中国认可
国际互认
检测
TESTING
CNAS L14701

TEST REPORT

Applicant:	Shenzhen LEMAX New Energy Co., Ltd
Address:	A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China
EUT Name:	Grid-connected PV Inverter
Mode Name Under Test:	SUN-110K-G03
Series Model Name:	SUN-70K-G03, SUN-75K-G03, SUN-80K-G03, SUN-90K-G03, SUN-100K-G03, SUN-110K-G03
Brand Name:	LEMAX
Test Standard:	EN IEC 61000-6-2:2019, EN IEC 61000-6-4:2019, IEC 61000-6-2:2016, IEC 61000-6-4:2018, IEC 61000-3-11:2017, IEC 61000-3-12:2011, EN IEC 61000-3-11:2019, EN 61000-3-12:2011
Sample Arrival Date:	Jan. 21, 2021
Test Date:	Jan. 21, 2021 ~ Feb. 06, 2021
Date of Issue:	Feb. 02, 2023

ISSUED BY:

Dongguan BALUN Testing Technology Co., Ltd.

Tested by: Yongqing Chen

Checked by: Tao Zheng

Approved by: Simon Qi

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Feb. 02, 2023	Initial Issue

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Test Laboratory

Name	Dongguan BALUN Testing Technology Co., Ltd.
Address	Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong Province, P. R. China 523808

1.2. Test Location

Name	Dongguan BALUN Testing Technology Co., Ltd.
Location	Room 104, 204, 205, Building 1, No. 6, Industrial South Road, Songshan Lake District, Dongguan, Guangdong Province, P. R. China 523808

2. PRODUCT INFORMATION

2.1. Applicant Information

Applicant	Shenzhen LEMAX New Energy Co., Ltd
Address	A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

2.2. Manufacturer Information

Manufacturer	Shenzhen LEMAX New Energy Co., Ltd
Address	A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

2.3. Factory Information

Factory	NingBo Deye Inverter Technology Co.,Ltd.
Address	No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China.

2.4. General Description for Equipment under Test (EUT)

EUT Name	Grid-connected PV Inverter
Mode Name Under Test	SUN-110K-G03
Series Model Name	SUN-70K-G03, SUN-75K-G03, SUN-80K-G03, SUN-90K-G03, SUN-100K-G03, SUN-110K-G03
Description of Model name differentiation	The variants models have the same appearance, topology, PCB board and software. The number of MPPT will be differentiated according to different power levels. The output power and input power are different which controlled by software. Dongguan BALUN Testing Technology Co., Ltd. is not responsible for the authenticity of the above statements.
Hardware Version	N/A
Software Version	DSP: Ver0175 CPLD: Ver3205

Parameters Table：

Model	SUN-70K-G03	SUN-75K-G03	SUN-80K-G03
Input Side			
Max.DC Power(kW)	105	112.5	120
Max.DC Input Voltage(V)	1000		
Start-up DC Input Voltage(V)	250		
MPPT Operating Range(V)	200~850		
Max.DC Input Current(A)	40*4		
Number of MPPT/Strings per MPPT	4/4		
Output Side			
Rated Output Power(kW)	70	75	80
Max.Active Power(kW)	77	82.5	88
Rated AC Grid Voltage(V)	230/400		
AC Grid Voltage Range(V)	277~460		
Rated Grid Frequency(Hz)	50/60(Optional)		
Operating Phase	Three phase		
Rated AC Grid Output Current(A)	101.5	108.7	115.9
Max.AC Output Current(A)	111.6	119.6	127.5
Output Power Factor	>0.99		
Grid Current THD	<2%		
DC Injection Current(mA)	<0.5%		
Grid Frequency Range	47-52 or 57-62（optional）		
Efficiency			
Max.Efficiency	98.7%		
Euro Efficiency	98.3%		
MPPT Efficiency	>99%		
General Data			
Size(mm, W×H×D)	838×577×323		
Weight(kg)	73.7		
Topology	Transformerless		
Internal consumption	<1W(Night)		
Operating temperature	-25 ~ 65℃		
Ingress protection	IP65		
Max. operation altitude	2000m		
Cooling Concept	Smart cooling		
Noise Emission(Typical)	<55dB		
Designed Lifetime	>20 Years		
Grid Connection Standard	EN50549, IEC61727, VDE 0126-1-1, IEC62109-1-2		
Operation surrounding humidity	0~100%		
Safety EMC / Standard	IEC62109-1/-2,AS3100,EN61000-6-4		
DC Connection	MC-4 mateable		
AC Connection	IP65 rated plug		
Display	LCD 240×160		
Interface	RS-485/RS-232/Wifi/LAN		

Model	SUN-90K-G03	SUN-100K-G03	SUN-110K-G03
Input Side			
Max.DC Power(kW)	135	150	165
Max.DC Input Voltage(V)	1000		
Start-up DC Input Voltage(V)	250		
MPPT Operating Range(V)	200~850		
Max.DC Input Current(A)	40*6		
Number of MPPT/Strings per MPPT	6/4		
Output Side			
Rated Output Power(kW)	90	100	110
Max.Active Power(kW)	99	110	121
Rated AC Grid Voltage(V)	230/400		
AC Grid Voltage Range(V)	277~460		
Rated Grid Frequency(Hz)	50/60(Optional)		
Operating Phase	Three phase		
Rated AC Grid Output Current(A)	130.4	144.9	159.4
Max.AC Output Current(A)	143.5	159.4	175.4
Output Power Factor	>0.99		
Grid Current THD	<2%		
DC Injection Current(mA)	<0.5%		
Grid Frequency Range	47-52 or 57-62（optional）		
Efficiency			
Max.Efficiency	98.7%		
Euro Efficiency	98.3%		
MPPT Efficiency	>99%		
General Data			
Size(mm, W×H×D)	838×577×323		
Weight(kg)	73.7		
Topology	Transformerless		
Internal consumption	<1W(Night)		
Operating temperature	-25 ~ 65℃		
Ingress protection	IP65		
Max. operation altitude	2000m		
Cooling Concept	Smart cooling		
Noise Emission(Typical)	<55dB		
Designed Lifetime	>20 Years		
Grid Connection Standard	EN50549, IEC61727, VDE 0126-1-1, IEC62109-1-2		
Operation surrounding humidity	0~100%		
Safety EMC / Standard	IEC62109-1/-2,AS3100,EN61000-6-4		
DC Connection	MC-4 mateable		
AC Connection	IP65 rated plug		
Display	LCD 240×160		
Interface	RS-485/RS-232/Wifi/LAN		

2.5. Ancillary Equipment

Note: not applicable.

2.6. Technical Information

Interfaces present on the EUT	AC Ports	From mains to AC power adapter.
	DC Ports	From DC power supply to EUT.
	Telecom Port	No Telecom Ports.
	Signal Ports	RS-485, which cable length is less than 3m.
About the Product		The equipment is Grid-connected PV Inverter, the above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

Labels：

LEMAX

Product Name	Grid-connected PV Inverter
Model	SUN-70K-G03
Max. DC Input Power	105kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	4×40Adc
Max. short circuit input current	4×64Adc
Rated AC Grid Voltage	3L/N/PE 230/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	70kW
Max. Active Power	77kW
Max. Apparent Output Power	77kVA
Max. AC Output Current	111.6Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

Safety Warning

5min *The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.*

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature，Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

LEMAX

Product Name	Grid-connected PV Inverter
Model	SUN-75K-G03
Max. DC Input Power	112.5kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	4×40Adc
Max. short circuit input current	4×64Adc
Rated AC Grid Voltage	3L/N/PE 230/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	75kW
Max. Active Power	82.5kW
Max. Apparent Output Power	82.5kVA
Max. AC Output Current	119.6Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

Safety Warning

5min *The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.*

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature，Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

LEMAX

Product Name	Grid-connected PV Inverter
Model	SUN-80K-G03
Max. DC Input Power	120kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	4×40Adc
Max. short circuit input current	4×64Adc
Rated AC Grid Voltage	3L/N/PE 230/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	80kW
Max. Active Power	88kW
Max. Apparent Output Power	88kVA
Max. AC Output Current	127.5Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

Safety Warning

5min *The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.*

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature，Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

LEMAX

Product Name	Grid-connected PV Inverter
Model	SUN-90K-G03
Max. DC Input Power	135kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	6×40Adc
Max. short circuit input current	6×64Adc
Rated AC Grid Voltage	3L/N/PE 230/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	90kW
Max. Active Power	99kW
Max. Apparent Output Power	99kVA
Max. AC Output Current	143.5Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

Safety Warning

5min *The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.*

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature，Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

LEMAX

Product Name	Grid-connected PV Inverter
Model	SUN-100K-G03
Max. DC Input Power	150kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	6×40Adc
Max. short circuit input current	6×64Adc
Rated AC Grid Voltage	3L/N/PE 230/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	100kW
Max. Active Power	110kW
Max. Apparent Output Power	110kVA
Max. AC Output Current	159.4Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

Safety Warning

5min *The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.*

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature，Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

LEMAX

Product Name	Grid-connected PV Inverter
Model	SUN-110K-G03
Max. DC Input Power	165kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	6×40Adc
Max. short circuit input current	6×64Adc
Rated AC Grid Voltage	3L/N/PE 230/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	110kW
Max. Active Power	121kW
Max. Apparent Output Power	121kVA
Max. AC Output Current	175.4Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

Add: A301, Building #A, Jian Creative Center, No. 54 Jizheng Road, Longgang District, Shenzhen, China

Safety Warning

5min *The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.*

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature，Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

3. SUMMARY OF TEST RESULTS

3.1. Test Standards

No.	Identity	Document Title
1	EN IEC 61000-6-2:2019	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
2	EN IEC 61000-6-4:2019	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
3	EN IEC 61000-3-11:2019	Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection
4	EN 61000-3-12:2011	Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase
5	IEC 61000-6-2:2016	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
6	IEC 61000-6-4:2018	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
7	IEC 61000-3-11:2017	Electromagnetic compatibility (EMC) — Part 3-11: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems — Equipment with rated current ≤ 75 A and subject to conditional connection
8	IEC 61000-3-12:2011	Electromagnetic compatibility (EMC) — Part 3-12: Limits — Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase

3.2. Verdict

No.	Base Standard	Description		Test Verdict	Result	Remark
Emission						
1	EN IEC 61000-6-4:2019, IEC 61000-6-4:2018	Radiated Emission	Below 1 GHz	P	Annex A.1	--
			Above 1 GHz	N		Note 1
2	EN IEC 61000-6-4:2019, IEC 61000-6-4:2018	Conducted Emission	AC Ports	P	Annex A.2	--
			Telecom Ports	N		Note 2
3	EN 61000-3-12:2011, IEC 61000-3-12:2011	Harmonic Current Emissions		P	Annex A.3	--
4	IEC 61000-3-11:2017, EN IEC61000-3-11:2019	Voltage Fluctuations & Flicker		P	Annex A.4	--
Immunity						
5	IEC 61000-4-2:2008	Electrostatic Discharge Immunity		P	Annex A.5	--
6	IEC 61000-4-3:2006 +A1:2007+A2:2010	Radiated RF Electromagnetic Field Immunity		P	Annex A.6	--
7	IEC 61000-4-4:2012	Electrical Fast Transient/Burst Immunity	AC Ports	P	Annex A.7	--
			DC Ports	P		--
			Signal Ports	N		Note 3
8	IEC 61000-4-5:2014	Surge Immunity	AC Ports	P	Annex A.8	--
			DC Ports	P		--
			Signal Ports	N		Note 4
9	IEC 61000-4-6:2013	Immunity to Conducted Disturbances Induced by RF Fields	AC Ports	P	Annex A.9	--
			DC Ports	P		--
			Signal Ports	N		Note 3
10	IEC 61000-4-8:2009	Power-frequency magnetic field		P	Annex A.10	--
11	IEC 61000-4-34:2005 +A1:2009	Voltage Dips and Short Interruptions Immunity	AC Ports	P	Annex A.11	--

Note 1: The highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall be made below 1 GHz.

Note 2: Telecommunications/network port is a point of connection for voice, data and signaling transfers intended to interconnect widely dispersed systems via such means as direct connection to multi-user telecommunications networks, local area networks and similar networks. A port generally intended for interconnection of components of an ITE system under test and used in accordance with its functional specifications, is not considered to be a telecommunication port. The EUT does not have telecommunication port according to above definition.

Note 3: Signal/control port is a port at which a conductor or cable intended to carry signals is connected to the equipment. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m. The signal ports cable length of EUT is less than

2m.

Note 4: Signal/control port is a port at which a conductor or cable intended to carry signals is connected to the equipment. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 30 m. The signal ports cable length of EUT is less than 2m.

Note 5: The differences between this report and the report No.BL-DG20C0755-401, which was issued by Shenzhen BALUN Technology Co., Ltd. on Feb. 26, 2021 is that :
a: Change the applicant information, manufacturer information, EUT name and series model.
b: Update the labels and EUT external photos.
The sample under test is the same. All test result please refer to report BL-DG20C0755-401, which was issued by Shenzhen BALUN Technology Co., Ltd. on Feb. 26, 2021.

This report judges the test conclusions:

——Not applicable for this test product N

——Meet requirements P

——Does not meet the requirements F

3.3. Test Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Conducted emissions (Mains port)	3.77 dB
Radiated emissions (30 MHz-1 GHz)	4.81 dB

4. GENERAL TEST CONFIGURATIONS

4.1. Test Environments

Environment Parameter	Selected Values During Tests			
	Temperature	Voltage	Relative Humidity	Ambient Pressure
Normal Temperature, Normal Voltage (NTNV)	20°C ~ 27°C	AC 400V 50Hz MPPT 200V~850V	50% ~ 57%	100kPa ~ 100.6kPa

4.2. Test Equipment List

Radiated Emission Test For Frequency Below 1 GHz						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Keysight	N9038A	MY55330115	2020.03.16	2021.03.15	√
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-01202	2018.12.20	2021.12.19	√
Anechoic Chamber	YIHENG ELECTRONIC	12.0m*7.0m*7.5m	YHEMC018	2019.03.05	2022.03.04	√
Description	Manufacturer	Name		Version		
Test Software	BALUN	BL410-E		V19.319		

Conducted Emission						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Keysight	N9038A	MY55330115	2020.03.16	2021.03.15	√
LISN	SCHWARZBECK	NNLK 8129	8129-462	2020.11.10	2021.11.09	√
Anechoic Chamber	YIHENG ELECTRONIC	12.0m*7.0m*7.5m	YHEMC018	2019.03.05	2022.03.04	√
Description	Manufacturer	Name		Version		
Test Software	BALUN	BL410-E		V19.319		

Voltage Fluctuations & Flicker and Harmonic Current Emissions Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Power Analyzer	FULKE	435II	37143115	2020.03.04	2021.03.03	√
Three-phase Flicker Impedance	HTEC	FI-75A	172101	2020.09.21	2021.09.20	√

Electrostatic Discharge Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
ESD Test System	SCHLODER	SESD 30000	607339	2020.05.13	2021.05.12	√

Radiated RF Electromagnetic Field Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Anechoic Chamber	YIHENG ELECTRONIC	12.0m*7.0m*7.5m	YHEMC018	2019.03.05	2022.03.04	√
Signal Generator	ROHDE&SCHWARZ	N5181A	MY50141978	2020.03.16	2021.03.15	√
Power Amplifier	rflight	NTWPA-008 10200E	18093198	2020.03.16	2021.03.15	√
Power Amplifier	rflight	NTWPA-106 0100E	18093195	2020.03.16	2021.03.15	√
Power Meter	Agilent	E4417A	GB41292042	2020.03.18	2021.03.17	√
Feld Strength Meter	Narda	EP601	511WX51129	2020.03.18	2021.03.17	√
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-01202	2018.12.20	2021.12.19	√
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	9120D-1986	2018.12.20	2021.12.19	√
Description	Manufacturer	Name		Version		
Test Software	BALUN	BL410-E		V19.319		

Electrical Fast Transient/Burst Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EFT Test System	HTEC	HEFT 51	1331011	2020.03.16	2021.03.15	√
EFT coupling network	HTEC	ECDN 51	150601	2020.03.16	2021.03.15	√

Transients and Surges Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
SURGE Generator (AC/DC Ports)	HTEC	HCWG 70	151601	2020.03.16	2021.03.15	√
SURGE coupling network (AC/DC Ports)	HTEC	SCDN303P7	151602	2020.03.16	2021.03.15	√

Immunity to Conducted Disturbances Induced by RF Fields						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Conducted Disturbances Test System	Schloder GmbH	CDG 6000	18901932-0101	2020.09.21	2021.09.20	√
CDN-M2+3	Schloder GmbH	CDN M2+3-32	18901802-0110	2020.09.21	2021.09.20	√
CDN-M5	TESEQ	CDN-M5-100	A2560005/2016	2020.09.21	2021.09.20	√

Voltage Dips and Short Interruptions Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Voltage Fault Simulating Generator	HTEC	HPFS303P	152301	2020.03.16	2021.03.15	√
Voltage Fault Coupling Network	HTEC	HV3P30	152302	2020.03.16	2021.03.15	√

Power Frequency Magnetic Fields Immunity						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Magnetic Field Tester	HEAFELY	HPFMF 1000	183102	2020.05.13	2021.05.12	√

4.3. Test Enclosure list

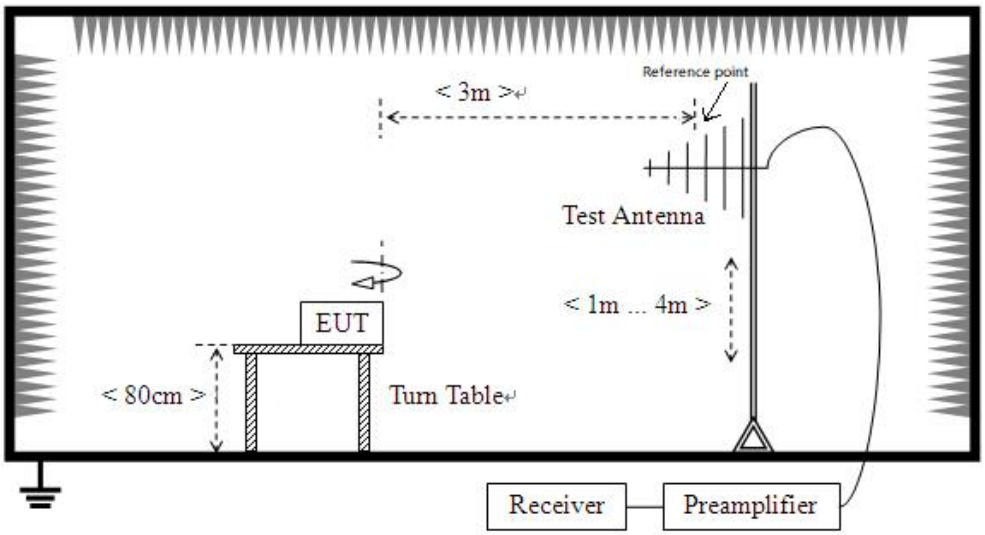
Name	Manufacturer	Model	Serial No.	Length	Description
DC Source	WKDY	WPLA-150W	W20180626011	N/A	N/A
AC Source	WKDY	WPLA-33075KVA	N/A	N/A	N/A

4.4. Test Configurations

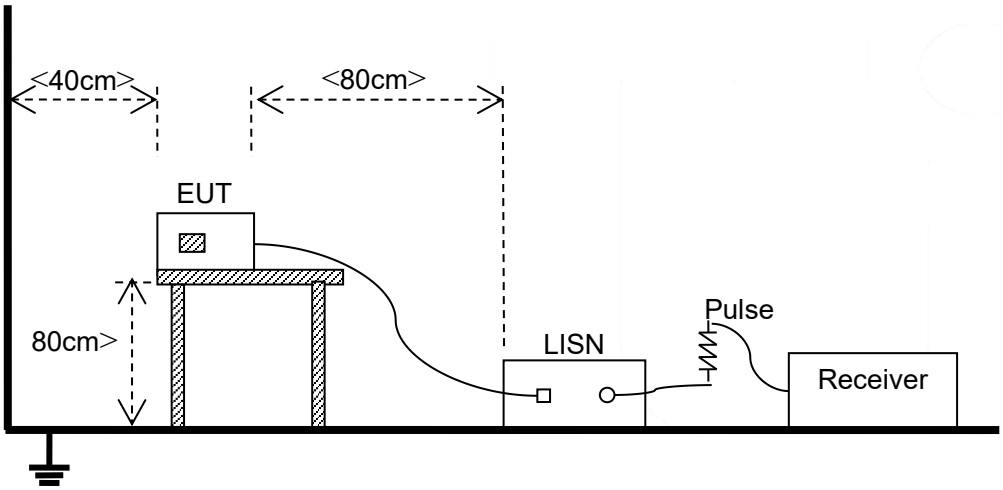
Test Configurations (TC) No.	Description
TC01	Grid-connected(100% Load) EUT+ DC Source+AC Grid
TC02	Grid-connected(50% Load) EUT+ DC Source+AC Grid
TC03	Grid-connected(10% Load) EUT+ DC Source+AC Grid
TC04	Standby EUT+AC Grid

4.5. Description of Test Setup

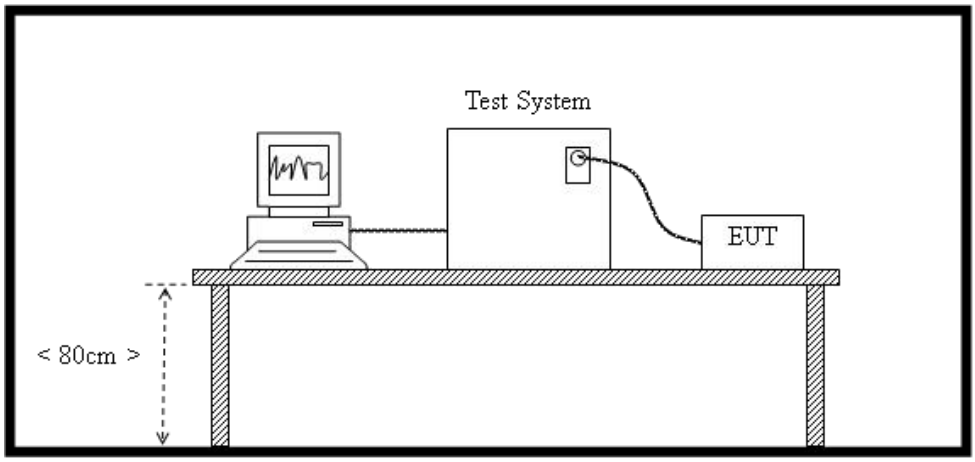
Test Setup 1 For Radiated Emission Test (30 MHz-1 GHz)



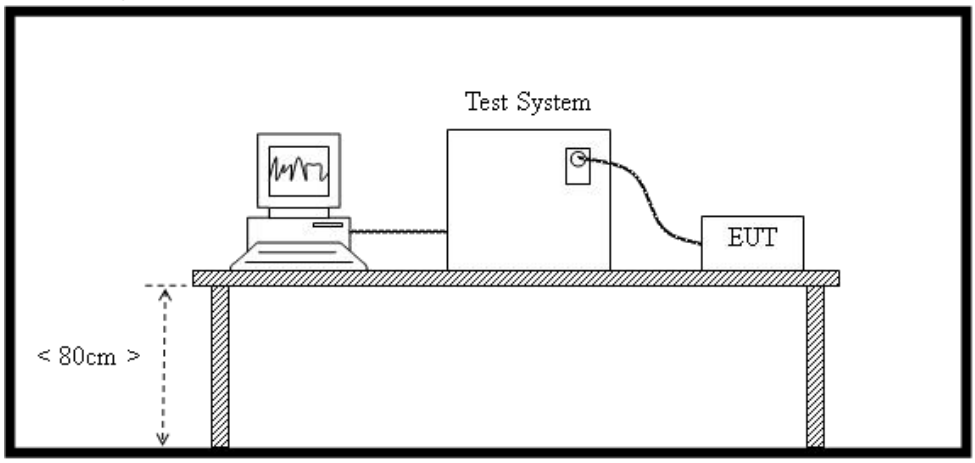
Test Setup 2 For Conducted disturbance voltage at mains terminals Test



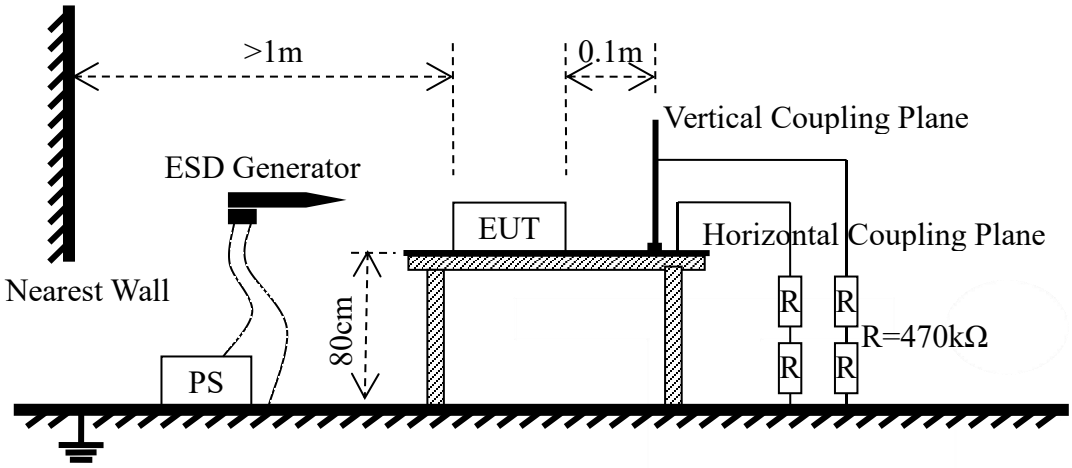
Test Setup 3 For Harmonic Current Emissions Measurement Test



Test Setup 4 For Voltage Fluctuations and Flicker Measurement Test

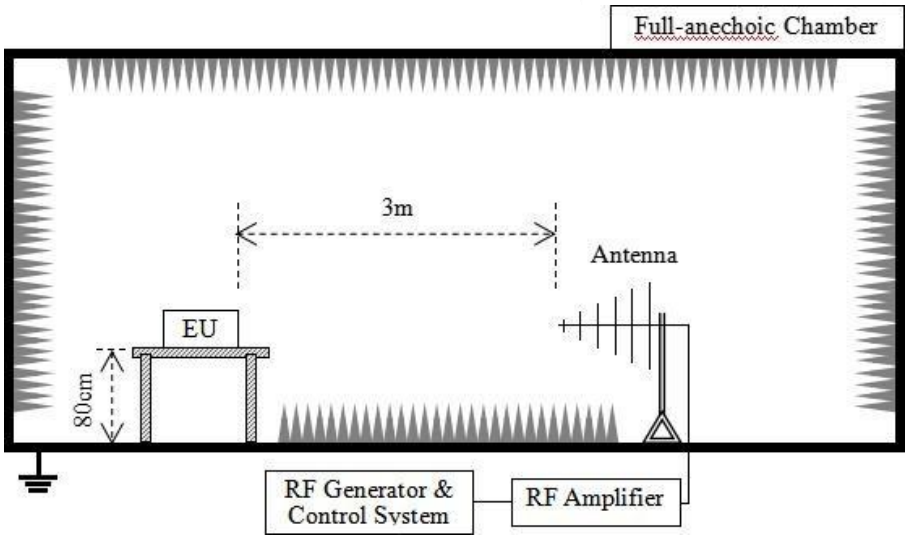


Test Setup 5 For Electrostatic Discharge Immunity Test

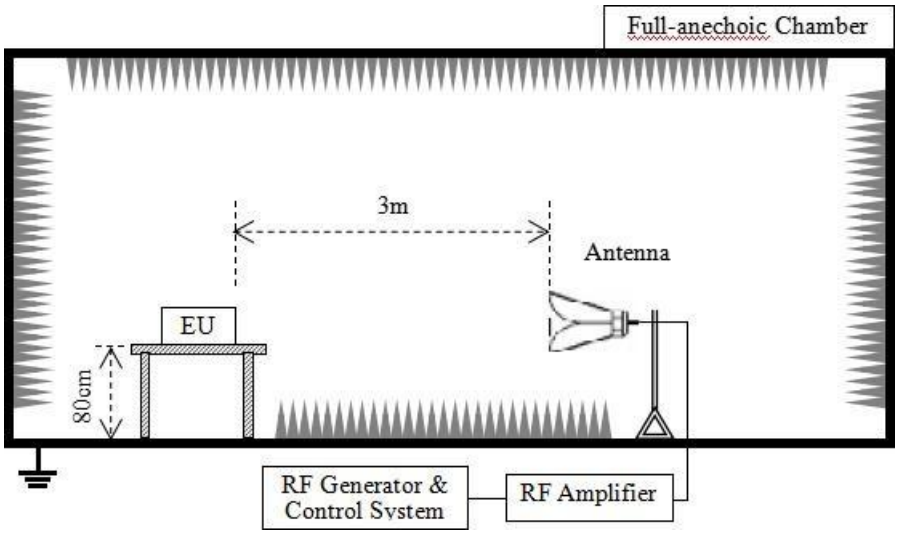


Test Setup 6 For Radiated Immunity Test

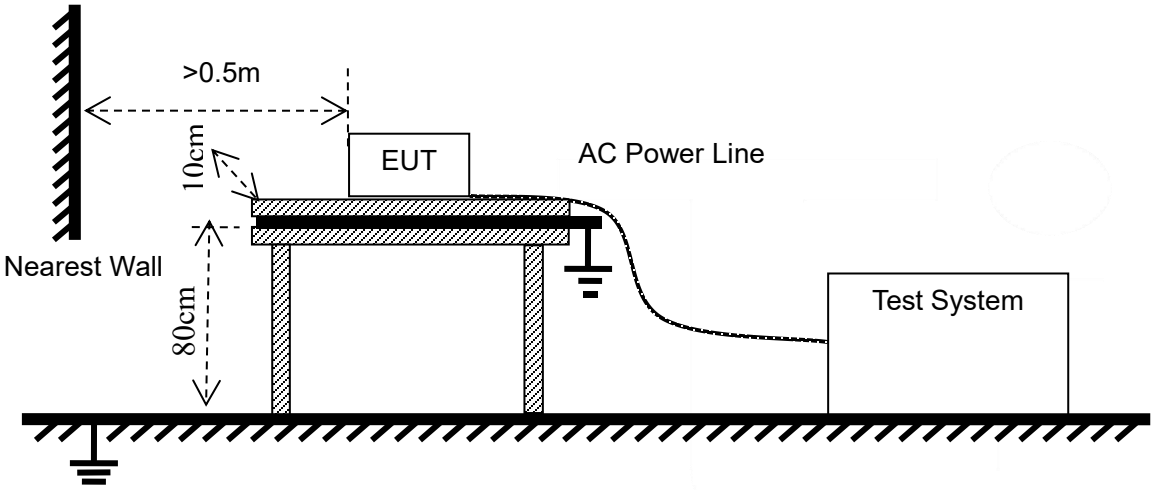
For below 1GHz



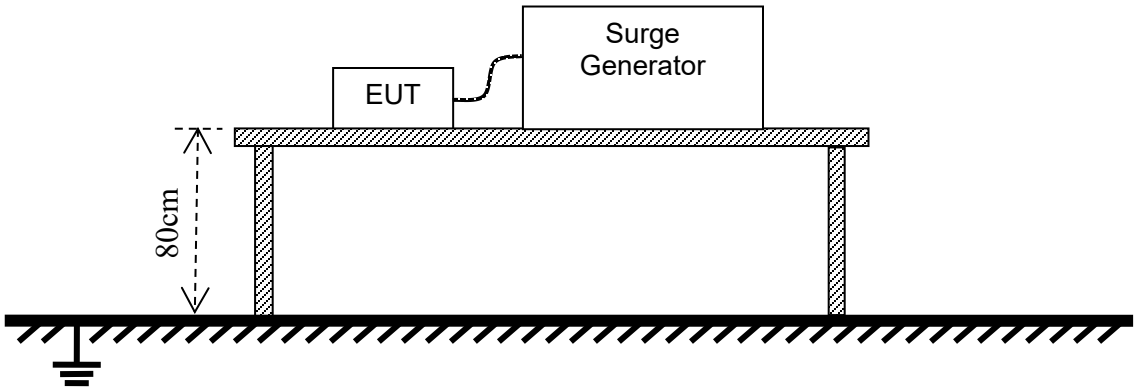
For above 1GHz



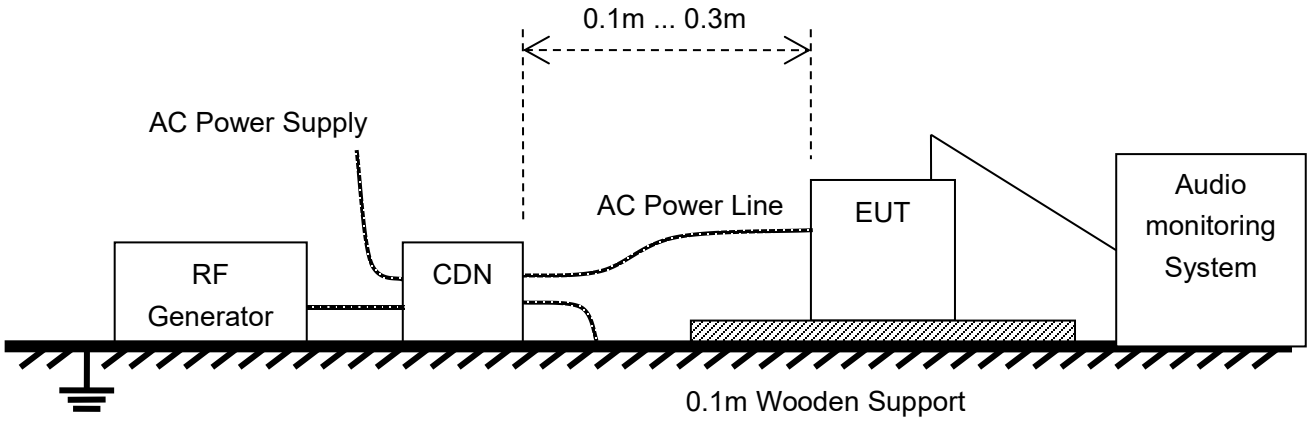
Test Setup 7 For Electrical Fast Transient / Burst Immunity Test



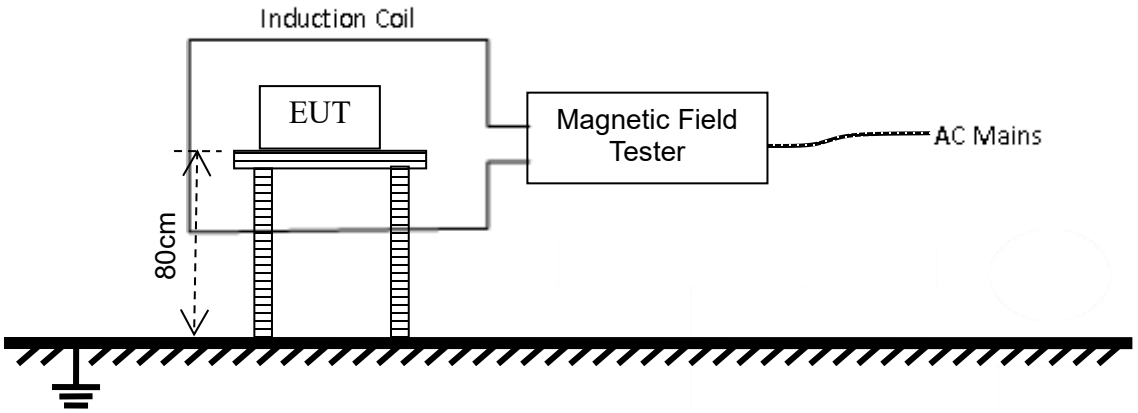
Test Setup 8 For Surge Immunity Test



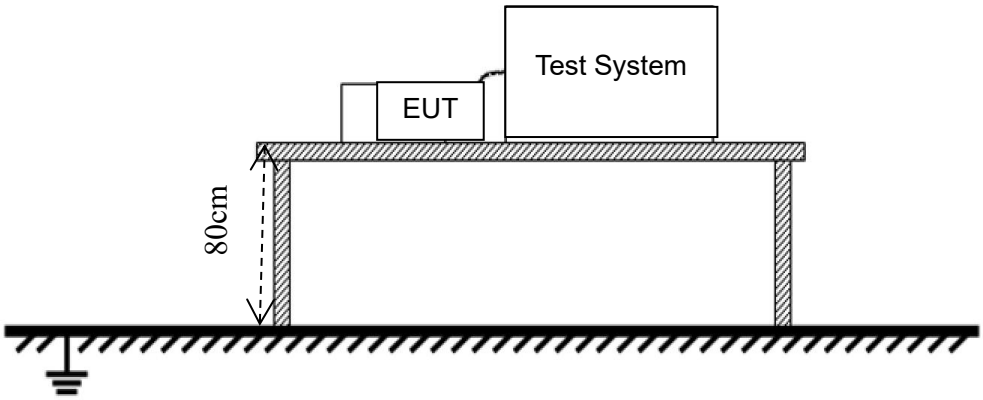
Test Setup 9 For Immunity to Conducted Disturbances Induced By RF Fields Test



Test Setup 10 Power Frequency Magnetic Fields



Test Setup 11 For Voltage Dips and Short Interruptions Immunity Test



4.6. Test Conditions

Test Case	Test Conditions	
Radiated Emission	Test Env.	NTNV
	Test Setup	Test Setup 1
	Test Configuration	TC01, TC02, TC04
Conducted Emission	Test Env.	NTNV
	Test Setup	Test Setup 2
	Test Configuration	TC01, TC02, TC04
Harmonic Current Emissions	Test Env.	NTNV
	Test Setup	Test Setup 3
	Test Configuration	TC02
Voltage Fluctuations & Flicker	Test Env.	NTNV
	Test Setup	Test Setup 4
	Test Configuration	TC02
Electrostatic Discharge Immunity	Test Env.	NTNV
	Test Setup	Test Setup 5
	Test Configuration	TC03
Radiated RF Electromagnetic Field Immunity	Test Env.	NTNV
	Test Setup	Test Setup 6
	Test Configuration	TC03
Electrical Fast Transient/Burst Immunity	Test Env.	NTNV
	Test Setup	Test Setup 7
	Test Configuration	TC03
Surge Immunity	Test Env.	NTNV
	Test Setup	Test Setup 8
	Test Configuration	TC03
Immunity to Conducted Disturbances Induced by RF Fields	Test Env.	NTNV
	Test Setup	Test Setup 9
	Test Configuration	TC03
Power-frequency magnetic field	Test Env.	NTNV
	Test Setup	Test Setup 10
	Test Configuration	TC03
Voltage Dips and Short Interruptions Immunity	Test Env.	NTNV
	Test Setup	Test Setup 11
	Test Configuration	TC03
Note: Based on client request, all normal using modes of the normal function were tested but only the worst test data of the worst mode is reported by this report. The grid-connected(50% Load) is the worst test mode for radiated emission and grid-connected(100% Load) is the worst test mode for conducted emission in this report.		

5. TEST ITEMS

5.1. Emission Tests

5.1.1. Radiated Emission

5.1.1.1. Limit

Frequency range (MHz)	Distance (at 3 m)	Distance (at 10 m)
	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Limit (dBμV/m)
30 - 230	50	40
230 - 1000	57	47

Frequency range (MHz)	Distance (at 3 m)	
	Peak Limit (dBμV/m)	Average Limit (dBμV/m)
1000-3000	76	56
3000-6000	80	60

NOTE:

1) If the highest internal frequency of the EUT is less than 108MHz, the measurement shall only be made up to 1GHz; If the highest internal frequency of the EUT is between 108MHz and 500MHz, the measurement shall only be made up to 2GHz; If the highest internal frequency of the EUT is between 500MHz and 1GHz, the measurement shall only be made up to 5GHz; If the highest internal frequency of the EUT is above 1GHz, the measurement shall be made up to 6GHz; Where the highest internal frequency is not known, tests shall be performed up to 6GHz.

2) At transitional frequencies the lower limit applies.

5.1.1.2. Test Procedure

All Radiated Emission tests were performed in the azimuth plane. And test data and plots are recorded in this test report.

An initial pre-scan was performed in the chamber using the EMI Receiver in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by Bi-Log antenna with 2 orthogonal polarities.

5.1.2. Conducted Emission

5.1.2.1. Test Limit

AC Port

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
0.15 - 0.50	79	66
0.50 - 30	73	60

NOTE:

1) The lower limit shall apply at the band edges.

Telecom Port

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
0.15 - 0.50	97-87	84-74
0.50 - 30	87	74

NOTE:

1) The lower limit shall apply at the band edges.
2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.
3) The current and voltage disturbance limits are derived for use with an impedance stabilization network (ISN) which presents a common mode (asymmetric mode) impedance of 150 Ω to telecommunication port under test.

Discontinuous disturbances

The click limit Lq is calculated by increasing the relevant quasi-peak limit L for continuous disturbances (as given in AC Port quasi-peak limit) by:

Frequency (MHz)	Click rate N	
	Click limit Lq (dB) N < 0,2	Click limit Lq (dB) 0,2 ≤ N < 30
0.15 - 30	AC Port quasi-peak limit + 44	AC Port quasi-peak limit + 20 lg (30/N)

5.1.2.2. Test Procedure

The EUT is connected to the power mains through a LISN which provides 50 Ω/50 μH or 150 Ω of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Telecommunication port was checked to find out the maximum conducted emission.

5.1.3. Harmonic Current Emissions (≤16A)

5.1.3.1. Limit

For each harmonic order, all 1.5s smoothed r.m.s. harmonic current values, as defined as follows, shall be either:

a) Less than or equal to 150% of the applicable limits, or

b) Less than or equal to 200% of the applicable limits under the following conditions, which apply all together:

1) The EUT belongs to Class A for harmonics;

2) The excursion beyond 150% of the applicable limits lasts less than 10%of the test observation period or in total 10min (within the test observation period), whichever is smaller, and

3) The average value of the harmonic current, taken over the entire test observation period, is less than 90% of the applicable limits.

Harmonic currents less than 0.6% of the input current measured under the test conditions, or less than 5mA, whichever is greater, are disregarded.

For the 21st and higher odd order harmonica, the average value obtained for each individual odd harmonic over the full observation period, calculated from the 1.5s smoothed r.m.s., may exceed the applicable limits by 50% provided that the following conditions are met:

- The measured partial odd harmonic current does not exceed the partial odd harmonic current which can be calculated from the applicable limits;
- All 1.5s smoothed r.m.s. individual harmonic current values shall be less than or equal to 150% of the applicable limits.

Note: These exemptions (the use of the partial odd harmonic current for the average values and the 200% short term limit for single 1.5s smoothed values) are mutually exclusive and cannot be together.

Limits for Class A equipment				Limits for Class D equipment		
odd harmonic		Even harmonics		Harmonic order (n)	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
Harmonic order (n)	Maximum permissible harmonic current A	Harmonic order (n)	Maximum permissible harmonic current A			
3	2.30	2	1.08	3	3.4	2.30
5	1.14	4	0.43	5	1.9	1.14
7	0.77	6	0.30	7	1.0	0.77
9	0.40	8≤n≤40	0.23*(8/n)	9	0.5	0.40
11	0.33			11	0.35	0.33
13	0.21			15≤n≤39 (odd harmonics only)	3.85/n	0.15*(15/n)
15≤n≤39	0.15*(15/n)					
Note: For Class B equipment, the harmonics of the input current shall not exceed the values given in Table “limits for Class A equipment” multiplied by a factor of 1.5.						

For the purpose of harmonic current limitation, equipment is classified as follows:(Note: Class C equipment requirement not include in this standard.)

Class A:
– balanced three-phase equipment;
– household appliances, excluding equipment identified as class D;
– tools, excluding portable tools;
– dimmers for incandescent lamps;
– audio equipment.
Equipment not specified in one of the three other classes shall be considered as class A equipment.
Class B:
– portable tools;
– arc welding equipment which is not professional equipment.
Class C:
– lighting equipment.
Class D:
Equipment having a specified power according to 6.2.2 less than or equal to 600 W, of the following types:
– personal computers and personal computer monitors;
– television receivers.

5.1.3.2. Test Procedure

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

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 necessary for the EUT to be exercised.

5.1.4. Harmonic Current Emissions (＞16A)

5.1.4.1. Limit

S_{SC}

value of the three-phase short-circuit power calculated from the nominal interphase system voltage $U_{nominal}$ and the line impedance Z of the system at the PCC:

$$S_{SC}=U^2_{normimal}/Z$$

where Z is the system impedance at the power frequency

S_{equ}

value calculated from the rated current I_{equ} of the piece of equipment stated by the manufacturer and the rated voltage Up (single phase) or U_l (interphase) as follows:

$S_{equ} = U_p I_{equ}$ for single-phase equipment and the single-phase part of hybrid equipment

$S_{equ} = U_i I_{equ}$ for interphase equipment

$S_{equ} = \sqrt{3}\ U_i I_{equ}$ for balanced three-phase equipment and the three-phase part of hybrid equipment

$S_{equ} = \sqrt{3}\ U_i I_{equ\ max}$ for unbalanced three-phase equipment

S_{sce}

characteristic value of a piece of equipment defined as follows:

$R_{sce} = S_{SC}/(3\ S_{equ})$ for single-phase equipment and the single-phase part of hybrid equipment

$R_{sce} = S_{SC}/(2\ S_{equ})$ for interphase equipment

$R_{sce} = S_{SC}/(S_{equ})$ for all three-phase equipment and the three-phase part of hybrid equipment

The limits given apply to 230/400 V, 50 Hz systems. The limits for the other systems will be added in a future edition of this standard.

NOTE 1 In some non-European countries, the proposed methodology cannot be applied because the short-circuit power data is not always available.

The harmonic current limits specified in the tables apply to each of the line currents and not to current in the neutral conductor.

For equipment with multiple rated currents, an assessment is made for each current.

As an example (for the same equipment):

Rated voltage: 230 V single phase, rated current: x A per phase, assessment and test at 230 V.

Rated voltage: 400 V three phase, rated current: y A per phase, assessment and test at 400 V.

The harmonic current limits are specified in Tables 2 to 5

Equipment complying with the harmonic current emission limits corresponding to R_{sce} = 33 is suitable for connection at any point of the supply system.

NOTE 2 Values are based on a minimum value of Rsce = 33. Short-circuit ratios less than 33 are not considered.

NOTE 3 In order to reduce the depth of commutation notches of converters, a short-circuit ratio higher than 33 may be necessary.

For equipment not complying with the harmonic current emission limits corresponding to R_{sce} = 33, higher emission values are allowed, under the assumption that the short-circuit ratio R_{sce} is greater than 33. It is

expected that this will apply to the majority of equipment with input current above 16 A per phase. See requirement for product documentation in Clause 6.

Table 2 is applied to equipment other than balanced three-phase equipment and Tables 3, 4 and 5 are applied to balanced three-phase equipment.

Table 3 may be used for any balanced three-phase piece of equipment.

Table 4 may be used with balanced three-phase equipment if any one of these conditions is met.
a) The 5th and 7th harmonic currents are each less than 5 % of the reference current during the whole test observation period.
b) The design of the piece of equipment is such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value in the whole interval [0°，360°]
c) The phase angle of the 5th harmonic current related to the fundamental phase-to-neutral voltage (see 3.16) is in the range of 90 ° to 150 ° during the whole test observation period.

Table 5 may be used with balanced three-phase equipment if any one of these conditions is met:
d) The 5th and 7th harmonic currents are each less than 3 % of the reference current during the whole test observation period.
e) The design of the piece of equipment is such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value in the whole interval [0 °, 360 °].
f) The phase angle of the 5th harmonic current related to the fundamental phase-to-neutral voltage (see 3.16) is in the range of 150 ° to 210 ° during the whole test observation period.

Table 3, Table 4 or Table 5 can be applied to hybrid equipment in one of the following circumstances:
a) hybrid equipment having a maximum 3rd harmonic current of less than 5 % of the reference current，or
b) there is provision in the construction of hybrid equipment to separate the balanced three- phase and the single-phase or interphase loads for the measurement of supply currents, and when the current is being measured, the part of the equipment being measured draws the same current as under normal operating conditions. In that case, the relevant limits shall be applied separately to the single-phase or interphase part and to the balanced three-phase part. Table 3, Table 4 or Table 5 applies to the current of the balanced three- phase part, even if the rated current of the balanced three-phase part is less than or equal to 16 A per phase. Table 2 applies to the current of the single-phase or interphase part, but if the rated current of the single-phase or interphase part is less than or equal to 16 A, the manufacturer may apply the relevant limits of IEC 61000-3-2 to the single-phase or interphase part instead of the limits stated in Table 2.

For verification purposes, when circumstance b) above applies, the manufacturer shall state in the product documentation the rated current and give in the test report the measured and specified values of the input current as defined in 4.1, for each separate load. The value of R_{sce} for this type of hybrid equipment is determined as follows:
• the minimum R_{sce} value is first determined for each of the two loads, using the reference current of the considered part for the calculation of the harmonic current emissions to be compared to the limit values given in Tables 2 to 5; in case IEC 61000-3-2 is applied to the single-phase or interphase part instead of Table 2 limits, the minimum R_{sce} value for this part is deemed to be equal to 33;
• then, for each of the two parts, the minimum value of S_{sc} is calculated from its minimum R_{sce} value and its rated current (see 3.11 and 3.14);
• finally, the value of R_{sce} for the hybrid equipment is determined from the highest of both minimum values

of S_{sc} and the rated apparent power of the whole hybrid equipment.

Table 2 Current emission limits for equipment other than balanced three-phase equipment

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %						Admissible harmonic parameters %	
	I_3	I_5	I_7	I_9	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	21.6	10.7	7.2	3.8	3.1	2	23	23
66	24	13	8	5	4	3	26	26
120	27	15	10	6	5	4	30	30
250	35	20	13	9	8	6	40	40
≥350	41	24	15	12	10	8	47	47
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.								

Table 3 Current emission limits for balanced three-phase equipment

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %				Admissible harmonic parameters %	
	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	10.7	7.2	3.1	2	13	22
66	14	9	5	3	16	25
120	19	12	7	4	22	28
250	31	20	12	7	37	38
≥350	40	25	15	10	48	46
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.						

Table 4 Current emission for balanced three-phase equipment under specified conditions(a,b,c)

Minimum R_{sce}	Admissible individual harmonic current I_h/I_{ref} [a] %				Admissible harmonic parameters %	
	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
33	10.7	7.2	3.1	2	13	22
≥120	40	25	15	10	48	46
The relative values of even harmonics up to order 12 shall not exceed 16/h %. Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd order harmonics. Linear interpolation between successive R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.						

Table 5 Current emission for balanced three-phase equipment under specified conditions(d,e,f)

Minimum R_{sce} = 33	Admissible individual harmonic current I_h/I_{ref} [a] %												Admissible harmonic parameters %	
--	I_5	I_7	I_{11}	I_{13}	I_{17}	I_{19}	I_{23}	I_{25}	I_{29}	I_{31}	I_{35}	I_{37}	THC/I_{ref}	$PWHC/I_{ref}$
33	10.7	7.2	3.1	2	2	1.5	1.5	1.5	1	1	1	1	13	22
≥250	25	17.3	12.1	10.7	8.4	7.8	6.8	6.5	5.4	5.2	4.9	4.7	35	70
For R_{sce} equal to 33, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 1% of I_{ref}. For R_{sce}≥250, the relative values of even harmonics up to order 12 shall not exceed 16/h %. The relative values of all harmonics from I_{14} to I_{40} not listed above shall not exceed 3% of I_{ref}. Linear interpolation between both R_{sce} values is permitted. a: I_{ref}=reference current; I_h=harmonica current component.														

5.1.5. Voltage Fluctuations and Flicker

5.1.5.1. Limit

The 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;
- T_{max}, the accumulated time value of d(t) with a deviation exceeding 3.3% during a single voltage change at the EUT terminals, shall not exceed 500ms;
- The maximum relative steady-state voltage change, dc, shall not exceed 3.3%;
- The maximum relative voltage change d_{max}, shall not exceed:

a) 4% without additional conditions;

b) 6% for equipment which is:

— switched manually, or

— switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.

Note: The cycling frequency is further limited by the P_{st} and P_{lt} limits.

c) 7% for equipment which is:

— attended whilst in use, or

— switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

In the case of equipment having several separately controlled circuits with limits b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energized immediately on restoration of supply after a power supply interruption, limits a) shell apply; for all equipment with manual switching, limits b) or c) shall apply depending on the rate of switching.

P_{st} and P_{lt} requirement shall not be applied to voltage changes caused by manual switching.

The limits shall not be applied to voltage changes associated with emergency switching or emergency interruptions.

5.1.5.2. Test Procedure

During the Flicker measurement, the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours. The test specifications refer the next table.

No.	Specification	Value
1	Test Frequency	50 Hz
2	Test Voltage	230 VAC
3	Waveform	Sine
4	Test Time	10 minutes for Pst; 2 hours for Plt

5.2. Immunity Tests

5.2.1. Test Performance Criteria for Immunity Test

5.2.1.1. General Performance Criteria

Type	Description
Criterion A	The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.
Criterion B	The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.
Criterion C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

5.2.2. Electrostatic Discharge Immunity

5.2.2.1. Test Specification

Specification	Value
Basic Standard	IEC 61000-4-2:2008
Discharge Impedance	330 Ohm / 150 pF
Discharge Voltage	Air Discharge: 2 kV; 4 kV; 8 kV; Contact Discharge: 2 kV; 4 kV
Polarity	Positive / Negative
Number of Discharge	Minimum 20 times at each test point
Discharge Mode	Single discharge
Discharge Period	1 second minimum

5.2.2.2. Test Procedure

1. Electrostatic discharges are applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

2. The test is performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

3. The time interval between two successive single discharges is at least 1 second.

4. The ESD generator is held perpendicularly to the surface to which the discharge is applied and the return cable is at least 0.2 meters from the EUT.

5. Contact discharges are applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

6. Air discharges are 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 is removed from the EUT and re-triggered for a new single discharge. The test is repeated until all discharges were completed.

7. At least ten single discharges (in the most sensitive polarity) are applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator is positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.

8. At least ten single discharges (in the most sensitive polarity) are applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the EUT were completely illuminated. The VCP (dimensions 0.5 m*0.5 m) is placed vertically to and 0.1 meters from the EUT.

5.2.3. Radio Frequency Electromagnetic Field Immunity

5.2.3.1. Test Specification

Specification	Value	
Basic Standard	IEC 61000-4-3:2006+A1:2007+A2:2010	
Frequency Range	80 MHz to 1000 MHz	1.4 GHz to 6.0 GHz
Field Strength	10 V/m (unmodulated, r.m.s)	3 V/m (unmodulated, r.m.s)
Modulation	1 kHz sine wave, 80%, AM modulation	
Frequency Step	1% of fundamental	
Polarity of Antenna	Horizontal and Vertical	
Test Distance	3 m	
Antenna Height	1.5 m	
Dwell Time	3 seconds	

5.2.3.2. Test Procedure

1. The testing is performed in a fully anechoic chamber. The transmit antenna is located at a distance of 3 meters from the EUT.

2. The test signal is 80% amplitude modulated with a 1 kHz sine wave.

3. The frequency range is swept from 80 MHz to 1000 MHz and 1400 MHz to 6000 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers. The rate of sweep does not exceed 1.5*10-3 decade/s. Where the frequency range is swept incrementally, the step size is 1% of fundamental.

4. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

5. The field strength level is 10 V/m for 80 MHz to 1000MHz, 3 V/m for 1400 MHz to 6000 MHz.

6. The test is performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides,but only the worst side data is reported in this report.

5.2.4. Electrical Fast Transient / Burst Immunity

5.2.4.1. Test Specification

Specification	Value	
Basic Standard	IEC 61000-4-4:2012	
Test Voltage	AC Power Port: 2 kV.	
	DC Power Port: 1 kV.	
	Signal Port: 1 kV.	
Polarity	Positive / Negative	
Impulse Frequency	5 kHz	100 kHz
Impulse Wave Shape	5/50 ns	
Burst Duration	15 ms	0.75 ms
Burst Period	300 ms	
Test Duration	> 1 min	

NOTE:

1) The signal ports tests apply only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.

2) The DC ports test not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging.

3) The EUT with a DC power input port intended for use with an AC-DC power adaptor shall be tested on the AC power input of the AC-DC power adaptor specified by the manufacturer or where none is so specified, using a typical AC-DC power adaptor.

4) The test applicable to DC power input ports and signal ports intended to be connected permanently to cables longer than 3 m.

5.2.4.2. Test Procedure

1. The EUT is tested with 2000 V discharges to the AC power input leads, 1000 V for signal port and DC port.

2. Both positive and negative polarity discharges are applied.

3. The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1 m.

4. The duration time of each test sequential is 1min.

5. The transient / burst waveform is in accordance with IEC 61000-4-4:2012, 5/50 ns.

5.2.5. Surge Immunity

5.2.5.1. Test Specification

Specification		Value		
Ports class		AC Power Port	DC Power Port	Signal Port
Basic Standard		IEC 61000-4-5:2014		
Waveform		Voltage: 1.2/50 μs; Current: 8/20 μs		
Test Voltage	line to ground	0.5 kV, 1 kV, 2 kV;	0.5 kV, 1 kV	0.5 kV, 1 kV
	line to line	0.5 kV, 1 kV	0.5 kV	/
Polarity		Positive / Negative		
Phase Angle		0°, 90°, 180°, 270°	N/A	
Repetition Rate		60 seconds		
Times		5 times per condition		

NOTE:

1) The Signal ports test not applicable to ports interfacing with long distance lines which inside a building is longer than 30 m, or which leaves the building (including a line installed outdoors).

2) Signal ports directly connected to AC power network shall be treated as AC power ports.

3) The DC ports test not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging.

4) The EUT with a DC power input port intended for use with an AC-DC power adaptor shall be tested on the AC power input of the AC-DC power adaptor specified by the manufacturer or where none is so specified, using a typical AC-DC power adaptor.

5.2.5.2. Test Procedure

The EUT and the auxiliary equipment are placed on a table of 0.8 m heights above a metal ground reference plane. The size of ground plane is greater than 1 m*1 m and project beyond the EUT by at least 0.1 m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT is less than 2 meters (provided by the manufacturer).

The EUT is connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise is applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).

The surges are applied line to line and line(s) to earth. When testing line to earth the test voltage is applied successively between each of the lines and earth. Set up to the test level specified increased the test voltage. All lower levels including the selected test level are tested. The polarity of each surge level included positive and negative test pulses.

5.2.6. Immunity to Conducted Disturbances Induced by RF Fields

5.2.6.1. Test Specification

Specification	Value		
Basic Standard	IEC 61000-4-6:2013		
Frequency Range	0.15 MHz – 80 MHz		
Test Voltage	10 V (unmodulated, r.m.s)		
Modulation	1 kHz sine wave, 80% AM		
Frequency Step	1% of fundamental		
Coupled Cable	AC Power Line	DC Power Line	Signal Line
Coupling Device	CDN-M1/2/3/4/5, Capacitive clamp		

NOTE:

1) The DC port and Signal port only apply to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.

2) The test level can also be defined as the equivalent current into a 150 Ω load at signal ports.

5.2.6.2. 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 150 Ohm load resistor.

The test signal is 80% amplitude modulated with a 1 kHz sine wave.

The frequency range is 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 sweep rate shall not exceed 1.5*10-3 decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.

The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.

Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

5.2.7. Power Frequency Magnetic Fields Immunity

5.2.7.1. Test Specification

Specification	Value
Basic Standard	IEC 61000-4-8:2009
Field Frequency	50/60 Hz
Test Level	30 A/m
Polarity	Horizontal and Vertical
Test Duration	5 min

NOTE:

1) The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency.

2) Applicable only to apparatus containing devices susceptible to magnetic fields.

5.2.7.2. Test Procedure

The EUT shall be subjected to the test magnetic field by using the induction coil of standard dimensions (1 m*1 m) and shown in Section 15.1. The induction coil shall then be rotated by 90° in order to expose the EUT to the test field with different orientations.

5.2.8. Voltage Dips and Short Interruptions Immunity

5.2.8.1. Test Specification

AC Ports

Specification	Value
Basic Standard	IEC 61000-4-34:2005+A1:2009
Frequency	50/60Hz
Voltage Dips	100% reduction: 20 ms 60% reduction: 200/240 ms 30% reduction: 500/600 ms
Voltage Interruptions	100% reduction: 5000/6000 ms
Voltage Phase Angle	0°

NOTE:

1) Applicable only to AC input ports.

5.2.8.2. Test Procedure

The power cord is used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.

The EUT is tested for a) 100% voltage dip of supplied voltage with duration of 20 ms; b) 60% voltage dip of supplied voltage with duration of 200 or 240 ms; c) 30% voltage dip of supplied voltage and duration 500 or 600 ms. Both of the dip tests are carried out for a sequence of three voltage dips with intervals of 10 seconds.

100% voltage interruption of supplied voltage with duration of 5000 or 6000 ms is followed, which is a sequence of three voltage interruptions with intervals of 10 seconds.

Voltage reductions occur at 0 degrees crossover point of the voltage waveform. The performance of the EUT is checked after the voltage dip or interruption.

ANNEX A TEST RESULTS

A.1 Radiated Emission

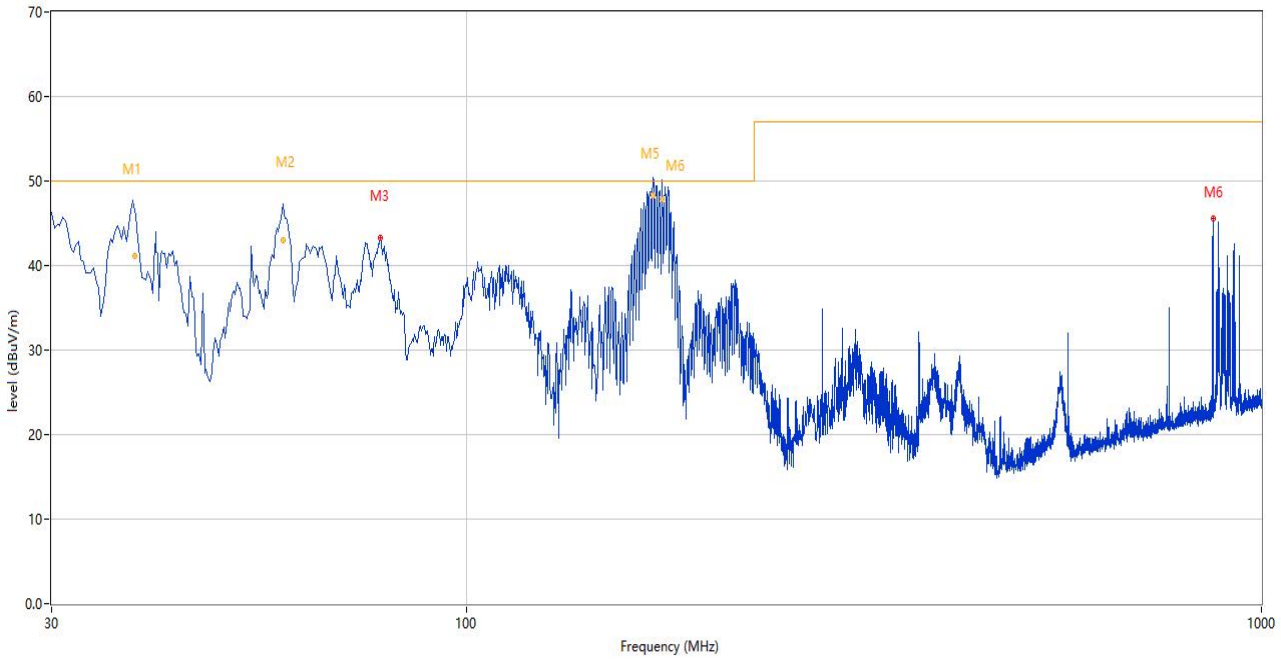
Note 1: The symbol of "--" in the table which means not application.

Note 2: Measurements shall be made with a quasi-peak measuring receiver in the frequency range 30 MHz to 1000 MHz. To reduce the testing time, a peak measuring receiver may be used instead of a quasi-peak measuring receiver. In case of dispute, measurement with a quasi-peak measuring receiver will take precedence.

Test Data and Plots- (Below 1 GHz)

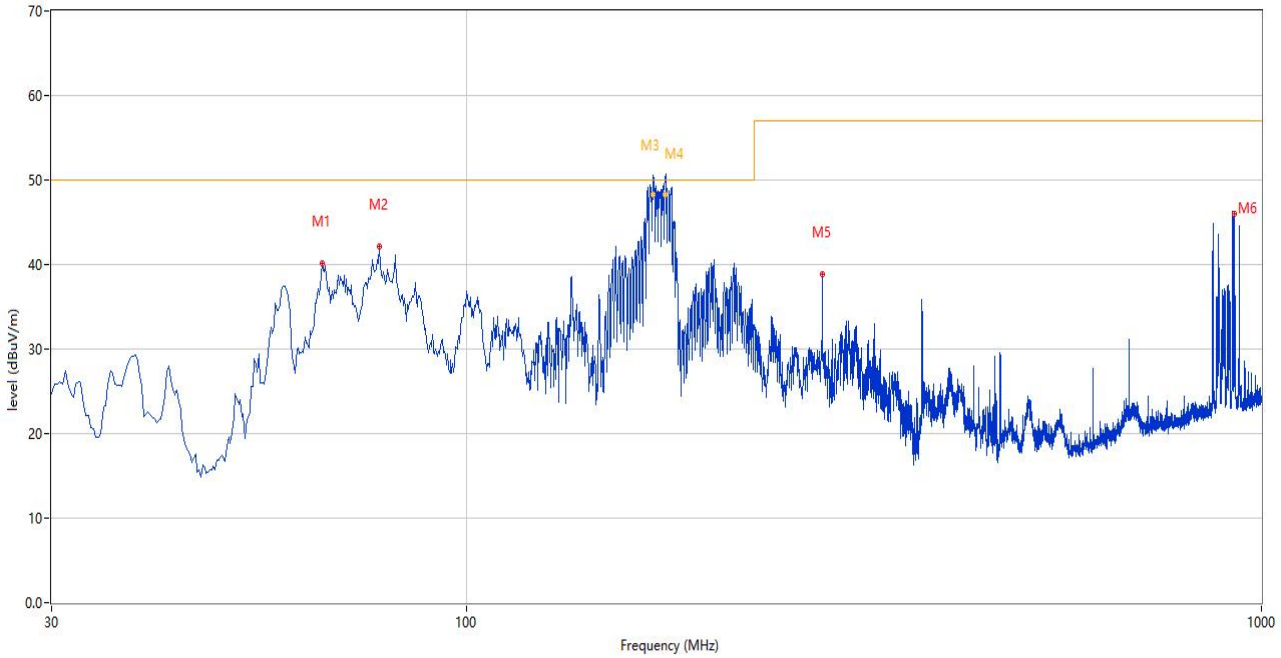
The worst test mode: Grid-connected (50% Load)

A.1.1 Test Antenna Vertical, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1*	38.191	41.17	-27.61	50.0	-8.83	QP	175.00	120	Vertical	P
2*	58.678	43.03	-27.16	50.0	-6.97	QP	147.00	108	Vertical	P
3	77.772	43.26	-31.67	50.0	-6.74	Peak	214.00	200	Vertical	P
4*	171.862	48.55	-29.63	50.0	-1.45	QP	360.00	200	Vertical	P
5*	175.985	48.12	-29.45	50.0	-1.88	QP	0.00	100	Vertical	P
6	868.807	45.59	-12.08	57.0	-11.41	Peak	360.00	200	Vertical	P

A.1.2 Test Antenna Horizontal, 30 MHz – 1 GHz



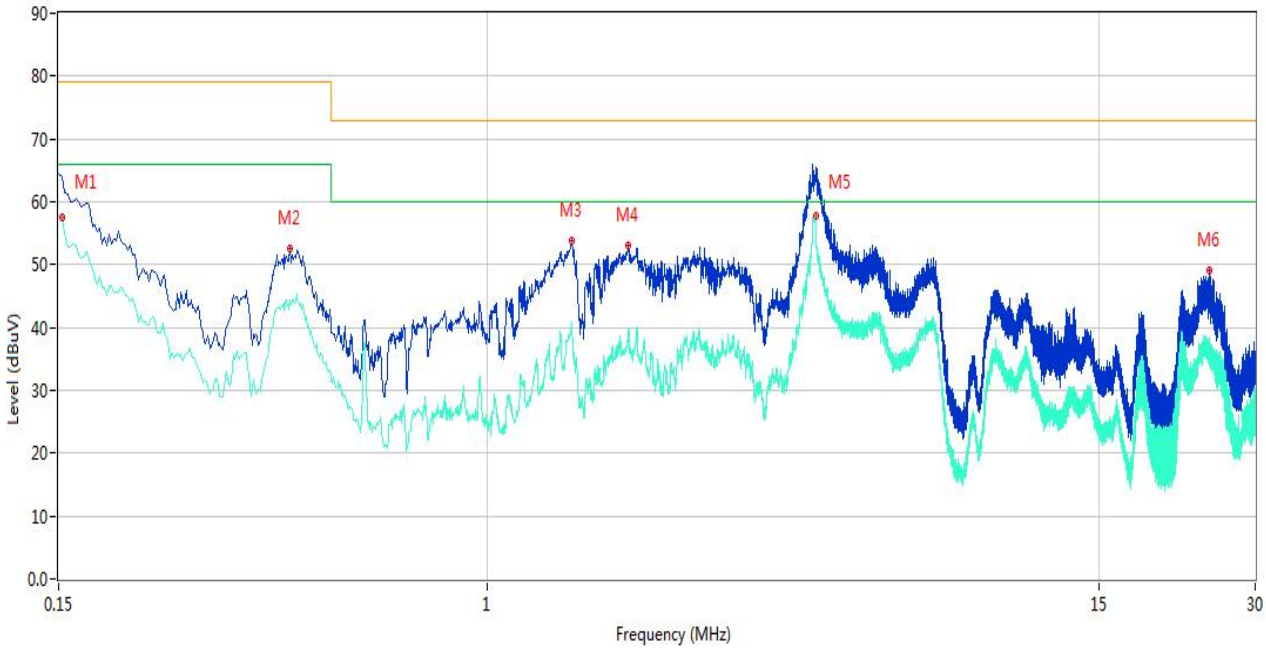
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	65.647	40.12	-28.09	50.0	-9.88	Peak	118.00	300	Horizontal	P
2	77.530	42.10	-31.66	50.0	-7.90	Peak	285.00	300	Horizontal	P
3*	171.378	48.41	-29.65	50.0	-1.59	QP	287.00	100	Horizontal	P
4*	177.925	48.43	-29.27	50.0	-1.57	QP	0.00	100	Horizontal	P
5	280.017	38.91	-24.96	57.0	-18.09	Peak	312.00	100	Horizontal	P
6	923.370	46.04	-11.22	57.0	-10.96	Peak	67.00	100	Horizontal	P

A.2 Conducted Emission

Test Data and Plots-AC Port

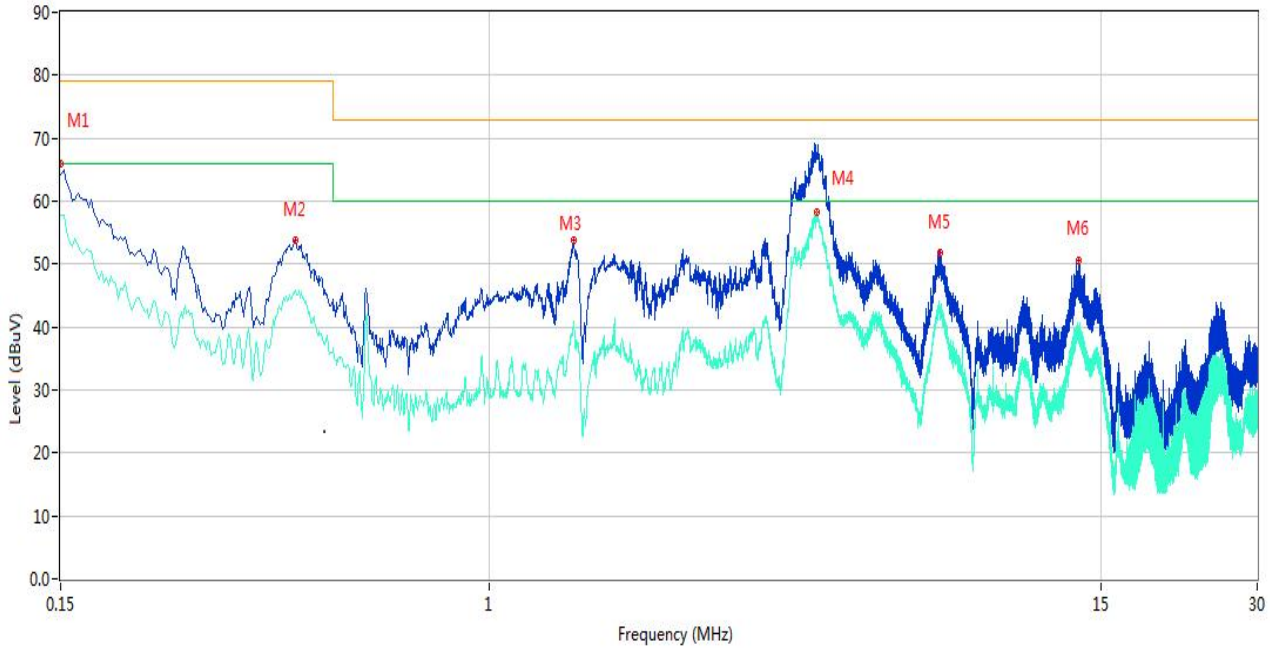
The worst test mode: Grid-connected (100% Load)

A.2.1 L1 Phase



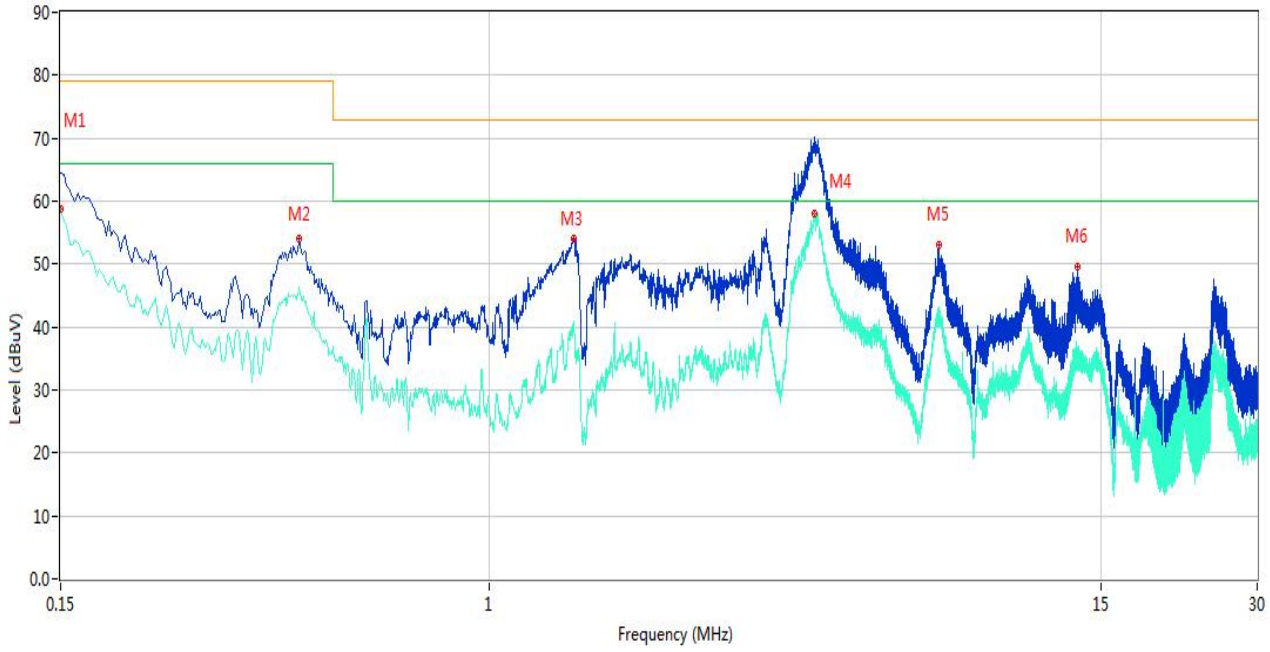
No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.152	63.88	10.00	79.00	-15.12	Peak	L1	P
1**	0.152	57.43	10.00	66.00	-8.57	AV	L1	P
2	0.418	52.54	9.99	79.00	-26.46	Peak	L1	P
2**	0.418	44.46	9.99	66.00	-21.54	AV	L1	P
3	1.456	53.81	10.02	73.00	-19.19	Peak	L1	P
3**	1.456	39.24	10.02	60.00	-20.76	AV	L1	P
4	1.872	53.16	10.05	73.00	-19.84	Peak	L1	P
4**	1.872	38.78	10.05	60.00	-21.22	AV	L1	P
5	4.296	64.42	10.08	73.00	-8.58	Peak	L1	P
5**	4.296	57.45	10.08	60.00	-2.55	AV	L1	P
6	24.504	49.10	9.88	73.00	-23.90	Peak	L1	P
6**	24.504	35.79	9.88	60.00	-24.21	AV	L1	P

A.2.2 L2 Phase



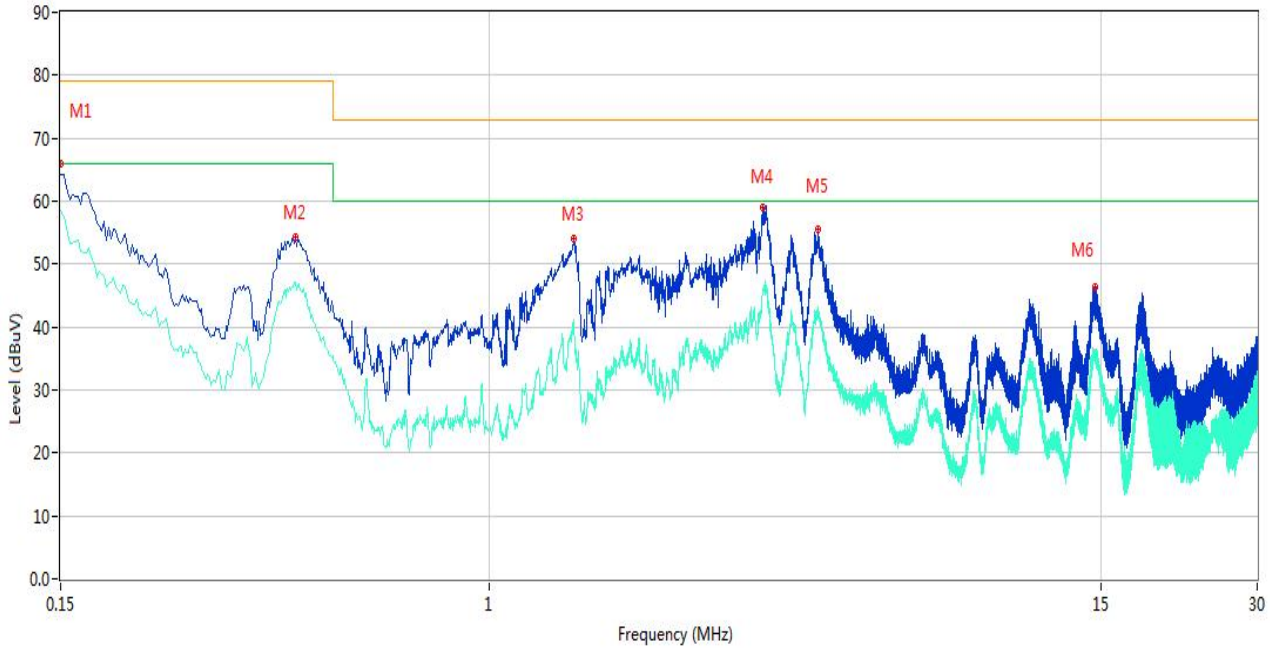
No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.152	65.00	10.00	79.00	-14.00	Peak	L2	P
1**	0.152	57.76	10.00	66.00	-8.24	AV	L2	P
2	0.424	53.75	9.92	79.00	-25.25	Peak	L2	P
2**	0.424	45.84	9.92	66.00	-20.16	AV	L2	P
3	1.456	53.84	10.02	73.00	-19.16	Peak	L2	P
3**	1.456	40.03	10.02	60.00	-19.97	AV	L2	P
4	4.278	67.10	10.01	73.00	-5.90	Peak	L2	P
4**	4.278	58.18	10.01	60.00	-1.82	AV	L2	P
5	7.364	51.76	9.94	73.00	-21.24	Peak	L2	P
5**	7.364	43.07	9.94	60.00	-16.93	AV	L2	P
6	13.596	50.56	10.12	73.00	-22.44	Peak	L2	P
6**	13.596	39.95	10.12	60.00	-20.05	AV	L2	P

A.2.3 L3 Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.150	64.50	9.96	79.00	-14.50	Peak	L3	P
1**	0.150	58.65	9.96	66.00	-7.35	AV	L3	P
2	0.432	53.96	9.93	79.00	-25.04	Peak	L3	P
2**	0.432	46.34	9.93	66.00	-19.66	AV	L3	P
3	1.458	54.01	10.02	73.00	-18.99	Peak	L3	P
3**	1.458	39.59	10.02	60.00	-20.41	AV	L3	P
4	4.230	69.64	10.01	73.00	-3.36	Peak	L3	P
4**	4.230	58.04	10.01	60.00	-1.96	AV	L3	P
5	7.348	53.05	9.94	73.00	-19.95	Peak	L3	P
5**	7.348	41.65	9.94	60.00	-18.35	AV	L3	P
6	13.514	49.56	10.11	73.00	-23.44	Peak	L3	P
6**	13.514	35.08	10.11	60.00	-24.92	AV	L3	P

A.2.4 N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.150	64.31	9.96	79.00	-14.69	Peak	N	P
1**	0.150	58.39	9.96	66.00	-7.61	AV	N	P
2	0.424	54.34	9.92	79.00	-24.66	Peak	N	P
2**	0.424	47.22	9.92	66.00	-18.78	AV	N	P
3	1.458	54.06	10.02	73.00	-18.94	Peak	N	P
3**	1.458	39.03	10.02	60.00	-20.97	AV	N	P
4	3.360	58.93	10.09	73.00	-14.07	Peak	N	P
4**	3.360	45.35	10.09	60.00	-14.65	AV	N	P
5	4.300	55.62	10.06	73.00	-17.38	Peak	N	P
5**	4.300	43.06	10.06	60.00	-16.94	AV	N	P
6	14.626	46.27	10.16	73.00	-26.73	Peak	N	P
6**	14.626	35.79	10.16	60.00	-24.21	AV	N	P

A.3 Harmonic Current Emissions

Power R_{sce}	33	Active power(W)	17247.79
Voltage(V)：	231.4	Frequency(Hz)	50
Reference current Iref(r.m.s.)(A)	74.74		
Equipment category	Balanced three-phase equipment		

Equipment category:	Balanced three-phase equipment					
Minimum R_{sce} = 33	Admissible individual harmonic current I_h/I_{ref} %				Admissible harmonic parameters %	
--	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	$PWHC/I_{ref}$
limit	10.7	7.2	3.1	2	13	22
L1	1.765	0.864	0.449	0.333	2.123	2.597
L2	1.797	0.932	0.528	0.329	2.220	2.662
L3	1.625	0.861	0.419	0.344	2.045	2.565
Verdict	P	P	P	P	P	P

Minimum R_{sce} = 33	Admissible individual harmonic current I_h/I_{ref} %						Admissible harmonic parameters %	
--	I_2	I_4	I_6	I_8	I_{10}	I_{12}	THC/I_{ref}	$PWHC/I_{ref}$
limit	8	4	2.66	2	1.6	1.3	13	22
L1	0.036	0.057	0.056	0.077	0.082	0.037	2.123	2.597
L2	0.303	0.096	0.119	0.027	0.062	0.034	2.220	2.662
L3	0.366	0.073	0.129	0.060	0.060	0.041	2.045	2.565
Verdict	P	P	P	P	P	P	P	P

A.4 Voltage Fluctuations & Flicker

Voltage(V)	231.4	Frequency(Hz)	50
Current (A)	74.74	Coupling Line	L1
Test Parameter	Limit	Measurement Value	Verdict
P_{st}	1.0	0.350	P
P_{lt}	0.65	0.308	P
T_{dt}	0.5	0	P
d_{max} (%)	4	1.530	P
d_c (%)	3.3	0.043	P

Voltage(V)	230.5	Frequency(Hz)	50
Current (A)	74.97	Coupling Line	L2
Test Parameter	Limit	Measurement Value	Verdict
P_{st}	1.0	0.349	P
P_{lt}	0.65	0.335	P
T_{dt}	0.5	0	P
d_{max} (%)	4	2.174	P
d_c (%)	3.3	0.145	P

Voltage(V)	230.7	Frequency(Hz)	50
Current (A)	74.67	Coupling Line	L3
Test Parameter	Limit	Measurement Value	Verdict
P_{st}	1.0	0.396	P
P_{lt}	0.65	0.284	P
T_{dt}	0.5	0	P
d_{max} (%)	4	2.192	P
d_c (%)	3.3	0.045	P

A.5 Electrostatic Discharge Immunity

Test Points	Discharge Level (kV)	Discharge Mode	Number of Discharge	Met Criteria	Required Criteria	Verdict
HCP	±2, ±4	Contact Discharge	100	A	B	P
VCP	±2, ±4	Contact Discharge	100	A	B	P
Metal screw	±2, ±4	Connect discharge	160	A	B	P
Heat sink	±2, ±4	Connect discharge	160	A	B	P
Display screen	±2, ±4, ±8	Air discharge	160	A	B	P
Gap	±2, ±4, ±8	Air discharge	160	A	B	P

A.6 Radio Frequency Electromagnetic Field Immunity

Antenna Polarity	Frequency (MHz)	Side	Field Strength (V/m)	Met Criteria	Required Criteria	Verdict
Vertical	80 - 1000	Front, Back, Left, Right	10	A	A	P
Horizontal	80 - 1000	Front, Back, Left, Right	10	A	A	P
Vertical	1400 - 6000	Front, Back, Left, Right	3	A	A	P
Horizontal	1400 - 6000	Front, Back, Left, Right	3	A	A	P

A.7 Electrical Fast Transient/Burst Immunity

Test Data (AC Output Port)

Burst Parameters	5/50ns	Pulse Frequency	5kHz	Pulse group action time	15ms		Burst interval	300ms
			100kHz		0.75ms			
Test Port	Coupling Line			Polarity	Test Level (kV)	Met Criteria	Required Criteria	Verdict
AC Output Port	L1+L2+L3+N+PE			+ / -	0.5, 1, 2	A	B	P

Test Data (PV Input Port)

Burst Parameters	5/50ns	Pulse Frequency	5kHz	Pulse group action time	15ms		Burst interval	300ms
			100kHz		0.75ms			
Test Port	Coupling Line			Polarity	100kHz	Met Criteria	Required Criteria	Verdict
PV Input Port	P+&P-&PE			+ / -	0.5, 1	A	B	P

A.8 Surge Immunity

Test Data (AC Output Port)

Times	5 times for positive and negative		Time interval		60s		
Test Port	Coupling Line	Polarity	Voltage (kV)	Test Waveform	Met Criteria	Required Criteria	Verdict
AC Output Port	L1-N, L2-N, L3-N, L1-L2, L1-L3, L2-L3	+ / -	0.5, 1	1.2/50us	A	B	P
AC Output Port	L1-PE, L2-PE, L3-PE, N-PE	+ / -	0.5, 1, 2	1.2/50us	B	B	P

Test Data (PV Input Port)

Times	5 times for positive and negative		Time interval		60s		
Test Port	Coupling Line	Polarity	Voltage (kV)	Test Waveform	Met Criteria	Required Criteria	Verdict
PV Input Port	P+ to P-	+ / -	0.5	1.2/50us	A	B	P
PV Input Port	P+ to PE, P- to PE	+ / -	0.5, 1	1.2/50us	B	B	P

A.9 Immunity to Conducted Disturbances Induced by RF Fields

Test Data (AC Output Port)

Test Port	Frequency (MHz)	Test Voltage(V)	Met Criteria	Required Criteria	Verdict
AC Output Port	0.15 - 80	10	A	A	P

Test Data (PV Input Port)

Test Port	Frequency (MHz)	Test Voltage(V)	Met Criteria	Required Criteria	Verdict
PV Input Port	0.15 - 80	10	A	A	P

A.10 Power Frequency Magnetic Fields Immunity

Test direction	Test level(A/m)	Met Criteria	Required Criteria	Verdict
X, Y, Z	30	A	A	P

A.11 Voltage Dips and Short Interruptions Immunity

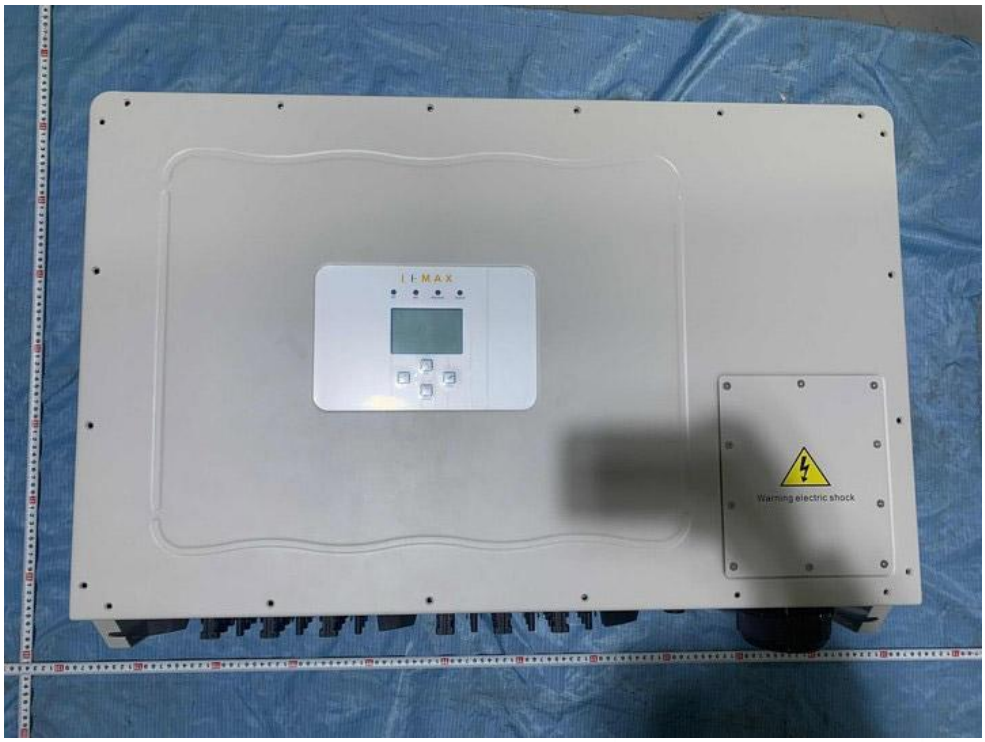
Test Mode	Residual voltage (%)	Duration (ms)	Times	Interval (sec)	Met Criteria	Required Criteria	Verdict
Voltage Dips	0	20	3	10	B	B	P
Voltage Dips	40	200	3	10	B	C	P
Voltage Dips	70	500	3	10	B	C	P
Voltage Interruptions	0	5000	3	10	B	C	P

ANNEX B TEST SETUP PHOTOS

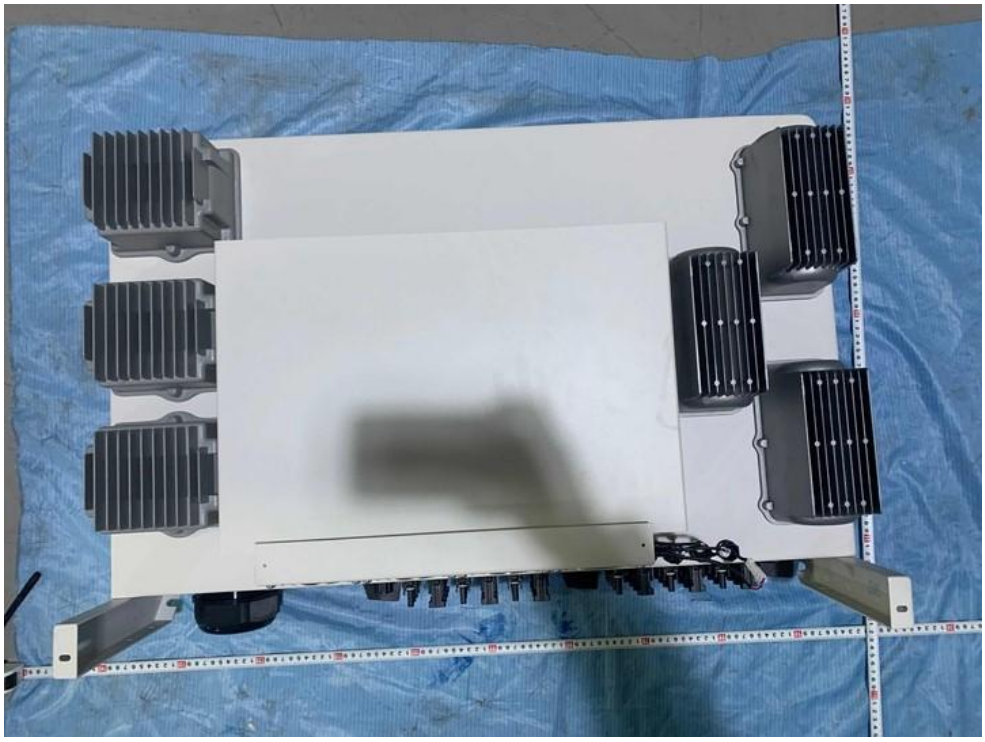
Note: TEST SETUP PHOTOS please refer to original test report No.BL-DG20C0755-401, which was issued by Shenzhen BALUN Technology Co., Ltd. on Feb. 26, 2021 section ANNEX B TEST SETUP PHOTOS.

ANNEX C EUT EXTERNAL PHOTOS

Front



Back



Left

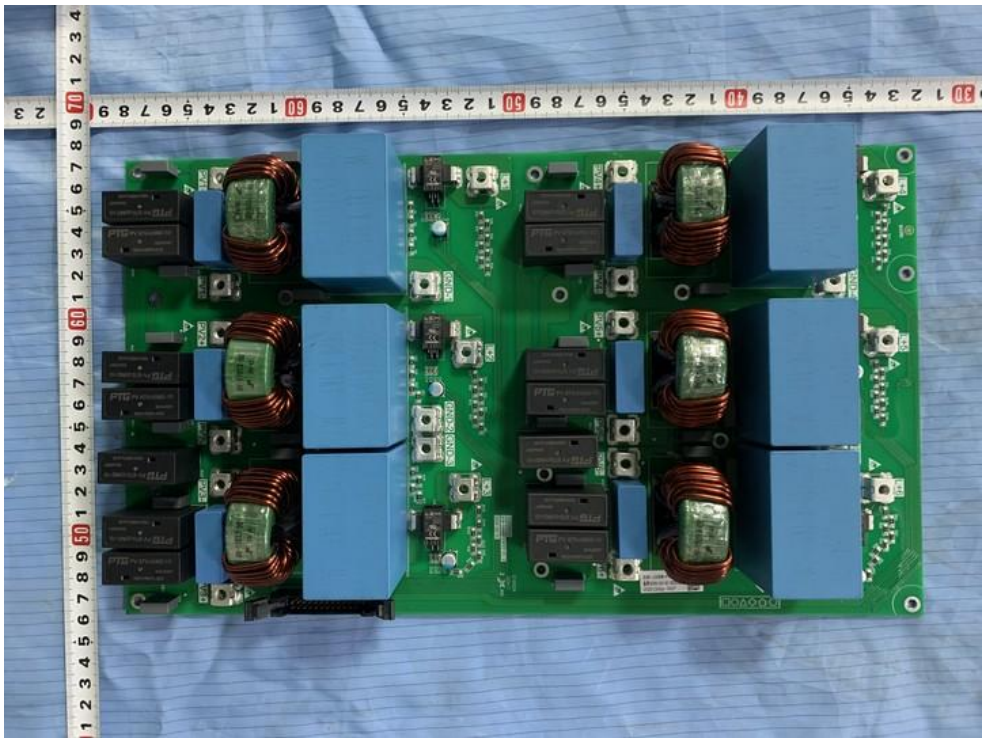
Right

Top

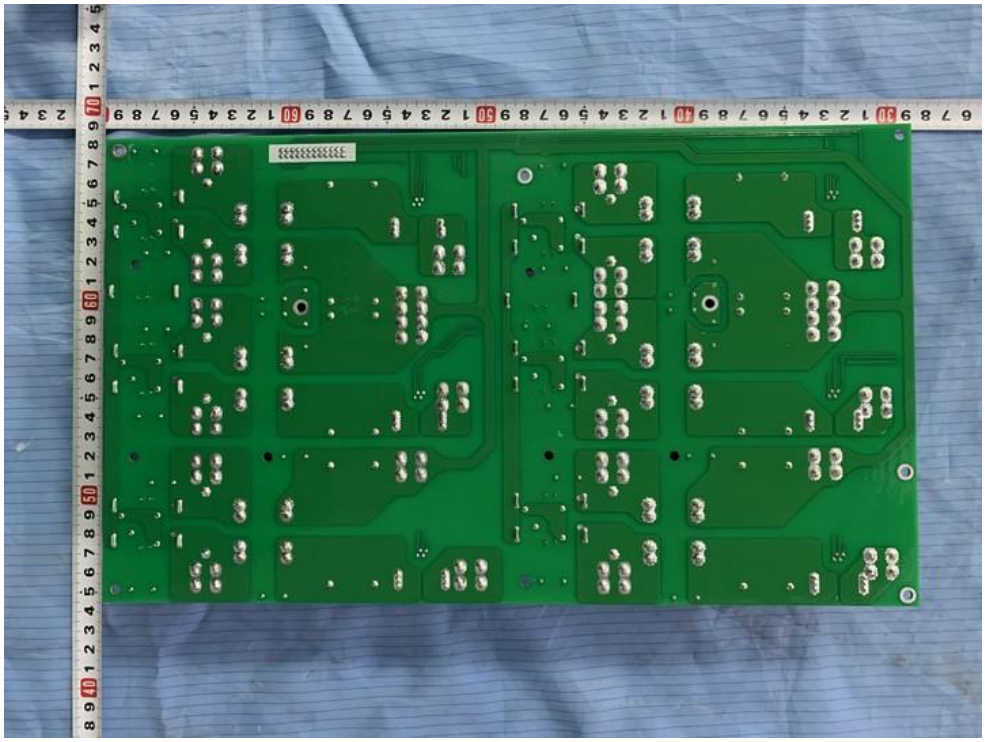
Interface

ANNEX D EUT INTERNAL PHOTOS

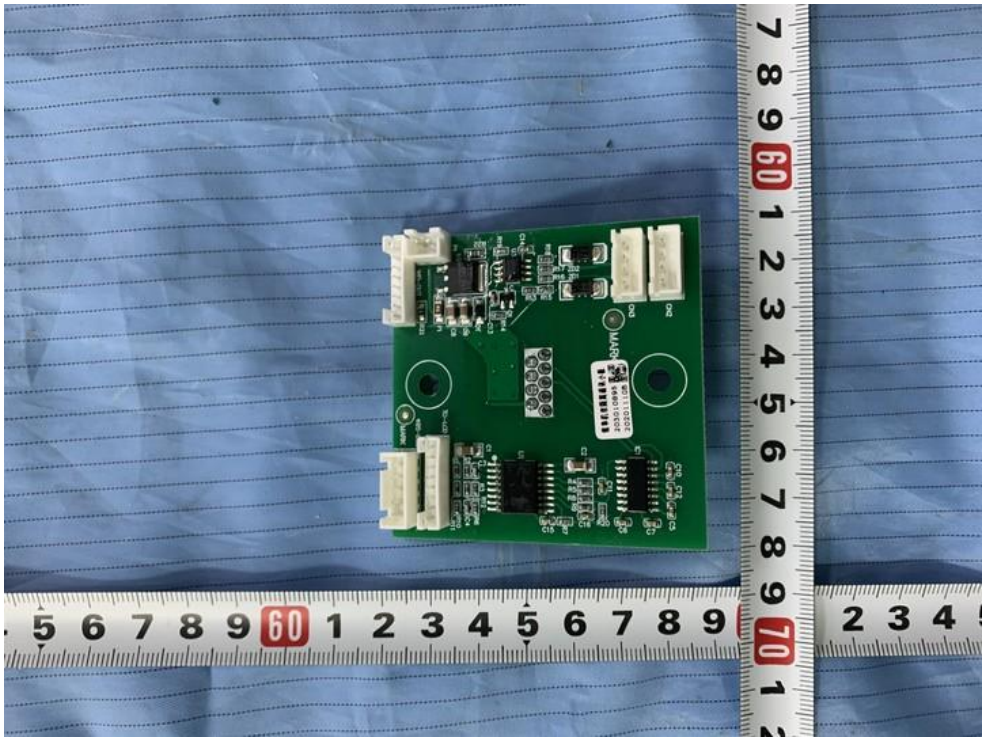
The front view of PV board



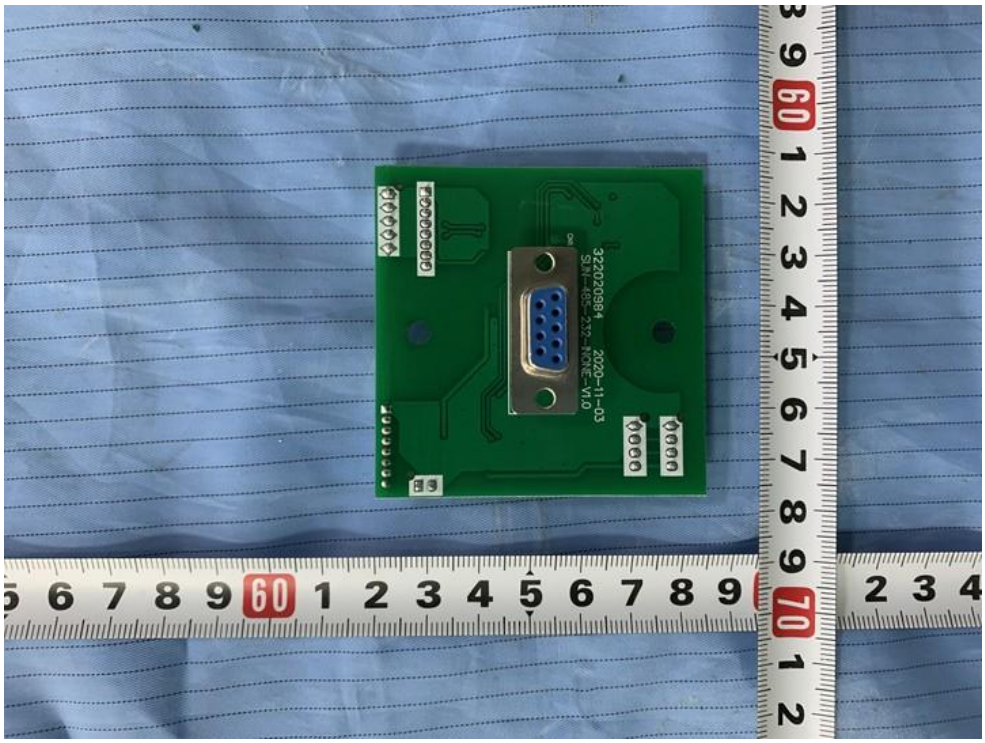
The back view of PV board



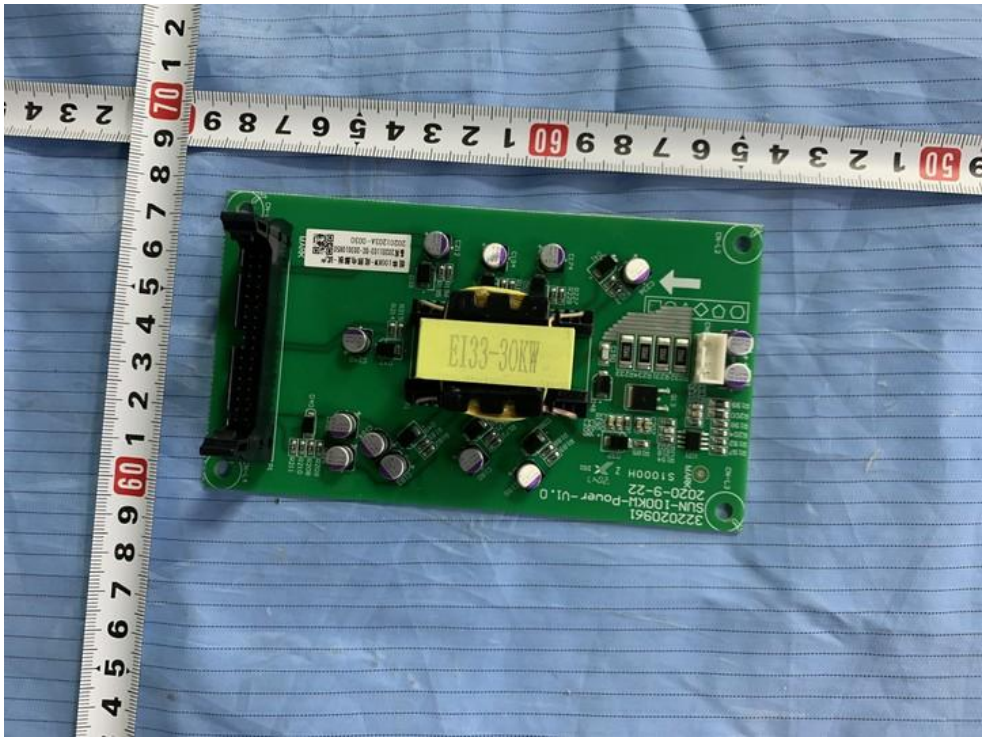
The front view of Wi-Fi board



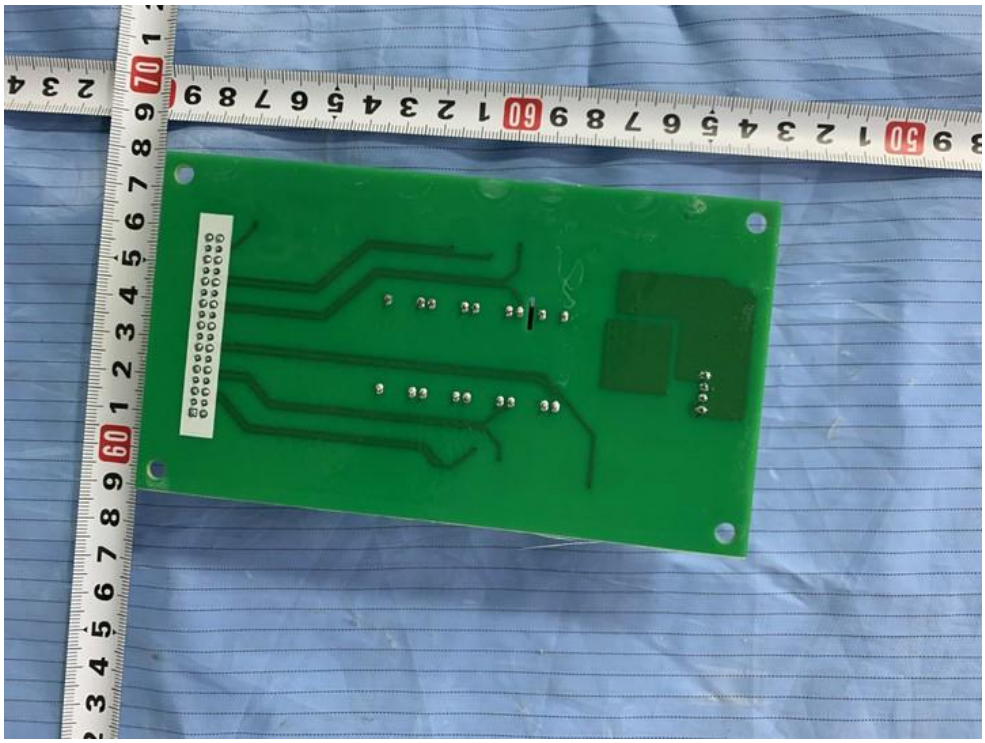
The back view of Wi-Fi board



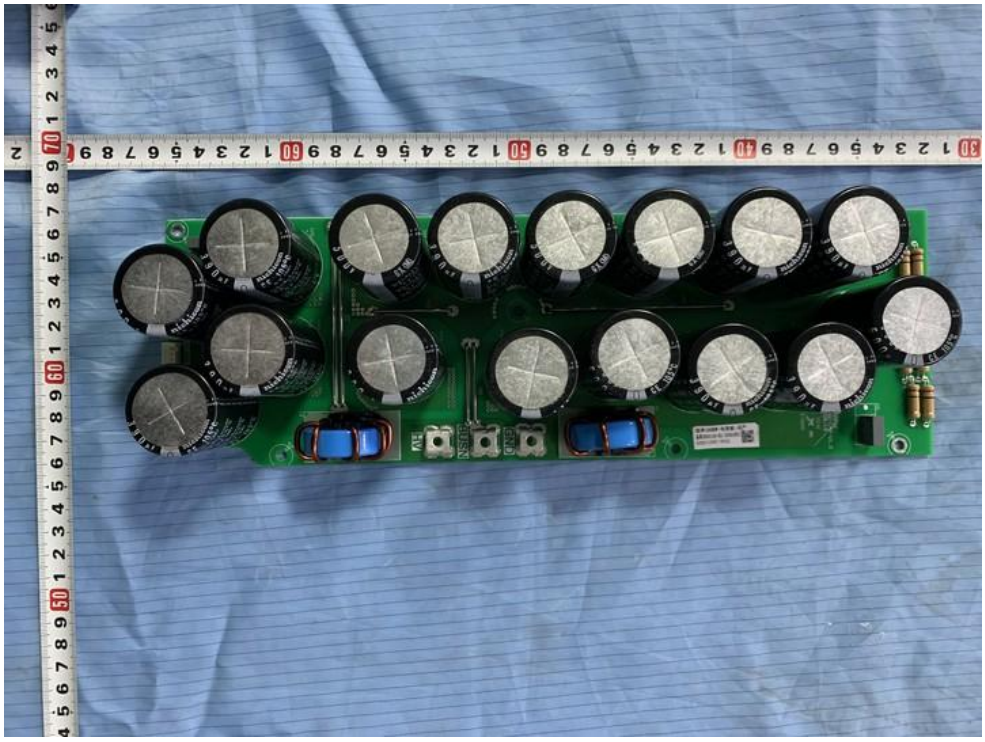
The front view of bottom power board



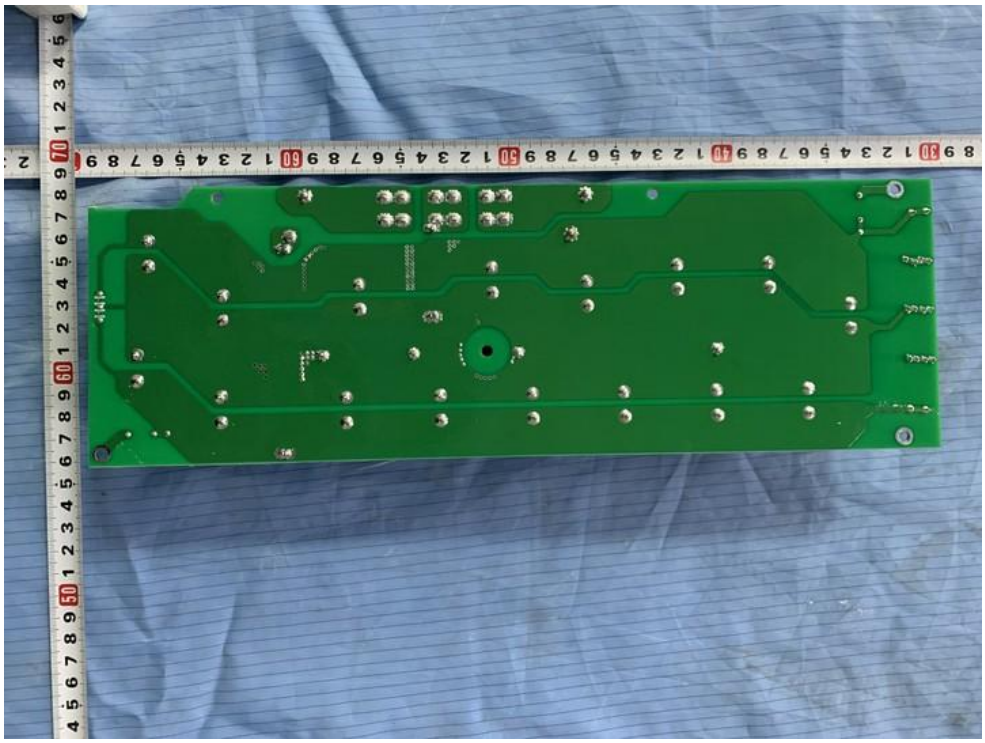
The back view of bottom power board



The front view of capacitance board

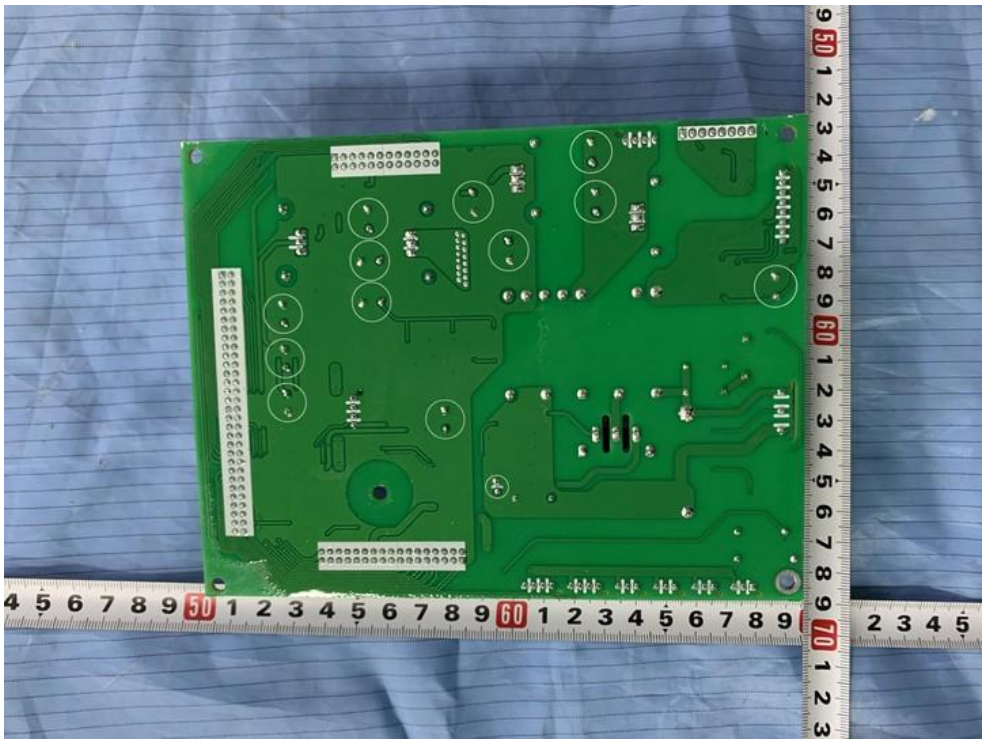


The back view of capacitance board

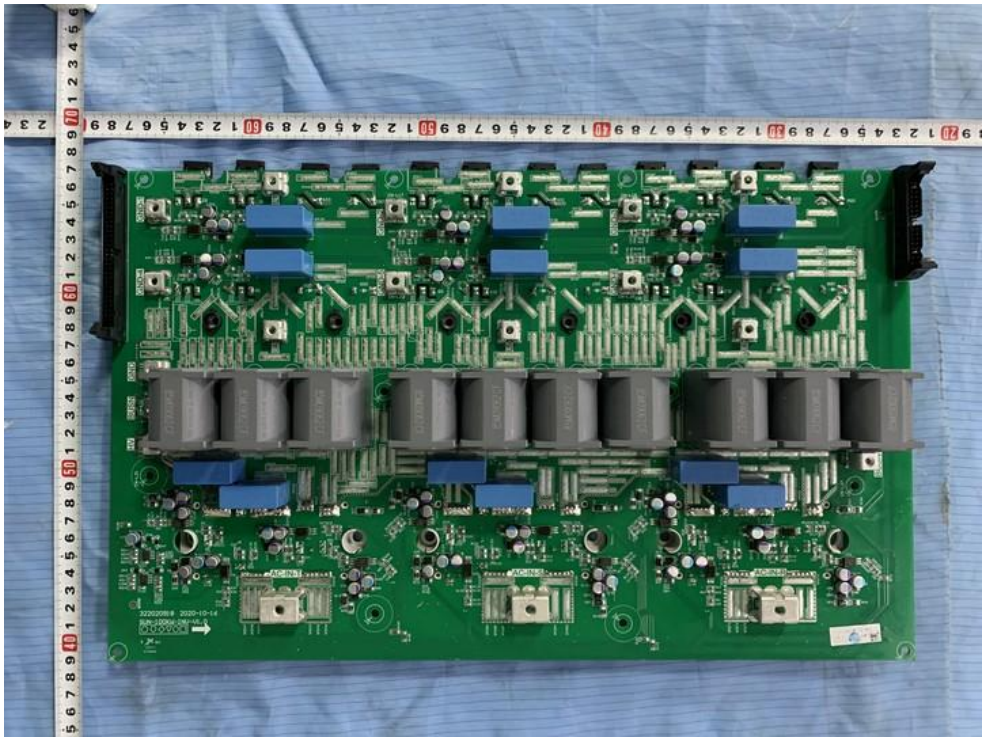


The front view of top power board

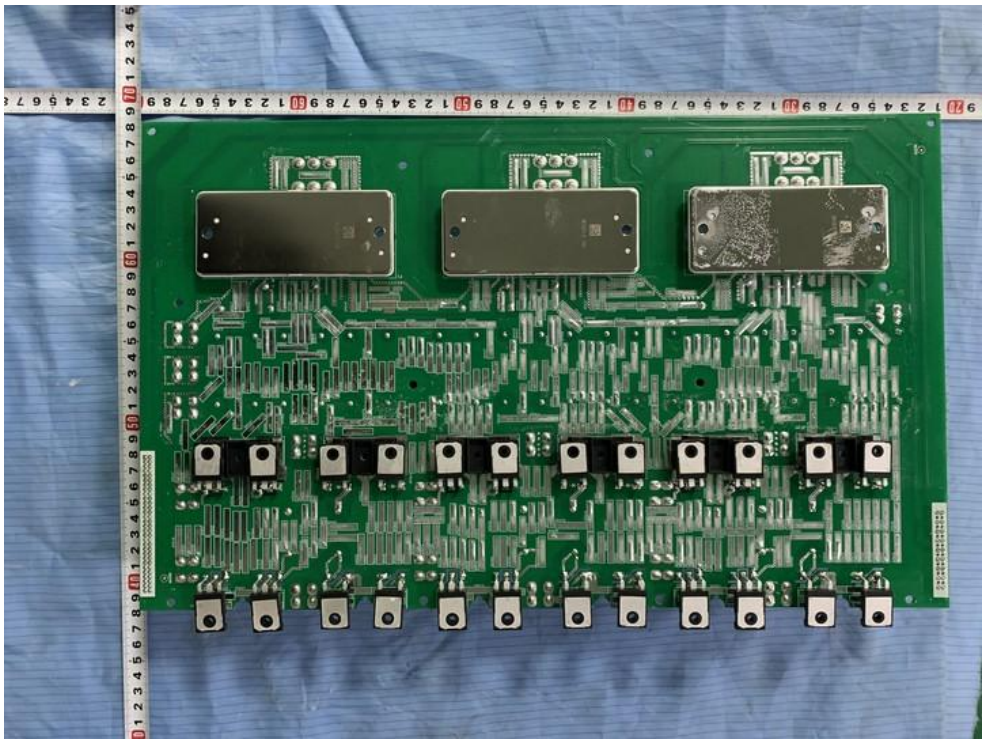
The back view of top power board



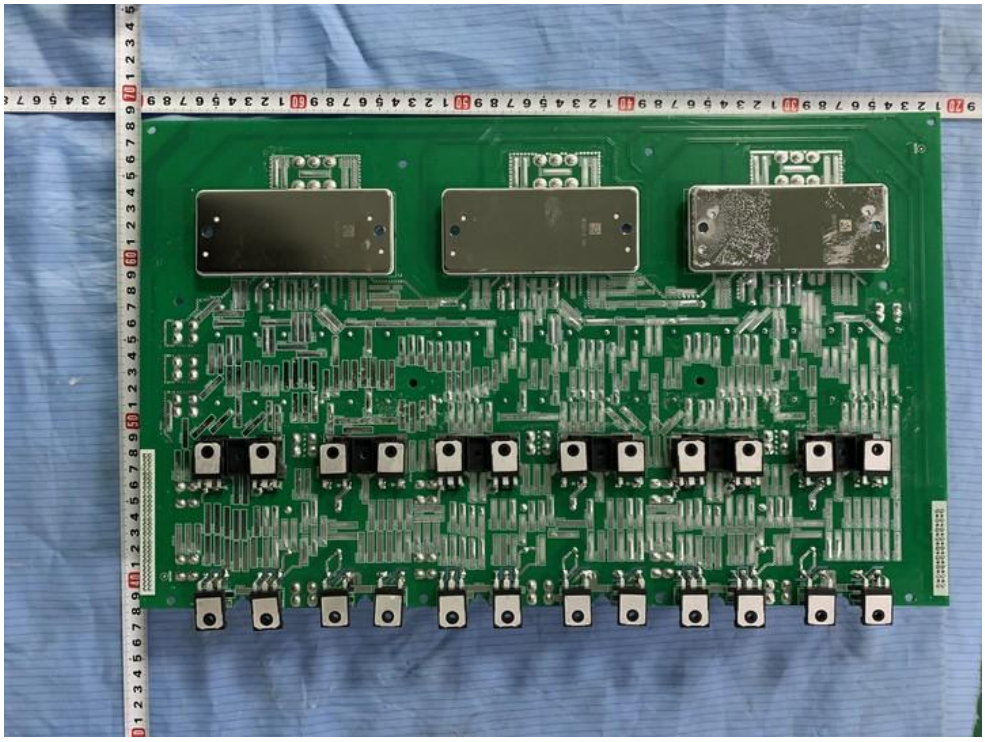
The front view of driver board



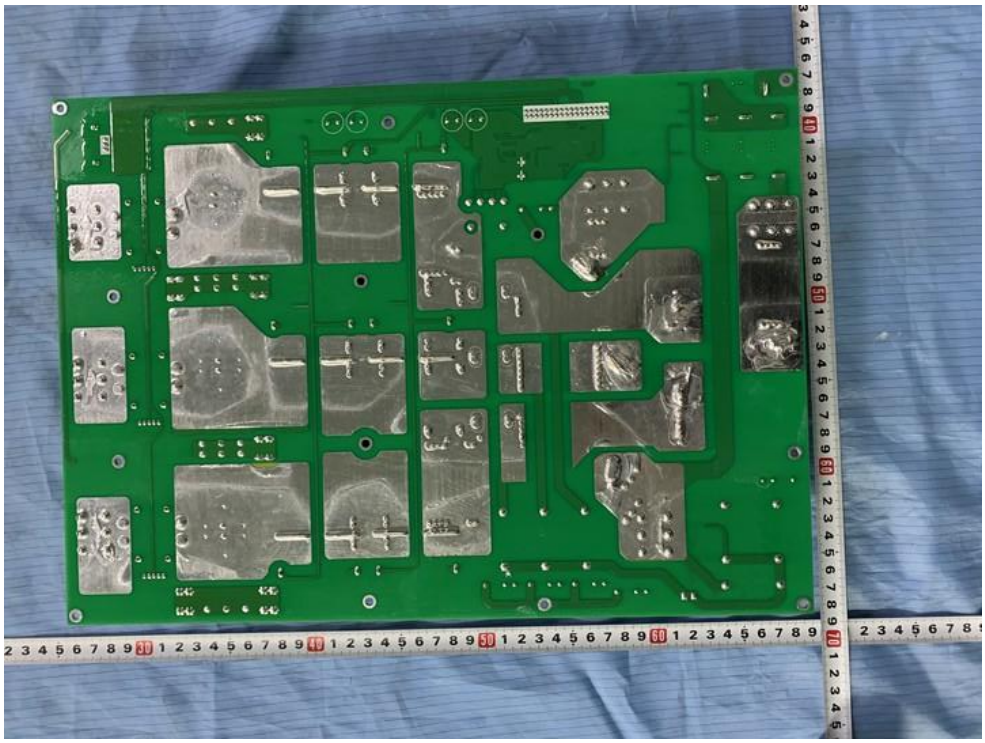
The back view of driver board



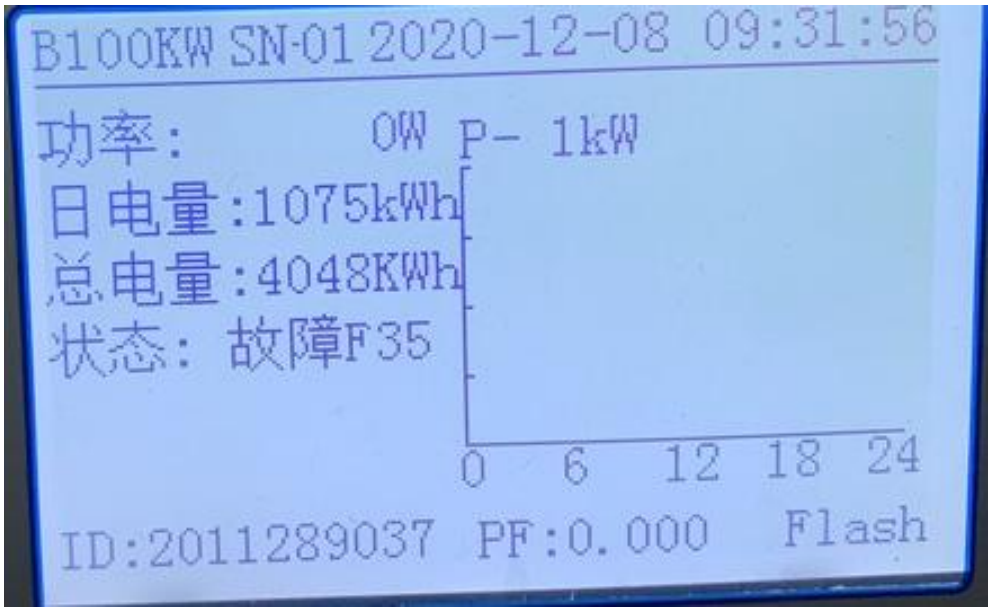
The front view of main control board



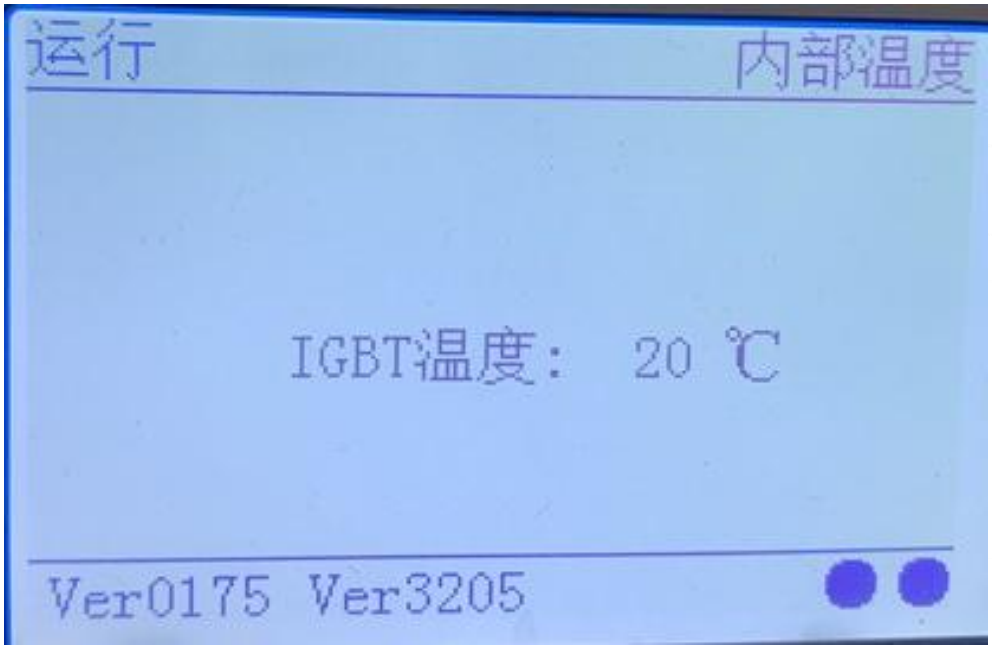
The back view of main control board



Serial number



Software version



Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.

2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.

3. For the report with CNAS mark, the items marked with "☆" are not within the accredited scope.

4. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the “inspection and testing dedicated stamp” or test report stamp.

5. The test data and results are only valid for the tested samples provided by the customer.

6. This report shall not be partially reproduced without the written permission of the laboratory.

7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--