

TEST REPORT

FCC Part 15C

Equipment under test Wireless Charging

Model name EA1702

FCC ID 2ACCCEA1702

Applicant KOMATECH Co.,Ltd.

Manufacturer KOMATECH Co.,Ltd.

Date of test(s) 2018.01.19~2018.01.25, 2018.03.05

Date of issue 2018.03.06

Issued to

KOMATECH Co.,Ltd.
62-16 19th st, Gamjeong-ro,
Gimpo-si, Gyeonggi-do, Korea
Tel: +82-31-999-3940 / Fax: +82-31-997-7900

Issued by

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

Test and report completed by :	Report approval by :
	
Young-Jin Lee Test engineer	Hyeon-Su Jang Technical manager



Revision history

Revision	Date of issue	Test report No.	Description
-	2018.01.26	KES-RF-18T0016	Initial
R1	2018.01.26	KES-RF-18T0016-R1	Retest Radiated spurious emission

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

TABLE OF CONTENTS

1.	General information	4
1.1.	EUT description	4
1.2.	Test configuration	4
1.3.	Test frequency	4
1.4.	Test mode	4
1.5.	Information about derivative model	5
1.6.	Device modifications.....	5
1.7.	Accessory information	5
1.8.	Measurement Uncertainty	5
2.	Summary of tests	6
3.	Test results	7
3.1.	Radiated spurious emission	7
3.2.	20dB Bandwidth.....	21
3.3.	AC conducted emissions	22
Appendix A. Measurement equipment		24
Appendix B. Test setup photo.....		25

1. General information

Applicant KOMATECH Co.,Ltd.
 Applicant address 62-16 19th st, Gamjeong-ro, Gimpo-si, Gyeonggi-do, Korea
 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, Yeosu-si, Gyeonggi-do, Korea
 Test Facility FCC Accreditation Designation No.: KR0100, Registration No.: 444148
 FCC rule part(s): Part 15C
 FCC ID: 2ACCCEA1702
 Test device serial No. ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test Wireless Charging
 Frequency 0.110 MHz ~ 0.145 MHz
 Modulation type ASK
 Model: EA1702
 Antenna specification Internal type(Coil antenna)
 Power source DC 12.0 V

1.2. Test configuration

The **KOMATECH Co.,Ltd. Wireless Charging FCC ID: 2ACCCEA1702** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15C
 ANSI C63.10-2013

1.3. Test frequency

		Frequency Range
Power source	DC 12.0 V	0.110 MHz ~ 0.145 MHz

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	DongGuan RulHeng Electronic Technology Co., LTD.	RH-120200-1KO	-	Output : 12V, 2A

1.8. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.62 dB
Uncertainty for Radiation emission test (include Fundamental emission)	9kHz - 30MHz	4.54 dB
	30MHz - 1GHz	4.36 dB
	Above 1GHz	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

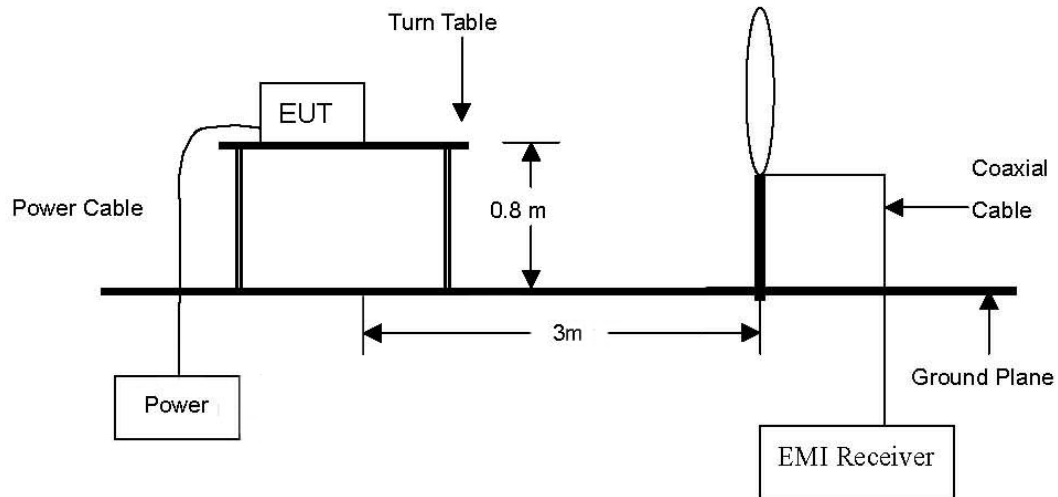
FCC Part Sections	Parameter	Test results
15.209	Radiated spurious emission	Pass
-	99% occupied bandwidth	Pass
15.207	AC conducted emissions	Pass

3. Test results

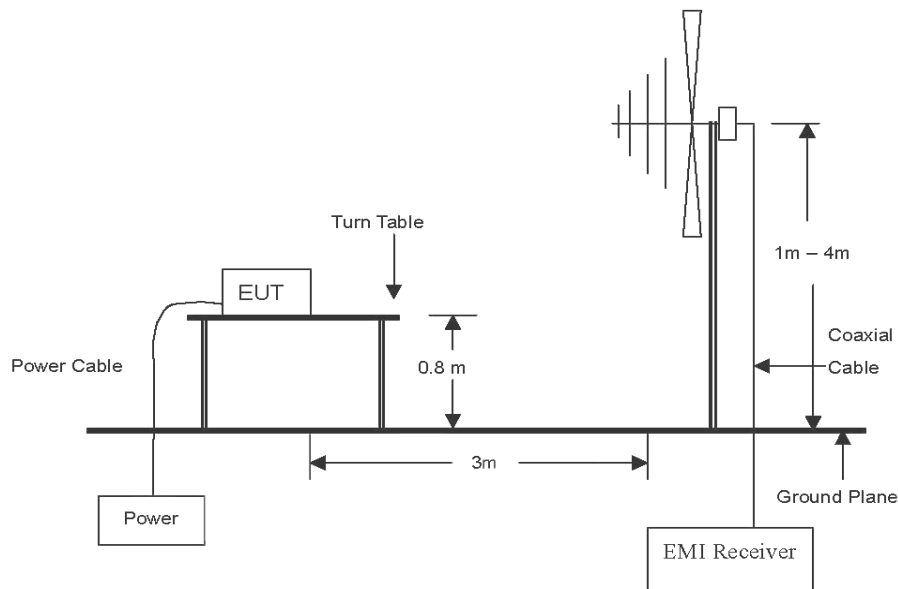
3.1. Radiated spurious emission

Test setup

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



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



Test procedure

[9 kHz to 30 MHz]

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 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.

The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 Hz / 300 Hz for peak detection (PK) at frequency below 9 kHz~ 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 kHz / 10 kHz for peak detection (PK) at frequency below 150 kHz~ 30 MHz.
3. For the frequency bands 9~ 90 kHz, 110~490 kHz the radiated emission limits are based on measurements employing an average detector.

[30 MHz to 1 GHz]

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.

The spectrum analyzer is set to:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.

Note:

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

D_m = Measurement distance in meters

D_s = Specification distance in meters

For 300m: $40\log(300/3) = 80$ dB for frequency band 0.009 MHz to 0.490 MHz

For 30m: $40\log(30/3) = 40$ dB for frequency band 0.490 MHz to 30 MHz

5. No significant emissions were found in the 90 - 110kHz 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 (MHz)	Distance (Meters)	Radiated ($\mu\text{V/m}$)
0.009 ~ 0.490	300	2400 / F(kHz)
0.490 ~ 1.705	30	24000 / F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

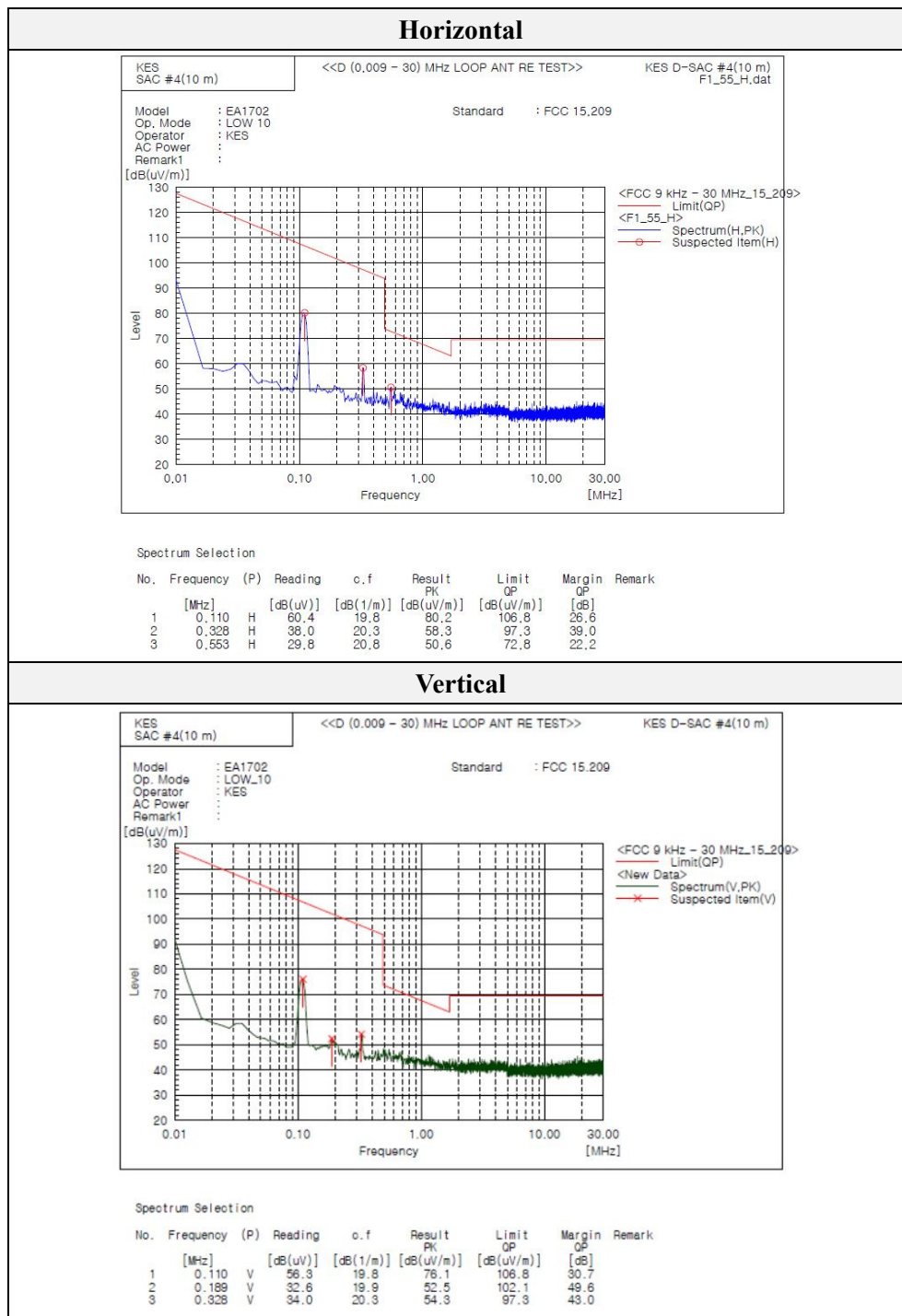
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 MHz, 76 ~ 88 MHz, 174 ~ 216 MHz or 470 ~ 806 MHz. However, operation within these frequency bands is permitted under other sections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

Test results (Below 30 MHz)

Mode: 15W // 10 % charger

Distance of measurement: 3 meter

Channel: Low

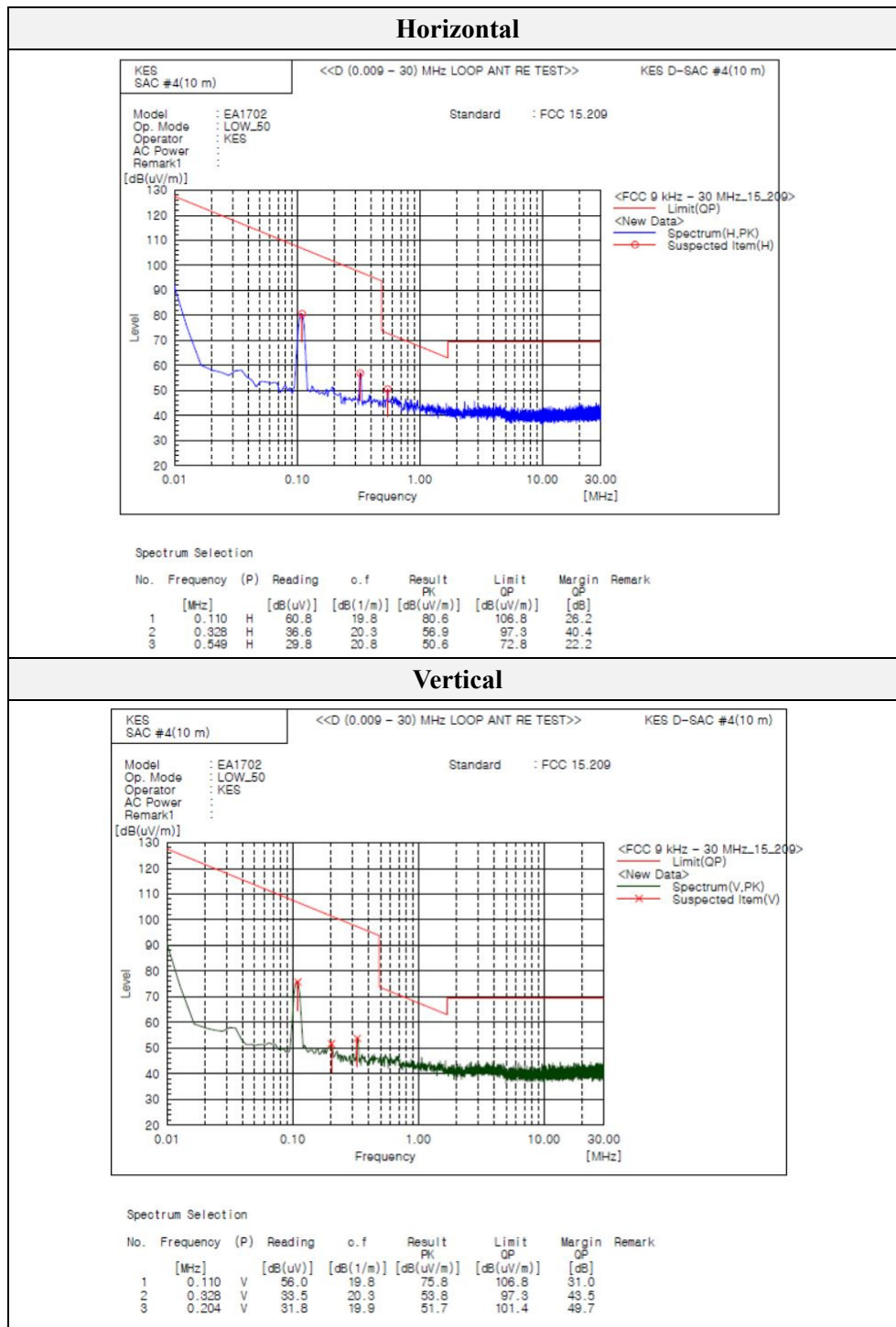


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 50 % charge

Distance of measurement: 3 meter

Channel: Low

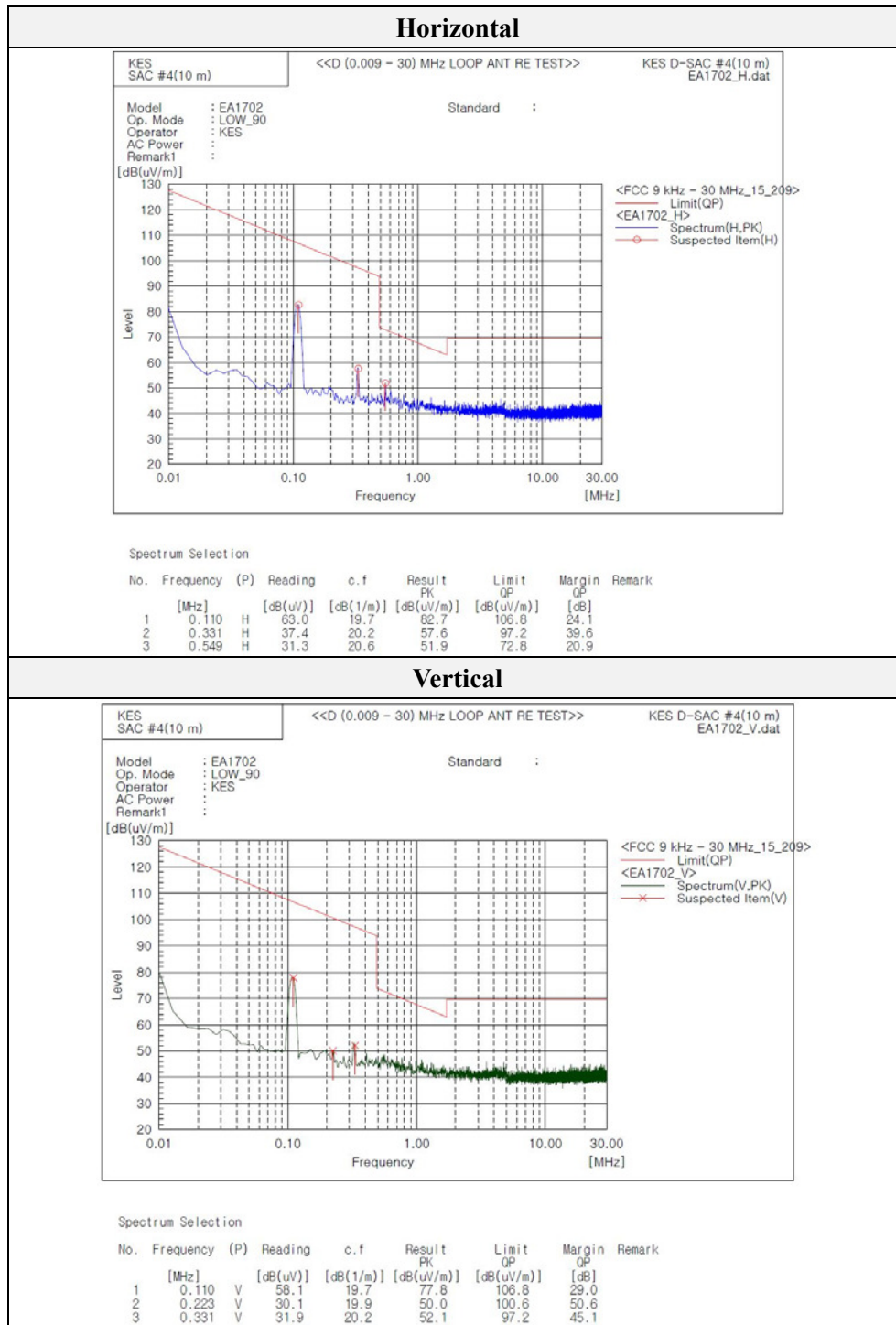


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 90 % charge

Distance of measurement: 3 meter

Channel: Low

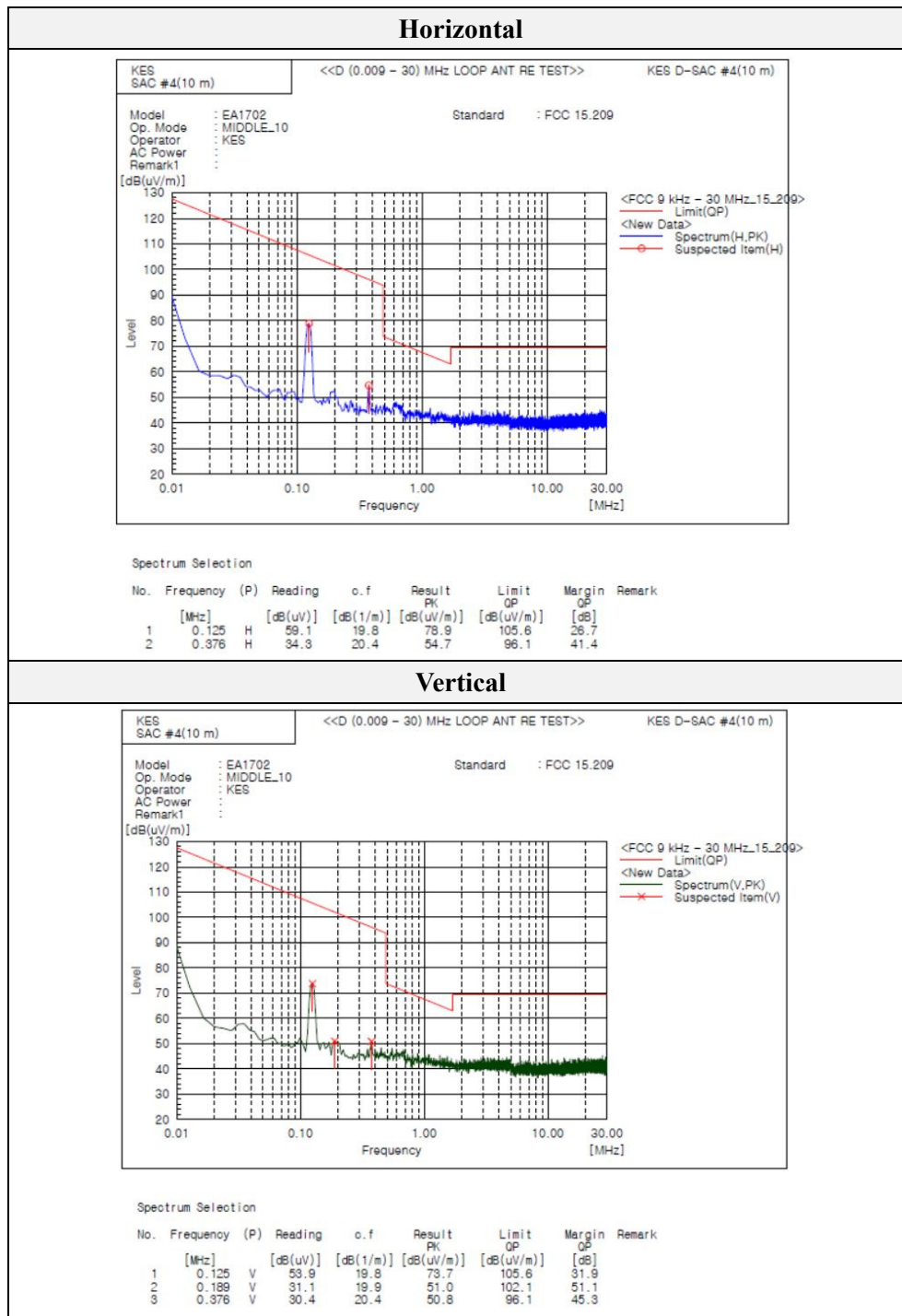


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 10 % charger

Distance of measurement: 3 meter

Channel: Middle

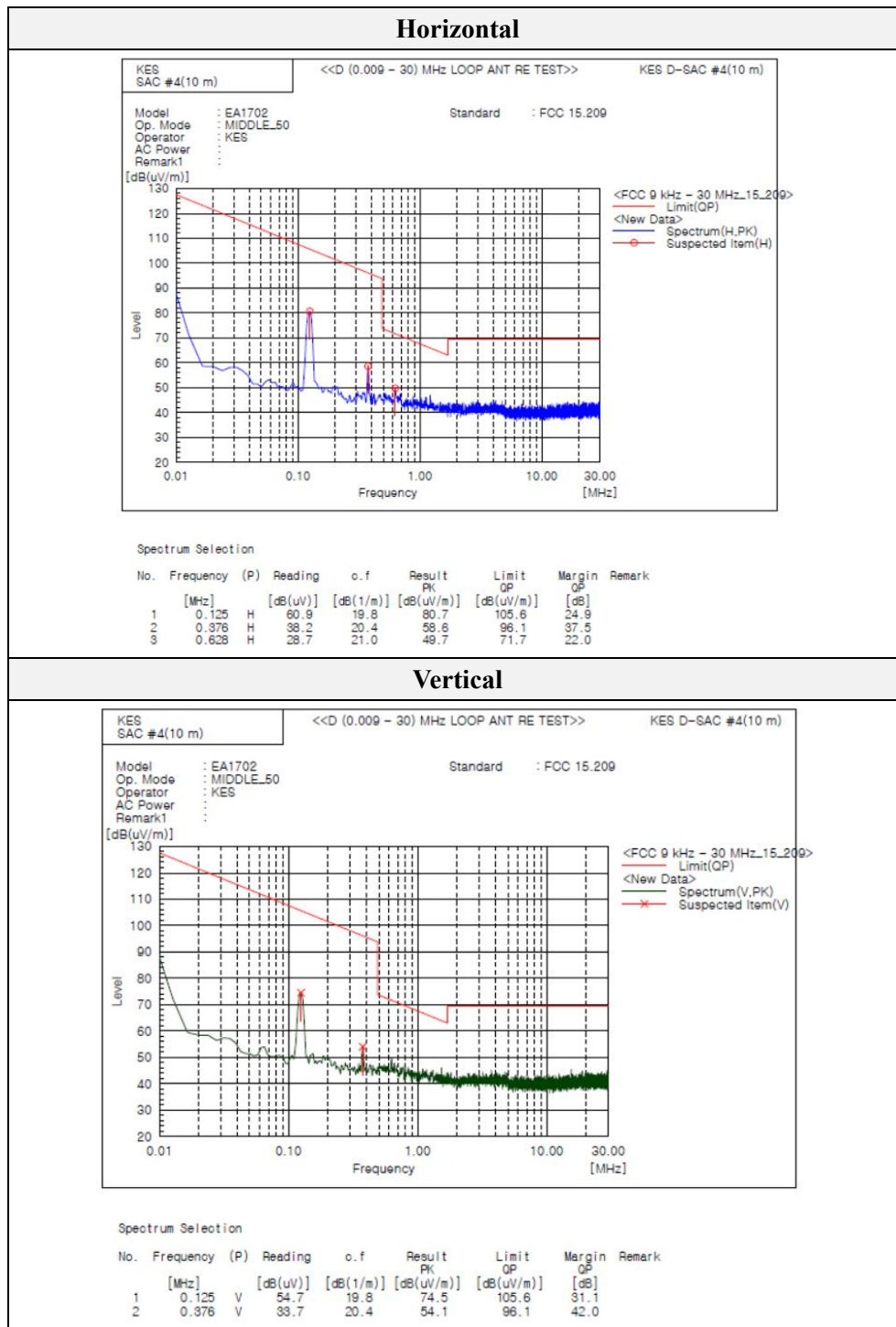


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 50 % charge

Distance of measurement: 3 meter

Channel: Middle

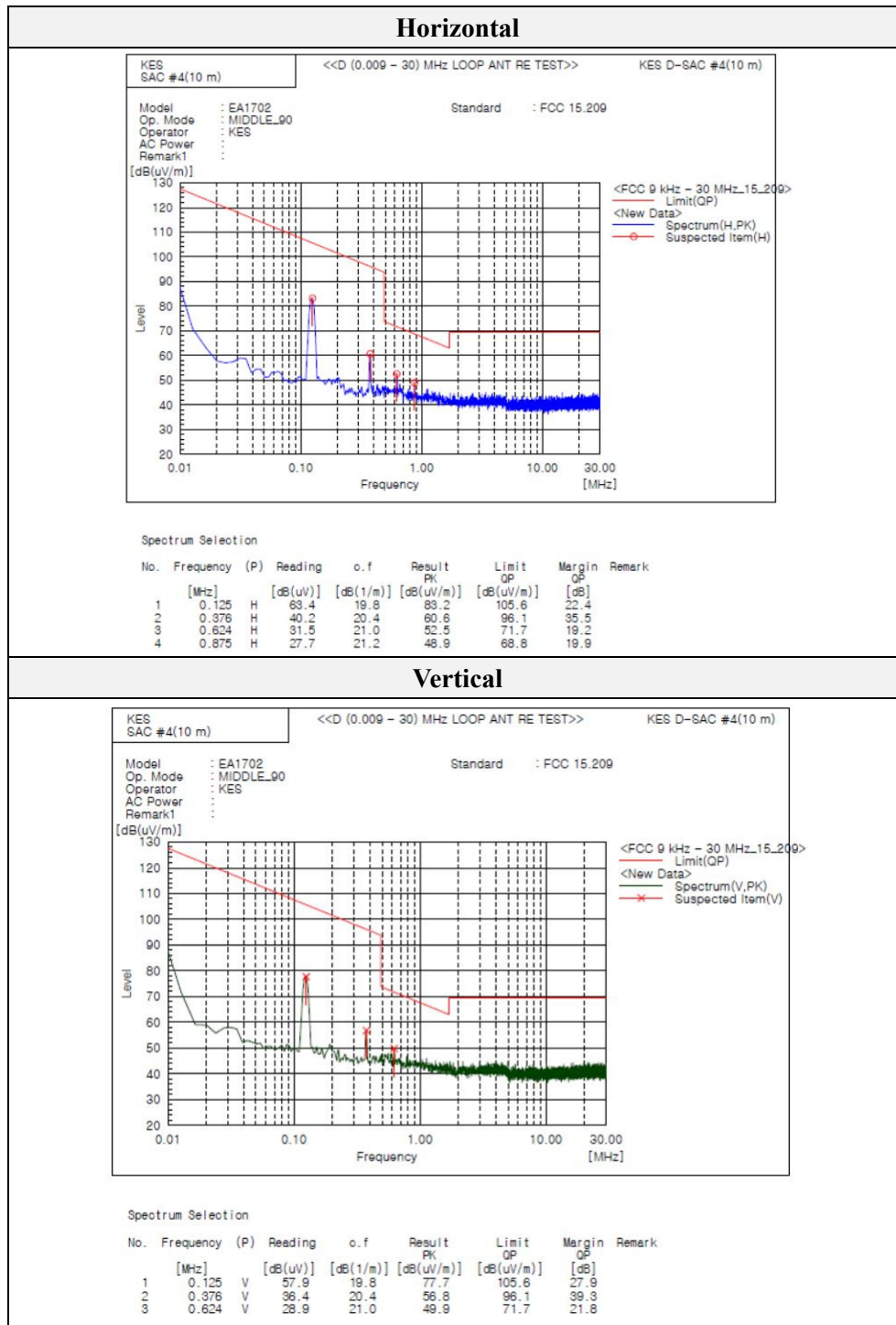


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 90 % charge

Distance of measurement: 3 meter

Channel: Middle



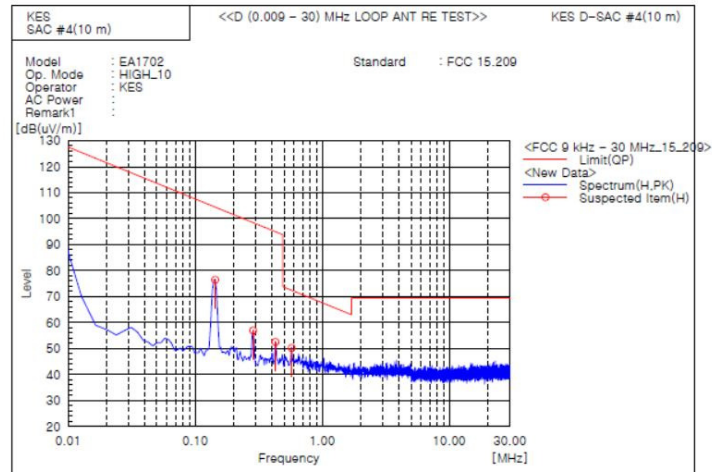
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 10 % charger

Distance of measurement: 3 meter

Channel: High

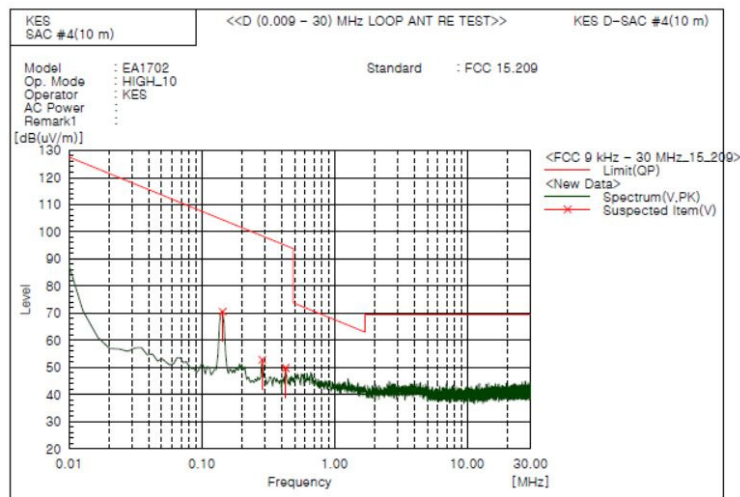
Horizontal



Spectrum Selection

No.	Frequency (P)	Reading	c.f	Result	Limit	Margin	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	PK [dB(uV/m)]	OP [dB(uV/m)]	OP [dB]	
1	0.144	H 56.7	19.8	76.5	104.4	27.9	
2	0.288	H 36.7	20.2	56.9	98.5	41.6	
3	0.429	H 32.0	20.5	52.8	95.0	42.6	
4	0.575	H 29.3	20.9	50.2	72.4	22.2	

Vertical



Spectrum Selection

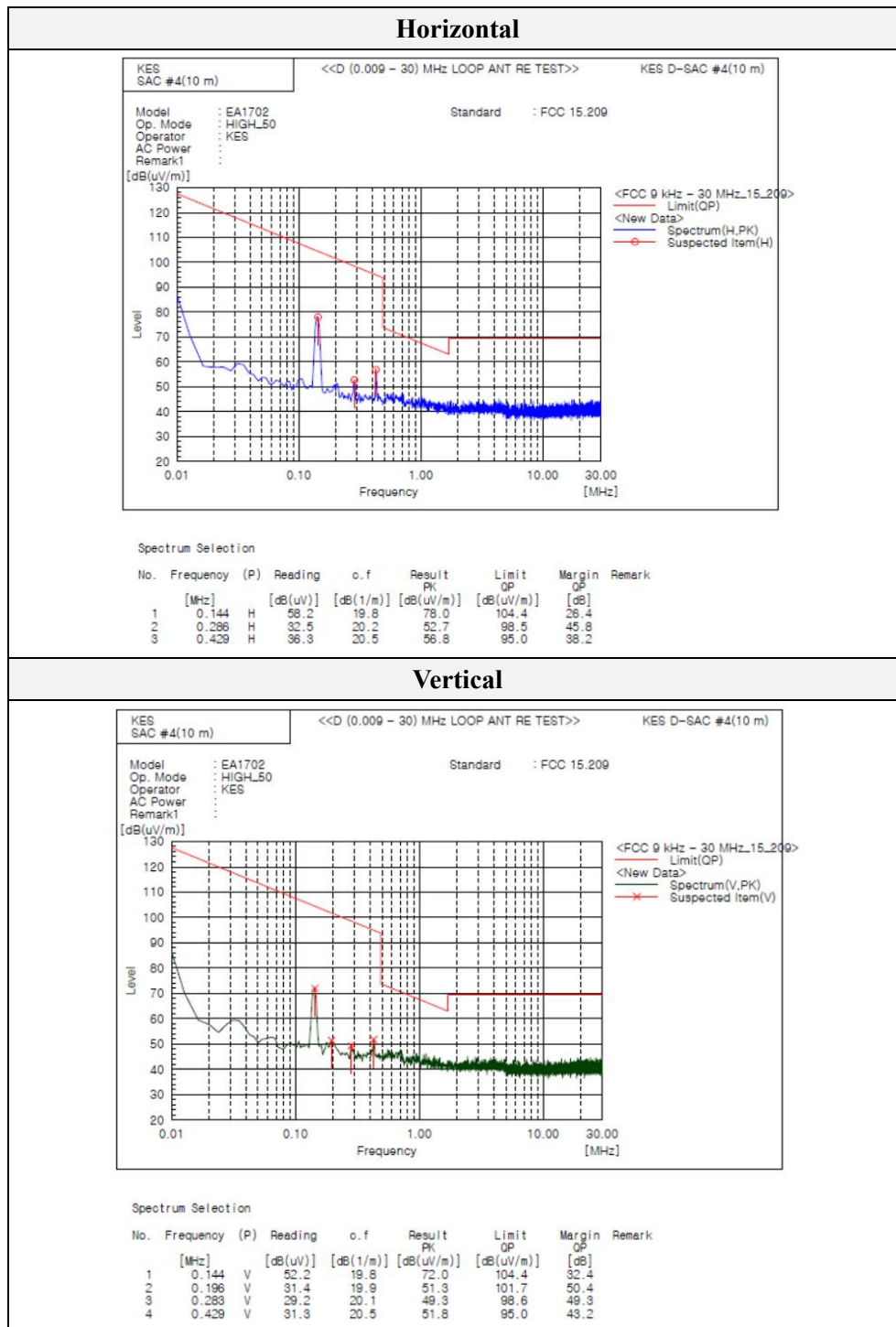
No.	Frequency (P)	Reading	c.f	Result	Limit	Margin	Remark
	[MHz]	[dB(uV)]	[dB(1/m)]	PK [dB(uV/m)]	OP [dB(uV/m)]	OP [dB]	
1	0.144	V 50.7	19.8	70.5	104.4	33.9	
2	0.288	V 32.6	20.2	52.8	98.5	45.7	
3	0.429	V 29.3	20.5	49.8	95.0	45.2	

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 50 % charge

Distance of measurement: 3 meter

Channel: High

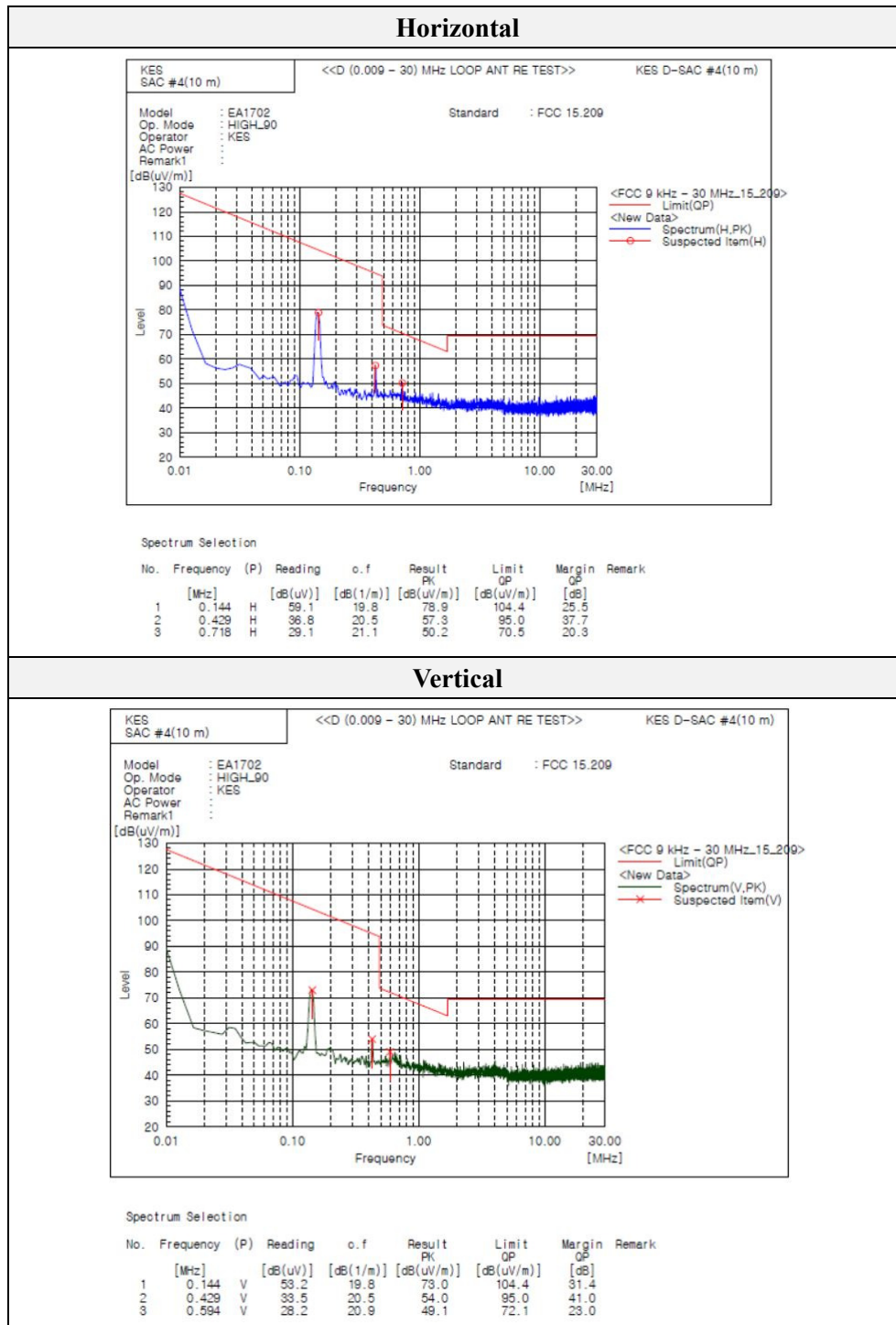


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Mode: 15W // 90 % charge

Distance of measurement: 3 meter

Channel: High



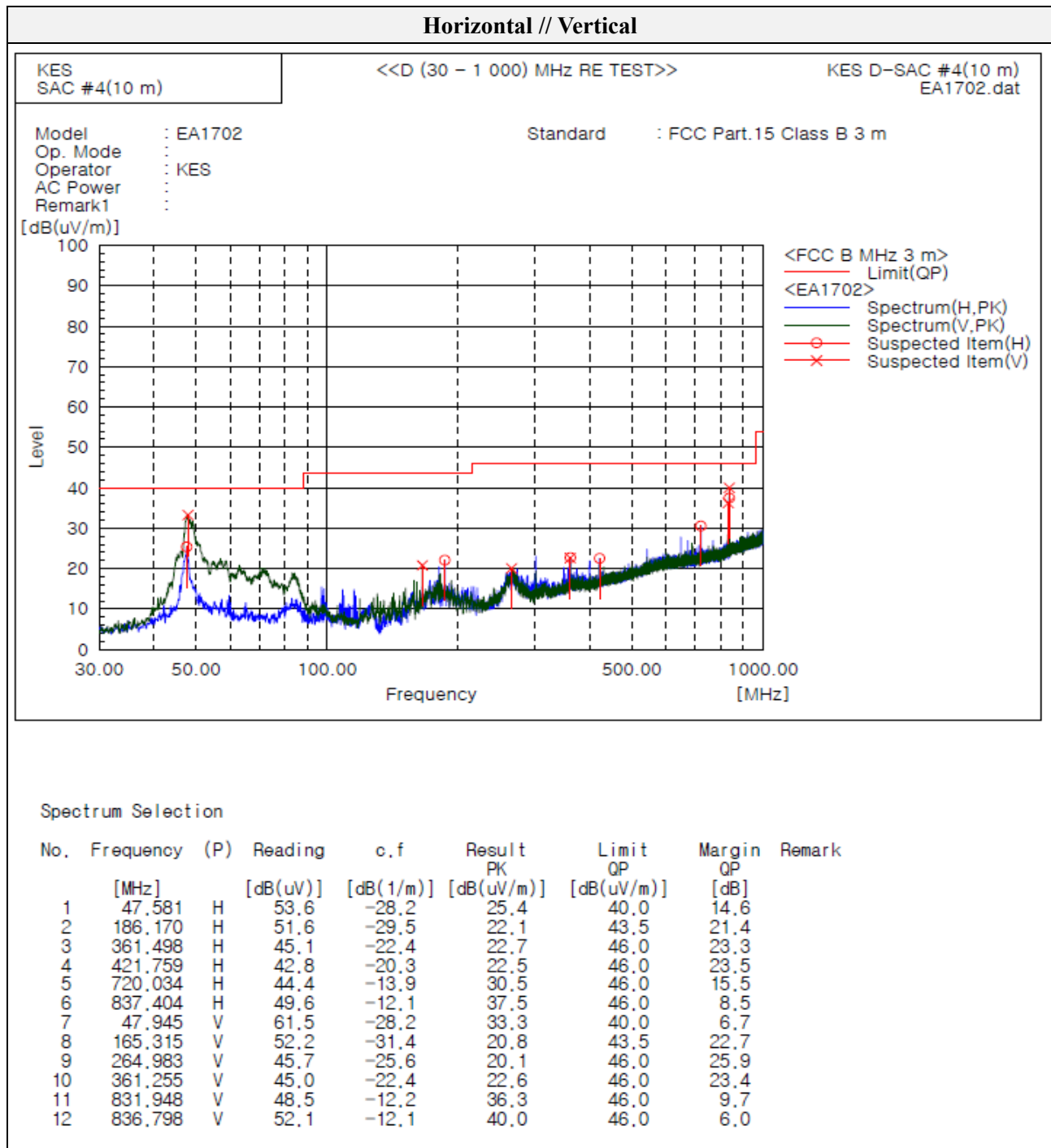
This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Test results (Below 1 000 MHz)

Mode: 15W // 90 % charge

Distance of measurement: 3 meter

Channel: Middle (Worst case)

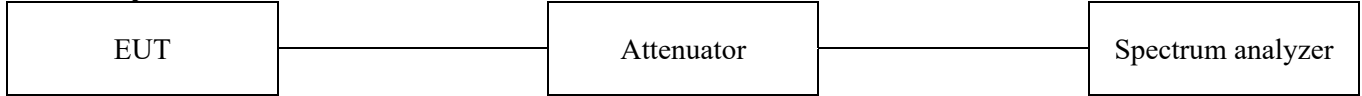


This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

3.2. 20dB Bandwidth

Test setup



Test procedures

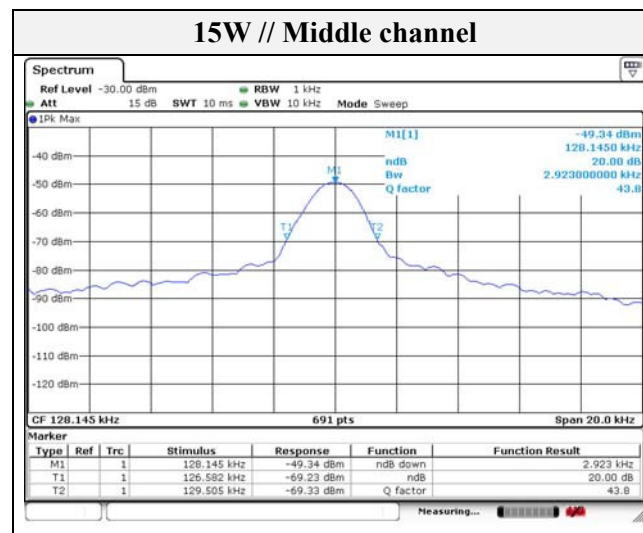
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the emission bandwidth. The VBW is set to $\geq$ RBW. The sweep time is coupled.

Limit

None; for reporting purposes only.

Test results

Power source(W)	Frequency(MHz)	Measured bandwidth(kHz)
15.0	0.128	2.92



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 kHz to 30 MHz, 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 (MHz)	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



Test results

Mode: 15W // 90 % charge

Channel: Middle (Worst case)

Hot Line

Level in dBμV

Frequency in Hz

FCC Part 15 Class B Voltage on Mains QP
FCC Part 15 Class B Voltage on Mains AV

Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr (dB)
0.310000	---	28.07	49.97	21.90	1000.0	9.000	L1	19.6
0.310000	41.58	---	59.97	18.39	1000.0	9.000	L1	19.6
0.815000	---	35.49	46.00	10.51	1000.0	9.000	L1	20.0
0.815000	39.95	---	56.00	16.05	1000.0	9.000	L1	20.0
1.280000	---	35.29	46.00	10.71	1000.0	9.000	L1	20.1
1.280000	40.32	---	56.00	15.68	1000.0	9.000	L1	20.1
1.745000	---	18.89	46.00	27.11	1000.0	9.000	L1	20.2
1.745000	32.02	---	56.00	23.98	1000.0	9.000	L1	20.2
5.510000	---	23.87	50.00	26.13	1000.0	9.000	L1	19.7
5.510000	36.83	---	60.00	23.17	1000.0	9.000	L1	19.7
6.445000	---	18.76	50.00	31.24	1000.0	9.000	L1	19.7
6.445000	30.19	---	60.00	29.81	1000.0	9.000	L1	19.7

Neutral Line

Level in dBμV

Frequency in Hz

FCC Part 15 Class B Voltage on Mains QP
FCC Part 15 Class B Voltage on Mains AV

Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr (dB)
0.160000	---	28.77	55.46	26.69	1000.0	9.000	N	19.4
0.160000	53.34	---	65.46	12.12	1000.0	9.000	N	19.4
0.585000	---	29.31	46.00	16.69	1000.0	9.000	N	19.8
0.585000	35.15	---	56.00	20.85	1000.0	9.000	N	19.8
3.155000	---	31.41	46.00	14.59	1000.0	9.000	N	20.1
3.155000	35.17	---	56.00	20.83	1000.0	9.000	N	20.1
4.790000	---	31.40	46.00	14.60	1000.0	9.000	N	19.8
4.790000	35.57	---	56.00	20.43	1000.0	9.000	N	19.8
5.490000	---	31.03	50.00	18.97	1000.0	9.000	N	19.7
5.490000	34.86	---	60.00	25.14	1000.0	9.000	N	19.7
23.630000	---	25.97	50.00	24.03	1000.0	9.000	N	20.5
23.630000	32.89	---	60.00	27.11	1000.0	9.000	N	20.5

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum Analyzer	R&S	FSV40	101002	1 year	2018.07.04
Loop Antenna	Schwarzbeck	FMZB1513	225	2 years	2019.05.10
Trilog-broadband antenna	SCHWARZBECK	VULB 9163	9168-714	2 years	2018.11.28
Preamplifier	HP	8449B	3008A00538	1 year	2018.07.04
Preamplifier	AGILENT	8449B	3008A01729	1 year	2018.05.31
EMI Test Receiver	R&S	ESR3	101781	1 year	2018.04.27
EMI Test Receiver	R&S	ESU26	100552	1 year	2018.04.19
Pulse Limiter	R&S	ESH3-Z2	101915	1 year	2018.11.27
LISN	SCHWARZBECK	NSLK8126	8126157	1 year	2018.03.24

Peripheral device

Device	Manufacturer	Model No.	S/N	Note
AC/DC Adapter	DongGuan RulHeng Electronic Technology Co., LTD.	RH-120200-1KO		Output : 12V, 2A
10/50/90% Load	PNTELECOM CO., LTD	N/A	N/A	N/A