G4B(www.g4b.go.kr)진위확인코드 : tZM/7C7QW1A=

시점확인 진본 2023-11-06 15:32:08 KST 정부시점확인센터

TEST REPORT

KES Co., Ltd.
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1. Client

Applicant	: Wavecompany LTD.
Applicant Address	: B-#716 DMC Hi-Tech Industry Center, 330, Seongam-ro, Mapo-gu, Seoul, Korea

2. Sample Description

Product name	: Electric stimulator
Model/Type No.	: 2ch E-Stim MV2
Variant Model	: -
Manufacturer	: Wavecompany LTD.
Manufacturer Address	: B-#716 DMC Hi-Tech Industry Center, 330, Seongam-ro, Mapo-gu, Seoul, Korea
3. FCC ID	: 2BCWF2CHESTIMMV2
4. Date of Receipt	: Aug. 24, 2023
5. Test date	: Sep. 17, 2023 ~ Sep. 18, 2023
6. Date of Issue	: Nov. 06, 2023
7. Test Results	: 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
Nov. 06, 2023	KES-EM-23T0947	Issued

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1.0 General Product Description

Main Specifications of EUT are:

Division	Characteristic
Frequency	Bluetooth
Power	Charge : DC 5 V (USB) Operating : DC 3.7 V (Battery / 250 mAh)
Components	EUT x 1 EA , Cable x 2 EA , Pad 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.

☒ 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
Electric stimulator	2ch E-stim MV2	-	Wavecompany LTD.	EUT
Pad	-	-	-	-

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Smartphone	SM-G955N	-	Samsung Electronics Co., Ltd.	-
Adapter	MCS-04KD	-	Dongdo Electronics(Yantai) Co.,Ltd.	
Osciloscope	DS1074Z	-	RIGOL	
Probe	-	-	-	

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1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
Electric stimulator (EUT)	USB C Type	Adapter	USB	0.8	U
	Wireless	Smartphone	Wireless	-	-
	3.5 ㎜	Pad (EUT)	2 Pin	0.5	U
	3.5 ㎜		2 Pin	0.5	U
Pad (EUT)	2 Pin	Probe	2 Pin	1.0	U
Probe	BNC	Osciloscope	BNC	-	-

* Unshielded = U, Shielded = S

1.7 EUT Operating Mode(s)

Test mode	Normal operating
Operating	1 . The charging status of LED was confirmed through EUT. 2. Connect EUT and Pad with a wire. 3. Check the pulse waveform through Pad and Probe. 4. EUT and Smartphone were connected wirelessly and the communication status was checked through the program(nRF Tool) provided by applicant.

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

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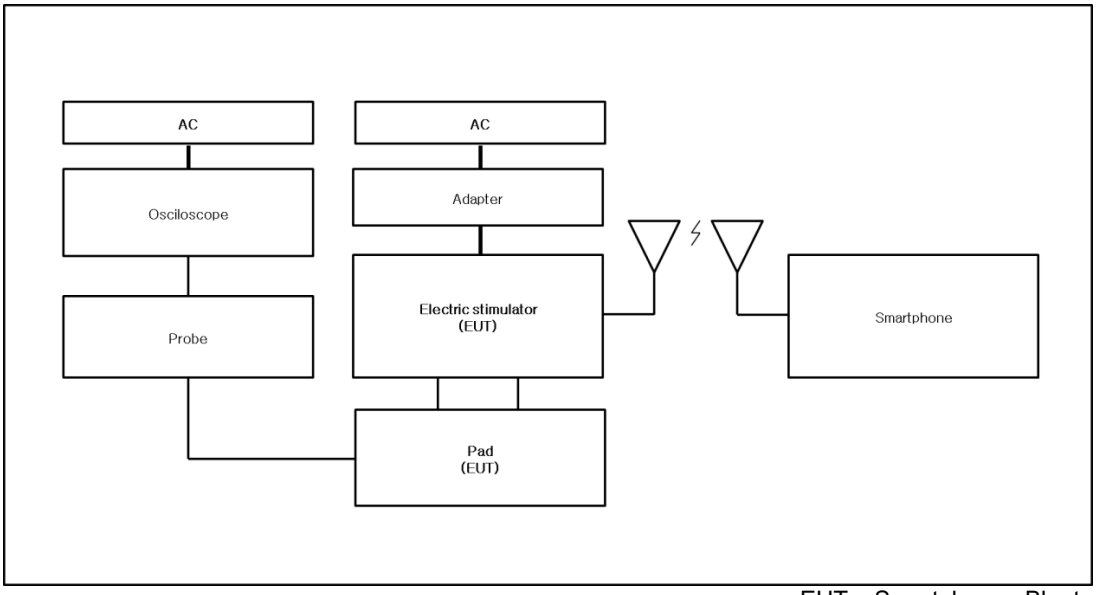
1.8 Configuration



EUT – Smartphone : Bluetooth

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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, Republic of. 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 ㎑ to 30 ㎒. 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㎓ at 10 m or 3 m distance and a Peak and Average detector above 1 ㎓ 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-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

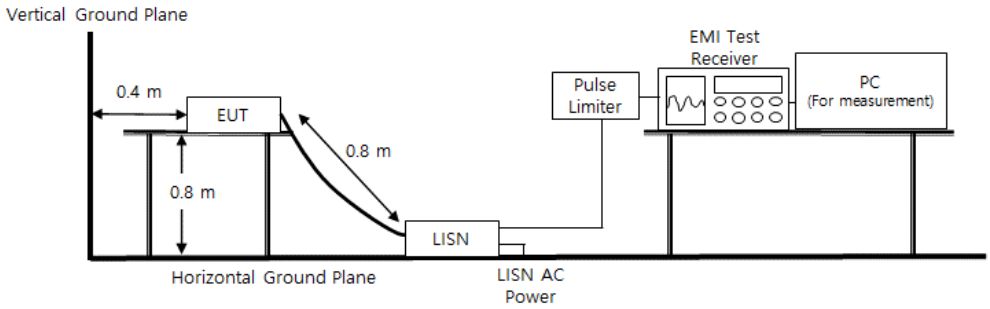
Test Date
Sep. 18, 2023

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, 11, 2023	1 Year
☒	LISN	ENV216	R & S	101787	11, 10, 2023	1 Year
☒	LISN	ESH2-Z5	R & S	100450	11, 10, 2023	1 Year
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 10, 2023	1 Year

Diagram of test setup



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Test Conditions

Temperature:	(24,1 ± 0,1) ℃
Relative Humidity:	(48,5 ± 0,0) % R.H.

Frequency Range of Measurement

150 ㎑ to 30 ㎒

Instrument Settings

IF Band Width: 9 ㎑

Test Results

The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

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2.2 Radiated Electric Field Emissions(Below 1 ㎓)

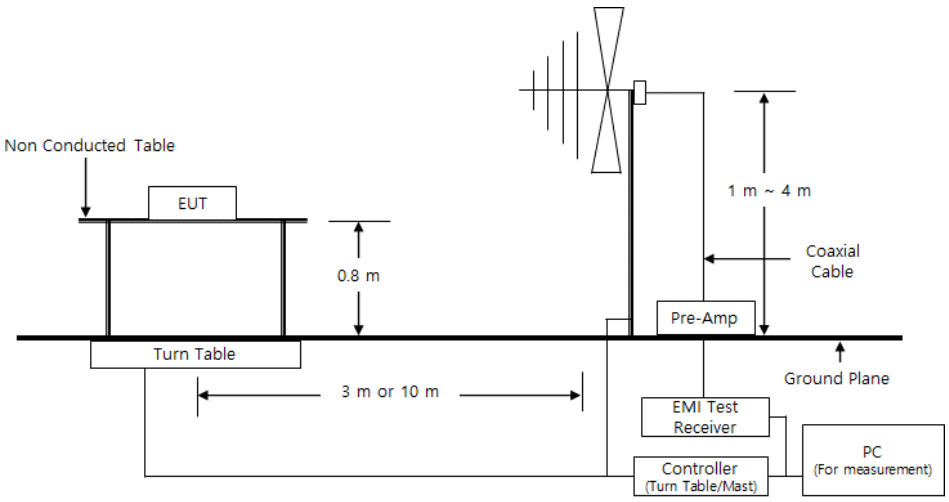
Test Date
Sep. 17, 2023

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
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	03, 21, 2024	1 Year
☒	AMPLIFIER	SCU 01	R & S	100603	11, 10, 2023	1 Year
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 17, 2024	2 Year
☒	ATTENUATOR	8491A	HP	32173	03, 03, 2024	1 Year

Diagram of test setup



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Test Conditions

Temperature: (24,4 ± 0,1) ℃
Relative Humidity: (48,6 ± 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.

G4B(www.g4b.go.kr)진위확인코드 : tZM/7C7QW1A=

2.3 Radiated Electric Field Emissions(Above 1 ㎓)

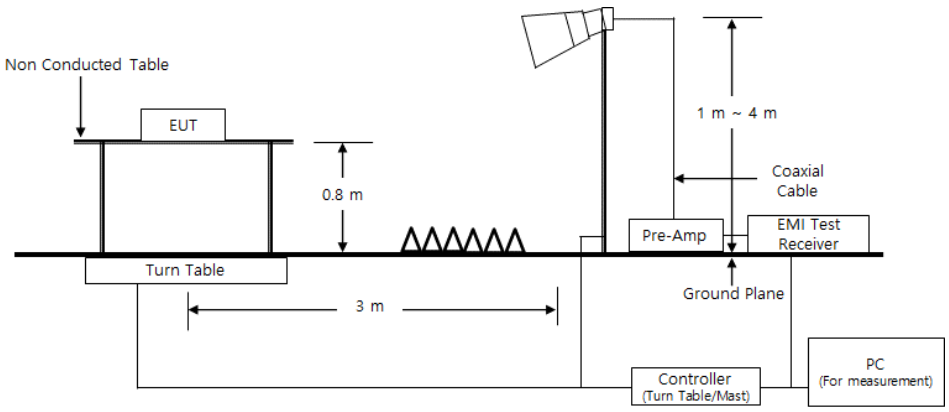
Test Date
Sep. 18, 2023

Test Location
SEMI ANECHOIC CHAMBER #5

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	Rohde & Schwarz	100552	03, 21, 2024	1 Year
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	11, 08, 2023	1 Year
☒	PREAMPLIFIER	8449B	HP	3008A00538	05, 31, 2024	1 Year
☒	ATTENUATOR	8491B	HP	23094	03, 21, 2024	1 Year

Diagram of test setup



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G4B(www.g4b.go.kr)진위확인코드 : tZM/7C7QW1A=

Test Conditions

Temperature: (24,2 ± 0,1) ℃
Relative Humidity: (48,1 ± 0,0) % 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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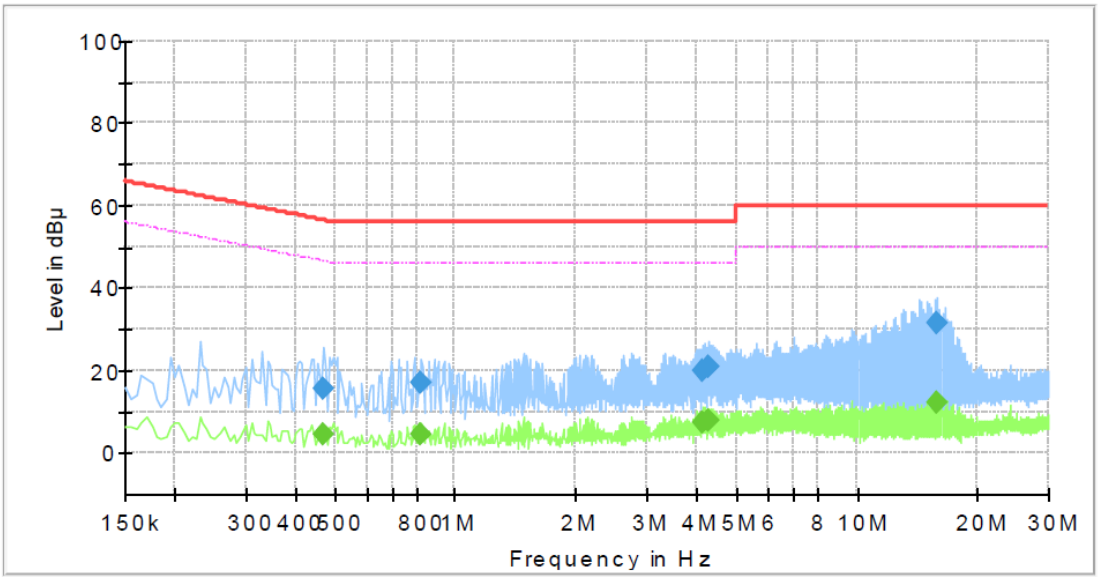
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

HOT LINE

Common Information

Test Description:	Conducted Emission
Model No.:	2ch E-Stim MV2
Phase:	
Mode:	Bluetooth
Operator Name:	KES



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.470000	---	4.63	46.51	41.88	1000.0	9.000	L1	19.4
0.470000	15.65	---	56.51	40.86	1000.0	9.000	L1	19.4
0.820000	---	4.49	46.00	41.51	1000.0	9.000	L1	19.5
0.820000	16.91	---	56.00	39.09	1000.0	9.000	L1	19.5
4.145000	---	7.43	46.00	38.57	1000.0	9.000	L1	19.7
4.145000	20.15	---	56.00	35.85	1000.0	9.000	L1	19.7
4.255000	---	7.92	46.00	38.08	1000.0	9.000	L1	19.7
4.255000	20.78	---	56.00	35.22	1000.0	9.000	L1	19.7
15.805000	---	12.00	50.00	38.00	1000.0	9.000	L1	20.1
15.805000	31.45	---	60.00	28.55	1000.0	9.000	L1	20.1

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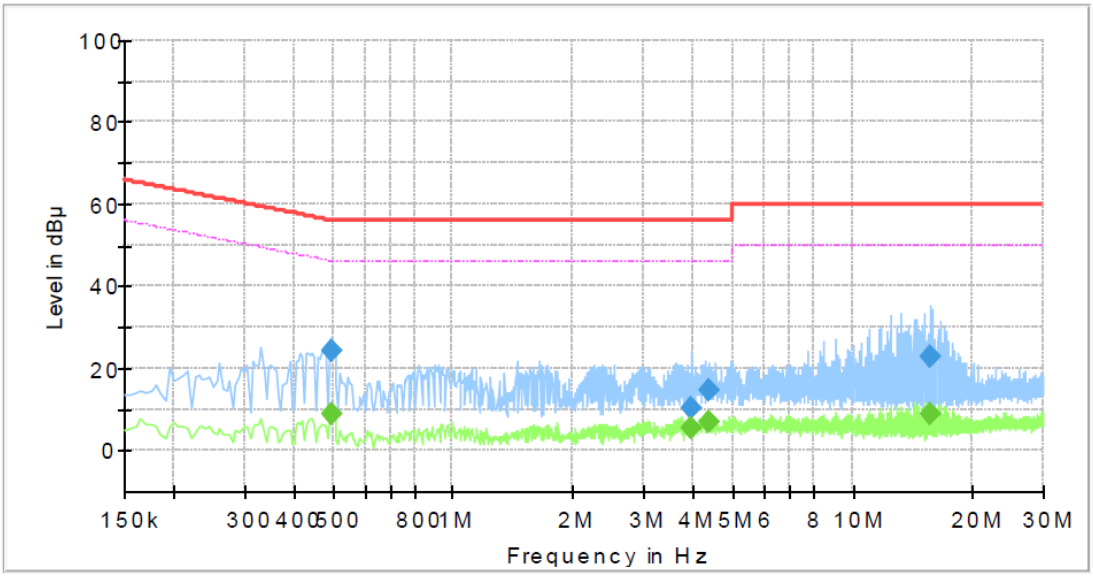
NEUTRAL LINE

Common Information

Test Description:	Conducted Emission
Model No.:	2ch E-Stim MV2
Phase:	
Mode:	Bluetooth
Operator Name:	KES



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.495000	---	8.62	46.08	37.46	1000.0	9.000	N	19.4
0.495000	24.06	---	56.08	32.02	1000.0	9.000	N	19.4
3.965000	---	5.31	46.00	40.69	1000.0	9.000	N	19.7
3.965000	10.19	---	56.00	45.81	1000.0	9.000	N	19.7
4.375000	---	6.83	46.00	39.17	1000.0	9.000	N	19.7
4.375000	14.80	---	56.00	41.20	1000.0	9.000	N	19.7
15.755000	---	8.93	50.00	41.07	1000.0	9.000	N	20.1
15.755000	22.92	---	60.00	37.08	1000.0	9.000	N	20.1

♦ 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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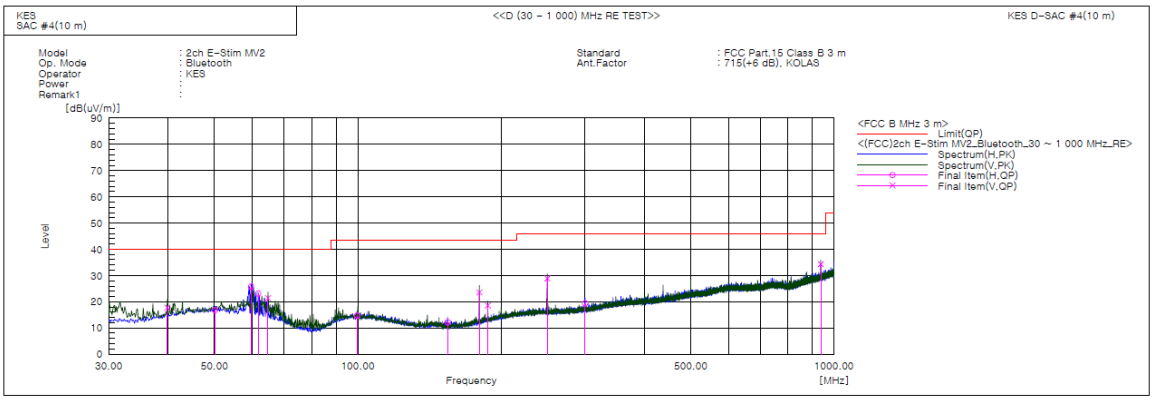
Radiated Electric Field Emissions(Below 1 ㎓)



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	39.821	V	40.5	-22.7	17.8	40.0	22.2	100.0	299.0	
2	50.128	H	37.7	-20.9	16.8	40.0	23.2	400.0	3.0	
3	59.706	H	47.8	-22.0	25.8	40.0	14.2	400.0	5.0	
4	61.768	H	45.5	-22.4	23.1	40.0	16.9	400.0	5.0	
5	64.799	V	44.6	-23.2	21.4	40.0	18.6	135.0	11.0	
6	99.598	H	37.4	-22.7	14.7	43.5	28.8	248.0	23.0	
7	154.524	H	37.8	-25.6	12.2	43.5	31.3	198.0	176.0	
8	179.986	V	47.6	-24.0	23.6	43.5	19.9	152.0	31.0	
9	187.504	V	41.8	-23.2	18.6	43.5	24.9	110.0	280.0	
10	249.948	V	48.7	-19.8	28.9	46.0	17.1	100.0	3.0	
11	300.024	H	37.9	-18.5	19.4	46.0	26.6	400.0	112.0	
12	937.556	V	39.5	-5.1	34.4	46.0	11.6	400.0	124.0	

♦ Calculation – SAC #4(10 m)
Result(QP) [㏈(㎶/m)] = (Reading(QP)[㏈(㎶)] + c.f[㏈(1/m)]
Margin(QP)[㏈] = Limit[㏈(㎶/m)] - Result(QP) [㏈(㎶/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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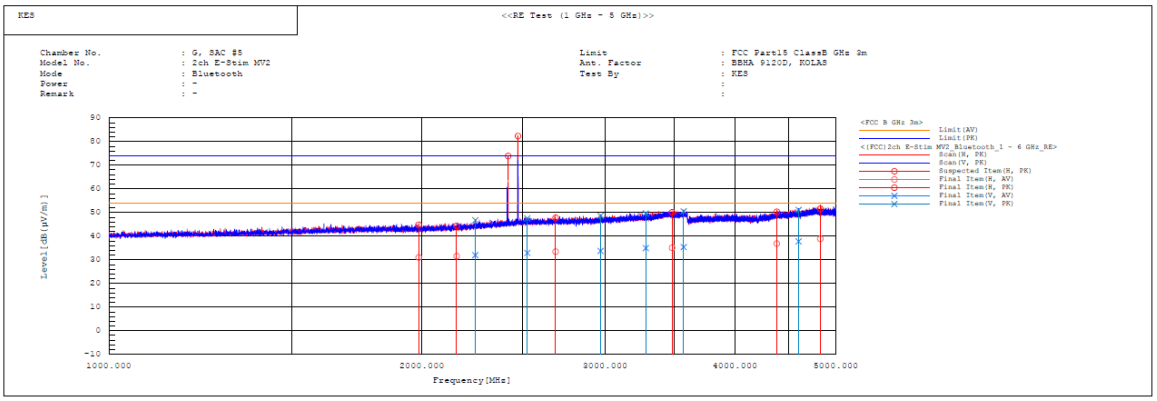
Radiated Electric Field Emissions(Above 1 ㎓)

- (1 ~ 5) ㎓



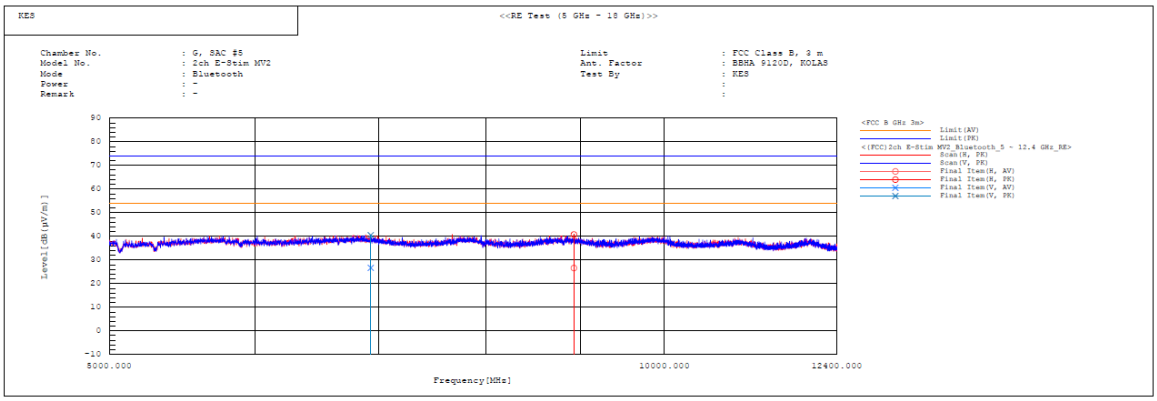
Final Result

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	1986.268	H	28.4	42.2	2.6	31.0	44.8	54.0	74.0	23.0	29.2	400.0	46.9	
2	2160.409	H	28.3	41.1	3.3	31.6	44.4	54.0	74.0	22.4	29.6	400.0	300.5	
3	2251.615	V	28.3	43.1	3.7	32.0	46.8	54.0	74.0	22.0	27.2	110.0	60.3	
4	2525.635	V	28.2	42.8	4.7	32.9	47.5	54.0	74.0	21.1	26.5	100.0	193.6	
5	2688.702	H	28.2	42.5	5.3	33.5	47.8	54.0	74.0	20.5	26.2	298.0	80.6	
6	2970.715	V	27.6	42.4	6.2	33.8	48.6	54.0	74.0	20.2	25.4	107.0	137.4	
7	3283.118	V	28.4	43.0	6.6	35.0	49.6	54.0	74.0	19.0	24.4	124.0	15.6	
8	3480.445	H	28.3	43.3	6.8	35.1	50.1	54.0	74.0	18.9	23.9	400.0	23.7	
9	3569.982	V	28.5	43.6	6.9	35.4	50.5	54.0	74.0	18.6	23.5	100.0	218.9	
10	4387.332	H	26.8	40.2	10.1	36.9	50.3	54.0	74.0	17.1	23.7	355.0	317.3	
11	4605.200	V	27.5	40.8	10.3	37.8	51.1	54.0	74.0	16.2	22.9	100.0	193.6	
12	4832.001	H	27.3	40.0	11.6	38.9	51.6	54.0	74.0	15.1	22.4	370.0	306.3	
13	2420.800	H	---------	---------	4.4	----------	----------	----------	----------	--------	--------	400.0	83.6	
14	2474.000	H	---------	---------	4.6	----------	----------	----------	----------	--------	--------	400.0	335.9	

* Exclusion bands
- Fundamental Frequency: (2 402 ~ 2 480) ㎒

G4B(www.g4b.go.kr)진위확인코드 : tZM/7C7QW1A=

- (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)
6 931.277	40.500	V	1.000	35.940	7.600	34.830	49.210	74.000	24.790
8 931.277	40.800	H	1.000	38.330	9.560	34.530	54.160	74.000	19.840

- 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)
6 931.277	26.700	V	1.000	35.940	7.600	34.830	35.410	54.000	18.590
8 931.277	26.600	H	1.000	38.330	9.560	34.530	39.960	54.000	14.040

♦ 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

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