



# TEST REPORT

## KCTL Inc.

65, Sinwon-ro, Yeongtong-gu,  
Suwon-si, Gyeonggi-do, 16677, Korea  
TEL: 82-31-285-0894 FAX: 82-505-299-8311  
[www.kctl.co.kr](http://www.kctl.co.kr)

Report No.:  
KR18-SEC0006

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# KCTL

### 1. Client

- Name : Hanwha Techwin Co., Ltd
- Address : 1204, Changwon-daero, Seongsan-gu, Changwon-si,  
Gyeongsangnam-do, Korea
- Date of Receipt : 2017-12-18

### 2. Use of Report : -

### 3. Name of Product and Model : 2M 32x N/W Explosion-proof PTZ Camera / TNU-6320E

### 4. Manufacturer and Country of Origin : Wonwoo Engineering Co., Ltd. / Korea

### 5. Date of Test : 2018-01-02 to 2018-01-07

### 6. Test method used : EN 55032:2015, Class A EN 50130-4:2011 /A1:2014 EN 61000-3-2:2014 EN 61000-3-3:2013

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

Affirmation	Tested by	Technical Manager
	 Name : Mincheol Baek (Signature)	 Name : Sunbin Hwang (Signature)

2018-01-11

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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
2018-01-11	Originally issued	-

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## 1. Applicant information

**Applicant:** Hanwha Techwin Co., Ltd  
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 Gyeongsangnam-do, Korea  
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**Fax:** +82-31-8018-3717  
**E-mail:** js2002.kang@hanwha.com  
**Contact name:** Jesoon Kang

**Manufacturer:** Wonwoo Engineering Co., Ltd.  
**Address:** 7F201, Techno-park III Biz-city,397,Seokcheon-ro,  
 Ojeong-gu,Bucheon-city.Gyeonggi-do,korea

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## 2. Laboratory information

### Address

#### **KCTL Inc. (Suwon Lab.)**

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Telephone Number: 82 31 285 0894

Facsimile Number: 82 505 299 8311

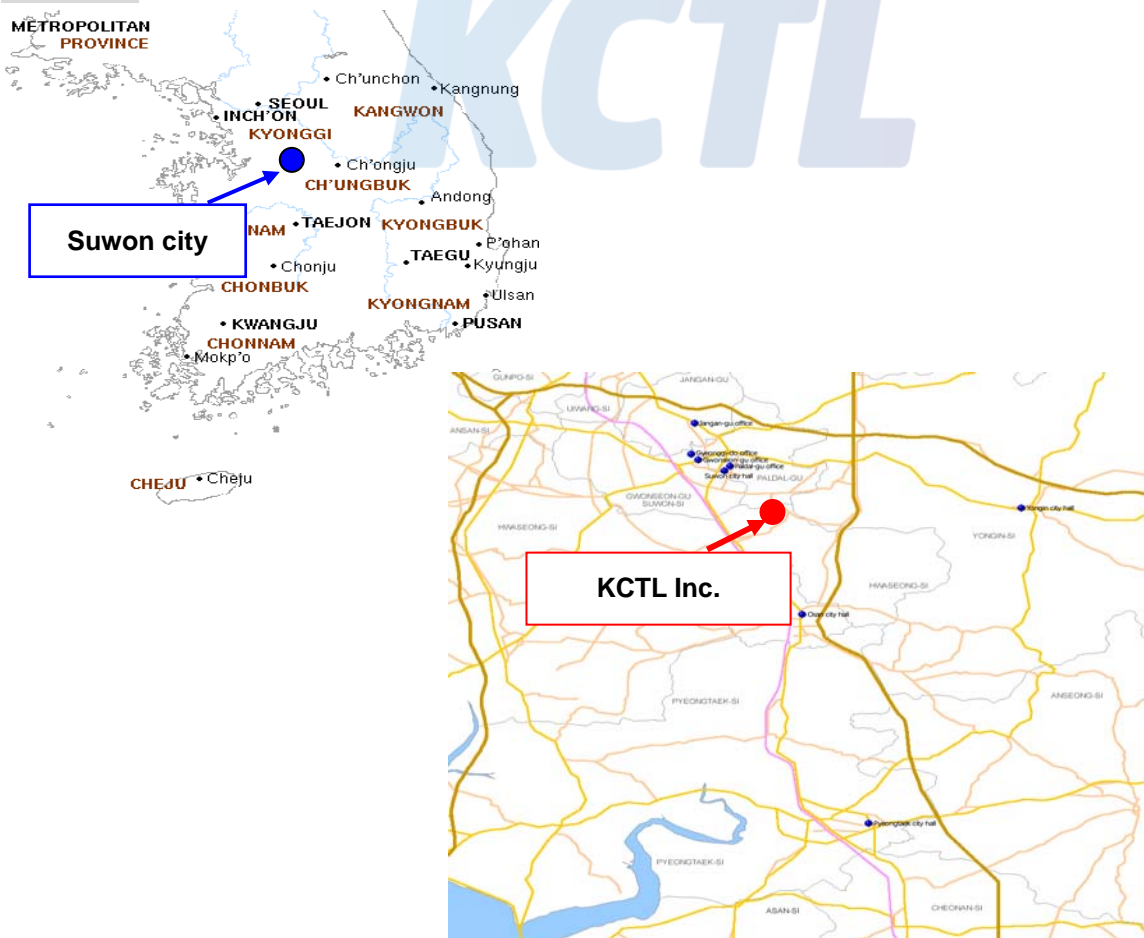
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

VCCI Registration No. : R-3327, G-198, C-3706, T-1849

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

### **SITE MAP**



### 3. Test system configuration

#### 3.1 Operation environment

	Temperature	Humidity	Pressure
Chamber 10 m(RE)	25.3 °C / 25.5 °C	22.8 % R.H. / 21.6 % R.H.	-
Shielded room(CE)	26.5 °C	21.6 % R.H.	-
Shielded room(ESD)	24.7 °C	38.2 % R.H.	102.2 kPa

#### Test site

These testing items were performed following locations;

Test item	Test site
Conducted Emission	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	6F Fully anechoic chamber (3 m)
Electric Fast Transient/BURST	Shielded Room
Surge	Shielded Room
Conducted RF immunity	Shielded Room
Voltage dip/interruption	Shielded Room
Mains supply voltage variations	Shielded Room

## 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 (Confidence level about 95 %, $k = 2$ )		
Shielded Room (CE#1)	9 kHz ~ 150 kHz: 3.66 dB	
	150 kHz ~ 30 MHz: 3.24 dB	
Shielded Room (CE#2)	9 kHz ~ 150 kHz: 3.48 dB	
	150 kHz ~ 30 MHz: 3.06 dB	
Radiated Emission measurement (Confidence level about 95 %, $k = 2$ )		
10 m Chamber (4F)	30 MHz ~ 300 MHz	3 m: 5.02 dB
		10 m: 5.00 dB
	300 MHz ~ 1 000 MHz	3 m: 5.16 dB
		10 m: 5.04 dB
	1 GHz ~ 6 GHz	3 m: 6.30 dB
10 m Chamber (2F)	30 MHz ~ 300 MHz	3 m: 5.54 dB
		10 m: 5.52 dB
	300 MHz ~ 1 000 MHz	3 m: 5.60 dB
		10 m: 5.48 dB
	1 GHz ~ 6 GHz	3 m: 6.32 dB
Radio Frequency Electromagnetic Fields (Confidence level about 95 %, $k = 2$ )		
0.86 dB		
Disturbance Power Electromagnetic Fields (Confidence level about 95 %, $k = 2$ )		
2.82 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	2F	EP5RE_V 4.6.0(TOYO)	align="center">☒
	4F	EP5RE_V 5.11.10(TOYO)	
Harmonics current, Voltage fluctuations and flickers	CTS 4_V 4.6.2 (AMETEK)		☒
Radiated RF immunity	3F	EMC32_V 9.01.0 (ROHDE & SCHWARZ)	align="center">☒
	6F	EMC32_V 8.53.0 (ROHDE & SCHWARZ)	
Electrical Fast Transient/BURST, Surge, Voltage dip/interruption	6F(#1)	ISMIEC_V 4.08(EM TEST)	align="center">☒
	6F(#2)	ISMIEC_V 4.07(EM TEST)	
	3F(#3)	IEC_V 5.2.9(EM TEST)	
Conducted RF immunity	6F(#1)	EMC32_V 9.25.00 (ROHDE & SCHWARZ)	align="center">☒
	3F(#2)	ICD_V 5.3.4(EM TEST)	



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## 4. Description of EUT

### 4.1 General information

Power source - 24VAC

Power Consumption – Max 75W

Pan/Tilt range – Pan: 360 degrees limitless rotating, Tilt: -90 ~ +90 degrees

Operating speed – Pan: 1~50 degrees/sec, Tilt: 1~50 degrees/sec

Ambient temperature -  $-40^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$

Pan/Tilt operating – Preset position feedback, Manual

Housing material – Stainless steel (SUS316/304)

Weight – 35Kg

Dimension – 384(W) x 402(H) x 250(D)

Cable entry size – NTP 3/4"

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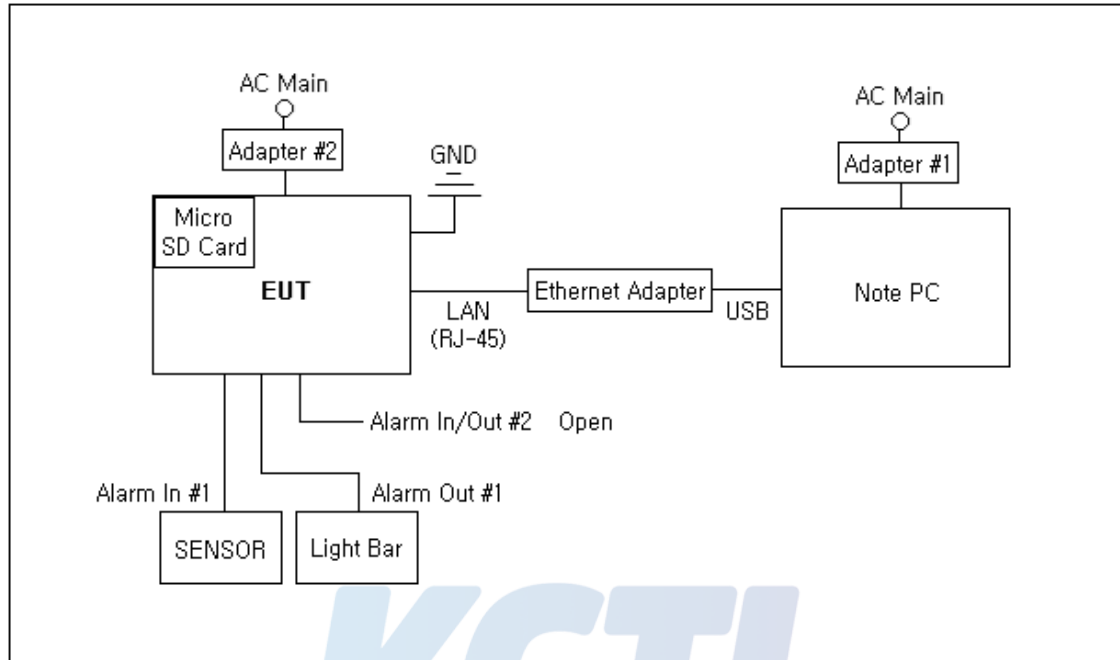
## 4.2 Product description

Type of product	2M 32x N/W Explosion-proof PTZ Camera
Model name (Basic)	TNU-6320E
Model name (Variant)	-
Difference	-
Serial no	-
Testing voltage	EMI Test: 230 V, 50 Hz EMS Test: AC 24 V
Input rating	AC 24 V
Internal clock frequency	400 MHz
Note	Adapter was not provided by the manufacturer.

## 4.3 Auxiliary equipments

Type	Model / Part #	S/N	Manufacturer
Note PC	NT271B5E-K3015	JGFE91DF600016L	SAMSUNG
Adapter #1	ADP-60ZH D	-	SAMSUNG
Adapter #2	W&T- L10145W240600	-	W&T ELECTRONIC CO., LTD
Light Bar	DS-360	-	DAE MYUNG ELECTRONICS CO., LTD
SENSOR	-	-	DAE MYUNG ELECTRONICS CO., LTD
Micro SD Card (64 GB)	-	-	SAMSUNG
Ethernet Adapter	-	-	-

#### 4.4 Test configuration



	Start		End		Cable		
	Name	I/O port	Name	I/O port	Length (m)	Spec.	Cable
1	EUT	Power	Adapter #2	-	1.2	Unshield	-
2		Micro SD	Micro SD Card	-	Direct	-	-
3		LAN(RJ-45)	Ethernet Adapter	-	3.0	Shield	Out-door
4		Alarm Out #1	Light Bar	-	3.0	Unshield	Out-door
5		Alarm In #1	SENSOR	-	3.0	Unshield	Out-door
6		Alarm In/Out #2	Open	-	1.0	Unshield	-
7		GND	GND	-	2.0	-	-
8	Note PC	Power	Adapter #1	-	1.5	Unshield	-
9		USB	Ethernet Adapter	-	0.1	Shield	-

## 4.5 Operating conditions

The EUT was configured as normal intended use.

Test mode	Normal operating
Test #1	Check the video output to the EUT with Note PC. (Used Program: Web view)
	Ping test.
	Check the signal test with SENSOR/Light Bar.

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## 5. Summary of test results

### 5.1 Summary of EMI emission test results

Applied	Test items	Test method	Result
<input checked="" type="checkbox"/>	Conducted Emission	EN 55032:2015	Pass
<input checked="" type="checkbox"/>	Radiated Emission	EN 55032:2015	Pass
<input checked="" type="checkbox"/>	Harmonics current	EN 61000-3-2:2014	Pass
<input checked="" type="checkbox"/>	Voltage fluctuations and flickers	EN 61000-3-3:2013	Pass

### 5.2 Summary of immunity test results

Applied	Test items	Test method	Result
<b>EN 50130-4:2011 /A1:2014</b>			
<input checked="" type="checkbox"/>	Electrostatic discharge	EN 61000-4-2:2009	Pass
<input checked="" type="checkbox"/>	Radiated RF immunity	EN 61000-4-3:2006 /A2:2010	Pass
<input checked="" type="checkbox"/>	Electrical Fast Transient/BURST	EN 61000-4-4:2012	Pass
<input checked="" type="checkbox"/>	Surge	EN 61000-4-5:2014	Pass
<input checked="" type="checkbox"/>	Conducted RF immunity	EN 61000-4-6:2014	Pass
<input type="checkbox"/>	Voltage dip/interruption	EN 61000-4-11:2004	N/A
<input type="checkbox"/>	Mains supply voltage variations	EN 50130-4:2011 /A1:2014	N/A

This product complies with the requirements of the EMC Directive 2014/30/EU.

## 5.3 Performance criteria

The variety and the diversity of the apparatus within the scope of this document makes it difficult to define precise criteria for the evaluation of the immunity test results.

If as a result of the application of the tests defined in this standard, the apparatus becomes dangerous or unsafe then the apparatus shall be deemed to have failed the test.

A functional description and a definition of performance by the manufacture and noted in the test report, based on the following criteria:

### Electrostatic discharge

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of discharge is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. The EUT shall meet the acceptance criteria for the functional test (see Clause 6), after the conditioning.

### Radiated electromagnetic fields

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change, and no such flickering of indicators occurs at a field strength of 3 V/m.

For components of CCTV systems, where the status is monitored by observing the TV picture, then deterioration of the picture is allowed at 10 V/m, providing.

- (a) there is no permanent damage or change to the EUT  
(e.g. no corruption of memory or changes to programmable setting etc.)
- (b) at 3 V/m, any deterioration of the picture is so minor that the system could still be used;  
and
- (c) there is no observable deterioration of the picture at 1 V/m.

The EUT shall meet the acceptance criteria for the functional test(see Clause 6), after the conditioning.

### Fast transient burst / slow high energy voltage surge

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of the bursts is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. The EUT shall meet the acceptance criteria for the functional test

(see Clause 6), after the conditioning.

### Slow high energy voltage surge

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the application of the surges is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. The EUT shall meet the acceptance criteria for the functional test (see Clause 6), after the conditioning.

### Conducted RF immunity

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change, and no such flickering of indicators occurs at  $U_0 = 130 \text{ dB}\mu\text{V}$ .

For components of CCTV systems, where the status is monitored by observing the TV picture, then deterioration of the picture is allowed at  $U_0 = 140 \text{ dB}\mu\text{V}$ , providing

- (a) there is no permanent damage or change to the EUT  
(e.g. no corruption of memory or changes to programmable settings, etc.)
- (b) at  $U_0 = 130 \text{ dB}\mu\text{V}$ , any deterioration of the picture is so minor that the system could still be used, and
- (c) there is no observable deterioration of the picture at  $U_0 = 120 \text{ dB}\mu\text{V}$ .

The EUT shall meet the acceptance criteria for the functional test(see Clause 6), after the conditioning.

### Voltage dip/interruption / Voltage variation

There shall be no damage, malfunction or change of status due to the conditioning.

Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs, which could be interpreted by associated equipment as a change. The EUT shall meet the acceptance criteria for the functional test(see Clause 6), after the conditioning.

### Mains supply voltage variations

There shall be no damage, malfunction or change of status due to the different supply voltage conditions. The EUT shall meet the acceptance criteria for the functional test(see Clause 6), during the conditioning.

## 6. Test results

### 6.1 Conducted Emission

Test specification	EN 55032:2015, Class A		
Testing voltage	230 V, 50 Hz		
Test facility	Shielded room (CE#2)		
Date	2018-01-02		
Temperature (°C)	26.5 °C	Humidity (% R.H.)	21.6 % 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 emission measurement

☒ AC main

Frequency [MHz]	Resolution Bandwidth [kHz]	Class A (dB( $\mu$ V))		Class B (dB( $\mu$ V))	
		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

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Frequency [MHz]	Resolution Bandwidth [kHz]	Class A Limits (dB( $\mu$ V))		Current Limits (dB( $\mu$ V))	
		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( $\mu$ V))		Current Limits (dB( $\mu$ V))	
		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



If the reading on the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 seconds at each measurement frequency, the highest reading shall be recorded, with the exception of any brief isolated high reading (which shall be ignored).

#### 6.1.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
EMI TEST RECEIVER	ESCI	100710	R&S	2018.08.24	<input checked="" type="checkbox"/>
TWO-LINE V-NETWORK	ENV216	101352	R&S	2018.08.25	<input checked="" type="checkbox"/>
TWO-LINE V-NETWORK	NNLK8121	8121-472	SCHWARZBECK	2018.08.25	<input checked="" type="checkbox"/>
IMPEDANCE STABILIZATION NETWORK	ISN ST08	24342	TESEQ	2018.05.18	<input checked="" type="checkbox"/>

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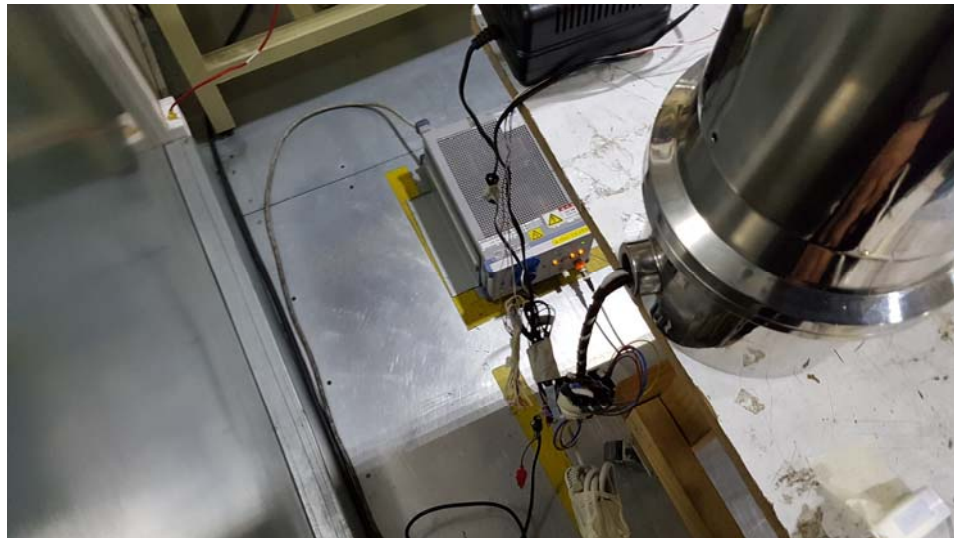
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### 6.1.3 Photographs of test setup

AC Main



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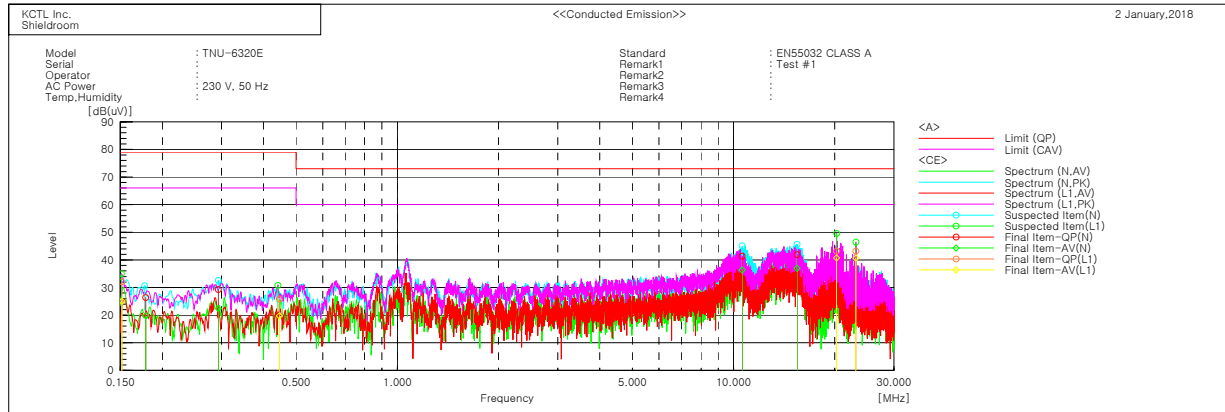
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### 6.1.4 Conducted emission measurement result

#### 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	0.17845	15.9	9.3	10.4	26.3	19.7	79.0	66.0	52.7	46.3
2	0.29346	19.2	12.4	10.0	29.2	22.4	79.0	66.0	49.8	43.6
3	10.61305	31.1	26.2	10.2	41.3	36.4	73.0	60.0	31.7	23.6
4	15.45216	31.6	26.7	10.3	41.9	37.0	73.0	60.0	31.1	23.0

--- 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	0.15167	22.1	14.9	10.1	32.2	25.0	79.0	66.0	46.8	41.0
2	0.44605	15.7	9.6	10.1	25.8	19.7	79.0	66.0	53.2	46.3
3	20.25645	32.9	30.4	10.3	43.2	40.7	73.0	60.0	29.8	19.3
4	23.12853	32.9	30.4	10.3	43.2	40.7	73.0	60.0	29.8	19.3

# KCTL Inc.

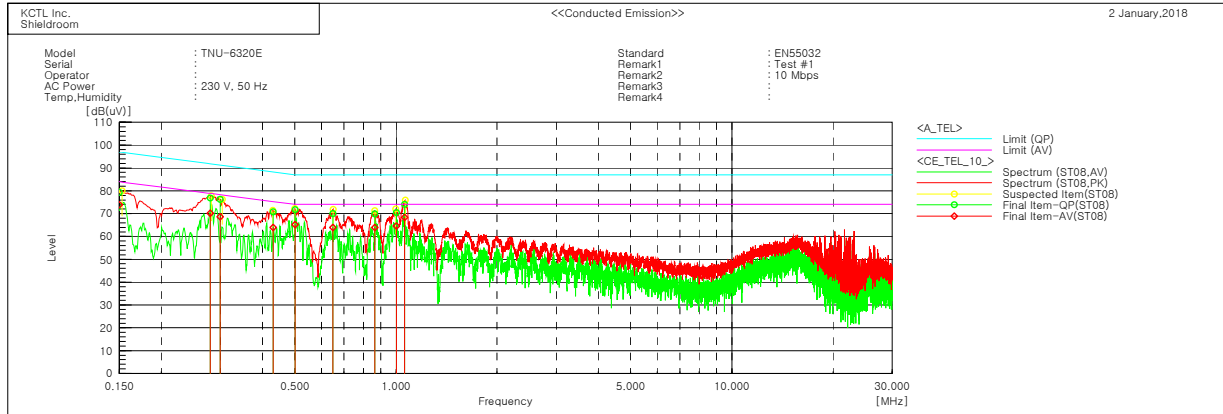
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### Final Result

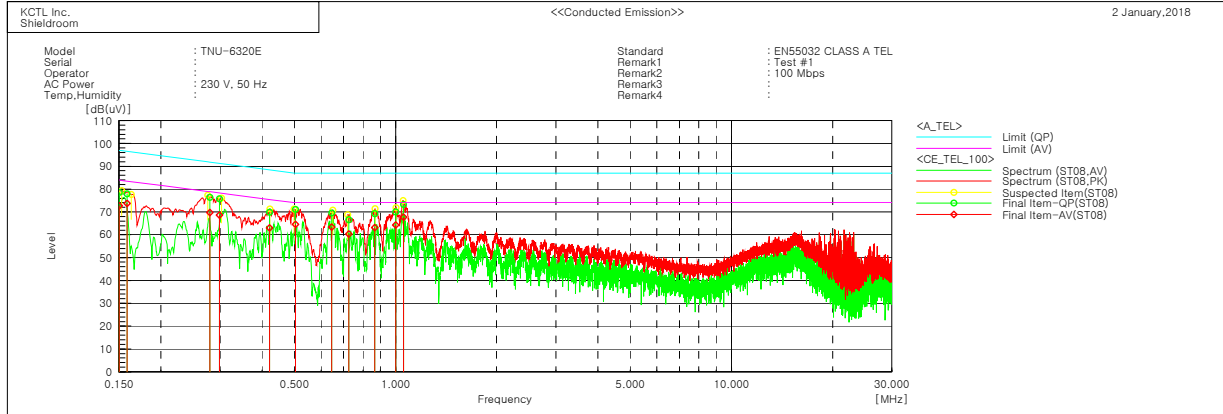
--- ST08 Phase ---									
No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin
	[MHz]	[dB(uV)]	[dB(uV)]	[dB]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB(uV)]	QP CAV [dB]
1	0.15003	69.6	64.3	9.7	79.3	74.0	97.0	84.0	17.7 10.0
2	0.27977	67.2	60.5	9.7	76.9	70.2	91.8	78.8	14.9 8.6
3	0.29851	66.6	58.9	9.7	76.3	68.6	91.3	78.3	15.0 9.7
4	0.43084	61.0	54.2	9.8	70.8	64.0	88.2	75.2	17.4 11.2
5	0.50061	61.9	55.3	9.8	71.7	65.1	87.0	74.0	15.3 8.9
6	0.64808	60.1	54.0	9.9	70.0	63.9	87.0	74.0	17.0 10.1
7	0.86386	59.9	54.0	9.9	69.8	63.9	87.0	74.0	17.2 10.1
8	1.00248	60.6	54.6	9.9	70.5	64.5	87.0	74.0	16.5 9.5
9	1.06129	64.1	58.4	9.9	74.0	68.3	87.0	74.0	13.0 5.7

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## Final Result

--- ST08 Phase ---		Reading		c.f	Result		Limit		Margin	
No.	Frequency	QP	CAV		QP	CAV	QP	AV	QP	CAV
	[MHz]	[dB(uV)]	[dB(uV)]		[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB(uV)]	[dB]	[dB]
1	0.15021	68.9	62.9	9.7	78.6	72.6	97.0	84.0	18.4	11.4
2	0.15872	68.3	64.0	9.7	78.0	73.7	96.5	83.5	18.5	9.8
3	0.27982	66.6	60.0	9.7	76.3	69.7	91.8	78.8	15.5	9.1
4	0.29918	66.1	58.9	9.7	75.8	68.6	91.3	78.3	15.5	9.7
5	0.42137	60.1	53.3	9.8	69.9	63.1	88.4	75.4	18.5	12.3
6	0.50312	61.4	54.8	9.8	71.2	64.6	87.0	74.0	15.8	9.4
7	0.64562	59.6	53.4	9.9	69.5	63.3	87.0	74.0	17.5	10.7
8	0.7247	56.7	50.5	9.9	66.6	60.4	87.0	74.0	20.4	13.6
9	0.86699	59.3	53.3	9.9	69.2	63.2	87.0	74.0	17.8	10.8
10	1.00073	60.1	54.3	9.9	70.0	64.2	87.0	74.0	17.0	9.8
11	1.05588	63.4	57.8	9.9	73.3	67.7	87.0	74.0	13.7	6.3

## 6.2 Radiated Emission

Test specification		EN 55032:2015, Class A		
Testing voltage		230 V, 50 Hz		
Test facility		10 m Chamber (2F)		
Test distance		10 m, 3 m		
Date		2018-01-07		
10 m	Temperature (°C)	25.3 °C	Humidity (% R.H.)	22.8 % R.H.
3 m		25.5 °C		21.6 % R.H.
Remarks		Pass		

Of those emissions above ( $L - 20$  dB), where  $L$  is the limit level in logarithmic units, record at least the emission levels and the frequencies of the six highest emissions.

The following data lists the significant emission frequencies, measured levels, correction factors (for antenna and cables), orientation of table, polarization and height of antenna, the corrected reading, the limit, and the amount of margin. All measurements were taken utilizing quasi-peak detection unless stated otherwise.

Measurements were performed at an antenna to EUT distance of 10 or 3 meters and elevated between 1 and 4 meters. Both vertical and horizontal antenna polarizations were measured.

Below 1 GHz, peak detector function mode for prescan was used with resolution bandwidth of 120 kHz and a video bandwidth of 300 kHz and sweep method.

The sweep time for prescan set below 200 ms up and final measurement with quasi-peak detector evaluated for suspected frequencies points, which are detected from prescan measurement.

Final measurements consisted of 3 steps.

First step, frequency fine tuning to find exact emission frequency.

Second step, rechecking to search for maximum height and azimuth for interference from EUT

In final step, there are conducted measuring with quasi-peak detector for points

which are detected from 1<sup>st</sup> step & 2<sup>nd</sup> step.

## 6.2.1 Limits of radiated emission measurement

### ☒ Limits below 1 GHz

Frequency [MHz]	Resolution Bandwidth [kHz]	Class A (dB( $\mu$ V/m)) @ 10 m	Class B (dB( $\mu$ V/m)) @ 10 m
30 ~ 230	120	40	30
230 ~ 1 000	120	47	37

### ☒ Limits above 1 GHz

Frequency [GHz]	Resolution Bandwidth [MHz]	Class A @ 3 m		Class B @ 3 m	
		Average limit (dB( $\mu$ V/m))	Peak limit (dB( $\mu$ V/m))	Average limit (dB( $\mu$ V/m))	Peak limit (dB( $\mu$ V/m))
1 ~ 3	1	56	76	50	70
3 ~ 6	1	60	80	54	74

Note - The lower limit applies at the transition frequency.

Measurements within 20 dB of the limit were then maximized by adjusting turntable position.

Final measurements were made using an C/Average detector.

Results checked manually and points close to the limit line were re-measured.

## 6.2.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
EMI TEST RECEIVER	ESCI7	100732	R&S	2018.08.24	<input checked="" type="checkbox"/>
Bilog Antenna	VULB9168	440	SCHWARZBECK	2018.08.05	<input checked="" type="checkbox"/>
AMPLIFIER	310N	344922	SONOMA	2018.08.25	<input checked="" type="checkbox"/>
COAXIAL FIXED ATTENUATOR	8491A	MY52461848	Agilent	2018.08.24	<input checked="" type="checkbox"/>
Antenna Mast	MA4000-EP	303	Innco Systems	-	<input checked="" type="checkbox"/>
Turn Table	DT2000	79	Innco Systems	-	<input checked="" type="checkbox"/>
PREAMPLIFIER	8449B	3008A02343	AGILENT	2018.08.25	<input checked="" type="checkbox"/>
DOUBLE RIDGED HORN ANTENNA	3115	00155772	ETS-LINDGREN	2018.10.20	<input checked="" type="checkbox"/>
Spectrum Analyzer	FSV40	100988	R&S	2018.01.06	<input type="checkbox"/>



### 6.2.3 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:

$$\text{Result} = \text{M.R} + \text{C.F}(\text{A.F} + \text{C.L} + 3 \text{ dB Att} - \text{A.G})$$

M.R = Meter Reading

C.F = Correction Factor

A.F = Antenna Factor

C.L = Cable Loss

A.G = Amplifier Gain

3 dB Att = 3 dB Attenuator

If M.R is 30 dB, A.F 12 dB, C.L 5 dB, 3 dB, A.G 35 dB

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

AV = CAV : Abbreviation of CISPR Average

Correction

$$E_m = E_{dm} + 20\log(d/3)$$

$E_m$ : Result,  $E_{dm}$ : Measured value of the measured distance

#### 6.2.4 Photographs of test setup

30 MHz ~ 1 GHz



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1 GHz ~ 6 GHz

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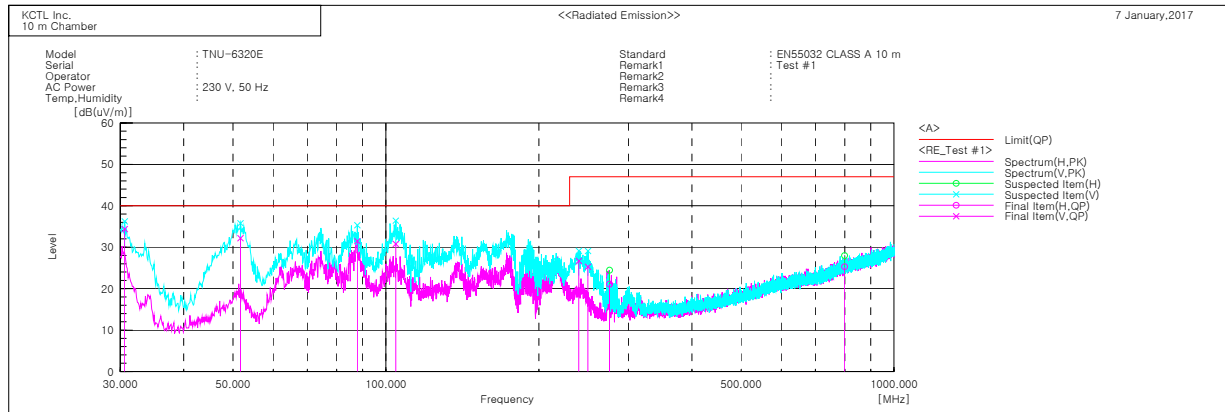
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## 6.2.5 Radiated emission measurement result

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]
1	30.606	V	50.1	-15.7	34.4	40.0	5.6	115.0	352.0
2	51.704	V	46.2	-14.0	32.2	40.0	7.8	132.0	89.3
3	87.836	V	50.5	-19.0	31.5	40.0	8.5	348.0	291.5
4	104.569	V	48.1	-17.3	30.8	40.0	9.2	105.0	101.9
5	239.763	V	40.0	-13.3	26.7	47.0	20.3	225.0	56.8
6	249.947	V	38.0	-12.7	25.3	47.0	21.7	210.0	49.3
7	275.531	H	32.4	-11.3	21.1	47.0	25.9	327.0	263.5
8	799.695	H	22.1	3.2	25.3	47.0	21.7	385.0	26.0

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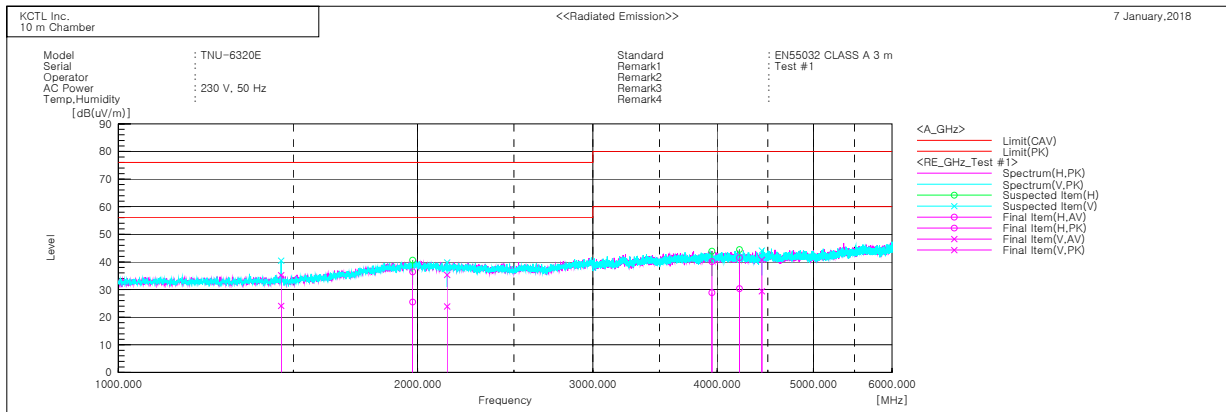
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1 GHz ~ 6 GHz



## Final Result

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1	1458.125	V	30.8	41.9	-6.7	24.1	35.2	56.0	76.0	31.9	40.8	100.0	158.1
2	1976.875	H	25.8	36.7	-0.3	25.5	36.4	56.0	76.0	30.5	39.6	100.0	196.6
3	2141.250	V	24.3	35.7	-0.4	23.9	35.3	56.0	76.0	32.1	40.7	100.0	358.8
4	3953.750	H	22.5	33.7	6.4	28.9	40.1	60.0	80.0	31.1	39.9	100.0	214.3
5	4215.000	H	23.5	34.7	6.8	30.3	41.5	60.0	80.0	29.7	38.5	100.0	65.7
6	4437.500	V	22.4	33.8	7.0	29.4	40.8	60.0	80.0	30.6	39.2	100.0	117.7

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## ◆ Correction(Distance: 3.7 m)

Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
1458.125	V	30.8	41.9	-4.9	25.9	37.0	56.0	76.0	30.1	39.0
1976.875	H	25.8	36.7	1.5	27.3	38.2	56.0	76.0	28.7	37.8
2141.250	V	24.3	35.7	1.4	25.7	37.1	56.0	76.0	30.3	38.9
3953.750	H	22.5	33.7	8.2	30.7	41.9	60.0	80.0	29.3	38.1
4215.000	H	23.5	34.7	8.6	32.1	43.3	60.0	80.0	27.9	36.7
4437.500	V	22.4	33.8	8.8	31.2	42.6	60.0	80.0	28.8	37.4

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## 6.3 Harmonics

Test specification	EN 61000-3-2:2014				
Testing voltage	230 V, 50 Hz(From Adapter #2)				
Test facility	EMI Test area(6F)				
Date	2018-01-02				
Temperature(°C)	24.8 °C	Humidity (% R.H.)	23.6 % R.H.	Pressure (kPa)	102.2 kPa
Remarks	Pass				

### 6.3.1 Measurement procedure

The equipment is supplied in series with shunt(s) R<sub>m</sub> or current transformer(s) from a source having the same nominal voltage and frequency as the rated supply voltage and frequency of the equipment. Measurements shall be made under normal load, or conditions for adequate heat discharge, and under normal operating conditions. User's operation controls or automatic programmers shall be set to produce the maximum harmonic component, for each successive harmonic component in turn. For the purpose of harmonic current limitation, equipment is classified as follows :

Class A : Equipment not specified in one of the three other Classes shall be considered as Class A equipment.

- Balanced three-phase equipment;
- Household appliances, excluding equipment identified as Class D;
- Tools, excluding portable tools;
- Dimmers for incandescent lamps;
- Audio equipment.

Class B : Portable tools; Arc welding equipment which is not professional equipment.

Class C : Lighting equipment.

Class D : Equipment having a specified power according to 6.2.2 less than or equal to 600 w, of the following types:

- Personal computers and personal computer monitors;
- Television receivers.
- Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

### 6.3.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
Hamonic / Flicker Meter (AC POWER SOURCE)	5001IX	54894	C.I.	2018.03.21	<input checked="" type="checkbox"/>
Hamonic / Flicker Meter (Analyzer)	PACS-1	72072	C.I.	2018.04.07	<input checked="" type="checkbox"/>

### 6.3.3 Photographs of test setup





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### 6.3.4 Measurement result

#### Harmonics – Class-A per Ed. 4.0 (2014)(Run time)

EUT: TNU-6320E

Test category: Class-A per Ed. 4.0 (2014) (European limits)

Test date: 02/01/2018

Start time: 08:20:47

Test duration (min): 2.5

Data file name: H-000479.cts\_data

Comment: Comments

Customer: Hanwha Techwin Co., Ltd

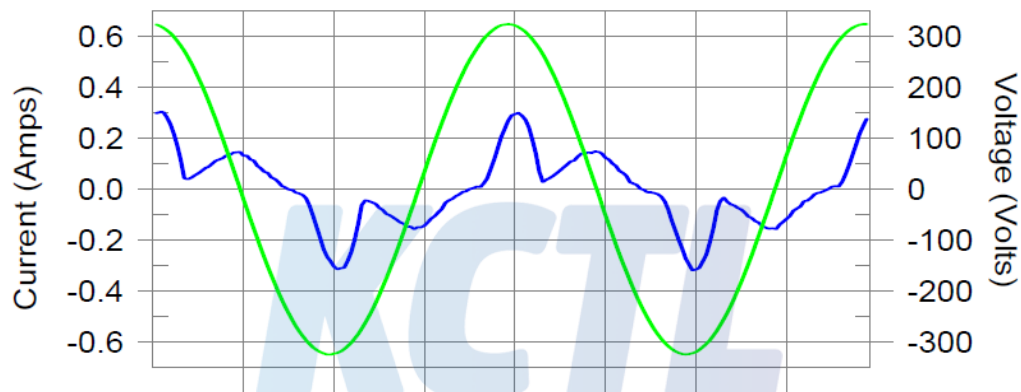
Tested by: KCTL Inc.

Test Margin: 100

End time: 08:23:38

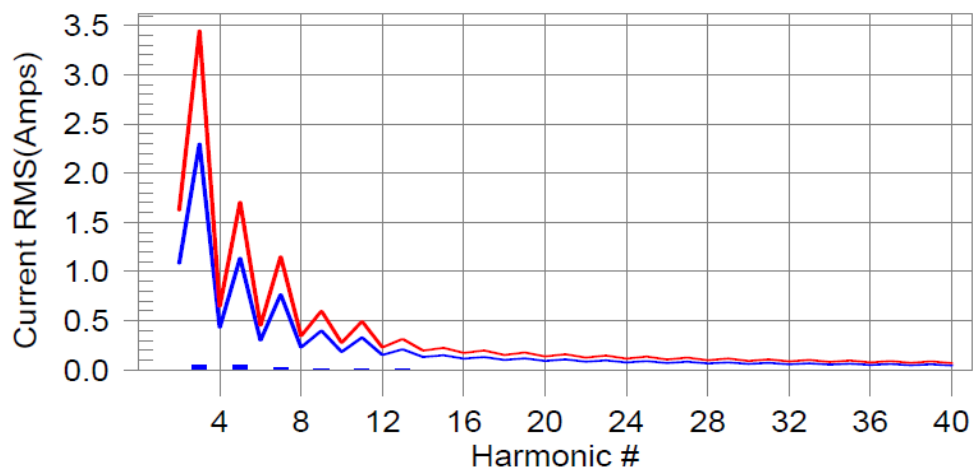
Test Result: Pass Source qualification: Normal

#### Current & voltage waveforms



#### Harmonics and Class A limit line

#### European Limits



Test result: Pass Worst harmonic was #5 with 4.1% of the limit.



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### Current Test Result Summary (Run time)

EUT: TNU-6320E  
Test category: Class-A per Ed. 4.0 (2014) (European limits)  
Test date: 02/01/2018 Start time: 08:20:47 End time: 08:23:38  
Test duration (min): 2.5 Data file name: H-000479.cts\_data  
Comment: Comments  
Customer: Hanwha Techwin Co., Ltd

Test Result: Pass Source qualification: Normal  
THC(A): 0.075 I-THD(%): 61.6 POHC(A): 0.000 POHC Limit(A): 0.251  
Highest parameter values during test:  
V\_RMS (Volts): 229.45 Frequency(Hz): 50.00  
I\_Peak (Amps): 0.326 I\_RMS (Amps): 0.143  
I\_Fund (Amps): 0.121 Crest Factor: 2.284  
Power (Watts): 21.7 Power Factor: 0.664

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.002	1.080	N/A	0.002	1.620	N/A	Pass
3	0.054	2.300	2.3	0.054	3.450	1.6	Pass
4	0.001	0.430	N/A	0.001	0.645	N/A	Pass
5	0.047	1.140	4.1	0.047	1.710	2.7	Pass
6	0.000	0.300	N/A	0.000	0.450	N/A	Pass
7	0.019	0.770	2.5	0.019	1.155	1.7	Pass
8	0.000	0.230	N/A	0.000	0.345	N/A	Pass
9	0.007	0.400	1.7	0.007	0.600	1.1	Pass
10	0.000	0.184	N/A	0.000	0.276	N/A	Pass
11	0.005	0.330	1.6	0.005	0.495	1.0	Pass
12	0.000	0.153	N/A	0.000	0.230	N/A	Pass
13	0.005	0.210	N/A	0.005	0.315	N/A	Pass
14	0.000	0.131	N/A	0.000	0.197	N/A	Pass
15	0.002	0.150	N/A	0.002	0.225	N/A	Pass
16	0.000	0.115	N/A	0.000	0.173	N/A	Pass
17	0.002	0.132	N/A	0.002	0.198	N/A	Pass
18	0.000	0.102	N/A	0.000	0.153	N/A	Pass
19	0.002	0.118	N/A	0.002	0.178	N/A	Pass
20	0.000	0.092	N/A	0.000	0.138	N/A	Pass
21	0.001	0.107	N/A	0.001	0.161	N/A	Pass
22	0.000	0.084	N/A	0.000	0.125	N/A	Pass
23	0.001	0.098	N/A	0.001	0.147	N/A	Pass
24	0.000	0.077	N/A	0.000	0.115	N/A	Pass
25	0.001	0.090	N/A	0.001	0.135	N/A	Pass
26	0.000	0.071	N/A	0.000	0.107	N/A	Pass
27	0.001	0.083	N/A	0.001	0.125	N/A	Pass
28	0.000	0.066	N/A	0.000	0.099	N/A	Pass
29	0.001	0.078	N/A	0.001	0.116	N/A	Pass
30	0.000	0.061	N/A	0.000	0.092	N/A	Pass
31	0.001	0.073	N/A	0.001	0.109	N/A	Pass
32	0.000	0.058	N/A	0.000	0.086	N/A	Pass
33	0.001	0.068	N/A	0.001	0.102	N/A	Pass
34	0.000	0.054	N/A	0.000	0.081	N/A	Pass
35	0.000	0.064	N/A	0.000	0.096	N/A	Pass
36	0.000	0.051	N/A	0.000	0.077	N/A	Pass
37	0.000	0.061	N/A	0.000	0.091	N/A	Pass
38	0.000	0.048	N/A	0.000	0.073	N/A	Pass
39	0.000	0.058	N/A	0.000	0.087	N/A	Pass
40	0.000	0.046	N/A	0.000	0.069	N/A	Pass

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### Voltage Source Verification Data (Run time)

EUT: TNU-6320E  
Test category: Class-A per Ed. 4.0 (2014) (European limits)  
Test date: 02/01/2018 Start time: 08:20:47  
Test duration (min): 2.5 Data file name: H-000479.cts\_data  
Comment: Comments  
Customer: Hanwha Techwin Co., Ltd

Tested by: KCTL Inc.

Test Margin: 100

End time: 08:23:38

Test Result: Pass Source qualification: Normal

Highest parameter values during test:

Voltage (Vrms):	229.45	Frequency(Hz):	50.00
I <sub>Peak</sub> (Amps):	0.326	I <sub>RMS</sub> (Amps):	0.143
I <sub>Fund</sub> (Amps):	0.121	Crest Factor:	2.284
Power (Watts):	21.7	Power Factor:	0.664

Harm#	Harmonics V-rms	Limit V-rms	% of Limit	Status
2	0.099	0.459	21.67	OK
3	0.514	2.065	24.90	OK
4	0.023	0.459	5.02	OK
5	0.024	0.918	2.59	OK
6	0.028	0.459	6.16	OK
7	0.014	0.688	2.03	OK
8	0.020	0.459	4.29	OK
9	0.021	0.459	4.51	OK
10	0.007	0.459	1.55	OK
11	0.032	0.229	13.88	OK
12	0.026	0.229	11.13	OK
13	0.017	0.229	7.44	OK
14	0.008	0.229	3.59	OK
15	0.010	0.229	4.57	OK
16	0.016	0.229	6.97	OK
17	0.007	0.229	3.20	OK
18	0.016	0.229	6.98	OK
19	0.006	0.229	2.79	OK
20	0.011	0.229	4.90	OK
21	0.006	0.229	2.44	OK
22	0.013	0.229	5.62	OK
23	0.010	0.229	4.32	OK
24	0.021	0.229	9.04	OK
25	0.007	0.229	2.97	OK
26	0.021	0.229	9.14	OK
27	0.006	0.229	2.78	OK
28	0.011	0.229	4.66	OK
29	0.007	0.229	3.08	OK
30	0.021	0.229	9.15	OK
31	0.006	0.229	2.81	OK
32	0.010	0.229	4.23	OK
33	0.006	0.229	2.51	OK
34	0.012	0.229	5.19	OK
35	0.009	0.229	3.89	OK
36	0.011	0.229	5.00	OK
37	0.011	0.229	4.91	OK
38	0.007	0.229	2.86	OK
39	0.010	0.229	4.29	OK
40	0.012	0.229	5.06	OK

## 6.4 Flicker

Test specification	EN 61000-3-3:2013				
Testing voltage	230 V, 50 Hz(From Adapter #2)				
Test facility	EMI Test area(6F)				
Date	2018-01-02				
Temperature(°C)	24.8 °C	Humidity (% R.H.)	23.6 % R.H.	Pressure (kPa)	102.2 kPa
Remarks	Pass				

### 6.4.1 Measurement procedure

EUT was connected to the power analyzer system.

Measurement was performed to obtain the desired flicker parameters.

The measuring time depends on which parameters are to be measured.

$P_{It}$  = 2 h

$P_{st}$  = 10 min

Controls and automatic programs shall be set to produce the most unfavorable sequence of voltage changes, using only those combinations of controls and programs are mentioned by the manufacturer in the instruction manual.

#### 6.4.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
Hamonic / Flicker Meter (AC POWER SOURCE)	5001IX	54894	C.I.	2018.03.21	<input checked="" type="checkbox"/>
Hamonic / Flicker Meter (Analyzer)	PACS-1	72072	C.I.	2018.04.07	<input checked="" type="checkbox"/>

#### 6.4.3 Photographs of test setup



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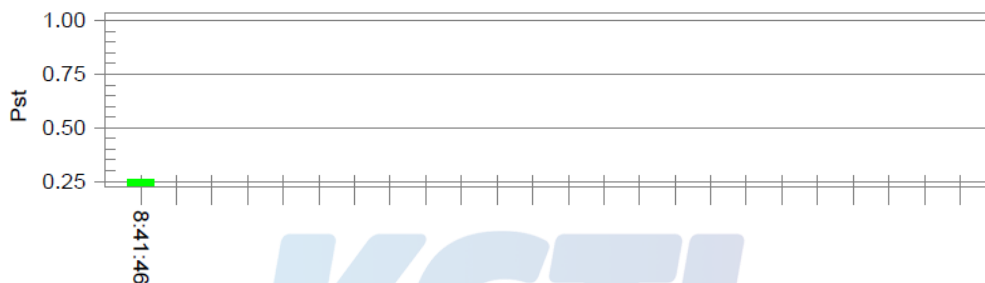
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#### 6.4.4 Measurement result

**Flicker Test Summary per EN/IEC61000-3-3 (Run time)****EUT: TNU-6320E****Test category: All parameters (European limits)****Test date: 02/01/2018****Test duration (min): 10****Comment: Comments****Customer: Hanwha Techwin Co., Ltd****Tested by: KCTL Inc.****Test Margin: 100****End time: 08:41:48****Start time: 08:31:16****Data file name: F-000480.cts\_data****Test Result: Pass****Status: Test Completed****Pst and limit line****European Limits****Plt and limit line****Parameter values recorded during the test:****Vrms at the end of test (Volt): 229.41****Highest dt (%): 0.00****T-max (mS): 0****Highest dc (%): 0.00****Highest dmax (%): -0.02****Highest Pst (10 min. period): 0.261****Highest Plt (2 hr. period): 0.114****Test limit (%): N/A N/A****Test limit (mS): 500.0 Pass****Test limit (%): 3.30 Pass****Test limit (%): 4.00 Pass****Test limit: 1.000 Pass****Test limit: 0.650 Pass**

## 6.5 Electrostatic Discharge

Test specification	EN 61000-4-2:2009				
Test level	<input checked="" type="checkbox"/> Contact: $\pm 6$ kV <input type="checkbox"/> Air: $\pm 2$ kV, $\pm 4$ kV, $\pm 8$ kV <input type="checkbox"/> HCP: $\pm 6$ kV <input checked="" type="checkbox"/> VCP: $\pm 6$ kV				
Discharge impedance	330 $\Omega$ / 150 pF				
Number of discharge (Each polarity)	<input checked="" type="checkbox"/> Contact: 10 <input type="checkbox"/> Air: 10 <input checked="" type="checkbox"/> HCP / VCP: 10				
Interval between discharges	1 s				
Testing voltage	AC 24 V				
Test facility	Shielded room (6F)				
Date	2018-01-03				
Temperature( $^{\circ}$ C)	24.7 $^{\circ}$ C	Humidity (% R.H.)	38.2 % R.H.	Pressure (kPa)	102.2 kPa
Remarks	Pass -There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs.				

### 6.5.1 Measurement procedure

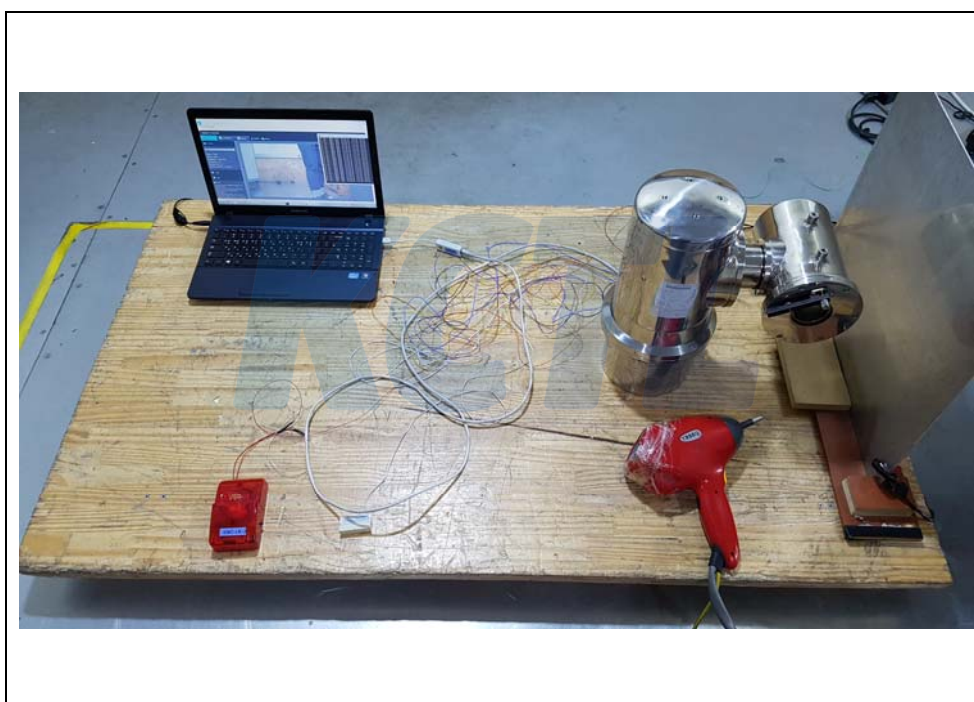
A ground reference plane was located on the floor, and connected to earth via a low Impedance connection. The return cable of the ESD generator was connected to the reference plane. In case of floor standing equipment, EUT was placed on the reference plane on 0.1 m of insulating Support. In case of table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



### 6.5.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
ESD TESTER	PESD1600	H011309	HAEFELY	2018.05.04	<input type="checkbox"/>
ESD TESTER	NSG 437	182	TESEQ	2018.04.06	<input checked="" type="checkbox"/>
HCP	-	-	-	-	<input type="checkbox"/>
VCP	-	-	-	-	<input checked="" type="checkbox"/>

### 6.5.3 Photographs of test setup



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### 6.5.4 Measurement result

#### Electrostatic Discharge (Test Point)

Air discharge



Contact discharge



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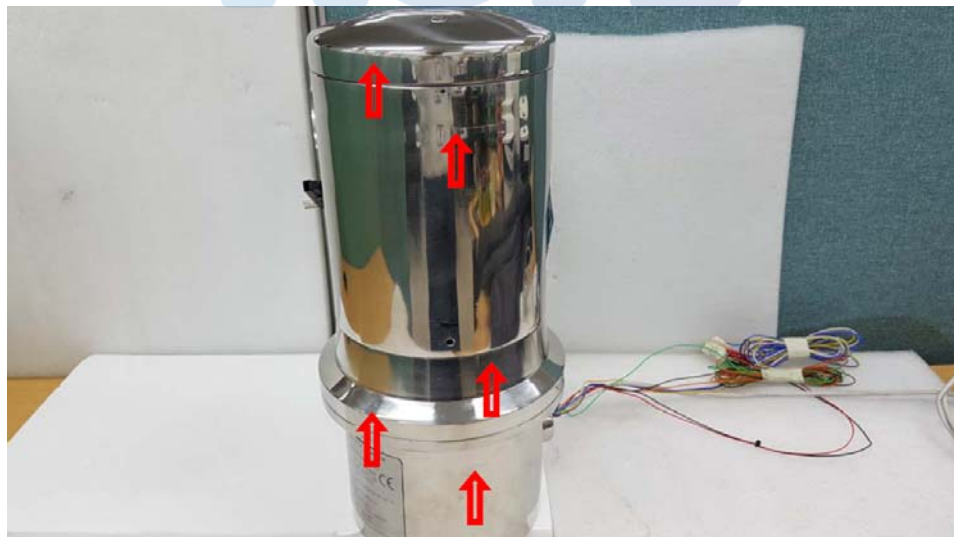
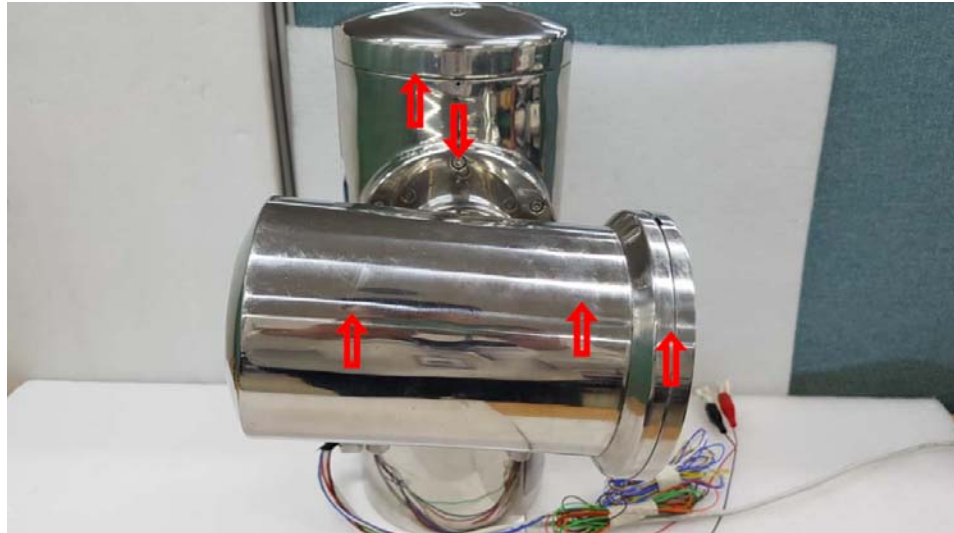


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#### HCP/VCP discharge

Location(EUT)	Applied level (±)	Result
HCP (All 4 sides)	± 6 kV	-
VCP (All 4 sides)	± 6 kV	Pass

#### Contact discharge

Location(EUT)	Applied level (±)	Result
Front	± 6 kV	Pass
Rear	± 6 kV	Pass
Left	± 6 kV	Pass
Right	± 6 kV	Pass

#### Air discharge

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

## 6.6 Radio Frequency Electromagnetic Fields

Test specification	EN 61000-4-3:2006 /A2:2010				
Tested frequency	80 MHz ~ 1 GHz, 1 GHz ~ 2.7 GHz				
Test level & Modulation	1 V/m, 3 V/m, 10 V/m, 80 % Amplitude Modulation (1 kHz) 1 V/m, 3 V/m, 10 V/m, Pulse Modulation (1 Hz (0.5 s ON: 0.5s OFF))				
Frequency Step	1 % step				
Dwell time	3 s				
Distance	3 m from EUT to tip of antenna				
Testing voltage	AC 24 V				
Test facility	6F Fully anechoic chamber (3 m)				
Date	2018-01-02				
Temperature(°C)	22.6 °C	Humidity (% R.H.)	19.3 % R.H.	Pressure(kPa)	102.3 kPa
Remarks	Pass -There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs.				

### 6.6.1 Measurement procedure

The test was performed at 3 m 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 m above the floor.

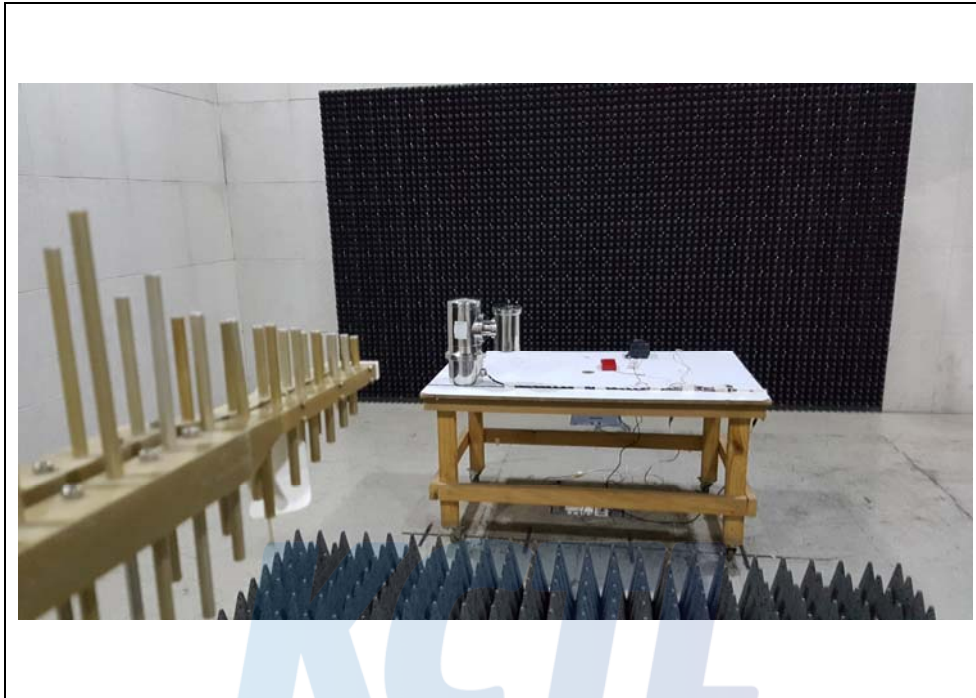
The EUT was tested all sides, horizontal and vertical polarization.

## 6.6.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
POWER METER	PM2002	302852	AR	2018.08.25	<input checked="" type="checkbox"/>
POWER SENSOR	PH2000	303224	AR	2018.08.25	<input checked="" type="checkbox"/>
POWER SENSOR	PH2000	311217	AR	2018.08.25	<input checked="" type="checkbox"/>
DUAL DIRECTIONAL COUPLER	DC6180	303976	AR	2018.08.25	<input checked="" type="checkbox"/>
Dual Directional Coupler	DC7200A	0349434	AR	2018.08.16	<input checked="" type="checkbox"/>
Signal Generator	SMB100A	101737	R&S	2018.05.04	<input checked="" type="checkbox"/>
BROADBAND AMPLIFIER	BBA 100	100996-1	R&S	-	<input checked="" type="checkbox"/>
RF Power Amplifier	100S1G6AB	0349688	AR	-	<input checked="" type="checkbox"/>
Broadband Ant.	LPDA-0803	130269	ETS-LINDGREN	-	<input checked="" type="checkbox"/>
Antenna master	-	-	-	-	<input checked="" type="checkbox"/>
Stacked Log.-Per. Antenna 0.1 GHz - 9 GHz	STLP9149	9149-511	SCHWARZBECK	-	<input checked="" type="checkbox"/>

### 6.6.3 Photographs of test setup

[80 MHz ~ 1 GHz]



[1 GHz ~ 2.7 GHz]



#### 6.6.4 Measurement result

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

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## 6.7 Electric Fast Transient/BURST

Test specification	EN 61000-4-4:2012				
Coupling	<input checked="" type="checkbox"/> AC 24 V <input checked="" type="checkbox"/> Signal: Clamp <input checked="" type="checkbox"/> Telecommunication: Clamp				
Test level	<input checked="" type="checkbox"/> AC 24 V: $\pm 1$ kV Peak <input checked="" type="checkbox"/> Signal: $\pm 1$ kV Peak <input checked="" type="checkbox"/> Telecommunication: $\pm 1$ kV Peak				
Repetition frequency	100 kHz, Tr/Th = 5 / 50 ns				
Coupling time (Minimum)	60 s				
Testing voltage	AC 24 V				
Test facility	Shielded room (6F)				
Date	2018-01-03				
Temperature(°C)	24.5 °C	Humidity (% R.H.)	20.5 % R.H.	Pressure (kPa)	102.2 kPa
Remarks	Pass -There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs.				

### 6.7.1 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 m wooden table.

For tabletop equipment, EUT was placed on a 0.1 m above the ground reference plane.

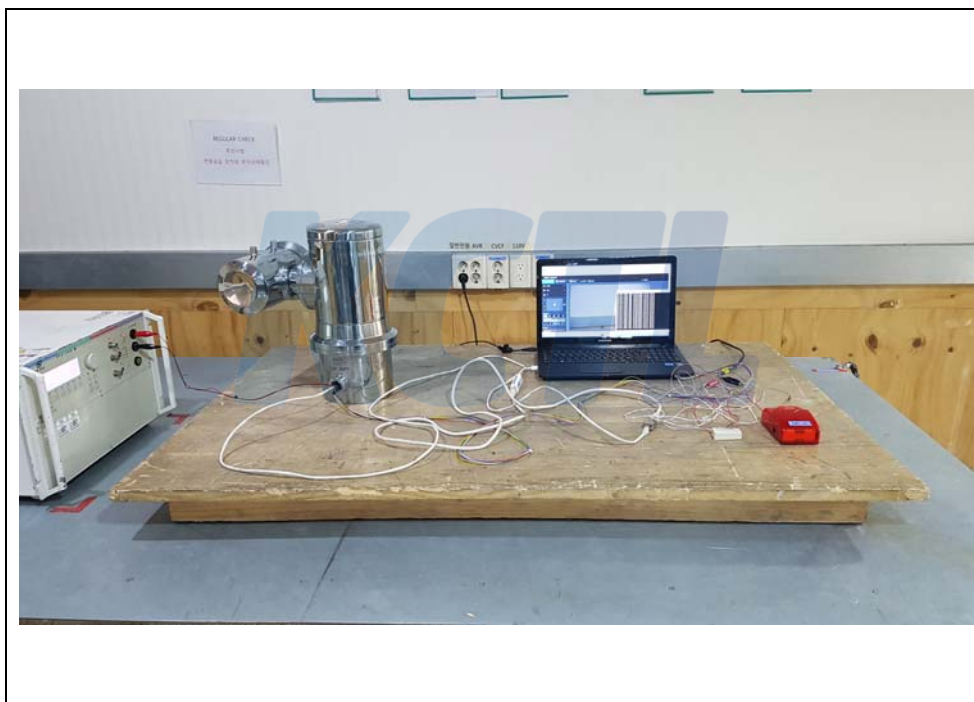
Test generator and coupling/decoupling network was placed on, and bounded to, the ground reference plane. When using the coupling clamp, the minimum distance between the coupling plates and all other conductive surfaces, except the ground reference plane beneath the coupling clamp, Shall be 0.5 m.



## 6.7.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
ULTRA COMPACT SIMULATOR	UCS 500-M6BS1	V0545100858	EM TEST	2018.04.07	<input checked="" type="checkbox"/>
ULTRA COMPACT SIMULATOR	UCS 500M	0701-03	EM TEST	2018.08.24	<input type="checkbox"/>
Capacitive Coupling clamp	CA HFK	0001	EM TEST	2018.08.24	<input checked="" type="checkbox"/>

## 6.7.3 Photographs of test setup



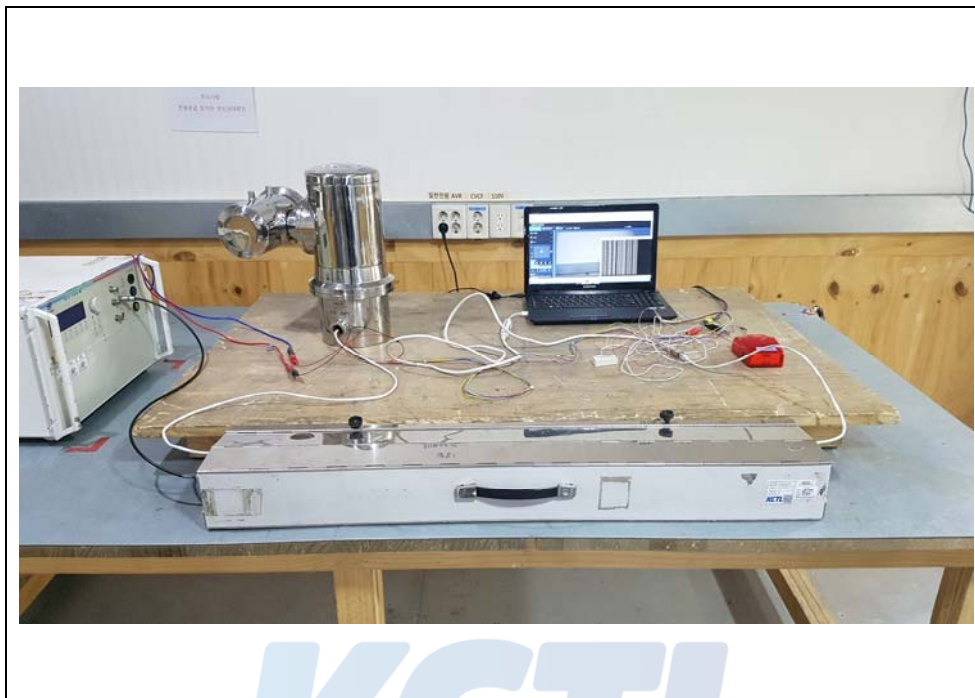


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#### 6.7.4 Measurement result

##### AC Line

Coupling point	(+)	(-)	Result
AC 24 V	+ 1 kV	- 1 kV	Pass

##### Signal

Coupling point	(+)	(-)	Result
Alarm In/Out	+ 1 kV	- 1 kV	Pass

##### Telecommunication

Coupling point	(+)	(-)	Result
LAN(RJ-45)	+ 1 kV	- 1 kV	Pass

## 6.8 Surge

Test specification	EN 61000-4-5:2014				
Coupling	<input checked="" type="checkbox"/> AC 24 V: Direct <input checked="" type="checkbox"/> Signal: CDN <input checked="" type="checkbox"/> Telecommunication: CDN				
Test level	<input checked="" type="checkbox"/> AC Main: <input checked="" type="checkbox"/> Differential mode: $\pm 0.5 \text{ kV}, \pm 1 \text{ kV}$ <input checked="" type="checkbox"/> Signal: $\pm 0.5 \text{ kV}, \pm 1 \text{ kV}$ <input type="checkbox"/> Common mode: $\pm 0.5 \text{ kV}, \pm 1 \text{ kV}, \pm 2 \text{ kV}$ <input checked="" type="checkbox"/> Telecommunication: $\pm 0.5 \text{ kV}, \pm 1 \text{ kV}$				
Coupling Impedance	<input checked="" type="checkbox"/> Differential mode: $18 \mu\text{F}$ <input type="checkbox"/> Common mode: $10 \Omega + 9 \mu\text{F}$ <input checked="" type="checkbox"/> $40 \Omega + 0.5 \mu\text{F}$ <input type="checkbox"/> Direct				
Surge pulse shape	$\text{Tr/Th} = 1.2 / 50 \mu\text{s}$				
Angles	$0^\circ, 90^\circ, 180^\circ, 270^\circ$				
Number of surge	5				
Coupling time	60 s				
Testing voltage	AC 24 V				
Test facility	Shielded room (6F)				
Date	2018-01-03				
Temperature( $^\circ\text{C}$ )	23.8 $^\circ\text{C}$	Humidity (% R.H.)	21.2 % R.H.	Pressure (kPa)	102.3 kPa
Remarks	Pass -There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs.				

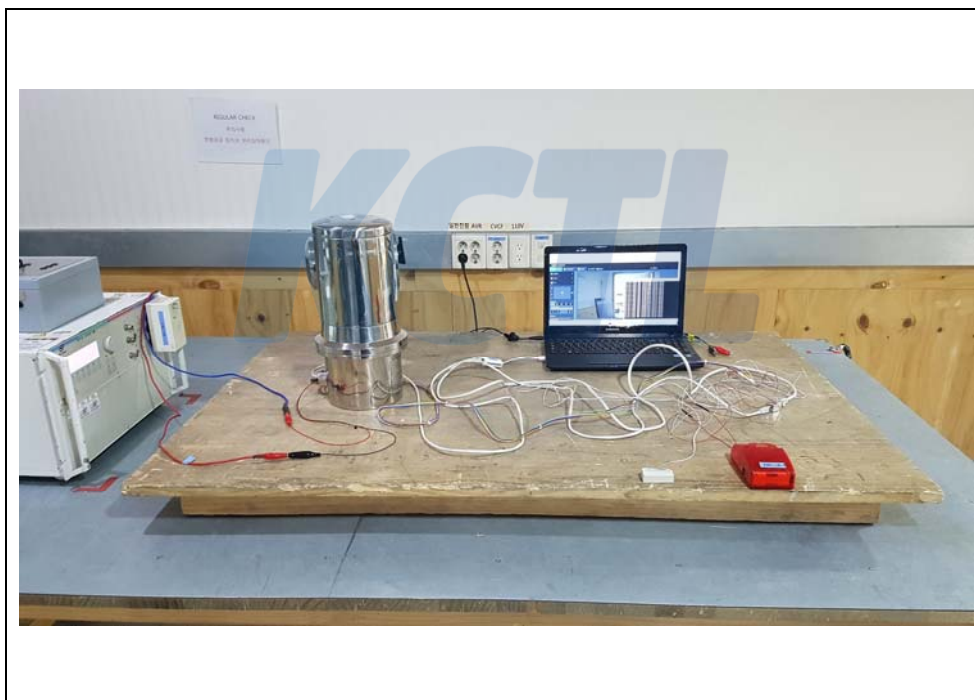
### 6.8.1 Measurement procedure

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.

### 6.8.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
ULTRA COMPACT SIMULATOR	UCS 500-M6BS1	V0545100858	EM TEST	2018.04.07	<input checked="" type="checkbox"/>
ULTRA COMPACT SIMULATOR	UCS500M	0701-03	EM TEST	2018.08.24	<input type="checkbox"/>
ULTRA COMPACT SIMULATOR	UCS500N5V	P1429136861	EM TEST	2018.08.24	<input type="checkbox"/>
COUPLING & DECOUPLING NETWORK	CNV 508 N1	V1108108861	EM TEST	2018.08.25	<input checked="" type="checkbox"/>

### 6.8.3 Photographs of test setup



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#### 6.8.4 Measurement result

##### AC Line

Coupling point	(+)	(-)	Result
AC 24 V	+ 0.5 kV, + 1 kV	- 0.5 kV, - 1 kV	Pass

##### Signal

Coupling point	(+)	(-)	Result
Alarm In/Out	+ 0.5 kV, + 1 kV	- 0.5 kV, - 1 kV	Pass

##### Telecommunication

Coupling point	(+)	(-)	Result
LAN(RJ-45)	+ 0.5 kV, + 1 kV	- 0.5 kV, - 1 kV	Pass

## 6.9 Conducted Immunity

Test specification	EN 61000-4-6:2014				
Tested frequency	0.15 MHz ~ 100 MHz				
Test level & Modulation	1 V/m, 3 V/m, 10 V/m, 80 % Amplitude Modulation (1 kHz) 1 V/m, 3 V/m, 10 V/m, Pulse Modulation (1 Hz (0.5 s ON: 0.5s OFF))				
Frequency Step	1 % step				
Dwell time	3 s				
Coupling method	<input checked="" type="checkbox"/> AC 24 V: CDN(M2) <input checked="" type="checkbox"/> Signal: Clamp <input checked="" type="checkbox"/> Telecommunication: ISN(ST08)				
Testing voltage	AC 24 V				
Test facility	Shielded room (6F)				
Date	2018-01-03				
Temperature(°C)	22.7 °C	Humidity (% R.H.)	22.5 % R.H.	Pressure(kPa)	102.2 kPa
Remarks	Pass -There shall be no damage, malfunction or change of status due to the conditioning. Flickering of an indicator during the conditioning is permissible, providing that there is no residual change in the EUT or any change in outputs.				

### 6.9.1 Measurement procedure

A ground reference plane was located on the floor.

The test was performed on a ground reference plane on a 0.1 m wooden table.

This test were performed using CDN for mains, clamp for signal and injection probe.

The frequency range was swept from 0.15 MHz to 80 MHz. This frequency range was Modulated with 1 kHz 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 m length were tested.

## 6.9.2 Used equipments

Equipment	Model no.	Serial no.	Makers	Next Cal. Date	Used
POWER SENSOR	NRP-Z91	103183	R&S	2018.08.25	<input checked="" type="checkbox"/>
POWER SENSOR	NRP-Z91	103184	R&S	2018.08.25	<input checked="" type="checkbox"/>
C.D.N	CDN L-801 M2 / M3	2936	EM TEST	2018.08.24	<input checked="" type="checkbox"/>
C.D.N	CDN M2/M3N	0111-04	EM TEST	2018.08.24	<input checked="" type="checkbox"/>
SIGNAL GENERATOR	SMC100A	105221	R&S	2018.08.01	<input checked="" type="checkbox"/>
COAXIAL FIXED ATTENUATOR	73-6-34	MU918	MCE/ WEINSCHEL	2018.08.01	<input checked="" type="checkbox"/>
BROADBAND AMPLIFIER	BBA150	101937	R&S	2018.08.25	<input checked="" type="checkbox"/>
EM Clamp	KEMZ 801	17643	SCHAFFNER	2018.04.07	<input checked="" type="checkbox"/>
IMPEDANCE STABILIZATION NETWORK	ISN ST08	24342	TESEQ	2018.05.18	<input checked="" type="checkbox"/>

## 6.9.3 Photographs of test setup





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#### 6.9.4 Measurement result

##### AC Line

Coupling point	Coupling method	Result
Power	CDN(M2)	Pass

##### Signal

Coupling point	Coupling method	Result
Alarm In/Out	Clamp	Pass

##### Telecommunication

Coupling point	Coupling method	Result
LAN(RJ-45)	ISN(ST08)	Pass

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## 7. EUT photographs

### Front View



### Rear View





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**KCTL**Left ViewRight View

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