
EMC TEST REPORT


Test Report No. : KES-EM-22T0965
Date of Issue : Dec. 06, 2022
Product name : FROMIS9 OFFICIAL LIGHT STICK
Model/Type No. : FRFA23JOS900NN0
Variant Mode : -
Applicant : ELCOMTEC CO., LTD.
Applicant Address : 231, Dongbu-daero, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, Republic of Korea
Manufacturer : ELCOMTEC CO., LTD.
Manufacturer Address : 231, Dongbu-daero, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, Republic of Korea
FCC ID : 2A9BA-FRFA23JO
Date of Receipt : Nov. 03, 2022
Test date : Nov. 29, 2022
Test Results : **In Compliance** **Not in Compliance**

Tested by



Dae Hyun, Kim
EMC Test Engineer

Reviewed by



Dong Hun, Jang
EMC Technical Manager



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (2) of (29)

REPORT REVISION HISTORY

| Date | Test Report No. | Revision History |
|---------------|------------------------|-------------------------|
| Dec. 06, 2022 | KES-EM-22T0965 | Issued |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd. This document may be altered or revised by KES Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by KES Co., Ltd. will constitute fraud and shall nullify the document.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



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 | Support Equipments | 5 |
| 1.6 | External I/O Cabling | 6 |
| 1.7 | EUT Operating Mode(s) | 6 |
| 1.8 | Configuration..... | 7 |
| 1.9 | Remarks when standards applied | 8 |
| 1.10 | Calibration Details of Equipment Used for Measurement | 8 |
| 1.11 | Test Facility | 8 |
| 1.12 | Measurement Procedure..... | 8 |
| 1.13 | 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)..... | 21 |
| APPENDIX B - Test Setup Photos and Configuration..... | | 25 |
| | Radiated Electric Field Emissions(Below 1 GHz) | 26 |
| | Radiated Electric Field Emissions(Above 1 GHz)..... | 28 |



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (4) of (29)

1.0 General Product Description

Main Specifications of EUT are:

| Division | Characteristic |
|------------|--|
| Frequency | Bluetooth 2.4 GHz Band , Zigbee 2.4 GHz Band |
| Power | DC 4.5 V (AAA Battery x 3 EA) |
| Components | EUT x 1 EA |

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

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 (AAA Battery x 3)

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 |
|------------------------------|-----------------|---------------|--------------------|---------|
| FROMIS9 OFFICIAL LIGHT STICK | FRFA23JOS900NN0 | - | ELCOMTEC CO., LTD. | EUT |
| FROMIS9 OFFICIAL LIGHT STICK | FRFA23JOS900NN0 | - | ELCOMTEC 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

■ Bluetooth Mode

| Start | | END | | Cable Spec. | |
|------------------------------------|----------|-------------|----------|-------------|--------|
| Description | I/O Port | Description | I/O Port | Length | Shield |
| FROMIS9 OFFICIAL LIGHT STICK (EUT) | Wireless | SmartPhone | Wireless | - | - |

* Unshielded = U, Shielded = S

■ Zigbee Mode

| Start | | END | | Cable Spec. | |
|------------------------------------|----------|----------------------------------|----------|-------------|--------|
| Description | I/O Port | Description | I/O Port | Length | Shield |
| FROMIS9 OFFICIAL LIGHT STICK (EUT) | Wireless | &TEAM OFFICIAL LIGHT STICK (EUT) | Wireless | - | - |

* Unshielded = U, Shielded = S

1.7 EUT Operating Mode(s)

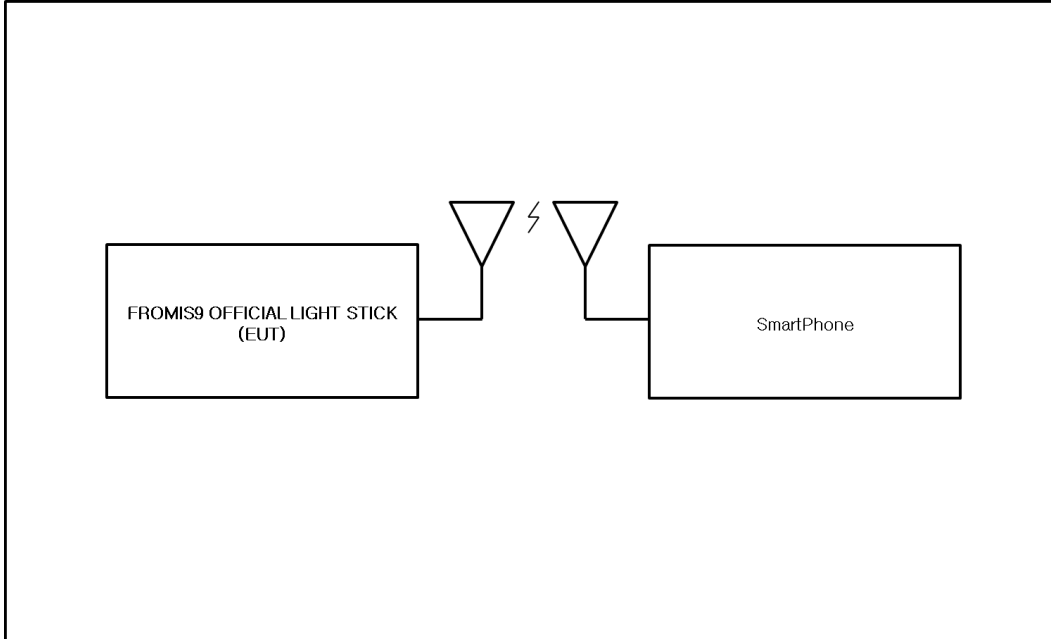
| Test mode | operating |
|-----------|--|
| Bluetooth | Connect EUT and Smart wirelessly. The normal operation state of EUT was confirmed through the application of SmartPhone. |
| Zigbee | The transmission and reception status were checked through the LED of EUT. |

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

1.8 Configuration

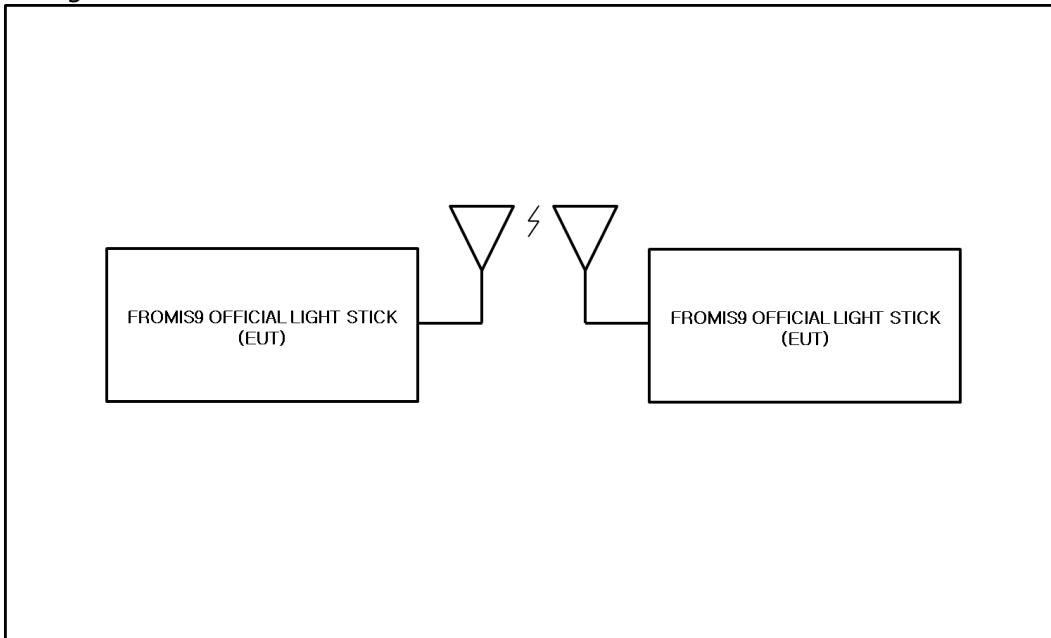
- AC Main
- DC Main

■ Bluetooth Mode



EUT - SmartPhone : Bluetooth 2.4 GHz Band

■ Zigbee Mode



EUT - EUT : Zigbee 2.4 GHz Band

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 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-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 |

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



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

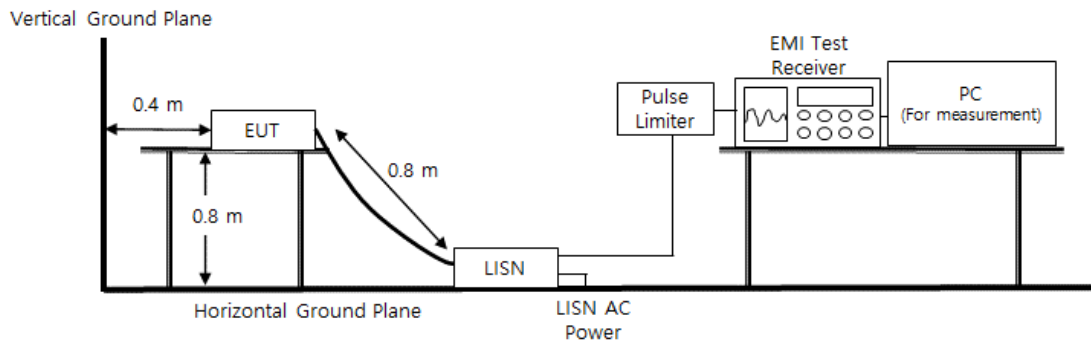
Test Location

Electro wave Shieldroom #6

Test Equipment

| Used | Description | Model Number | Manufacturer | Serial Number | Cal. Due | 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 | 11, 11, 2023 | 1 Year |
| <input type="checkbox"/> | LISN | ENV216 | R & S | 101787 | 11, 10, 2023 | 1 Year |
| <input type="checkbox"/> | LISN | ESH2-Z5 | R & S | 100450 | 11, 10, 2023 | 1 Year |
| <input type="checkbox"/> | PULSE LIMITER | ESH3-Z2 | R & S | 101915 | 11, 10, 2023 | 1 Year |

Diagram of test setup



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (12) of (29)

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

The EUT applied portable Use equipment.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

2.2 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Nov. 29, 2022

Test Location

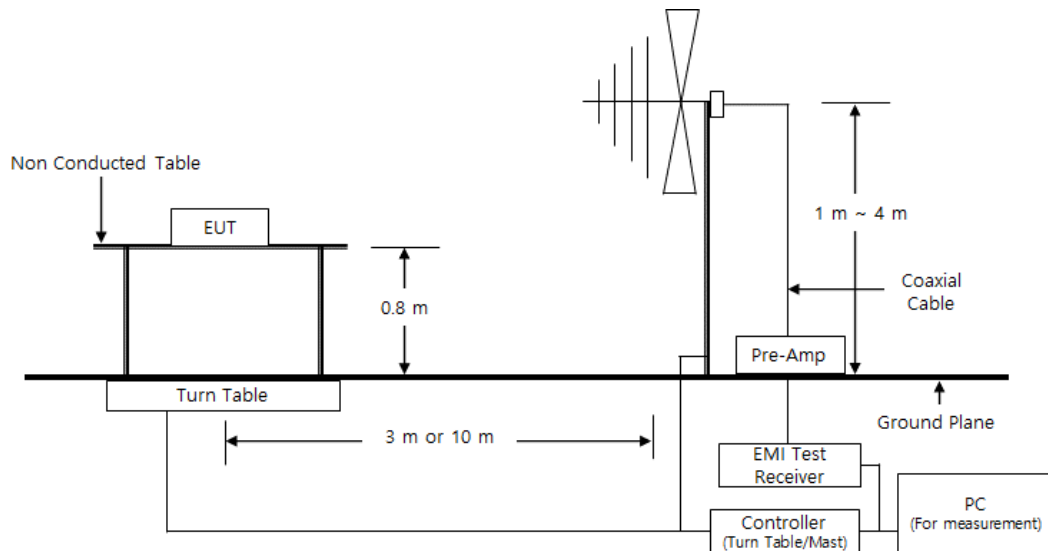
OPEN AREA TEST SITE #2

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 | 1 Year |
| <input checked="" type="checkbox"/> | TRILOG-BROADBAND ANTENNA | VULB9163 | Schwarzbeck | 715 | 11, 17, 2024 | 2 Year |
| <input checked="" type="checkbox"/> | ATTENUATOR | 8491A | HP | 32173 | 03, 08, 2023 | 1 Year |

Diagram of test setup



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (14) of (29)

Test Conditions

Temperature: (22,5 ± 0,1) °C
Relative Humidity: (46,5 ± 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.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

2.3 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Nov. 29, 2022

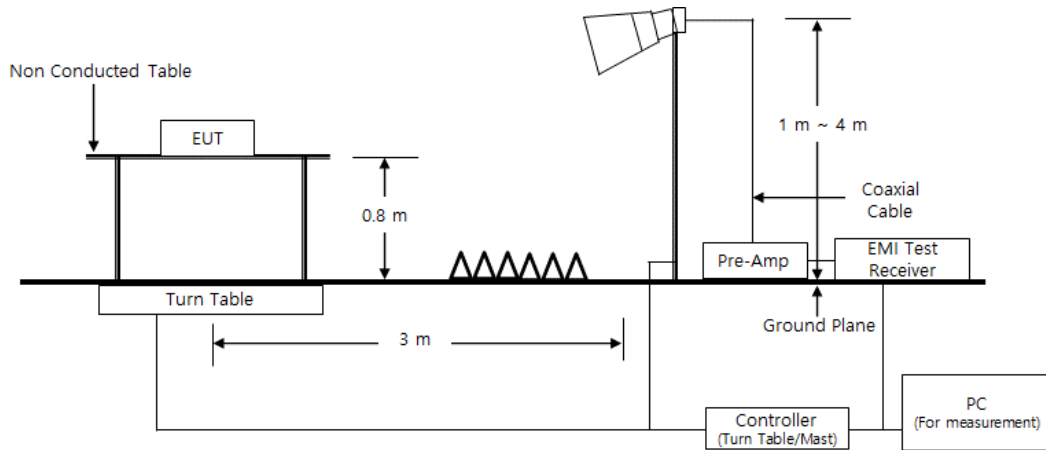
Test Location

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, 31, 2023 | 1 Year |
| ☑ | HORN ANTENNA | BBHA 9120D | SCHWARZBECK | 9120D-1802 | 12, 16, 2022 | 1 Year |
| ☑ | PREAMPLIFIER | 8449B | HP | 3008A00538 | 06, 02, 2023 | 1 Year |
| ☑ | ATTENUATOR | 8491B | HP | 23094 | 04, 21, 2023 | 1 Year |

Diagram of test setup



This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
 The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (16) of (29)

Test Conditions

Temperature: (22,8 ± 0,1) °C
Relative Humidity: (46,4 ± 0,1) % 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.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (17) of (29)

APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports HOT LINE

N/A

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (18) of (29)

NEUTRAL LINE

N/A

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

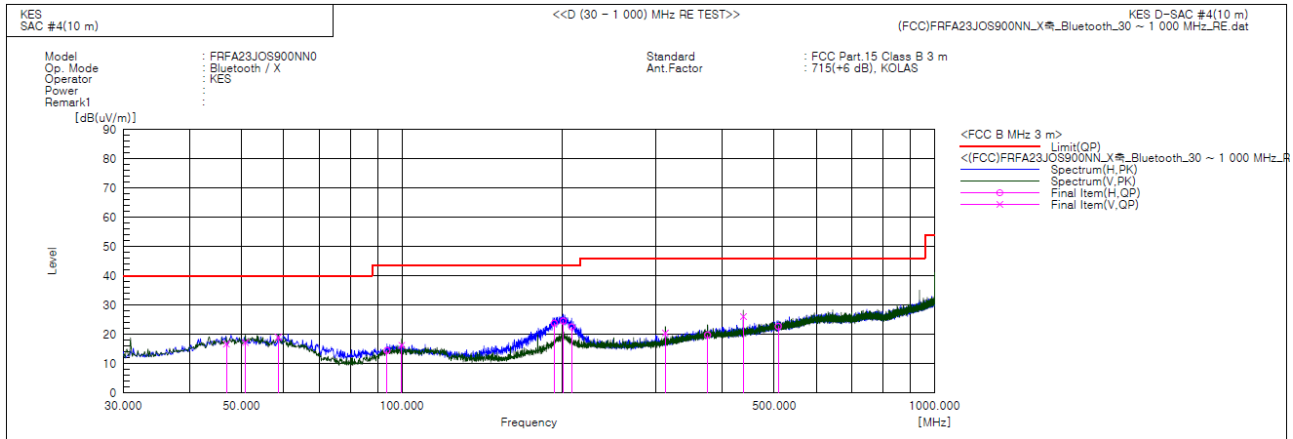
Reading Value : Not shown in the table.

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

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

Radiated Electric Field Emissions(Below 1 GHz)

Bluetooth Mode

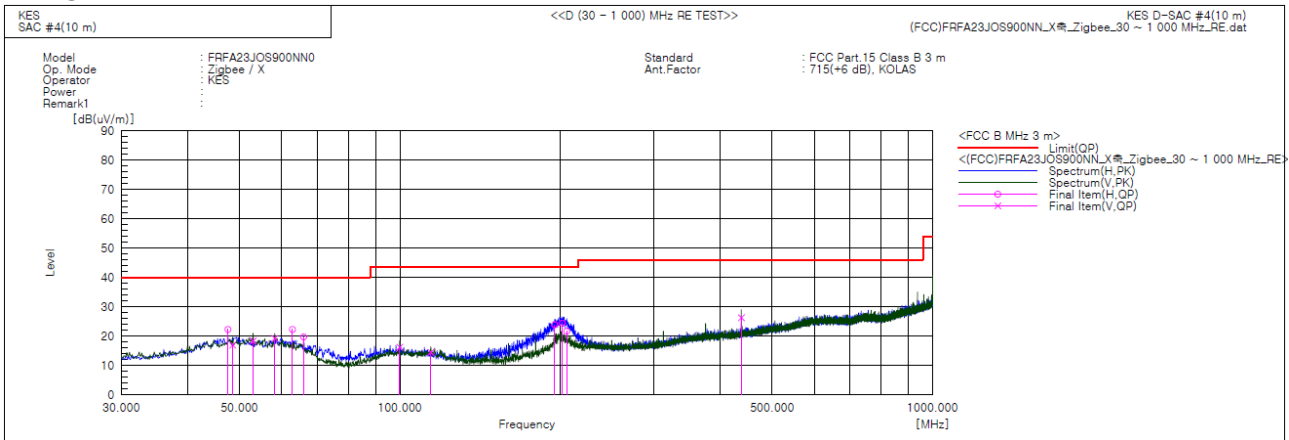


Final Result

| 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 | 46.854 | V | 37.7 | -21.0 | 16.7 | 40.0 | 23.3 | 100.0 | 41.0 | |
| 2 | 50.855 | V | 38.1 | -20.9 | 17.2 | 40.0 | 22.8 | 130.0 | 353.0 | |
| 3 | 58.615 | V | 40.7 | -21.7 | 19.0 | 40.0 | 21.0 | 100.0 | 275.0 | |
| 4 | 93.778 | H | 37.7 | -23.2 | 14.5 | 43.5 | 29.0 | 400.0 | 172.0 | |
| 5 | 99.961 | V | 38.9 | -22.6 | 16.3 | 43.5 | 27.2 | 156.0 | 128.0 | |
| 6 | 193.324 | H | 46.3 | -22.5 | 23.8 | 43.5 | 19.7 | 359.0 | 90.0 | |
| 7 | 200.963 | H | 46.3 | -21.7 | 24.6 | 43.5 | 18.9 | 400.0 | 61.0 | |
| 8 | 208.359 | H | 43.6 | -21.1 | 22.5 | 43.5 | 21.0 | 297.0 | 53.0 | |
| 9 | 312.513 | V | 38.4 | -17.9 | 20.5 | 46.0 | 25.5 | 142.0 | 228.0 | |
| 10 | 374.956 | H | 34.9 | -15.1 | 19.8 | 46.0 | 26.2 | 400.0 | 259.0 | |
| 11 | 437.521 | V | 40.0 | -13.9 | 26.1 | 46.0 | 19.9 | 100.0 | 168.0 | |
| 12 | 508.695 | H | 34.5 | -11.8 | 22.7 | 46.0 | 23.3 | 400.0 | 229.0 | |

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

Zigbee 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 | 47.581 | H | 43.3 | -21.0 | 22.3 | 40.0 | 17.7 | 320.0 | 272.0 | |
| 2 | 48.551 | V | 37.8 | -20.9 | 16.9 | 40.0 | 23.1 | 100.0 | 301.0 | |
| 3 | 53.038 | V | 39.3 | -20.9 | 18.4 | 40.0 | 21.6 | 125.0 | 115.0 | |
| 4 | 58.251 | V | 40.9 | -21.7 | 19.2 | 40.0 | 20.8 | 100.0 | 312.0 | |
| 5 | 62.859 | H | 45.0 | -22.7 | 22.3 | 40.0 | 17.7 | 400.0 | 271.0 | |
| 6 | 66.011 | H | 43.3 | -23.6 | 19.7 | 40.0 | 20.3 | 400.0 | 263.0 | |
| 7 | 99.970 | V | 38.8 | -22.6 | 16.2 | 43.5 | 27.3 | 151.0 | 149.0 | |
| 8 | 114.390 | V | 38.2 | -23.7 | 14.5 | 43.5 | 29.0 | 150.0 | 254.0 | |
| 9 | 195.385 | H | 46.2 | -22.3 | 23.9 | 43.5 | 19.6 | 380.0 | 60.0 | |
| 10 | 201.811 | H | 46.0 | -21.6 | 24.4 | 43.5 | 19.1 | 330.0 | 90.0 | |
| 11 | 205.813 | H | 43.0 | -21.3 | 21.7 | 43.5 | 21.8 | 400.0 | 41.0 | |
| 12 | 437.532 | V | 40.2 | -13.9 | 26.3 | 46.0 | 19.7 | 100.0 | 88.0 | |

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

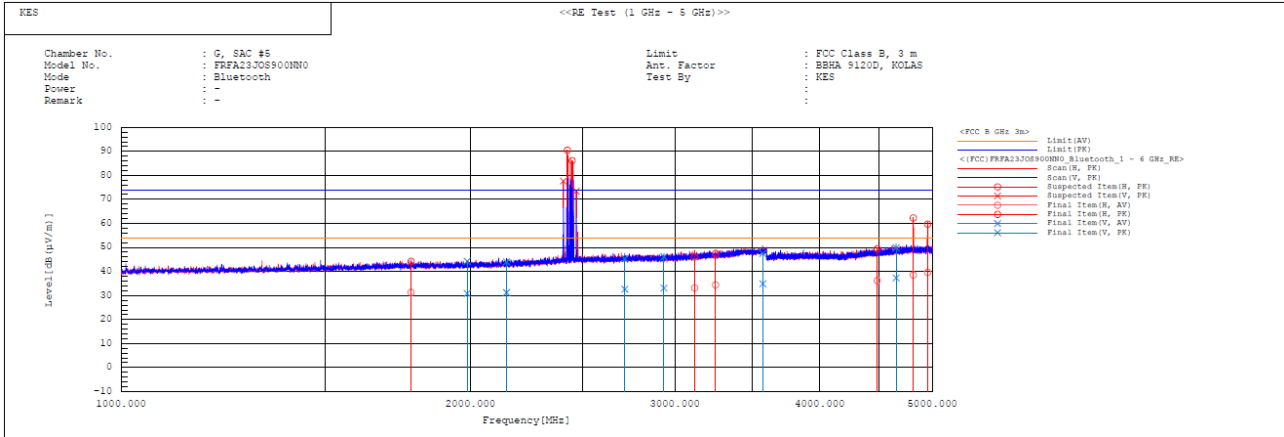
Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value



Radiated Electric Field Emissions(Above 1 GHz)

Bluetooth Mode

- (1 ~ 5) GHz



Final Result

| No. | Frequency [MHz] | Pol | Reading | | c.f | Result | | Limit | | Margin | | Height [cm] | Angle [deg] | Remark |
|-----|-----------------|-----|-------------|-------------|------|---------------|---------------|---------|---------|--------|-------|-------------|-------------|--------|
| | | | AV [dB(μV)] | PK [dB(μV)] | | AV [dB(μV/m)] | PK [dB(μV/m)] | AV [dB] | PK [dB] | | | | | |
| 1 | 1778.323 | H | 30.1 | 43.0 | 1.2 | 31.3 | 44.2 | 54.0 | 74.0 | 22.7 | 29.8 | 400.0 | 247.8 | |
| 2 | 1997.650 | V | 28.9 | 42.3 | 1.9 | 30.8 | 44.2 | 54.0 | 74.0 | 23.2 | 29.8 | 110.0 | 134.9 | |
| 3 | 2149.273 | V | 28.8 | 41.6 | 2.4 | 31.2 | 44.0 | 54.0 | 74.0 | 22.8 | 30.0 | 135.0 | 222.8 | |
| 4 | 2716.893 | V | 28.4 | 41.1 | 4.2 | 32.6 | 45.3 | 54.0 | 74.0 | 21.4 | 28.7 | 100.0 | 123.0 | |
| 5 | 2936.420 | V | 28.3 | 41.3 | 4.8 | 33.1 | 46.1 | 54.0 | 74.0 | 20.9 | 27.9 | 100.0 | 222.8 | |
| 6 | 3121.861 | H | 28.0 | 40.8 | 5.2 | 33.2 | 46.0 | 54.0 | 74.0 | 20.8 | 28.0 | 387.0 | 357.8 | |
| 7 | 3253.602 | H | 29.0 | 42.1 | 5.4 | 34.4 | 47.5 | 54.0 | 74.0 | 19.6 | 26.5 | 350.0 | 186.8 | |
| 8 | 3572.974 | V | 29.0 | 41.6 | 5.9 | 34.9 | 47.5 | 54.0 | 74.0 | 19.1 | 26.5 | 145.0 | 88.7 | |
| 9 | 4484.118 | H | 27.4 | 40.6 | 8.8 | 36.2 | 49.4 | 54.0 | 74.0 | 17.8 | 24.6 | 400.0 | 330.8 | |
| 10 | 4654.007 | V | 28.0 | 40.5 | 5.3 | 37.3 | 49.8 | 54.0 | 74.0 | 16.7 | 24.2 | 100.0 | 345.0 | |
| 11 | 4816.567 | H | 28.4 | 52.2 | 10.1 | 38.5 | 62.3 | 54.0 | 74.0 | 15.5 | 11.7 | 400.0 | 13.8 | |
| 12 | 4955.605 | H | 28.8 | 48.9 | 10.8 | 39.6 | 59.7 | 54.0 | 74.0 | 14.4 | 14.3 | 320.0 | 5.2 | |
| 13 | 2406.000 | V | ----- | ----- | 3.3 | ----- | ----- | ----- | ----- | ----- | ----- | 100.0 | 134.9 | |
| 14 | 2424.000 | H | ----- | ----- | 3.3 | ----- | ----- | ----- | ----- | ----- | ----- | 400.0 | 56.9 | |
| 15 | 2447.600 | H | ----- | ----- | 3.4 | ----- | ----- | ----- | ----- | ----- | ----- | 400.0 | 109.6 | |
| 16 | 2467.600 | V | ----- | ----- | 3.4 | ----- | ----- | ----- | ----- | ----- | ----- | 100.0 | 357.8 | |

* Exclusion Bands

- Fundamental Frequency: 2.4 GHz

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr

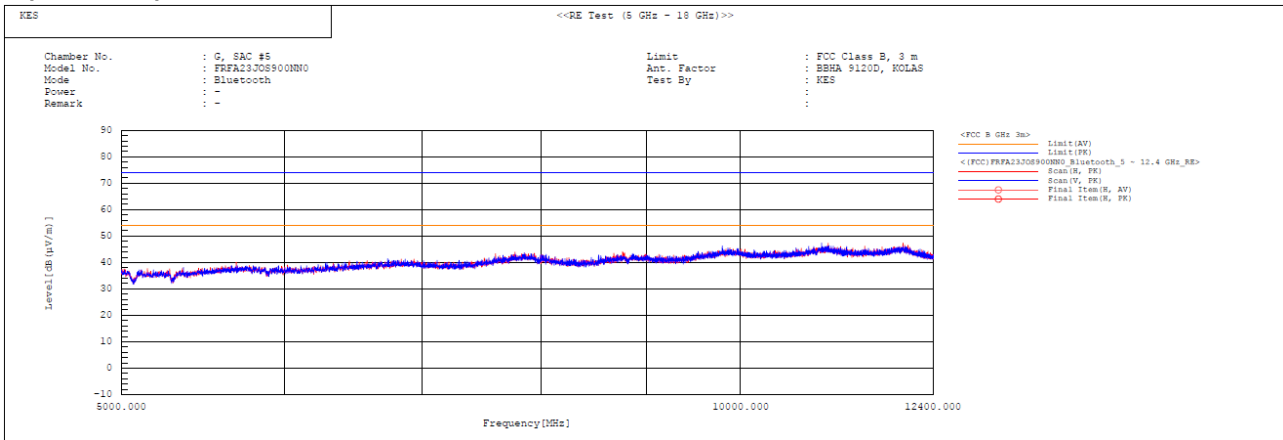


KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

Report No.:
KES-EM-22T0965
Page (22) of (29)

- (5 ~ 12,4) GHz



* No spurious emission were detected above 5 GHz.

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
The authenticity of the test report, contact shchoi@kes.co.kr



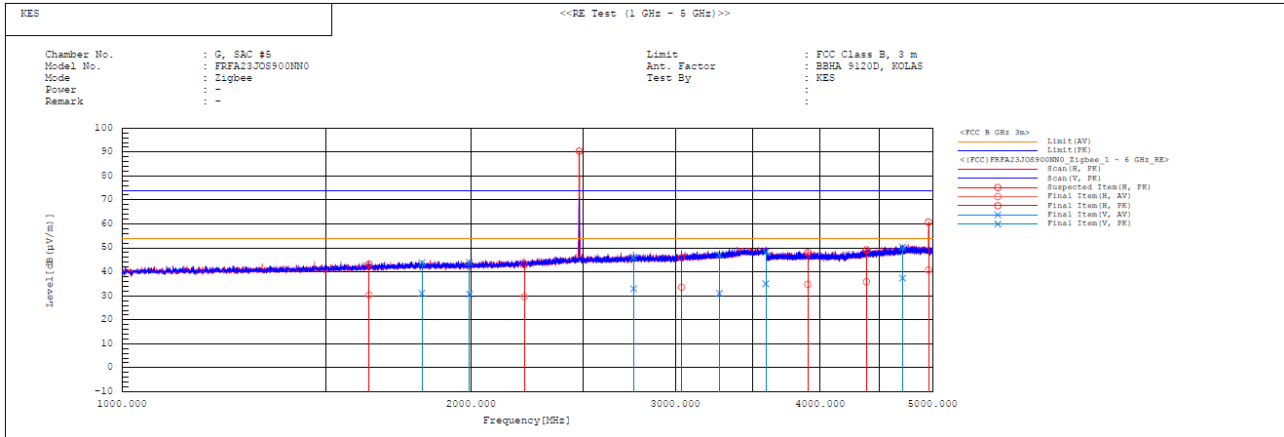
KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
 Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
 Tel: +82-31-425-6200 / Fax: +82-31-424-0450
 www.kes.co.kr

Report No.:
 KES-EM-22T0965
 Page (23) of (29)

■ Zigbee Mode

- (1 ~ 5) GHz



Final Result

| No. | Frequency [MHz] | Pol | Reading | | c.f | Result | | Limit | | Margin | | Height [cm] | Angle [deg] | Remark |
|-----|-----------------|-----|--------------|--------------|------|----------------|----------------|---------|---------|---------|---------|-------------|-------------|--------|
| | | | AV [dB (µV)] | PK [dB (µV)] | | AV [dB (µV/m)] | PK [dB (µV/m)] | AV [dB] | PK [dB] | AV [dB] | PK [dB] | | | |
| 1 | 1814.663 | V | 29.8 | 42.5 | 1.3 | 31.1 | 43.8 | 54.0 | 74.0 | 22.9 | 30.2 | 122.0 | 226.8 | |
| 2 | 1994.009 | V | 28.8 | 41.9 | 1.9 | 30.7 | 43.8 | 54.0 | 74.0 | 23.3 | 30.2 | 100.0 | 197.2 | |
| 3 | 2762.984 | V | 28.5 | 41.7 | 4.4 | 32.9 | 46.1 | 54.0 | 74.0 | 21.1 | 27.9 | 153.0 | 292.9 | |
| 4 | 3275.684 | V | 25.6 | 41.7 | 5.4 | 31.0 | 47.1 | 54.0 | 74.0 | 23.0 | 26.9 | 110.0 | 349.1 | |
| 5 | 3590.803 | V | 29.0 | 42.2 | 6.0 | 35.0 | 48.2 | 54.0 | 74.0 | 19.0 | 25.8 | 100.0 | 244.6 | |
| 6 | 4712.456 | V | 27.8 | 40.7 | 9.6 | 37.4 | 50.3 | 54.0 | 74.0 | 16.6 | 23.7 | 100.0 | 271.7 | |
| 7 | 1633.515 | H | 30.0 | 42.9 | 0.4 | 30.4 | 43.3 | 54.0 | 74.0 | 23.6 | 30.7 | 400.0 | 228.6 | |
| 8 | 2223.671 | H | 27.1 | 40.4 | 2.6 | 29.7 | 43.0 | 54.0 | 74.0 | 24.3 | 31.0 | 390.0 | 237.7 | |
| 9 | 3038.400 | H | 28.6 | 40.9 | 5.0 | 33.6 | 45.9 | 54.0 | 74.0 | 20.4 | 28.1 | 400.0 | 138.5 | |
| 10 | 3903.218 | H | 28.2 | 41.4 | 6.6 | 34.8 | 48.0 | 54.0 | 74.0 | 19.2 | 26.0 | 400.0 | 359.5 | |
| 11 | 4386.073 | H | 27.3 | 40.6 | 8.6 | 35.9 | 49.2 | 54.0 | 74.0 | 18.1 | 24.8 | 357.0 | 277.9 | |
| 12 | 4960.894 | H | 29.9 | 49.9 | 10.9 | 40.8 | 60.8 | 54.0 | 74.0 | 13.2 | 13.2 | 370.0 | 99.4 | |
| 13 | 2480.000 | H | ----- | ----- | 3.5 | ----- | ----- | ----- | ----- | ----- | ----- | 400.0 | 106.8 | |

* Exclusion Bands

- Fundamental Frequency: 2.4 GHz

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
 The authenticity of the test report, contact shchoi@kes.co.kr

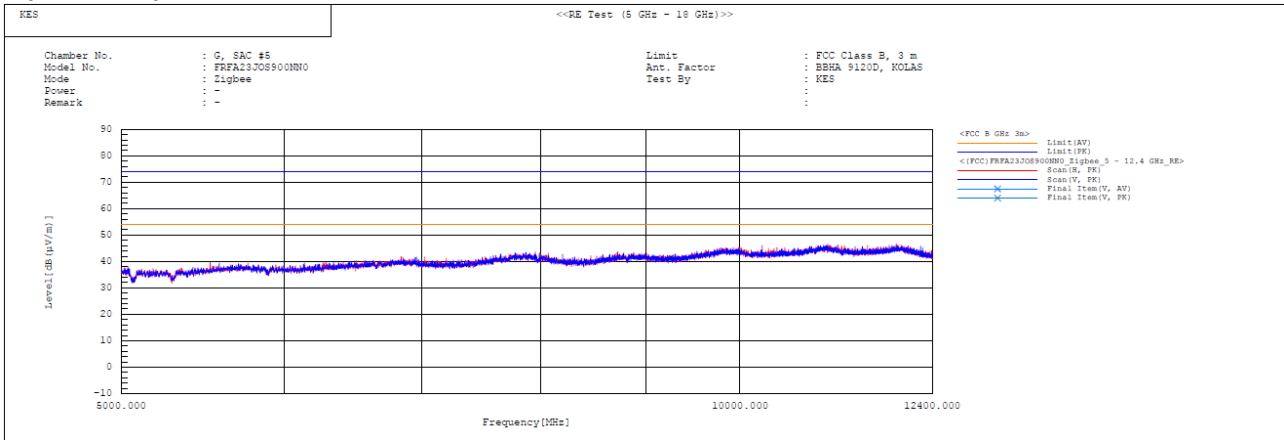


KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil,
 Dongan-gu, Anyang-si, Gyeonggi-do, 14057, Korea
 Tel: +82-31-425-6200 / Fax: +82-31-424-0450
 www.kes.co.kr

Report No.:
 KES-EM-22T0965
 Page (24) of (29)

- (5 ~ 12,4) GHz



* No spurious emission were detected above 5 GHz.

◆ Calculation

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

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

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: Marjin value

This report shall not be reproduced except in full, without the written approval of KES Co., Ltd.
 The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
 The authenticity of the test report, contact shchoi@kes.co.kr