.761	V	56.0	-22.9	33.1	40.0	6.9	100.0	295.0	
2	46.248	V	54.1	-22.3	31.8	40.0	8.2	133.0	183.0	
3	101.780	V	54.9	-23.2	31.7	43.5	11.8	169.0	156.0	
4	104.448	H	46.6	-23.2	23.4	43.5	20.1	400.0	252.0	
5	112.935	H	48.4	-23.8	24.6	43.5	18.9	377.0	244.0	
6	158.646	V	53.0	-26.1	26.9	43.5	16.6	162.0	201.0	

Mode: 5W // 90 % charge

Distance of measurement: 3 meter

Horizontal // Vertical



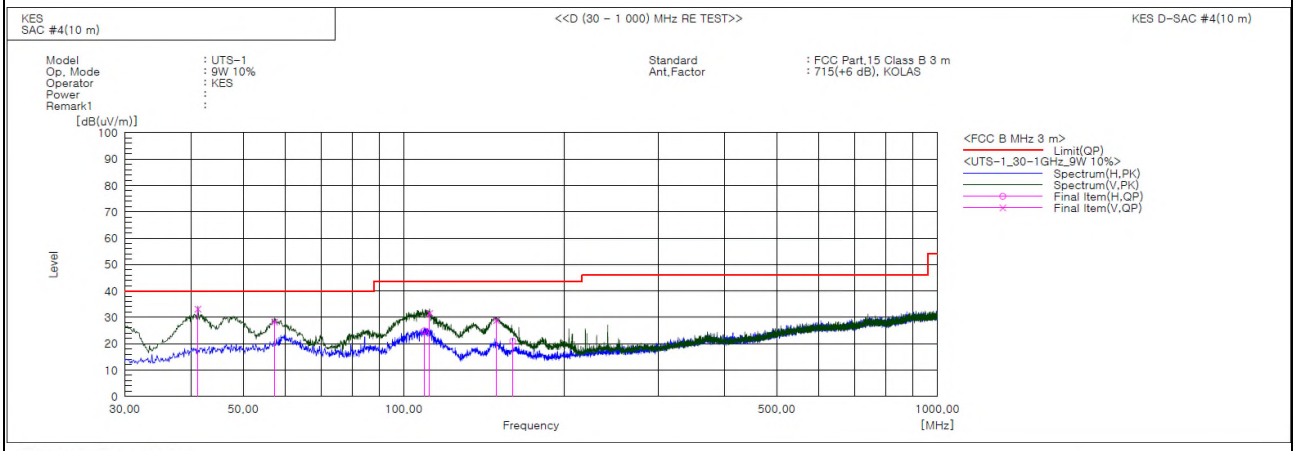
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	41.761	V	57.4	-22.9	34.5	40.0	5.5	113.0	219.0	
2	58.009	V	51.2	-22.7	28.5	40.0	11.5	140.0	118.0	
3	101.901	V	53.7	-23.2	30.5	43.5	13.0	165.0	168.0	
4	105.296	H	47.6	-23.2	24.4	43.5	19.1	400.0	51.0	
5	114.269	V	54.6	-23.9	30.7	43.5	12.8	100.0	180.0	
6	114.390	H	47.7	-24.0	23.7	43.5	19.8	400.0	54.0	

Mode: 9W // 10 % charge

Distance of measurement: 3 meter

Horizontal // Vertical



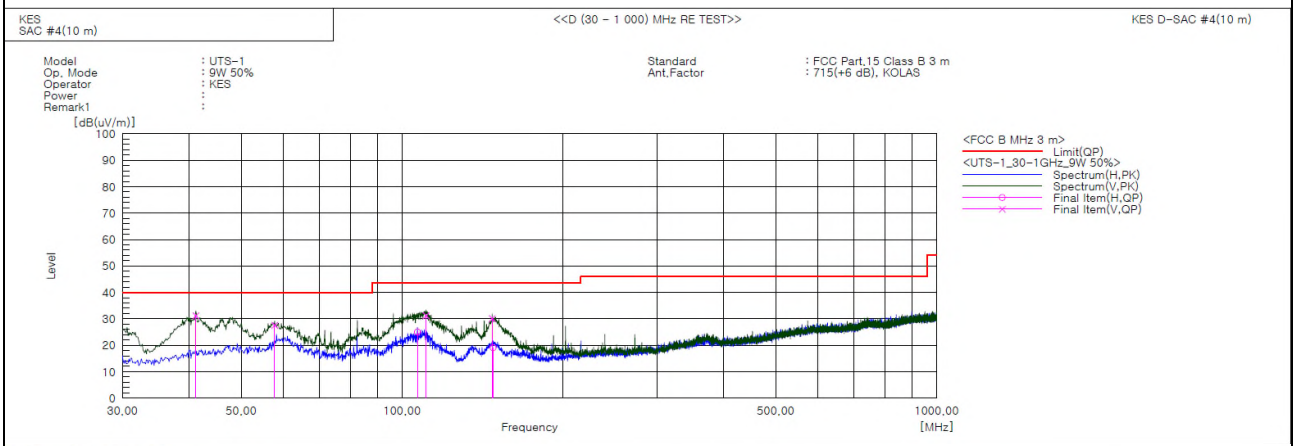
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	41.155	V	56.2	-23.1	33.1	40.0	6.9	110.0	93.0	
2	57.281	V	50.8	-22.6	28.2	40.0	11.8	108.0	155.0	
3	109.298	H	48.3	-23.4	24.9	43.5	18.6	400.0	219.0	
4	111.844	V	55.1	-23.6	31.5	43.5	12.0	100.0	204.0	
5	149.310	V	55.6	-26.9	28.7	43.5	14.8	145.0	200.0	
6	160.101	H	46.9	-26.0	20.9	43.5	22.6	392.0	305.0	

Mode: 9W // 50 % charge

Distance of measurement: 3 meter

Horizontal // Vertical



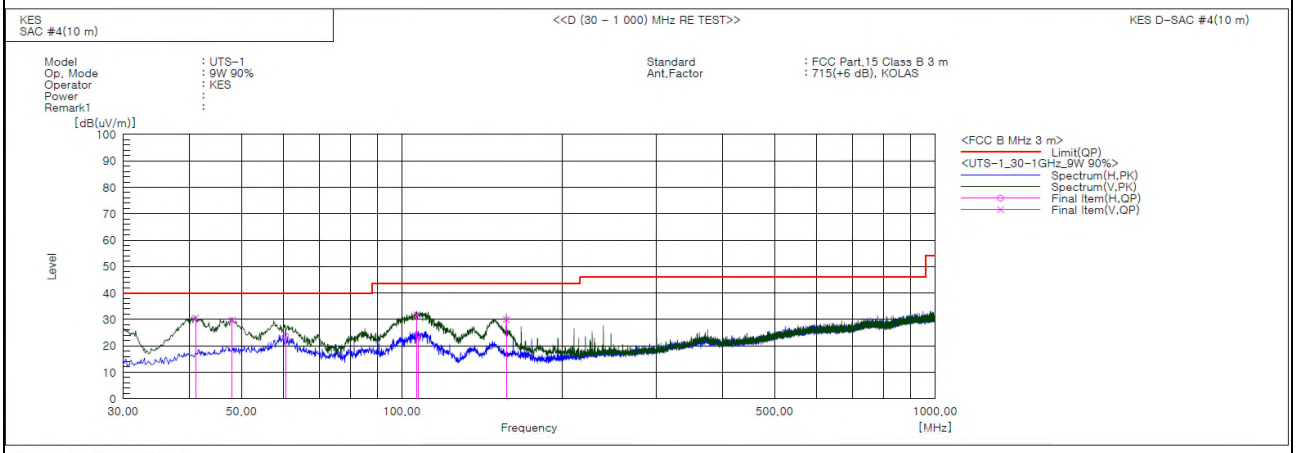
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	41.155	V	54.3	-23.1	31.2	40.0	8.8	134.0	271.0	
2	57.766	V	50.3	-22.7	27.6	40.0	12.4	100.0	77.0	
3	106.873	H	48.3	-23.3	25.0	43.5	18.5	233.0	230.0	
4	110.874	V	54.7	-23.5	31.2	43.5	12.3	117.0	221.0	
5	147.370	V	57.0	-26.9	30.1	43.5	13.4	142.0	198.0	
6	147.976	H	46.0	-26.9	19.1	43.5	24.4	344.0	77.0	

Mode: 9W // 90 % charge

Distance of measurement: 3 meter

Horizontal // Vertical

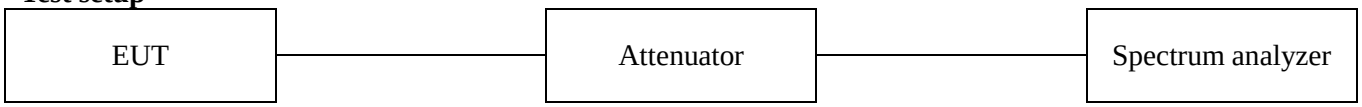


Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	41.034	V	53.6	-23.1	30.5	40.0	9.5	123.0	35.0	
2	48.066	V	51.6	-22.0	29.6	40.0	10.4	210.0	35.0	
3	60.555	H	46.8	-23.1	23.7	40.0	16.3	334.0	5.0	
4	106.630	V	55.1	-23.3	31.8	43.5	11.7	110.0	202.0	
5	107.358	H	47.0	-23.3	23.7	43.5	19.8	400.0	228.0	
6	156.949	V	56.3	-26.3	30.0	43.5	13.5	142.0	129.0	

3.2. 20dB Bandwidth

Test setup



Test procedures

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the emission bandwidth. The VBW is set to ≥RBW. The sweep time is coupled.

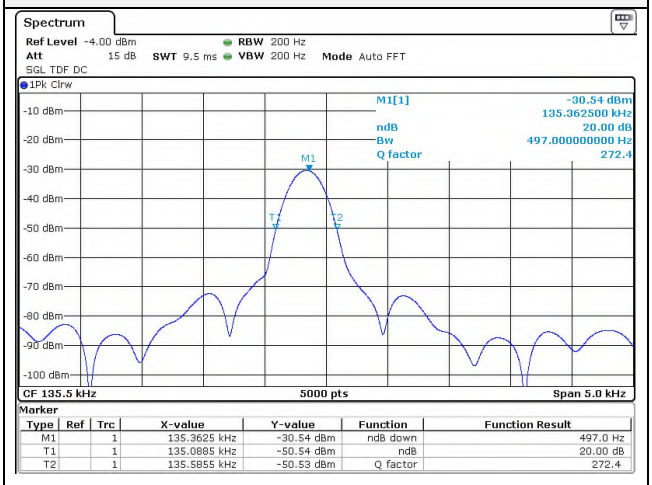
Limit

None; for reporting purposes only.

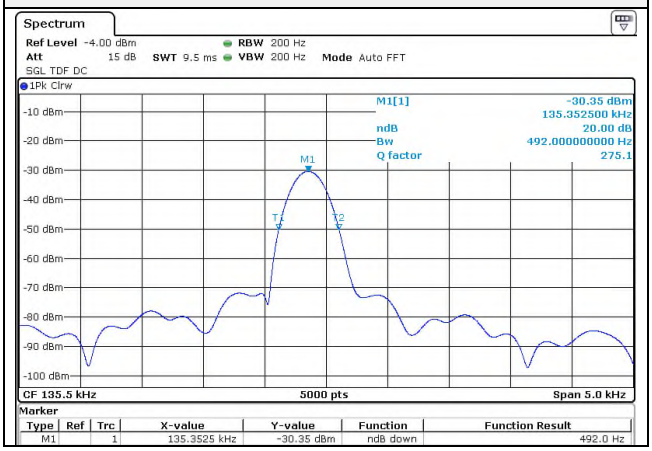
Test results

Test Mode	Frequency(㎒)	Measured bandwidth(㎑)
5W	0.135	0.497
9W	0.135	0.492

5W



9W



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.

3.3. AC conducted emissions

Limit

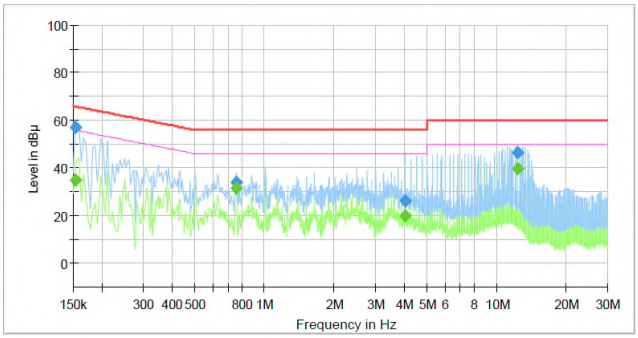
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following 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

Test results

Mode: 5W // 10 % charge

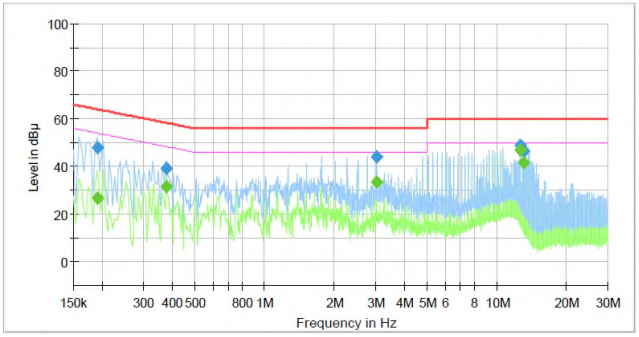
Hot Line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	---	34.79	55.78	20.99	1000.0	9.000	L1	19.6
0.154000	57.04	---	65.78	8.74	1000.0	9.000	L1	19.6
0.758000	---	31.52	46.00	14.48	1000.0	9.000	L1	19.7
0.758000	33.84	---	56.00	22.16	1000.0	9.000	L1	19.7
4.030000	---	19.85	46.00	26.15	1000.0	9.000	L1	19.9
4.030000	26.09	---	56.00	29.91	1000.0	9.000	L1	19.9
12.338000	---	39.73	50.00	10.27	1000.0	9.000	L1	20.5
12.338000	46.65	---	60.00	13.35	1000.0	9.000	L1	20.5

Neutral Line

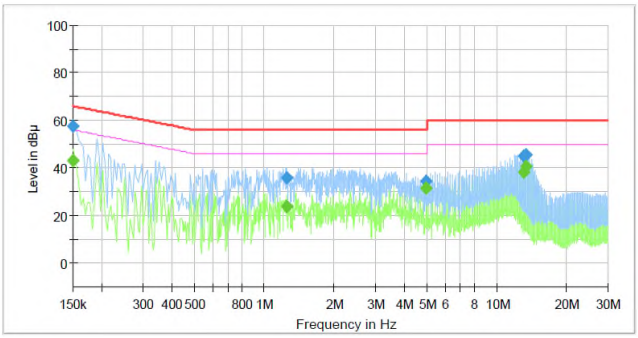


Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.190000	---	26.68	54.04	27.36	1000.0	9.000	N	19.6
0.190000	47.67	---	64.04	16.37	1000.0	9.000	N	19.6
0.378000	---	31.39	48.32	16.93	1000.0	9.000	N	19.7
0.378000	39.21	---	58.32	19.11	1000.0	9.000	N	19.7
3.022000	---	33.31	46.00	12.69	1000.0	9.000	N	19.8
3.022000	44.16	---	56.00	11.84	1000.0	9.000	N	19.8
12.622000	---	46.79	50.00	3.21	1000.0	9.000	N	20.6
12.622000	48.84	---	60.00	11.16	1000.0	9.000	N	20.6
13.126000	---	41.82	50.00	8.18	1000.0	9.000	N	20.6
13.126000	46.38	---	60.00	13.62	1000.0	9.000	N	20.6

Mode: 9W // 10 % charge

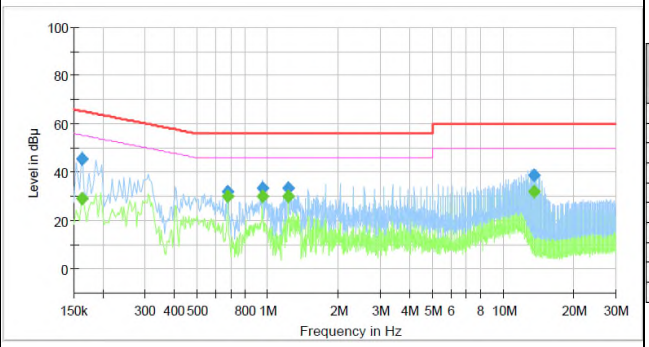
Hot Line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	43.00	56.00	13.00	1000.0	9.000	L1	19.6
0.150000	57.69	---	66.00	8.31	1000.0	9.000	L1	19.6
1.250000	---	23.75	46.00	22.25	1000.0	9.000	L1	19.8
1.250000	35.75	---	56.00	20.25	1000.0	9.000	L1	19.8
4.950000	---	31.55	46.00	14.45	1000.0	9.000	L1	19.9
4.950000	34.43	---	56.00	21.57	1000.0	9.000	L1	19.9
13.118000	---	38.33	50.00	11.67	1000.0	9.000	L1	20.5
13.118000	45.06	---	60.00	14.94	1000.0	9.000	L1	20.5
13.358000	---	40.48	50.00	9.52	1000.0	9.000	L1	20.6
13.358000	45.33	---	60.00	14.67	1000.0	9.000	L1	20.6

Neutral Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.162000	---	28.95	55.36	26.41	1000.0	9.000	N	19.6
0.162000	45.35	---	65.36	20.01	1000.0	9.000	N	19.6
0.678000	---	29.88	46.00	16.12	1000.0	9.000	N	19.7
0.678000	31.96	---	56.00	24.04	1000.0	9.000	N	19.7
0.950000	---	29.85	46.00	16.15	1000.0	9.000	N	19.7
0.950000	33.20	---	56.00	22.80	1000.0	9.000	N	19.7
1.218000	---	30.20	46.00	15.80	1000.0	9.000	N	19.7
1.218000	33.48	---	56.00	22.52	1000.0	9.000	N	19.7
13.554000	---	31.75	50.00	18.25	1000.0	9.000	N	20.6
13.554000	38.79	---	60.00	21.21	1000.0	9.000	N	20.6

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration due.
Spectrum Analyzer	R&S	FSV40	101002	2020.06.24
Loop Antenna	Schwarzbeck	FMZB1513	225	2021.02.15
Trilog-broadband antenna	SCHWARZBECK	VULB 9163	715	2020.11.29
AC POWER SOURCE	HP	6813A	3729A00754	2021.01.15
EMI Test Receiver	R&S	ESR3	101783	2021.01.20
EMI Test Receiver	R&S	ESU26	100551	2021.04.01
LISN	R&S	ENV216	101786	2021.01.20

Peripheral device

Device	Manufacturer	Model No.	S/N	Note
Mobile phone	SAMSUNG	SM-N950N	-	-