

Test Report EMC

Test Location:
Independent Test Laboratories Ltd
 218A Annex Road, Middleton,
 Christchurch 8024, New Zealand

Test Laboratory:
PowerLab Limited
 5 Sheffield Crescent,
 Christchurch 8053, New Zealand



All tests reported herein have been performed in accordance with the Laboratory's terms of registration. Laboratory Registration Number: 42

Equipment under Test:

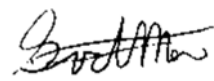

Applicant:	Enphase Energy NZ Limited
Manufacturer/Supplier:	Enphase Energy NZ Limited 1 Treffers Road, Wigram Christchurch 8042
File number:	ITL EMC 181038-1
EUT:	Micro Inverter
Brand/model:	IQ7PLUS-72-2-INT, IQ7-60-2-INT
EUT received:	20 April 2018

Applied standards:

Australian / New Zealand Standard (AS/NZS)	European Standard	IEC/CISPR-Standard
-	EN 50065-2-2::2003 + A1:2005	-
AS/NZS 61000.6.2: 2013	EN 61000-6-2: 2008	IEC 61000-6-2: 2008

Remarks to the Standards:	Tested to selected clauses of the applied standards for radiated radio frequency field immunity
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Result:	PASSED
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Date of issue:	31 May 2018	
Tested by:	Schalk van der Merwe EMC Test Engineer	
Checked by:	Vinesh Chand IANZ Signatory	

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This test report contains only the results of a single investigation carried out on the products submitted. It is not a generally valid judgement by Independent Test Laboratories Limited regarding the properties of similar products taken from current production.

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1 Description of the Sample (EUT)

Type of EUT:	Micro Inverter
Models:	IQ7PLUS-72-2-INT, IQ7-60-2-INT
Serial number:	121813027696

Technical data:

Rated voltage: IQ7 IQ7 plus	27 – 37 Vd.c. 27 – 45 Vd.c.	Protection class:	II
Rated current:	1.26A & 1.04A	Switching load resistive:	Load tower 300 watts
Rated power consumption:	290W & 240W	Switching load inductive:	-
Rated frequency:	50/60 Hz		
Number of phases:	one		

Voltage during the Test (If not otherwise specified):

Nominal voltage:	230 V~	Nominal frequency:	50 Hz
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Power Input and Load Terminals AC or DC

No.	Description	Specified length
1	Three phase cable for AC output and two core flexible cable for DC input	-

Additional Terminals for Signal- Control and Data-Terminals, Ancillary devices

No.	Description of the Terminal	Specified length	Shield type
1	None	-	-

Operating modes of the sample:

No.	Description
1	Loaded and with PLC operation every 300 mS for RE, 1 sec for Radiated immunity..

Operating modes used for Testing:

No.	Operating mode	Reason
1	On	Normal operation

General remarks:

The Enphase Micro Inverter model IQ7PLUS-72-2-INT and IQ7-60-2-INT was Class II double insulated micro inverter with the enclosure made from plastics. Connections were by were via MC4 connectors (or Amphenol H4 UTX with additional Q-DCC-5 adapter). The Enphase Micro Inverter was designed to be mounted under an outdoor solar panel.

The firmware image for the products was 520-00082-r01-v02.12.02.

Approximate overall dimensions of the micro inverter were (mm): 175H x 212W x 30D.

Disturbance sources

No.	Description	Manufacturer	Type designation	Remarks
1	PCB	Enphase	F-Wave	CA94V-0 E342828

EMC-measures for the suppression of emissions

No.	Location	Description	Specification	Manufacturer	Type designation
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Description of shield- and contacting measures for EMC

No.	Description of the measure
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Immunity Performance criteria

Performance criterion A: The equipment 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 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, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance criterion B: The equipment 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 equipment 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 equipment if used as intended.

Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

2 EUT Setup and Conditions

2.1 Measurement Equipment Used

Inventory number	Description	Manufacturer	Type	Cal. Due Date
ITL - EMC1006	Horn Antenna	ETS Lindgren	3115	12/10/2020
ITL - EMC1045	Signal Generator	IFR	2025	7/03/2019
ITL - EMC1047	Power Amplifier 80 – 1000 MHz	Ophir	5127	N/A
ITL - EMC1052	Power Amplifier 0.15 – 250 MHz	Com Power	ACS-250-100W	N/A
ITL - EMC1060	Isotropic Probe	ETS	HI-6053	22/06/2019
ITL - EMC1062	Antenna - BiLog	Schaffner	CBL6140A	N/A
ITL - EMC1078	Signal Generator	Rohde and Schwarz	SMIQ 06L	5/07/2018
ITL - SAF1009	Multimeter	GWinstek	GDM-457	11/06/2018
ITL - SAF1116	Function Generator	GWinstek	AFG-2105	3/05/2019
-----	Software	AR	Version 3.8.2	No calibration required

3 Measurement Uncertainty

Parameter	Range	Uncertainty (dB)
Conducted Emissions (mains port) Using LISN	(9 kHz – 150 kHz)	4.0
Conducted Emissions (mains port) Using LISN	(150 kHz – 30 MHz)	3.6
Disturbance power Using Absorption Clamp	(30 MHz – 300 MHz)	4.5
Radiated Emissions (electric field strength on OATS or Anechoic Room)	(30 MHz – 1000 MHz)	5.2
Radiated Emissions (electric field strength on OATS or Anechoic Room)	(1000 MHz – 18 GHz)	6.0
Voltage		
- Up to 1000 V	up to 1 kHz	±1,5 %
	1kHz up to 5 kHz	±2 %
	5 kHz up to 20 kHz	±3 %
	20 kHz and above	±5 %
- 1000 V and above	dc up to 20 kHz	±3 %
	20 kHz and above	±5 %
Current		
- Up to 5 A	up to 60 Hz	±1,5 %
	above 60 Hz up to 5 kHz	±2,5 %
	5 kHz up to 20 kHz	±3,5 %
	20 kHz and above	±5 %
- Above 5 A	up to 5 kHz	±2,5 %
	5 kHz up to 20 kHz	±3,5 %
	20 kHz and above	± 5%
Frequency	up to 10 kHz	±0,2 %
Power Factor (50/60 Hz)		±0,05
Time	10 ms up to 200 ms	±5 %
	200 ms up to 1 s	±10 ms
	1 s and above	±1 %
Temperature		
	- 35°C to below 100° C	±2° C
	100° C up to 500° C	±3 %
	below - 35°C ± 3°C	±3° C
Relative humidity	30% to 95% RH	±6% RH

4 Applied basic standards

AS/NZS Standard	European Standard	IEC/CISPR-Standard
AS/NZS 61000.4.3: 2013	EN 61000-4-3:2006 + A1:2008 + A2:2010	IEC 61000-4-3:2006 + A1:2007 + A2:2010

5 Summary of Test results

5.1 Summary of immunity Tests

Test	Test parameters and severity levels	page	Requirement of the standard (Criteria)	Result
1. Radiated RF IEC 61000-4-3	10 V/m (80 MHz to 1.0 GHz) 3 V/m (1.4 GHz to 2.0 GHz) 1 V/m (2.0 GHz to 2.7 GHz) 1 s dwell time 80% AM @ 1 kHz	8	A	PASSED
2. Radiated RF Pulse	10 V/m 900MHz 1 sec dwell time AM & pulse	8	A	PASSED

6 Test and measuring results

6.1 Immunity test results

6.1.1 Radiated RF Electromagnetic Field Immunity to IEC 61000-4-3

General information about the Test:

Tested by:	Schalk van der Merwe
Test date:	22 April 2018

Instruments:			
Inventory number	Description	Manufacturer	Type
EMC1068	Power Meter	Hewlett Packard	HP437B
EMC1047	Power Amplifier 80 – 1000 MHz	Ophir	5127
EMC1042	Power Amplifier 800MHz – 2500 MHz	Ophir	5101
EMC1062	Antenna – X-Wing BiLog	Schaffner	CBL6144
EMC1006	Antenna - Horn	ETS	3115
EMC1060	Isotropic Probe	ETS	HI-6053
EMC1078	Signal Generator 300kHz - 6.4 GHz	R&S	SMIQ 06L
SAF1116	Function Generator	GWinstek	AFG-2105

Environmental conditions:

Parameter	Rated value	Measured value
Ambient temperature:	15 °C - 35 °C	17 °C
Atmospheric pressure:	(860 - 1060) hPa	1011 hPa
Relative humidity:	30 % - 60 %	47 %

Information concerning the Test:

Test set-up:	Refer to photo in the appendix
Test site:	Fully Anechoic Room (3m)
Operating modes:	Normal operation – LED status monitored and Oscilloscope
Performance criteria:	A
Required Test level:	10 V/m (80 MHz to 1.0 GHz), 3 V/m (1.4 GHz to 2.0 GHz), 1 V/m (2.0 GHz to 2.7 GHz) 10 V/m 900MHz Pulse 1 s dwell time 80% AM @ 1 kHz

Result: PASSED

Generator:

Dwell time per frequency:	1 s
Frequency range:	80 MHz – 27000 MHz
Modulation:	80% AM with 1000 Hz sinusoidal signal
Step size in %(log.):	1%
Control software:	AR emcware ver 3.8.2

Generator:



Dwell time per frequency:	1 s
Frequency range:	900 MHz
Modulation:	AM & pulse (200Hz Square wave)
Step size in %(log.):	Set steps
Control software:	AR emcware ver 3.8.2



80 MHz to 1000 MHz					
Scan No.	EUT Azimuth	Polarisation	Field	Result	Comments
1	Front (0°)	Vertical	10 V/m	Pass	No change was observed
2	Front (0°)	Horizontal	10 V/m	Pass	No change was observed
3	RHS (90°)	Vertical	10 V/m	Pass	No change was observed
4	RHS (90°)	Horizontal	10 V/m	Pass	No change was observed
5	Back (180°)	Vertical	10 V/m	Pass	No change was observed
6	Back (180°)	Horizontal	10 V/m	Pass	No change was observed
7	LHS (270°)	Vertical	10 V/m	Pass	No change was observed
8	LHS (270°)	Horizontal	10 V/m	Pass	No change was observed
9	Top (0°)	Vertical	10 V/m	Pass	No change was observed
10	Bottom (180°)	Horizontal	10 V/m	Pass	No change was observed
1.4 GHz to 2 GHz					
Scan No.	EUT Azimuth	Polarisation	Field	Result	Comments
11	Front (0°)	Vertical	3 V/m	Pass	No change was observed
12	Front (0°)	Horizontal	3 V/m	Pass	No change was observed
13	RHS (90°)	Vertical	3 V/m	Pass	No change was observed
14	RHS (90°)	Horizontal	3 V/m	Pass	No change was observed
15	Back (180°)	Vertical	3 V/m	Pass	No change was observed
16	Back (180°)	Horizontal	3 V/m	Pass	No change was observed
17	LHS (270°)	Vertical	3 V/m	Pass	No change was observed
18	LHS (270°)	Horizontal	3 V/m	Pass	No change was observed
19	Top (0°)	Vertical	3 V/m	Pass	No change was observed
20	Bottom (180°)	Horizontal	3 V/m	Pass	No change was observed
2 GHz to 2.7 GHz					
Scan No.	EUT Azimuth	Polarisation	Field	Result	Comments
21	Front (0°)	Vertical	1 V/m	Pass	No change was observed
22	Front (0°)	Horizontal	1 V/m	Pass	No change was observed
23	RHS (90°)	Vertical	1 V/m	Pass	No change was observed
24	RHS (90°)	Horizontal	1 V/m	Pass	No change was observed
25	Back (180°)	Vertical	1 V/m	Pass	No change was observed
26	Back (180°)	Horizontal	1 V/m	Pass	No change was observed
27	LHS (270°)	Vertical	1 V/m	Pass	No change was observed
28	LHS (270°)	Horizontal	1 V/m	Pass	No change was observed
29	Top (0°)	Vertical	1 V/m	Pass	No change was observed
30	Bottom (180°)	Horizontal	1 V/m	Pass	No change was observed

900 MHz Pulse					
Scan No.	EUT Azimuth	Polarisation	Field	Result	Comments
31	Front (0°)	Vertical	10 V/m	Pass	No change was observed
32	Front (0°)	Horizontal	10 V/m	Pass	No change was observed
33	RHS (90°)	Vertical	10 V/m	Pass	No change was observed
34	RHS (90°)	Horizontal	10 V/m	Pass	No change was observed
35	Back (180°)	Vertical	10 V/m	Pass	No change was observed
36	Back (180°)	Horizontal	10 V/m	Pass	No change was observed
37	LHS (270°)	Vertical	10 V/m	Pass	No change was observed
38	LHS (270°)	Horizontal	10 V/m	Pass	No change was observed
39	Top (0°)	Vertical	10 V/m	Pass	No change was observed
40	Bottom (180°)	Horizontal	10 V/m	Pass	No change was observed

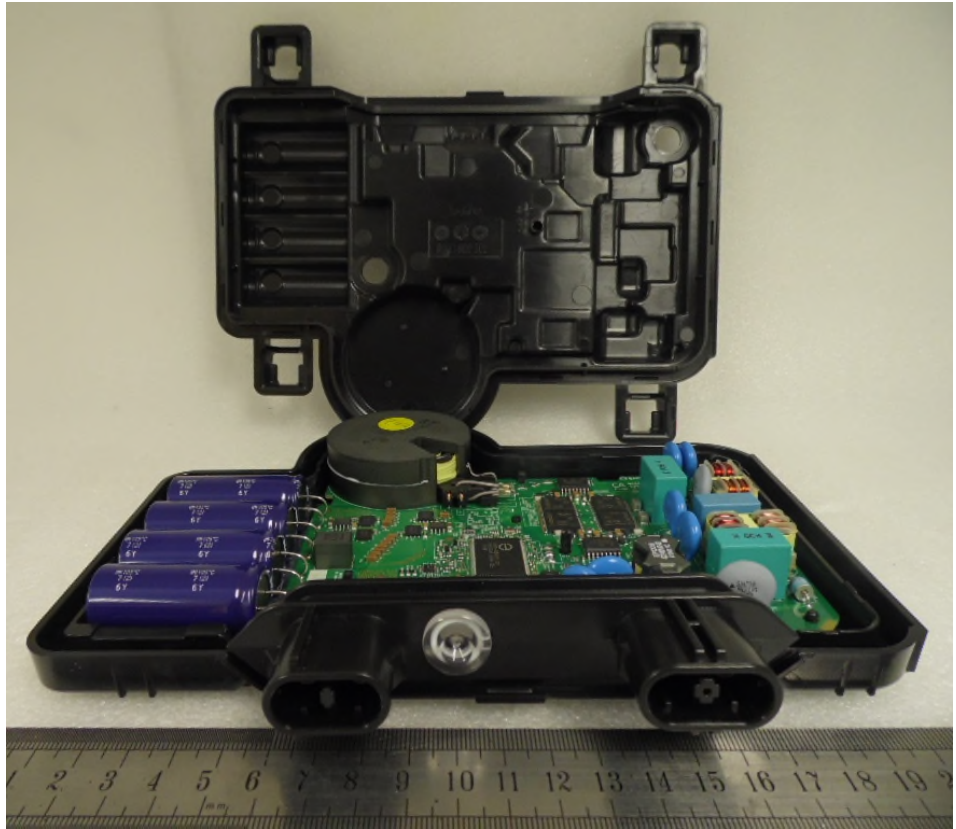
7 Appendix

7.1 Product photos

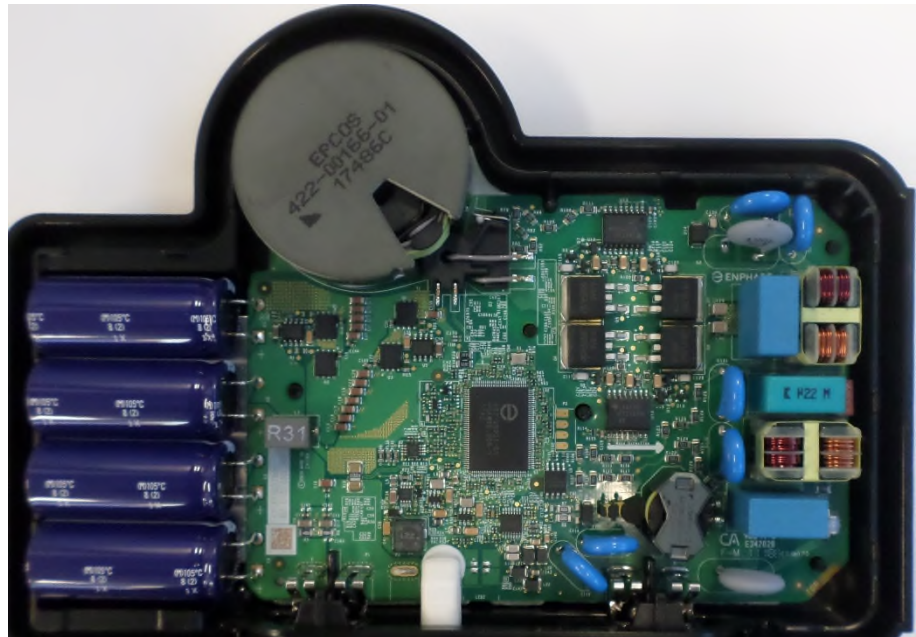
<p>Overall view</p>	 <p>A photograph showing the ENPHASE IQ7 device from an angled perspective. The device is black and rectangular with rounded corners. It has several connectors on the front and top. A metal ruler is placed below the device for scale, showing measurements in centimeters from 9 to 24.</p>
<p>Top view</p>	 <p>A photograph showing the back of the ENPHASE IQ7 device. The back panel is black and features several warning labels and technical specifications. The ENPHASE logo and model number 'IQ7' are prominently displayed. The labels include safety warnings and technical details.</p> <p>ENPHASE IQ7</p> <p>IQ7 is a Grid Support Inverter. Inverter For Enphase systems. For more information, visit the website: http://enphase.com, contact your installer.</p> <p>Power Output Range: 0-3.7 kW Max. Input Power: 3.7 kW Max. Input Voltage: 600V AC AC Input Current: 15A AC Input Voltage: 120V AC Input Frequency: 50/60 Hz AC Output Power: 3.7 kW Operating Temperature: -40°C to 140°C Storage Temperature: -40°C to 140°C Humidity: 0-95% Assembled in China</p> <p>WARNING: ELECTRIC SHOCK HAZARD. DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDING AND WILL BE ENERGIZED WITH SUNLIGHT. DISCONNECT BOTH AC AND DC BEFORE SERVICING.</p> <p>WARNING: HOT SURFACE. TO REDUCE THE RISK OF BURNS, DO NOT TOUCH.</p>

Side view	 A side view of a black, rectangular electronic device, possibly a power supply or converter, resting on a light-colored surface. The device has a central circular component and several smaller components on the sides. A ruler is placed below the device for scale, showing markings from 8 to 23 cm.
Connector view	 A close-up view of the connectors on the device. There are two large, black, rectangular connectors on the left and right, and a smaller, circular connector in the center. A ruler is placed below the connectors for scale, showing markings from 8 to 15 cm.

Internal view



Top PCB

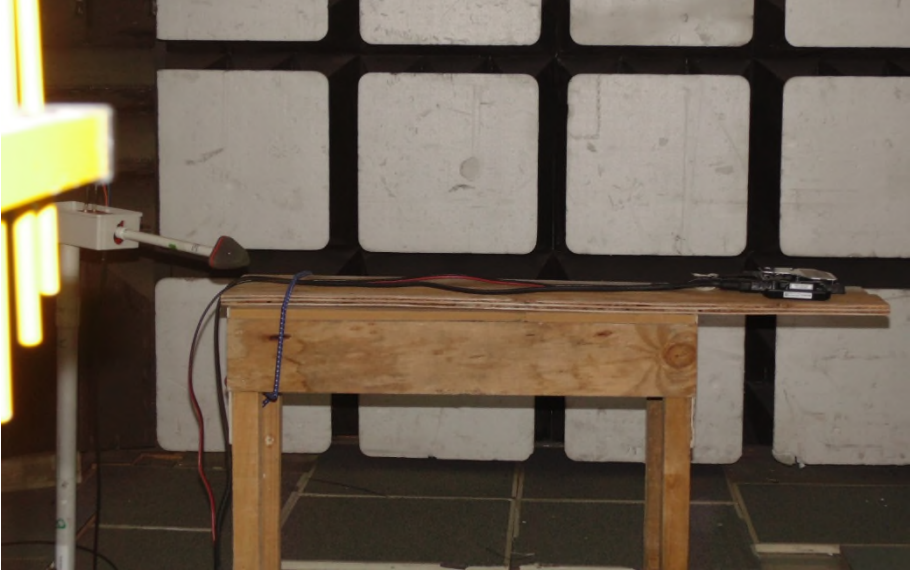
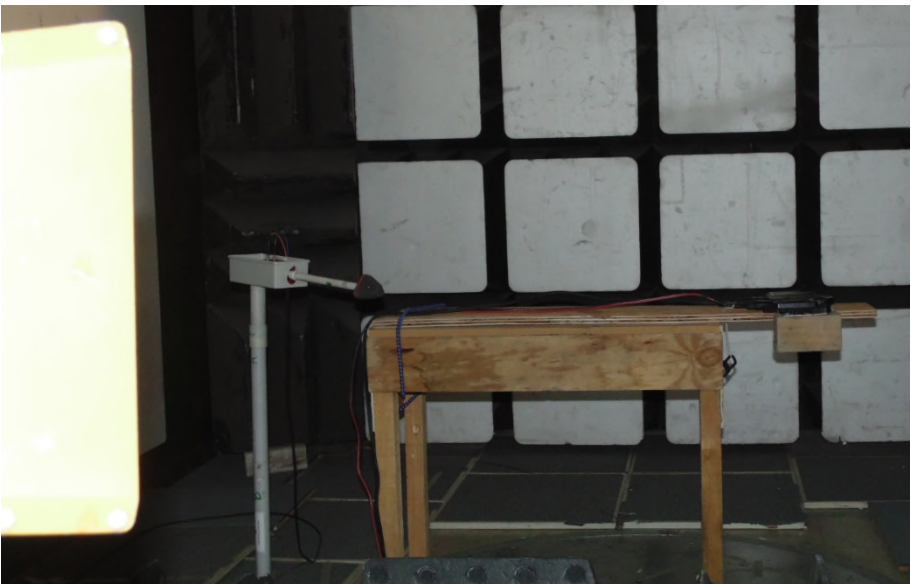


Support Equipment
used



7.2 Test setup photos

7.2.1 Immunity test setup

<p>Radiated Field Immunity 80MHz – 1GHz</p>	
<p>Radiated Field Immunity 1 GHz – 2.7GHz</p>	

END OF REPORT