LIST OF USED ACRONYMS

Acronym	Description
ACS	Accessibility
BEND	Conduit Bending
BOX	Terminal Box Knock Out
BREAK	Module Breakage
BYT	Bypass Diode
CPV	Performance of CPV modules
CUT	Cut Susceptibility
DAH	Damp Heat
DSC	Partial Discharge
EL	Electroluminescence
ER	Energy rating
FIRE	Fire
GCO	Performance at different G
GRD	Ground Continuity
HAR	Hail test
HSP_215	Hot-Spot Endurance test for c-Si modules
HSP_646	Hot-Spot Endurance test for thin-film modules
HUF	Humidity Freeze Test
IMP	Impulse Voltage
IN	Insulation test (IEC 61215: dielectric withstand test)
IR	Infrared
LS	Light Soaking
MATR	IV curve at different G and T
MEL	Mechanical Load
NOCT	Nominal Operating Cell Temperature
OE	Outdoor Exposure
PID	Potential Induce Degradation
PL	Performance at Low Irradiance
PM	Performance at STC
PM400	Performance at 400 W/m^2
PM_NOCT	Performance at NOCT
PM_OUT	Performance Outdoor with MPPT3K
PRE	Preconditioning
REV	Reverse Current Overload
ROB	Robustness of Termination
SR	Spectral Response
TC	Thermal Cycling
TCO	Measurement of Temperature Coefficients
TEMP	Temperature
UV	UV Preconditioning
VI	Visual Inspection

WL	Wet Leakage Current

ISO 17025 ACCREDITED TEST PROCEDURES

Accreditation number **STS 531**
Accreditation standard ISO/IEC 17025:2005

Group of product or material, field of activity	**Principle of measurement (²) (characteristics, measuring ranges, type of test)**	**Test method, remarks (national, international standards, validated in-house test methods)**
PV module test: Electrical performance (*)	Performance at standard test conditions (STC)	IEC 60904-1 IEC 61215, 10.2 IEC 61646, 10.2 IEC 61853-1, 7.2 EN 50380, 3.3.1
	Performance at nominal operating cell temperature (NOCT)	IEC 61215, 10.6 IEC 61646, 10.6 IEC 61853-1, 7.3 EN 50380, 3.3.2
	Performance at low irradiance (LIC)	IEC 61215, 10.7 IEC 61646, 10.7 IEC 61853-1, 7.4 EN 50380, 3.3.3
	Performance at high temperature conditions (HTC)	IEC 61853-1, 7.5
	Performance at low temperature conditions (LTC)	IEC 61853-1, 7.6
	Measurement of temperature coefficients	IEC 61215, 10.4 IEC 61646, 10.4 IEC 61853-1, Cpt. 8 EN 50380, 3.5.2

(*) The accreditation refers to cristalline silicon and thin-film single junction test devices

1) Type A: It is not allowed to change the scope

2) Type B: Optimizing defined test methods (adapt to client's needs, adapted standard) is allowed

3) Type C: Introduction of additional test methods for the different types of test is allowed

ISO 17025 ACCREDITED TEST PROCEDURES

Group of product or material, field of activity	**Principle of measurement (²) (characteristics, measuring ranges, type of test)**	**Test method, remarks (national, international standards, validated in-house test methods)**
PV module test: Electrical performance (*)	Irradiance dependency	IEC 61853-1, Cpt.8
	Irradiance and temperature performance mesurements	IEC 61853-1, Cpt.8 EN 50380, 3.5.2
	Spectral response of single junction PV cells or modules	IEC 60904-8
PV module test: Lifetime and safety	Preconditioning	IEC 61215, Cpt.5 IEC 61853-1, Cpt.5
	Visual inspection	IEC 61215, 10.1 IEC 61646, 10.1 IEC 61730-2, MST 01
	Insulation test	IEC 61215, 10.3 IEC 61646, 10.3
	Dielectric withstand test	IEC 61730-2, MST 16
	Nominal operating cell temperature determination	IEC 61215, 10.5 IEC 61646, 10.5 IEC 61853-1, 7.3 EN 50380, 3.5.1
	Outdoor exposure test	IEC 61215, 10.8 IEC 61646, 10.8
	Thermal cycling test (50/100 cycles)	IEC 61215, 10.11 IEC 61646, 10.11 IEC 61730-2, MST 51

(*) The accreditation refers to cristalline silicon and thin-film single junction test devices

1) Type A: It is not allowed to change the scope

2) Type B: Optimizing defined test methods (adapt to client's needs, adapted standard) is allowed

3) Type C: Introduction of additional test methods for the different types of test is allowed

ISO 17025 ACCREDITED TEST PROCEDURES

Group of product or material, field of activity	Principle of measurement (²) (characteristics, measuring ranges, type of test)	Test method, remarks (national, international standards, validated in-house test methods)
PV module test: Lifetime and safety	Humidity freeze test (10 cycles)	IEC 61215, 10.12 IEC 61646, 10.12 IEC 61730-2, MST 52
	Damp heat	IEC 61215, 10.13 IEC 61646, 10.13 IEC 61730-2, MST 53
	Robustness of termination test	IEC 61215, 10.14 IEC 61646, 10.14 IEC 61730-2, MST 42
	Wet leakage current test	IEC 61215, 10.15 IEC 61646, 10.15 IEC 61730-2, MST 17
	Mechanical load test	IEC 61215, 10.16 IEC 61646, 10.16 IEC 61730-2, MST 34
	Hail test	IEC 61215, 10.17 IEC 61646, 10.17
	Hail test for other classes	IEC 61215, 10.17 IEC 61646, 10.17 VKF Prüfbestimmung Nr. 25
	Hot-spot endurance test	IEC 61215, 10.9 IEC 61730-2, MST 22
	Bypass diode thermal test	IEC 61215, 10.18 IEC 61646, 10.18 IEC 61730-2, MST 25
	Light soaking	IEC 61646, 10.19 IEC 61853-1, Cpt. 5

1) Type A: It is not allowed to change the scope

2) Type B: Optimizing defined test methods (adapt to client's needs, adapted standard) is allowed

3) Type C: Introduction of additional test methods for the different types of test is allowed

ISO 17025 ACCREDITED TEST PROCEDURES

Group of product or material, field of activity	Principle of measurement (²) (characteristics, measuring ranges, type of test)	Test method, remarks (national, international standards, validated in-house test methods)
Component test: Safety	Ground continuity test	IEC 61730-2, MST 13
	Accessibilty test	IEC 61730-2, MST 11
	Cut susceptibility test	IEC 61730-2, MST 12
	Reverse current overload test	IEC 61730-2, MST 26
	Module breakage test	IEC 61730-2, MST 32
	Conduit bending test	IEC 61730-2, MST 33
	Terminal box knock out test	IEC 61730-2, MST 44

1) Type A: It is not allowed to change the scope

2) Type B: Optimizing defined test methods (adapt to client's needs, adapted standard) is allowed

3) Type C: Introduction of additional test methods for the different types of test is allowed

SPECIAL TESTS (NOT ACCREDITED ISO17025)

Group of product or material, field of activity	**Principle of measurement (characteristics, measuring ranges, type of test)**	**Test method, remarks (national, international standards, validated in-house test methods)**
PV module test: Electrical performance PV module test: Lifetime and safety	Performance of CPV modules Energy yield Electroluminescence Infrared imaging	

IDENTIFICATION OF MODULES

Manufacturer: Pramac

Module type:

OVERALL TEST:	PASSED

MODULES IDENTIFICATION	
SERIAL NUMBER	**INTERNAL LABEL**
110925000401000119	13-170/C/1
110925000337000120	13-170/C/2

SERVICE INFORMATION

Order number: 13-170
Order date: 08.10.2013
Sample receipt date: 11.10.2013
Test period : 17.10.2013 - 19.11.2013

GENERAL REMARKS

MANUFACTURER NAMEPLATE/DATASHEET PARAMETERS

GENERAL	
Model	Luce MCPH P7L
Cell technology	micromorph

MECHANICAL FEATURES		SOURCE
Module length	110 cm	DS
Module height	130 cm	DS
Number of cells in parallel	3	DS
Number of cells in series	55	DS
Single cell area	75.72 cm²	DS

ELECTRICAL FEATURES		SOURCE
Security class	Class II	NP
Maximum power (Pm)	120 W	NP
Open circuit voltage (Voc)	72 V	NP
Short circuit current (Isc)	2.66 A	NP
Maximum power voltage (Vm)	54.4 V	NP
Maximum power current (Im)	2.2 A	NP
Maximum system voltage	1000 V	NP
Pm minimum tolerance	-2.5 %	NP
Pm maximun tolerance	2.5 %	NP

TEMPERATURE FEATURES	SOURCE

LEGEND:
DS: datasheet
NP: nameplate

DETAILED TECHNICAL CHARACTERISTICS

CELLS
BYPASS DIODES
INTERCONNECTION
FRAME
JUNCTION BOX
SUPERSTRATE
SUBSTRATE
ENCAPSULANT

TEST SEQUENCE

Legend:	Green: test passed	Red: test failed

MODULE 13-170/C/1	MODULE 13-170/C/2
WL 17.10.2013	WL 17.10.2013
IR 13.11.2013	IR 13.11.2013
PM 13.11.2013	PM 13.11.2013
LS 13.11.2013	LS 13.11.2013
PM 19.11.2013	PM 19.11.2013

MODULE 13-170/C/1
TEST RESULTS

GENERAL INFORMATION	
Manufacturer	Pramac
Module label	13-170/C/1
Type	Luce MCPH P7L
Serial number	110925000401000119

REMARKS

LIGHT SOAKING

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/1
Type	Luce MCPH P7L	**Starting date**	13.11.2013
Serial Number	110925000401000119	**Ending date**	18.11.2013

Result:	**PASSED**	Notes:

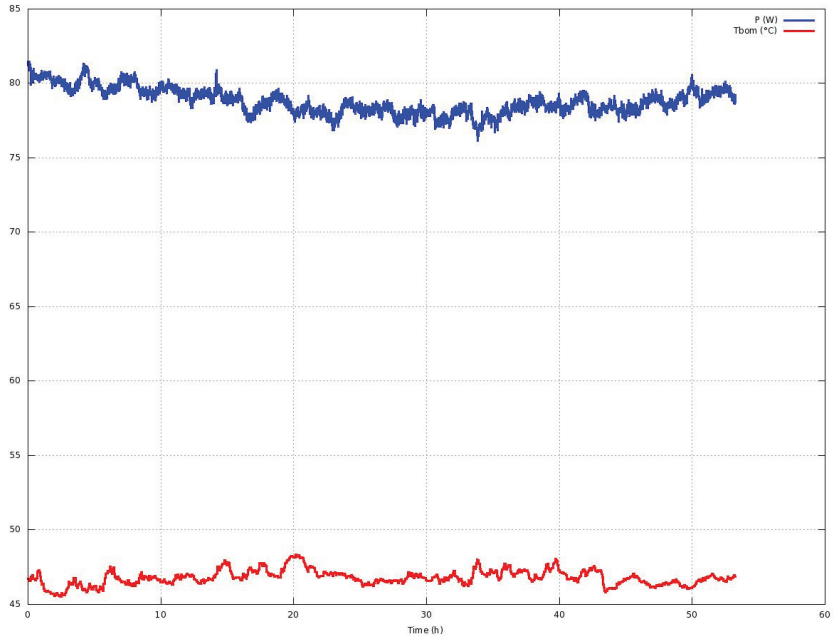
UNCERTAINTY

MPPT = ± 1.5 %	Temperature = ± 0.5 °C

REMARKS

The module was subject to an irradiation of 1000 W/m² for 115 hours in MPP tracking.

Power and Temperature trends during the test



ELECTRICAL PERFORMANCE SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/1
Type	Luce MCPH P7L
Serial Number	110925000401000119

Notes:	All the values are corrected to 1000 W/m²

SUMMARY OF PERFORMANCES RESULTS (ΔPm=Pm-Pm(previous))

Date	After	Pm [W]	ΔPm [%]	Voc [V]	Isc [A]	Vm [V]	Im [A]	FF [%]
13.11.2013	INITIAL	124.20	0.00	71.99	2.788	55.57	2.235	61.9
19.11.2013	LS	113.74	-8.42	71.07	2.680	53.30	2.134	59.7

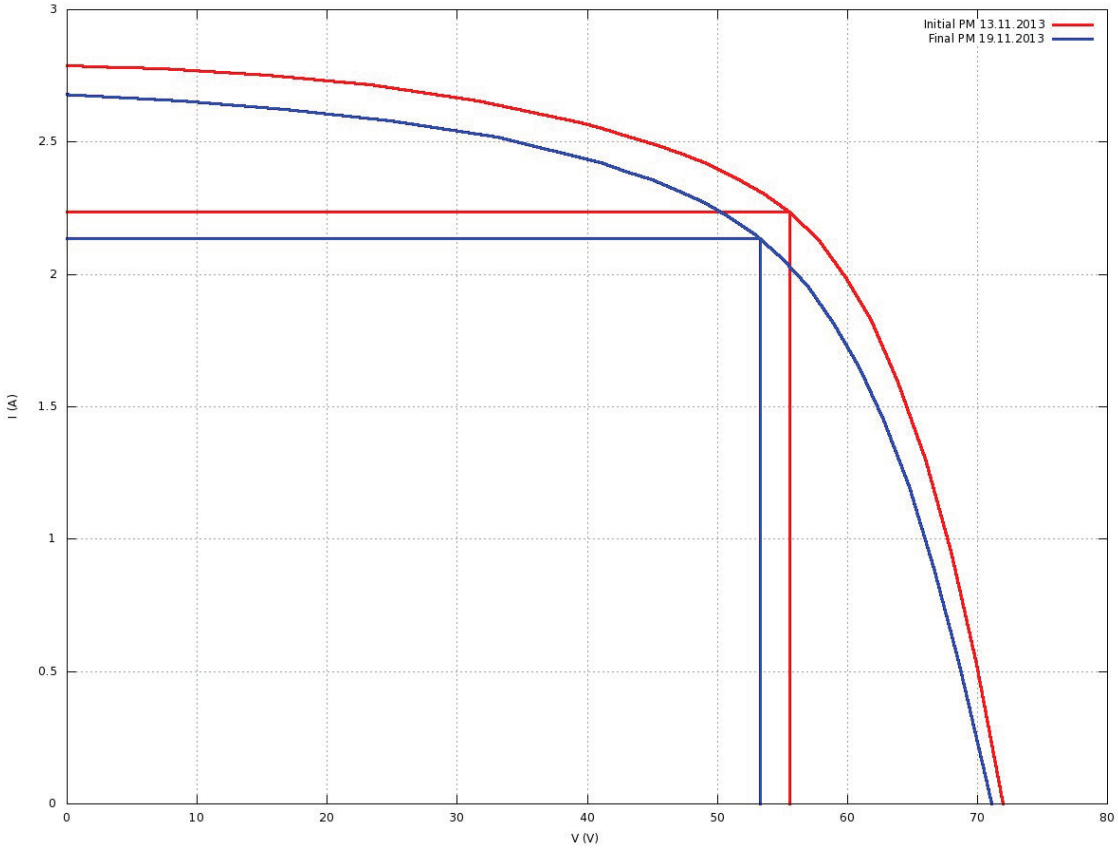
ELECTRICAL PERFORMANCE SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/1
Type	Luce MCPH P7L
Serial Number	110925000401000119

Notes:	All the values are corrected to 1000 W/m²

Comparison between first and last measurement



ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/1
Type	Luce MCPH P7L	**Date of Measurement**	13.11.2013
Serial Number	110925000401000119		

Result:	**PASSED**	Notes:

TEST RESULTS

Test conditions	
Measurement mode	multiflash
Reference Cell	054-2008
Reference Cell Temperature	25±1 °C
Module Temperature	25±1 °C
Mean Irradiance	1000 W/m²

Values corrected to 1000 W/m²	
Pmax	124.20 W
Vmp	55.57 V
Imp	2.235 A
Voc	71.99 V
Isc	2.788 A
Fill factor	61.9 %
Module efficiency	8.7 %

UNCERTAINTY

This measure is not accredited ISO17025

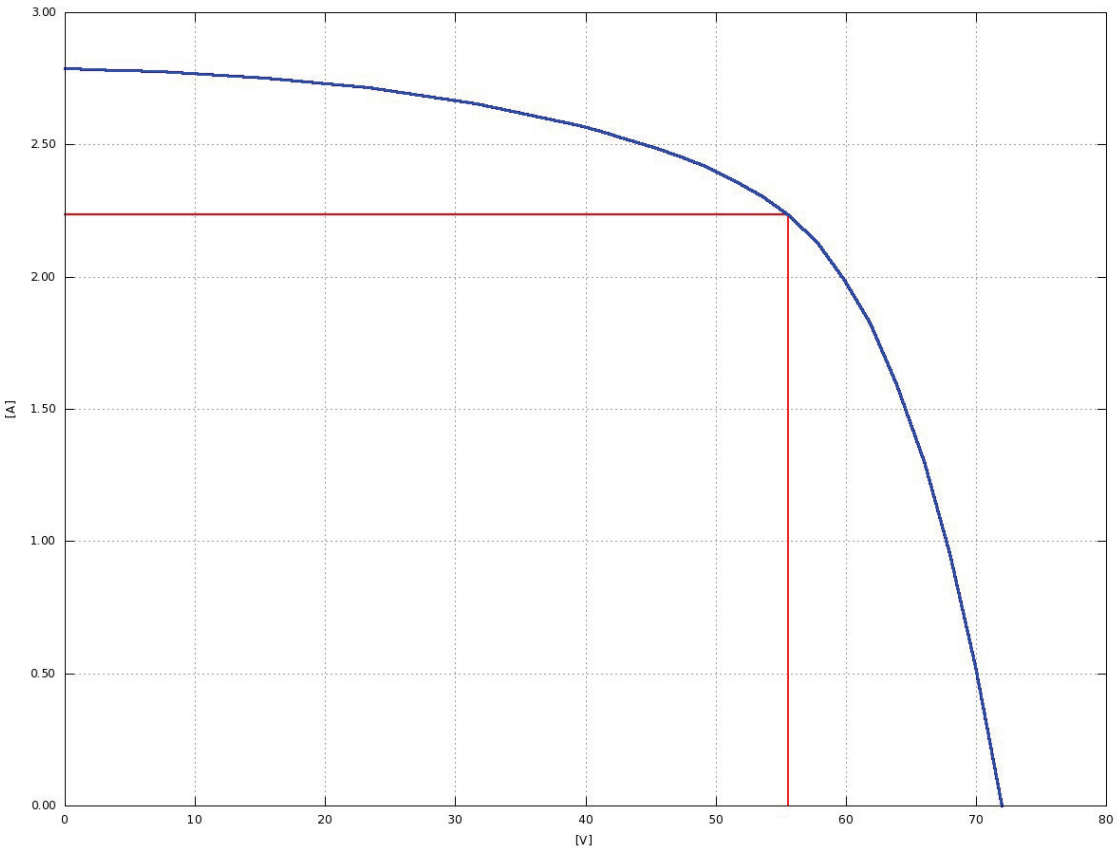
REMARKS

ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/1
Type	Luce MCPH P7L	**Date of Measurement**	13.11.2013
Serial Number	110925000401000119		

Result:	**PASSED**	Notes: All values are corrected to 1000 W/m²



ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/1
Type	Luce MCPH P7L	**Date of Measurement**	19.11.2013
Serial Number	110925000401000119		

Result:	**PASSED**	Notes:

TEST RESULTS

Test conditions	
Measurement mode	multiflash
Reference Cell	054-2008
Reference Cell Temperature	25±1 °C
Module Temperature	25±1 °C
Mean Irradiance	1000 W/m²

Values corrected to 1000 W/m²	
Pmax	113.74 W
Vmp	53.30 V
Imp	2.134 A
Voc	71.07 V
Isc	2.680 A
Fill factor	59.7 %
Module efficiency	8.0 %

UNCERTAINTY

This measure is not accredited ISO17025

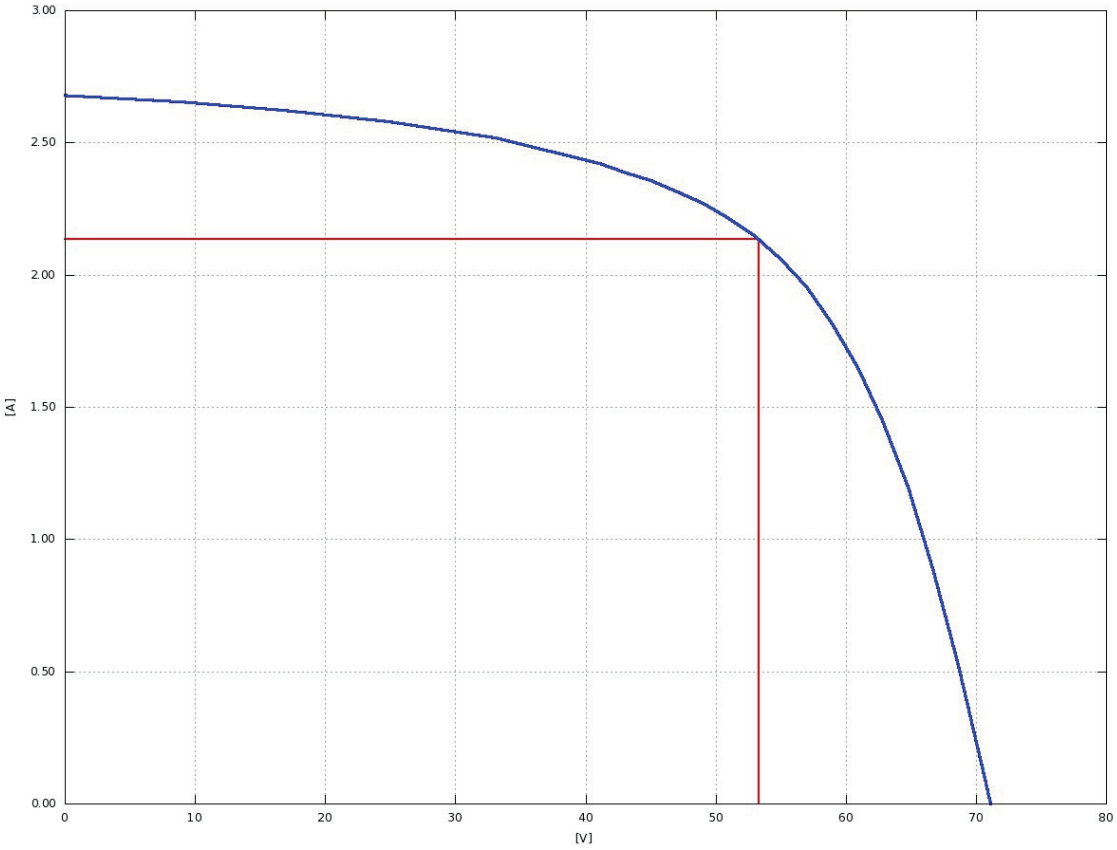
REMARKS

ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/1
Type	Luce MCPH P7L	**Date of Measurement**	19.11.2013
Serial Number	110925000401000119		

Result:	**PASSED**	Notes: All values are corrected to 1000 W/m²



WET LEAKAGE SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/1
Type	Luce MCPH P7L
Serial Number	110925000401000119

Notes:	

RESULTS

Date	After	Insulation resistance	Area resistance	Water temperature	Water conducibility
17.10.2013	INITIAL	98.3 Mohm	141.0 Mohm * m²	22.0 °C	1140.0 µS

WET LEAKAGE TEST

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/1
Type	Luce MCPH P7L	**Starting date**	17.10.2013
Serial Number	110925000401000119	**Ending date**	17.10.2013

Result:	**PASSED**	Notes:

TEST RESULTS

Insulation resistance	98.3 Mohm
Area resistance	141 Mohm * m²
Water temperature	22 °C
Water conducibility	1140 µS

UNCERTAINTY

Total uncertainty = ± 0.8%

REMARKS

INFRARED IMAGING SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/1
Type	Luce MCPH P7L
Serial Number	110925000401000119

Notes:	

RESULTS

Date	After	Isc [A]
13.11.2013	INITIAL	2.630

INFRARED

GENERAL INFORMATION

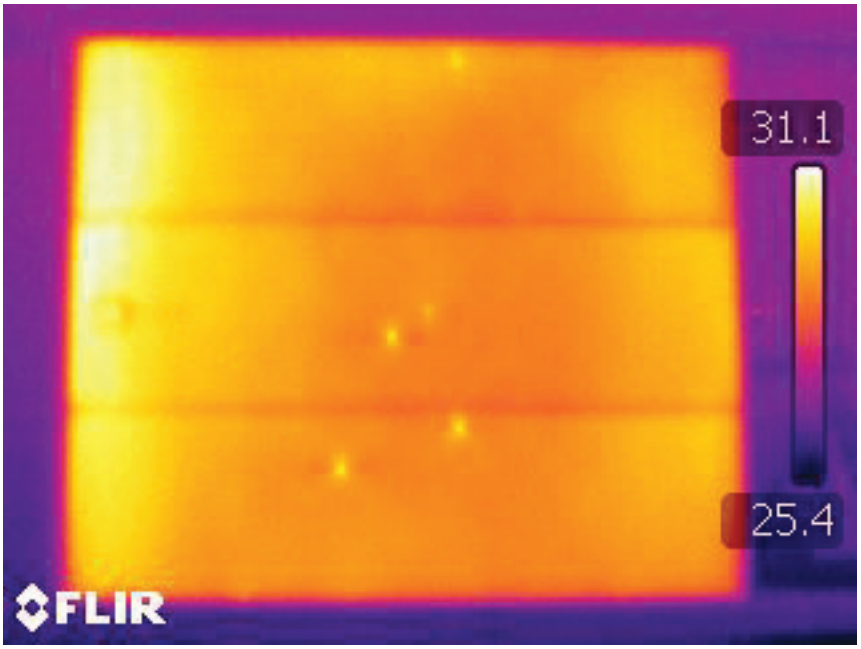
Manufacturer	Pramac	**Module Label**	13-170/C/1
Type	Luce MCPH P7L	**Starting date**	13.11.2013
Serial Number	110925000401000119	**Ending date**	13.11.2013

Result:	**PASSED**	Notes: Test current 2.63 A Time ISC 640 s

UNCERTAINTY

REMARKS

Picture N° 1



MODULE 13-170/C/2
TEST RESULTS

GENERAL INFORMATION	
Manufacturer	Pramac
Module label	13-170/C/2
Type	Luce MCPH P7L
Serial number	110925000337000120

REMARKS

LIGHT SOAKING

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/2
Type	Luce MCPH P7L	**Starting date**	13.11.2013
Serial Number	110925000337000120	**Ending date**	18.11.2013

Result:	**PASSED**	Notes:

UNCERTAINTY

MPPT = ± 1.5 %	Temperature = ± 0.5 °C

REMARKS

The module was subject to an irradiation of 1000 W/m² for 115 hours in Voc.

ELECTRICAL PERFORMANCE SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/2
Type	Luce MCPH P7L
Serial Number	110925000337000120

Notes:	All the values are corrected to 1000 W/m²

SUMMARY OF PERFORMANCES RESULTS (ΔPm=Pm-Pm(previous))

Date	After	Pm [W]	ΔPm [%]	Voc [V]	Isc [A]	Vm [V]	Im [A]	FF [%]
13.11.2013	INITIAL	126.01	0.00	71.46	2.793	55.00	2.291	63.1
19.11.2013	LS	116.14	-7.83	71.23	2.688	53.62	2.166	60.7

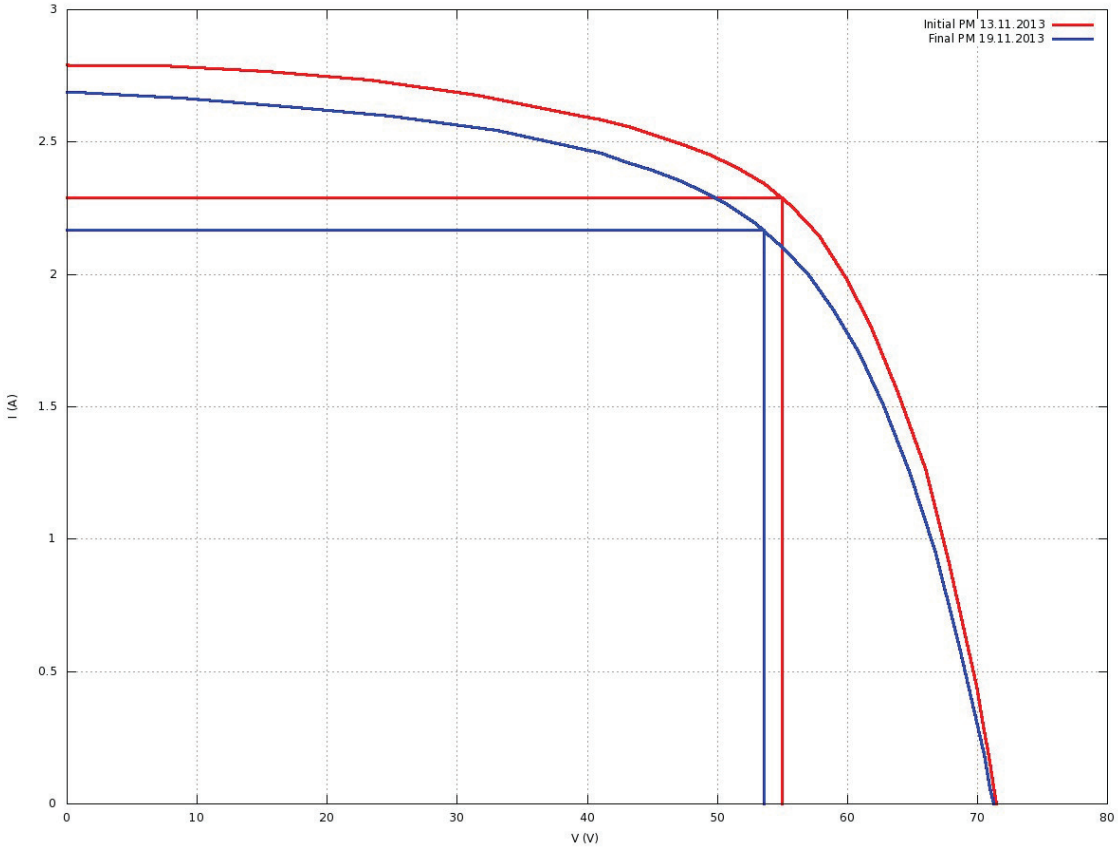
ELECTRICAL PERFORMANCE SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/2
Type	Luce MCPH P7L
Serial Number	110925000337000120

Notes:	All the values are corrected to 1000 W/m²

Comparison between first and last measurement



ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/2
Type	Luce MCPH P7L	**Date of Measurement**	13.11.2013
Serial Number	110925000337000120		

Result:	**PASSED**	Notes:

TEST RESULTS

Test conditions	
Measurement mode	multiflash
Reference Cell	054-2008
Reference Cell Temperature	25±1 °C
Module Temperature	25±1 °C
Mean Irradiance	1000 W/m²

Values corrected to 1000 W/m²	
Pmax	126.01 W
Vmp	55.00 V
Imp	2.291 A
Voc	71.46 V
Isc	2.793 A
Fill factor	63.1 %
Module efficiency	8.8 %

UNCERTAINTY

This measure is not accredited ISO17025

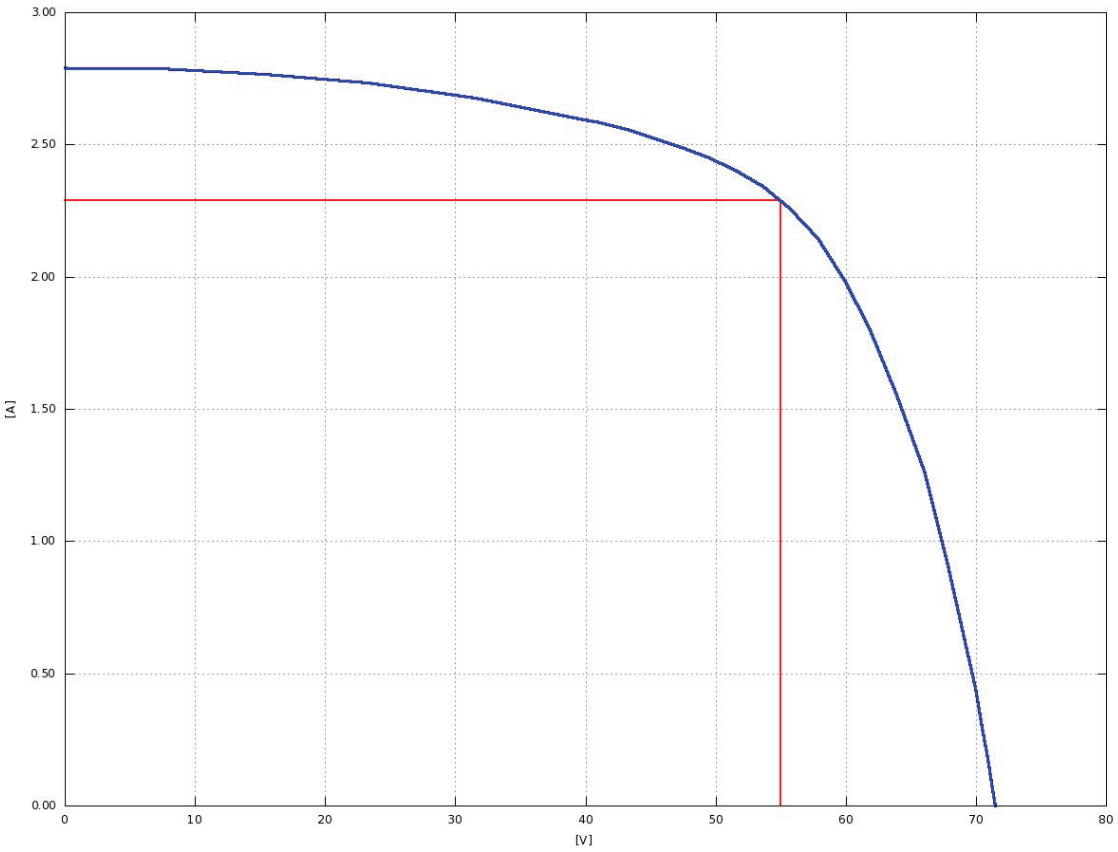
REMARKS

ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/2
Type	Luce MCPH P7L	**Date of Measurement**	13.11.2013
Serial Number	110925000337000120		

Result:	**PASSED**	Notes: All values are corrected to 1000 W/m²



ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/2
Type	Luce MCPH P7L	**Date of Measurement**	19.11.2013
Serial Number	110925000337000120		

Result:	**PASSED**	Notes:

TEST RESULTS

Test conditions	
Measurement mode	multiflash
Reference Cell	054-2008
Reference Cell Temperature	25±1 °C
Module Temperature	25±1 °C
Mean Irradiance	1000 W/m²

Values corrected to 1000 W/m²	
Pmax	116.14 W
Vmp	53.62 V
Imp	2.166 A
Voc	71.23 V
Isc	2.688 A
Fill factor	60.7 %
Module efficiency	8.1 %

UNCERTAINTY

This measure is not accredited ISO17025

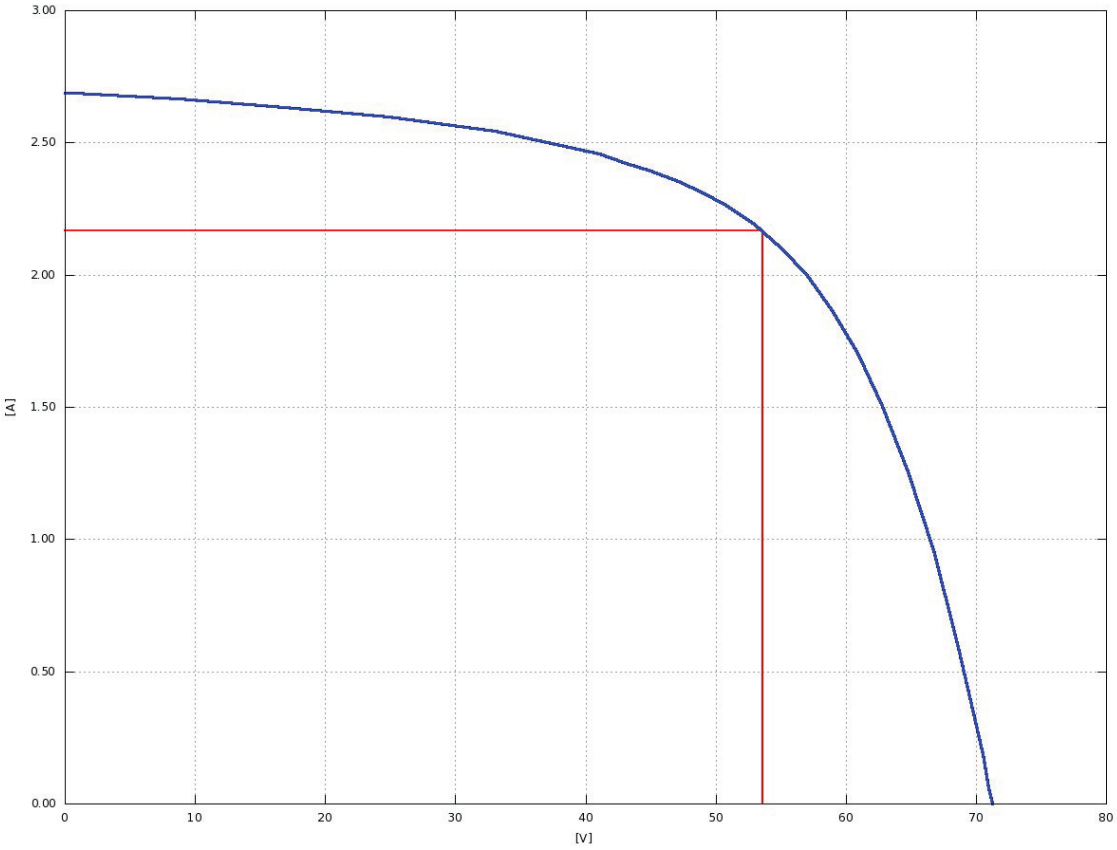
REMARKS

ELECTRICAL PERFORMANCE MEASUREMENT AT STC

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/2
Type	Luce MCPH P7L	**Date of Measurement**	19.11.2013
Serial Number	110925000337000120		

Result:	**PASSED**	Notes: All values are corrected to 1000 W/m²



WET LEAKAGE SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/2
Type	Luce MCPH P7L
Serial Number	110925000337000120

Notes:	

RESULTS

Date	After	Insulation resistance	Area resistance	Water temperature	Water conducibility
17.10.2013	INITIAL	97.6 Mohm	140.0 Mohm * m²	22.0 °C	1140.0 µS

WET LEAKAGE TEST

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/2
Type	Luce MCPH P7L	**Starting date**	17.10.2013
Serial Number	110925000337000120	**Ending date**	17.10.2013

Result:	**PASSED**	Notes:

TEST RESULTS

Insulation resistance	97.6 Mohm
Area resistance	140 Mohm * m²
Water temperature	22 °C
Water conducibility	1140 µS

UNCERTAINTY

Total uncertainty = ± 0.8%

REMARKS

INFRARED IMAGING SUMMARY

GENERAL INFORMATION

Manufacturer	Pramac
Module Label	13-170/C/2
Type	Luce MCPH P7L
Serial Number	110925000337000120

Notes:	

RESULTS

Date	After	Isc [A]
13.11.2013	INITIAL	2.630

INFRARED

GENERAL INFORMATION

Manufacturer	Pramac	**Module Label**	13-170/C/2
Type	Luce MCPH P7L	**Starting date**	13.11.2013
Serial Number	110925000337000120	**Ending date**	13.11.2013

Result:	**PASSED**	Notes: Test current 2.63 A Time ISC 420 s

UNCERTAINTY

REMARKS

Picture N° 1