



TEST REPORT



Report No. : KES-EM-23T1094-R1
Page 1 / 23

KES Co., Ltd.

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1. Client

Applicant : LEETEK LIFE CO.,LTD
Applicant Address : 2F, 47, Ojeong-ro, Bucheon-si, Gyeonggi-do, Republic of Korea

2. Sample Description

Product name : Sensor Receiver
Model/Type No. : LFW2921-01
Variant Model : LF-1
Manufacturer : LEETEK LIFE CO.,LTD
Manufacturer Address : 2F, 47, Ojeong-ro, Bucheon-si, Gyeonggi-do, Republic of Korea

3. FCC ID : 2BDLQ-LFW2921-01

4. Date of Receipt : Jan. 30, 2024

5. Test date : Dec. 06, 2023 ~ Dec. 08, 2023

6. Date of Issue : Feb. 20, 2024

7. Test Results : In Compliance

Tested by

Reviewed by

Eun Gu, Jeon
EMC Test Engineer
[전은구]2024/02/20

Dong Hun, Jang
EMC Technical Manager
[장동훈]2024/02/20

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



REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Dec. 18, 2023	KES-EM-23T1094	Issued
Feb. 20, 2024	KES-EM-23T1094-R1	The EUT fundamental frequency changed to 902.5 MHz

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TABLE OF CONTENTS

1.0	General Product Description.....	4
1.1	Test Voltage & Frequency.....	5
1.2	Variant Model Differences.....	5
1.3	Device Modifications.....	5
1.4	Equipment Under Test.....	5
1.5	System Configuration.....	5
1.6	Support Equipments.....	5
1.7	External I/O Cabling.....	6
1.8	EUT Operating Mode(s).....	6
1.9	Configuration.....	7
1.10	Remarks when standards applied.....	8
1.11	Calibration Details of Equipment Used for Measurement.....	8
1.12	Test Facility.....	8
1.13	Measurement Procedure.....	8
1.14	Laboratory Accreditations and Listings.....	9
2.0	Test Regulations.....	10
2.1	Conducted Emissions at Mains Power Ports.....	11
2.2	Radiated Electric Field Emissions(Below 1 GHz).....	13
2.3	Radiated Electric Field Emissions(Above 1 GHz).....	15
APPENDIX A – TEST DATA.....		17
Conducted Emissions at Mains Power Ports.....		17
Radiated Electric Field Emissions(Below 1 GHz).....		19
Radiated Electric Field Emissions(Above 1 GHz).....		20
APPENDIX B - Test Setup Photos and Configuration.....		21
Radiated Electric Field Emissions(Below 1 GHz).....		22
Radiated Electric Field Emissions(Above 1 GHz).....		23



1.0 General Product Description

Main Specifications of EUT are:

Division	Characteristic
Frequency	(902.5 ~ 927.5) MHz(Send/Receive)
Power	DC 5 V (USB A Type)
Components	EUT 1 EA, SMA Antenna 1 EA, Core 1 EA



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

Addition of a derivative model in the form of a management model for each vendor (no changes to basic model and hardware, circuit)

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Sensor Receiver	LFW2921-01	-	Lee Technology Korea Co.,Ltd.	EUT

1.5 System Configuration

Description	Model Number	Serial Number	Manufacturer	Remarks
SMA Antenna	-	-	-	-

1.6 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Diper Sensor	LFW2930-01	-	Lee Technology Korea Co.,Ltd.	-
Laptop	LG15N54	503NZWY038929	LG Electronics Co., Ltd.	-
Laptop Adapter	PA-1900-14	OF2R263348701776 4	LITE-ON TECHNOLOGY COPORATION	-



1.7 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
Sensor Receiver (EUT)	Wireless	Diper Sensor	Wireless	-	-
	SMA	SMA Antenna (EUT)	SMA	-	-
	USB A Type	Laptop	USB A Type	1.0	U
Laptop	DC IN	Laptop Adapter	DC OUT	1.6	U

* Unshielded = U, Shielded = S

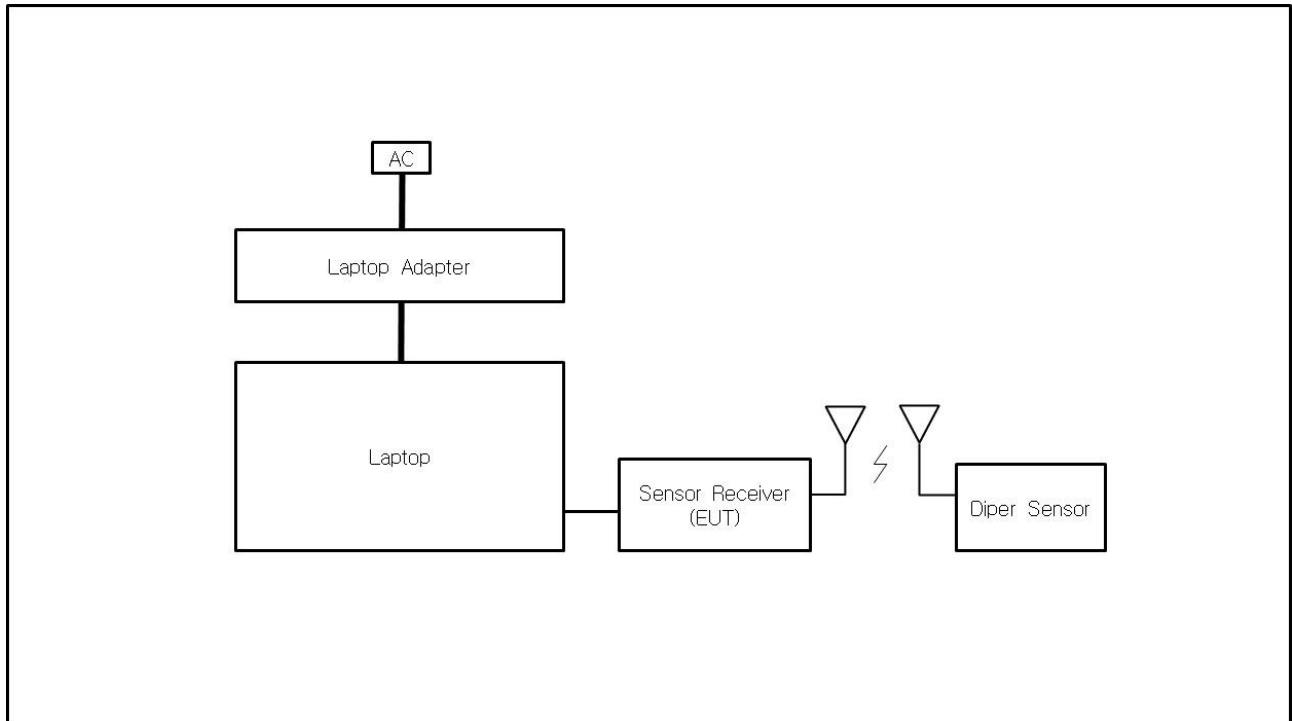
1.8 EUT Operating Mode(s)

Test mode	Normal operating
Operating	Check the EUT normal operated of Laptop program(ComTest) log and The EUT LED green blinking.

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



1.9 Configuration



EUT -Dipole Sensor : 902.5 MHz(Send/Receive)



1.10 Remarks when standards applied

N/A

1.11 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.

1.12 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

1.13 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



1.14 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

Dec. 06, 2023

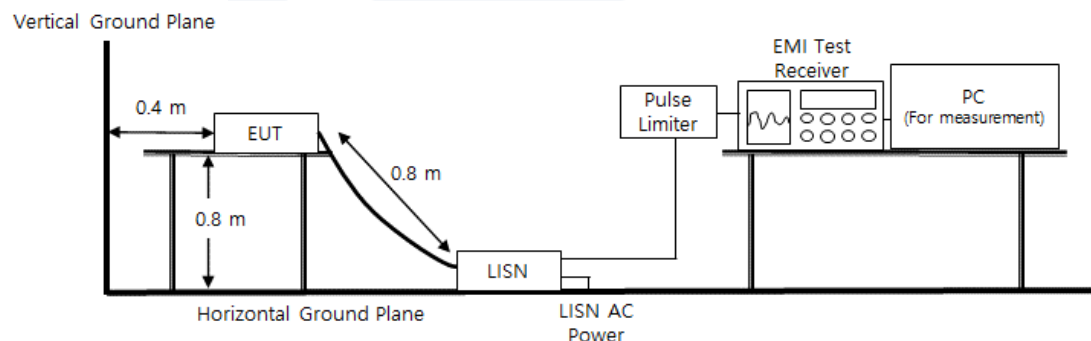
Test Location

Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
☒	EMI Test S/W	EMC32	R & S	9.12.00	-	-
☒	EMI TEST RECEIVER	ESR3	R & S	101783	11, 08, 2024	1 Year
☒	LISN	ENV216	R & S	101787	11, 08, 2024	1 Year
☐	LISN	ESH2-Z5	R & S	100450	11, 08, 2024	1 Year
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 08, 2024	1 Year

Diagram of test setup





Test Conditions

Temperature: (21,9 ± 0,1) °C
Relative Humidity: (45,7 ± 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

Dec. 08, 2023

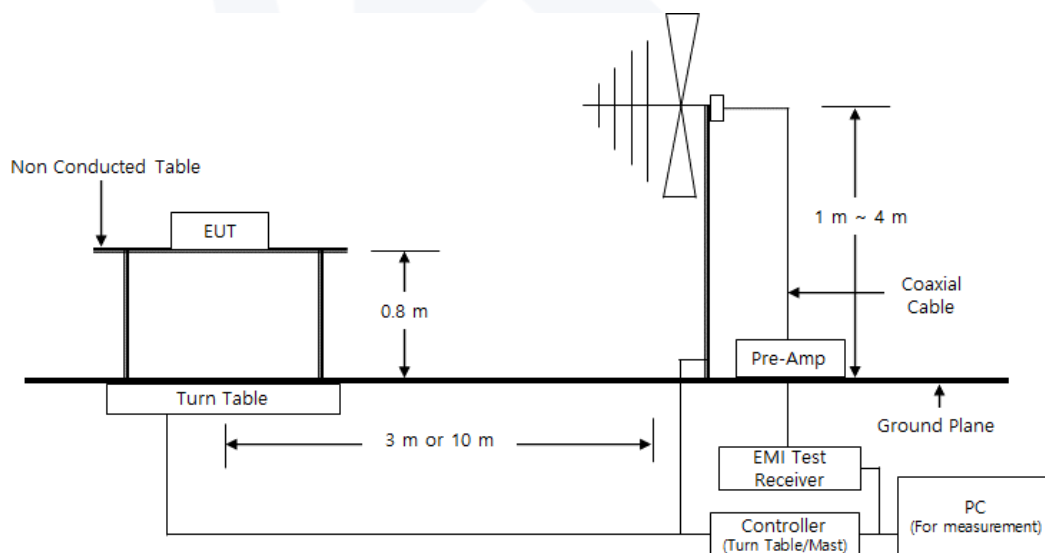
Test Location

☐ OPEN AREA TEST SITE #2☒ SEMI ANECHOIC CHAMBER #6(3m)

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
☒	EMI Test S/W	ES10/RE	TOYO Corporation	2022.01.000	-	-
☒	EMI TEST RECEIVER	ESU26	R & S	100517	07, 31, 2024	1 Year
☒	AMPLIFIER	310N	SONOMA INSTRUMENT	186549	03, 21, 2024	1 Year
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	714	04, 19, 2024	2 Year
☒	ATTENUATOR	6806.17.A	HUBER+SUHNER	-	03, 21, 2024	1 Year

Diagram of test setup





Test Conditions

Temperature: (21,6 ± 0,1) °C
Relative Humidity: (42,8 ± 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

Dec. 06, 2023

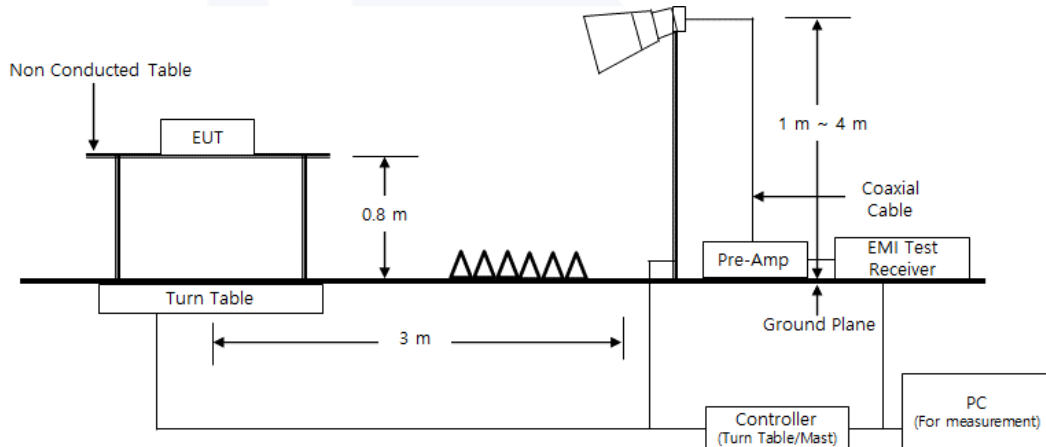
Test Location

SEMI ANECHOIC CHAMBER #5

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
☒	EMI Test SW	ES10/RE	TOYO Corporation	2022.01.000	-	-
☒	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	03, 21, 2024	1 Year
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	11, 03, 2024	1 Year
☒	PREAMPLIFIER	8449B	HP	3008A00538	05, 31, 2024	1 Year
☒	ATTENUATOR	8491B	HP	23094	03, 21, 2024	1 Year

Diagram of test setup





Test Conditions

Temperature: (23,0 ± 0,1) °C
Relative Humidity: (45,7 ± 0,2) % R.H.

Frequency Range of Measurement

1 GHz to 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.



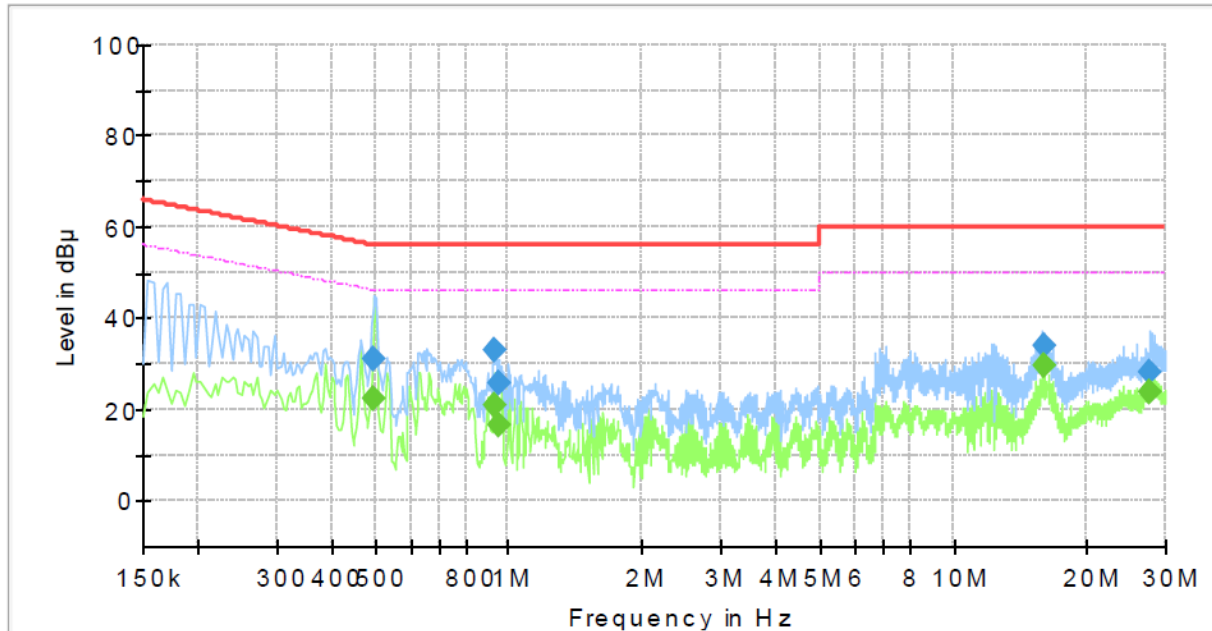
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

HOT LINE

Common Information

Test Description: Conducted Emission
Model No.: LFW2921-01
Phase: L1
Mode:
Operator Name: KES



Final Result

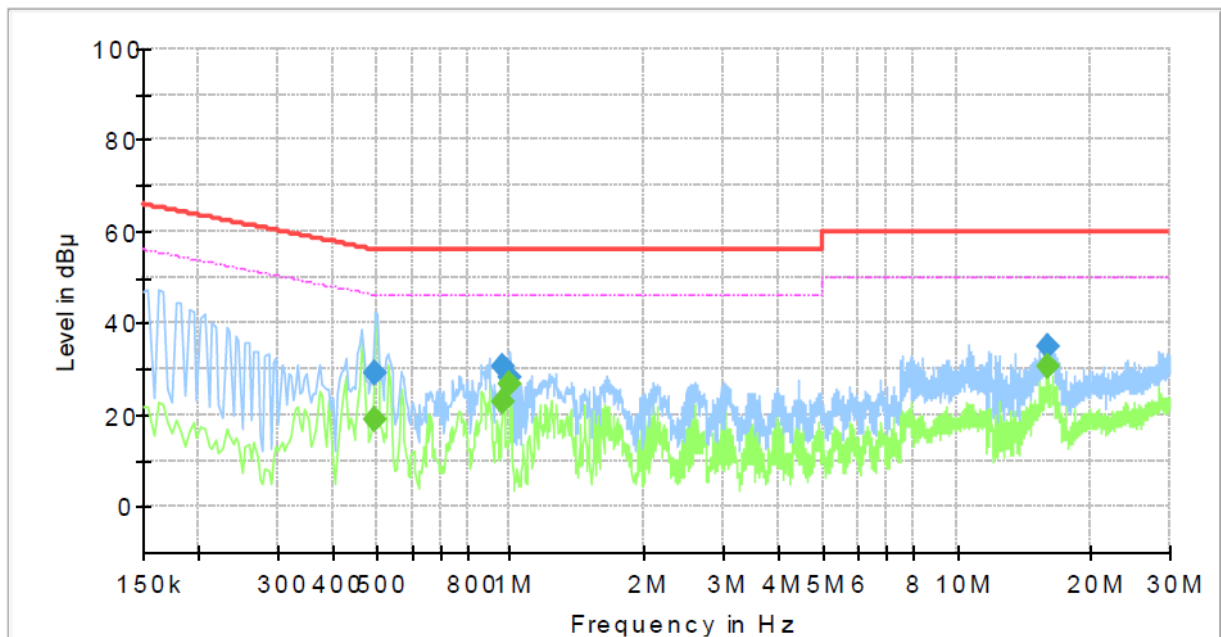
Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.498000	---	22.18	46.03	23.85	1000.0	9.000	L1	19.5
0.498000	30.95	---	56.03	25.08	1000.0	9.000	L1	19.5
0.930000	---	20.97	46.00	25.03	1000.0	9.000	L1	19.5
0.930000	32.78	---	56.00	23.22	1000.0	9.000	L1	19.5
0.946000	---	16.35	46.00	29.65	1000.0	9.000	L1	19.5
0.946000	25.53	---	56.00	30.47	1000.0	9.000	L1	19.5
16.086000	---	29.76	50.00	20.24	1000.0	9.000	L1	20.2
16.086000	33.85	---	60.00	26.15	1000.0	9.000	L1	20.2
27.710000	---	23.62	50.00	26.38	1000.0	9.000	L1	20.4
27.710000	28.12	---	60.00	31.88	1000.0	9.000	L1	20.4



NEUTRAL LINE

Common Information

Test Description: Conducted Emission
Model No.: LFW2921-01
Phase: N
Mode:
Operator Name: KES

**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.498000	---	18.81	46.03	27.22	1000.0	9.000	N	19.4
0.498000	29.04	---	56.03	26.99	1000.0	9.000	N	19.4
0.962000	---	22.97	46.00	23.03	1000.0	9.000	N	19.5
0.962000	30.69	---	56.00	25.31	1000.0	9.000	N	19.5
0.998000	---	26.77	46.00	19.23	1000.0	9.000	N	19.5
0.998000	28.29	---	56.00	27.71	1000.0	9.000	N	19.5
16.082000	---	30.38	50.00	19.62	1000.0	9.000	N	20.2
16.082000	34.90	---	60.00	25.10	1000.0	9.000	N	20.2

◆ Calculation

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

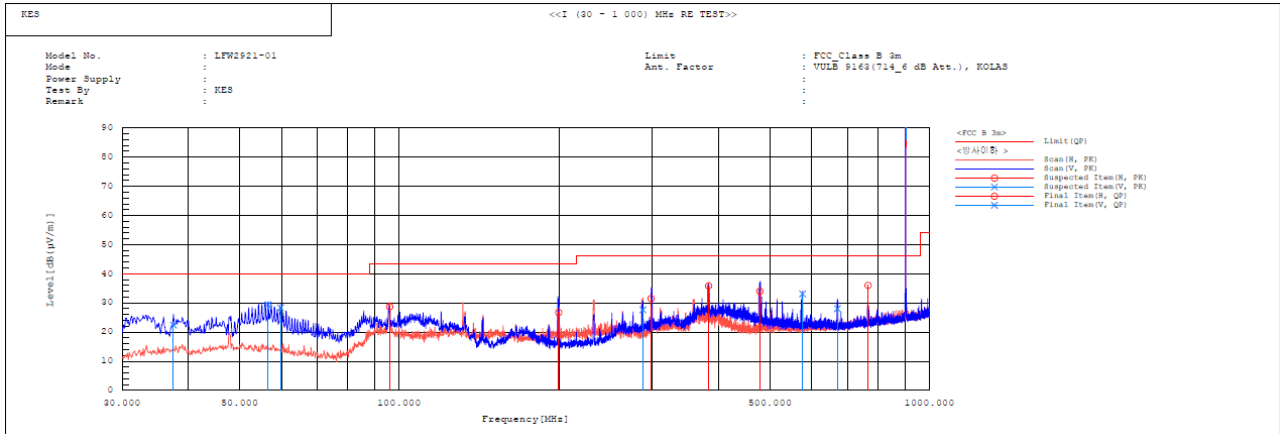
QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))



Report No. : KES-EM-23T1094-R1

Radiated Electric Field Emissions(Below 1 GHz)**Final Result**

No.	Frequency [MHz]	Pol	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	37.518	V	36.1	-13.7	22.4	40.0	17.6	142.0	311.1	
2	56.542	V	41.7	-12.3	29.4	40.0	10.6	102.0	219.9	
3	59.732	V	40.9	-12.6	28.3	40.0	11.7	162.0	359.9	
4	95.952	H	42.6	-13.9	28.7	43.5	14.8	203.0	269.3	
5	199.841	H	39.2	-12.5	26.7	43.5	16.8	179.0	86.1	
6	288.168	V	37.7	-10.1	27.6	46.0	18.4	129.0	0.1	
7	298.648	H	41.4	-9.9	31.5	46.0	14.5	196.0	273.8	
8	383.247	H	43.2	-7.4	35.8	46.0	10.2	241.0	227.7	
9	478.939	H	39.7	-5.7	34.0	46.0	12.0	221.0	205.8	
10	576.264	V	37.2	-4.1	33.1	46.0	12.9	106.0	154.0	
11	670.564	V	31.5	-3.5	28.0	46.0	18.0	131.0	45.4	
12	766.382	H	38.2	-2.2	36.0	46.0	10.0	201.0	162.9	
13	902.030	V	-----	0.3	-----	-----	-----	150.0	91.5	
14	902.030	H	-----	0.3	-----	-----	-----	100.0	0.0	

*** Exclusion bands**

Fundamental Frequency: 902.5 MHz

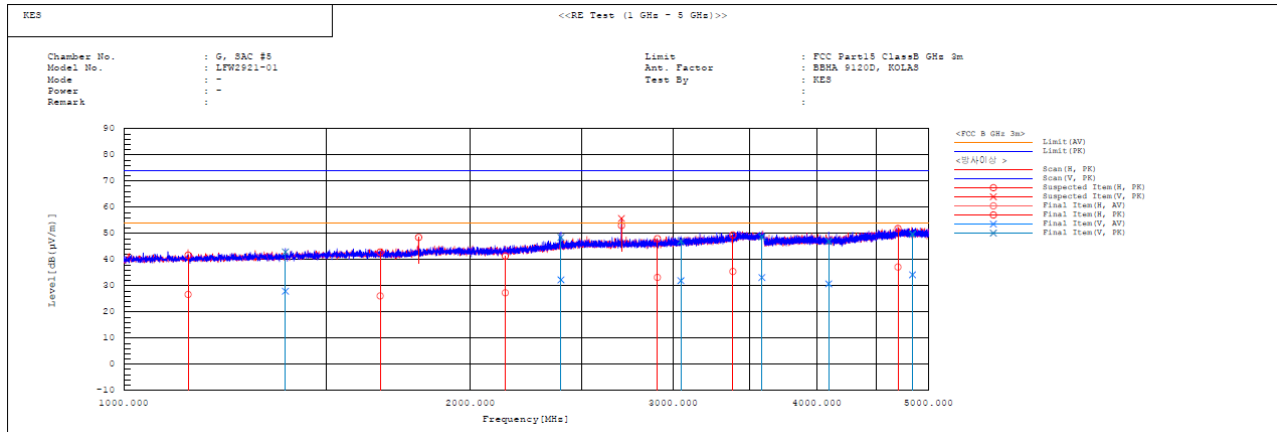
◆ Calculation – SAC #4(10 m)
$$\text{Result(QP)} [\text{dB}(\mu\text{V/m})] = (\text{Reading(QP)} [\text{dB}(\mu\text{V})] + \text{c.f} [\text{dB}(1/\text{m})])$$
$$\text{Margin(QP)} [\text{dB}] = \text{Limit} [\text{dB}(\mu\text{V/m})] - \text{Result(QP)} [\text{dB}(\mu\text{V/m})]$$

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

**Radiated Electric Field Emissions(Above 1 GHz)**

- (1 ~ 5) GHz

**Final Result**

No.	Frequency [MHz]	Pol	Reading AV [dB(μV/m)]	Reading PK [dB(μV/m)]	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	1137.624	H	27.9	42.9	-1.2	26.7	41.7	54.0	74.0	27.3	32.3	400.0	48.1	
2	1382.242	V	27.9	42.9	0.0	27.9	42.9	54.0	74.0	26.1	31.1	118.0	75.5	
3	1670.284	H	24.8	41.6	1.3	26.1	42.9	54.0	74.0	27.9	31.1	359.0	138.7	
4	2145.158	H	24.1	38.2	3.2	27.3	41.4	54.0	74.0	26.7	32.6	192.0	187.3	
5	2397.485	V	28.0	44.2	4.3	32.3	48.5	54.0	74.0	21.7	25.5	149.0	194.1	
6	2907.429	H	27.3	42.1	5.9	33.2	48.0	54.0	74.0	20.8	26.0	295.0	183.0	
7	3047.586	V	25.6	40.8	6.3	31.9	47.1	54.0	74.0	22.1	26.9	166.0	207.1	
8	3380.899	H	28.7	42.6	6.8	35.5	49.4	54.0	74.0	18.5	24.6	201.0	77.7	
9	3582.687	V	26.0	41.5	7.1	33.1	48.6	54.0	74.0	20.9	25.4	106.0	2.7	
10	4095.436	V	22.0	38.3	8.7	30.7	47.0	54.0	74.0	23.3	27.0	107.0	238.7	
11	4703.382	H	26.2	40.9	11.0	37.2	51.9	54.0	74.0	16.8	22.1	372.0	156.6	
12	4842.458	V	22.4	37.9	11.8	34.2	49.7	54.0	74.0	19.8	24.3	162.0	240.7	
13	1804.000	H	-----	-----	1.9	-----	-----	-----	-----	-----	-----	312.0	106.9	
14	2706.000	H	-----	-----	5.3	-----	-----	-----	-----	-----	-----	142.0	324.0	
15	2706.100	V	-----	-----	5.3	-----	-----	-----	-----	-----	-----	156.0	288.7	

*** Exclusion bands**

Harmonic Frequency: 1 805 MHz, 2 707 MHz

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

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