



KES Co., Ltd.

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Report No.:

KES-EM-23T0638

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EMC TEST REPORT

Test Report No. : KES-EM-23T0638
Date of Issue : Jul. 18, 2023
Product name : LK-BT
Model/Type No. : LK-BT240
Variant Model : LK-BT120, LK-BT60, BT60, BT120, BT240
Applicant : KLT Co., Ltd.
Applicant Address : 34-12, Bangchon-ro 955beon-gil, Tanhyeon-myeon, Paju-si,
Gyeonggi-do, Republic of Korea
Manufacturer : KLT Co., Ltd.
Manufacturer Address : 34-12, Bangchon-ro 955beon-gil, Tanhyeon-myeon, Paju-si,
Gyeonggi-do, Republic of Korea
Equipment authorization : **Supplier's Declaration of Conformity**
Date of Receipt : Jun. 26, 2023
Test date : Jul. 03, 2023
Test Results : ☒ In Compliance ☐ Not in Compliance

Tested by

Dae Hyun, Kim
EMC Test Engineer

Reviewed by

Dong Il, Lee
EMC Technical Manager

This test report is not related to KS Q ISO/IEC 17025 and KOLAS.

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REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Jul. 18, 2023	KES-EM-23T0638	Issued

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1.0 General Product Description

Main Specifications of EUT are:

Division	Characteristic
Frequency	Bluetooth
Power	DC 4.5 V (Battery)
Components	EUT x 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.

☒ DC 4.5 V (Battery)

1.2 Variant Model Differences

BT60	All electronic circuits are the same. The difference of mechanical capacity grease volume is 60cc
BT120	All electronic circuits are the same. The difference of mechanical capacity grease volume is 120cc
BT240	All electronic circuits are the same. The difference of mechanical capacity grease volume is 240cc
LK-BT60	All electronic circuits are the same. Derivative models added due to ODM progress The difference of mechanical capacity grease volume is 60cc
LK-BT120	All electronic circuits are the same. Derivative models added due to ODM progress The difference of mechanical capacity grease volume is 120cc

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
LK-BT	LK-BT240	-	KLT Co., Ltd.	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Smartphone	SM-G955N	-	Samsung Electronics Co., Ltd.	-

1.6 External I/O Cabling

■ Operating Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
LK-BT (EUT)	-	-	-	-	-

* Unshielded = U, Shielded = S

■ Bluetooth Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
LK-BT (EUT)	Wireless	Smartphone	Wireless	-	-

* Unshielded = U, Shielded = S

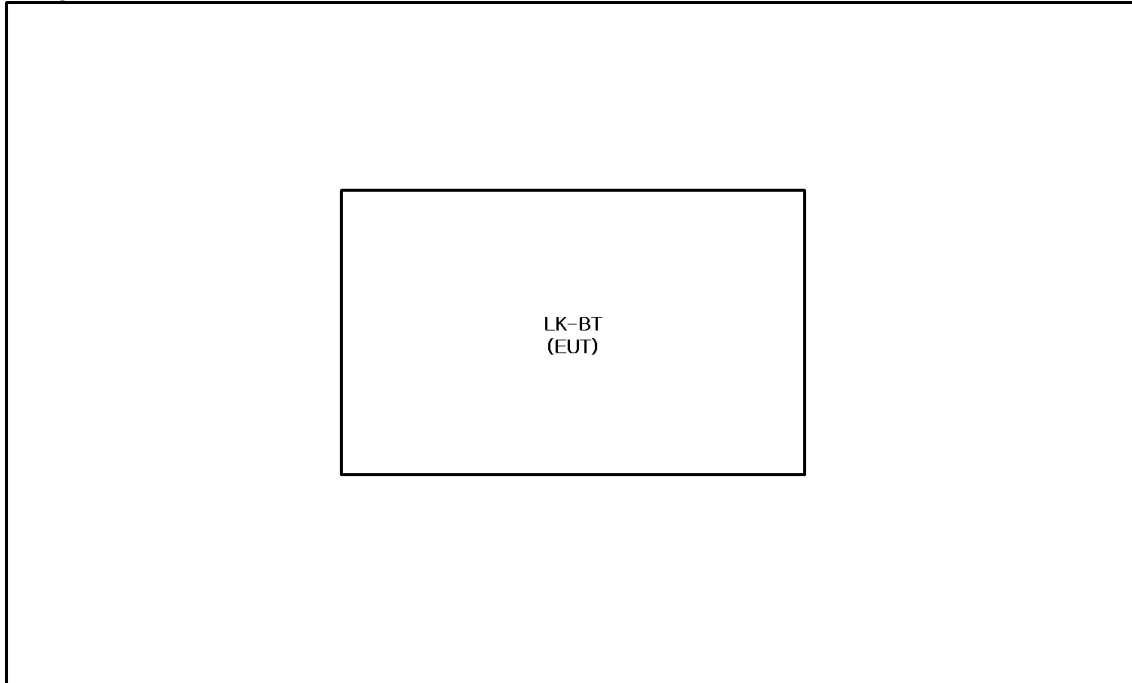
1.7 EUT Operating Mode(s)

Test mode	Normal operating
Operating	EUT Turn on the power. Tested under the maximum load condition of EUT.
Bluetooth	Connect EUT and Smartphone wirelessly. Checked the wireless communication status through the application of Smartphone.

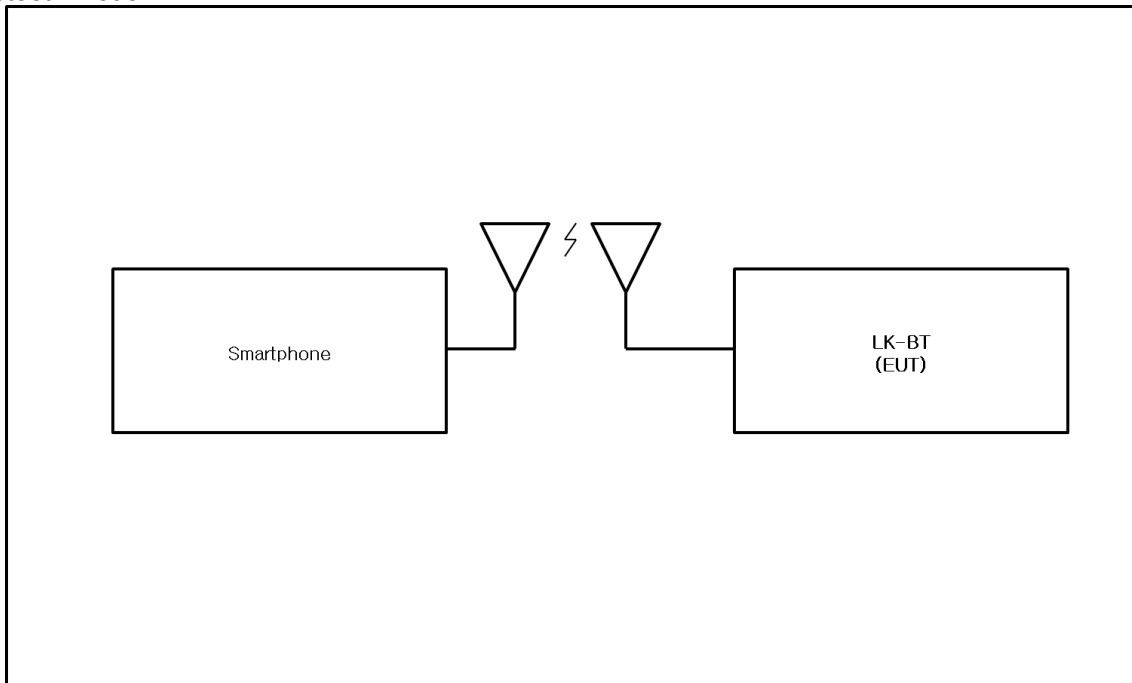
EUT Test operating S/W		
Name	Version	Manufacture Company
Pulsarlube BT	3.9	pulsarlube

1.8 Configuration

■ Operating Mode



■ Bluetooth Mode



EUT – Smartphone : Bluetooth

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, Republic of. The sites are constructed in conformance with the requirements of ANSI C63.4a-2017 and CISPR 16-1-4:2019

1.12 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



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

2.1 Conducted Emissions at Mains Power Ports

Test Date

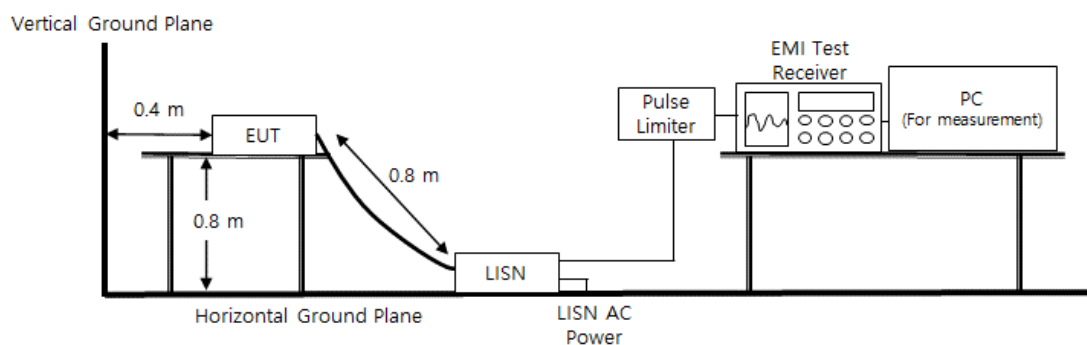
N/A

Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☐	EMI Test S/W	EMC32	R & S	9.12.00	-
☐	EMI TEST RECEIVER	ESR3	R & S	101783	11, 11, 2023
☐	LISN	ENV216	R & S	101787	11, 10, 2023
☐	LISN	ESH2-Z5	R & S	100450	11, 10, 2023
☐	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 10, 2023

Diagram of test setup




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Test Conditions

Temperature: °C
Relative Humidity: % 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

It is not tested apply because it is powered by battery.

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2.2 Radiated Electric Field Emissions(Below 1 GHz)

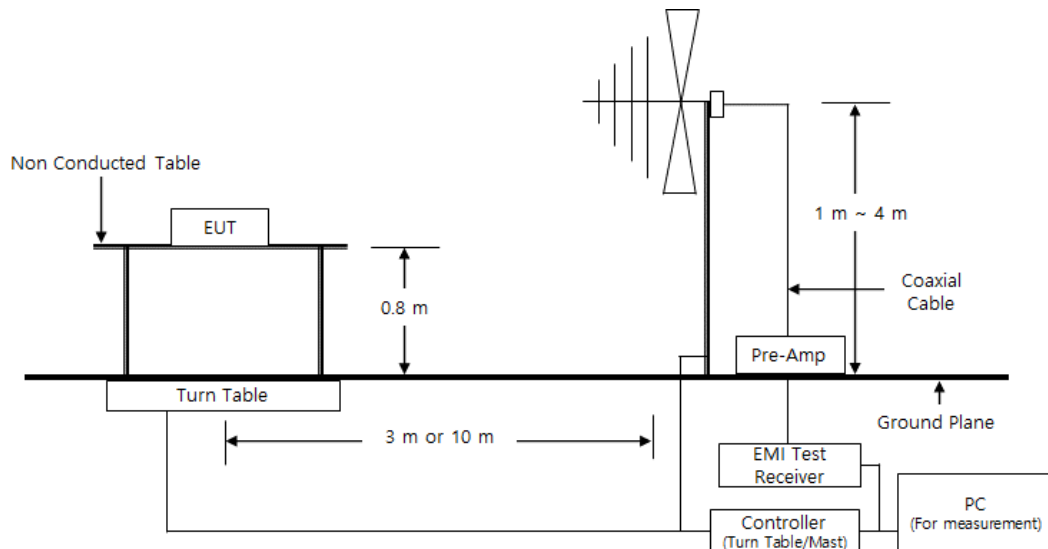
Test Date
 Jul. 03, 2023

Test Location
 SEMI ANECHOIC CHAMBER #4(10 m)

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	03, 21, 2024
☒	AMPLIFIER	SCU 01	R & S	100603	11, 10, 2023
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 17, 2024
☒	ATTENUATOR	8491A	HP	32173	03, 03, 2024

Diagram of test setup





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Test Conditions

Temperature: $(24,7 \pm 0,2) ^\circ\text{C}$
Relative Humidity: $(45,6 \pm 0,1) \% \text{ R.H.}$

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.

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2.3 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Jul. 03, 2023

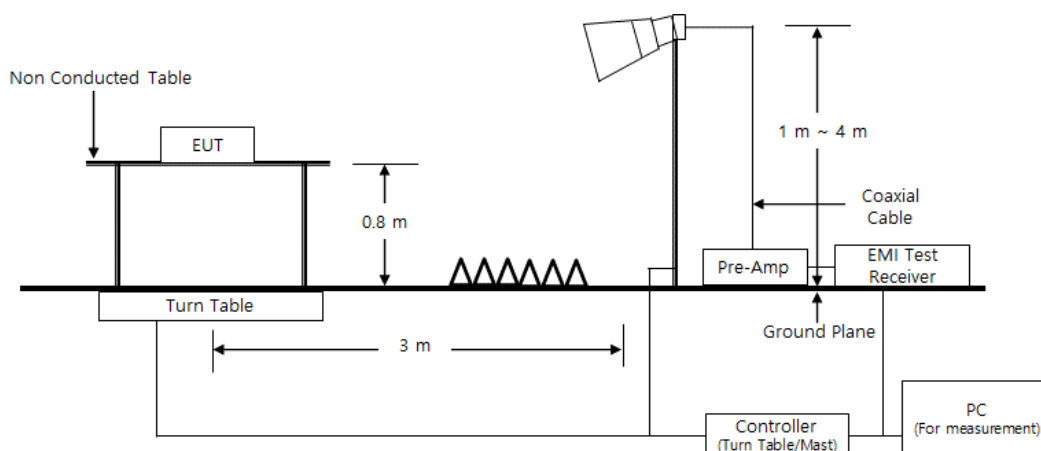
Test Location

SEMI ANECHOIC CHAMBER #5

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due
☒	EMI Test SW	ES10/RE	TOYO Corporation	2022.01.000	-
☒	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	03, 21, 2024
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	11, 08, 2023
☒	PREAMPLIFIER	8449B	HP	3008A00538	05, 31, 2024
☒	ATTENUATOR	8491B	HP	23094	03, 21, 2024

Diagram of test setup





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Test Conditions

Temperature: $(24,2 \pm 0,2) ^\circ\text{C}$
Relative Humidity: $(44,8 \pm 0,2) \% \text{ R.H.}$

Frequency Range of Measurement

1 GHz to 12,4 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.

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APPENDIX A – TEST Bluetooth Mode

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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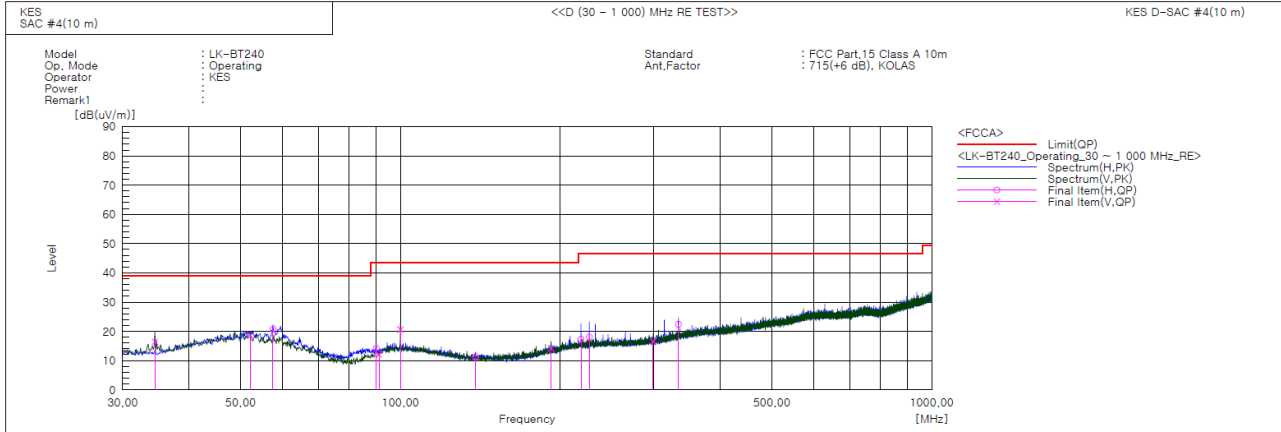
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Radiated Electric Field Emissions(Below 1 GHz)

■ Operating Mode



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	34.486	V	40.9	-24.5	16.4	39.0	22.6	100.0	231.0	
2	52.189	V	39.2	-20.7	18.5	39.0	20.5	100.0	175.0	
3	57.524	H	42.1	-21.3	20.8	39.0	18.2	400.0	15.0	
4	90.019	H	38.3	-24.1	14.2	43.5	29.3	400.0	52.0	
5	91.110	V	35.9	-23.8	12.1	43.5	31.4	133.0	90.0	
6	99.961	V	43.0	-22.4	20.6	43.5	22.9	127.0	153.0	
7	138.398	H	36.7	-25.4	11.3	43.5	32.2	375.0	22.0	
8	191.990	V	36.4	-22.2	14.2	43.5	29.3	100.0	212.0	
9	218.665	H	37.3	-20.0	17.3	46.5	29.2	334.0	153.0	
10	226.668	H	37.8	-19.7	18.1	46.5	28.4	400.0	30.0	
11	298.933	V	34.6	-18.0	16.6	46.5	29.9	150.0	116.0	
12	333.489	H	38.5	-16.1	22.4	46.5	24.1	400.0	38.0	

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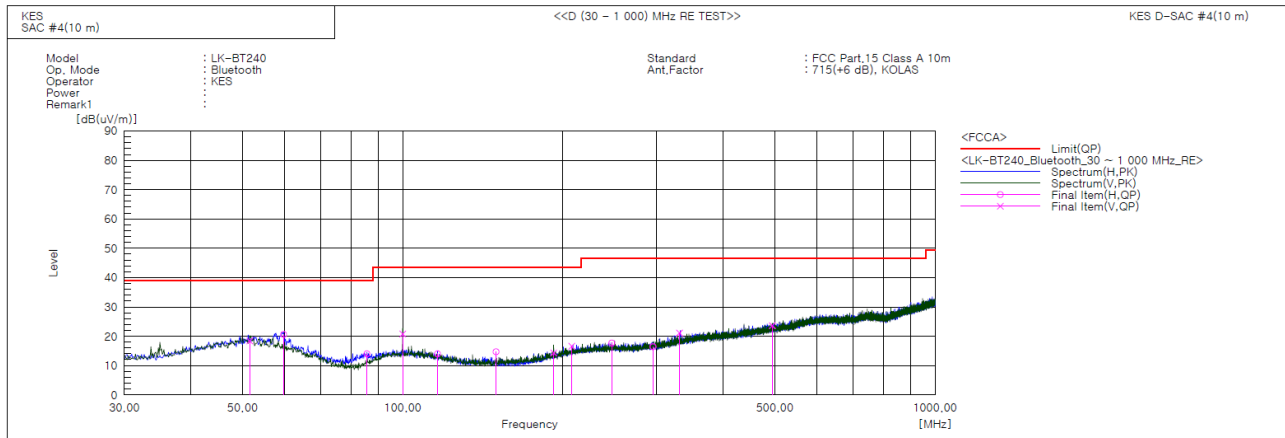
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Bluetooth Mode



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	51.583	V	39.1	-20.7	18.4	39.0	20.6	100.0	197.0	
2	59.706	H	42.3	-21.7	20.6	39.0	18.4	400.0	85.0	
3	85.654	H	40.0	-26.0	14.0	39.0	25.0	386.0	61.0	
4	99.988	V	43.2	-22.4	20.8	43.5	22.7	111.0	138.0	
5	116.209	H	37.6	-23.6	14.0	43.5	29.5	400.0	85.0	
6	149.674	H	40.0	-25.3	14.7	43.5	28.8	290.0	239.0	
7	191.995	V	36.5	-22.2	14.3	43.5	29.2	120.0	312.0	
8	207.631	V	37.3	-20.7	16.6	43.5	26.9	135.0	108.0	
9	247.038	H	37.0	-19.3	17.7	46.5	28.8	330.0	61.0	
10	295.174	H	34.6	-18.2	16.4	46.5	30.1	400.0	213.0	
11	330.943	V	37.3	-16.2	21.1	46.5	25.4	100.0	101.0	
12	494.266	V	34.8	-11.2	23.6	46.5	22.9	100.0	349.0	

Calculation

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

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

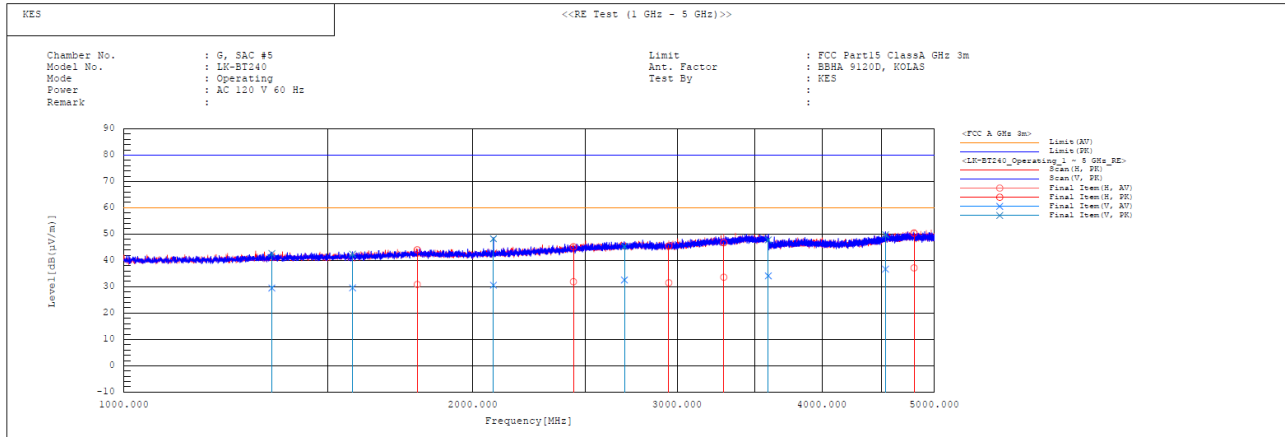
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Radiated Electric Field Emissions(Above 1 GHz)

■ Operating Mode

- (1 ~ 5) GHz



Final Result

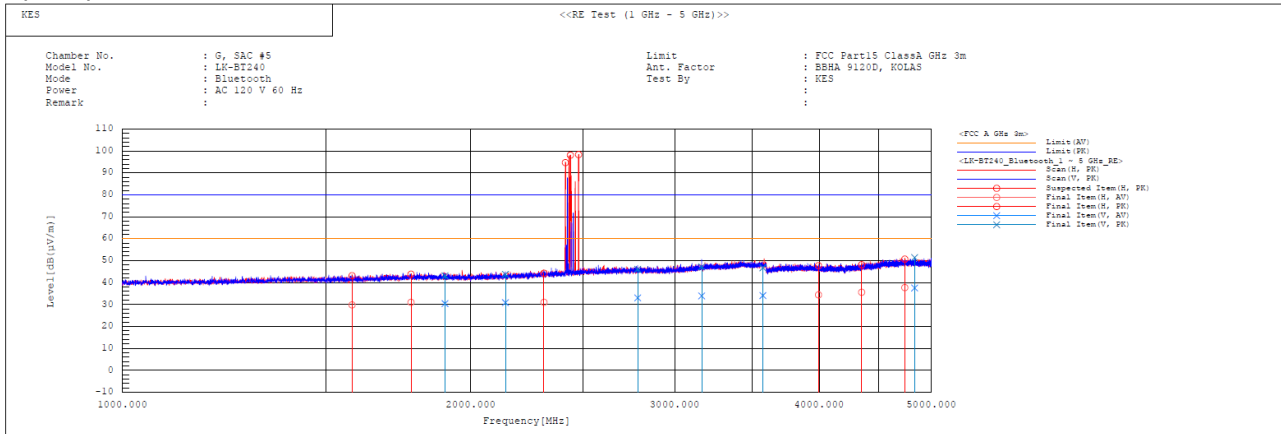
No.	Frequency	Pol	Reading AV	Reading PK	c.f	Result AV	Result PK	Limit AV	Limit PK	Margin AV	Margin PK	Height	Angle	Remark
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[deg]	
1	1341.645	V	29.9	43.0	-0.4	29.5	42.6	60.0	80.0	30.5	37.4	142.0	144.5	
2	1574.888	V	29.4	42.2	0.2	29.6	42.4	60.0	80.0	30.4	37.6	132.0	51.7	
3	1790.458	H	29.3	42.4	1.6	30.9	44.0	60.0	80.0	29.1	36.0	219.0	34.5	
4	2083.209	V	28.4	46.0	2.2	30.6	48.2	60.0	80.0	29.4	31.8	100.0	90.4	
5	2441.159	H	28.6	41.9	3.3	31.9	45.2	60.0	80.0	28.1	34.8	190.0	61.7	
6	2701.689	V	28.1	40.8	4.5	32.6	45.3	60.0	80.0	27.4	34.7	111.0	246.6	
7	2950.887	H	26.5	40.5	5.0	31.5	45.5	60.0	80.0	28.5	34.5	400.0	65.7	
8	3290.492	H	27.6	40.7	6.0	33.6	46.7	60.0	80.0	26.4	33.3	400.0	184.7	
9	3594.780	V	28.2	41.9	5.9	34.1	47.8	60.0	80.0	25.9	32.2	100.0	152.0	
10	4536.860	V	27.5	40.6	9.2	36.7	49.8	60.0	80.0	23.3	30.2	100.0	79.9	
11	4801.635	H	27.2	40.4	10.0	37.2	50.4	60.0	80.0	22.8	29.6	400.0	100.8	

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■ Bluetooth Mode

- (1 ~ 5) GHz



Final Result

No.	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]	Remark
1	1579.202	H	29.6	42.9	0.2	29.8	43.1	60.0	80.0	30.2	36.9	340.0	98.3	
2	1775.207	H	29.5	42.3	1.5	31.0	43.8	60.0	80.0	29.0	36.2	400.0	349.8	
3	1899.456	V	28.6	41.2	1.8	30.4	43.0	60.0	80.0	29.6	37.0	130.0	114.6	
4	2142.905	V	28.4	41.3	2.4	30.8	43.7	60.0	80.0	29.2	36.3	100.0	179.2	
5	2312.968	H	28.1	41.3	2.9	31.0	44.2	60.0	80.0	29.0	35.8	400.0	128.2	
6	2786.876	V	28.2	41.2	4.8	33.0	46.0	60.0	80.0	27.0	34.0	100.0	287.7	
7	3165.111	V	28.0	41.2	5.9	33.9	47.1	60.0	80.0	26.1	32.9	156.0	5.8	
8	3574.781	V	28.1	40.8	5.9	34.0	46.7	60.0	80.0	26.0	33.3	137.0	136.7	
9	3992.864	H	27.6	40.9	6.8	34.4	47.7	60.0	80.0	25.6	32.3	400.0	215.5	
10	4352.110	H	27.2	39.7	8.4	35.6	48.1	60.0	80.0	24.4	31.9	352.0	41.3	
11	4742.001	H	27.8	40.8	9.9	37.7	50.7	60.0	80.0	22.3	29.3	400.0	341.1	
12	4834.700	V	27.3	41.2	10.2	37.5	51.4	60.0	80.0	22.5	28.6	110.0	118.3	
13	2414.000	H	-----	-----	3.2	-----	-----	-----	-----	-----	-----	100.0	0.6	
14	2438.000	H	-----	-----	3.3	-----	-----	-----	-----	-----	-----	100.0	138.7	
15	2477.600	H	-----	-----	3.5	-----	-----	-----	-----	-----	-----	100.0	92.3	

* Exclusion Bands

- Fundamental Frequency: (2 402 ~ 2 480) MHz



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- (5 ~ 12,4) GHz

PEAK

Frequency (MHz)	Reading PK (dBuV)	Polarization	Height (m)	ANT Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5 733.200	39.300	V	1.000	32.630	6.460	33.570	44.820	80.000	35.180
7 033.400	39.200	H	1.000	35.220	7.930	34.740	47.610	80.000	32.390

CISPR AVERAGE

Frequency (MHz)	Reading CISPR AV (dBuV)	Polarization	Height (m)	ANT Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5 733.200	26.600	V	1.000	32.630	6.460	33.570	32.120	60.000	27.880
7 033.400	26.200	H	1.000	35.220	7.930	34.740	34.610	60.000	25.390

◆ 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: Margin value

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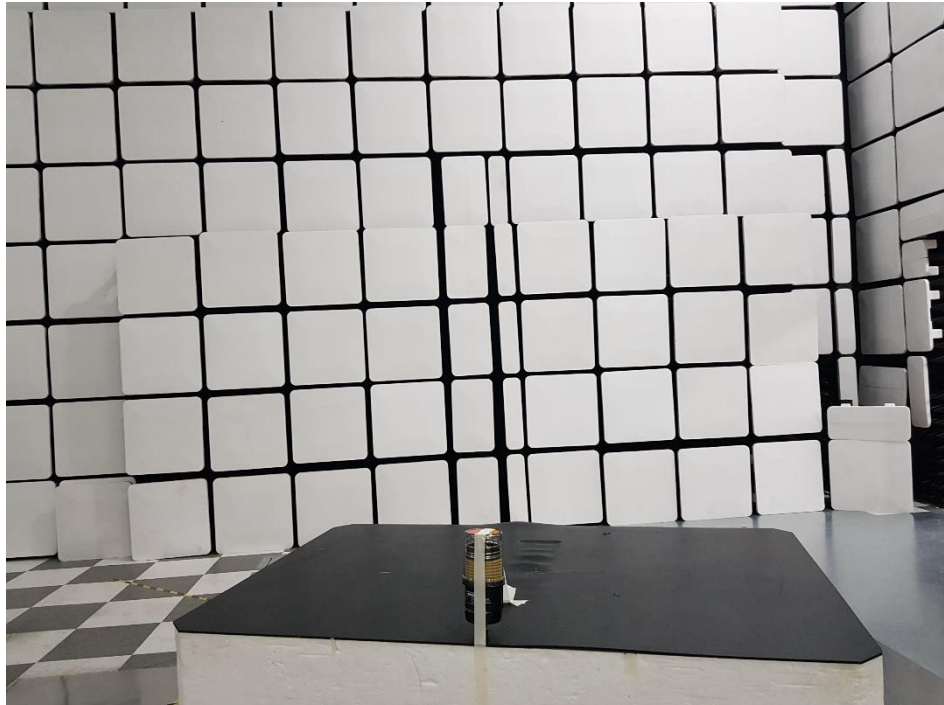
Report No.:
KES-EM-23T0638
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Test Setup Photos and Configuration

Conducted Emissions at Mains Power Ports

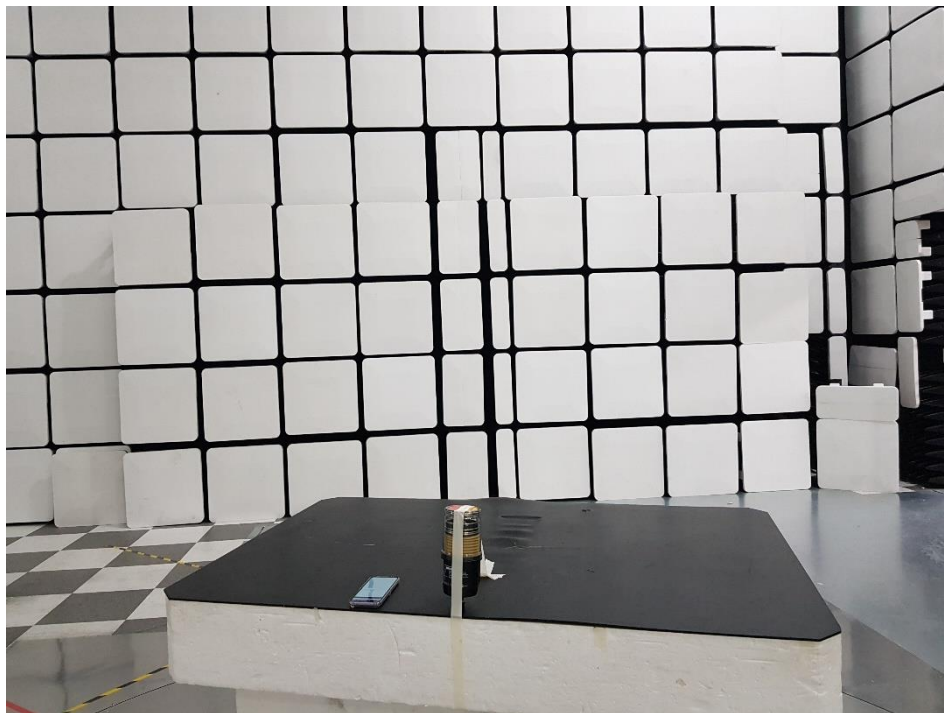
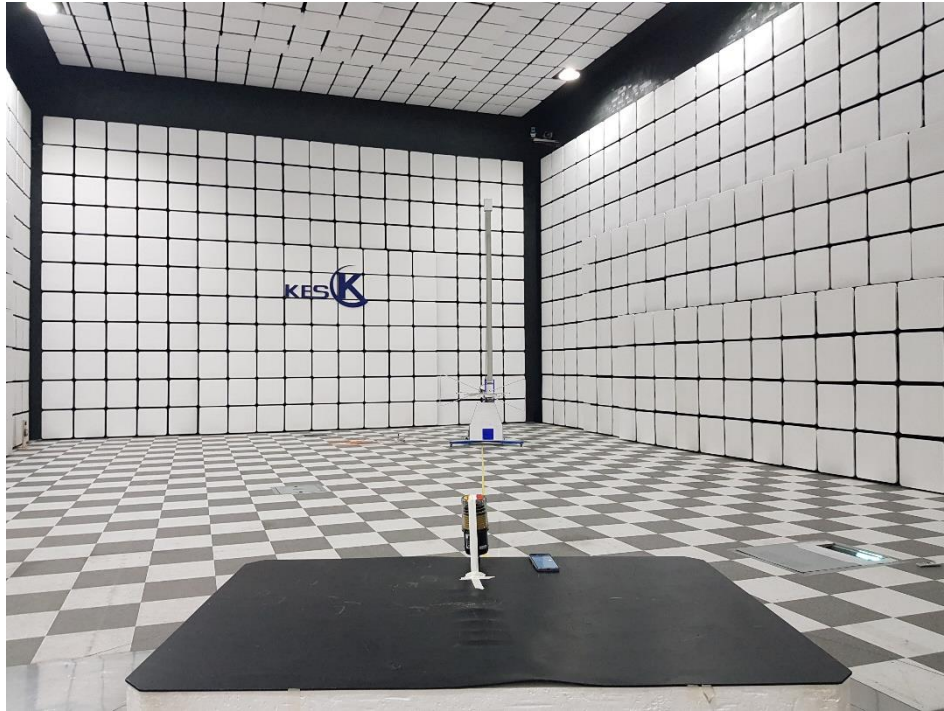
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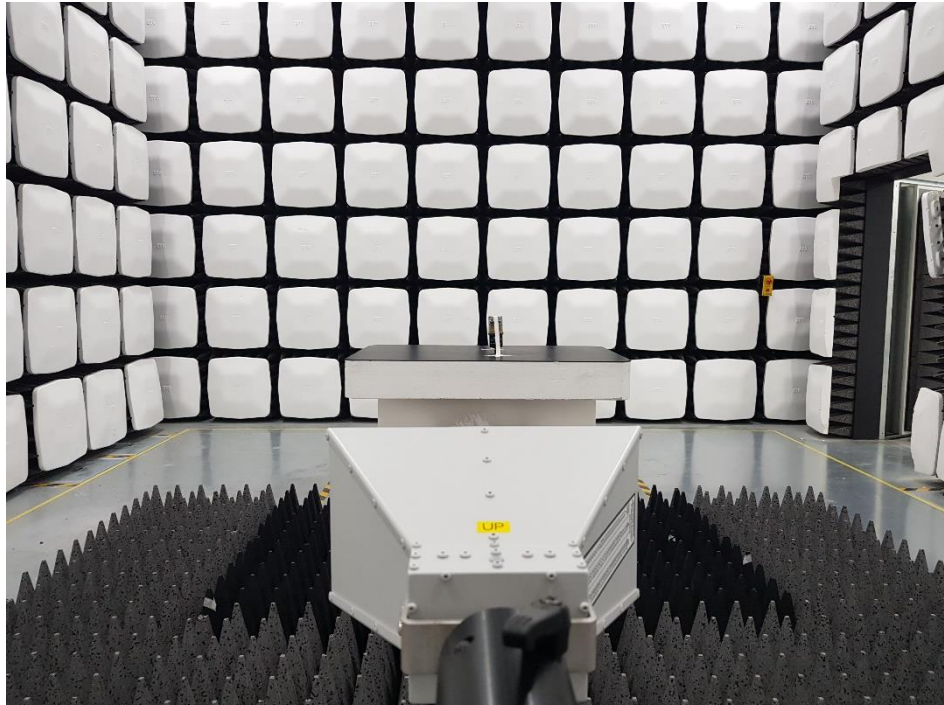
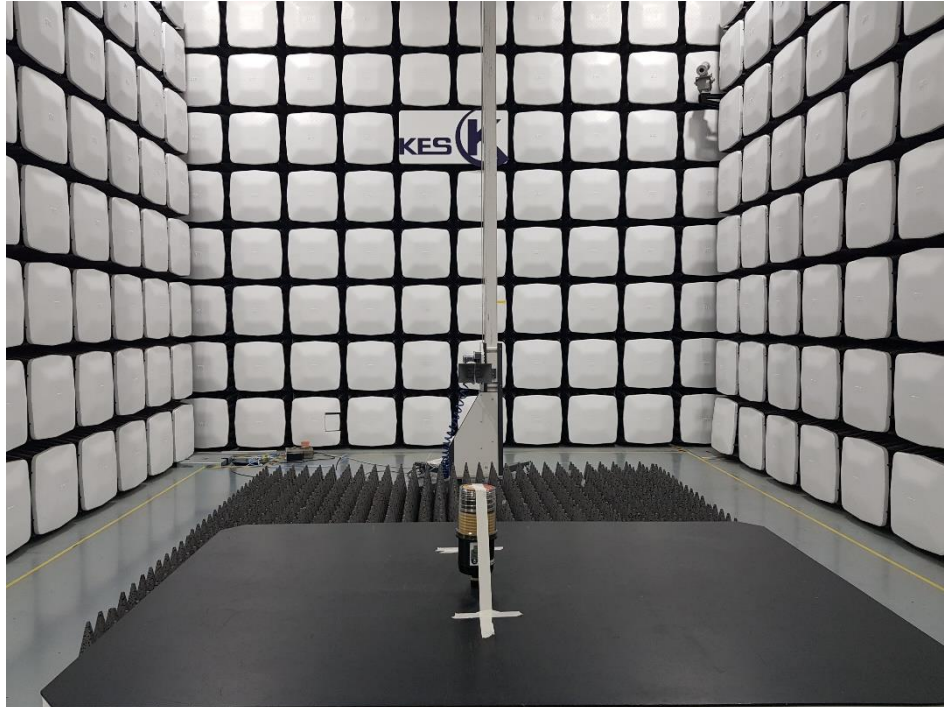
Radiated Electric Field Emissions(Below 1 GHz)**■ Operating Mode**

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■ Bluetooth Mode

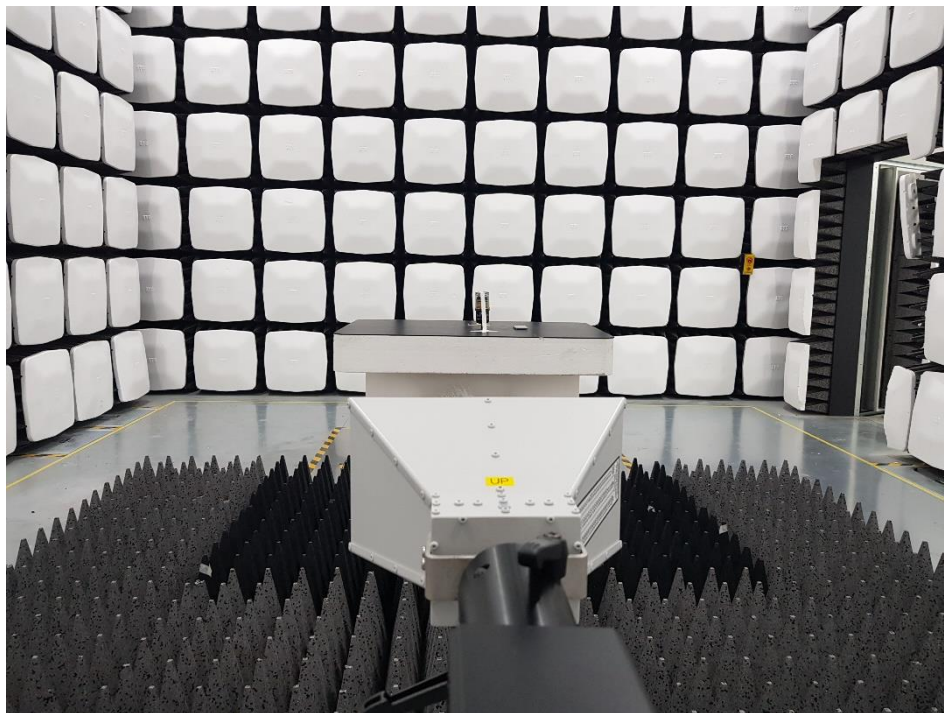
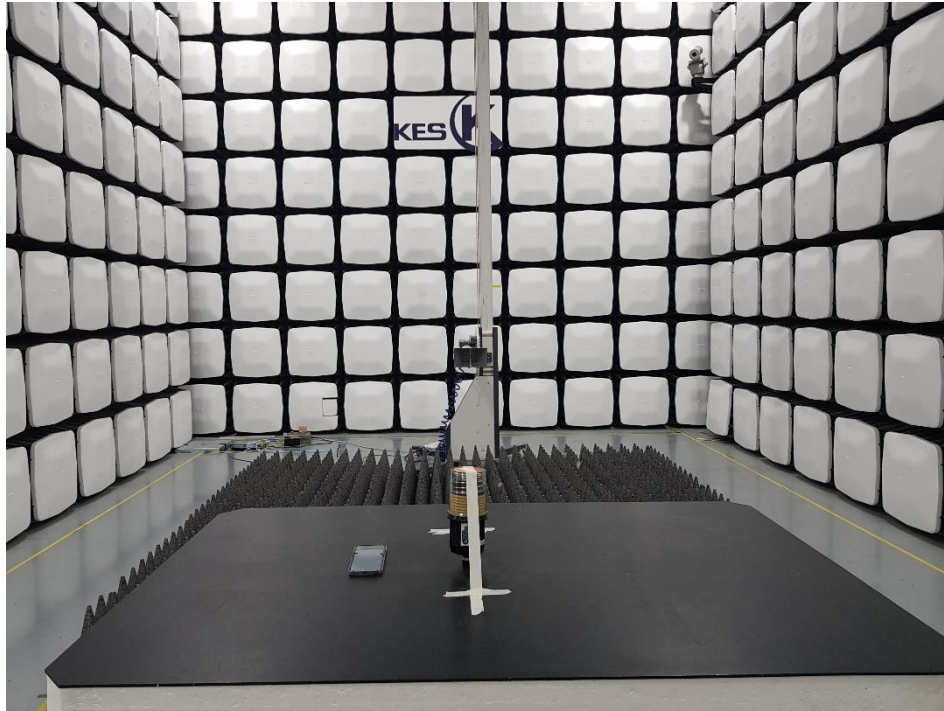


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Radiated Electric Field Emissions(Above 1 GHz)**■ Operating Mode**

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■ Bluetooth Mode



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EUT External Photographs

(Top)



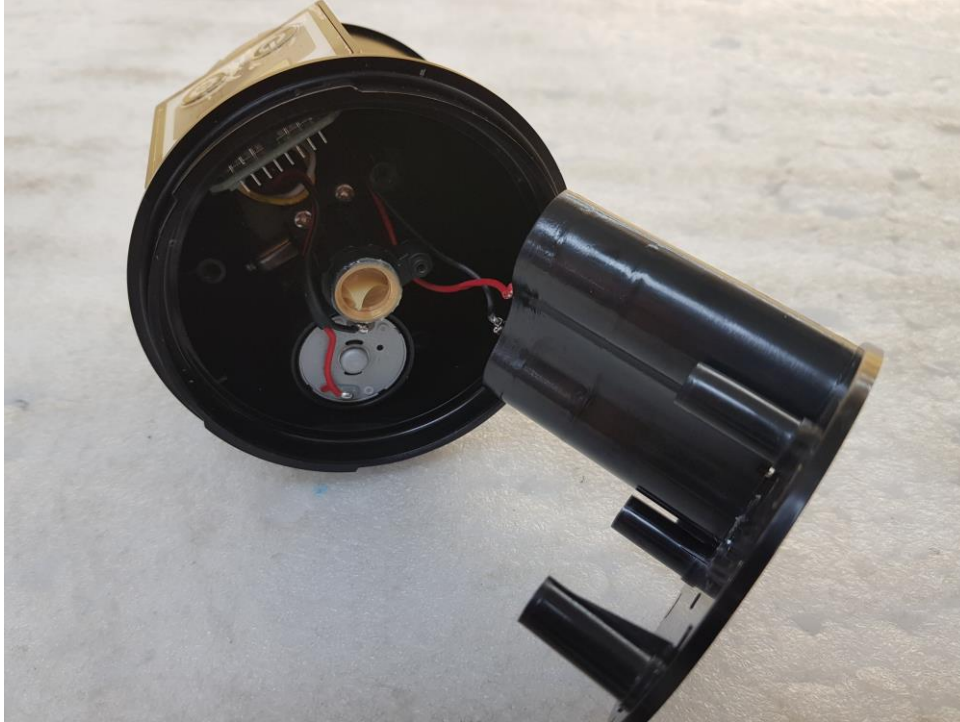
(Bottom)



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EUT Internal Photographs

(Internal View)



Label Photographs



LK-BT

LK-BT240