

EMC TEST REPORT

Report No. : N2404R-0404

Receipt No. : A2024-03060

Model and/or type referene : TNU-6324E

Test item description : 2M 32x Network PTZ Camera

Trade Mark/Brand name : N/A

Additional model name : N/A

Applicant / Manufacturer : Hanwha Vision Co., Ltd / Wonwoo Engineering Co.,Ltd

Test Device Serial No. : N/A

EMC Directive : Electromagnetic Compatibility Directive 2014/30/EU

Test Standards : **EN 55032:2015+A11:2020**
EN 50130-4:2011+A1:2014
EN IEC 61000-3-2:2019+A1:2021
EN 61000-3-3:2013+A2:2021

Date of issue : April 11, 2024

Test result : **Complies**

Tested by YOO Byeongkook
(+ signature) / Test Engineer

Reviewed by BAE Jeonghwa
(+ signature) / Technical Manager

The results in this report apply only to the sample(s) tested.

It is not allowed to copy this report even partly without the allowance of the test laboratory.

This report is NOT related to KS Q ISO/IEC 17025 and KOLAS.

Revision History

Rev. No.	Issued Report No.	Issued Date	Revisions	Effect Section
0	N2404R-0404	April 11, 2024	Origin report	All

>>TABLE OF CONTENTS<<

1. General information.....	4
1.1 Test Performed	4
2. Information about test item.....	5
2.1 Applicant information	5
2.2 Equipment Under Test (EUT) description.....	5
2.3 Test conditions.....	5
2.4 Ancillary Equipment	6
2.5 Variant Model.....	6
2.6 Cable List.....	6
2.7 Block diagram of the EUT test.....	6
3. Test Report.....	7
3.1 Test Summary	7
3.1.1 Summary of EMI emission test results	7
3.1.2 Summary of EMS immunity test results	7
3.2 EMISSION	8
3.2.1 Requirements for radiated emissions.....	8
3.2.2 Requirements for radiated emissions from FM receivers	12
3.2.3 Requirements for outdoor units of home satellite receiving systems	22
3.2.4 Requirements for conducted emissions from the AC mains power ports.....	16
3.2.5 Requirements for asymmetric mode conducted emissions	20
3.2.6 Requirements for conducted differential voltage emissions.....	25
3.2.7 Harmonic Current (AC power input port).....	28
3.2.8 Voltage Variation and Flicking (AC power input port)	31
3.3 IMMUNITY	34
3.3.1 Electrostatic Discharge	34
3.3.2 RF Electromagnetic Field.....	37
3.3.3 Electrical Fast Transients common mode	39
3.3.4 Surge.....	40
3.3.5 RF current common mode	42
3.3.6 Voltage dips and interruptions.....	43
APPENDIX.....	44

1. General information

1.1 Test Performed

RRA Designation No.: KR0157

KOLAS Accreditation No. : KT511

Laboratory : **NTREE Co., Ltd.**

1st laboratory : 228-60, Saneop-ro 155beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do,

Address 16648, Rep. of Korea

Telephone : +82-31-893-0999

Facsimile : +82-31-297-0444

2nd laboratory : 135-1, Donghwagongdan-ro, Munmak-eup, Wonju-si, Gangwon-do,

Address Rep. of Korea

Telephone : +82-33-747-4499

Facsimile : +82-70-5176-2117

SITE MAP

1st laboratory



2nd laboratory



2. Information about test item

2.1 Applicant information

Company name : Hanwha Vision Co., Ltd
Address : 6, Pangyo-ro 319beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do,
Republic of Korea
Telephone / Facsimile : +82-70-7147-8276 / +82-31-8018-3712
Contact name : KIM Myeongsu
Manufacturer : Wonwoo Engineering Co.,Ltd
Manufacturer Address : 81, Magokjungang6-ro, Gangseo-gu, Seoul, Republic of Korea

2.2 Equipment Under Test (EUT) description

Classification of installation : Class A
Test item particulars : 2M 32x Network PTZ Camera
Trademark : N/A
Model and/or type reference : TNU-6324E
Additional model name : N/A
Serial number : N/A
Date (s) of performance of tests : March 21, 2024 to March 25, 2024
Date of receipt of test item : March 21, 2024
EUT condition : Pre-productions, not damaged
Interface Ports : AC IN, LAN, ALARM
EUT Power Source : AC 230 V, 50 Hz
Internal clock frequency : 72 MHz
Firmware version : -
Note : -

2.3 Test conditions

Temp. / Humid. / Pressure : EMI : (21.4 - 21.6) °C / (43.8 - 44.2) % R.H.
EMS: (21.4 - 21.8) °C/ (43.4 - 43.9) % R.H. / (100.9 - 101.1) kPa
Test mode : Operating mode
Test Voltage : AC 230 V, 50 Hz

2.4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
NOTEBOOK	81DC	PF16LXMH	Lenovo
NOTEBOOK ADAPTER	PA-1450-55LR	SA10M42701	LITE-ON
ALARM	N/A	N/A	N/A
SENSOR	N/A	N/A	N/A

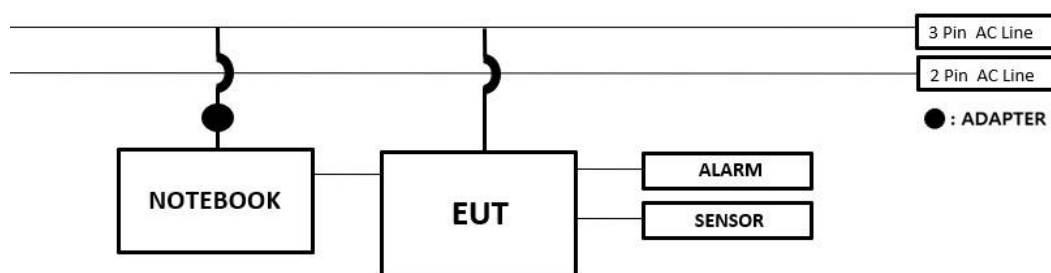
2.5 Variant Model

- N/A

2.6 Cable List

Cable List					
Type	Length (m)	Shielding (Cable/backshell)	Remarks		Type
			From	to	
EUT	2.5	NO / NO	AC IN	AC OUT	AC MAIN SOURCE
EUT	> 3.0	NO / NO	LAN	LAN	NOTEBOOK
EUT	> 3.0	NO / NO	ALARM	ALARM	ALARM
EUT	> 3.0	NO / NO	ALARM	ALARM	SENSOR

2.7 Block diagram of the EUT test



NOTE) After configuring the EUT as shown in the layout, it was tested under continuous camera program control operation and ping test.

2.8 Modification

- N/A

3. Test Report

3.1 Test Summary

3.1.1 Summary of EMI emission test results

Applied	Test items	Test method	Result
☒	Requirements for radiated emissions	EN 55032:2015+A11:2020	C
☐	Requirements for radiated emissions from FM receivers	EN 55032:2015+A11:2020	N/A
☐	Requirements for outdoor units of home satellite receiving systems	EN 55032:2015+A11:2020	N/A
☒	Requirements for conducted emissions from the AC mains power ports	EN 55032:2015+A11:2020	C
☒	Requirements for asymmetric mode conducted emissions	EN 55032:2015+A11:2020	C
☐	Requirements for conducted differential voltage emissions	EN 55032:2015+A11:2020	N/A
☒	Harmonic Current emission	EN IEC 61000-3-2:2019 +A1:2021	C
☒	Voltage fluctuations and flicker	EN 61000-3-3:2013+A2:2021	C

3.1.2 Summary of EMS immunity test results

Applied	Test items	Test method	Result
EN 50130-4:2011+A1:2014			
☒	Electrostatic Discharge	EN 61000-4-2:2009	C
☒	RF Electromagnetic field (80 MHz to 2.7 GHz)	EN 61000-4-3:2006 +A1:2008+A2:2010	C
☒	Fast Transients common mode	EN 61000-4-4:2004+A1:2010	C
☒	Surge, line to line and line to ground	EN 61000-4-5:2006	C
☒	RF common mode (0.15 MHz to 100 MHz)	EN 61000-4-6:2009	C
☒	Voltage Dips and Interruptions	EN 61000-4-11:2004	C

Note 1: C=Complies N/A=Not Applicable F=Fail

Note 2: The highest internal source of an EUT is defined as the highest frequency generated or used within the EUT or on which the EUT operates or tunes.

If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz.

If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz.

If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz.

If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less.

(The highest internal source of an EUT : **72 MHz**)

Note 3: The test was performed at 1st Laboratory.

3.2 EMISSION

3.2.1 Requirements for radiated emissions

Definition:

The test assesses the ability of ancillary equipment to limit their internal noise from being radiated from the enclosure.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 55032:2015+A11:2020
Measuring Distance	: Below 1 GHz - ☐ 3 m, ☒ 10 m / Above 1 GHz - 3 m
Measurement Frequency range	: 30 MHz to 6 000 MHz
Measurement RBW	: Below 1 GHz – 120 kHz / Above 1 GHz – 1 MHz
Test mode	: Operating Mode
Result	: Complies

A sample calculation:

- C.F (correction factor)= Ant. Factor + Cable loss – (Amp. +6 dB Att.) (Below 1 GHz)

- C.F (correction factor)= Ant. Factor + Cable loss – (Amp.) (Above 1 GHz)

- Emission Level= meter reading + C.F

- Sample calculation;

- Below 1 GHz

- At Frequency: **38.924 000 MHz** Result = Reading + C.F. = **53.11+ (-24.00) = 29.11** [dBμV/m]

- Measurement Data's kept in NTREE Co., Ltd

- Above 1 GHz

- At Frequency: - **MHz** Result = Reading + C.F. = -+ (-) = - [dBμV/m]

(☐ Peak, ☐ CISPR Average)

- Measurement Data's kept in NTREE Co., Ltd

Limit of below 1 GHz - CLASS A

Frequency Range (MHz)	Quasi-peak (dB(μV/m))	Distance (m)
30 to 230	40	10
230 to 1 000	47	
30 to 230	50	3
230 to 1 000	57	

Limit of below 1 GHz - CLASS B

Frequency Range (MHz)	Quasi-peak (dB(μV/m))	Distance (m)
30 to 230	30	10
230 to 1 000	37	
30 to 230	40	3
230 to 1 000	47	

Limit of above 1 GHz - CLASS A

Frequency Range (MHz)	Average (dBμV/m)	Peak (dBμV/m)	Distance (m)
1 000 to 3 000	56	76	3
3 000 to 6 000	60	80	
NOTE:	The lower limit applies at the transition frequency.		

Limit of above 1 GHz - CLASS B

Frequency Range (MHz)	Average (dBμV/m)	Peak (dBμV/m)	Distance (m)
1 000 to 3 000	50	70	3
3 000 to 6 000	54	74	
NOTE:	The lower limit applies at the transition frequency.		

Used equipments – (Below 1 GHz)

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	EMI Test Receiver	ESR7	ROHDE & SCHWARZ	101302	2025.03.07
☒	Amplifier	TK-PA01S	TESTEK	200103-L	2024.11.01
☒	Tri-Log Antenna	VULB9168	Schwarzbeck	578	2024.10.13

Used equipments – (Above 1 GHz)

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☐	-	-	-	-	-

Measurement Data:

- Refer to the Next page (Maximum emission configuration)

* Below 1 GHz

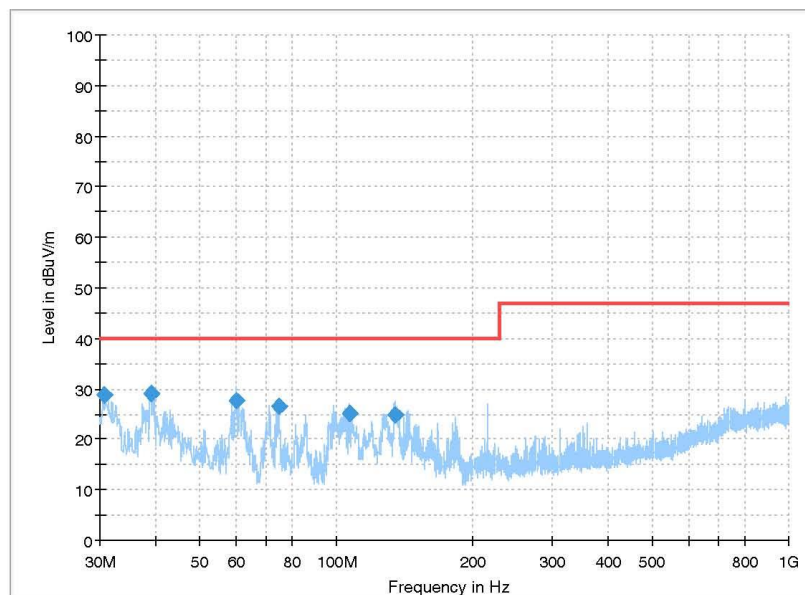
RE+1

2024-03-22

Test Report

Common Information

Test Description:	A2024-03060
Test Mode:	Operating Mode
Test Standard:	EN 55032
Environment Conditions:	AC 230 V, 50 Hz
Operator Name:	YOO Byeongkook
Comment:	-



Final Result

Frequency (MHz)	QuasiPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.582000	28.69	40.00	11.31	2000.0	120.000	100.0	V	104.0	-23.9
38.924000	29.11	40.00	10.89	2000.0	120.000	100.0	V	284.0	-24.0
60.167000	27.70	40.00	12.30	2000.0	120.000	200.0	V	134.0	-23.3
74.523000	26.44	40.00	13.56	2000.0	120.000	200.0	V	39.0	-26.2
106.630000	25.07	40.00	14.93	2000.0	120.000	100.0	V	172.0	-26.6
135.051000	24.82	40.00	15.18	2000.0	120.000	100.0	V	343.0	-24.0

1 / 1

3.2.2 Requirements for radiated emissions from FM receivers

Definition:

The test assesses the ability of ancillary equipment to limit their internal noise from being radiated from the enclosure.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 55032:2015+A11:2020
Measuring Distance	: ☐ 10 m / ☐ 3 m
Measurement Frequency range	: 30 MHz to 1 000 MHz
Measurement RBW	: 120 kHz
Test mode	: - mode
Result	: Not Applicable

A sample calculation:

- C.F (correction factor)= Ant. Factor + Cable loss – (Amp. + 10 dB Att.)
- Emission Level= meter reading + C.F
- Sample calculation ;
 - At Frequency : - **MHz** Result = Reading + C.F. = -+ (-) = - [dB(μV/m)]
- Measurement Data's kept in NTREE Co., Ltd.

Limit - CLASS B

Frequency Range (MHz)	Quasi-peak (dB(μV/m))		Distance (m)
	Fundamental	Harmonics	
30 to 230	50	42	10
230 to 300		42	
300 to 1 000		46	
30 to 230	60	52	3
230 to 300		52	
230 to 1 000		56	

Used equipment

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☐	-	-	-	-	-

Measurement Data:

- Refer to the Next page (Maximum emission configuration)

3.2.3 Requirements for outdoor units of home satellite receiving systems

Definition:

The test assesses the ability of ancillary equipment to limit their internal noise from being radiated from the enclosure.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 55032:2015+A11:2020
Measuring Distance	: Below 1 GHz - 10 m / Above 1 GHz - 3 m
Measurement Frequency range	: 30 MHz to 6 000 MHz
Measurement RBW	: Below 1 GHz – 120 kHz / Above 1 GHz – 1 MHz
Test mode	: - mode
Result	: Not Applicable

A sample calculation:

- C.F (correction factor)= Ant. Factor + Cable loss – (Amp. +6 dB Att.) (Below 1 GHz)

- C.F (correction factor)= Ant. Factor + Cable loss – (Amp.) (Above 1 GHz)

- Emission Level= meter reading + C.F

- Sample calculation:

- Below 1 GHz

- At Frequency : - **MHz** Result = Reading + C.F. = -+ (-) = - [dB μ V/m]

- Above 1 GHz

- At Frequency : - **MHz** Result = Reading + C.F. = -+ (-) = - [dB μ V/m]

(☐ Peak, ☐ CISPR Average)

- Measurement Data's kept in NTREE Co., Ltd.

Limit of Requirements for outdoor units of home satellite receiving systems

Frequency Range (MHz)	Measurement		Limits	Applicable to
	Distance (m)	Detector type /Bandwidth		
30 to 230	10	Quasi-peak / 120 kHz	30 dB(μV/m)	
230 to 1 000			37 dB(μV/m)	
1 000 to 2 500	3	Average / 1 MHz	50 dB(μV/m)	LO leakage and spurious radiated emissions from the EUT, in the region outside ±7° of the main beam axis.
2 500 to 18 000			64 dB(μV/m)	
1 000 to 18 000	3		37 dB(μV/m)	LO leakage from the EUT, in the region within ±7° of the main beam axis.
1 000 to 18 000	N/A		30 dBpW	
For details of the EUT configuration, see Annex H of EN 55032.				
For radiated emissions measurements at frequencies up to 1 GHz, the requirements defined in Table Limit of below 1 GHz - CLASS B at 3.2.1 shall be satisfied.				
Apply the appropriate limits across the entire frequency range.				

Used equipments

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☐	-	-	-	-	-

Measurement Data:

- (Maximum emission configuration)

3.2.4 Requirements for conducted emissions from the AC mains power ports

Definition:

The test assesses the ability of the EUT to limit its internal noise from being present on the AC mains Power and Signal Line In / Output ports.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 55032:2015+A11:2020
Measurement Frequency range and RBW	: 150 kHz - 30 MHz : 9 kHz
Test mode	: Operating Mode
Result	: Complies

A sample calculation:

- C.F (correction factor)= LISN Insertion loss + Cable loss
- Emission Level= meter reading + C.FP
- Sample calculation;
 - At Frequency: **0.185 500 MHz** Result = Reading + C.F. = **51.60+ (10.00) = 61.60** [dBμV /m]
 - (☐ Quasi-peak, ☒ CISPR Average)
- Measurement Data's kept in NTREE Co., Ltd.

Limits for conducted emissions from the AC mains ports of class A equipment.

Applicable to AC mains power port		
Frequency Range (MHz)	Quasi-peak (dB(μV))	CISPR Average (dB(μV))
0.15 to 0.5	79	66
0.5 to 30	73	60
Apply across the entire frequency range.		

Limits for conducted emissions from the AC mains ports of class B equipment.

Applicable to AC mains power port		
Frequency Range (MHz)	Quasi-peak (dB(μV))	CISPR Average (dB(μV))
0.15 to 0.5	66 to 56	56 to 46
0.5 to 5	56	46
5 to 30	60	50
Apply across the entire frequency range.		

Used equipment

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	EMI Test Receiver	ESR3	ROHDE & SCHWARZ	102019	2024.11.01
☒	Two-Line V-Network (MAIN)(KC,CE,FCC)	ENV216	ROHDE & SCHWARZ	102177	2025.03.07
☒	Two-Line V-Network (SUB)	ENV216	ROHDE & SCHWARZ	102026	2024.11.01

Measurement Data:

- (Maximum emission configuration)
- No other emissions were detected at a level greater than 20 dB below limit

- LINE

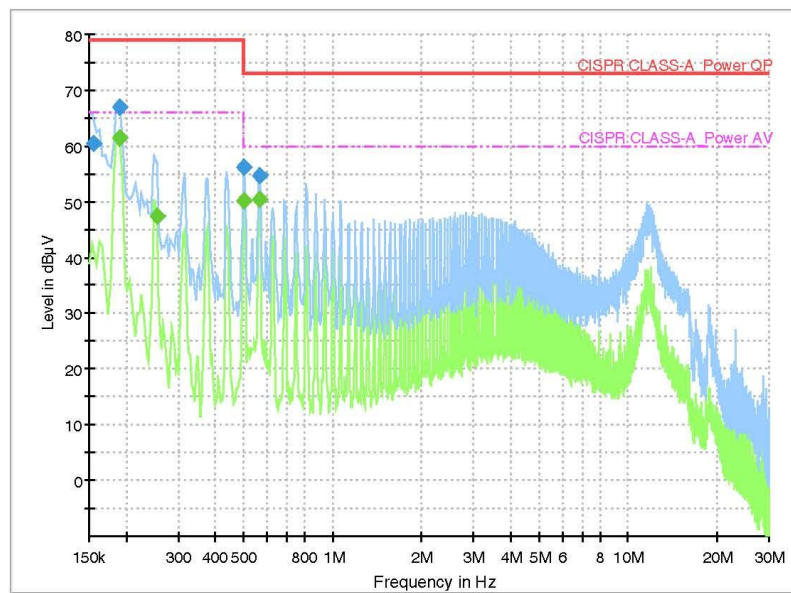
CE_L+1

2024-03-21

Test Report

Common Information

Test Description:	A2024-03060
Test Mode:	Operating Mode
Test Standard:	EN 55032
Environment Conditions:	AC 230 V, 50 Hz
Operator Name	YOO Byeongkook
Comment:	-



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154500	60.42	---	79.00	18.58	2000.0	9.000	L1	9.9
0.189500	66.99	---	79.00	12.01	2000.0	9.000	L1	10.0
0.190501	---	61.56	66.00	4.44	2000.0	9.000	L1	10.0
0.253500	---	47.29	66.00	18.71	2000.0	9.000	L1	9.7
0.501500	56.15	---	73.00	16.85	2000.0	9.000	L1	9.9
0.501500	---	50.16	60.00	9.84	2000.0	9.000	L1	9.9
0.565500	---	50.51	60.00	9.49	2000.0	9.000	L1	9.9
0.565500	54.79	---	73.00	18.21	2000.0	9.000	L1	9.9

1 / 1

- NEUTRAL

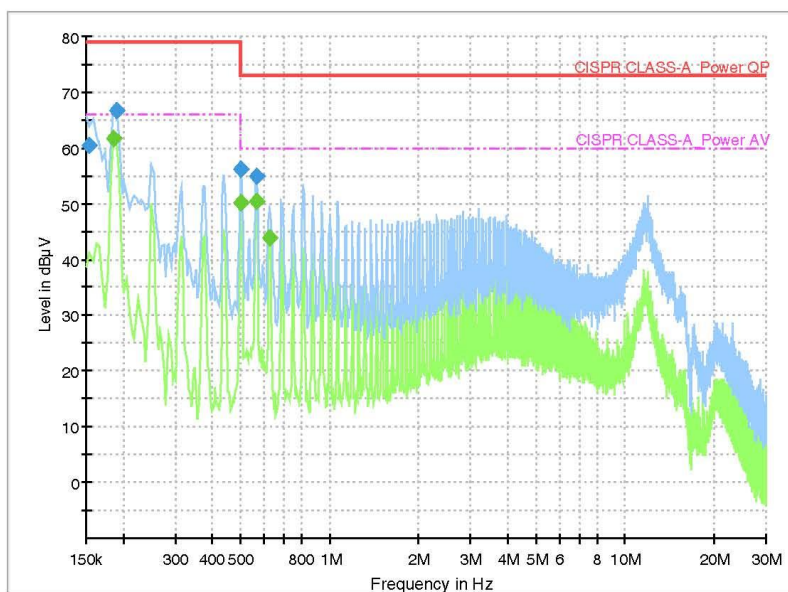
CE_N+1

2024-03-21

Test Report

Common Information

Test Description: A2024-03060
Test Mode: Operating Mode
Test Standard: EN 55032
Environment Conditions: AC 230 V, 50 Hz
Operator Name: YOO Byeongkook
Comment: -



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	60.46	---	79.00	18.54	2000.0	9.000	N	9.9
0.185500	---	61.60	66.00	4.40	2000.0	9.000	N	10.0
0.189500	66.67	---	79.00	12.33	2000.0	9.000	N	9.9
0.501500	---	50.14	60.00	9.86	2000.0	9.000	N	9.9
0.501500	56.09	---	73.00	16.91	2000.0	9.000	N	9.9
0.565500	---	50.52	60.00	9.48	2000.0	9.000	N	9.9
0.565500	54.85	---	73.00	18.15	2000.0	9.000	N	9.9
0.625500	---	43.92	60.00	16.08	2000.0	9.000	N	9.9

1 / 1

3.2.5 Requirements for asymmetric mode conducted emissions

Definition:

The test assesses the ability of the EUT to limit its internal noise from being present on the AC mains Power and Signal Line In / Output ports.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 55032:2015+A11:2020
Measurement Frequency range and RBW	: 150 kHz - 30 MHz : 9 kHz
Test mode	: Operating Mode
Result	: Complies

A sample calculation:

- C.F (correction factor)= AAN / CVP / Current Probe Insertion loss + Cable loss
- Emission Level= meter reading + C.F
- Sample calculation;
 - At Frequency: **16.226 860 MHz** Result = Reading + C.F. = **47.28+ (9.70) = 56.98** [dB μ V /m]
 - (☐ Quasi-peak, ☒ CISPR Average)
- Measurement Data's kept in NTREE Co., Ltd.

Limit of for asymmetric mode conducted emissions from Class A equipment.

1. Wired network ports					
2. Optical fiber port with metallic shield or tension members.					
3. Antenna ports					
Frequency Range (MHz)	Coupling device	Voltage limits		Current limit	
		Quasi-peak (dB(μV))	Average (dB(μV))	Quasi-peak (dB(μA))	Average (dB(μA))
0.15 to 0.5	AAN	97 to 87	84 to 74	N/A	
0.5 to 30		87	74		
0.15 to 0.5	CVP and current probe	97 to 87	84 to 74	53 to 43	40 to 30
0.5 to 30		87	74	40	30
0.15 to 0.5	current probe	N/A		53 to 43	40 to 30
0.5 to 30				40	30

The choice of coupling device and measurement procedure is defined in Annex C.

AC mains ports that also have the function of a wired network port shall meet the limits given in Table limits for conducted emissions from the AC mains ports of class A equipment at 3.2.3.

The measurement shall cover the entire frequency range.

The application of the voltage and/or current limits is dependent on the measurement procedure used.

Refer to Table C.1 for applicability.

Testing is required at only one EUT supply voltage and frequency.

Applicable to ports listed above and intended to connect to cables longer than 3 m.

Limit of for asymmetric mode conducted emissions from Class B equipment.

1. Wired network ports 2. Optical fiber port with metallic shield or tension members. 3. Broadcast receiver tuner ports 4. Antenna ports					
Frequency Range (MHz)	Coupling device	Voltage limits		Current limit	
		Quasi-peak (dB(μV))	Average (dB(μV))	Quasi-peak (dB(μA))	Average (dB(μA))
0.15 to 0.5	AAN	84 to 74	74 to 64	N/A	
0.5 to 30		74	64		
0.15 to 0.5	CVP and Current probe	84 to 74	74 to 64	40 to 30	30 to 20
0.5 to 30		74	64	30	20
0.15 to 0.5	Current probe	N/A		40 to 30	30 to 20
0.5 to 30				30	20

The choice of coupling device and measurement procedure is defined in Annex C.

Screened ports including TV broadcast receiver tuner ports are measured with a common-mode impedance of 150 Ω. This is typically accomplished with the screen terminated by 150 Ω to earth.

AC mains ports that also have the function of a wired network port shall meet the limits given in Table limits for conducted emissions from the AC mains ports of class B equipment at 3.2.3.

The measurement shall cover the entire frequency range.

The application of the voltage and/or current limits is dependent on the measurement procedure used. Refer to Table C.1 for applicability.

Testing is required at only one EUT supply voltage and frequency.

Applicable to ports listed above and intended to connect to cables longer than 3 m.

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	EMI Test Receiver	ESR3	ROHDE & SCHWARZ	102019	2024.11.01
☒	Two-Line V-Network (MAIN)	ENV216	ROHDE & SCHWARZ	102177	2025.03.07
☒	Two-Line V-Network (SUB)	ENV216	ROHDE & SCHWARZ	102026	2024.11.01
☒	Impedance Stabilization Network	ENY81	ROHDE & SCHWARZ	100227	2024.11.07

Measurement Data:

- (Maximum emission configuration)
- No other emissions were detected at a level greater than 20 dB below limit

- Data

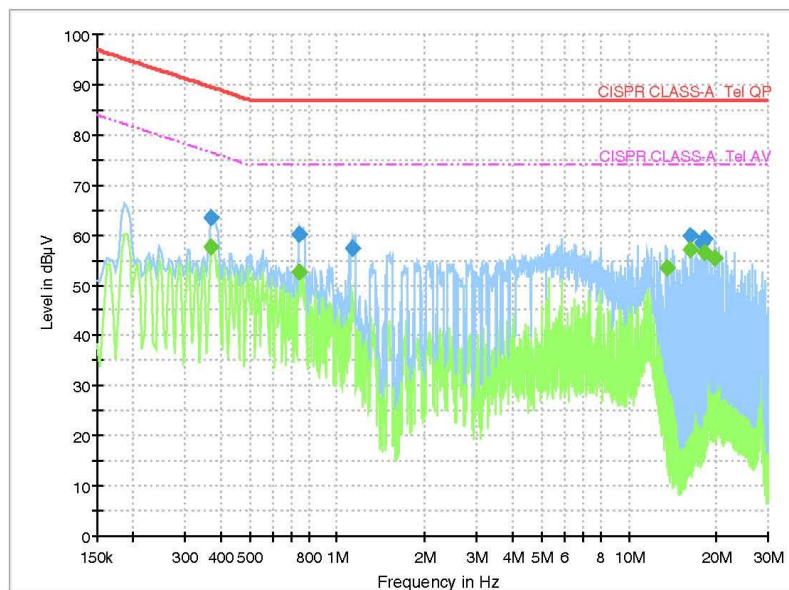
CE_TEL+1

2024-03-21

Test Report

Common Information

Test Description: A2024-03060
Test Mode: Operating Mode
Test Standard: EN 55032
Environment Conditions: AC 230 V, 50 Hz
Operator Name: YOO Byeongkook
Comment: LAN - 100 Mbps



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.369500	---	57.76	76.51	18.76	1000.0	9.000	9.6
0.369500	63.44	---	89.51	26.08	1000.0	9.000	9.6
0.741500	---	52.60	74.00	21.40	1000.0	9.000	9.5
0.741500	60.06	---	87.00	26.94	1000.0	9.000	9.5
1.128350	57.50	---	87.00	29.50	1000.0	9.000	9.5
13.480600	---	53.56	74.00	20.44	1000.0	9.000	9.7
16.226860	59.92	---	87.00	27.08	1000.0	9.000	9.7
16.226860	---	56.98	74.00	17.02	1000.0	9.000	9.7
17.691540	58.37	---	87.00	28.63	1000.0	9.000	9.7
18.244780	---	56.43	74.00	17.57	1000.0	9.000	9.7
18.244780	59.36	---	87.00	27.64	1000.0	9.000	9.7
19.709460	---	55.44	74.00	18.56	1000.0	9.000	9.7

1 / 1

3.2.6 Requirements for conducted differential voltage emissions

Definition:

The test assesses the ability of the EUT to limit its internal noise from being present on the AC mains Power and Signal Line In / Output ports.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 55032:2015+A11:2020
Measurement Frequency range	: Below 1 GHz : 120 kHz (Quasi Peak)
and RBW(Detector)	Above 1 GHz : 1 MHz (Peak, CISPR Average)
Test mode	: - mode
Result	: Not Applicable

A sample calculation:

- C.F (correction factor) = Matching pad + POWER SPLITTER/COMBINER + Cable loss
- Emission Level= meter reading + C.F
- Sample calculation;
 - At Frequency: - **MHz** Result = Reading + C.F. = -+ (-) = - [dBμV]
- Measurement Data's kept in NTREE Co., Ltd.

Limit of for conducted differential voltage emissions from Class B equipment.

Applicable to

1. TV broadcast receiver tuner ports with an accessible connector
2. RF modulator output ports
3. FM broadcast receiver tuner ports with an accessible connector

Frequency Range (MHz)	Coupling device	Class B limits dB(μV) 75 Ω			Applicability
		Other	Local Oscillator Fundamental	Local Oscillator Harmonics	
30 to 950	For frequencies ≤1 GHz Quasi Peak/ 120 kHz	46	46	46	See ^a
950 to 2 150		46	54	54	
950 to 2 150		46	54	54	See ^b
30 to 300	For frequencies ≥1 GHz Peak/ 1 MHz	46	54	50	See ^c
300 to 1 000				52	
30 to 300	For frequencies ≥1 GHz Peak/ 1 MHz	46	66	59	See ^d
300 to 1 000				52	
30 to 950		46	76	46	See ^e
950 to 2150			N/A	54	

a Television receivers (analogue or digital), video recorders and PC TV broadcast receiver tuner cards working in channels between 30 MHz and 1 GHz, and digital audio receivers.

b Tuner units (not the LNB) for satellite signal reception.

c Frequency modulation audio receivers and PC tuner cards.

d Frequency modulation car radios.

e Applicable to EUTs with RF modulator output ports (for example DVD equipment, video recorders, camcorders and decoders etc.) designed to connect to TV broadcast receiver tuner ports. Limits specified for the LO are for the RF modulator carrier signal and harmonics.

The term 'other' refers to all emissions other than the fundamental and the harmonics of the LO.

The measurement shall cover the entire frequency range.

The EUT shall be tuned in accordance with Table B.3 and clause C.4.2.1.

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☐	-	-	-	-	-

Measurement Data:

- (Maximum emission configuration)

3.2.7 Harmonic Current (AC power input port)

Definition:

This part deals with the Limitation of harmonic currents injected into the public supply system.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method : **EN IEC 61000-3-2:2019+A1:2021**
 Test mode : Operating mode
 Result : **Complies**

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	HAR1000 System	HAR1000-1P	EMC PARTNER	HAR1000-1P 230V-0212	2024.08.03

Measurement Data:

- Uncertainty(HAR) = ± 2.24 % (with a 95 % confidence level, $k = 2$)

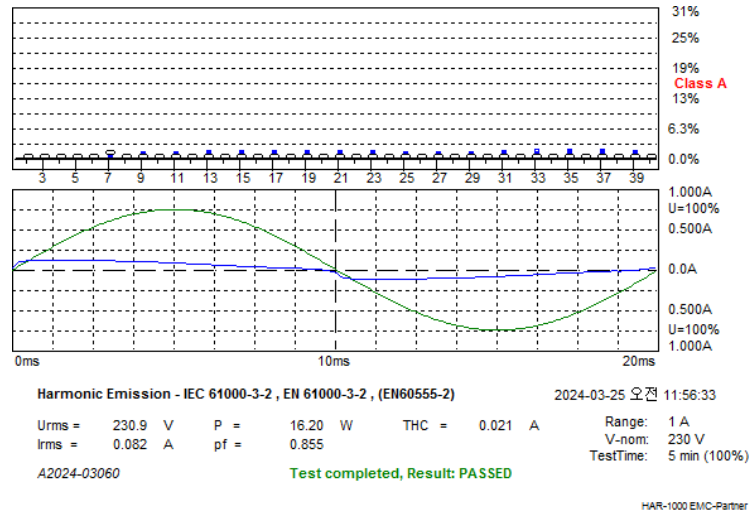
“It has been demonstrated that the HAR generator meets the specified requirements in the standard with at least 95 % confidence.”

*** DATA**

Operator YOO Byeongkook

Unit A2024-03060

Serial Number



Urms = 230.9V Freq = 50.065 Range: 1 A

Irms = 0.082A Ipk = 0.122A cf = 1.482

P = 16.20W S = 18.94VA pf = 0.855

THDi = 26.9 % THDu = 0.10 % Class A

Test - Time : 5min (100 %)

Test completed, Result: PASSED

Order	Freq.	Iavg	Irms	Imax	Limit	Status
	[Hz]	[A]	[A]	[A]	[A]	
1	50	0.0798	0.0793	0.0870		
2	100	0.0000	0.0001	0.0001	1.0800	
3	150	0.0163	0.0161	0.0179	2.3000	
4	200	0.0000	0.0001	0.0001	0.4300	
5	250	0.0100	0.0099	0.0108	1.1400	
6	300	0.0000	0.0001	0.0001	0.3000	
7	350	0.0064	0.0063	0.0068	0.7700	
8	400	0.0000	0.0001	0.0001	0.2300	
9	450	0.0000	0.0042	0.0046	0.4000	
10	500	0.0000	0.0001	0.0001	0.1840	

11	550	0.0000	0.0032	0.0034	0.3300
12	600	0.0000	0.0001	0.0001	0.1533
13	650	0.0000	0.0026	0.0029	0.2100
14	700	0.0000	0.0001	0.0001	0.1314
15	750	0.0000	0.0021	0.0023	0.1500
16	800	0.0000	0.0001	0.0001	0.1150
17	850	0.0000	0.0018	0.0019	0.1324
18	900	0.0000	0.0001	0.0001	0.1022
19	950	0.0000	0.0015	0.0016	0.1184
20	1000	0.0000	0.0001	0.0001	0.0920
21	1050	0.0000	0.0014	0.0015	0.1071
22	1100	0.0000	0.0001	0.0001	0.0836
23	1150	0.0000	0.0013	0.0013	0.0978
24	1200	0.0000	0.0001	0.0001	0.0767
25	1250	0.0000	0.0012	0.0012	0.0900
26	1300	0.0000	0.0001	0.0001	0.0708
27	1350	0.0000	0.0010	0.0011	0.0833
28	1400	0.0000	0.0001	0.0001	0.0657
29	1450	0.0000	0.0009	0.0010	0.0776
30	1500	0.0000	0.0001	0.0001	0.0613
31	1550	0.0000	0.0009	0.0011	0.0726
32	1600	0.0000	0.0001	0.0001	0.0575
33	1650	0.0000	0.0009	0.0011	0.0682
34	1700	0.0000	0.0001	0.0001	0.0541
35	1750	0.0000	0.0010	0.0011	0.0643
36	1800	0.0000	0.0001	0.0001	0.0511
37	1850	0.0000	0.0009	0.0010	0.0608
38	1900	0.0000	0.0001	0.0001	0.0484
39	1950	0.0000	0.0007	0.0008	0.0577
40	2000	0.0000	0.0001	0.0001	0.0460

3.2.8 Voltage Variation and Flicking (AC power input port)

Definition:

This section is concerned with the limitation of voltage fluctuations and flicker impressed on the public low-voltage system.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 61000-3-3:2013+A2:2021
Test mode	: Operating mode
Result	: Complies

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	HAR1000 System	HAR1000-1P	EMC PARTNER	HAR1000-1P 230V-0212	2024.08.03

Measurement Data:

- Uncertainty(FLK) = ± 2.24 % (with a 95 % confidence level, $k = 2$)

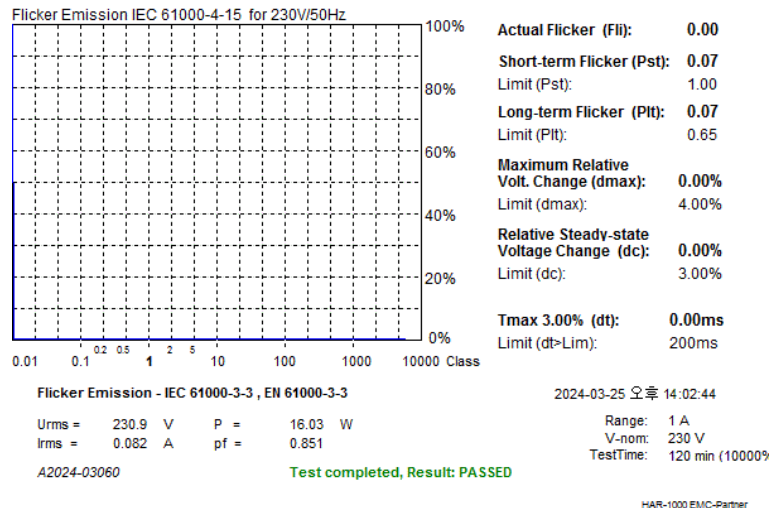
“It has been demonstrated that the FLK generator meets the specified requirements in the standard with at least 95 % confidence.”

*** DATA**

Operator YOO Byeongkook

Unit A2024-03060

Serial Number



Urms = 230.9V Freq = 50.065 Range: 1 A

Irms = 0.082A IpK = 0.122A cf = 1.491

P = 16.03W S = 18.83VA pf = 0.851

Test - Time : 12 x 10min = 120min (10000 %)

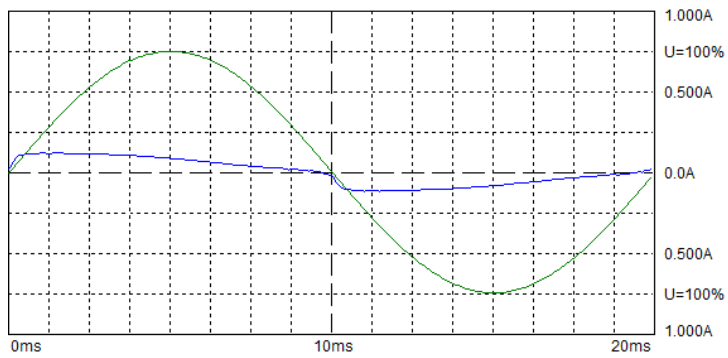
LIN (Line Impedance Network) : L: 0.24ohm +j0.15ohm N: 0.16ohm +j0.10ohm

Limits : Plt : 0.65 Pst : 1.00
 dmax : 4.00 % dc : 3.00 %
 dtLim: 3.00 % dt>Lim: 200ms

Test completed, Result: PASSED

	dmax
	[%]
1	0.000
2	0.000
3	0.000

4 0.000
5 0.000
6 0.000
7 0.000
8 0.000
9 0.000
10 0.000
11 0.000
12 0.000



3.3 IMMUNITY

3.3.1 Electrostatic Discharge

Definition:

The test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 61000-4-2:2009
Temperature / Humidity / Pressure	: 21.7 °C / 43.5 % R.H. / 100.9 kPa
Discharge Impedance	: (330 ± 10 %) Ω / (150 ± 10 %) pF
Type of Discharge (air discharge)	: ±2.0, 4.0, 8.0 kV
Type of Discharge (contact discharge)	: ±6.0 kV
Number of discharges at each point	: 20 of each polarity
Discharge Repetition on Rate	: 1 / sec
Test mode	: Operating Mode
Performance Criteria	: B (Refer to the attachment I)
Result	: Complies

Used equipments

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	ESD Simulator	ESD 30N	EM TEST	P1315117206	2025.03.11

Measurement Data:

- Uncertainty (ESD) = ±5 % (with a 95 % confidence level, $k = 2$)

“It has been demonstrated that the ESD generator meets the specified requirements in the standard with at least 95 % confidence.”

ESD Test Point and Result:

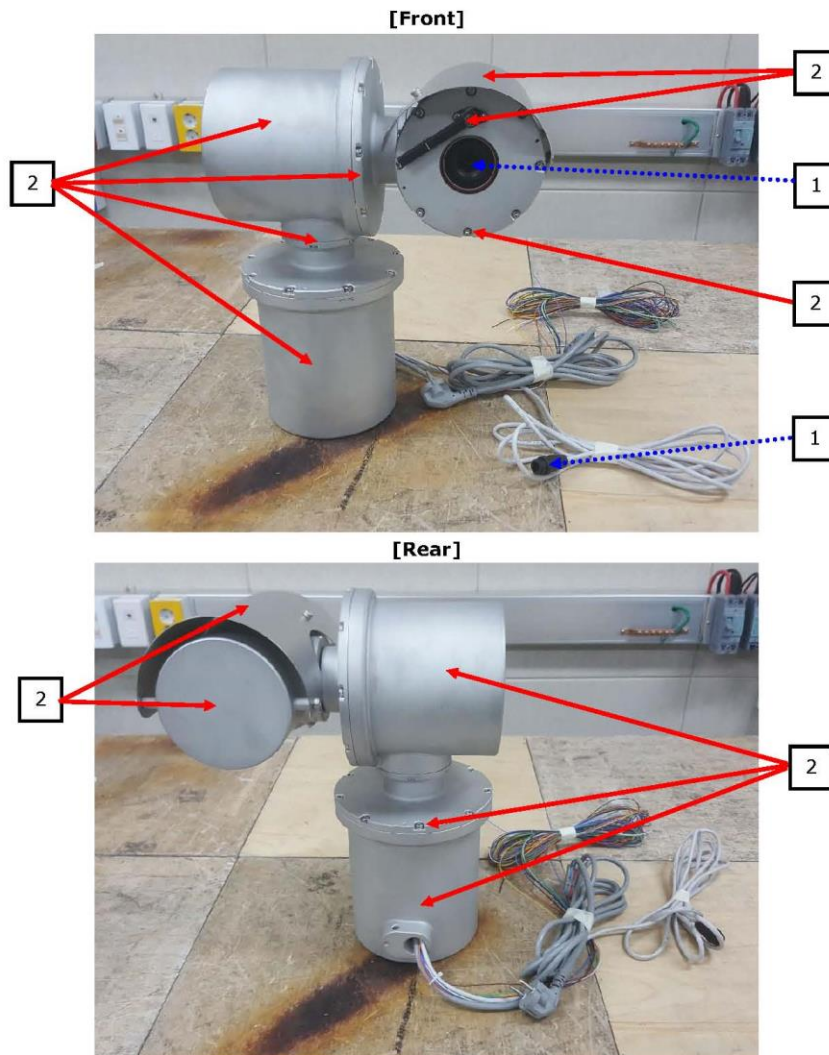
1. Indirect Discharge

No.	Position	Kind of Discharge	Results	Remarks
1	HCP	CONTACT	A	No reaction recognized.
2	VCP	CONTACT	A	No reaction recognized.

2. Direct Discharge

No.	Position	Kind of Discharge	Result	Remarks
1	Non-metal(ENCLOSURE, LAN)	AIR	A	No reaction recognized.
2	metal(ENCLOSURE, SCREW)	CONTACT	A	No reaction recognized.

[Test point] Air Discharge(A)
Contact Discharge(C)



3.3.2 RF Electromagnetic Field

Definition:

The test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic field disturbance.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 61000-4-3:2006+A1:2008+A2:2010
Frequency range and Test level	: 80 MHz to 2.7 GHz
Test level	: 10 V/m (r.m.s) (unmodulated)
Duty cycle	: 80 % AM, 1 kHz, sinusoidal Pulse modulation : 1 Hz (0.5 s ON : 0.5 s OFF)
Rep. frequency	: 1 % of fundamental
Test mode	: Operating Mode
Performance Criteria	: A (Refer to the attachment I)
Result	: Complies

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	SIGNAL GENERATOR (RadiCentre)	CTR1009B	DARE	-	2025.02.16
☒	Log. - Per. Antenna	STLP9128DS	Schwarzbeck	9128DS 052	-
☒	POWER AMPLIFIER	MT400	PRANA	1812-2438	-
☒	Dual Directional Coupler	C3908-714	WERLATONE	118241	2025.02.16
☒	POWER SENSOR	RPR2006C	DARE	RPR6C-1901015	2025.02.16
☒	POWER SENSOR	RPR2006C	DARE	RPR6C-1901016	2025.02.16
☒	Double Ridged Broadband Horn Antenna(KOLAS)	BBHA 9120D	Schwarzbeck	2891	2024.05.18
☒	Directional coupler	DC7205A	AR	359241	2024.12.21
☒	POWER AMPLIFIER	BPA10T60W100	L2MICROWAVE	S2011-0004	-

Measurement Data:

- Uncertainty(RS) = ± 1.6 dB (with a 95 % confidence level, $k = 2.28$)

"It has been demonstrated that the RS system meets the specified requirements in the standard with at least 95 % confidence."

Port	EUT Side	Result		Remark
		Horizontal	Vertical	
Enclosure	Front	A	A	No reaction recognized.
	Rear	A	A	No reaction recognized.
	Left	A	A	No reaction recognized.
	Right	A	A	No reaction recognized.

3.3.3 Electrical Fast Transients common mode

Definition:

The test assesses the ability of the EUT to operate as intended in the event of Electrical Fast Transients presence on one of the input/output ports.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 61000-4-4:2004+A1:2010
Signal line length	: ☒ Above 3 m, ☐ Below 3 m
Test level	: ☒ ±1.0 kV (Signal port, DC power input port) : ☒ ±2.0 kV (AC power input port))
Polarity	: Negative / positive
Repetition frequency	: 100 kHz Tr/Th = 5 / 50 ns
Test mode	: Operating Mode
Performance Criteria	: B (Refer to the attachment I)
Result	: Complies

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	EMC IMMUNITY TEST SYSTEM	IMU3000	EMC PARTNER	F5-S6-T6-D-V-1504	2024.11.01
☒	Capacitive coupling clamp	CN-EFT1000	EMC PARTNER	1651	2024.11.02

Measurement Data:

- Uncertainty(EFT) = ±10 % (with a 95 % confidence level, $k = 2$)

“It has been demonstrated that the EFT/Burst generator meets the specified requirements in the standard with at least 95 % confidence.”

- Power port

Line	Test level	Result	Remarks
L – N	±2.0 kV	-	-
L – N – PE	±2.0 kV	A	No reaction recognized.
Positive - Negative	±1.0 kV	-	-

- Signal line port

Line	Test level	Result	Remarks
LAN, ALARM	±1.0 kV	A	No reaction recognized.

3.3.4 Surge

Definition:

The test assesses the ability of the EUT to operate as intended in the event of surge presence on the AC main power input ports.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 61000-4-5:2006
Polarity pulses	: 0 °, 90 °, 180 °, 270 °
Test level	AC Power port : ☒ ±0.5, 1.0 kV (Line to Line)
	☒ ±0.5, 1.0, 2.0 kV (Line to Ground)
	Signal lines / ☒ ±0.5, 1.0 kV
	Other supply lines
Wave shape	: 1.2 / 50 µs pulse
Number of surges	: 5 (at each phase)
Test mode	: Operating Mode
Performance Criteria	: B (Refer to the attachment I)
Result	: Complies

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	EMC IMMUNITY TEST SYSTEM	IMU3000	EMC PARTNER	F5-S6-T6-D-V-1504	2024.11.01
☒	CDN(1.25/50, 10/700)	CDN UTP ED3	EMC PARTNER	ED3-1516	2024.11.02

Measurement Data:

- Uncertainty(SURGE) = ±10 % (with a 95 % confidence level, $k = 2$)

“It has been demonstrated that the Surge generator meets the specified requirements in the standard with at least 95 % confidence.”

- AC Power port

Phase	Line	Level	Result	Remark
0 °	Line(L) to line(N)	±0.5, 1.0 kV	A	No reaction recognized.
	Line(L) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.
	Line(N) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.
90 °	Line(L) to line(N)	±0.5, 1.0 kV	A	No reaction recognized.
	Line(L) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.
	Line(N) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.
180 °	Line(L) to line(N)	±0.5, 1.0 kV	A	No reaction recognized.
	Line(L) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.
	Line(N) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.
270 °	Line(L) to line(N)	±0.5, 1.0 kV	A	No reaction recognized.
	Line(L) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.
	Line(N) to ground(PE)	±0.5, 1.0, 2.0 kV	A	No reaction recognized.

- DC Power port

Line	Level	Result	Remark
-	± - kV	-	-

- Signal port

Port	Level	Result	Remark
LAN, ALARM	±0.5, 1.0 kV	A	No reaction recognized.

3.3.5 RF current common mode

Definition:

The test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic disturbance on the input/output ports.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 61000-4-6:2009
Frequency range	: 0.15 MHz to 100 MHz
Test level	: 140 dB μ V (r.m.s) (unmodulated) 10 V (Modulated)
Amplitude Modulation	: 80 % AM, 1 kHz, sinusoidal
Pulse Modulation	: 1 Hz (0.5 s ON : 0.5 s OFF)
Step size	: 1 % of fundamental.
Test mode	: Operating Mode
Performance Criteria	: A (Refer to the attachment I)
Result	: Complies

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	COMPACT IMMUNITY TEST SYSTEM	NSG4070	TESEQ	54939	2024.11.02
☒	CDN	CDN M016	TESEQ	44553	2024.11.01
☒	CDN	CDN M2/M3 PE 16A	Schwarzbeck	00004	2025.03.07
☒	RF INJECTION CLAMP	KEMZ801A	TESEQ	44985	2024.11.08

Measurement Data:

- Uncertainty(CS) = ± 1.25 dB (with a 95 % confidence level, $k = 2$)

“It has been demonstrated that the CS system meets the specified requirements in the standard with at least 95 % confidence.”

- AC / DC POWER port

Port	Coupling	Result	Remarks
AC POWER	CDN(M3)	A	No reaction recognized

- Signal port

Signal Line	Coupling	Result	Remarks
LAN, ALARM	RF INJECTION CLAMP	A	No reaction recognized

3.3.6 Voltage dips and interruptions

Definition:

The test assesses the ability of the EUT to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

The tests were performed according to the NT-QP-2.007 procedure of the NTREE Co., Ltd.

Test method	: EN 61000-4-11:2004
Voltage drop and Interruption	: 40 % for duration of 10 period 70 % for duration of 25 period 0 %, 80 % for duration of 250 period
Ut	: AC 230 V, 50 Hz
Test mode	: Operating Mode
Performance Criteria	: B, C (Refer to the attachment I)
Result	: Complies

Used equipments:

Used	Equipment	Model name	Manufacturer	Serial No.	Next Cal.
☒	EMC IMMUNITY TEST SYSTEM	IMU3000	EMC PARTNER	F5-S6-T6-D-V-1504	2024.11.01

Measurement Data:

- Uncertainty(DIP) = ± 5 % (with a 95 % confidence level, $k = 2$)

“It has been demonstrated that the Voltage dips generator meets the specified requirements in the standard with at least 95 % confidence.”

Test Level %Ut	Voltage droop and interruptions %Ut	Duration of Reduction (period)	Result	Remarks
80	20	250	A	No reaction recognized
70	30	25	A	No reaction recognized
40	60	10	A	No reaction recognized
0	100	250	B	During the test, Power of EUT is OFF but Self-recovery after finish the test

APPENDIX

Attachment I PERFORMANCE CRITERIA

Performance criterion A

The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed 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. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed 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 however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

Criteria of Radiated electromagnetic fields and Conducted disturbances induced by electromagnetic fields are given in the following contents.

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 ($U_0 = 140 \text{ dB}\mu\text{V}$) , 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 3 V/m ($U_0 = 130 \text{ dB}\mu\text{V}$), 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 1 V/m ($U_0 = 120 \text{ dB}\mu\text{V}$).

Attachment II

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 (with a 95 % confidence level , $k = 2$)		
Shielded Room(#1)	9 kHz to 30 MHz	2.0 dB
Radiated Emission measurement (with a 95 % confidence level , $k = 2$)		
10 m Chamber	30 MHz: to 1 000 MHz	5.1 dB
3 m Chamber(#1)	1 000 MHz: to 6 000 MHz	5.1 dB

Attachment III

PHOTOGRAPHS

Radiated disturbances (Maximum emission configuration) – Below 1 GHz**[Front]****[Rear]**

Conducted emissions from the AC mains power ports

[Front]



[Rear]



Asymmetric mode conducted emissions

[Front]



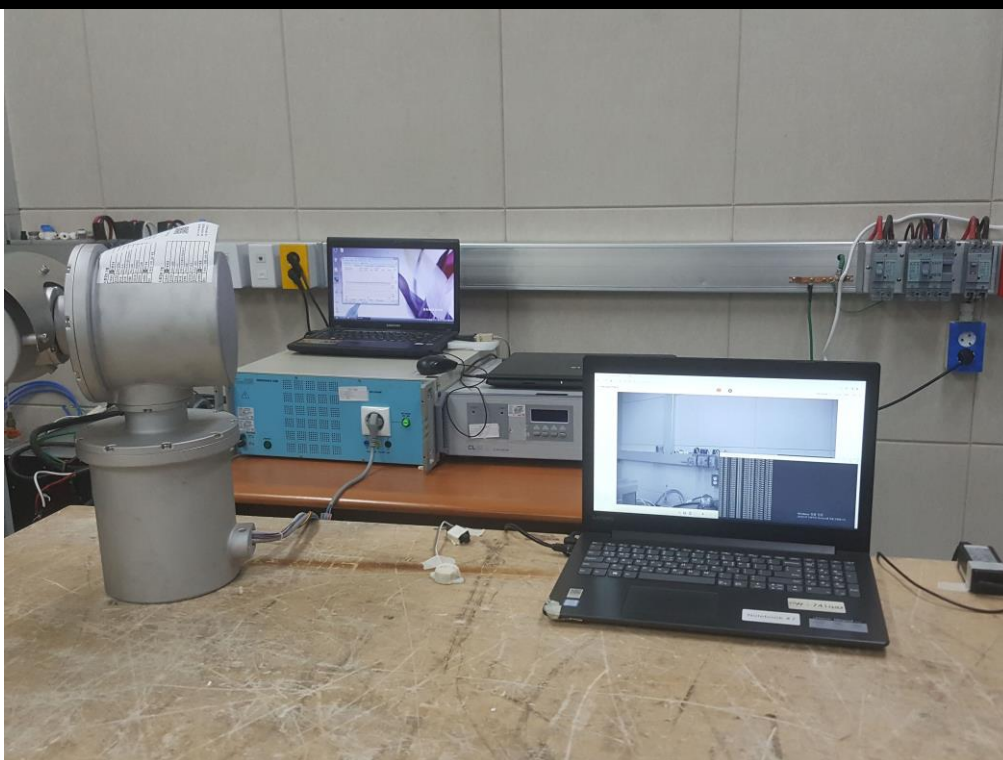
[Rear]



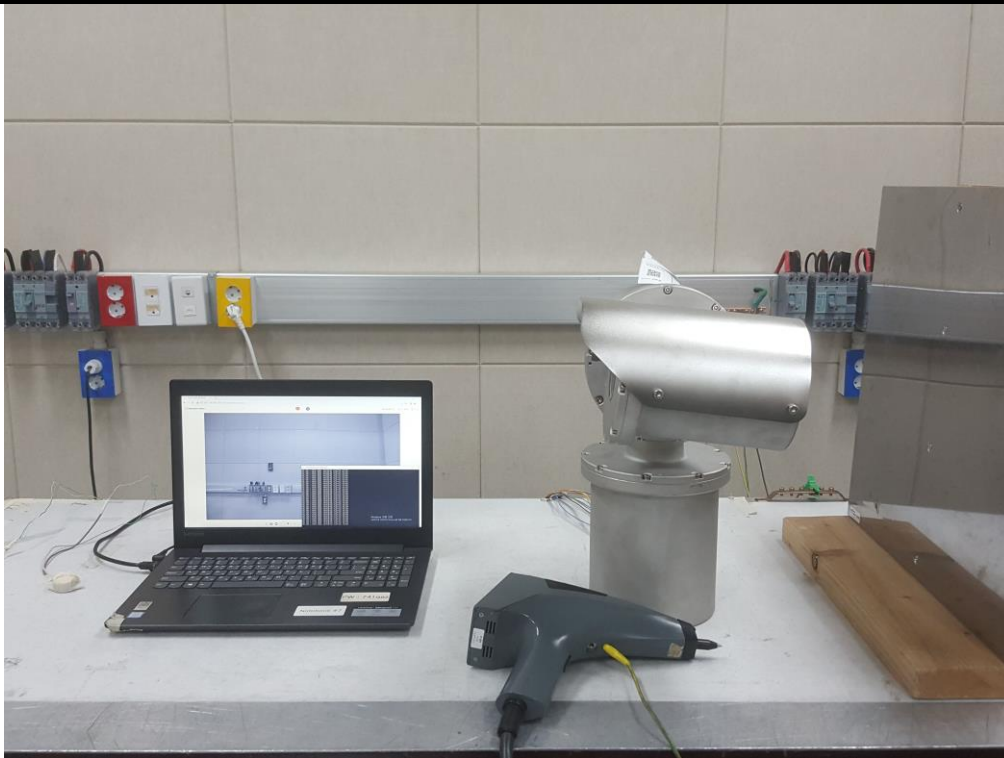
Harmonic



Flicker



Electromagnetic Discharge



RF Electromagnetic Field



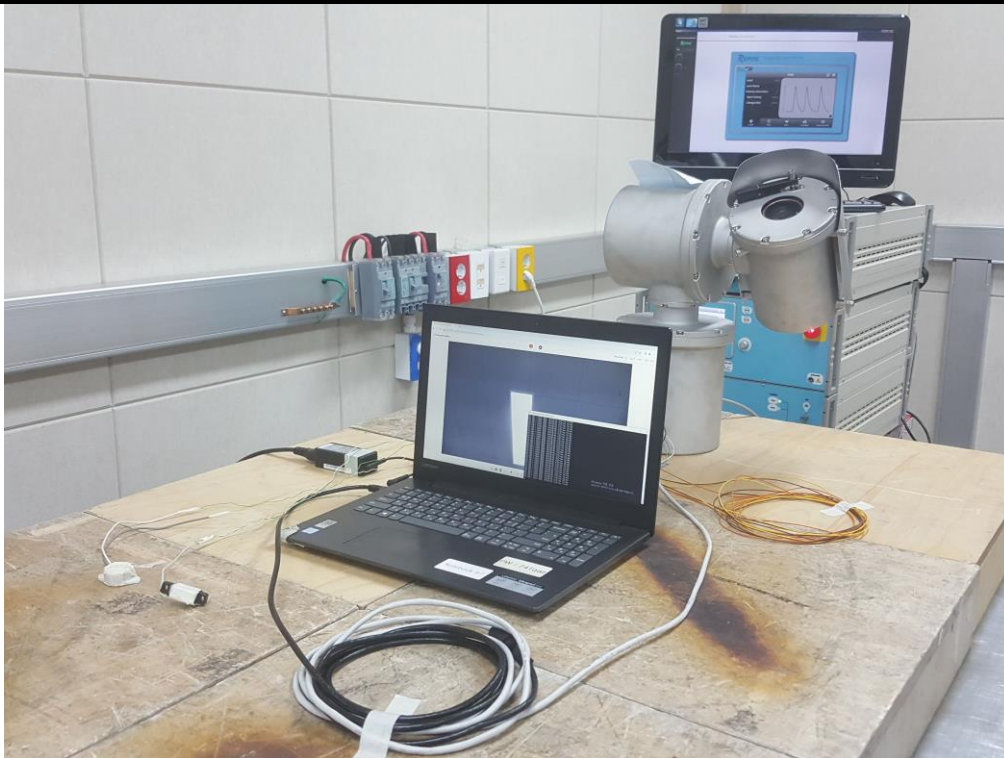
Fast Transients common mode



Fast Transients common mode_Clamp



Surge



RF current common mode

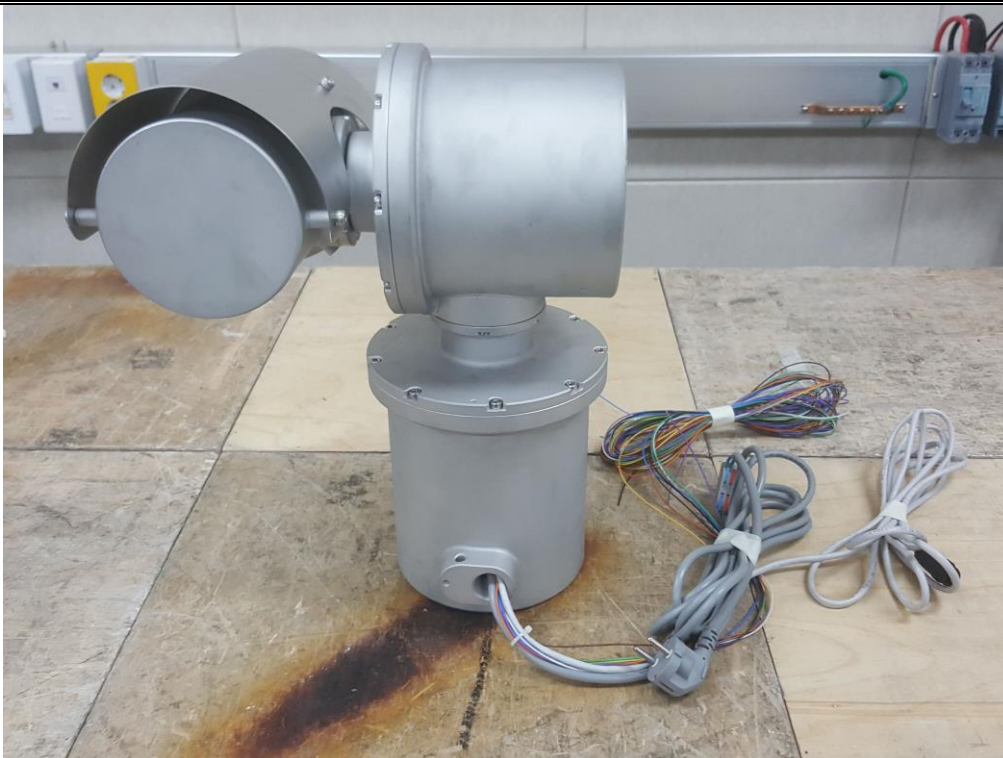


RF current common mode_Clamp



Voltage dips and interruptions



EUT Photo**Front of EUT****Rear of EUT**

Internal of EUT



- End -