



EMC TEST REPORT

For

Industrial Control Switchboard

Model No. : MNS, GCK, GCS, VFD, ATS, ACC, ACP, AP, AL, AF, APE, ALE, AD,
AS, AR, AW, JXF, XM, XL-21, GGD, GGJ, DB, PDU, ODC, OSG, ODB,
OTC, AH, AM, AA, AJ

Applicant : Riches hardware Co., Ltd
Building 168 Guangren Road, Xintian Group, Dongya Village
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Manufacturer : Riches hardware Co., Ltd
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Report Number : ATJC25101380005000E

Date of Test : Oct. 13 - 25, 2025

Issued Date : Oct. 25, 2025

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1 GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Riches hardware Co., Ltd
Address of applicant: Building 168 Guangren Road, Xintian Group, Dongya Village Committee, Ruhu Town, Huicheng District, Huizhou City, Guangdong Province, China
Manufacturer: Riches hardware Co., Ltd
Address of manufacturer: Building 168 Guangren Road, Xintian Group, Dongya Village Committee, Ruhu Town, Huicheng District, Huizhou City, Guangdong Province, China

General Description of E.U.T

EUT Description: Industrial Control Switchboard
EUT-Model No.: MNS
Series No.: GCK, GCS, VFD, ATS, ACC, ACP, AP, AL, AF, APE, ALE, AD, AS, AR, AW, JXF, XM, XL-21, GGD, GGJ, DB, PDU, ODC, OSG, ODB, OTC, AH, AM, AA, AJ
Model Difference: Only the model name and the color of the exterior are different.
EUT Power Rating: Input:1000V~, 50/60Hz, 4000kW Max

Remark:

The test data gathered are from the production sample provided by the manufacturer.

1.2 Test Standards

The following Declaration of Conformity report of EUT is prepared in accordance with

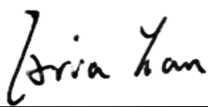
EN IEC 61000-6-3:2021

EN IEC 61000-6-1:2019

EN IEC 61000-3-2:2019+A2:2024

EN 61000-3-3:2013+A2:2021+AC:2022-01

The objective of the manufacturer is to demonstrate compliance with the described standards above.

Tested By : 
(Aria Yan)

Date: Oct. 25, 2025

Check By : 
(Henry Tian)

Date: Oct. 25, 2025

1.3 Test Summary

For the EUT described above. The standards used were EN 61000-6-3 Class B for Emissions & EN IEC 61000-6-1 for Immunity.

Table 1 : Tests Carried Out Under EN IEC 61000-6-3:2021

Standard	Test Items	Status
EN IEC 61000-6-3:2021	Disturbance Voltage at The Mains Terminals (150KHz to 30MHz)	√
	Radiated Disturbances (30MHz to 1000MHz)	√
EN IEC 61000-3-2:2019+A2:2024	Harmonic current emissions	√
EN 61000-3-3:2013+A2:2021 +AC:2022-01	Voltage fluctuations & flicker	√

√ Indicates that the test is applicable

× Indicates that the test is not applicable

Table 2 : Tests Carried Out Under EN IEC 61000-6-1:2019

Standard	Test Items	Status
EN 61000-4-2:2009	Electrostatic discharge Immunity	√
EN IEC 61000-4-3:2020	Radiated Susceptibility (80MHz to 1GHz)	√
EN 61000-4-4:2012	Electrical fast transients/burst immunity test	√
EN 61000-4-5:2014+A1:2017	Surge immunity test	√
EN 61000-4-6:2023	Immunity to conducted disturbances, induced by radio-frequency fields	√
EN IEC 61000-4-11:2020+AC:2022-10	Voltage dips, short interruptions and voltage variations immunity tests	√

√ Indicates that the test is applicable

× Indicates that the test is not applicable

1.4 Test Methodology

All measurements contained in this report were conducted with CISPR 16-1: 2002, radio disturbance and immunity measuring apparatus, and CISPR16-2: 2002, Method of measurement of disturbances and immunity.

1.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

1.6 Test Equipment List and Details

Immunity shielded room				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMC PARTNER TRANSIENT 2000	EMC PARTNER	TRA2000	881	10/30/2025
Power-frequency Magnetic field	SCHAFFNER	CCN 1000-1	72046	10/30/2025
Induction Coil Interface	SCHAFFNER	INA2141	6003	10/30/2025
Signal Generator	Marconi	2022D	119246/003	10/30/2025
Power Amplifier	M2S	A00181-1000	9801-112	10/30/2025
CDN	MEB	M3-8016	003683	10/30/2025
Power Amplifier	M2S	AC8113/800-250A	9801-179	10/30/2025
Power Antenna	SCHAFFNER	CBL6140A	1204	10/30/2025
ESD 2000	EMC PARTNER	ESD2000	182	10/30/2025
Harmonic & Flicker Tester	California instruments	PACS-3	SB2588/01	10/30/2025
AC Power Source	California instruments	5001iX-CTS-40	SB2588	10/30/2025
EMI Test Receiver	R&S	ESCI	100005	10/30/2025
Spectrum Analyzer	R&S	FSU	100114	10/30/2025
Pre Amplifier	H.P.	HP8447E	2945A02715	10/30/2025
Bilog Antenna	SUNOL Sciences	JB3	A021907	10/30/2025
Cable	TIME MICROWAVE	LMR-400	N-TYPE04	10/30/2025
System-Controller	CCS	N/A	N/A	N.C.R
Turn Table	CCS	N/A	N/A	N.C.R
Antenna Tower	CCS	N/A	N/A	N.C.R
Triple-Loop Antenna	EVERFINE	LLA-2	N/A	10/30/2025
LISN	AFJ	LS16	16010222119	10/30/2025
LISN(EUT)	Mestec	AN3016	04/10040	10/30/2025

2 Disturbance Voltage at The Mains Terminals

2.1. LIMITS

FREQUENCY (MHz)	Class (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

NOTE:

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
- (3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

2.2. TEST PROCEDURE

Procedure of Preliminary Test

The EUT and Support equipment, if needed, was set up as per the test configuration to simulate typical usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per EN 55013 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor standing equipment, it is placed on the ground plane, which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.

All I/O cables were positioned to simulate typical actual usage as per EN 55013.

The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in Item 3.1 were scanned during the preliminary test.

After the preliminary scan, we found the test mode described in Item 3.1 producing the highest emission level.

The EUT configuration and cable configuration of the above highest emission levels were recorded for reference of the final test.

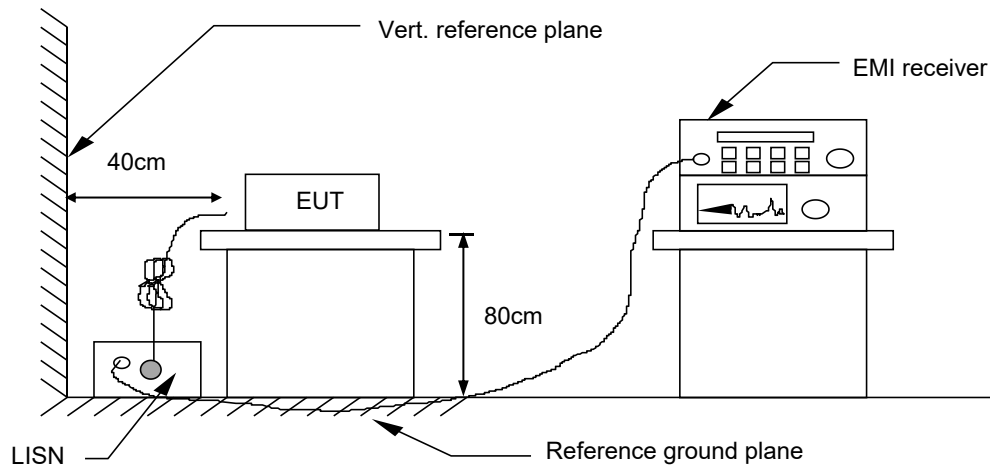
Procedure of Final Test

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

2.3. TEST SETUP

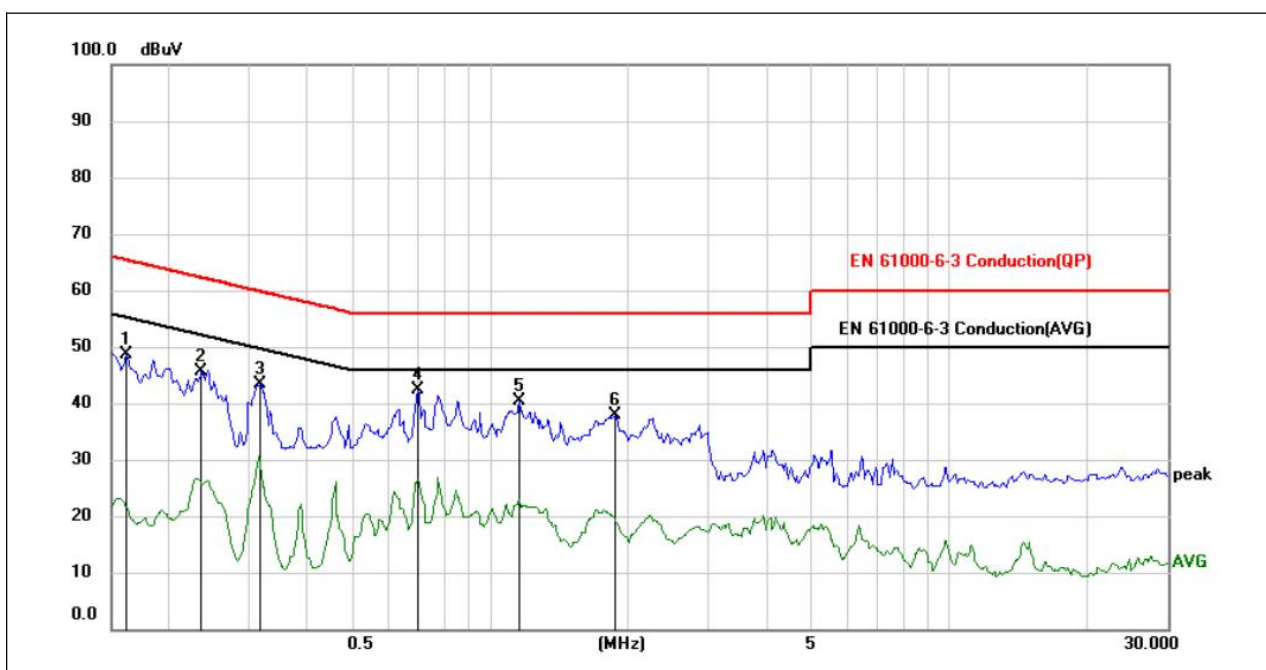


For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

2.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

EUT :	Industrial Control Switchboard	Mdoel Name :	MNS
Temperature :	24℃	Relative Humidity :	54%
Pressure :	1010 hPa	Test Date :	Oct. 25, 2025
Test Mode :	Normal Operating	Phase :	L
Test Power :	AC1000V		

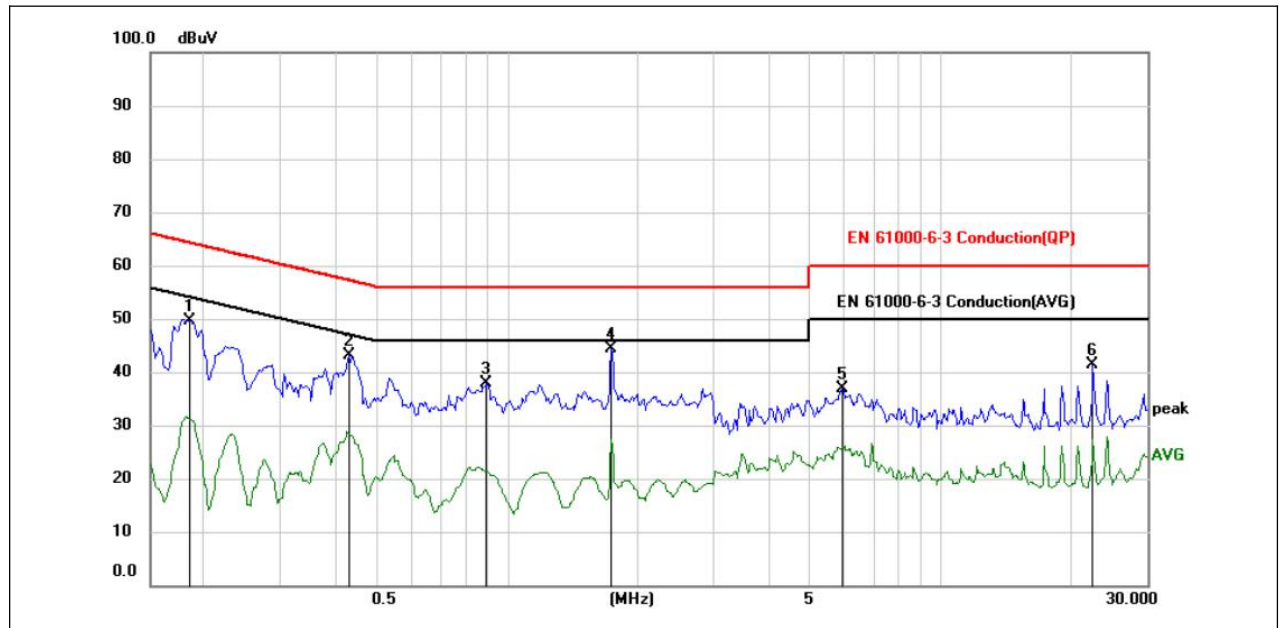


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.1617	38.23	10.38	48.61	65.38	-16.77	peak
2		0.2358	35.25	10.40	45.65	62.24	-16.59	peak
3		0.3175	33.08	10.42	43.50	59.77	-16.27	peak
4	*	0.6995	31.67	10.75	42.42	56.00	-13.58	peak
5		1.1635	29.50	10.88	40.38	56.00	-15.62	peak
6		1.8850	27.15	10.83	37.98	56.00	-18.02	peak

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. N/A means All Data have pass Limit.

EUT :	Industrial Control Switchboard	Mdoel Name :	MNS
Temperature :	24℃	Relative Humidity :	54%
Pressure :	1010 hPa	Test Date :	Oct. 25, 2025
Test Mode :	Normal Operating	Phase :	N
Test Power :	AC1000V		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1850	39.30	10.39	49.69	64.26	-14.57	peak
2		0.4308	32.76	10.43	43.19	57.24	-14.05	peak
3		0.8988	27.00	10.85	37.85	56.00	-18.15	peak
4	*	1.7412	33.63	10.85	44.48	56.00	-11.52	peak
5		5.9484	25.58	11.23	36.81	60.00	-23.19	peak
6		22.4259	28.80	12.50	41.30	60.00	-18.70	peak

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. N/A means All Data have pass Limit.

3 RADIATED DISTURBANCES

3.1 MEASUREMENT UNCERTAINTY

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ± 4.0 dB.

3.2 LIMIT OF RADIATED DISTURBANCES (Class B)

Frequency (MHz)	Distance (Programmable timers)	Field Strengths Limits (dB μ V/m)
30 ~ 230	3	40
230 ~ 1000	3	47

Note: (1) The tighter limit shall apply at the edge between two frequency bands.
(2) Distance refers to the distance in meters between the test instrument antenna and the closest point of any part of the E.U.T.

3.3 EUT SETUP

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the CISPR 16-1: 2002, CISPR 16-2: 2002. The specification used was EN 55022 Class B limits.

The EUT was placed on the center of the test table.

Maximum emission emitted from EUT was determined by manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation and the levels in the final result of the test were recorded with the EUT running in the operating mode that maximum emission was emitted.

3.4 TEST RECEIVER SETUP

According to EN 61000-6-3 rules, the frequency was investigated from 30 to 1000 MHz. During the radiated emission test, the test receiver was set with the following configurations:

Test Receiver Setting:

Detector.....Peak & Quasi-Peak
IF Band Width.....120KHz
Frequency Range.....30MHz to 1000MHz
Turntable Rotated.....0 to 360 degrees

Antenna Position:

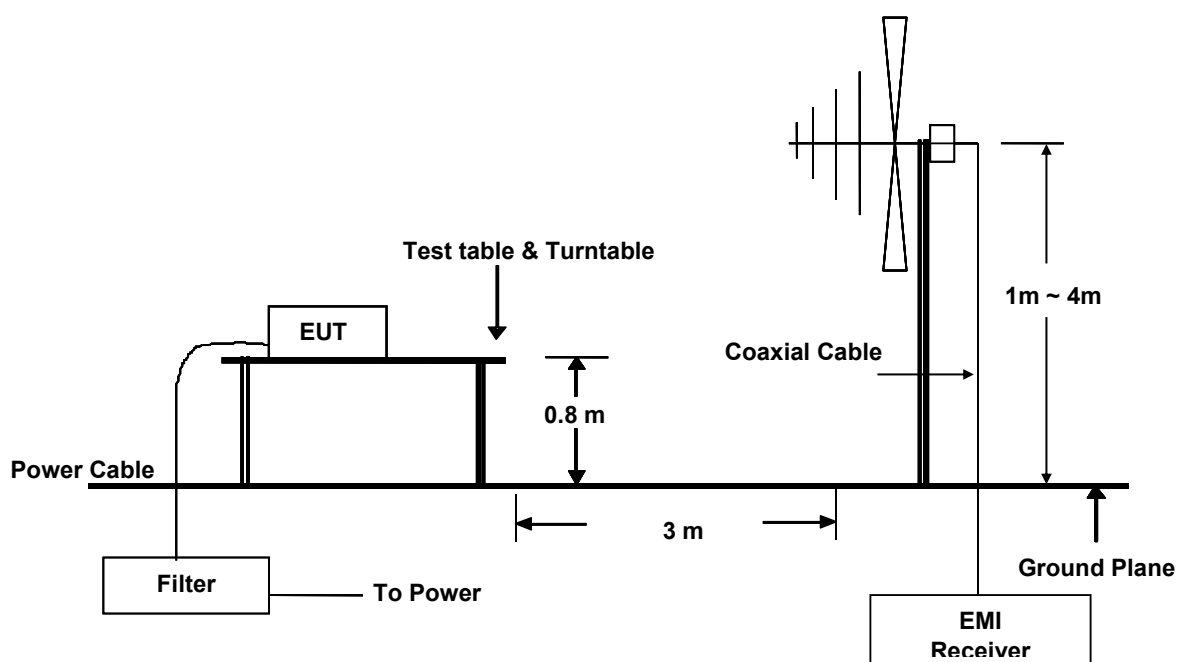
Height.....1m to 4m
Polarity.....Horizontal and Vertical

3.5 TEST PROCEDURE

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -10 dB μ V of specification limits), and are distinguished with a "QP" in the data table.

3.6 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

3.7 TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

EUT :	Industrial Control Switchboard	Model Name :	MNS
Temperature :	24℃	Relative Humidity :	54%
Pressure :	1010 hPa	Test Date :	Oct. 25, 2025
Test Mode :	Normal operating	Polarization :	Vertical
Test Power :	AC1000V		

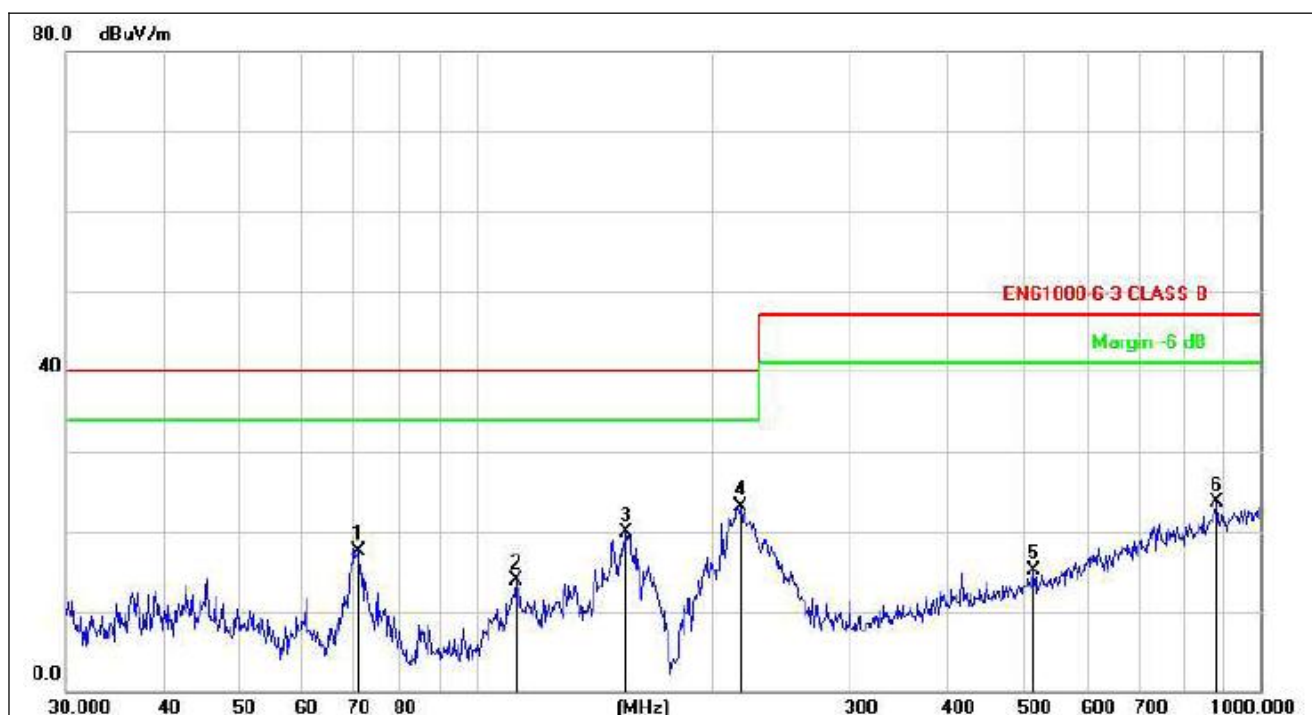


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		45.0583	41.73	-17.42	24.31	40.00	-15.69	peak
2		60.7043	40.81	-18.26	22.55	40.00	-17.45	peak
3		103.0800	42.22	-20.90	21.32	40.00	-18.68	peak
4	*	162.6106	43.40	-18.14	25.26	40.00	-14.74	peak
5		216.0240	40.11	-20.06	20.05	40.00	-19.95	peak
6		919.2866	28.52	-4.84	23.68	47.00	-23.32	peak

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. N/A means All Data have pass Limit.

EUT :	Industrial Control Switchboard	Model Name :	MNS
Temperature :	24℃	Relative Humidity :	54%
Pressure :	1010 hPa	Test Date :	Oct. 25, 2025
Test Mode :	Normal operating	Polarization :	Horizontal
Test Power :	AC1000V		



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		70.5836	37.58	-20.09	17.49	40.00	-22.51	peak
2		112.1303	34.27	-20.37	13.90	40.00	-26.10	peak
3		154.8204	37.74	-17.74	20.00	40.00	-20.00	peak
4	*	216.7828	43.16	-20.01	23.15	40.00	-16.85	peak
5		513.6331	28.04	-12.96	15.08	47.00	-31.92	peak
6		878.3214	29.04	-5.29	23.75	47.00	-23.25	peak

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. N/A means All Data have pass Limit.

4 HARMONICS CURRENT MEASUREMENT

4.1. LIMITS OF HARMONICS CURRENT MEASUREMENT

Limits for Class A equipment		Limits for Class D equipment		
Harmonics Order n	Max. permissible harmonics current A	Harmonics Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd harmonics		Odd Harmonics only		
3	2.30	3	3.4	2.30
5	1.14	5	1.9	1.14
7	0.77	7	1.0	0.77
9	0.40	9	0.5	0.40
11	0.33	11	0.35	0.33
13	0.21	13	0.30	0.21
15≤n≤39	0.15x15/n	15≤n≤39	3.85/n	0.15x15/n
Even harmonics				
2	1.08			
4	0.43			
6	0.30			
8≤n≤40	0.23x8/n			

NOTE: 1. Class A and Class D are classified according to item 4.4.3.

2. According to section 7 of EN IEC 61000-3-2, the above limits apply for all equipments with a rated power more than 75W, except for Power supply equipment.

4.2. TEST PROCEDURE

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under POWER SUPPLY operating conditions for each successive harmonic component in turn.

The classification of EUT is according to section 5 of EN IEC 61000-3-2.

The EUT is classified as follows:

Class A: Balanced three-phase equipment, Household appliances excluding equipment as Class D, Tools excluding portable tools, Dimmers for incandescent lamps, audio equipment, equipment not specified in one of the three other classes.

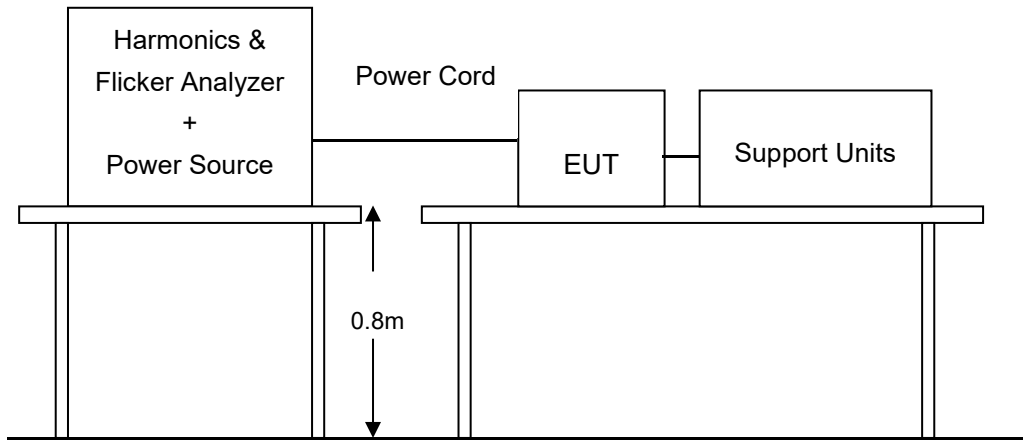
Class B: Portable tools; Arc welding equipment which is not professional equipment.

Class C: Power supply equipment.

Class D: Equipment having a specified power less than or equal to 600W of the following types: Personal computers and personal computer monitors and television receivers.

The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.

4.3. TEST SETUP



For the actual test configuration, please refer to the related item.

4.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	PASS
Test Results	PASS

Please refer to the following page.

Determination of Voltage Harmonics and Limits

Order(n)	U _{hdf}	Limit(%)	Limit Percent (%)	Result
1	100%	---	---	---
2	0.01%	0.20	4.03%	Pass
3	0.01%	0.90	0.94%	Pass
4	0.00%	0.20	0.96%	Pass
5	0.00%	0.40	0.96%	Pass
6	0.00%	0.20	1.21%	Pass
7	0.00%	0.30	0.92%	Pass
8	0.00%	0.20	1.18%	Pass
9	0.00%	0.20	2.40%	Pass
10	0.01%	0.20	2.91%	Pass
11	0.00%	0.10	1.52%	Pass
12	0.01%	0.10	5.81%	Pass
13	0.00%	0.10	3.05%	Pass
14	0.00%	0.10	3.03%	Pass
15	0.00%	0.10	0.27%	Pass
16	0.00%	0.10	1.46%	Pass
17	0.00%	0.10	1.12%	Pass
18	0.00%	0.10	0.28%	Pass
19	0.00%	0.10	0.82%	Pass
20	0.00%	0.10	0.15%	Pass
21	0.00%	0.10	1.29%	Pass
22	0.00%	0.10	0.37%	Pass
23	0.00%	0.10	2.46%	Pass
24	0.00%	0.10	0.65%	Pass
25	0.00%	0.10	1.19%	Pass
26	0.00%	0.10	0.34%	Pass
27	0.00%	0.10	2.20%	Pass
28	0.00%	0.10	0.15%	Pass
29	0.00%	0.10	2.84%	Pass
30	0.00%	0.10	0.15%	Pass
31	0.00%	0.10	1.35%	Pass
32	0.00%	0.10	1.12%	Pass
33	0.00%	0.10	2.15%	Pass
34	0.00%	0.10	1.41%	Pass
35	0.00%	0.10	1.22%	Pass
36	0.00%	0.10	1.76%	Pass
37	0.00%	0.10	0.73%	Pass
38	0.00%	0.10	0.57%	Pass
39	0.00%	0.10	2.07%	Pass
40	0.00%	0.10	0.89%	Pass

5 VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

5.1. LIMITS OF VOLTAGE FLUCTUATION AND FLICKS MEASUREMENT

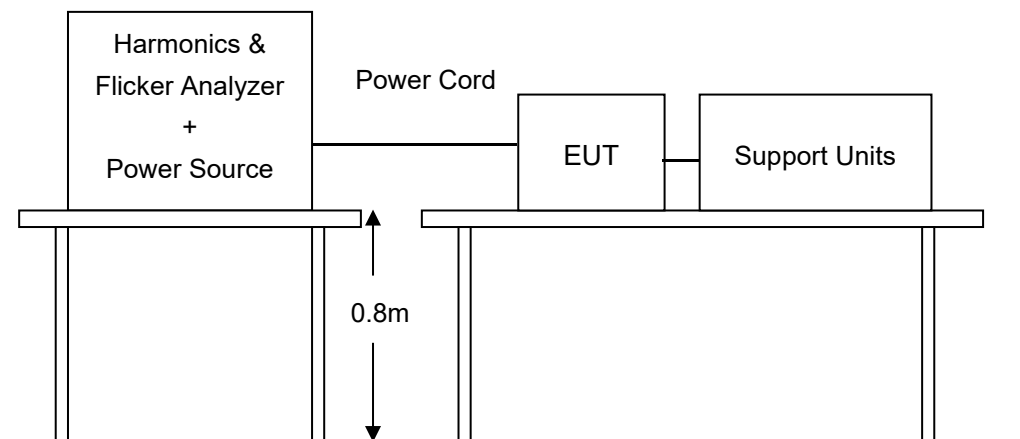
Test item	Limit	Remark
P_{st}	1.0	P_{st} means short-term flicker indicator
P_{lt}	0.65	P_{lt} means long-term flicker indicator
T_{dt} (ms)	500	T_{dt} means maximum time that dt exceeds 3 %
d_{max} (%)	4%	d_{max} means maximum relative voltage change
dc (%)	3.3%	dc means relative steady-state voltage change

5.2. TEST PROCEDURE

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under POWER SUPPLY operating conditions.

During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

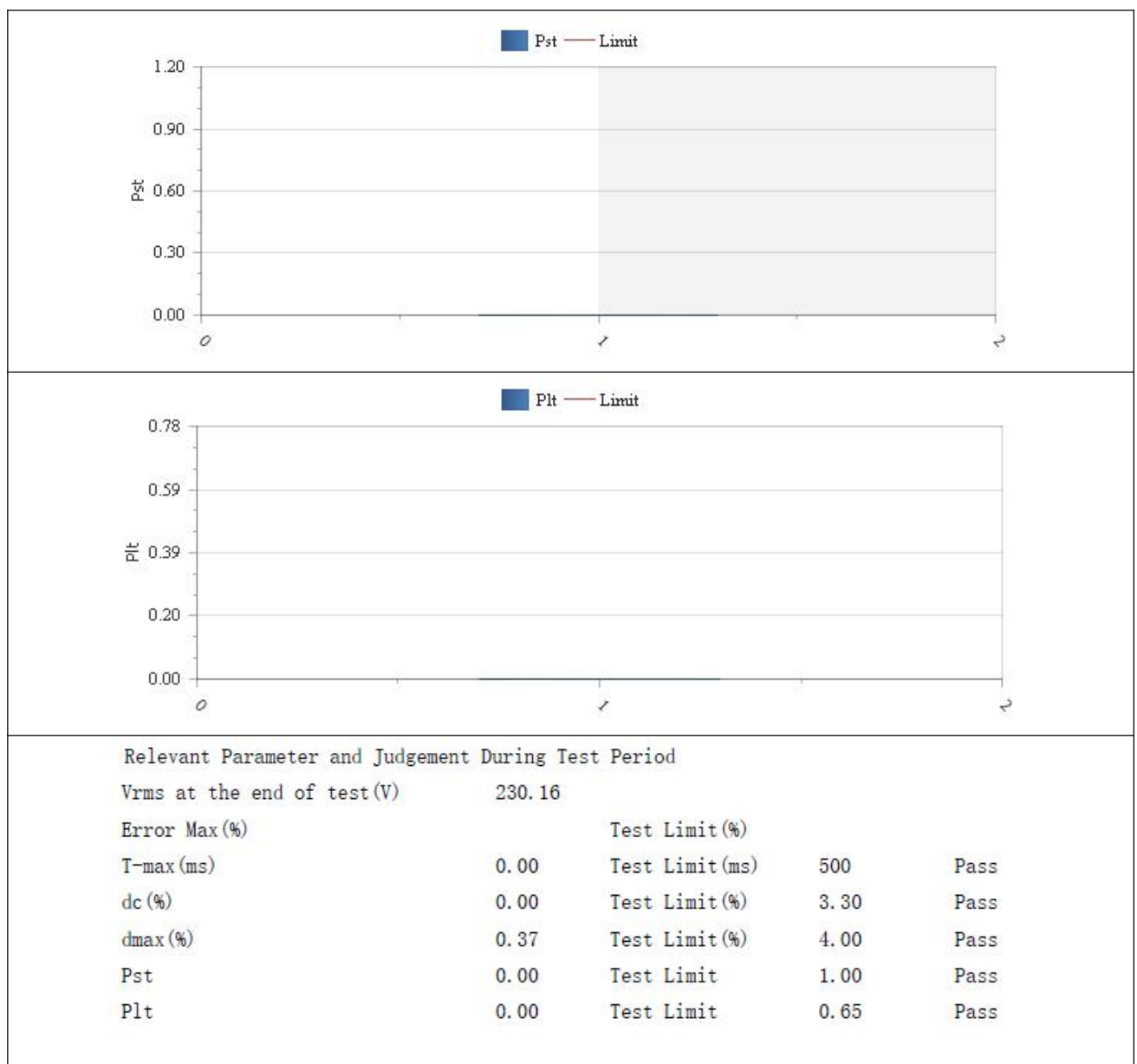
5.3. TEST SETUP



For the actual test configuration, please refer to the related item.

5.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	PASS
Test Results	PASS



6 IMMUNITY TEST

6.1. GENERAL DESCRIPTION

Product Standard	EN IEC 61000-6-1	
	Test Type	Minimum Requirement
Basic Standard, Specification, and Performance Criterion required	EN 61000-4-2	Electrostatic Discharge – ESD: 8kV air discharge, 4kV Contact discharge, Performance Criterion B
	EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test – RS: 80 ~1000 MHz, 3V/m, 80% AM(1kHz), Performance Criterion A
	EN 61000-4-4	Electrical Fast Transient/Burst - EFT, Power line: 1kV, Signal line: 0.5kV, Performance Criterion B
	EN 61000-4-5	Surge Immunity Test: 1.2/50 us Open Circuit Voltage, 8 /20 us Short Circuit Current, Power Port ~ Line to line: 1kV, Line to ground: 2kV Signal Port ~ Lines to ground : 1kV Performance Criterion B
	EN 61000-4-6	Conducted Radio Frequency Disturbances Test –CS: 0.15 ~ 80 MHz, 3Vrms, 80% AM, 1kHz, Performance Criterion A
	EN 61000-4-8	Power frequency magnetic field immunity test 50 Hz, 1A/m Performance Criterion A
	EN 61000-4-11	Voltage Dips: i) >95% reduction for 0.5 period, Performance Criterion B ii) 30% reduction for 25 period, Performance Criterion C Voltage Interruptions: >95% reduction for 250 period Performance Criterion C

6.2. GENERAL PERFORMANCE CRITERIA DESCRIPTION

Criteria A:	The apparatus shell continues to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Criteria B:	After test, the apparatus shell continues to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomenon 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. However, no change of operating state if stored data is allowed to persist after the test. If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.
Criteria C:	Temporary loss of function is allowed, provided the functions is self-recoverable or can be restored by the operation of controls by the user in accordance with the manufacturer instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

6.3. ELECTROSTATIC DISCHARGE (ESD)

6.3.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-2
Discharge Impedance:	330 ohm
Charging Capacity:	150pF
Discharge Voltage:	Air Discharge: 8 kV (Direct) Contact Discharge: 4 kV (Direct/Indirect)
Polarity:	Positive & Negative
Number of Discharge:	Minimum 10 times at each test point
Discharge Mode:	1 time/s
Performance Criterion:	N/A

6.3.2. TEST PROCEDURE

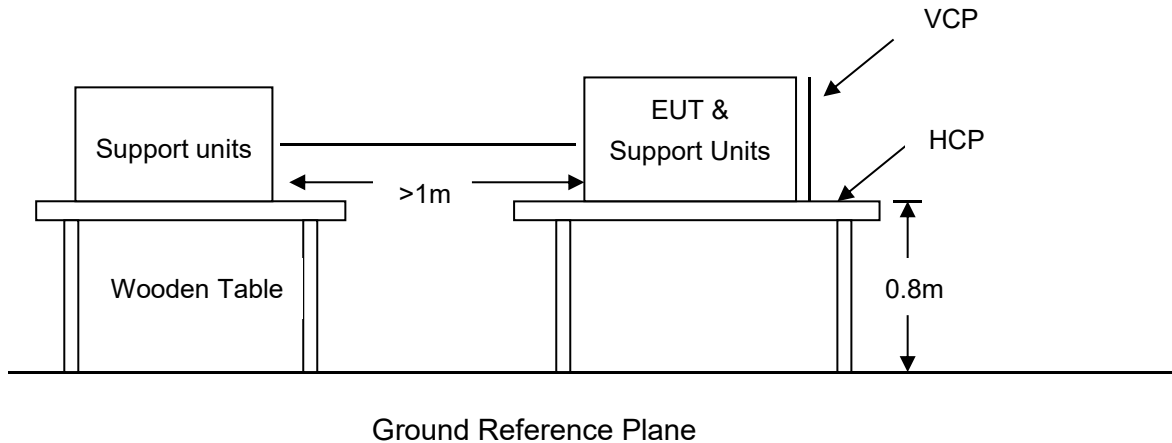
The discharges shall be applied in two ways:

- a) Contact discharges to the conductive surfaces and coupling planes:
Twenty dischargers (10 with positive and 10 with negative polarity) shall be applied on each accessible metallic part of the enclosure, terminals are excluded. In case of a non-conductive enclosure, dischargers shall be applied on the horizontal or vertical coupling planes. Test shall be performed at a maximum repetition rate of one discharge per second.
- b) Air discharges at slots and apertures and insulating surfaces:
On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area ON handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

The basic test procedure was in accordance with IEC 61000-4-2:

- a) The EUT was located 0.1 m minimum from all side of the **HCP** (dimensions 1.6m x 0.8m).
- b) The support units were located another table 30 cm away from the EUT, but direct support unit was/were located at same location as EUT on the HCP and keep at a distance of 10 cm with EUT.
- c) The time interval between two successive single discharges was at least 1 second.
- d) Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- e) Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
- f) At least ten single discharges (in the most sensitive polarity) were applied at the front edge of each **HCP** opposite the center point of each unit of the EUT and 0.1 meters from the front of the EUT. The long axis of the discharge electrode was in the plane of the **HCP** and perpendicular to its front edge during the discharge.
- g) At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **Vertical Coupling Plane (VCP)** in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.

6.3.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **Ground Reference Plane**. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **Horizontal Coupling Plane** (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940k total impedance. The equipment under test, was installed in a representative system as described in section 7 of EN 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

6.3.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

Air Discharge						
Test locations		Test Levels	Results			
		± 8 kV	Pass	Fail	Performance Criterion	Observation
Button	1Points	☒	☒	☐	B	Note ☐ 1 ☒ 2
Screen	2Points	☒	☒	☐	B	Note ☐ 1 ☒ 2
Slot	2Points	☒	☒	☐	B	Note ☐ 1 ☒ 2

Contact Discharge						
Test locations		Test Levels	Results			
		± 4 kV	Pass	Fail	Performance Criterion	Observation
HCP	4Points	☒	☒	☐	B	Note ☐ 1 ☒ 2
VCP	4Points	☒	☒	☐	B	Note ☐ 1 ☒ 2

NOTE: 1. There was no change compared with initial operation during the test.
2. The loss of function of the EUT during the test and it was recovered by itself operation after the test.

6.4. RADIATED, RADIO-FREQUENCY, ELECTROMAGNETIC FIELD (RS)

6.4.1. TEST SPECIFICATION

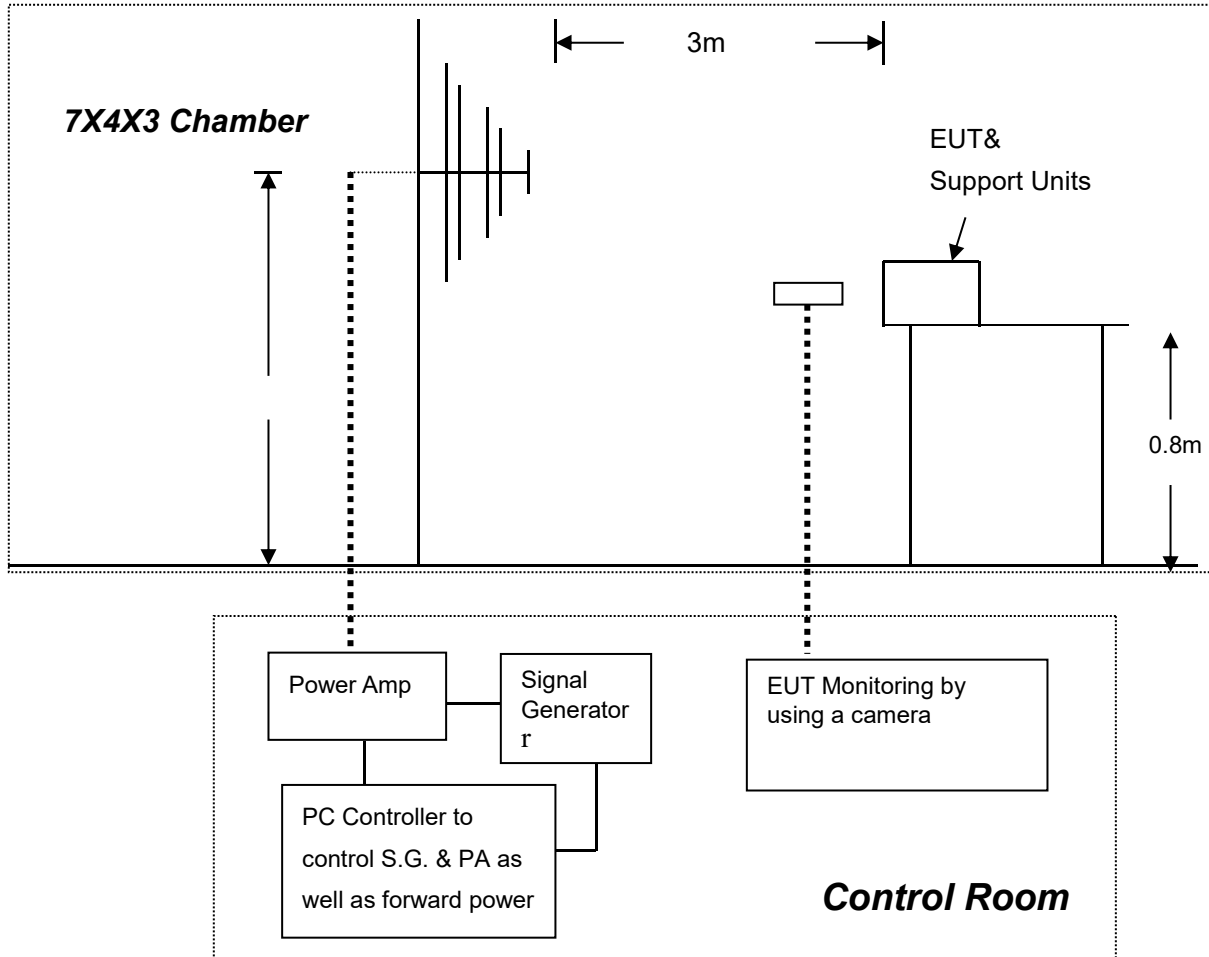
Basic Standard:	EN 61000-4-3
Frequency Range:	80 MHz ~1000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Test Distance:	3 m
Antenna Height:	1.5m
Performance Criterion:	A

6.4.2. TEST PROCEDURE

The test procedure was in accordance with EN 61000-4-3

- a) The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
- b) The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80% amplitude modulated with a 1kHz sine-wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s, where the frequency range is swept incrementally, the step size was 1% of preceding frequency value.
- c) The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- d) The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

6.4.3. TEST SETUP



For the actual test configuration, please refer to the related item.

NOTE:

TABLETOP EQUIPMENT

The EUT installed in a representative system as described in section 7 of EN 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

6.4.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

Frequency (MHz)	Polarity	Postion	Field Strength (V/m)	Observation	Results
80 ~ 1000	V&H	Front	3	Note	PASS
80 ~ 1000	V&H	Rear	3	Note	PASS
80 ~ 1000	V&H	Left	3	Note	PASS
80 ~ 1000	V&H	Right	3	Note	PASS

NOTE:

There was no change compared with the initial operation during the test.

6.5. ELECTRICAL FAST TRANSIENT (EFT)

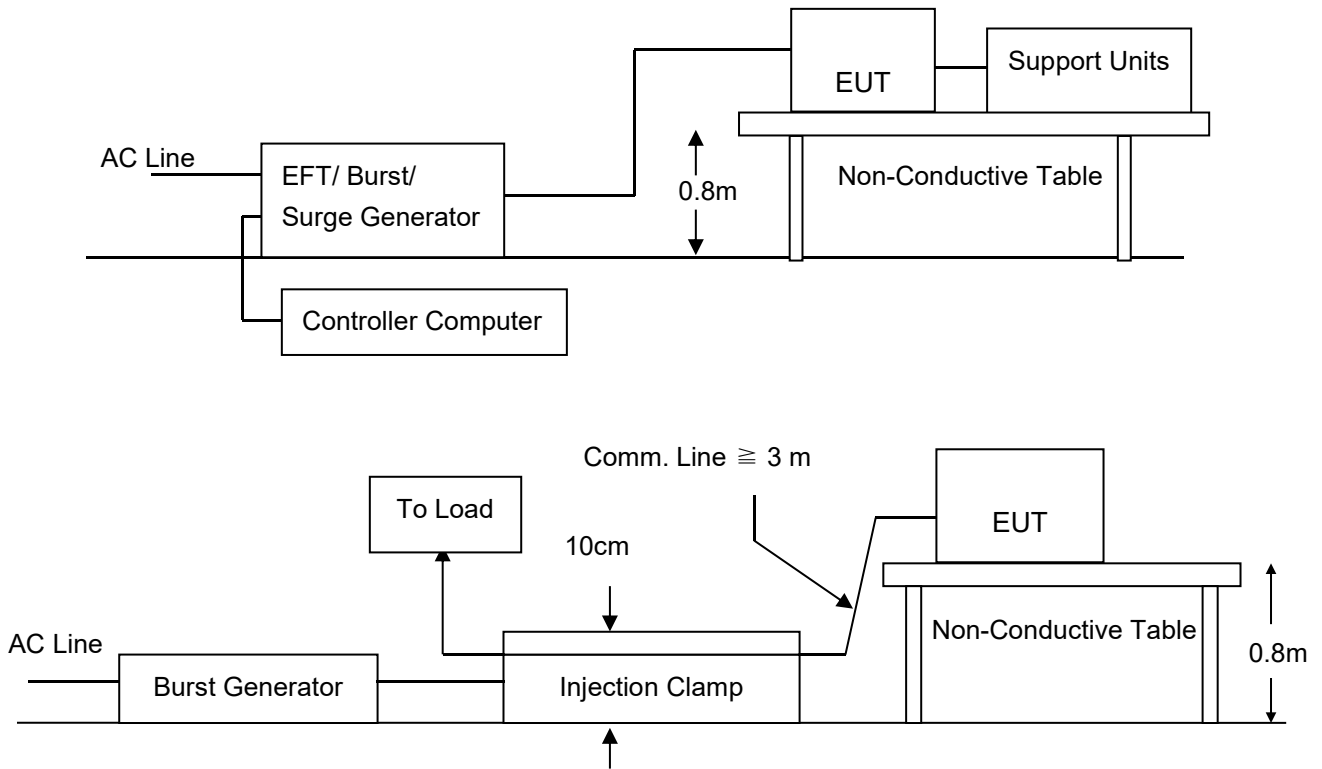
6.5.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-4
Test Voltage:	Power Line: 1 kV Signal/Control Line: 0.5 kV
Polarity:	Positive & Negative
Impulse Frequency:	5 kHz
Impulse Wave-shape:	5/50 ns
Burst Duration:	15 ms
Burst Period:	300ms
Test Duration:	Not less than 1 min.
Performance Criterion:	B

6.5.2. TEST PROCEDURE

- Both positive and negative polarity discharges were applied.
- The length of the “hot wire” from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 meter.
- The duration time of each test sequential was 1 minute.
- The transient/burst waveform was in accordance with EN 61000-4-4, 5/50ns.

6.5.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLETOP EQUIPMENT

The configuration consisted of a wooden table (0.8m high) standing on the Ground Reference Plane. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system. A minimum distance of 0.5m was provided between the EUT and the walls of the laboratory or any other metallic structure.

FLOOR STANDING EQUIPMENT

The EUT installed in a representative system as described in section 7 of IEC 61000-4-4 and its cables, were isolated from the Ground Reference Plane by an insulating support that is 0.1-meter thick. The GRP consisted of a sheet of aluminum (at least 0.25mm thick and 2.5m square) connected to the protective grounding system.

6.5.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

Test Point	Polarity	Test Level (kV)	Performance Criterion	Observation	Results
L	+/-	1	B	Note ☐ 1 ☒ 2	PASS
N	+/-	1	B	Note ☐ 1 ☒ 2	PASS
L – N	+/-	1	B	Note ☐ 1 ☒ 2	PASS
PE	--	--	--	Note ☐ 1 ☐ 2	N/A
L – PE	--	--	--	Note ☐ 1 ☐ 2	N/A
N – PE	--	--	--	Note ☐ 1 ☐ 2	N/A
L – N – PE	--	--	--	Note ☐ 1 ☐ 2	N/A
RJ45 UTP cable	--	--	--	Note ☐ 1 ☐ 2	N/A

NOTE:

1. There was no change compared with initial operation during the test.
2. The loss of function of the EUT during the test and it was recovered by itself operation after the test.

6.6. SURGE IMMUNITY TEST

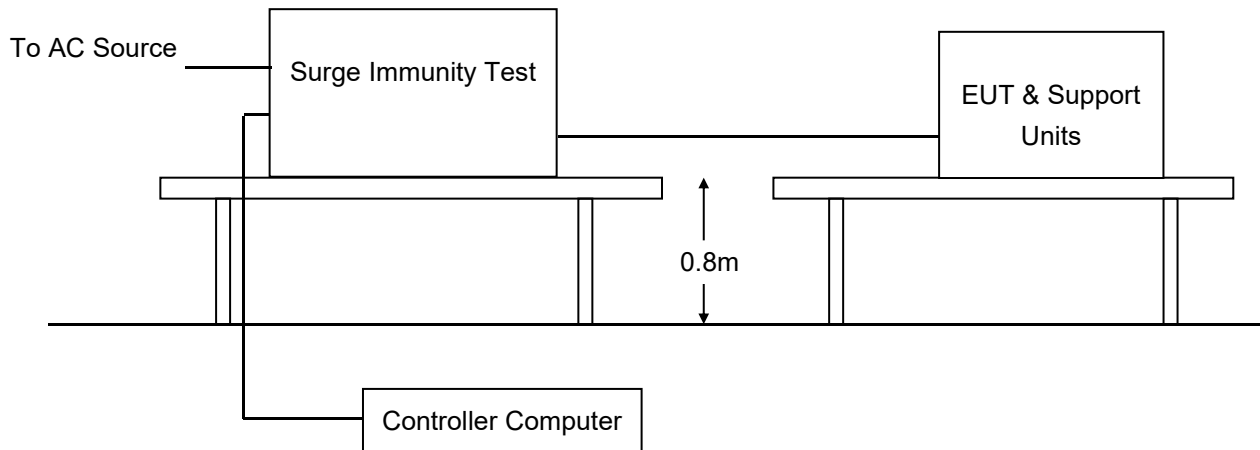
6.6.1 TEST SPECIFICATION

Basic Standard:	EN 61000-4-5
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8/20 us Short Circuit Current
Test Voltage:	Power line ~ line to line: 1 kV line to ground: 2kV Telecommunication line: 1 kV
Surge Input/Output:	Power Line: L-N / L-PE / N-PE Telecommunication line: T-Ground / R-Ground
Generator Source Impedance:	2 ohm between networks 12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0/90/180/270
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points
Performance Criterion:	B

6.6.2. TEST PROCEDURE

- For EUT power supply:
The surge is applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.
- For test applied to unshielded un-symmetrically operated interconnection lines of EUT:
The surge was applied to the lines via the capacitive coupling. The coupling / decoupling networks didn't influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.
- For test applied to unshielded symmetrically operated interconnection / telecommunication lines of EUT:
The surge was applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor were not specified. The interconnection line between the EUT and the coupling/decoupling networks was shorter than 2 meters in length.

6.6.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

6.6.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

Test Point	Polarity	Test Level (kV)	Performance Criterion	Observation	Results
L - N	+/-	1	B	Note ☐ 1 ☒ 2	PASS
L- PE	--	--	--	Note ☐ 1 ☐ 2	N/A
N - PE	--	--	--	Note ☐ 1 ☐ 2	N/A
R - Ground	--	--	--	Note ☐ 1 ☐ 2	N/A
T - Ground	--	--	--	Note ☐ 1 ☐ 2	N/A

NOTE:

1. There was no change compared with initial operation during the test.
2. The loss of function of the EUT during the test and it was recovered by itself operation after the test.

6.7. CONDUCTED RADIO FREQUENCY DISTURBANCES (CS)

6.7.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-6
Frequency Range:	0.15 MHz ~ 80 MHz
Field Strength:	3 V
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Coupled cable:	Power Mains, Shielded
Coupling device:	CDN-M3/2 (3 wires)
Performance Criterion:	A

6.7.2. TEST PROCEDURE

The EUT shall be tested within its intended operating and climatic conditions.

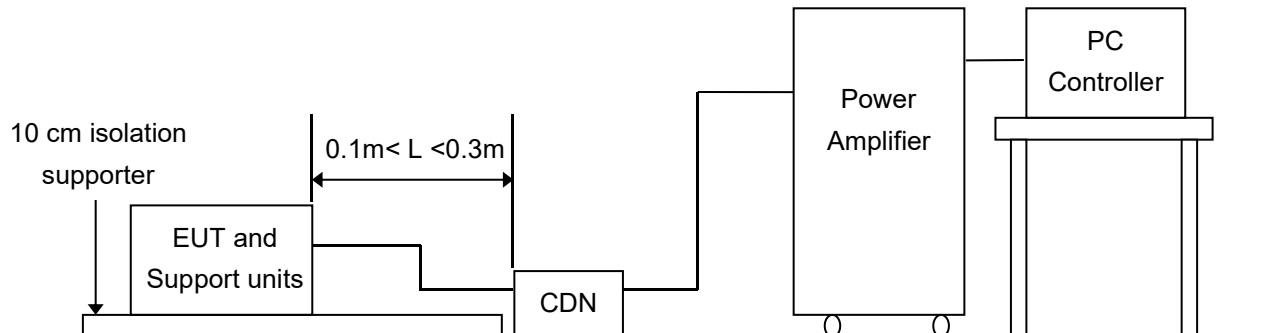
The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50-ohm load resistor.

The frequency range was swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal was modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. The sweep rate was 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally, the step size was 1 % of preceding frequency value from 150 kHz to 80 MHz.

The dwell time at each frequency was less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequency(ies) and harmonics or frequencies of dominant interest, was analyzed separately.

Attempts were made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.

6.7.3. TEST SETUP



For the actual test configuration, please refer to the related item.

Note:

1. The EUT is setup 0.1m above Ground Reference Plane
2. The CDNS and / or EM clamp used for real test depends on ports and cables configuration of EUT.

NOTE:

TABLE-TOP AND FLOOR-STANDING EQUIPMENT

The equipment to be tested is placed on an insulating support of 0.1 meters height above a ground reference plane. All relevant cables shall be provided with the appropriate coupling and decoupling devices at a distance between 0.1 meters and 0.3 meters from the projected geometry of the EUT on the ground reference plane.

6.7.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

Frequency Band (MHz)	Field Strength (Vrms)	Injected Position	Injection Method	Performance Criterion	Observation	Results
0.15 ~ 80	3	AC Mains	CDN-M3	A	Note ☒ 1 ☐ 2	PASS
0.15 ~ 80	3	N/A			Note ☐ 1 ☐ 2	N/A

NOTE:

1. There was no change compared with initial operation during the test.
2. The loss of function of the EUT during the test and it was recovered by itself operation after the test.

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6.8. POWER FREQUENCY MAGNETIC FIELD

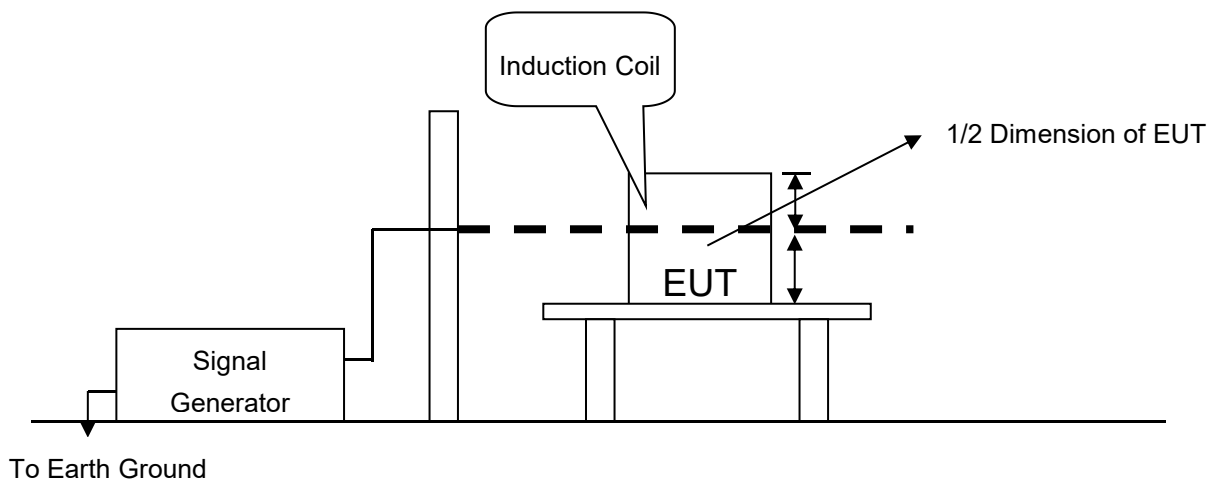
6.8.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-8
Frequency Range:	50/60Hz
Field Strength:	3A/m
Observation Time:	5 minutes
Inductance Coil:	Rectangular type, 1mx1m
Performance criterion:	N/A

6.8.2. TEST PROCEDURE

- The equipment is configured and connected to satisfy its functional requirements. It shall be placed on the GRP with the interposition of a 0.1m-thick insulating support.
- The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
- The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.
- The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.

6.8.3. TEST SETUP



For the actual test configuration, please refer to the related item.

NOTE:

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TABLETOP EQUIPMENT

The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

FLOOR-STANDING EQUIPMENT

The equipment shall be subjected to the test magnetic field by using induction coils of suitable dimensions. The test shall be repeated by moving and shifting the induction coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil shifted to different positions along the side of the EUT, in steps corresponding to 50 % of the shortest side of the coil. The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

6.8.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

Direction	Field Strength (A/m)	Performance Criterion	Observation	Results
X	3	A	Note ☒ 1 ☐ 2	PASS
Y	3	A	Note ☒ 1 ☐ 2	PASS
Z	3	A	Note ☒ 1 ☐ 2	PASS

NOTE:

1. There was no change compared with initial operation during the test.
2. The loss of function of the EUT during the test and it was recovered by itself operation after the test.

6.9. VOLTAGE DIP & VOLTAGE INTERRUPTIONS

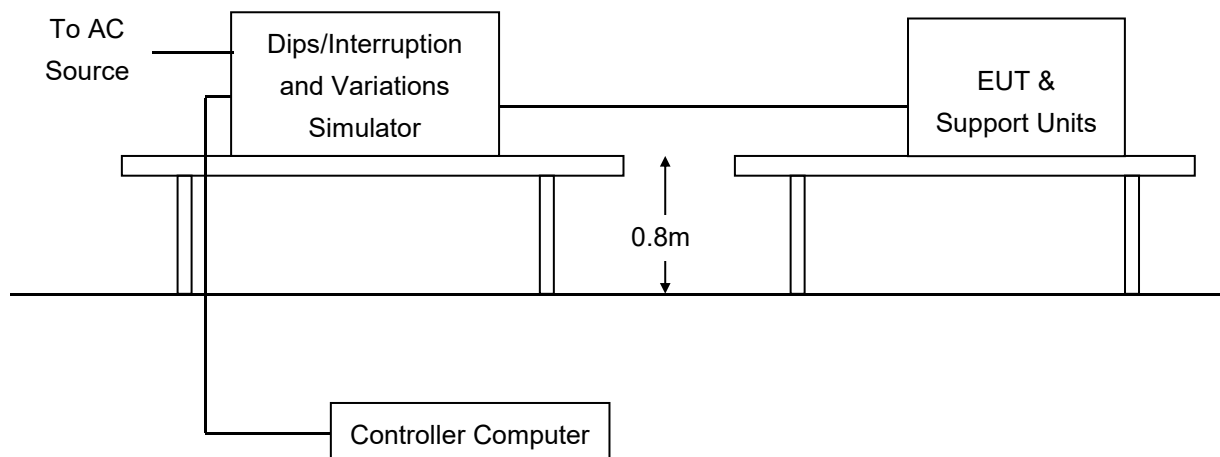
6.9.1. TEST SPECIFICATION

Basic Standard:	EN 61000-4-11
Test Duration Time:	Minimum three test events in sequence
Interval Between Event:	Minimum 10 seconds
Phase Angle:	0 / 45 / 90 / 135 / 180 / 225 / 270 / 315 / 360
Test Cycle:	3 times
Performance Criterion:	B,C

6.9.2. TEST PROCEDURE

1. The EUT and support units were located on a wooden table, 0.8 m away from ground floor.
2. Setting the parameter of tests and then perform the test software of test simulator.
3. Conditions changes to occur at 0 degree crossover point of the voltage waveform.
4. Recording the test result in test record form.

6.9.3. TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

6.9.4. TEST RESULTS

Temperature (°C)	22~28
Humidity (%RH)	50~58
Barometric Pressure (mbar)	950~1000
EUT	Industrial Control Switchboard
M/N	MNS
Operating Mode	Normal Operating
Test Results	PASS

Test Power: 1000Vac				
Voltage (% Reduction)	Duration (Period)	Performance Criterion	Observation	Results
100	0.5	☐ A ☒ B ☐ C	Note ☐ 1 ☒ 2 ☐ 3	PASS
30	10	☐ A ☐ B ☒ C	Note ☐ 1 ☐ 2 ☒ 3	PASS

NOTE:

1. There was no change compared with initial operation during and after the test.
No unintentional response was found during the test.
2. The function stopped during the test, but can be recoverable by itself operation after the test.
3. The function stopped during the test, but can be recoverable manually after the test.

EUT Photographs

Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



--END--