EMC TEST REPORT

Test Report No.	:	KES-E2-18T0055-R3
Date of Issue	:	Dec. 31, 2018
Product name	:	THINKWARE DASH CAM
Model/Type No.	:	Q800PRO
Variant Mode	:	QA100
FCC ID	:	2ADTG-Q800PRO
Applicant	:	THINKWARE CORPORATION
Applicant Address	:	A, 9FL., Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
Manufacturer	:	THINKWARE CORPORATION
Manufacturer Address	:	A, 9FL., Samwhan Hipex, 240, Pangyoyeok-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea
Equipment authorization	:	**Supply's Declaration of Conformity**
Date of Receipt	:	Nov. 22, 2018
Test date	:	Dec. 11, 2018 ~ Dec. 24, 2018
Test Results	:	☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Mun Hye, Jung
EMC Test Engineer

Reviewed by

Dong-Hun, Jang
EMC Technical Manager

This test report is not related to KOLAS.

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Dec. 14, 2018	KES-E2-18T0055	Issued
Dec. 26, 2018	KES-E2-18T0055-R1	1.Changed class A to Class B. 2.For above 1GHz test result section,update the result tables to be in English and also attach the test plots to the report. 3.The EUT photos deleted. . 4.Added FCC ID.
Dec. 28, 2018	KES-E2-18T0055-R2	IC ID was deleted.
Dec. 31, 2018	KES-E2-18T0055-R3	Remarks of Conducted Emissions at Mains Power Ports was revised.

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1.0 General Product Description

Main Specifications of EUT are:

Item	Specification	Remarks
Model name	Q800 PRO	
Dimensions / Weight	107 x 60.5 x 30 mm / 102.7 g 4.2 x 2.4 x 1.18 inch / 0.22 lb	
Memory	microSD memory card	16 GB, 32 GB, 64 GB, 128 GB (UHS-I)
Recording mode	Continuous Rec	Records videos in 1-minute segments (dual channels are supported for recording the front and rear view)
	Incident Rec	Records 10 seconds before and after the incident (total 20 seconds)
	Manual Rec	Records from 10 seconds before and 50 seconds after manually starting the recording (total 1 minute)
	Parking Rec (parking mode)	(Optional)
	Audio Recording	Press the voice recording button to turn the audio recording on or off
Camera sensor	5.14 Megapixel, 1/2.8" Sony STARVIS	
Angle of view (Lens)	Approximately 140° (diagonally)	
Video	QHD (2560 x 1440) / H.264 / file extension: MP4	
Frame rate	Maximum 30 fps	Applies equally to the front / rear recording
Audio	HE-AAC	
Acceleration sensor	3-axis acceleration sensor (3D, ±3G)	5 levels for sensitivity adjustment available
Rear camera (optional)	V-IN port	Optional accessory that requires separate purchase
GPS	Embedded GPS	Safety driving section alert supported
Power input	DC 12 / 24 V supported	
Power consumption	2ch: 4.2 W / 1ch: 2.9 W (mean)	Except for the fully charged supercapacitor / GPS
Auxiliary power unit	Super capacitor	
LED indicator	• Front: Security LED • Rear: GPS LED, Rec LED, Wi-Fi LED	
Alarm	Built-in speakers	Voice guide (buzzer sounds)

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 ☒ 24 Vdc ☐ PoE

Frequency ☐ 50 Hz ☐ 60 Hz ☐ Hz

1.2 Variant Model Differences

Add Simple Derivatives

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
THINKWARE DASH CAM	Q800PRO	-	THINKWARE CORPORATION	EUT
Micro SD card	-	-	-	-

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
THINKWARE REAR CAM	BCFH-200	-	THINKWARE CORPORATION	-
GPS receiver	-	-	THINKWARE CORPORATION	-
SmartPhone	SHV-E210L	R33D713KA3F	Samsung Electronics Co., Ltd.	-

1.6 External I/O Cabling

■ WIFI(12 Vdc/24 Vdc) MODE

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
Wireless Video Baby Camera (EUT)	DC IN	DC POWER	DC OUT	2.5	U
	V-IN	THINKWARE REAR CAM	V-OUT	7.5	U
	GPS	GPS receiver	GPS	5.0	U
	Wireless	Smart Phone	Wireless	-	-
	Micro SD slot	Micro SD card	Micro SD slot	-	-

* Unshielded=U, Shielded=S

■ Recording(12 Vdc/24 Vdc) MODE

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
THINKWARE DASH CAM (EUT)	DC IN	DC POWER	DC OUT	2.5	U
	V-IN	THINKWARE REAR CAM	V-OUT	7.5	U
	GPS	GPS receiver	GPS	5.0	U
	Micro SD slot	Micro SD card	Micro SD slot	-	-

* Unshielded=U, Shielded=S

1.7 EUT Operating Mode(s)

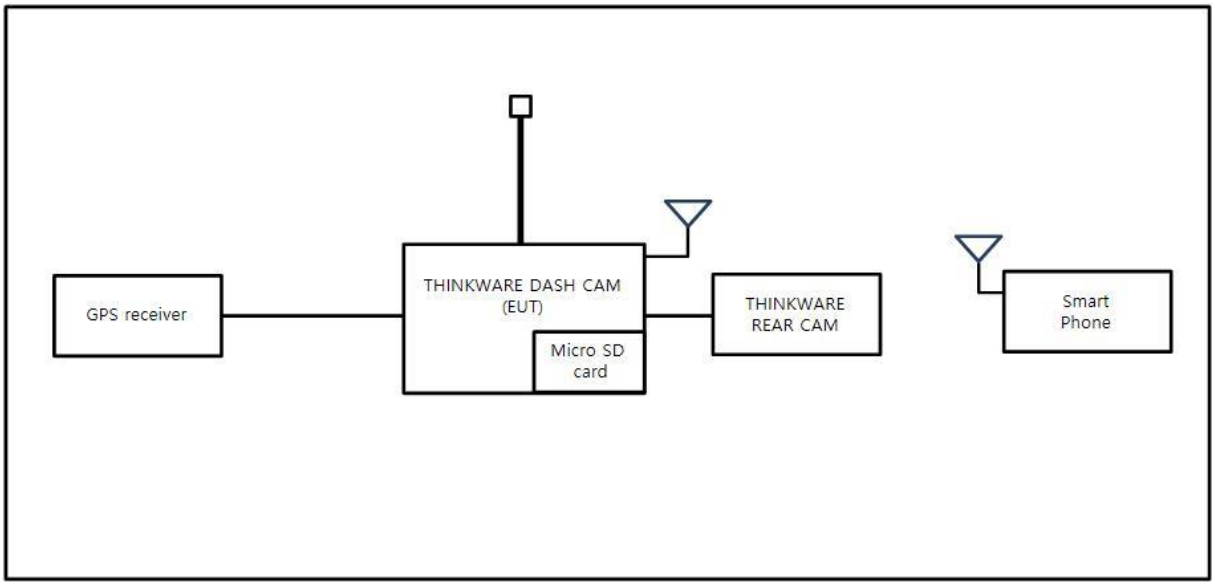
Test mode	operating
WIFI (12 Vdc/24 Vdc)	Connect the EUT and SmartPhone wirelessly and check network status on SmartPhone.
Recording (12 Vdc/24 Vdc)	1. During the test, the EUT operation was confirmed with REC LED. 2. After the test, it was confirmed that the images of the EUT were recorded on the Micro SD card.

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

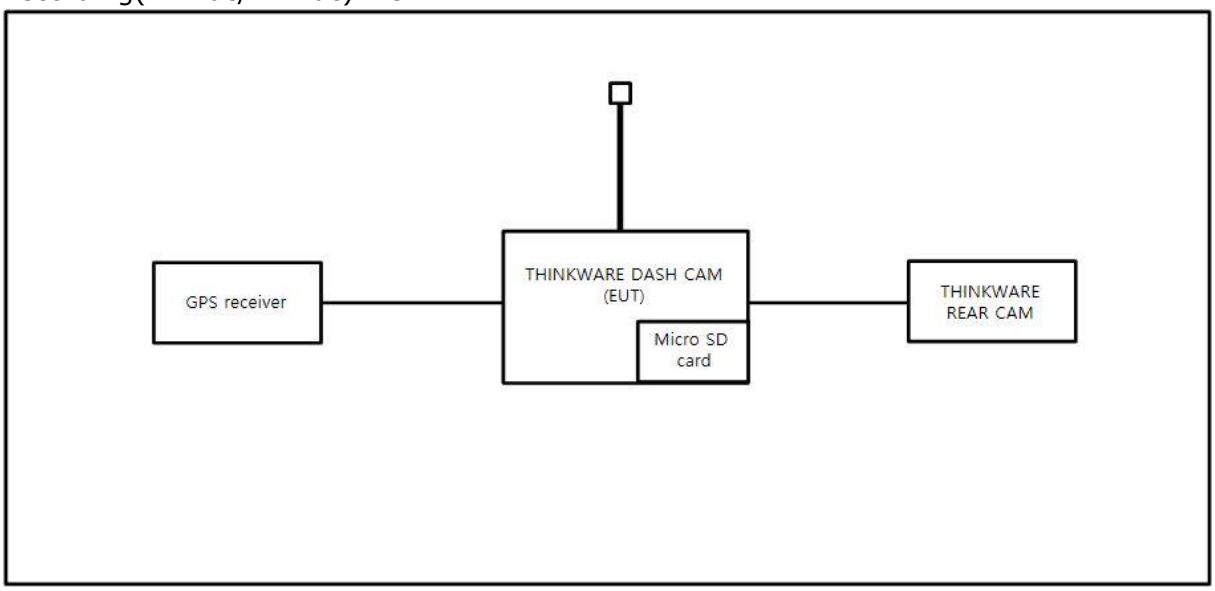
1.8 Configuration

■ AC Main
□ DC Main

■ WIFI(12 Vdc/24 Vdc) MODE



■ Recording(12 Vdc/24 Vdc) 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 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-4308, C-4798, T-2311, G-914
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 17 07 01633 001

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

☐ **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**

- ☐ 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

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
☐	EMI Test S/W	EMC32	R & S	9.12.00	-
☐	EMI TEST RECEIVER	ESR3	R & S	101781	04, 25, 2019
☐	LISN	ENV216	R & S	101787	01, 05, 2019
☐	LISN	ESH2-Z5	R & S	100450	04, 25, 2019
☐	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 26, 2019

Test Conditions
Temperature: ℃
Relative Humidity: % 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
N/A: It is not tested apply because it is powered by DC.

2.2 Radiated Electric Field Emissions(Below 1 ㎓)

Test Date
Dec. 24, 2018

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, 11, 2019
☒	AMPLIFIER	SCU 01	R & S	100603	11, 26, 2019
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	714	11, 26, 2020

Test Conditions
Temperature: 21,0 ℃
Relative Humidity: 50,5 % 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.

2.3 Radiated Electric Field Emissions(Above 1 ㎓)

Test Date
Dec. 11, 2018

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, 11, 2019
☒	PREAMPLIFIER	8449B	AGILENT	3008A01742	01, 11, 2019
☐	ATTENUATOR	8491A	HP	35496	03, 21, 2019
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	03, 12, 2020

Test Conditions
Temperature: 20,7 ℃
Relative Humidity: 50,6 % R.H.

Frequency Range of Measurement
1 ㎓ to 12 ㎓

Instrument Settings
IF Band Width: 1 ㎒

Test Results
The requirements are:
☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks
See Appendix A for test data.

APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

HOT LINE

N/A

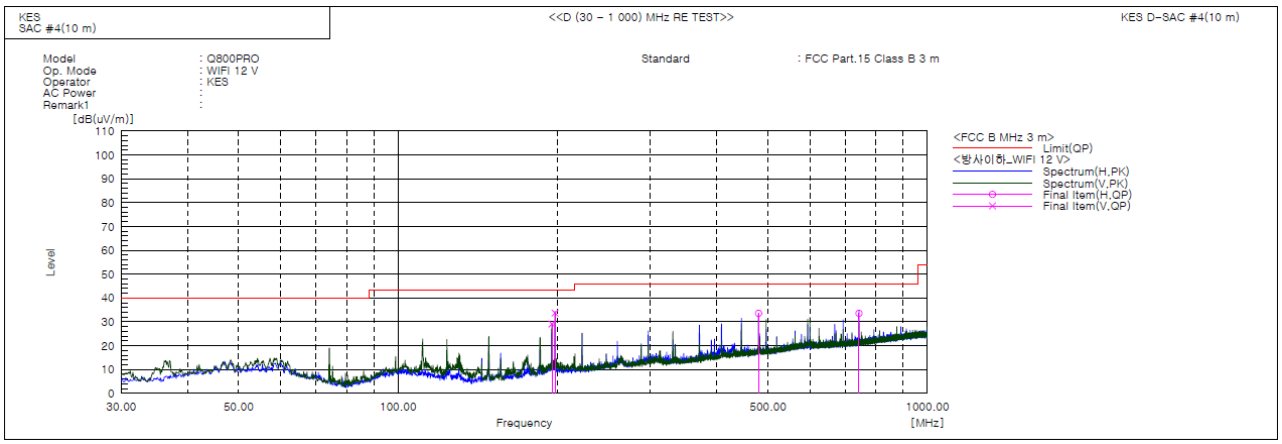
NEUTRAL LINE

N/A

◆ Calculation
QuasiPeak[㏈uV] / CAverage [㏈uV] = Reading Value[㏈uV] + Corr. [㏈]
QuasiPeak / CAverage : The Final Value
Reading Value : Not shown in the table.
Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

Radiated Electric Field Emissions(Below 1 ㎓)

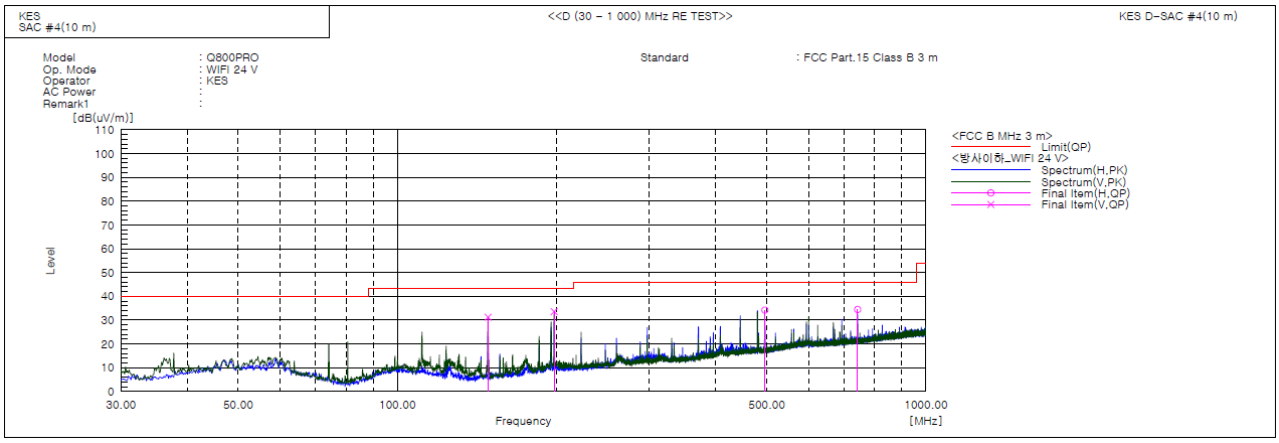
■ WIFI 12 Vdc



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	195.375	V	57.9	-28.8	29.1	43.5	14.4	100.0	102.0	
2	198.004	V	62.3	-28.6	33.7	43.5	9.8	123.0	82.0	
3	480.024	H	54.2	-20.6	33.6	46.0	12.4	100.0	324.0	
4	742.586	H	49.5	-15.9	33.6	46.0	12.4	154.0	130.0	

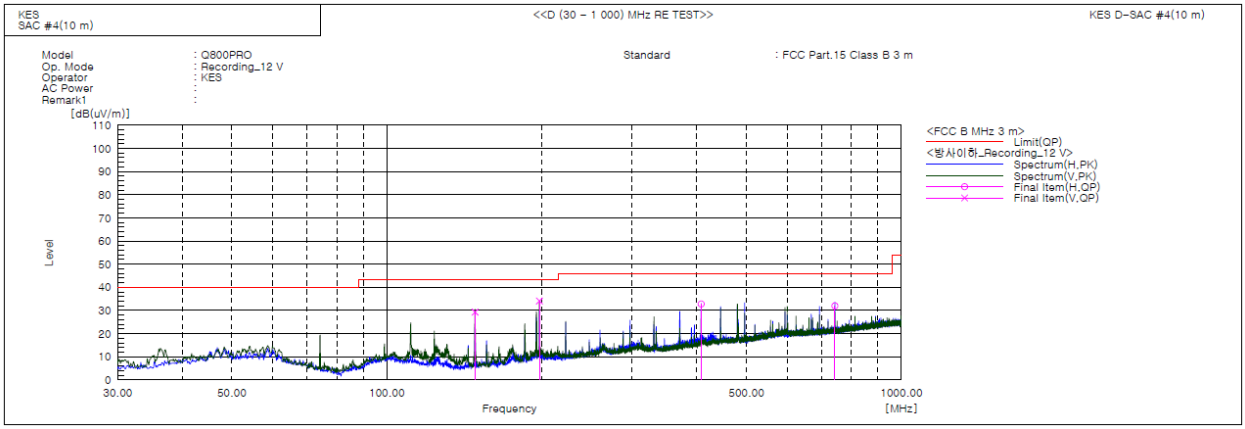
■ WIFI 24 Vdc



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	148.491	V	63.7	-32.5	31.2	43.5	12.3	100.0	267.0	
2	197.931	V	62.2	-28.6	33.6	43.5	9.9	123.0	96.0	
3	495.843	H	54.3	-20.1	34.2	46.0	11.8	211.0	115.0	
4	742.586	H	50.4	-15.9	34.5	46.0	11.5	100.0	131.0	

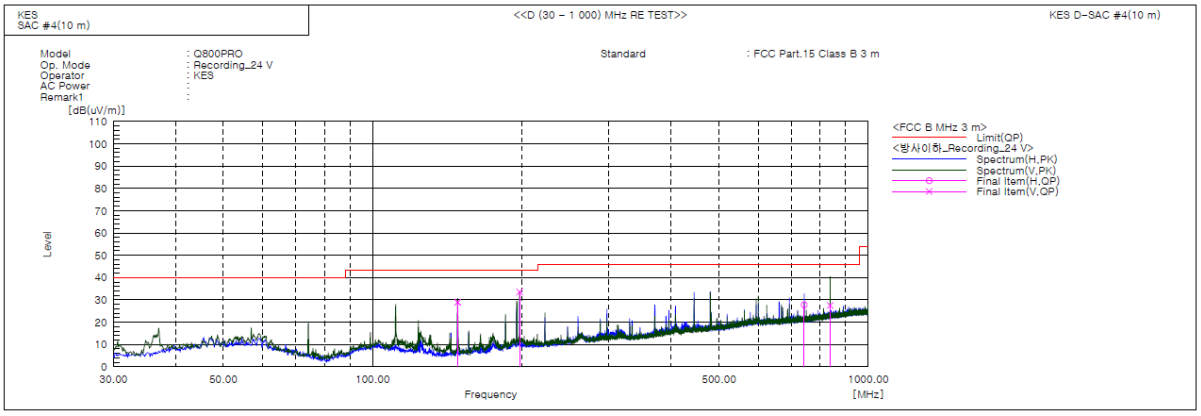
■ Recording 12 Vdc



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	148.461	V	61.8	-32.5	29.3	43.5	14.2	107.0	267.0	
2	197.931	V	62.7	-28.6	34.1	43.5	9.4	100.0	97.0	
3	408.300	H	55.2	-22.4	32.8	46.0	13.2	206.0	349.0	
4	742.586	H	47.9	-15.9	32.0	46.0	14.0	113.0	139.0	

■ Recording 24 Vdc



Final Result

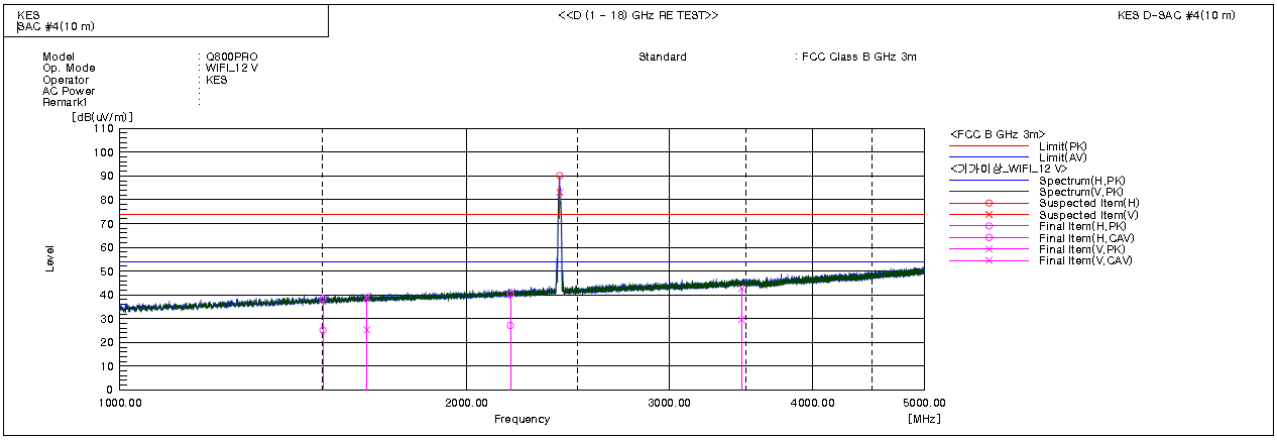
No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	148.461	V	61.5	-32.5	29.0	43.5	14.5	100.0	293.0	
2	197.931	V	62.2	-28.6	33.6	43.5	9.9	116.0	58.0	
3	742.586	H	43.7	-15.9	27.8	46.0	18.2	100.0	101.0	
4	837.889	V	42.0	-14.5	27.5	46.0	18.5	151.0	119.0	

♦ 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

Radiated Electric Field Emissions(Above 1 ㎓)

■ WIFI 12 Vdc

(1 – 5) ㎓



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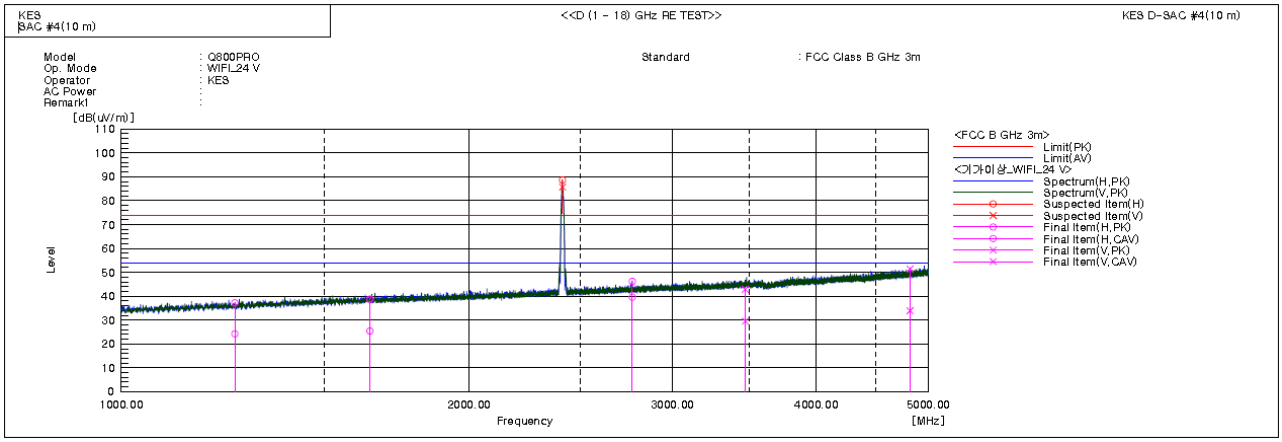
Frequency		Reading	Polarization	Antenna Hight	Factor value		AMP Factor (dB)	Result	Limit	Margin [dB]
[㎒]		[dB㎶]		[m]	Antenna [dB/m]	Cable [dB]		[dB㎶/m]	[dB㎶/m]	
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

AV

Frequency		Reading	Polarization	Antenna Hight	Factor value		AMP Factor (dB)	Result	Limit	Margin [dB]
[㎒]		[dB㎶]		[m]	Antenna [dB/m]	Cable [dB]		[dB㎶/m]	[dB㎶/m]	
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

■ WIFI 24 Vdc

(1 – 5) GHz



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	Frequency [MHz]	Reading [dBμV]	Polarization	Antenna Hight [m]	Factor value Antenna [dB/m]	Factor value Cable [dB]	AMP Factor (dB)	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

AV

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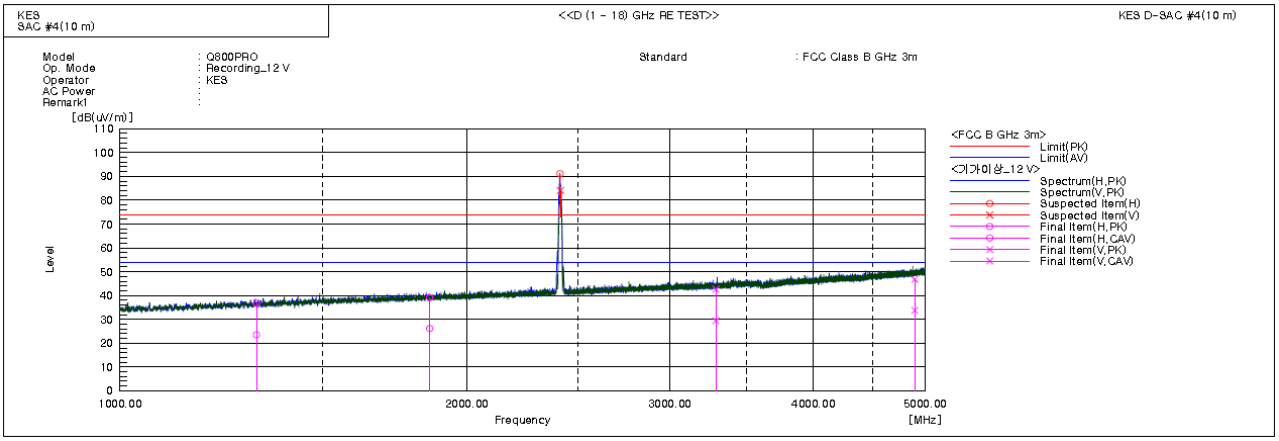
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

■ Recording 12 Vdc
(1 – 5) GHz



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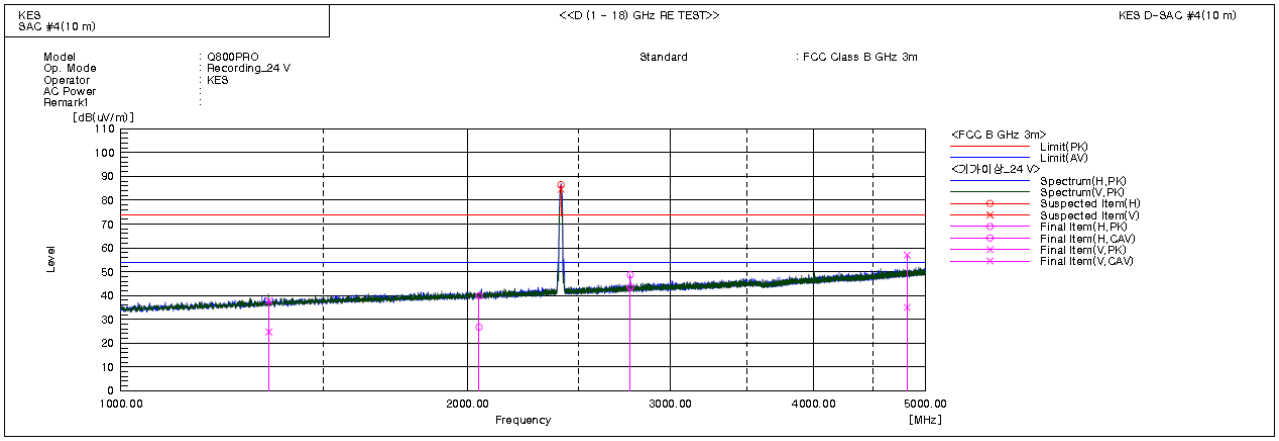
Frequency		Reading	Polarization	Antenna Hight	Factor value		AMP Factor (dB)	Result	Limit	Margin [dB]
[MHz]		[dBμV]		[m]	Antenna [dB/m]	Cable [dB]		[dBμV/m]	[dBμV/m]	
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

AV

Frequency		Reading	Polarization	Antenna Hight	Factor value		AMP Factor (dB)	Result	Limit	Margin [dB]
[MHz]		[dBμV]		[m]	Antenna [dB/m]	Cable [dB]		[dBμV/m]	[dBμV/m]	
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

■ Recording 24 Vdc

(1 – 5) ㎓



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Frequency		Reading	Polarization	Antenna Hight	Factor value		AMP Factor (dB)	Result	Limit	Margin [dB]
[㎒]		[dB㎶]		[m]	Antenna [dB/m]	Cable [dB]		[dB㎶/m]	[dB㎶/m]	
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

AV

Frequency		Reading	Polarization	Antenna Hight	Factor value		AMP Factor (dB)	Result	Limit	Margin [dB]
[㎒]		[dB㎶]		[m]	Antenna [dB/m]	Cable [dB]		[dB㎶/m]	[dB㎶/m]	
1	501.000	44.880	H	1.240	25.160	9.120	37.360	41.800	74.000	32.200
1	639.000	43.480	V	3.590	25.840	9.530	37.350	41.500	74.000	32.500
2	185.000	38.640	H	0.000	28.070	11.070	37.580	40.200	74.000	33.800
3	469.000	30.770	V	1.000	30.960	13.950	37.880	37.800	74.000	36.200

Exclusion Band: 2.4 ㎓

♦ Calculation

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

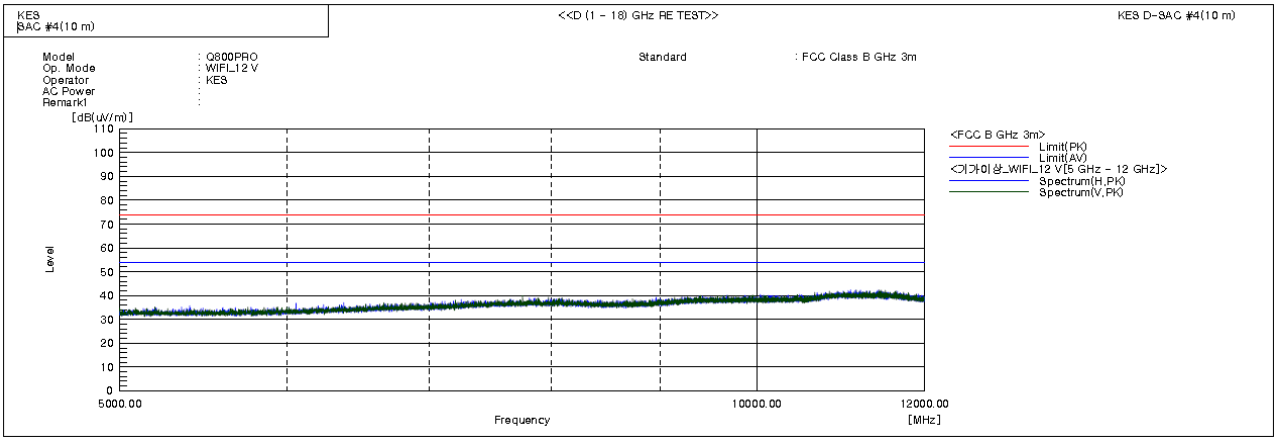
Margin(PK/CAV)[dB] = Limit[dB(㎶/m)] - Result(PK/CAV) [dB(㎶/m)]

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

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

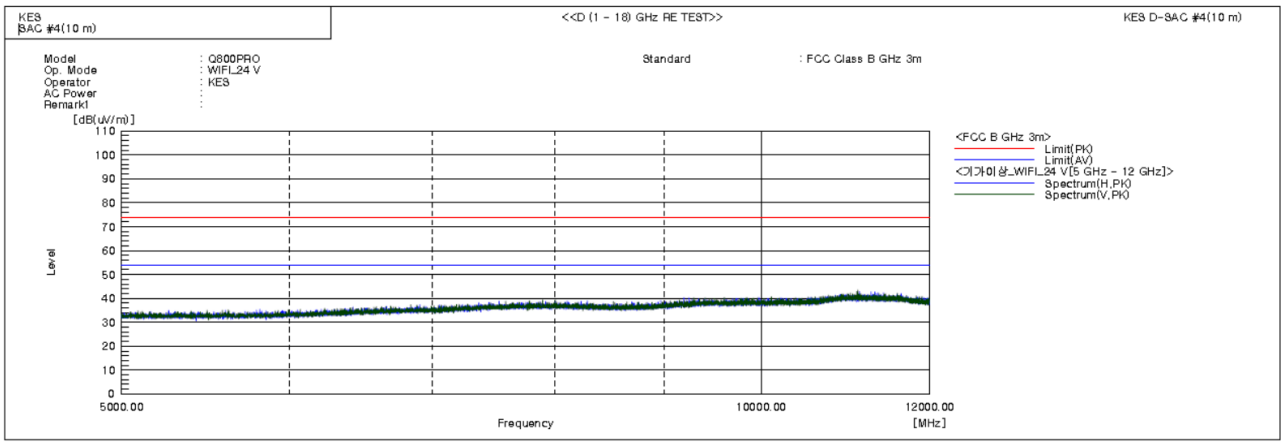
■ WIFI 12 Vdc

(5 – 12) GHz



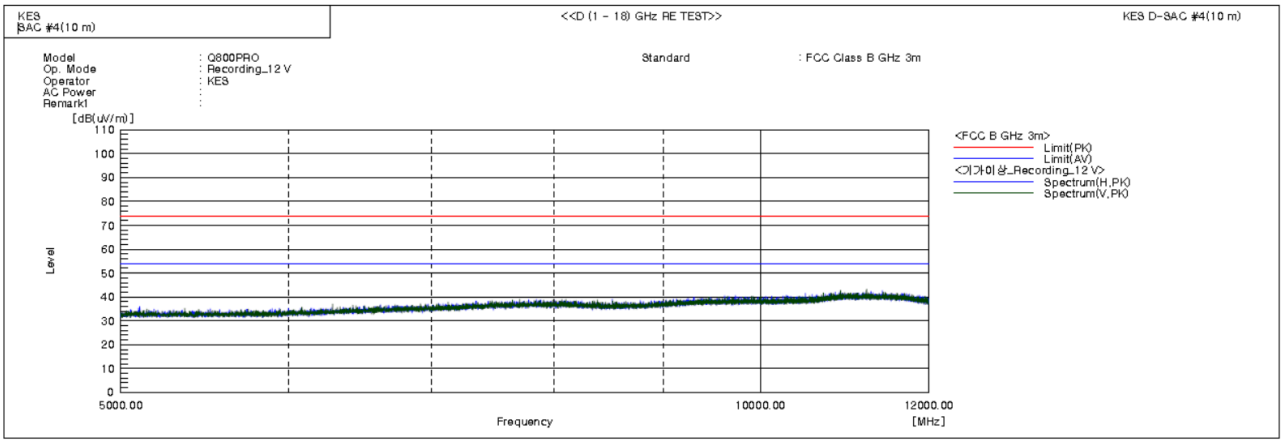
■ WIFI 24 Vdc

(5 – 12) GHz



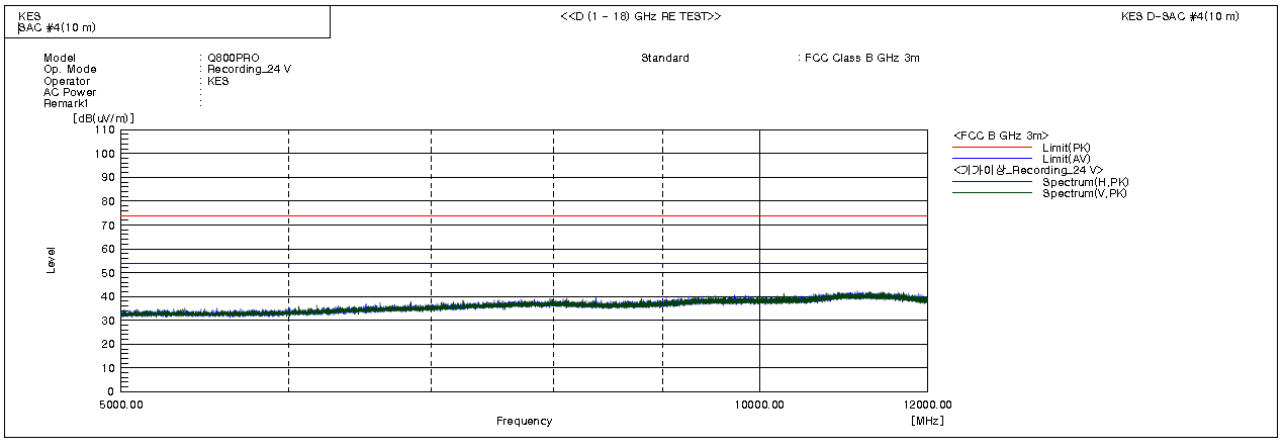
■ Recording 12 Vdc

(5 – 12) ㎓



■ Recording 24 Vdc

(5 – 12) ㎓



(5 – 12) ㎓: No spurious emission were detected above 5 ㎓.