



KES Co., Ltd.

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Report No.:
KES-EM-23T0167
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EMC TEST REPORT

Test Report No. : KES-EM-23T0167
Date of Issue : Mar. 02, 2023
Product name : BIGHIT REPEATER
Model/Type No. : BHR
Variant Mode : -
Applicant : PARTRON CO., LTD
Applicant Address : 22,Samsung1-ro2-gil, Hwaseong-si, Gyeonggi-do South Korea
Manufacturer : PARTRON CO., LTD
Manufacturer Address : 22,Samsung1-ro2-gil, Hwaseong-si, Gyeonggi-do South Korea
FCC ID : 2AD5K-BHR
Date of Receipt : Jun. 07, 2022
Test date : Jun. 16, 2022
Test Results : **In Compliance** **Not in Compliance**

Tested by

Yun-Ju, Won
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

Tested by Dong-Jun, Shin
(Retired person)
Proxy signature : Yun-Ju, Won

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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Mar. 02, 2023	KES-EM-23T0167	Issued

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1.0 General Product Description

Main Specifications of EUT are:

Item	Details
Wireless Operating Frequency	LoRa / Zigbee
Power	Charging : DC 5 V (USB) Operating : DC 3.7 V (Battery)
Port	SMA (LoRa) / Zigbee (N) / USB Mini
Components	EUT 1 EA

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1.1 Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

AC 120 V / 60 Hz

1.2 Variant Model Differences

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
BIGHIT REPEATER (Transmitter)	BHR	-	PARTRON CO., LTD	EUT
BIGHIT REPEATER (Receiver)	BHR	-	PARTRON CO., LTD	-

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
NoteBook	LG15N54	503NZWY038929	엘지전자(주)	-
NoteBook Adapter	PA-1900-14	OF2R2633487017 764	LITE-ON TECHNOLOGY CORPORATION	-
Zigbee ANT	-	-	-	-
Adapter	EP-TA20KWK	-	DONGYANG E&P VIETNAM CO., LTD.	-



1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
BIGHIT REPEATER (Transmitter) (EUT)	USB Mini	NoteBook	USB	1.0	U
	Wireless	BIGHIT REPEATER (Receiver) (EUT)	Wireless	-	-
BIGHIT REPEATER (Receiver) (EUT)	USB Mini	Adapter	USB	1.8	U
	Wireless	Stick	Wireless	-	-
	N	Zigbee ANT	N	5.0	U
NoteBook	DC Jack	NoteBook Adapter	DC Jack	1.9	U

* Unshielded = U, Shielded = S

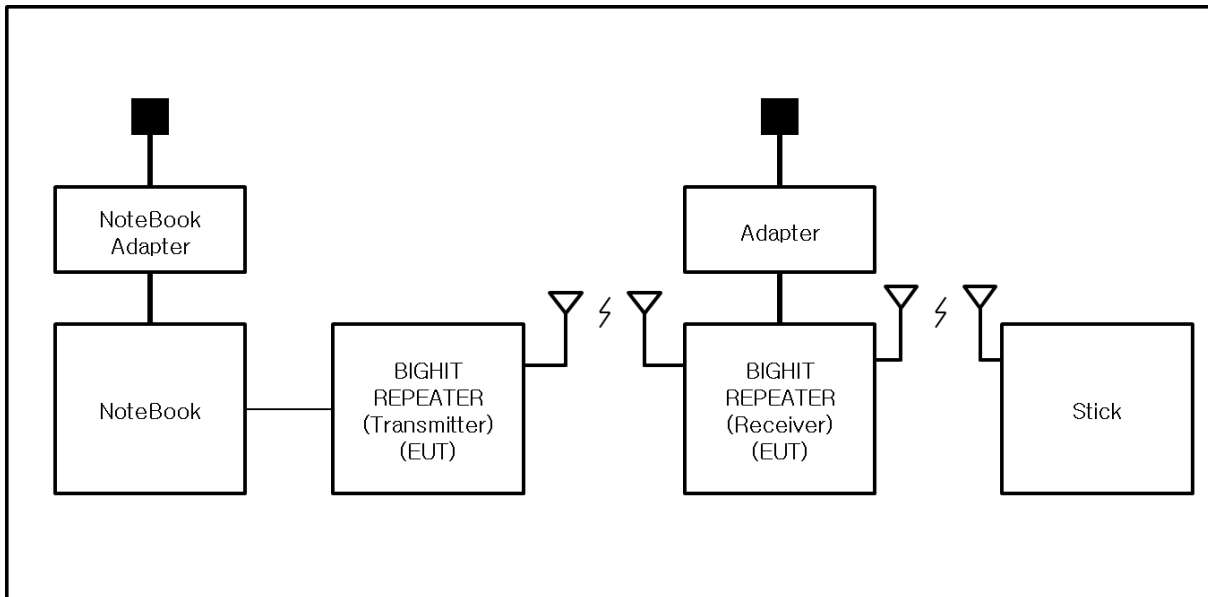
1.7 EUT Operating Mode(s)

Test mode	operating
Operating	1. Connect the EUT to your smartphone wirelessly 2. Play a 1 kHz tone on your smartphone to see if it is output from the speaker. 3. Control the EUT through the application provided by the applicant

E.U.T Test operating S/W		
Name	Version	Manufacture Company
Light Stick	1.5.4.0	-

1.8 Configuration

■ AC Main
 □ DC Main



EUT(Transmitter) – EUT(Receiver): LoRa
 EUT(Receiver) - Stick : Zigbee

1.9 Remarks when standards applied

N/A

1.10 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less.

1.11 Test Facility

The measurement facility is located at 473-21 Gayeo-ro, Yeosu-si, Gyeonggi-do, 12658, Korea. The sites are constructed in conformance with the requirements of ANSI C63.4a-2017 and CISPR 16-1-4:2019

1.12 Measurement Procedure

- Conducted Emissions







The conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emission exceed the average limit with the instrument set to the quasi-peak mode, the measurements are made in the average mode. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded. Quasi-peak readings are distinguished with a "QP".

- Radiated Electric Field Emissions

The test was done at a SEMI ANECHOIC CHAMBER with quasi-peak detector. The final test data was measured using a Quasi-Peak detector below 1GHz at 10 m or 3 m distance and a Peak and Average detector above 1 GHz at 3 m distance. Test was proceeded worst case test mode and cable configuration. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency.

Measurement procedures was In accordance with ANSI C63.4-2014 7.3.3, 7.3.4, 8.3.1.1, 8.3.1.2, 8.3.2.1, 8.3.2.2

1.13 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	RRA	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
International	KOLAS	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KT489
USA	FCC	3 m & 10 m Semi-Anechoic Chamber Conducted test site to perform FCC Part 15/18 measurements.	 KR0100
Canada	ISED	3 m & 10 m Semi-Anechoic Chamber and Conducted test site	 23298
JAPAN	VCCI	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site)	 C-20136, T-20137, R-20181, G-20176
Europe	TÜV SÜD	EMI (3 m & 10 m Semi-Anechoic Chamber and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 CARAT 001633 0004

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2.0 Test Regulations

The emissions tests were performed according to following regulations:

47 CFR Part 15, Subpart B

CISPR 22:2009 +A1:2010

Class A

Class B

ANSI C63.4a-2017

Class A

Class B

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2.1 Conducted Emissions at Mains Power Ports

Test Date

Jun. 16, 2022

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
<input checked="" type="checkbox"/>	EMI Test S/W	EMC32	R & S	9.12.00	-	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESR3	R & S	101783	11, 11, 2023	1 Year
<input checked="" type="checkbox"/>	LISN	ENV216	R & S	101787	11, 10, 2023	1 Year
<input checked="" type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	11, 10, 2023	1 Year
<input checked="" type="checkbox"/>	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 10, 2023	1 Year

Test Conditions

Temperature: (24,1 ± 0,2) °C

Relative Humidity: (44,3 ± 0,1) % R.H.

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Results

The requirements are:

- PASS
 NOT PASS
 NOT APPLICABLE

Remarks-See Appendix A for test data.

2.2 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Jun. 16, 2022

Test Location

OPEN AREA TEST SITE #2 SEMI ANECHOIC CHAMBER 4(10m)

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
<input checked="" type="checkbox"/>	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESU26	R & S	100551	03, 31, 2023	1 Year
<input checked="" type="checkbox"/>	AMPLIFIER	SCU 01	R & S	100603	11, 10, 2023	2 Year
<input checked="" type="checkbox"/>	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 17, 2024	1 Year
<input checked="" type="checkbox"/>	ATTENUATOR	8491A	HP	32173	03, 08, 2023	1 Year

Test Conditions

Temperature: (23,1 ± 0,1) °C
Relative Humidity: (44,7 ± 0,1) % R.H.

Frequency Range of Measurement

30 MHz to 1 GHz

Instrument Settings

IF Band Width: 120 kHz

Test Results

The requirements are:

- PASS
 NOT PASS
 NOT APPLICABLE

Remarks

See Appendix A for test data.

2.3 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Jun. 16, 2022

Test Location

SEMI ANECHOIC CHAMBER #5

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
<input checked="" type="checkbox"/>	EMI Test S/W	ES10/RE	TOYO Corporation	2022.01.000	-	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	03, 31, 2023	1 Year
<input checked="" type="checkbox"/>	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	11, 08, 2023	1 Year
<input checked="" type="checkbox"/>	PREAMPLIFIER	8449B	HP	3008A00538	06, 02, 2023	1 Year
<input checked="" type="checkbox"/>	ATTENUATOR	8491B	HP	23094	04, 21, 2023	1 Year

Test Conditions

Temperature: (23,1 ± 0,1) °C
Relative Humidity: (44,7 ± 0,1) % R.H.

Frequency Range of Measurement

1 GHz to 2,5 GHz

Instrument Settings

IF Band Width: 1 MHz

Test Results

The requirements are:

- PASS
- NOT PASS
- NOT APPLICABLE

Remarks

See Appendix A for test data.

APPENDIX A – TEST DATA

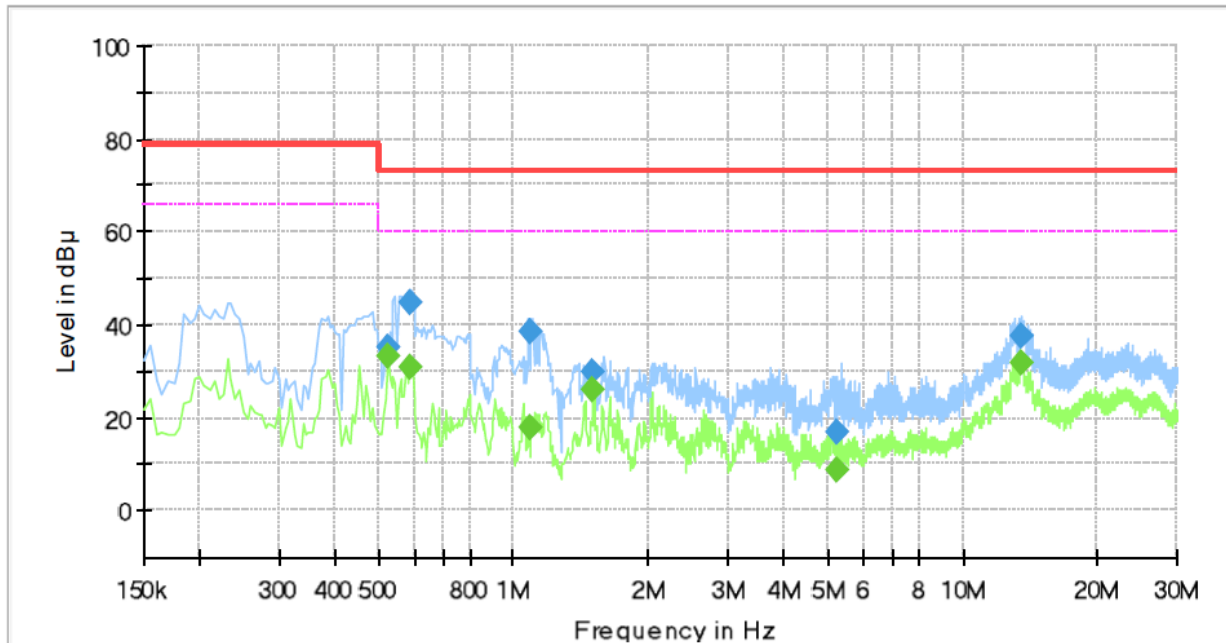
Conducted Emissions at Mains Power Ports

■ Transmitter

HOT LINE

Common Information

Test Description:	Conducted Emission
Model No.:	BHR
Phase:	
Mode:	Transmitter_L1
Operator Name:	KES



Final Result

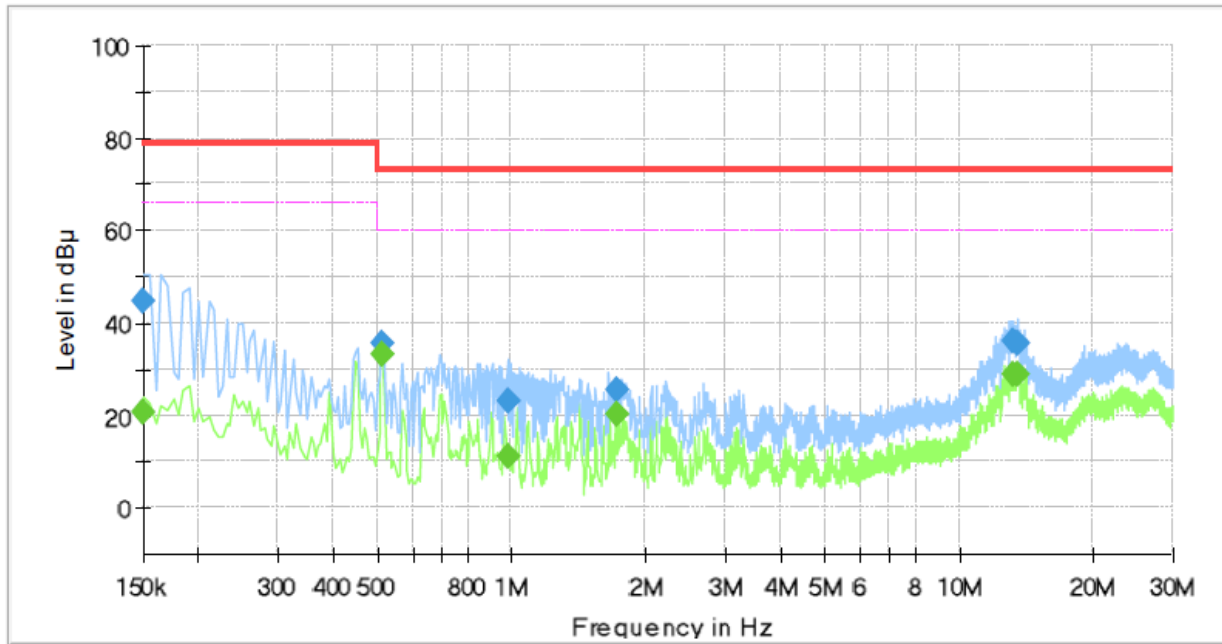
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.525000	35.04	---	73.00	37.96	1000.0	9.000	L1	19.7
0.525000	---	33.26	60.00	26.74	1000.0	9.000	L1	19.7
0.590000	44.69	---	73.00	28.31	1000.0	9.000	L1	19.8
0.590000	---	30.86	60.00	29.14	1000.0	9.000	L1	19.8
1.085000	38.40	---	73.00	34.60	1000.0	9.000	L1	20.1
1.085000	---	17.92	60.00	42.08	1000.0	9.000	L1	20.1
1.505000	29.65	---	73.00	43.35	1000.0	9.000	L1	20.2
1.505000	---	25.97	60.00	34.03	1000.0	9.000	L1	20.2
5.240000	16.73	---	73.00	56.27	1000.0	9.000	L1	19.6
5.240000	---	8.79	60.00	51.21	1000.0	9.000	L1	19.6
13.545000	---	31.69	60.00	28.31	1000.0	9.000	L1	19.9
13.545000	37.36	---	73.00	35.64	1000.0	9.000	L1	19.9

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NEUTRAL LINE

Common Information

Test Description:	Conducted Emission
Model No.:	BHR
Phase:	
Mode:	Transmitter_N
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	20.97	66.00	45.03	1000.0	9.000	N	19.4
0.150000	44.60	---	79.00	34.40	1000.0	9.000	N	19.4
0.515000	---	33.43	60.00	26.57	1000.0	9.000	N	19.7
0.515000	35.57	---	73.00	37.43	1000.0	9.000	N	19.7
0.980000	---	11.36	60.00	48.64	1000.0	9.000	N	20.0
0.980000	23.15	---	73.00	49.85	1000.0	9.000	N	20.0
1.710000	---	20.43	60.00	39.57	1000.0	9.000	N	20.3
1.710000	25.48	---	73.00	47.52	1000.0	9.000	N	20.3
13.145000	---	29.08	60.00	30.92	1000.0	9.000	N	19.9
13.145000	36.04	---	73.00	36.96	1000.0	9.000	N	19.9
13.465000	---	28.84	60.00	31.16	1000.0	9.000	N	19.9
13.465000	35.58	---	73.00	37.42	1000.0	9.000	N	19.9

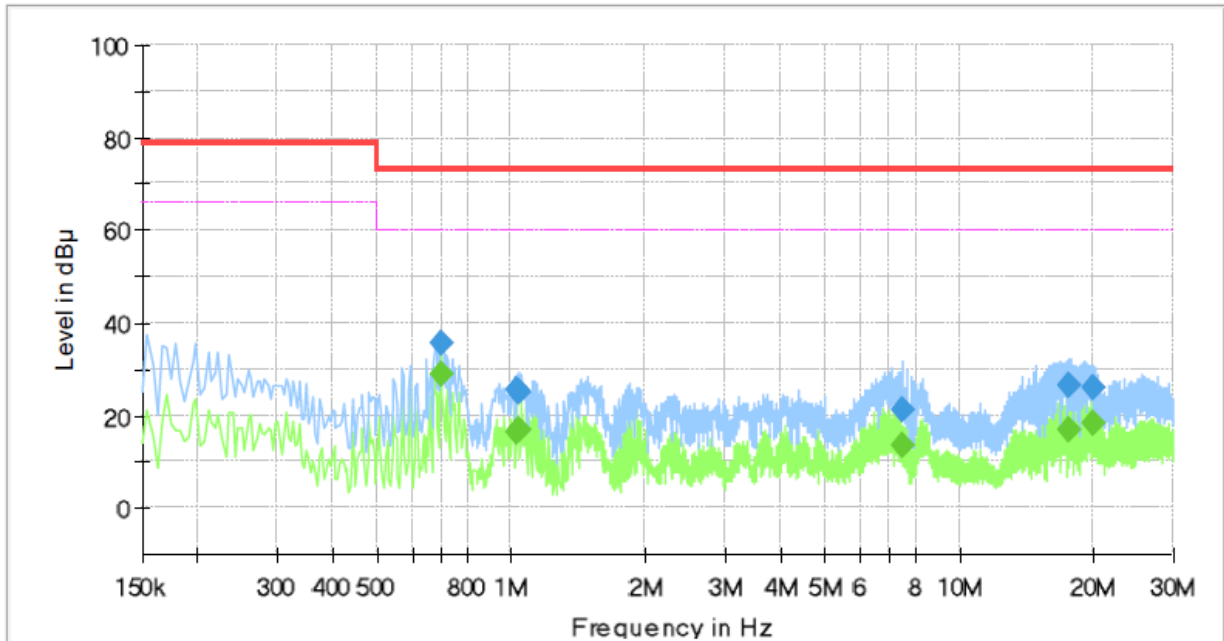
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■ Receiver

HOT LINE

Common Information

Test Description:	Conducted Emission
Model No.:	BHR
Phase:	
Mode:	Receiver_L1
Operator Name:	KES



Final Result

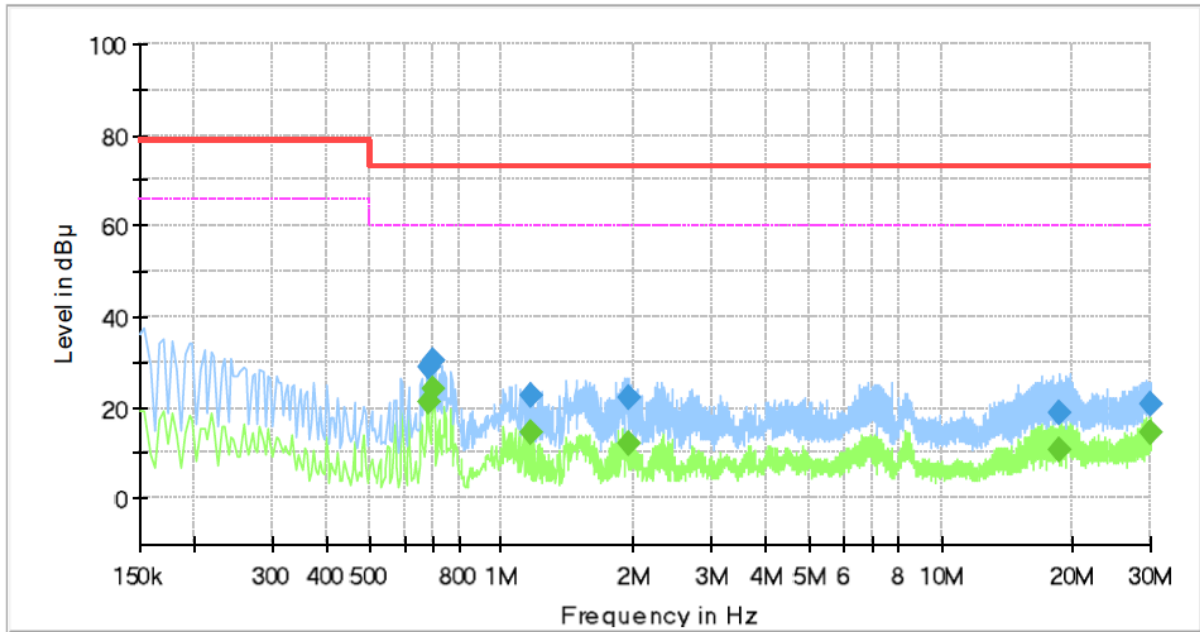
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.698000	35.49	---	73.00	37.51	1000.0	9.000	L1	20.1
0.698000	---	28.72	60.00	31.28	1000.0	9.000	L1	20.1
1.030000	25.38	---	73.00	47.62	1000.0	9.000	L1	20.2
1.030000	---	16.46	60.00	43.54	1000.0	9.000	L1	20.2
1.042000	24.98	---	73.00	48.02	1000.0	9.000	L1	20.2
1.042000	---	17.01	60.00	42.99	1000.0	9.000	L1	20.2
7.490000	---	13.56	60.00	46.44	1000.0	9.000	L1	19.9
7.490000	21.36	---	73.00	51.64	1000.0	9.000	L1	19.9
17.506000	---	17.13	60.00	42.87	1000.0	9.000	L1	20.6
17.506000	26.52	---	73.00	46.48	1000.0	9.000	L1	20.6
19.854000	---	18.48	60.00	41.52	1000.0	9.000	L1	20.9
19.854000	26.13	---	73.00	46.87	1000.0	9.000	L1	20.9

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NEUTRAL LINE

Common Information

Test Description:	Conducted Emission
Model No.:	BHR
Phase:	
Mode:	Receiver_N
Operator Name:	KES



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.682000	---	21.21	60.00	38.79	1000.0	9.000	N	20.0
0.682000	28.72	---	73.00	44.28	1000.0	9.000	N	20.0
0.702000	---	24.15	60.00	35.85	1000.0	9.000	N	20.0
0.702000	30.29	---	73.00	42.71	1000.0	9.000	N	20.0
1.162000	---	14.39	60.00	45.61	1000.0	9.000	N	20.2
1.162000	22.54	---	73.00	50.46	1000.0	9.000	N	20.2
1.954000	---	12.03	60.00	47.97	1000.0	9.000	N	20.5
1.954000	22.07	---	73.00	50.93	1000.0	9.000	N	20.5
18.590000	---	10.53	60.00	49.47	1000.0	9.000	N	20.7
18.590000	18.62	---	73.00	54.38	1000.0	9.000	N	20.7
29.906000	---	14.45	60.00	45.55	1000.0	9.000	N	21.3
29.906000	20.89	---	73.00	52.11	1000.0	9.000	N	21.3

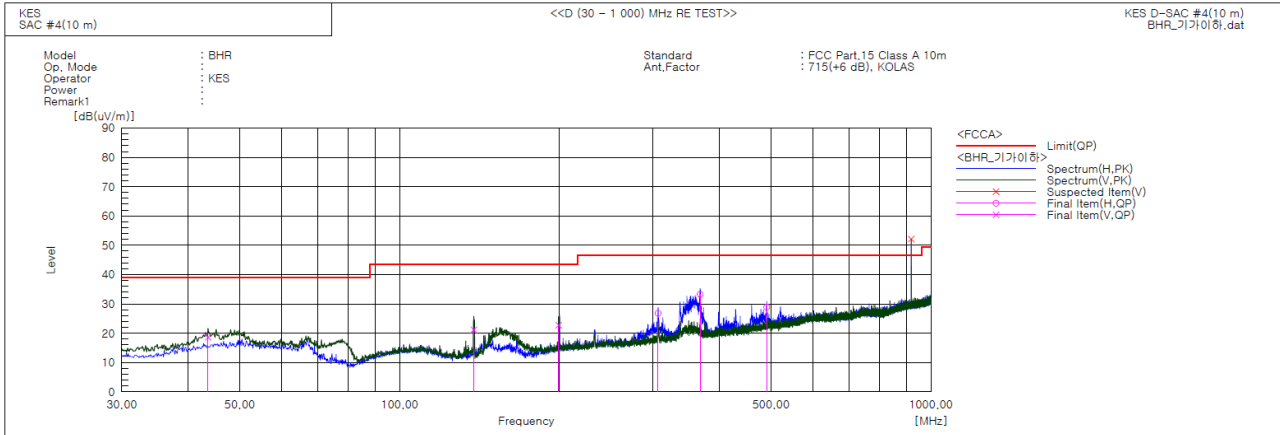
◆ Calculation

QuasiPeak [dBµV] / CAverage [dBµV] = Reading Value [dBµV] + Corr. [dB]
 QuasiPeak / CAverage : The Final Value
 Reading Value : Not shown in the table.
 Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

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Radiated Electric Field Emissions(Below 1 GHz)



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	43.580	V	40.2	-21.6	18.6	39.0	20.4	133.0	129.0	
2	137.913	V	46.6	-25.5	21.1	43.5	22.4	152.0	308.0	
3	199.144	V	43.7	-21.0	22.7	43.5	20.8	104.0	166.0	
4	306.450	H	44.4	-17.6	26.8	46.5	19.7	287.0	121.0	
5	367.803	H	48.2	-14.9	33.3	46.5	13.2	382.0	151.0	
6	490.750	H	40.6	-11.7	28.9	46.5	17.6	319.0	98.0	
7	918.025	V	-----	-3.9	-----	46.5	-----	150.0	356.0	

Fundamental Frequency : 918 MHz Band

◆ Calculation - SAC #4(10 m)

$$\text{Result(QP)} [dB(\mu V/m)] = (\text{Reading(QP)} [dB(\mu V)] + \text{c.f} [dB(1/m)])$$

$$\text{Margin(QP)} [dB] = \text{Limit} [dB(\mu V/m)] - \text{Result(QP)} [dB(\mu V/m)]$$

Reading(QP) : Reading value, Result(QP) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value

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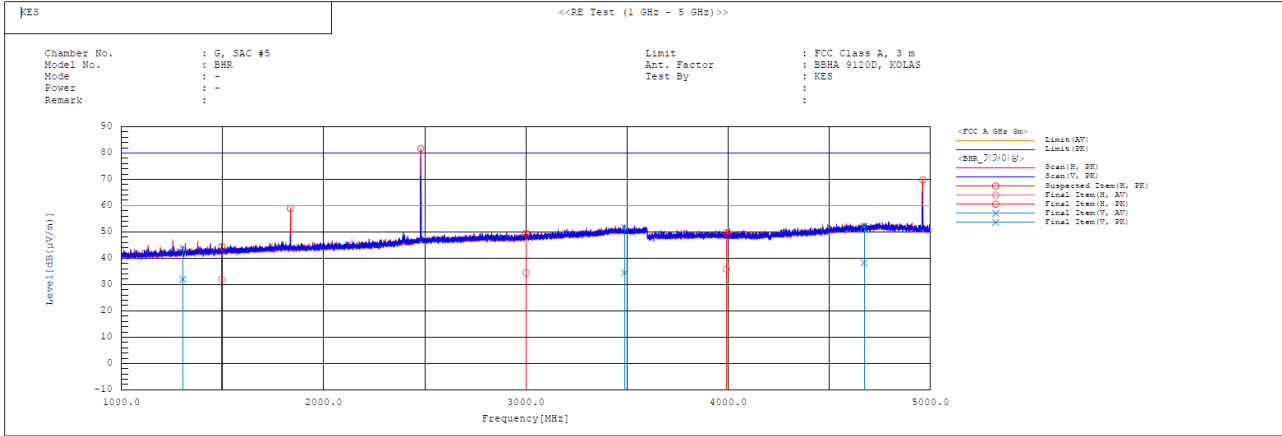
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Radiated Electric Field Emissions(Above 1 GHz)

- (1 ~ 5) GHz



Final Result

No.	Range	Frequency [MHz]	Pol	Reading AV [dB(µV)]	Reading PK [dB(µV)]	c.f [dB(1/m)]	Result AV [dB(µV/m)]	Result PK [dB(µV/m)]	Limit AV [dB(µV/m)]	Limit PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]	Rema
1	Range1	1302.564	V	31.8	43.5	0.2	32.0	43.7	60.0	80.0	28.0	36.3	336.0	230.5	
2	Range1	1495.871	H	30.9	43.3	1.1	32.0	44.4	60.0	80.0	28.0	35.6	309.0	206.2	
3	Range1	3000.161	H	27.3	42.4	7.1	34.4	49.5	60.0	80.0	25.6	30.5	108.0	96.2	
4	Range1	3487.982	V	26.4	43.7	8.0	34.4	51.7	60.0	80.0	25.6	28.3	347.0	153.8	
5	Range1	3991.026	H	26.5	40.3	9.4	35.9	49.7	60.0	80.0	24.1	30.3	351.0	50.2	
6	Range1	4672.114	V	26.0	40.1	12.2	38.2	52.3	60.0	80.0	21.8	27.7	125.0	354.3	
7	Range1	1835.600	H	-----	-----	2.7	-----	-----	-----	-----	-----	-----	100.0	344.1	
8	Range1	2490.400	H	-----	-----	5.0	-----	-----	-----	-----	-----	-----	100.0	237.8	
9	Range1	4961.600	H	-----	-----	13.1	-----	-----	-----	-----	-----	-----	200.0	205.6	

- Fundamental Frequency : 2.4 GHz Band
- Harmonic Frequency : 1.8 GHz, 4.9 GHz Band

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- (5 ~ 18) GHz

PEAK

Frequency (MHz)	Reading PK (dBuV)	Polarization	Height (m)	ANT Factor (dB)	Cable Loss (dB)	AMP Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
6 833.000	41.700	H	1.000	35.030	11.160	34.820	53.070	74.000	20.930
8 772.600	40.100	H	1.000	37.440	12.380	34.140	55.780	74.000	18.220

CISPR AVERAGE

Frequency (MHz)	Reading CISPR AV (dBuV)	Polarization	Height (m)	ANT Factor (dB)	Cable Loss (dB)	AMP Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
6 833.000	27.600	H	1.000	35.030	11.160	34.820	38.970	54.000	15.030
8 772.600	27.100	H	1.000	37.440	12.380	34.140	42.780	54.000	11.220

◆ Calculation

Result(PK/CAV) [dB(μV/m)] = (Reading(PK/CAV)[dB(μV)] + c.f[dB(1/m)])

Margin(PK/CAV)[dB] = Limit[dB(μV/m)] - Result(PK/CAV) [dB(μV/m)]

Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Marjin value

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