



TEST REPORT

KCTL Inc. 52-20, Sinjeong-ro 41beon-gil, Giheung-gu, Yongin-si, Gyeonggi-Do, Korea TEL: 82-31-326-6700 FAX: 82-31-326-6799 www.kctl.co.kr		Report No.: KR17-YEF0077 Page (1) of (26)	
1. Client ◦ Name : UNIVE Co.,Ltd. ◦ Address : SUNTECHCITY 1 RM 405, 474, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea ◦ Date of Receipt : 2017-10-25 2. Use of Report : - 3. Name of Product and Model : DisplayPort 1.3 Active Optical Cable (AOC) / UPO-A0KB 4. Manufacturer and Country of Origin : UNIVE Co.,Ltd. / Korea 5. Date of Test : 2017-11-01 to 2017-11-02 6. Test method used : FCC Part 15 Subpart B, Class B 7. Test Results : Refer to the test result in the test report			
Affirmation	Tested by	Technical Manager	
	Name : Youngbae Seo (Signature) 	Name : Jaeho Park (Signature) 	
2017-11-10			
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REPORT REVISION HISTORY

Date	Revision	Page No
2017-11-10	Originally issued	-

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1. Applicant information

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2. Laboratory information

Address

KCTL Inc. (Yongin Lab.)

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Telephone Number: 82 31 326 6700

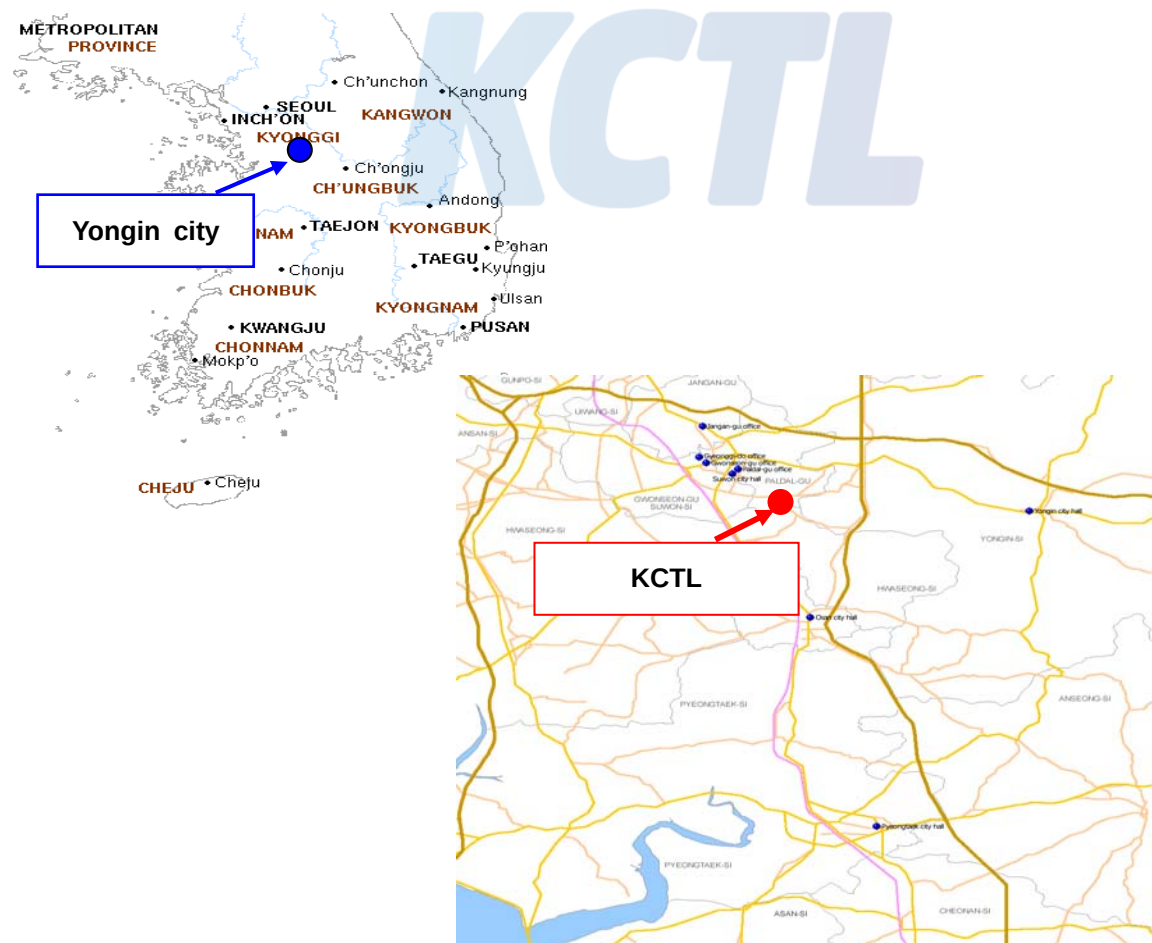
Facsimile Number: 82 31 326 6799

FCC Site Designation No: KR0040

VCCI Registration No. : C-2915, T-1320, R-4386, G-547

KOLAS NO.: KT231

SITE MAP



3. Test system configuration

3.1 Operation environment

	Temperature	Humidity	Pressure
Chamber 10 m(RE)	24.4 °C	47.3 % R.H.	-
Chamber 3 m(RE)	-	-	-
Shielded room(CE)	22.4 °C	37.1 % R.H.	-

Test site

These testing items were performed following locations;

Test item	Test site
Conducted Emission	Shielded Room
Radiated Emission	10 m Chamber

3.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC.

The factors contributing to uncertainties are test receiver, cable loss, antenna factor calibration, Antenna directivity, antenna factor variation with height, antenna phase center variation, antenna frequency interpolation, measurement distance variation, site imperfection, mismatch, and system repeatability. Based on CISPR 16-4-2, the measurement uncertainty level with a 95 % confidence level was applied.

Conducted Emission measurement_AMN (Confidence level about 95 %, $k = 2$)		
Shielded Room (CE#1)	9 kHz ~ 150 MHz : 3.65 dB	
	150 kHz ~ 30 MHz : 3.42 dB	
Shielded Room (CE#2)	9 kHz ~ 150 MHz : 3.55 dB	
	150 kHz ~ 30 MHz : 3.12 dB	
Radiated Emission measurement (Confidence level about 95 %, $k = 2$)		
10 m Chamber	30 MHz ~ 300 MHz	3 m : 4.98 dB
		10 m : 4.96 dB
	300 MHz ~ 1 000 MHz	3 m : 5.12 dB
		10 m : 4.98 dB
	1 GHz ~ 6 GHz	3 m : 5.68 dB
3m Chamber	1 GHz ~ 6 GHz	3 m : 5.44 dB

3.3 Measurement Program

These test items were performed by software programs;

Test item	Measurement Program	Used
Conducted Emission	EP5CE_V 5.4.0(TOYO)	☒
Radiated Emission	EP5RE_V 4.6.0(TOYO)	☒
Disturbance Power	EMC32_V 9.12(R&S)	☐
Radiated Electromagnetic Disturbance	EMC32_V 9.2(R&S)	☐
Discontinuous interference	AFJ Click Meter Soft CMS_V 1.0	☐
Radiated RF Immunity	TDK Radiated Immunity Lab_V 9.62	☐
Conducted RF Immunity	TDK Conducted Immunity Lab_V 3.33	☐
Immunity of Broadcast Receivers	T80-K1_V 2.21(R&S)	☐
Harmonics current emissions, Voltage fluctuations and flicker	IEC Soft_V 2.4f(N4L)	☐

4. Description of EUT

4.1 General information

Parameter	Min.	Typ.	Max	Unit
ABSOLUTE MAXIMUM RATINGS				
Storage Temperature	-20		85	°C
Relative Humidity	5		85	%
Electrostatic Discharge Immunity (Air: 8kV, Contact: 6kV)	B			Class
RECOMMENDED OPERATING CONDITIONS				
Operating Temperature	-20		70	°C
ELECTRICAL CHARACTERISTICS				
Supply Voltage	3.0	3.3	3.6	V
Operating Current		190		mA
Power Consumption		0.67		W
Data rate/channel	1.65		8.1	Gbps
Differential input Voltage	340		1380	mVpp
Differential output Voltage		600		mVpp

PHYSICAL CHARACTERISTICS

Parameter	Value	Unit
Cable Assembly		
Cable Type	Hybrid Cable Plastic Optical Fibers and Electrical Wires	
Cable Dimensions (W x H)	5.10 x 2.90	mm
Cable Color	Non-UL: green Plenum: orange / black / aqua	
Connector Pull Strength	20	Kgf
Minimum Bend radius	2	mm
Case Material	PC(Polycarbonate)	

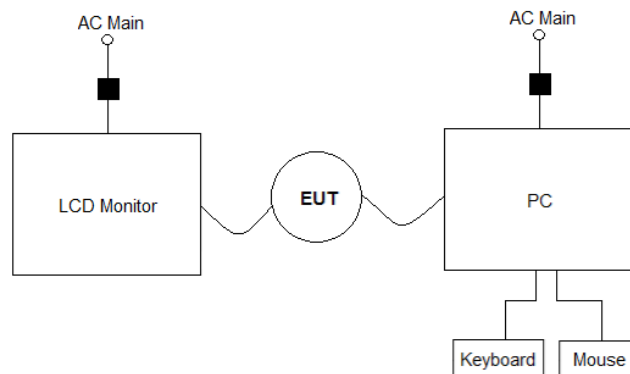
4.2 Product description

Type of product	DisplayPort 1.3 Active Optical Cable (AOC)
Model name (Basic)	UPO-A0KB
Model name (Variant)	-
Difference	-
Trade name	-
Serial no	-
Testing voltage	120 V, 60 Hz
Input rating	DC 3.3V
Internal clock frequency	Below 108 MHz

4.3 Auxiliary equipments

Type	Model / Part #	S/N	Manufacturer
LCD Monitor	P2815Qf	CN-0WJJGR-72872-467-AVNM	HONGFUJIN Precision Electronics (Chong Qing) Co., Ltd.
PC	EliteDesk 800 G1 TWR	6CR4080MLR	HEWLETT-PACKARD COMPANY
Keyboard	K291B	M0412000178	MONTEREY INTERNATIONAL CORP.
Mouse	M-UV96	-	LOGITECH INC.

4.4 Test configuration



	Start		End		Cable	
	Name	I/O port	Name	I/O port	Length (m)	Spec.
1	EUT	DP	LCD Monitor	DP	100	Unshield
2		DP	PC	DP	100	Unshield
3	LCD Monitor	Power	AC Main	-	1.6	Unshield (Core 1EA)
4	PC	Power	AC Main	-	1.6	Unshield (Core 1EA)
5		USB	Keyboard	-	1.2	Unshield
6		USB	Mouse	-	1.4	Unshield

4.5 Operating conditions

The EUT was configured as normal intended use.

Test mode	Normal operating
1	Normal Operating Mode.

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5. Summary of test results

In the above configuration tested, The EUT complied with the requirement of the specification

5.1 Summary of EMI emission test results

FCC Part 15 Subpart B (Class B)

ANSI C63.4 – 2014

Applied	Test items	Test method	Result
☒	Conducted Emission	ANSI C63.4 – 2014	Pass
☒	Radiated Emission	ANSI C63.4 – 2014	Pass

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6. Test results

6.1 Conducted Emissions

Test specification	FCC Part 15, Section 15.107(e), Class B		
Testing voltage	120 V, 60 Hz		
Test facility	Shielded room (CE#1)		
Date	2017. 11. 01		
Temperature (°C)	22.4 °C	Humidity (% R.H.)	37.1 % R.H.
Remarks	Pass		

6.1.1 Limits of conducted emissions measurement

☒ AC main

Frequency [MHz]	Class A (dB(μV))		Class B (dB(μV))	
	Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	79	66	66 ~ 56 *	56 ~ 46*
0.5 ~ 5	73	60	56	46
5 ~ 30	73	60	60	50

*The limit decreases linearly with the logarithm of frequency

6.1.2 Measurement procedure

The measurements were performed in a shielded room. EUT was setup as shown in photograph and placed on a non-metallic table height of 0.8 m above the reference ground plane. The rear of table was located 0.4 m to the vertical conducted plane. EUT was power through the LISN, which was bonded to the ground plane. The LISN power was filtered. Each EUT power lead, except ground (safety) lead was individually connected through a LISN to input power source. EUT signal cables that hung closer than 0.4 m to the Horizontal metal ground 0.3 m ~ 0.4 m long. The power cord was bundles in the center. All peripheral equipment was powered from a sub LISN. The LISN and ISN were positioned 0.8 m from the EUT. Peak and Average detection were used in preliminary testing and Quasi-peak and Average detections were used at final measurement. Both lines of power cord, hot and neutral, were measured.

Result QP/CAV[dB(μ V)] = Reading QP/CAV[dB(μ V)] + c.f.(Insertion Loss [dB] + Cable Loss [dB])

Result QP/CAV : Result, Reading QP/CAV : Meter Reading, c.f : Correction Factor

Margin (QP/CAV) = Limit (QP/CAV) – Results (QP/CAV)

Note1) QP : Abbreviation of Quasi-Peak

Note2) CAV : Abbreviation of CISPR Average

6.1.3 Used equipments

Equipment	Model	Serial No.	Makers	Next Cal. Date	Used
EMI Test Receiver	ESCI	100373	R&S	2018.11.01	☐
Two Line V-Network	ENV216	101718	R&S	2018.09.19	☒
Two Line V-Network	ESH2-Z5	842966/014	R&S	2018.09.20	☐
EMI Test Receiver	ESCI	100154	R&S	2018.05.02	☒
Two Line V-Network	ENV216	101719	R&S	2018.09.19	☐
Two Line V-Network	ESH3-Z5	862770/025	R&S	2018.05.23	☐
V-Network	ESH3-Z6	100431	R&S	2018.05.02	☐
V-Network	ESH3-Z6	100432	R&S	2018.05.02	☐

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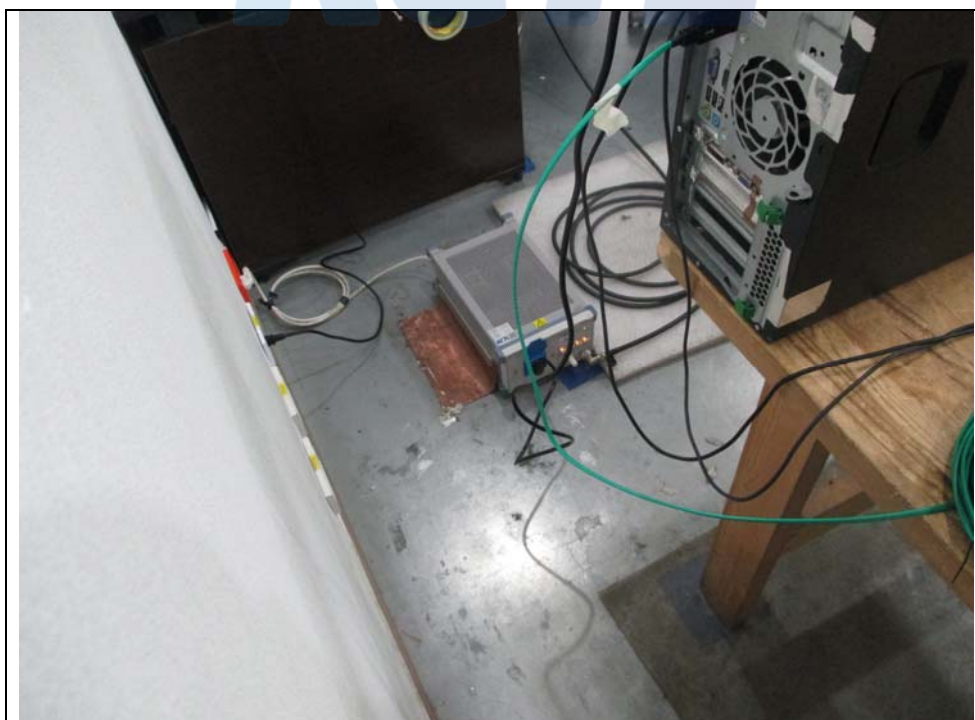
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6.1.4 Photographs of test setup

* AC Main



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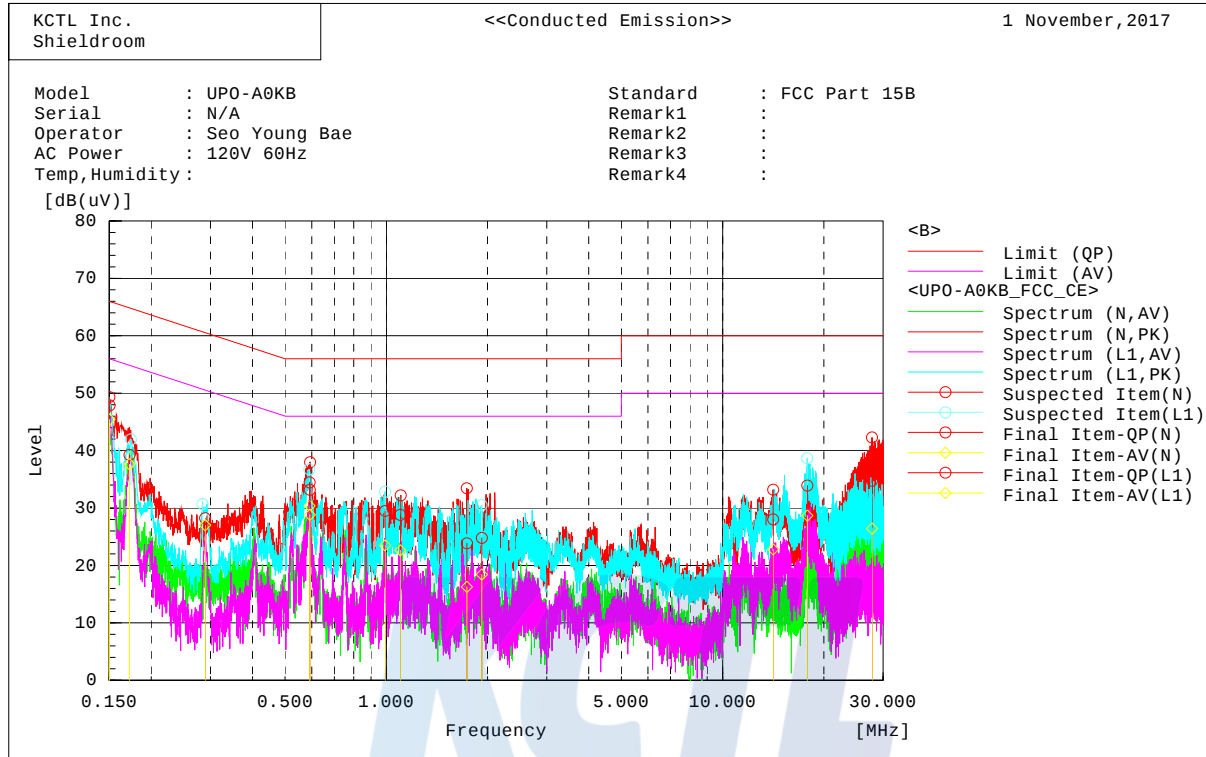
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6.1.5 Conducted emissions measurement result

* AC Main



Final Result

--- N Phase ---

No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin QP	Margin CAV
	[MHz]	[dB(uV)]	[dB(uV)]	[dB]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB]	[dB]
1	0.15021	38.1	35.6	9.8	47.9	45.4	66.0	56.0	18.1	10.6
2	0.59097	24.6	20.5	9.9	34.5	30.4	56.0	46.0	21.5	15.6
3	1.10021	19.0	12.8	9.8	28.8	22.6	56.0	46.0	27.2	23.4
4	1.73613	14.1	6.5	9.8	23.9	16.3	56.0	46.0	32.1	29.7
5	14.13535	18.0	12.8	10.0	28.0	22.8	60.0	50.0	32.0	27.2
6	27.80974	24.6	16.2	10.2	34.8	26.4	60.0	50.0	25.2	23.6

--- L1 Phase ---

No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin QP	Margin CAV
	[MHz]	[dB(uV)]	[dB(uV)]	[dB]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB]	[dB]
1	0.1722	29.2	27.6	10.0	39.2	37.6	64.9	54.9	25.7	17.3
2	0.28895	18.5	17.3	9.7	28.2	27.0	60.6	50.6	32.4	23.6
3	0.59209	23.3	18.9	9.9	33.2	28.8	56.0	46.0	22.8	17.2
4	0.99117	19.7	13.7	9.8	29.5	23.5	56.0	46.0	26.5	22.5
5	1.9236	15.1	8.7	9.7	24.8	18.4	56.0	46.0	31.2	27.6
6	17.85343	23.9	18.7	10.0	33.9	28.7	60.0	50.0	26.1	21.3

6.2 Radiated Emission

Test specification	FCC Part 15, Section 15.109(g), Class B		
Testing voltage	120 V, 60 Hz		
Test facility	10 m Chamber		
Test distance	3 m		
Date	2017. 11. 02		
Temperature (°C)	24.4 °C	Humidity (% R.H.)	47.3 % R.H.
Remarks	Pass		

6.2.1 Limits of radiated emission measurement

☒ Limits below 1 GHz

Frequency [MHz]	Class A (dB(μV/m)) @ 10 m	Class B (dB(μV/m)) @ 3 m
30-88	39.08	40.00
88-216	43.52	43.52
216-960	43.44	46.02
Above 960	49.54	53.98

* Note- Alternative standard: CISPR, Pub. 22 *

☐ Limits above 1 GHz

Frequency [GHz]	Class A @ 3 m		Class B @ 3 m	
	Peak limit (dB(μV/m))	Average limit (dB(μV/m))	Peak limit (dB(μV/m))	Average limit (dB(μV/m))
Above 1 GHz	79.5	59.5	74	54

Note - The lower limit applies at the transition frequency.

6.2.2 Measurement procedure

The test was done at a 10 m Chamber with a quasi-peak detector.

EUT was placed on a non-metallic table height of 0.8 m above the reference ground plane.

Cables were folded back and forth forming a bundle 0.3 m to 0.4 m long and were hanged at a 0.4 m height to the ground plane. Cables connected to EUT were fixed to cause maximum emission.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.

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6.2.3 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
EMI Test Receiver	ESCI	100374	R&S	2018.05.02	☒
Amplifier	310N	353132	SONOMA	2018.09.19	☒
Attenuator	8491B 3dB	MY39263388	Agilent	2018.09.19	☒
Bi-Log Antenna	CBL 6112D	40522	TESEQ	2018.03.16	☒
EMI Test Receiver	ESCI7	100872	R&S	2018.07.12	☐
Amplifier	8449B OPT H02	3008A0530	HP	2018.09.19	☐
Horn Antenna	HF906	100530	R&S	2019.02.27	☐

6.2.4 Sample calculation

The field strength is calculated adding the antenna Factor, cable loss and, Antenna pad adding, subtracting the amplifier gain from the measured reading.

The sample calculation is as follow:

-Below 1 GHz

$$\text{Result QP [dB}(\mu\text{V/m)}] = \text{Reading QP [dB}(\mu\text{V)}] + \text{c.f(Antenna Factor [dB/m]} + \text{Cable Loss [dB]} \\ + 3 \text{ dB Att [dB]} - \text{Amp Gain [dB]})$$

Result QP : Result, Reading QP : Meter Reading, c.f : Correction Factor

Margin (QP) = Limit (QP) – Results (QP)

Note1) QP : Abbreviation of Quasi-Peak

-Above 1 GHz

$$\text{Result PK/CAV [dB}(\mu\text{V/m)}] = \text{Reading PK/CAV [dB}(\mu\text{V)}] + \text{c.f(Antenna Factor [dB/m]} + \text{Cable Loss [dB]} \\ - \text{Amp Gain [dB]})$$

Result PK/CAV : Result, Reading PK/CAV : Meter Reading, c.f : Correction Factor

Margin (PK/CAV) = Limit (QP/CAV) – Results (QP/CAV)

Note1) PK : Abbreviation of Peak

Note2) CAV : Abbreviation of CISPR Average

If Reading is 30 dB, Antenna Factor 12 dB, Cable Loss 5 dB, Attenuator 3 dB, Amp Gain 35 dB

The result is

$$30 + 12 + 5 + 3 - 35 = 15 \text{ dB}(\mu\text{V/m)}$$

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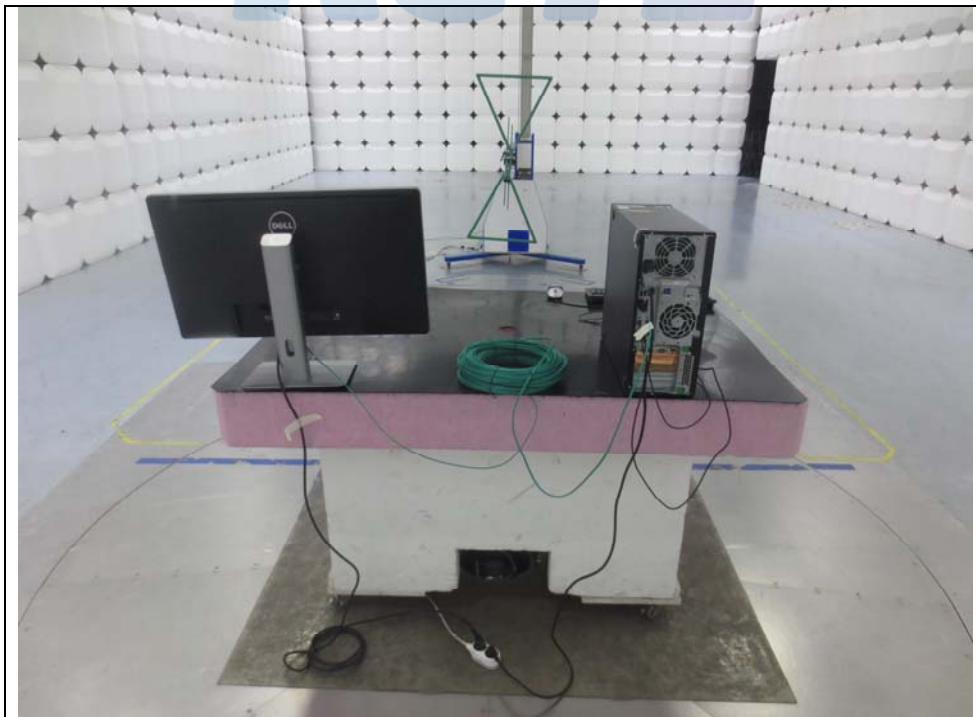
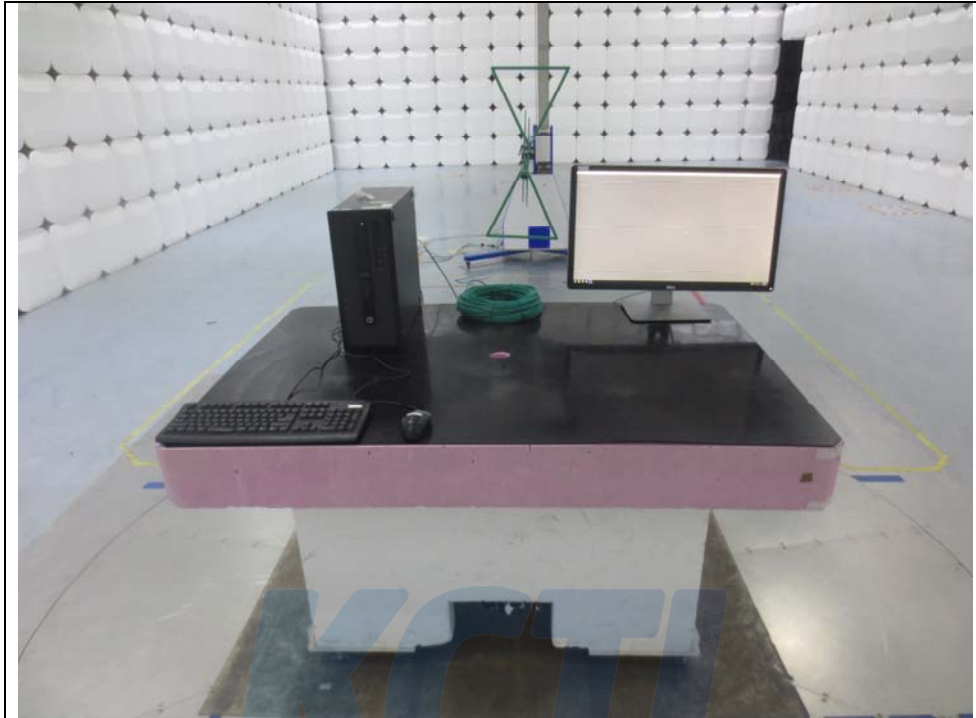
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6.2.5 Photographs of test setup

* 30 MHz ~ 1 GHz



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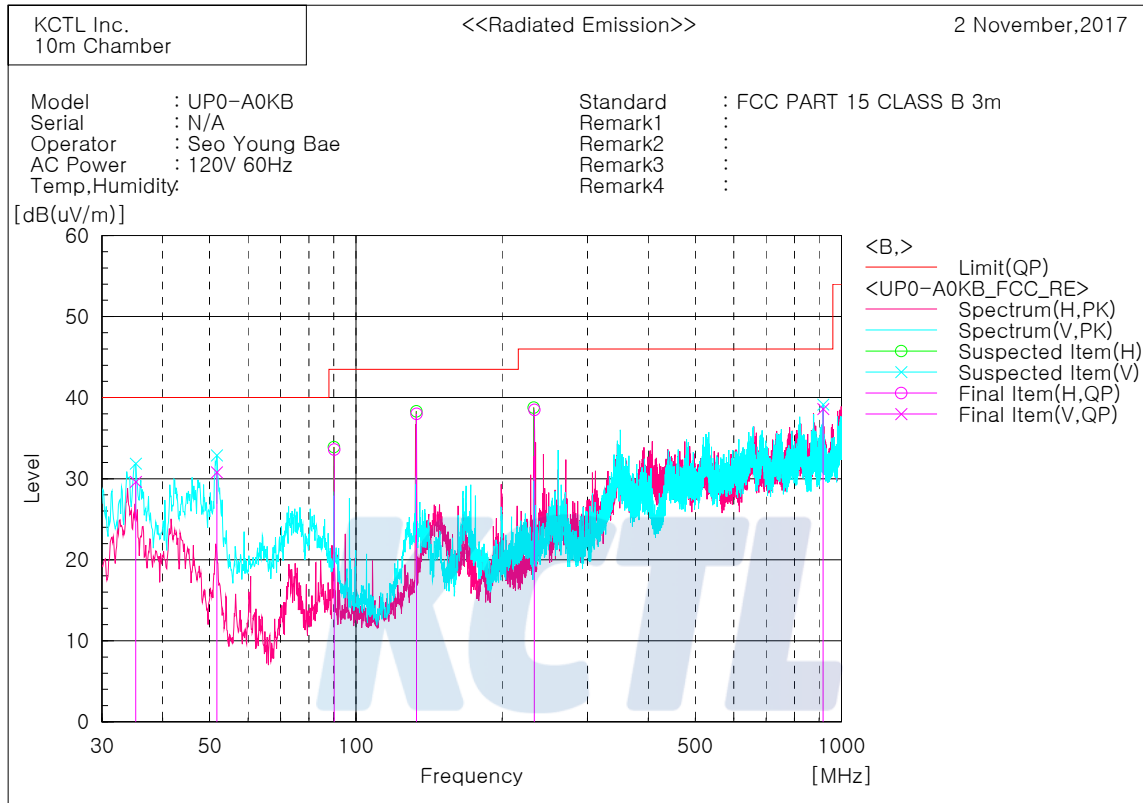
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6.2.6 Radiated emission measurement result

* Graph and Data

* 30 MHz ~ 1 GHz



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	35.214	V	41.1	-11.5	29.6	40.0	10.4	100.0	32.0	
2	51.704	V	51.2	-20.4	30.8	40.0	9.2	100.0	60.0	
3	90.220	H	51.2	-17.6	33.6	43.5	9.9	300.0	121.0	
4	133.260	H	52.6	-14.6	38.0	43.5	5.5	200.0	239.0	
5	233.204	H	51.8	-13.3	38.5	46.0	7.5	100.0	190.0	
6	917.550	V	36.5	2.1	38.6	46.0	7.4	100.0	72.0	

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7. EUT photographs

Front View



Rear View



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KCTLLeft ViewRight View

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Inside



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