



KES Co., Ltd.

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Report No.:
KES-EM-22T0464
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EMC TEST REPORT

Test Report No. : KES-EM-22T0464
Date of Issue : May. 25, 2022
Product name : Remote control
Model/Type No. : FSB-REM22
Variant Mode : -
Applicant : FESBO
Applicant Address : FESBO, 279, Chungnyeol-daero, Dongnae-gu, Busan, Republic of Korea
Manufacturer : FESBO
Manufacturer Address : FESBO, 279, Chungnyeol-daero, Dongnae-gu, Busan, Republic of Korea
FCC ID : 2A66F-FSB-REM22
Date of Receipt : May. 18, 2022
Test date : May. 23, 2022
Test Results : **In Compliance** **Not in Compliance**

Tested by

Se Heon, Kim
EMC Test Engineer

Reviewed by

Dong Hun, Jang
EMC Technical Manager

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REPORT REVISION HISTORY

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1.0 General Product Description

Main Specifications of EUT are:

Item	Details
Frequency Band	447.697 MHz
Dimension	(48 x 78 x 13) mm
Total Weight	30 g
BATTERY (Power)	DC 3 V, CR2032 Battery

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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.

DC 3 V (Battery Power)

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
Remote control	FSB-REM22	-	FESBO	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Scoreboard	FSB-888M3A	-	FESBO	-
Adapter	ETA-U90KWK	-	Samsung Electronics	-

1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
Remote control (EUT)	Wireless	Scoreboard	Wireless	-	-
Scoreboard	USB Type C	Adapter	USB	0.4	U

* Unshielded = U, Shielded = S

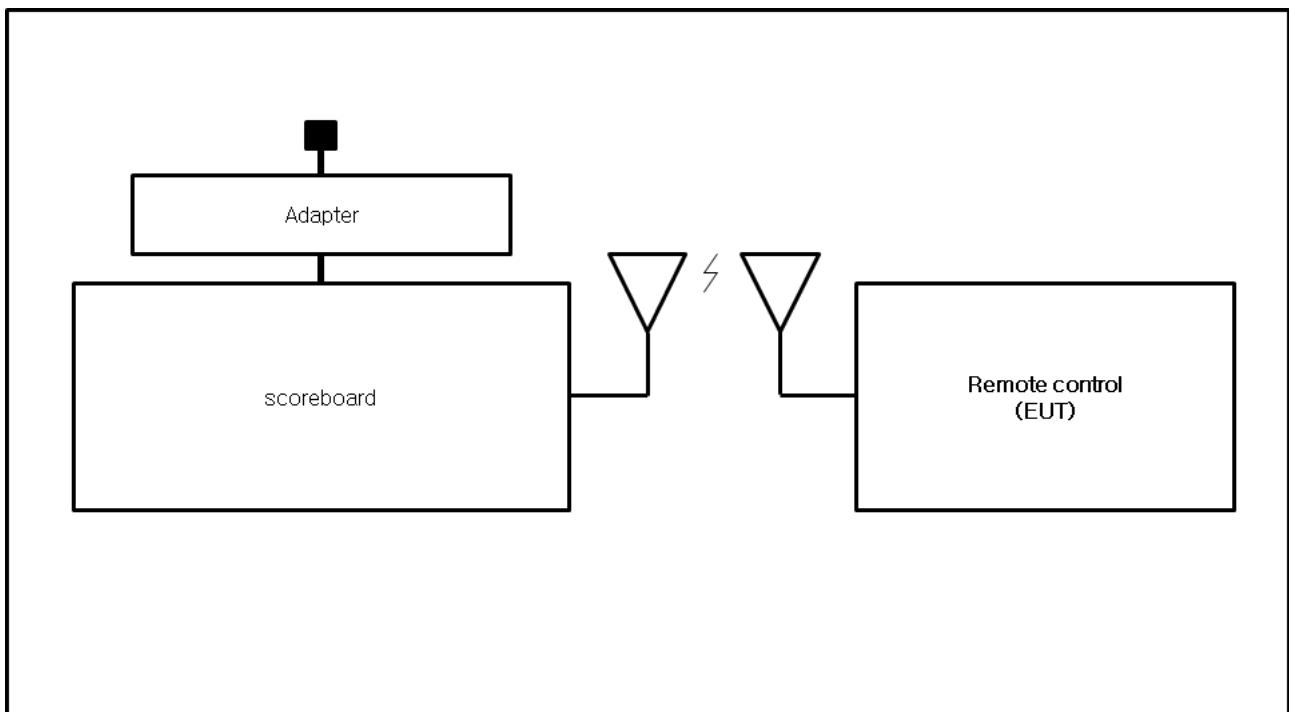
1.7 EUT Operating Mode(s)

Test mode	operating
Operating	Transmit a signal from the EUT. It was tested while receiving a signal from the scoreboard and checking the normal operation state.

EUT Test operating S/W		
Name	Version	Manufacture Company
-	-	-

1.8 Configuration

- AC Main
- DC Main





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, Yeoju-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 1 GHz 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



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1.13 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	RRA	EMI (3 m & 10 m Semi-Aechoic Chamber ,10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KR0100
International	KOLAS	EMI (3 m & 10 m Semi-Aechoic Chamber , and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 KT489
USA	FCC	3 m & 10 m Semi-Aechoic Chamber, 10 m Open Area and Conducted test site to perform FCC Part 15/18 measurements.	 KR0100
Canada	ISED	3 m & 10 m Semi-Aechoic Chamber and Conducted test site	 23298
JAPAN	VCCI	Mains Ports Conducted Interference Measurement, Telecommunication Ports Conducted Disturbance Measurement and Radiation 10 meter site, Facility for measuring radiated disturbance above 1 GHz	 R-20056, C-20036 T-20040, G-20057
Europe	TÜV SÜD	EMI (3 m & 10 m Semi-Aechoic Chamber , 10 m Open Area 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

<input type="checkbox"/> CISPR 22:2009 +A1:2010	<input type="checkbox"/> Class A	<input type="checkbox"/> Class B
<input checked="" type="checkbox"/> ANSI C63.4a-2017	<input type="checkbox"/> Class A	<input checked="" type="checkbox"/> Class B

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2.1 Conducted Emissions at Mains Power Ports

Test Date

N/A

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
<input type="checkbox"/>	EMI Test S/W	EMC32	R & S	9.12.00	-	-
<input type="checkbox"/>	EMI TEST RECEIVER	ESR3	R & S	101783	12, 28, 2022	1 Year
<input type="checkbox"/>	LISN	ENV216	R & S	101787	12, 27, 2022	1 Year
<input type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	12, 27, 2022	1 Year
<input type="checkbox"/>	PULSE LIMITER	ESH3-Z2	R & S	101915	12, 27, 2022	1 Year

Test Conditions

Temperature: (\pm) °C

Relative Humidity: (\pm) % 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

N/A

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2.2 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

May. 23, 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, 24, 2022	1 Year
<input checked="" type="checkbox"/>	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	12, 08, 2022	2 Year
<input checked="" type="checkbox"/>	ATTENUATOR	8491A	HP	32173	03, 08, 2023	1 Year

Test Conditions

Temperature: (23,7 ± 0,0) °C

Relative Humidity: (42,3 ± 0,0) % 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.
- The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z.



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2.3 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

May. 23, 2022

Test Location

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"/>	PREAMPLIFIER	8449B	AGILENT	3008A01742	12, 27, 2022	1 Year
<input checked="" type="checkbox"/>	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	12, 16, 2022	1 Year

Test Conditions

Temperature: (23,7 \pm 0,0) °C

Relative Humidity: (42,2 \pm 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.
- Since the frequency is 447 MHz, it measures up to 5 times the frequency.



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APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

HOT LINE

N/A

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NEUTRAL LINE

N/A

◆ Calculation

QuasiPeak[dBuV] / CAverage [dBuV] = Reading Value[dBuV] + Corr. [dB]

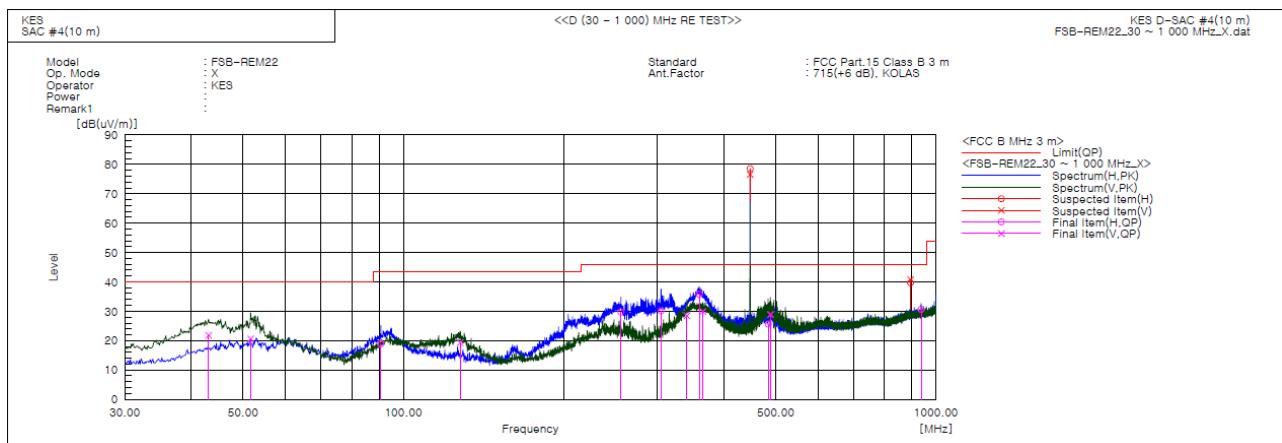
QuasiPeak / CAverage : The Final Value

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) QP	Reading [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	43.095	V	43.8	-22.0	21.8	40.0	18.2	104.0	278.0	
2	51.704	V	42.0	-21.4	20.6	40.0	19.4	148.0	87.0	
3	90.746	H	43.4	-24.5	18.9	43.5	24.6	382.0	26.0	
4	127.849	V	45.0	-25.7	19.3	43.5	24.2	121.0	210.0	
5	256.131	H	49.7	-20.0	29.7	46.0	16.3	393.0	8.0	
6	304.631	H	48.8	-18.7	30.1	46.0	15.9	355.0	163.0	
7	340.521	V	45.1	-16.6	28.5	46.0	17.5	140.0	147.0	
8	359.194	H	52.0	-16.2	35.8	46.0	10.2	379.0	174.0	
9	364.771	V	46.0	-16.1	29.9	46.0	16.1	115.0	204.0	
10	484.445	H	38.7	-13.1	25.6	46.0	20.4	361.0	169.0	
11	488.810	V	41.9	-13.0	28.9	46.0	17.1	136.0	323.0	
12	937.556	H	36.3	-5.6	30.7	46.0	15.3	377.0	197.0	
13	447.706	V	-----	-14.3	-----	46.0	-----	100.0	37.0	
14	447.706	H	-----	-14.3	-----	46.0	-----	100.0	265.0	
15	895.483	V	-----	-5.8	-----	46.0	-----	100.0	37.0	
16	895.483	H	-----	-5.8	-----	46.0	-----	100.0	280.0	

* Exclusion Bands

- Fundamental Frequency: 447 MHz Band

- Harmonic Frequency: 895 MHz Band

It was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

◆ Calculation – SAC #4(10 m)

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

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

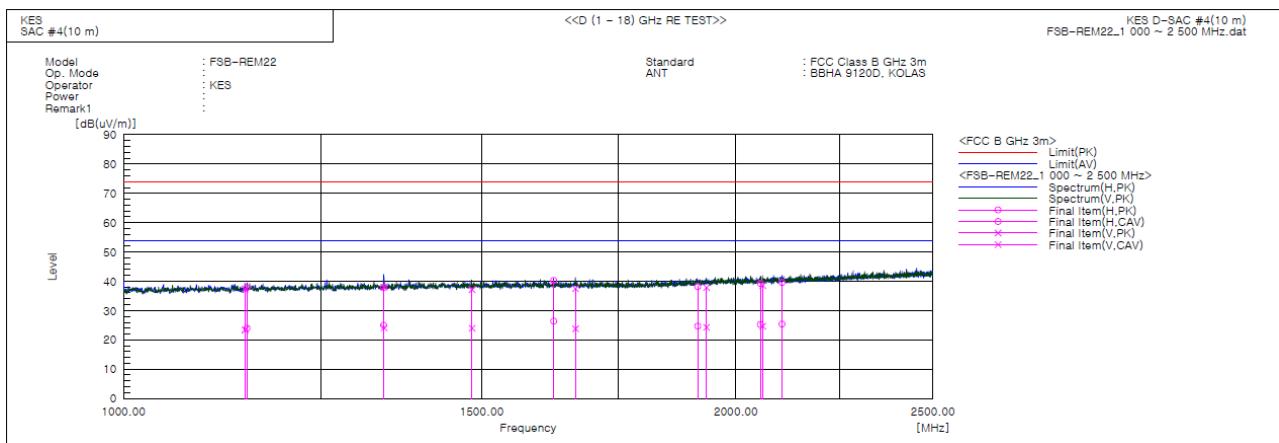


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Radiated Electric Field Emissions(Above 1 GHz)



Final Result

No.	Frequency [MHz]	(P) PK [dB(uV)]	Reading CAV [dB(uV)]	Reading CAV [dB(1/m)]	c.f	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB]	Limit AV [dB]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	1147.445	V 42.6	28.6	-5.2	37.4	23.4	74.0	54.0	36.6	30.6	129.0	267.0		
2	1150.195	H 43.1	29.2	-5.2	37.9	24.0	74.0	54.0	36.1	30.0	367.0	56.0		
3	1342.515	H 42.0	29.1	-4.1	37.9	25.0	74.0	54.0	36.1	29.0	343.0	180.0		
4	1343.020	V 42.1	28.2	-4.1	38.0	24.1	74.0	54.0	36.0	29.9	110.0	289.0		
5	1483.640	V 40.6	27.4	-3.4	37.2	24.0	74.0	54.0	36.8	30.0	137.0	140.0		
6	1627.360	H 43.1	29.2	-2.8	40.3	26.4	74.0	54.0	33.7	27.6	371.0	243.0		
7	1668.085	V 40.1	26.4	-2.6	37.5	23.8	74.0	54.0	36.5	30.2	101.0	106.0		
8	1915.605	H 39.8	26.3	-1.6	38.2	24.7	74.0	54.0	35.8	29.3	374.0	150.0		
9	1934.735	V 39.5	25.9	-1.6	37.9	24.3	74.0	54.0	36.1	29.7	104.0	16.0		
10	2056.470	H 40.3	26.3	-1.0	39.3	25.3	74.0	54.0	34.7	28.7	356.0	348.0		
11	2061.890	V 39.5	25.7	-1.0	38.5	24.7	74.0	54.0	35.5	29.3	108.0	282.0		
12	2107.345	H 40.4	26.2	-0.8	39.6	25.4	74.0	54.0	34.4	28.6	366.0	310.0		

♦ Calculation

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

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

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: Margin value

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