

TEST REPORT

Report No. :	10/65-95
Equipment Under Test (EUT) No. .. :	EM-65-0182
TISI No. :	-
Testing Laboratory	Electrical and Electronic Products Testing Center
Address	141 Thailand Science Park, Innovation Cluster 2 Tower D Phahonyothin Road, Khlong Nueng, Klong Luang, Pathum Thani 12120, Thailand.
Applicant's name	Primus Company Limited.
Address	119 Soi Srimuang-Anusorn, Sutthisarnvinijchai Rd., DinDang, DinDang, Bangkok 10400
Manufacturer's Name	Primus Company Limited.
Address	119 Soi Srimuang-Anusorn, Sutthisarnvinijchai Rd., DinDang, DinDang, Bangkok 10400
Standard	IEC 60601-1-2:2014
Non-standard test method :	-
Test item description :	Toilet Lift
Trademark :	Primus Co., Ltd.
Model/Type reference	PHC-01-Series
S/N :	-
Ratings :	230Vac, 50 Hz
Date of receive :	9 December 2021
Date of tested :	13, 16, 17 December 2021, 11 February 2022
Date of issue :	22 March 2022

Tested by



(MR. Prajak Choieklin)
Engineer

Approved by



(MR. Anake Meemoosor)
Operation Manager

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1 SUMMARY OF TESTING

This product was tested and complied according to following specification standards:

IEC60601-1-2 Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances - Requirements and tests

Test Item	Test Specification	Test Method	Result
Conducted Emission	IEC60601-1-2:2014	CISPR11:2010 (Ed.5.1)	PASS
Radiated Emission	IEC60601-1-2:2014	CISPR11:2010 (Ed.5.1)	PASS
Harmonic Emission	IEC60601-1-2:2014	EN 61000-3-2:2014	PASS
Voltage Fluctuation	IEC60601-1-2:2014	EN 61000-3-3:2013	PASS
Electrostatic Discharge	IEC60601-1-2:2014, 2kV, 4kV, 8kV, 15kV air, 8kV contact, Criterion B	IEC61000-4-2:2008 (Ed 2.0)	PASS
Radiated Immunity	IEC60601-1-2:2014, 80MHz to 2700 MHz, 3V/m 1kHz 80% AM Criterion A	IEC61000-4-3:2010 (Ed 3.1)	PASS
Electrical Fast Transient	IEC60601-1-2:2014, 2kV 5/50ns 5kHz, Criterion B	IEC61000-4-4:2012 (Ed 2.0)	PASS
Surge	IEC60601-1-2:2014, 1.2/50us, 0.5kV, 1kV DM, 0.5kV, 1kV, 2kV CM, Criterion B	IEC61000-4-5:2017 (Ed 2.0)	PASS
Conducted Immunity	IEC60601-1-2:2014, 0.150 MHz to 80 MHz, 3V 1kHz 80% AM Criterion A	IEC61000-4-6:2013 (Ed 3.0)	PASS
Power frequency Magnetic	IEC60601-1-2:2014, 30A/m 50Hz, Criterion A	IEC61000-4-8:2009 (Ed 2.0)	PASS
Voltage Dips	IEC60601-1-2:2014 V Dip 0% 0.5P, Criterion B, V Dip 0% 1P, Dip 30% 25P, Interrupt 250P Criterion C,	IEC61000-4-11:2017 (Ed 2.0)	PASS

Note: -

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2 TEST PLAN AND DEVIATIONS FROM STANDARD

2.1 Test Plan

No.	Test Item	Input Voltage	Mode	Test Port	Test Specification
1	Conducted Emission	230 V / 50 Hz	A	AC Main	IEC60601-1-2:2014
2	Radiated Emission	230 V / 50 Hz	A	Enclosure	IEC60601-1-2:2014
3	Harmonic Emission	230 V / 50 Hz	A	AC Main	IEC60601-1-2:2014
4	Voltage Fluctuation	230 V / 50 Hz	A	AC Main	IEC60601-1-2:2014
5	Electrostatic Discharge	230 V / 50 Hz	A	Enclosure	IEC60601-1-2:2014 2kV, 4kV, 8kV, 15kV air, 8kV contact, Criterion B
6	Radiated Immunity	230 V / 50 Hz	A	Enclosure	IEC60601-1-2:2014 80MHz to 2700 MHz, 3V/m 1kHz 80% AM Criterion A
7	Electrical Fast Transient	230 V / 50 Hz	A	AC Main	IEC60601-1-2:2014 2kV 5/50ns 5kHz, Criterion B
8	Surge	230 V / 50 Hz	A	AC Main	IEC60601-1-2:2014 1.2/50us, 0.5kV, 1kV DM, 0.5kV, 1kV, 2kV CM, Criterion B
9	Conducted Immunity	230 V / 50 Hz	A	AC Main	IEC60601-1-2:2014 0.150 MHz to 80 MHz, 3V 1kHz 80% AM Criterion A
10	Power Frequency magnetic	230 V / 50 Hz	A	Enclosure	IEC60601-1-2:2014, 30A/m 50Hz, Criterion A
11	Voltage Dips	230 V / 50 Hz	A	AC Main	IEC60601-1-2:2014 V Dip 0% 0.5P, Criterion B, V Dip 0% 1P, Dip 30% 25P, Interrupt 250P, Criterion C

2.2 Deviations from standard

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3 TEST CONDITIONS

3.1 Operation Mode

A: Normal operated.

3.2 Uncertainty Application

3.2.1 Uncertainty application according to CISPR 16-4-2 for Conducted Emission, Radiated Disturbance and Disturbance Power Testing.

Compliance or Non-Compliance with a disturbance limit was determined in the following manner

If U_{lab} is less than or equal to U_{cispr} in table 1, then:

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit.
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

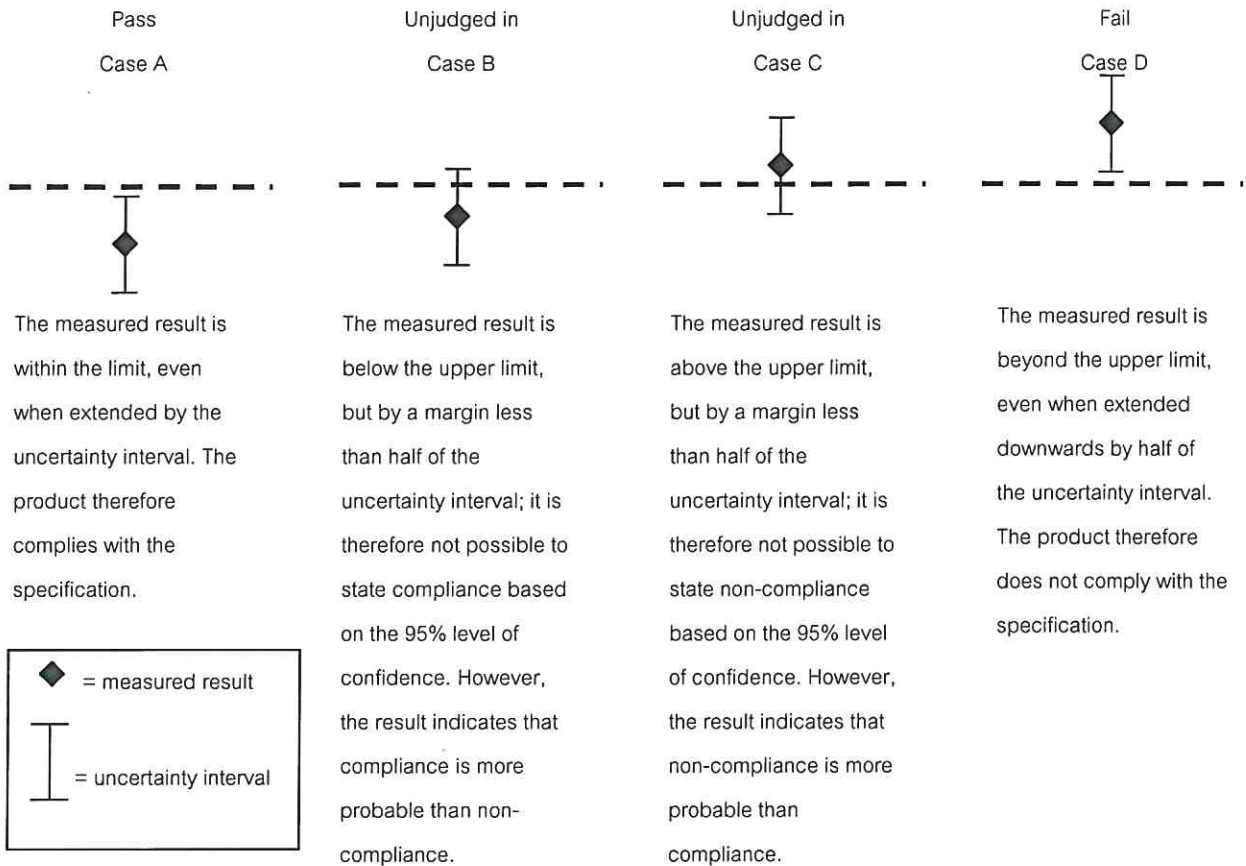
If U_{lab} is greater than U_{cispr} in table 1, then:

- Compliance is deemed to occur if no measured disturbance, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.
- Non-Compliance is deemed to occur if any measured disturbance, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Table 1 - Values of U_{cispr}

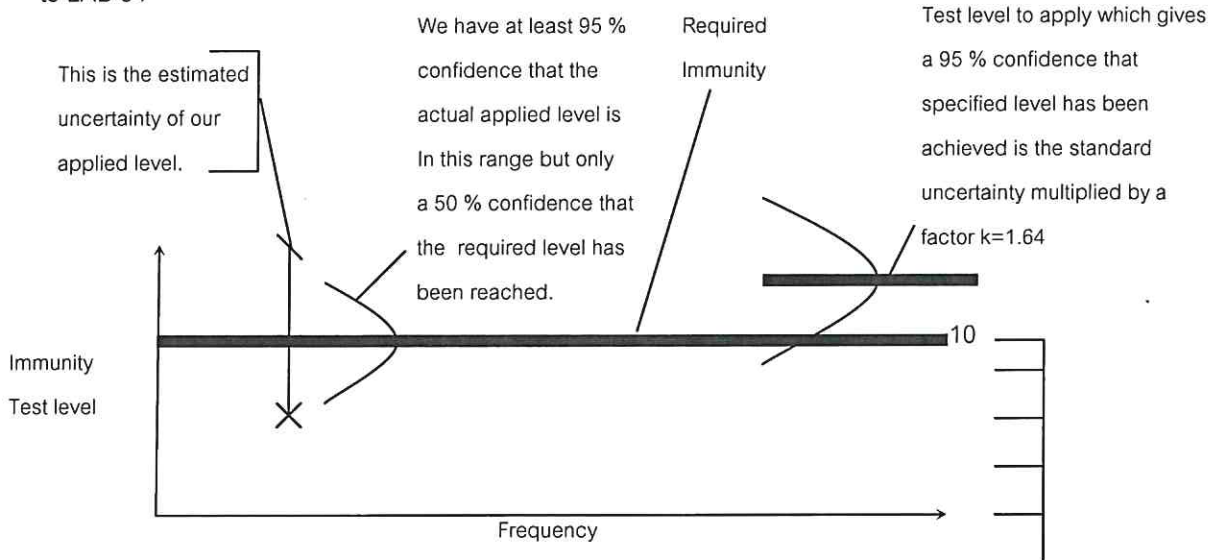
Abbreviation	Testing system	Frequency range	U_{lab}	U_{cispr}	$U_{lab} - U_{cispr}$
CE	Conducted Emission	9 kHz - 150 kHz	2.88	4.00	-1.12
CE	Conducted Emission	150 kHz - 30 MHz	3.51	3.60	-0.09
RE	Radiated Disturbance	30 MHz - 1000 MHz	4.80	5.20	-0.40
RE	Radiated Disturbance	1 GHz - 6 GHz	5.11	5.2	-0.09
PE	Disturbance Power	30 MHz - 300 MHz	2.42	4.50	-2.08

3.2.2 Uncertainty Application according to LAB 34 for other testing system.



3.2.3 Uncertainty Application for immunity testing.

Uncertainty of each test systems are applied for compliance with related standard according to LAB 34



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3.3 Equipment Classifications

Class B

3.4 Protection Classifications

-

3.5 Performance Criteria of Test Specification

Criterion A – The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed a performance level specified by the manufacturer, when the apparatus is used as intended.

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.

Normal operation of the EUT shall be restored after the test, self-recovery to the conditions immediately prior to the application of the test is accepted where this is a normal means of recovery. In these cases, operator response is permitted to re-initialize an operation.

Criterion C – Temporary loss of function is allowed provided the function is self recoverable or can be restored by the operation of the controls.

3.6 EUT Function Monitoring

The specific phenomena are monitored by LED Power.

4 TEST SYSTEM CONFIGURATION

4.1 EUT Exercise Software

-

4.2 EUT Modifications

-

5 EUT DESCRIPTION

5.1 EUT Specification

Input Voltage	230 Vac / 50 Hz
Input Current/Power	≤16 A
Clock/Oscillator	-

5.2 EUT Configuration

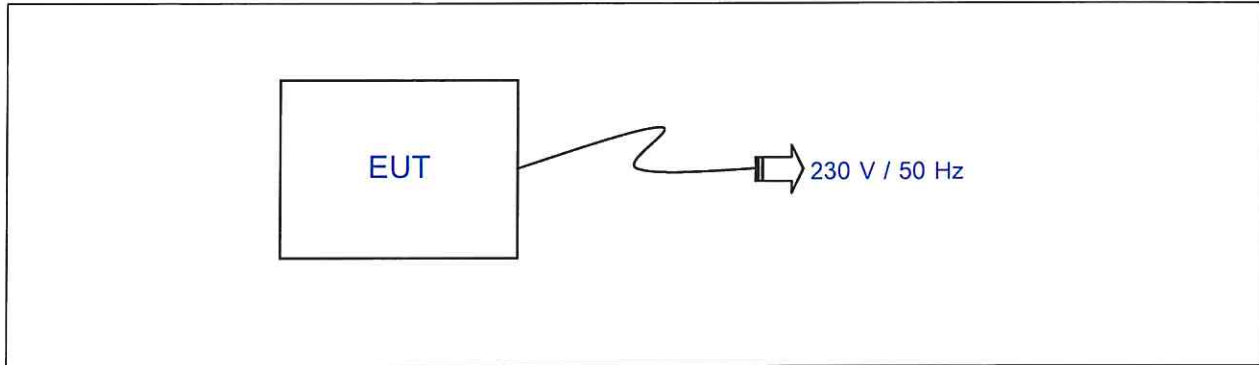


FIGURE 1 - EUT Configuration.

5.3 Peripherals Description

Diagram	Description	Trade Name	Model	Serial Number
-	-	-	-	-

5.4 Cables Description

Ref	Cable Type	Shield	Length (meters)	Ferrite	Connector	Connection Point 1	Connection Point 2
1	AC Power line	No	1.5	No	AC	EUT	AC Supply

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6 TEST SETUP AND RESULT

6.1 Test Item: Conducted Emission

6.1.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
EMI Test Receiver	Rohde & Schwarz	ESU26	100572	DKD	12-09-22
LISN	Rohde & Schwarz	ESH2-Z5	831886/009	NIMT	26-09-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: ± 3.51 dB

- Test Location: TRM-001

- Test Environment

Temperature ($^{\circ}$ C)	25	Humidity (%)	55
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- Test Setup Description

The disturbance voltage at the main terminals testing measurements were performed with the EMI receiver to observe the emission characteristics and to identify the frequency of emission that had the highest amplitude related to the EUT configuration for the disturbance voltage at the main terminals testing.

The EUT was placed in shield room. The power line of the EUT was connected to the LISN, which was located in the shield room. The EMI receiver in the control room measured the noise signals from the EUT. The testing method and the EUT setup were performed according to CISPR11. The EUT configuration for the disturbance voltage at the main terminals testing is shown in FIGURE 2 and 3, respectively.

● Test Picture

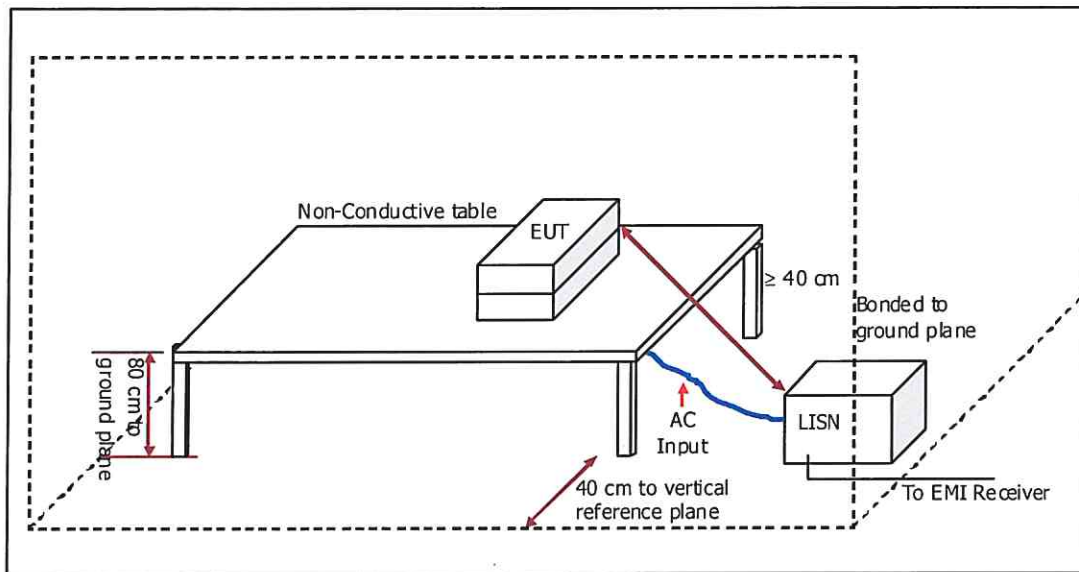


FIGURE 2 - The setup diagram.



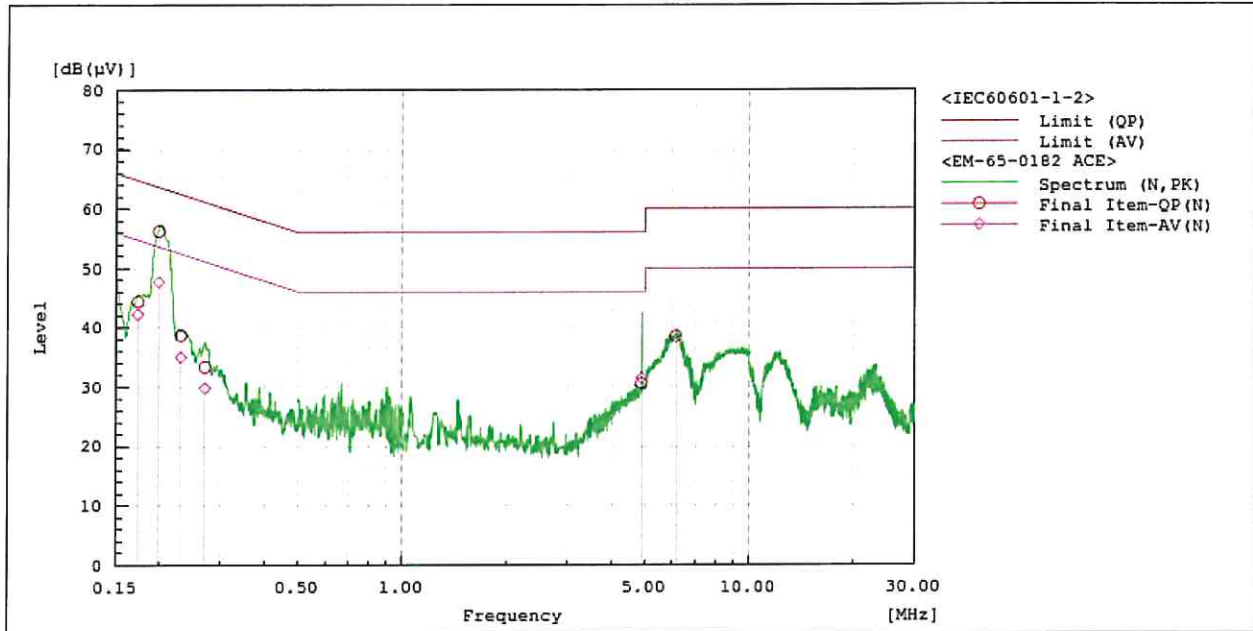
FIGURE 3 - The test setup picture.

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6.1.2 Test Result.

Measurement Port	AC Main	Operation Mode	A (See 3.1)
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Test Result for Neutral.

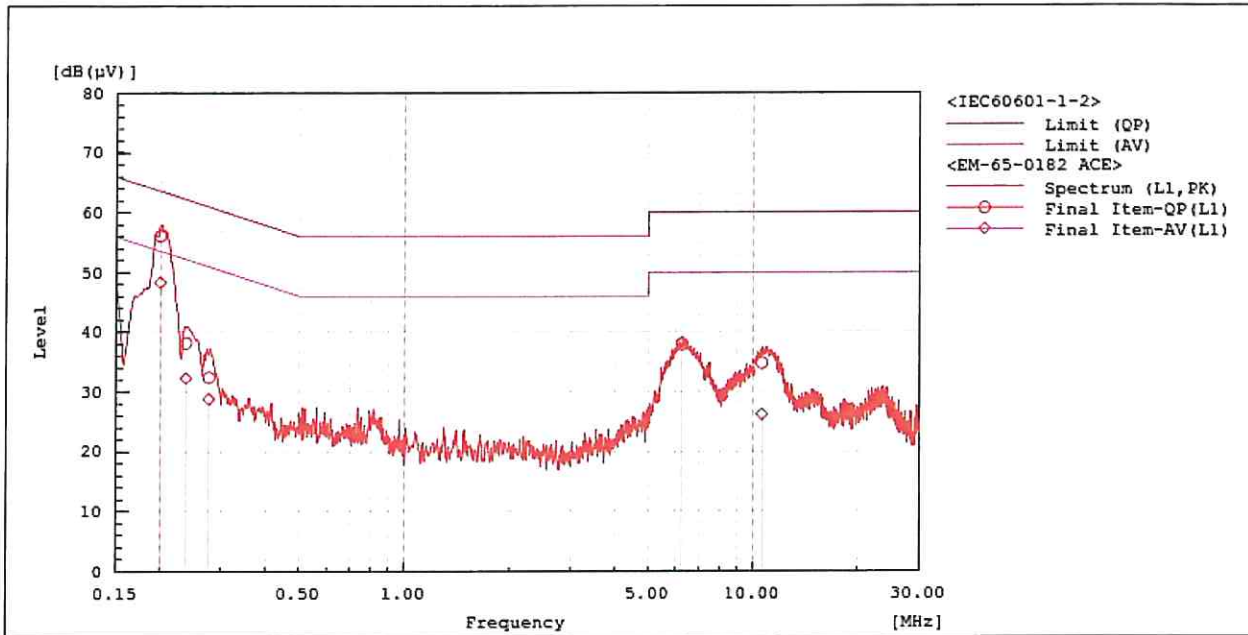


Measurement Result of Quasi-Peak and Average Detector

--- N Phase ---										
No.	Frequency	Reading QP	Reading CAV	c.f	Result QP	Result CAV	Limit QP	Limit AV	Margin QP	Margin CAV
	[MHz]	[dB (µV)]	[dB (µV)]	[dB]	[dB (µV)]	[dB (µV)]	[dB (µV)]	[dB (µV)]	[dB]	[dB]
1	0.1732	34.2	32.1	10.2	44.4	42.3	64.8	54.8	20.4	12.5
2	0.19894	46.0	37.5	10.2	56.2	47.7	63.7	53.7	7.5	6.0
3	0.23053	28.5	24.8	10.2	38.7	35.0	62.4	52.4	23.7	17.4
4	0.27039	23.2	19.6	10.2	33.4	29.8	61.1	51.1	27.7	21.3
5	4.88752	20.1	21.1	10.4	30.5	31.5	56.0	46.0	25.5	14.5
6	6.1409	28.0	28.3	10.5	38.5	38.8	60.0	50.0	21.5	11.2

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Test Result for Line 1.



Measurement Result of Quasi-Peak and Average Detector

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB (µV)]	Reading CAV [dB (µV)]	c.f [dB]	Result QP [dB (µV)]	Result CAV [dB (µV)]	Limit QP [dB (µV)]	Limit AV [dB (µV)]	Margin QP [dB]	Margin CAV [dB]
1	0.2002	45.9	38.1	10.2	56.1	48.3	63.6	53.6	7.5	5.3
2	0.23739	28.0	22.1	10.2	38.2	32.3	62.2	52.2	24.0	19.9
3	0.27581	22.2	18.6	10.2	32.4	28.8	60.9	50.9	28.5	22.1
4	6.2626	27.4	27.8	10.5	37.9	38.3	60.0	50.0	22.1	11.7
5	10.597	23.9	15.3	10.9	34.8	26.2	60.0	50.0	25.2	23.8

Result: Pass

Tested by: MR. Prajak Choieklin

6.2 Test Item: Radiated Disturbance

6.2.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
EMI Test Receiver	Rohde & Schwarz	ESU26	100572	DKD	12-09-22
Amplifier	Sonoma	310	186897	NIMT	27-04-22
Trilog - Broadband Antenna	SCHWARZBECK	VULB9162	9162-088	UKAS	25-05-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: ± 4.80 dB

- Test Location: TRM-002

- Test Environment

Temperature (°C)	25	Humidity (%)	56
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- Test Setup Description

The radiated emission measurement was performed with EMI receiver to observe the emission characteristic and identify the frequency of emission that has the highest amplitude relative to limit by operating the EUT with a typical configuration. The EUT configuration, cable configurations of operation are determined for producing the maximum level of emissions.

The EUT was placed on the 80 cm height non-metallic table on a 1 m radius turntable.

The Trilog antenna (30 MHz - 2GHz) were used for received the noise of EUT and put on the antenna mast, which they were inside the semi-anechoic chamber. The testing method and the EUT setup were performed according to CISPR11. The EUT configuration setup is shown in figures 4 and 5 respectively.

● Test Picture

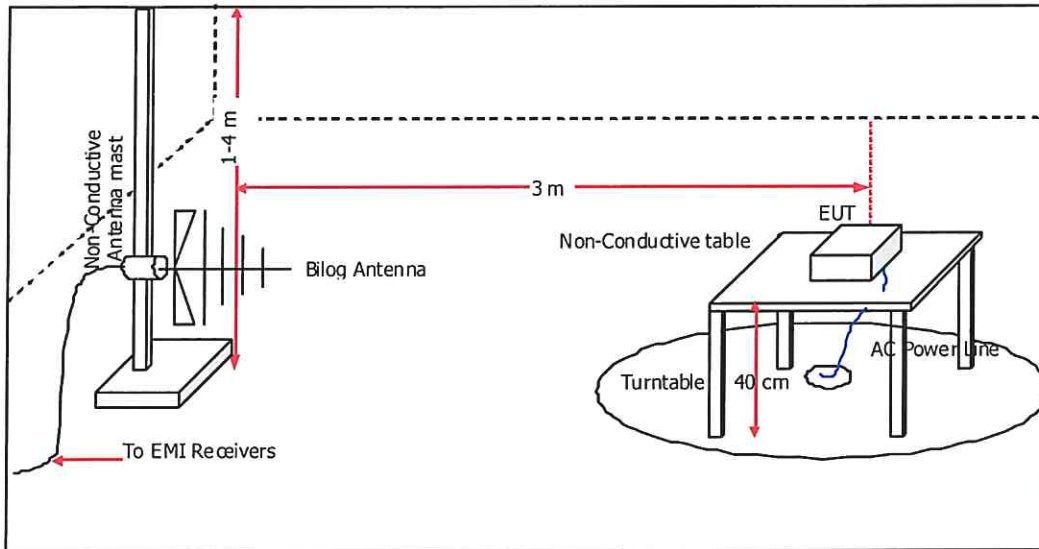


FIGURE 4 - The test setup diagram.



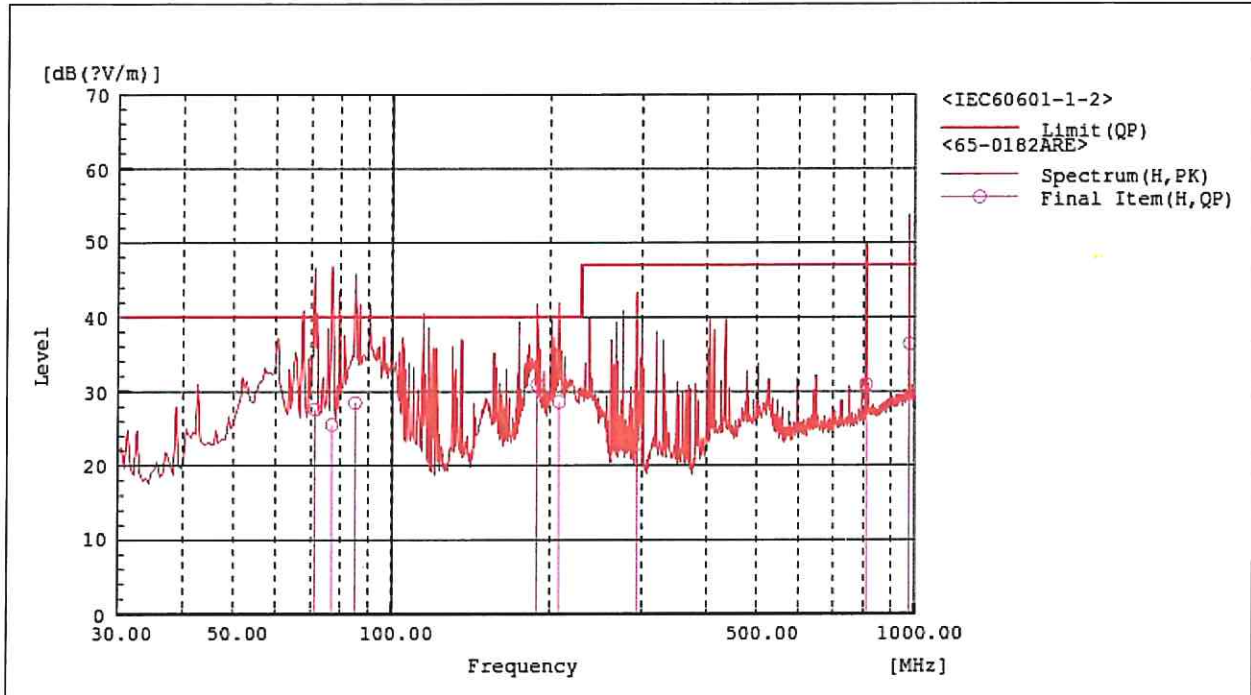
FIGURE 5 - The test setup picture.

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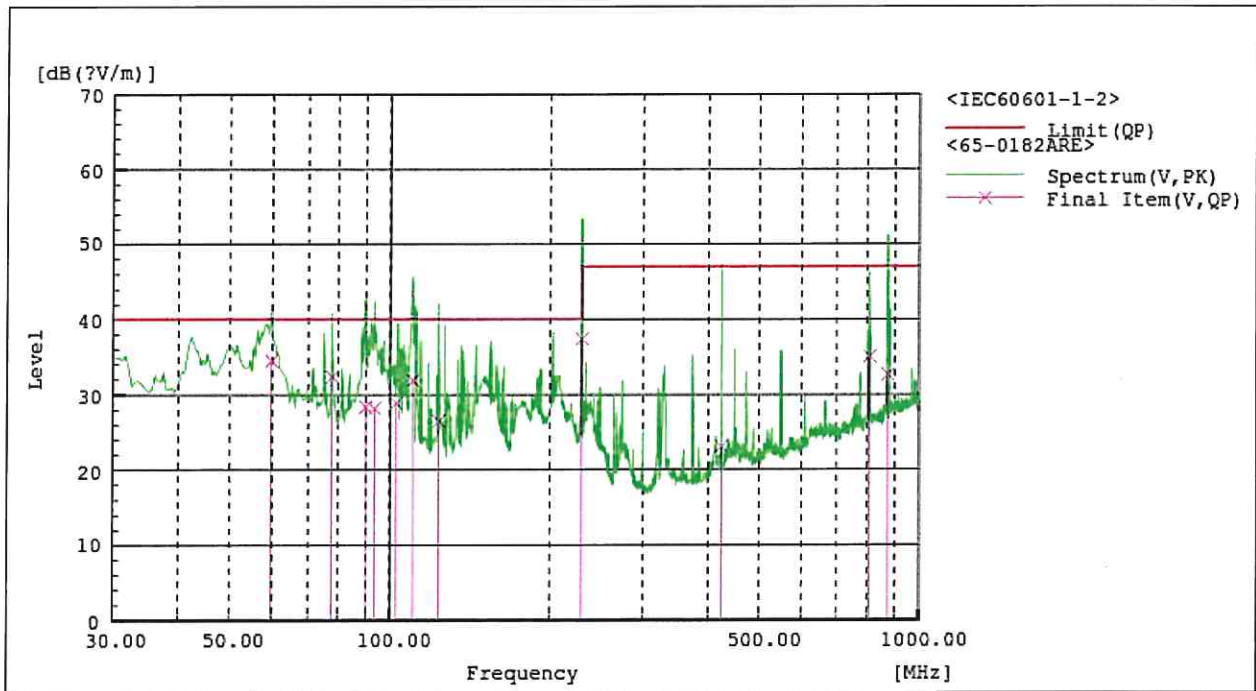
6.2.2 Test Result

Measurement Port	Enclosure	Operation Mode	A (See 3.1)
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Test result for horizontal polarization.



Test result for vertical polarization.



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Measurement Result of Peak and Average Detector

No.	Frequency [MHz]	(P)	Reading QP [dB (µV)]	c.f [dB (1/m)]	Result QP [dB (µV/m)]	Limit QP [dB (µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	71.080	H	45.8	-18.2	27.6	40.0	12.4	100.0	0.0
2	76.761	H	44.9	-19.4	25.5	40.0	14.5	100.0	0.0
3	85.064	H	47.0	-18.5	28.5	40.0	11.5	100.0	0.0
4	189.512	H	46.7	-15.8	30.9	40.0	9.1	100.0	0.0
5	208.304	H	43.5	-14.9	28.6	40.0	11.4	100.0	0.0
6	293.523	H	35.4	-12.5	22.9	47.0	24.1	100.0	0.0
7	807.590	H	33.2	-2.3	30.9	47.0	16.1	100.0	0.0
8	977.542	H	35.6	0.8	36.4	47.0	10.6	100.0	0.0
9	59.717	V	48.9	-14.4	34.5	40.0	5.5	100.0	0.0
10	77.635	V	51.8	-19.4	32.4	40.0	7.6	100.0	0.0
11	89.872	V	45.7	-17.3	28.4	40.0	11.6	100.0	0.0
12	93.368	V	44.9	-16.7	28.2	40.0	11.8	100.0	0.0
13	102.751	V	42.8	-13.9	28.9	40.0	11.1	100.0	0.0
14	110.412	V	47.6	-15.7	31.9	40.0	8.1	100.0	0.0
15	123.522	V	44.3	-17.8	26.5	40.0	13.5	100.0	0.0
16	230.155	V	51.5	-14.1	37.4	47.0	9.6	100.0	0.0
17	423.498	V	32.6	-9.5	23.1	47.0	23.9	100.0	0.0
18	806.457	V	37.4	-2.3	35.1	47.0	11.9	100.0	0.0
19	873.305	V	33.8	-1.1	32.7	47.0	14.3	100.0	0.0

Result: Pass

Tested by: MR. Prajak Choieklin

6.3 Test Item: Harmonic Emission

6.3.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
Signal Conditioning Unit	TESEQ	CCN1000-3	1347A01034	A2LA	18-04-22
AC-Power Source	TESEQ	NSG1007	1347A01034	-	18-04-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: $\pm 3.85\%$

- Test Location: Test area

- Test Environment

Temperature (°C)	25	Humidity (%)	55
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- Test Setup Description

The harmonic load currents were measured according to EN 61000-3-2. The EUT was connected to AC power source, which was decoupled from the public mains connection. The analysis was performed with a measurement in a time domain of transient harmonic load currents. The data was transformed into a frequency range and assessed up to the 40th harmonic by using the Discrete Fourier Transforms. The EUT configuration for the harmonic current emission testing is shown in FIGURE 6 and 7, respectively.

● Test Picture

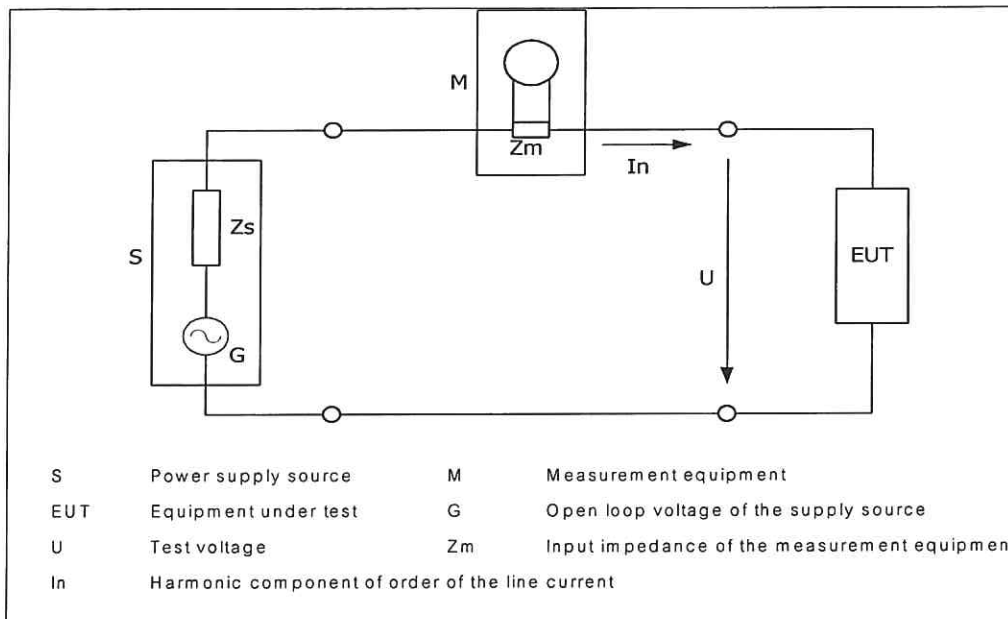


FIGURE 6 - The setup diagram.



FIGURE 7 - The test setup picture.

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6.3.2 Test Result

Measurement Port		AC Main		Operation Mode		A (See 3.1)	
Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.002	1.080	N/A	0.008	1.620	N/A	Pass
3	0.048	2.300	2.1	0.073	3.450	2.1	Pass
4	0.001	0.430	N/A	0.007	0.645	N/A	Pass
5	0.026	1.140	2.2	0.033	1.710	1.9	Pass
6	0.001	0.300	N/A	0.005	0.450	N/A	Pass
7	0.033	0.770	4.3	0.048	1.155	4.2	Pass
8	0.001	0.230	N/A	0.003	0.345	N/A	Pass
9	0.024	0.400	6.1	0.041	0.600	6.8	Pass
10	0.001	0.184	N/A	0.002	0.276	N/A	Pass
11	0.010	0.330	3.1	0.016	0.495	3.2	Pass
12	0.001	0.153	N/A	0.002	0.230	N/A	Pass
13	0.009	0.210	4.1	0.017	0.315	5.3	Pass
14	0.001	0.131	N/A	0.001	0.197	N/A	Pass
15	0.009	0.150	5.7	0.018	0.225	7.9	Pass
16	0.001	0.115	N/A	0.002	0.173	N/A	Pass
17	0.006	0.132	4.2	0.011	0.198	5.8	Pass
18	0.001	0.102	N/A	0.001	0.153	N/A	Pass
19	0.007	0.118	6.3	0.014	0.178	7.9	Pass
20	0.001	0.092	N/A	0.001	0.138	N/A	Pass
21	0.005	0.107	5.0	0.011	0.161	7.0	Pass
22	0.001	0.084	N/A	0.001	0.125	N/A	Pass
23	0.005	0.098	5.3	0.008	0.147	5.6	Pass
24	0.001	0.077	N/A	0.001	0.115	N/A	Pass
25	0.005	0.090	N/A	0.008	0.135	N/A	Pass
26	0.001	0.071	N/A	0.001	0.107	N/A	Pass
27	0.004	0.083	N/A	0.006	0.125	N/A	Pass
28	0.001	0.066	N/A	0.001	0.099	N/A	Pass
29	0.004	0.078	N/A	0.006	0.116	N/A	Pass
30	0.000	0.061	N/A	0.001	0.092	N/A	Pass
31	0.003	0.073	N/A	0.006	0.109	N/A	Pass

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Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
32	0.000	0.058	N/A	0.001	0.086	N/A	Pass
33	0.003	0.068	N/A	0.005	0.102	N/A	Pass
34	0.000	0.054	N/A	0.001	0.081	N/A	Pass
35	0.003	0.064	N/A	0.006	0.096	N/A	Pass
36	0.000	0.051	N/A	0.001	0.077	N/A	Pass
37	0.003	0.061	N/A	0.006	0.091	N/A	Pass
38	0.000	0.048	N/A	0.001	0.073	N/A	Pass
39	0.002	0.058	N/A	0.005	0.087	N/A	Pass
40	0.000	0.046	N/A	0.001	0.069	N/A	Pass

Result: Pass

Tested by: MR. Prajak Choieklin

6.4 Test Item: Voltage Fluctuation

6.4.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
Signal Conditioning Unit	TESEQ	CCN1000-3	1347A01034	A2LA	18-04-22
Three Phase Impedance Network	TESEQ	INA2197	1347A01034	A2LA	18-04-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: $\pm 2.46\%$

- Test Location: Test area

- Test Environment

Temperature (°C)	25	Humidity (%)	56
------------------	----	--------------	----

- Test Setup Description

The Voltage fluctuation (flicker) was tested according to EN61000-3-3. The EUT was decoupled from the public main and connected to the reference impedance according to IEC 725. The voltage fluctuation testing was performed automatically with the Harmonic & Flicker Analyzer and the software. The EUT was operated continuously. The measurement was made after a steady state has been reached. The EUT configuration for the voltage fluctuation testing is shown in FIGURE 8 and 9, respectively.

● Test Picture

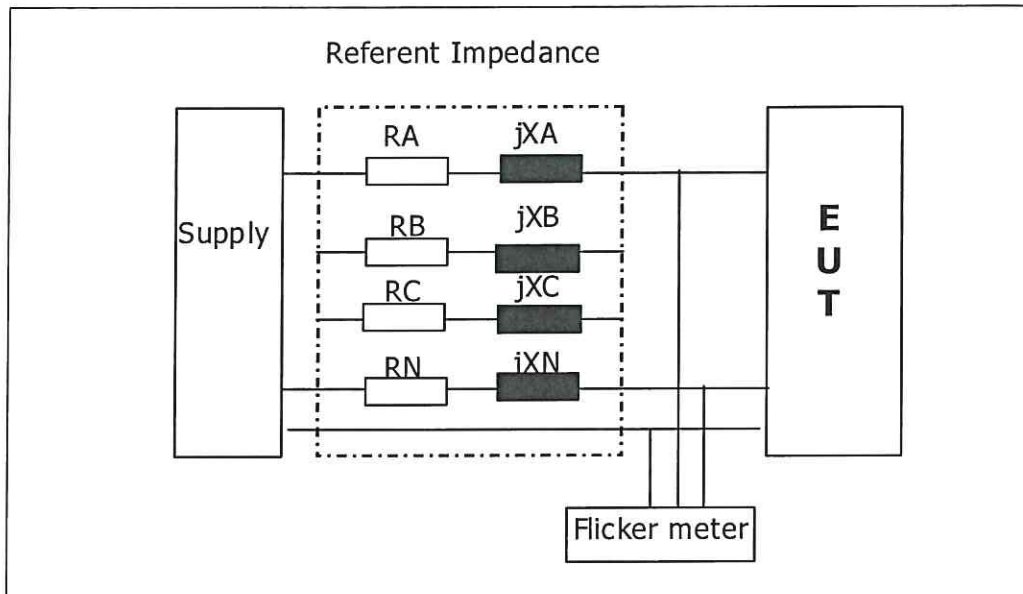


FIGURE 8 - The setup diagram.



FIGURE 9 - The test setup picture.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.4.2 Test Result

Measurement Port	AC Main	Operation Mode	A (See 3.1)
------------------	---------	----------------	-------------

Maximum Flicker Results

T-max (mS):	0.0	Test limit (mS):	500.0	Pass
Highest dc (%):	0.68	Test limit (%):	3.30	Pass
Highest dmax (%):	0.82	Test limit (%):	4.00	Pass
Highest Pst (10 min. period):	0.164	Test limit:	1.000	Pass
Highest Plt (2 hr. period):	0.097	Test limit:	0.650	Pass

Result: Pass

Tested by: MR. Prajak Choieklin

6.5 Test Item: Electrostatic Discharge

6.5.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
ESD Generator	TESEQ	NSG438	1226	NIST	02-03-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: $\pm 7.09 \%$

- Test Location: Test area

- Test Environment

Temperature ($^{\circ}\text{C}$)	25	Humidity (%)	55
------------------------------------	----	--------------	----

- Test Setup Description

The ESD was executed at a few weak points which can be normally touched by an operator or customer. The repetition rate between the impulses was at least 1 sec. The EUT was placed on the ground plane. The test points are shown in Figure 10.

The EUT configuration and diagram for the electrostatic discharge testing are shown in FIGURE 11 and 12 respectively. The parameters of the ESD generator and the critical test point are shown in above Table.

Electrostatic Discharge Testing Description

No.	Test Points	Type of Testing	Test Voltage (KV)	Number of Discharge per pol.	Operation Mode (see3.1)	Performance Criterion
1	A1-A4	Air	$\pm 2, \pm 4, \pm 8 \pm 15$	10	A	B
2	C5-C14	Contact	± 8	10	A	B
3	VCP	Contact	± 8	10	A	B

● Test Picture

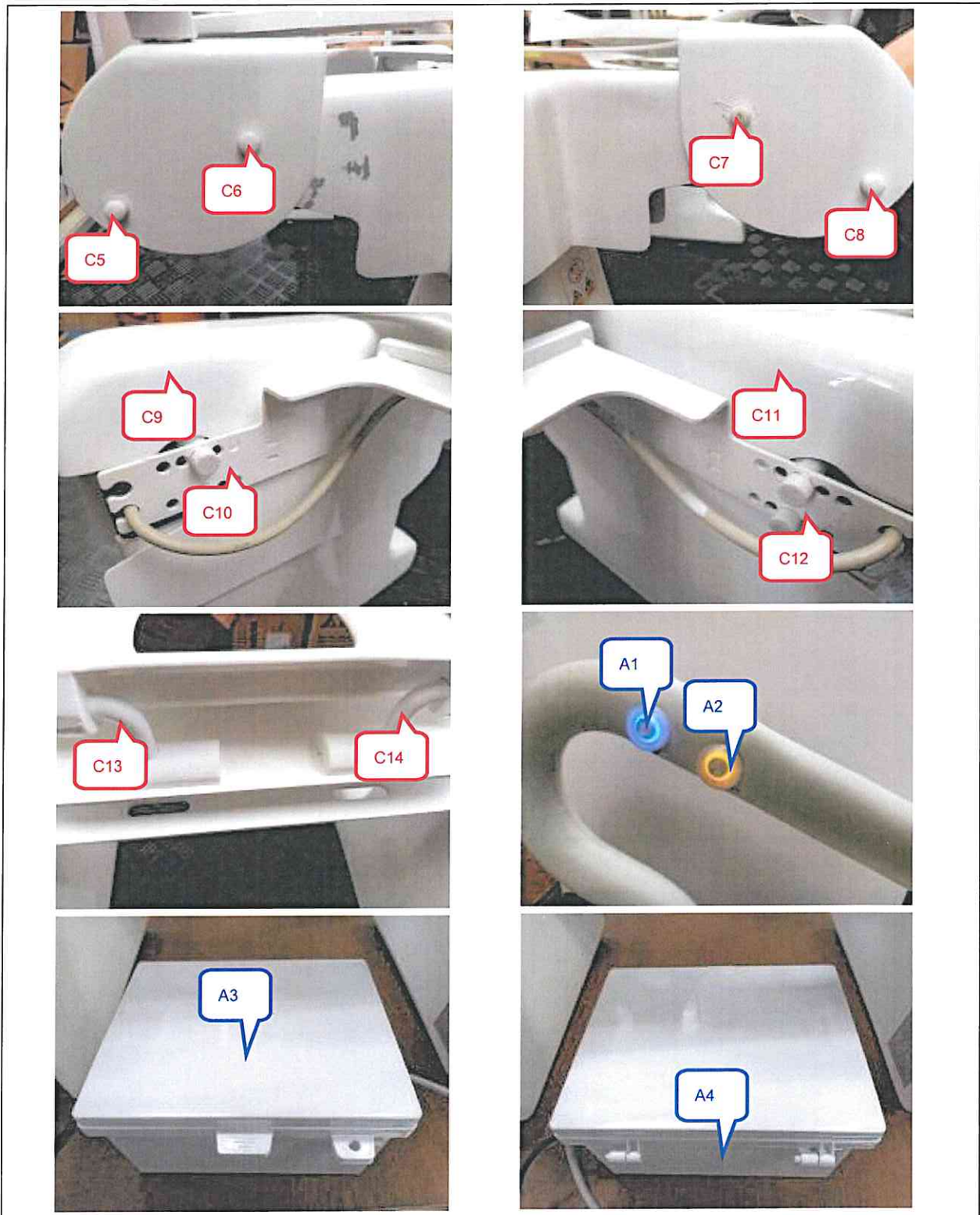


FIGURE 10 - Test points.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

• Test Picture

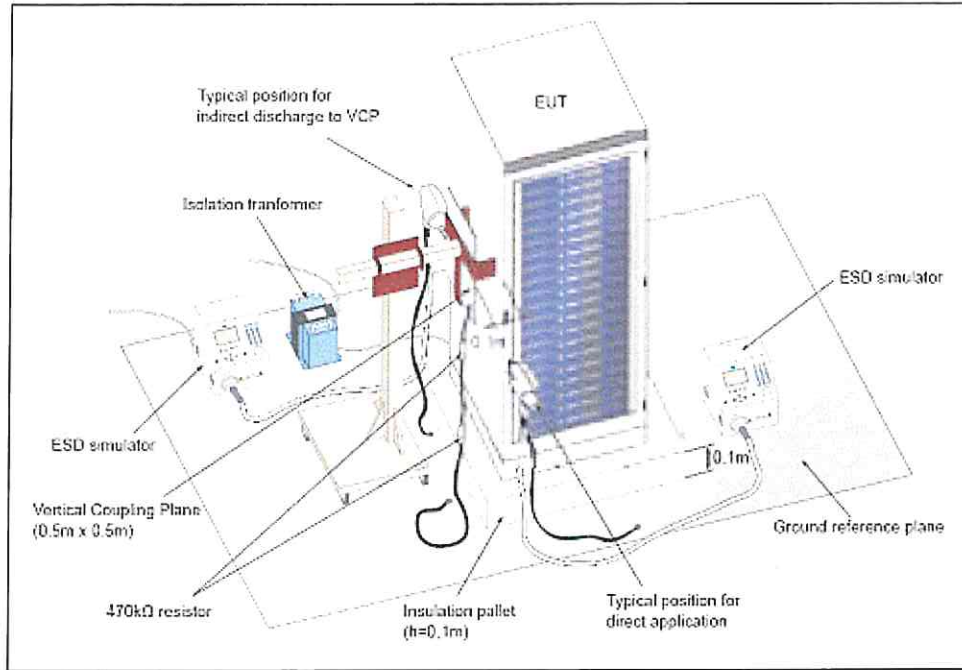


FIGURE 11 - The setup diagram.



FIGURE 12 - The test setup picture.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.5.2 Test Result

Contact Discharge

Test Point	Operation Mode	Test Execution							
		ESD Test Level (kV) / Number of Discharge (Times)							
		+ 2/10	- 2/10	+ 4/10	- 4/10	+ 8/10	- 8/10	+ 15/10	- 15/10
C5	A	-	-	-	-	NORM	NORM	-	-
C6	A	-	-	-	-	NORM	NORM	-	-
C7	A	-	-	-	-	NORM	NORM	-	-
C8	A	-	-	-	-	NORM	NORM	-	-
C9	A	-	-	-	-	NORM	NORM	-	-
C10	A	-	-	-	-	NORM	NORM	-	-
C11	A	-	-	-	-	NORM	NORM	-	-
C12	A	-	-	-	-	NORM	NORM	-	-
C13	A	-	-	-	-	NORM	NORM	-	-
C14	A	-	-	-	-	NORM	NORM	-	-
VCP	A	-	-	-	-	NORM	NORM	-	-

Note: “-”: Not Test “ND”: Not Discharge “NORM”: Normal “AB”: Abnormal

Air Discharge

Test Point	Operation Mode	Test Execution							
		ESD Test Level (kV) / Number of Discharge (Times)							
		+ 2/10	- 2/10	+ 4/10	- 4/10	+ 8/10	- 8/10	+ 15/10	- 15/10
A1	A	ND	ND	ND	ND	ND	ND	ND	ND
A2	A	ND	ND	ND	ND	ND	ND	ND	ND
A3	A	ND	ND	ND	ND	ND	ND	ND	ND
A4	A	ND	ND	ND	ND	ND	ND	ND	ND

Note: “-”: Not Test “ND”: Not Discharge “NORM”: Normal “AB”: Abnormal

Phenomena Observed/Comments
-

Result: Pass

Tested by: MR. Prajak Choieklin

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.6 Test Item: Radiated Immunity

6.6.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
RF Generator	TESEQ	ITS6006	37556	NIST	15-05-22
Power Meter	TESEQ	PM6006	74528	NIST	15-05-22
Power Meter	TESEQ	PM6006	74529	NIST	15-05-22
Power Meter	TESEQ	PM6006	74530	NIST	15-05-22
Power Amplifier	TESEQ	CBA1G-275	T44430	NIST	15-05-22
Power Amplifier	TESEQ	CBA3G-100	T44429	NIST	15-05-22
RF immunity testing	TESEQ	AS1860-50	1067826	NIST	15-05-22
Bilog Antenna	AR	ATL80M1G	0343177	NIST	15-05-22
Horn Antenna	AMETEK	AM0.2-2HA	14635	NIST	19-05-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: ± 1.78 dB

- Test Location: TRM-004

- Test Environment

Temperature (°C)	25	Humidity (%)	55
------------------	----	--------------	----

- Test Setup Description

The RF power used in this testing was pre-calibrated according to the IEC61000-4-3 standard. The EUT was placed in the Compact hydride Chamber (TRM-004). The EUT was placed only four side directly to the antenna. The transmitter antenna was operated in both the vertical and horizontal polarizations. The tested frequencies for the both polarization of the antenna ranges were scanned from 80 MHz to 2700 MHz.

The EUT was located on the table in the uniform field area. The distance between the transmitter antenna and the outer edge of the EUT was 3 meters. The EUT configurations for radiated immunity testing are shown in FIGURE 13 and 14.

● Test Picture

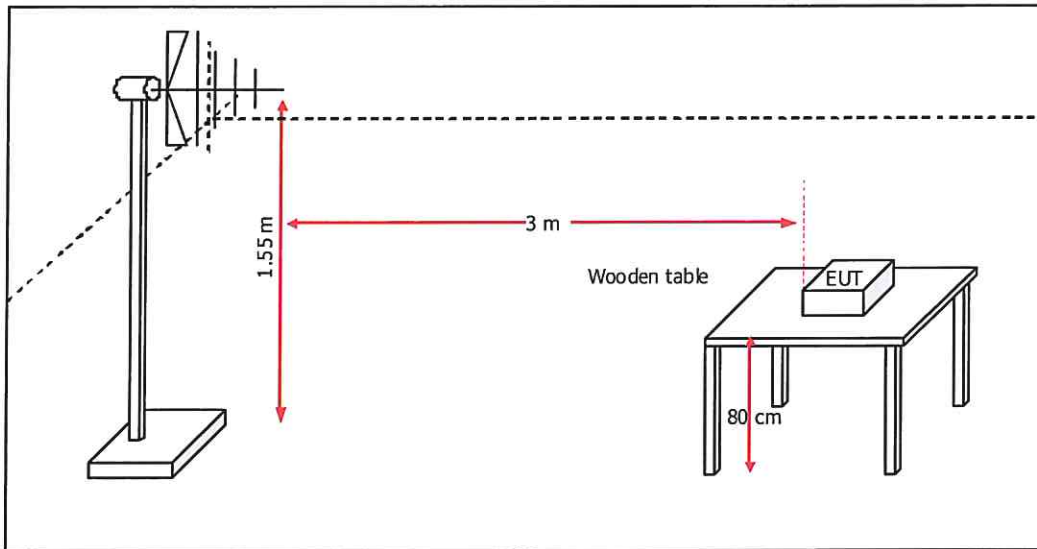


FIGURE 13 - The setup diagram.



FIGURE 14 - The test setup picture.

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6.6.2 Test Result

Test Condition 1					
Operation Mode	A (See 3.1)				
Test Level:	3V/m	Start Frequency:	80 MHz	Stop Frequency:	1000 MHz
Step Size:	1%	Modulation Frequency:	1 kHz	Modulation Type:	AM, 80%
Step mode:	Log	Dwell time	3 s	Port:	Enclosure
Side	Polarity		Result		
Front	Vertical		NORM		
Front	Horizontal		NORM		
Right	Vertical		NORM		
Right	Horizontal		NORM		
Back	Vertical		NORM		
Back	Horizontal		NORM		
Left	Vertical		NORM		
Left	Horizontal		NORM		

Note: “-“ : Not Test “NORM” : Normal “AB” : Abnormal

Phenomena Observed/Comments
-

Test Condition 2					
Operation Mode	A (See 3.1)				
Test Level:	3 V/m	Start Frequency:	1000MHz	Stop Frequency:	2700 MHz
Step Size:	1%	Modulation Frequency:	1kHz	Modulation Type:	AM, 80%
Step mode:	Log	Dwell time	3 s	Port:	Enclosure
Side	Polarity		Result		
Front	Vertical		NORM		
Front	Horizontal		NORM		
Right	Vertical		NORM		
Right	Horizontal		NORM		
Back	Vertical		NORM		
Back	Horizontal		NORM		
Left	Vertical		NORM		
Left	Horizontal		NORM		

Note: “-“ : Not Test “NORM” : Normal “AB” : Abnormal

Phenomena Observed/Comments
-

Result: Pass

Tested by: MR. Prajak Choieklin

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.7 Test Item: Electrical Fast Transient

6.7.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacturer	Model	S/N	Traceability	Due Date
EFT Simulator	TESEQ	NSG 3040/ CDN 3043/ FTM 3425-40	1943/2026/419	NIST	19-05-22
Capacitive Coupling Clamp	TESEQ	CDN 3425	1752	-	-

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: $\pm 5.03 \%$

- Test Location: Test area

- Test Environment

Temperature ($^{\circ}\text{C}$)	25	Humidity (%)	52
------------------------------------	----	--------------	----

- Test Setup Description

The EUT was placed on the ground reference plane. The EUT was arranged and connected to the auxiliary equipment for operating. The distance from the EUT to other conductive materials was more than 0.5 m. For the power line testing, the coupling decoupling network (CDN) was used for coupling the EFT signal to the EUT's power line. The distance between the EUT and the CDN was 0.5 m. For the control line testing, the capacitive coupling clamp (CCL) was used for coupling the EFT signal to the EUT's control line. The distance between the EUT and the CCL was 0.5 m. The EUT configuration for the electrical fast transient testing is shown in FIGURE 15 and 16 respectively.

The Electrical Fast Transient Testing Descriptions

Test Line	Voltage	Port	Repetition Rate (kHz)	During Time (Sec/Polarity)	Performance criteria
L-N	$\pm 2 \text{ kV}$	AC	100	120	B
N-G	$\pm 2 \text{ kV}$	AC	100	120	B

● Test Picture

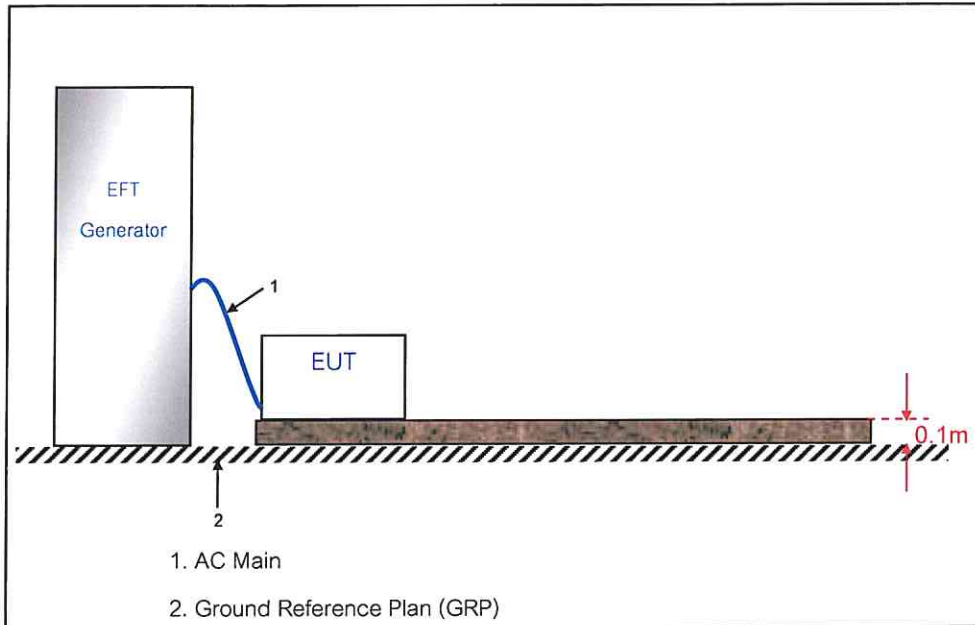


FIGURE 15 - The setup diagram.



FIGURE 16 - The test setup picture.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.7.2 Test Result

Test Parameters			
Rise time :	5 ns	Period Time :	300 ms
Impulse Duration :	50 ns	Duration of Burst :	15 ms
Positive Burst :	1 min	Negative Burst :	1 min

Test Line	Voltage (kV)	Port	Repetition Rate (kHz)	During Time (s /Polarity)	Result
L-N	± 2 kV	AC Main	100	120	NORM
N-G	± 2 kV	AC Main	100	120	NORM

Note: “-“: Not Test “NORM”: Normal “AB”: Abnormal

Phenomena Observed/Comments
-

Result: Pass

Tested by: MR. Prajak Choieklin

6.8 Test Item: Surge

6.8.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
Surge Simulator	TESEQ	NSG3040/ CDN 3043/ CWM 3450-40	1943/2026/1093	NIST	17-05-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: $\pm 6.78 \%$

- Test Location: Test area

- Test Environment

Temperature ($^{\circ}\text{C}$)	25	Humidity (%)	56
------------------------------------	----	--------------	----

- Test Setup Description

The EUT was placed the ground reference plane. The EUT was arranged and connected to the auxiliary equipment for operating. The distance from the EUT to the other conductive materials was more than 1 m.

For the Surge testing of the power line, the CDN (coupling decoupling network) was used for coupling the surge to the EUT. The AC power cord between EUT and CDN was 1 m. The EUT configuration for the surge immunity testing is shown in FIGURE 17 and 18 respectively.

Surge Testing Description

Voltage (kV)	Test Point	Port	Number of apply Per polarity	Phase angle	Performance criteria
± 1	L - N	AC	5	$0^{\circ}, 90^{\circ}, 180^{\circ}, 270^{\circ}$	B
± 2	N - G	AC	5	$0^{\circ}, 90^{\circ}, 180^{\circ}, 270^{\circ}$	B

● Test Picture

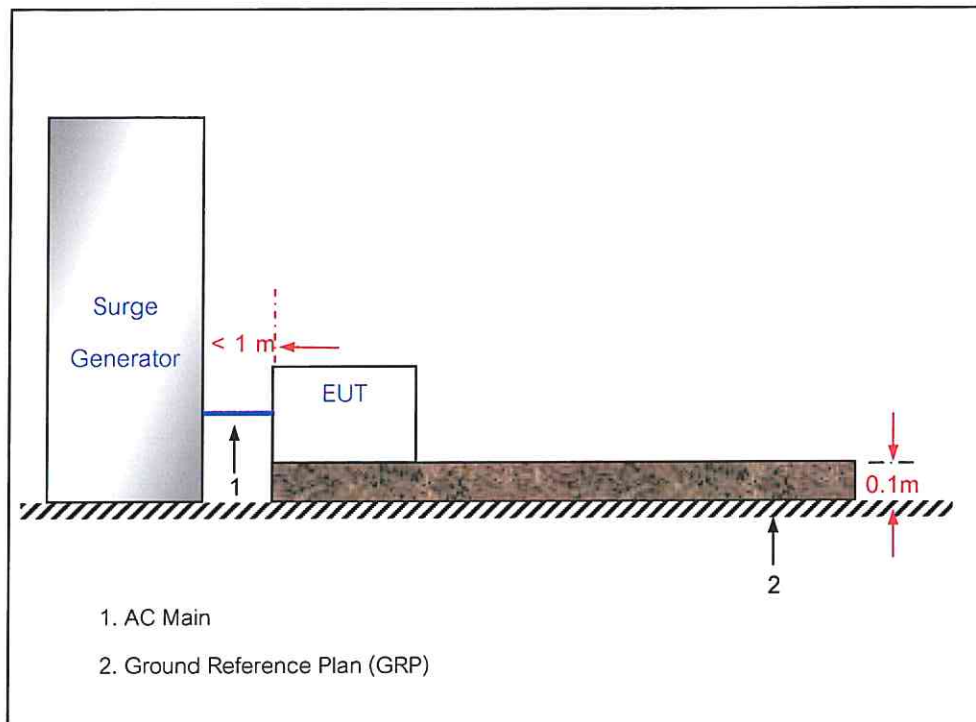


FIGURE 17 - The setup diagram.

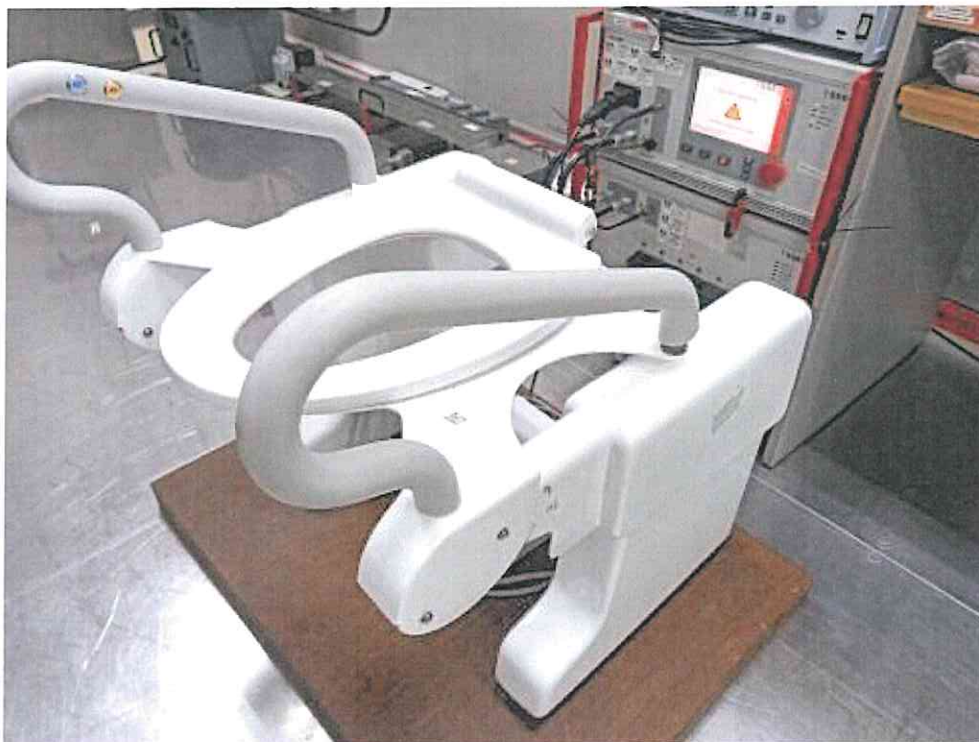


FIGURE 18 - The test setup picture.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.8.2 Test Result

Test Parameters									
Wave Form:	1.2/50 μ S	Generator Source Impedance:	2 Ω	Surge Repetition Rate:	1Pulse/min				
Coupling Mode	Phase	+ 0.5 kV	- 0.5 kV	+ 1 kV	- 1 kV	+ 2 kV	- 2 kV	+ 3 kV	- 3 kV
L - N	0 $^{\circ}$, 90 $^{\circ}$, 180 $^{\circ}$, 270 $^{\circ}$	-	-	NORM	NORM	-	-	-	-

Note: “-”: Not Test “NORM”: Normal “AB”: Abnormal

Test Parameters									
Wave Form:	1.2/50 μ S	Generator Source Impedance:	12 Ω	Surge Repetition Rate:	1Pulse/min				
Coupling Mode	Phase	+ 0.5 kV	- 0.5 kV	+ 1 kV	- 1 kV	+ 2 kV	- 2 kV	+ 3 kV	- 3 kV
N - G	0 $^{\circ}$, 90 $^{\circ}$, 180 $^{\circ}$, 270 $^{\circ}$	-	-	-	-	NORM	NORM	-	-

Phenomena Observed/Comments
-

Tested by: MR. Prajak Choieklin

Result: Pass

6.9 Test Item: Conducted Immunity

6.9.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
EM clamp	TESEQ	KEMZ 801AS50	38662	TESEQ	15-06-22
Compact immunity test system	TESEQ	NSG 4070B-30	39604	DKD	04-05-22
Dual directional coupler	TESEQ	DCP 0100A	40093	TESEQ	04-05-22
Power Amplifier	TESEQ	CBA400M-110	T44431	TESEQ	20-05-22
Current injection probe	TESEQ	CIP 9136A	35442	TESEQ	15-05-22
Coupling/Decoupling network	TESEQ	CDN M332S	37751	TESEQ	14-05-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: ± 2.09 dB

- Test Location: Test area

- Test Environment

Temperature (°C)	25	Humidity (%)	55
------------------	----	--------------	----

- Test Setup Description

The EUT was set up according to IEC61000-4-6. The EUT was placed on the 10 cm high isolator above the ground reference plane. The power cord and signal line were placed on the 3-5 cm high non-metallic supporting above the ground reference plane. The conducted interference signal was connected to the 6 dB attenuator before connected to the CDN and the EM-Clamp for injecting the RF signal to the EUT at the power cord and the signal line respectively. The test setup diagram and the test setup picture are shown in the FIGURE 19 and 20.

● Test Picture

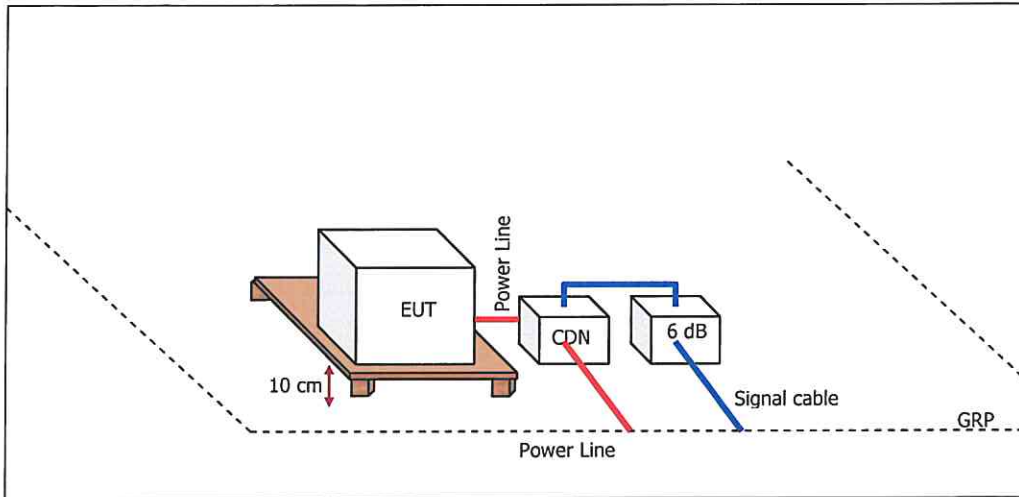


FIGURE 19 - The setup diagram.

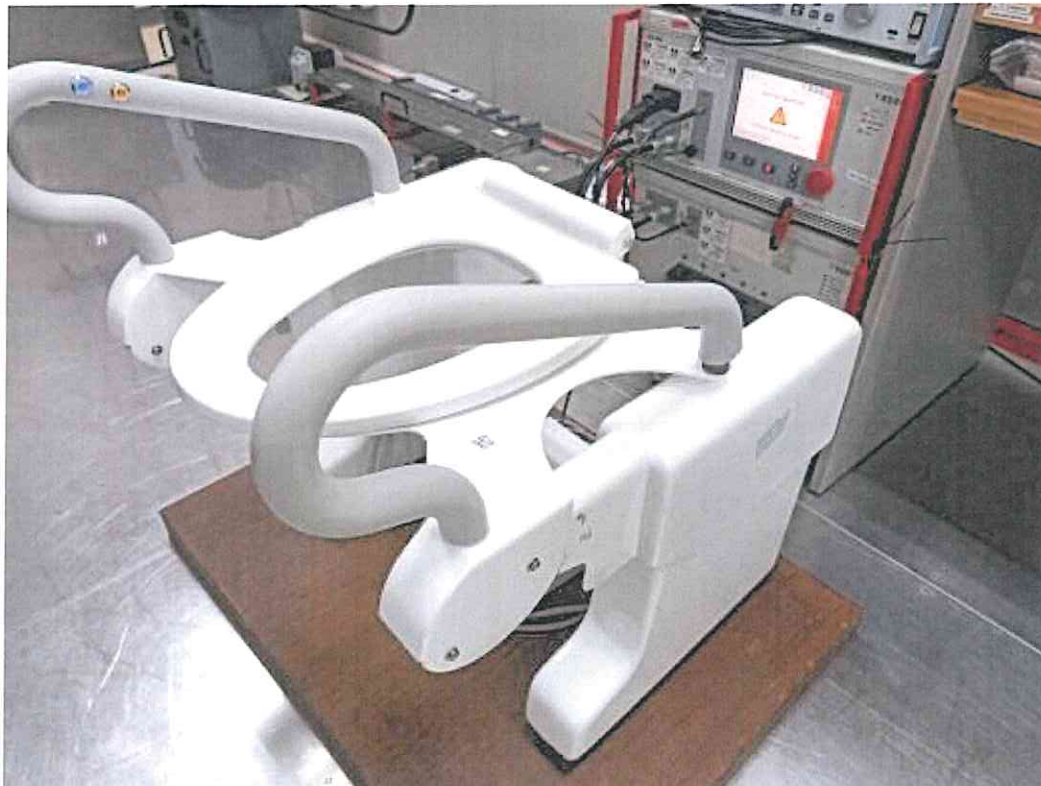


FIGURE 20 - The test setup picture.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

141 Thailand Science Park (TSP) Innovation Cluster 2 Tower D, Phahonyothin Road Khlong Nueng, Khlong Luang Pathum Thani
12120 Thailand

Tel 02-117-8600, Fax 02-117-8625, website www.ptec.or.th

6.9.2 Test Result

Test port	Test level	Frequency	Step frequency	Modulation	Dwell time	Result
AC Power Line	3 V	0.150 MHz - 80 MHz	1% Log	AM 80% with 1kHz	3 s	NORM

Note: “-“ : Not Test “NORM” : Normal “AB” : Abnormal

Phenomena Observed/Comments
-

Result: Pass

Tested by: MR. Prajak Choieklin

6.10 Test Item: Power Frequency Magnetic

6.10.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
Induction Coil Interface	TESEQ	INA2141	1423	UKAS	06-05-22
Induction Coil	TESEQ	INA703	1987	UKAS	06-05-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: $\pm 1.15\%$

- Test Location: TRM-004

- Test Environment

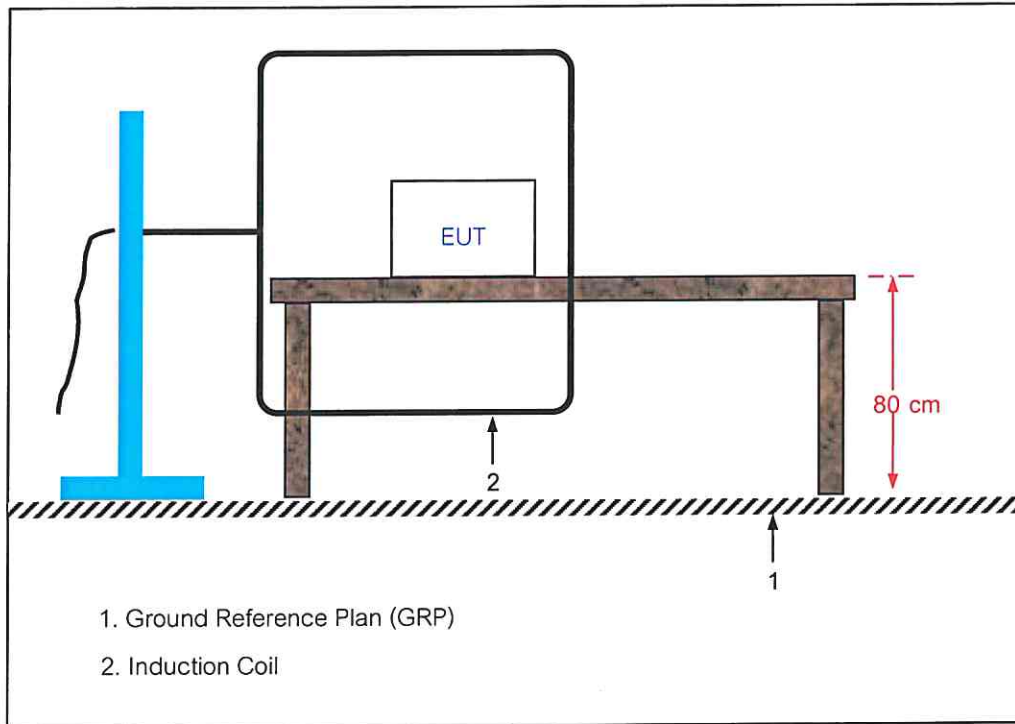
Temperature ($^{\circ}\text{C}$)	25	Humidity (%)	52
------------------------------------	----	--------------	----

- Test Setup Description

The power frequency magnetic field was tested according to the immersion method of EN61000-4-8.

The induction coil was rotated by 90° in order to expose the EUT to the test field with different orientations. The EUT was placed on the reference ground plane is shown in the FIGURE 21 and 22.

● Test Picture



- 1. Ground Reference Plan (GRP)
- 2. Induction Coil

FIGURE 21 - The setup diagram.

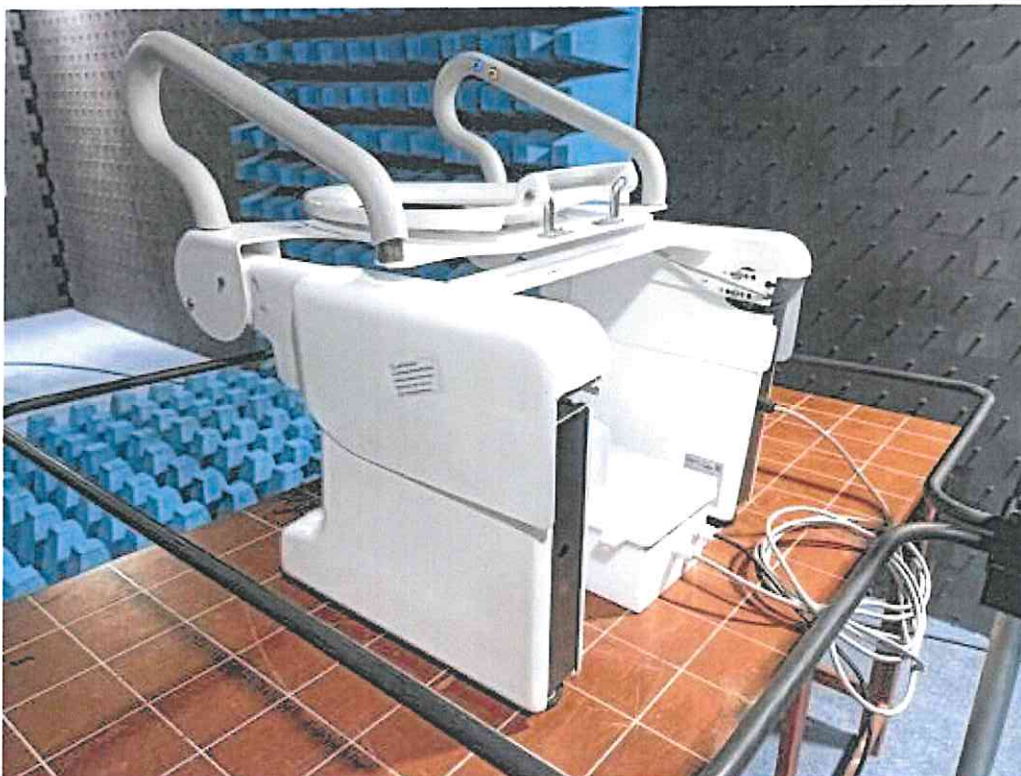


FIGURE 22 - The test setup picture.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.10.2 Test Result

Magnetic Field (A/m)	Axis	Result
30 A/m	X,Y,Z	NORM

Note: “-” : Not Test “NORM” : Normal “AB” : Abnormal

Phenomena Observed/Comments
-

Result: Pass

Tested by: MR. Prajak Choieklin

6.11 Test Item: Voltage Dips

6.11.1 Test Setup

- Test Specification

See 1 and 2.1

- Test Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
PQF Simulator	TESEQ	NSG 3041/ PQM 3403/ INA 6501	1943/1035/223	NIST	18-05-22

- Customer's Equipment

Equipment Name	Manufacture	Model	S/N	Traceability	Due date
-	-	-	-	-	-

- Test Uncertainty: $\pm 4.83\%$

- Test Location: Test area

- Test Environment

Temperature ($^{\circ}\text{C}$)	25	Humidity (%)	55
------------------------------------	----	--------------	----

- Test Setup Description

The EUT was placed on the ground reference plane. The power cord of the EUT is 1 meter and it was connected to the voltage dip and the interruption generator. The EUT was arranged and connected to the auxiliary equipment for operating.

The EUT configuration for the voltage dip and the short interruption testing are shown in FIGURE 23 and 24 respectively.

The voltage dip and the interruption testing descriptions.

Phenomena	Test Level in% (ut)	Cycle	Phase angle	Performance criteria
V. Dip	0	0.5	$0^{\circ}, 45^{\circ}, 90^{\circ}, 135^{\circ}, 180^{\circ}, 225^{\circ}, 270^{\circ}, 315^{\circ}$	B
V. Dip	0	1	0°	C
V. Dip	70	25	0°	C
Interruption	0	250	0°	C

● Test Picture

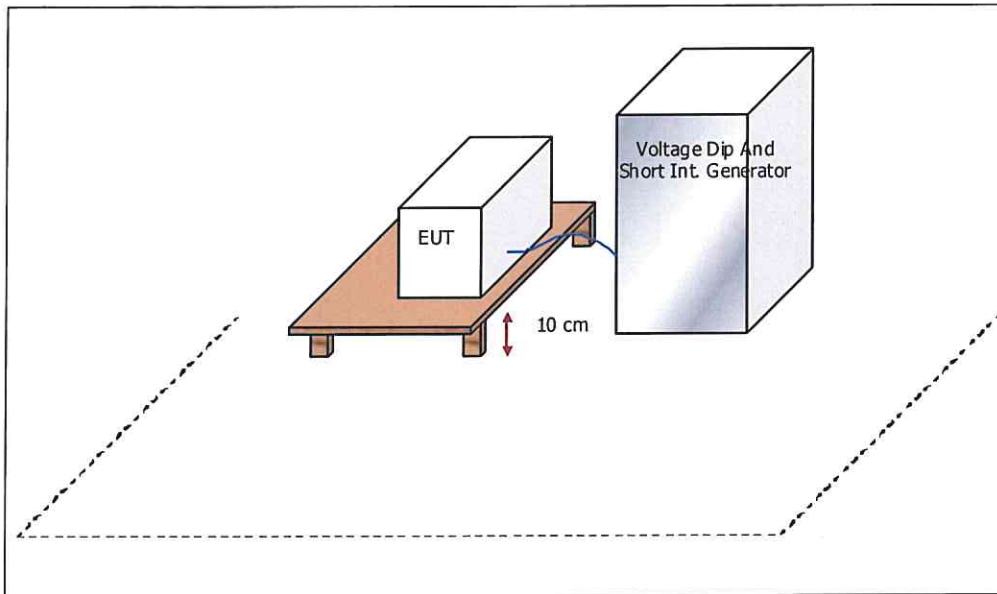


FIGURE 23 - The setup diagram.

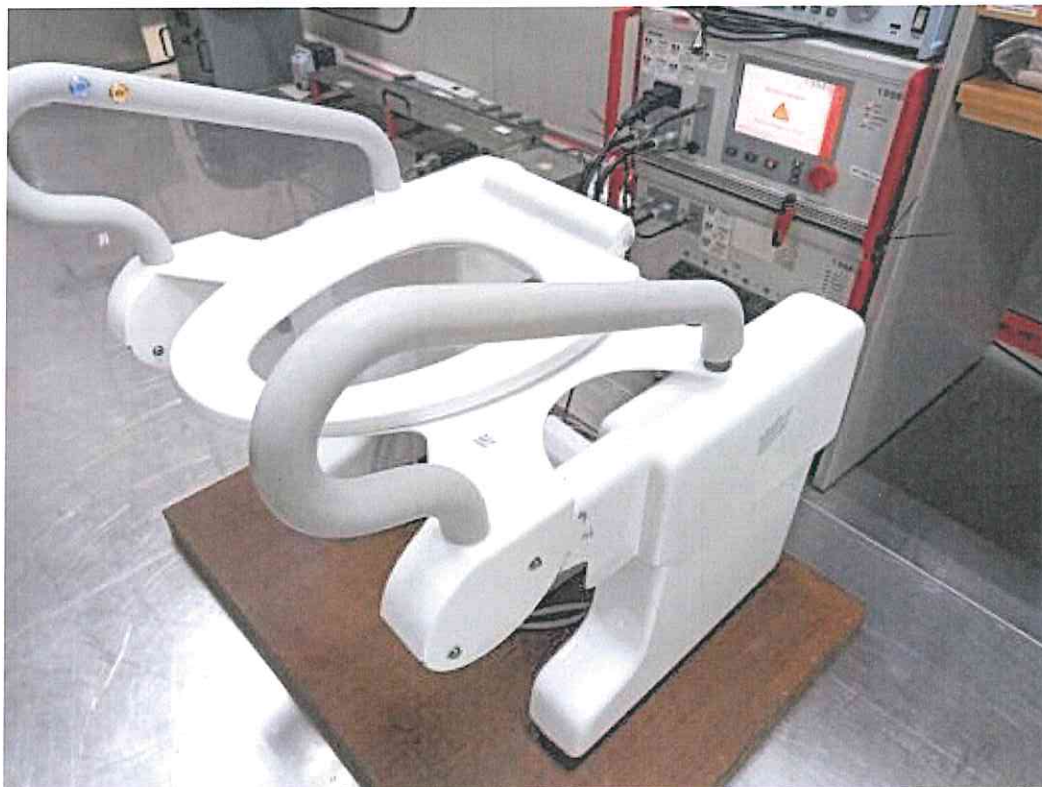


FIGURE 24 - The test setup picture.

This test report is test results from the EUT only, not the product's quality certificate. It shall not be reproduced except in full without the written approval of testing laboratory.

6.11.2 Test Result

Test Phenomena	Number of Test	I/P Voltage / Frequency	Test Level in% (ut)	Phase angle (°)	Cycle	Criteria	Result
V. Dip	3	230 V / 50Hz	0	0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°	0.5	B	NORM
V. Dip	3	230 V / 50Hz	0	0°	1	C	NORM
V. Dip	3	230 V / 50Hz	70	0°	25	C	NORM
Interruption	3	230 V / 50Hz	0	0°	250	C	NORM

Note: “-“ : Not Test “NORM” : Normal “AB” : Abnormal

Phenomena Observed/Comments
-

Result: Pass

Tested by: MR. Prajak Choieklin

----- End of Report -----