EMC TEST REPORT

Test Report No.	:	KES-E1-19T0494-R2
Date of Issue	:	Sep. 09, 2019
Product name	:	Shift RED Drone
Model/Type No.	:	SHIFT Drone1
Variant Mode	:	-
Applicant	:	this is engineering Inc.
Applicant Address	:	352, Daewangpangyo-ro 815, Sujeong-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
Manufacturer	:	this is engineering Inc.
Manufacturer Address	:	352, Daewangpangyo-ro 815, Sujeong-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
FCC ID	:	2AR74-SFD1D
Date of Receipt	:	Jun. 21, 2019
Test date	:	Aug. 19, 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
Aug. 20, 2019	KES-E1-19T0494	Issued
Sep. 05, 2019	KES-E1-19T0494-R1	added measurement uncertainty and phrase (Page 12).
Sep. 09, 2019	KES-E1-19T0494-R2	added radiated electric field emissions(Above 1 ㎓) data.

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1.0 General Product Description

Main Specifications of EUT are:

Item	spec
Operating Frequency	2.4 ㎓ / 5 ㎓
Power	DC 5 V (USB) / DC 3.7 V , 1100 mAh (Battery)
Size	(100 x 100 x 60) ㎜
Weight	255 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

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Shift RED Drone	SHIFT Drone1	-	this is engineering Inc.	EUT

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Shift RED Controller	SHIFT Controller1	-	this is engineering Inc.	-
Smart Phone	SM-G955N	-	Samsung Electronic Co., Ltd.	-
AC/DC Adapter	MCS-04KD	-	Dongdo Electroncs(Yantal) Co., Ltd	-
Micro SD Card	-	-	Sandisk	-

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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**
Shift RED Drone (EUT)	Wireless	Shift RED Controller	Wireless	-	-
	Wireless	Smart Phone	Wireless	-	-
	Micro SD Card Slot	Micro SD Card	Micro SD Card Slot	-	-

■ Charge Mode

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
Shift RED Drone (EUT)	USB C Type	AC/DC Adapter	USB	1.0	U

1.7 EUT Operating Mode(s)

Test mode	operating
Operating	1. EUT and Shift RED Drone and smartphone were connected wirelessly. 2. Tested under normal operating conditions.
Charge	Confirmed the charge of EUT through LED.

EUT Test operating S/W		
Name	**Version**	**Manufacture Company**
SHIFT Drone	0.2.5	Apple Distribution International

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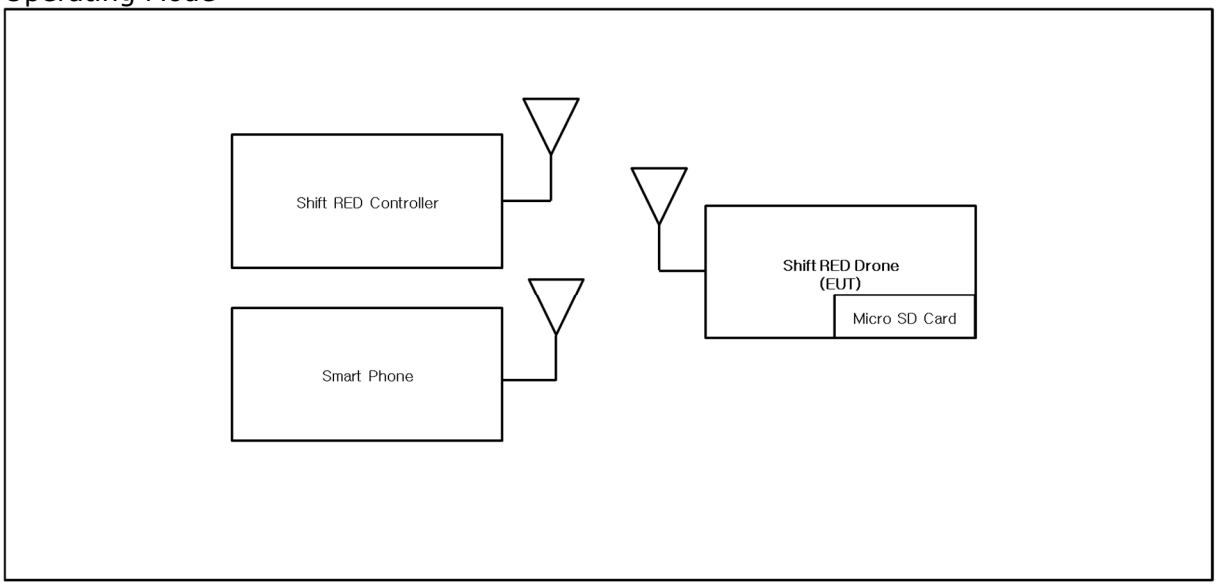
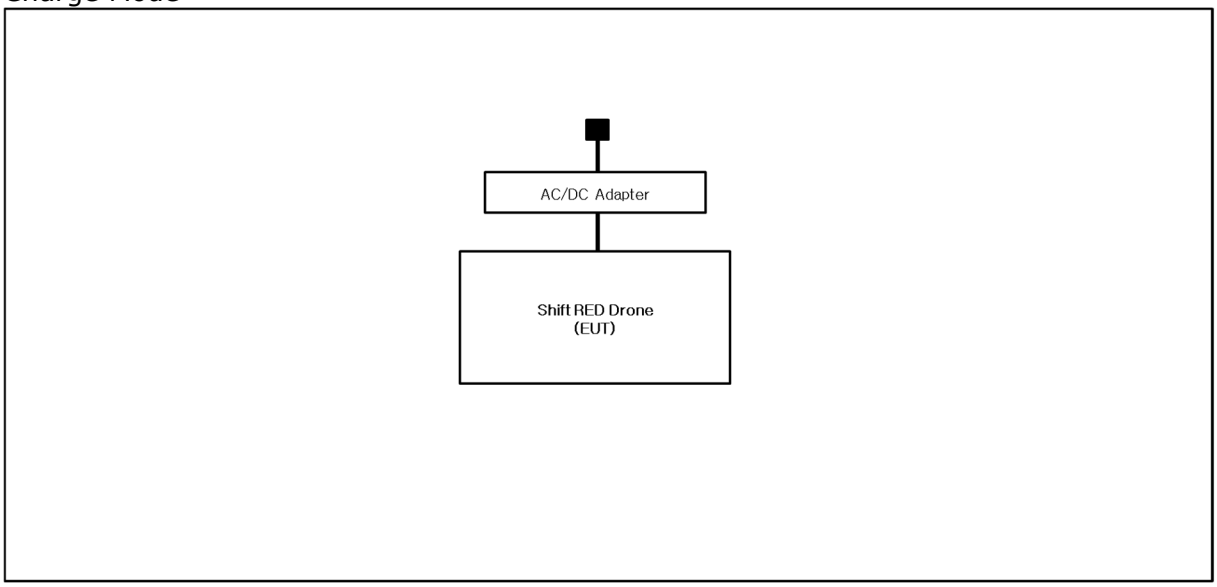
1.8 Configuration

■ AC Main
□ DC Main

■ Operating Mode



■ Charge Mode



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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. 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

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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 ☐ Group 1 ☐ Group 2
☐ Class A ☐ 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. 19, 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: 24.1 ℃
Relative Humidity: 53.3 % 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
Aug. 19, 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: 24.3 ℃
Relative Humidity: 54.3 % R.H.

Frequency Range of Measurement
30 ㎒ to 1 ㎓

Instrument Settings
IF Band Width: 120 ㎑

Test Results
The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.
The basic axis among the three orthogonal axes is the worst data.

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2.3 Radiated Electric Field Emissions(Above 1 ㎓)

Test Date
Aug. 19, 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: 24.3 ℃
Relative Humidity: 54.3 % R.H.

Frequency Range of Measurement
1 ㎓ to 30 ㎓

Instrument Settings
IF Band Width: 1 ㎒

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

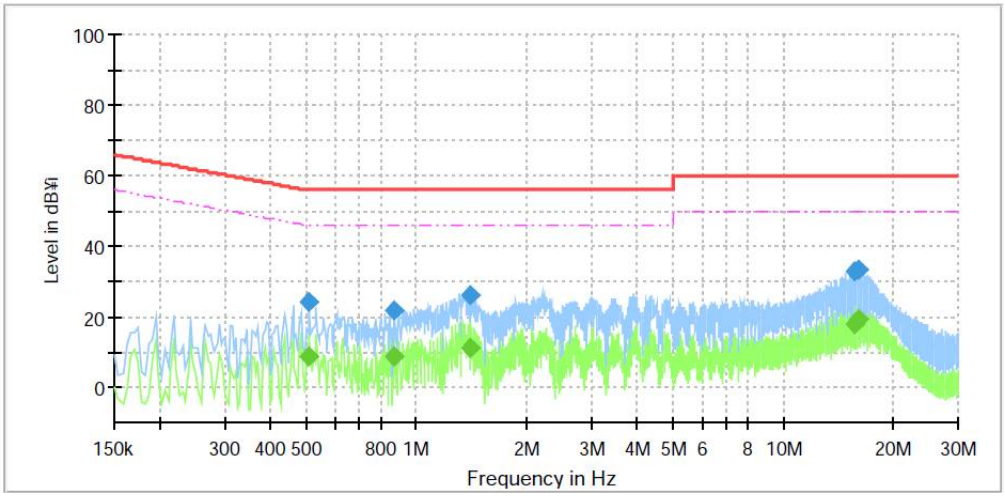
Conducted Emissions at Mains Power Ports

■ Charge Mode

HOT LINE

Common Information

Test Description:	Conducted Emission
Model No.:	SHIFT Drone1
Phase:	Charge
Mode:	
Operator Name:	KES



Final_Result

Frequency (MHz)	MaxPeak (dB¥µ V)	Average (dB¥µ V)	Limit (dB¥µ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.510000	---	8.58	46.00	37.42	1000.0	9.000	L1	9.7
0.510000	24.34	---	56.00	31.66	1000.0	9.000	L1	9.7
0.870000	---	8.95	46.00	37.05	1000.0	9.000	L1	9.7
0.870000	21.80	---	56.00	34.20	1000.0	9.000	L1	9.7
1.406000	---	11.06	46.00	34.94	1000.0	9.000	L1	9.7
1.406000	26.20	---	56.00	29.80	1000.0	9.000	L1	9.7
15.582000	---	18.22	50.00	31.78	1000.0	9.000	L1	10.1
15.582000	32.78	---	60.00	27.22	1000.0	9.000	L1	10.1
16.122000	---	19.29	50.00	30.71	1000.0	9.000	L1	10.2
16.122000	33.64	---	60.00	26.36	1000.0	9.000	L1	10.2

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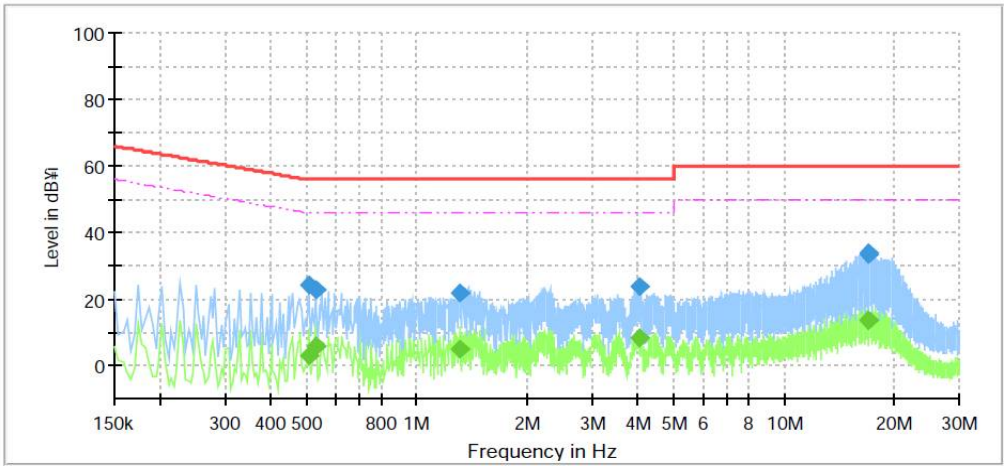
NEUTRAL LINE

Common Information

Test Description:	Conducted Emission
Model No.:	SHIFT Drone1
Phase:	Charge
Mode:	
Operator Name:	KES



Final_Result

Frequency (MHz)	MaxPeak (dB¥µ V)	Average (dB¥µ V)	Limit (dB¥µ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.506000	---	3.08	46.00	42.92	1000.0	9.000	N	9.6
0.506000	24.40	---	56.00	31.60	1000.0	9.000	N	9.6
0.530000	---	6.10	46.00	39.90	1000.0	9.000	N	9.6
0.530000	22.65	---	56.00	33.35	1000.0	9.000	N	9.6
1.310000	---	4.89	46.00	41.11	1000.0	9.000	N	9.7
1.310000	22.06	---	56.00	33.94	1000.0	9.000	N	9.7
4.018000	---	8.43	46.00	37.57	1000.0	9.000	N	9.8
4.018000	23.81	---	56.00	32.19	1000.0	9.000	N	9.8
16.962000	---	13.80	50.00	36.20	1000.0	9.000	N	10.3
16.962000	33.57	---	60.00	26.43	1000.0	9.000	N	10.3
17.002000	---	13.55	50.00	36.45	1000.0	9.000	N	10.3
17.002000	33.98	---	60.00	26.02	1000.0	9.000	N	10.3

♦ 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)

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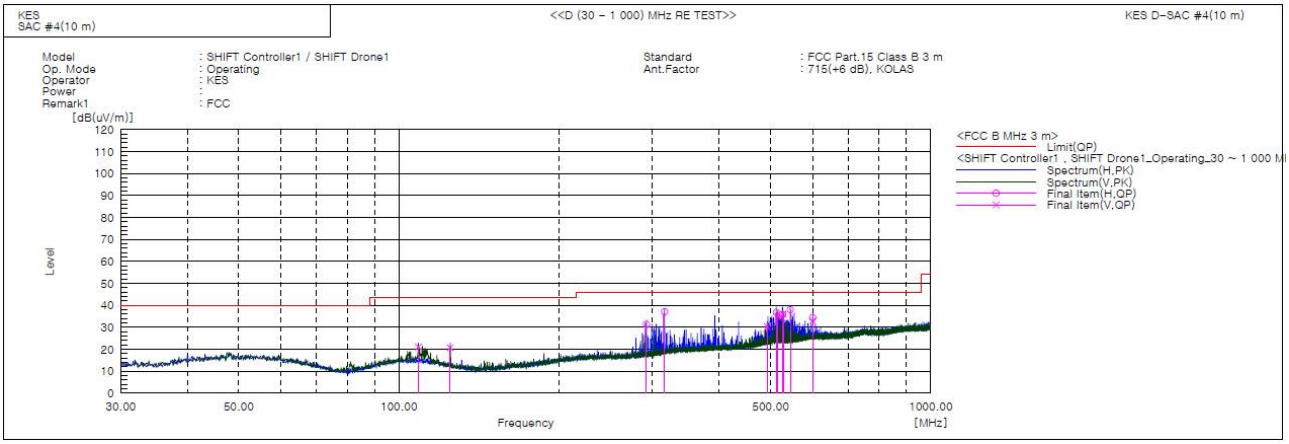
Radiated Electric Field Emissions(Below 1 ㎓)

■ 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	108.821	V	44.5	-23.4	21.1	43.5	22.4	116.0	47.0	
2	124.922	V	46.3	-25.6	20.7	43.5	22.8	132.0	194.0	
3	292.153	H	51.6	-20.2	31.4	46.0	14.6	374.0	43.0	
4	315.911	H	56.1	-19.0	37.1	46.0	8.9	351.0	213.0	
5	492.436	V	45.0	-14.6	30.4	46.0	15.6	110.0	54.0	
6	512.588	H	50.9	-14.1	36.8	46.0	9.2	349.0	49.0	
7	515.972	V	48.9	-14.1	34.8	46.0	11.2	137.0	336.0	
8	526.279	H	49.7	-13.9	35.8	46.0	10.2	284.0	201.0	
9	527.846	V	49.9	-13.9	36.0	46.0	10.0	106.0	137.0	
10	544.352	H	51.6	-13.6	38.0	46.0	8.0	400.0	221.0	
11	599.996	H	46.0	-11.6	34.4	46.0	11.6	366.0	134.0	
12	599.996	V	44.4	-11.6	32.8	46.0	13.2	187.0	46.0	

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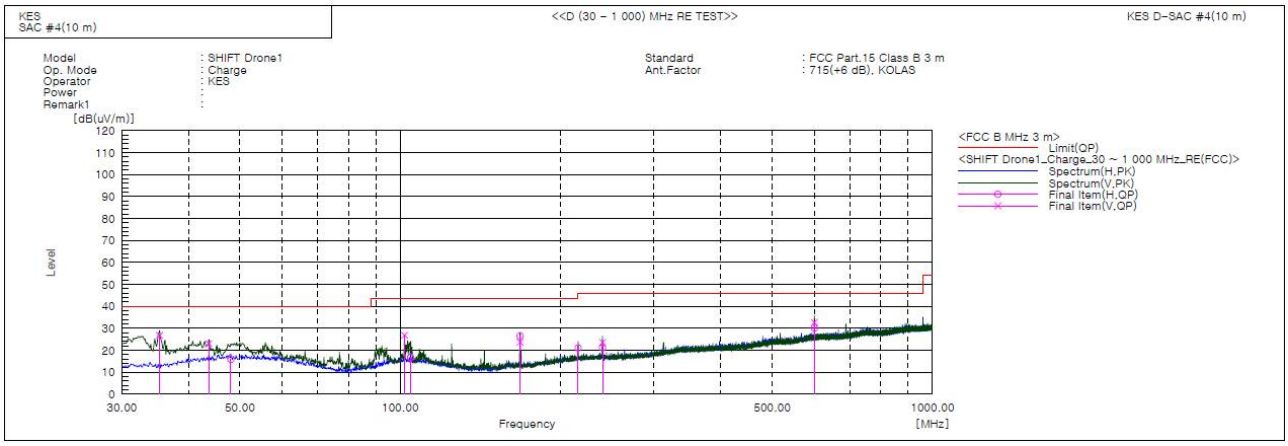
■ Charge Mode



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	35.314	V	52.3	-25.5	26.8	40.0	13.2	110.0	231.0	
2	43.722	V	45.6	-22.6	23.0	40.0	17.0	185.0	290.0	
3	48.069	H	38.0	-22.1	15.9	40.0	24.1	351.0	227.0	
4	101.923	V	50.2	-23.3	26.9	43.5	16.6	103.0	132.0	
5	104.683	H	40.1	-23.3	16.8	43.5	26.7	220.0	265.0	
6	167.981	V	49.2	-25.5	23.7	43.5	19.8	100.0	322.0	
7	167.997	H	52.1	-25.5	26.6	43.5	16.9	330.0	243.0	
8	215.963	H	43.0	-21.9	21.1	43.5	22.4	246.0	258.0	
9	240.014	V	44.9	-21.3	23.6	46.0	22.4	246.0	350.0	
10	240.022	H	42.4	-21.3	21.1	46.0	24.9	116.0	337.0	
11	599.996	V	44.3	-11.6	32.7	46.0	13.3	228.0	338.0	
12	600.008	H	41.7	-11.6	30.1	46.0	15.9	194.0	322.0	

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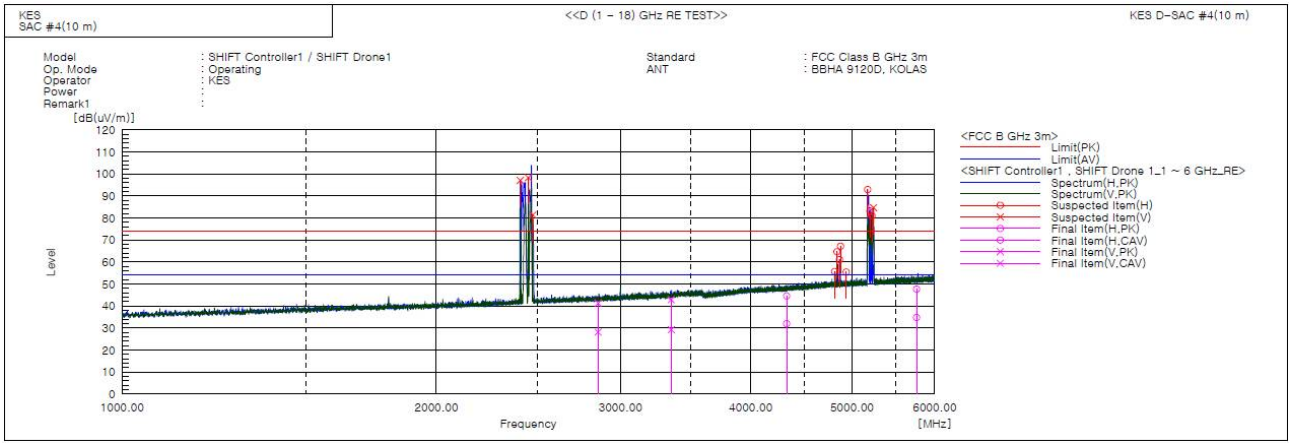
Radiated Electric Field Emissions(Above 1 GHz)

■ Operating 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	2856.894	V	38.1	25.0	3.2	41.3	28.2	74.0	54.0	32.7	25.8	124.0	240.0	
2	3356.169	V	38.0	24.4	4.9	42.9	29.3	74.0	54.0	31.1	24.7	116.0	224.0	
3	4328.731	H	35.8	23.2	8.8	44.6	32.0	74.0	54.0	29.4	22.0	299.0	296.0	
4	5764.875	H	34.6	21.7	13.1	47.7	34.8	74.0	54.0	26.3	19.2	213.0	357.0	
5	2406.250	V	--------	--------	1.4	--------	--------	74.0	54.0	--------	--------	200.0	297.0	
6	2449.375	V	--------	--------	1.6	--------	--------	74.0	54.0	--------	--------	200.0	345.0	
7	2473.750	V	--------	--------	1.7	--------	--------	74.0	54.0	--------	--------	200.0	178.0	
8	4811.875	H	--------	--------	10.8	--------	--------	74.0	54.0	--------	--------	200.0	233.0	
9	4836.875	H	--------	--------	10.8	--------	--------	74.0	54.0	--------	--------	200.0	121.0	
10	4864.375	H	--------	--------	10.9	--------	--------	74.0	54.0	--------	--------	100.0	313.0	
11	4875.625	H	--------	--------	11.0	--------	--------	74.0	54.0	--------	--------	100.0	345.0	
12	4936.250	H	--------	--------	11.1	--------	--------	74.0	54.0	--------	--------	200.0	117.0	
13	5176.250	H	--------	--------	11.8	--------	--------	74.0	54.0	--------	--------	100.0	258.0	
14	5201.250	H	--------	--------	11.8	--------	--------	74.0	54.0	--------	--------	100.0	286.0	
15	5226.875	H	--------	--------	11.9	--------	--------	74.0	54.0	--------	--------	200.0	129.0	
16	5243.125	V	--------	--------	11.9	--------	--------	74.0	54.0	--------	--------	100.0	274.0	

* Operating Mode Exclusion Band
- Fundamental Frequency: 2.4 GHz, 5.1 GHz, 5.2 GHz
- Harmonic Frequency: 4.8 GHz, 4.9 GHz

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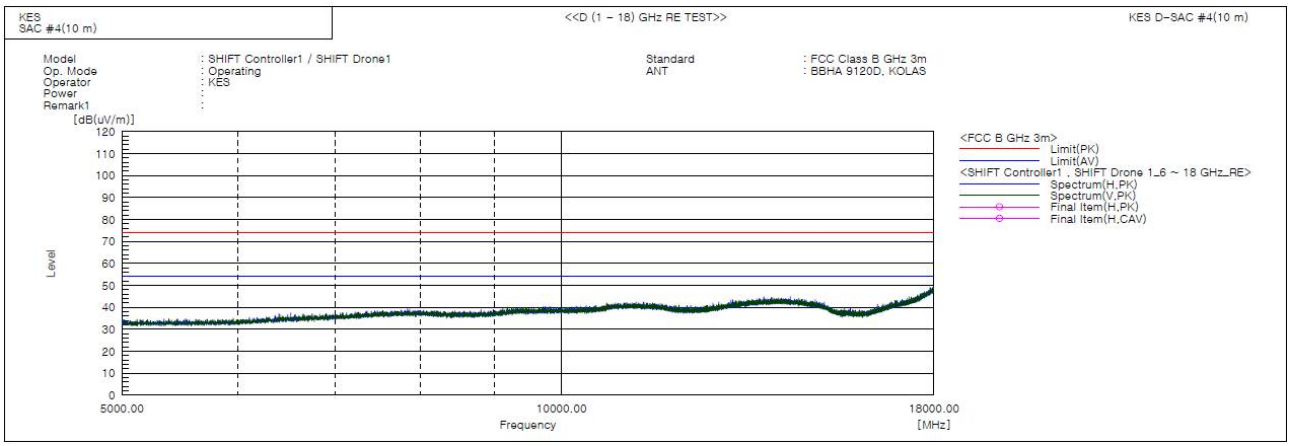
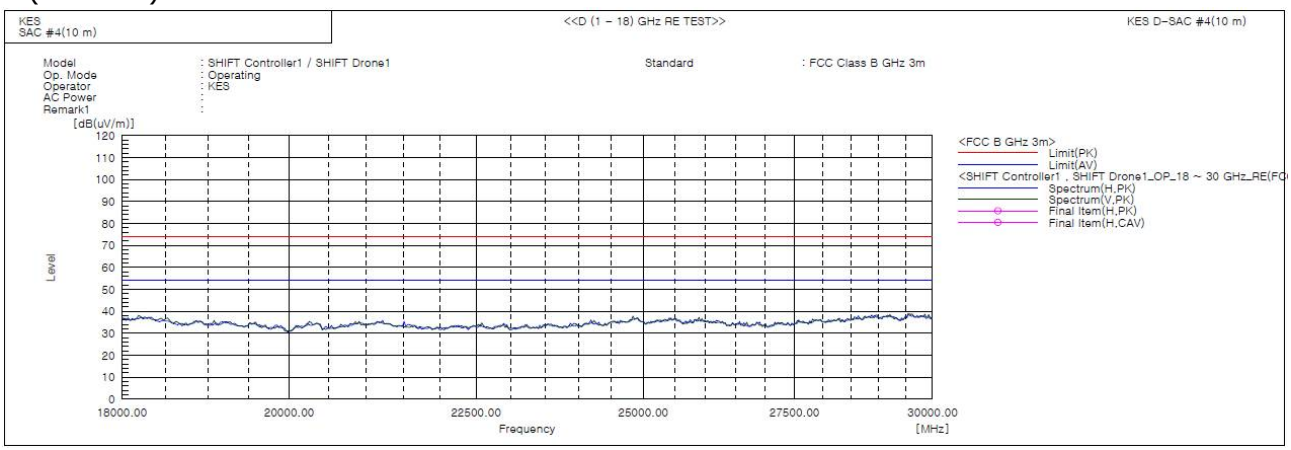
– (6 ~ 18) GHz



– (18 ~ 30) GHz



* No spurious emission were detected above 6 GHz.

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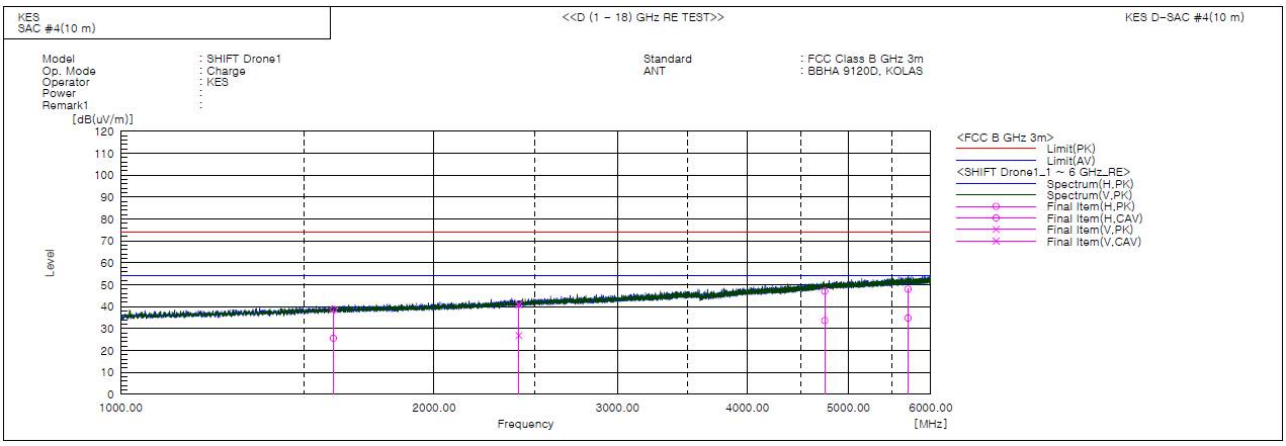
■ Charge Mode



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	1600.806	H	41.1	27.9	-2.3	38.8	25.6	74.0	54.0	35.2	28.4	211.0	305.0	
2	2412.731	V	39.5	25.5	1.4	40.9	26.9	74.0	54.0	33.1	27.1	136.0	233.0	
3	4746.569	H	36.6	23.2	10.5	47.1	33.7	74.0	54.0	26.9	20.3	124.0	174.0	
4	5705.688	H	35.0	21.8	13.0	48.0	34.8	74.0	54.0	26.0	19.2	100.0	16.0	

♦ Calculation

Result(PK/CAV) [dB(㎶/m)] = (Reading(PK/CAV)[dB(㎶)] + c.f[dB(1/m)]
Margin(PK/CAV)[dB] = Limit[dB(㎶/m)] - Result(PK/CAV) [dB(㎶/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: Marjin value

Uncertainty of measurement

Uncertainty of measurement 5.76 dB
(Confidence level: Approx. 95 %, k=2)

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