



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (24) of (36)



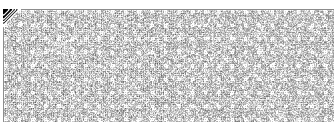
Mode: BLE_1 Mbps
Channel: 20
Distance of measurement: 3 meter

- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1 001.30	47.50	Peak	H	-9.59	-	37.91	74.00	36.09
1 396.26	50.51	Peak	V	-6.88	-	43.63	74.00	30.37
1 595.24	52.94	Peak	V	-5.28	-	47.66	74.00	26.34
1 792.62	47.81	Peak	V	-3.39	-	44.42	74.00	29.58
4 883.10	48.19	Peak	H	7.09	-	55.28	74.00	18.72
4 883.10	44.95	Peak	V	7.09	-	52.04	74.00	21.96
4 884.60	34.51	Average	H	7.10	1.76	43.37	54.00	10.63

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)

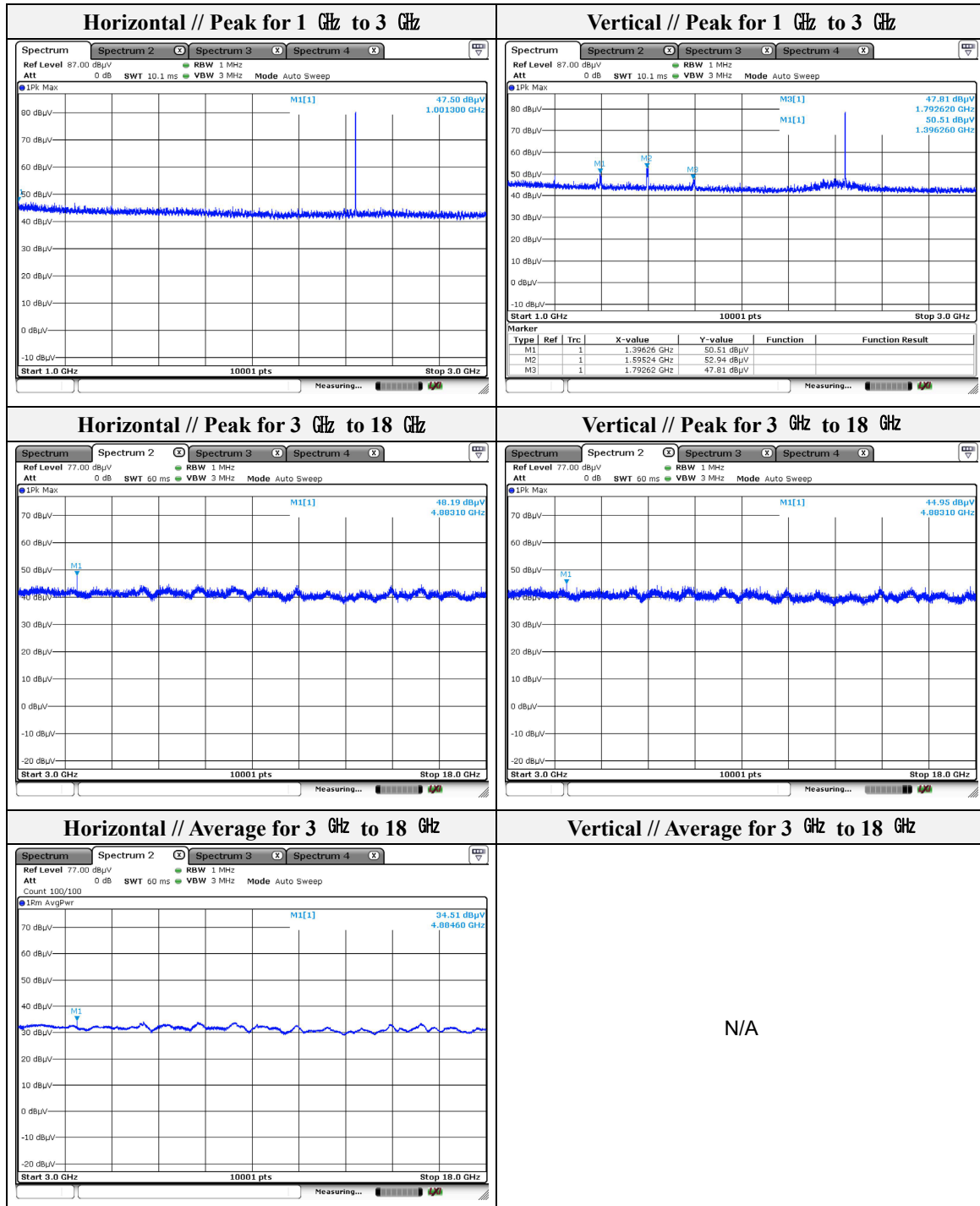




KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (25) of (36)



Note.

1. Average test would be performed if the peak result were greater than the average limit.

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)





KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (26) of (36)

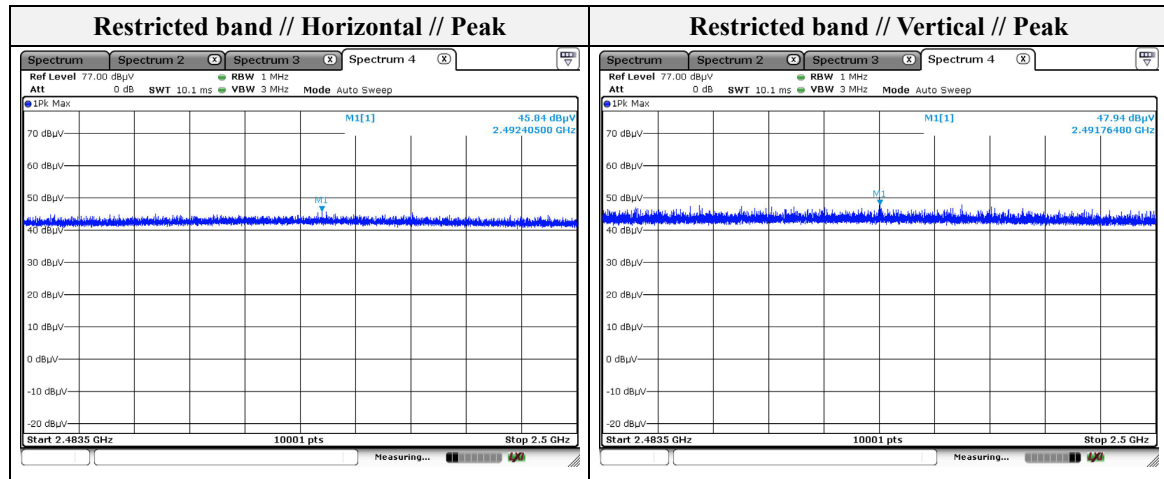
Mode: BLE_1 Mbps
Channel: 39
Distance of measurement: 3 meter

- Spurious

Frequency (MHz)	Level (dBμV)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1199.68	49.14	Peak	H	-8.21	-	40.93	74.00	33.07
1393.26	48.17	Peak	H	-6.90	-	41.27	74.00	32.73
1396.86	52.24	Peak	V	-6.87	-	45.37	74.00	28.63
1597.84	52.47	Peak	V	-5.25	-	47.22	74.00	26.78
1797.22	48.31	Peak	V	-3.35	-	44.96	74.00	29.04
4961.10	49.53	Peak	H	7.65	-	57.18	74.00	16.82
4961.10	46.26	Peak	V	7.65	-	53.91	74.00	20.09
4961.10	37.83	Average	H	7.65	1.76	47.24	54.00	6.76

- 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)
2491.76	47.94	Peak	V	-0.56	-	47.38	74.00	26.62
2492.41	45.84	Peak	H	-0.56	-	45.28	74.00	28.72



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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)

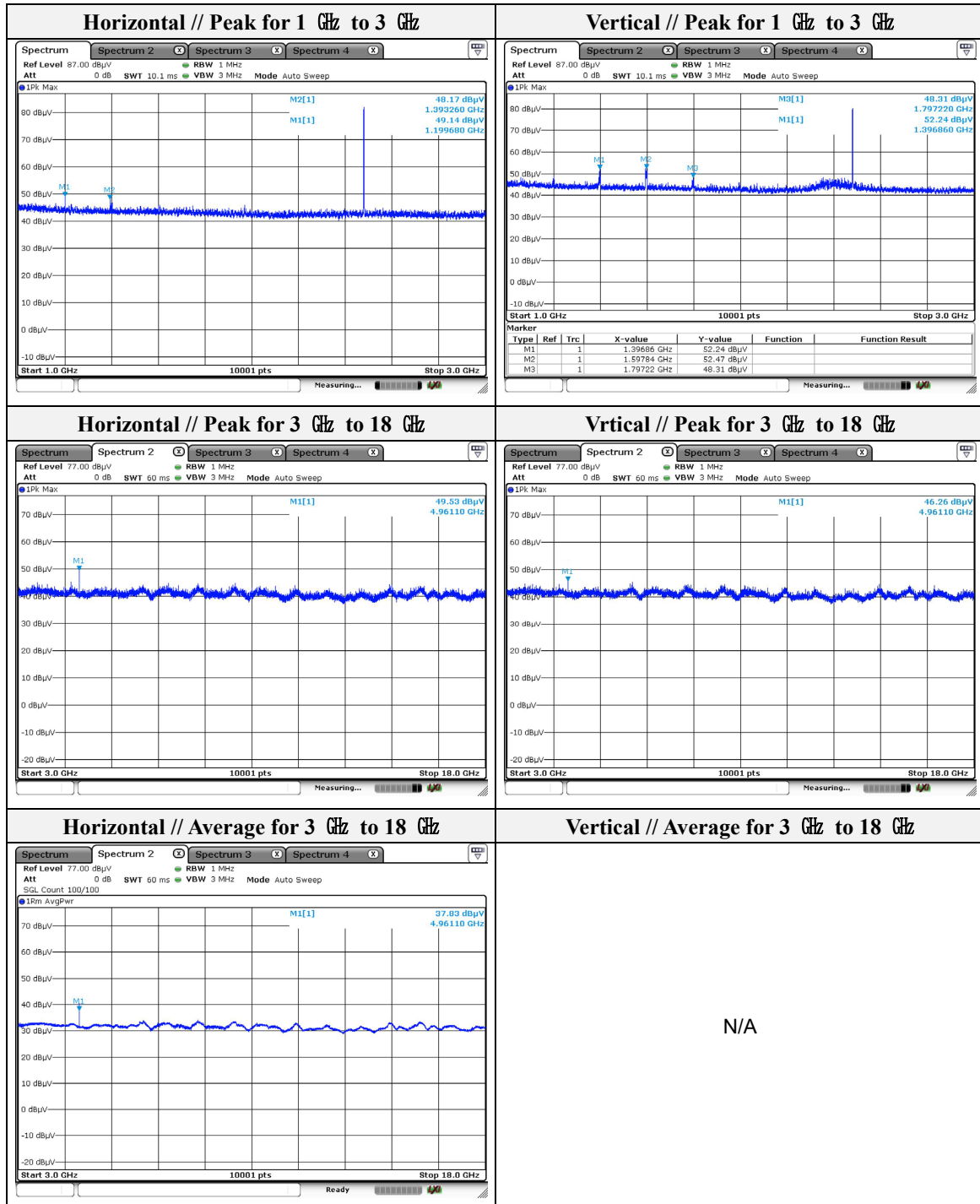




KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (27) of (36)

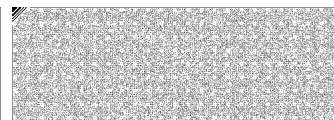


Note.

1. Average test would be performed if the peak result were greater than the average limit.

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)





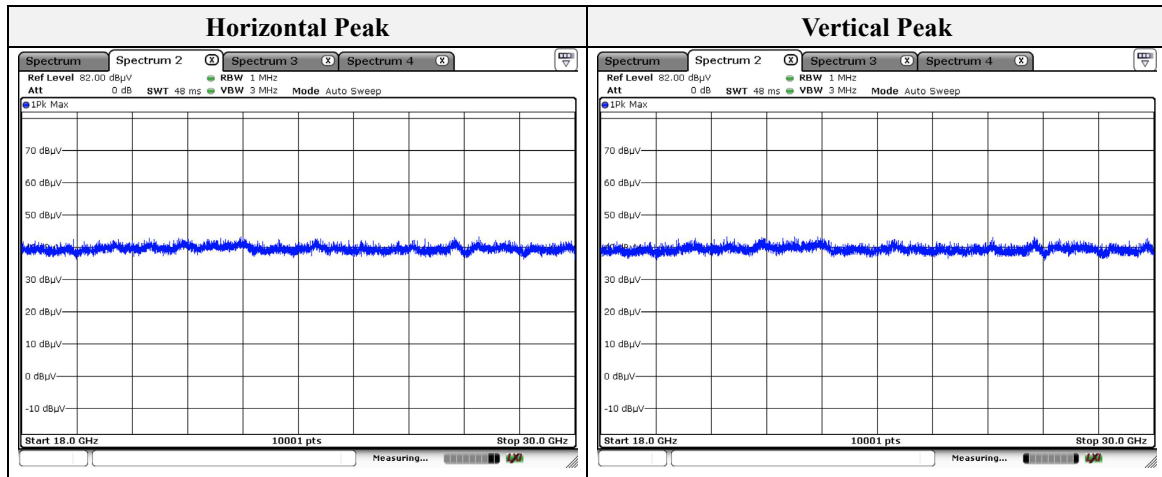
KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (28) of (36)

Test results (18 GHz to 30 GHz)

Mode: BLE_1 Mbps
Channel: 00 (Worst case)
Distance of easurement : 3 meter

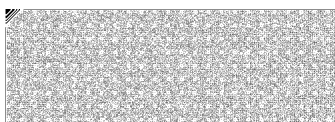


Note.

No spurious emission were detected above 18 GHz.

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)



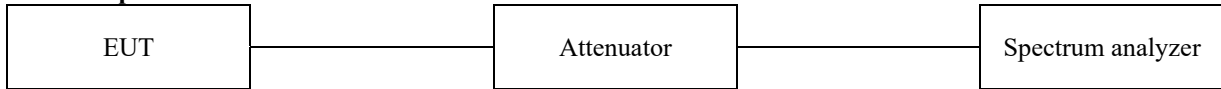


KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (29) of (36)

3.5 Conducted spurious emissions & band edge

Test setup



Test procedure

Band edge

ANSI C63.10 – Section 11.11

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100 kHz
4. VBW = 300 kHz
5. Detector = Peak
6. Trace mode = max hold
7. Sweep time = auto
8. The trace was allowed to stabilize

Out of band emissions

ANSI C63.10 – Section 11.11

1. Start frequency was set to 30 MHz and stop frequency was set to 25 GHz for 2.4 GHz frequencies and 40 GHz for 5 GHz frequencies
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Limit

According to 15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section 15.205(a), must also comply the radiated emission limits specified in section 15.209(a) (see section 15.205(c))

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)

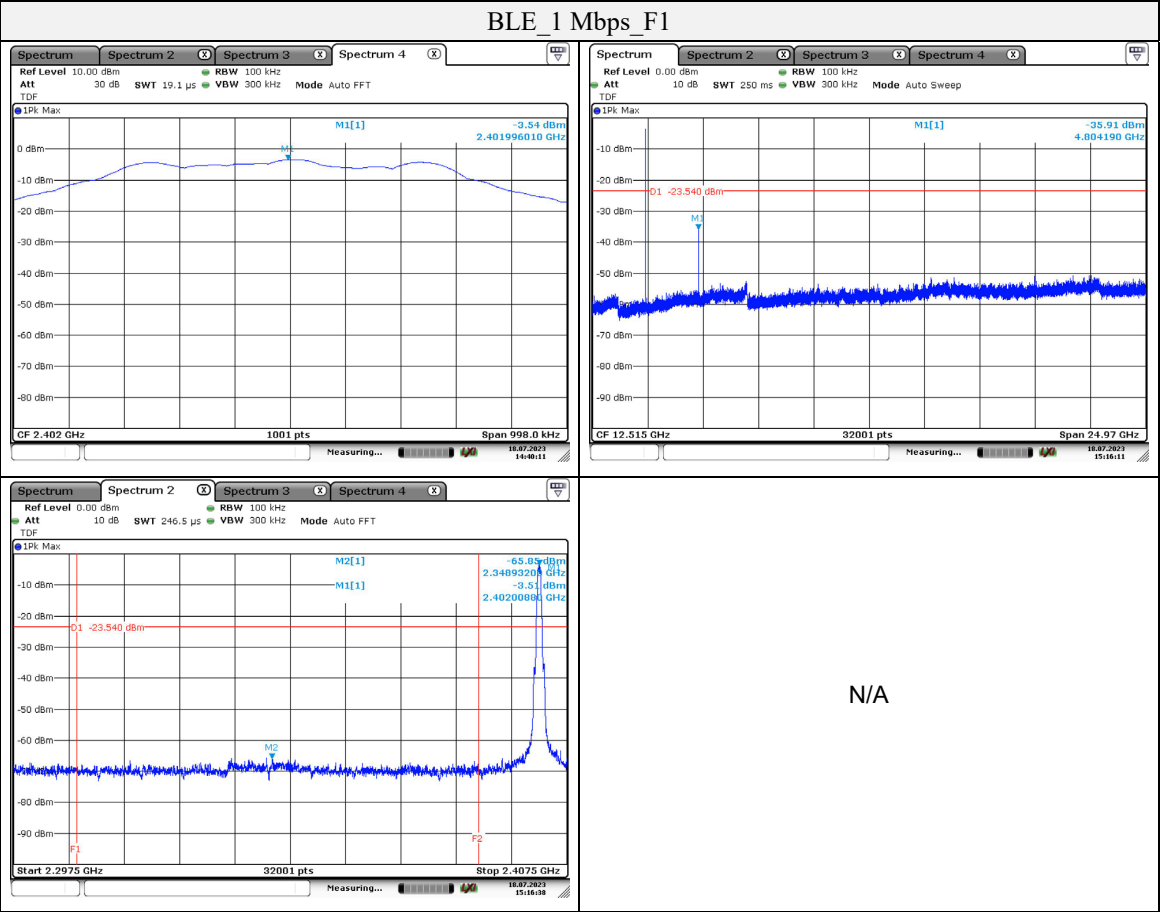




KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

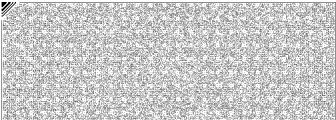
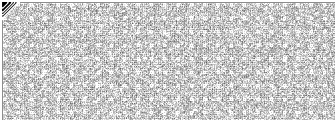
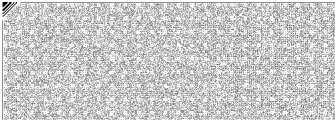
Test report No.:
KES-RF-23T0113
Page (30) of (36)

Test results



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.
The authenticity of the test report, contact kes@kes.co.kr

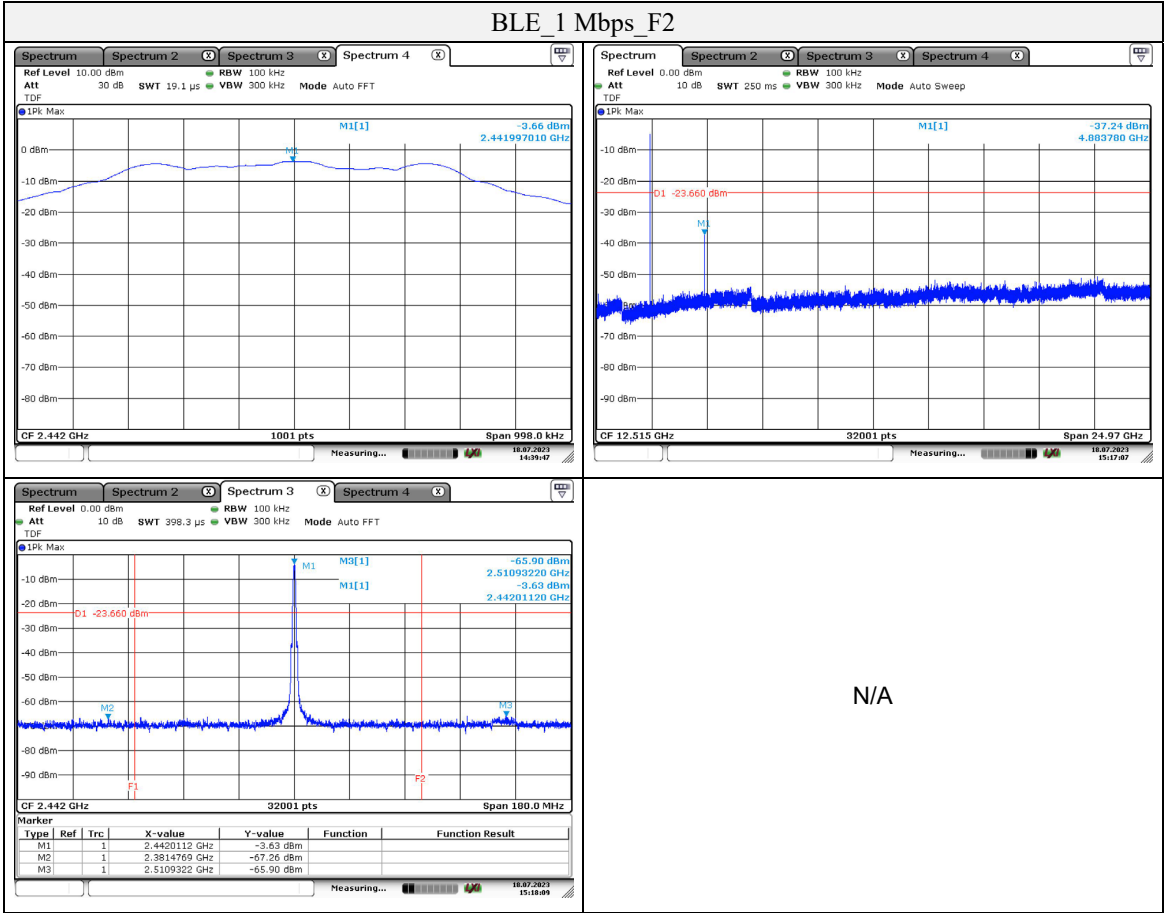
KES-QP16-F01(00-23-01-01)





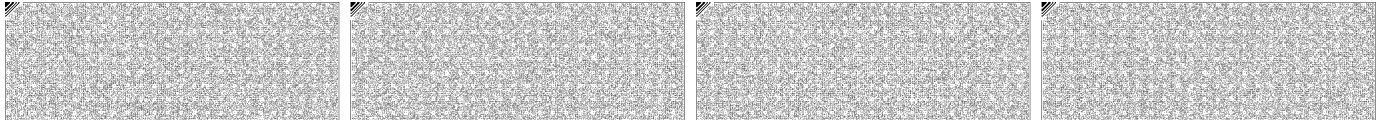
KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (31) of (36)



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.
The authenticity of the test report, contact kes@kes.co.kr

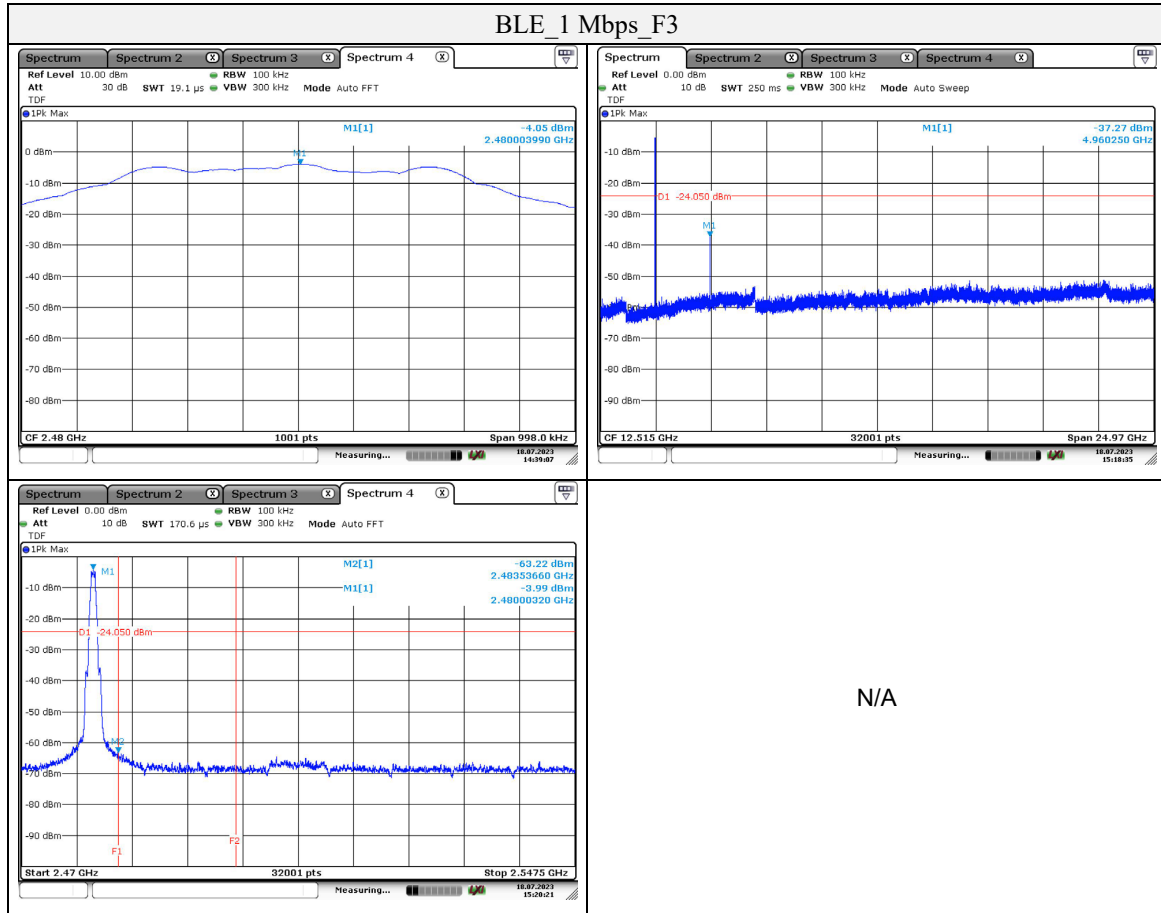
KES-QP16-F01(00-23-01-01)





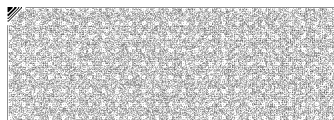
KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (32) of (36)



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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)





KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (33) of (36)

3.6. AC conducted emissions

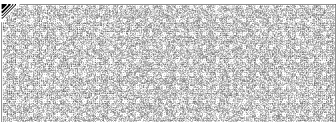
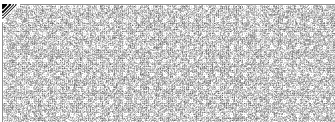
Limit

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

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)





KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (34) of (36)

Test results

Mode: BLE_1 Mbps
Channel: 00 (Worst case)

Hot Line

The spectrum plot for the Hot Line shows the signal level in dBm across a frequency range from 150k to 30M Hz. The y-axis ranges from 0 to 100 dBm. A red line represents the limit, and a blue line represents the measured signal. The signal is mostly below the limit, with some peaks near 100 MHz and 10 MHz.

Final Result

Frequency (MHz)	QuasiPeak (dBm V)	CAverage (dBm V)	Limit (dBm V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.562000	---	30.75	46.00	15.25	1000.0	9.000	L1	19.5
0.562000	38.31	---	56.00	17.69	1000.0	9.000	L1	19.5
0.994000	---	19.52	46.00	26.48	1000.0	9.000	L1	19.6
0.994000	25.61	---	56.00	30.39	1000.0	9.000	L1	19.6
1.530000	---	11.49	46.00	34.51	1000.0	9.000	L1	19.6
1.530000	18.68	---	56.00	37.32	1000.0	9.000	L1	19.6
9.582000	---	26.04	50.00	23.96	1000.0	9.000	L1	20.3
9.582000	35.20	---	60.00	24.80	1000.0	9.000	L1	20.3
10.154000	---	27.65	50.00	22.35	1000.0	9.000	L1	20.3
10.154000	36.44	---	60.00	23.56	1000.0	9.000	L1	20.3

Neutral Line

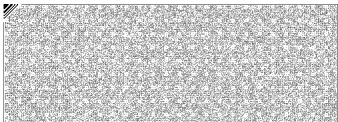
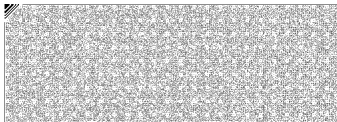
The spectrum plot for the Neutral Line shows the signal level in dBm across a frequency range from 150k to 30M Hz. The y-axis ranges from 0 to 100 dBm. A red line represents the limit, and a blue line represents the measured signal. The signal is mostly below the limit, with some peaks near 100 MHz and 10 MHz.

Final Result

Frequency (MHz)	QuasiPeak (dBm V)	CAverage (dBm V)	Limit (dBm V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.554000	---	33.63	46.00	12.37	1000.0	9.000	N	19.5
0.554000	48.72	---	56.00	7.28	1000.0	9.000	N	19.5
0.558000	---	34.22	46.00	11.78	1000.0	9.000	N	19.5
0.558000	49.25	---	56.00	6.75	1000.0	9.000	N	19.5
3.974000	---	27.02	46.00	18.98	1000.0	9.000	N	19.8
3.974000	45.58	---	56.00	10.42	1000.0	9.000	N	19.8
4.062000	---	26.74	46.00	19.26	1000.0	9.000	N	19.9
4.062000	45.19	---	56.00	10.81	1000.0	9.000	N	19.9
5.926000	---	27.07	50.00	22.93	1000.0	9.000	N	20.1
5.926000	39.45	---	60.00	20.55	1000.0	9.000	N	20.1
7.590000	---	29.33	50.00	20.67	1000.0	9.000	N	20.2
7.590000	39.14	---	60.00	20.86	1000.0	9.000	N	20.2

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)




KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (35) of (36)

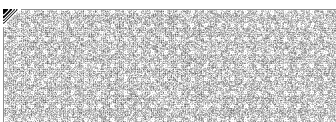
3.7. Antenna requirement

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 §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. 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 § 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.

The EUT has an internal chip antenna and meets the requirements of this section.

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)





KES Co., Ltd.
3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Test report No.:
KES-RF-23T0113
Page (36) of (36)

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
EMI Test Receiver	R&S	ESU26	100552	1 year	2024.03.21
Spectrum Analyzer	R&S	FSV40	101002	1 year	2024.06.14
EMI Test Receiver	R&S	ESR3	101783	1 year	2023.11.11
ATTENUATOR	KEYSIGHT	8493C	82506	1 year	2024.01.17
Power Meter	Anritsu	ML2495A	1438001	1 year	2024.01.13
Pulse Power Sensor	Anritsu	MA2411B	1339205	1 year	2024.01.13
SIGNAL GENERATOR	KEYSIGHT	N5182B	MY59100115	1 year	2024.05.26
SIGNAL GENERATOR	Anritsu	68369B	002118	1 year	2024.05.12
BAND REJECT FILTER	MICRO-TRONICS	BRM50702	G272	1 year	2024.01.12
Attenuator	KEYSIGHT	-	-	1 year	2024.03.21
Loop Antenna	Schwarzbeck	FMZB1513	1513-257	2 years	2025.03.22
Horn Antenna	A.H	SAS-571	414	1 year	2024.01.16
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA 9170550	1 year	2024.01.16
TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	714	2 years	2024.04.19
Amplifier	SONOMA INSTRUMENT	310N	186549	1 year	2024.03.21
PREAMPLIFIER	HP	8449B	3008A00538	1 year	2024.05.31
BROADBAND AMPLIFIER	SCHWARZBECK	BBV9721	PS9721-003	1 year	2024.01.16
DC POWER SUPPLY	AGILENT	6632B	US36351824	1 year	2024.01.13
LISN	R&S	ENV216	101787	1 year	23.11.10
PULSE LIMITER	R&S	ESH3-Z2	101915	1 year	23.11.10

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook computer	LG Electronics Inc.,	LG15N54	504NZJV027828
Jig board	-	-	-

The end of test report.

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.
The authenticity of the test report, contact kes@kes.co.kr

KES-QP16-F01(00-23-01-01)

