

Test Report

Report No. : HA0124NB020630EM
Applicant : Ningbo Zhongdi Industry & Trade Co., Ltd.
Address : Jishigang Industry Zone, Haishu District, Ningbo 315171, P. R. China
Trade Mark(s) : Zhongdi
Manufacturer : Same as the applicant
Address : Same as the applicant
Manufacturing site : Same as the applicant
Address : Same as the applicant

Equipment Under Test (EUT):

EUT Name : Soldering Iron Controller
Model/Type No. : ZD-98 200C, ZD-98 200B, ZD-98 30C, ZD-98 30B
Standards : Refer to page 2
Date of Receipt : February 29, 2024
Date of Test : March 01, 2024 to March 14, 2024
Date of Issue : March 15, 2024
Test Result : **PASS***

Prepared By:

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Prepared By



Bill Dong

Engineer

Reviewed By



Milse xie

Technical Manager

*The test results have been reviewed against the Directives above and found to meet their essential requirement. The results shown in this test report refer only to the sample(s) tested. This document cannot be reproduced except in full, without prior written approval of HATEK.

1 Test Summary

1.1 Test Items

Test Items	Result
Disturbance Voltage on Mains Terminal 0.15MHz- 30MHz	P
Discontinuous Disturbance Voltage/Click	P
Continuous Disturbance Power, 30MHz - 300MHz	P
Radiation Emission, 30MHz - 1000MHz	N/A
Harmonic Current	P
Voltage Fluctuations-Flicker	P
ESD	P
Radiated Immunity (80MHz - 1GHz)	N/A
Electrical Fast Transients (EFT)	P
Surge Immunity	P
Injected Currents, 0.15MHz - 230MHz	P
Power Frequency Magnetic Field Immunity	N/A
Voltage Dips and Interruptions	P
Remark:	P: Pass/ F: Fail/ N/A: Not Applicable

1.2 Test Specification

The equipment(s) comply with the requirements according to the following standards:

EN IEC 55014-1:2021 : Electromagnetic compatibility-Requirements for household appliances, electric tools and similar apparatus Part1: Emission;

EN IEC 55014-2:2021 : Electromagnetic compatibility-Requirements for household appliances, electric tools and similar apparatus Part2: Immunity;

EN IEC 61000-3-2:2019+A1:2021: Limits for harmonic current emissions (equipment input current ≤ 16 A per phase);

EN 61000-3-3:2013+A1:2019+A2:2021: Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.

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2 General Information

2.1 Client Information

Applicant : Ningbo Zhongdi Industry & Trade Co., Ltd.

Address : Jishigang Industry Zone, Haishu District, Ningbo 315171, P. R. China

2.2 General Description of E.U.T.

Rated input voltage : AC 220-240V, 50Hz

Rated Input power : 48W

Protection class : Class I

2.3 Identifies and differences:

All models are the same, just different in appearance.
Therefore, we test ZD-98 200C and the worst test data is listed in the report as representative.

2.4 Environment

- ☒ Residential (domestic) environment
- ☒ Commercial and light-industrial environment
- ☐ Industrial environment
- ☐ Medical environment.

2.5 Submitted Documents

Constructional Data Form for EMC

Circuit diagram, user's manual, labels and construction drawings etc.

3 Test Facility and Instrument list

3.1 Test Facility

All the tests done in this report are subcontracted to Shenzhen Most Technology Service Co., Ltd. (No.5, 2nd Langshan Road, North District, Hi-tech Industrial Park, Nanshan, Shenzhen, Guangdong. China)

3.2 Instrument list

Table 1: List of Test and Measurement Equipment of Laboratory

Shielding Room - Disturbance Voltage Test				
Equipment	Manufacturer	Model	Serial No.	Due Date
Receiver	R&S	ESR3	102043	08/25/2024
LISN	R&S	ENV216	102058	08/25/2024
Absorbing Clamp	R&S	MDS21	100789	06/10/2024
ESD Simulator	EM-TEST	ESD 30N	P1526159867	11/17/2024
3M Chamber & Accessory Equipment	TDK	SAC-3	----	---
Signal Generator	R&S	SMB100A	179680	08/25/2024
Stacked double Log.-Per. Antenna	R&S	HL046E	-----	N/A
Power Amplifier	R&S	BBA150-BC1000	102131	08/25/2024
Power Amplifier	BONN	1060-400/100D	1610682	N/A
Stacked Double Log-Per Antenna	SCHWARZBEC K	STLP9149	9149435	N/A
Compact Generator	EM-TEST	UCS500N7	P1608172945	08/25/2024
coupling/decoupling network	EM-TEST	CNI503B7	P1626181212	08/25/2024
Motorized Variac	EM-TEST	MV2616	P1532162313	08/25/2024
Signal Generator	R&S	SMC100A	105636	08/25/2024
Power Amplifier	R&S	BBA150A200 B250	102124	08/25/2024
Attenuator	Bird	300-A-FFN-06	1617	08/25/2024
CDN	FCC	FCC-801-M2/M3-16A	170209	08/25/2024
Harmonic & Flicker System	EM-TEST	DPA 503N& AIF 503N32.1	P1545166605 & P1613178045	08/25/2024
Multifunction AC/DC Power Source	EM-TEST	NetWave 30-400	P1613178144	08/25/2024

3.3 Measurement Uncertainty

Conducted Emission (9-150KHz)	:	U = 3.6 dB
Conducted Emission (150K-30MHz)	:	U = 3.6 dB
Disturbance Power	:	U = 3.6 dB
Radiated Emission (30-1000MHz)	:	U = 4.5 dB
Radiated Emission (1- 6GHz)	:	U = 5.5dB
Expanded Measurement Uncertainty (K=2)		

4 Test Results EMISSION

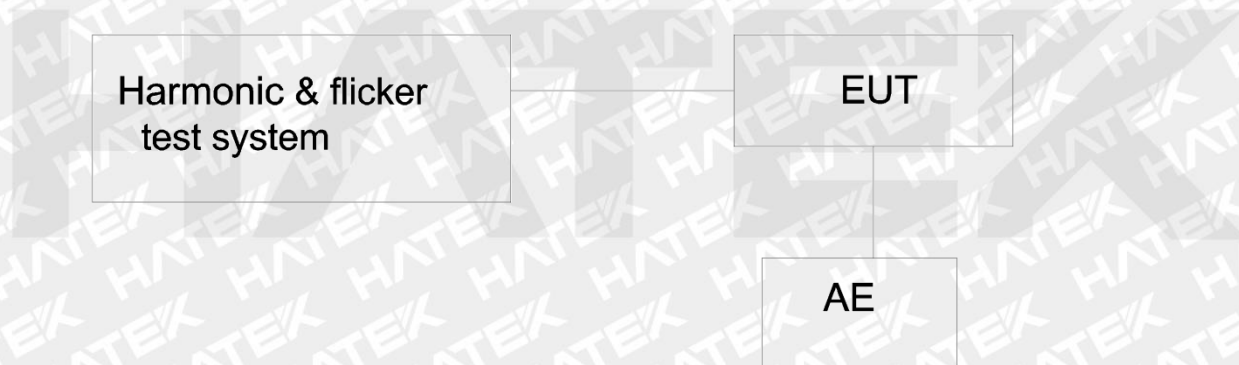
4.1 Emission in the Frequency Range from 0 kHz to 30 MHz

4.1.1 Harmonics on AC Mains

General test information

Temperature	: 25°C
Relative Humidity	: 51 %RH
Test procedure	: EN IEC 61000-3-2:2019+A1:2021
Test duration	: 2.5min
Harmonic order	: 2 – 40 th
Frequency range	: 0 – 2kHz
Test result	: Pass

Block Diagram of Test Set up



Test Procedure

The harmonics on AC Mains in the frequency from 0 to 2 kHz were measured in accordance with EN IEC 61000-3-2:2019+A1:2021.

The measurement of Harmonics of the fundamental current were measured up to 40 order harmonics using a digital power meter with an analogue output and frequency analyser which was integrated in the harmonic & flicker test system. This equipment is in compliance with the requirements of EN IEC 61000-3-2:2019+A1:2021.

The results indicated in the following tables and figures were those measured and recorded by an automatic measuring system.

Test Results:

According to the Clause 7 in the EN IEC 61000-3-2:2019+A1:2021

For the following categories of equipment, limits are not specified in this standard:

- equipment with a rated power of 75 W or less, other than lighting equipment;

This product is not defined as lighting equipment, and has rated power less than 75W, therefore, no limit apply according to EN 61000-3-2.

4.1.2 Voltage changes, voltage fluctuations and flicker on AC mains

General test information

Test procedure : EN 61000-3-3:2013+A1:2019+A2:2021
 Temperature : 25°C
 Relative Humidity : 51 %RH
 Test result : Pass

Block Diagram of Test Set up



Test Procedure

According to the A.10 of the EN 61000-3-3:2013+A1:2019+A2:2021:

According to the characteristics of the sample, as specified by clause 5 of the basic standard, following limits apply:

- the value of P_{st} shall not be greater than 1.0;
- the value of P_{lt} shall not be greater than 0.65;
- the value of $d(t)$ during a voltage change shall not exceed 3.3% for more than 500ms;
- the relative steady-state voltage change, d_c , shall not exceed 3.3%;
- the maximum relative voltage change d_{max} , shall not exceed 6%.

The measurement was carried in accordance with Annex B of the basic standard and the EUT was set to produce the most unfavorable sequence of voltage changes.

Following are the measurement results obtained via an automatic testing system.

Table 2: Voltage fluctuations and flicker measurement results

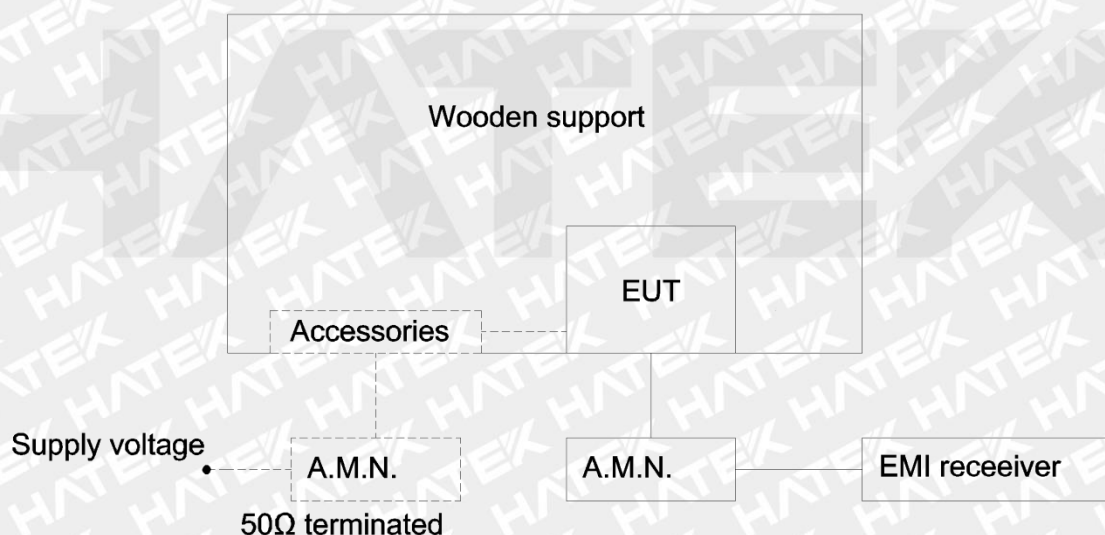
	d_c	$d_{max}(\text{average})$	$d(t)$	P_{st}	P_{lt}
Limits	3.3%	6%	3.3%/500ms	1.0	N/A
Result	0.023%	0.054%	0.00ms	0.037	-

4.1.3 Mains Terminal Continuous Disturbance Voltage

General test information

Test procedure : EN IEC 55014-1:2021 and CISPR 16-1 series standards
 Frequency range : 0.15-30MHz
 Kind of test site : EMC Chamber
 Temperature : 25 °C
 Relative Humidity : 51 %RH
 Operational condition : ON
 Artificial hand : Yes
 Earthing : Through artificial hand to AMN.
 Test result : Pass

Block Diagram of Test Set up



- ☒ For table top equipment, wooden support is 0.8m height.
- ☐ For floor standing equipment, wooden support is 0.1m height.

Test Procedure

The measurement setup was made according to EN IEC 55014-1:2021 in an EMC Chamber.

Prior to the measurements the test object operated about 15 minutes (warm-up) in order to stabilize its operating conditions and to ensure reliable measurement values.

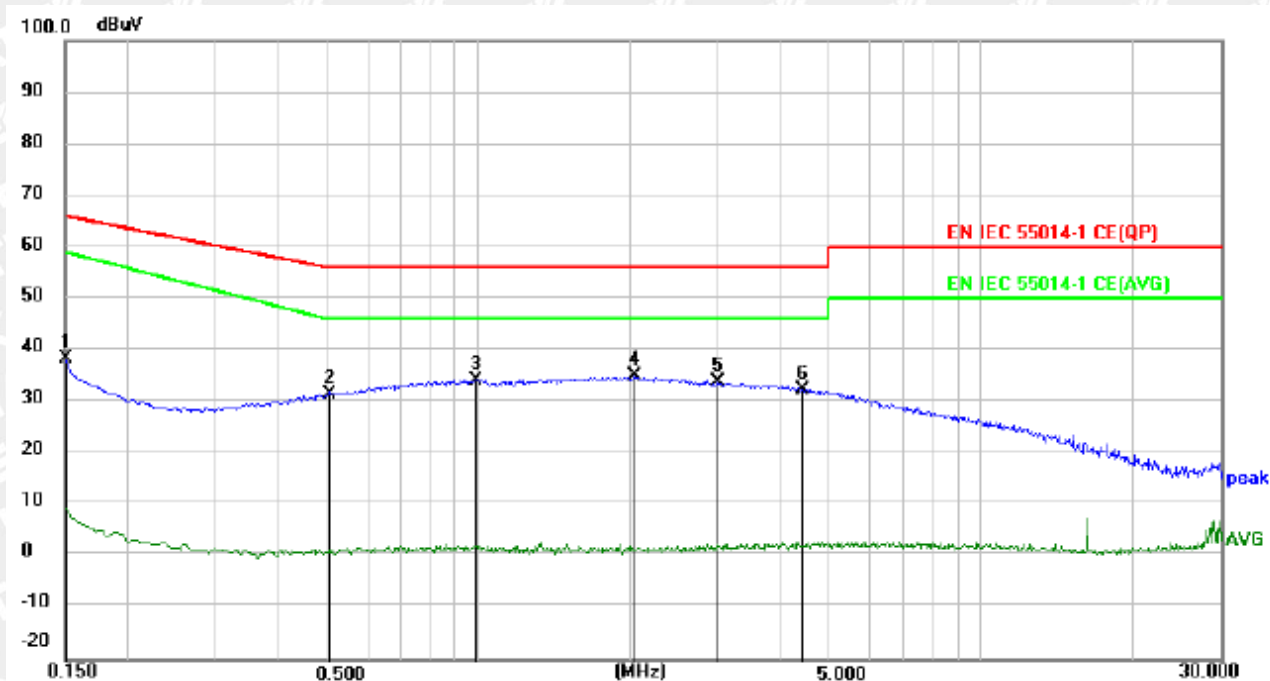
Furthermore an internal calibration with the test receiver was conducted prior to each measurement. And the measurement was made in the state the maximum disturbance was obtained.

The tested object was set-up on a wooden table. The length of the power cord of the tested object was about 1.5m. The EUT was set 0.8m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3m and 0.4m. The EUT (Equipment under Test) was wrapped with artificial hand that was earthed through the Artificial Mains Network (AMN).

The Interference Voltage was determined according to clause 5 of EN IEC 55014-1:2021 while measuring the line and neutral conductor by turns.

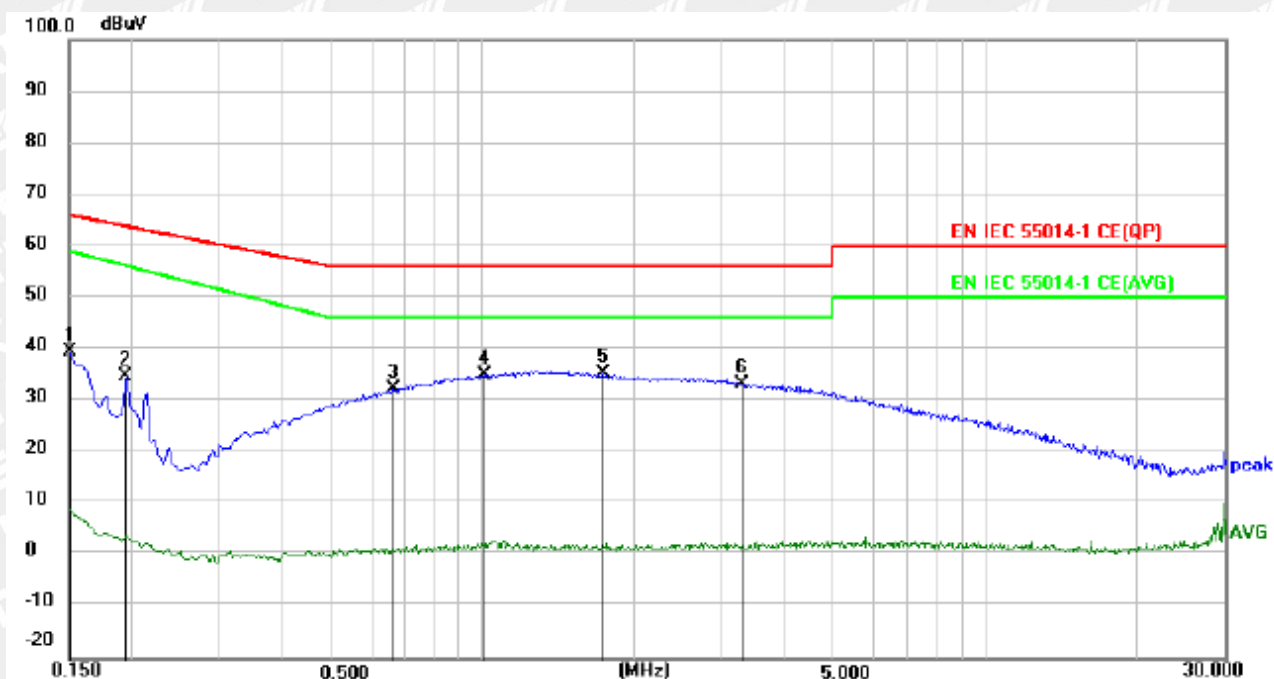
In the Figures, the symbol “+” means Quasi-Peak Value and the symbol “x” means Average Value which was measured in final measurement.

Figure 1: Test Curve of Conducted Emission in the frequency range of 150kHz - 30MHz, L line



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1500	28.96	9.52	38.48	66.00	-27.52	peak	P
2	0.5010	22.00	9.54	31.54	56.00	-24.46	peak	P
3	0.9870	24.74	9.56	34.30	56.00	-21.70	peak	P
4 *	2.0355	25.34	9.57	34.91	56.00	-21.09	peak	P
5	3.0075	24.25	9.60	33.85	56.00	-22.15	peak	P
6	4.4115	22.77	9.65	32.42	56.00	-23.58	peak	P

Figure 2: Test Curve of Conducted Emission in the frequency range of 150kHz - 30MHz, N line



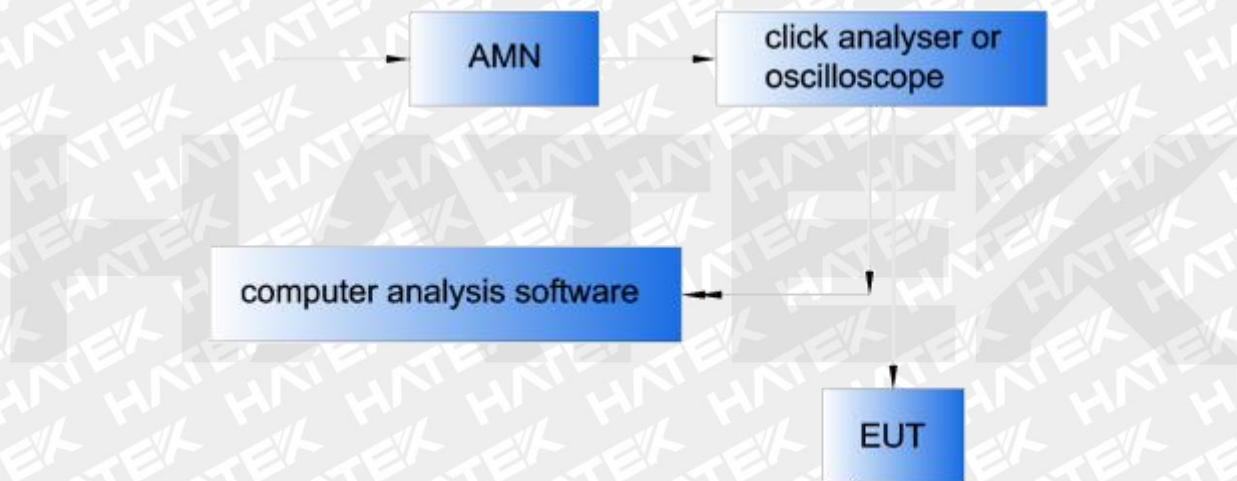
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1500	30.14	9.49	39.63	66.00	-26.37	peak	P
2	0.1949	25.34	9.51	34.85	63.83	-28.98	peak	P
3	0.6630	22.82	9.55	32.37	56.00	-23.63	peak	P
4	1.0095	25.52	9.56	35.08	56.00	-20.92	peak	P
5 *	1.7430	25.67	9.56	35.23	56.00	-20.77	peak	P
6	3.2775	23.75	9.60	33.35	56.00	-22.65	peak	P

4.1.4 Discontinuous Interference on AC Mains

General test information

Frequency range	: 0.15-30MHz
Kind of test site	: EMC Chamber
Temperature	: 25°C
Relative Humidity	: 51 %RH
Operational condition	: ON
Port	: EN IEC 55014-1:2021
Limit	: EN IEC 55014-1:2021
Test result	: Pass

Block Diagram of Test Set up



The discontinuous interference on AC mains in the frequency range from 0.15 to 30MHz were measured in accordance to EN IEC 55014-1:2021.

The measurement setup was made according to EN IEC 55014-1:2021, clause 4.2 in an shielding room. The used measurement equipment was in accordance to CISPR 16-1 series standards.

The test setup is according to clause 7.3.4.2 of EN IEC 55014-1:2021.

The clicks were measured when the thermostat of the EUT started or stopped.

The clicks were measured at the frequency of 0.15MHz, 0.5MHz, 1.4MHz and 30MHz.

The tests include RUN A and RUN B. The first one is to detect the Click rate and RUN B is to detect how many clicks overtop the limits that are calculated according the formula below.

For $0.2 \leq N < 30$ the Sensitivity = RUN A + $20 \cdot \log (30/\text{Click rate})$ and for $N < 0.2$ the Sensitivity = RUN A + 44.

Table 3: Click Test Results of RUN A

Measured Frequency (MHz)	0.15	0.5	1.4	30
Sensitivity(dBuV)	66.0	56.0	56.0	60.0
Last Time T(min./sec.)	120	120	120	120
Short Click Number n1	26	25	13	0
Long Click Number n2	0	0	2	0
Total Click Number n=n1+n2	26	25	13	0
Click Rated $N=F \times n/T$	0.22	0.21		

According to the clause 5.4.3.4 of EN 55014-1:

- “
- the click rate is not more than 5.
 - none of the caused clicks has a duration longer than 20ms,
 - 90% of the caused clicks have a duration less than 10ms

These conditions shall be verified at one frequency only, 150 kHz or 500 kHz, at which the higher click rate occurs. If one of these conditions is not satisfied then limits in accordance with 5.4.2 apply.”

Therefore the EUTs are deemed to fulfill the relevant requirements.

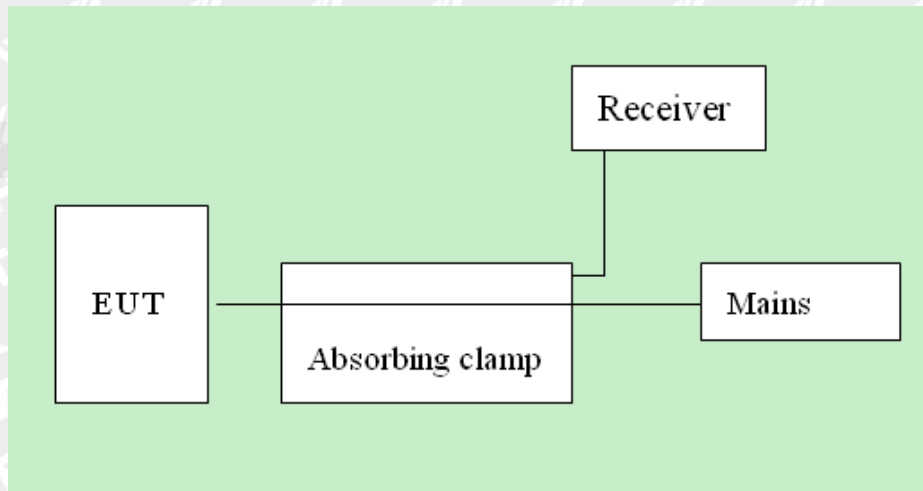
4.2 Emission in the Frequency Range from 30 MHz to 1000 MHz

4.2.1 Disturbance Power on Mains

General test information

Frequency Range	: 30 – 300MHz
Kind of test site	: EMC Chamber
Temperature	: 25 °C
Relative Humidity	: 51 %RH
Operational condition	: ON
Port	: Mains
Limit	: EN IEC 55014-1:2021, clause 4.1.2.1, Household and similar appliances
Test result	: Pass

Block Diagram of Test Set up



☒ For table top equipment, wooden support is 0.8m height.

☐ For floor standing equipment, wooden support is 0.1m height.

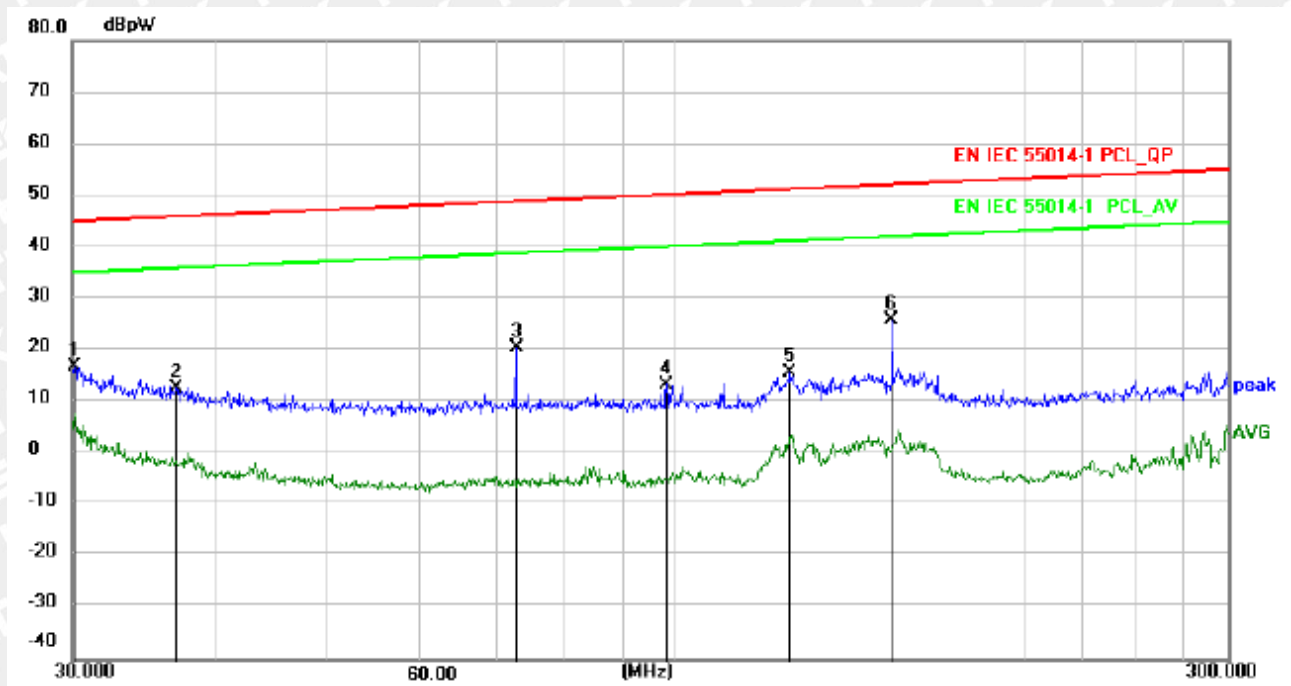
Test Procedure

Furthermore an internal calibration with the test receiver was conducted prior to each measurement.

The tested object was set-up on a wooden bench. The length of the power cord of the test object was about 1.5m. The length of power cord of EUT plus that of the extension cord was approximately 6.0m.

In the Figures, the symbol “+” means Quasi-Peak Value and the symbol “x” means Average Value which was measured in final measurement.

Figure 3: Test Curve of Power Disturbance in the frequency range of 30–300MHz, AC line



No.	Frequency (MHz)	Reading (dBUV)	Factor (dB)	Level (dBpW)	Limit (dBpW)	Margin (dB)	Detector	Position (cm)	P/F
1	30.1800	14.22	2.58	16.80	45.03	-28.23	peak		P
2	36.9600	10.12	2.44	12.56	45.91	-33.35	peak		P
3	72.7200	19.29	1.07	20.36	48.85	-28.49	peak		P
4	98.1600	12.52	0.88	13.40	50.15	-36.75	peak		P
5	125.5200	15.18	0.47	15.65	51.22	-35.57	peak		P
6 *	153.7800	25.29	0.66	25.95	52.10	-26.15	peak		P

5 Test Results I M M U N I T Y

Performance criterion:

Performance criterion A: The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is 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 (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed.

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, or by any operation specified in the instructions for use.

Room temperature	:	24-26 °C
Relative Humidity	:	45-58%

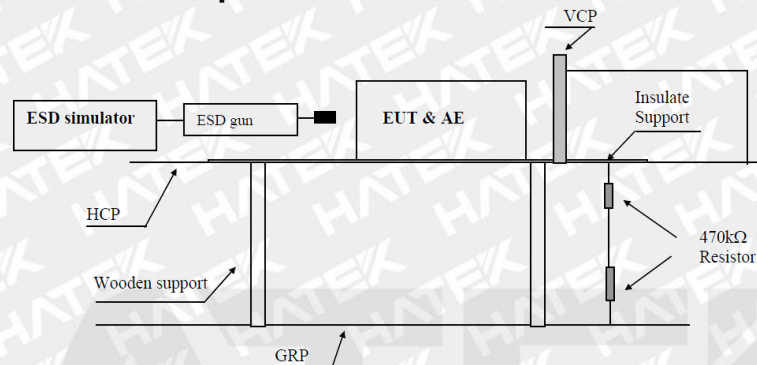
Conclusion: Pass

5.1 Enclosure

5.1.1 Electrostatic Discharge

Charge voltage	: $\pm 4.0\text{kV}$ (Conducted Discharge) $\pm 8.0\text{kV}$ (Air Discharge)
Polarity	: positive / negative
Number of discharges	: >10
Performance criteria	: B

Block Diagram of Test Set up



- ☒ For table top equipment, wooden support is 0.8m height.
- ☐ For floor standing equipment, wooden support is 0.1m height.

Test Procedure

The immunity against electrostatic discharge was tested in accordance with EN IEC 55014-2:2021. Test setup and ESD-Generator are according to EN 61000-4-2 which is specified by EN IEC 55014-2:2021.

The EUT is placed on 0,8m wood table above the ground plane. And the minimum distance between the EUT and all other conductive structures except the ground plane beneath the EUT is more than 0,5m. The reference ground plane is an aluminium sheet of 0,25mm minimum thickness. The reference ground plane is connected to the protective earth. The size of the ground plane is 2m × 2m.

A horizontal coupling plane (HCP), 1,6m × 0,8m, is placed on the table and isolated from the EUT and cables by an insulating support 0,5mm thick. Vertical coupling plane (VCP) of dimensions 0,5m × 0,5m is placed parallel to and positioned at a distance of 0,1m from the EUT.

Table 4: ESD, Positive / Negative Polarity

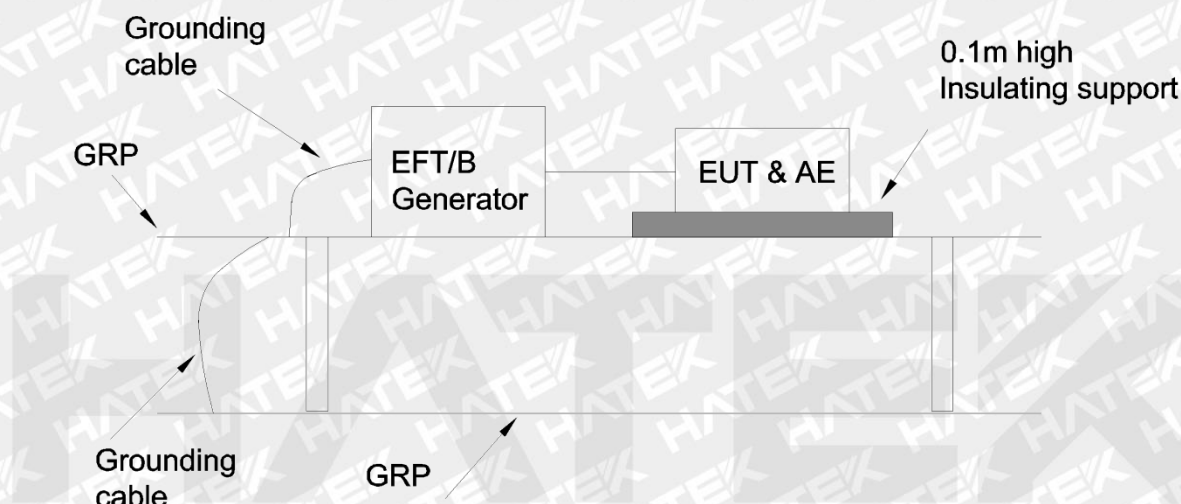
Position	Kind of Discharge	Remarks	Result
Nonmetal Enclosure	Air discharge $\pm 8\text{kV}$	No disturbance of function and output parameter	Pass
Metal Enclosure	Contact discharge $\pm 4\text{kV}$	No disturbance of function and output parameter	Pass
Coupling plane (Both HCP and VCP)	Contact discharge $\pm 4\text{kV}$	No disturbance of function and output parameter	Pass

5.2 Input and Output AC Power Ports

5.2.1 Fast Transients on AC Power Lines

Test Voltage	: $\pm 1\text{kV}$
Polarity	: negative/positive
Repetition frequency	: 5kHz
Test duration	: $\geq 120\text{sec}$
Tr/Tn	: $5\text{ns}/50\text{ns}$
Performance criteria	: B

Block Diagram of Test Set up



Test Procedure

The immunity against fast transients on AC power lines was tested in accordance to EN IEC 55014-2:2021. Test setup and the fast transient noise generator are according to EN 61000-4-4 which is specified by EN IEC 55014-2:2021.

The EUT is placed on 0,1m wood table above the ground plane. And the minimum distance between the EUT and all other conductive structures except the ground reference plane is more than 0,5m.

The length between the coupling device and the EUT is less than 1m. The cord length more than 1m, the excess length of the cable shall gathered into a flat coil with a 0,4m diameter, and situated at a distance of 0,1m above the ground reference plane.

The reference ground plane is an aluminium sheet of 0,25mm minimum thickness. The reference ground plane is connected to the protective earth. The size of the ground plane is $2\text{m} \times 2\text{m}$.

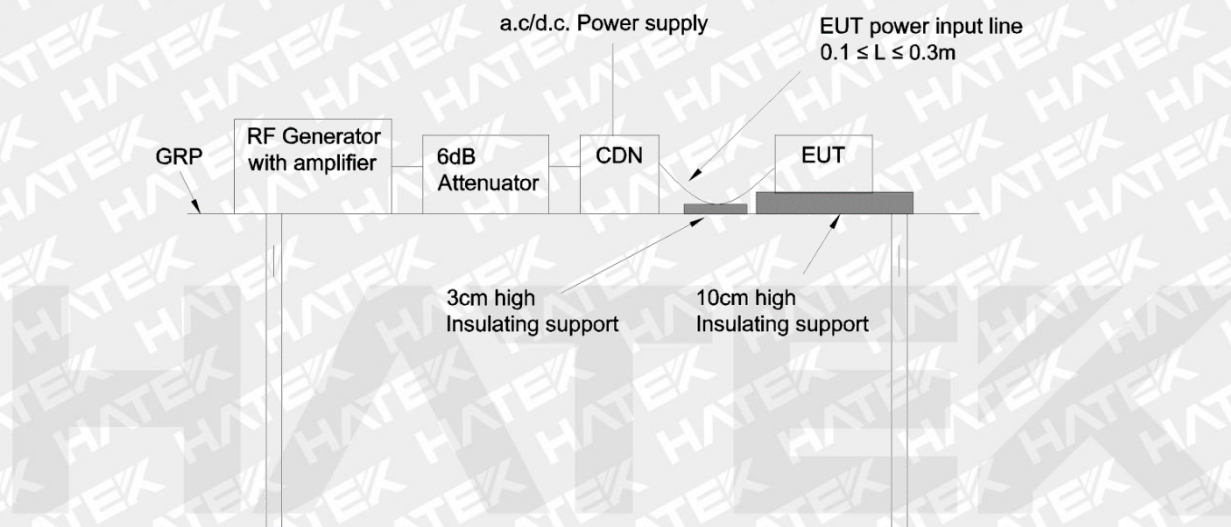
Table 5: Burst, AC Power lines, Positive and Negative Polarity

Line	Result	Remark
AC Input (L+N+PE)	$\pm 1\text{kV}$ Pass	No disturbance of function

5.2.2 Injected Current into AC Power Port

Voltage Level	: 3V(rms)(unmodulated)
Environmental phenomena	: r.f. current, common mode, 1kHz, 80%AM
Source impedance	: 150Ω
Frequency range	: 0.15-230 MHz
Sweeping rate	: $\leq 1,5 \times 10^{-3}$ decades/s
Performance criteria	: A

Block Diagram of Test Set up



Test Procedure

The immunity against injected current into AC power port was tested according to EN IEC 55014-2:2021 in a shielded room. The Test setup and the test generator are according to EN 61000-4-6 which is specified by EN IEC 55014-2:2021.

The EUT is placed on 0,1m wood table above the ground plane. And the minimum distance between the EUT and all other conductive structures except the reference ground plane is more than 0,5m. The EUT comprised a single unit. The coupling and decoupling networks were inserted on the power supply connection. The coupling and decoupling networks was placed on the ground reference plane, making direct contact with it at about 0,1-0,3 meter from EUT. The cable between EUT and CDN is as short as possible and not bundled nor wrapped. The height of cable between the EUT and the coupling and decoupling networks above the ground reference plane was 50mm.

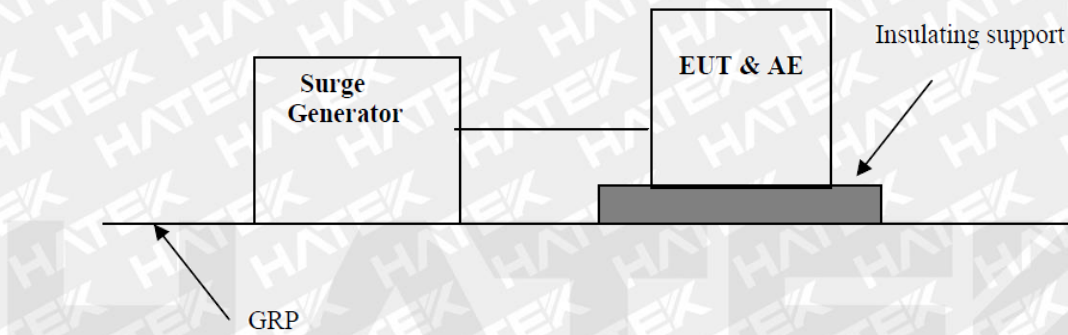
Table 6: Injected current, AC Power Port

Line	Coupling Method:	Remark	Result
AC Power Lines	CDN M-3	No disturbance of function	Pass

5.2.3 Surges to AC Power Port

Test Level	:	phase to neutral $\pm 1\text{kV}$ phase/neutral to PE $\pm 2\text{kV}$
Tr/Tn	:	1.2/50 μs (open-circuit voltage) 8/20 μs (short-circuit current)
Test numbers	:	5 positive and 5 negative pulses
Repetition rate	:	1 surge/min
Performance criteria	:	B

Block Diagram of Test Set up



Test Procedure

The immunity against surges to AC power port was tested in accordance to EN IEC 55014-2:2021. Test setup and the Combination Wave Generator (CWG) are according to EN 61000-4-5 which is specified by EN IEC 55014-2:2021.

The EUT is placed on 0,1m wood table above the ground plane.

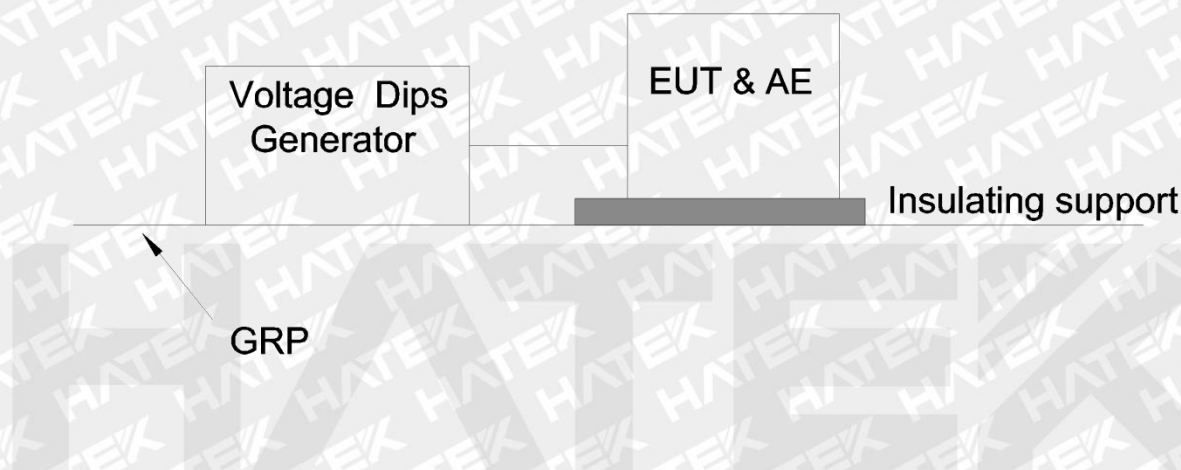
Table 7: Surges to AC Power lines, positive/negative

Line	Tested voltage/coupling phase	Test angle	Observation	Result
Phase to neutral	+1 kV, $+\pi/2$ (5 times)	90°	No disturbance of function and output parameter	Pass
	-1 kV, $-\pi/2$ (5 times)	270°		Pass
phase/neutral to PE	+2 kV, $+\pi/2$ (5 times)	90°	No disturbance of function and output parameter	Pass
	-2 kV, $-\pi/2$ (5 times)	270°		Pass

5.2.4 Voltage dips and interruptions to AC Power Port

Performance criteria	:	C	
Test level (in % UT) and	:	0	0.5/0.5 periods(50/60Hz)
duration (in periods of the	:	40	10/12 periods(50/60Hz)
rated frequency)	:	70	25/30 periods(50/60Hz)

Block Diagram of Test Set up



Test Procedure

The immunity against voltage dips and interruptions to AC power port was tested in accordance to EN IEC 55014-2:2021. Test setup and the test generator are according to EN 61000-4-11 which is specified by EN IEC 55014-2:2021. The EUT was placed directly on the table of aluminum.

Table 8: Test condition and Test Result for Voltage dips and Short interruptions

Test level (in % UT)	Duration	Performance criteria	Remarks	Result
0	0,5 (10ms)	C	No disturbance of function	Pass
40	10 (200ms)	C	No disturbance of function	Pass
70	25 (0.5s)	C	No disturbance of function	Pass

6 Photographs of the EUT

Photograph 1: Set-up for Disturbance Voltage



Photograph 2: Set-up for Disturbance Power



Photograph 3: Set-up for EFT, Surge and Voltage Dips



Photograph 4: Overall view of EUT



Photograph 5: Overall view of EUT



Photograph 6: Overall view of EUT



Photograph 7: Overall view of EUT



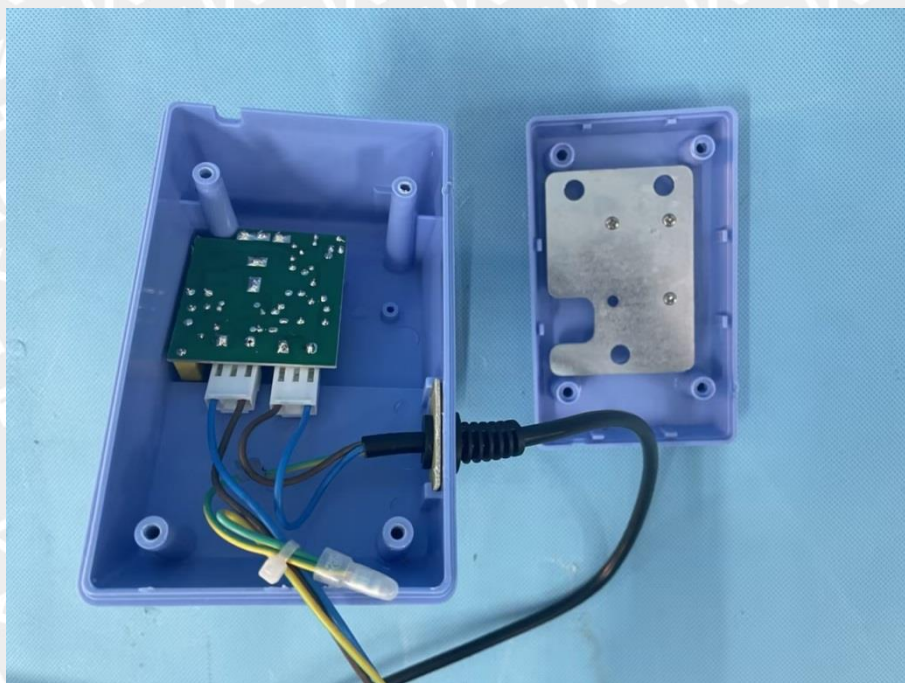
Photograph 8: Overall view of EUT



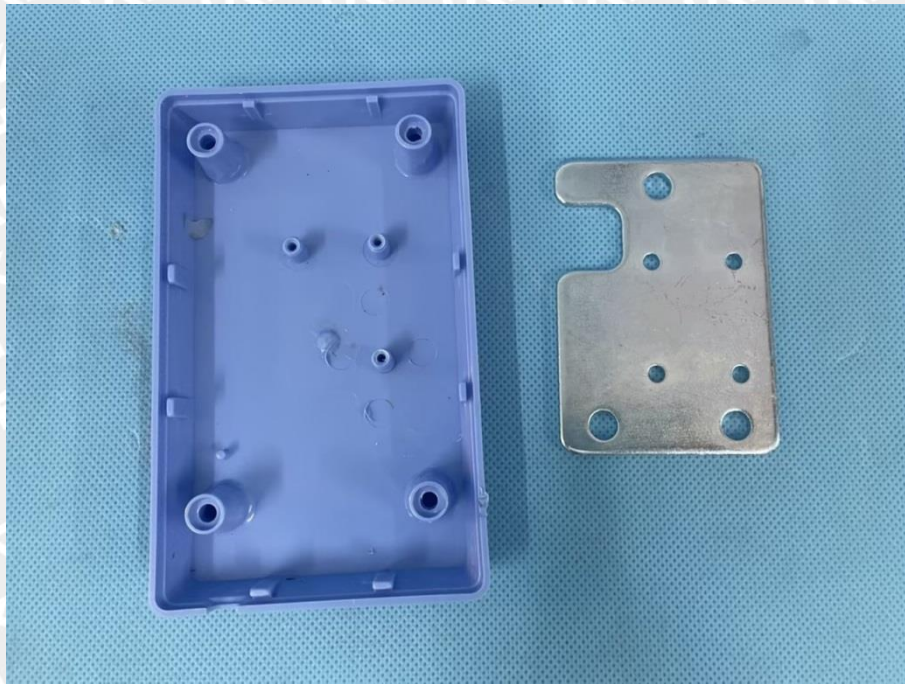
Photograph 9: Internal view of EUT



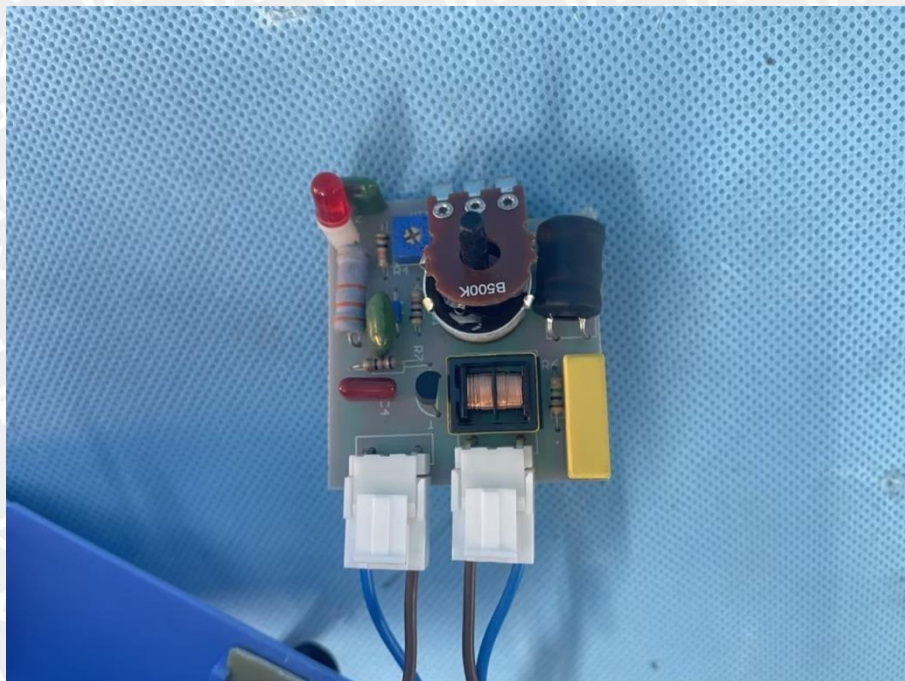
Photograph 10: Internal view of EUT



Photograph 11: Internal view of EUT



Photograph 12: Internal view of EUT



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