

**KES Co., Ltd.**

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Tel: +82-31-425-6200 / Fax: +82-31-424-0450  
www.kes.co.kr

Report No.:

KES-E2-19T0098

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# EMC TEST REPORT

Test Report No. : KES-E2-19T0098  
Date of Issue : Oct. 01, 2019  
Product name : Smart Ear  
Model/Type No. : DHFA2FWU  
Variant Mode : DHFA2FBU, DHFA2FGU  
Applicant : Olive Union inc  
Applicant Address : 15, Beobwon-ro, Seocho-gu, Seoul, Republic of Korea  
Manufacturer : MOSTOP Co.,Ltd.  
Manufacturer Address : 9-9, Dongtansandan 4-gil, Dongtan-myeon, Hwasung-si, Gyeonggi-do, Korea  
FCC ID : 2AOLH-DHFA2FWU  
Date of Receipt : Aug. 02, 2019  
Test date : Aug. 29, 2019 ~ Aug. 30, 2019  
Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

*Tested by*

Dae Hyun, Kim  
EMC Test Engineer

*Reviewed by*

Dong-Hun, Jang  
EMC Technical Manager

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**REPORT REVISION HISTORY**

Date	Test Report No.	Revision History
Oct. 01, 2019	KES-E2-19T0098	Issued

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## 1.0 General Product Description

### Main Specifications of EUT are:

Item	spec
Operating Frequency	2.4 GHz (Bluetooth)
Power	Earphone : DC 3.7 V (Battery) Cradle : DC 5 V (USB)
Size	Earphone : (20 x 20 x 24) mm Cradle : (38 x 38 x 21) mm
Weight	Earphone : 7 g Cradle : 60 g

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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.

Voltage ☐ 230 Vac ☒ 120 Vac ☐ 12 Vdc ☒ DC 3.7 V (Battery)

Frequency ☐ 50 Hz ☒ 60 Hz ☐ Hz

### 1.2 Variant Model Differences

Color difference - DHFA2FBU(Black), DHFA2FGU(Gold)

### 1.3 Device Modifications

Not applicable

### 1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Smart Ear	DHFA2FWU	-	MOSTOP Co.,Ltd.	EUT
Smart Ear Charger	DHFA2CWU	-	MOSTOP Co.,Ltd.	
Adapter	-	-	-	

### 1.5 Support Equipments

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

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## 1.6 External I/O Cabling

### ■ Operating Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
Smart Ear (EUT)	Wireless	SmartPhone	Wireless	-	-

### ■ Charge Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
Smart Ear (EUT)	Charger Port	Smart Ear Charger	Charger Port	-	-
Smart Ear Charger	Micro 5 Pin	Adpater	USB	1.0	U

## 1.7 EUT Operating Mode(s)

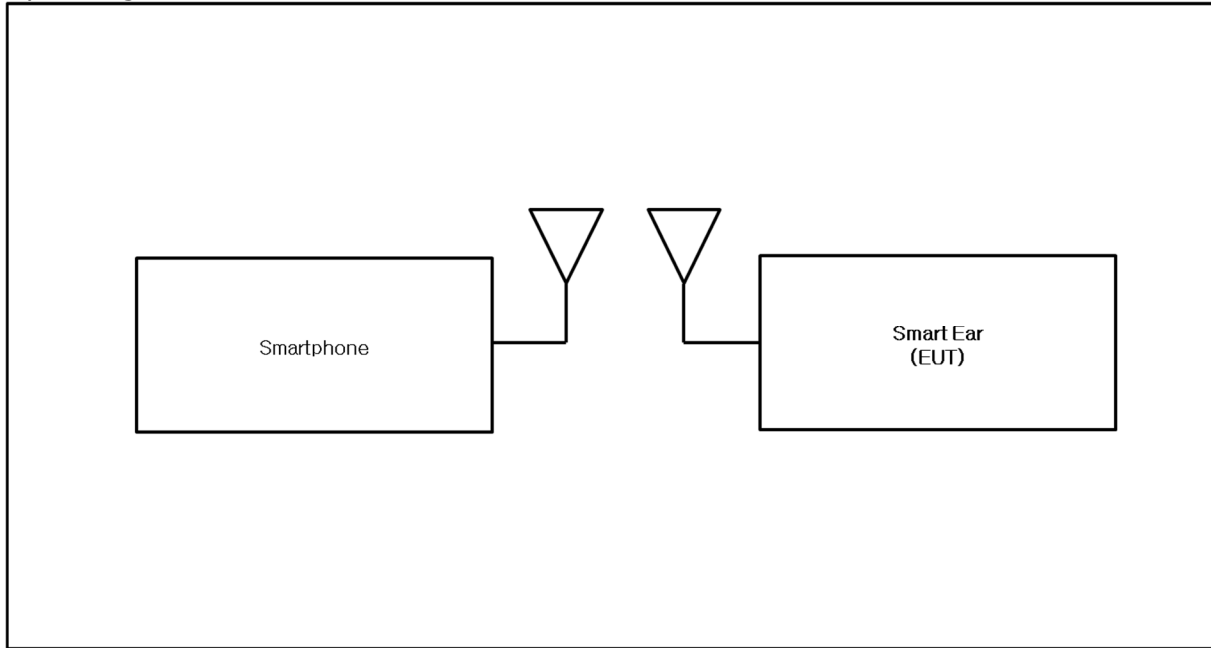
Test mode	operating
Operating	EUT and SmartPhone to Bluetooth pairing. Normal operation was confirmed by playing 1 kHz Tone built in Smartphone.
Charge	The normal charging state was confirmed by led of 'Smart Ear Charger'.

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

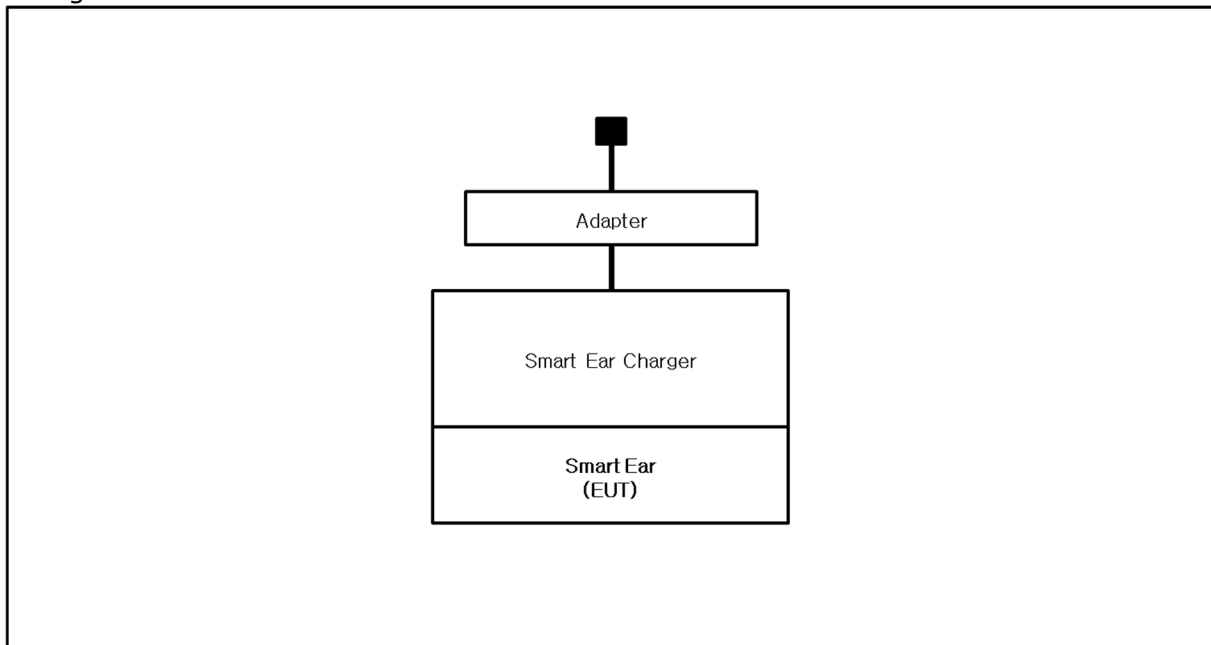
## 1.8 Configuration

■ AC Main  
 □ DC Main

### ■ Operating Mode



### ■ Charge Mode



## 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. The sites are constructed in conformance with the requirements of ANSI C63.4:2014 and CISPR 16-1-4:2012

## 1.12 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	 23298-1
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 0003





## 2.0 Test Regulations

The emissions tests were performed according to following regulations:

☐ **EMC – Directive 2014/30/EU**

☐ EN 61000-6-3:2011

☐ EN 61000-6-1:2007

☐ EN 61000-6-4:2007 +A1:2011

☐ EN 61000-6-2:2005

☐ EN 55011:2007 +A1:2010

☐ Group 1  
☐ Class A

☐ Group 2  
☐ Class B

☐ EN 55014-1:2006 +A2:2011

☐ EN 55014-2:1997 +A2:2008

☐ EN 55015:2013

☐ EN 55032:2015

☐ Class A

☐ Class B

☐ EN 55024:2010

☐ EN 50130-4:2011 +A1:2014

☐ EN 61000-3-2:2014

☐ EN 61000-3-3:2013

☐ EN 61326-1:2013



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☐ **VCCI V-3 / 2015.04**

☐ Class A

☐ Class B

☐ **AS/NZS:2013**

☐ Class A

☐ Class B

☒ **47 CFR Part 15, Subpart B**

☐ CISPR 22:2009 +A1:2010

☐ Class A

☐ Class B

☒ ANSI C63.4-2014

☐ Class A

☒ Class B

☐ **IC Regulation ICES-003 : 2016**

☐ CAN/CSA CISPR 22-10

☐ Class A

☐ Class B

☐ ANSI C63.4-2014

☐ Class A

☐ Class B

☐ **RE- Directive 2014/53/EU**

☐ EN 301 489-1 V1.9.2

☐ Equipment for fixed use

☐ Equipment for vehicular use

☐ Equipment for portable use

☐ EN 301 489-3 V1.6.1

☐ EN 301 489-17 V2.2.1

☐ EN 60945:2002

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## 2.1 Conducted Emissions at Mains Power Ports

**Test Date**

Aug. 29, 2019

**Test Location**

Electro wave Shieldroom #6

**Test Equipment**

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
<input checked="" type="checkbox"/>	EMI Test S/W	EMC32	R & S	9.12.00	-	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESR3	R & S	101781	04, 22, 2020	1 Year
<input checked="" type="checkbox"/>	LISN	ENV216	R & S	101787	01, 04, 2020	1 Year
<input type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	04, 22, 2020	1 Year
<input checked="" type="checkbox"/>	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 26, 2019	1 Year

**Test Conditions**

Temperature: 23.2 °C  
Relative Humidity: 53.5 % 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.

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## 2.2 Radiated Electric Field Emissions(Below 1 GHz)

**Test Date**

Aug. 29, 2019

**Test Location**☐ OPEN AREA TEST SITE #2☒ SEMI ANECHOIC CHAMBER #4(10 m)**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	04, 09, 2020	1 Year
<input checked="" type="checkbox"/>	AMPLIFIER	SCU 01	R & S	100603	11, 26, 2019	1 Year
<input checked="" type="checkbox"/>	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 29, 2020	2 Year
<input checked="" type="checkbox"/>	ATTENUATOR	8491A	HP	32173	03, 11, 2020	1 Year

**Test Conditions**

Temperature: 23.4 °C

Relative Humidity: 53.7 % 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, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

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## 2.3 Radiated Electric Field Emissions(Above 1 GHz)

### Test Date

Aug. 30, 2019

### Test Location

SEMI ANECHOIC CHAMBER #4(10 m)

### 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	04, 09, 2020	1 Year
<input checked="" type="checkbox"/>	PREAMPLIFIER	8449B	AGILENT	3008A01742	01, 08, 2020	1 Year
<input type="checkbox"/>	ATTENUATOR	8491A	HP	35496	03, 11, 2020	1 Year
<input checked="" type="checkbox"/>	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	03, 12, 2020	2 Year

### Test Conditions

Temperature: 23.2 °C  
Relative Humidity: 52.9 % 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.
- The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.



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## APPENDIX A – TEST DATA

### Conducted Emissions at Mains Power Ports

■ Charge Mode

HOT LINE

### Common Information

Test Description:

Model No.:

Phase:

Mode:

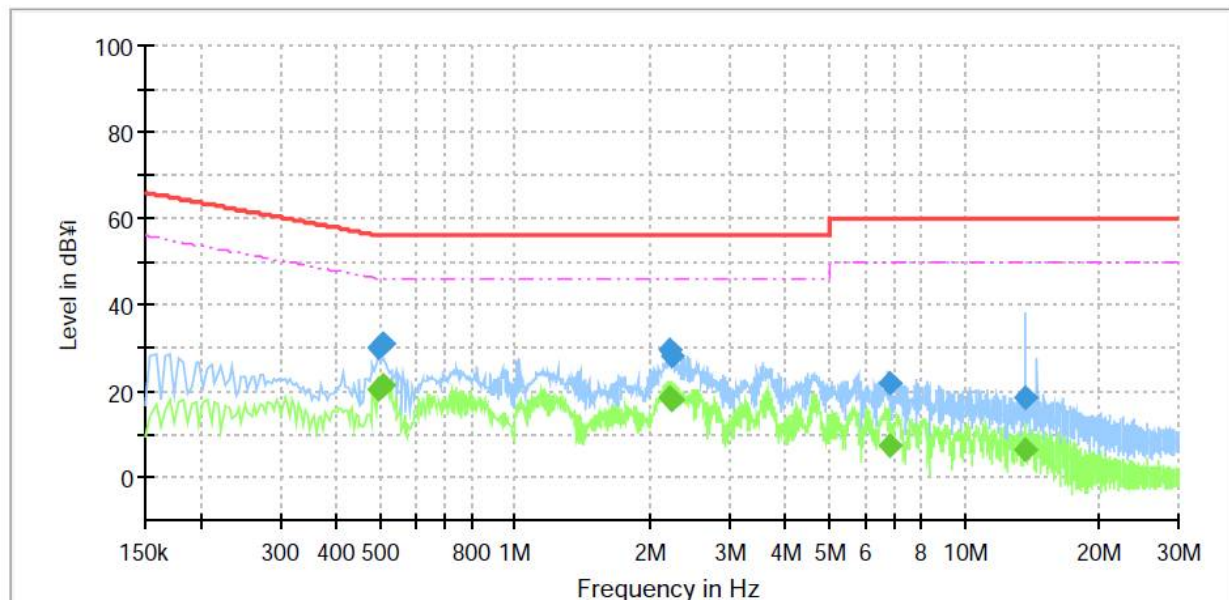
Operator Name:

Conducted Emission

DHFA2FWU / DHFAEWU / DHFA2CWU

Charge

KES



### Final Result

Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.498000	---	20.21	46.03	25.82	1000.0	9.000	L1	9.7
0.498000	29.91	---	56.03	26.12	1000.0	9.000	L1	9.7
0.506000	---	21.43	46.00	24.57	1000.0	9.000	L1	9.7
0.506000	31.23	---	56.00	24.77	1000.0	9.000	L1	9.7
2.214000	---	18.24	46.00	27.76	1000.0	9.000	L1	9.7
2.214000	29.34	---	56.00	26.66	1000.0	9.000	L1	9.7
2.222000	---	18.14	46.00	27.86	1000.0	9.000	L1	9.7
2.222000	28.22	---	56.00	27.78	1000.0	9.000	L1	9.7
6.802000	---	7.13	50.00	42.87	1000.0	9.000	L1	9.9
6.802000	21.85	---	60.00	38.15	1000.0	9.000	L1	9.9
13.726000	---	6.22	50.00	43.78	1000.0	9.000	L1	10.1
13.726000	18.52	---	60.00	41.48	1000.0	9.000	L1	10.1

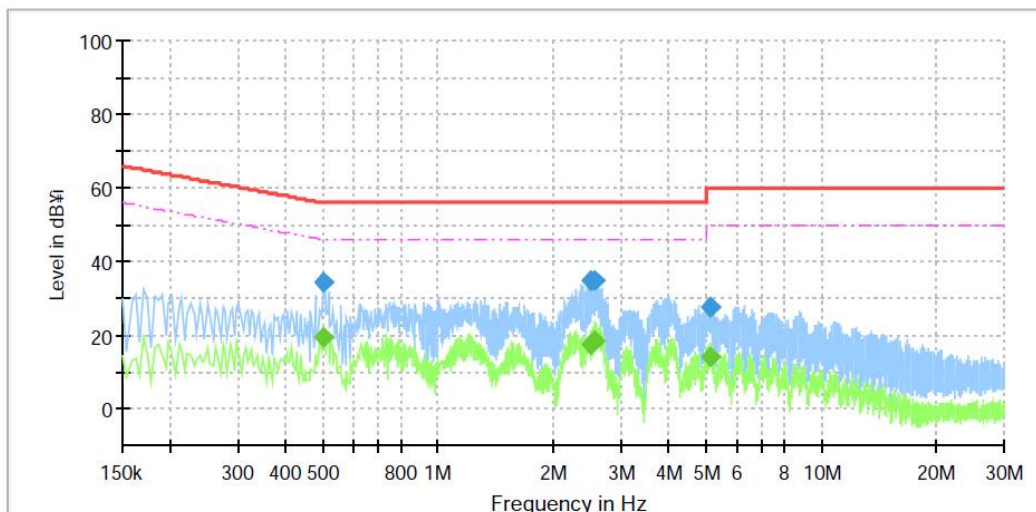
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## NEUTRAL LINE

### Common Information

Test Description:	Conducted Emission
Model No.:	DHFA2FWU / DHFA2EWU / DHFA2CWU
Phase:	
Mode:	Charge
Operator Name:	KES



### Final Result

Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.502000	---	19.48	46.00	26.52	1000.0	9.000	N	9.6
0.502000	34.21	---	56.00	21.79	1000.0	9.000	N	9.6
2.490000	---	17.28	46.00	28.72	1000.0	9.000	N	9.7
2.490000	34.75	---	56.00	21.25	1000.0	9.000	N	9.7
2.574000	---	18.40	46.00	27.60	1000.0	9.000	N	9.7
2.574000	34.93	---	56.00	21.07	1000.0	9.000	N	9.7
5.130000	---	14.08	50.00	35.92	1000.0	9.000	N	9.8
5.130000	27.60	---	60.00	32.40	1000.0	9.000	N	9.8

#### ◆ Calculation

$$\text{QuasiPeak [dBμV]} / \text{CAverage [dBμV]} = \text{Reading Value [dBμV]} + \text{Corr. [dB]}$$

QuasiPeak / CAverage : The Final Value

Reading Value : Not shown in the table.

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

### Uncertainty of measurement

HOT Line : Uncertainty of measurement 2.38 dB

(Confidence level: Approx. 95 %,  $k=2$ )

Neutral Line : Uncertainty of measurement 2.38 dB

(Confidence level: Approx. 95 %,  $k=2$ )

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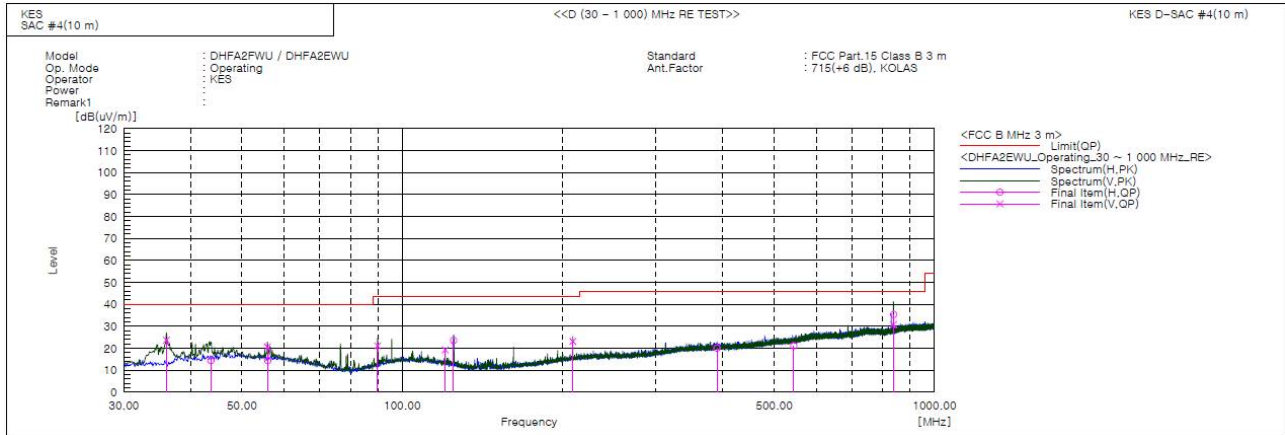
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## Radiated Electric Field Emissions(Below 1 GHz)

### ■ 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	36.074	V	49.1	-25.3	23.8	40.0	16.2	113.0	256.0	
2	43.731	H	37.0	-22.6	14.4	40.0	25.6	279.0	260.0	
3	55.831	V	43.2	-22.5	20.7	40.0	19.3	110.0	30.0	
4	55.932	H	36.9	-22.5	14.4	40.0	25.6	339.0	14.0	
5	89.876	V	46.7	-25.6	21.1	43.5	22.4	100.0	134.0	
6	120.457	V	44.2	-24.9	19.3	43.5	24.2	197.0	126.0	
7	124.942	H	49.2	-25.6	23.6	43.5	19.9	240.0	45.0	
8	209.220	V	45.4	-22.2	23.2	43.5	20.3	280.0	296.0	
9	390.483	H	37.0	-16.9	20.1	46.0	25.9	222.0	153.0	
10	543.992	H	34.7	-13.6	21.1	46.0	24.9	209.0	6.0	
11	837.180	V	39.8	-9.0	30.8	46.0	15.2	167.0	117.0	
12	838.162	H	44.4	-9.0	35.4	46.0	10.6	328.0	97.0	

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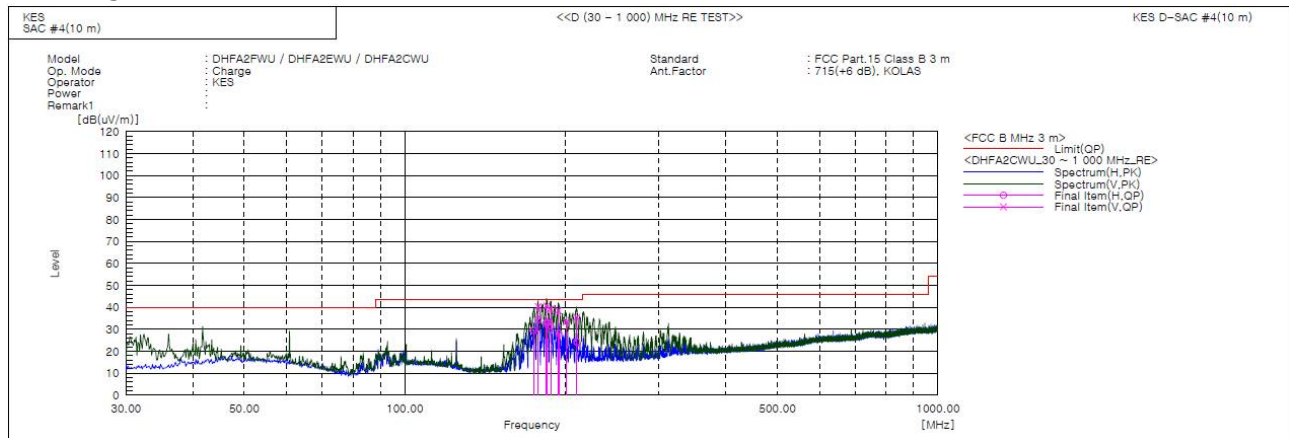


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### Charge Mode



### 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	174.422	H	54.8	-25.2	29.6	43.5	13.9	322.0	257.0	
2	177.923	V	65.4	-25.0	40.4	43.5	3.1	110.0	353.0	
3	177.929	H	59.3	-25.0	34.3	43.5	9.2	314.0	233.0	
4	184.359	V	65.2	-24.5	40.7	43.5	2.8	129.0	341.0	
5	184.718	H	57.4	-24.4	33.0	43.5	10.5	274.0	257.0	
6	187.750	H	55.7	-24.1	31.6	43.5	11.9	386.0	249.0	
7	187.868	V	63.4	-24.1	39.3	43.5	4.2	100.0	337.0	
8	194.051	V	62.1	-23.5	38.6	43.5	4.9	107.0	358.0	
9	194.536	H	51.5	-23.4	28.1	43.5	15.4	346.0	237.0	
10	200.963	V	56.2	-22.8	33.4	43.5	10.1	111.0	310.0	
11	210.178	V	57.7	-22.2	35.5	43.5	8.0	102.0	358.0	
12	210.420	H	46.5	-22.2	24.3	43.5	19.2	17.2	253.0	

### ◆ 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

### Uncertainty of measurement

Horizontal : Uncertainty of measurement 4.16 dB

(Confidence level: Approx. 95 %, k=2)

Vertical : Uncertainty of measurement 4.24 dB

(Confidence level: Approx. 95 %, k=2)

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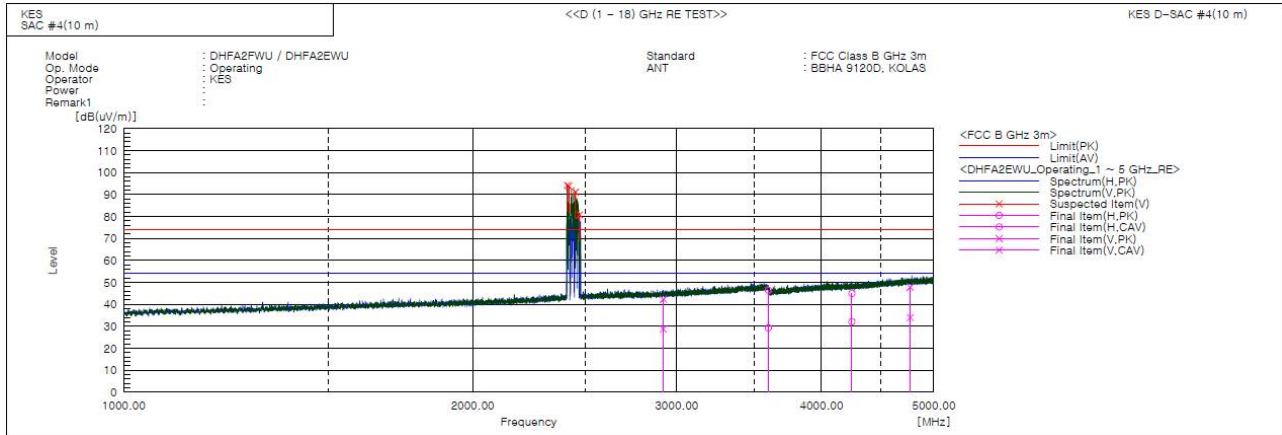
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## Radiated Electric Field Emissions(Above 1 GHz)

### ■ Operating Mode – (1 ~ 5) GHz



#### Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	2921.745	V	38.8	25.2	3.5	42.3	28.7	74.0	54.0	31.7	25.3	123.0	298.0	
2	3599.445	H	40.9	23.7	5.6	46.5	29.3	74.0	54.0	27.5	24.7	322.0	337.0	
3	4249.905	H	36.5	23.6	8.5	45.0	32.1	74.0	54.0	29.0	21.9	281.0	205.0	
4	4771.570	V	37.2	23.4	10.6	47.8	34.0	74.0	54.0	26.2	20.0	108.0	224.0	
5	2414.000	V			1.4			74.0	54.0			100.0	173.0	
6	2421.000	V			1.5			74.0	54.0			100.0	165.0	
7	2453.500	V			1.6			74.0	54.0			100.0	149.0	
8	2473.000	V			1.7			74.0	54.0			100.0	280.0	

\* Operating Mode Exclusion Bands

- Fundamental Frequency: 2.4 GHz

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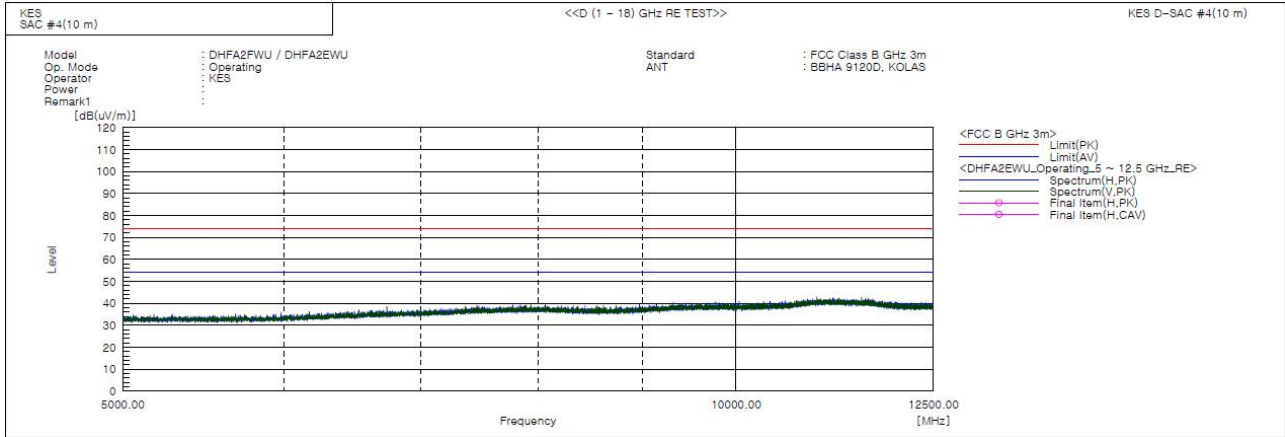


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- (5 ~ 12.5) GHz



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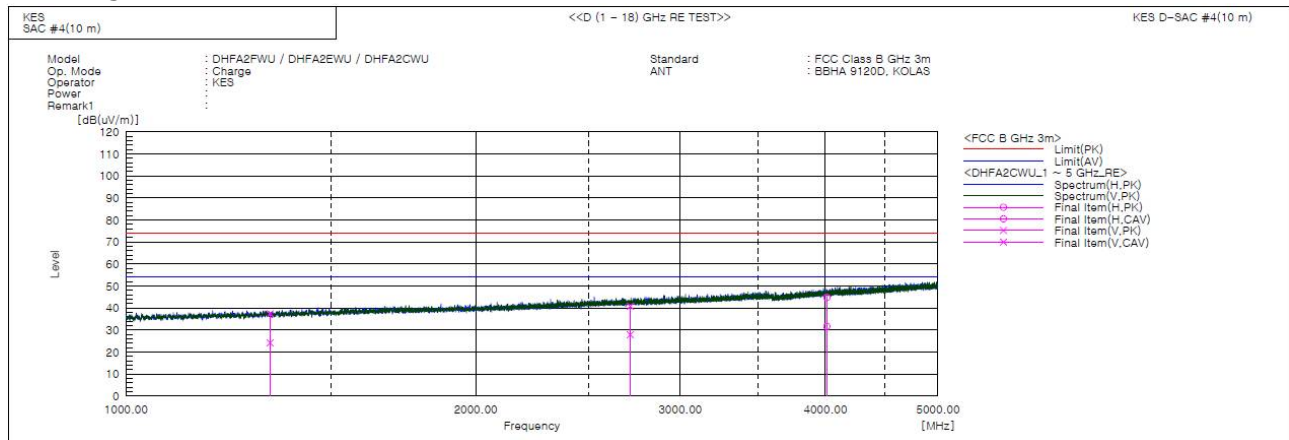


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### Charge Mode



#### Final Result

No.	Frequency [MHz]	(P)	Reading PK [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB(1/m)]	Result PK [dB(uV/m)]	Result CAV [dB(uV/m)]	Limit PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	1330.625	V	41.3	28.1	-3.9	37.4	24.2	74.0	54.0	36.6	29.8	121.0	0.0	
2	2717.400	V	38.1	25.2	2.7	40.8	27.9	74.0	54.0	33.2	26.1	106.0	37.0	
3	4011.685	H	37.0	23.9	7.8	44.8	31.7	74.0	54.0	29.2	22.3	294.0	183.0	

### Calculation

Result(PK/CAV) [dB(uV/m)] = (Reading(PK/CAV)[dB(uV)] + c.f[dB(1/m)])

Margin(PK/CAV)[dB] = Limit[dB(uV/m)] - Result(PK/CAV) [dB(uV/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

\* No spurious emission were detected above 5 GHz.

### Uncertainty of measurement

Uncertainty of measurement 5.76 dB

(Confidence level: Approx. 95 %, k=2)

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