CE EMC Test Report

Test Standard(s):	EN 55014-1:2017 EN 55014-2:2015 EN 61000-3-2:2014 EN 61000-3-3:2013
Applicant:	
Product Name:	CoolAir
Model:	
Report No.:	ZKS200400477-1
Tested Date:	2020-04-24
Issued Date:	2020-04-29
Tested By :	Lieber Ouyang (Engineer)
Approved By:	Lahm Peng (Manager)
Prepared By:	

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1. General Information

1.1 Product Information

Applicant and Manufacturer	
Applicant:	
Address of Applicant:	
Manufacturer:	
Address of Manufacturer:	

General Description of EUT	
Product Name:	CoolAir
Model No.:	
Trade Name:	--
Adding Model(s):	--
Classification of Apparatus:	Category II
Rated Voltage:	DC 5V/1.5A by adapter
Note 1: The test data is gathered from a production sample, provided by the manufacturer.	

1.2 Compliance Standards

Compliance Standards	
EN 55014-1	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission
EN 55014-2	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard
EN 61000-3-2	Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16 A per phase)
EN 61000-3-3	Electromagnetic compatibility (EMC) – Part 3-3: Limits – 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
The objective of the manufacturer or applicant is to demonstrate compliance with the above standards.	
According to standards for test methodology	
IEC 61000-4-2	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
IEC 61000-4-5	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
IEC 61000-4-6	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
IEC 61000-4-11	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests
All measurements contained in this report were conducted with all above standards	
Maintenance of compliance is the responsibility of the manufacturer or applicant. Any modification of the product, which result is lowering the emission, should be checked to ensure compliance has been maintained.	

1.3 Test Facilities

Testing Lab: Global United Technology Services Co., Ltd.
All measurement facilities used to collect the measurement data are located at No.301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

1.4 Test Setup Information

List of Test Modes			
Test Mode	Description	Remark	
TM1	Operating	--	
TM2	--	--	
List and Details of Auxiliary Cable			
Description	Length (M)	Shielded/Unshielded	With/Without Ferrite
--	--	--	--
List and Details of Auxiliary Equipment			
Description	Manufacturer	Model	Serial Number
--	--	--	--
The equipment under test (EUT) was configured to measure its highest possible emission and immunity level. The test modes were adapted according to the operation manual for use.			

1.5 Measurement Uncertainty

Parameter	Conditions	Uncertainty
Conducted Disturbance	9kHz ~30MHz	±2.75 dB
Radiated Disturbance	30MHz ~ 1GHz	±4.89 dB

1.6 Performance Criteria for EMS

All the test data has been collected and analyzed within this report in accordance with Immunity requires the following as specific performance criteria:	
A	The apparatus shall continue to operate as intended during and after the test. The manufacturer specifies some minimum performance level. The performance level may be specified by the manufacturer as a permissible loss of performance.
B	The apparatus shall continue to operate as intended after the test. This indicates that the EUT does not need to function at normal performance levels during the test, but must recover. Again some minimal performance is defined by the manufacture. No change in operating state or loss or data is permitted.
C	Temporary loss of function is allowed. Operation of the EUT may stop as long as it is either automatically reset or can be manually restored by operation of the controls.

1.7 List of Test and Measurement Instruments

Description	Manufacturer	Model	Serial Number	Due. Date
EMI Test Receiver	Rohde & Schwarz	ESCS30	830245/009	2021-04-22
AMN	Rohde & Schwarz	ESH2-Z5	100002	2021-04-22
EMI Test Receiver	Rohde & Schwarz	ESI26	838786/013	2021-04-22
Pre-amplifier	CD	PAP-0118	24004	2021-04-22
Bilog Antenna	Chase	CBL6112B	2591	2021-04-22
Digital Power Analyzer	California Instrument	5001ix-CTS-400	X71730	2021-04-22
ESD Generator	SCHNAFFNER	NSG 435	2103	2021-04-22
Signal Generator	Rohde & Schwarz	SMT03	100059	2021-04-22
Voltage Probe	Rohde & Schwarz	URV5-Z2	100013	2021-04-22
Power Amplifier	AR	150W1000	300999	2021-04-22
Power Amplifier	AR	25S1G4AM1	305993	2021-04-22
Immunity Simulator	EMTEST	UCS500M4	0800-44	2021-04-22
CS Immunity Tester	EMTEST	CWS500	0900-12	2021-04-22

2. Summary of Test Results

Standards	Description of Test Items	Result
EN 55014-1	Terminal Disturbance Voltages	Passed
	Disturbance Power	N/A
	Radiated Disturbances	Passed
	Discontinuous Disturbance	N/A
EN 61000-3-2	Harmonic Current Emission	Passed
EN 61000-3-3	Voltage Fluctuation and Flicker	Passed
EN 55014-2	Electrostatic Discharge Immunity	Passed
	Radio Frequency Electromagnetic Fields Immunity	N/A
	Fast Transient Immunity	Passed
	Surges Immunity	Passed
	Injected Currents Immunity	Passed
	Voltage Dips/Interruptions Immunity	Passed
Passed: The EUT complies with the essential requirements in the standard Failed: The EUT does not comply with the essential requirements in the standard N/A: Not applicable		

3. Terminal Disturbance Voltage

3.1 Standard and Limit

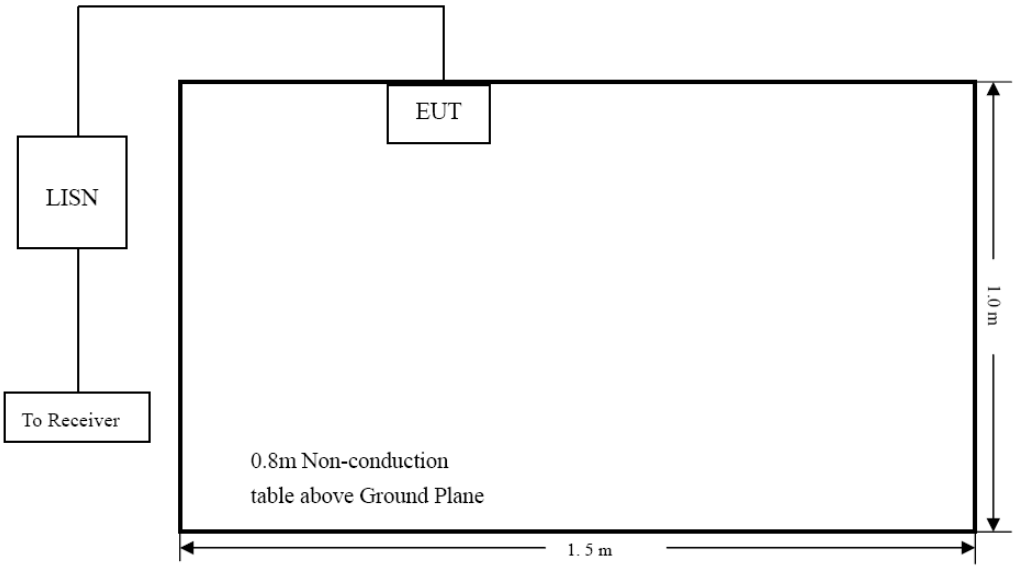
According to the standard EN 55014-1, clause 4.3.3.6 - Limits for conducted disturbance at mains terminals, the limit of conducted disturbance as below:

Frequency range	$P \leq 700$ W		700 W < $P \leq 1\,000$ W		$P > 1\,000$ W	
1	2	3	4	5	6	7
MHz	Quasi-peak dBμV	Average dBμV	Quasi-peak dBμV	Average dBμV	Quasi-peak dBμV	Average dBμV
0,15 to 0,35	Decreasing linearly with the logarithm of the frequency from:					
	66 to 59	59 to 49	70 to 63	63 to 53	76 to 69	69 to 59
0,35 to 5	59	49	63	53	69	59
5 to 30	64	54	68	58	74	64
The lower limit applies at the transition frequencies. Key P = rated power of the motor only.						

Main Terminals

3.2 Test Procedure

Test is conducting under the description of EN 55014-1 clause 5 - Methods of measurement of terminal disturbance voltages.

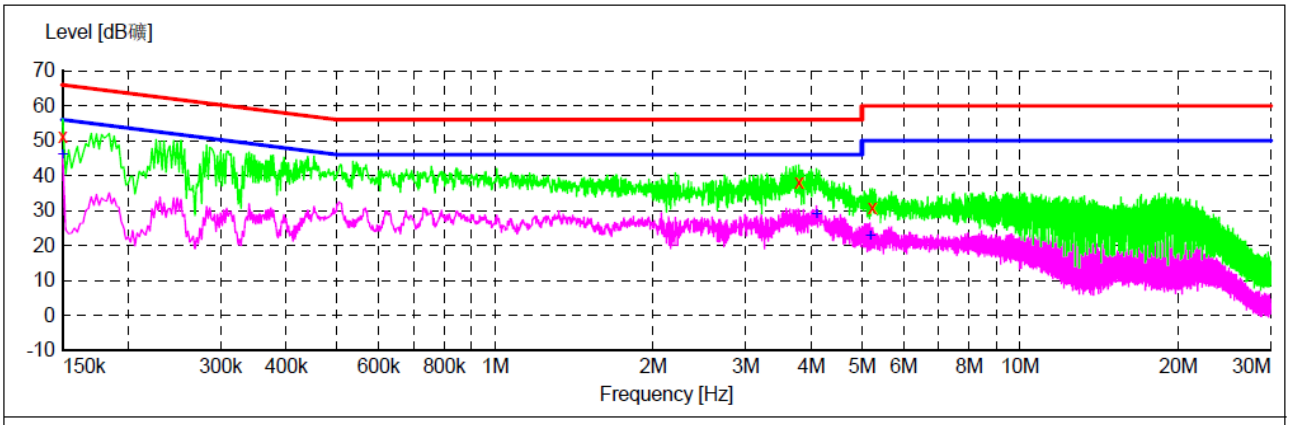


Test Setup Block Diagram

3.3 Test Data and Results

Based on all tested data, the EUT complied with the EN 55014-1 standard limit, and with the worst case as below:

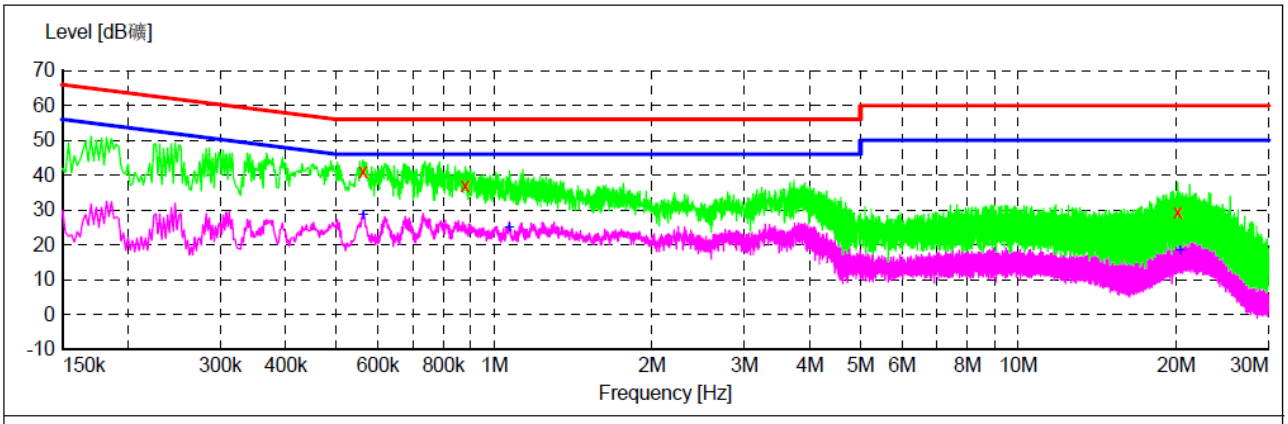
Test Plots and Data of Conducted Emissions	
Tested Model:	Nexfan-01
Tested Mode:	TM1
Test Power Specification:	AC 230V/50Hz
Test Power Line:	Live
Remark:	



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	51.10	10.8	66	14.9	QP	L1	GND
3.790000	38.00	11.4	56	18.0	QP	L1	GND
5.235000	30.70	11.4	60	29.3	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	46.10	10.8	56	9.9	AV	L1	GND
4.095000	28.90	11.4	46	17.1	AV	L1	GND
5.180000	22.80	11.4	50	27.2	AV	L1	GND

Test Plots and Data of Conducted Emissions	
Tested Model:	Nexfan-01
Tested Mode:	TM1
Test Power Specification:	AC 230V/50Hz
Test Power Line:	Neutral
Remark:	



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.562000	41.00	11.0	56	15.0	QP	N	GND
0.880000	37.00	11.1	56	19.0	QP	N	GND
20.165000	29.20	11.7	60	30.8	QP	N	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.562000	28.60	11.0	46	17.4	AV	N	GND
1.068000	25.10	11.1	46	20.9	AV	N	GND
20.360000	18.50	11.7	50	31.5	AV	N	GND

4. Radiated Disturbance

4.1 Standard and Limit

According to the standard EN 55014-1, clause 4.3.4.5 - Limits for radiated disturbance, the limit of radiated disturbance as below:

Testing method	Basic standard	Frequency range MHz	Limit [a] Quasi-peak dBμV/m	Remarks
OATS or SAC [b]	CISPR 16-2-3	30 to 230 230 to 1 000	30 37	Measurement distance 10 m
FAR [c]	CISPR 16-2-3	30 to 230 230 to 1 000	42 to 35 [d] 42	Measurement distance 3 m
FAR [c]	IEC 61000-4-22	30 to 230 230 to 1 000	42 to 35 [d] 42	Measurement distance 3 m
TEM-Waveguide [e]	IEC 61000-4-20	30 – 230 230 – 1 000	30 37	–

a The lower limit is applies at the transition frequency.

b Measurements may be made at closer distance, down to 3 m. An inverse proportionality factor of 20 dB per decade shall be used to normalize the measured data to the specified distance for determining the limit. in this case the recommendations of the CISPR basic standards shall be considered when testing large EUT at frequency approaching 30 MHz, due to near field effects.

c All equipment shall be measured within the test volume as described in 5.3.4.3 and shown in Figures 12 to 19.

d Decreasing linearly with the logarithm of the frequency.

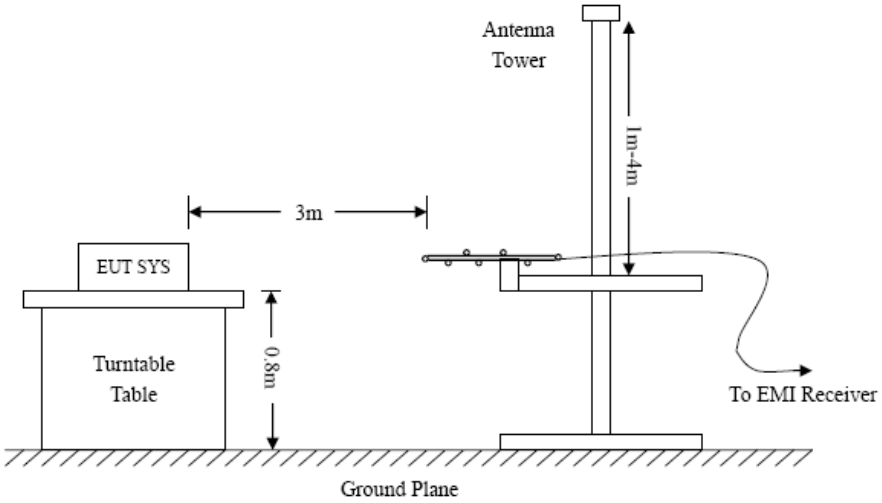
e The TEM waveguide method shall be limited to battery operated EUT without cables attached and with a maximum size according to 6.2 of IEC 61000-4-20:2010 (the largest dimension of the enclosure is equal to the wavelength at the maximum measurement frequency, 300 mm at 1 GHz).

The test report shall state which test method was used and which limits were applied.

Limits below 1GHz at a measurement distance of 10 m
(Limit at 3m = limit at 10 m + 10dB)

4.2 Test Procedure

Test is conducting under the description of EN55014-1 clause 5 - Methods of measurement of radiated emission.

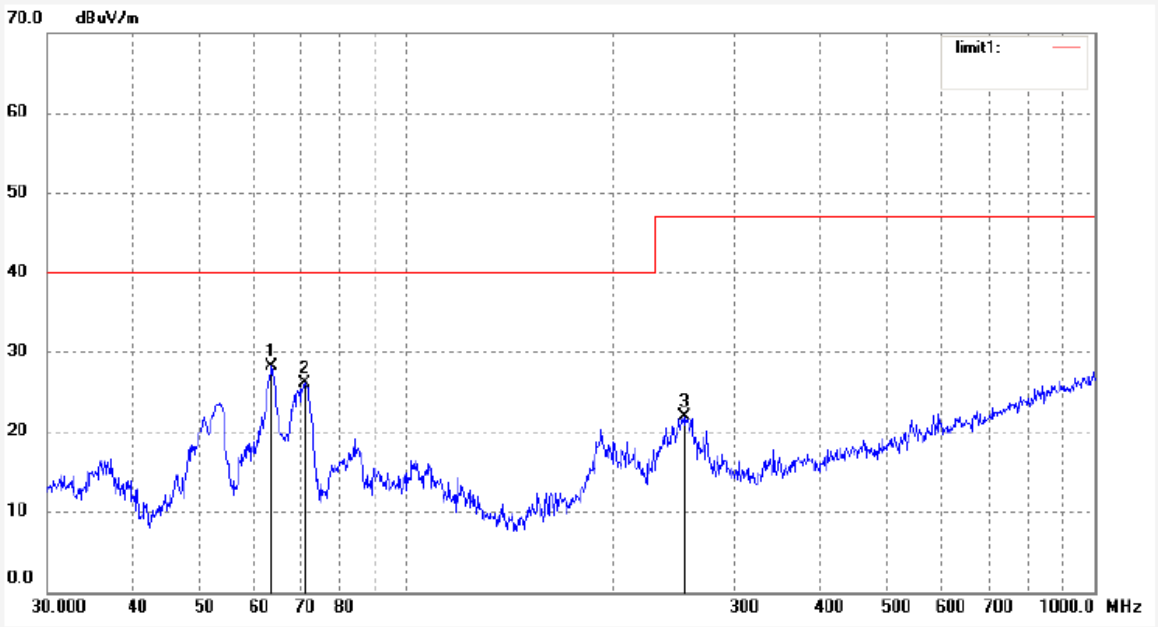


Test Setup Block Diagram

4.3 Test Data and Results

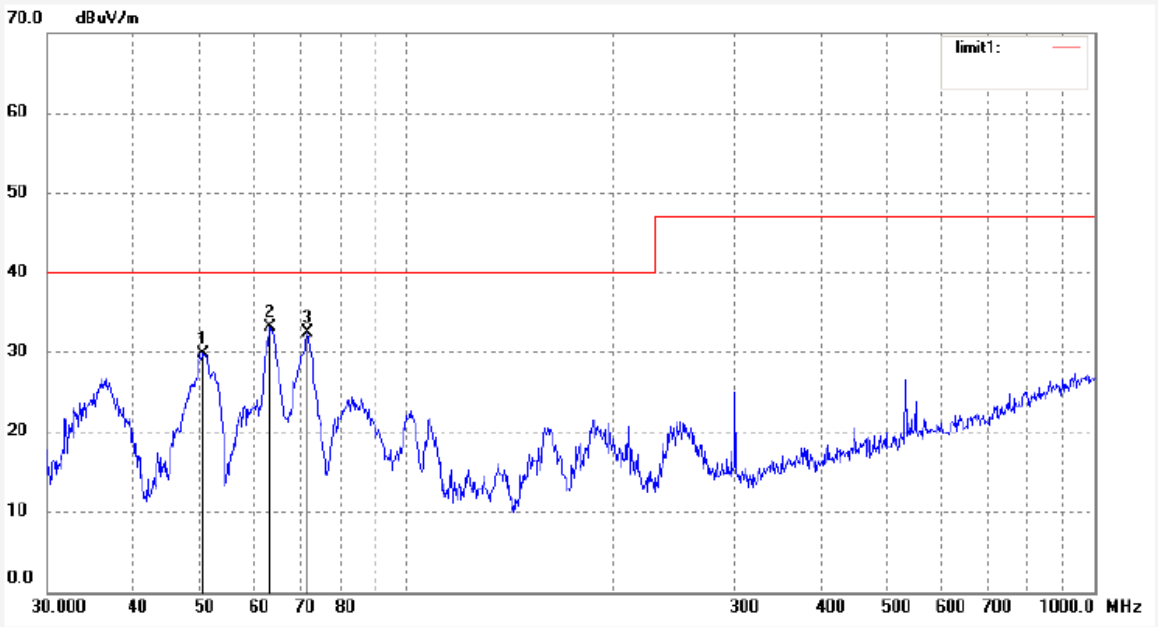
Based on all tested data, the EUT complied with the EN 55014-1 standard limit, and with the worst case as below:

Test Plots and Data of Radiated Emissions	
Tested Model:	Nexfan-01
Tested Mode:	TM1
Test Power Specification:	AC 230V/50Hz
Test Antenna Polarization:	Horizontal
Remark:	



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	63.6312	55.46	-27.27	28.19	40.00	-11.81	peak			
2	71.2033	53.79	-27.54	26.25	40.00	-13.75	peak			
3	254.0312	45.45	-23.41	22.04	47.00	-24.96	peak			

Test Plots and Data of Radiated Emissions	
Tested Model:	Nexfan-01
Tested Mode:	TM1
Test Power Specification:	AC 230V/50Hz
Test Antenna Polarization:	Vertical
Remark:	



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	50.6389	56.18	-26.30	29.88	40.00	-10.12	peak			
2	63.1857	60.35	-27.27	33.08	40.00	-6.92	peak			
3	71.7054	60.01	-27.56	32.45	40.00	-7.55	peak			

5. Harmonic Current Emissions

5.1 Standard and Limit

According to the standard EN 61000-3-2 Clause 7.1, limits for class A equipment.

5.2 Test Procedure

Test is conducting under the description of EN 61000-3-2.

5.3 Test Data and Results

According to Clause 7 of EN61000-3-2, the rated power of the EUT is less than 75W, belong to ‘equipment with a rated power of 75W or less’, therefore ‘limits are not specified in this edition of the standards’. It is deem to full fit the requirements of the standards.

Result: The EUT is compliance with the requirements of this section.

6. Voltage Fluctuation and Flicker

6.1 Standard and Limit

According to the standard EN 61000-3-3 Clause 5.

6.2 Test Procedure

Test is conducting under the description of EN 61000-3-3.

6.3 Test Data and Results

According to clause 6.1 of EN 61000-3-3, “Tests need not be made on equipment which is unlikely to produce significant voltage fluctuations or flicker.”

The maximum rated input power of the EUTs is about 75W only, which unlikely to produce significant voltage fluctuation. Therefore no test was applied.

Result: The EUT is compliance with the requirements of this section.

7. Electrostatic Discharges (ESD)

7.1 Standard and Limit

According to the standard EN 55014-2 Clause 5.1, Limit as below:

Test Specifications	Test Levels	Performance Criterion
Air Discharge	8kV	B
Contact Discharge	4kV	B

7.2 Test Procedure

Test is conducting under the description of IEC 61000-4-2.

7.3 Test Results

Air Discharge	**Test Levels (kV)**							
Test Points	-2	+2	-4	+4	-8	+8	-15	+15
Surface	A	A	A	A	A	A	--	--
Slots	A	A	A	A	A	A	--	--
LED	A	A	A	A	A	A	--	--
Buttons	A	A	A	A	A	A		

Contact Discharge	**Test Levels (kV)**							
Test Points	-2	+2	-4	+4	-6	+6	-8	+8
Metal Parts	A	A	A	A	--	--	--	--

8. Radio Frequency Electromagnetic Fields (R/S)

8.1 Standard and Limit

According to the standard EN 55014-2 Clause 5.5, Limit as below:

Test Specifications	Test Levels	Performance Criterion
80MHz-1000MHz	3V/m	A

8.2 Test Procedure

Test is conducting under the description of IEC 61000-4-3.

8.3 Test Results

Frequency step: 1% of fundamental
Dwell time: 1 second
Modulation: AM by 1kHz sine wave with 80% modulation depth

Frequency Range	EM Field	Polarization	Front	Rear	Left	Right
80MHz-1GHz	3V/m	Horizontal	A	A	A	A
80MHz-1GHz	3V/m	Vertical	A	A	A	A

9. Fast Transients (EFT)

9.1 Standard and Limit

According to the standard EN 55014-2 Clause 5.2, Limit as below:

Test Specifications	Test Levels (5/50ns)	Performance Criterion
AC Power Ports	1kV	B
DC Power Ports	0.5kV	B
Signal Ports	0.5kV	B

9.2 Test Procedure

Test is conducting under the description of IEC 61000-4-4.

9.3 Test Results

EFT Test Ports		**Test Levels (kV)**					
		+0.5	**-0.5**	**+1.0**	**-1.0**	**+2.0**	**-2.0**
Power Port (AC Power Supply)	L (Live)	A	A	A	A	--	--
	N (Neutral)	A	A	A	A	--	--
	G (Ground)	--	--	--	--	--	--
	L + N	A	A	A	A	--	--
	L + G	--	--	--	--	--	--
	N + G	--	--	--	--	--	--
	L + N + G	--	--	--	--	--	--
Power Port (DC Power Supply)	P (Positive)	--	--	--	--	--	--
	N (Negative)	--	--	--	--	--	--
	P + N	--	--	--	--	--	--
Signal Ports	--	--	--	--	--	--	--
	--	--	--	--	--	--	--

10. Surges

10.1 Standard and Limit

According to the standard EN 55014-2 Clause 5.6, Limit as below:

Test Specifications	Test Levels (1.2/50us)	Performance Criterion
Line to Line	2kV	B
Line to Ground	1kV	B

10.2 Test Procedure

Test is conducting under the description of IEC 61000-4-5.

10.3 Test Results

Surges Test Ports		**Test Levels (kV)**					
		+0.5	**-0.5**	**+1.0**	**-1.0**	**+2.0**	**-2.0**
AC Power Port	L – N	A	A	A	A	--	--
	L – G	--	--	--	--	--	--
	N – G	--	--	--	--	--	--

11. Injected Currents (C/S)

11.1 Standard and Limit

According to the standard EN 55014-2 Clause 5.3, Limit as below:

Test Specifications	Test Levels	Performance Criterion
0.15MHz-230MHz	3V	A

11.2 Test Procedure

Test is conducting under the description of IEC 61000-4-6.

11.3 Test Results

Sweep frequency range: 150 kHz ~ 230 MHz
Frequency step: 1% of fundamental
Dwell time: 1 second

C/S Test Ports	**Test Levels**	**Modulation**	**Result**
AC Power Port	3V	AM 80%, 1kHz sinewave	A

12. Voltage Dips and Interruptions

12.1 Standard and Limit

According to the standard EN 55014-2 Clause 5.7, Limit as below:

Test Specifications	Test Periods	Performance Criterion
100% reduction	0.5 periods	B
60% reduction	10 periods	C
30% reduction	25 periods	C

12.2 Test Procedure

Test is conducting under the description of IEC 61000-4-11.

12.3 Test Results

U: Voltage dips in % U_T (U_T is rated voltage for the EUT)
T: Test duration

Dips Test Levels	**U**	**T**	**Phase Angle**	**Result**
1	100%	10ms	0/90/180/270	A
2	60%	200ms	0/90/180/270	B
3	30%	500ms	0/90/180/270	B

Annex A. EUT Photos

EUT View 1

EUT View 2

EUT View 3

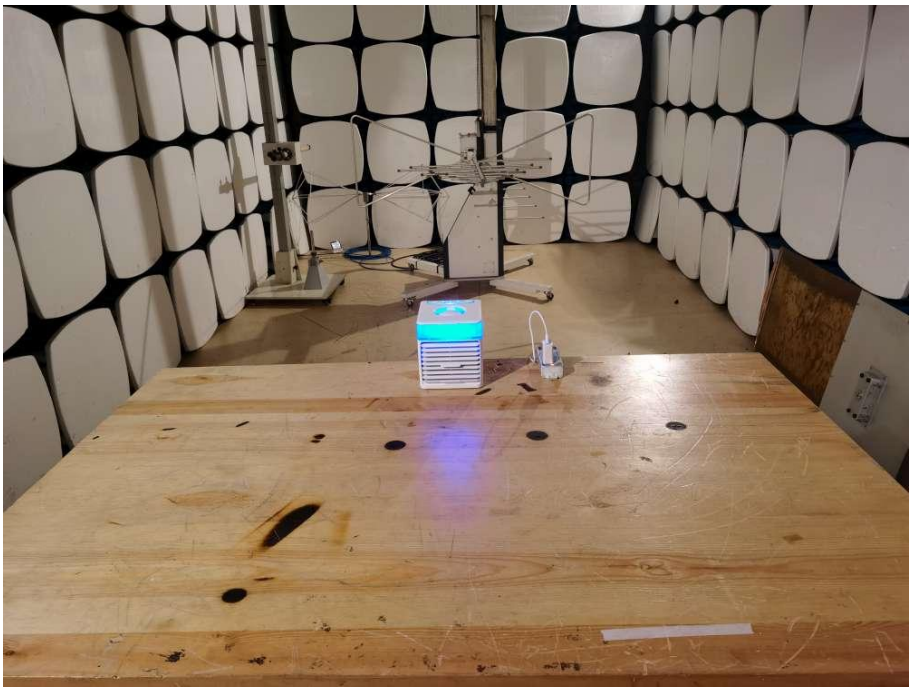
EUT View 4

EUT View 5

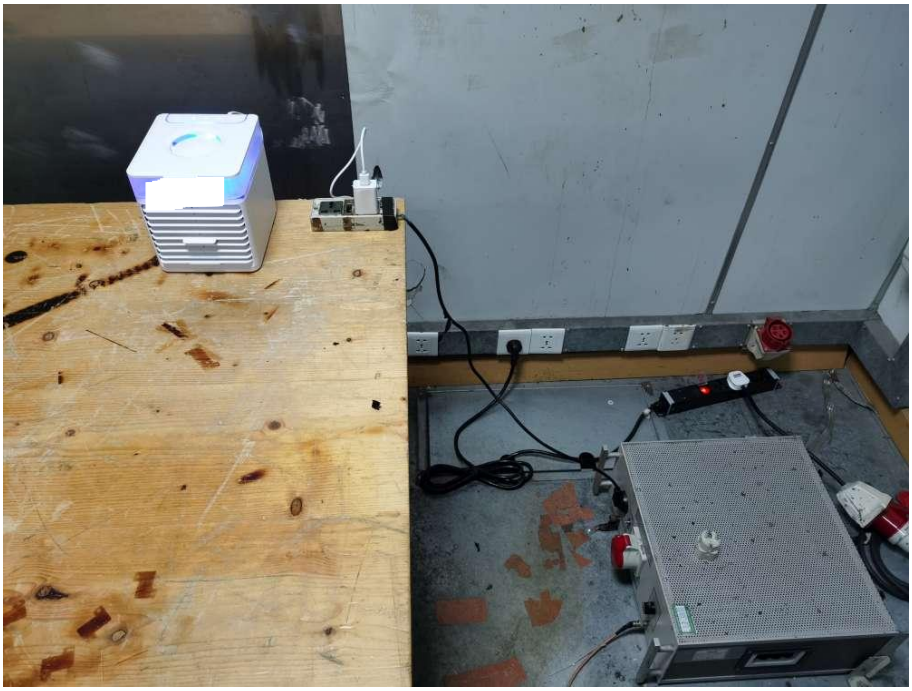
EUT View 6

Annex B. Test Setup Photos

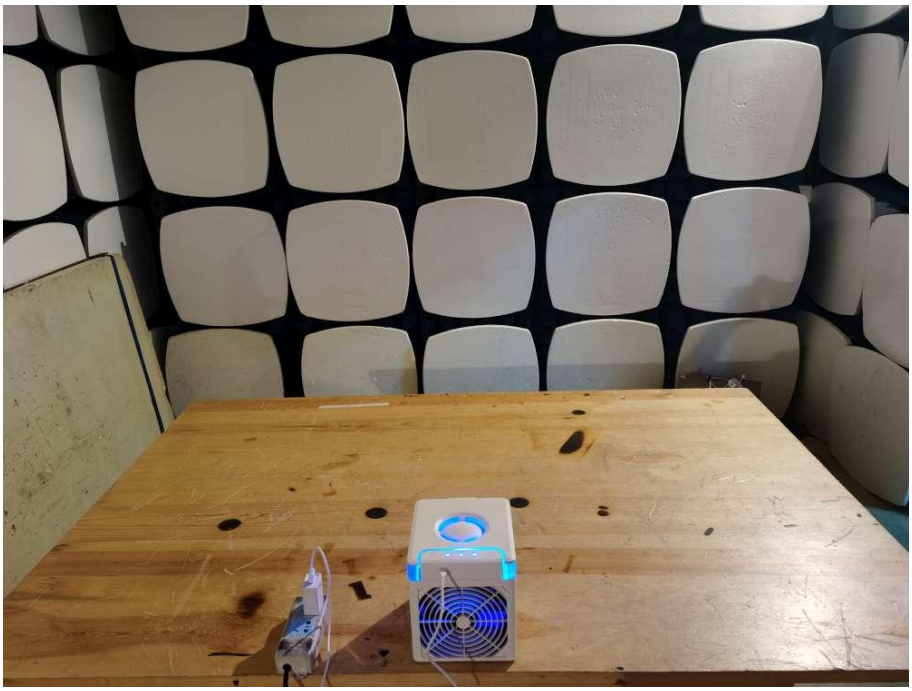
Radiation Emission Test View



Conduction Emission Test View



R/S Test View



Annex C. Label and Information

CE Mark Sample

CE Mark Specifications

Text is Black in color and is justified. Labels are printed in indelible ink on permanent adhesive backing or silk-screened onto the EUT or shall be affixed at a conspicuous location on the EUT. The ‘CE’ marking must be affixed to the EUT or to its data plate. Where this is not possible or not warranted on account of the nature of the apparatus, it must be affixed to the packaging, if any, and to the accompanying documents. The ‘CE’ marking must have a height of at least 5 mm. If the ‘CE’ marking is reduced or enlarged the proportions given in the above graduated drawing must be respected.

******* END OF REPORT *******