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TEST REPORT

KCTL Inc.
52-20, Sinjeong-ro 41beon-gil, Giheung-gu,
Yongin-si, Gyonggi-Do, Korea
TEL: 82-31-326-6700 FAX: 82-505-299-8311
www.kctl.co.kr

KCTL

1. Client

- Name : MultimediaLink Inc.
- Address : #812, 19, Ojeongongeop-gil, Uiwang-si, Gyeonggi-do, 16072 Republic of Korea
- Date of Receipt : 2018-11-07

2. Use of Report : -

3. Name of Product and Model : 10.1 inch HDMI Touch Screen Monitor / UM-1080CH

4. Manufacturer and Country of Origin : MultimediaLink Inc. / Korea

5. Date of Test : 2018-11-16 to 2018-11-22

6. Test method used : EN 55032:2015
EN 55024:2010

7. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Youngbae Seo (Signature)	Technical Manager Name : Jaeho Park (Signature)

2018-11-23

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

REPORT REVISION HISTORY

Date	Revision	Page No
2018-11-23	Originally issued	-

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1. Applicant information

Applicant:	MultimediaLink Inc.
Address:	#812, 19, Ojeongongeop-gil, Uiwang-si, Gyeonggi-do, 16072 Republic of Korea
Telephone:	+82-31-462-0290
Fax:	+82-303-0943-0293
E-mail:	hcpark@multimedia-link.com
Contact name:	Hyunchul Park

Manufacturer:	MultimediaLink Inc.
Address:	#812, 19, Ojeongongeop-gil, Uiwang-si, Gyeonggi-do, 16072 Republic of Korea
Telephone:	+82-31-462-0290
Fax:	+82-303-0943-0293
E-mail:	hcpark@multimedia-link.com
Contact name:	Hyunchul Park

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2. Laboratory information

Address

KCTL Inc. (Yongin Lab.)

52-20, Sinjeong-ro 41beon-gil, Giheung-gu, Yongin-si, Gyonggi-Do, Korea

Telephone Number: 82 31 326 6700

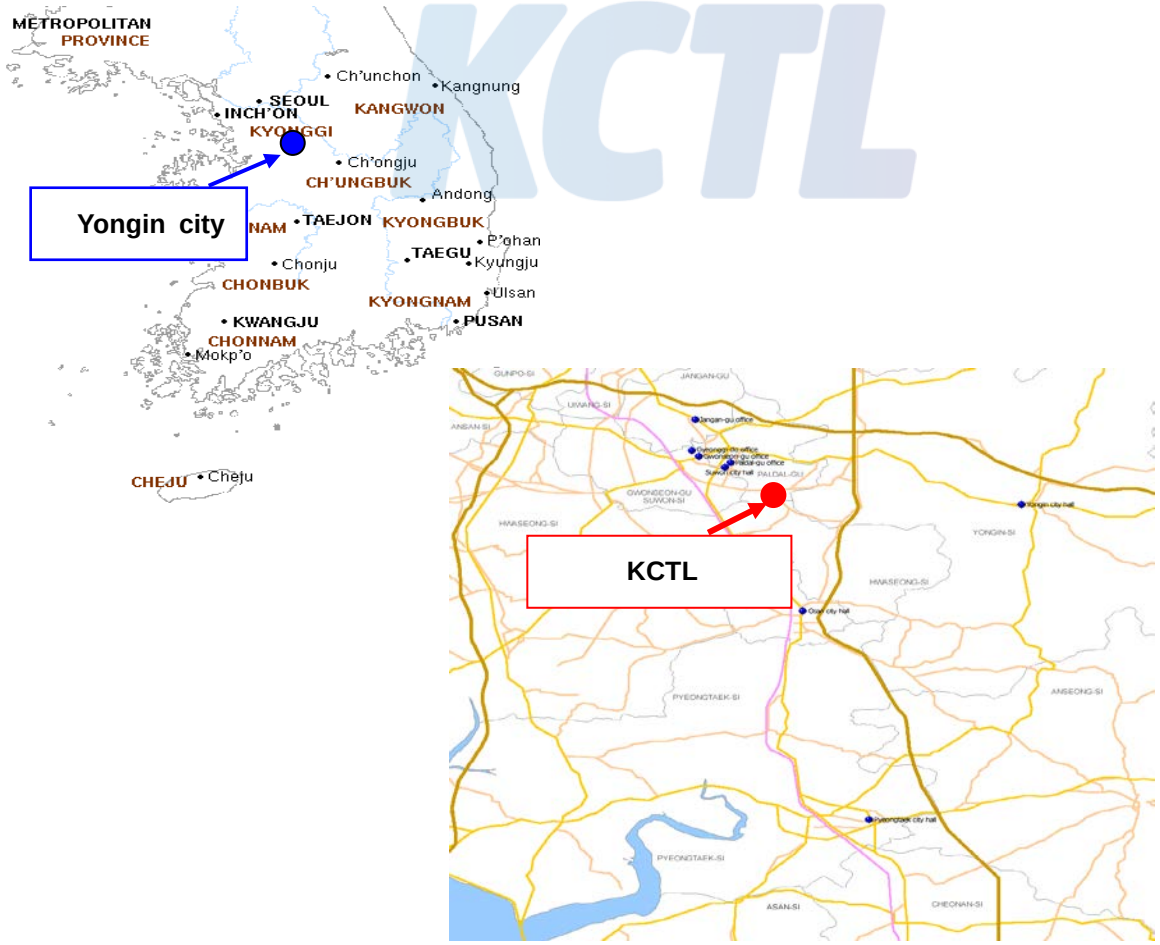
Facsimile Number: 82 505 299 8311

FCC Site Designation No: KR0040

VCCI Registration No. : C-2915, T-11320, R-4386, G-10547

KOLAS NO.: KT231

SITE MAP



3. Test system configuration

3.1 Operation environment

	Temperature	Humidity	Pressure
Chamber 10 m(RE)	17.9 °C	47.8 % R.H.	-
Chamber 10 m(RE)	18.1 °C	47.3 % R.H.	-
Shielded room(CE)	19.1 °C	33.5 % R.H.	-

Test site

These testing items were performed following locations;

Test item	Test site
Conducted Emission	Shielded Room
Disturbance power	Shielded Room
Discontinuous interference	Shielded Room
Radiated Emission	10 m Chamber
Harmonics current	EMI Test area
Voltage fluctuations and flickers	EMI Test area
Electrostatic discharge	Shielded Room
Radiated RF immunity	3 m Chamber
Electric Fast Transient/BURST	Shielded Room
Surge	Shielded Room
Conducted RF immunity	Shielded Room
Voltage dip/interruption	Shielded Room

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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 kHz : 3.63 dB	
	150 kHz ~ 30 MHz : 3.18 dB	
Shielded Room (CE#2)	9 kHz ~ 150 kHz : 3.70 dB	
	150 kHz ~ 30 MHz : 3.25 dB	
Conducted Emission measurement_AAN (Confidence level about 95 %, *k* = 2)		
Shielded Room	150 kHz ~ 30 MHz	AAN with a_{LCL} = 55…40 dB : 4.16 dB
		AAN with a_{LCL} = 65…50 dB : 4.54 dB
		AAN with a_{LCL} = 75…60 dB : 4.98 dB
Radiated Emission measurement (Confidence level about 95 %, *k* = 2)		
10 m Chamber	30 MHz ~ 300 MHz	3 m : 5.04 dB
		10 m : 5.00 dB
	300 MHz ~ 1 000 MHz	3 m : 5.34 dB
		10 m : 5.20 dB
	1 GHz ~ 6 GHz	3 m : 5.72 dB
3m Chamber	1 GHz ~ 6 GHz	3 m : 5.62 dB
Disturbance Power Electromagnetic Fields (Confidence level about 95 %, *k* = 2)		
Shielded Room	30 MHz ~ 300 MHz	3.15 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)	☐

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4. Description of EUT

4.1 General information

Product Name		10.1 inch USB Touch Screen Monitor
Model Name		UM-1080CH
Display	Display Type	10.1 inch, IPS TFT-LCD
	Resolution	1280 x 800, WXGA
	Aspect Ration	16:10
	Brightness	250cd/
	Contrast ration	800:01:00
	View Angle	85/85/85/85(Typ.)(L/R/U/D)
TSP	Panel Structure	Glass/Glass Type, Capacitive Touch Panel
	Finger contact area	Φ≥5mm
	Multi-point	10 touch-point
Display processor		DisplayLink DL-125
Memory		DDR-400(Max up to 200MHz)
HDMI Receiver IC		TC358743 : HDMI Signal Input to CSI Signal Output
Bridge IC		RTS5880 : CSI Signal Input to USB 3.0 Signal Output
USB Audio IC		CM6510B : I2S Signal Input to USB 2.0 Signal Output
Connector(I/O Port)		Micro HDMI, Mini USB 10p, Mini USB 5P
Key		Brightness up / down button, Reset button
USB Adapter		5.0V / 3A Adapter
Power Consumption		Max 7.5W (5V / 1.5A)
Dimension		275.50mm(W)x174.60mm(H)x16.20mm(D)

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4.2 Product description

Type of product	10.1 inch HDMI Touch Screen Monitor
Model name (Basic)	UM-1080CH
Model name (Variant)	UM-1080H, UM-1080CH-G, UM-1080CH-NB, UM-1080H-NB, UM-1080CH-G-NB
Difference	Stand
Serial no	-
Testing voltage	230 V, 50 Hz
Input rating	DC 5 V(USB) Note PC Adapter Input: AC (100-240) V, (50/60) Hz, 1.41 A Output: DC 19.5 V, 2.31 A
Internal clock frequency	Above 108 MHz
Note	-

4.3 Auxiliary equipments

Type	Model / Part #	S/N	Manufacturer
Note PC	HSTNN-Q96C	-	HP Inc.
AC/DC Adapter	HSTNN-AA44	-	ACBEL POLYTECH INC.

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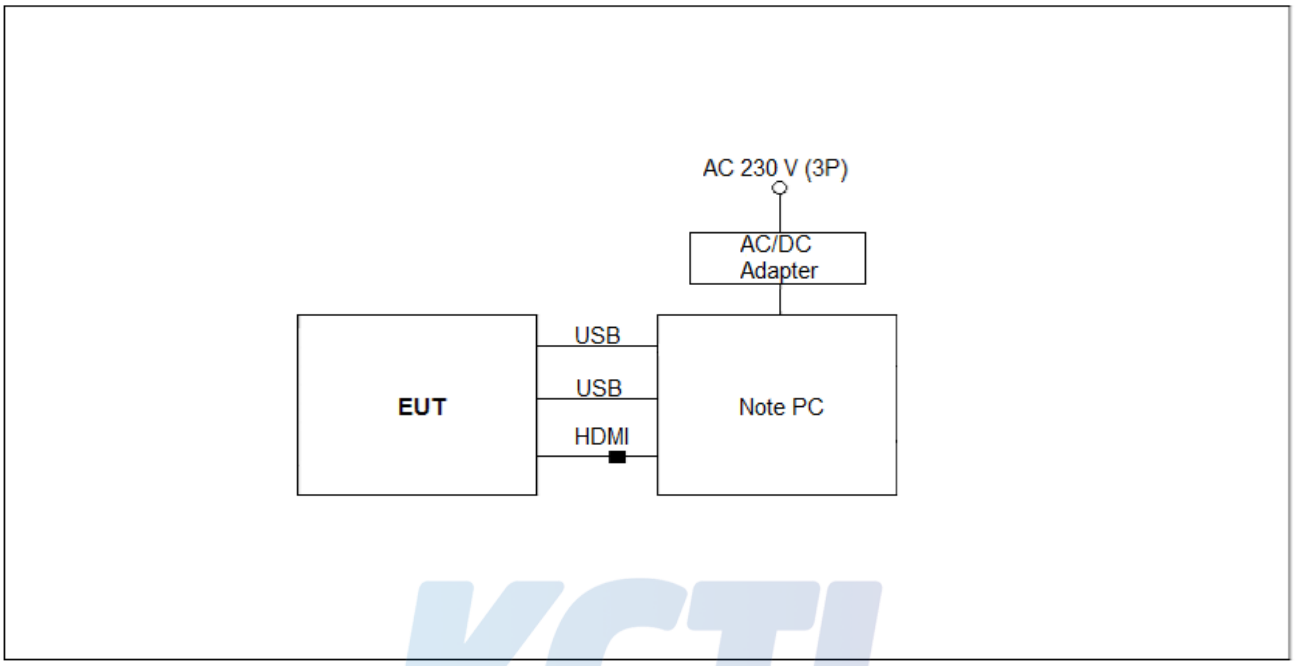
4.4 Test configuration



	Start		End		Cable	
	Name	I/O port	Name	I/O port	Length (m)	Spec.
1	**EUT**	Mini USB	Note PC	USB	1.2	Unshield
2		Mini USB	Note PC	USB	1.2	Unshield
3		Micro HDMI	Note PC	HDMI	1.2	Shield (Core 1EA)
4	Note PC	DC In	AC/DC Adapter	DC Out	1.6	Unshield
5	AC/DC Adapter	Power	AC Main	-	1.8	Unshield

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4.5 Operating conditions

The EUT was configured as normal intended use.

Test mode	Normal operating
#1	HDMI Mode(1280 x 800)

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5. Summary of test results

5.1 Summary of EMI emission test results

Applied	Test items	Test method	Result
☒	Conducted Emission	EN 55032:2015	Pass
☒	Radiated Emission	EN 55032:2015	Pass
☐	Conducted differential voltage	EN 55032:2015	N/A
☐	Harmonics current	EN 61000-3-2:2014	N/A
☐	Voltage fluctuations and flickers	EN 61000-3-3:2013	N/A

5.2 Summary of immunity test results

Applied	Test items	Test method	Result
EN 55024:2010 +A1:2015			
☒	Electrostatic Discharge	EN 61000-4-2:2009	Pass
☒	Radiated Susceptibility	EN 61000-4-3:2006 +A2:2010	Pass
☒	Electric Fast Transient/Burst	EN 61000-4-4:2012	Pass
☒	Surge Transient	EN 61000-4-5:2014	Pass
☒	Conducted Susceptibility	EN 61000-4-6:2014	Pass
☐	Power Frequency Magnetics	EN 61000-4-8:2010	N/A
☒	Voltage Dips and Interruptions	EN 61000-4-11:2004	Pass

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5.3 Performance criteria

Performance criterion A: The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended.
The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B: After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test.
If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as untended.

Performance criterion C: Loss of function is allowed, provided the function is self-recoverable or can be restored by the operating of the controls by the user In accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

6. Test results

6.1 Conducted Emission

Test specification	EN 55032:2015, Class B		
Testing voltage	230 V 50 Hz		
Test facility	Shielded room (CE#1)		
Date	2018. 11. 19		
Temperature (°C)	19.1 °C	Humidity (% R.H.)	33.5 % R.H.
Remarks	Pass		

Both conducted lines are measured in Quasi-Peak and C/Average mode, including the worst-case data points for each tested configuration. The EUT measured in accordance with the methods described in standards.

6.1.1 Limits of conducted emissions measurement

☒ AC main

Frequency [MHz]	Resolution Bandwidth [kHz]	Class A Limits (dB(μV))		Class B Limits (dB(μV))	
		Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	9	79	66	66 ~ 56 *	56 ~ 46*
0.5 ~ 5	9	73	60	56	46
5 ~ 30	9	73	60	60	50

☐ Telecommunication

Frequency [MHz]	Resolution Bandwidth [kHz]	Class A Limits (dB(μV))		Current Limits (dB(μV))	
		Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	9	97 to 87	84 to 74	53 to 43	40 to 30
0.5 ~ 30	9	87	74	43	30
Frequency [MHz]	Resolution Bandwidth [kHz]	Class B Limits (dB(μV))		Current Limits (dB(μV))	
		Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	9	84 to 74	74 to 64	40 to 30	30 to 20
0.5 ~ 30	9	74	64	30	20

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(μV)] = Reading QP/CAV[dB(μV)] + 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	2019.03.05	☒
Two Line V-Network	ENV216	101718	R&S	2019.09.18	☒
Two Line V-Network	ESH2-Z5	842966/014	R&S	2019.09.18	☐
EMI Test Receiver	ESCI	100374	R&S	2019.04.26	☐
Two Line V-Network	ENV216	101719	R&S	2019.07.31	☐
Two Line V-Network	ESH3-Z5	862770/025	R&S	2019.04.26	☐
V-Network	ESH3-Z6	100431	R&S	2019.04.26	☐
V-Network	ESH3-Z6	100432	R&S	2019.04.26	☐
Impedance Stabilization Network	ISN T800	36208	TESEQ	2019.07.17	☐
Impedance Stabilization Network	ISN T8-Cat6	37172	TESEQ	2019.07.17	☐
Impedance Stabilization Network	ISN T200A	34520	TESEQ	2019.07.17	☐
Impedance Stabilization Network	ISN ST08	43553	TESEQ	2019.07.12	☐

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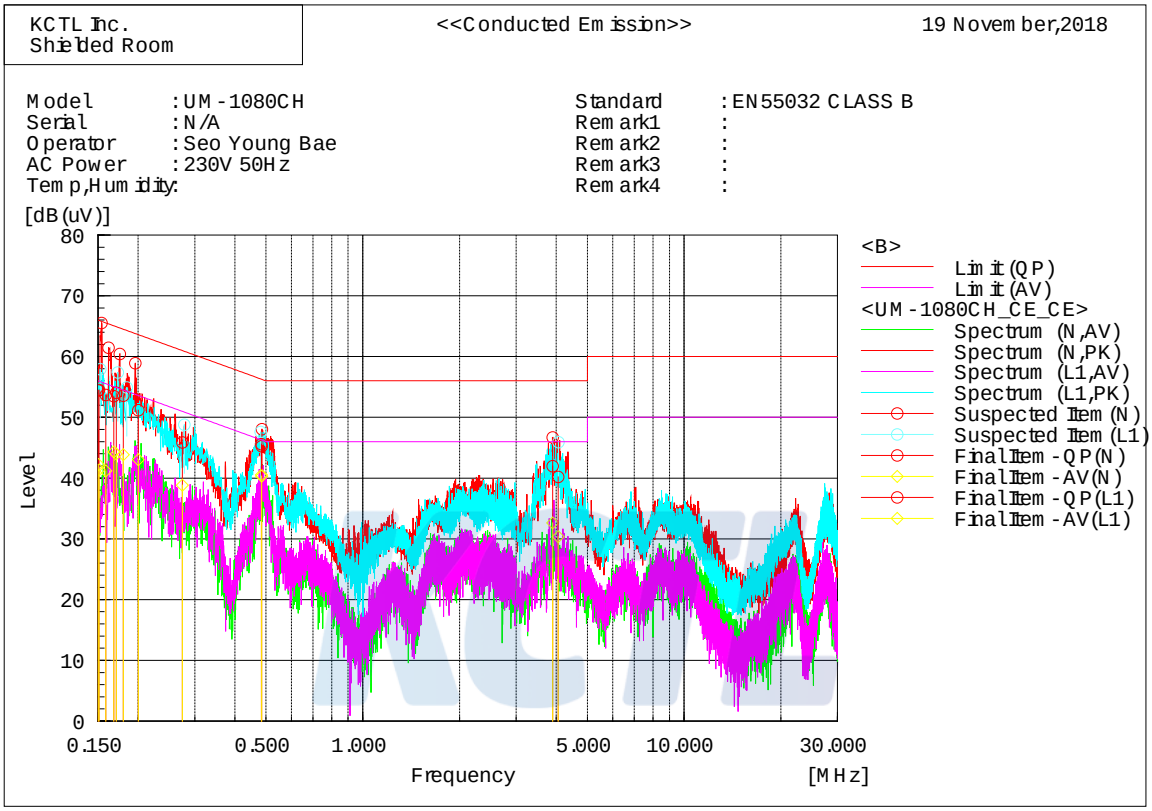
6.1.4 Photographs of test setup

* AC Main

6.1.5 Conducted emissions measurement result

*** Graph and Data**

* AC Main



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.15113	44.7	31.6	9.8	54.5	41.4	65.9	55.9	11.4	14.5
2	0.15844	43.7	31.2	10.0	53.7	41.2	65.5	55.5	11.8	14.3
3	0.17095	43.9	33.9	10.1	54.0	44.0	64.9	54.9	10.9	10.9
4	0.20006	41.3	33.1	9.9	51.2	43.0	63.6	53.6	12.4	10.6
5	0.48382	35.6	30.5	10.0	45.6	40.5	56.3	46.3	10.7	5.8
6	3.90055	32.1	22.8	9.8	41.9	32.6	56.0	46.0	14.1	13.4

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(uV)]	Reading CAV [dB(uV)]	c.f [dB]	Result QP [dB(uV)]	Result CAV [dB(uV)]	Limit QP [dB(uV)]	Limit AV [dB(uV)]	Margin QP [dB]	Margin CAV [dB]
1	0.15016	44.6	32.4	9.8	54.4	42.2	66.0	56.0	11.6	13.8
2	0.16806	43.4	34.2	10.1	53.5	44.3	65.1	55.1	11.6	10.8
3	0.17975	43.5	33.7	10.1	53.6	43.8	64.5	54.5	10.9	10.7
4	0.2747	36.1	29.1	9.7	45.8	38.8	61.0	51.0	15.2	12.2
5	0.48445	35.3	30.3	10.0	45.3	40.3	56.3	46.3	11.0	6.0
6	4.05919	30.4	20.6	9.8	40.2	30.4	56.0	46.0	15.8	15.6

6.2 Radiated Emissions

Test specification	EN 55032:2015, Class B		
Testing voltage	230 V 50 Hz		
Test facility	10 m Chamber		
Test distance	10 m		
Date	2018. 11. 16		
Temperature (°C)	17.9 °C	Humidity (% R.H.)	47.8 % R.H.
Remarks	Pass		

Test specification	EN 55032:2015, Class B		
Testing voltage	230 V 50 Hz		
Test facility	10 m Chamber		
Test distance	3 m		
Date	2018. 11. 16		
Temperature (°C)	18.1 °C	Humidity (% R.H.)	47.3 % R.H.
Remarks	Pass		

6.2.1 Limits of radiated emissions measurement

☒ Limits below 1 ㎓

Frequency [㎒]	Class A (dB(㎶/m)) @ 10 m	Class B (dB(㎶/m)) @ 10 m
30 ~ 230	40	30
230 ~ 1 000	47	37

☒ Limits above 1 ㎓

Frequency [㎓]	Class A @ 3 m		Class B @ 3 m	
	Average limit (dB(㎶/m))	Peak limit (dB(㎶/m))	Average limit (dB(㎶/m))	Peak limit (dB(㎶/m))
1 ~ 3	56	76	50	70
3 ~ 6	60	80	54	74
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	ESCI7	100872	R&S	2019.07.12	☒
Amplifier	310N	353132	SONOMA	2019.09.18	☒
Attenuator	8491B 6dB	MY39270721	KEYSIGHT	2019.09.18	☒
Bi-Log Antenna	CBL 6112D	40522	TESEQ	2020.03.26	☒
Amplifier	8449B OPT H02	3008A0530	HP	2019.09.18	☒
Horn Antenna	3115	9012-3602	EMCO	2020.03.26	☒

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

Result QP[dB(μV/m)] = Reading QP[dB(μV)] + c.f(Antenna Factor [dB/m] + Cable Loss [dB] + 6 dB Att [dB] − 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

Result PK/CAV [dB(μV/m)] = Reading PK/CAV [dB(μV)] + c.f(Antenna Factor [dB/m] + Cable Loss [dB] − 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

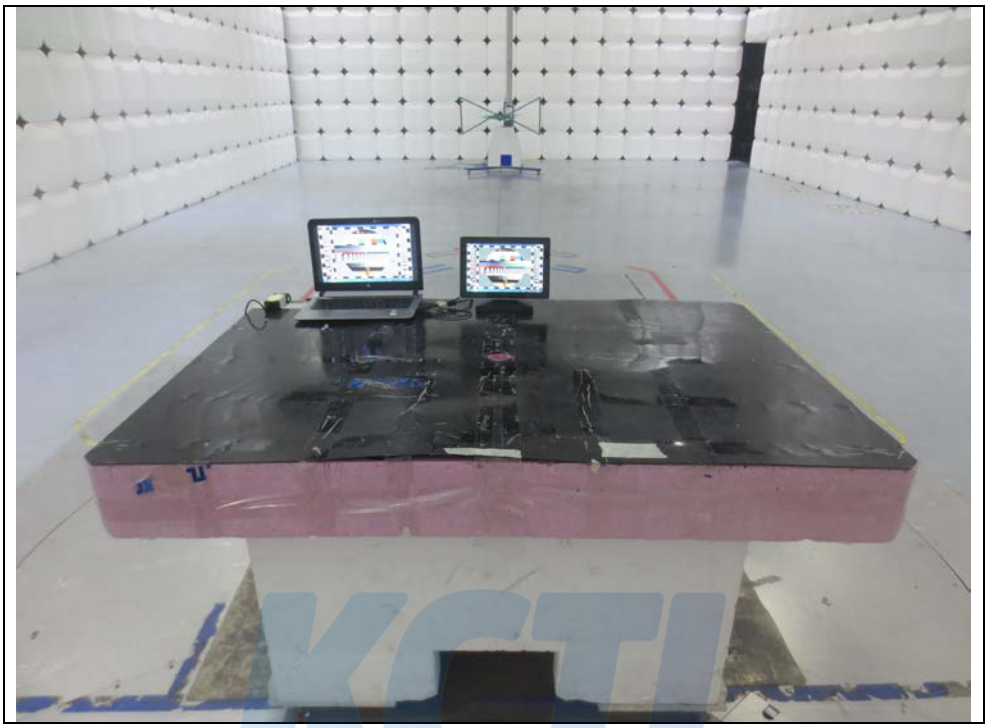
If Reading is 30 dBμV, Antenna Factor 12 dB/m, Cable Loss 5 dB, Attenuator 6 dB, Amp Gain 35 dB

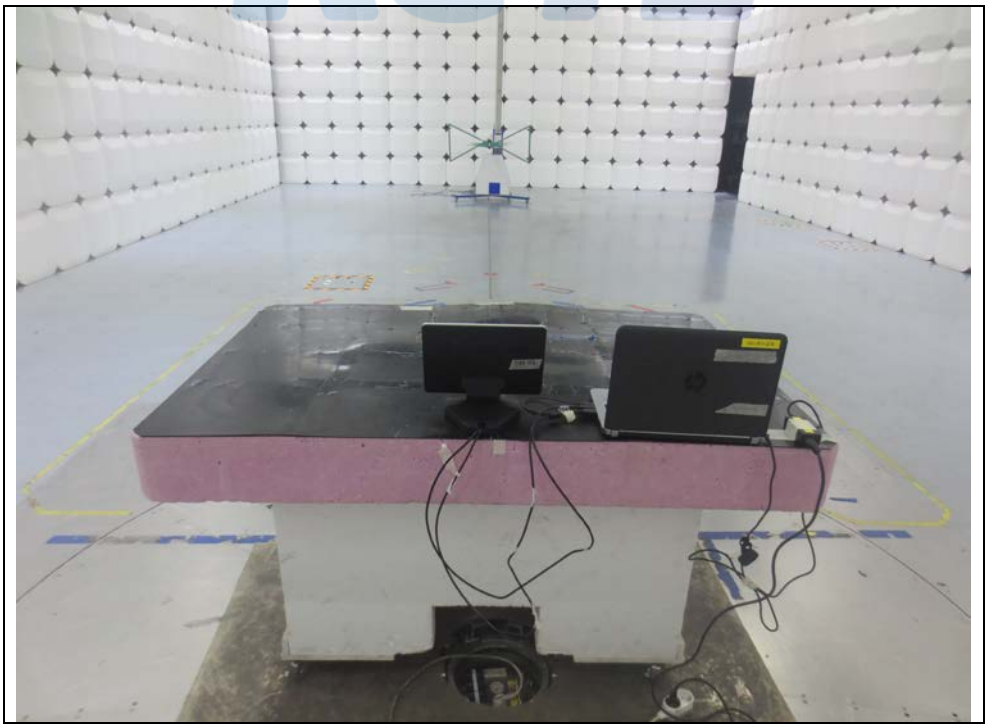
The result is

30 + 12 + 5 + 6 - 35 = 18 dB(μV/m)

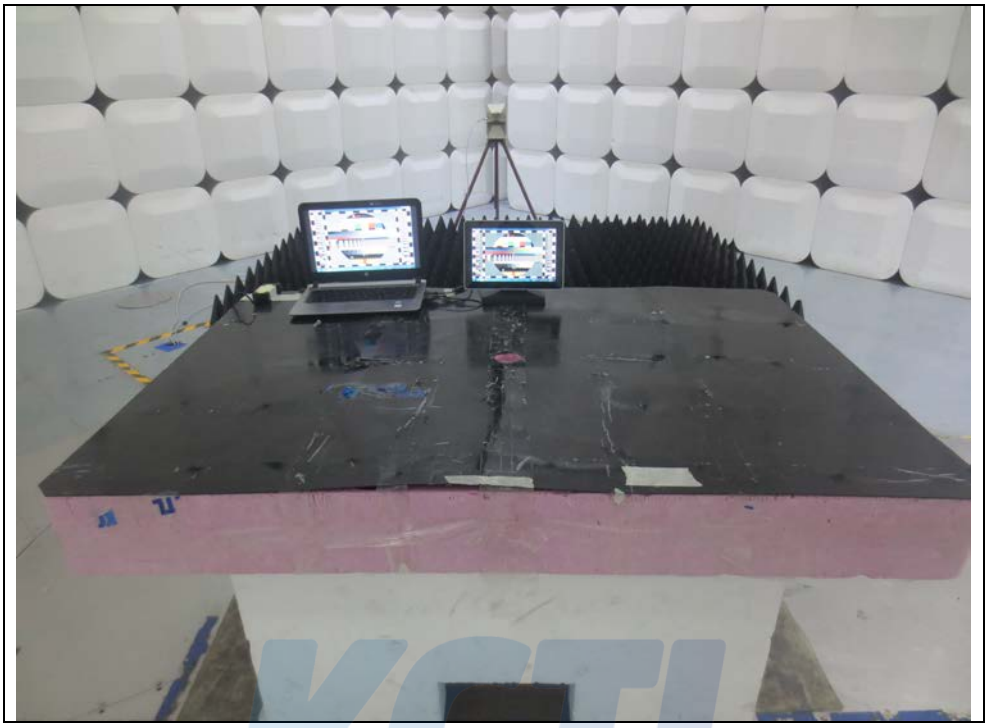
6.2.5 Photographs of test setup

* 30 ㎒ ~ 1 ㎓





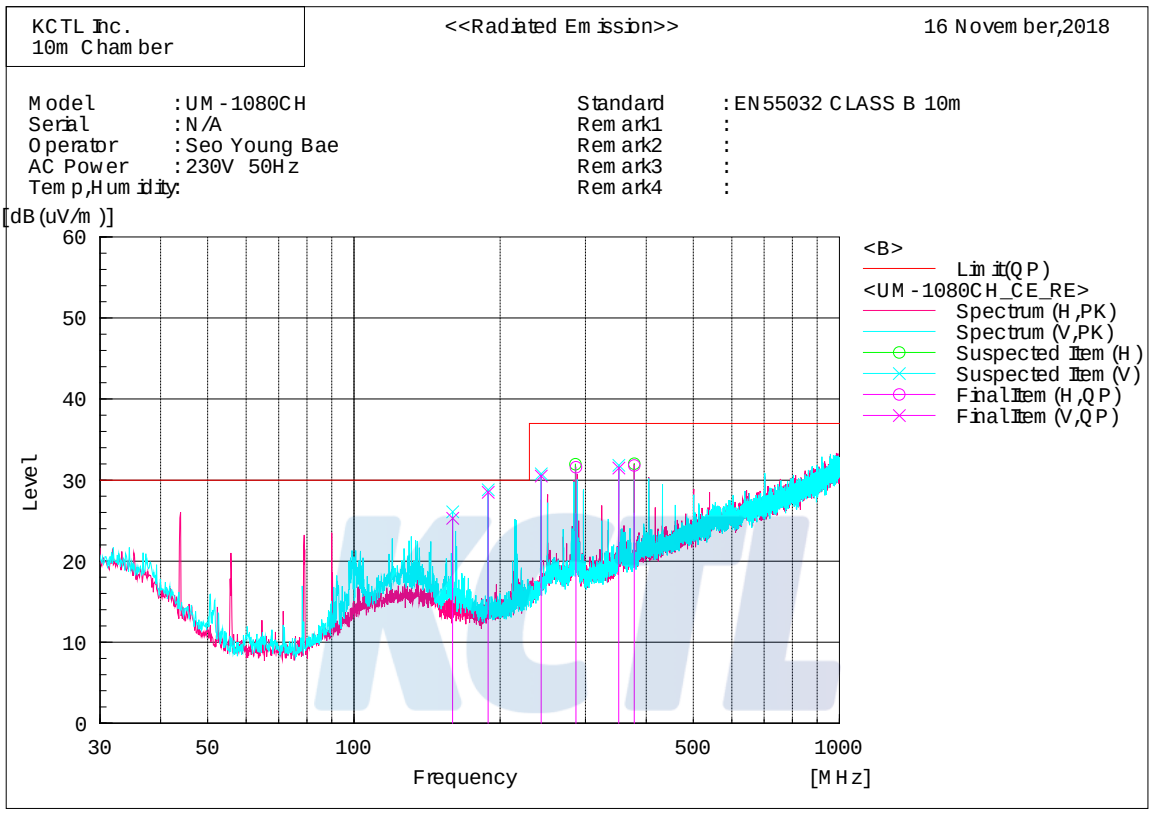
* 1 ㎓ ~ 6 ㎓



6.2.6 Radiated emissions measurement result

*** Graph and Data**

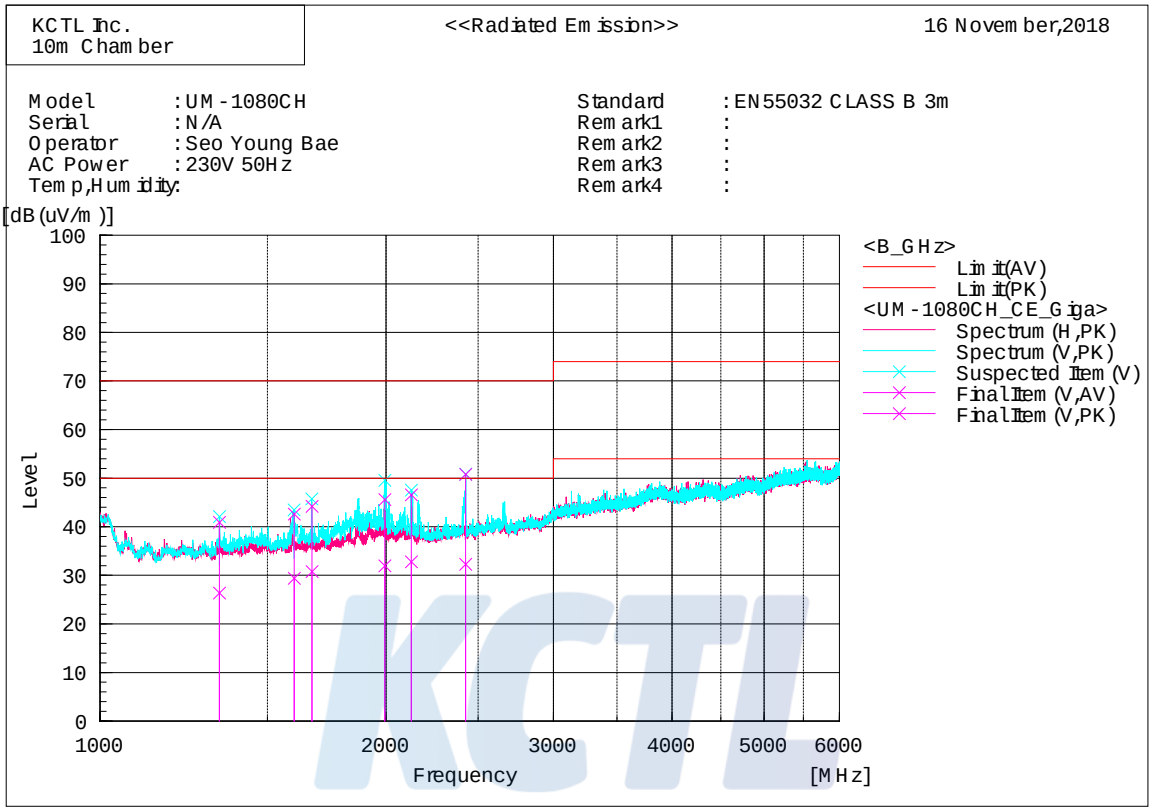
* 30 MHz ~ 1 GHz



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	159.738	V	38.5	-13.2	25.3	30.0	4.7	100.0	144.0	
2	188.994	V	42.6	-14.1	28.5	30.0	1.5	100.0	177.0	
3	242.990	V	41.2	-10.7	30.5	37.0	6.5	100.0	109.0	
4	286.680	H	40.6	-9.0	31.6	37.0	5.4	400.0	156.0	
5	351.075	V	38.7	-7.2	31.5	37.0	5.5	100.0	190.0	
6	378.006	H	38.5	-6.7	31.8	37.0	5.2	354.0	179.0	

* 1 GHz ~ 6 GHz



Final Result

No.	Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	c.f [dB(1/m)]	Result AV [dB(uV/m)]	Result PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]	Remark
1	1335.721	V	30.6	45.1	-4.2	26.4	40.9	50.0	70.0	23.6	29.1	100.0	321.0	
2	1600.851	V	31.8	45.0	-2.4	29.4	42.6	50.0	70.0	20.6	27.4	100.0	7.0	
3	1670.820	V	32.7	46.1	-1.9	30.8	44.2	50.0	70.0	19.2	25.8	100.0	151.0	
4	1993.450	V	30.7	44.3	1.3	32.0	45.6	50.0	70.0	18.0	24.4	100.0	34.0	
5	2126.299	V	31.1	44.9	1.7	32.8	46.6	50.0	70.0	17.2	23.4	100.0	200.0	
6	2425.308	V	29.5	48.0	2.8	32.3	50.8	50.0	70.0	17.7	19.2	100.0	245.0	

◈ Correction(Distance: 3.0 m)

Frequency [MHz]	(P)	Reading AV [dB(㎶)]	Reading PK [dB (㎶)]	c.f	Result AV [dB(㎶/m)]	Result PK [dB(㎶/m)]	Limit AV [dB(㎶/m)]	Limit PK [dB(㎶/m)]	Margin AV [dB]	Margin PK [dB]
1335.721	V	30.60	45.10	-4.2	26.40	40.90	50.00	70.00	23.60	29.10
1600.851	V	31.80	45.00	-2.4	29.40	42.60	50.00	70.00	20.60	27.40
1670.820	V	32.70	46.10	-1.9	30.80	44.20	50.00	70.00	19.20	25.80
1993.450	V	30.70	44.30	1.3	32.00	45.60	50.00	70.00	18.00	24.40
2126.299	V	31.10	44.90	1.7	32.80	46.60	50.00	70.00	17.20	23.40
2425.308	V	29.50	48.00	2.8	32.30	50.80	50.00	70.00	17.70	19.20

6.3 Electrostatic Discharge

Test specification	EN 61000-4-2:2009, Criteria : B				
Test level	☒ Contact: ± 4 ㎸ ☒ Air: ± 2 ㎸, ± 4 ㎸, ± 8 ㎸ ☒ HCP: ± 4 ㎸ ☒ VCP: ± 4 ㎸				
Discharge impedance	330 Ω / 150 ㎊				
Number of discharge (Each polarity)	☒ Contact: 25 ☒ Air: 10 ☒ HCP / VCP: 25				
Interval between discharges	1 s				
Testing voltage	230 V 50 Hz				
Test facility	Shielded room				
Date	2018. 11. 19				
Temperature(°C)	18.5 °C	Humidity (% R.H.)	35.7 % R.H.	Pressure (㎪)	101.3 ㎪
Remarks	Pass - B: LCD screen was flickered during the test, But after test, EUT's operation was self recovered.				

6.3.1 Measurement procedure

A ground reference plane was located on the floor, and connected to earth via a low Impedance connection. The return cable of the ESD generator was connected to the reference plane.
In case of floor standing equipment, EUT was placed on the reference plane on 0.1 ㎡ of insulating Support. In case of table top equipment, EUT was placed on a wooden table 0.8 ㎡ above the reference grounded floor. A horizontal coupling plane (HCP) was placed on the table, and Connected to the reference plane via a 470 ㎏Ω resistor located in each end (0.5 ㎜ insulating support between EUT and HCP). In both cases a vertical coupling plane(VCP) OF 0.5 X 0.5 ㎡ was located 0.1 ㎡ from the EUT's sides. The VCP was connected to the reference plane in the same matter as the HCP.

6.3.2 Used equipments

Equipment	Model No.	Serial No.	Makers	Next Cal. Date	Used
ESD GUN	DITO	P1339124876	EM TEST	2019.01.18	☐
ESD Simulator	ESS-2000	ESS0442747	Noiseken	2019.04.27	☒
ESD Gun	TC-815P	ESS0442694	Noiseken	2019.04.27	☒
HCP	-	-	-	-	☒
VCP	-	-	-	-	☒

6.3.3 Photographs of test setup

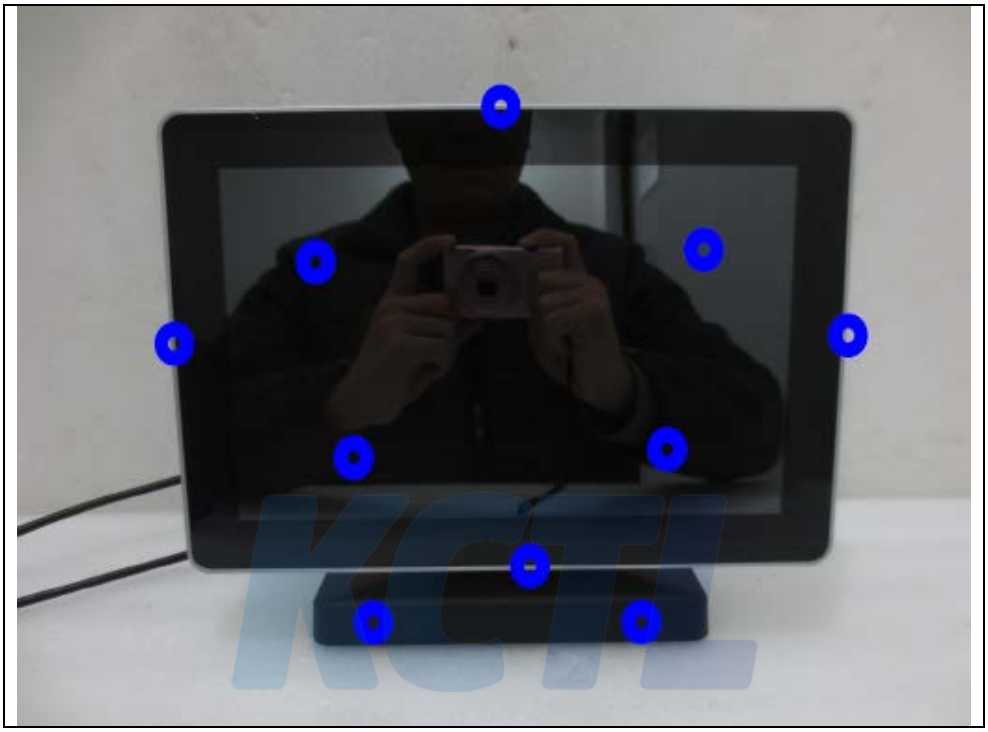
6.3.4 Measurement result

Electrostatic Discharge (Test Point)

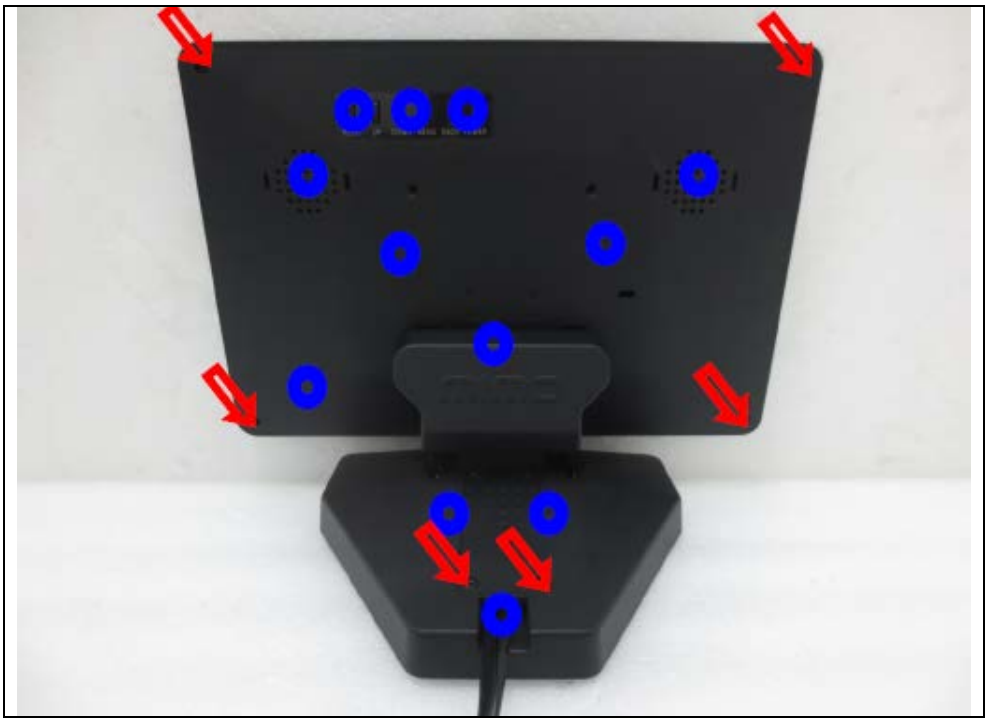
Air discharge

Contact discharge

[Front]



[Rear]



[Left]

[Right]

HCP/VCP discharge

Location(EUT)	Applied level (±)	Result
HCP (All 4 sides)	± 4 kV	B
VCP (All 4 sides)	± 4 kV	A

Contact discharge

Location(EUT)	Applied level (±)	Result
Rear Surface	± 4 kV	B

Air discharge

Location(EUT)	Applied level (±)	Result
Front Surface	± 2 kV, ± 4 kV, ± 8 kV	A
Rear Surface	± 2 kV, ± 4 kV, ± 8 kV	A
Left Surface	± 2 kV, ± 4 kV, ± 8 kV	A
Right Surface	± 2 kV, ± 4 kV, ± 8 kV	A

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6.4 Radiated Susceptibility

Test specification	EN 61000-4-3:2006 +A2:2010, Criteria : A				
Tested frequency	80 ㎒ ~ 1 ㎓				
Test level & Modulation	3 V/m, 80 % Amplitude Modulation (1 ㎑)				
Frequency Step	1 % step				
Dwell time	1 s				
Distance	3 ㎥ from EUT to tip of antenna				
Testing Voltage	230 V 50 Hz				
Test facility	3 ㎥ Chamber				
Date	2018. 11. 21				
Temperature(°C)	19.6 °C	Humidity (% R.H.)	34.8 % R.H.	Pressure (㎪)	101.4 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

6.4.1 Measurement procedure

The test was performed at 3 ㎥ full anechoic chamber.

For floor standing equipment, the EUT was standing on the floor.

For tabletop equipment, the EUT was located on a wooden table 0.8 ㎥ above the floor.

The EUT was tested all sides, horizontal and vertical polarization.

6.4.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. date	Used
Signal Generator	SMIQ06B	100733	R/S	2019.09.18	☒
Power Meter	NRVD	101242	R/S	2019.05.24	☒
Power Sensor	NRV-Z51	100330	R/S	2019.05.24	☒
Power Sensor	NRV-Z51	100331	R/S	2019.05.24	☒
Directional Coupler	DC6180	14180	A/R	2019.09.18	☒
Directional Coupler	DC7200A	0349435	A/R	2019.07.12	☐
Log Periodic Antenna	HL046	100030	R/S	-	☒
Log Periodic Dipole Antenna	LPDA-0803	#130232	TDK RF Solutions	-	☐
Power Amplifier	500W1000M5	19701	A/R	-	☒

6.4.3 Photographs of test setup

6.4.4 Measurement result

Location(EUT)	Antenna polarization	Result
Front side	Horizontal	A
	Vertical	A
Rear side	Horizontal	A
	Vertical	A
Left side	Horizontal	A
	Vertical	A
Right side	Horizontal	A
	Vertical	A

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6.5 Electric Fast Transient/Burst

Test specification	EN 61000-4-4:2012, Criteria : B				
Coupling	☒ AC main ☐ Signal: Clamp ☐ Telecommunication: Clamp				
Test level	☒ AC main: ± 1 ㎸ Peak ☐ Signal: ± 0.5 ㎸ Peak ☐ Telecommunication: ± 0.5 ㎸ Peak				
Repetition frequency	5 ㎑, Tr/Th = 5 / 50 ㎱				
Coupling time (Minimum)	60 s				
Testing voltage	230 V 50 Hz				
Test facility	Shielded room				
Date	2018. 11. 19				
Temperature(°C)	18.7 °C	Humidity (% R.H.)	36.3 % R.H.	Pressure (㎪)	101.3 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

6.5.1 Measurement procedure

A ground reference plane was located on the floor.
EFT generator was connected to reference ground plane via low impedance connection.
For floor standing equipment, EUT was placed on a 0.1 ㎡ wooden table.
For tabletop equipment, EUT was placed on a 0.1 ㎡ above the ground reference plane.
Test generator and coupling/decoupling network was placed on, and bounded to, the ground reference plane. When using the coupling clamp, the minimum distance between the coupling plates and all other conductive surfaces, except the ground reference plane beneath the coupling clamp, Shall be 0.5 ㎡.

6.5.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. date	Used
Burst Tester	PHV41.2	083057-18	HAEFELY	2019.04.26	☒
Capacitor Clamp	IP4A	083078-32	HAEFELY	2019.04.26	☐

6.5.3 Photographs of test setup

6.5.4 Measurement result

* AC main

Coupling point	(+)	(-)	Result
L	+ 1 kV	- 1 kV	A
N	+ 1 kV	- 1 kV	A
PE	+ 1 kV	- 1 kV	A
L-N	+ 1 kV	- 1 kV	A
L-PE	+ 1 kV	- 1 kV	A
N-PE	+ 1 kV	- 1 kV	A
L-N-PE	+ 1 kV	- 1 kV	A

* Signal

Coupling point	(+)	(-)	Result
-	-	-	-

* Telecommunication

Coupling point	(+)	(-)	Result
-	-	-	-

6.6 Surge Transient

Test specification	EN 61000-4-5:2014, Criteria : B				
Coupling	☒ AC main: Direct ☐ Signal: Direct / CDN				
Test level	☒ AC main: ☒Differential mode: ± 0.5 kV, ± 1 kV ☒Common mode: ± 0.5 kV, ± 1 kV, ± 2 kV ☐ Signal: ± 0.5 kV, ± 1 kV				
Coupling Impedance	☒ Differential mode: 2 Ω + 18 μF ☒ Common mode: 12 Ω + 9 μF ☐ 40 Ω + 0.5 μF ☐ Direct				
Surge pulse shape	Tr/Th = 1.2 / 50 μs				
Angles	0 °, 90 °, 180 °, 270 °				
Number of surge	5				
Coupling time	30 s				
Testing Voltage	230 V 50 Hz				
Test facility	Shielded room				
Date	2018. 11. 20				
Temperature(°C)	19.7 °C	Humidity (% R.H.)	33.9 % R.H.	Pressure (kPa)	101.5 kPa
Remarks	Pass - A: There was no change of operation status during above testing.				

6.6.1 Measurement procedure

A ground reference plane was located on the floor. SURGE generator was connected to reference ground plane via low impedance connection. For floor standing equipment & table top equipment, EUT was placed on a wooden table.

6.6.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. date	Used
Surge Tester	PSURGE4.1	082876-05	HAEFELY	2019.09.18	☒
EMC Immunity Test System	EMC PRO PLUS	905220	THERMO FISHER SCIENTIFIC	2019.05.28	☐
Telecom Coupler/ Decoupler	CM-TELCD	905227	THERMO FISHER SCIENTIFIC	2019.05.28	☐

6.6.3 Photographs of test setup

6.6.4 Measurement result

* AC main

Coupling point	(+)	(-)	Result
L-N	+ 0.5 kV, + 1 kV	- 0.5 kV, - 1 kV	A
L-PE	+ 0.5 kV, + 1 kV, + 2 kV	- 0.5 kV, - 1 kV, - 2 kV	A
N-PE	+ 0.5 kV, + 1 kV, + 2 kV	- 0.5 kV, - 1 kV, - 2 kV	A

* Signal

Coupling point	(+)	(-)	Result
-	-	-	-

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6.7 Conducted Susceptibility

Test specification	EN 61000-4-6:2014, Criteria : A				
Tested frequency	0.15 ㎒ ~ 80 ㎒				
Test level & Modulation	3 ㏈, 80 % Amplitude Modulation (1 ㎑)				
Frequency Step	1 % step				
Dwell time	1 s				
Coupling method	☒ AC main: CDN (M016) ☐ Signal: EM Clamp ☐ Telecommunication: CDN (ST08)				
Testing Voltage	230 V 50 Hz				
Test facility	Shielded room				
Date	2018. 11. 22				
Temperature(°C)	20.5 °C	Humidity (% R.H.)	33.1 % R.H.	Pressure (㎪)	101.4 ㎪
Remarks	Pass - A: There was no change of operation status during above testing.				

6.7.1 Measurement procedure

A ground reference plane was located on the floor.

The test was performed on a ground reference plane on a 0.1 ㎡ wooden table. This test were Performed using CDN for mains, clamp for signal and injection probe. The frequency range was swept from 0.15 ㎒ to 80 ㎒. This frequency range was Modulated with 1 ㎑ sine wave at 80 %. The signal generators provided the modulated frequency at a 1 % step size.

The power and all network cable, I/O cables longer than 3 ㎡ length were tested.

6.7.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. date	Used
Signal Generator	SMT 02	833414/019	R/S	2019.09.18	☒
Power Amplifier	75A250AM2	344844	A/R	-	☒
Millivoltmeter	URV 5	836671/003	R/S	2019.05.24	☒
INSERTION UNIT 50 Ω	URV 5-Z2	DE10501	R/S	2019.05.24	☒
INSERTION UNIT 50 Ω	URV 5-Z2	DE10502	R/S	2019.05.24	☒
Directional Coupler	DC2000	14262	A/R	2019.01.19	☒
Attenuator	50FH-006-50	N/A	JFW	2019.04.26	☒
50Ω Terminator	50LH50NF	86050	Alan	2019.09.18	☐
CDN	FCC-801-M2-16A	161225	FCC	2019.09.18	☐
CDN	FCC-801-M3-50	28	FCC	2019.04.26	☐
CDN	FCC-801-M3-25A	101510	FCC	2019.09.18	☐
CDN	FCC-801-C1-BNC-75	130078	FCC	2019.09.18	☐
CDN	CDN T8-10	42006	TESEQ	2019.04.26	☐
CDN	CDN M016	43260	TESEQ	2019.07.12	☐
CDN	CDN M016	43261	TESEQ	2019.07.12	☐
CDN	CDN M016	43262	TESEQ	2019.07.12	☒
CDN	ISN ST08	43553	TESEQ	2019.07.12	☐
EM Clamp	FCC-203I	2	FCC	2019.01.19	☐
Decoupling Clamp	FCC-205ADC	1	FCC	2019.01.19	☐
Artificial Hand	FCC-AH-1	44	FCC	-	☐
Artificial Hand	FCC-AH-1	45	FCC	-	☐

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6.7.3 Photographs of test setup

6.7.4 Measurement result

* AC main

Coupling point	Coupling method	Result
Power	CDN (M016) S/N: 43262	A

* Signal

Coupling point	Coupling method	Result
-	-	-

* Telecommunication

Coupling point	Coupling method	Result
-	-	-

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6.8 Voltage Dips and Interruptions

Test specification	EN 61000-4-11:2004 , Criteria: B or C				
Number of dips	3 T				
Duration	10 s				
Phase	Zero crossing (0 °, 180 °)				
Testing Voltage	100 V, 50 Hz / 240 V, 50 Hz 100 V, 60 Hz / 240 V, 60 Hz				
Test facility	Shielded room				
Date	2018. 11. 20				
Temperature(°C)	19.6 °C	Humidity (% R.H.)	34.3 % R.H.	Pressure (㎪)	101.5 ㎪
Remarks	Pass				

6.8.1 Measurement procedure

The dips/interruption test is only applicable to AC mains.

The dips/interruptions were applied at zero crossing.

6.8.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. date	Used
ULTRA COMPACT GENERATOR	UCS 500N5P	P1251107280	EM TEST	2019.04.05	☒
Motor Variac	MV2616	P1246105272	EM TEST	-	☒

6.8.3 Photographs of test setup

6.8.4 Measurement result

* 100 V, 50 Hz / 240 V, 50 Hz

Test Level (%UT)	Dip/Int. (%UT)	Duration /Period	Angle (°)	Count number	Result
0 %	100 %	0.5 Period	0, 180	3T	A
70 %	30 %	25 Period	0	3T	A
0 %	100 %	250 Period	0	3T	C

* 100 V, 60 Hz / 240 V, 60 Hz

Test Level (%UT)	Dip/Int. (%UT)	Duration /Period	Angle (°)	Count number	Result
0 %	100 %	0.5 Period	0, 180	3T	A
70 %	30 %	30 Period	0	3T	A
0 %	100 %	300 Period	0	3T	C

Comment:

- A: There was no change of operation status during above testing. (0.5/25/30 Period)
- C: The power of EUT is off during the interruption test. After the test, EUT's operation was self recovered. (250/300 Period)
- Removed the Note PC Battery and tested.

7. EUT photographs

Front View

Rear View

Left View

Right View

Inside

Panel Label