



KES Co., Ltd.

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Report No.:
KES-EM-20T0570
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EMC TEST REPORT

Test Report No. : KES-EM-20T0570
Date of Issue : Sep. 02, 2020
Product name : Wireless Module
Model/Type No. : EXT AP
Variant Mode : -
Applicant : DRTECH Corporation
Applicant Address : Suite No.1, 1Floor / Suite No.2 3Floor, 29,
Dunchon-daero 541 beon-gil, Jungwon-gu, Seongnam-si,
Gyeonggi-do, 13216, Korea
Manufacturer : DRTECH Corporation
Manufacturer Address : Suite No.1, 1Floor / Suite No.2 3Floor, 29,
Dunchon-daero 541 beon-gil, Jungwon-gu, Seongnam-si,
Gyeonggi-do, 13216, Korea
FCC ID : RNH-EXTAP
Date of Receipt : Jun. 01, 2020
Test date : Aug. 31, 2020
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
Sep. 02, 2020	KES-EM-20T0570	Issued

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1.0 General Product Description

Main Specifications of EUT are:

Item	Spec
Operating Frequency	1. (2 402 ~ 2 480) MHz / (Bluetooth) 2. (2 412 ~ 2462) MHz / (Wifi 2.4 GHz) 3. (5 180 ~5240) MHz , (5 745 ~ 5 825) MHz / (Wifi 5 GHz)
Power	DC 5 V
Dimension	(19 x 12) mm

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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 230Vac 120 Vac DC 12 V DC 24 V DC 5 V
Frequency 50 Hz 60 Hz 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
Wireless Module	EXT AP	-	DRTECH Corporation	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Notebook	15U480	-	LG Electronics Inc.	-
Notebook Adapter	A13-040N3A	-	Chicony POWER TECHNOLOGY	-
Jig Board 1	-	-	-	-
Jig Board 2	-	-	-	-

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1.6 External I/O Cabling

■ Wifi 2.4 GHz / Wifi 5 GHz Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
Wireless Module (EUT)	Wireless	Notebook	Wireless	1.0	U
	-	Jig Board 1	-	-	-
Jig Board 1	3 Pin	Notebook	USB	0.7	U

■ Bluetooth Mode

Start		END		Cable Spec.	
Description	I/O Port	Description	I/O Port	Length	Shield
Wireless Module (EUT)	Wireless	Jig Board 2	Wireless	1.0	U
	-	Jig Board 1	-	-	-
Jig Board 1	3 Pin	Notebook	USB	0.7	U

1.7 EUT Operating Mode(s)

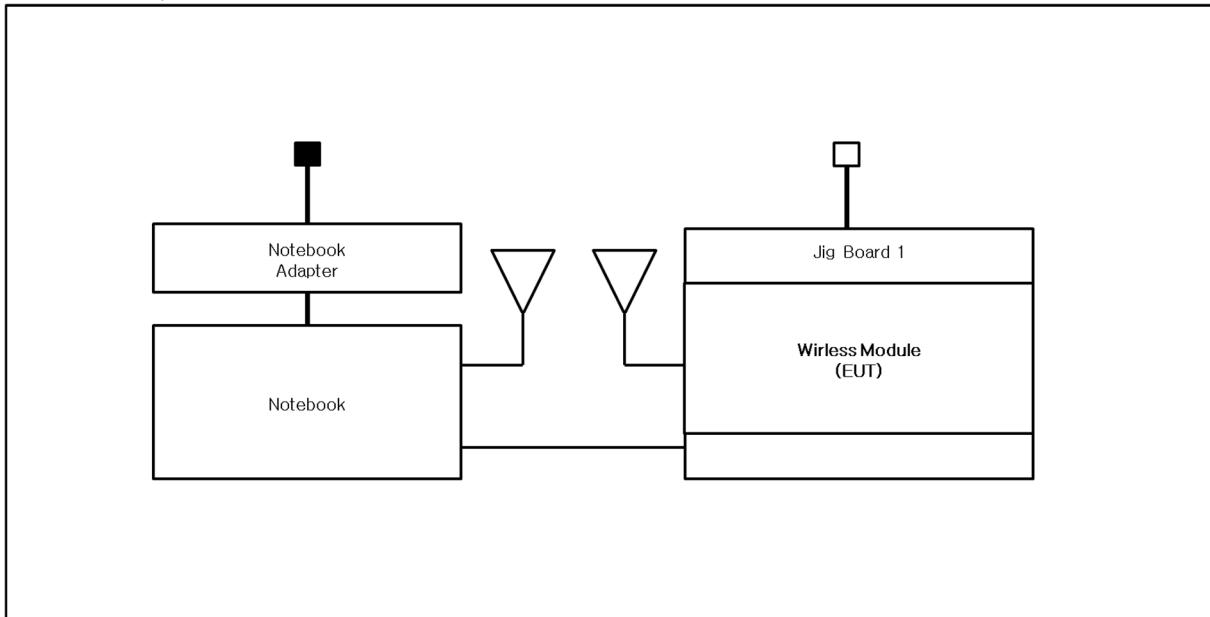
Test mode	operating
Wifi 2.4 GHz / Wifi 5 GHz Mode	1. Connect the EUT and Notebook Wirelessly. 2. The operation of EUT was confirmed through the continuous Pingtest of Notebook.
Bluetooth	1. Connect the EUT and Jig Board2 Wirelessly. 2. The operation of EUT was confirmed through the LED of Jig Board 2.

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

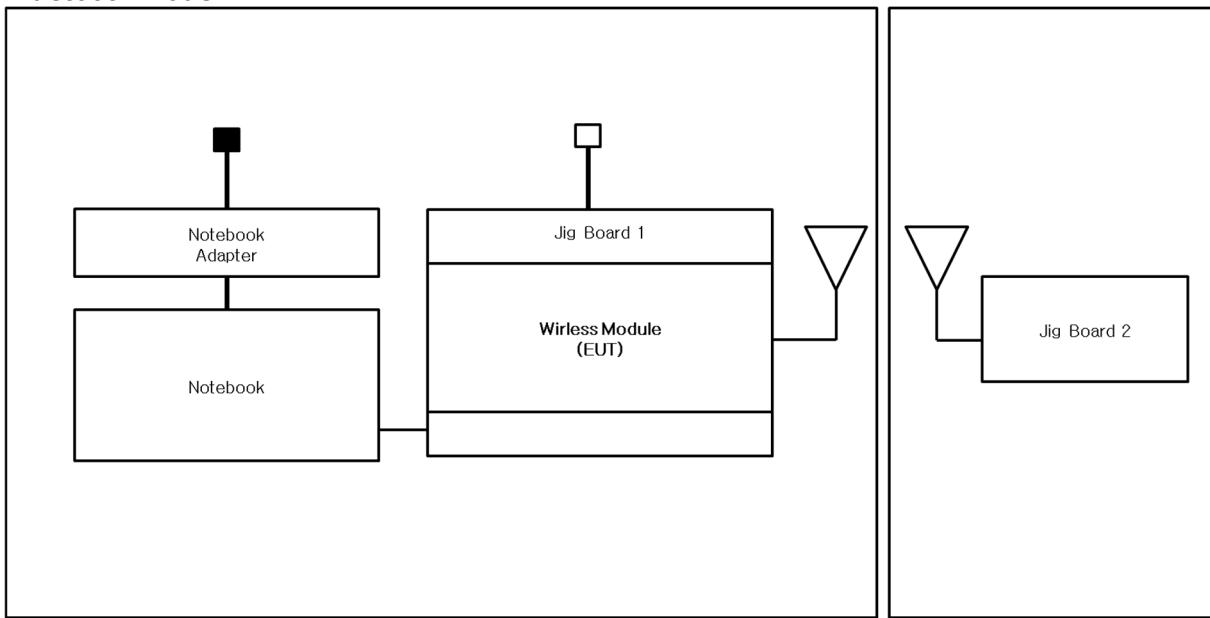
1.8 Configuration

- AC Main
- DC Main

■ Wifi 2.4 GHz / Wifi 5 GHz Mode



■ Bluetooth 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, Yeoju-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 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 1 GHz 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



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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	 23298-1
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 0004

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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
- EN 55014-1:2006 +A2:2011
- EN 55014-2:1997 +A2:2008
- EN 55015:2013
- EN 55032:2015
- EN 55024:2010
- EN 50130-4:2011 +A1:2014
- EN 61000-3-2:2014
- EN 61000-3-3:2013
- EN 61326-1:2013

Group 1
 Class A

Group 2
 Class B



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<input type="checkbox"/> VCCI V-3 / 2015.04	<input type="checkbox"/> Class A	<input type="checkbox"/> Class B
<input type="checkbox"/> AS/NZS:2013	<input type="checkbox"/> Class A	<input type="checkbox"/> Class B
<input checked="" type="checkbox"/> 47 CFR Part 15, Subpart B		
<input type="checkbox"/> CISPR 22:2009 +A1:2010	<input type="checkbox"/> Class A	<input type="checkbox"/> Class B
<input checked="" type="checkbox"/> ANSI C63.4-2014	<input type="checkbox"/> Class A	<input checked="" type="checkbox"/> Class B
<input type="checkbox"/> IC Regulation ICES-003 : 2016		
<input type="checkbox"/> CAN/CSA CISPR 22-10	<input type="checkbox"/> Class A	<input type="checkbox"/> Class B
<input type="checkbox"/> ANSI C63.4-2014	<input type="checkbox"/> Class A	<input type="checkbox"/> Class B
<input type="checkbox"/> RE- Directive 2014/53/EU		
<input type="checkbox"/> EN 301 489-1 V1.9.2		
<input type="checkbox"/> Equipment for fixed use		
<input type="checkbox"/> Equipment for vehicular use		
<input type="checkbox"/> Equipment for portable use		
<input type="checkbox"/> EN 301 489-3 V1.6.1		
<input type="checkbox"/> EN 301 489-17 V2.2.1		
<input type="checkbox"/> EN 60945:2002		

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2.1 Conducted Emissions at Mains Power Ports

Test Date

N/A

Test Location

Electro wave Shieldroom

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	04, 20, 2021	1 Year
<input type="checkbox"/>	LISN	ENV216	R & S	101787	01, 02, 2021	1 Year
<input type="checkbox"/>	LISN	ESH2-Z5	R & S	100450	01, 02, 2021	1 Year
<input type="checkbox"/>	PULSE LIMITER	ESH3-Z2	R & S	101915	01, 02, 2021	1 Year

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

It is not tested apply, Because it is powered by DC.

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2.2 Radiated Electric Field Emissions(Below 1 GHz)

Test Date

Jun. 31, 2020

Test Location

OPEN AREA TEST SITE #2 SEMI ANECHOIC CHAMBER #5

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	6.0.120	-	-
<input checked="" type="checkbox"/>	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	04, 01, 2021	1 Year
<input checked="" type="checkbox"/>	BILOG ANTENNA	VULB 9168	SCHWARZBECK	9168-461	05, 26, 2022	2 Year
<input checked="" type="checkbox"/>	AMPLIFIER	310N	SONOMA INSTRUMENT	401123	06, 08, 2021	1 Year

Test Conditions

Temperature: 24,2 °C

Relative Humidity: 52,0 % 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.

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2.3 Radiated Electric Field Emissions(Above 1 GHz)

Test Date

Aug. 31, 2020

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, 01, 2021	1 Year
<input checked="" type="checkbox"/>	PREAMPLIFIER	8449B	AGILENT	3008A01742	01, 02, 2021	1 Year
<input checked="" type="checkbox"/>	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	12, 13, 2020	1 Year
<input checked="" type="checkbox"/>	SPECTRUM ANALYZER	FSV40	R & S	101725	06, 22, 2021	1 Year
<input checked="" type="checkbox"/>	HORN ANTENNA	BBHA 9170D	SCHWARZBECK	BBHA9170550	01, 20, 2021	1 Year
<input checked="" type="checkbox"/>	BROADBAND AMPLIFIER	BBV9721	SCHWARZBECK	PS9721-003	01, 17, 2021	1 Year

Test Conditions

Temperature: 23,4 °C

Relative Humidity: 51,6 % R.H.

Frequency Range of Measurement

1 GHz to 30 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

N/A

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NEUTRAL LINE

N/A

◆ Calculation

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

QuasiPeak / CAverage : The Final Value

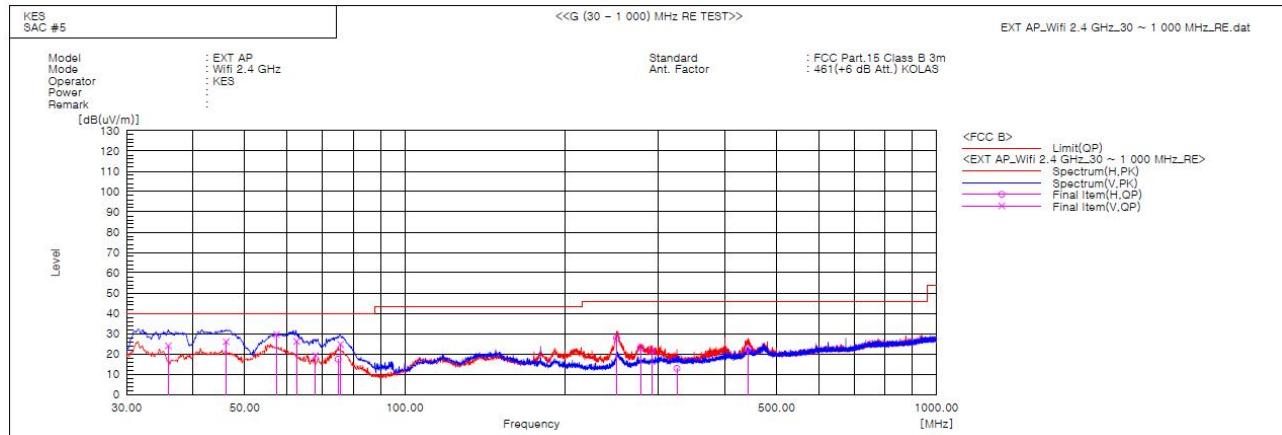
Reading Value : Not shown in the table.

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

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Radiated Electric Field Emissions(Below 1 GHz)

■ Wifi 2.4 GHz Mode

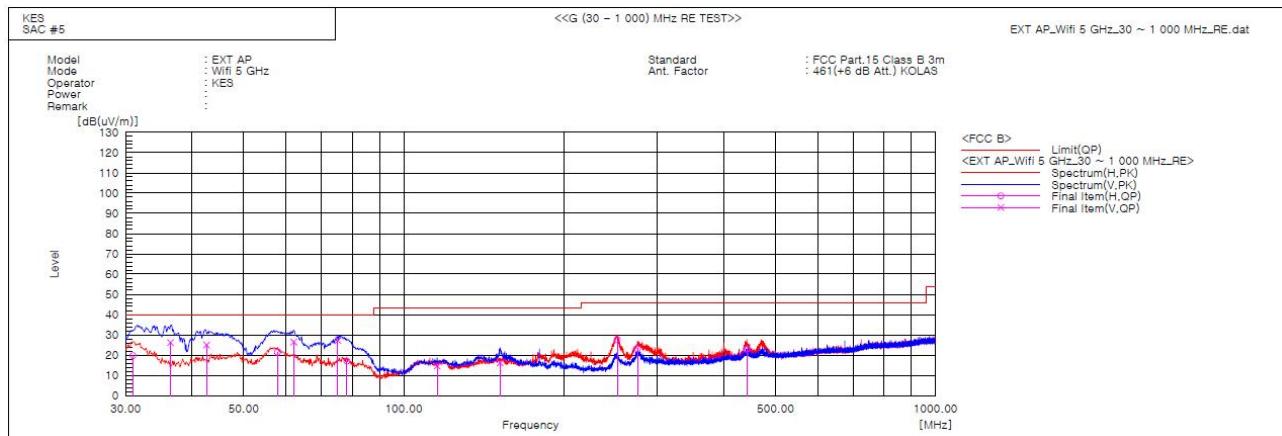


Final Result

No.	Frequency [MHz]	(P) [dB(uV)]	Reading QP	c.f [dB(1/m)]	Result QP	Limit QP	Margin QP	Height [cm]	Angle [deg]	Remark
1	35.941	V	37.8	-13.8	24.0	40.0	16.0	103.0	300.0	
2	46.126	V	38.7	-12.7	26.0	40.0	14.0	107.0	153.3	
3	57.403	V	42.9	-13.3	29.6	40.0	10.4	100.0	101.2	
4	62.616	V	40.0	-13.8	26.2	40.0	13.8	112.0	317.5	
5	67.951	V	34.0	-14.7	19.3	40.0	20.7	136.0	181.5	
6	74.984	H	33.7	-16.3	17.4	40.0	22.6	400.0	97.3	
7	75.711	V	41.2	-16.5	24.7	40.0	15.3	105.0	0.6	
8	250.190	H	41.8	-14.0	27.8	46.0	18.2	110.0	163.9	
9	278.320	H	35.9	-12.8	23.1	46.0	22.9	117.0	273.8	
10	291.658	H	33.9	-12.3	21.6	46.0	24.4	106.0	38.1	
11	324.880	H	24.6	-11.7	12.9	46.0	33.1	132.0	36.5	
12	442.008	H	31.1	-8.6	22.5	46.0	23.5	197.0	356.8	

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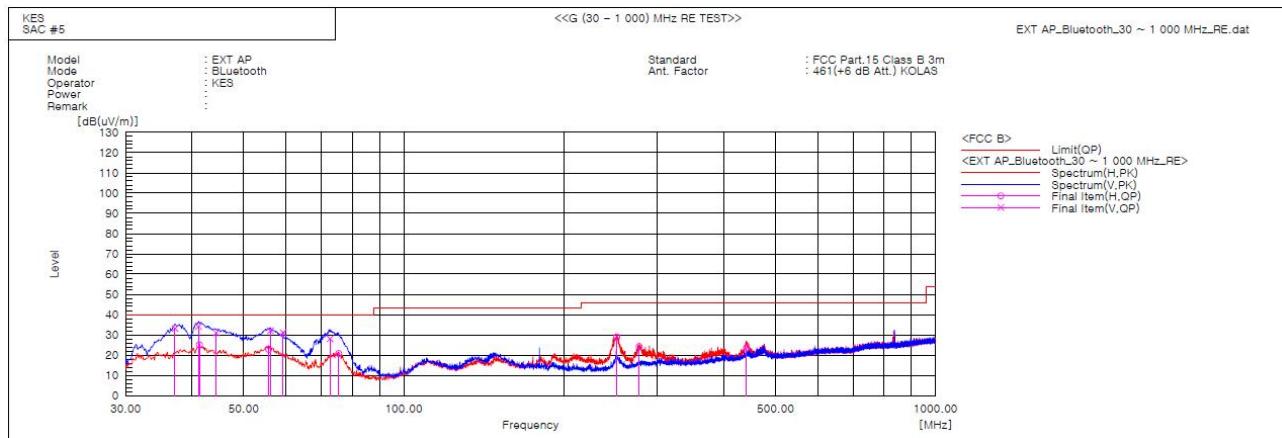
■ Wifi 5 GHz Mode



Final Result

No.	Frequency [MHz]	(P) QP	Reading [dB(uV)]	c.f [dB(1/m)]	Result QP	Limit QP	Margin QP	Height [cm]	Angle [deg]	Remark
1	30.970	H	34.0	-14.2	19.8	40.0	20.2	400.0	35.5	
2	36.426	V	40.0	-13.8	26.2	40.0	13.8	102.0	201.6	
3	42.610	V	37.9	-12.9	25.0	40.0	15.0	101.0	257.3	
4	57.888	H	34.7	-13.3	21.4	40.0	18.6	400.0	0.5	
5	62.131	V	40.2	-13.7	26.5	40.0	13.5	104.0	0.4	
6	75.226	V	43.6	-16.4	27.2	40.0	12.8	111.0	317.9	
7	78.136	H	34.1	-17.1	17.0	40.0	23.0	400.0	89.8	
8	115.603	V	30.4	-15.8	14.6	43.5	28.9	124.0	116.5	
9	151.735	V	28.9	-12.7	16.2	43.5	27.3	103.0	359.8	
10	252.009	H	41.6	-13.9	27.7	46.0	18.3	110.0	176.0	
11	275.046	H	36.2	-12.9	23.3	46.0	22.7	114.0	26.2	
12	441.523	H	31.6	-8.6	23.0	46.0	23.0	100.0	2.0	

■ Bluetooth Mode



Final Result

No.	Frequency [MHz]	(P) QP [dB(uV)]	Reading QP [dB(1/m)]	c.f	Result QP [dB(uV/m)]	Limit QP [dB]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	37.153	V	46.9	-13.7	33.2	40.0	6.8	116.0	330.4	
2	41.156	V	47.3	-13.1	34.2	40.0	5.8	107.0	241.1	
3	41.279	H	38.2	-13.1	25.1	40.0	14.9	398.0	321.6	
4	44.429	V	43.7	-12.7	31.0	40.0	9.0	155.0	155.4	
5	55.714	H	36.0	-13.2	22.8	40.0	17.2	297.0	347.6	
6	56.190	V	45.4	-13.3	32.1	40.0	7.9	133.0	127.4	
7	59.343	V	44.5	-13.4	31.1	40.0	8.9	124.0	308.0	
8	72.680	V	43.8	-15.8	28.0	40.0	12.0	100.0	358.9	
9	75.470	H	37.3	-16.5	20.8	40.0	19.2	322.0	91.3	
10	251.524	H	42.9	-13.9	29.0	46.0	17.0	311.0	147.4	
11	277.108	H	37.1	-12.8	24.3	46.0	21.7	231.0	272.6	
12	440.674	H	32.0	-8.6	23.4	46.0	22.6	234.0	4.5	

◆ 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 4.40 dB

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

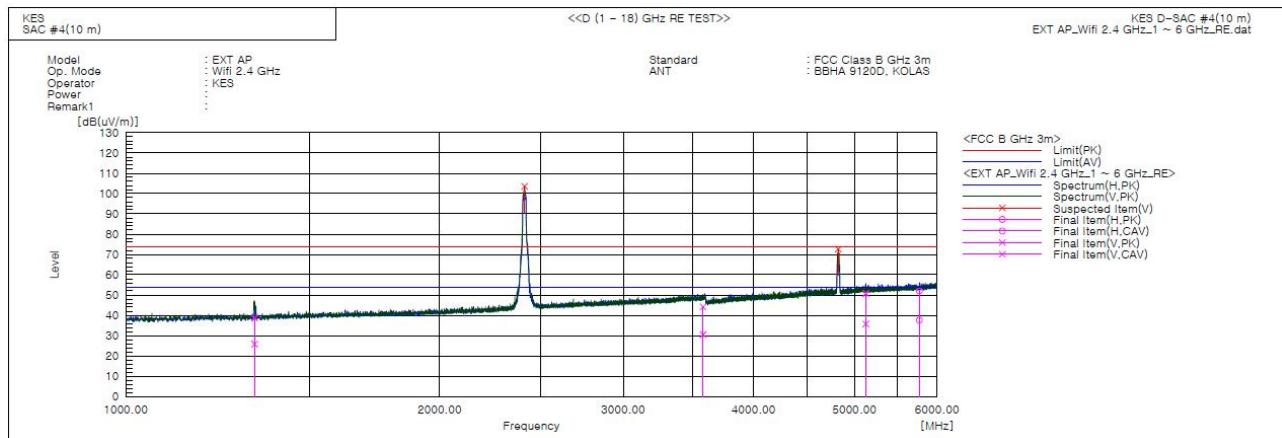
Vertical : Uncertainty of measurement 4.36 dB

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

Radiated Electric Field Emissions(Above 1 GHz)

■ Wifi 2.4 GHz Mode

- (1 ~ 6) GHz



Final Result

No.	Frequency [MHz]	(P) 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	1328.552	V 42.2	29.3	-3.5	38.7	25.8	74.0	54.0	35.3	28.2	121.0	253.0	
2	3578.752	V 38.3	24.6	5.9	44.2	30.5	74.0	54.0	29.8	23.5	128.0	231.0	
3	5125.619	V 38.3	23.3	12.5	50.8	35.8	74.0	54.0	23.2	18.2	100.0	342.0	
4	5770.021	H 38.1	23.7	13.9	52.0	37.6	74.0	54.0	22.0	16.4	324.0	74.0	
5	2412.500	V _____	1.6	_____	_____	74.0	54.0	54.0	_____	_____	100.0	99.0	
6	4822.500	V _____	11.3	_____	74.0	54.0	54.0	54.0	_____	_____	150.0	73.0	

* Wifi 2.4 GHz Mode Exclusion Band

- Fundamental Frequency: 2.4 GHz
- Harmonic Frequency: 4.8 GHz

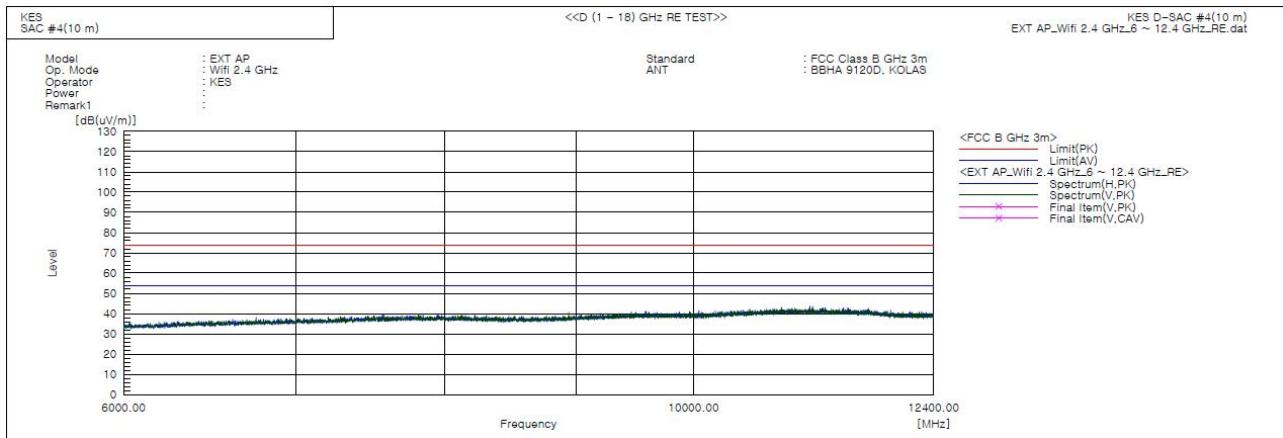


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- (6 ~ 12.4) GHz



* No spurious emission were detected above 6 GHz.

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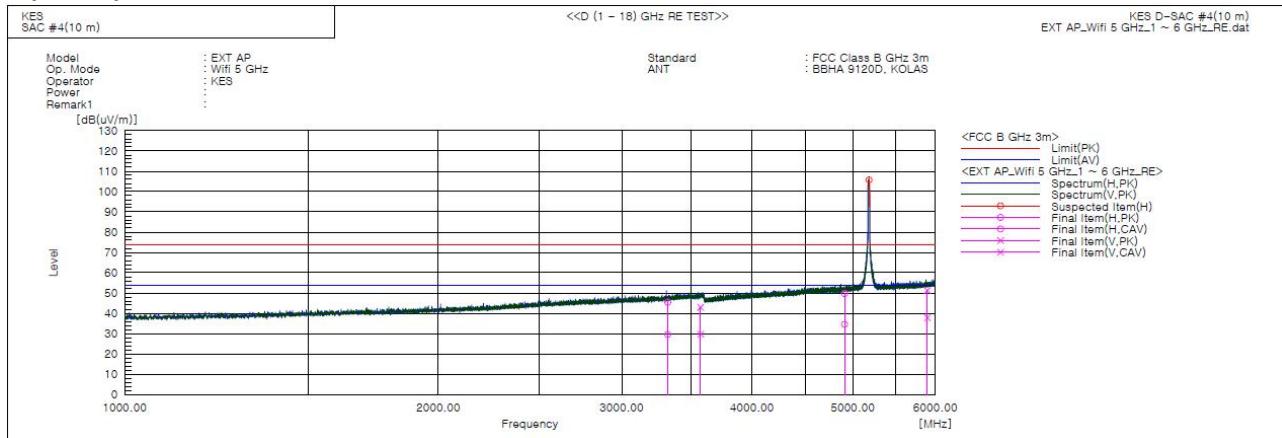
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■ Wifi 5 GHz Mode

- (1 ~ 6) GHz



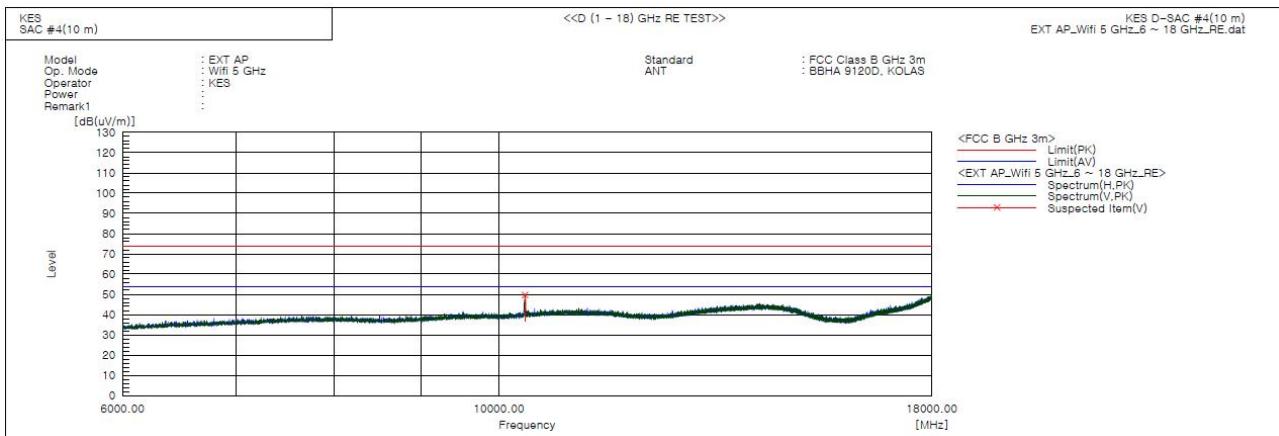
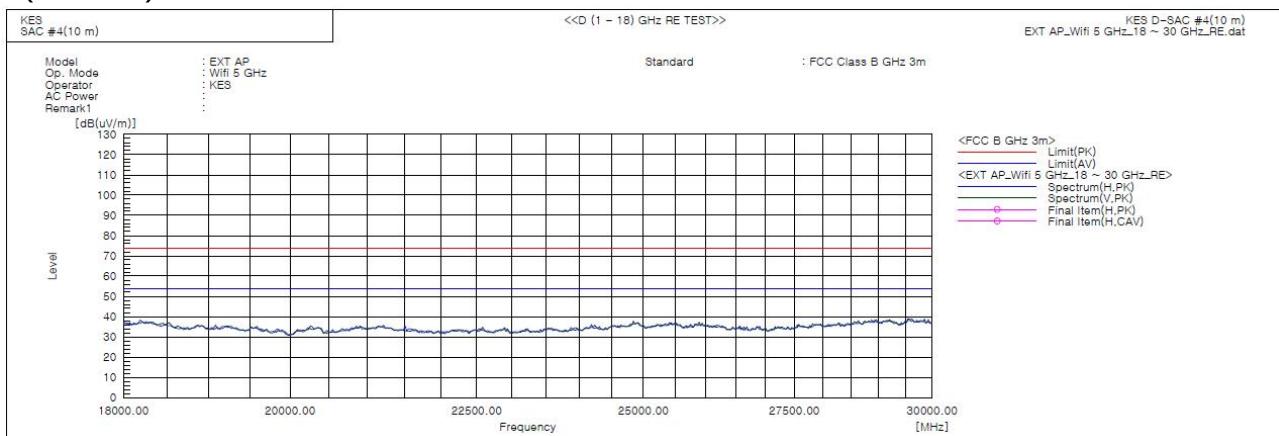
Final Result

No.	Frequency [MHz]	(P) 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]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [deg]	Remark
1	321.663	H 40.0	24.2	5.4	45.4	29.6	74.0	54.0	28.6	24.4	225.0	357.0	
2	3570.444	V 37.0	23.9	5.9	42.9	29.8	74.0	54.0	31.1	24.2	127.0	264.0	
3	4909.607	H 37.9	22.8	11.8	49.7	34.6	74.0	54.0	24.3	19.4	231.0	138.0	
4	5893.681	V 37.1	23.6	14.2	51.3	37.8	74.0	54.0	22.7	16.2	118.0	5.0	
5	5180.625	H	12.6				74.0	54.0			200.0	131.0	

* WiFi 5 GHz Mode Exclusion Band

- Fundamental Frequency: 5.1 GHz
- Harmonic Frequency: 10.3 GHz

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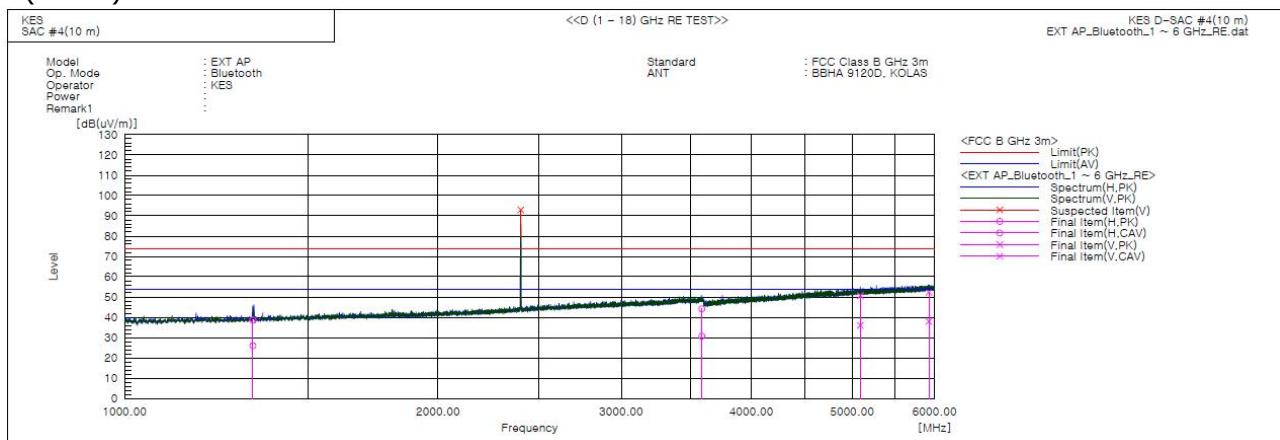
- (6 ~ 18) GHz

- (18 ~ 30) GHz


* No spurious emission were detected above 6 GHz.



■ Bluetooth Mode

- (1 ~ 6) GHz



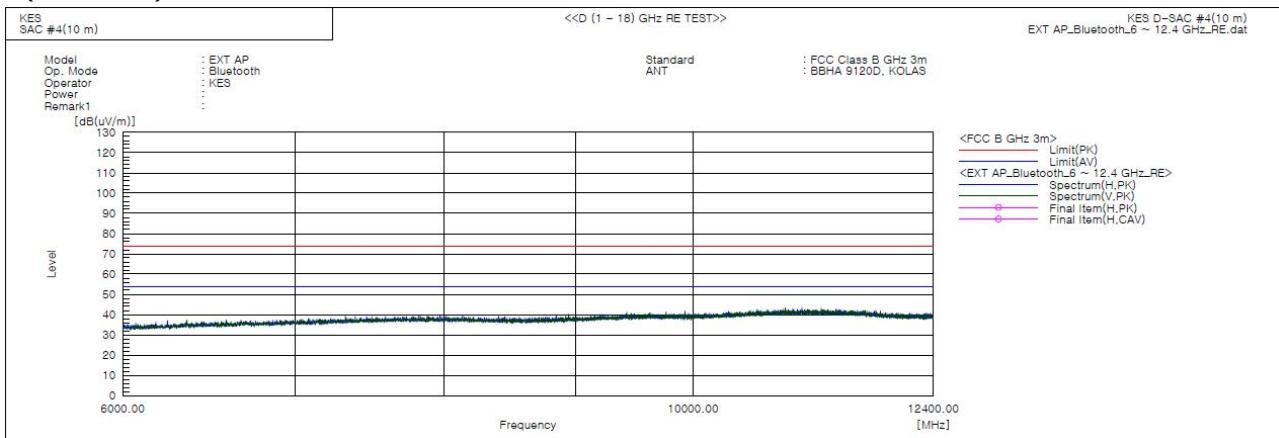
Final Result

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	1328.125	H	42.1	29.5	-3.5	38.6	26.0	74.0	54.0	35.4	28.0	326.0	241.0	
2	3585.022	H	38.2	24.8	5.9	44.1	30.7	74.0	54.0	29.9	23.3	247.0	338.0	
3	5090.219	V	38.2	23.5	12.5	50.7	36.0	74.0	54.0	23.3	18.0	125.0	158.0	
4	5923.742	V	37.9	23.6	14.4	52.3	38.0	74.0	54.0	21.7	16.0	102.0	348.0	
5	2402.000	V	_____	_____	1.5	_____	_____	74.0	54.0	_____	_____	150.0	348.0	

* Bluetooth Mode Exclusion Band
- Fundamental Frequency: 2.4 GHz

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- (6 ~ 12.4) GHz



* No spurious emission were detected above 6 GHz.

◆ Calculation

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

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

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

Uncertainty of measurement

Uncertainty of measurement 5.94 dB

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

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