



TEST REPORT



Report No. : KES-RF250177
Page 1 / 24

KES Co., Ltd.
#3002, #3503, #3701, 40, Simin-daero365beon-gil, Dongan-gu,
Anyang-si, Gyeonggi-do, 14057, Republic of Korea
Tel : +82-31-425-6200, Fax : +82-31-341-3838

■ FCC TEST REPORT

1. Client

- Name : DMBH Co., Ltd.
- Address : 401-603, Bucheon Techno-park, 655, Pyeongcheon-ro Wonmi-gu,
Bucheon-si, Gyeonggi-do, Korea

2. Sample Description

- Product item : InBirdie Swing
- Model name : InBirdie Swing
- Manufacturer etc. : DMBH Co., Ltd.

3. Date of test : 2025.04.01 ~ 2025.04.10

4. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

- Address : 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea

5. Test method used : Part 15 Subpart C 15.247

6. Test result : PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This laboratory is not accredited for the test results marked *.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by	Technical Manager
	Name : Gu-Bong, Kang (Signature)	Name : Yeong-Jun Cho (Signature)

2025 . 04. 14.

KES Co., Ltd.

Accredited by KOLAS, Republic of KOREA



REPORT REVISION HISTORY

Date	Test Report No.	Revision History
2025.04.14	KES-RF250177	Initial

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd. This document may be altered or revised by KES Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KES Co., Ltd. will constitute fraud and shall nullify the document.

Use of uncertainty of measurement for decisions on conformity (decision rule):

☒ No decision rule is specified by the standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty(“simple acceptance” decision rule, previously known as “accuracy method”).

☐ Other (to be specified, for example when required by the standard or client)



TABLE OF CONTENTS

1.	General information	4
1.1.	EUT description	4
1.2.	Test configuration.....	4
1.3.	Information about derivative model	5
1.4.	Accessory information	5
1.5.	Device modifications.....	5
1.6.	Sample calculation	5
1.7.	Measurement Uncertainty	5
1.8.	Frequency/channel operations	6
2.	Summary of tests	7
3.	Test results	8
3.1.	Radiated restricted band and emissions	8
3.2.	AC conducted emissions	21
3.3.	Antenna Requirement.....	23
Appendix A.	Measurement equipment.....	24





Report No. : KES-RF250177

1. General information

Applicant: DMBH Co., Ltd.
Applicant address: 401-603, Bucheon Techno-park, 655, Pyeongcheon-ro Wonmi-gu,
Bucheon-si, Gyeonggi-do, Korea
Test site: KES Co., Ltd.
Test site address: ☐ #3002, #3503, #3701, 40, Simin-daero365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Republic of Korea
☒ 473-21, Gayeo-ro, Yeosu-si, Gyeonggi-do, Korea
Test Facility: FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC rule part(s): 15.247
FCC ID: 2A3CB-INBIRDIESW
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test: InBirdie Swing
Frequency range: 2 402 MHz ~ 2 480 MHz (LE 1 Mbps)
Model: InBirdie Swing
Modulation technique: GFSK
Number of channels: 2 402 MHz ~ 2 480 MHz : 40 ch
Antenna specification: Chip Antenna // Peak gain: 1.90 dBi
Power source: DC 3.7 V (Battery)
H/W version: V1.0
S/W version: V0.1

1.2. Test configuration

The DMBH Co., Ltd. // InBirdie Swing // InBirdie Swing // FCC ID: 2A3CB-INBIRDIESW was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.247
KDB 558074 D01 v05 r02
ANSI C63.10-2013



Report No. : KES-RF250177

1.3. Information about derivative model

N/A

1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.5. Device modifications

N/A

1.6. Sample calculation

Where relevant, the following sample calculation is provided

For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

For Radiation test :

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) – Amplifier gain (dB)

1.7. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.22 dB (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 GHz	4.04 dB (SAC #6)
	Above 1 GHz	5.32 dB (SAC #5)
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.		



1.8. Frequency/channel operations

Ch.	Frequency (MHz)	Mode
00	2 402	LE 1 Mbps
.	.	.
19	2 440	LE 1 Mbps
.	.	.
39	2 480	LE 1 Mbps





2. Summary of tests

Section in FCC Part 15	Test description	Test results
15.247(a)(2)	6 dB bandwidth	N/T ^{Note.1}
15.247(b)(3)	Output power	N/T ^{Note.1}
15.247(e)	Power spectral density	N/T ^{Note.1}
15.205, 15.209	Radiated restricted band and emission	Pass
15.247(d)	Conducted spurious emission and band edge	N/T ^{Note.1}
15.207(a)	AC Conducted emissions	Pass
15.203	Antenna Requirement	Pass

*N/T: Not Tested

Note:

1. This product is equipped with an approved module, please refer to Module Report below for details. Report No. UCSFR-1706-002
2. By the request of applicant, test is performed with power setting value below :
LE 1 Mbps : default

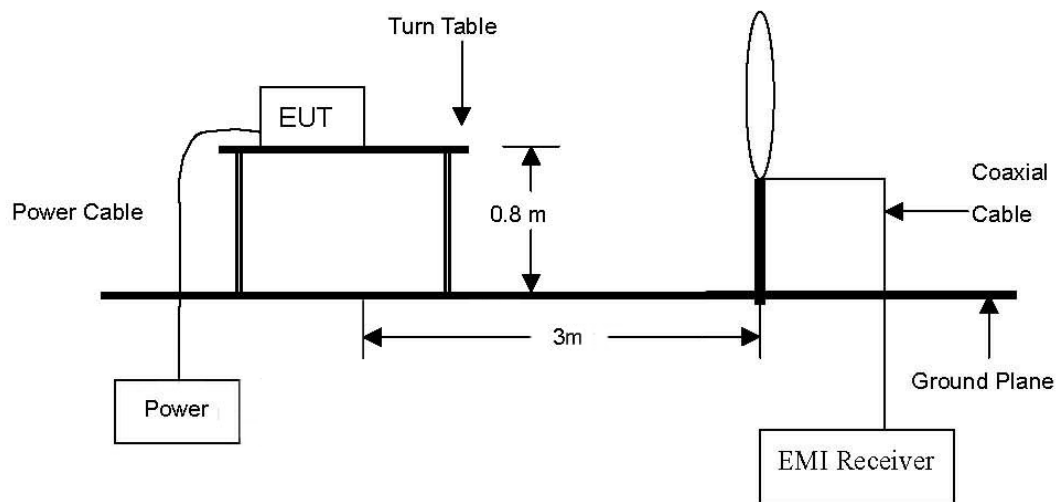


3. Test results

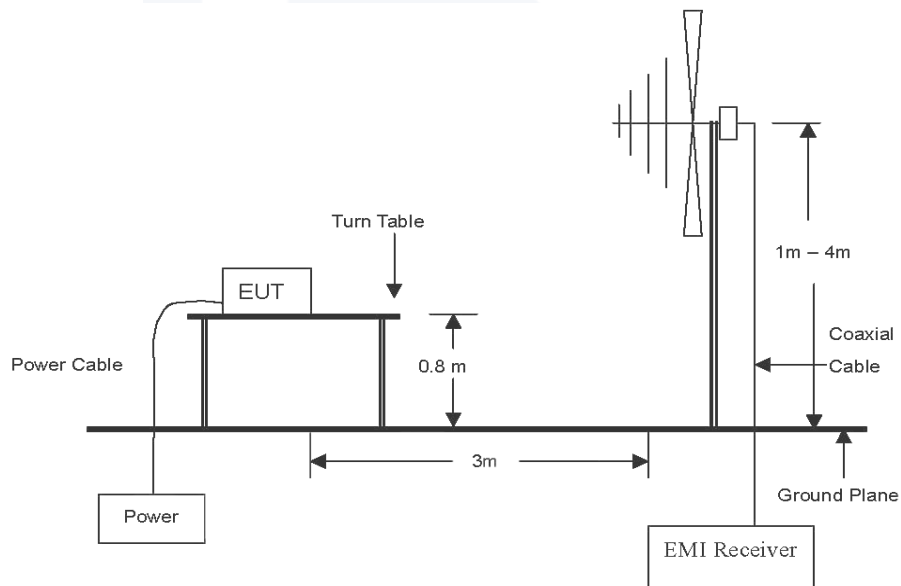
3.1. Radiated restricted band and emissions

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.

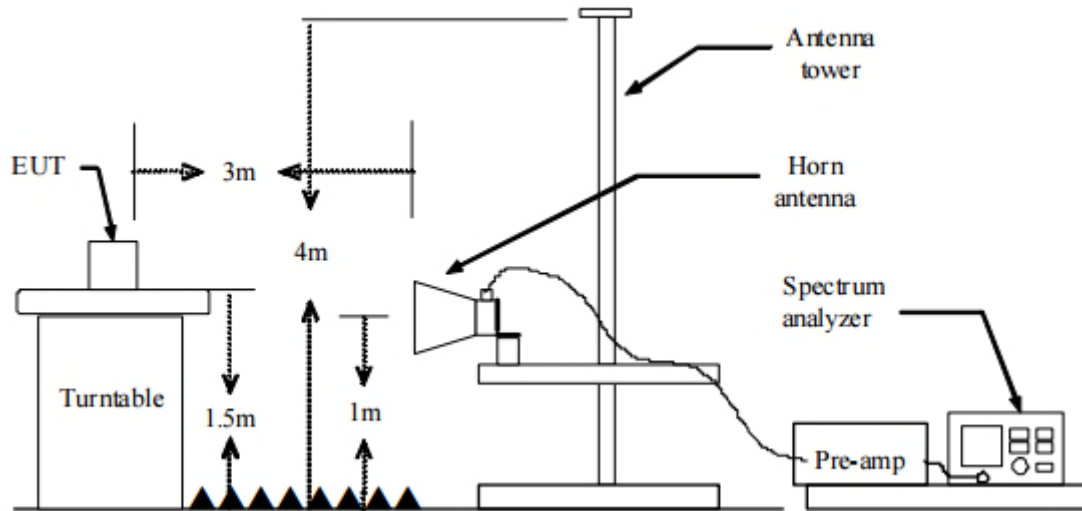


The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.





The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



Test procedure

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

Test procedure below 30 MHz

1. 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.
2. 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, ground parallel and perpendicular of the antenna are set to make the measurement. It was determined that parallel was worst-case orientation; therefore, all final radiated testing was performed with the EUT in parallel.
3. 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.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground for 30 MHz-1 GHz and 1.5 meters for above 1 GHz at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The antenna is a bi-log antenna, a horn antenna, and its height are varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
5. Spectrum analyzer settings for $f < 1$ GHz:
 - ① Span = wide enough to fully capture the emission being measured
 - ② RBW = 120 kHz
 - ③ VBW $\geq$ RBW
 - ④ Detector = quasi peak
 - ⑤ Sweep time = auto
 - ⑥ Trace = max hold



6. Spectrum analyzer settings for $f \geq 1$ GHz: Peak

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW ≥ 3 MHz
- ④ Detector = peak
- ⑤ Sweep time = auto
- ⑥ Trace = max hold
- ⑦ Trace was allowed to stabilize

7. Spectrum analyzer settings for $f \geq 1$ GHz: Average

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW $\geq 3 \times$ RBW
- ④ Detector = RMS, if $\text{span}/(\# \text{ of points in sweep}) \leq (\text{RBW}/2)$. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
- ⑤ Averaging type = power(i.e., RMS)
 - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
 - 2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
- ⑥ Sweep = auto
- ⑦ Trace = max hold
- ⑧ Perform a trace average of at least 100 traces.
- ⑨ A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is $10 \log(1/x)$, where x is the duty cycle.
 - 2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is $20 \log(1/x)$, where x is the duty cycle.
 - 3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

**Note.**

1. $f < 30$ MHz, extrapolation factor of 40 dB/decade of distance. $F_d = 40\log(D_m/D_s)$
 $f \geq 30$ MHz, extrapolation factor of 20 dB/decade of distance. $F_d = 20\log(D_m/D_s)$
 Where:
 F_d = Distance factor in dB
 D_m = Measurement distance in meters
 D_s = Specification distance in meters
2. Field strength(dB μ V/m) = Level(dB μ V) + CF (dB) + or DCF(dB)
3. Margin(dB) = Limit(dB μ V/m) – Field strength(dB μ V/m)
4. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
5. 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**.
6. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
7. According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although 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.

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 (μ 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.



Report No. : KES-RF250177

Duty cycle

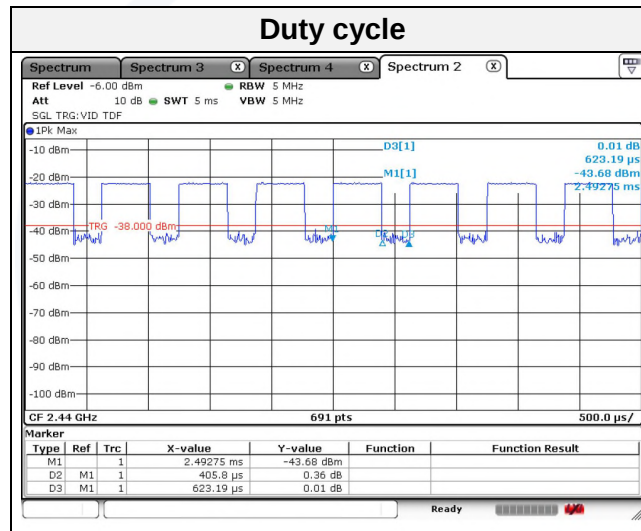
Regarding to KDB 558074 D01_v05 r02, 6. Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

- A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on- and off-times of the transmitted signal.
- The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on- and off-times of the transmitted signal.

Mode	T _{on} time (ms)	Period (ms)	Duty cycle (Linear)	Duty cycle (%)	Duty cycle correction factor (dB)
LE 1 Mbps	0.41	0.62	0.66	66.13	1.80

Duty cycle (Linear) = T_{on} time/Period

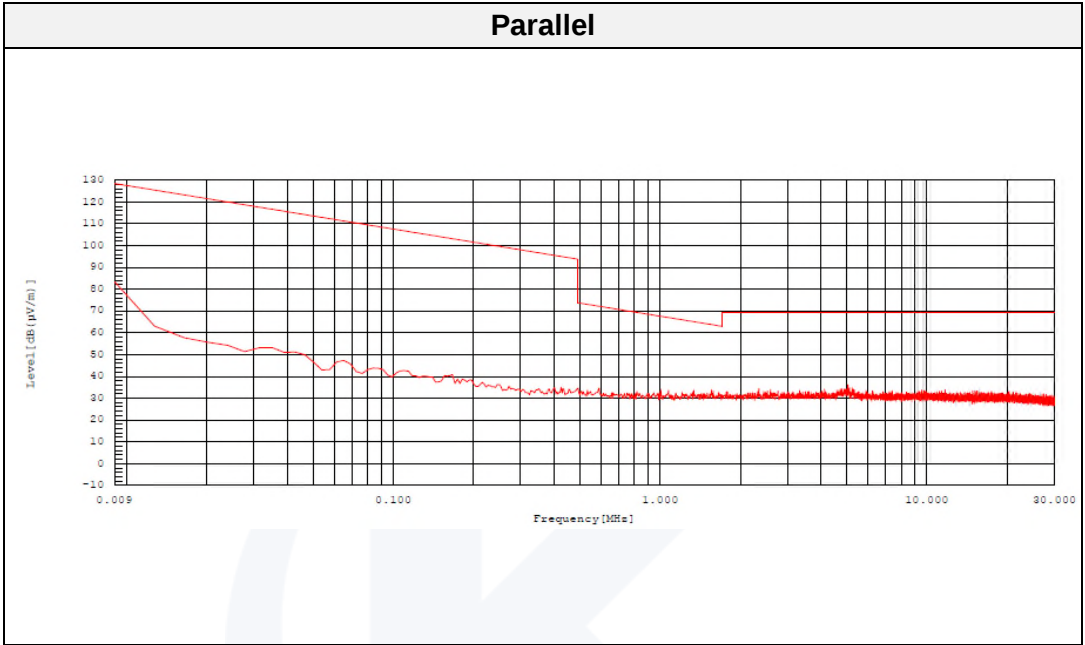
DCF(Duty cycle correction factor (dB)) = 10log(1/duty cycle)





Test results (Below 30 MHz)

Mode:	LE 1 Mbps
Distance of measurement:	3 meter
Channel:	39 (Worst case)

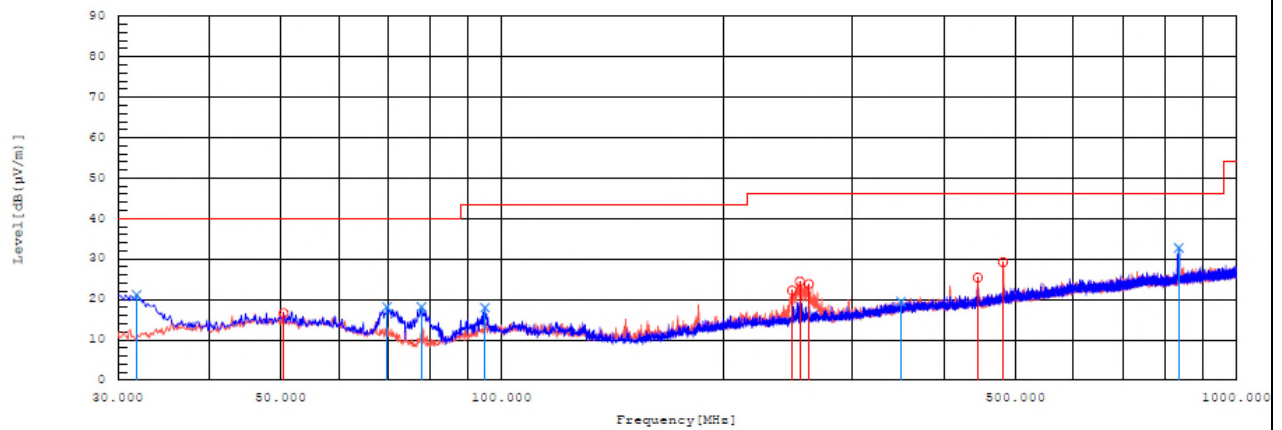


Note.

1. No spurious emission were detected under 30 MHz, above data is peak result.

**Test results (Below 1 000 MHz)**

Mode: LE 1 Mbps
Distance of measurement: 3 meter
Channel: 39 (Worst case)

Horizontal // Vertical**Final Result**

No.	Frequency [MHz]	Pol	Reading QP [dB(μV)]	c.f [dB(l/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	31.819	V	36.9	-15.8	21.1	40.0	18.9	103.0	251.6	
2	50.491	H	29.0	-12.4	16.6	40.0	23.4	105.0	0.0	
3	69.770	V	34.3	-16.2	18.1	40.0	21.9	100.0	0.0	
4	77.773	V	36.4	-18.3	18.1	40.0	21.9	152.0	0.0	
5	94.869	V	32.8	-14.9	17.9	43.5	25.6	102.0	122.7	
6	248.371	H	33.9	-11.7	22.2	46.0	23.8	105.0	305.2	
7	254.555	H	35.9	-11.5	24.4	46.0	21.6	107.0	0.0	
8	261.709	H	35.2	-11.4	23.8	46.0	22.2	109.0	0.0	
9	349.615	V	27.8	-8.4	19.4	46.0	26.6	133.0	330.4	
10	444.796	H	32.5	-7.1	25.4	46.0	20.6	214.0	254.0	
11	481.293	H	35.3	-6.1	29.2	46.0	16.8	192.0	319.3	
12	835.464	V	33.0	-0.3	32.7	46.0	13.3	146.0	88.5	

**Test results (Above 1 000 MHz)**

Mode: LE 1 Mbps

Distance of measurement: 3 meter

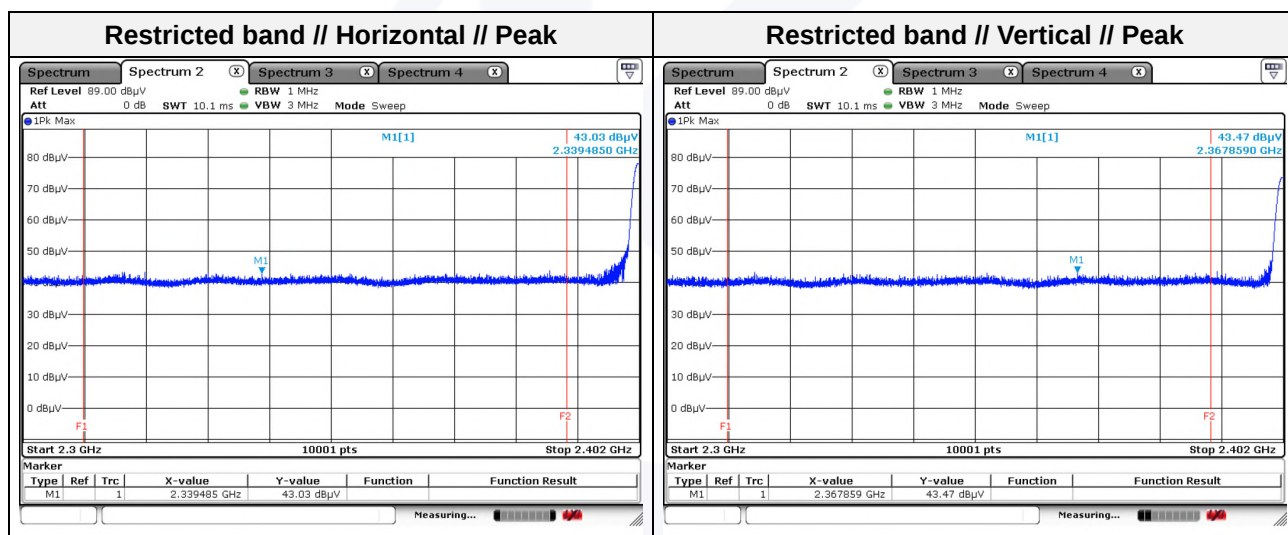
Channel: 00

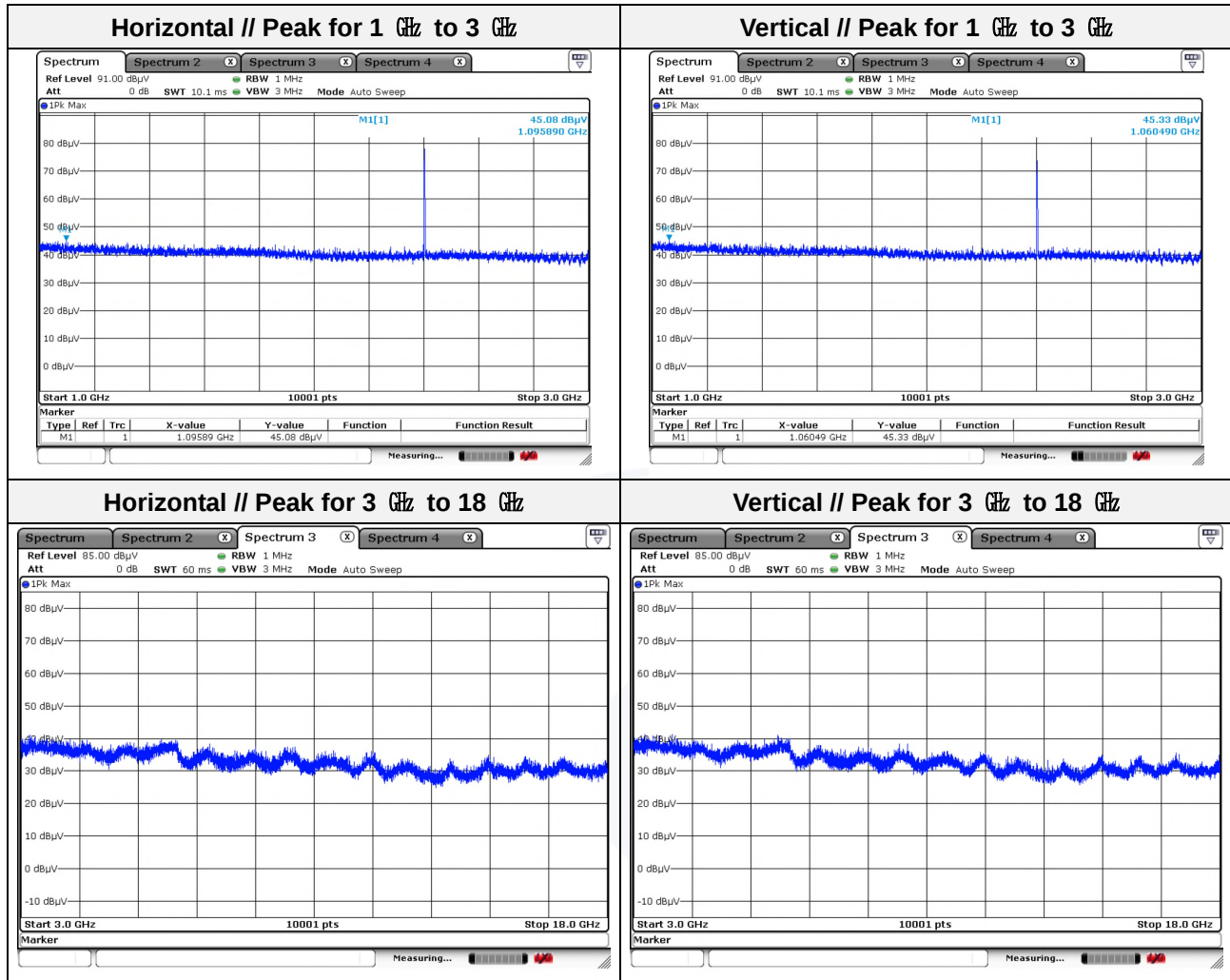
- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 060.49	45.33	Peak	V	-7.56	-	37.77	74.00	36.23
1 095.89	45.08	Peak	H	-7.38	-	37.70	74.00	36.30

- Band edge

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2 339.49	43.03	Peak	H	-2.24	-	40.79	74.00	33.21
2 367.86	43.47	Peak	V	-2.16	-	41.31	74.00	32.69





Note.

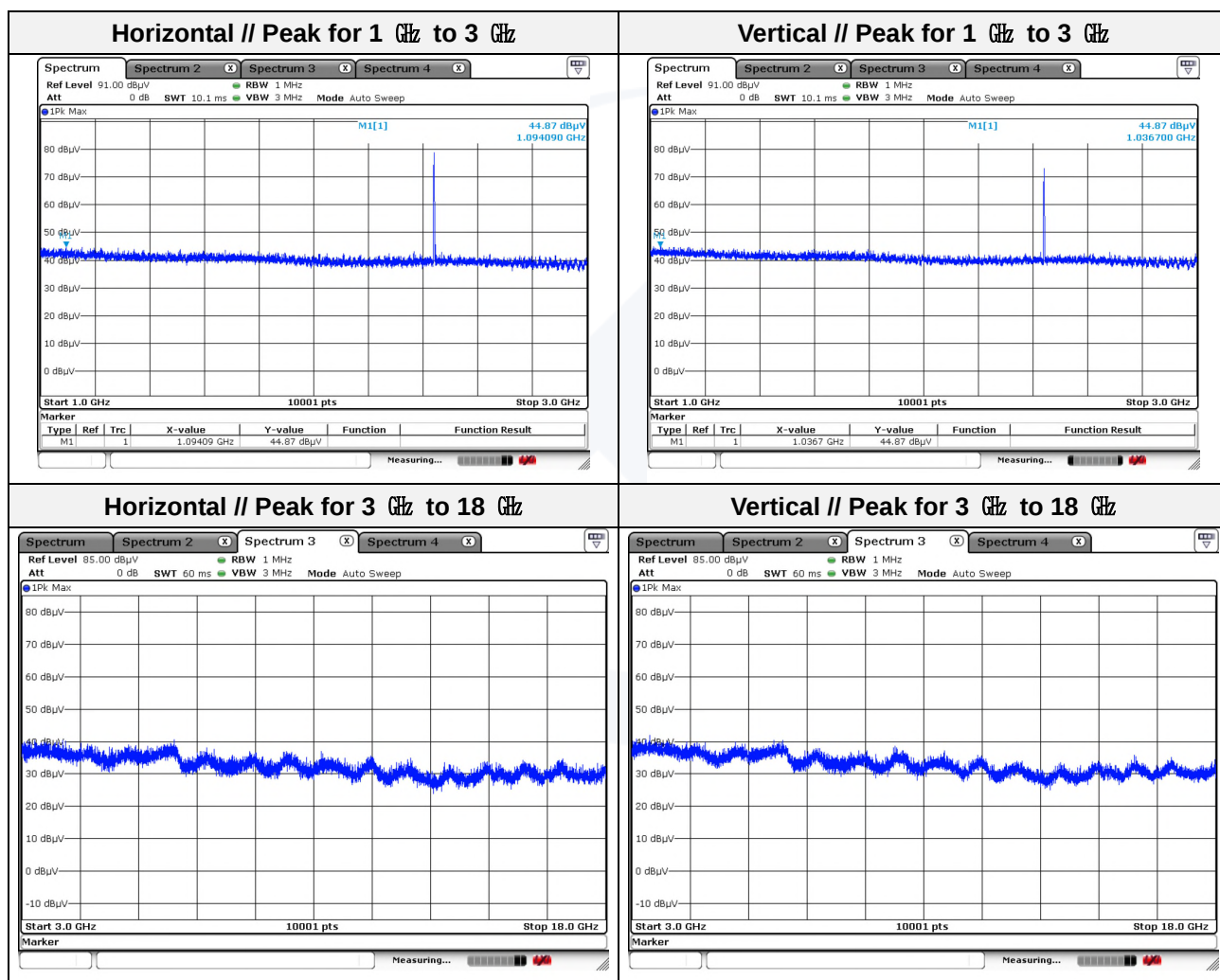
1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Mode: LE 1 Mbps
Distance of measurement: 3 meter
Channel: 20

- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 036.70	44.87	Peak	V	-7.69	-	37.18	74.00	36.82
1 094.09	44.87	Peak	H	-7.38	-	37.49	74.00	36.51



Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



Report No. : KES-RF250177

Mode: LE 1 Mbps

Distance of measurement: 3 meter

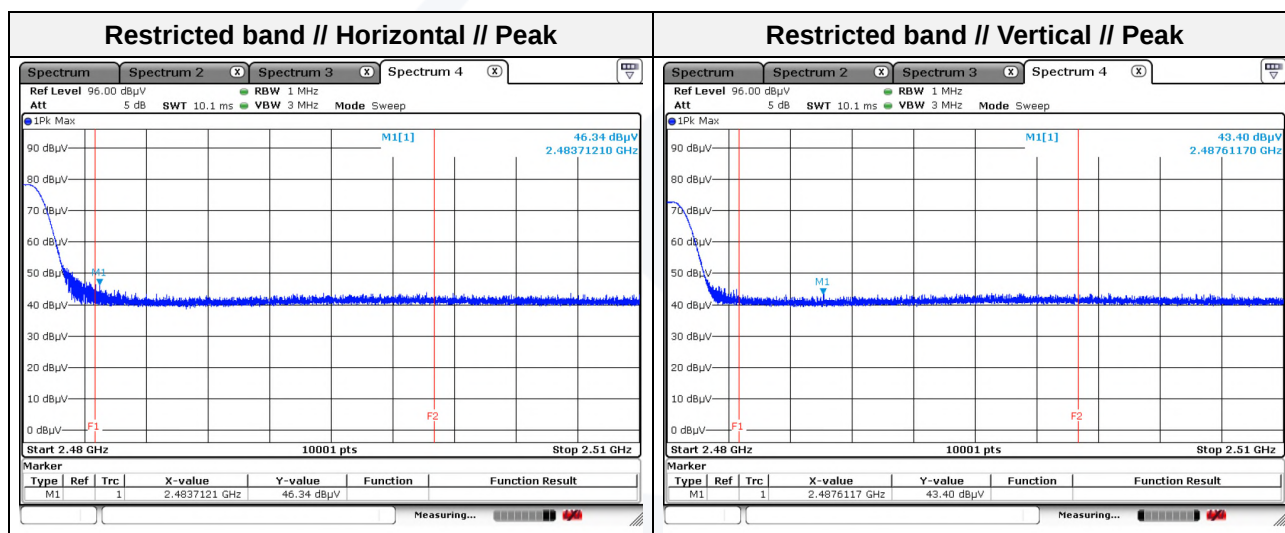
Channel: 39

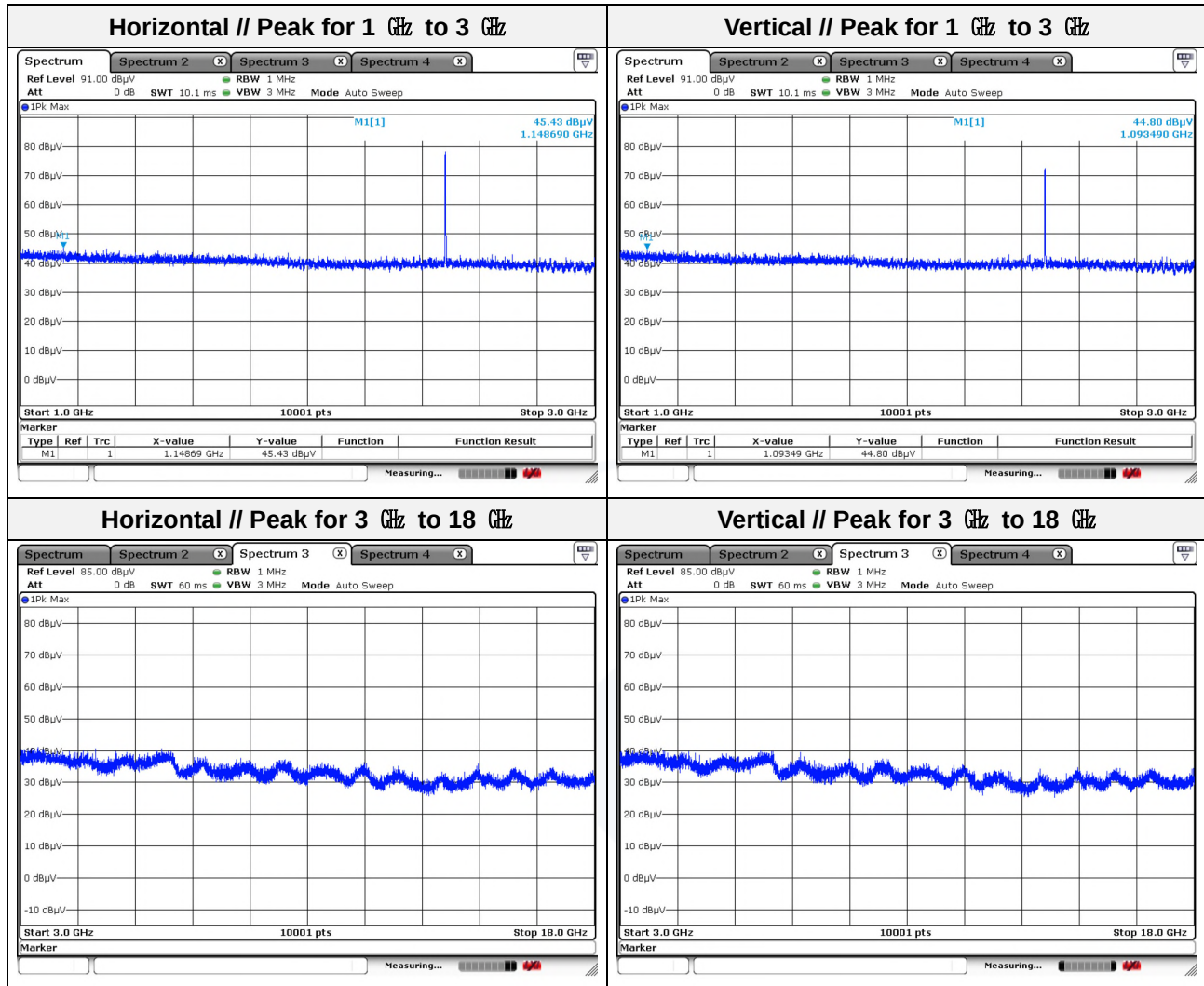
- Spurious

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1 093.49	44.80	Peak	V	-7.39	-	37.41	74.00	36.59
1 148.69	45.43	Peak	H	-7.10	-	38.33	74.00	35.67

- Band edge

Frequency (MHz)	Level (dB μ V)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2 483.71	46.34	Peak	H	-1.91	-	44.43	74.00	29.57
2 487.61	43.40	Peak	V	-1.90	-	42.17	74.00	31.83





Note.

1. No spurious emission were detected above 3 GHz.
2. Average test would be performed if the peak result were greater than the average limit.



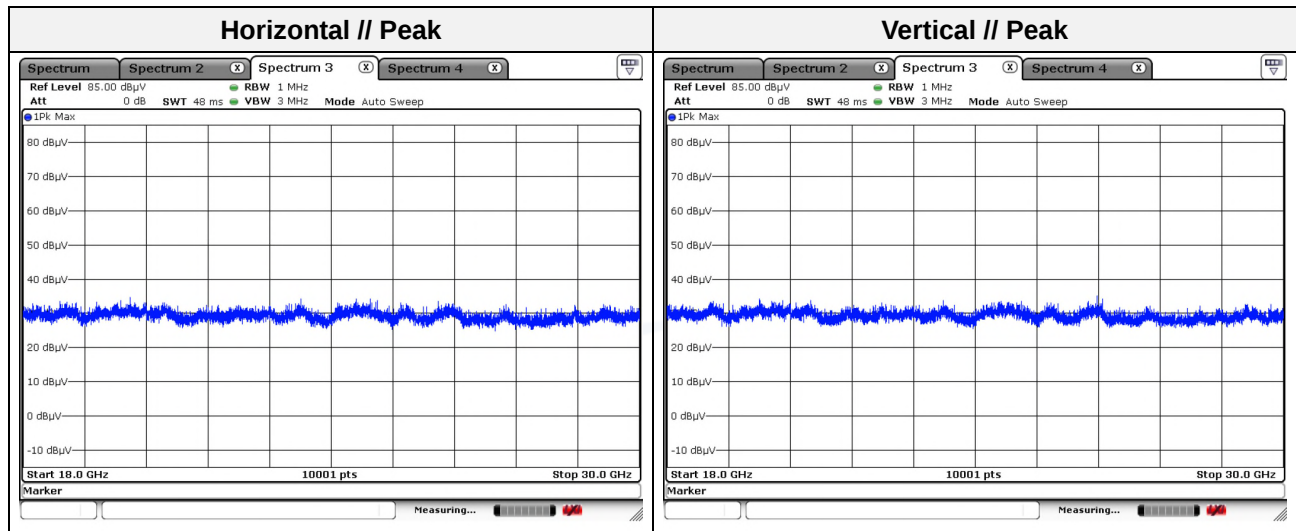
Report No. : KES-RF250177

Test results (18 GHz to 30 GHz) – Worst case

Mode: LE 1 Mbps

Distance of measurement: 3 meter

Channel: 39 (Worst case)



Note.

1. No spurious emission were detected above 18 GHz.



3.2. 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 (dB μ V)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

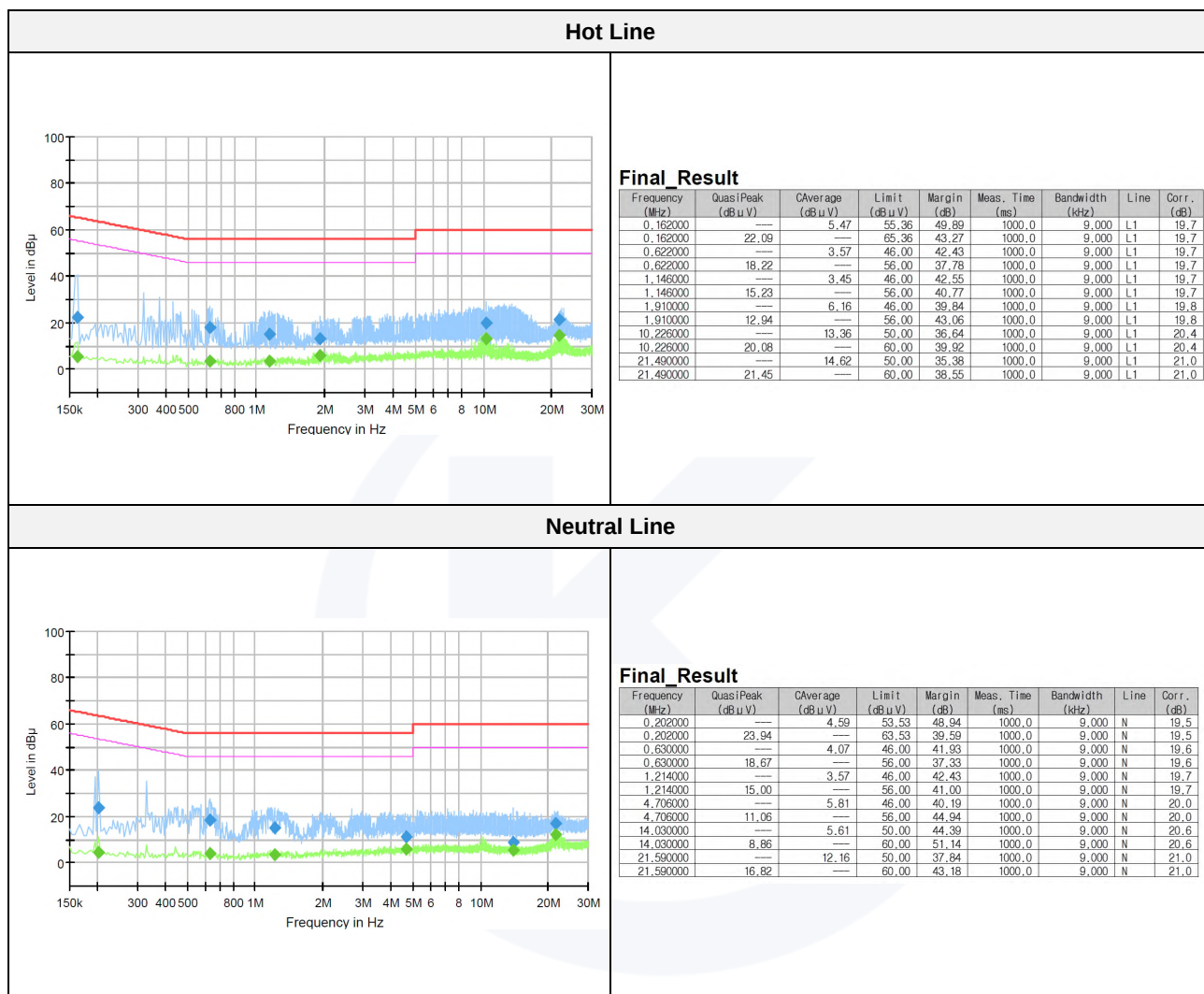
*Decreases with the logarithm of the frequency.



Test results

Mode: LE 1 Mbps

Channel: 39 (Worst case)





3.3. Antenna Requirement

According to 15.207(a), 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

**Appendix A. Measurement equipment**

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
Spectrum analyzer	R&S	FSV40	101725	1 year	2025.06.12
SIGNAL GENERATOR	KEYSIGHT	N5182B	MY59100115	1 year	2025.04.15
SIGNAL GENERATOR	Anritsu	68369B	002118	1 year	2025.04.15
LOOP ANTENNA	TESEQ	HLA6121	66547	2 years	2026.01.22
TRILOG-BROADBAND ANTENNA	Schwarzbeck	VULB 9163	714	2 years	2026.04.19
Attenuator	HUBER+SHHNER	6806.17.A	NONE	1 year	2026.02.13
ATTENUATOR	HP	8491B	23094	1 year	2026.02.13
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	1 year	2026.01.13
Amplifier	SONOMA INSTRUMENT	310N	401123	1 year	2026.02.13
PREAMPLIFIER	HP	8449B	3008A00538	1 year	2025.04.30
BROADBAND AMPLIFIER	SCHWARZBECK	BBV9721	PS9721-003	1 year	2026.01.09
DC POWER SUPPLY	SORENSEN	DCS40-75E	1408A02745	1 year	2026.01.08
EMI Test Receiver	R & S	ESR7	101190	1 year	2025.07.29
EMI Test Receiver	R&S	ESR3	101783	1 year	2025.11.06
PULSE LIMITER	R&S	ESH2-Z2	101915	1 year	2025.11.06
LISN	R&S	ENV216	101786	1 year	2026.01.09
Cable	-	-	#5	1 year	2025.11.01
Cable (SR #6)	RG 400	-	-	0.5 year	2025.07.25
Cable (SAC #5)	SUCOFLEX106	HUBER SUHNER	-	0.5 year	2025.07.25
	SUCOFLEX106	HUBER SUHNER	-		
	LH21D/2xSMA	OSI Cable	-		
Cable (SAC #6)	TCLH21D-SMSM-2.5M 0222	OSI Cable	-	0.5 year	2025.07.25
	TCLH21D-NMNM-10.0M 0222	OSI Cable	-		
	TCLH21D-SMSM-7.0M 0222	OSI Cable	-		

* Statement of Traceability: KES Co., Ltd. attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	LG Electronics Inc.,	LGS53	306QCZP560949
Test Jig Board	N/A	N/A	N/A

The End.