



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-E2-19T0096
Page (1) of (19)

EMC TEST REPORT

Test Report No. : KES-E2-19T0096
Date of Issue : Oct. 01, 2019
Product name : Smart Ear Charger
Model/Type No. : DHFA2CWU
Variant Mode : DHFA2CBU, DHFA2CGU
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-DHFA2CWU
Date of Receipt : Aug. 16, 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

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-E2-19T0096

Page (2) of (19)

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Oct. 01, 2019	KES-E2-19T0096	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



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-E2-19T0096

Page (3) of (19)

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.....	6
1.9	Remarks when standards applied	7
1.10	Calibration Details of Equipment Used for Measurement.....	7
1.11	Test Facility	7
1.12	Laboratory Accreditations and Listings	7
2.0	Test Regulations.....	8
2.1	Conducted Emissions at Mains Power Ports.....	10
2.2	Radiated Electric Field Emissions(Below 1 GHz)	11
2.3	Radiated Electric Field Emissions(Above 1 GHz)	12
APPENDIX A – TEST DATA.....		13
Conducted Emissions at Mains Power Ports.....		13
Radiated Electric Field Emissions(Below 1 GHz)		15
Radiated Electric Field Emissions(Above 1 GHz).....		16
APPENDIX B - Test Setup Photos and Configuration.....		17
Conducted Voltage Emissions		17
Radiated Electric Field Emissions(Below 1 GHz)		18
Radiated Electric Field Emissions(Above 1 GHz).....		19

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-E2-19T0096

Page (4) of (19)

1.0 General Product Description

Main Specifications of EUT are:

Item	spec
Power	DC 5 V (USB)
Size	(38 x 38 x 21) mm
Weight	60 g

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-E2-19T0096

Page (5) of (19)

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 - DHFA2CBU(Black), DHFA2CGU(Gold)

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

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

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
SmartPhone	SM-G955N	-	Samsung Electronics Co., Ltd	-
Smart Ear	DHFA2EWU	-	MOSTOP Co.,Ltd.	-
Adapter	-	-	-	-

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

1.6 External I/O Cabling

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

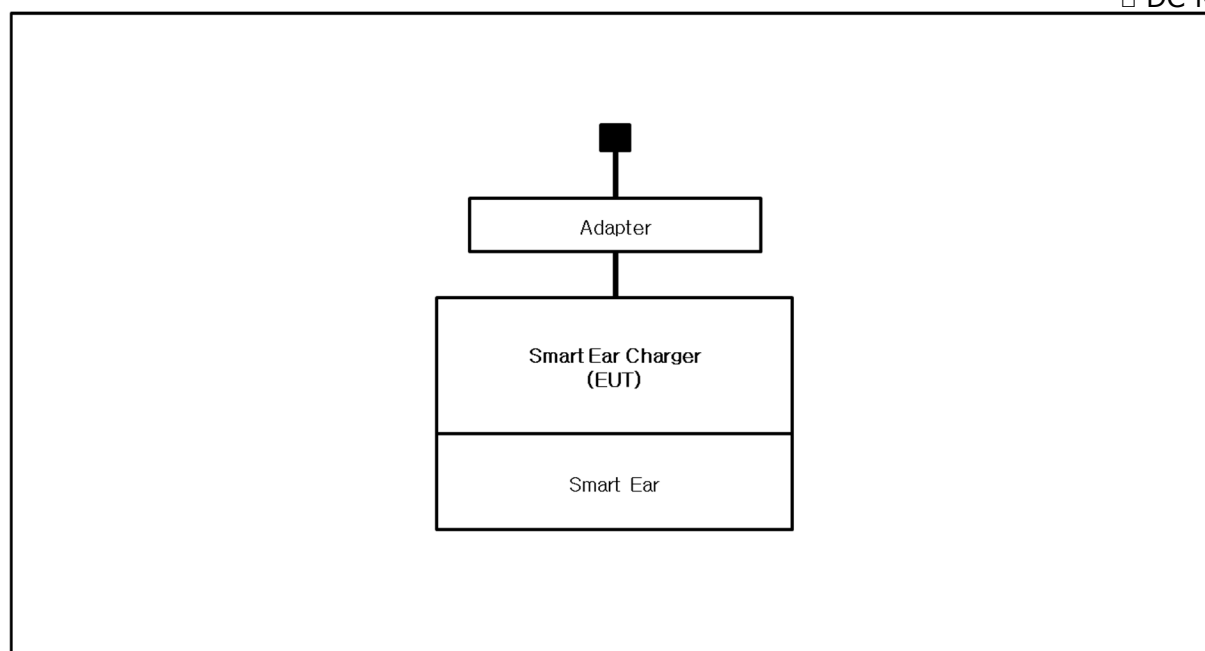
1.7 EUT Operating Mode(s)

Test mode	operating
Operating	The normal charging state was confirmed by led of EUT.

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

1.8 Configuration

■ AC Main
□ DC Main



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



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-E2-19T0096

Page (9) of (19)

☐ **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

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-E2-19T0096

Page (10) of (19)

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
☒	EMI Test S/W	EMC32	R & S	9.12.00	-
☒	EMI TEST RECEIVER	ESR3	R & S	101781	04, 22, 2020
☒	LISN	ENV216	R & S	101787	01, 04, 2020
☐	LISN	ESH2-Z5	R & S	100450	04, 22, 2020
☒	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 26, 2019

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

RemarksSee 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-E2-19T0096

Page (11) of (19)

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
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	04, 09, 2020
☒	AMPLIFIER	SCU 01	R & S	100603	11, 26, 2019
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 29, 2020
☒	ATTENUATOR	8491A	HP	32173	03, 11, 2020

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

RemarksSee 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-E2-19T0096

Page (12) of (19)

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
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	04, 09, 2020
☒	PREAMPLIFIER	8449B	AGILENT	3008A01742	01, 08, 2020
☒	ATTENUATOR	8491A	HP	35496	03, 11, 2020
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	03, 12, 2020

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

RemarksSee 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-E2-19T0096
Page (13) of (19)

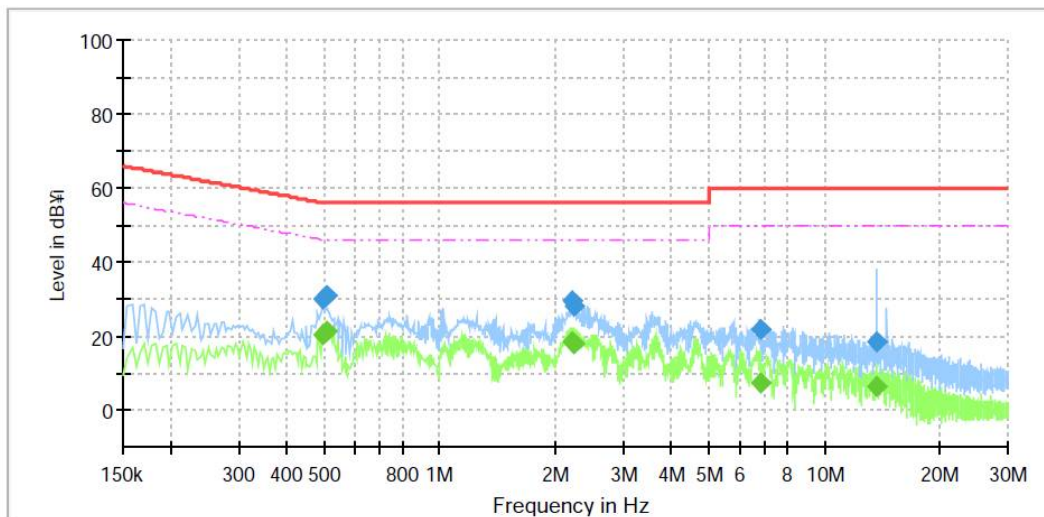
APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

HOT LINE

Common Information

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



Final Result

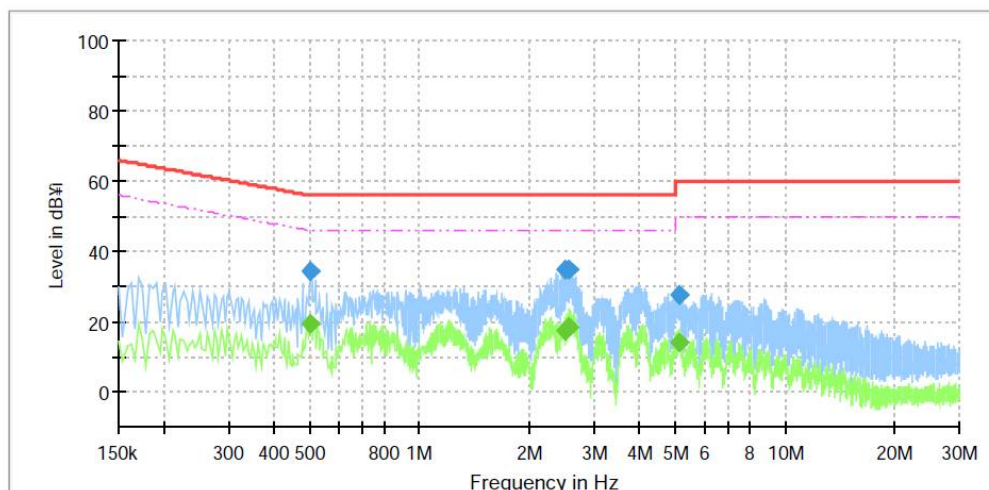
Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.498000	---	20.21	46.03	25.82	1000.0	9.000	L1	9.7
0.498000	29.91	---	56.03	26.12	1000.0	9.000	L1	9.7
0.506000	---	21.43	46.00	24.57	1000.0	9.000	L1	9.7
0.506000	31.23	---	56.00	24.77	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

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

NEUTRAL LINE

Common Information

Test Description:	Conducted Emission
Model No.:	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

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))

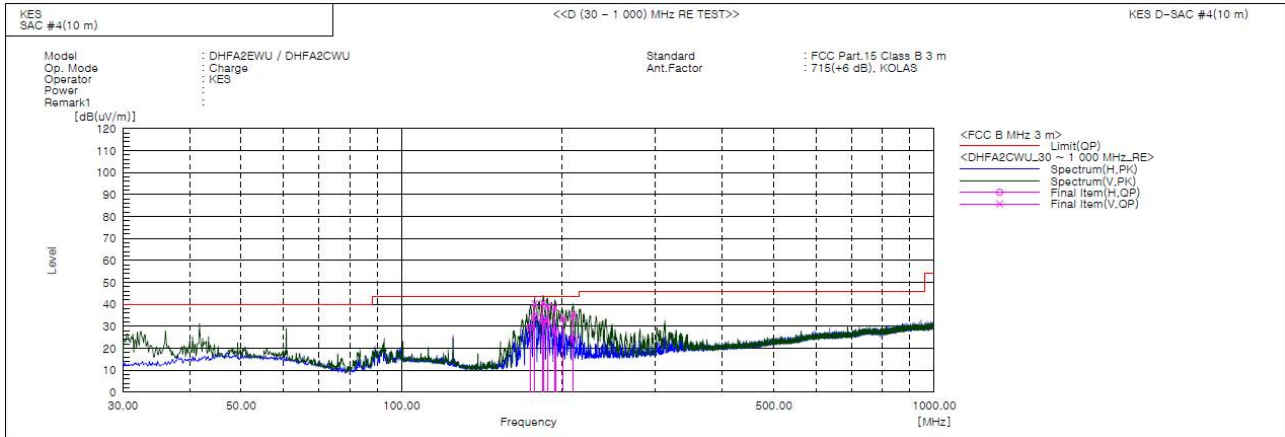
Uncertainty of measurement

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 %, $k=2$)



Radiated Electric Field Emissions(Below 1 GHz)



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)

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

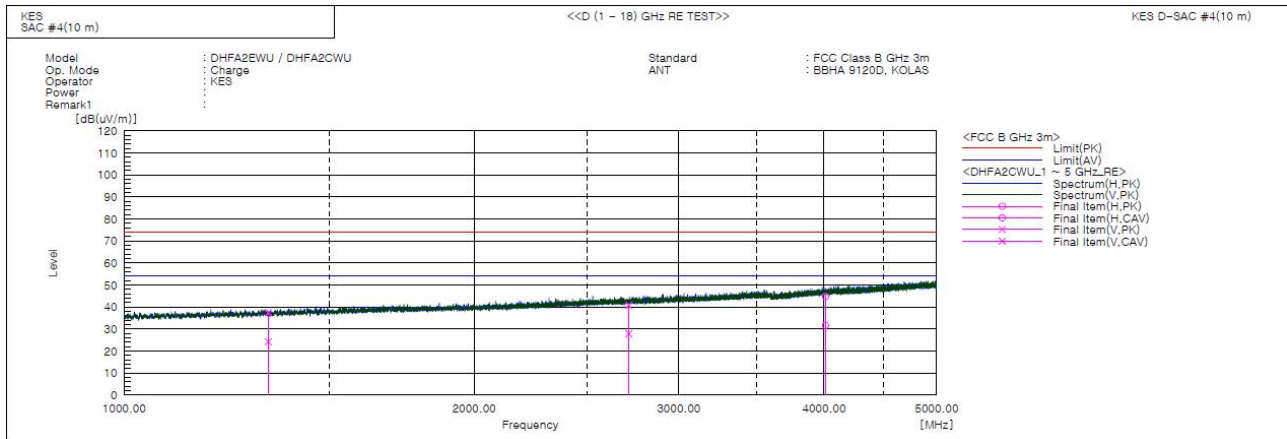


KES Co., Ltd.

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-E2-19T0096
Page (16) of (19)

Radiated Electric Field Emissions(Above 1 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	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(μ V/m)] = (Reading(PK/CAV)[dB(μ V)] + c.f[dB(1/m)])

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

Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss + ATT Factor - 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 %, $k=2$)

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