केन्द्रीय विद्युत अनुसंधान संस्थान
(भारत सरकार की सोसाइटी, विद्युत मंत्रालय)
प्रो सर सी. वी. रामन रोड़, सदाशिवनगर डाक घर, पो. बा. सं. 8066, बेंगलूर - 560 080
CENTRAL POWER RESEARCH INSTITUTE
(A Govt of India Society under Min. of Power)
Prof. Sir C.V. Raman Road, Sadashivanagar P.O., P.B. No. 8066, Bangalore - 560 080, India
वेबसाइट/website : http://www.cpri.in

ENERGY EFFICIENCY AND RENEWABLE ENERGY DIVISION

Phone/Tele fax: 080-23604682 email: msb@cpri.in, ered@cpri.in

CPRI/ERED/SPV/2015 *04/03/2015*

To,

M/s. Solar Idea Pvt. Ltd.,
H. No. 8-2-277/A/7,
Plot No. 126, Road No. 2,
Banjara Hills, Hyderabad, Telangana 500034

Dear Sir,

Please find enclosed the test report for the following:

1. Efficiency and Environmental test report as per IEC 61683 for 1 kVA/1kW sine wave Solar PCU – 1 No.

Please acknowledge the receipt of the test report. Thank you for utilizing our services.

Corrections, if any, in the report may please be brought to our notice within 45 days from the date of issue of the report.

Kindly arrange to take back the equipment tested within 15 days, failing which the same will be disposed off as per CPRI rules.

Thanking you,

Yours Sincerely,

(M. Siddhartha Bhatt)
Additional Director

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TEST REPORT

CENTRAL POWER RESEARCH INSTITUTE
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P.B. No. 8066, Sadashivanagar Post Office
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Bangalore – 560080 (INDIA)

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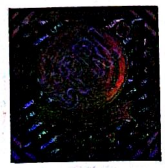
TEST REPORT

Test Report Number : CPRI/ERED/INV/3613/2015 Date : 04/03/2015

Name and address of the customer	: Solar Idea Private Limited H NO 8-2-277/A/7, Road No. 2, Banjarahills, Hyderabad-500 034
Name and address of the manufacturer	: Same as above
Particulars of the sample tested	: 1000 VA Inverter/UPS
Condition of the sample on receipt	: New
Type	: 103-SOLAR UPS
Designation	: 24 Volt DC input, 1kW Power Conditioning Unit
Serial Number	: 00306/15
Number of sample tested	: One set
Date(s) of test(s)	: 19/01/2015 to 02/03/2015
CPRI Sample Code No(s)	: 2015EREDINVS419-2
Particulars of the test conducted	: Environmental test as per manufacturer request IEC 60068-2-30: 2005, IEC 60068-2-14: 2009 IEC 60068-2-1: 2007, IEC 60068-2-: 2007
Test accordance with Standard/specification	: IEC 60068-2-30: 2005, IEC 60068-2-14: 2009 IEC 60068-2-1: 2007, IEC 60068-2-: 2007
Sampling Plan	: Submitted by the Manufacturer
Customer's Requirement	: Environmental test as per manufacturer request IEC 60068-2-30: 2005, IEC 60068-2-14: 2009 IEC 60068-2-1: 2007, IEC 60068-2-: 2007
Deviation if any	: Nil
Name of the witnessing persons	: Nil
Customer Representative	: Nil
Other than Customer Representative	: Nil
Test(s) subcontracted with	: Nil
Address of the laboratory	: Nil
Documents constituting this report (in words)	
Number of sheets	: Nine
Number of oscillogram/s	: Nil
Number of Photos	: Two
Number of test circuit diagrams	: Nil
Number of drawings	: Nil

04/03/15

R. Sudhir Kumar
Test in-charge



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Additional Director

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1.0 DESCRIPTION OF POWER CONDITIOING UNIT

Sl. No.	Particulars	Details
1.1	Power rating	1 kW
1.2	Input voltage DC	24 V DC
1.3	Output AC	220±5 V, 50 Hz
1.4	Power factor	0.8 lag to Unity (1)
1.5	Model	103- Solar UPS/INV
2.0 Particulars of test conducted		
2.1	Climatic Test	
2.1.1	Damp Heat Cyclic Test IEC 60068-2-30: 2005	Damp Heat Cyclic Test (12 h+12 h cycle) IEC 60068-2-30: 2005 Test Db: 25 ^{0}C to 55 ^{0}C ± 2 ^{0}C variant-1 (12 h + 12 h cycle) – 24 hours per cycle. No. of cycles: Two
2.1.2	Change of temperature test IEC 60068-2-14: 2009.	Change of temperature test – IEC 60068-2-14: 2009. Test Nb Cl. 8. 0 Each temperature Cycle : -5 ^{0}C ± 2 ^{0}C for one hour and +55 ^{0}C ± 2 ^{0}C for one hour with rate of change at 1 ^{0}C/min No. of cycles: five
2.1.3	Cold test IEC 60068-2-1: 2007	Cold test as per IEC 60068-2-1: 2007 Test Ab Cl. 5.2 & Cl. 6.0: -10 ^{0}C ± 2 ^{0}C for two hours
2.1.4	Dry Heat Test IEC 60068-2-: 2007	Dry Heat Test as per IEC 60068-2-: 2007 Test Bb Cl. 5.2 & Cl. 6.0 + 55 ^{0}C ± 2C for 16 hours No. of cycles – One
2.1.5	Functional Test	Functional test as per customer request to be conducted after each climatic test
2.1.6	Visual Examination	Visual examination to be conducted after each climatic test.
2.1.7	Insulation Resistance Test	Insulation resistance test to be done after completion of all tests

Test in- Charge

Test Engineer

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Test Report Number : CPRI/ERED/INV/3613/2015 Date : 04/03/2015

TEST RESULTS

The test sample was mounted within the working space in environmental test chamber at ambient temperature. A view of the test sample is as shown in Photographs

1. DAMP HEAT CYCLIC TEST

(As per IEC60068 2-30 Ed. 2005 Variant 1 and customer's request)

a. Initial stabilization of test sample is carried out at 25 ^{0}C ± 3 ^{0}C and RH 75 %

b. After stabilization, RH is increased to 95 % maintaining the temperature at 25 ^{0}C ± 3 ^{0}C in one hour.

c. Conditioning

Step No.	Environmental Test profiles steps	Duration
1.	Changing condition from 25 ^{0}C to 55 ^{0}C with RH above 95 % (Ramp time 10 ^{0}C/hr.)	3 hours
2.	Maintaining the condition of 55 ^{0}C ± 2 ^{0}C at RH between 90 % and 96 %	9 hours
3.	Changing condition from 55 ^{0}C to 25 ^{0}C with RH above 95 % (Ramp time 10 ^{0}C/hr.)	3 hours
4.	Maintaining the condition of 25 ^{0}C at RH above 95 %	9 hours

The above 4 steps constitutes one cycle.

No. of cycles performed: 2

d. On completion of damp heat cycles, RH is reduced from 95 % to 75 % in less than 1 hour with chamber temperature 25 ^{0}C ± 3 ^{0}C

e. Recovery period

Sample is kept inside the chamber for recovery for 2 hours at 25 ^{0}C and 75 ± 2 % RH

f. Functional Test

Applied Voltage across the positive and negative terminals at input side	24 V (DC)
The inverter switch at the front panel shall be kept in 'ON' position and check output	ON
AC voltage across AC output terminals	219.3 V (AC)
Status of lamp connected across AC output terminals	Lamp On

g. Visual Examination

On visual inspection with naked eye, no visible physical damages / deterioration are observed.

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TEST RESULTS

2. CHANGE OF TEMPERATURE TEST

(As per IEC60068- 2- 14 Ed. 2009 Test Nb Cl. 8. 0 and customer's request)

The test sample was mounted within the working space in environmental test chamber at ambient temperature.

a. Conditioning

Step No.	Environmental Test profiles steps	Duration
1.	Changing temperature from 25 ^{0}C (ambient) to -5 ^{0}C at rate of 1 ^{0}C / min	30 min.
2.	Maintaining the temperature of -5 ^{0}C	1 hour
3.	Changing temperature from -5 ^{0}C to 55 ^{0}C at rate of 1^{0}C/ min	1 hour
4.	Maintaining the temperature of +55 ^{0}C	1 hour
5.	Changing temperature from 55 ^{0}C to 25 ^{0}C (ambient) at rate of 1^{0}C/ min	30 min.

The above 5 steps constitutes one cycle.
No. of cycles performed: 5

b. Recovery period

On completion of the test cycles, the test condition is maintained at standard atmospheric conditions of 25 ± 2 ^{0}C & <50 % RH 2 hours recovery period

c. Functional Test

Applied Voltage across the positive and negative terminals at input side	24 V (DC)
The inverter switch at the front panel shall be kept in 'ON' position and check output	ON
AC voltage across AC output terminals	216.2 V (AC)
Status of lamp connected across AC output terminals	Lamp On

d. Visual Examination

On visual inspection with naked eye, no visible physical damages / deterioration are observed.

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TEST RESULTS

3. COLD TEST

(As per IEC60068- 2- 1 Ed. 2007 Test Ab Cl. 5. 2 & Cl. 6 and customer's request).

The test sample was mounted within the working space in environmental test chamber at ambient temperature.

a. Conditioning

Step No.	Environmental Test profiles steps	Duration
1.	Changing temperature from 25 ^{0}C (Ambient) to -10 ^{0}C at rate of 1 ^{0}C / min	35 min.
2.	Maintaining the temperature of -10 ^{0}C for temperature stability of sample	3 hours
3.	Maintaining the temperature of -10 ± 2 ^{0}C	2 hours

b. Recovery period

On completion of the test condition, the temperature was gradually raised to standard atmospheric conditions of 25 ± 2 ^{0}C & <50 % RH 2 hours recovery period

c. Functional Test

Applied Voltage across the positive and negative terminals at input side	24 V (DC)
The inverter switch at the front panel shall be kept in 'ON' position and check output	ON
AC voltage across AC output terminals	218.5 V (AC)
Status of lamp connected across AC output terminals	Lamp ON

d. Visual Examination

On visual inspection with naked eye, no visible physical damages / deterioration are observed.

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TEST RESULTS

4. DRY HEAT TEST

(As per IEC60068-2-2 Ed. 2007 Test Bb Cl. 5. 2 & Cl. 6. 0 and customer's request)

The test sample was mounted within the working space in environmental test chamber at ambient temperature.

a. Conditioning

Step No.	Environmental Test profiles steps	Duration
1.	Changing temperature from 25 ^{0}C (Ambient) to 55 ± 2 ^{0}C at rate of 1 ^{0}C/ min with RH below 50 %	30 min.
2.	Maintaining the temperature of 55 ± 2 ^{0}C for temperature stability of sample	3 hours
3.	Maintaining the temperature of 55 ± 2 ^{0}C	16 hours

b. Recovery period

On completion of the test condition, the temperature was gradually lowered to standard atmospheric conditions of 25 ± 2 ^{0}C & < 50 % RH 2 hours recovery period

c. Functional Test

Applied Voltage across the positive and negative terminals at input side	24 V (DC)
The inverter switch at the front panel shall be kept in 'ON' position and check output	ON
AC voltage across AC output terminals	217.8 V (AC)
Status of lamp connected across AC output terminals	Lamp ON

d. Visual Examination

On visual inspection with naked eye, no visible physical damages / deterioration are observed.

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5. INSULATION RESISTANCE TEST

Insulation Resistance test was conducted within 30 minutes of recovery period after the completion of dry heat test with megger at a voltage of 500 V (DC).

Sl. No.	Test Connection	Measure Values (MΩ)	Specified Values (As per Customers Requirements) (MΩ)
1	Between shorted Battery Terminals (+ve and –ve) and grounded enclosure	75.6	>50
2	Between shorted AC terminals and grounded enclosure	80.1	>50
3	Between battery terminals and AC terminals shorted and grounded enclosure.	94.3	>50

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Test Chamber Details:

1. Work Space: 1m (H) x 1m (W) x 1m (D)
2. Temperature range : - 40 ^{o}C to 180 ^{o}C
3. Accuracy (Temp) : ± 1.0 ^{o}C
4. Humidity Range: 10 % RH to 98 % RH
5. Accuracy: ±3 % RH
6. Serial No. KLS/0316/12-13
7. Model No. KEW/EC-40

Photographs of tested sample:

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TEST REPORT

Test Report Number : CPRI/ERED/INV/3612/2015 **Date : 04/03/2015**

Name and address of the customer	: Solar Idea Private Limited H NO 8-2-277/A/7, Road No. 2 Banjarahills, Hyderabad-500 034
Name and address of the manufacturer	: Same as above
Particulars of the sample tested	: 1000 VA Inverter
Condition of the sample on receipt	: New
Type	: 103-SOLAR UPS
Designation	: 24 Volt DC input, 1kW Power Conditioning Unit
Serial Number	: 00306/15
Number of sample tested	: One set
Date(s) of test(s)	: 19/01/2015 to 02/03/2015
CPRI Sample Code No(s)	: 2015EREDINVS419-1
Particulars of the test conducted	: Efficiency test as per IEC 61683
Test accordance with Standard/specification	: Efficiency test as per IEC 61683
Sampling Plan	: Submitted by the Manufacturer
Customer's Requirement	: Efficiency test as per IEC 61683
Deviation if any	: Nil
Name of the witnessing persons	: Nil
Customer Representative	: Nil
Other than Customer Representative	: Nil
Test(s) subcontracted with	: Nil
Address of the laboratory	: Nil
Documents constituting this report (in words)	
Number of sheets	: Seven
Number of oscillogram/s	: Nil
Number of Photos	: Nil
Number of test circuit diagrams	: Nil
Number of drawings	: Nil

04/03/15

R. Sudhir Kumar
Test in-charge

(M. Siddhartha Bhatt)
Additional Director

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Test Report Number : CPRI/ERED/INV/3612/2015 **Date** : 04/03/2015

DESCRIPTION OF POWER CONDITIOING UNIT

Sl. No.	Particulars	Details
01	Power rating	1 kW
02	Input voltage DC	24 V DC
03	Output AC	220±5 V, 50 Hz
04	Power factor	0.8 lag to Unity
05	Model	103- Solar UPS

TEST CONDITIONS & EQUIPMENTS

Sl. No.	Particulars	Details
01	Temperature during test	25 °C
02	Load	Electronic load (variable)
03	Power source	DC power source
04	Measuring Instruments	Power analyzers Make: HIOKI Sl. Nos. 130309616

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TEST RESULTS

1) No load Test: No load test is carried out as per IEC 61683 standard

a) DC voltage : 24.05 V
b) DC Current: 0.71 A
c) Power: 17.07 W
d) Energy recorded for 1 minutes: 0.28 Wh
e) Observation: Nil

2) Efficiency test: As per IEC 61683 standard

a) Power efficiency

Measured voltage, voltage THD, current & current THD at AC side and voltage & current at DC side in stand-alone mode.

Sl. No.	Testing, % load	AC side				DC side	
		Voltage, V	Voltage THD, %	Current, A	Current THD, %	Voltage, V	Current, A
1	120%	219.51	6.17	5.50	5.10	24.06	60.13
2	100%	214.70	4.97	4.70	3.00	24.02	49.31
3	75%	215.24	4.88	3.48	2.65	24.09	35.37
4	50%	215.45	4.91	2.35	2.92	24.01	23.38
5	25%	217.69	3.72	1.15	5.43	24.09	11.55
6	10%	219.90	3.13	0.46	10.66	24.02	4.99

Measured power at AC & DC side and efficiency at peak power.

Sl. No.	Testing, % load	AC Power, W	DC Power, W	Efficiency, %
1	120%	1207.07	1446.67	83.44
2	100%	1008.67	1184.46	85.16
3	75%	748.40	852.03	87.84
4	50%	504.95	561.33	89.96
5	25%	249.68	278.16	89.76
6	10%	99.58	119.81	83.11

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TEST RESULTS

b) Energy efficiency: Energy is logged for a period of one minute.

Sl. No.	Testing, % load	AC Energy, Wh	DC Energy, Wh	Energy Efficiency, %
1	120%	20.14	24.14	83.43
2	100%	16.82	19.76	85.12
3	75%	12.48	14.21	87.83
4	50%	8.42	9.36	89.96
5	25%	4.15	4.63	89.63
6	10%	1.67	1.99	83.92

c) Weighted energy efficiency:

Weighted energy efficiency is calculated by considering energy consumption at 100 % (Full load), 75 % (3/4th load), 50 % (1/2th load) and 25 % (1/4th load) for a duration of one minute. The no load loss is also considered for a period of one minute.

$$\eta_{WT} = \frac{\sum P_{Oi}.T_i}{\sum P_{Ii}.T_i} = \frac{\sum P_{O1}.T_1 + P_{O2}.T_2 + P_{O3}.T_3 + P_{O4}.T_4}{P_{I0}.T_0 + P_{I1}.T_1 + P_{I2}.T_2 + P_{I3}.T_3 + P_{I4}.T_4} = \frac{\sum E_{O1} + E_{O2} + E_{O3} + E_4}{E_{I0} + E_{I1} + E_{I2} + E_{I3} + E_{I4}}$$

Where E_{O1}, E_{O2}, E_{O3} & E_{O4} AC energy output for one minute for full load, 3/4th load, 1/2th load and 1/4th load respectively in Wh, E_{I0} is the no load DC energy for a period of one minute and E_{I1}, E_{I2}, E_{I3} & E_{I4} DC energy output for one minute for full load, 3/4th load, 1/2th load and 1/4th load respectively in Wh.

$$\eta_{WT} = \frac{41.87*100}{0.28+47.96} = \frac{41.87*100}{48.24} = 86.79\ \%$$

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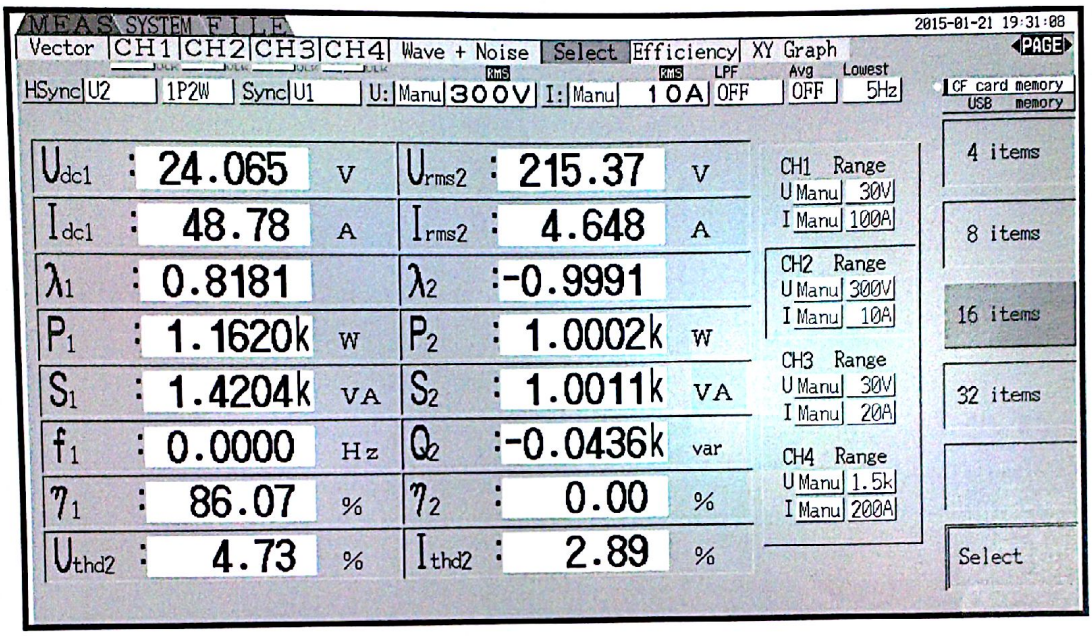
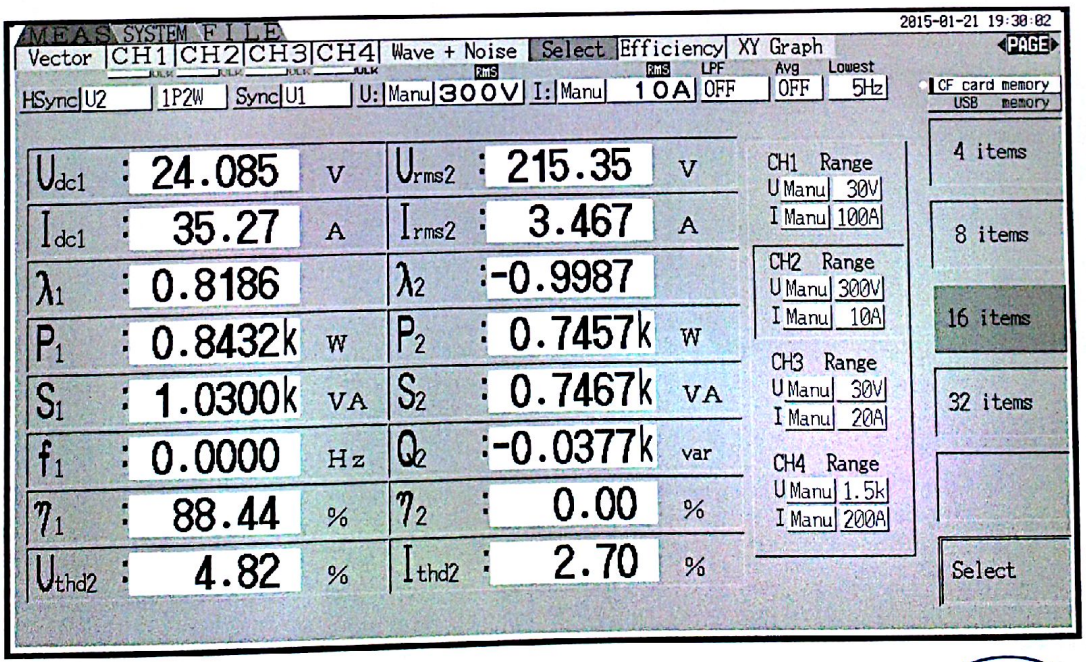
TEST RESULTS

3) Instantaneous readings

a) At full load



b) 75 % load test



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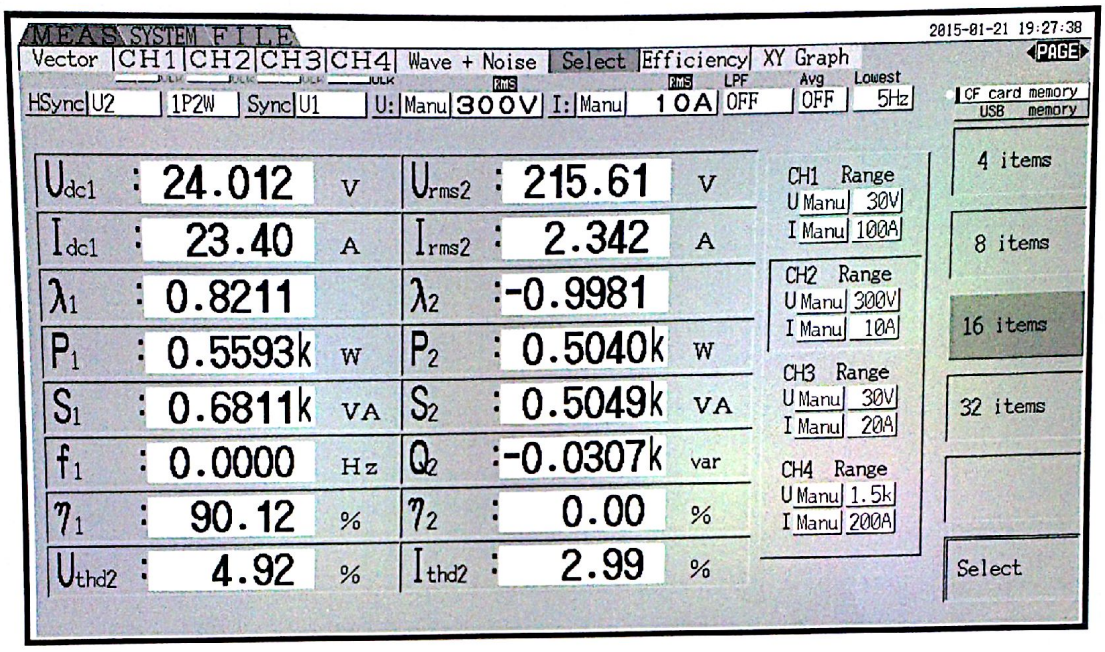
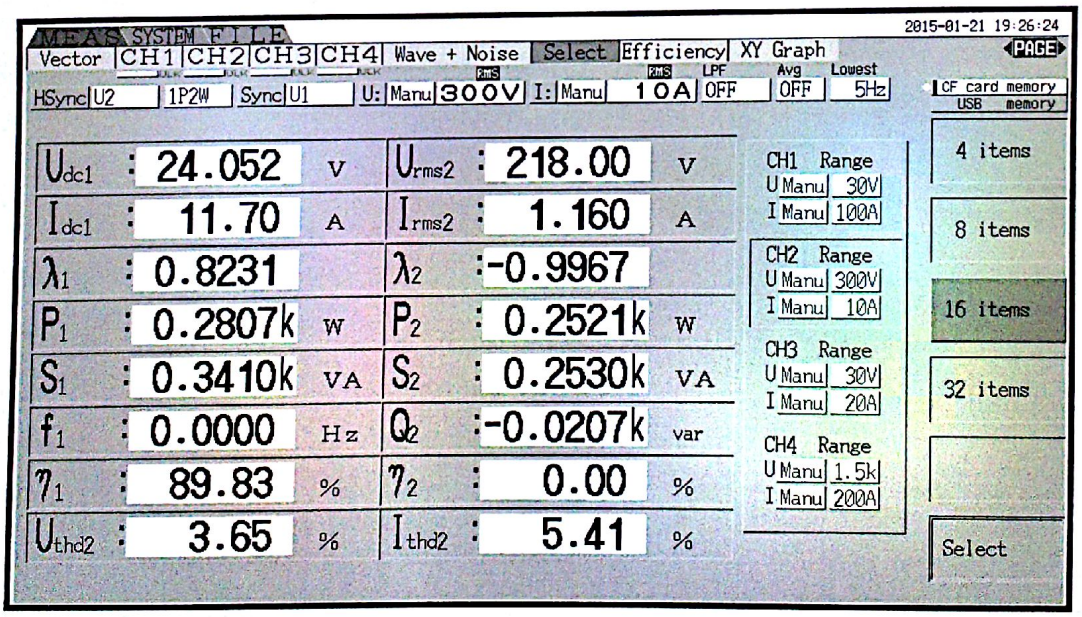
TEST RESULTS

c) At 50 % load test



d) At 25 % load test



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