EMC TEST REPORT

The device described below is tested by Dongguan Nore Testing Center Co., Ltd. to determine the maximum emission levels emanating from the device, the severe levels which the device can endure and E.U.T.'s performance criterion. The test results are contained in this test report. Dongguan Nore Testing Center Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

Applicant / Manufacturer	:	TommaTech UG
Address	:	Angerlweg 14 85748 Garching HRB Nummer 213239 Amtsgericht München, Germany
Factory	:	TommaTech UG
Address	:	Angerlweg 14 85748 Garching HRB Nummer 213239 Amtsgericht München, Germany
E.U.T.	:	INVERTER
Brand Name	:	TOMMATECH
Model No.	:	Tommatech 5K+Plus MPPT
Measurement Standard	:	EN 55032: 2015 EN 55024:2010+A1: 2015 (EN 61000-4-2: 2009, EN 61000-4-3: 2006+A2: 2010, EN 61000-4-4: 2012, EN 61000-4-5: 2014, EN 61000-4-6: 2014,EN 61000-4-11: 2004)
Date of Receiver	:	February 24, 2018
Date of Test	:	February 25, 2018 to February 28, 2018
Date of Report	:	March 01, 2018

This Test Report is Issued Under the Authority of :

Prepared by | Approved & Authorized Signer

Joe

Joe Chen / Engineer | Iori Fan / Authorized Signatory

This report shows that the E.U.T. is technically compliant with the EN 55032 and EN 55024. This report applies to above tested sample only and shall not be reproduced in part without written approval of Dongguan Nore Testing Center Co., Ltd.

TEL: +86-769-22022444 FAX: +86-769-22022799 Web: www.ntc-c.com
Address: Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong, China

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Appendix I (Photos of E.U.T.) (11 pages)

Revision History of This Test Report

Report Number	Description	Issued Date
NTC1802640EV00	Initial Issue	2018-03-01

1. SUMMARY OF TEST RESULTS

The E.U.T. has been tested according to the following specifications:

EMISSION			
Standard	**Test Type**	**Result**	**Remarks**
EN 55032: 2015	Mains Terminal Disturbance Voltage Test	PASS	Uncertainty: 2.7dB
	Conducted Disturbance at the telecommunication ports	N/A	Uncertainty:2.7dB
	Radiated Emission Test	PASS	Uncertainty: 3.4dB

IMMUNITY(EN 55024: 2010+A1: 2015)			
Standard	**Test Type**	**Result**	**Remarks**
EN 61000-4-2: 2009	Electrostatic discharge immunity test	PASS	Meets the requirements of Performance Criterion B
EN 61000-4-3: 2006+A2: 2010	Radio-frequency, electromagnetic field immunity test	PASS	Meets the requirements of Performance Criterion A
EN 61000-4-4: 2012	Electrical fast transient/ burst immunity test	PASS	Meets the requirements of Performance Criterion B
EN 61000-4-5: 2014	Surge immunity test	PASS	Meets the requirements of Performance Criterion B
EN 61000-4-6: 2014	Injected Currents immunity test	PASS	Meets the requirements of Performance Criterion A
EN 61000-4-11: 2004	Voltage Dips and Interruptions	PASS	Meets the requirements of Performance Criterion B&C

2. GENERAL INFORMATION

2.1 Details of E.U.T.

E.U.T.	:	INVERTER
Model No.	:	Tommatech 5K+Plus MPPT
Brand Name	:	TOMMATECH
EUT Type	:	Class A This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
Operation Frequency	:	Below 108MHz (Declaration by manufacturer)
Rating	:	**Inverter Mode:** Rated power: 5000W DC Input: 48VDC, 117A AC Output: 230VAC, 50Hz, 22A, 1Φ **AC Mode:** AC Input: 230VAC, 50Hz, 35A, 1Φ DC Output: 54VDC, Max. 60A, Default 30A AC Output: 230VAC, 50Hz, 22A 1Φ **Solar Mode:** Rated Current: 80A System voltage: 48VDC Min. Solar voltage: 40VDC Max. Solar voltage(VOC): 145VDC
Test Voltage	:	AC 230V/ 50Hz, DC 48V External battery
Description of model difference	:	None
Remark	:	None

2.2 Description of Support Device

None

2.3 Block Diagram of Test Setup

(1) Normal operation mode

(2) Inverter mode

2.4 Test Facility

Site Description

EMC Lab : Listed by CNAS, November 02, 2016
The certificate is valid until August 13, 2018
The Laboratory has been assessed and proved to be in compliance with CNAS/CL01
The Certificate Registration Number is L5795.

Listed by FCC, July 03, 2014
The Certificate Number is 665078.

Listed by Industry Canada, June 08, 2017
The Certificate Registration Number. Is 46405-9743

Name of Firm : Dongguan Nore Testing Center Co., Ltd.
(Dongguan NTC Co., Ltd.)

Site Location : Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong Province, China

2.5 Abnormalities from Standard Conditions

None

3. MEASURING DEVICES AND TEST EQUIPMENT

3.1 For Mains terminals Disturbance voltage Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI	101152	Mar. 08, 2017	1 Year
2.	L.I.S.N	Rohde & Schwarz	ENV 216	101317	Mar. 08, 2017	1 Year
3.	L.I.S.N	Schwarzbeck	NNLK8129	8129-212	Mar. 22, 2017	1 Year
4.	RF Switching Unit	Compliance Direction Systems Inc.	RSU-M2	38311	Mar. 08, 2017	1 Year
5.	Pulse Limiter	MTS-systemtechnik	MTS-IMP-136	261115-01 0-0022	Mar. 08, 2017	1 Year

3.2 For Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI7	100837	Mar. 08, 2017	1 Year
2.	Antenna	Schwarzbeck	VULB9162	9162-010	Mar. 22, 2017	1 Year
3.	Positioning Controller	UC	UC 3000	N/A	N/A	N/A
4.	Color Monitor	SUNSPO	SP-140A	N/A	N/A	N/A
5.	Single Phase Power Line Filter	SAEMC	PF201A-32	110210	N/A	N/A
6.	3 Phase Power Line Filter	SAEMC	PF401A-200	110318	N/A	N/A
7.	DC Power Filter	SAEMC	PF301A-200	110245	N/A	N/A
8.	Cable	Huber+Suhner	CBL3-NN-9M	21490001	Mar. 08, 2017	1 Year
9.	Cable	Huber+Suhner	CIL02	N/A	Mar. 08, 2017	1 Year
10.	Power Amplifier	HP	HP 8447D	1145A00203	Mar. 08, 2017	1 Year

3.3 For Electrostatic Discharge Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	ESD Tester	TESEQ	NSG 437	432	Mar. 22, 2017	1 Year

3.4 For RF Electromagnetic Field Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	RF Power Meter	ESE	4242	13984	Nov. 04, 2017	1 Year
2.	Power Amplifier	TESEQ	CBA 1G-150	T44029	N/A	1 Year
3.	Signal Generator	Agilent	N5181A	MY50142530	Nov. 01, 2017	1 Year
4.	Power Sensor	ESE	51011EMC	35716	Nov. 04, 2017	1 Year
5.	Antenna	Schwarzbeck	VULB9162	9162-010	Mar. 22, 2017	1 Year

3.5 For Electrical Fast Transient /Burst Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Burst Tester	EM TEST	UCS 500N	V1104108683	Mar. 08, 2017	1 Year
2.	Coupling Clamp	EM TEST	HFK	0311-94	Mar. 08, 2017	1 Year
3.	Test Soft	EM TEST	lec. control	N/A	N/A	N/A

3.6 For Surge Immunity Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Surge Tester	EM TEST	UCS 500N	V1104108683	Mar. 08, 2017	1 Year
2.	Test Soft	EM TEST	lec. control	N/A	N/A	N/A

3.7 For Injected Currents Immunity Measurement

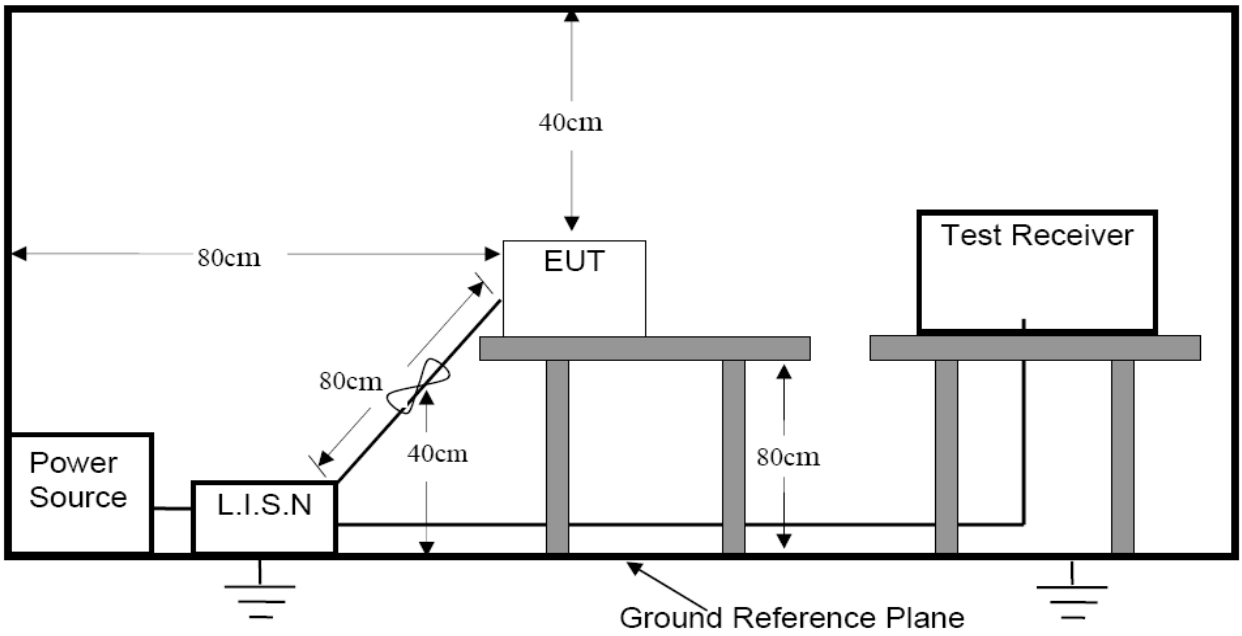
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	C/S Test System	HAEFELY	WinPAMP	NSEMC002	N/A	N/A
2.	CDN	FRANNOKIA	CDN-M2+M3	A2210150	Mar. 22, 2017	1 Year

3.8 For Voltage Dips and Interruptions Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Dips Tester	EM TEST	UCS500N	V1104108683	Mar. 08, 2017	1 Year
2.	Test Soft	EM TEST	lec.control	N/A	N/A	N/A
3.	Dips Modulator	EM TEST	V4780S2	0111-11	Mar. 08, 2017	1 Year

4. MAINS TERMINAL DISTURBANCE VOLTAGE MEASUREMENT

4.1 Block Diagram of Test Setup



4.2 Limit of Mains Terminal Disturbance voltage measurement

Test Standard: EN 55032

Limits for conducted disturbance at the mains ports.

Frequency range	Limits (dB(uV))	
(MHz)	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50
*Decreasing linearly with the logarithm of the frequency.		

Note:

1. If the limits for the average detector are met when using the quasi-peak detector,then the limits for the measurements with the average detector are considered to be met.
2. The higher value measured with and without the outer conductor screen of the antenna terminal connected to earth is considered.
3. Television receivers with teletext facilities should be tested in teletext mode with teletext picture.

4.3 Test Procedure

The E.U.T. is put on the 0.8 m high table and connected to the AC mains through a Artificial Mains Network (AMN). This provided a 50ohm coupling impedance for the tested equipments. Both sides of AC line are checked to find out the maximum conducted emission levels according to the EN55022 regulations during conducted emission test.

The bandwidth of the test receiver (R&S Test Receiver ESCI) is set at 9 KHz.

4.4 Operating Condition of E.U.T.

4.4.1 Setup the E.U.T. and simulators as shown in Section 2.3.

4.4.2 Turn on the power of all equipments.

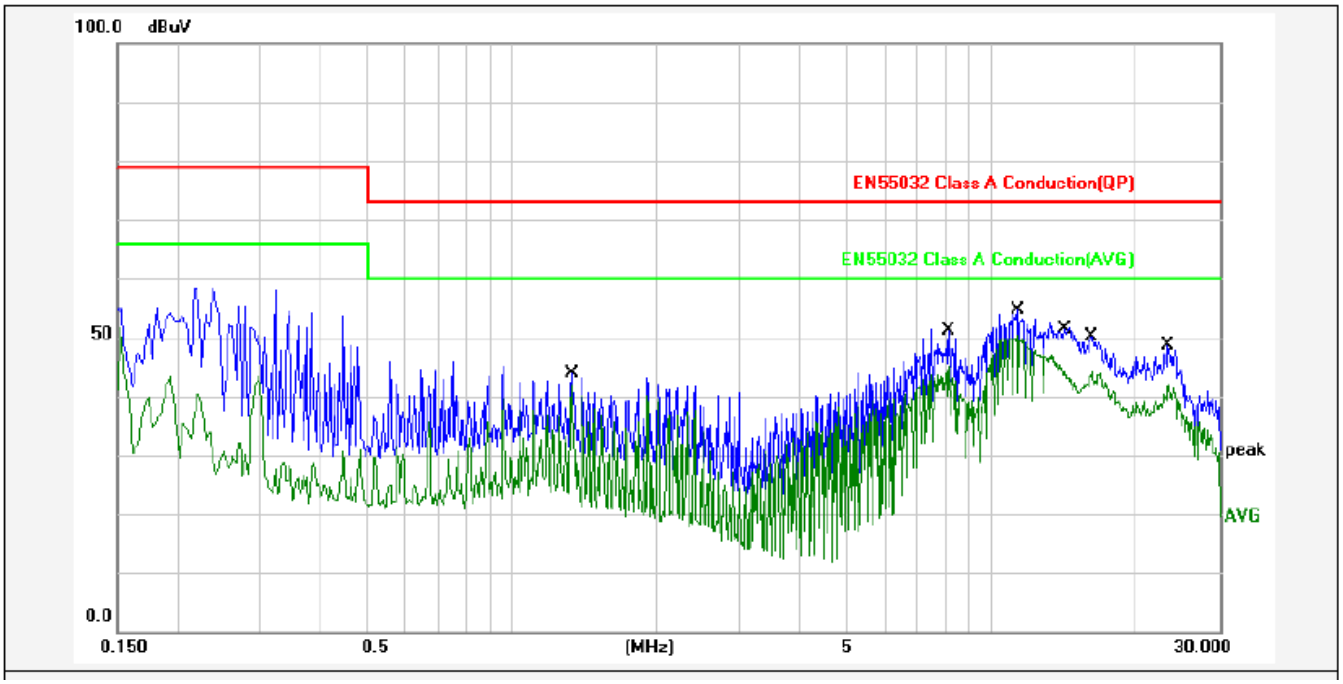
4.4.3 Let the E.U.T. work in test modes (Normal operation mode, Inverter mode) and test it.

4.5 Mains Terminal Disturbance Voltage Test Results

PASS.

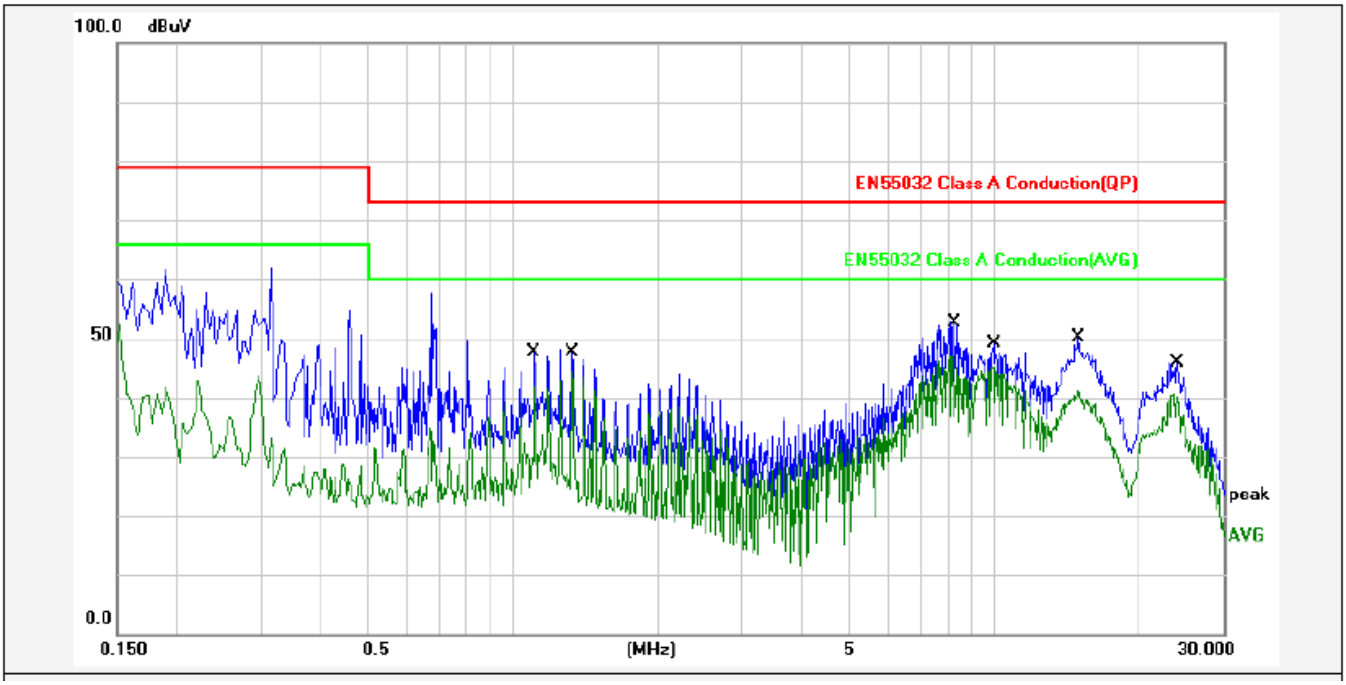
Please refer to the following pages.

E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26°C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	AC 230V/50Hz
Test Mode :	Normal operation mode	Phase:	Line



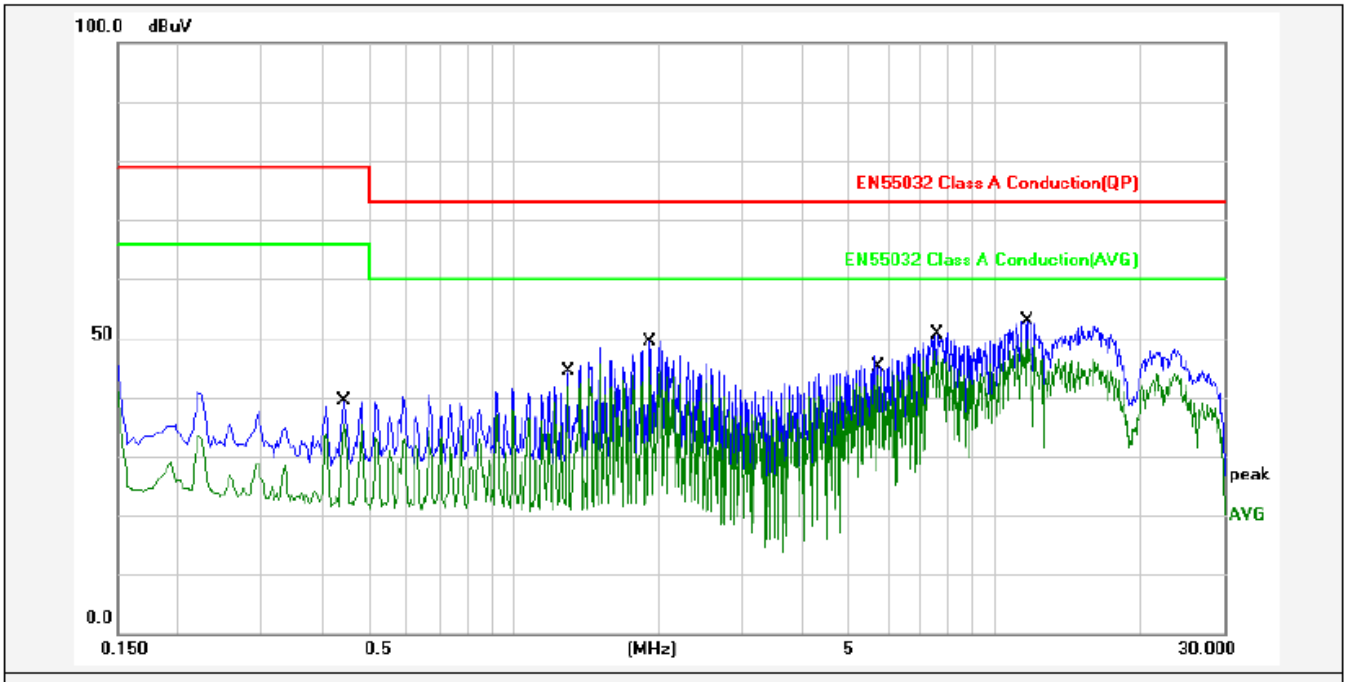
No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	1.3340	10.32	30.60	40.92	73.00	-32.08	QP	P	
2	1.3340	10.32	28.65	38.97	60.00	-21.03	AVG	P	
3	8.1859	10.34	37.70	48.04	73.00	-24.96	QP	P	
4	8.1859	10.34	31.85	42.19	60.00	-17.81	AVG	P	
5	11.3698	10.35	41.38	51.73	73.00	-21.27	QP	P	
6	11.3698	10.35	37.07	47.42	60.00	-12.58	AVG	P	
7	14.2538	10.36	37.91	48.27	73.00	-24.73	QP	P	
8	14.2538	10.36	30.81	41.17	60.00	-18.83	AVG	P	
9	16.2499	10.41	36.72	47.13	73.00	-25.87	QP	P	
10	16.2499	10.41	30.68	41.09	60.00	-18.91	AVG	P	
11	23.6020	10.60	34.94	45.54	73.00	-27.46	QP	P	
12	23.6020	10.60	28.33	38.93	60.00	-21.07	AVG	P	

E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26°C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	AC 230V/50Hz
Test Mode :	Normal operation mode	Phase:	Neutral



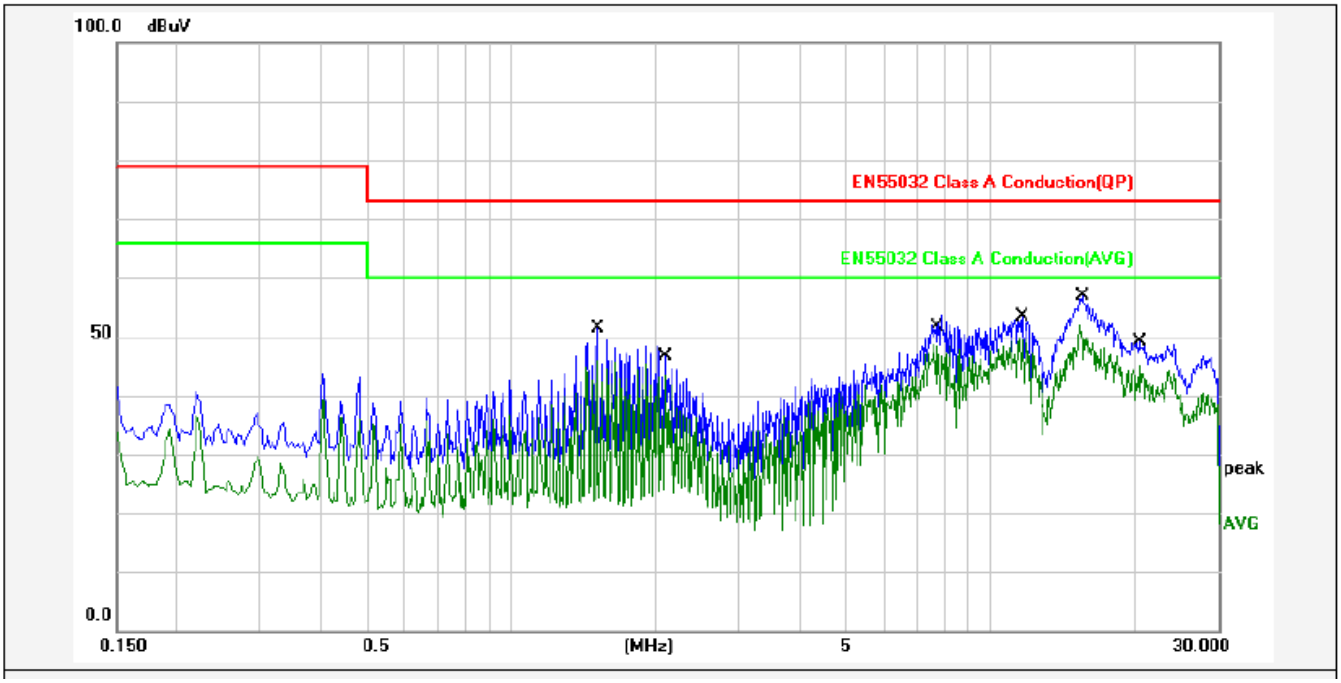
No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	1.1100	10.32	34.21	44.53	73.00	-28.47	QP	P	
2	1.1100	10.32	28.56	38.88	60.00	-21.12	AVG	P	
3	1.3300	10.32	34.41	44.73	73.00	-28.27	QP	P	
4	1.3300	10.32	31.06	41.38	60.00	-18.62	AVG	P	
5	8.2418	10.34	39.45	49.79	73.00	-23.21	QP	P	
6	8.2418	10.34	33.57	43.91	60.00	-16.09	AVG	P	
7	9.9419	10.35	35.89	46.24	73.00	-26.76	QP	P	
8	9.9419	10.35	31.80	42.15	60.00	-17.85	AVG	P	
9	15.0419	10.36	36.75	47.11	73.00	-25.89	QP	P	
10	15.0419	10.36	27.70	38.06	60.00	-21.94	AVG	P	
11	23.6500	10.60	32.33	42.93	73.00	-30.07	QP	P	
12	23.6500	10.60	26.94	37.54	60.00	-22.46	AVG	P	

E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26°C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	DC 48V
Test Mode :	Inverter mode	Phase:	Neutral



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.4444	10.33	25.94	36.27	79.00	-42.73	QP	P	
2	0.4444	10.33	22.01	32.34	66.00	-33.66	AVG	P	
3	1.2960	10.32	28.33	38.65	73.00	-34.35	QP	P	
4	1.2960	10.32	28.58	38.90	60.00	-21.10	AVG	P	
5	1.9180	10.32	36.09	46.41	73.00	-26.59	QP	P	
6	1.9180	10.32	31.84	42.16	60.00	-17.84	AVG	P	
7	5.7134	10.34	33.51	43.85	73.00	-29.15	QP	P	
8	5.7134	10.34	30.25	40.59	60.00	-19.41	AVG	P	
9	7.4859	10.34	37.55	47.89	73.00	-25.11	QP	P	
10	7.4859	10.34	34.47	44.81	60.00	-15.19	AVG	P	
11	11.6823	10.35	38.96	49.31	73.00	-23.69	QP	P	
12	11.6823	10.35	36.37	46.72	60.00	-13.28	AVG	P	

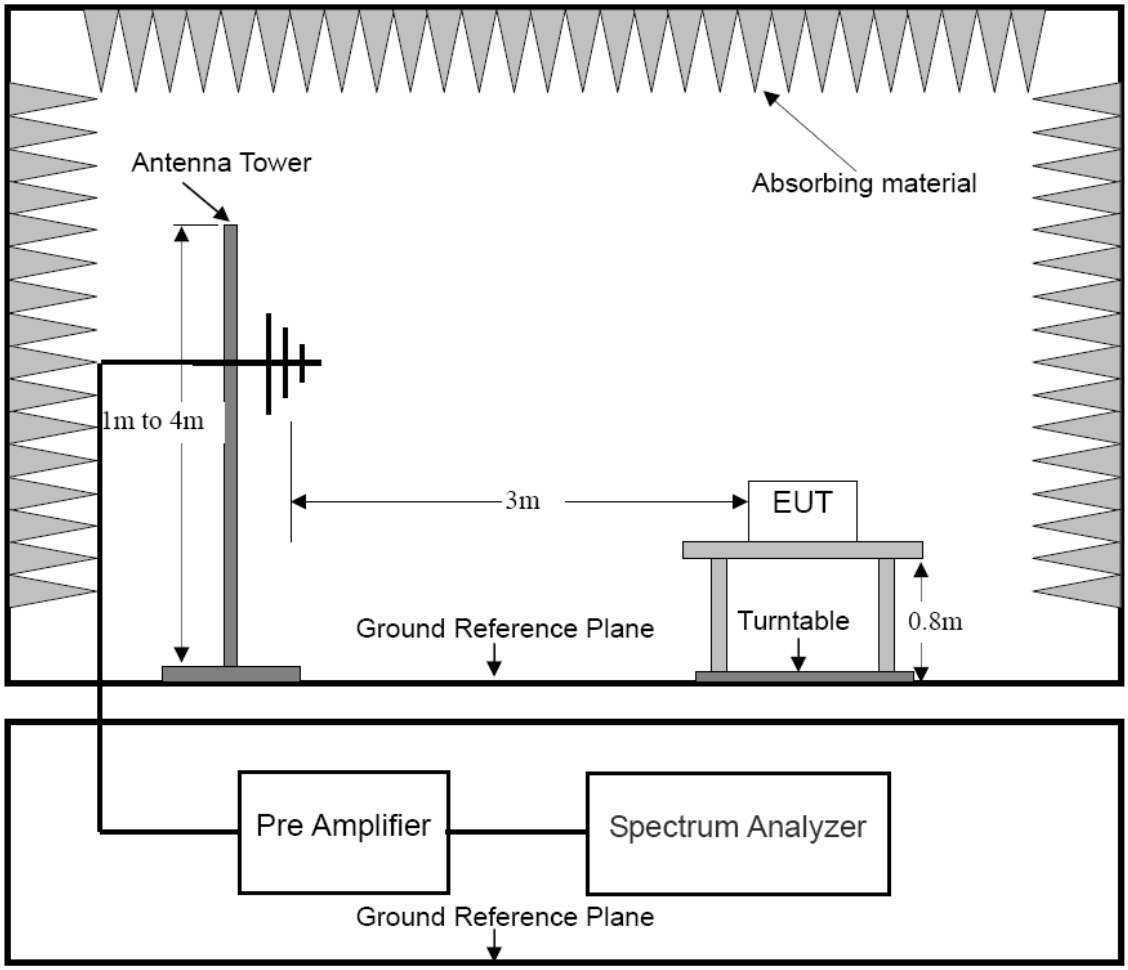
E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26˚C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	DC 48V
Test Mode :	Inverter mode	Phase:	Line



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	1.5140	10.32	38.11	48.43	73.00	-24.57	QP	P	
2	1.5140	10.32	32.57	42.89	60.00	-17.11	AVG	P	
3	2.1060	10.32	33.41	43.73	73.00	-29.27	QP	P	
4	2.1060	10.32	30.14	40.46	60.00	-19.54	AVG	P	
5	7.6819	10.34	38.72	49.06	73.00	-23.94	QP	P	
6	7.6819	10.34	35.26	45.60	60.00	-14.40	AVG	P	
7	11.5219	10.35	39.93	50.28	73.00	-22.72	QP	P	
8	11.5219	10.35	36.20	46.55	60.00	-13.45	AVG	P	
9	15.4699	10.38	43.50	53.88	73.00	-19.12	QP	P	
10	15.4699	10.38	38.53	48.91	60.00	-11.09	AVG	P	
11	20.4900	10.58	35.63	46.21	73.00	-26.79	QP	P	
12	20.4900	10.58	31.65	42.23	60.00	-17.77	AVG	P	

5. RADIATED EMISSION MEASUREMENT

5.1 Block Diagram of Test



5.2 Limit of Radiated Emission Measurement

Test Standard: EN 55032

Limits for radiated disturbance of class A at a measuring distance of 3m
Limits below 1GHz

Frequency range MHz	Quasi-peak limits dB(uV/m)
30 to 230	50
230 to 1000	57
Note 1 The lower limit shall apply at the transition frequency. Note 2 Additional provisions may be required for cases where interference occurs.	

5.3 Test Procedure

E.U.T. and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. E.U.T. is set 3.0 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1.0 meter and 4.0 meter to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna. Both horizontal and vertical polarization of the antenna is set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to EN 55022 on radiated emission measurement.
The bandwidth of the EMI test receiver (R&S ESCI7) is set at 120 KHz.
The frequency range from 30 MHz to 1000 MHz is checked.

5.4 Operating Condition of E.U.T.

5.4.1 Setup the E.U.T. and simulators as shown in Section 2.3.

5.4.2 Turn on the power of all equipments.

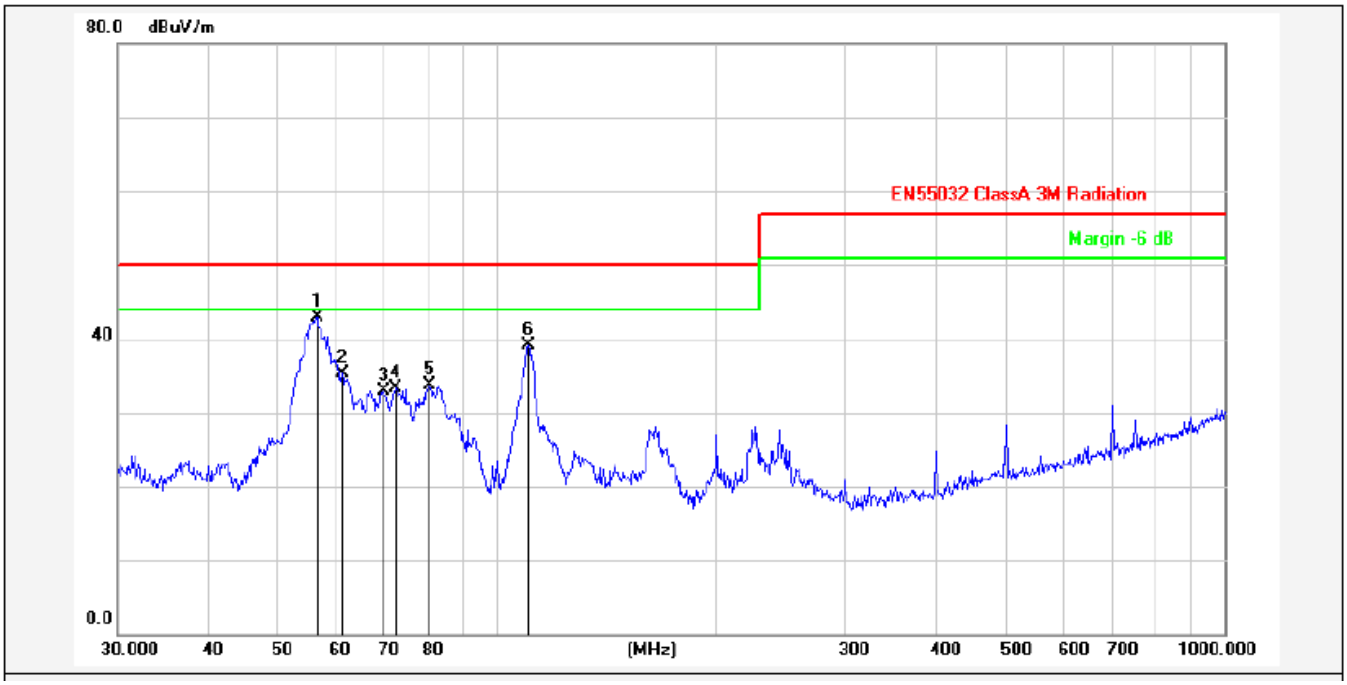
5.4.3 Let the E.U.T. work in test modes (Normal operation mode, Inverter mode) and test it.

5.5 Radiated Emission Measurement Result

PASS.

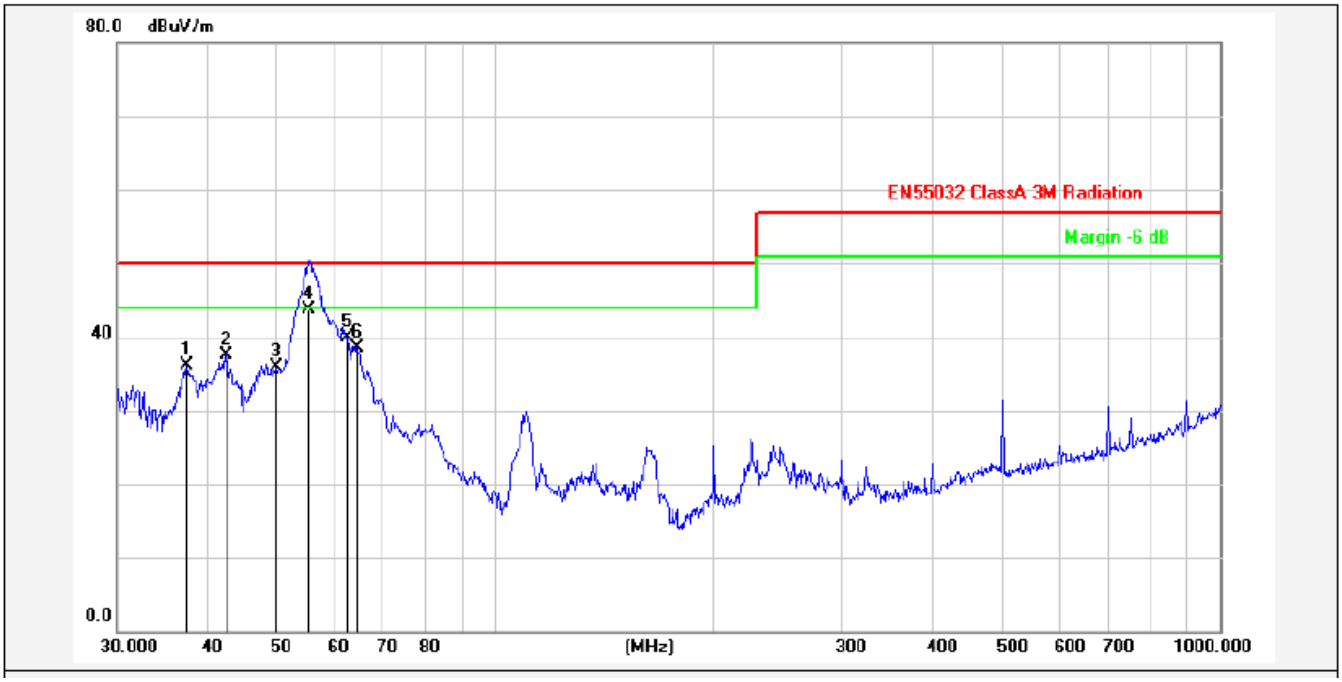
Please refer to the following pages.

E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26°C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	AC 230V/50Hz
Test Mode :	Normal operation mode	Phase:	Horizontal



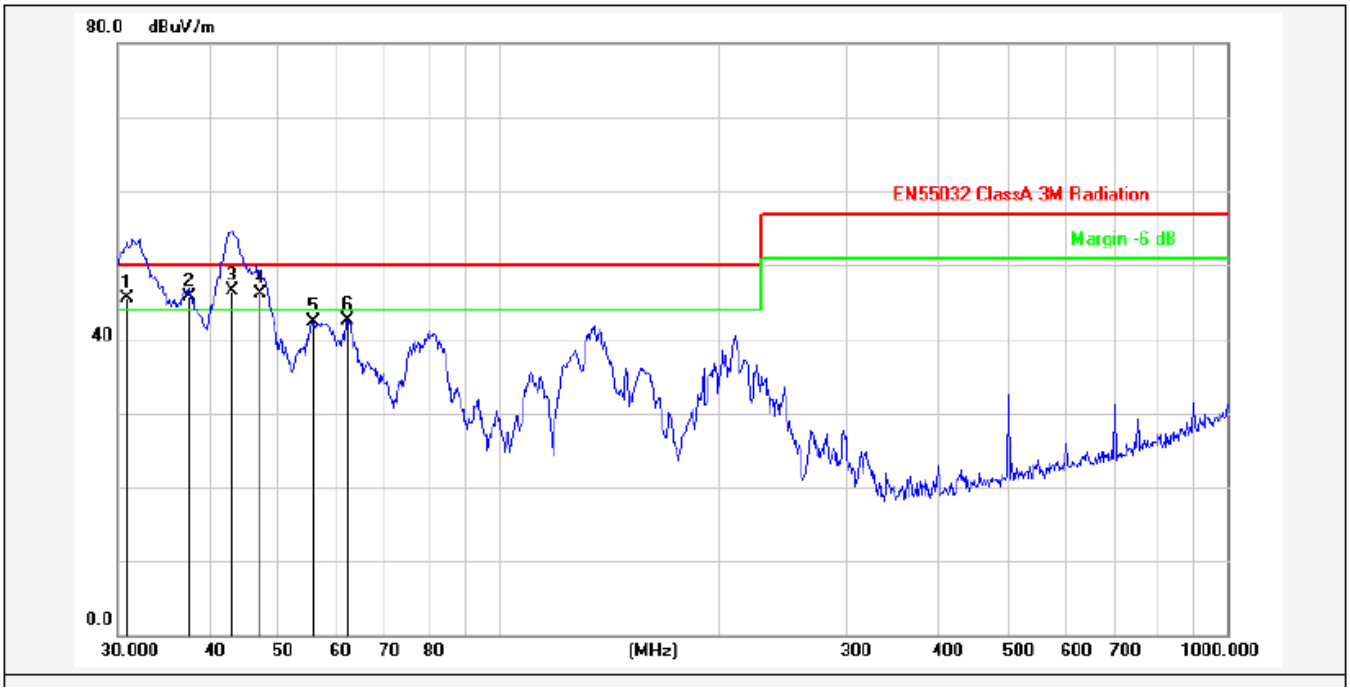
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	56.3947	-12.75	55.73	42.98	50.00	-7.02	QP			P	
2	61.1315	-13.45	48.83	35.38	50.00	-14.62	QP			P	
3	69.6003	-12.12	45.07	32.95	50.00	-17.05	QP			P	
4	72.3375	-11.74	45.06	33.32	50.00	-16.68	QP			P	
5	80.6440	-8.91	42.64	33.73	50.00	-16.27	QP			P	
6	110.1816	-6.04	45.15	39.11	50.00	-10.89	QP			P	

E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26°C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	AC 230V/50Hz
Test Mode :	Normal operation mode	Phase:	Vertical



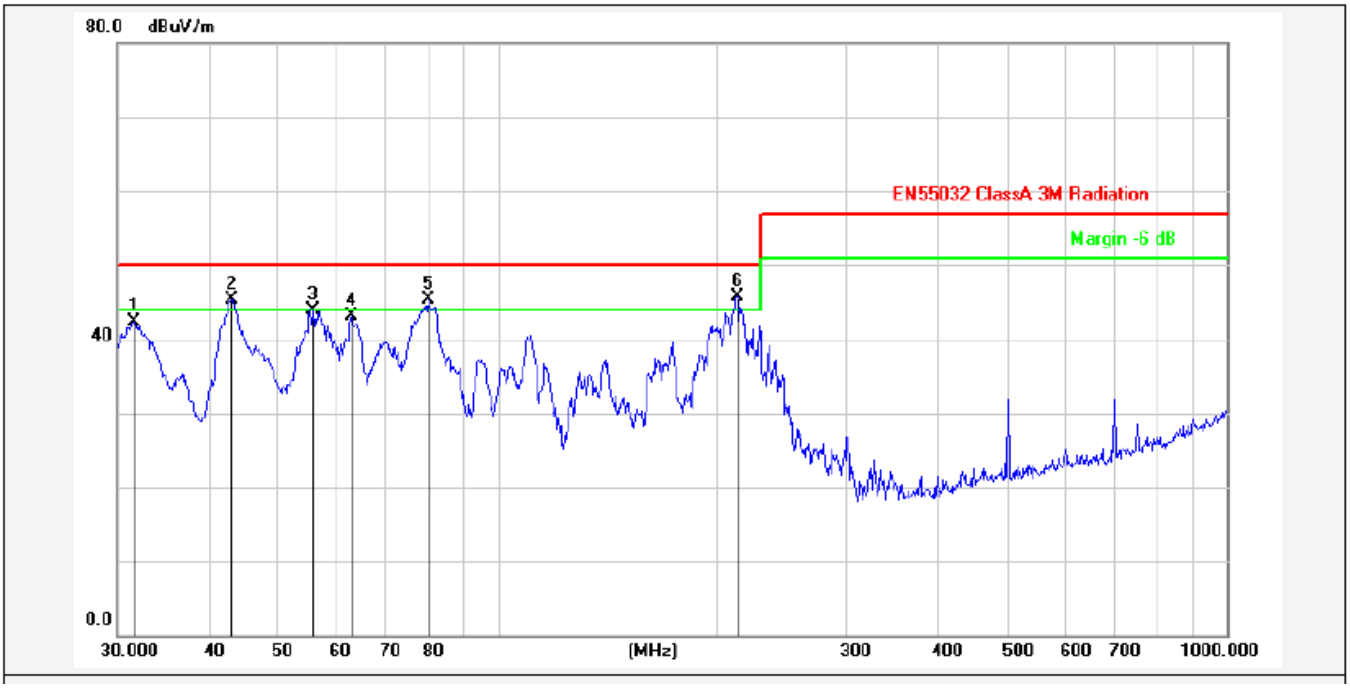
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	37.4164	-2.81	38.87	36.06	50.00	-13.94	QP			P	
2	42.4508	-5.42	43.02	37.60	50.00	-12.40	QP			P	
3	49.8813	-11.11	46.96	35.85	50.00	-14.15	QP			P	
4	55.2207	-12.47	56.27	43.80	50.00	-6.20	QP			P	
5	62.4313	-13.24	53.05	39.81	50.00	-10.19	QP			P	
6	64.4330	-12.94	51.50	38.56	50.00	-11.44	QP			P	

E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26°C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	DC 48V
Test Mode :	Inverter mode	Phase:	Vertical



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	30.7743	-0.92	46.42	45.50	50.00	-4.50	QP			P	
2	37.5478	-2.86	48.66	45.80	50.00	-4.20	QP			P	
3	43.1217	-5.94	52.54	46.60	50.00	-3.40	QP			P	
4	46.9947	-8.91	55.11	46.20	50.00	-3.80	QP			P	
5	55.8047	-12.60	54.98	42.38	50.00	-7.62	QP			P	
6	61.9950	-13.31	55.78	42.47	50.00	-7.53	QP			P	

E.U.T :	INVERTER	Model Name :	Tommatech 5K+Plus MPPT
Temperature :	26°C	Relative Humidity :	55 %
Pressure :	1006 hPa	Test Voltage :	DC 48V
Test Mode :	Inverter mode	Phase:	Horizontal



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	31.6202	-1.17	43.53	42.36	50.00	-7.64	QP			P	
2	43.0505	-5.88	51.18	45.30	50.00	-4.70	QP			P	
3	55.8047	-12.60	56.50	43.90	50.00	-6.10	QP			P	
4	62.8708	-13.18	56.23	43.05	50.00	-6.95	QP			P	
5	80.0806	-8.97	54.37	45.40	50.00	-4.60	QP			P	
6	213.0151	-7.13	52.85	45.72	50.00	-4.28	QP			P	

6. PERFORMANCE CRITERIA FOR IMMUNITY

The performance criteria are referred to the test standard: EN 55024

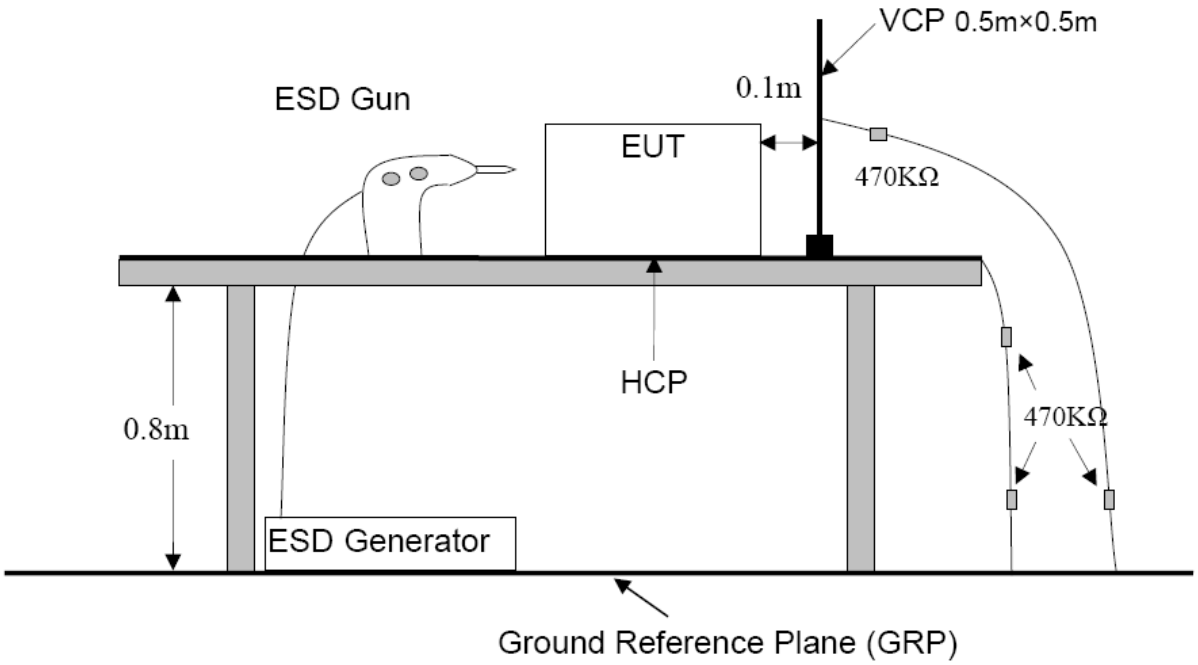
Performance Criteria A
The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance Criteria B
After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance of loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.
During the test, degradation of performance is allowed. However, no change of operation state or stored data is allowed to persist after test.
If the minimum performance lever (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonable expect from the equipment if used as intended.

Performance Criteria C
Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.
Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

7. ELECTROSTATIC DISCHARGE TEST

7.1 Block Diagram of Test Setup



7.2 Test Standard and Severity Levels

7.2.1 Test Standard:

EN 55024
(EN 61000-4-2 Air Discharge: Severity Level: 3, ± 8KV;
Contact Discharge: Level: 2, ± 4KV)

7.2.2 Severity Levels:

Level	Test Voltage Contact Discharge (KV)	Test Voltage Air Discharge (KV)
1.	±2	±2
2.	±4	±4
3.	±6	±8
4.	±8	±15
X	Special	Special

7.3 Test Procedure

7.3.1 Air Discharge**:**

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the E.U.T.. After each discharge, the discharge electrode shall be removed from the E.U.T.. The generator is then re-triggered for a new single discharge and repeated 25 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed

7.3.2 Contact Discharge**:**

All the procedure shall be same as Section 7.3.1. except that the tip of the discharge electrode shall touch the E.U.T..

7.3.3 Indirect discharge for horizontal coupling plane

At least 10 single discharges(in the most sensitive polarity) shall be applied at the front edge of each HCP opposite the center point of each unit(if applicable) of the E.U.T. and 0.1m from the front of the E.U.T.. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.

7.3.4 Indirect discharge for vertical coupling plane

At least 10 single discharge (in the most sensitive polarity) shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the E.U.T.. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the E.U.T. are completely illuminated.

7.4 Test Results

PASS.

Please refer to the following page.

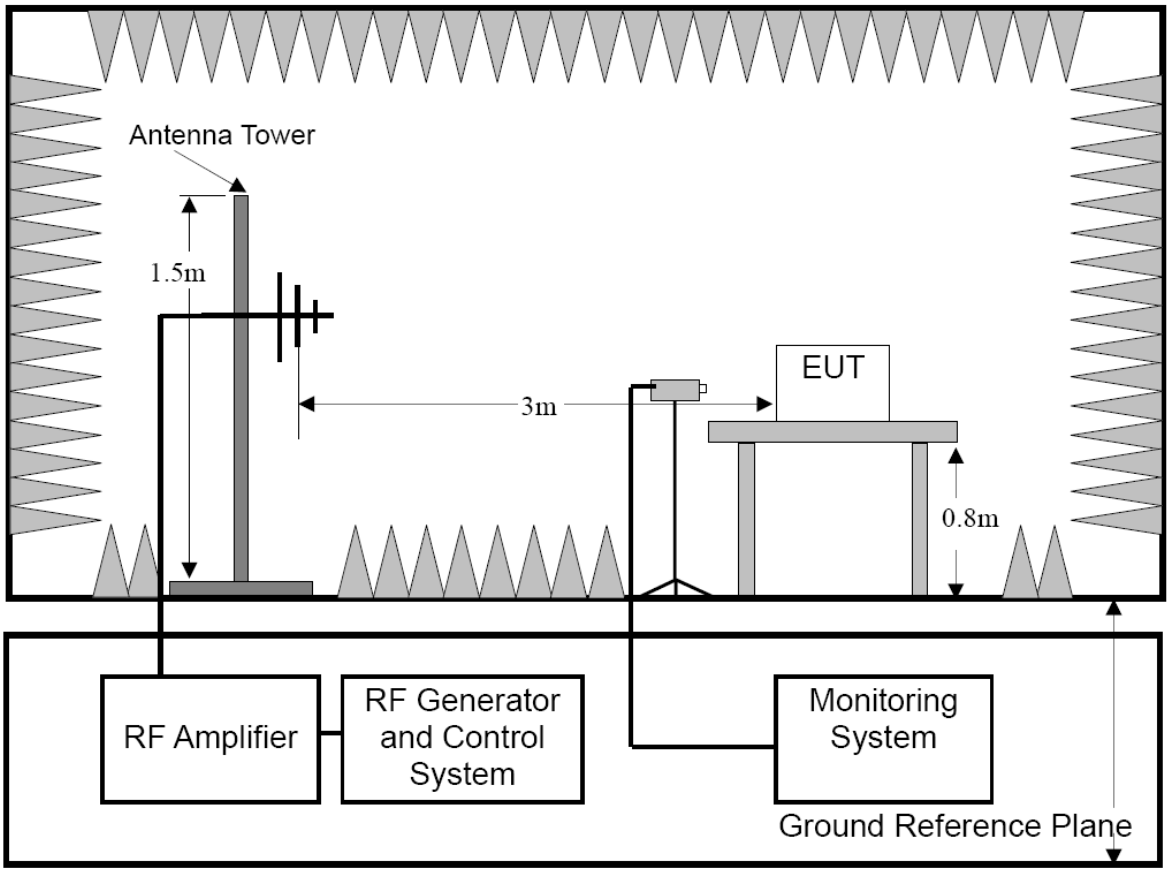
Electrostatic Discharge Test Results

Ambient Condition:	Temp.: 25 ℃	R.H.: 54 %	Air Pressure: 101 kPa
Power Supply:	AC 230V 50Hz, DC 48V battery	Required Performance Criterion:	B
Test Specifications:	±2, 4 KV Contact Discharge; ±2, 4, 8 KV Air Discharge For each point positive 25 times and negative 25 times		
Tested mode:	Normal operation mode, Inverter mode		

Test Point	**Kind** A-Air Discharge C-Contact Discharge	**Result** (Performance Criterion)
Metal	C	A
Screen	A	A
Button	A	A
Indirect Discharge (HCP)	C	A
Indirect Discharge (VCP)	C	A
Note:		
Test Equipment : ESD Tester (TESEQ, NSG 437)		Test Engineer : Stan

8. RF FIELD STRENGTH SUSCEPTIBILITY TEST

8.1 Block Diagram of Test Setup



8.2 Test Standard and Severity Levels

8.2.1 Test Standard

EN 55024
(EN 61000-4-3, Severity Level: 2, 3V / m)

8.2.2 Severity Levels

Level	Field Strength V/m
1.	1
2.	3
3.	10
X	Special

8.3 Test Procedure

The E.U.T. and its simulators are placed on a turn table which is 0.8 meter above ground. E.U.T. is set 3 meter away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarization of the antenna are set on test. Each of the four sides of E.U.T. must be faced this transmitting antenna and measured individually.
All the scanning conditions are as follows **:**

Condition of Test	Remarks
1. Fielded Strength	3 V/m (Severity Level 2)
2. Radiated Signal	Modulated
3. Scanning Frequency	80 - 1000 MHz
4. Dwell time of radiated	0.0015 decade/s
5. Waiting Time	1 Sec.

8.4 Test Results

PASS.

Please refer to the following page.

RF Field Strength Susceptibility Test Results

Ambient Condition:	Temp.: 25 ℃	R.H.: 54 %	Air Pressure: 101 kPa	
Power Supply:	AC 230V 50Hz, DC 48V battery	Required Performance Criterion: A		
Test Specifications:	Modulation: 1kHz, 80%AM;	Step Size: 1%;	Dwell Time: 1s	
Tested mode:	Normal operation mode, Inverter mode			
Frequency (MHz)	Level (V/m)	Antenna polarity	Side	Result (Performance Criterion)
80-1000	3	Horizontal	Front	A
			Left	A
			Right	A
			Back	A
		Vertical	Front	A
			Left	A
			Right	A
			Back	A
Note:				

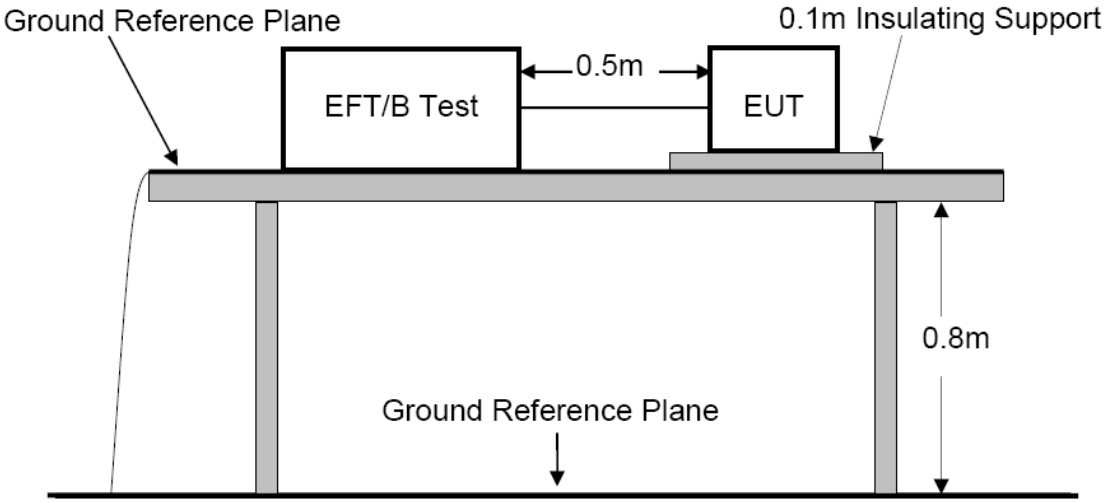
Test Equipment **:**

1. Signal Generator : N5181A (Agilent)
2. Power Amplifier : CBA 1G-150 (TESEQ)
3. Antenna: VULB9162 (Schwarzbeck)
4. RF Power Meter. Dual Channel : 4242 (ESE)
5. Power Sensor: 51011EMC (ESE)

Test Engineer : Stan

9. ELECTRICAL FAST TRANSIENT/BURST TEST

9.1 Block Diagram of Test Setup



9.2 Test Standard and Severity Levels

9.2.1 Test Standard

EN 55024
(EN 61000-4-4, Severity Level, Level 2: **1**KV)

9.2.2 Severity level

Open circuit output test voltage and repetition rate of the impulses				
Level	On power port, PE		On I/O (Input/Output) Signal data and control ports	
	Voltage peak KV	Repetition rate KHz	Voltage peak KV	Repetition rate KHz
1.	0.5	5 or 100	0.25	5 or 100
2.	1.0	5 or 100	0.5	5 or 100
3.	2.0	5 or 100	1.0	5 or 100
4.	4.0	5 or 100	2.0	5 or 100
X	Special	Special	Special	Special

Note 1 Use of 5 KHz repetition rates is traditional; however, 100 KHz is closer to reality. Product committees should determine which frequencies are relevant for specific products or product types.

Note 2 With some products, there may be no clear distinction, between power ports and I/O ports, in which case it is up to product committees to make this determination for test purposes.

Note 3 “X” is an open level. The level has to be specified in the dedicated equipment specification.

9.3 Test Procedure

The E.U.T. is put on the table which is 0.8 meter high above the ground. This reference ground plane shall project beyond the E.U.T. by at least 0.1m on all sides and the minimum distance between E.U.T. and all other conductive structure, except the ground plane beneath the E.U.T., shall be more than 0.5m.

9.3.1 For input and output AC power ports**:**

The E.U.T. is connected to the power mains by using a coupling device which couples the EFT interference signal to AC power lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 minutes.

9.3.2 For signal lines ports**:**

It's unnecessary to test.

9.3.3 For DC ports**:**

It's unnecessary to test.

9.4 Test Result

PASS.

Please refer to the following page.

Electrical Fast Transient/Burst Test Results

Ambient Condition:	Temp.: 25 ℃	R.H.: 54 %	Air Pressure: 101 kPa
Power Supply:	AC 230V 50Hz	Required Performance Criterion: B	
Test Specifications:	Repetition Frequency: 5kHz; Duration: 15ms; Period: 300ms		
Test mode:	Normal operation mode		
Line : ☒ AC Mains ☐ Signal line ☐ DC line Coupling : ☒ Direct ☐ Capacitive			

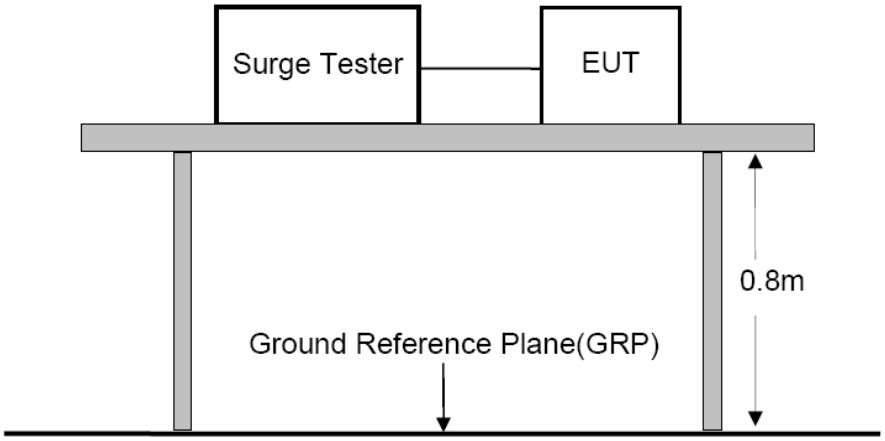
Line	**Test Voltage**	**Result** (Performance Criterion)
L	±1KV	A
N	±1KV	A
PE	±1KV	A
L、N	±1KV	A
L、PE	±1KV	A
N、PE	±1KV	A
L、N、PE	±1KV	A
Signal line		
DC line		

Note :

Test Equipment : Burst Tester(EM TEST, UCS500N) Test Engineer : Stan

10. SURGE IMMUNITY TEST

10.1 Block Diagram of Test Setup



10.2 Test Standard and Severity Levels

10.2.1 Test Standard

EN 55024
(EN 61000-4-5, Severity Level: Line To Line, Level 2: 1.0KV; Line To Earth, Level 3: 2.0KV)

10.2.2 Severity level

Severity Level	Open-Circuit Test Voltage KV
1	0.5
2	1.0
3	2.0
4	4.0
*	Special

10.3 Test Procedure

1. Set up the E.U.T. and test generator as shown on Section 10.1.
2. For line to line coupling mode, provide a 1.0KV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to E.U.T. selected points.
3. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.
4. Different phase angles are done individually.
5. Record the E.U.T. operating situation during compliance test and decide the E.U.T. immunity criterion for above each test.

10.4 Test Result

PASS.

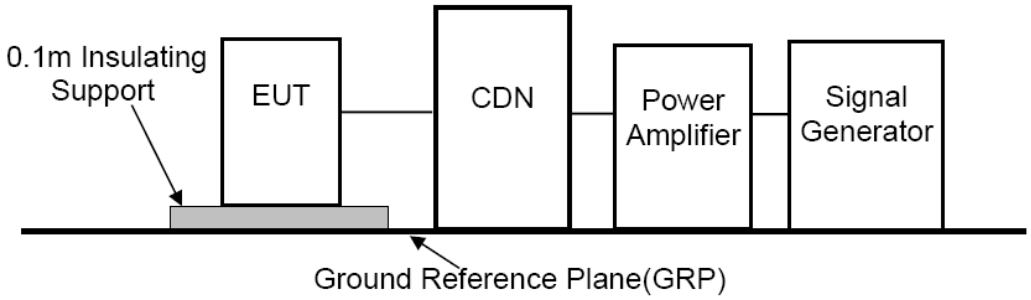
Please refer to the following page.

Surge Immunity Test Results

Ambient Condition:	Temp.: 25 ℃	R.H.: 54 %	Air Pressure: 101 kPa
Power Supply:	AC 230V 50Hz	Required Performance Criterion: B	
Test Specifications:	Voltage surge 1.2/50 us ; Current surge 8/20 us ; Five positive and five negative pulses each at 0°, 90°, 180° and 270°.		
Test mode:	Normal operation mode		
Line	**Phase Angle**	**Test Voltage**	**Result** (Performance Criterion)
L-N	0°, 90°, 180°, 270°	±1KV	A
L-PE	0°, 90°, 180°, 270°	±2KV	A
N-PE	0°, 90°, 180°, 270°	±2KV	A
Signal line			
DC line			
Note :			
Test Equipment : Burst Tester(EM TEST, UCS500N)			Test Engineer : Stan

11. INJECTED CURRENTS SUSCEPTIBILITY TEST

11.1 Block Diagram of Test Setup



11.2 Test Standard and Severity Levels

11.2.1 Test Standard

EN 55024
(EN 61000-4-6, Severity Level**: 3**V (rms),0.15MHz ~ 80MHz)

11.2.2 Severity level

Level	Field Strength V
1.	1
2.	3
3.	10
X	Special

11.3 Test Procedure

1. Set up the E.U.T., CDN and test generators as shown on Section 11.1.
2. Let the E.U.T. work in test mode and measure it.
3. The E.U.T. are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from E.U.T.. Cables between CDN and E.U.T. are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
4. The disturbance signal described below is injected to E.U.T. through CDN.
5. The E.U.T. operates within its operational mode(s) under intended climatic conditions after power on.
6. The frequency range is swept from 150 KHz to 80 MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1KHz sine wave.
7. The rate of sweep shall not exceed $1.5*10^{-3}$decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.
8. Recording the E.U.T. operating situation during compliance testing and decide the E.U.T. immunity criterion.

11.4 Test Result

PASS.

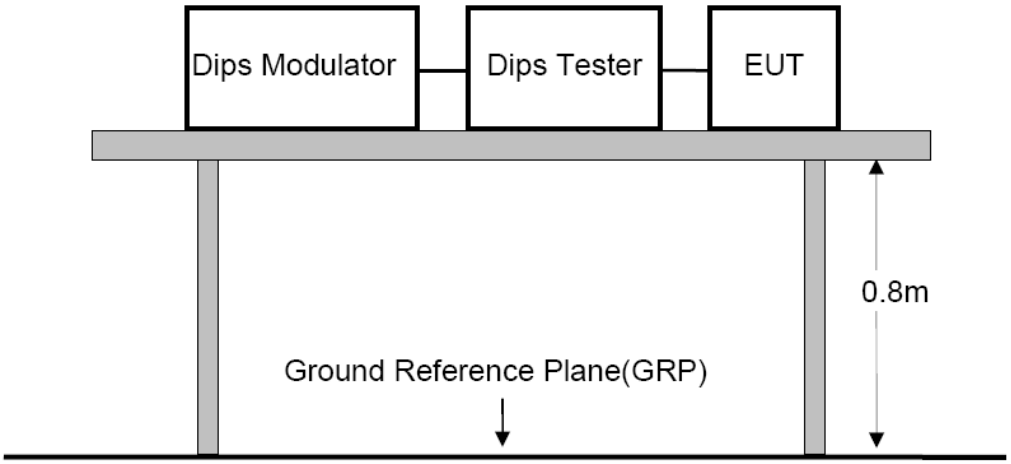
Please refer to the following page.

Injected Currents Susceptibility Test Results

Ambient Condition:	Temp.: 25℃	R.H.: 54%	Air Pressure: 101 kPa
Power Supply:	AC 230V 50Hz	Required Performance Criterion: A	
Test Specifications:	Modulation : 1KHz, 80%AM, Step Size : 1%, Dwell Time : 1s		
Test mode:	Normal operation mode		
Test Port	Frequency (MHz)	Level(V)	Result (Performance Criterion)
AC Mains	0.15~80	3	A
Note :			
Test Equipment : FRANNOKIA, CIT-10		Test Engineer : Stan	

12.VOLTAGE DIPS AND INTERRUPTIONS TEST

12.1 Block Diagram of Test Setup



12.2 Test Standard and Severity Levels

12.2.1 Test Standard
EN 55024
(EN 61000-4-11: 2004)

12.2.2 Severity level

Test Level %UT	Voltage dip and short interruptions %UT	Duration (in period)
0	100	0.5 1
40	60	10 12
70	30	25 30
80	20	250 300
X	X	X

12.3 Test Procedure

1. Set up the E.U.T. and test generator as shown on Section 12.1.
2. The interruptions is introduced at selected phase angles with specified duration.
3. Record any degradation of performance.

12.4 Test Result

PASS.

Please refer to the following page.

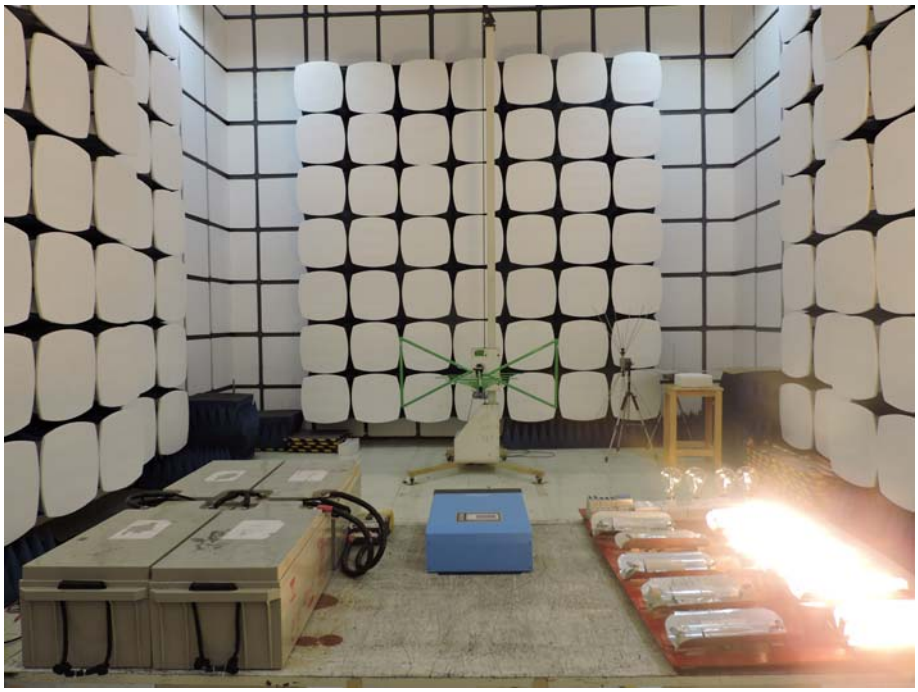
Voltage Dips And Interruptions Test Results

Ambient Condition:	Temp.: 25 ℃	R.H.: 54 %	Air Pressure: 101 kPa
Power Supply:	AC 230V 50Hz	Required Performance Criterion: B & C	
Test Specifications:	>95%UTreduction,0.5Cycle;30%UTreduction,25Cycle; >95%UTreduction 250Cycle		
Test mode:	Normal operation mode		
Test Level % UT	Duration (in period)	Result (Performance Criterion)	
0	0.5P	A	
70	25P	A	
0	250P	C	
Note : The normal operation mode changes to stored energy operation mode and the output voltage of EUT would dips during the test, but it can be resumed by users after test.			
Test Equipment : Dips Tester: EM TEST, UCS 500N		Test Engineer : Stan	

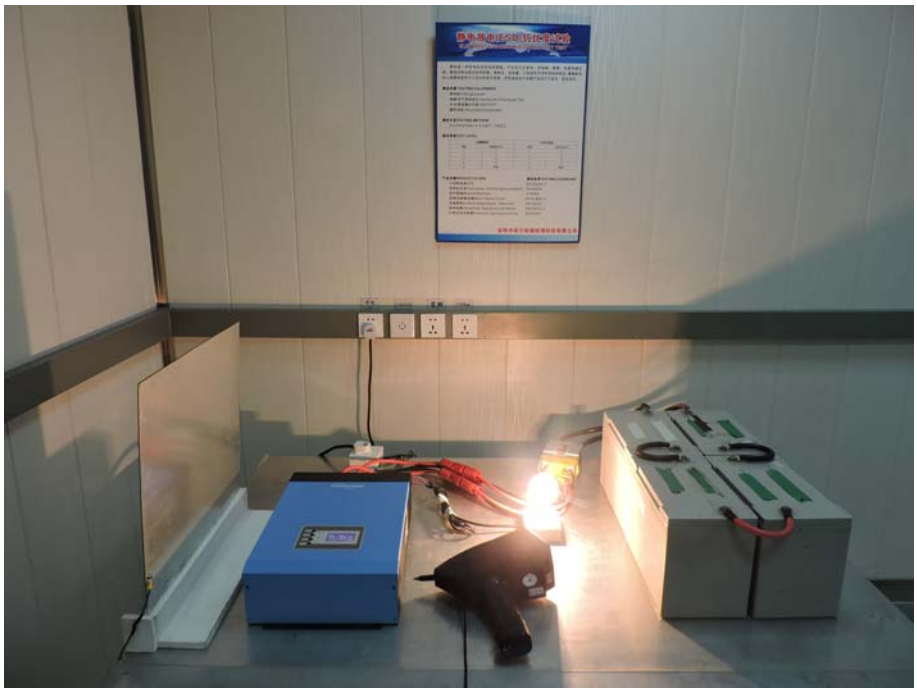
13.PHOTOGRAPH

13.1 Photo of Conducted Emission Measurement

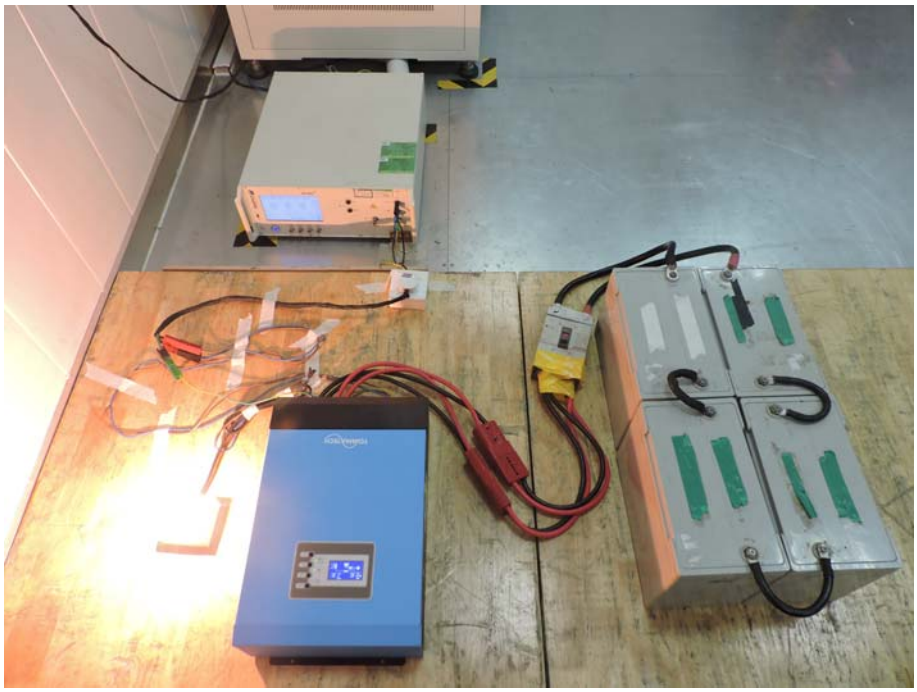
13.2 Photo of Radiation Emission Measurement



13.3 Photo of Electrostatic Discharge Test



13.4 Photo of Electrical Fast Transient /Surge /Voltage Dips Test



APPENDIX I
(Photos of E.U.T.)

Figure 1
General Appearance of the E.U.T.

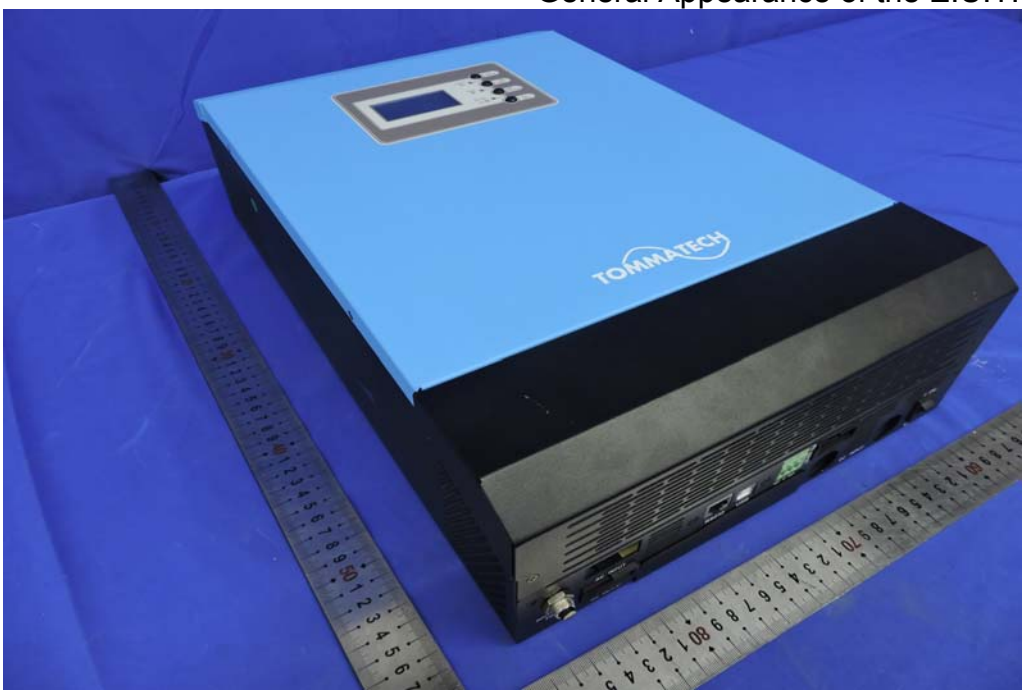


Figure 2
General Appearance of the E.U.T.

Figure 3
General Appearance of the E.U.T.

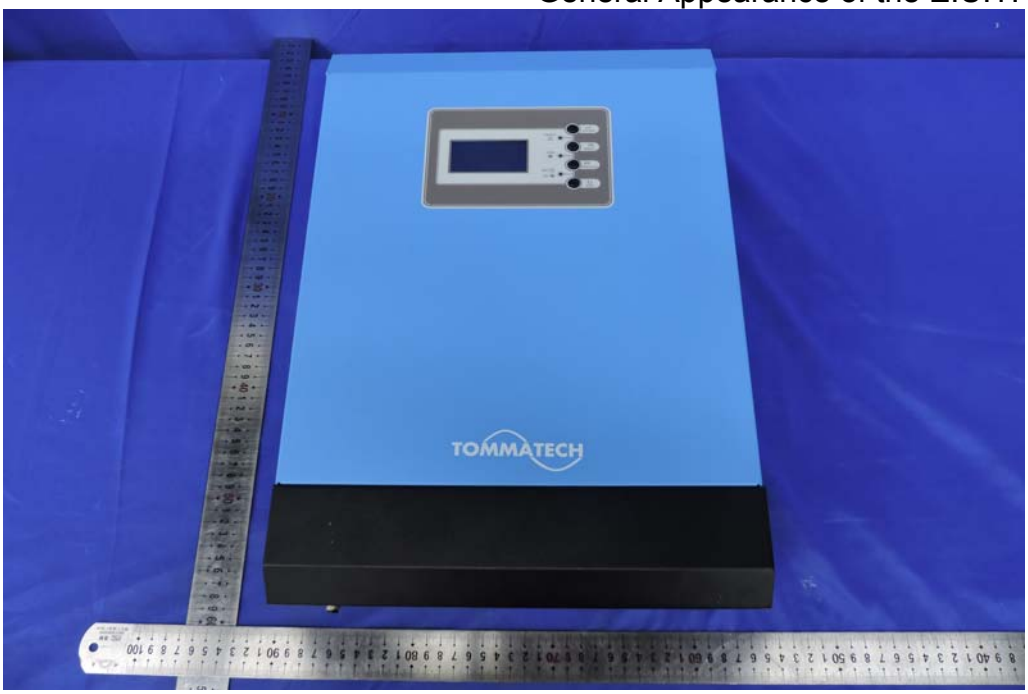


Figure 4
General Appearance of the E.U.T.

Figure 5
General Internal of the E.U.T.

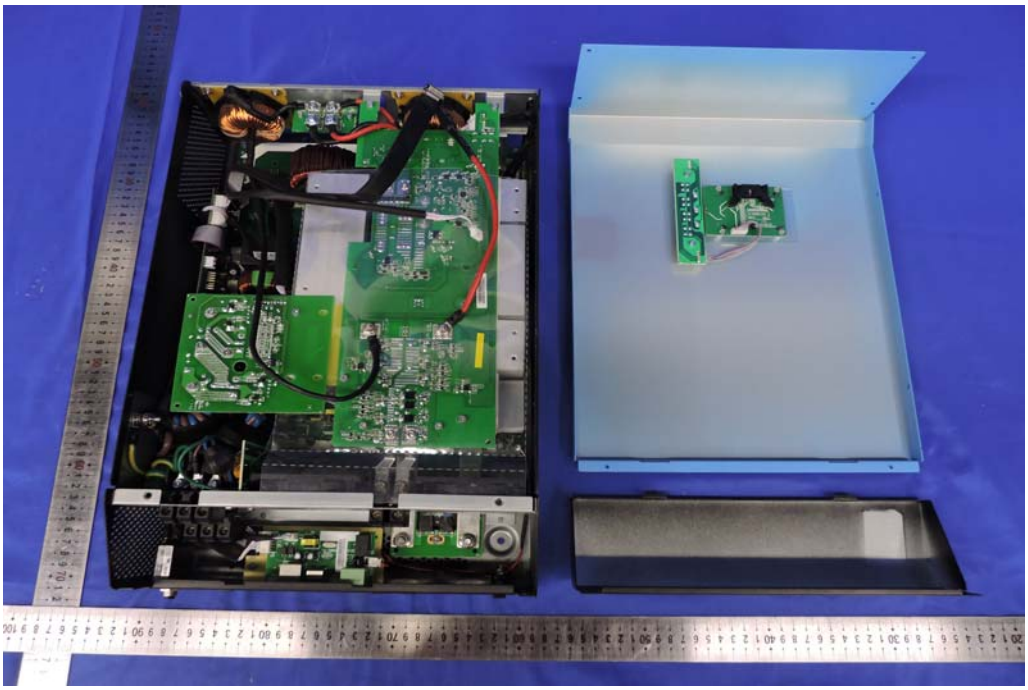


Figure 6
General Appearance of the PCB

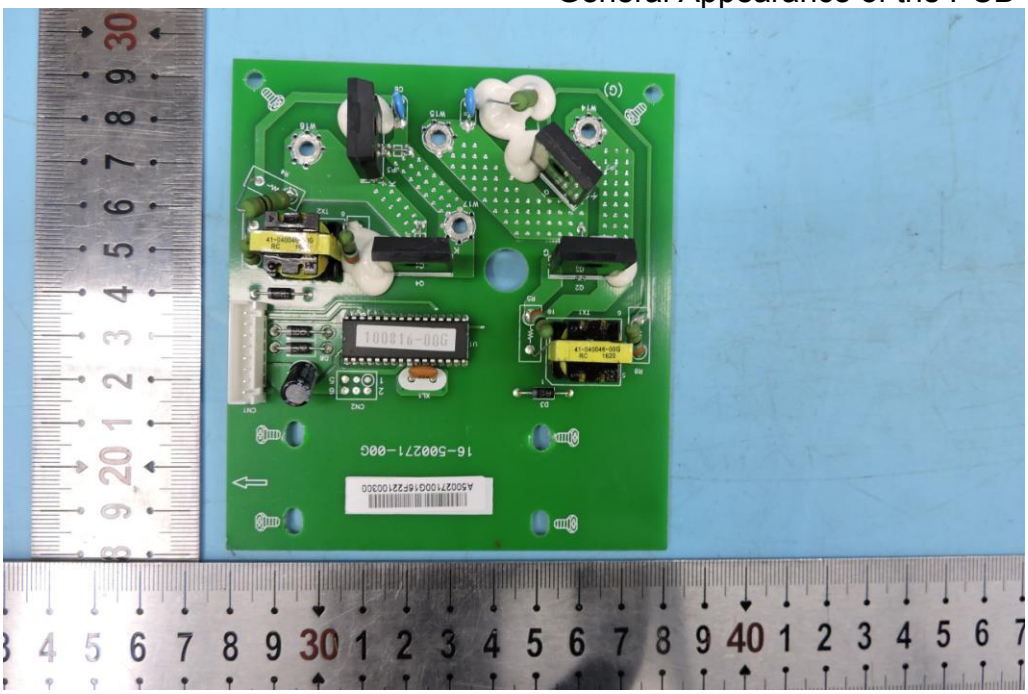


Figure 7
General Appearance of the PCB

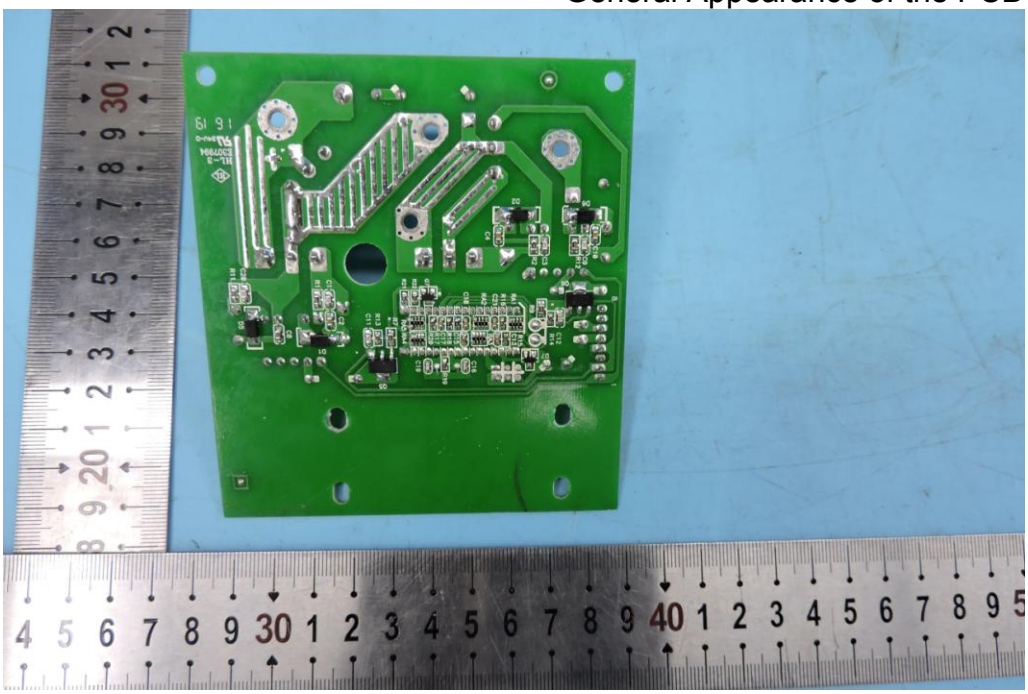


Figure 8
General Appearance of the PCB

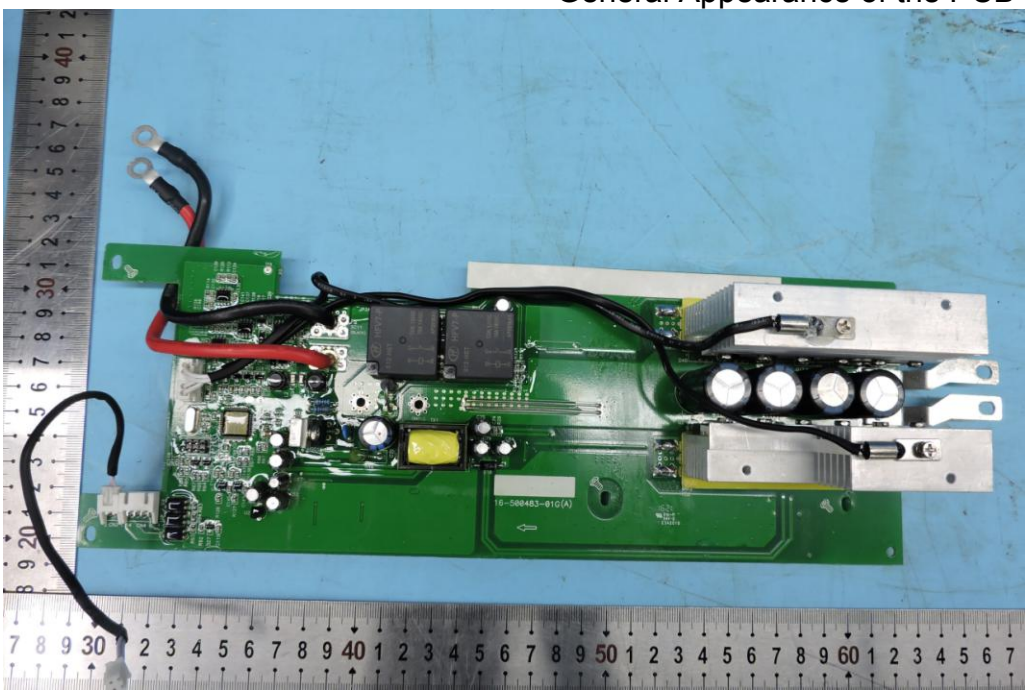


Figure 9
General Appearance of the PCB

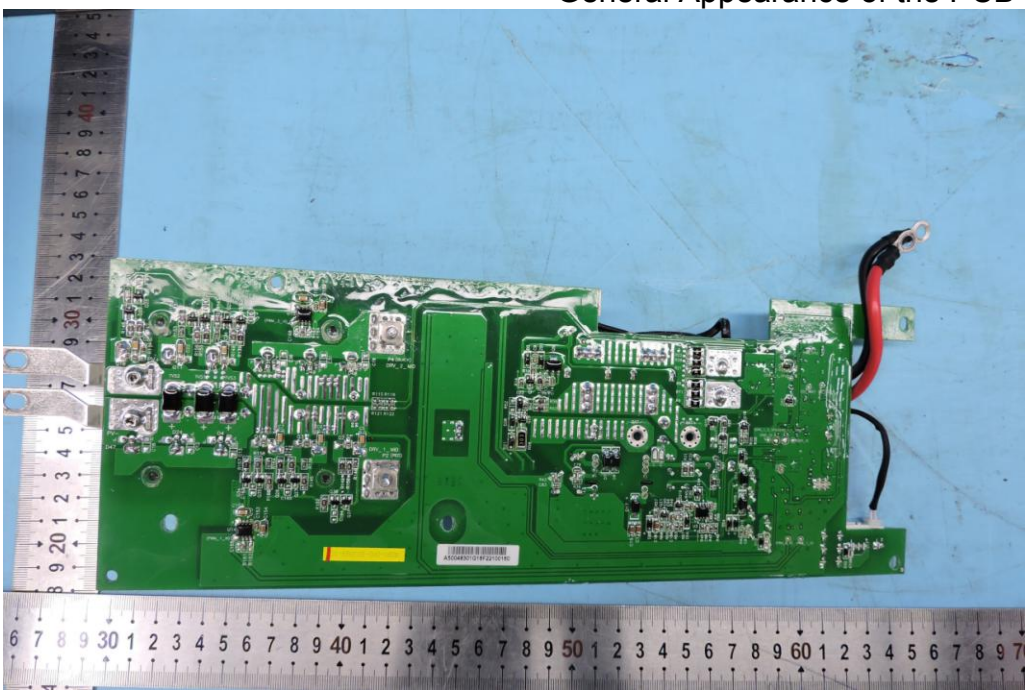


Figure 10
General Appearance of the PCB

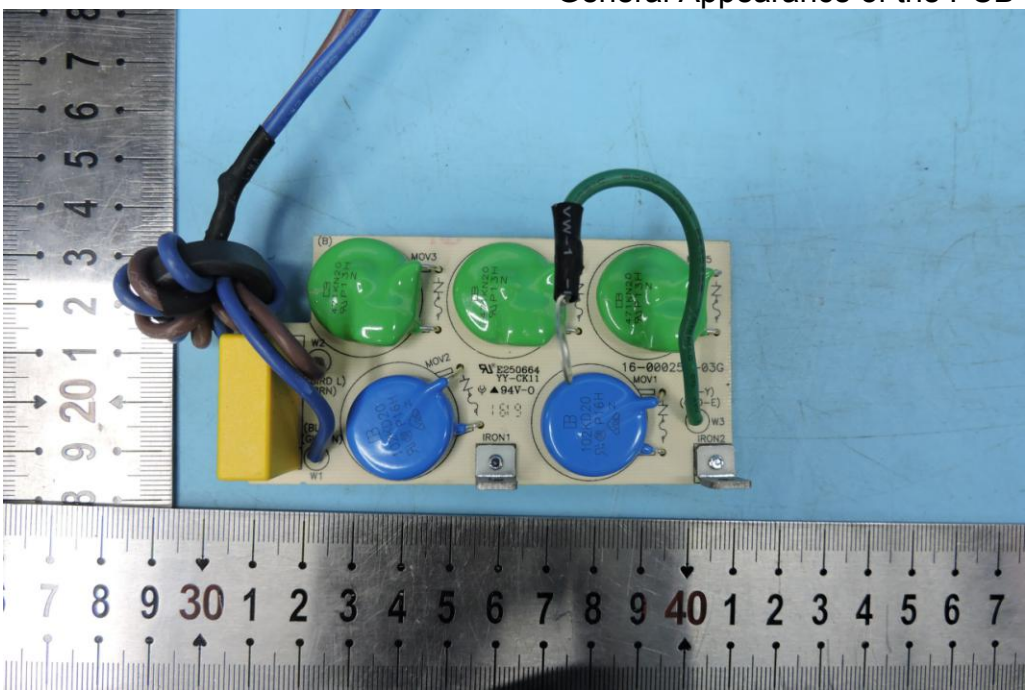


Figure 11
General Appearance of the PCB

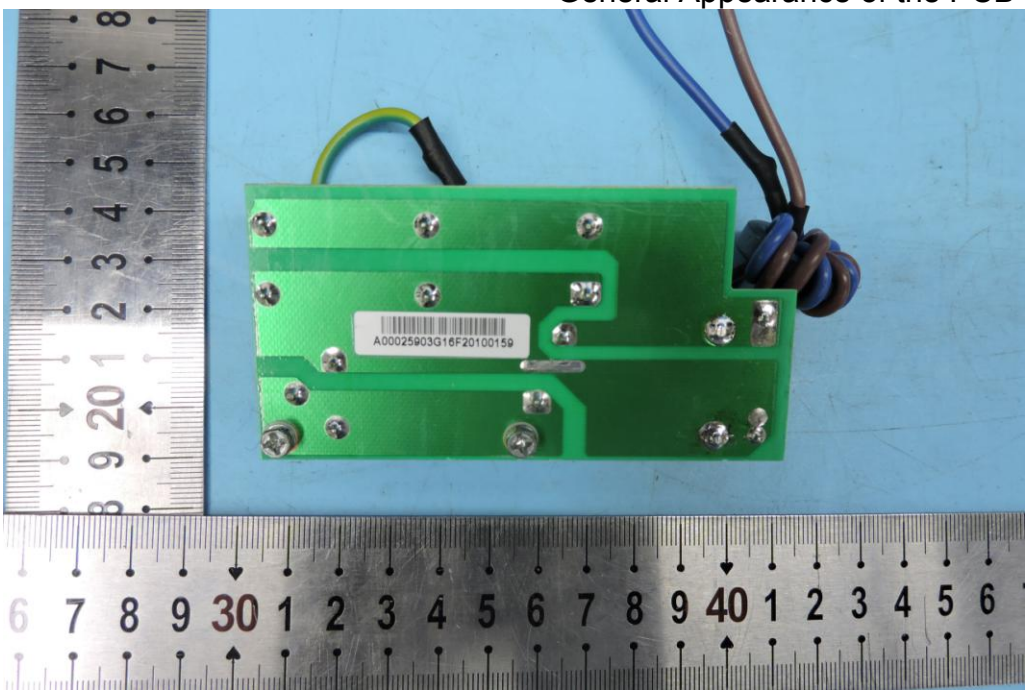


Figure 12
General Appearance of the PCB

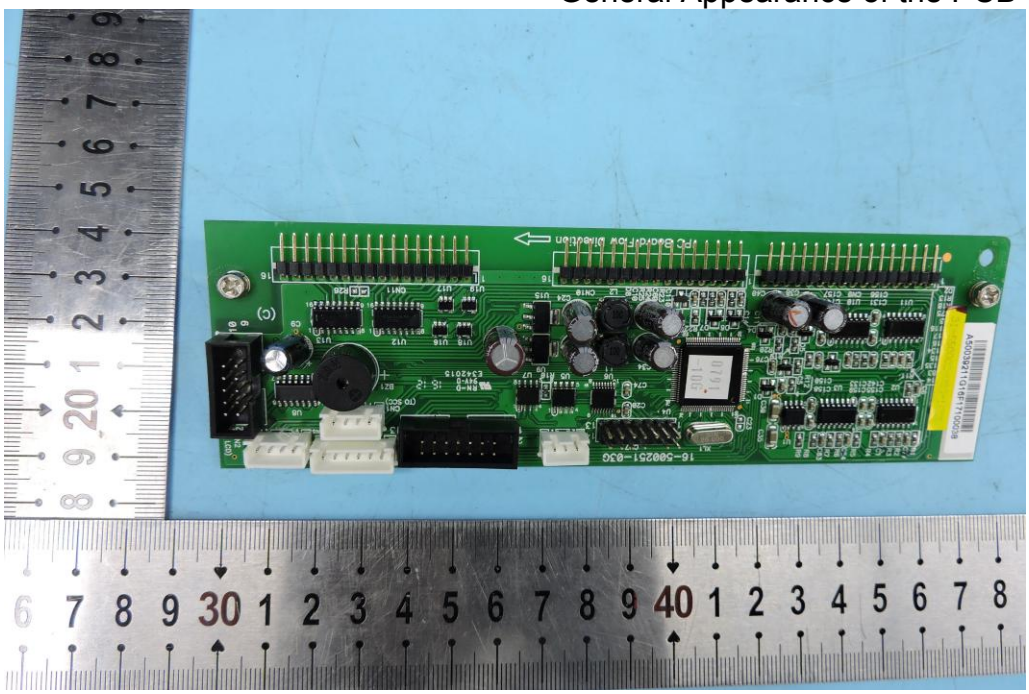


Figure 13
General Appearance of the PCB

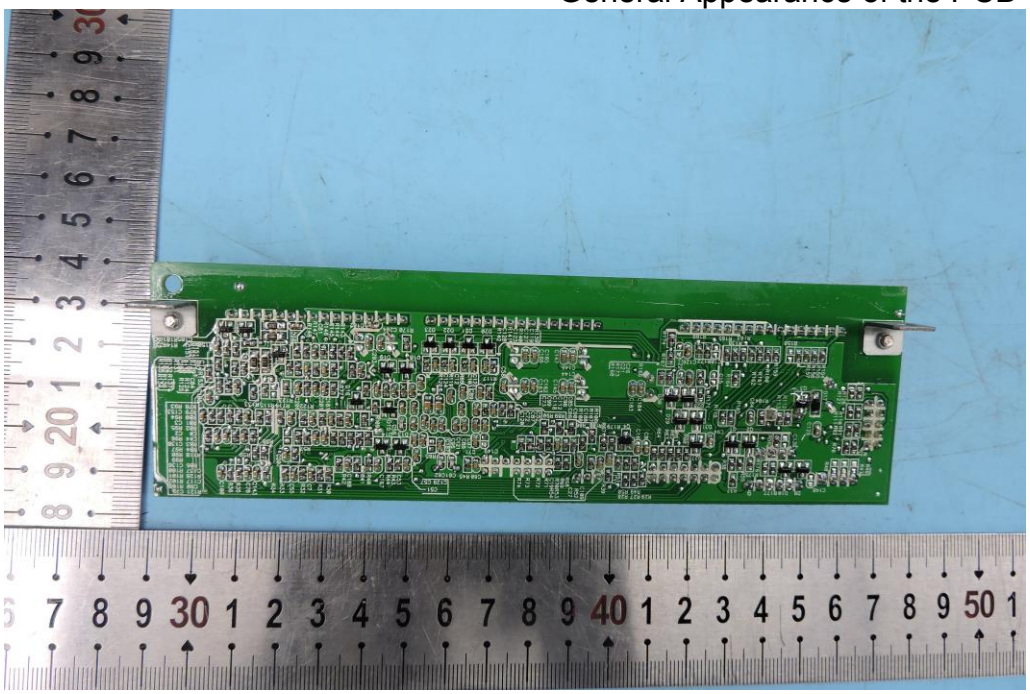


Figure 14
General Appearance of the PCB

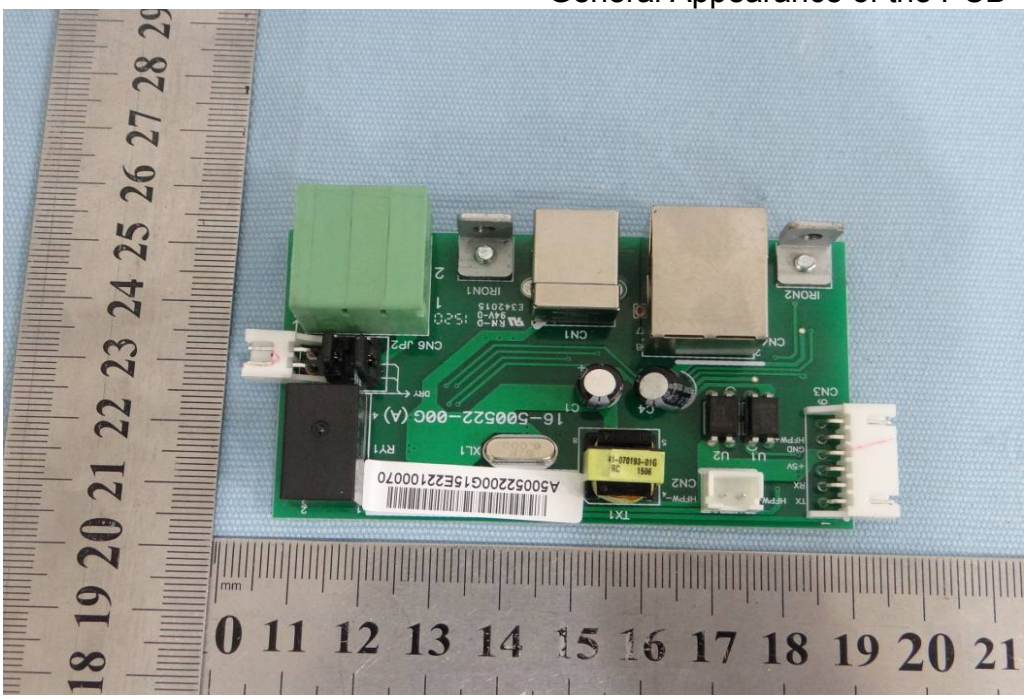


Figure 15
General Appearance of the PCB

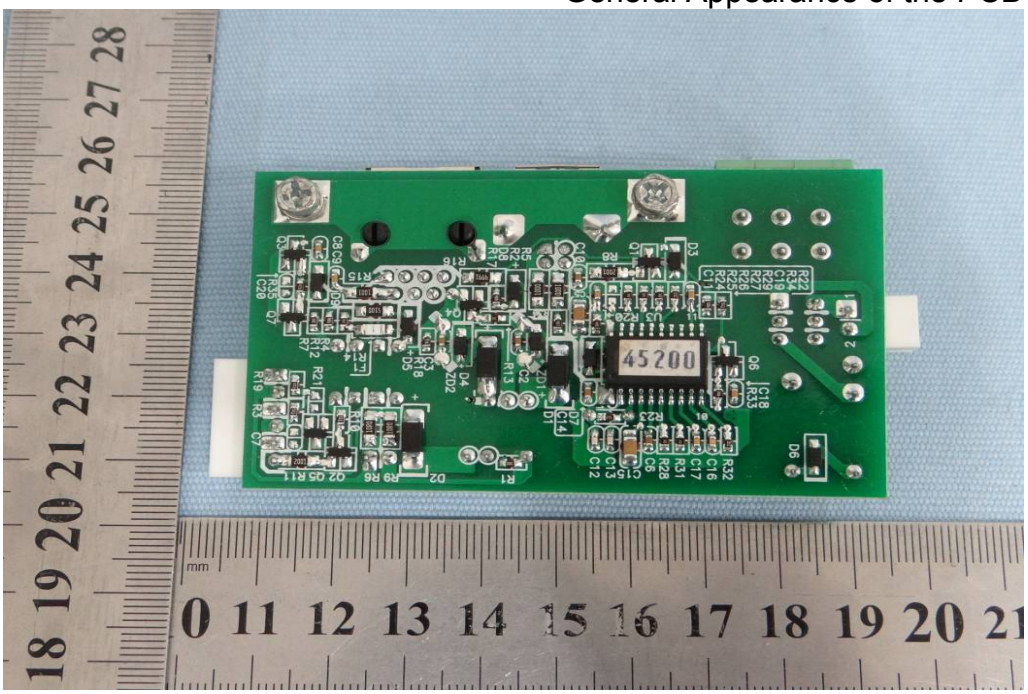


Figure 16
General Appearance of the PCB

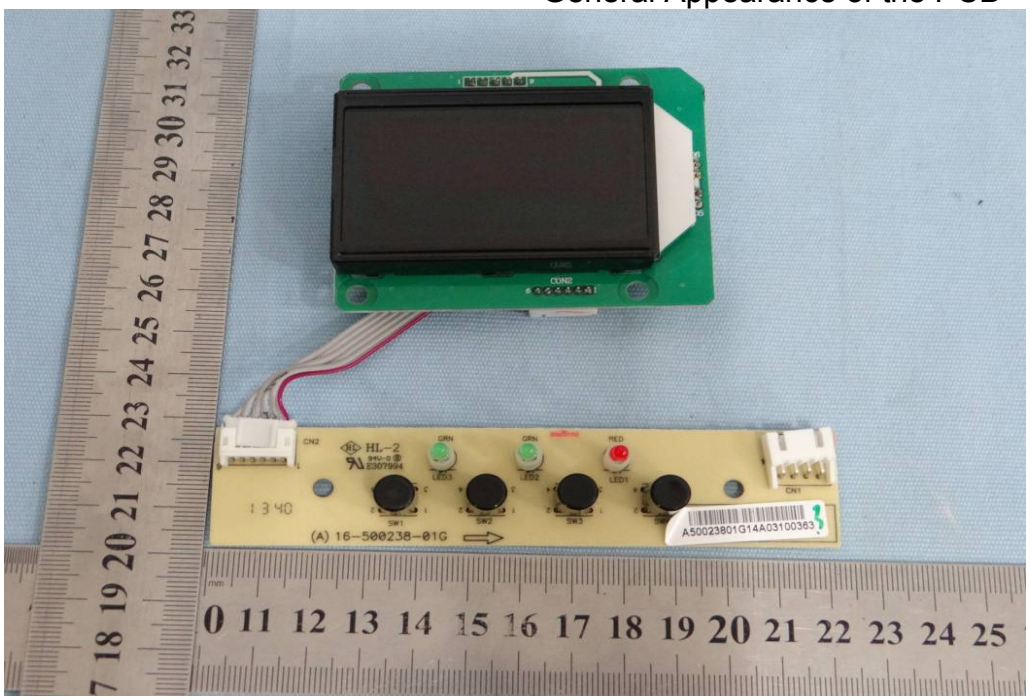


Figure 17
General Appearance of the PCB

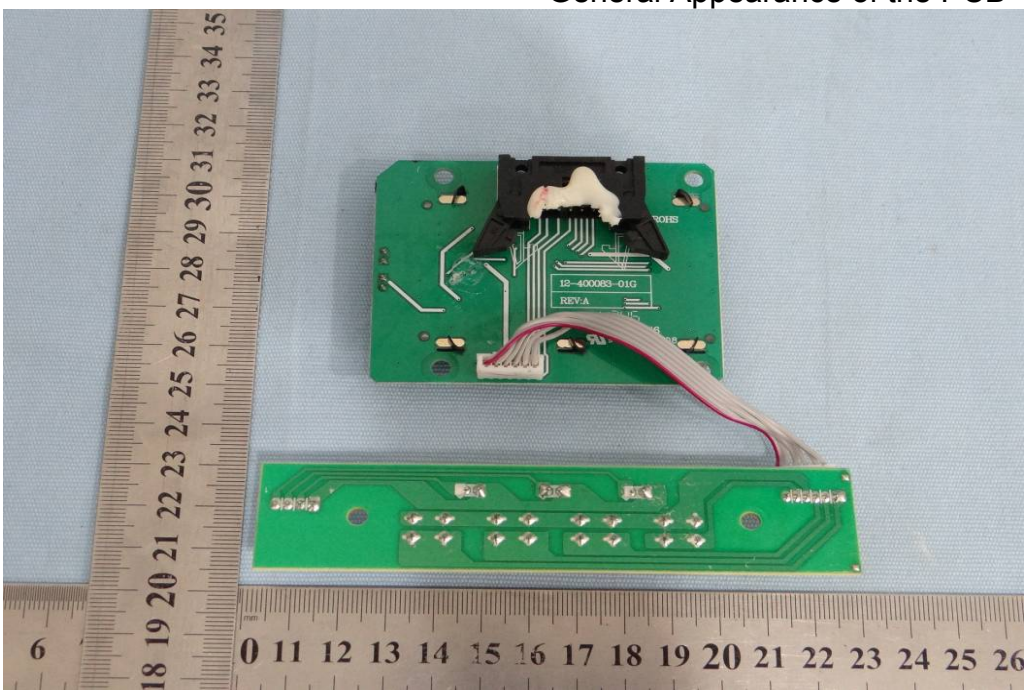


Figure 18
General Appearance of the PCB

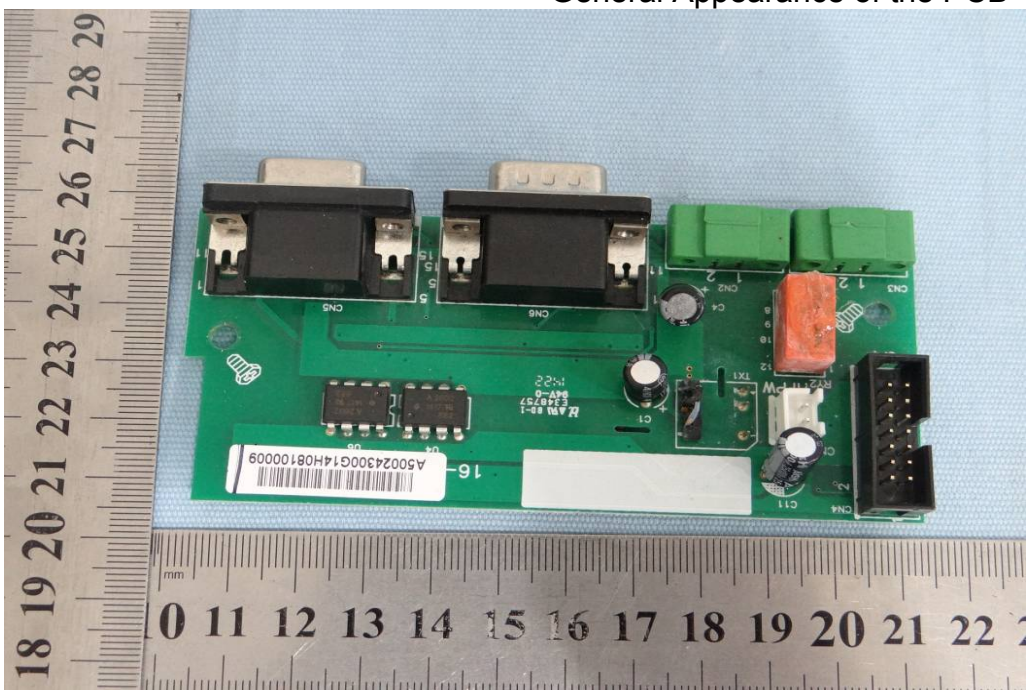


Figure 19
General Appearance of the PCB

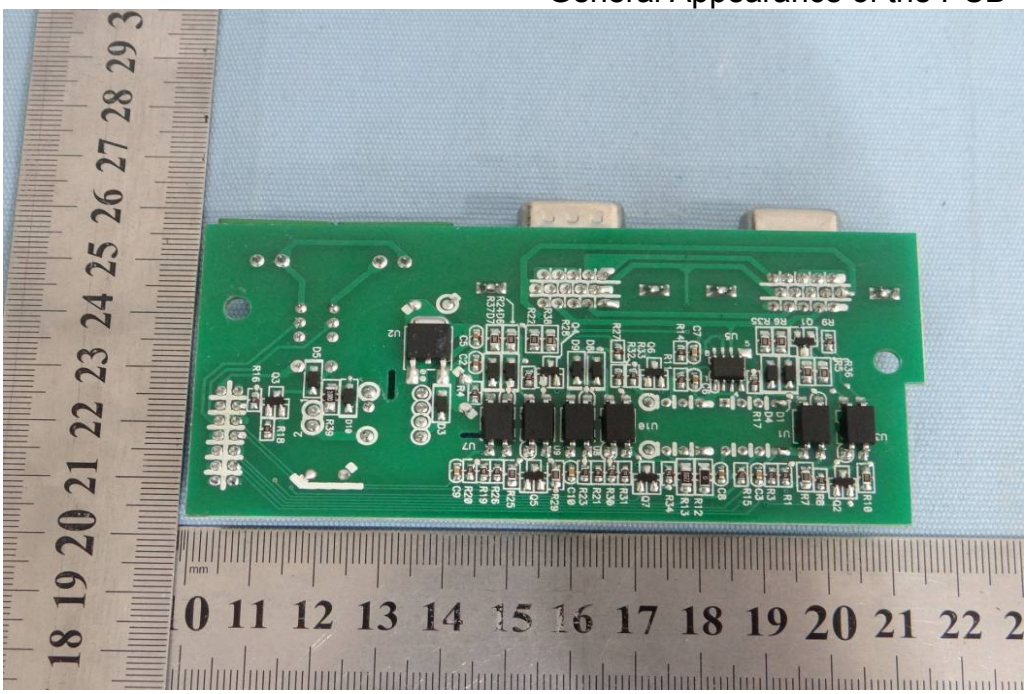


Figure 20
General Appearance of the PCB

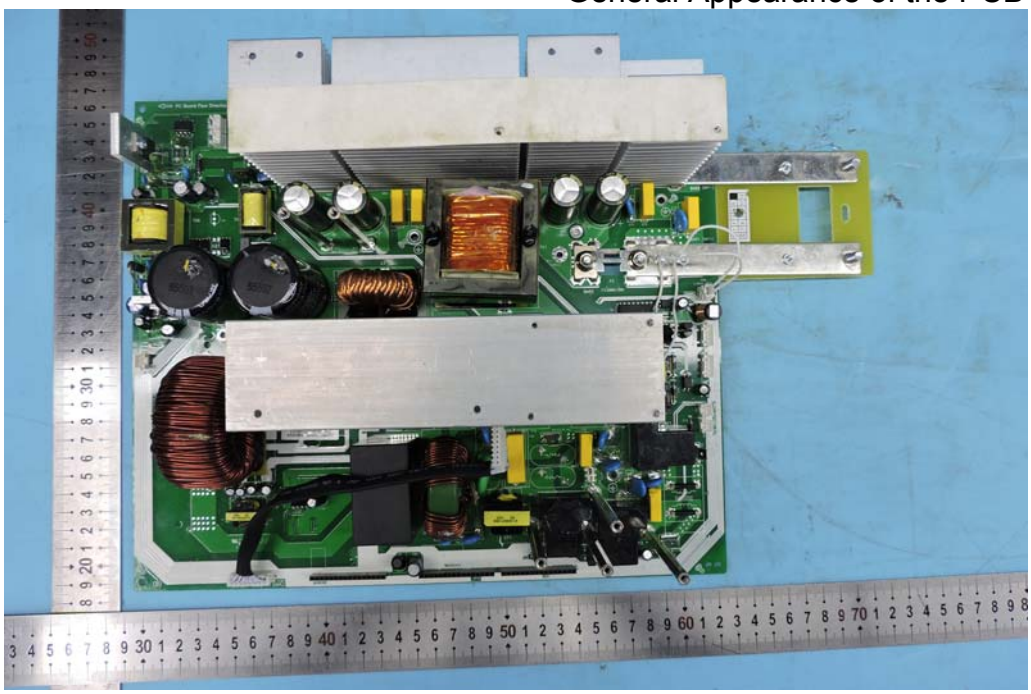
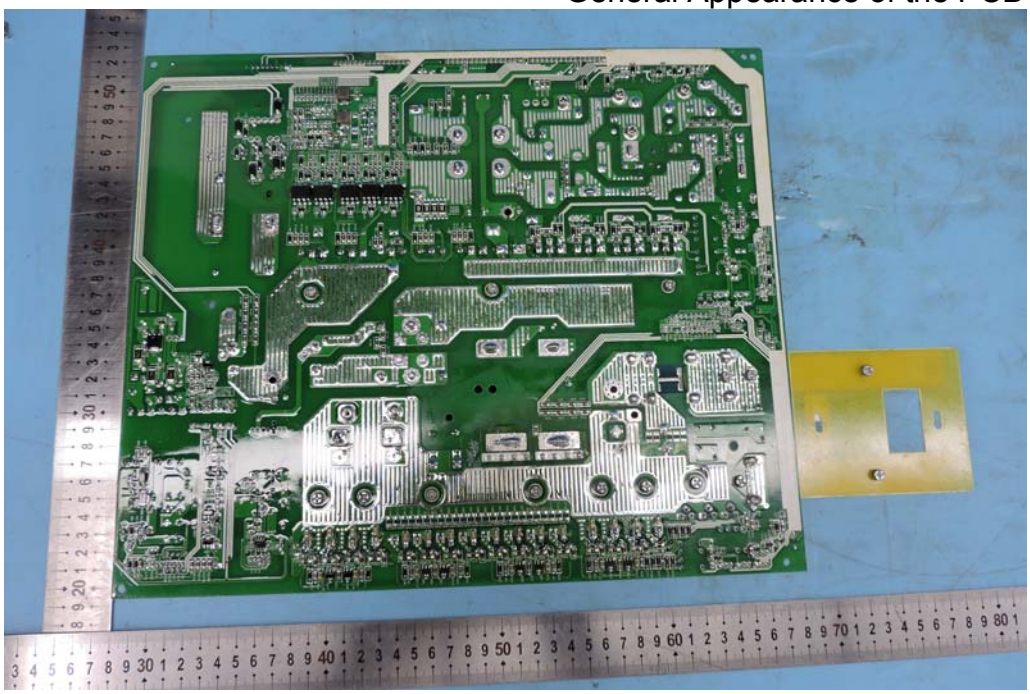


Figure 21
General Appearance of the PCB



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