Prüfbericht-Nr.: *Test Report No.*:	**CN21F5SR 001**	**Auftrags-Nr.:** *Order No.*:	244257030	Seite 1 von 209 *Page 1 of 209*
Kunden-Referenz-Nr.: *Client Reference No.*:	1344616	**Auftragsdatum:** *Order date*:	10.02.2020	
Auftraggeber: *Client*:	SolaX Power Network Technology (Zhe jiang) Co., Ltd. No. 288 Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000, P.R. China			
Prüfgegenstand: *Test item*:	Grid Tied Inverer With Storage System			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	X1-Hybrid-x-y, X1-Fit-x-z (x=3.0, 3.7, 5.0, 6.0, 7.5; y=D or M; z=M or W)			
Auftrags-Inhalt: *Order content*:	AK certification			
Prüfgrundlage: *Test specification*:	CEI 0-21: 2019			

Wareneingangsdatum: *Date of receipt*:	04.03.2021
Prüfmuster-Nr.: *Test sample No.*:	A003005594-001
Prüfzeitraum: *Testing period*:	05.03.2021 – 28.04.2021
Ort der Prüfung: *Place of testing*:	TÜV Rheinland (Shanghai) Co., Ltd.
Prüflaboratorium: *Testing laboratory*:	TÜV Rheinland (Shanghai) Co., Ltd.
Prüfergebnis*: *Test result**:	Pass

geprüft von / *tested by*:			**kontrolliert von** / *reviewed by*:		
09.05.2021	Jingge Pan / PE	Jingge Pan	10.05.2021	Tobias Yang / Reviewer	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:

None.

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery*:	Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

TEST REPORT

☒ **CEI 0-21:2019-04**

Regola tecnica di riferimento per la connessione di Utenti attivi e passivi alle reti BT delle imprese distributrici di energia elettrica

/Reference technical rules for the connection of active and passive users to the LV electrical Utilities

Report reference no...... :	**CN21F5SR 001**
Tested by (name + signature) ..... :	See coverpage
Approved by (name + signature) .... :	See coverpage
Date of issue..... :	See coverpage
Total number of pages..... :	See coverpage
Testing Laboratory..... :	TÜV Rheinland (Shanghai) Co..Ltd.
Address..... :	No. 177, 178, Lane 777 West Guangzhong Road. Jing'an District. Shanghai. 200072 P.R.China
Applicant's name..... :	**SolaX Power Network Technology (Zhe jiang) Co., Ltd.**
Address..... :	No. 288 Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000, P.R. China
Test item description..... :	Hybrid Grid-Interactive Inverter With Storage Battery System
Trade Mark ..... :	SOLAX POWER
Manufacturer..... :	SolaX Power Network Technology (Zhe jiang) Co., Ltd.
Model/Type reference..... :	See rating label and model list for detail
Ratings..... :	See model list
Sample ..... :	
Samples received on ..... :	See coverpage
TUV reference samples..... :	See coverpage
Samples tested n. ..... :	See coverpage
Testing ..... :	
Start Date: ..... :	See coverpage
End Date: ..... :	See coverpage

Testing procedure and testing location:	
☒ **Testing Laboratory**: Testing location/ address.....:	TÜV Rheinland (Shanghai) Co..Ltd. No. 177, 178, Lane 777 West Guangzhong Road. Jing'an District. Shanghai. 200072 P.R.China
☐ **Associated Laboratory:** Testing location/ address.....: Tested by (name + signature).....: Approved by (+ signature).....:	
☐ Testing procedure: TMP Testing location/ address.....: Tested by (name + signature).....: Approved by (+ signature).....:	
☐ Testing procedure: WMT Testing location/ address.....: Tested by (name + signature).....: Witnessed by (+ signature).....: Approved by (+ signature).....:	
☐ Testing procedure: SMT Testing location/ address.....: Tested by (name + signature).....: Approved by (+ signature).....: Supervised by (+ signature).....:	
☐ Testing procedure: RMT Testing location/ address.....: Tested by (name + signature).....: Approved by (+ signature).....: Supervised by (+ signature).....:	

Reference Standard:

CEI 0-21:2019-04
Regola tecnica di riferimento per la connessione di Utenti attivi e passivi alle reti BT delle imprese distributrici di energia elettrica
/Reference technical rules for the connection of active and passive users to the LV electrical Utilities.

The standard refers to the following standards:

Allienamento al Regolamento UE 2016/631, UE 2016/1388 e UE 2016/1447 (RfG)
/ Allignment with the Regulation UE 2016/631, UE 2016/1388 e UE 2016/1447 (Requirements for Generators - RfG)

CEI EN 60068-2-2:2008-11
Prove ambientali - Parte 2-2: Prove - Prova B: Caldo secco
/Environmental testing - Part 2-2: Tests - Test B: Dry heat

CEI EN 60068-2-78:2002:03
Prove ambientali - Parte 2-78: Prove - Prova Cab: Caldo umido, regime stazionario
/Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state

CEI EN 60068-2-1:2007:11
Prove ambientali - Parte 2-1: Prove - Prova A: Freddo
/Environmental testing - Part 2-1: Tests - Test A: Cold

CEI EN 60068-2-14:2010
Prove ambientali - Parte 2-14: Prove - Prova N: Cambio di temperatura
/Environmental testing - Part 2-14: Tests - Test N: Change of temperature

CEI EN 60255-5:2001-11
Parte 5: Coordinamento dell'isolamento per i relè di misura e per i dispositivi di protezione
Prescrizioni e prove
/Electrical Relays - Part 5: Insulation coordination for measuring relays and protection equipment – Requirements and tests

CEI EN 61000-3-2:2007-04 + CEI EN 61000-3-2/A1/A2:2011-09
Compatibilità elettromagnetica (EMC)
Parte 3-2: Limiti - Limiti per le emissioni di corrente armonica (apparecchiature con corrente di ingresso <= 16 A per fase)
/Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)

CEI EN 61000-3-3:2009-09
Compatibilità elettromagnetica (EMC)
Parte 3-3: Limiti - Limitazione delle variazioni di tensioni, fluttuazioni di tensione e del flicker in sistemi di alimentazione in bassa tensione per apparecchiature con corrente nominale <= 16 A per fase e non soggette ad allacciamento su condizione
/Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection.

CEI EN 61000-3-12:2012
Compatibilità elettromagnetica (EMC)
Limiti per le correnti armoniche prodotte da apparecchiature collegate alla rete pubblica a bassa tensione aventi correnti di ingresso > 16 A e <= 75 A per fase
/ Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current =<16 A per phase)

CEI EN 61000-3-11:2011
Compatibilità elettromagnetica (EMC)
Limitazione delle variazioni di tensione, delle fluttuazioni di tensione e del flicker in sistemi di alimetazione pubblici a bassa tensione - Apparecchiature con correnti nominali < 75A e soggetti ad allacciamento su condizione
/ Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current =<16 A per phase and not subject to conditional connection

CEI EN 60146-1-1:1997 + A1:1998
Convertitori a semiconduttori - Prescrizioni generali e convertitori commutati dalla linea
Prove di isolamento (§ 4.2.1).
/ Semiconductor converters - General requirements and line commutated converters - Part 1-1: Specification of basic requirements Insulation tests (§. 4.2.1).

Document not attached recalled into this test report:

Appendix No.	Description	Page(s)
1	Attachment-Photo document	11
2		
3		
4		
5		
6		

Informazioni generali sul prodotto / *General product information*:	
Product:	☐ Static generator (Photovoltaic grid tied inverter) ☒ Energy Storage System (EES) ☐ Synchronous generator ☐ Asynchronous generator ☐ Wind Full converter (FC) ☐ Wind Doubly Fed Induction Generator
License Holder: *Address:*	SolaX Power Network Technology (Zhe jiang) Co., Ltd. No. 288 Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000, P.R. China
Manufacturing plant: *Address:*	SolaX Power Network Technology (Zhe jiang) Co., Ltd. No. 288 Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000, P.R. China
Model(s):	For Complete list of product see 'General Product information' Section
N°serie / Serial n°:	
Testing Location: *Address:*	***§. N.1 Esecuzione delle prove – accreditamento*** *N.1 Testing - Accreditation* ☒ EA - ISO/EN 17025 testing Laboratory *(See testing laboratory address)* ☐ Manufacturing Plant / Customer facility *EA - ISO/EN 17025 testing Laboratory (witnessing)* *(see Manufacturing plant address)*
Testing Laboratory: *Address:*	TÜV Rheinland (Shanghai) Co..Ltd. No. 177, 178, Lane 777 West Guangzhong Road. Jing'an District. Shanghai. 200072 P.R.China
Input Voltage (Rated):	See model list
Output Voltage (Rated):	See model list
Software version:	DSP1：2.07 DSP2：2.01 ARM：2.03

Test item particulars ..... :	
Equipment mobility..... :	☐ Stationary ☒ fixed
Connection to the mains..... :	☒ permanent connection
Enviromental category ..... :	☒ outdoor .
Over voltage category Mains..... :	☒ OVC III
Over voltage category PV..... :	☒ OVC II
Mains supply tolerance (%)..... :	--
Tested for power systems..... :	--
IT testing, phase-phase voltage (V)..... :	--
Class of equipment..... :	☒ Class I
Pollution degree..... :	☐ PD 1 ☒ PD 2 (Inside) ☒ PD 3(Outside)

Test case verdicts:	
Test case does not apply to the test object ..... :	N/A
Test object does meet the requirement ..... :	P(Pass)
Test object does not meet the requirement..... :	F(Fail)
Testing ..... :	
Date of receipt of test item..... :	See first page
Date (s) of performance of tests ..... :	See first page

General remarks:

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
The test results presented in this report relate only to the items tested.
”(see remark #)” refers to a remark appended to the report.
”(see annex #)” refers to an annex appended to the report.
”(see enclosure #)” refers to additional information appended to the report.
”(see appended table)” refers to a table appended to the report.
Throughout this report a point is used as the decimal separator.

General product information:

DISPOSITIVO DI INTERFACCIA	PROTEZIONE DI INTERFACCIA	DISPOSITIVO DI CONVERSIONE STATICA	DISPOSITIVO DI GENERAZIONE ROTANTE
☒	☒	☒	☐

Description of tested item:

Verified Sample:

Descrizione /Description:	Hybrid Grid-Interactive Inverter With Storage Battery System
Costruttore / Manufacturer:	**SolaX Power Network Technology (Zhe jiang) Co., Ltd** No. 288 Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province 310000, P.R. China
Modello/ Model	Hybrid Inverter: X1-Hybrid-x-y, X1-Fit-x-z (x=3.0, 3.7, 5.0, 6.0, 7.5; y=D or M; z=M or W)
N°serie / Serial n°	N/A
Number of phases	Single

Test Setup:

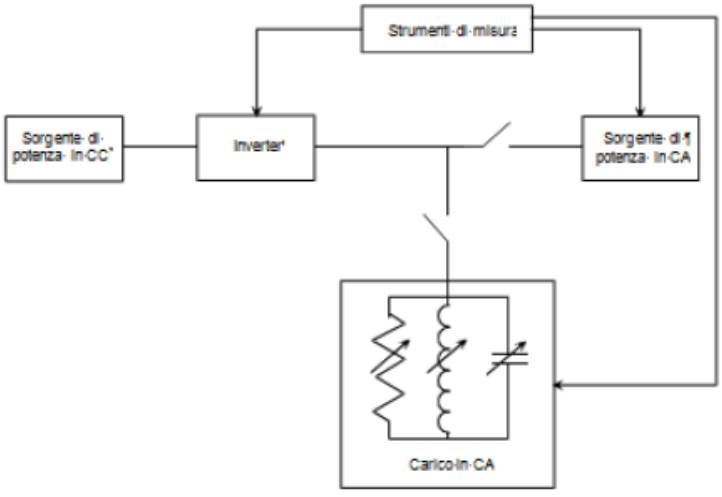


Figura 20 – Simulatore di rete BT

Technical Information:

The PCEs under test (EUTs) are single-phase Grid-connected hybrid Inverter which utilizes the advanced power electronics conversion components such as MOSFET, IGBT to convert the variable DC power generated from the photovoltaic (PV) arrays as well as batteries to the stable utility AC power which can be fed into the commercial electrical grid. The battery port able to be charged by the energy from either PV port or AC grid port. The three models are able to work in stand-alone mode with the accessory backup box while the grid voltage is not present.

X1-Hybrid-7.5-D: Basic model; Nomenclature for model X1-Hybrid-xx-y manufacturer's designation:
xx: maybe 3.0, 3.7, 5.0, 6.0, 7.5;
y: maybe D, or M, "D" means with "DC Switch"; "M" means Externally attached Mate box for full load off-grid operation.

Model Difference:

The models X1-Hybrid-3.0-D, X1-Hybrid-3.7-D, X1-Hybrid-5.0-D, X1-Hybrid-6.0-D are identical to X1-Hybrid-7.5-D except for the model name and electrical ratings.
The models X1-Hybrid-3.0-M, X1-Hybrid-3.7-M, X1-Hybrid-5.0-M, X1-Hybrid-6.0-M are identical to X1-Hybrid-7.5-M except for the model name and electrical ratings.
The models X1-Hybrid-3.0-M, X1-Hybrid-3.7-M, X1-Hybrid-5.0-M, X1-Hybrid-6.0-M, Hybrid-7.5-M are identical to X1-Hybrid-3.0-D, X1-Hybrid-3.7-D, X1-Hybrid-5.0-D, X1-Hybrid-6.0-D, X1-Hybrid-7.5-D except for the model name and without DC switch.

Unless otherwise specified, all the tests were conducted on the basic model of X1-Hybrid-7.5-D to represent the others.

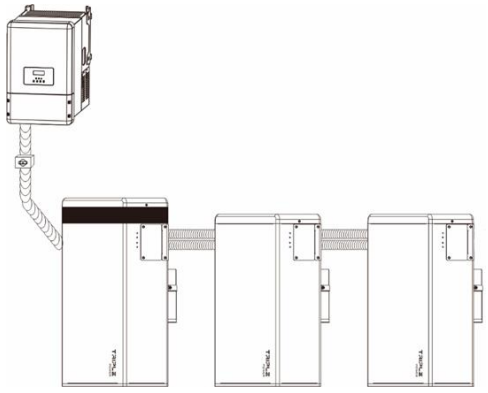
The Hybrid inverter was tested with the battery energy system, T-BAT H 5.8, T-BAT P17.3.

The battery energy system T-BAT-SYS-HV series was consist of one main control module and 0 to 2 sub modules.

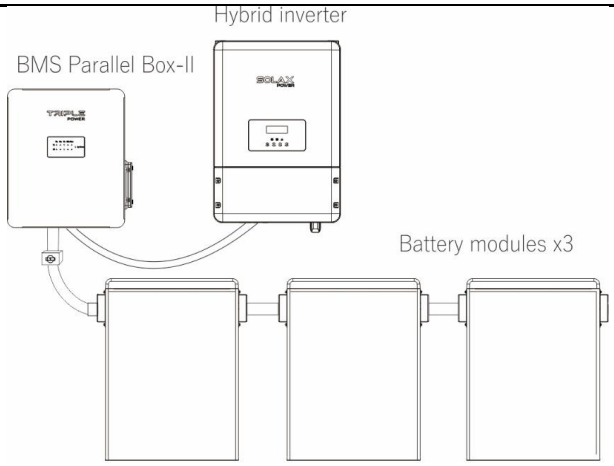
The battery energy system T-BAT-S series was consist of one BMS Parallel Box II and 1 to 3 sub modules.

The battery energy system T-BAT-P series was consist of one BMS Parallel Box II and n sub modules (n=2, 4, 6).

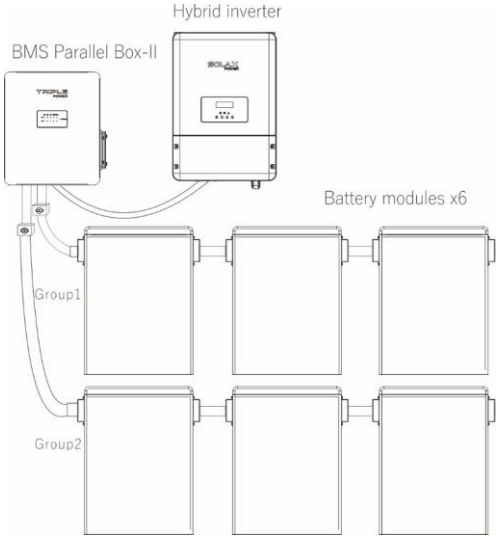
Block Diagramm of battery energy system:



T-BAT-SYS-HV series



T-BAT-S series



T-BAT-P series

Battery energy system

MODEL	T-BAT H 5.8	T-BAT H 11.5	T-BAT H 17.3
PACK type	5.8	11.5	17.3
Battery type	Li-on(LFP)	Li-on(LFP)	Li-on(LFP)
Component	LF50 CELL	LF50 CELL	LF50 CELL
Voltage [v]	115.2	230.4	345.6
Operating voltage range [v]	100-131	200-262	300-393
Battery Module	9S1P*4=1 Module	Module*2	Module*3
Rated Capacity[AH]	50	50	50
Total energy [KWH]	5.8	11.5	17.3
Usable energy[kwh]	5.2	10.4	15.6

Faradic charge efficiency	99%	99%	99%
Battery roundtrip efficiency	95%	95%	95%
Standard power[kw]	2.9	5.8	8.7
Max power[kw]	3.5	7	10.5
Recommend charge/discharge current [a]	25	25	25
Maxcharge/discharge current [A]	35	35	35

MODEL	**T-BAT S 5.8**	**T-BAT S 11.5**	**T-BAT S 17.3**
Battery type	Li-on(LFP) 50Ah	Li-on(LFP) 50Ah	Li-on(LFP) 50Ah
Component	1P36S*1S	1P36S *2S	1P36S *3S
Voltage [v]	115.2	230.4	345.6
Operating voltage range [v]	100-131	200-262	300-393
Battery Module	1P9S*4=1 Module	Module*2S	Module*3S
Rated Capacity[AH]	50	50	50
Total energy [KWH]	5.8	11.5	17.3
Standard power[kw]	2.9	5.8	8.7
Max power[kw]	3.5	7	10.5

MODEL	**T-BAT P 5.8**	**T-BAT P 11.5**	**T-BAT P 17.3**
Battery type	Li-on(LFP) 50Ah	Li-on(LFP) 50Ah	Li-on(LFP) 50Ah
Component	1P36S*2P	1P36S *4P	1P36S *6P
Voltage [v]	115.2	230.4	345.6
Operating voltage range [v]	100-131	200-262	300-393
Battery Module	Module *2P	Module *4P	Module *6P
Rated Capacity[AH]	100	100	100
Total energy [KWH]	11.5	23	34.6
Standard power[kw]	2.9	5.8	8.7
Max power[kw]	3.5	7	10.5

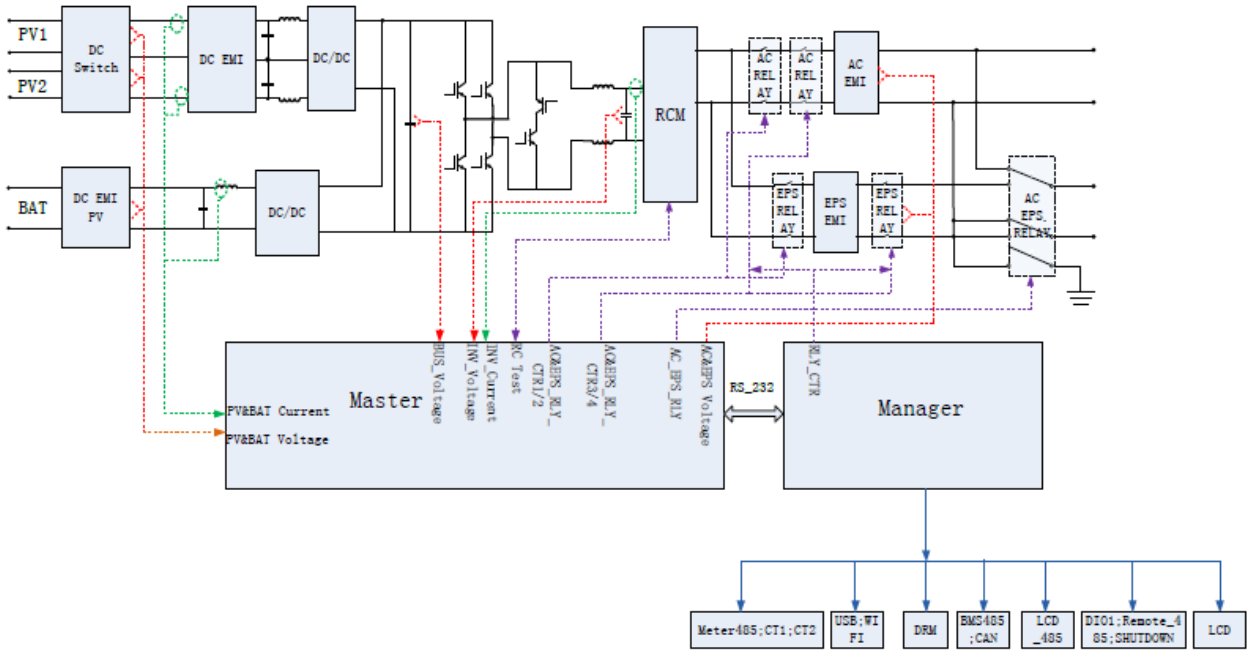
General information	
Cycel life[90% DOD]	6000 Cycles
Expected life time	5Year
Available charge/discharge temperature range [℃]	0°C to 55°C
Full-load charge/discharge	5°C to 48°C

temperature range [℃]	
Storage temperature[℃]	-20°C to 55°C (3 months)
	0°C to 40°C (1 year)
Humidity[%]	4% to 100%,(condensing)
Altitude	Below 2000m
Protection	IP55
System to Inverter	CAN2.0
Battery to battery/BMS	RS485
Data collection port /FW UPDATE	CAN2.0
Master control LED Indicator Working mode	1 LED
Master control Capacity indicator	4LED (25%, 50%, 75%, 100%)
Battery module LED	2 LED
Reset	Button
Switch on/off	Button*1+breaker*1
Safety	CE, RCM, TUV(IEC62619) UL1973,ROHS
EMC	
UN number	UN3840
Hazardous materials classifcation	Class 9
Transport testing requirement	UN38.3

Block Diagramm:

The PCE does not provide galvanic separation between the DC input and AC output circuit (Non-isolation or transformer-less). The output circuit of each phase can be switched off by two relays in series for the redundant protection. When single-fault occurs to one relay, the other redundant one will still maintain the basic insulation between PV input and AC output circuit to the mains. All the relays have functional self-checking before the PCE starting.

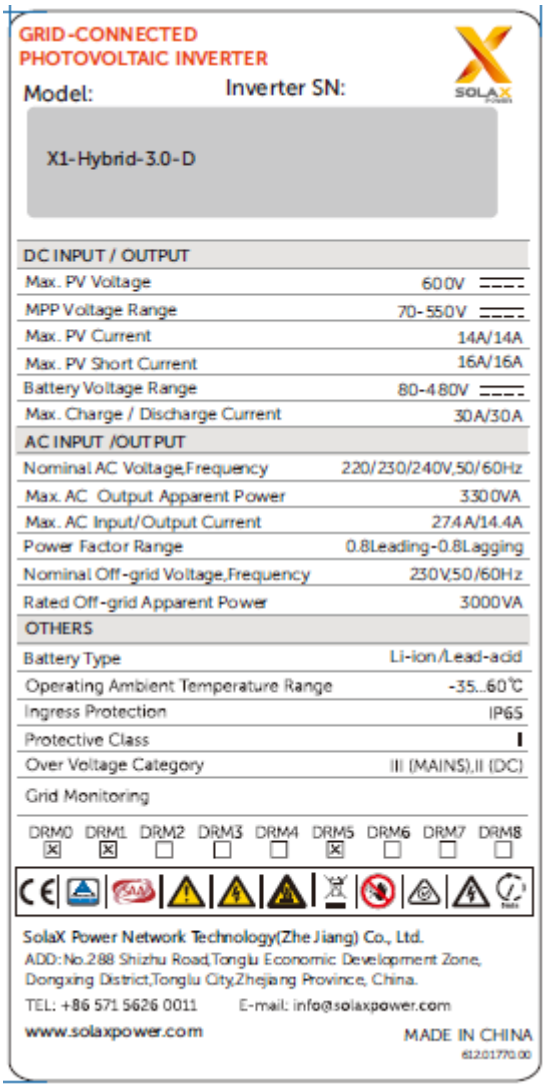
Remark: External circuit breakers or fuses for PV array and Grid connection is required which statement is provided in the installation manual. The PCE is provided EMC filter at the input and output circuit.



Protective function in PCE:

1. PV array insulation resistance detecting
2. Residual current monitoring
3. Over and under grid voltage / frequency protection
4. Anti-islanding protection
5. DC injection current protection
6. Over current protection
7. Over temperature protection and auto derating function
8. Relay self-checking function
9. RCMU self-checking function
10. Relays used in series as grid auto-disconnection devices for redundant NS protection
11. Short-circuit protection relies on external circuit breaks which are specified in the installation manual

Copy of marking plate:



GRID-CONNECTED
PHOTOVOLTAIC INVERTER

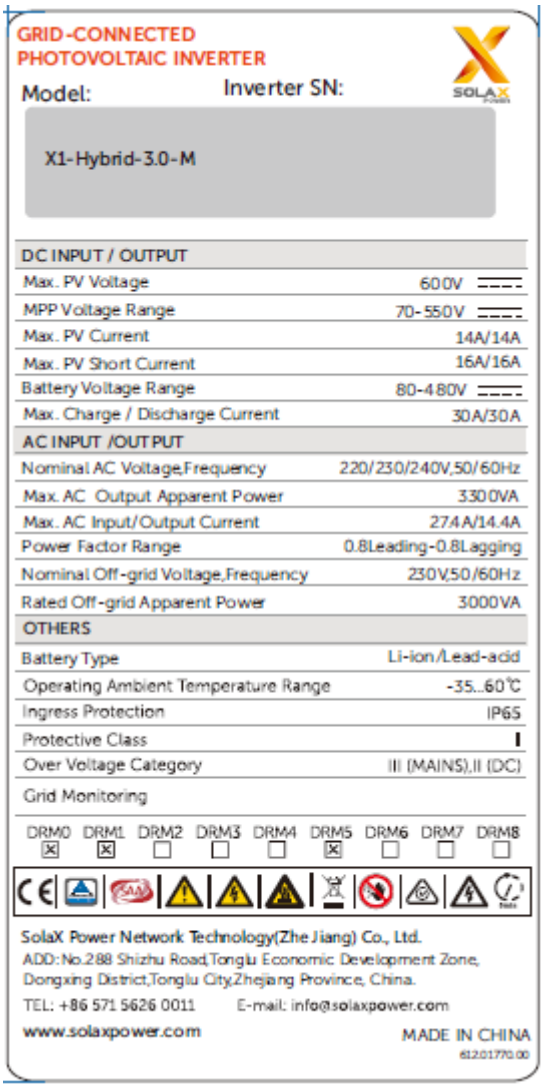
Model: Inverter SN:

X1-Hybrid-3.0-D

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT /OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	3300VA
Max. AC Input/Output Current	27.4A/14.4A
Power Factor Range	0.8Leading-0.8Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	3000VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35..60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Grid Monitoring	

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

SolaX Power Network Technology(Zhe Jiang) Co., Ltd.
ADD:No.288 Shizhu Road,Tonglu Economic Development Zone,
Dongxing District,Tonglu City,Zhejiang Province, China.
TEL: +86 571 5626 0011 E-mail: info@solaxpower.com
www.solaxpower.com MADE IN CHINA
612.01770.00



GRID-CONNECTED
PHOTOVOLTAIC INVERTER

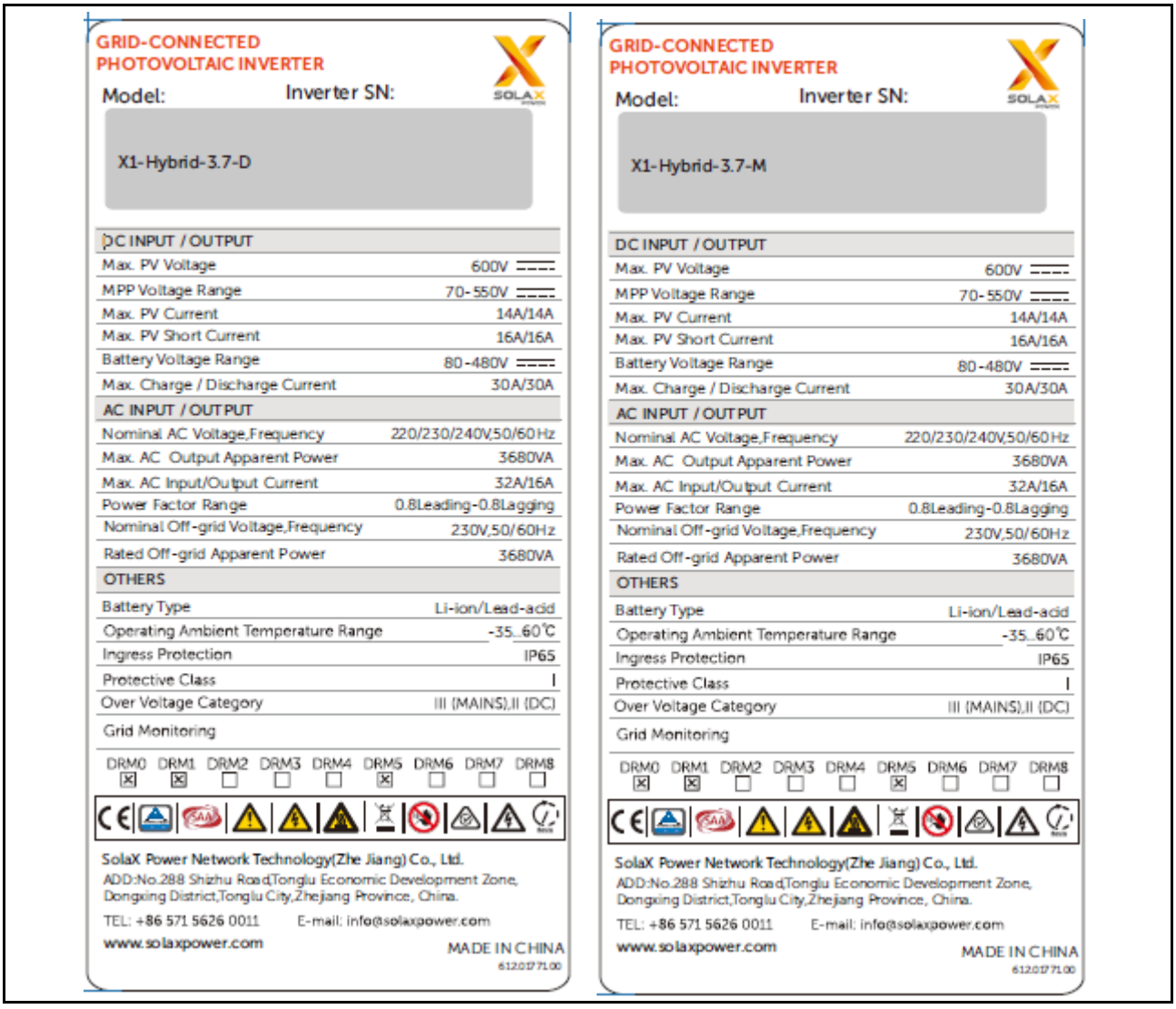
Model: Inverter SN:

X1-Hybrid-3.0-M

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT /OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	3300VA
Max. AC Input/Output Current	27.4A/14.4A
Power Factor Range	0.8Leading-0.8Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	3000VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35..60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Grid Monitoring	

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

SolaX Power Network Technology(Zhe Jiang) Co., Ltd.
ADD:No.288 Shizhu Road,Tonglu Economic Development Zone,
Dongxing District,Tonglu City,Zhejiang Province, China.
TEL: +86 571 5626 0011 E-mail: info@solaxpower.com
www.solaxpower.com MADE IN CHINA
612.01770.00



GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: Inverter SN:

X1-Hybrid-3.7-D

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	3680VA
Max. AC Input/Output Current	32A/16A
Power Factor Range	0.8Leading-0.8Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	3680VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35~60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Grid Monitoring	

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

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GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: Inverter SN:

X1-Hybrid-3.7-M

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	3680VA
Max. AC Input/Output Current	32A/16A
Power Factor Range	0.8Leading-0.8Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	3680VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35~60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Grid Monitoring	

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

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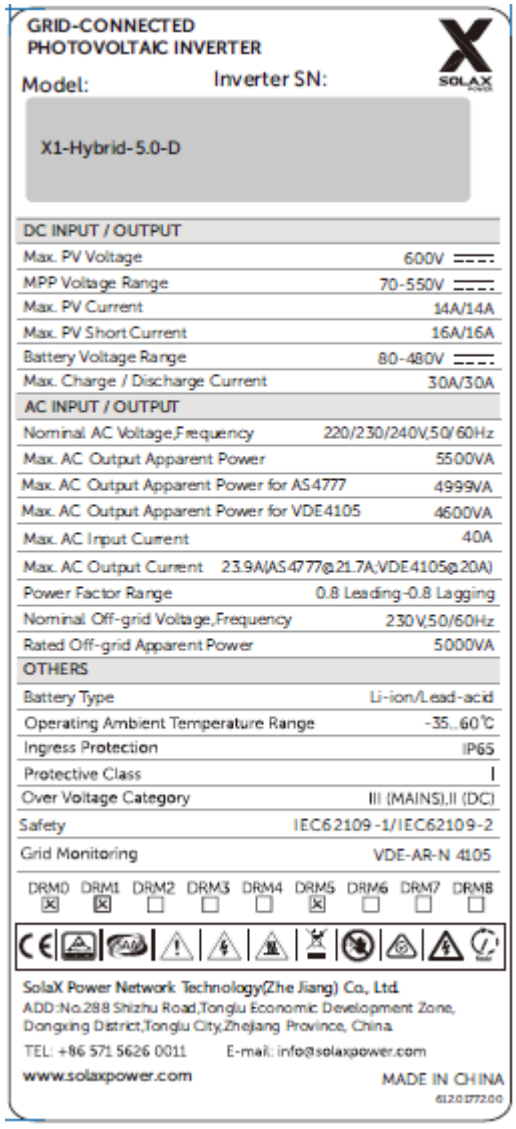

GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: X1-Hybrid-5.0-D Inverter SN:

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	5500VA
Max. AC Output Apparent Power for AS4777	4999VA
Max. AC Output Apparent Power for VDE4105	4600VA
Max. AC Input Current	40A
Max. AC Output Current	23.9A(AS4777@21.7A;VDE4105@20A)
Power Factor Range	0.8 Leading-0.8 Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	5000VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35...60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Safety	IEC62109-1/IEC62109-2
Grid Monitoring	VDE-AR-N 4105

DRM0 ☒ DRM1 ☒ DRM2 ☐ DRM3 ☐ DRM4 ☐ DRM5 ☒ DRM6 ☐ DRM7 ☐ DRM8 ☐

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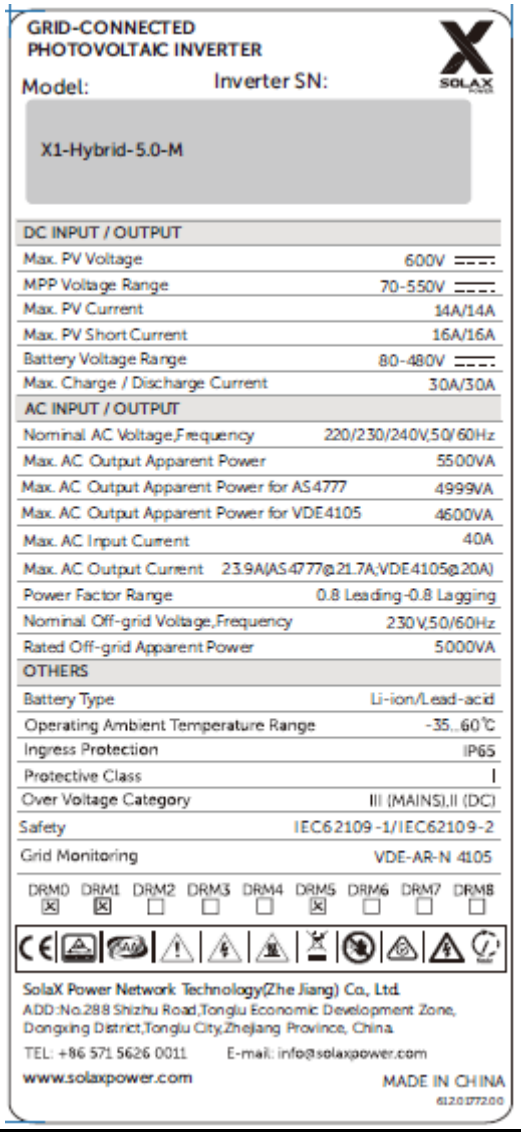

GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: X1-Hybrid-5.0-M Inverter SN:

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	5500VA
Max. AC Output Apparent Power for AS4777	4999VA
Max. AC Output Apparent Power for VDE4105	4600VA
Max. AC Input Current	40A
Max. AC Output Current	23.9A(AS4777@21.7A;VDE4105@20A)
Power Factor Range	0.8 Leading-0.8 Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	5000VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35...60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Safety	IEC62109-1/IEC62109-2
Grid Monitoring	VDE-AR-N 4105

DRM0 ☒ DRM1 ☒ DRM2 ☐ DRM3 ☐ DRM4 ☐ DRM5 ☒ DRM6 ☐ DRM7 ☐ DRM8 ☐

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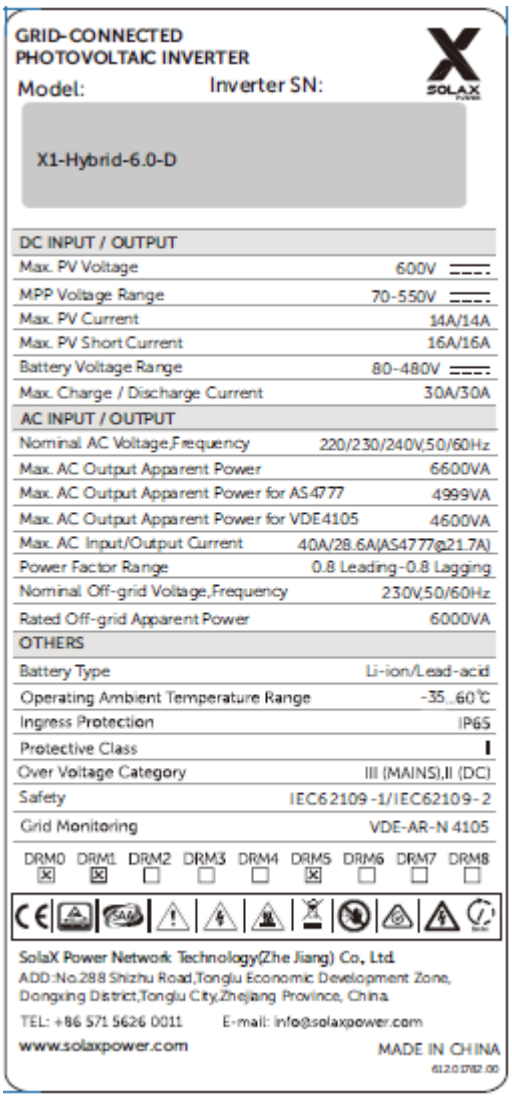

GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: X1-Hybrid-6.0-D

Inverter SN:

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	6600VA
Max. AC Output Apparent Power for AS4777	4999VA
Max. AC Output Apparent Power for VDE4105	4600VA
Max. AC Input/Output Current	40A/28.6A(AS4777@21.7A)
Power Factor Range	0.8 Leading-0.8 Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	6000VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35...60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Safety	IEC62109-1/IEC62109-2
Grid Monitoring	VDE-AR-N 4105

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

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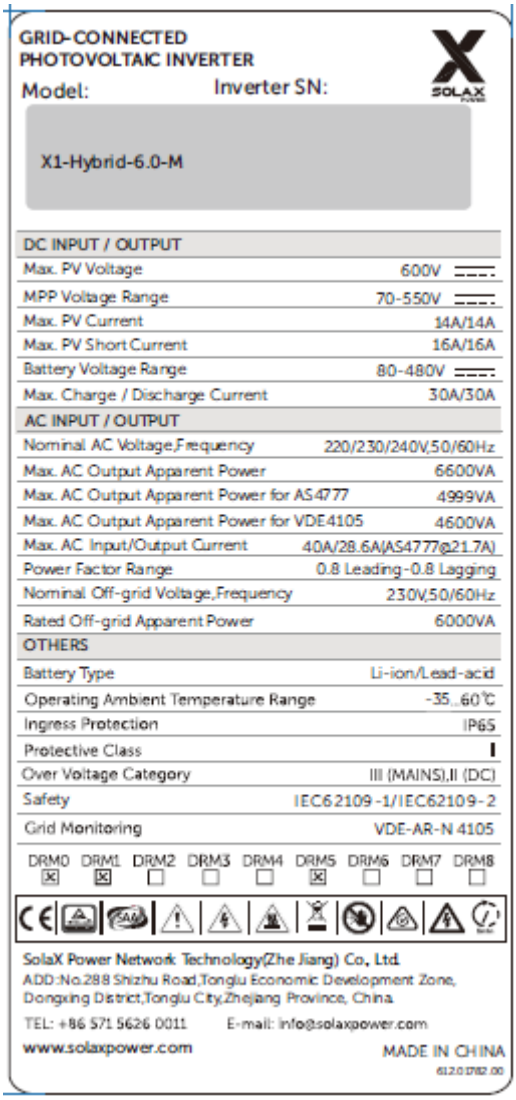

GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: X1-Hybrid-6.0-M

Inverter SN:

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	6600VA
Max. AC Output Apparent Power for AS4777	4999VA
Max. AC Output Apparent Power for VDE4105	4600VA
Max. AC Input/Output Current	40A/28.6A(AS4777@21.7A)
Power Factor Range	0.8 Leading-0.8 Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	6000VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35...60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Safety	IEC62109-1/IEC62109-2
Grid Monitoring	VDE-AR-N 4105

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

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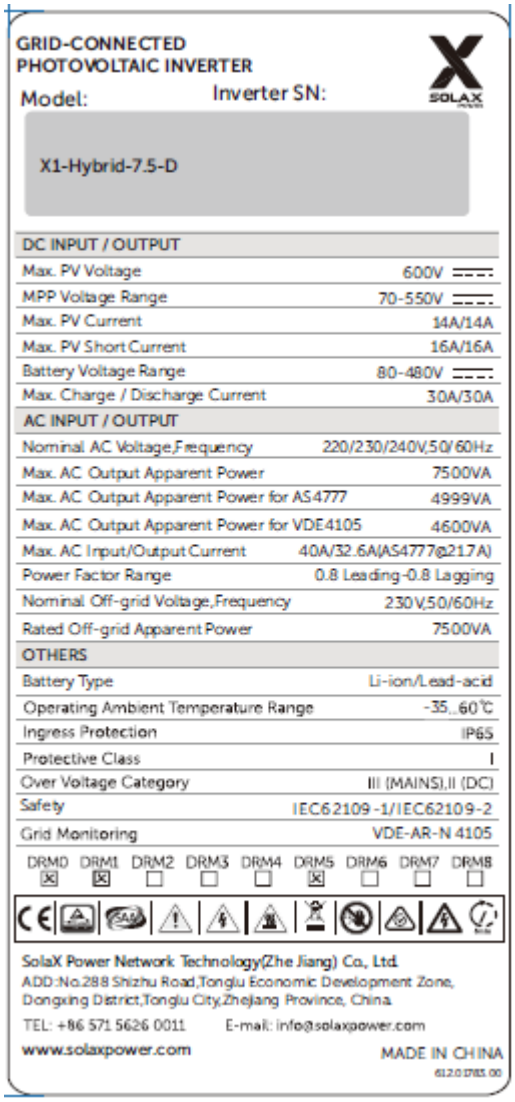

GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: X1-Hybrid-7.5-D

Inverter SN:

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	7500VA
Max. AC Output Apparent Power for AS4777	4999VA
Max. AC Output Apparent Power for VDE4105	4600VA
Max. AC Input/Output Current	40A/32.6A(AS4777@217A)
Power Factor Range	0.8 Leading-0.8 Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	7500VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35...60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Safety	IEC62109-1/IEC62109-2
Grid Monitoring	VDE-AR-N 4105

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

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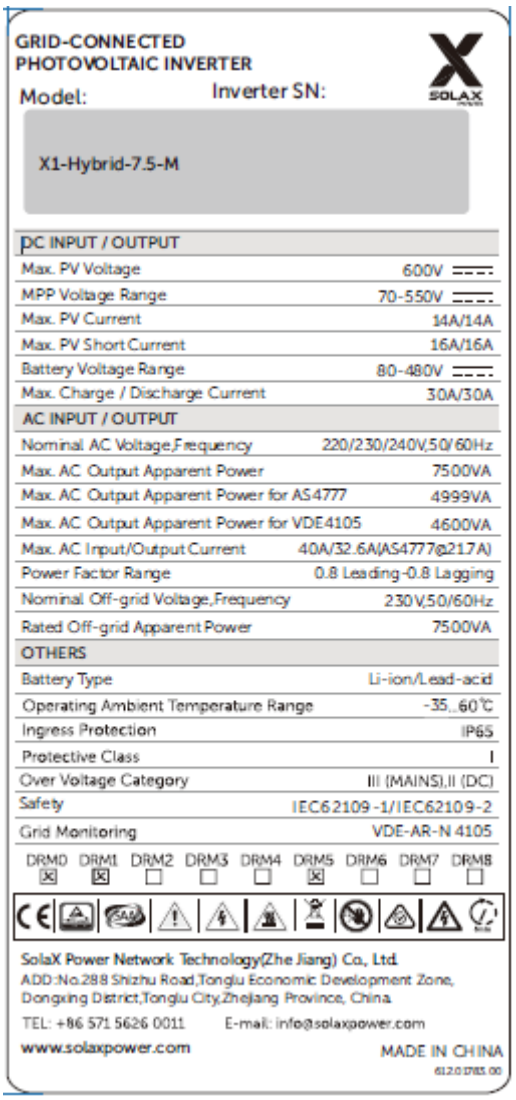

GRID-CONNECTED
PHOTOVOLTAIC INVERTER

Model: X1-Hybrid-7.5-M

Inverter SN:

DC INPUT / OUTPUT	
Max. PV Voltage	600V ⎓
MPP Voltage Range	70-550V ⎓
Max. PV Current	14A/14A
Max. PV Short Current	16A/16A
Battery Voltage Range	80-480V ⎓
Max. Charge / Discharge Current	30A/30A
AC INPUT / OUTPUT	
Nominal AC Voltage,Frequency	220/230/240V,50/60Hz
Max. AC Output Apparent Power	7500VA
Max. AC Output Apparent Power for AS4777	4999VA
Max. AC Output Apparent Power for VDE4105	4600VA
Max. AC Input/Output Current	40A/32.6A(AS4777@217A)
Power Factor Range	0.8 Leading-0.8 Lagging
Nominal Off-grid Voltage,Frequency	230V,50/60Hz
Rated Off-grid Apparent Power	7500VA
OTHERS	
Battery Type	Li-ion/Lead-acid
Operating Ambient Temperature Range	-35...60℃
Ingress Protection	IP65
Protective Class	I
Over Voltage Category	III (MAINS),II (DC)
Safety	IEC62109-1/IEC62109-2
Grid Monitoring	VDE-AR-N 4105

DRM0	DRM1	DRM2	DRM3	DRM4	DRM5	DRM6	DRM7	DRM8
☒	☒	☐	☐	☐	☒	☐	☐	☐

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Model list:

MODELS LIST		X1-Hybrid-3.0-D X1-Hybrid-3.0-M	X1-Hybrid-3.7-D X1-Hybrid-3.7-M
PV INPUT	V_{MAX} PV [Vdc]	600	
	I_{SC} PV [A]	16/16	
	MPP Voltage Range V_{MPP} [Vdc]	70-550	
	Max. Input Current I_{MAX} [A]	14/14	
	MPP Full Power Voltage Range [Vdc]	115-480	135-480
	Startup PV Voltage[Vdc]	90	
	Overvoltage Category(OVC)	II	
AC Input and Output Data	Rated Input / Output Voltage Ur [Vac]	220/230/240	
	Normal Operating Voltage Range Un[Vac]	180-270	
	Rated Input / Output Frequency F_{NETZ}[Hz]	50 / 60	
	Normal Operating Frequency Range Fn[Hz]	45~55Hz/55~65Hz	
	Rated Input / Output Power [W]	3000	3680
	Max. Input Apparent power [VA]	6300	7360
	Max. Output Apparent power [VA]	3300	3680
	Max. Input Current Imax[A]	27.4	32
	Max. Output Current Imax[A]	14.4	16
	Power Factor cosφ [λ]	[-0.8, +0.8]	
	THD [I] (100% full power)	<2%	
	DC injection [I] (%, 100% full power)	<0.5In	
	Overvoltage Category(OVC)	III	
Off-grid Output	Rated Output Voltage Ur [Vac]	230	
	Rated Output Frequency [Hz]	50 / 60	
	Rated Output Power [VA]	3000	3680
	Rated Current Ir [A]	13	16
	THD [I] (100% full power)	<2%	
	Overvoltage Category(OVC)	II	

Battery Data	V_{MAX} BAT [Vdc]	480V
	Battery Type	Li-ion battery
	Voltage Range	80-480
	Max. Charge/Discharge Current I_{MAX} [A]	30/30
	Overvoltage Category(OVC)	II
System data	Type of inverter	Non-isolated
	Protective Class	I
	Enclosure Protection (IP)	IP65
	Operating Temperature Range [℃]	-35 to +60 (>45 derating)
	Pollution degree (PD)	PD3
	Altitude [m]	3000
	Size [mm]	482 * 417 * 181
	Weight [kg]	22

MODELS LIST		X1-Hybrid-5.0-D X1-Hybrid-5.0-M	X1-Hybrid-6.0-D X1-Hybrid-6.0-M
PV INPUT	V_{MAX} PV [Vdc]	600	
	I_{SC} PV [A]	16/16	
	MPP Voltage Range V_{MPP} [Vdc]	70-550	
	Max. Input Current I_{MAX} [A]	14/14	
	MPP Full Power Voltage Range [Vdc]	190-480	225-480
	Startup PV Voltage[Vdc]	90	
	Overvoltage Category(OVC)	II	
AC Input and Output Data	Rated Input / Output Voltage Ur [Vac]	220/230/240	
	Normal Operating Voltage Range Un[Vac]	180-270	
	Rated Input / Output Frequency F_{NETZ}[Hz]	50 / 60	
	Normal Operating Frequency Range Fn[Hz]	45~55Hz/55~65Hz	
	Rated Input / Output Power [W]	5000	6000
	Max. Input Apparent power [VA]	9200	9200
	Max. Output Apparent power [VA]	5500	6600
	Max. Input Current Imax[A]	40	40
	Max. Output Current Imax[A]	23.9	28.6
	Power Factor cosφ [λ]	[-0.8, +0.8]	
	THD [I] (100% full power)	<2%	
	DC injection [I] (%, 100% full power)	<0.5In	
	Overvoltage Category(OVC)	III	

Off-grid Output	Rated Output Voltage Ur [Vac]	230	
	Rated Output Frequency [Hz]	50 / 60	
	Rated Output Power [VA]	5000	6000
	Rated Current Ir [A]	21.7	26.1
	THD [I] (100% full power)	<2%	
	Overvoltage Category(OVC)	II	

Battery Data	V_{MAX} BAT [Vdc]	480V
	Battery Type	Li-ion battery
	Voltage Range	80-480
	Max. Charge/Discharge Current I_{MAX} [A]	30/30
	Overvoltage Category(OVC)	II
System data	Type of inverter	Non-isolated
	Protective Class	I
	Enclosure Protection (IP)	IP65
	Operating Temperature Range [ºC]	-35 to +60 (>45 derating)
	Pollution degree (PD)	PD3
	Altitude [m]	3000
	Size [mm]	482 * 417 * 181
	Weight [kg]	22

MODELS LIST		**X1-Hybrid-7.5-D** **X1-Hybrid-7.5-M**
PV INPUT	V_{MAX} PV [Vdc]	600
	I_{SC} PV [A]	16/16
	MPP Voltage Range V_{MPP} [Vdc]	70-550
	Max. Input Current I_{MAX} [A]	14/14
	MPP Full Power Voltage Range [Vdc]	280-480
	Startup PV Voltage[Vdc]	90
	Overvoltage Category(OVC)	II
AC Input and Output Data	Rated Input / Output Voltage Ur [Vac]	220/230/240
	Normal Operating Voltage Range Un[Vac]	180-270
	Rated Input / Output Frequency F_{NETZ}[Hz]	50 / 60
	Normal Operating Frequency Range Fn[Hz]	45~55Hz/55~65Hz
	Rated Input / Output Power [W]	7500
	Max. Input Apparent power [VA]	9200
	Max. Output Apparent power [VA]	7500
	Max. Input Current Imax[A]	40

	Max. Output Current Imax[A]	32.6
	Power Factor cosφ [λ]	[-0.8, +0.8]
	THD [I] (100% full power)	<2%
	DC injection [I] (%, 100% full power)	<0.5In
	Overvoltage Category(OVC)	III
Off-grid Output	Rated Output Voltage Ur [Vac]	230
	Rated Output Frequency [Hz]	50 / 60
	Rated Output Power [VA]	7500
	Rated Current Ir [A]	32.6
	THD [I] (100% full power)	<2%
	Overvoltage Category(OVC)	II

Battery Data	V_{MAX} BAT [Vdc]	480V
	Battery Type	Li-ion battery
	Voltage Range	80-480
	Max. Charge/Discharge Current I_{MAX} [A]	30/30
	Overvoltage Category(OVC)	II
System data	Type of inverter	Non-isolated
	Protective Class	I
	Enclosure Protection (IP)	IP65
	Operating Temperature Range [ºC]	-35 to +60 (>45 derating)
	Pollution degree (PD)	PD3
	Altitude [m]	3000
	Size [mm]	482 * 417 * 181
	Weight [kg]	23

Tests performed (name of test and test clause):

Allegato A: Caratteristiche e prove per il Sistema di Protezione di Interfaccia (SPI)
Annex A: Requirements and test for Interface Protection System (SPI)

Sample 1: Hybrid inverter, X1-Hybrid-7.5-M
Sample 2: Hybrid inverter, X1-Hybrid-7.5-M with T-BAT P 17.3.
Sample 3: Hybrid inverter, X1-Hybrid-7.5-M with T-BAT H 5.8.
Sample 4: Hybrid inverter, X1-Hybrid-3.0-M with T-BAT H 5.8.

A.4 Verifiche e prove sul SPI[1] ***/test and inspection on SPI***

Test	Ref. CEI 0-21	Ref. standard	Result	Sample
Prove funzionali sull'SPI */Functional test on SPI*	**A.4.3** **A.4.3.1** **A.4.3.2** **A.4.7** (limit conditions)	Condizioni di riferimento / Reference conditions (20 °C) – **Tab.9**	PASS	1
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B) - **Tab.12**	PASS	1
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab) - **Tab.12**	PASS	1
		Freddo / Cold test CEI EN 60068-2-1 (Test A) - **Tab.12**	PASS	1

A.4.3.3 Prescrizioni aggiuntive per le prove funzionali
/Additional requirements of the functional test

Test	Ref. CEI 0-21	Ref. standard	Result	Sample
Insensibilità delle armoniche del relè di frequenza	**A.4.3.3.1**	CEI 0-21:2019-04	PASS	1
Segnale di telescatto	**A.4.3.3.2**	CEI 0-21:2019-04	PASS	1
Segnale di telecomnicazione	**A.4.3.3.3**	CEI 0-21:2019-04	PASS	1
Verifica di insensibilità alla derivata di frequenza (ROCOF)	**A.4.3.4**	CEI 0-21:2019-04	PASS	1
Autotest	**A.4.4**	CEI 0-21:2019-04	PASS	1
Single Fault tolerance	**A.4.5**	CEI 0-21:2019-04	PASS	1

[1] Interface protection System (SPI) can be integrated to inverter with output power up to 11.08KW.

A.4.6: Prove di compatibilità EMC				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Compatibilità elettromagnetica /Electromagnetic compatibility	**A.4.6**	CEI EN 60255-26 CEI EN 50263 (Severità classe 2 – Livello industriale) – **Tab.11**	PASS	Note 1)

Note 1) Please refer to EMC report no.C20-291-WT, issued by Shanghai Inspection and Testing Institude of Instruments and Automation Systems Co.,Ltd.

A.4.7 Compatibilità Climatica / Climatic compatibility				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Compatibilità Climatica /Climatic compatibility **Storage conditions**	**A.4.7** (limit conditions)	Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B) - **Tab.12**	PASS	1
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab) - **Tab.12**	PASS	1
		Freddo / Cold test CEI EN 60068-2-1 (Test A) - **Tab.12**	PASS	1
		Ciclo termico /changing temperature CEI EN 60068-2-14 - **Tab.12**	PASS	1
Compatibilità Climatica /Climatic compatibility **Inverter in working conditions**	**A.4.7** (limit conditions)	Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B) - **Tab.12**	PASS	1
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab) - **Tab.12**	PASS	1
		Freddo / Cold test CEI EN 60068-2-1 (Test A) - **Tab.12**	PASS	1
		Ciclo termico /changing temperature CEI EN 60068-2-14 - **Tab.12**	PASS	1

A.4.8 Prove di isolamento */Insulating test*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Tenuta ad impulso /Pulse test	**A.4.8**	CEI EN 60255-5 Note[2]	PASS	1
Rigidità Dielettrica /Dielectric Strength		CEI EN 60255-5 Note [1]	PASS	1
Resistenza di Isolamento /insulation resistance		CEI EN 60255-5 Note [1]	PASS	1

[2] In case of integrated SPI, reference standard for insulating test is the CEI 60146-1-1.

A.4.9 Prove di sovraccaricabilità dei circuiti di misura / *Measurement circuits Overload*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Prove di sovraccaricabilità dei circuiti di misura / *Measurement circuits Overload*	**A.4.9**	CEI 0-21:2019-04	N/A	SPI integrata
			N/A	SPI integrata
			N/A	SPI integrata

Allegato B: Prove sugli inverter per impianti indirettamente connessi
Allegato B: Inverter tests for PV plants not directly connected to the grid

B.1 Prove sull'inverter / inverter tests				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Armoniche di corrente /Harmonics measurement (full power, 66% and 33% of max. power) ☐ CEI EN 61000-3-2 ☒ CEI EN 61000-3-12	**B.1 Tab. 14 Tab. 15**	Condizioni di riferimento / Reference conditions (20 °C) – **Tab.14**	PASS	1
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B) - **Tab.15**	PASS	1
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab) - **Tab.15**	PASS	1
		Freddo / Cold test CEI EN 60068-2-1 (Test A) - **Tab.15**	PASS	1
Fluttuazioni di tensione /Flicker measurement (full power, 66% and 33% of max. power) ☐ CEI EN 61000-3-3 ☒ CEI EN 61000-3-11	**B.1 Tab. 14 Tab. 15**	Condizioni di riferimento / Reference conditions (20 °C) – **Tab.14**	PASS	1
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B) - **Tab.15**	PASS	1
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab) - **Tab.15**	PASS	1
		Freddo / Cold test CEI EN 60068-2-1 (Test A) - **Tab.15**	PASS	1

B.1.1 Condizioni di connessione, riconnessione ed erogazione graduale della potenza *Connection, re-connection conditions, and gradual increase of the power production*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica delle condizioni di connessione e riconnessione /*Check of the connection and re-connection conditions*	**8.4.1.3 B.1.1.1**	CEI 0-21:2019-04	PASS	1
Verifica della erogazione graduale della potenza attiva /*Check of the gradual increase of the power production*	**8.4.1.3 B.1.1.2**	CEI 0-21:2019-04	PASS	1

B.1.2 Erogazione della potenza reattiva / *Reactive power production (or adsorbtion)*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica dei requisiti costruttivi: capability erogazione della potenza reattiva */ Check of the constructive requirements: reactive power production capability* *Not Applicable for plant with power <800W.*	**8.4.4.2** **B.1.2.1**	CEI 0-21:2019-04	PASS	1
Erogazione di potenza reattiva secondo un livello assegnato */ Reactive power production according to an assigned level* *Applicable for plant with power >11.08KW.*	**B.1.2.3**	CEI 0-21:2019-04	PASS	1
Tempo di risposta ad una variazione a gradino del livello assegnato */Reaction time after a step variation of the assigned level.* *Applicable for plant with power >11.08KW.*	**B.1.2.4**	CEI 0-21:2019-04	PASS	1
Erogazione automatica di potenza reattiva secondo una curva caratteristica cosphi= f(P) */ Automatic reactive power production according to a characteristic curve cos(phi)*	**B.1.2.5** *Annex E* **E.2**	CEI 0-21:2019-04	PASS	1
Erogazione automatica di potenza reattiva secondo una curva caratteristica Q=f(V) */ Automatic reactive power production according to a characteristic curve Q=f(V)* *Applicable for plant with power >11.08KW.*	**B.1.2.6** *Annex E* **E.2.1**	CEI 0-21:2019-04	PASS	1

B.1.3 Limitazione della potenza attiva / *Active power limitation*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Limitazione della potenza attiva per valori di tensione prossimi al 110 % di Un / *Active power limitation for voltage values near to 100 % di Un*	**8.5.3.1 B.1.3.1 Annex F.3**	CEI 0-21:2019-04	PASS	1
Regolazione della potenza attiva in presenza di transitori sulla rete di trasmissione / *Active power regulation in coincidence with transitory on the transmission grid*	**8.5.3.4 B.1.3.2 Annex F.3**	CEI 0-21:2019-04	PASS	1
Verifica del campo di funzionamento in tensione e frequenza /*Check the voltage and frequency operating range*	**8.4.4 B.1.3.3**	CEI 0-21:2019-04	PASS	1
Riduzione della potenza attiva in presenza di transitori di sottofrequenza sulla rete di trasmissione. / *Active power reduction in coincidence with transitory on the transmission grid* *Not mandatory on static generator*	**8.5.3.4 B.1.3.3.1**	CEI 0-21:2019-04	PASS	1
Limitazione della potenza attiva su comando esterno proveniente dal Distributore / *Active power limitation in coincidence with external command coming from the Electricity Distributor* *Not Applicable for plant with power <800W.*	**8.5.3.3 B.1.3.4 Annex F.4**	CEI 0-21:2019-04	PASS	1

B.1.4 Emissione di componente continua nella corrente di uscita / *DC current injection on the output*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica della emissione di componente continua *Check of DC current injection*	**8.4.4.1 B.1.4.1**	Condizioni di riferimento / Reference conditions (20 °C)	PASS	1
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B)	PASS	1
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab)	PASS	1
		Freddo / Cold test CEI EN 60068-2-1 (Test A)	PASS	1
Verifica delle protezioni contro l'immissione di componente continua *Check of protections against the DC current injection.*	**8.4.4.1 B.1.4.2**	Condizioni di riferimento / Reference conditions (20 °C)	PASS	1
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B)	PASS	1
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab)	PASS	1
		Freddo / Cold test CEI EN 60068-2-1 (Test A)	PASS	1

B.1.5 Verifica della insensibilità agli abbassamenti di tensione (LVFRT capability) / ***Check of the LVFRT capability***

Test non accreditato Accredia */Test not Accredia accredited*

Test	Ref. CEI 0-21	Ref. standard	Result	Sample
LVFRT Capability *Applicable for plant with power >11.08KW.*	**8.5.1 B.1.5**	CEI 0-21:2019-04	PASS	1

B.1.6 Verifica della insensibilità alle richiusure automatiche in discordanza di fase / *Check of the insensibility to the re-closures when phases are in discordance*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica della insensibilità alle richiusure automatiche in discordanza di fase */ Check of the insensibility to the re-closures when phases are in discordance*	**B.1.6** ☒ **B.1.6.1** ☐ **B.1.6.2** ☐ **B.1.6.3**	CEI 0-21:2019-04	PASS	1

Allegato B: Prove di compatibilità EMC				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Compatibilità elettromagnetica /Electromagnetic compatibility	**Annex B**	CEI EN 61000-6-3 CEI EN 61000-6-2	PASS	Note 2)

Note 2) Please refer to EMC report no. 50353262 001, issued by TÜV Rheinland (Shanghai) Co., Ltd.

Allegato B bis: Prove sui sistemi di accumulo
/ Annex Bbis: Tests on Energy storage systems

Bbis.3 Prove sull'inverter / inverter tests				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Scalarità e modularità: /Scalability and modularity ☐ Case A ☒ Case B ☐ Case C ☐ Case D *Not Applicable for plant with power <800W.*	**Bbis.2.2**	CEI 0-21:2019-04	PASS	2, 3, 4
Armoniche di corrente /Harmonics measurement (full power, 66% and 33% of Ps_{max}) (full power, 66% and 33% of Pc_{max} *only for bidirectional converters*) ☐ CEI EN 61000-3-2 ☒ CEI EN 61000-3-12	**Bbis.3** **Tab. 2Bbis** **Tab. 3Bbis**	Condizioni di riferimento / Reference conditions (20 °C) – **Tab.2Bbis**	PASS	2, 3, 4
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B) - **Tab.3Bbis**	PASS	2, 3, 4
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab) - **Tab.3Bbis**	PASS	2, 3, 4
		Freddo / Cold test CEI EN 60068-2-1 (Test A) - **Tab.3Bbis**	PASS	2, 3, 4
Fluttuazioni di tensione /Flicker measurement (full power, 66% and 33% of Ps_{max}) (full power, 66% and 33% of Pc_{max} *only for bidirectional converters*) ☐ CEI EN 61000-3-3 ☒ CEI EN 61000-3-11	**Bbis.3** **Tab. 2Bbis** **Tab. 3Bbis**	Condizioni di riferimento / Reference conditions (20 °C) – **Tab.2Bbis**	PASS	2, 3, 4
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B) - **Tab.3Bbis**	PASS	2, 3, 4
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab) - **Tab.3Bbis**	PASS	2, 3, 4
		Freddo / Cold test CEI EN 60068-2-1 (Test A) - **Tab.3Bbis**	PASS	2, 3, 4

Bbis.4 Verifica del campo di funzionamento in tensione e frequenza ***Check the operating range in voltage and frequency***				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica del campo di funzionamento /*Check the operating range*	**Bbis.4**	CEI 0-21:2019-04	PASS	2, 3, 4

Bbis.5 Condizioni di connessione, riconnessione ed erogazione graduale della potenza *Connection, re-connection conditions, and gradual increase of the power production*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica delle condizioni di connessione e riconnessione */Check of the connection and re-connection conditions*	**8.4.1.3 Bbis.5.1**	CEI 0-21:2019-04	PASS	2, 3, 4
Verifica della erogazione graduale della potenza attiva */Check of the gradual increase of the power production*	**8.4.1.3 Bbis.5.2**	CEI 0-21:2019-04	PASS	2, 3, 4

Bbis.6 Erogazione della potenza reattiva / ***Reactive power production (or adsorbtion)***				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica dei requisiti costruttivi: capability erogazione della potenza reattiva */ Check of the constructive requirements: reactive power production capability*	**Bbis.6.1**	CEI 0-21:2019-04	PASS	2, 3, 4
Erogazione di potenza reattiva secondo un livello assegnato */ Reactive power production according to an assigned level* *Applicable for plant with power >11.08KW.*	**Bbis.6.3**	CEI 0-21:2019-04	PASS	2, 3, 4
Tempo di risposta ad una variazione a gradino del livello assegnato */Reaction time after a step variation of the assigned level.* *Applicable for plant with power >11.08KW.*	**Bbis.6.5**	CEI 0-21:2019-04	PASS	2, 3, 4
Erogazione automatica di potenza reattiva secondo una curva caratteristica cosphi= f(P) */ Automatic reactive power production according to a characteristic curve cos(phi)*	**Bbis.6.6** *Annex E* **E.2**	CEI 0-21:2019-04	PASS	2, 3, 4
Erogazione automatica di potenza reattiva secondo una curva caratteristica Q=f(V) */ Automatic reactive power production according to a characteristic curve Q=f(V)* *Applicable for plant with power >11.08KW.*	**Bbis.6.8** *Annex E* **E.2.1**	CEI 0-21:2019-04	PASS	2, 3, 4

Bbis.7 Limitazione della potenza attiva / *Active power limitation*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Limitazione della potenza attiva per valori di tensione prossimi al 110 % di Un / *Active power limitation for voltage values near to 100 % di Un*	**8.5.3.1 Bbis.7.1 Annex F.3**	CEI 0-21:2019-04	PASS	2, 3, 4
Regolazione della potenza attiva in presenza di transitori di sovrafrequenza sulla rete di trasmissione / *Active power regulation in coincidence with transitory on the transmission grid*	**8.5.3.4 Bbis.7.2 Annex F.3**	CEI 0-21:2019-04	PASS	2, 3, 4
Riduzione della potenza attiva in presenza di transitori di sottofrequenza sulla rete di trasmissione. / *Active power reduction in coincidence with transitory on the transmission grid*	**8.5.3.4 Bbis.7.3**	CEI 0-21:2019-04	PASS	2, 3, 4
Limitazione della potenza attiva su comando esterno proveniente dal Distributore / *Active power limitation in coincidence with external command coming from the Electricity Distributor*	**Bbis7.4**	CEI 0-21:2019-04	PASS	2, 3, 4
Verifica del tempo di assestamento ad un comando di incremento/riduzione di potenza / *Check settling time with command to increase/decrease of power*	**Bbis7.4.1**	CEI 0-21:2019-04	PASS	2, 3, 4

Bbis.8 Emissione di componente continua nella corrente di uscita ***/ DC current injection on the output***				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica della emissione di componente continua ***/Check of DC current injection***	**Bbis.8.1**	Condizioni di riferimento / Reference conditions (20 °C)	PASS	2, 3, 4
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B)	PASS	2, 3, 4
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab)	PASS	2, 3, 4
		Freddo / Cold test CEI EN 60068-2-1 (Test A)	PASS	2, 3, 4
Verifica delle protezioni contro l'immissione di componente continua ***/ Check of protections against the DC current injection.***	**Bbis.8.2**	Condizioni di riferimento / Reference conditions (20 °C)	PASS	2, 3, 4
		Caldo secco / Dry heat test CEI EN 60068-2-2 (Test B)	PASS	2, 3, 4
		Umidità / Humidity test CEI EN 60068-2-78 (Test Cab)	PASS	2, 3, 4
		Freddo / Cold test CEI EN 60068-2-1 (Test A)	PASS	2, 3, 4

Bbis.9 Verifica della insensibilità agli abbassamenti di tensione (LVFRT capability) ***/ Check of the LVFRT capability*** **Test non accreditato Accredia** */Test not Accredia accredited*				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
LVFRT Capability *Applicable for plant with power >11.08KW.*	**8.5.1 Bbis.9**	CEI 0-21:2019-04	PASS	2, 3, 4

Bbis.10 Verifica della insensibilità alle richiusure automatiche in discordanza di fase ***/ Check of the insensibility to the re-closures when phases are in discordance***				
Test	**Ref. CEI 0-21**	**Ref. standard**	**Result**	**Sample**
Verifica della insensibilità alle richiusure automatiche in discordanza di fase */ Check of the insensibility to the re-closures when phases are in discordance*	**Bbis.10** ☒ **Bbis.10.1** ☐ **Bbis.10.2** ☐ **Bbis.10.3**	CEI 0-21:2019-04	PASS	2, 3, 4

TESTING RESULTS

Allegato A: Caratteristiche e prove per il Sistema di Protezione di Interfaccia (SPI)
Annex A: Requirements and test for Interface Protection System (SPI)

Prove funzionali sull'SPI */Functional test on SPI*

A.4.3 **A.4.3.1** **A.4.3.2** **A.4.7** (limit conditions)	**TABLE: Prove funzionali sull'SPI** */Functional test on SPI*	P

Ambient temperature (°C) ..... :	20°C ± 2°C
Humidity (RH %) ..... :	35% - 75% RH
Instrumentation list ..... :	See table "Measurement equipment and instrumentation"
Uncertainty ..... :	See Table "Testing Methods"
Condizioni di riferimento / Reference conditions	**Temperature test: 20°C ± 2°C**

Tabella 8 – Regolazioni del SPI (ad esclusione degli impianti di potenza inferiore a 800 W)

Protezione	Soglia di intervento	Tempo di intervento (tempo intercorrente tra l'istante di inizio della condizione anomala rilevata dalla protezione e l'emissione del comando di scatto)
Massima tensione (59.S1, misura a media mobile su 10 min, in accordo a CEI EN 61000-4-30)	1,10 Vn	Variabile in funzione del valore iniziale e finale di tensione, al massimo 603 s.
Massima tensione (59.S2)	1,15 Vn	0,2 s
Minima tensione (27.S1)	0,85 Vn	1,5 s
Minima tensione (27.S2) *	0,15 Vn	0,2 s
Massima frequenza (81>.S1)** ◊	50,2 Hz	0,1 s
Minima frequenza (81<.S1)** ◊	49,8 Hz	0,1 s
Massima frequenza (81>.S2) ◊	51,5 Hz	0,1 s oppure 1 s §
Minima frequenza (81<.S2) ◊	47,5 Hz	0,1 s oppure 4 s §

* Il valore indicato per il tempo di intervento deve essere adottato quando la potenza complessiva è superiore a 11,08 kW, mentre per potenze inferiori, può essere facoltativamente utilizzato un tempo di intervento senza ritardo intenzionale. Nel caso di generatori sincroni, il valore può essere innalzato a 0,7 Un e t = 0.150 s

** Soglia abilitata solo con segnale esterno al valore alto e con comando locale alto.

◊ Per valori di tensione al di sotto di 0,2 Vn, la protezione di massima/minima frequenza si deve inibire.

§ Si veda in proposito quanto riportato nel testo che segue la Fig. 15.

Tabella 8a – Regolazioni del SPI negli impianti di potenza inferiore a 800 W

Protezione	Soglia di intervento	Tempo di intervento (tempo intercorrente tra l'istante di inizio della condizione anomala rilevata dalla protezione e l'emissione del comando di scatto)
Massima tensione (59.S2)	1,15 Vn	0,2 s
Minima tensione (27.S1)	0,80 Vn	0,4 s
Massima frequenza (81>.S1)	51,5 Hz	0,1 s
Minima frequenza (81<.S1)	47,5 Hz	0,1 s

Tab. 1

Supplementary information:

Operator ..... :	See cover page
Supervisor ..... :	See cover page
Test Date..... :	See cover page

TABLE: Prove funzionali sull'SPI
/Functional test on SPI

Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento Worst case		Tempo di intervento Worst case	
Frequency	Misurato	Limite	Misurato	Limite	Misurato	Limite	Misurato	Limite
Phase A	[Hz]	[Hz]	[ms]	[ms]	[Hz]	[Hz]	[ms]	[ms]
[81<S2] Minima	47.49	47.50	110.0	100	47.5	47.50	100	100
	47.49		93.0					
	47.49		111.0					
[81>S2] Massima	51.52	51.50	94.0	100	51.5	51.50	100	100
	51.52		110.0					
	51.52		103.0					
Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento		Tempo di intervento	
Voltage	Misurato	Limite	Misurato	Limite	Misurato	Limite	Misurato	Limite
Phase A	[V]	[V]	[ms]	[ms]	[V]	[V]	[ms]	[ms]
[59.S1] Massima	253.0	1.10Vn 253.0	596300	≤ 603000	253.0	1.10Vn 253.0	603000	≤ 603000
	253.0		599200					
	253.0		597000					
[59.S2] Massima	263.2	1.15Vn 264.5	201.0	200	264.5	1.15Vn 264.5	200	200
	263.3		212.0					
	263.1		210.0					
[27.S1] Minima	195.4	0.85Vn 195.5	1490.0	1500	195.5	0.85Vn 195.5	1500	1500
	195.4		1508.0					
	195.4		1490.0					
[27.S2] Minima	34.4	0.15Vn 34.5	184.5	200	34.5	0.15Vn 34.5	200	200
	34.6		183.0					
	34.6		187.0					

TABLE: Prove funzionali sull'SPI
/Functional test on SPI

A 4.3.3.3 SEGNALE DI COMUNICAZIONE */ Signal of communication*								
Protection	**Soglie di intervento**		**Tempo di intervento**		**Soglie di intervento**		**Tempo di intervento**	
Frequency	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**
	[Hz]	**[Hz]**	**[ms]**	**[ms]**	**[Hz]**	**[Hz]**	**[ms]**	**[ms]**
Modalità Transitoria								
[81<S1] Minima	49.80	**49.80**	81.8	**100**	49.80	**49.80**	100	**100**
	49.80		89.8					
	49.80		85.8					
[81>S1] Massima	50.21	**50.20**	87.6	**100**	50.20	**50.20**	100	**100**
	50.21		83.8					
	50.21		87.4					
[81<S2] Minima	47.50	**47.50**	93.5	**100**	47.50	**47.50**	100	**100**
	47.50		94.0					
	47.50		80.2					
[81>S2] Massima	51.50	**51.50**	80.0	**100**	51.50	**51.50**	100	**100**
	51.50		83.2					
	51.50		82.8					
Modalità Definitiva								
[81<S2] Minima	47.49	**47.50**	3950.0	**4000**	47.50	**47.50**	4000	**4000**
	47.49		3930.0					
	47.49		3940.0					
[81>S2] Massima	51.51	**51.50**	990.0	**1000**	51.50	**51.50**	1000	**1000**
	51.51		992.0					
	51.51		998.0					

A.4.3 **A.4.3.1** **A.4.3.2** **A.4.7** (limit conditions))	**TABLE: Prove funzionali sull'SPI** / *Functional test on SPI*	P

Ambient temperature (°C) .....:	20°C ± 2°C
Humidity (RH %) .....:	35% - 75% RH
Instrumentation list .....:	See table "Measurement equipment and instrumentation"
Uncertainty .....:	See Table "Testing Methods"
Caldo secco */Dry heat test*	**Temperature test: +55 °C ± 2°C**

Supplementary information:	
Operator ..... :	see cover page.
Supervisor ..... :	see cover page.
Test Date..... :	see cover page.

TABLE: Prove funzionali sull'SPI
/Functional test on SPI

Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento Worst case		Tempo di intervento Worst case	
Frequency	Misurato	Limite	Misurato	Limite	Misurato	Limite	Misurato	Limite
	[Hz]	[Hz]	[ms]	[ms]	[Hz]	[Hz]	[ms]	[ms]
[81<S2] Minima	47.50	47.50	81.8	100	47.5	47.50	100	100
	47.49		86.4					
	47.49		81.6					
[81>S2] Massima	51.52	51.50	88.6	100	51.5	51.50	100	100
	51.52		82.0					
	51.52		81.0					
Protection	**Soglie di intervento**		**Tempo di intervento**		**Soglie di intervento**		**Tempo di intervento**	
Voltage	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**
Phase A	**[V]**	**[V]**	**[ms]**	**[ms]**	**[V]**	**[V]**	**[ms]**	**[ms]**
[59.S1] Massima	253.1	1.10Vn 253.0	600000	≤ 603000	253.0	1.10Vn 253.0	603000	≤ 603000
	253.1		600000					
	253.3		600000					
[59.S2] Massima	263.1	1.15Vn 264.5	168.0	200	264.5	1.15Vn 264.5	200	200
	263.0		196.0					
	263.0		186.0					
[27.S1] Minima	195.4	0.85Vn 195.5	1446.0	1500	195.5	0.85Vn 195.5	1500	1500
	195.4		1480.0					
	195.4		1490.0					
[27.S2] Minima	34.4	0.15Vn 34.5	188.0	200	34.5	0.15Vn 34.5	200	200
	34.3		196.0					
	34.2		184.0					

A.4.3 **A.4.3.1** **A.4.3.2** **A.4.7** (limit conditions))	**TABLE: Prove funzionali sull'SPI** / *Functional test on SPI*	P

Ambient temperature (°C) .....:	20°C ± 2°C
Humidity (RH %) .....:	35% - 75% RH
Instrumentation list .....:	See table "Measurement equipment and instrumentation"
Uncertainty .....:	See Table "Testing Methods"
Caldo Umido / *Cabt test*	**Temperature test: +40 °C± 2°C** **Humidity: 93 %± 3% RH**

Supplementary information:	
Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

TABLE: Prove funzionali sull'SPI
/Functional test on SPI

Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento Worst case		Tempo di intervento Worst case	
Frequency	Misurato	Limite	Misurato	Limite	Misurato	Limite	Misurato	Limite
	[Hz]	[Hz]	[ms]	[ms]	[Hz]	[Hz]	[ms]	[ms]
[81<S2] Minima	47.51	47.50	95.4	100	47.5	47.50	100	100
	47.52		92.2					
	47.51		88.6					
[81>S2] Massima	51.48	51.50	82.2	100	51.5	51.50	100	100
	51.47		87.4					
	51.48		77.6					
Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento		Tempo di intervento	
Voltage	Misurato	Limite	Misurato	Limite	Misurato	Limite	Misurato	Limite
Phase A	[V]	[V]	[ms]	[ms]	[V]	[V]	[ms]	[ms]
[59.S1] Massima	253.2	1.10Vn 253.0	600000	≤ 603000	253.0	1.10Vn 253.0	603000	≤ 603000
	253.2		600000					
	253.2		601000					
[59.S2] Massima	264.3	1.15Vn 264.5	187.0	200	264.5	1.15Vn 264.5	200	200
	264.4		183.0					
	264.3		191.0					
c[27.S1] Minima	195.7	0.85Vn 195.5	1442	1500	195.5	0.85Vn 195.5	1500	1500
	195.6		1436					
	195.5		1428					
[27.S2] Minima	34.4	0.15Vn 34.5	186.0	200	34.5	0.15Vn 34.5	200	200
	34.3		184.0					
	34.3		185.0					

A.4.3 **A.4.3.1** **A.4.3.2** **A.4.7** (limit conditions))	**TABLE: Prove funzionali sull'SPI** / *Functional test on SPI*	P

Ambient temperature (°C) .....:	20°C ± 2°C
Humidity (RH %) .....:	35% - 75% RH
Instrumentation list .....:	See table "Measurement equipment and instrumentation"
Uncertainty .....:	See Table "Testing Methods"
Freddo / *Cold test*	**Temperature test: -10 °C ± 2°C**

Supplementary information:	
Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

TABLE: Prove funzionali sull'SPI
/Functional test on SPI

Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento Worst case		Tempo di intervento Worst case	
Frequency	Misurato	Limite	Misurato	Limite	Misurato	Limite	Misurato	Limite
	[Hz]	[Hz]	[ms]	[ms]	[Hz]	[Hz]	[ms]	[ms]
[81<S2] Minima	47.50	47.50	90.2	100	47.5	47.50	100	100
	47.49		83.8					
	47.49		87.8					
[81>S2] Massima	51.52	51.50	81.2	100	51.5	51.50	100	100
	51.52		81.6					
	51.52		88.8					
Protection	**Soglie di intervento**		**Tempo di intervento**		**Soglie di intervento**		**Tempo di intervento**	
Voltage	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**
Phase A	**[V]**	**[V]**	**[ms]**	**[ms]**	**[V]**	**[V]**	**[ms]**	**[ms]**
[59.S1] Massima	253.5	1.10Vn 253.0	600000	≤ 603000	253.0	1.10Vn 253.0	603000	≤ 603000
	253.4		600000					
	253.2		600000					
[59.S2] Massima	263.8	1.15Vn 264.5	188.0	200	264.5	1.15Vn 264.5	200	200
	263.9		183.0					
	264.1		181.0					
[27.S1] Minima	195.4	0.85Vn 195.5	1422.0	1500	195.5	0.85Vn 195.5	1500	1500
	195.3		1426.0					
	195.4		1436.0					
[27.S2] Minima	31.7	0.15Vn 34.5	185.0	200	34.5	0.15Vn 34.5	200	200
	31.6		183.0					
	31.9		195.0					

A.4.3 **A.4.3.1** **A.4.3.2** **A.4.7** (limit conditions))	**TABLE: Prove funzionali sull'SPI** / *Functional test on SPI*	P

Ambient temperature (°C) ..... :	20°C ± 2°C
Humidity (RH %) ..... :	35% - 75% RH
Instrumentation list ..... :	See table "Measurement equipment and instrumentation"
Uncertainty ..... :	See Table "Testing Methods"
Cambio di temperatura / *Change of temperature*	**Temperature test: -10 °C / +55 °C ± 2°C**

Supplementary information:	
Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

TABLE: Prove funzionali sull'SPI
/Functional test on SPI

Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento Worst case		Tempo di intervento Worst case	
Frequency	Misurato	Limite	Misurato	Limite	Misurato	Limite	Misurato	Limite
	[Hz]	[Hz]	[ms]	[ms]	[Hz]	[Hz]	[ms]	[ms]
[81<S2] Minima	47.50	47.50	84.6	100	47.5	47.50	100	100
	47.50		95.6					
	47.50		80.8					
[81>S2] Massima	51.52	51.50	87.8	100	51.5	51.50	100	100
	51.52		81.0					
	51.52		87.4					
Protection	**Soglie di intervento**		**Tempo di intervento**		**Soglie di intervento**		**Tempo di intervento**	
Voltage	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**
Phase A	**[V]**	**[V]**	**[ms]**	**[ms]**	**[V]**	**[V]**	**[ms]**	**[ms]**
[59.S1] Massima	253.2	1.10Vn 253.0	551000	≤ 603000	253.0	1.10Vn 253.0	603000	≤ 603000
	253.2		555000					
	253.2		556000					
[59.S2] Massima	263.7	1.15Vn 264.5	186.0	200	264.5	1.15Vn 264.5	200	200
	263.2		185.0					
	263.5		181.0					
[27.S1] Minima	193.0	0.85Vn 195.5	1442.0	1500	195.5	0.85Vn 195.5	1500	1500
	192.9		1436.0					
	193.2		1434.0					
[27.S2] Minima	31.6	0.15Vn 34.5	187.0	200	34.5	0.15Vn 34.5	200	200
	32.3		181.0					
	31.5		185.0					

Figure: Prove funzionali sull'SPI
/Functional test on SPI

[59.S1] Massima tensione OV1 – 110% Vn – Trip Time

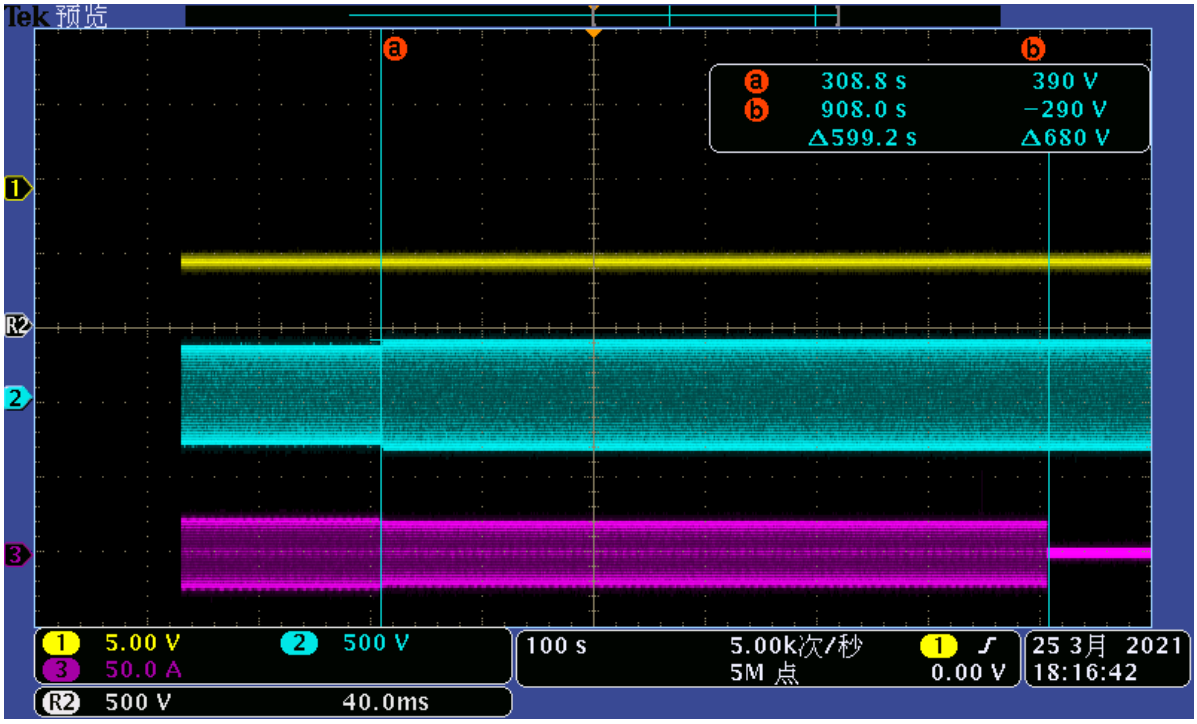


Figure: Prove funzionali sull'SPI
/Functional test on SPI

[59.S2] Massima tensione OV2 – 115% Vn – Trip Time

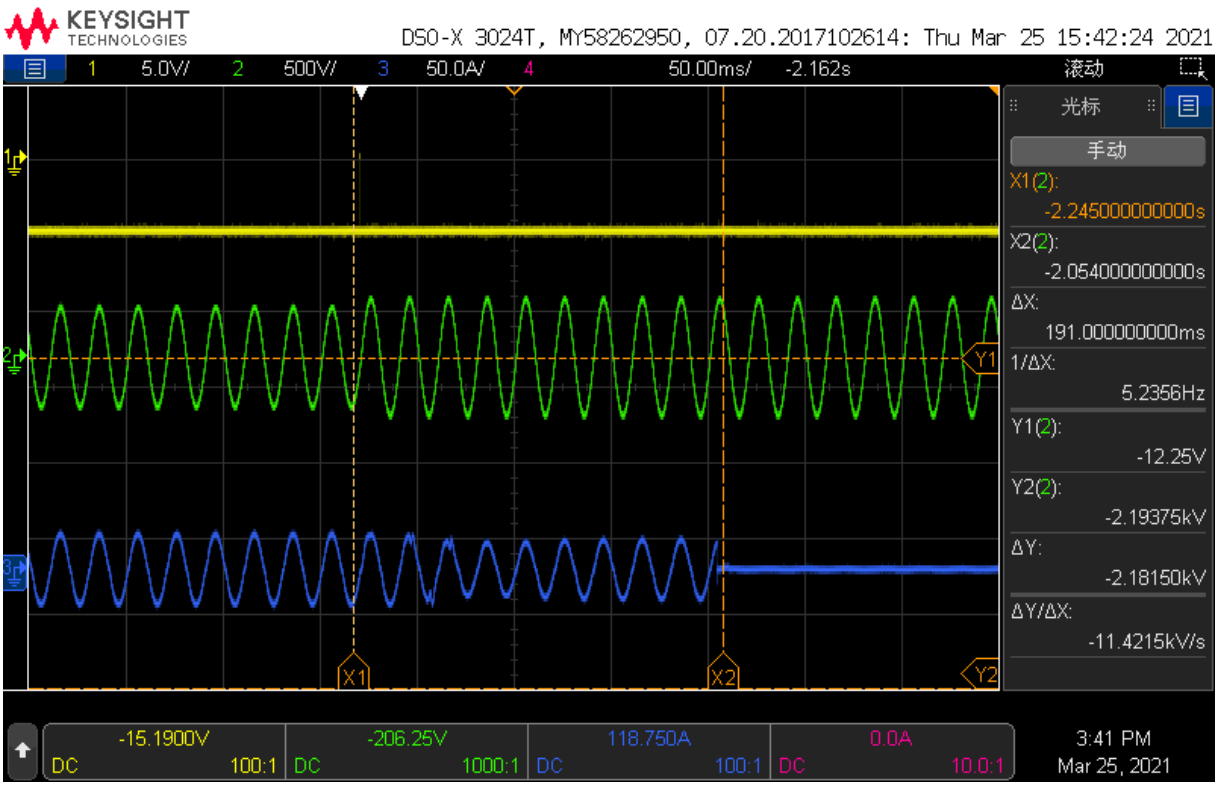


Figure: Prove funzionali sull'SPI
/Functional test on SPI

[27.S1] Minima tensione OV1 – 85% Vn – Trip Time

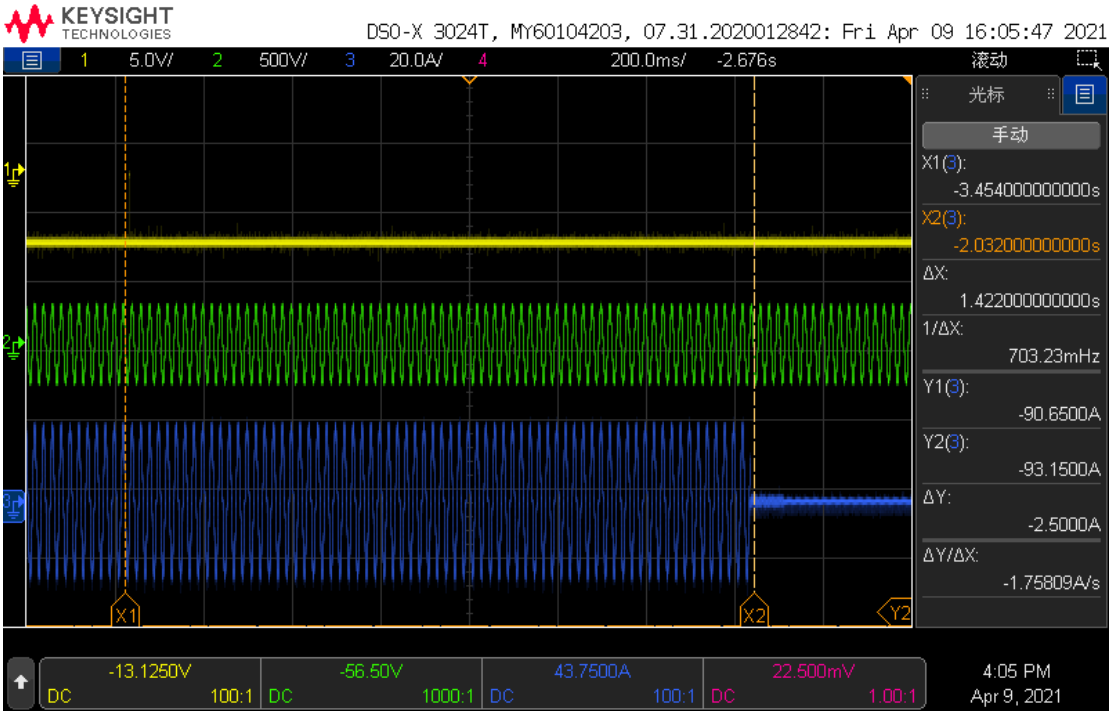


Figure: Prove funzionali sull'SPI
/Functional test on SPI

[27.S2] Minima tensione OV2 – 15% Vn – Trip Time

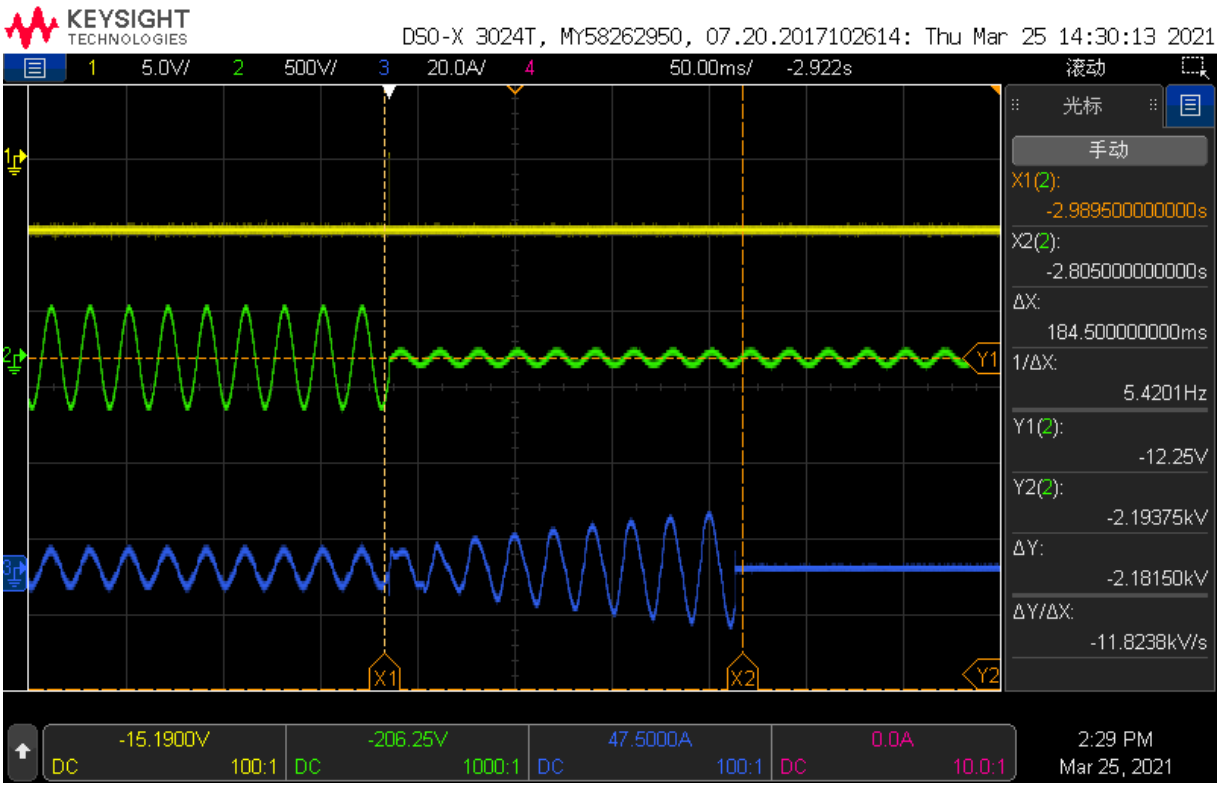


Figure: Prove funzionali sull'SPI
/Functional test on SPI

[81>S1] Massima frequenza OF1 – 50.20 Hz – Trip Time

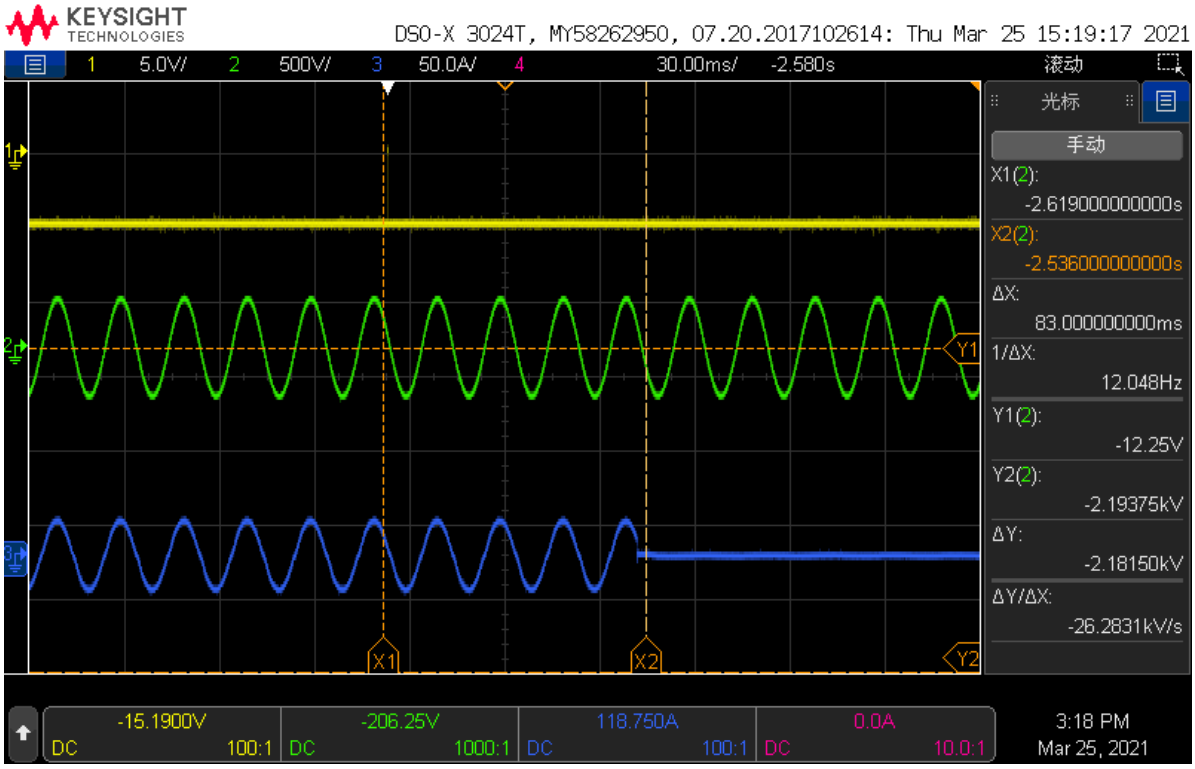


Figure: Prove funzionali sull'SPI
/Functional test on SPI

[81<S1] Minima frequenza UF1 – 49.80 Hz – Trip Time

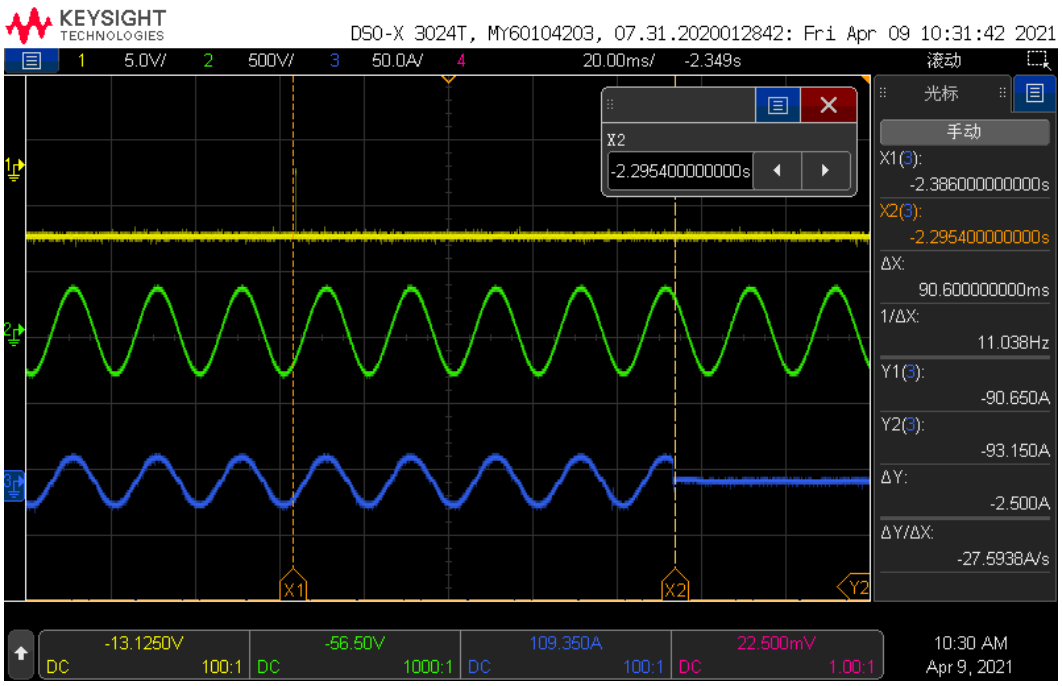


Figure: Prove funzionali sull'SPI
/Functional test on SPI

[81>S2] Massima frequenza OF2 – 51.50 Hz – Trip Time

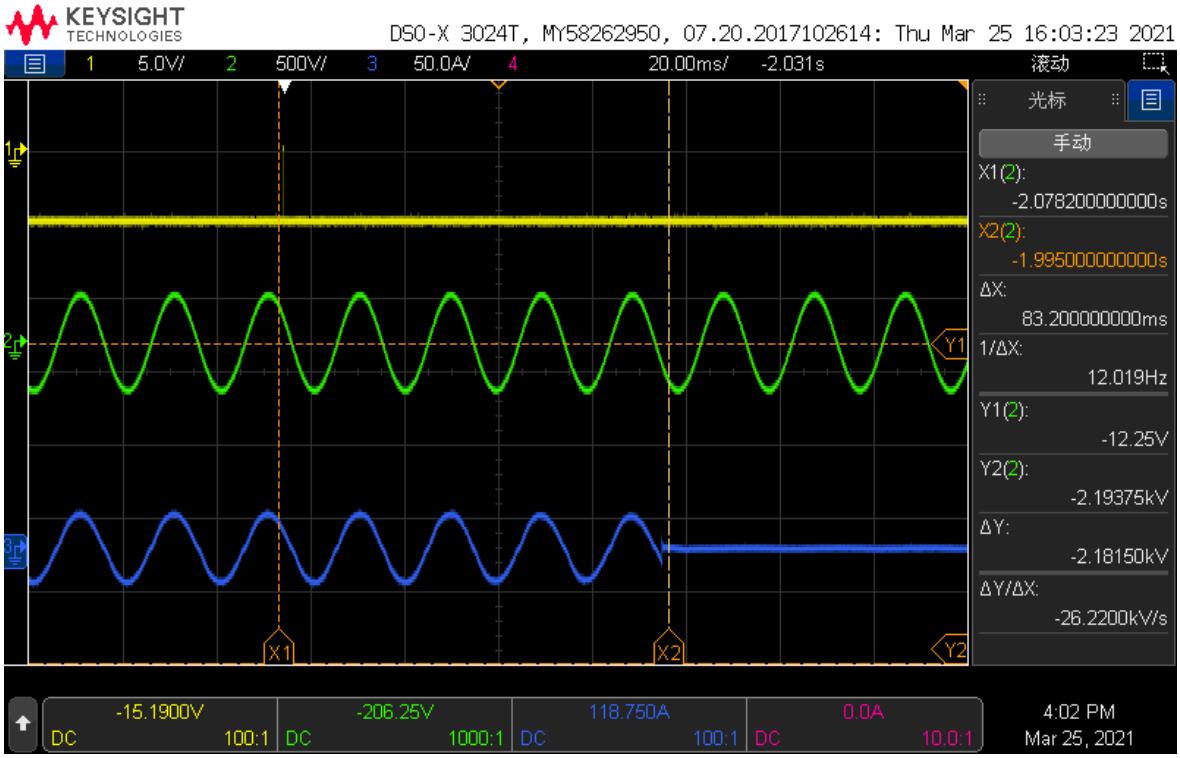
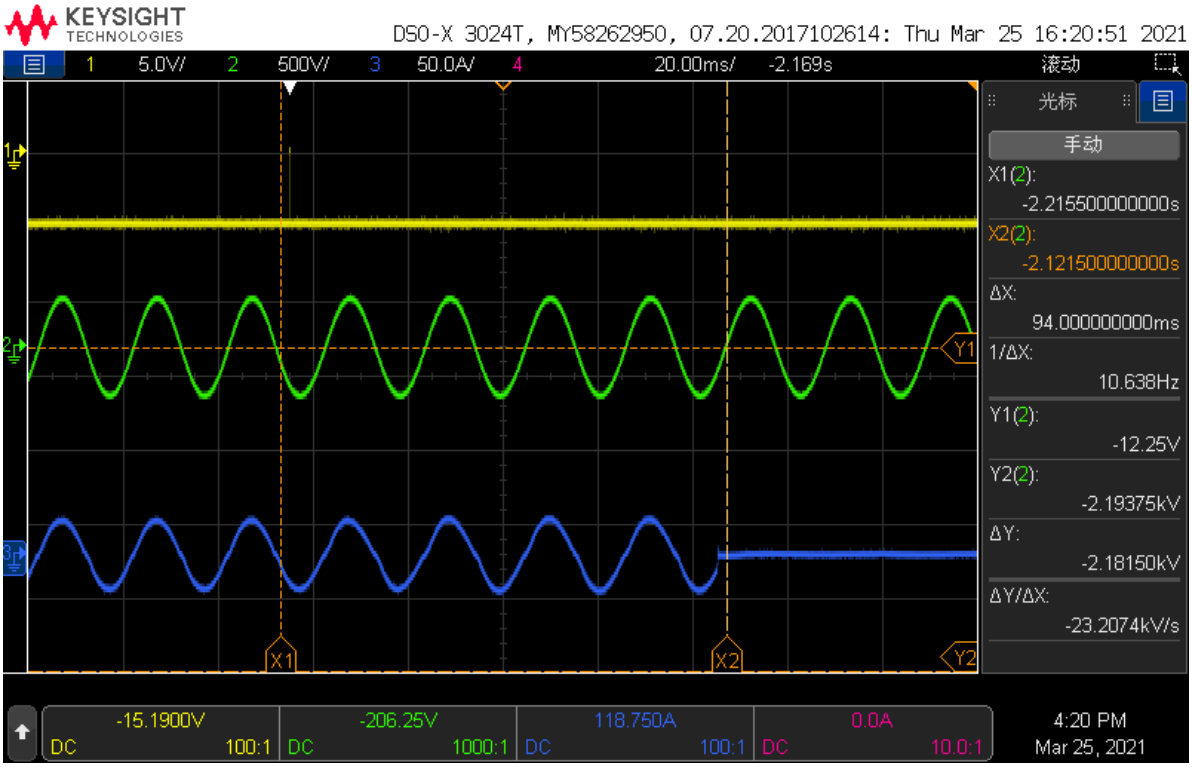


Figure: Prove funzionali sull'SPI
/Functional test on SPI

[81<S1] Minima frequenza UF2 – 47.50 Hz – Trip Time



Prescrizioni aggiuntive per le prove funzionali */Additional requirements of the functional test*

A.4.3.3.1	**TABLE: Insensibilità delle armoniche del relè di frequenza** */ Immunity at the harmonics of frequency relay*	P

Ambient temperature (°C) .....:	20°C ± 2°C
Humidity (RH %) .....:	35% - 75% RH
Instrumentation list .....:	See table "Measurement equipment and instrumentation"
Uncertainty .....:	See table

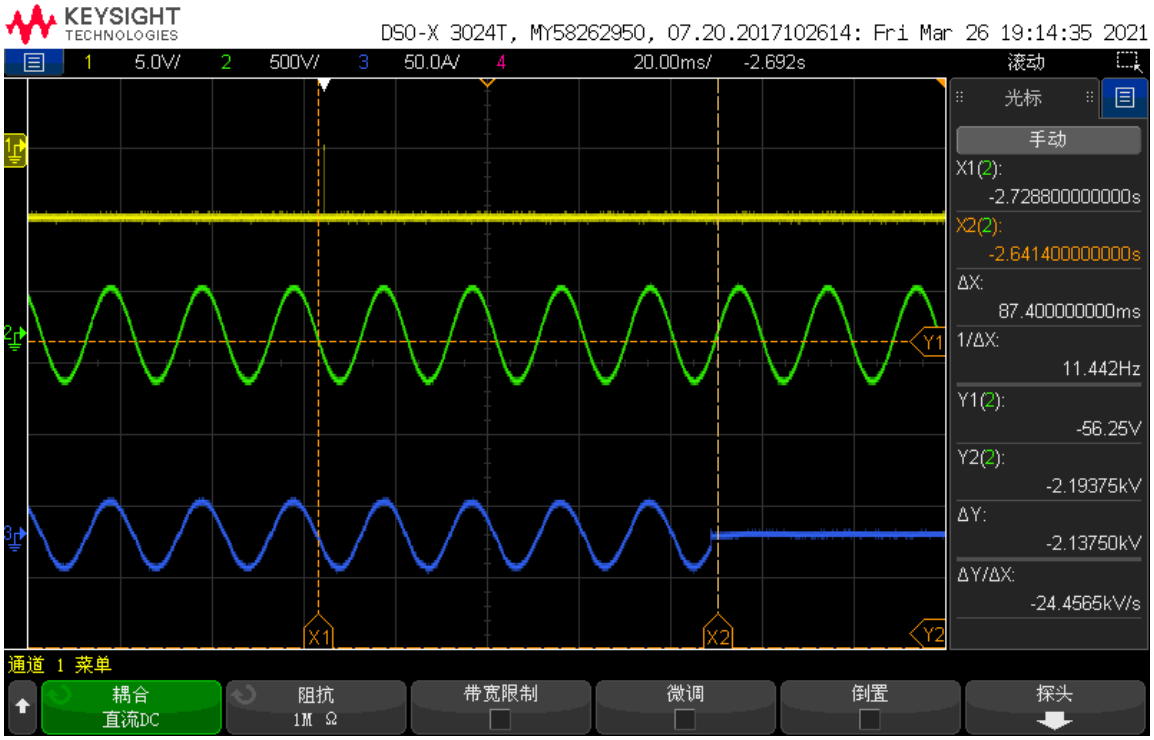
Supplementary Information:	
Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Protection	Soglie di intervento		Tempo di intervento		Soglie di intervento		Tempo di intervento	
Frequency	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**	**Misurato**	**Limite**
	[Hz]	**[Hz]**	**[ms]**	**[ms]**	**[Hz]**	**[Hz]**	**[ms]**	**[ms]**
[81<S2] Minima	47.50	**47.50**	86.6	**100 (4000)**	47.5	**47.50**	100	**100 (4000)**
	47.50		85.0					
	47.50		99.5					
[81>S2] Massima	51.50	**51.50**	80.8	**100 (1000)**	51.5	**51.50**	100	**100 (1000)**
	51.50		81.8					
	51.50		87.4					

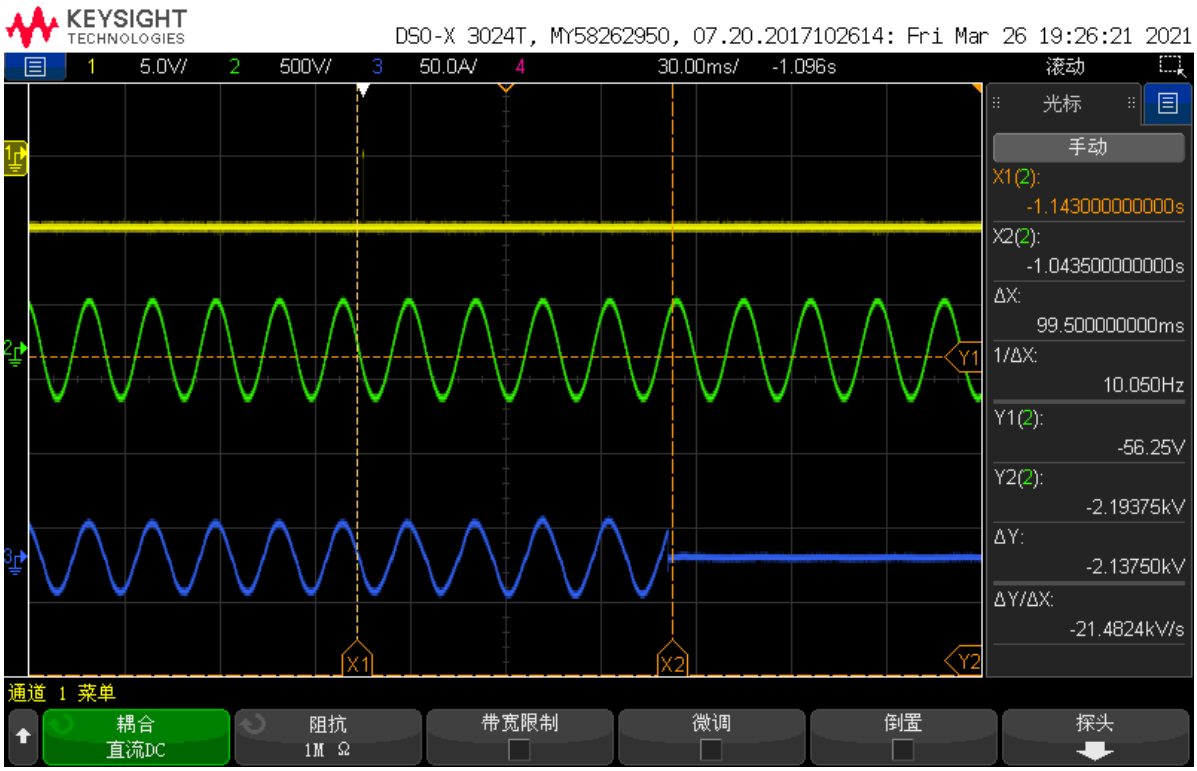
Grafico: Test di insensibilità delle armoniche del relè di frequenza

/ Graph: Immunity test at the harmonics of frequency relay

[81>S2] Massima frequenza OF2 – 51.50 Hz – Trip Time



[81<S1] Minima frequenza UF2 – 47.50 Hz – Trip Time



A.4.3.3.2	**TABLE: Segnale di telescatto** / *Signal of Telescatto*	P
Ambient temperature (°C) .....:	20°C ± 2°C	
Humidity (RH %) .....:	35% - 75% RH	
Instrumentation list .....:	See table “Measurement equipment and instrumentation”	
Uncertainty .....:	See table	

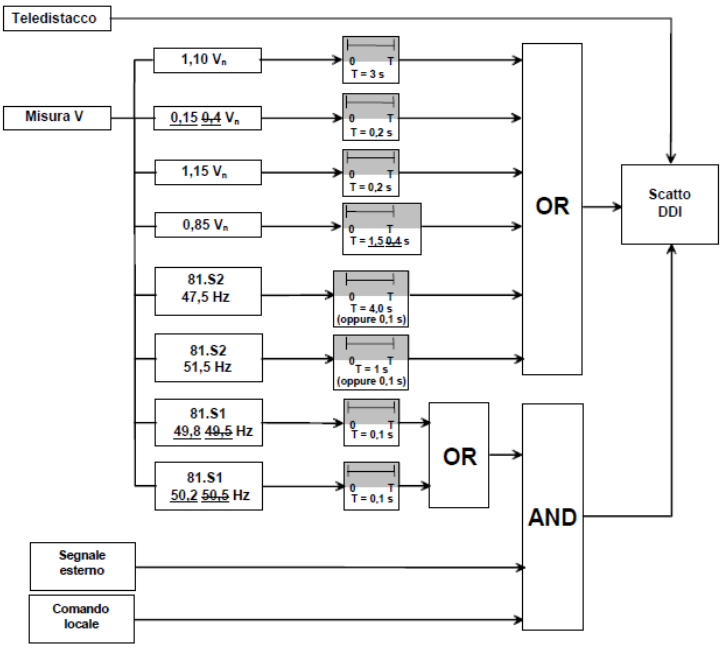


Figura 15 – Schema logico funzionale del SPI dei parchi di generazione (i valori tra parentesi si riferiscono alla modalità transitoria di funzionamento del SPI)

Functional Logic Scheme of the SPI

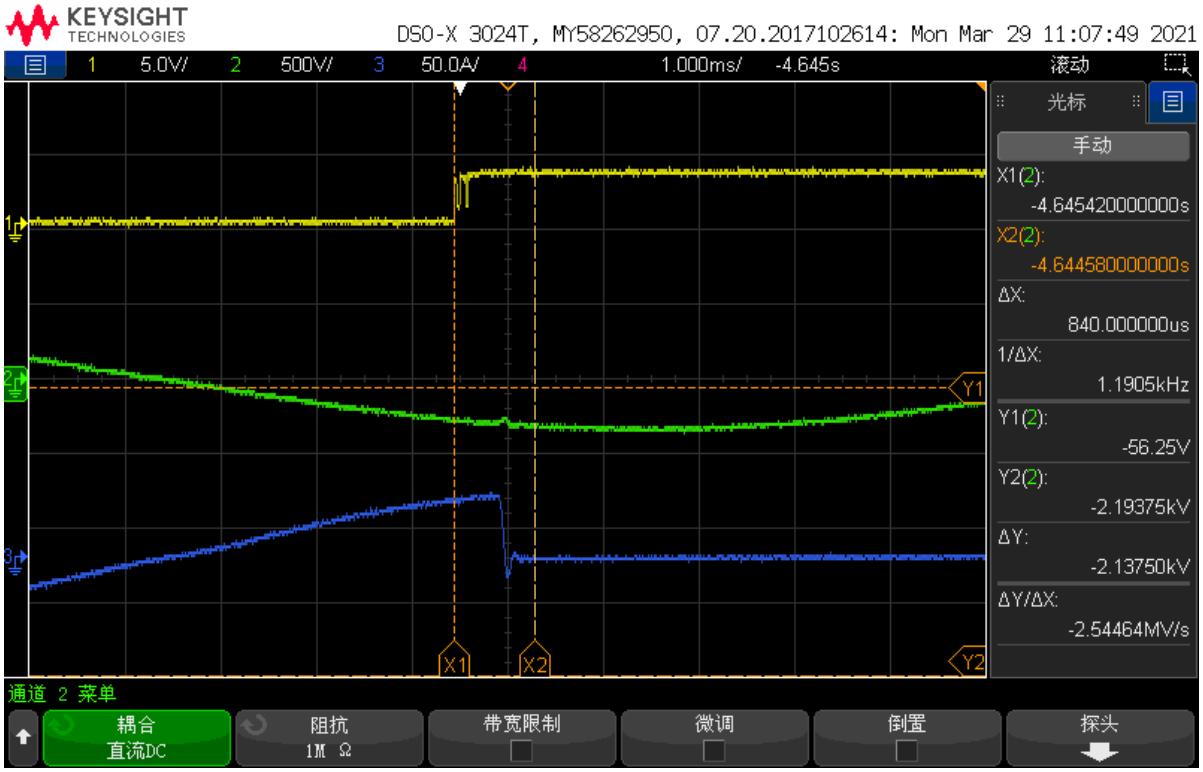
Supplementary Information:

The control command signal was injected from the RS485 port by PC.

Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Signal	Tempo di intervento	
	Misurato	Limite
	[ms]	[ms]
Telestacco	0.84	50

Trip Time Waveform (Oscilloscope)



A.4.3.3.3	**TABLE: Segnale di telecomunicazione** / *Signal of Telecommunication*	P
Ambient temperature (°C) .....:	20°C ± 2°C	
Humidity (RH %) .....:	35% - 75% RH	
Instrumentation list .....:	See table "Measurement equipment and instrumentation"	
Uncertainty .....:	See table	

Supplementary Information:

The control command signal was injected from the RS485 port by PC, then the control signal has be received by internal DSP for detection and process the telecominication control logic.

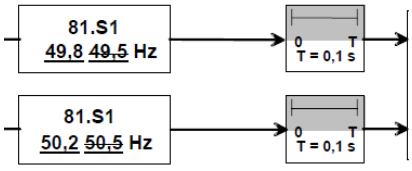
See the table of functional test on SPI where are been reported the threshold and trip time test in according to Transitory and Definitive Mode.

Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

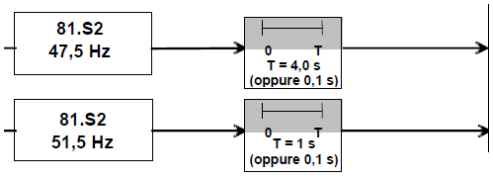
Signal	Status	Disconnection for 81<S2 or 81>S2 [Y / N]	Result [Y / N]
Telecomunicazione	Attendance	Y	Y
	Non-Attendance	N	N

Procedure:

- Telecominication Signal Non-Attendace → disconnection for **81<S1 or 81>S1**
  Set the frequency closed to 81<S1 or 81>S1



- Telecominication Signal Attendace → disconnection for **81<S2 or 81>S2**
  Set the frequency closed to 81<S2 or 81>S2



A.4.3.4	**TABLE: Verifica di insensibilità alla derivata di frequenza (ROCOF)** */ Check of immunity at the frequency derived (ROCOF)*	P

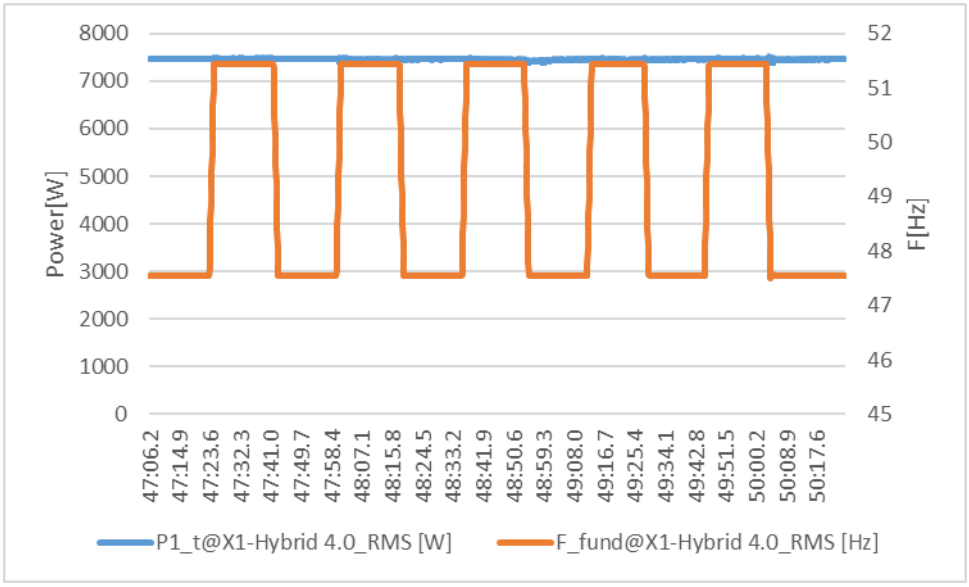
Ambient temperature (°C) .....:	20°C ± 2°C
Humidity (RH %) .....:	35% - 75% RH
Instrumentation list .....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table

Supplementary Information:	
Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Grafico: Test verifica di insensibilità alla derivata di frequenza (ROCOF)

/ Graph: Check of immunity test at the frequency derived (ROCOF)

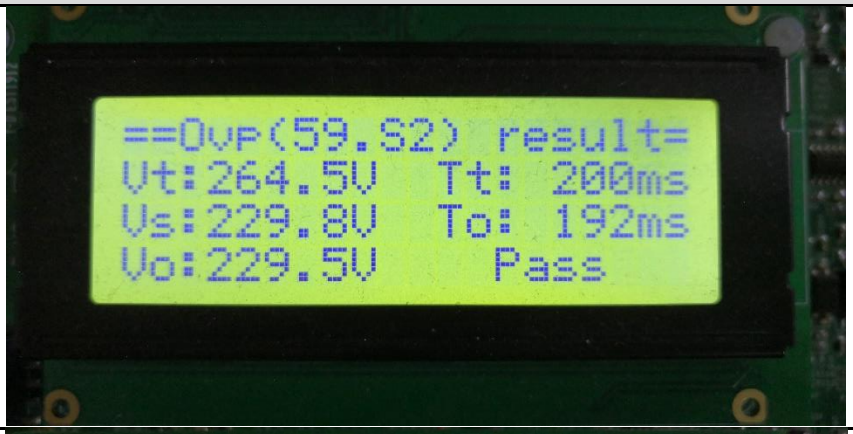
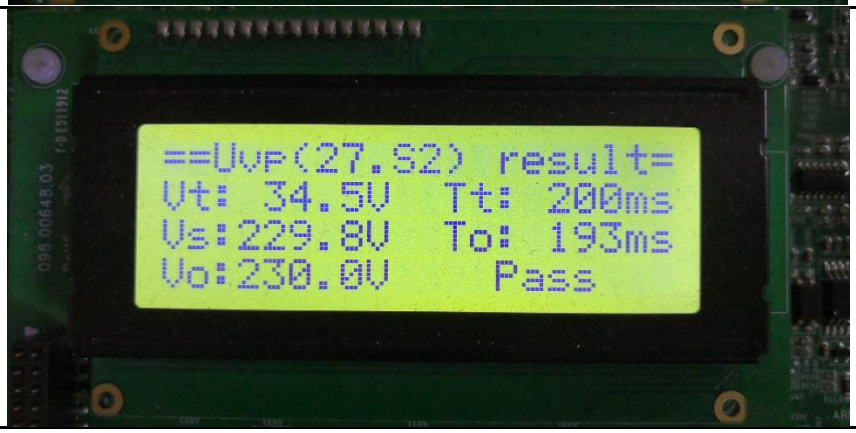
[81>S2] ROCOF – 51.50 Hz-47.5HZ

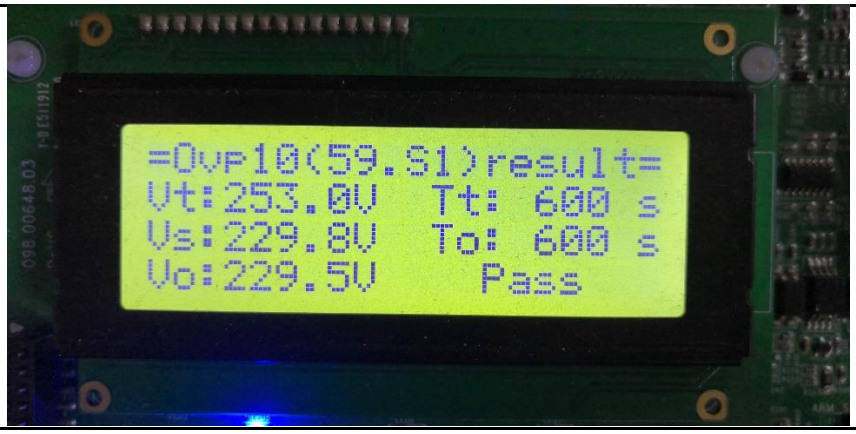
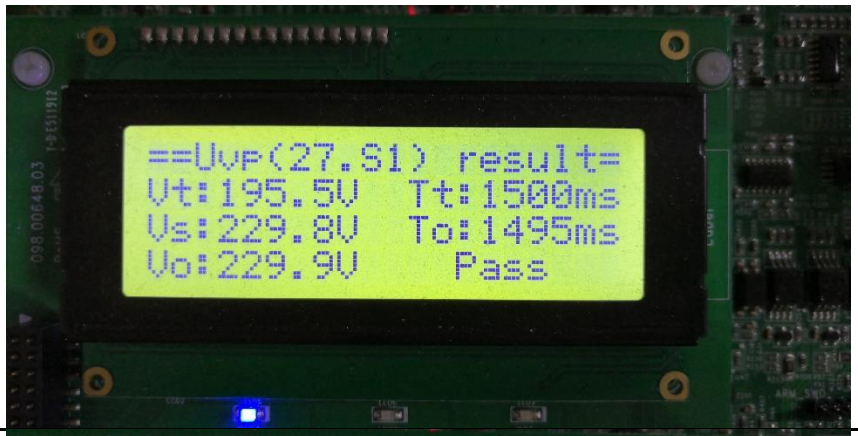
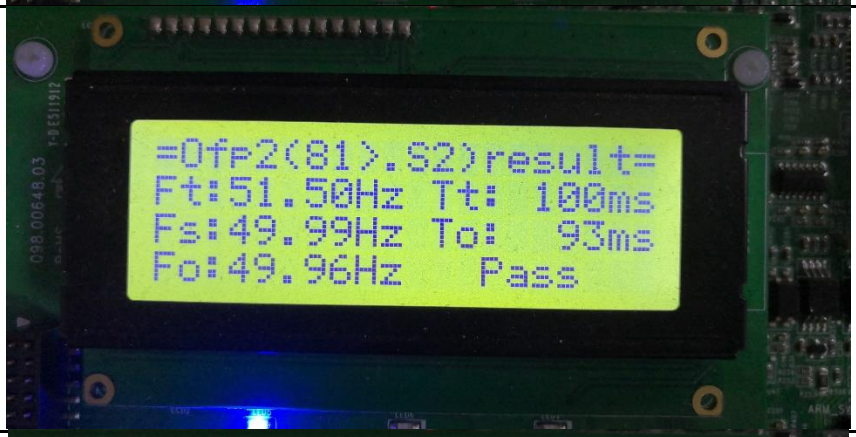
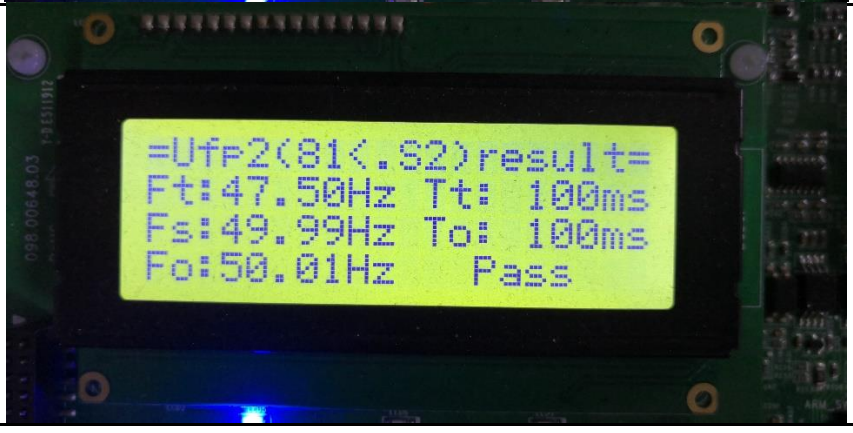


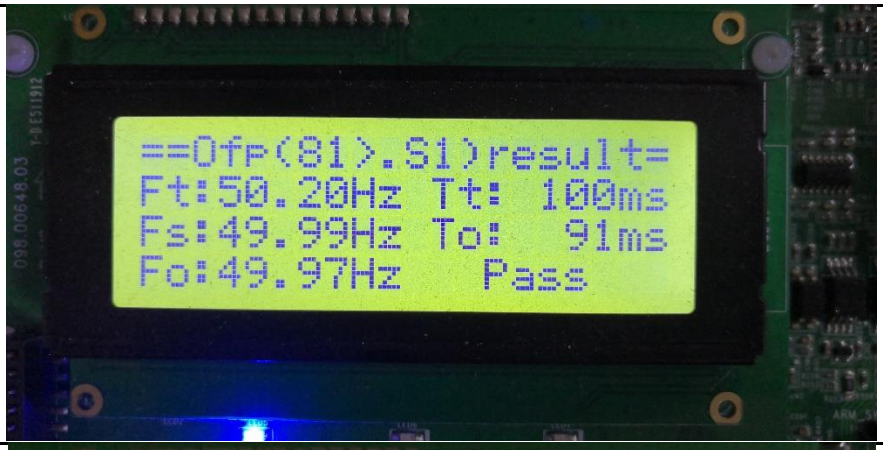
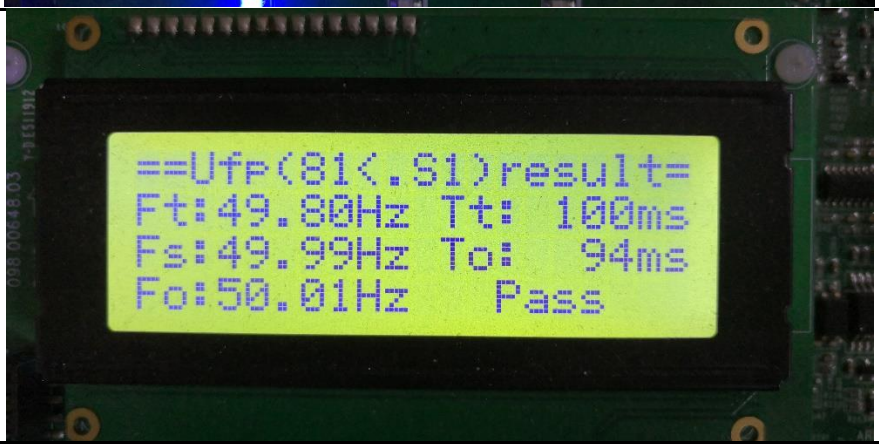
RESULT: The Inverter doesn't disconnects from the grid after ROCOF test

A.4.4	**TABLE: Autotest** / *Autotest function*	P
Ambient temperature (°C) .....:	20°C ± 2°C	
Humidity (RH %) .....:	35% - 75% RH	
Instrumentation list .....:	N/A	
Uncertainty .....:	N/A	

Supplementary Information: N/A	
Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Test	Pictures of the Autotest function
U>>	
U<<	

U> 10min		 =Ovp10(59.S1)result= Vt:253.0V Tt: 600 s Vs:229.8V To: 600 s Vo:229.5V Pass
U<		 ==Uvp(27.S1) result= Vt:195.5V Tt:1500ms Vs:229.8V To:1495ms Vo:229.9V Pass
F>>		 =Ofp2(81>.S2)result= Ft:51.50Hz Tt: 100ms Fs:49.99Hz To: 93ms Fo:49.96Hz Pass
F<<		 =Ufp2(81<.S2)result= Ft:47.50Hz Tt: 100ms Fs:49.99Hz To: 100ms Fo:50.01Hz Pass

F>		 ==Ofp(81>.S1)result= Ft:50.20Hz Tt: 100ms Fs:49.99Hz To: 91ms Fo:49.97Hz Pass	
F<		 ==Ufp(81<.S1)result= Ft:49.80Hz Tt: 100ms Fs:49.99Hz To: 94ms Fo:50.01Hz Pass	

A.4.5	TABLE: Single Fault tolerance	P
Ambient temperature (°C) .....:	20°C ± 2°C	
Humidity (RH %) .....:	35% - 75% RH	
Instrumentation list .....:	See table “Measurement equipment and instrumentation”	
Uncertainty .....:	See table	

Supplementary Information: Measurement result is based on report 50382222 001.	
Operator .....:	see cover page.
Supervisor .....:	see cover page.
Test Date.....:	see cover page.

Fault No.	Fault applied	Result
1	Relay / Contactor function check Loss / failure	Pass
2	PCE input Reversed	Pass
3	PCE input s-c	Pass
4	PCE input Over-voltage	Pass
5	PCE output Over-voltage (OVP function controlled by DSP / software is disable)	Pass
6	PCE output s-c	Pass
7	Battery input Reversed	Pass
8	Battery input s-c	Pass
9	Battery input Over-voltage	Pass
10	DSP failure Residual C136 S-C	Pass

Compatibilità Climatica / Climatic compatibility

A.4.7	**TABLE : Dry heat (Test B) – storage conditions.**	P

CEI EN 60068-2-2:2008-11 Prove ambientali - Parte 2-2: Prove - Prova B: Caldo secco */Environmental testing - Part 2-2: Tests - Test B: Dry heat*	
Condizioni di test */Test conditions*	dissipa calore /heat -dissipating
Tipo di campione */Specimen type*	Bb: graduale / gradual
Tipo di ventilazione */Air circulation*	forzata / forced air
Temperatura misurata */Measured temperature:*	70 °C
Duration:	16 h
Precondizionamento */Preconditioning* --	
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*	
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*	
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)	
Supplementary information: After the conditions, the inverter still work without any problem.	
Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

A.4.7	TABLE : Humidity test (Test Cab) - storage conditions.	P
CEI EN 60068-2-78:2002:03 Prove ambientali - Parte 2-78: Prove - Prova Cab: Caldo umido, regime stazionario /Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state		
Temperatura misurata */Measured temperature:*	40 °C	
Umidità misurata */measured humidity:*	93 RH%	
Duration:	96 h	
Instrumentation list	See table “Measurement equipment and instrumentation”	
Uncertainty	See table	
Precondizionamento */Preconditioning* -		
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)		
Supplementary information: After the conditions, the inverter still work without any problem.		
Operator .....:	See cover page.	
Supervisor .....:	See cover page.	
Test Date.....:	See cover page.	

A.4.7	TABLE : Cold test (Test A) – storage conditions.	P
CEI EN 60068-2-1:2007:11 Prove ambientali - Parte 2-1: Prove - Prova A: Freddo */Environmental testing - Part 2-1: Tests - Test A: Cold*		
Condizioni di test */Test conditions*	dissipa calore /heat -dissipating	
Tipo di campione */Specimen type*	Bb: graduale / gradual	
Tipo di raffreddamento del campione */Specimen cooling type*	senza raffreddamneto artificiale /without artificial cooling	
Tipo di ventilazione */Air circulation*	forzata / forced air	
Temperatura misurata */Measured temperature:*	-10 °C	
Duration:	16 h	
Instrumentation list:	See table “Measurement equipment and instrumentation”	
Uncertainty:	N/A	
Precondizionamento */Preconditioning* -		
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)		
Supplementary information: After the conditions, the inverter still work without any problem.		
Operator .....:	See cover page.	
Supervisor .....:	See cover page.	
Test Date.....:	See cover page.	

A.4.7	TABLE : Change of temperature (Test N) – storage conditions.	P
CEI EN 60068-2-14:2010 Prove ambientali - Parte 2-14: Prove - Prova N: Cambio di temperatura */Environmental testing - Part 2-14: Tests - Test N: Change of temperature*		
Prova/*Test*	NB: Cambio a velocità controllata */NB Change with specified rate of change*	
Tipo di ventilazione */Air circulation*	forzata / forced air	
N° cicli /*Number of cycle:*	1	
Temperatura minima T_A */Minimum temperature T_A* ….:	- 10 ± 2 °C	
Temperatura massima T_B */Maximum temperature T_B* .:	+70 ± 2°C	
Durata di esposizione t1 */Exposure time t_1* ……:	3 h	
Tempo di trasferimento t_2 */Transition time t_2 …:*	3 h	
Instrumentation list:	See table “Measurement equipment and instrumentation”	
Uncertainty:	N/A	
Precondizionamento */Preconditioning* -		
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)		
Supplementary information: After the conditions, the inverter still work without any problem.		
Operator ……:	See cover page.	
Supervisor ……:	See cover page.	
Test Date……:	See cover page.	

A.4.7	**TABLE : Dry heat (Test B) – working conditions.**	P
CEI EN 60068-2-2:2008-11 Prove ambientali - Parte 2-2: Prove - Prova B: Caldo secco */Environmental testing - Part 2-2: Tests - Test B: Dry heat*		
Condizioni di test */Test conditions*	dissipa calore /heat -dissipating	
Tipo di campione */Specimen type*	Bb: graduale / gradual	
Tipo di ventilazione */Air circulation*	forzata / forced air	
Temperatura misurata */Measured temperature:*	70 °C	
Duration:	16 h	
Precondizionamento */Preconditioning* --		
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)		
Supplementary information: After the conditions, the inverter still work without any problem.		
Operator .....:	See cover page.	
Supervisor .....:	See cover page.	
Test Date.....:	See cover page.	

A.4.7	TABLE : Humidity test (Test Cab) - working conditions.	P
CEI EN 60068-2-78:2002:03 Prove ambientali - Parte 2-78: Prove - Prova Cab: Caldo umido, regime stazionario /Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state		
Temperatura misurata */Measured temperature:*	40 °C	
Umidità misurata */measured humidity:*	93 RH%	
Duration:	96 h	
Instrumentation list	See table “Measurement equipment and instrumentation”	
Uncertainty	N/A	
Precondizionamento */Preconditioning* -		
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)		
Supplementary information: After the conditions, the inverter still work without any problem.		
Operator .....:	See cover page.	
Supervisor .....:	See cover page.	
Test Date.....:	See cover page.	

A.4.7	TABLE : Cold test (Test A) – working conditions.	P
CEI EN 60068-2-1:2007:11 Prove ambientali - Parte 2-1: Prove - Prova A: Freddo */Environmental testing - Part 2-1: Tests - Test A: Cold*		
Condizioni di test */Test conditions*	dissipa calore /heat -dissipating	
Tipo di campione */Specimen type*	Bb: graduale / gradual	
Tipo di raffreddamento del campione */Specimen cooling type*	senza raffreddamneto artificiale /without artificial cooling	
Tipo di ventilazione */Air circulation*	forzata / forced air	
Temperatura misurata */Measured temperature:*	-10 °C	
Duration:	16 h	
Instrumentation list:	See table “Measurement equipment and instrumentation”	
Uncertainty:	N/A	
Precondizionamento */Preconditioning* -		
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)		
Supplementary information: After the conditions, the inverter still work without any problem.		
Operator .....:	See cover page.	
Supervisor .....:	See cover page.	
Test Date.....:	See cover page.	

A.4.7	TABLE : Change of temperature (Test N) – working conditions.	P
CEI EN 60068-2-14:2010 Prove ambientali - Parte 2-14: Prove - Prova N: Cambio di temperatura */Environmental testing - Part 2-14: Tests - Test N: Change of temperature*		
Prova/*Test*	NB: Cambio a velocità controllata */NB Change with specified rate of change*	
Tipo di ventilazione */Air circulation*	forzata / forced air	
N° cicli /*Number of cycle:*	1	
Temperatura minima T_A */Minimum temperature T_A* ….:	- 10 ± 2 °C	
Temperatura massima T_B */Maximum temperature T_B* .:	+70 ± 2°C	
Durata di esposizione t1 */Exposure time t_1* ……:	3 h	
Tempo di trasferimento t_2 */Transition time t_2 …:*	3 h	
Instrumentation list:	See table “Measurement equipment and instrumentation”	
Uncertainty:	N/A	
Precondizionamento */Preconditioning* -		
Verifiche iniziali */Initial measurement* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Verifiche finali */Final measurement* Dopo il ciclo termico / *after thermal cycle* Verifica della corretta funzionalità del dispositivo / *verification of correct device functionality* Verifica del corretto funzionamento della protezione di interfaccia / *verification of correct interface protection*		
Condizioni particolari di prova */Particular test condition* Apparato non operativo (non alimentato) / device not operative (not powered)		
Supplementary information: After the conditions, the inverter still work without any problem.		
Operator ……:	See cover page.	
Supervisor ……:	See cover page.	
Test Date……:	See cover page.	

A.4.8	**TABLE: Insulation tests**	P

☐ CEI EN 60255-5:2001-11

Parte 5: Coordinamento dell'isolamento per i relè di misura e per i dispositivi di protezione

Prescrizioni e prove

/Electrical Relays - Part 5: Insulation coordination for measuring relays and protection equipment – Requirements and tests

☒ CEI EN 60146-1-1:1997 + A1:1998
Convertitori a semiconduttori - Prescrizioni generali e convertitori commutati dalla linea
Prove di isolamento (§ 4.2.1).
/ Semiconductor converters - General requirements and line commutated converters - Part 1-1: Specification of basic requirements Insulation tests (§. 4.2.1).

Ambient temperature (°C) ..... :	20°C ± 2°C
Humidity (RH %) ..... :	35% - 75% RH
Instrumentation list..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	N/A

Prova di rigidità dielettrica/ Dielectric strenght test

Test	Test Voltage (V)	R Measured after test MΩ @ 500Vdc	Limit
Between PE and AC output shorted	2120 Vdc	7.122	≥1MΩ
Between PE and DC + AC shorted	2120 Vdc	5.781	≥1MΩ

Supplementary information:

Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

TESTING RESULTS
Allegato B: Prove sugli inverter per impianti indirettamente connessi ***Allegato B: Inverter tests for PV plants not directly connected to the grid***

B.1: TABLE: Armoniche di corrente / Harmonics measurement ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**+55°C ± 2°C**
Humidity (RH %) .....:	65% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Supplementary information:	
Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Harmonics current measured on L1 phase charge mode (limits acc. to IEC 61000-3-12)				
	33%			
Order [h]	I [A]	I/In [%]	Limits [%]	Results
1	10.6491	32.666%	--	--
2	0.0039	0.012%	8	P
3	0.1599	0.490%	21.6	P
4	0.0154	0.047%	4	P
5	0.2668	0.818%	10.7	P
6	0.0080	0.025%	2.67	P
7	0.1702	0.522%	7.2	P
8	0.0060	0.018%	2	P
9	0.0986	0.302%	3.8	P
10	0.0126	0.039%	1.6	P
11	0.0490	0.150%	3.1	P
12	0.0086	0.026%	1.33	P
13	0.0422	0.129%	2	P
14	0.0078	0.024%	N/A	P
15	0.0258	0.079%	N/A	P
16	0.0037	0.011%	N/A	P
17	0.0251	0.077%	N/A	P
18	0.0026	0.008%	N/A	P
19	0.0218	0.067%	N/A	P
20	0.0034	0.010%	N/A	P
21	0.0224	0.069%	N/A	P
22	0.0033	0.010%	N/A	P
23	0.0138	0.042%	N/A	P
24	0.0047	0.014%	N/A	P
25	0.0146	0.045%	N/A	P
26	0.0008	0.002%	N/A	P
27	0.0112	0.034%	N/A	P
28	0.0030	0.009%	N/A	P
29	0.0103	0.032%	N/A	P
30	0.0021	0.006%	N/A	P
31	0.0071	0.022%	N/A	P
32	0.0009	0.003%	N/A	P
33	0.0069	0.021%	N/A	P
34	0.0012	0.004%	N/A	P
35	0.0048	0.015%	N/A	P
36	0.0015	0.005%	N/A	P
37	0.0049	0.015%	N/A	P
38	0.0005	0.002%	N/A	P
39	0.0033	0.010%	N/A	P
40	0.0011	0.003%	N/A	P
THDi	-	6.634%	13	P
PWHD	-	0.31%	22	P

B.1: TABLE: Armoniche di corrente / Harmonics measurement ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**-10°C ± 2°C**
Humidity (RH %) .....:	65% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Supplementary information:	
Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Harmonics current measured on L1 phase (limits acc. to IEC 61000-3-12)				
	33%			
Order [h]	I [A]	I/In [%]	Limits [%]	Results
1	10.6495	32.667%	--	--
2	0.0043	0.013%	8	P
3	0.1614	0.495%	21.6	P
4	0.0151	0.046%	4	P
5	0.2696	0.827%	10.7	P
6	0.0079	0.024%	2.67	P
7	0.1715	0.526%	7.2	P
8	0.0062	0.019%	2	P
9	0.0981	0.301%	3.8	P
10	0.0125	0.038%	1.6	P
11	0.0501	0.154%	3.1	P
12	0.0088	0.027%	1.33	P
13	0.0424	0.130%	2	P
14	0.0085	0.026%	N/A	P
15	0.0257	0.079%	N/A	P
16	0.0041	0.013%	N/A	P
17	0.0256	0.079%	N/A	P
18	0.0026	0.008%	N/A	P
19	0.0219	0.067%	N/A	P
20	0.0032	0.010%	N/A	P
21	0.0220	0.067%	N/A	P
22	0.0033	0.010%	N/A	P
23	0.0138	0.042%	N/A	P
24	0.0048	0.015%	N/A	P
25	0.0146	0.045%	N/A	P
26	0.0008	0.002%	N/A	P
27	0.0112	0.034%	N/A	P
28	0.0029	0.009%	N/A	P
29	0.0102	0.031%	N/A	P
30	0.0021	0.006%	N/A	P
31	0.0071	0.022%	N/A	P
32	0.0011	0.003%	N/A	P
33	0.0070	0.021%	N/A	P
34	0.0011	0.003%	N/A	P
35	0.0048	0.015%	N/A	P
36	0.0016	0.005%	N/A	P
37	0.0048	0.015%	N/A	P
38	0.0005	0.002%	N/A	P
39	0.0033	0.010%	N/A	P
40	0.0011	0.003%	N/A	P
THDi	-	6.654%	13	P
PWHD	-	0.32%	22	P

TESTING RESULTS
Allegato B bis: Prove sui sistemi di accumulo */ Annex B bis: Tests on Energy Storage Systems*

Terminologia e definizioni degli EESS in accordo al par. 8.5.3.4
/ Terminology and definitions for EESS systems in according to clause 8.5.3.4 :

CUS:	*Capacity of the storage system*	*34.8kWh*
PSN:	*Power from Battery to the Grid*	*7500W*
PCN:	*Power from the Grid to the Battery*	*7500W*
PS_{MAX}:	*Power from Battery to the Grid within the CUS – (range of 10% - 90%)*	*7500W*
PC_{MAX}:	*Power from Grid to the Battery within the CUS – (range of 10% - 90%)*	*7500W*
PN_{INV}:	*Rated Power from the Inverter*	*7500W*

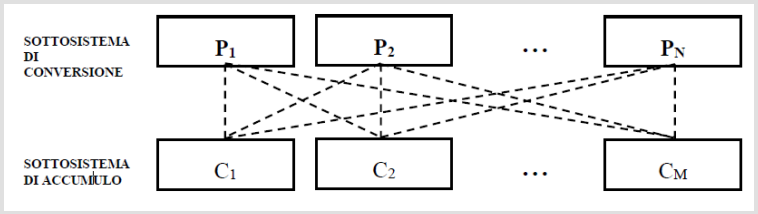
Operation Condition
$PS_{MAX} \geq PSN$
$PC_{MAX} \geq PCN$
$PS_{MAX} \leq PN_{INV}$
$PC_{MAX} \leq PN_{INV}$

Bbis.2.2: TABLE: Scalarità e modularità

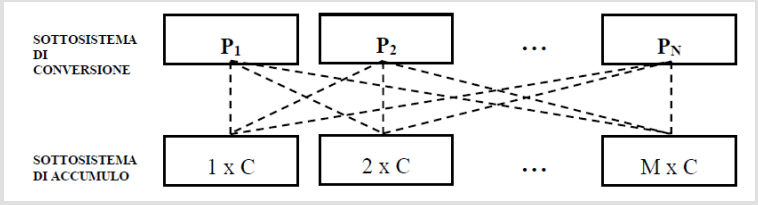
/Table: Scalarity and modularity

Ambient temperature (°C) .....:	N/A
Humidity (RH %) .....:	N/A
Instrumentation list.....:	N/A
Uncertainty .....:	N/A

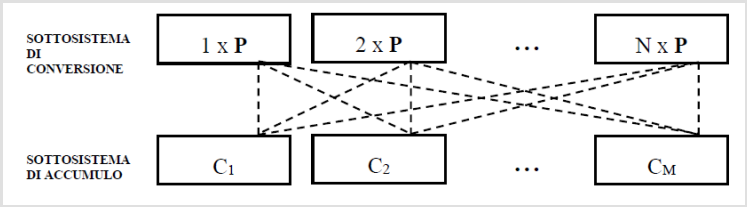
☐ Caso A



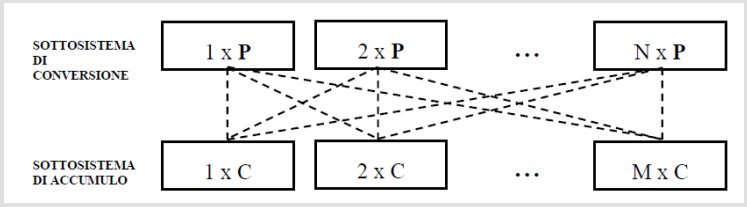
☒ Caso B



☐ Caso C



☐ Caso D



Supplementary information:

Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Configurazione di Energy Storage System
/ Energy Storage system configuration

Inverter:			
P_{MIN}		**P_{MAX}**	
P_1:	3K	**P_N:**	7.5K
$N_{module\ min}$:	N/A	**$N_{module\ max}$:**	N/A

Storage:			
E_{MIN}		**E_{MAX}**	
C_1:	N/A	**C_M:**	N/A
$M_{module\ min}$:	5.3kWh	**$M_{module\ max}$:**	5.3kWh*6

Tabella di prove per EESS:
/ Table of tests for EESS

Caso A		Potenza sottosistema di conversione (W)		
		P_1 (P_{MIN})	...	P_N (P_{MAX})
Capacità sottosistema di accumulo (Wh)	C_1 (E_{MIN})	Prove parziali Allegato Bbis	non sono richieste ulteriori prove	Prove parziali Allegato Bbis
	...	non sono richieste ulteriori prove	non sono richieste ulteriori prove	non sono richieste ulteriori prove
	C_M (E_{MAX})	non sono richieste ulteriori prove	non sono richieste ulteriori prove	Prove complete Allegato Bbis

Caso C		Potenza sottosistema di conversione (W)			
		modulo base P (P_{MIN})	2 moduli	≥ 3 moduli	N moduli (P_{MAX})
Capacità sottosistema di accumulo (Wh)	C_1 (E_{MIN})	Prove parziali Allegato Bbis	non sono richieste ulteriori prove	Prove parziali Allegato Bbis in una qualunque delle configurazioni con (almeno) 3 moduli del sottosistema di conversione	non sono richieste ulteriori prove
	...	non sono richieste ulteriori prove	non sono richieste ulteriori prove		non sono richieste ulteriori prove
	C_M (E_{MAX})	Prove complete Allegato Bbis	non sono richieste ulteriori prove		non sono richieste ulteriori prove

Caso B		Potenza sottosistema di conversione (W)		
		P_1 (P_{MIN})	...	P_N (P_{MAX})
Capacità sottosistema di accumulo (Wh)	modulo base C (E_{MIN})	Prove parziali Allegato Bbis	non sono richieste ulteriori prove	Prove parziali Allegato Bbis
	...	non sono richieste ulteriori prove	non sono richieste ulteriori prove	non sono richieste ulteriori prove
	M moduli (E_{MAX})	non sono richieste ulteriori prove	non sono richieste ulteriori prove	Prove complete Allegato Bbis

Caso D		Potenza sottosistema di conversione (W)			
		modulo base P (P_{MIN})	2 moduli	≥ 3 moduli	N moduli (P_{MAX})
Capacità sottosistema di accumulo (Wh)	modulo base C (E_{MIN})	Prove parziali Allegato Bbis	non sono richieste ulteriori prove	Prove parziali Allegato Bbis in una qualunque delle configurazioni con 3 moduli del sottosistema di conversione	non sono richieste ulteriori prove
	...	non sono richieste ulteriori prove	non sono richieste ulteriori prove		non sono richieste ulteriori prove
	M moduli (E_{MAX})	Prove complete Allegato Bbis	non sono richieste ulteriori prove		non sono richieste ulteriori prove

Bbis.3: TABLE: Armoniche di corrente /Harmonics measurement (Discharge mode) ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**25 °C ± 5 °C**
Humidity (RH %) .....:	65% ± 10% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Supplementary information:	
Operator .....:	See cover page
Supervisor .....:	See cover page
Test Date.....:	See cover page

Harmonics current measured on L1 phase (limits acc. to IEC 61000-3-12)								
	33%		66%		100%			
Order [h]	I [A]	I/In [%]	I [A]	I/In [%]	I [A]	I/In [%]	Limits [%]	Results
1	10.8660	33.3313%	21.6800	66.5031%	30.9758	95.0178%	--	--
2	0.0810	0.2485%	0.1627	0.4991%	0.2494	0.7650%	8	P
3	0.1673	0.5132%	0.2355	0.7224%	0.3088	0.9472%	21.6	P
4	0.0306	0.0939%	0.0376	0.1153%	0.0459	0.1408%	4	P
5	0.0279	0.0856%	0.2971	0.9113%	0.3619	1.1101%	10.7	P
6	0.0160	0.0491%	0.0295	0.0905%	0.0317	0.0972%	2.67	P
7	0.1164	0.3571%	0.2184	0.6699%	0.2837	0.8702%	7.2	P
8	0.0139	0.0426%	0.0128	0.0393%	0.0186	0.0571%	2	P
9	0.0986	0.3025%	0.1335	0.4095%	0.1643	0.5040%	3.8	P
10	0.0076	0.0233%	0.0083	0.0255%	0.0070	0.0215%	1.6	P
11	0.0515	0.1580%	0.0793	0.2433%	0.0954	0.2926%	3.1	P
12	0.0011	0.0034%	0.0050	0.0153%	0.0066	0.0202%	1.33	P
13	0.0486	0.1491%	0.0453	0.1390%	0.0618	0.1896%	2	P
14	0.0024	0.0074%	0.0017	0.0052%	0.0034	0.0104%	N/A	P
15	0.0352	0.1080%	0.0244	0.0748%	0.0337	0.1034%	N/A	P
16	0.0008	0.0025%	0.0034	0.0104%	0.0020	0.0061%	N/A	P
17	0.0318	0.0975%	0.0254	0.0779%	0.0239	0.0733%	N/A	P
18	0.0025	0.0077%	0.0032	0.0098%	0.0030	0.0092%	N/A	P
19	0.0234	0.0718%	0.0172	0.0528%	0.0131	0.0402%	N/A	P
20	0.0009	0.0028%	0.0011	0.0034%	0.0024	0.0074%	N/A	P
21	0.0282	0.0865%	0.0214	0.0656%	0.0136	0.0417%	N/A	P
22	0.0026	0.0080%	0.0022	0.0067%	0.0010	0.0031%	N/A	P
23	0.0175	0.0537%	0.0104	0.0319%	0.0082	0.0252%	N/A	P
24	0.0016	0.0049%	0.0013	0.0040%	0.0019	0.0058%	N/A	P
25	0.0164	0.0503%	0.0137	0.0420%	0.0069	0.0212%	N/A	P
26	0.0008	0.0025%	0.0006	0.0018%	0.0007	0.0021%	N/A	P
27	0.0113	0.0347%	0.0115	0.0353%	0.0070	0.0215%	N/A	P
28	0.0014	0.0043%	0.0019	0.0058%	0.0017	0.0052%	N/A	P
29	0.0126	0.0387%	0.0127	0.0390%	0.0053	0.0163%	N/A	P
30	0.0004	0.0012%	0.0010	0.0031%	0.0009	0.0028%	N/A	P
31	0.0077	0.0236%	0.0078	0.0239%	0.0047	0.0144%	N/A	P
32	0.0009	0.0028%	0.0005	0.0015%	0.0007	0.0021%	N/A	P
33	0.0085	0.0261%	0.0085	0.0261%	0.0048	0.0147%	N/A	P
34	0.0006	0.0018%	0.0011	0.0034%	0.0008	0.0025%	N/A	P
35	0.0052	0.0160%	0.0058	0.0178%	0.0033	0.0101%	N/A	P
36	0.0007	0.0021%	0.0009	0.0028%	0.0008	0.0025%	N/A	P
37	0.0063	0.0193%	0.0071	0.0218%	0.0042	0.0129%	N/A	P
38	0.0004	0.0012%	0.0005	0.0015%	0.0006	0.0018%	N/A	P
39	0.0035	0.0107%	0.0040	0.0123%	0.0038	0.0117%	N/A	P
40	0.0004	0.0012%	0.0005	0.0015%	0.0006	0.0018%	N/A	P
THDi	-	3.08%	-	2.30%	-	2.08%	13	P
PWHD	-	0.31%	-	0.50%	-	0.60%	22	P

Bbis.3: TABLE: Armoniche di corrente /Harmonics measurement **(Charge mode)** ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	25 °C ± 5 °C
Humidity (RH %) .....:	65% ± 10% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	N/A
Supplementary information: - *Test not applicable to unidirectional generators*	
Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

Harmonics current measured on L1 phase (limits acc. to IEC 61000-3-12)								
	33%		66%		100%			
Order [h]	I [A]	I/In [%]	I [A]	I/In [%]	I [A]	I/In [%]	Limits [%]	Results
1	10.9142	33.4791%	21.8923	67.1543%	32.842	100.7423%	--	--
2	0.0819	0.2512%	0.1626	0.4988%	0.2492	0.7644%	8	P
3	0.2138	0.6558%	0.2358	0.7233%	0.3090	0.9479%	21.6	P
4	0.0304	0.0933%	0.0378	0.1160%	0.0457	0.1402%	4	P
5	0.0284	0.0871%	0.2951	0.9052%	0.3621	1.1107%	10.7	P
6	0.0158	0.0485%	0.0294	0.0902%	0.0315	0.0966%	2.67	P
7	0.1169	0.3586%	0.2187	0.6709%	0.2839	0.8709%	7.2	P
8	0.0137	0.0420%	0.0130	0.0399%	0.0184	0.0564%	2	P
9	0.0991	0.3040%	0.1315	0.4034%	0.1645	0.5046%	3.8	P
10	0.0074	0.0227%	0.0082	0.0252%	0.0068	0.0209%	1.6	P
11	0.0520	0.1595%	0.0796	0.2442%	0.0956	0.2933%	3.1	P
12	0.0009	0.0028%	0.0052	0.0160%	0.0064	0.0196%	1.33	P
13	0.0491	0.1506%	0.0433	0.1328%	0.0620	0.1902%	2	P
14	0.0022	0.0067%	0.0016	0.0049%	0.0032	0.0098%	N/A	P
15	0.0357	0.1095%	0.0247	0.0758%	0.0339	0.1040%	N/A	P
16	0.0006	0.0018%	0.0036	0.0110%	0.0018	0.0055%	N/A	P
17	0.0323	0.0991%	0.0234	0.0718%	0.0241	0.0739%	N/A	P
18	0.0023	0.0071%	0.0031	0.0095%	0.0028	0.0086%	N/A	P
19	0.0239	0.0733%	0.0175	0.0537%	0.0133	0.0408%	N/A	P
20	0.0007	0.0021%	0.0013	0.0040%	0.0022	0.0067%	N/A	P
21	0.0287	0.0880%	0.0194	0.0595%	0.0138	0.0423%	N/A	P
22	0.0024	0.0074%	0.0021	0.0064%	0.0008	0.0025%	N/A	P
23	0.0180	0.0552%	0.0107	0.0328%	0.0084	0.0258%	N/A	P
24	0.0014	0.0043%	0.0015	0.0046%	0.0017	0.0052%	N/A	P
25	0.0169	0.0518%	0.0117	0.0359%	0.0071	0.0218%	N/A	P
26	0.0006	0.0018%	0.0005	0.0015%	0.0005	0.0015%	N/A	P
27	0.0118	0.0362%	0.0118	0.0362%	0.0072	0.0221%	N/A	P
28	0.0012	0.0037%	0.0021	0.0064%	0.0015	0.0046%	N/A	P
29	0.0131	0.0402%	0.0107	0.0328%	0.0055	0.0169%	N/A	P
30	0.0002	0.0006%	0.0009	0.0028%	0.0007	0.0021%	N/A	P
31	0.0082	0.0252%	0.0081	0.0248%	0.0049	0.0150%	N/A	P
32	0.0007	0.0021%	0.0007	0.0021%	0.0005	0.0015%	N/A	P
33	0.0090	0.0276%	0.0065	0.0199%	0.0050	0.0153%	N/A	P
34	0.0004	0.0012%	0.0010	0.0031%	0.0006	0.0018%	N/A	P
35	0.0057	0.0175%	0.0061	0.0187%	0.0035	0.0107%	N/A	P
36	0.0005	0.0015%	0.0011	0.0034%	0.0006	0.0018%	N/A	P
37	0.0068	0.0209%	0.0051	0.0156%	0.0044	0.0135%	N/A	P
38	0.0002	0.0006%	0.0004	0.0012%	0.0004	0.0012%	N/A	P
39	0.0040	0.0123%	0.0043	0.0132%	0.0040	0.0123%	N/A	P
40	0.0002	0.0006%	0.0007	0.0021%	0.0004	0.0012%	N/A	P
THDi	-	6.798%	-	4.952%	-	3.752%	13	P
PWHD	-	0.32%	-	0.47%	-	0.65%	22	P

Bbis.3: TABLE: Armoniche di corrente /Harmonics measurement **(Discharge mode)** ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**+55 °C ± 2 °C**
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	N/A
Supplementary information:	
Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

Harmonics current measured on L1 phase (limits acc. to IEC 61000-3-12)								
	33%		66%		100%			
Order [h]	I [A]	I/In [%]	I [A]	I/In [%]	I [A]	I/In [%]	Limits [%]	Results
1	10.8654	33.3294%	21.6822	66.5098%	30.9648	94.9840%	--	--
2	0.0810	0.2485%	0.1627	0.4991%	0.2494	0.7650%	8	P
3	0.1673	0.5132%	0.2355	0.7224%	0.3088	0.9472%	21.6	P
4	0.0306	0.0939%	0.0376	0.1153%	0.0459	0.1408%	4	P
5	0.0279	0.0856%	0.2971	0.9113%	0.3619	1.1101%	10.7	P
6	0.0160	0.0491%	0.0295	0.0905%	0.0317	0.0972%	2.67	P
7	0.1064	0.3264%	0.2144	0.6577%	0.2827	0.8672%	7.2	P
8	0.0139	0.0426%	0.0128	0.0393%	0.0176	0.0540%	2	P
9	0.0966	0.2963%	0.1335	0.4095%	0.1566	0.4804%	3.8	P
10	0.0076	0.0233%	0.0083	0.0255%	0.0070	0.0215%	1.6	P
11	0.0495	0.1518%	0.0763	0.2340%	0.0954	0.2926%	3.1	P
12	0.0011	0.0034%	0.0050	0.0153%	0.0066	0.0202%	1.33	P
13	0.0446	0.1368%	0.0453	0.1390%	0.0618	0.1896%	2	P
14	0.0024	0.0074%	0.0017	0.0052%	0.0034	0.0104%	N/A	P
15	0.0352	0.1080%	0.0244	0.0748%	0.0337	0.1034%	N/A	P
16	0.0008	0.0025%	0.0034	0.0104%	0.0020	0.0061%	N/A	P
17	0.0318	0.0975%	0.0254	0.0779%	0.0239	0.0733%	N/A	P
18	0.0025	0.0077%	0.0032	0.0098%	0.0030	0.0092%	N/A	P
19	0.0234	0.0718%	0.0172	0.0528%	0.0131	0.0402%	N/A	P
20	0.0009	0.0028%	0.0011	0.0034%	0.0024	0.0074%	N/A	P
21	0.0282	0.0865%	0.0214	0.0656%	0.0136	0.0417%	N/A	P
22	0.0026	0.0080%	0.0020	0.0061%	0.0010	0.0031%	N/A	P
23	0.0175	0.0537%	0.0104	0.0319%	0.0082	0.0252%	N/A	P
24	0.0016	0.0049%	0.0013	0.0040%	0.0019	0.0058%	N/A	P
25	0.0164	0.0503%	0.0137	0.0420%	0.0069	0.0212%	N/A	P
26	0.0008	0.0025%	0.0006	0.0018%	0.0007	0.0021%	N/A	P
27	0.0107	0.0328%	0.0115	0.0353%	0.0070	0.0215%	N/A	P
28	0.0014	0.0043%	0.0019	0.0058%	0.0017	0.0052%	N/A	P
29	0.0126	0.0387%	0.0127	0.0390%	0.0053	0.0163%	N/A	P
30	0.0004	0.0012%	0.0010	0.0031%	0.0009	0.0028%	N/A	P
31	0.0077	0.0236%	0.0078	0.0239%	0.0047	0.0144%	N/A	P
32	0.0009	0.0028%	0.0005	0.0015%	0.0007	0.0021%	N/A	P
33	0.0085	0.0261%	0.0085	0.0261%	0.0048	0.0147%	N/A	P
34	0.0006	0.0018%	0.0011	0.0034%	0.0008	0.0025%	N/A	P
35	0.0052	0.0160%	0.0058	0.0178%	0.0033	0.0101%	N/A	P
36	0.0007	0.0021%	0.0009	0.0028%	0.0008	0.0025%	N/A	P
37	0.0063	0.0193%	0.0071	0.0218%	0.0042	0.0129%	N/A	P
38	0.0004	0.0012%	0.0005	0.0015%	0.0006	0.0018%	N/A	P
39	0.0035	0.0107%	0.0040	0.0123%	0.0038	0.0117%	N/A	P
40	0.0004	0.0012%	0.0005	0.0015%	0.0006	0.0018%	N/A	P
THDi	-	6.654%	-	4.933%	-	3.712%	13	P
PWHD	-	0.32%	-	0.46%	-	0.64%	22	P

Bbis.3: TABLE: Armoniche di corrente /Harmonics measurement **(Charge mode)** ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**+55 °C ± 2 °C**
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	N/A
Supplementary information: - *Test not applicable to unidirectional generators*	
Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

Harmonics current measured on L1 phase (limits acc. to IEC 61000-3-12)								
	33%		66%		100%			
Order [h]	I [A]	I/In [%]	I [A]	I/In [%]	I [A]	I/In [%]	Limits [%]	Results
1	10.8659	33.3310%	21.6802	66.5037%	30.9650	94.9847%	--	--
2	0.0808	0.2479%	0.1626	0.4988%	0.2492	0.7644%	8	P
3	0.1678	0.5147%	0.2358	0.7233%	0.3090	0.9479%	21.6	P
4	0.0304	0.0933%	0.0378	0.1160%	0.0457	0.1402%	4	P
5	0.0284	0.0871%	0.2951	0.9052%	0.3621	1.1107%	10.7	P
6	0.0158	0.0485%	0.0294	0.0902%	0.0315	0.0966%	2.67	P
7	0.1069	0.3279%	0.2147	0.6586%	0.2829	0.8678%	7.2	P
8	0.0137	0.0420%	0.0130	0.0399%	0.0174	0.0534%	2	P
9	0.0971	0.2979%	0.1315	0.4034%	0.1568	0.4810%	3.8	P
10	0.0074	0.0227%	0.0082	0.0252%	0.0068	0.0209%	1.6	P
11	0.0500	0.1534%	0.0766	0.2350%	0.0956	0.2933%	3.1	P
12	0.0009	0.0028%	0.0052	0.0160%	0.0064	0.0196%	1.33	P
13	0.0451	0.1383%	0.0433	0.1328%	0.0620	0.1902%	2	P
14	0.0022	0.0067%	0.0016	0.0049%	0.0032	0.0098%	N/A	P
15	0.0357	0.1095%	0.0247	0.0758%	0.0339	0.1040%	N/A	P
16	0.0006	0.0018%	0.0036	0.0110%	0.0018	0.0055%	N/A	P
17	0.0323	0.0991%	0.0234	0.0718%	0.0241	0.0739%	N/A	P
18	0.0023	0.0071%	0.0031	0.0095%	0.0028	0.0086%	N/A	P
19	0.0239	0.0733%	0.0175	0.0537%	0.0133	0.0408%	N/A	P
20	0.0007	0.0021%	0.0013	0.0040%	0.0022	0.0067%	N/A	P
21	0.0287	0.0880%	0.0194	0.0595%	0.0138	0.0423%	N/A	P
22	0.0024	0.0074%	0.0019	0.0058%	0.0008	0.0025%	N/A	P
23	0.0180	0.0552%	0.0107	0.0328%	0.0084	0.0258%	N/A	P
24	0.0014	0.0043%	0.0015	0.0046%	0.0017	0.0052%	N/A	P
25	0.0169	0.0518%	0.0117	0.0359%	0.0071	0.0218%	N/A	P
26	0.0006	0.0018%	0.0005	0.0015%	0.0005	0.0015%	N/A	P
27	0.0112	0.0344%	0.0118	0.0362%	0.0072	0.0221%	N/A	P
28	0.0012	0.0037%	0.0021	0.0064%	0.0015	0.0046%	N/A	P
29	0.0131	0.0402%	0.0107	0.0328%	0.0055	0.0169%	N/A	P
30	0.0002	0.0006%	0.0009	0.0028%	0.0007	0.0021%	N/A	P
31	0.0082	0.0252%	0.0081	0.0248%	0.0049	0.0150%	N/A	P
32	0.0007	0.0021%	0.0007	0.0021%	0.0005	0.0015%	N/A	P
33	0.0090	0.0276%	0.0065	0.0199%	0.0050	0.0153%	N/A	P
34	0.0004	0.0012%	0.0010	0.0031%	0.0006	0.0018%	N/A	P
35	0.0057	0.0175%	0.0061	0.0187%	0.0035	0.0107%	N/A	P
36	0.0005	0.0015%	0.0011	0.0034%	0.0006	0.0018%	N/A	P
37	0.0068	0.0209%	0.0051	0.0156%	0.0044	0.0135%	N/A	P
38	0.0002	0.0006%	0.0004	0.0012%	0.0004	0.0012%	N/A	P
39	0.0040	0.0123%	0.0043	0.0132%	0.0040	0.0123%	N/A	P
40	0.0002	0.0006%	0.0007	0.0021%	0.0004	0.0012%	N/A	P
THDi	-	6.664%	-	4.963%	-	3.772%	13	P
PWHD	-	0.33%	-	0.46%	-	0.65%	22	P

Bbis.3: TABLE: Armoniche di corrente /Harmonics measurement **(Discharge mode)** ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**-10 °C ± 2 °C**
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	N/A
Supplementary information:	
Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

Harmonics current measured on L1 phase (limits acc. to IEC 61000-3-12)								
	33%		66%		100%			
Order [h]	I [A]	I/In [%]	I [A]	I/In [%]	I [A]	I/In [%]	Limits [%]	Results
1	10.8852	33.3902%	21.6622	66.4485%	31.9622	98.0436%	--	--
2	0.0810	0.2485%	0.1627	0.4991%	0.2494	0.7650%	8	P
3	0.1673	0.5132%	0.2355	0.7224%	0.3088	0.9472%	21.6	P
4	0.0306	0.0939%	0.0376	0.1153%	0.0459	0.1408%	4	P
5	0.0279	0.0856%	0.2971	0.9113%	0.3819	1.1715%	10.7	P
6	0.0160	0.0491%	0.0295	0.0905%	0.0317	0.0972%	2.67	P
7	0.1064	0.3264%	0.2144	0.6577%	0.2827	0.8672%	7.2	P
8	0.0139	0.0426%	0.0128	0.0393%	0.0176	0.0540%	2	P
9	0.0926	0.2840%	0.1335	0.4095%	0.1566	0.4804%	3.8	P
10	0.0076	0.0233%	0.0083	0.0255%	0.0070	0.0215%	1.6	P
11	0.0485	0.1488%	0.0763	0.2340%	0.0954	0.2926%	3.1	P
12	0.0011	0.0034%	0.0050	0.0153%	0.0066	0.0202%	1.33	P
13	0.0446	0.1368%	0.0453	0.1390%	0.0618	0.1896%	2	P
14	0.0024	0.0074%	0.0017	0.0052%	0.0034	0.0104%	N/A	P
15	0.0352	0.1080%	0.0244	0.0748%	0.0337	0.1034%	N/A	P
16	0.0008	0.0025%	0.0034	0.0104%	0.0020	0.0061%	N/A	P
17	0.0328	0.1006%	0.0254	0.0779%	0.0239	0.0733%	N/A	P
18	0.0025	0.0077%	0.0032	0.0098%	0.0030	0.0092%	N/A	P
19	0.0234	0.0718%	0.0172	0.0528%	0.0131	0.0402%	N/A	P
20	0.0010	0.0031%	0.0011	0.0034%	0.0024	0.0074%	N/A	P
21	0.0282	0.0865%	0.0214	0.0656%	0.0136	0.0417%	N/A	P
22	0.0026	0.0080%	0.0020	0.0061%	0.0010	0.0031%	N/A	P
23	0.0175	0.0537%	0.0104	0.0319%	0.0082	0.0252%	N/A	P
24	0.0016	0.0049%	0.0013	0.0040%	0.0019	0.0058%	N/A	P
25	0.0165	0.0506%	0.0137	0.0420%	0.0069	0.0212%	N/A	P
26	0.0008	0.0025%	0.0006	0.0018%	0.0007	0.0021%	N/A	P
27	0.0107	0.0328%	0.0115	0.0353%	0.0070	0.0215%	N/A	P
28	0.0014	0.0043%	0.0019	0.0058%	0.0017	0.0052%	N/A	P
29	0.0126	0.0387%	0.0129	0.0396%	0.0053	0.0163%	N/A	P
30	0.0004	0.0012%	0.0010	0.0031%	0.0009	0.0028%	N/A	P
31	0.0077	0.0236%	0.0078	0.0239%	0.0050	0.0153%	N/A	P
32	0.0009	0.0028%	0.0005	0.0015%	0.0007	0.0021%	N/A	P
33	0.0085	0.0261%	0.0085	0.0261%	0.0050	0.0153%	N/A	P
34	0.0006	0.0018%	0.0011	0.0034%	0.0008	0.0025%	N/A	P
35	0.0052	0.0160%	0.0062	0.0190%	0.0033	0.0101%	N/A	P
36	0.0007	0.0021%	0.0009	0.0028%	0.0008	0.0025%	N/A	P
37	0.0063	0.0193%	0.0071	0.0218%	0.0042	0.0129%	N/A	P
38	0.0004	0.0012%	0.0005	0.0015%	0.0006	0.0018%	N/A	P
39	0.0037	0.0113%	0.0040	0.0123%	0.0039	0.0120%	N/A	P
40	0.0004	0.0012%	0.0005	0.0015%	0.0006	0.0018%	N/A	P
THDi	-	6.674%	-	4.943%	-	3.723%	13	P
PWHD	-	0.32%	-	0.46%	-	0.64%	22	P

Bbis.3: TABLE: Armoniche di corrente /Harmonics measurement **(Charge mode)** ☐ CEI EN 61000-3-2 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-12 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**-10 °C ± 2 °C**
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	N/A
Supplementary information: - *Test not applicable to unidirectional generators*	
Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

Harmonics current measured on L1 phase (limits acc. to IEC 61000-3-12)								
	33%		66%		100%			
Order [h]	I [A]	I/In [%]	I [A]	I/In [%]	I [A]	I/In [%]	Limits [%]	Results
1	10.8857	33.3917%	21.6602	66.4423%	31.9624	98.0442%	--	--
2	0.0808	0.2479%	0.1626	0.4988%	0.2492	0.7644%	8	P
3	0.1678	0.5147%	0.2358	0.7233%	0.3090	0.9479%	21.6	P
4	0.0304	0.0933%	0.0378	0.1160%	0.0457	0.1402%	4	P
5	0.0284	0.0871%	0.2951	0.9052%	0.3821	1.1721%	10.7	P
6	0.0158	0.0485%	0.0294	0.0902%	0.0315	0.0966%	2.67	P
7	0.1069	0.3279%	0.2147	0.6586%	0.2829	0.8678%	7.2	P
8	0.0137	0.0420%	0.0130	0.0399%	0.0174	0.0534%	2	P
9	0.0931	0.2856%	0.1315	0.4034%	0.1568	0.4810%	3.8	P
10	0.0074	0.0227%	0.0082	0.0252%	0.0068	0.0209%	1.6	P
11	0.0490	0.1503%	0.0766	0.2350%	0.0956	0.2933%	3.1	P
12	0.0009	0.0028%	0.0052	0.0160%	0.0064	0.0196%	1.33	P
13	0.0451	0.1383%	0.0433	0.1328%	0.0620	0.1902%	2	P
14	0.0022	0.0067%	0.0016	0.0049%	0.0032	0.0098%	N/A	P
15	0.0357	0.1095%	0.0247	0.0758%	0.0339	0.1040%	N/A	P
16	0.0006	0.0018%	0.0036	0.0110%	0.0018	0.0055%	N/A	P
17	0.0333	0.1021%	0.0234	0.0718%	0.0241	0.0739%	N/A	P
18	0.0023	0.0071%	0.0031	0.0095%	0.0028	0.0086%	N/A	P
19	0.0239	0.0733%	0.0175	0.0537%	0.0133	0.0408%	N/A	P
20	0.0008	0.0025%	0.0013	0.0040%	0.0022	0.0067%	N/A	P
21	0.0287	0.0880%	0.0194	0.0595%	0.0138	0.0423%	N/A	P
22	0.0024	0.0074%	0.0019	0.0058%	0.0008	0.0025%	N/A	P
23	0.0180	0.0552%	0.0107	0.0328%	0.0084	0.0258%	N/A	P
24	0.0014	0.0043%	0.0015	0.0046%	0.0017	0.0052%	N/A	P
25	0.0170	0.0521%	0.0117	0.0359%	0.0071	0.0218%	N/A	P
26	0.0006	0.0018%	0.0005	0.0015%	0.0005	0.0015%	N/A	P
27	0.0112	0.0344%	0.0118	0.0362%	0.0072	0.0221%	N/A	P
28	0.0012	0.0037%	0.0021	0.0064%	0.0015	0.0046%	N/A	P
29	0.0131	0.0402%	0.0109	0.0334%	0.0055	0.0169%	N/A	P
30	0.0002	0.0006%	0.0009	0.0028%	0.0007	0.0021%	N/A	P
31	0.0082	0.0252%	0.0081	0.0248%	0.0052	0.0160%	N/A	P
32	0.0007	0.0021%	0.0007	0.0021%	0.0005	0.0015%	N/A	P
33	0.0090	0.0276%	0.0065	0.0199%	0.0052	0.0160%	N/A	P
34	0.0004	0.0012%	0.0010	0.0031%	0.0006	0.0018%	N/A	P
35	0.0057	0.0175%	0.0065	0.0199%	0.0035	0.0107%	N/A	P
36	0.0005	0.0015%	0.0011	0.0034%	0.0006	0.0018%	N/A	P
37	0.0068	0.0209%	0.0051	0.0156%	0.0044	0.0135%	N/A	P
38	0.0002	0.0006%	0.0004	0.0012%	0.0004	0.0012%	N/A	P
39	0.0042	0.0129%	0.0043	0.0132%	0.0041	0.0126%	N/A	P
40	0.0002	0.0006%	0.0007	0.0021%	0.0004	0.0012%	N/A	P
THDi	-	6.71%	-	4.942%	-	3.642%	13	P
PWHD	-	0.33%	-	0.46%	-	0.63%	22	P

Bbis.3: TABLE: Fluttuazioni di tensione /Flicker measurement **(full power, 66% and 33% of P_{st})** ☐ CEI EN 61000-3-3 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-11 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) .....:	**25 °C ± 5 °C**
Humidity (RH %) .....:	65% ± 10% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	N/A
Supplementary information:	
Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

100% PS_{max}	L1	L2	L3	Limit
Pst	0.22	-	-	1.00
Plt	0.21	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

66% PS_{max}	L1	L2	L3	Limit
Pst	0.18	-	-	1.00
Plt	0.18	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

33% PS_{max}	L1	L2	L3	Limit
Pst	0.13	-	-	1.00
Plt	0.13	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

Bbis.3: TABLE: Fluttuazioni di tensione /Flicker measurement **(full power, 66% and 33% of $P_{C_{max}}$)** ☐ CEI EN 61000-3-3 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-11 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) ……:	**25 °C ± 5 °C**
Humidity (RH %) ……:	65% ± 10% RH
Instrumentation list……:	See table “Measurement equipment and instrumentation”
Uncertainty ……:	N/A
Supplementary information: - *Test not applicable to unidirectional generators*	
Operator ……:	See cover page.
Supervisor ……:	See cover page.
Test Date……:	See cover page.

100% PC_{max}	L1	L2	L3	Limit
Pst	0.16	-	-	1.00
Plt	0.15	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

66% PC_{max}	L1	L2	L3	Limit
Pst	0.14	-	-	1.00
Plt	0.14	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

33% PC_{max}	L1	L2	L3	Limit
Pst	0.12	-	-	1.00
Plt	0.12	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

Bbis.3: TABLE: Fluttuazioni di tensione /Flicker measurement **(full power, 66% and 33% of Ps_{max})** ☐ CEI EN 61000-3-3 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-11 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) ……:	**+55 °C ± 2 °C**
Humidity (RH %) ……:	65% ± 5% RH
Instrumentation list……:	See table “Measurement equipment and instrumentation”
Uncertainty ……:	N/A
Supplementary information:	
Operator ……:	See cover page.
Supervisor ……:	See cover page.
Test Date……:	See cover page.

100% PS_{max}	L1	L2	L3	Limit
Pst	0.19	-	-	1.00
Plt	0.17	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

66% PS_{max}	L1	L2	L3	Limit
Pst	0.16	-	-	1.00
Plt	0.15	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

33% PS_{max}	L1	L2	L3	Limit
Pst	0.14	-	-	1.00
Plt	0.13	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

Bbis.3: TABLE: Fluttuazioni di tensione /Flicker measurement **(full power, 66% and 33% of $P_{C_{max}}$)** ☐ CEI EN 61000-3-3 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-11 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) ……:	**+55 °C ± 2 °C**
Humidity (RH %) ……:	65% ± 5% RH
Instrumentation list……:	See table “Measurement equipment and instrumentation”
Uncertainty ……:	N/A
Supplementary information: - *Test not applicable to unidirectional generators*	
Operator ……:	See cover page.
Supervisor ……:	See cover page.
Test Date……:	See cover page.

100% PC_{max}	L1	L2	L3	Limit
Pst	0.15	-	-	1.00
Plt	0.13	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

66% PC_{max}	L1	L2	L3	Limit
Pst	0.14	-	-	1.00
Plt	0.13	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

33% PC_{max}	L1	L2	L3	Limit
Pst	0.13	-	-	1.00
Plt	0.13	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

Bbis.3: TABLE: Fluttuazioni di tensione /Flicker measurement **(full power, 66% and 33% of Ps_{max})** ☐ CEI EN 61000-3-3 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-11 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) ……:	**-10 °C ± 2 °C**
Humidity (RH %) ……:	65% ± 5% RH
Instrumentation list……:	See table “Measurement equipment and instrumentation”
Uncertainty ……:	N/A
Supplementary information:	
Operator ……:	See cover page.
Supervisor ……:	See cover page.
Test Date……:	See cover page.

100% PS_{max}	L1	L2	L3	Limit
Pst	0.15	-	-	1.00
Plt	0.15	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

66% PS_{max}	L1	L2	L3	Limit
Pst	0.13	-	-	1.00
Plt	0.12	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

33% PS_{max}	L1	L2	L3	Limit
Pst	0.10	-	-	1.00
Plt	0.10	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

Bbis.3: TABLE: Fluttuazioni di tensione /Flicker measurement **(full power, 66% and 33% of $P_{C_{max}}$)** ☐ CEI EN 61000-3-3 (I_{rated} ≤ 16 A single-phase) ☒ CEI EN 61000-3-11 (16A < I_{rated} ≤ 75A single-phase)	
Ambient temperature (°C) ……:	**-10 °C ± 2 °C**
Humidity (RH %) ……:	65% ± 5% RH
Instrumentation list……:	See table “Measurement equipment and instrumentation”
Uncertainty ……:	N/A
Supplementary information: - *Test not applicable to unidirectional generators*	
Operator ……:	See cover page.
Supervisor ……:	See cover page.
Test Date……:	See cover page.

100% PC_{max}	L1	L2	L3	Limit
Pst	0.13	-	-	1.00
Plt	0.12	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

66% PC_{max}	L1	L2	L3	Limit
Pst	0.11	-	-	1.00
Plt	0.11	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

33% PC_{max}	L1	L2	L3	Limit
Pst	0.11	-	-	1.00
Plt	0.10	-	-	0.65
dc [%]	0.00	-	-	3.30
dmax [%]	0.00	-	-	6.00
dt [s]	0.00	-	-	0.50

Bbis.4	**TABLE: Verifica del campo di funzionamento in tensione e frequenza** ***/ Check the operating range in voltage and frequency***
Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	N/A

Supplementary information:

Voltage and frequency values are measured with at least 1 sample at second.

Test n.3 and 4, are not applicable at unidirectional generators.

Sn is the maximum active power delivered during test.

Operator ..... :	See cover page.
Supervisor ..... :	See cover page.
Test Date..... :	See cover page.

Test Point	Range of operation	Pout [W]	Cosφ	Test time [s]	Limit [%]	Result
Test 1	85% U_n – 47.5Hz	100% Ps_{max} (o P_{NINV})	1.00	at least 300	±5% Sn	No Disconnection
Test 2	110% U_n - 51.5Hz	100% Ps_{max} (o P_{NINV})	1.00	at least 300	±5% Sn	No Disconnection
Test 3	85% U_n – 47.5Hz	100% Pc_{max}	1.00	at least 300	±5% Sn	No Disconnection
Test 4	110% U_n - 51.5Hz	100% Pc_{max}	1.00	at least 300	±5% Sn	No Disconnection

Grafico Test 1: 85% U_n – 47.5Hz / 100% Ps_{max}

/ Graph Test 1: 85% Un – 47.5Hz

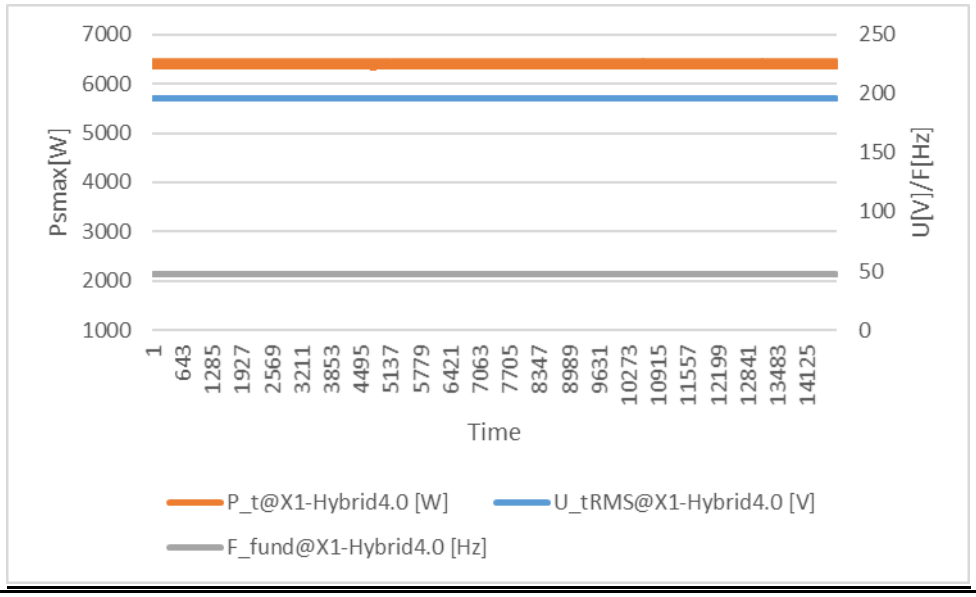


Grafico Test 2: 110% U_n - 51.5Hz / 100% Ps_{max}

/ Graph Test 2: 110% Un - 51.5Hz

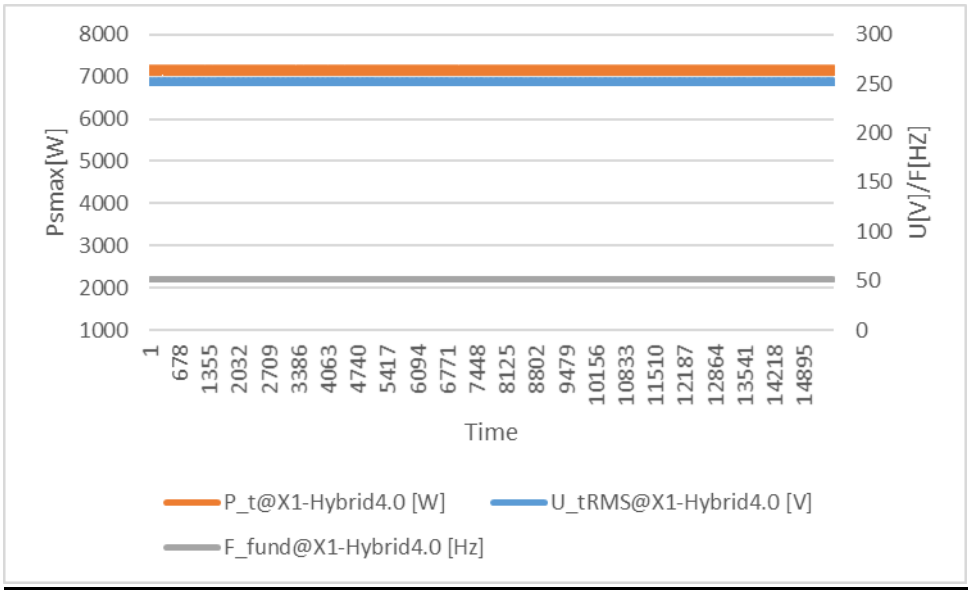


Grafico Test 3: 110% U_n - 51.5Hz / 100% Pc_{max}

/ Graph Test 1: 110% Un - 51.5Hz

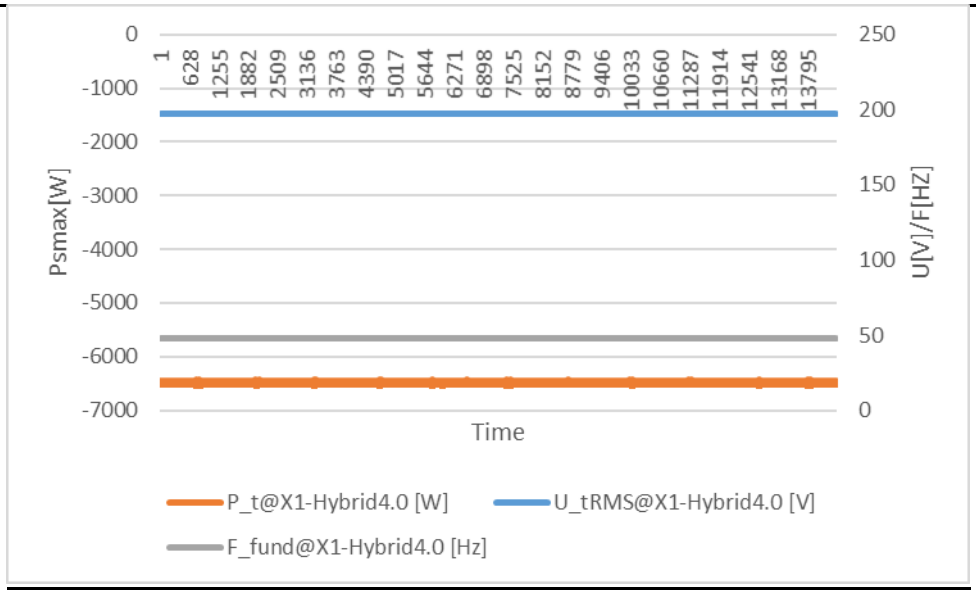
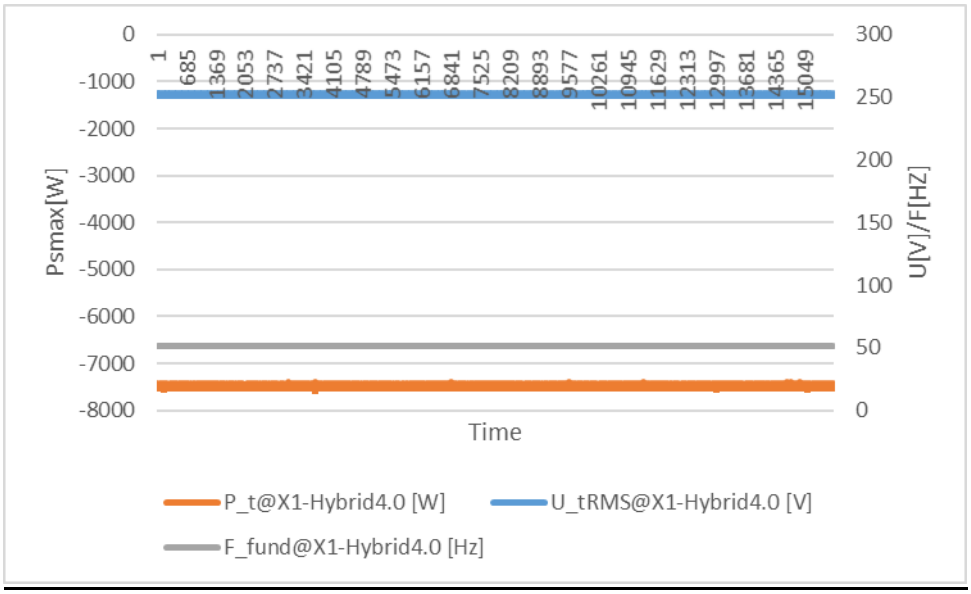


Grafico Test 2: 85% U_n – 47.5Hz / 100% Pc_{max}

/ Graph Test 2: 85% Un – 47.5Hz

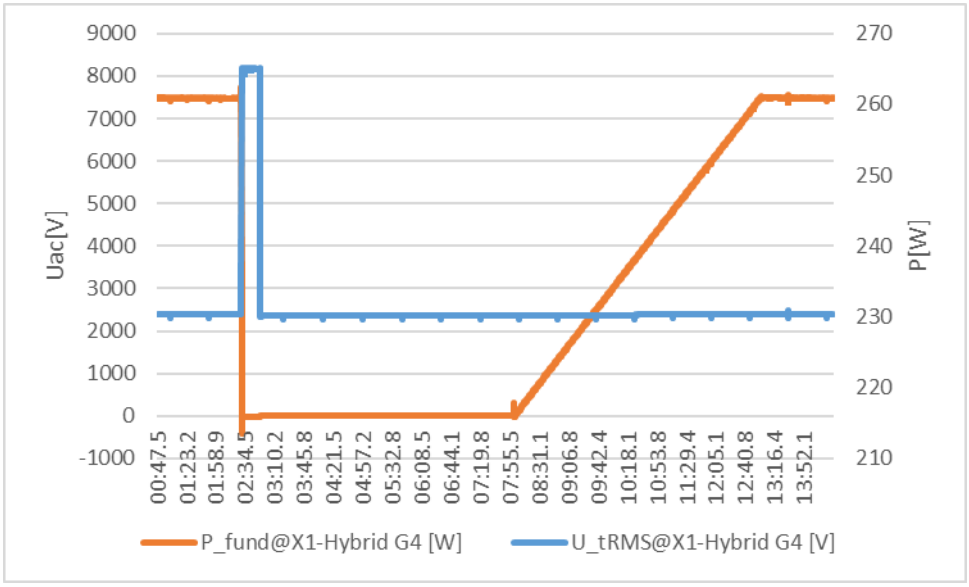


8.4.1.3 **Par. a) & b)** **Bbis.5.1** **Bbis.5.2**	**TABLE: Verifica delle condizioni di connessione e riconnessione** ***/ Check of the connection and re-connection conditions*** **TABLE: Verifica della erogazione graduale della potenza attiva** ***/ Check of the gradual increase of the power production***	
Ambient temperature (°C) ..... :		25 °C ± 5 °C
Humidity (RH %) ..... :		65% ± 5% RH
Instrumentation list..... :		See table “Measurement equipment and instrumentation”
Uncertainty ..... :		N/A
Supplementary information:		
Operator ..... :		See cover page.
Supervisor ..... :		See cover page.
Test Date..... :		See cover page.

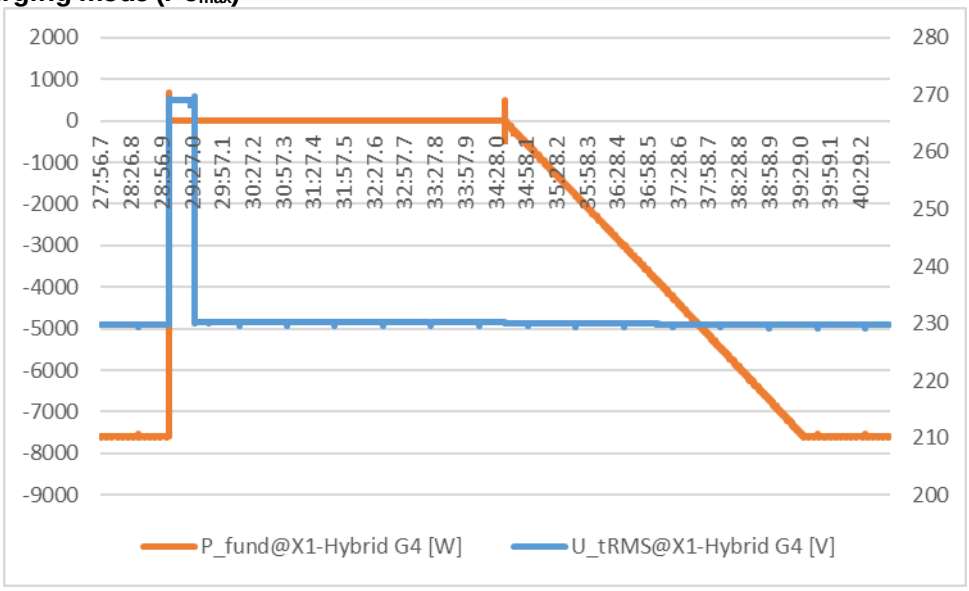
Voltage [Vac]	Voltage Condition [Vac]	Frequency [Hz]	Frequency condition [Hz]	Output Power [W]	Rec. Time [sec]	Ramp Time [sec]	Ramp gradient [%Pn/s]	Acceptability criteria	Note
254.3	V < 85% or V > 110%	50.00	49.9Hz < f < 50.1Hz	- - -	- - -	- - -	- - -	no connection after 30s	First connection
230.2	85%< V <110%	50.00	49.9Hz < f < 50.1Hz	7497	300	336	0.297	Connection Delay for Reconnection ≥30 s Ramp ratio P < 0.333 % Pn/s	Connection to grid (no after fault of the grid- ex. First connection) **Ref. a) 8.4.1.3**
190.1	V < 85%	50.00	49.9Hz < f < 50.1Hz	- - -	- - -	- - -	- - -	no connection after 300 s	UV **Ref. b) 8.4.1.3**
200.1	85%< V <110%	50.00	49.9Hz < f < 50.1Hz	7509	300	336	0.297	Connection Delay for Reconnection ≥300 s Ramp ratio P < 0.333 % Pn/s	Reconnection after fault recovery **Ref. b) 8.4.1.3**
259.7	V > 110%	50.00	49.9Hz < f < 50.1Hz	- - -	- - -	- - -	- - -	no connection after 300 s	OV **Ref. b) 8.4.1.3**
248.3	85%< V <110%	50.00	49.9Hz < f < 50.1Hz	7507	300	339	0.295	Connection Delay for Reconnection ≥300 s Ramp ratio P < 0.333 % Pn/s	Reconnection after fault recovery **Ref. b) 8.4.1.3**
229.8	85%< V <110%	47.40	f < 47.5Hz	- - -	- - -	- - -	- - -	no connection after 300 s	UF **Ref. b) 8.4.1.3**
229.8	85%< V <110%	49.95	49.9Hz < f < 50.1Hz	7504	302	334	0.300	Connection Delay for Reconnection ≥300 s Ramp ratio P < 0.333 % Pn/s	Reconnection after fault recovery **Ref. b) 8.4.1.3**
230.2	85%< V <110%	51.20	f > 51.1Hz	- - -	- - -	- - -	- - -	no connection after 300 s	OF **Ref. b) 8.4.1.3**
230.2	85%< V <110%	50.05	49.9Hz < f < 50.1Hz	7509	301	336	0.298	Connection Delay for Reconnection ≥300 s Ramp ratio P < 0.333 % Pn/s	Reconnection after fault recovery **Ref. b) 8.4.1.3**

Grafico Bbis.5.2: Verifica della erogazione graduale della Potenza attiva
/ Graph Bbis.5.2: *Check of the gradual increase of the power production*

Test in discharging mode (Ps_{max})



Test in charging mode (Pc_{max})



8.4.4.2 Bbis.6.1	TABLE: check of the constructive requirements: reactive power production capability
Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table
Max. cosφ declared..... :	☐ cosφ: 0.9 → Pout ≤ 11.08 KW (triangular) ☒ Q/Pn% = 48.43% →Pout > 11.08 KW (rectangular)

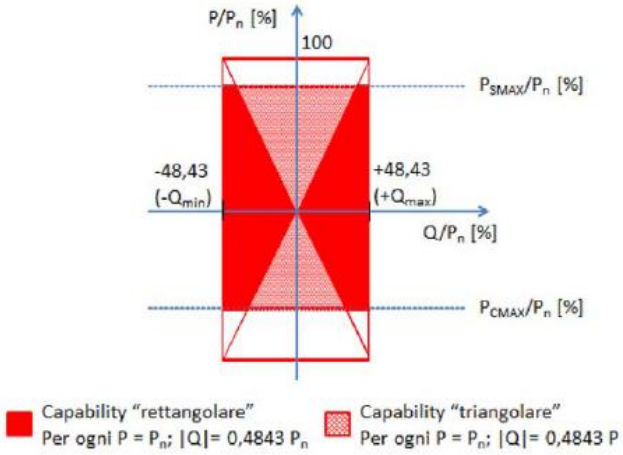


Figura 3Bbis – Capability per un sistema di accumulo con inverter bidirezionale.

Supplementary information:

For each of the 10 levels of active power, 1 value of inductive reactive power and 1 value of conductive reactive power shall be registered as average values in 1 min, based on the measurements at the fundamental in a window of 200ms.

Operator ..... :	See cover page.
Supervisor ..... :	See cover page.
Test Date..... :	See cover page.

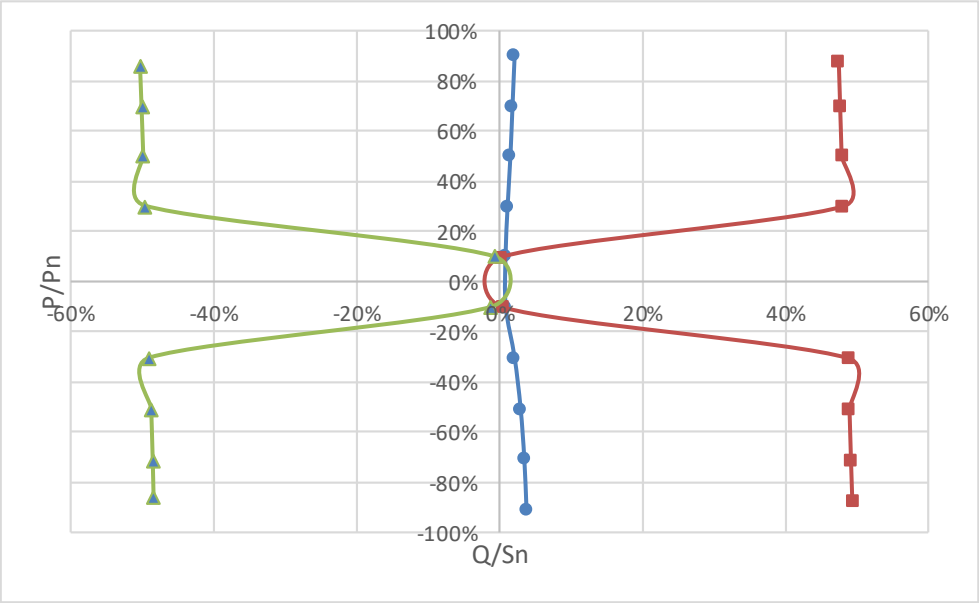
TABLE: Reactive power production with set point Q = 0 (Max.inverter and Max.Battery)							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Smax}	6771.1	90.28%	159.9	2.13%	6927.0	92.36%	0.999
70% - 80% P_{Smax}	5270.6	70.27%	137.2	1.83%	5441.2	72.55%	0.999
50% - 60% P_{Smax}	3769.8	50.26%	115.5	1.54%	3940.2	52.54%	0.999
30% - 40% P_{Smax}	2264.5	30.19%	86.63	1.15%	2375.4	31.67%	0.999
10% - 20% P_{Smax}	755.9	10.08%	64.38	0.85%	813.8	10.85%	0.996
10% - 20% P_{Cmax}	-754.0	-10.05%	66.04	0.88%	-811.2	-10.82%	0.996
30% - 40% P_{Cmax}	-2268.1	-30.24%	158.7	2.12%	-2457.2	-32.76%	0.997
50% - 60% P_{Cmax}	-3784.9	-50.46%	222.0	2.96%	-3952.3	-52.70%	0.998
70% - 80% P_{Cmax}	-5305.5	-70.74%	261.4	3.48%	-5401.6	-72.02%	0.999
90% - 100% P_{Cmax}	-6780.8	-90.41%	283.7	3.78%	-6968.3	-92.91%	0.999

TABLE: Reactive power adsorbed with set point Q = Qmin (Max.inverter and Max.Battery)							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Cmax}	-6441.2	-85.88%	-3630	-48.40%	-6651	-88.68%	-0.871
70% - 80% P_{Cmax}	-5317.1	-70.89%	-3639.2	-48.52%	-5431.1	-72.41%	-0.825
50% - 60% P_{Cmax}	-3791.8	-50.56%	-3654.7	-48.73%	-3956.8	-52.76%	-0.720
30% - 40% P_{Cmax}	-2271.1	-30.28%	-3670.9	-48.95%	-2412.2	-32.16%	-0.526
10% - 20% P_{Cmax}	-753.8	-10.05%	-86	-1.15%	-810.3	-10.80%	-0.200
10% - 20% P_{Smax}	759.2	10.12%	-61	-0.81%	811.4	10.82%	-0.201
30% - 40% P_{Smax}	2268	30.24%	-3718.9	-49.59%	2423.2	32.31%	-0.521
50% - 60% P_{Smax}	3772	50.29%	-3738.2	-49.84%	3923.2	52.31%	-0.710
70% - 80% P_{Smax}	5277.5	70.37%	-3756.9	-50.09%	5422.3	72.30%	-0.815
90% - 100% P_{Smax}	6481.8	86.42%	-3772.8	-50.30%	6768.3	90.24%	-0.864

TABLE: Reactive power produced with set point Q = Qmax							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Cmax}	-6587.8	-87.84%	3703.5	49.38%	-6777.4	-90.37%	0.872
70% - 80% P_{Cmax}	-5334.7	-71.13%	3689.3	49.19%	-5486.5	-73.15%	0.822
50% - 60% P_{Cmax}	-3810.3	-50.80%	3673.7	48.98%	-3969.6	-52.93%	0.720
30% - 40% P_{Cmax}	-2290.9	-30.55%	3658.1	48.77%	-2407.2	-32.10%	0.531
10% - 20% P_{Cmax}	-775.4	-10.34%	41.8	0.56%	-816.9	-10.89%	0.208
10% - 20% P_{Smax}	737.1	9.83%	23.4	0.31%	828.1	11.04%	0.199
30% - 40% P_{Smax}	2246.3	29.95%	3607.7	48.10%	2416.4	32.22%	0.529
50% - 60% P_{Smax}	3752.1	50.03%	3591.1	47.88%	3877.2	51.70%	0.722
70% - 80% P_{Smax}	5255.8	70.08%	3575.3	47.67%	5472.7	72.97%	0.827
90% - 100% P_{Smax}	6570.4	87.61%	3561.3	47.48%	6657.6	88.77%	0.879

Grafico: P/Q

/ Graph: Maximum reactive power adsorbed (Qmin) and produced (Qmax) as a function of the active power fed into the grid.



Bbis.6.3	TABLE: reactive power production according to an assigned level Required for inverter used in plant < 11.08KW (applicable for inverter with Pnom < 11.08 KW as well)
Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table "Measurement equipment and instrumentation"
Uncertainty ..... :	See table
Max. cosφ declared..... : SET-POINT	☐ cosφ: 0.9 → Pout ≤ 11.08 KW ☒ Q/Pn% = 48.43% →Pout > 11.08 KW
Supplementary information: - Output power during test set at 50%Pn (power level set by DC simulator). - Maintain each set point at least 60 s. - Calculate the average values in 1 min, based on measurements at the fundamental frequency in a window of 200ms.	
Operator ..... :	See cover page.
Supervisor ..... :	See cover page.
Test Date..... :	See cover page.

Tabella Bbis.6.3: Misura dell'accuratezza della regolazione della potenza reattiva in base ad un comando esterno

/ Tabella Bbis.6.3 : reactive power production according to an assigned level

Output Power [%]	Set point Q/Sn [%]	Output Power measured [W]	Reactive Power measured [Var]	Deviation ΔQ/Sn [%]	ΔQ Limit [%]	RESULT
50% PS_{MAX}	40.0 %	3756.5	2958.3	0.56%	≤ 5% Sn	PASS
50% PC_{MAX}	40.0 %	-3806.2	3038.0	0.51%	≤ 5% Sn	PASS

Bbis.6.5	**TABLE: Tempo di risposta ad una variazione a gradino del livello assegnato** ***/ Reaction time after a step variation of the assigned level.*** **Required for inverter used in plant < 11.08KW**
Ambient temperature (°C) .....:	25 °C ± 5 °C
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list .....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Max. cosφ declared.....:	Q/Pn% = 48.43% →Pout > 11.08 KW

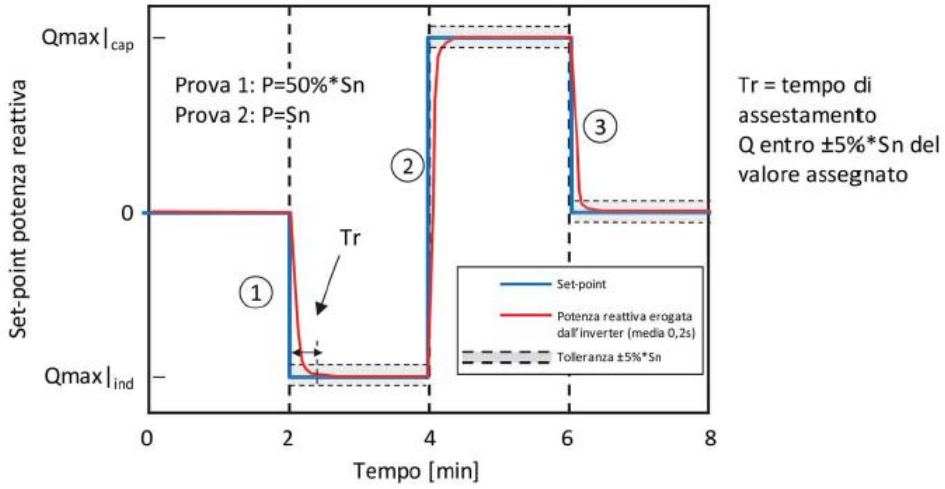


Figura 6Bbis – Misura del tempo di risposta a variazioni a gradino del set-point assegnato per la potenza reattiva

Supplementary information:

- Measurements performed with output power set at 50%Pnom and 100%Pnom
- Sample rate: at least 200ms.

Operator .....:	See cover page.
Supervisor .....:	See cover page.
Test Date.....:	See cover page.

Tabella Bbis.6.5 : Misura del tempo di risposta a variazioni a gradino del set-point assegnato per la potenza reattiva

/ Table: Reaction time after a step variation of the assigned level

Test 1 : 100% output power						
Step	Output Power [W]	transient	Output Voltage [V]	Reactive Power [Var]	Tr [s]	Limit [s]
1	6491	**0 → -Qmin**	230.9	-3759	1.0	10
2	6565	**-Qmin→ +Qmax**	231.3	3575	1.0	10
3	7522	**+Qmax → 0**	230.3	-187	1.5	10
Test 2 : 50% output power						
Step	Output Power [W]	transient	Output Voltage [V]	Reactive Power [Var]	Tr [s]	Limit [s]
1	3780	**0 → -Qmin**	230.7	-3732	1.0	10
2	3746	**-Qmin→ +Qmax**	230.8	3599	1.5	10
3	3772	**+Qmax → 0**	230.7	-133	1.0	10

Descrizione del metodo di controllo adottato / *description of control method used:*

This function can be control by the panel of inverter.

Grafico: Tempo di risposta ad una variazione a gradino del livello assegnato (Test 1 – 100% Pn).
/Graph of the reaction time after a step variation of the assigned level (Test 1 - 100%).

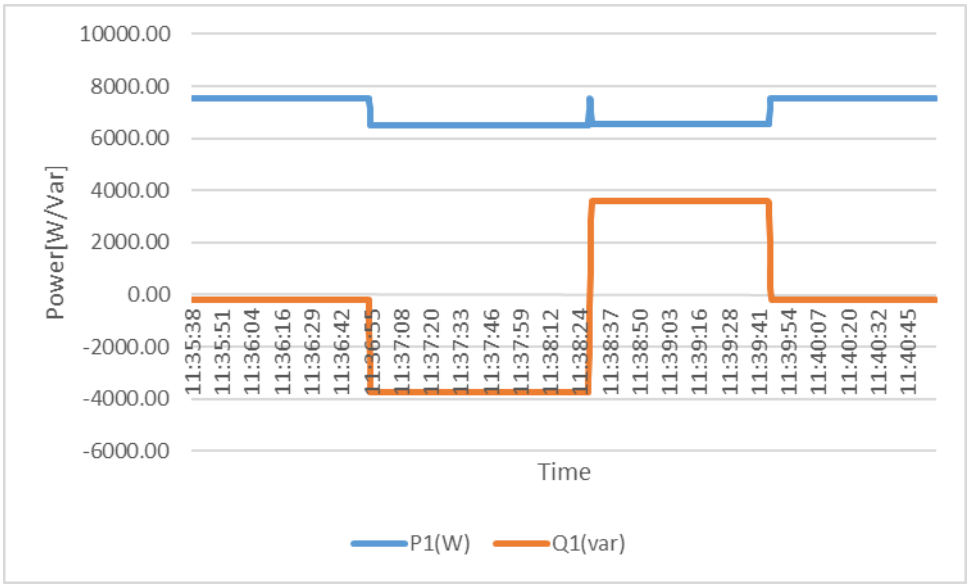
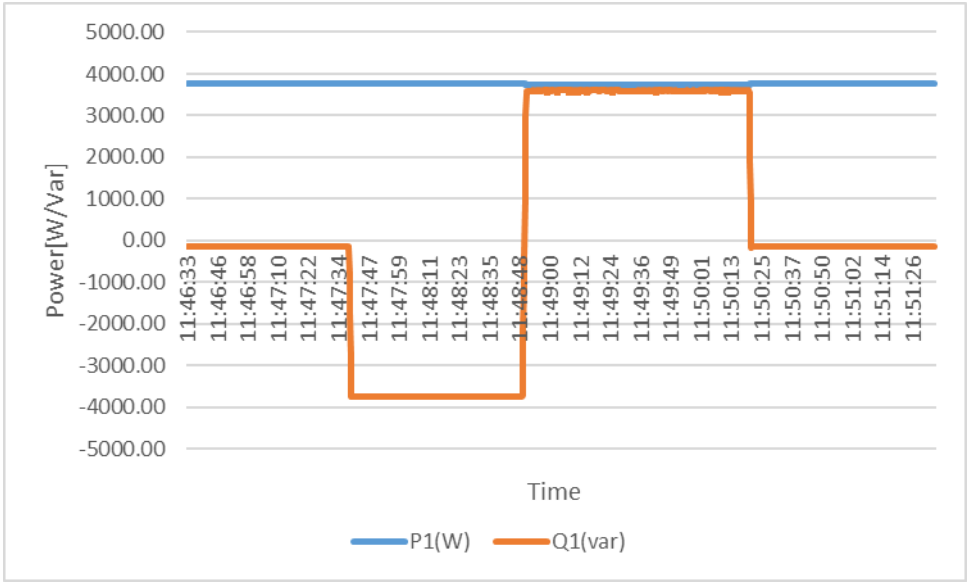


Grafico: Tempo di risposta ad una variazione a gradino del livello assegnato (Test 2 – 50% Pn).
/ Graph of the reaction time after a step variation of the assigned level (Test 2 – 50%).



Bbis.6.6 *Annex E* **E.2**	**TABLE: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ= f(P)** ***/ Automatic production of reactive power according to a characteristic curve cosφ= f(P)***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table
Max. cosφ declared..... :	☒ cosφ: 0.9 → Pout ≤ 11.08 KW ☐ Q/Pn% = 48.43% →Pout > 11.08 KW
Set value..... :	Lock-in: 1.05 Vn *(Vn and 1.1 Vn with steps of 0.01)* Lock-out: 230 V or 50%PS_{max} *(0.9 Vn and Vn with steps of 0.01)*

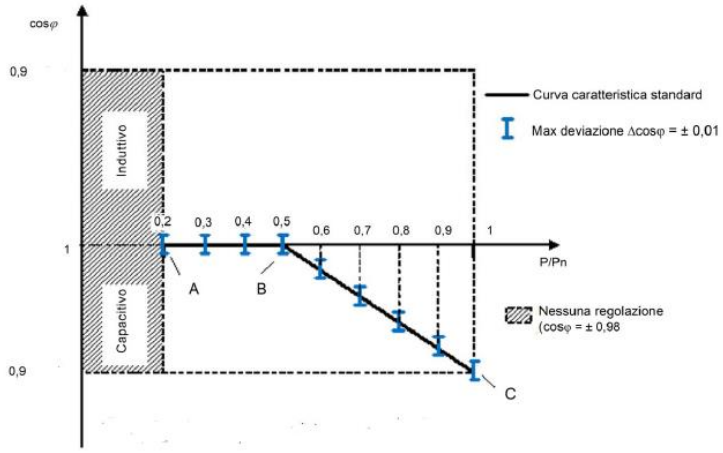


Figura 7Bbis – Curva caratteristica standard cosφ = f(P)

Supplementary information:

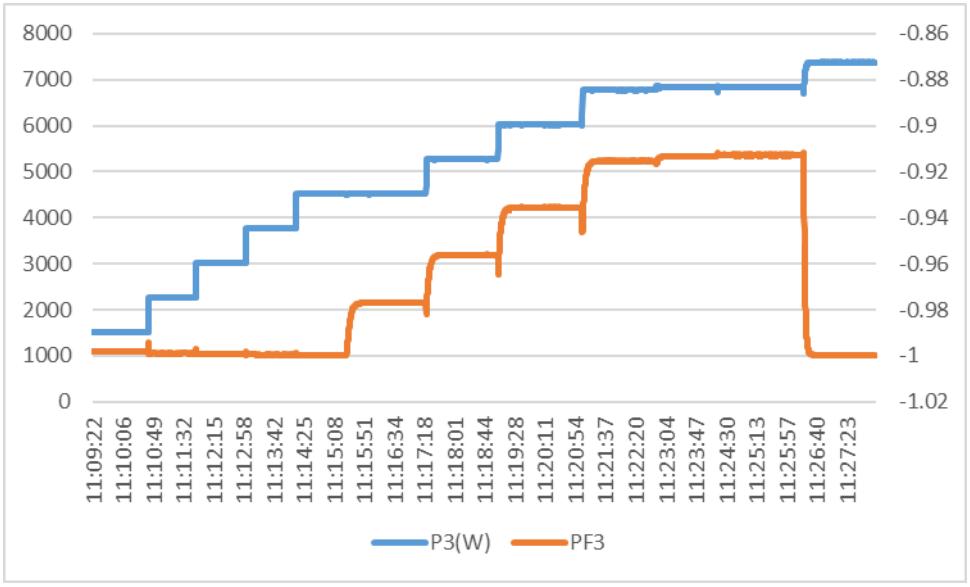
- Function must be anable by a local command of the converter.
- Each value must be reach in < 10s.

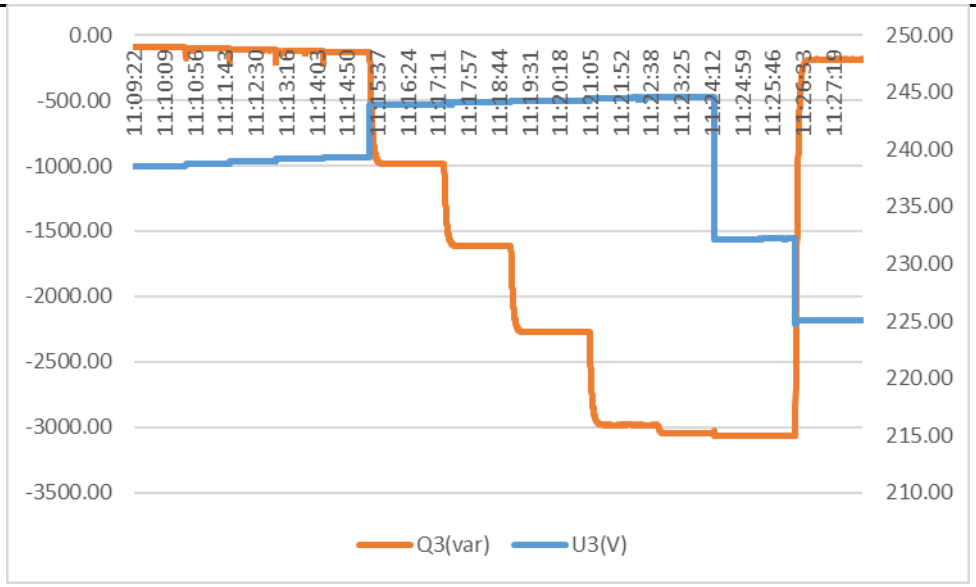
Operator ..... :	See cover page.
Supervisor ..... :	See cover page.
Test Date..... :	See cover page.

Tabella Bbis.7: Erogazione automatica di potenza reattiva secondo una curva caratteristica cos φ = f(P)
/ Table Bbis.7: *cosφ=f(P)*

P/PS$_{MAX}$ [%]	P [W]	Vout [V]	Q [Var]	Cosφ measured	Cosφ Set-point	ΔQ	Limit ΔQ/Pn	RESULT
20	1512.3	238.6	-93.4	-0,998	1.000	0.00	± 2.5%	P
30	2265.3	238.8	-104.9	-0.999	1.000	-93.40	± 2.5%	P
40	3018.7	239.2	-117.2	-0.993	1.000	-104.90	± 2.5%	P
50	3771.9	239.2	-126.5	-0.994	1.000	-117.20	± 2.5%	P
60	4526.5	239.3	-135.3	-0.996	1.000	-126.50	± 2.5%	P
60	4525.5	243.9	-987.6	-0.977	1.000	-135.30	± 2.5%	P
70	5278.8	244.1	-1613.5	-0.956	0.979	-52.68	± 2.5%	P
80	6030.1	244.2	-2291.3	-0.942	0.959	-58.20	± 2.5%	P
90	6777.2	244.5	-2983.2	-0.915	0.939	-86.65	± 2.5%	P
100	6844.2	244.6	-3049.1	-0.914	0.919	-81.33	± 2.5%	P
100	6846.2	232.2	-3068.5	-0.913	0.917	-81.90	± 2.5% Pn	P
100	7381.9	225.1	-187.9	0.999	0.917	-99.34	± 2.5% Pn	P

Grafico: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ= f(P)
/ Graph: Reactive power production according to a characteristic curve cos(phi) = f(P)




0.00
-500.00
-1000.00
-1500.00
-2000.00
-2500.00
-3000.00
-3500.00
250.00
245.00
240.00
235.00
230.00
225.00
220.00
215.00
210.00
11:09:22
11:10:09
11:10:56
11:11:43
11:12:30
11:13:16
11:14:03
11:14:50
11:15:37
11:16:24
11:17:11
11:17:57
11:18:44
11:19:31
11:20:18
11:21:05
11:21:52
11:22:38
11:23:25
11:24:12
11:24:59
11:25:46
11:26:33
11:27:19
Q3(var)
U3(V)

Bbis.6.8 *Annex E* E.2.1	**TABLE: Erogazione automatica di potenza reattiva secondo una curva caratteristica Q=f(V)** ***/ Automatic reactive power production according to a characteristic curve Q=f(V)*** **Required for inverter used in plant < 11.08KW**

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table
Set value..... :	Lock-in: 0.2*PS_{max} (or 0.2*P_{NINV}) and 0.2*PC_{max} Lock-out: 0.05*PS_{max}
Activation settings..... .	Activation of the protection with a delay from 0 to 30 s with step of 1 s (Default setting: 3 s)

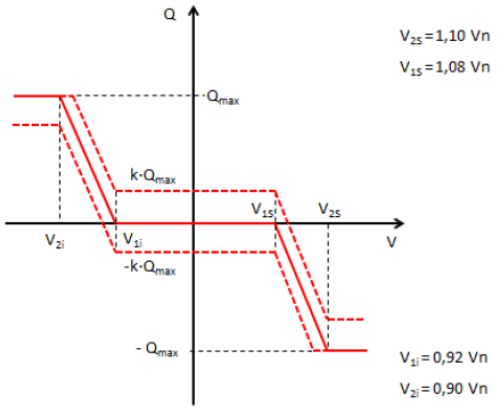


Figura 39 – Curve caratteristiche standard Q = f(V) [87]

Default settings:	V/Vn	Q/Pn%
V2i	0.90	Q_{MAX}
V1i	0.92	0.00%
V1s	1.08	0.00%
V2s	1.10	Q_{MIN}

Supplementary information:

The setting of k = 0 ÷ 1 with steps of 0.01

The setting of Q(V) function is enabled by a local command of the inverter.

Operator ..... :	see cover page.
Supervisor ..... :	see cover page.
Test Date..... :	see cover page.

Parametri definiti dal costruttore: / *Parameters defined by the customer*				
Discharge mode: Ps_{max}	k=0.1	V_{1s} = 1.08%Vn	V_{2s} = 1.1%Vn	Table A.1
		V_{1i} = 0.92%Vn	V_{2i} = 0.9%Vn	Table A.2
Discharge mode: Ps_{max}	k= - 0.1	V_{1s} = 1.08%Vn	V_{2s} = 1.1%Vn	Table A.3
		V_{1i} = 0.92%Vn	V_{2i} = 0.9%Vn	Table A.4
Charge mode: Pc_{max}	k=0.1	V_{1s} = 1.08%Vn	V_{2s} = 1.1%Vn	Table B.1
		V_{1i} = 0.92%Vn	V_{2i} = 0.9%Vn	Table B.2
Charge mode: Pc_{max}	k= - 0.1	V_{1s} = 1.08%Vn	V_{2s} = 1.1%Vn	Table B.3
		V_{1i} = 0.92%Vn	V_{2i} = 0.9%Vn	Table B.4

Table A.1: Discharge mode with k=0.1

Set Point		Measure			Q/Qn[%] expected	Δ Q %	LIMITS	RESULT
P/Ps_{max} [%]	V/Vn	P/Ps_{max} [%]	Vout [V]	Q [Var]				
<20%	1.07	19.15%	246.5	55.89	≈k Q_{max} (< ± 5 % Sn)	-4.09%	≤ ± 5% Sn	P
<20%	1.09	19.14%	250.3	51.7	≈k Q_{max} (< ± 5 % Sn)	-4.15%	≤ ± 5% Sn	P
<20 % → 30 %	1.09	30.24%	250.4	-1502.6	-0.4 Q_{max} (< 10 sec)	-0.67%	≤ ± 5% Sn	P
40%	1.09	40.26%	250.2	-1494.9	-0.4 Q_{max}	-0.57%	≤ ± 5% Sn	P
50%	1.09	50.34%	250.0	-1432.0	-0.4 Q_{max}	0.27%	≤ ± 5% Sn	P
60%	1.09	60.32%	249.9	-1442.9	-0.4 Q_{max}	0.12%	≤ ± 5% Sn	P
70%	1.09	70.37%	249.8	-1449.7	-0.4 Q_{max}	0.03%	≤ ± 5% Sn	P
80%	1.09	80.36%	247.7	-1430.8	-0.4 Q_{max}	0.28%	≤ ± 5% Sn	P
90%	1.09	90.72%	249.6	-1468.8	-0.4 Q_{max}	-0.22%	≤ ± 5% Sn	P
100%	1.09	97.89%	249.6	-1497,5	-0.4 Q_{max}	-0.61%	≤ ± 5% Sn	P
100%	1.10	90.22%	251.9	-3180.7	-0.9 Q_{max}	1.15%	≤ ± 5% Sn	P
100 % → 10%	1.10	10.19%	253.0	-3309.7	-0.9 Q_{max}	-0.57%	≤ ± 5% Sn	P
10 % → ≤ 5%	1.10	4.04%	253.0	52.63	≈k Q_{max} (< ± 5 % Sn)	-4.14%	≤ ± 5% Sn	P

Table A.2: Discharge mode with k= 0.1								
Set Point		Measure			Q/Qn[%] expected	Δ Q %	LIMIT	RESULT
P/Ps_{max} [%]	V/Vn	P/Ps_{max} [%]	Vout [V]	Q [Var]				
<20%	0.93	19.18%	214.0	87.37	≈k Q_{max} (< ± 5 % Sn)	-3.68%	≤ ± 5% Sn	P
<20%	0.91	19.17%	209.2	93.07	≈k Q_{max} (< ± 5 % Sn)	-3.60%	≤ ± 5% Sn	P
<20 % → 30 %	0.91	30.04%	209.3	2163.3	0.6 Q_{max} (< 10 sec)	-0.20%	≤ ± 5% Sn	P
40%	0.91	40.10%	209.1	2201.6	0.6 Q_{max}	0.31%	≤ ± 5% Sn	P
50%	0.91	50.12%	209.0	2192.6	0.6 Q_{max}	0.19%	≤ ± 5% Sn	P
60%	0.91	60.17%	208.8	2182.7	0.6 Q_{max}	0.06%	≤ ± 5% Sn	P
70%	0.91	70.17%	208.7	2154.0	0.6 Q_{max}	-0.32%	≤ ± 5% Sn	P
80%	0.91	80.18%	208.6	2136.3	0.6 Q_{max}	-0.56%	≤ ± 5% Sn	P
90%	0.91	85.87%	208.5	2175.0	0.6 Q_{max}	-0.04%	≤ ± 5% Sn	P
100%	0.91	86.71%	208.5	2177.9	0.6 Q_{max}	0.00%	≤ ± 5% Sn	P
100%	0.90	75.85%	206.3	3541.6	Q_{max}	-1.18%	≤ ± 5% Sn	P
100 % → 10%	0.90	9.77%	205.7	3592.6	Q_{max}	-0.50%	≤ ± 5% Sn	P
10 % → ≤ 5%	0.90	4.03%	205.7	86.51	≈k Q_{max} (< ± 5 % Sn)	-3.69%	≤ ± 5% Sn	P

Table A.3: Discharge mode with k= -0.1								
Set Point		**Measure**			**Q/Qn[%] expected**	**Δ Q %**	**LIMIT**	**RESULT**
P/Ps_{max} [%]	**V/Vn**	**P/Ps_{max} [%]**	**Vout [V]**	**Q [Var]**				
<20%	1.07	19.14%	246.3	58.72	≈k Q_{max} (< ± 5 % Sn)	-4.06%	≤ ± 5% Sn	P
<20%	1.09	19.07%	250.7	59.75	≈k Q_{max} (< ± 5 % Sn)	-4.04%	≤ ± 5% Sn	P
<20 % → 30 %	1.09	30.26%	250.8	-2085.0	-0.6 Q_{max} (< 10 sec)	1.24%	≤ ± 5% Sn	P
40%	1.09	40.29%	250.8	-2164.4	-0.6 Q_{max}	0.18%	≤ ± 5% Sn	P
50%	1.09	50.31%	250.7	-2173.2	-0.6 Q_{max}	0.06%	≤ ± 5% Sn	P
60%	1.09	60.35%	250.6	-2188.9	-0.6 Q_{max}	-0.15%	≤ ± 5% Sn	P
70%	1.09	70.36%	250.4	-2179.0	-0.6 Q_{max}	-0.01%	≤ ± 5% Sn	P
80%	1.09	80.38%	250.3	-2181.6	-0.6 Q_{max}	-0.05%	≤ ± 5% Sn	P
90%	1.09	90.38%	250.1	-2137.9	-0.6 Q_{max}	0.53%	≤ ± 5% Sn	P
100%	1.09	95.78%	250.0	-2144.1	-0.6 Q_{max}	0.45%	≤ ± 5% Sn	P
100%	1.10	87.81%	252.0	-3581.4	$-Q_{max}$	0.65%	≤ ± 5% Sn	P
100 % → 10%	1.10	10.17%	253.0	-3567.3	$-Q_{max}$	0.84%	≤ ± 5% Sn	P
10 % → ≤ 5%	1.10	4.04%	253.0	52.19	≈k Q_{max} (< ± 5 % Sn)	-4.14%	≤ ± 5% Sn	P

Table A.4: Discharge mode with k= -0.1								
Set Point		Measure			Q/Qn[%] expected	Δ Q %	LIMIT	RESULT
P/Ps_{max} [%]	V/Vn	P/Ps_{max} [%]	Vout [V]	Q [Var]				
<20%	0.93	19.18%	214.0	87.83	≈-k Q_{max} (< ± 5 % Sn)	-3.67%	≤ ± 5% Sn	P
<20%	0.91	19.18%	209.1	94.00	≈-k Q_{max} (< ± 5 % Sn)	-3.59%	≤ ± 5% Sn	P
<20 % → 30 %	0.91	30.12%	209.2	1502.7	0.4 Q_{max} (< 10 sec)	0.68%	≤ ± 5% Sn	P
40%	0.91	40.27%	209.1	1461.5	0.4 Q_{max}	0.13%	≤ ± 5% Sn	P
50%	0.91	50.20%	209.0	1453.3	0.4 Q_{max}	0.02%	≤ ± 5% Sn	P
60%	0.91	60.24%	208.8	1460.1	0.4 Q_{max}	0.11%	≤ ± 5% Sn	P
70%	0.91	70.22%	208.7	1441.2	0.4 Q_{max}	-0.14%	≤ ± 5% Sn	P
80%	0.91	80.22%	208.6	1399.9	0.4 Q_{max}	-0.69%	≤ ± 5% Sn	P
90%	0.91	88.69%	208.4	1464.2	0.4 Q_{max}	0.16%	≤ ± 5% Sn	P
100%	0.91	88.76%	208.4	1445.6	0.4 Q_{max}	-0.09%	≤ ± 5% Sn	P
100%	0.90	78.56%	205.8	3176.4	0.9 Q_{max}	-1.21%	≤ ± 5% Sn	P
100 % → 10%	0.90	9.81%	205.3	3224.2	0.9 Q_{max}	-0.57%	≤ ± 5% Sn	P
10 % → ≤ 5%		4.05%	205.3	87.17	≈-k Q_{max} (< ± 5 % Sn)	-3.68%	≤ ± 5% Sn	P

Table B.1: Charge mode with k=0.1								
Set Point		**Measure**			**Q/Qn[%] expected**	**Δ Q %**	**LIMIT**	**RESULT**
P/Pc$_{max}$ [%]	**V/Vn**	**P/Pc$_{max}$ [%]**	**Vout [V]**	**Q [Var]**				
<20%	1.07	19.13%	246.1	119.6	≈-k Q$_{max}$ (< ± 5 % Sn)	-3.25%	≤ ± 5% Sn	P
<20%	1.09	19.90%	251.3	128.4	≈ -k Q$_{max}$ (< ± 5 % Sn)	-3.13%	≤ ± 5% Sn	P
<20 % → 30 %	1.09	30.52%	251.2	-1357.5	-0.4 Q$_{max}$ (< 10 sec)	1.26%	≤ ± 5% Sn	P
40%	1.09	40.34%	251.4	-1373.8	-0.4 Q$_{max}$	1.04%	≤ ± 5% Sn	P
50%	1.09	50.39%	251.5	-1400.7	-0.4 Q$_{max}$	0.68%	≤ ± 5% Sn	P
60%	1.09	60.51%	251.6	-1360.7	-0.4 Q$_{max}$	1.22%	≤ ± 5% Sn	P
70%	1.09	70.64%	251.6	-1313.4	-0.4 Q$_{max}$	1.85%	≤ ± 5% Sn	P
80%	1.09	80.76%	251.8	-1371.8	-0.4 Q$_{max}$	1.07%	≤ ± 5% Sn	P
90%	1.09	90.95%	251.8	-1301.5	-0.4 Q$_{max}$	2.01%	≤ ± 5% Sn	P
100%	1.09	99.52%	250.6	-1504.9	-0.4 Q$_{max}$	-0.71%	≤ ± 5% Sn	P
100%	1.10	90.49%	254.6	-3206.1	-0.9 Q$_{max}$	0.81%	≤ ± 5% Sn	P
100 % → 10%	1.10	10.40%	254.1	-3276.3	-0.9 Q$_{max}$	-0.12%	≤ ± 5% Sn	P
10 % → ≤ 5%		4.06%	254.2	63.54	≈-k Q$_{max}$ (< ± 5 % Sn)	-3.99%	≤ ± 5% Sn	P

Table B.2: Charge mode with k=0.1								
Set Point		Measure			Q/Qn[%] expected	Δ Q %	LIMIT	RESULT
P/Pc$_{max}$ [%]	V/Vn	P/Pc$_{max}$ [%]	Vout [V]	Q [Var]				
<20%	0.93	-19.14%	214.0	118.5	≈k Q$_{max}$ (< ± 5 % Sn)	-3.26%	≤ ± 5% Sn	P
<20%	0.91	-19.15%	209.9	120.8	≈k Q$_{max}$ (< ± 5 % Sn)	-3.23%	≤ ± 5% Sn	P
<20 % → 30 %	0.91	-30.45%	209.8	2128.4	0.6 Q$_{max}$ (< 10 sec)	-0.66%	≤ ± 5% Sn	P
40%	0.91	-40.56%	209.9	2214.0	0.6 Q$_{max}$	0.48%	≤ ± 5% Sn	P
50%	0.91	-50.80%	210.1	2148.5	0.6 Q$_{max}$	-0.39%	≤ ± 5% Sn	P
60%	0.91	-60.85%	210.2	2195.6	0.6 Q$_{max}$	0.23%	≤ ± 5% Sn	P
70%	0.91	-71.02%	210.3	2168.0	0.6 Q$_{max}$	-0.13%	≤ ± 5% Sn	P
80%	0.91	-81.24%	210.4	2203.8	0.6 Q$_{max}$	0.34%	≤ ± 5% Sn	P
90%	0.91	-88.16%	210.5	2108.4	0.6 Q$_{max}$	-0.93%	≤ ± 5% Sn	P
100%	0.91	-87.92%	210.6	2160.4	0.6 Q$_{max}$	-0.23%	≤ ± 5% Sn	P
100%	0.90	-77.44%	208.3	3661.6	Q$_{max}$	0.42%	≤ ± 5% Sn	P
100 % → 10%	0.90	-10.42%	207.2	3608.3	Q$_{max}$	-0.29%	≤ ± 5% Sn	P
10 % → ≤ 5%		-4.05%	207.2	79.7	≈k Q$_{max}$ (< ± 5 % Sn)	-3.78%	≤ ± 5% Sn	P

Table B.3: Charge mode with k= -0.1								
Set Point		**Measure**			**Q/Qn[%] expected**	**Δ Q %**	**LIMIT**	**RESULT**
P/Pc$_{max}$ [%]	**V/Vn**	**P/Pc$_{max}$ [%]**	**Vout [V]**	**Q [Var]**				
<20%	1.07	18.12%	246.2	112.4	≈-k Q$_{max}$ (< ± 5 % Sn)	-3.34%	≤ ± 5% Sn	P
<20%	1.09	-19.12%	251.5	120.0	≈-k Q$_{max}$ (< ± 5 % Sn)	-3.24%	≤ ± 5% Sn	P
<20 % → 30 %	1.09	-30.17%	251.4	-2210.1	-0.6 Q$_{max}$ (< 10 sec)	-0.43%	≤ ± 5% Sn	P
40%	1.09	-40.22%	251.6	-2227.0	-0.6 Q$_{max}$	-0.65%	≤ ± 5% Sn	P
50%	1.09	-50.37%	251.7	-2200.4	-0.6 Q$_{max}$	-0.30%	≤ ± 5% Sn	P
60%	1.09	-60.49%	251.6	-2081.2	-0.6 Q$_{max}$	1.29%	≤ ± 5% Sn	P
70%	1.09	-70.66%	251.8	-2138.7	-0.6 Q$_{max}$	0.52%	≤ ± 5% Sn	P
80%	1.09	-80.79%	252.0	-2185.3	-0.6 Q$_{max}$	-0.10%	≤ ± 5% Sn	P
90%	1.09	-90.47%	252.1	-2201.4	-0.6 Q$_{max}$	-0.31%	≤ ± 5% Sn	P
100%	1.09	-95.79%	252.1	-2149.8	-0.6 Q$_{max}$	0.38%	≤ ± 5% Sn	P
100%	1.10	-87.22%	254.1	-3534.4	-Q$_{max}$	1.27%	≤ ± 5% Sn	P
100 % → 10%	1.10	-10.10%	254.3	-3642.7	-Q$_{max}$	-0.17%	≤ ± 5% Sn	P
10 % → ≤ 5%	1.10	4.04%	254.1	63.24	≈-k Q$_{max}$ (< ± 5 % Sn)	-4.00%	≤ ± 5% Sn	P

Table B.4: Charge mode with k= -0.1								
Set Point		Measure			Q/Qn[%] expected	Δ Q %	LIMIT	RESULT
P/Pc_{max} [%]	V/Vn	P/Pc_{max} [%]	Vout [V]	Q [Var]				
<20%	0.93	19.14%	214.0	120.0	≈-k Q_{max} (< ± 5 % Sn)	-3.24%	≤ ± 5% Sn	P
<20%	0.91	19.14%	209.9	120.0	≈-k Q_{max} (< ± 5 % Sn)	-3.24%	≤ ± 5% Sn	P
<20 % → 30 %	0.91	30.37%	209.8	1435.9	0.4 Q_{max} (< 10 sec)	-0.21%	≤ ± 5% Sn	P
40%	0.91	40.48%	210.0	1442.0	0.4 Q_{max}	-0.13%	≤ ± 5% Sn	P
50%	0.91	50.62%	210.1	1452.4	0.4 Q_{max}	0.01%	≤ ± 5% Sn	P
60%	0.91	60.79%	210.2	1497.2	0.4 Q_{max}	0.60%	≤ ± 5% Sn	P
70%	0.91	70.93%	210.4	1432.0	0.4 Q_{max}	-0.27%	≤ ± 5% Sn	P
80%	0.91	81.14%	210.5	1471.4	0.4 Q_{max}	0.26%	≤ ± 5% Sn	P
90%	0.91	90.33%	210.6	1455.8	0.4 Q_{max}	0.05%	≤ ± 5% Sn	P
100%	0.91	90.37%	210.6	1462.3	0.4 Q_{max}	0.14%	≤ ± 5% Sn	P
100%	0.90	79.79%	207.5	3296.1	0.9 Q_{max}	0.39%	≤ ± 5% Sn	P
100 % → 10%	0.90	10.37%	207.0	3241.3	0.9 Q_{max}	-0.34%	≤ ± 5% Sn	P
10 % → ≤ 5%	0.90	4.04%	207.1	78.23	≈-k Q_{max} (< ± 5 % Sn)	-3.80%	≤ ± 5% Sn	P

8.5.3.1 Bbis.7.1	**TABLE: Limitazione della potenza attiva per valori di tensione prossimi al 110 % di Un** */ Active power limitation for voltage values near to 100 % di Un*

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

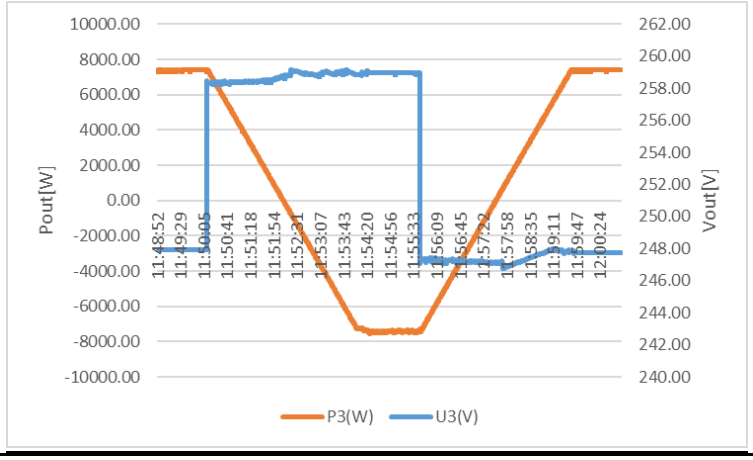
Supplementary information:

Please describe the enable mode of fuction defined by the customer
Active power was been measured with an average of 1 second.

Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

Set Point	**Measure**		**Limits**	**Result**
V/V$_{110\%}$ [%]	**P$_{out}$** [W]	**V$_{out}$** [V]		
-2%	7395.1	247.9	-	P
+2%	-7535.0	259.0	≤ 20% Ps$_{max}$ *(for unidirectional)* ≥ 80% Pc$_{max}$ *(for bidirectional)*	P
-2%	7397.8	248.1	-	P

Graph curve P=f(V) :



8.5.3.4 **8.5.3.5** **Bbis.7.2**	**TABLE: Verifica della riduzione automatica della potenza attiva in presenza di transitori di sovrafrequenza sulla rete** ***/Active power regulation in coincidence with transitory on the transmission grid***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

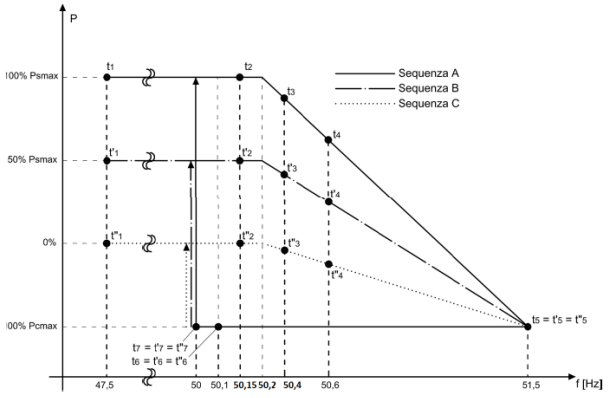


Figura 9Bbis – Curve di limitazione della potenza attiva per convertitori bidirezionali

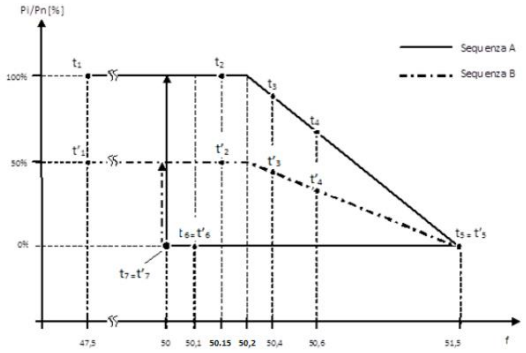


Figura 10Bbis – Curve di limitazione della potenza attiva per convertitori unidirezionali

Sequence test for Bi-directional EESS	*Sequence test for Uni-directional EESS*

Supplementary information:

Test shall be performed disabling the frequency threshold protection
Test was performed with a sampling time of 200ms
Sn is an active nominal power of the inverter

Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date ..... :	see cover page

Sequence A						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	100% Ps_{max}	50.00	7500	7513.1	± 2.5% S_n	t1
2	100% Ps_{max}	50.15	7500	7509.0	± 2.5% S_n	t2
3	100% Ps_{max}	50.40	5192.25	5390.0	± 2.5% S_n	t3
4	100% Ps_{max}	50.60	2884.5	3064.4	± 2.5% S_n	t4
5	100% Ps_{max}	51.49	-7384.5	-7355.0	± 2.5% S_n	t5
6	100% Ps_{max}	50.11	-7384.5	-7354.6	± 2.5% S_n	t6
7	100% Ps_{max}	50.00	7500	7534.5	± 2.5% S_n	t7
Sequence B						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	50% Ps_{max}	50.00	3750	3767.2	± 2.5% S_n	t1’
2	50% Ps_{max}	50.15	3750	3764.9	± 2.5% S_n	t2’
3	50% Ps_{max}	50.40	2019	2159.1	± 2.5% S_n	t3’
4	50% Ps_{max}	50.60	288.75	419.7	± 2.5% S_n	t4’
5	50% Ps_{max}	51.49	-7413.75	-7325.6	± 2.5% S_n	t5’
6	50% Ps_{max}	50.11	-7413.75	-7324.9	± 2.5% S_n	t6’
7	50% Ps_{max}	50.00	3750	3803.0	± 2.5% S_n	t7’

Sequence C*						
Step #	Set output power [%]	frequency [Hz]	Expected power value [W]	Actual power values [W]	limits	Graph point
1	0% PS_{max}	50.00	0	18.9	± 2.5% S_n	t1''
2	0% PS_{max}	50.15	0	12.0	± 2.5% S_n	t2''
3	0% PS_{max}	50.40	-1153.875	-1097.7	± 2.5% S_n	t3''
4	0% PS_{max}	50.60	-2307.675	-2206.7	± 2.5% S_n	t4''
5	0% PS_{max}	51.49	-7442.325	-7410.0	± 2.5% S_n	t5''
6	0% PS_{max}	50.11	-7442.325	-7408.9	± 2.5% S_n	t6''
7	0% PS_{max}	50.00	0	18.1	± 2.5% S_n	t7''

Sequence C applicable only for bidirectional converters.

Grafico Sequenza A: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence A: Active power regulation in coincidence with transitory on the transmission grid

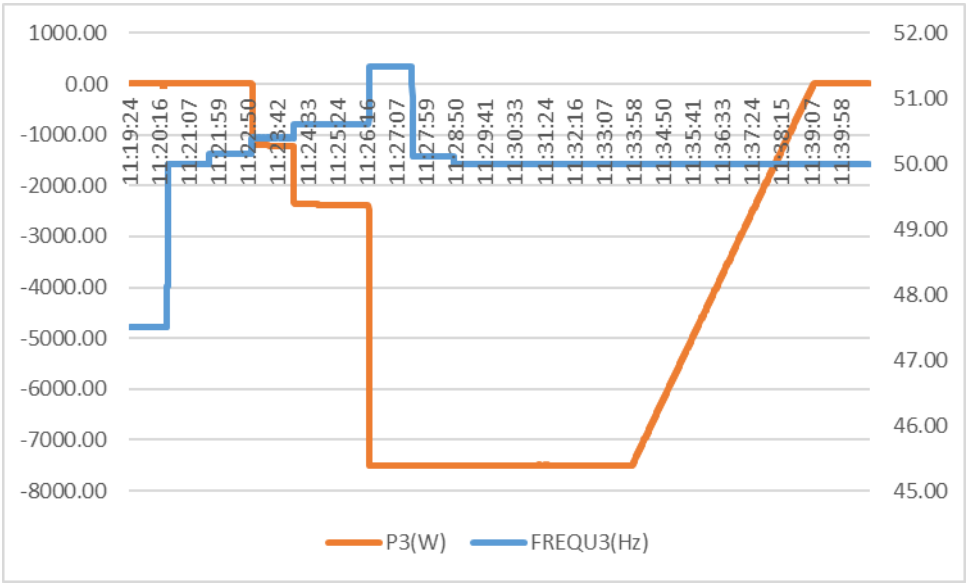


Grafico Sequenza B: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence B: Active power regulation in coincidence with transitory on the transmission grid

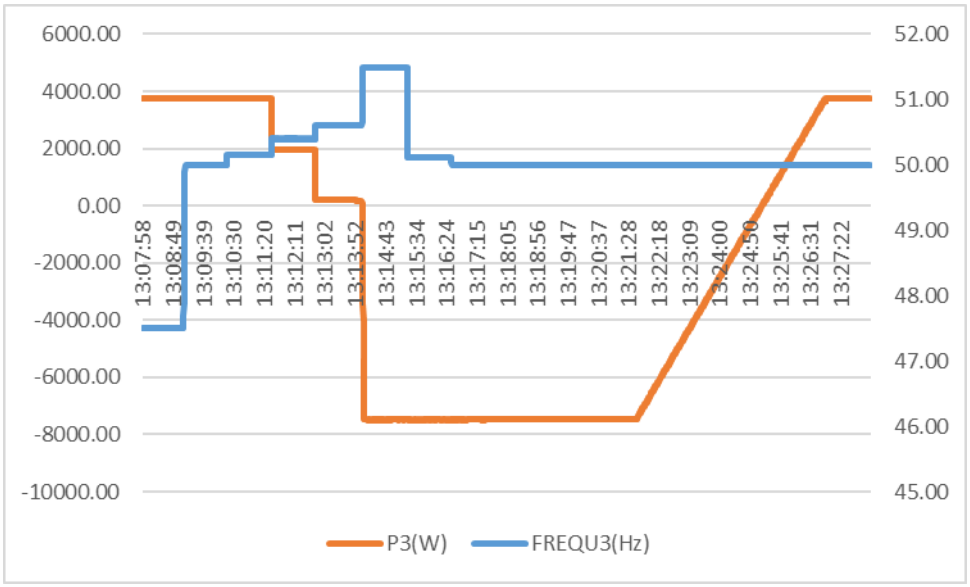
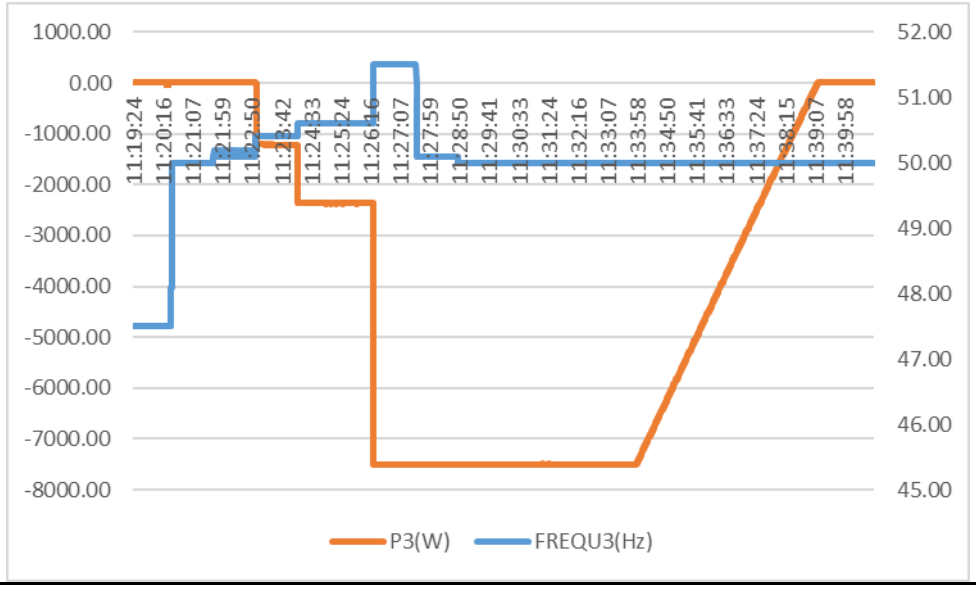


Grafico Sequenza C*: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence C: Active power regulation in coincidence with transitory on the transmission gri*



8.5.3.4 **8.5.3.5** **Bbis.7.3**	**TABLE: Regolazione della potenza attiva in presenza di transitori sulla rete di trasmissione** ***/Active power regulation in coincidence with transitory on the transmission grid***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

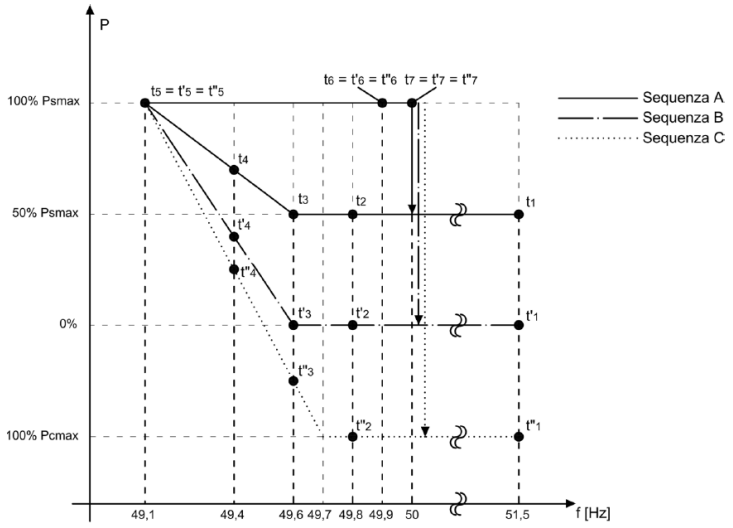


Figura 11Bbis – Curve di limitazione della potenza attiva

Supplementary information:

Test shall be performed disabling the frequency threshold protection
The storage needs an energy capacity of 20% of CUS

Test was performed with a sampling time of 200ms
Sn is an active nominal power of the inverter

Operator ..... :	See cover page
Supervisor ..... :	See cover page
Test Date..... :	See cover page

Sequence A						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	50% PS_{max}	50.00	3750	3756.0	± 2.5% S_n	t1
2	50% PS_{max}	49.85	3750	3752.6	± 2.5% S_n	t2
3	50% PS_{max}	49.60	4822.5	4937.6	± 2.5% S_n	t3
4	50% PS_{max}	49.40	5895	6044.7	± 2.5% S_n	t4
5	50% PS_{max}	49.11	7447.5	7569.5	± 2.5% S_n	t5
6	50% PS_{max}	49.89	7447.5	7567.8	± 2.5% S_n	t6
7	50% PS_{max}	50.00	3750	3730.7	± 2.5% S_n	t7
Sequence B						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	0% PS_{max}	50.00	0	18.9	± 2.5% S_n	t1’
2	0% PS_{max}	49.85	0	18.4	± 2.5% S_n	t2’
3	0% PS_{max}	49.60	2145	2232.6	± 2.5% S_n	t3’
4	0% PS_{max}	49.40	4282.5	4394.6	± 2.5% S_n	t4’
5	0% PS_{max}	49.11	7395	7452.5	± 2.5% S_n	t5’
6	0% PS_{max}	49.89	7395	7453.0	± 2.5% S_n	t6’
7	0% PS_{max}	50.00	0	18.5	± 2.5% S_n	t7’

Sequence C*						
Step #	Set output power [%]	frequency [Hz]	Expected power value [W]	Actual power values [W]	limits	Graph point
1	100% Pc_{max}	50.00	-7500	-7446.4	± 2.5% S_n	t1''
2	100% Pc_{max}	49.85	-7500	-7468.2	± 2.5% S_n	t2''
3	100% Pc_{max}	49.60	-3214.3	-3102.8	± 2.5% S_n	t3''
4	100% Pc_{max}	49.40	1071.5	1150.1	± 2.5% S_n	t4''
5	100% Pc_{max}	49.11	7285.7	7419.8	± 2.5% S_n	t5''
6	100% Pc_{max}	49.89	7285.7	7419.0	± 2.5% S_n	t6''
7	100% Pc_{max}	50.00	-7500	-7513.5	± 2.5% S_n	t7''
***Sequence C applicable only for bidirectional converters.**						

Grafico Sequenza A: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence A: Active power regulation in coincidence with transitory on the transmission grid

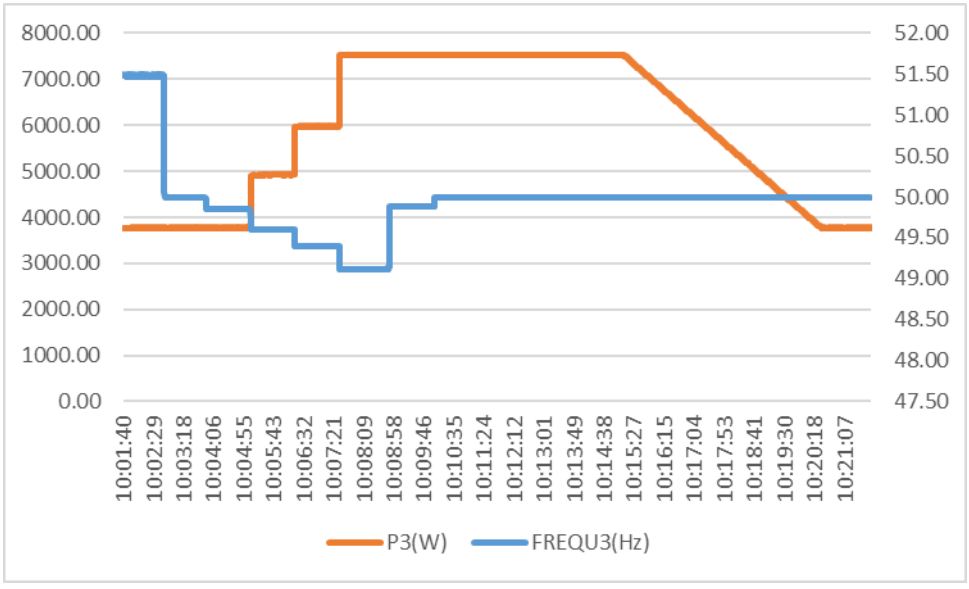


Grafico Sequenza B: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence B: Active power regulation in coincidence with transitory on the transmission grid

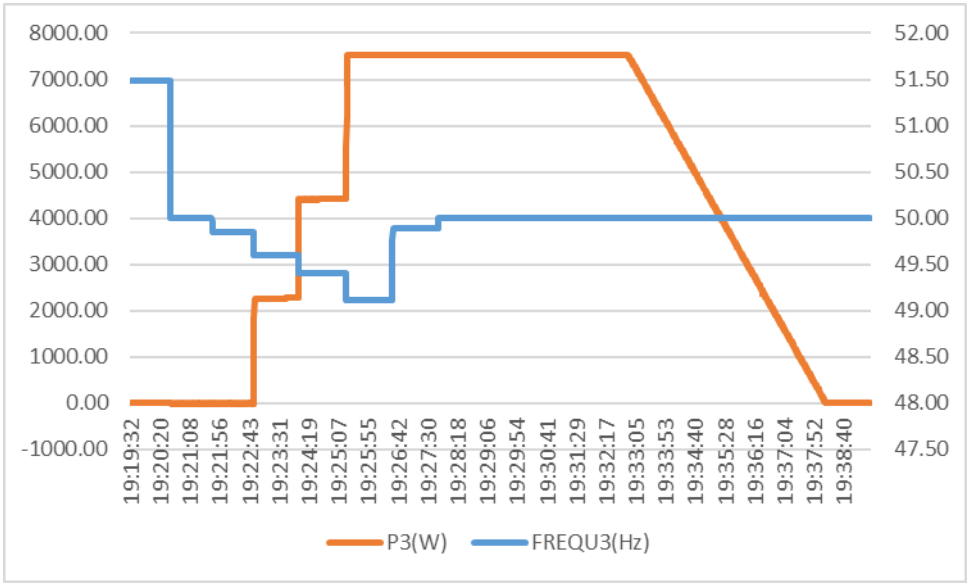
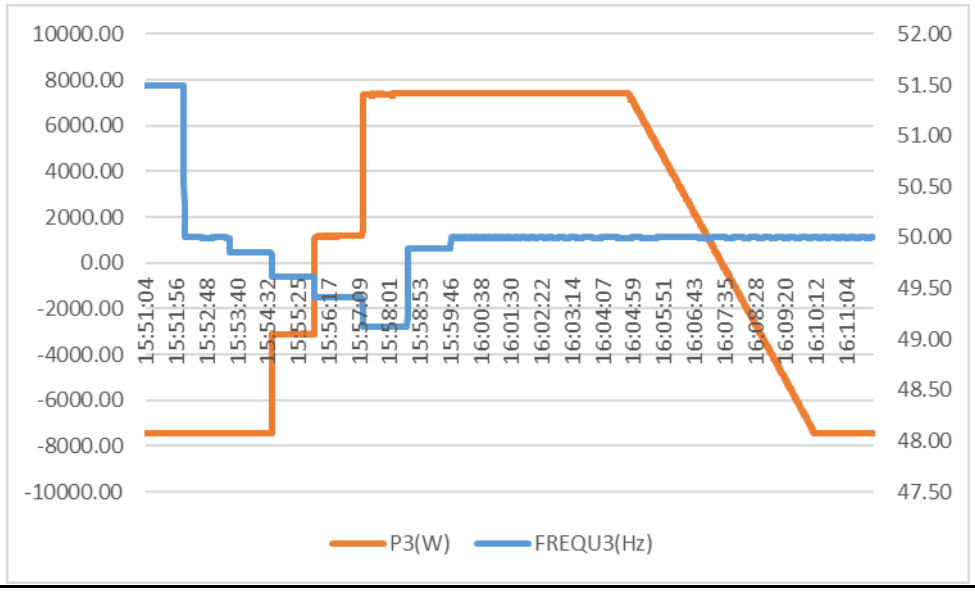


Grafico Sequenza C*: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence C: Active power regulation in coincidence with transitory on the transmission grid*



Bbis.7.4	**TABLE: Limitazione della potenza attiva su comando esterno proveniente dal Distributore** / ***Active power limitation in coincidence with external command coming from the Electricity Distributor***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

Supplementary information:

The setting point time’s of active power command is 60 seconds.

The active power was been measured with average value of 1 minute and its measure is checked at least after 30 seconds from the set-point of active power command.

Operator ..... :	See cover page
Supervisor ..... :	See cover page
Test Date..... :	See cover page

Test	Set Point	Output Power expected [W]	Output Power measured [W]	Δ P/Pn [%]	Limit [%]	RESULT
1	50%PS_{max} → 30%PS_{max}	2250	2282.6	0.43%	± 2.5% PS_{max}	PASS
2	50%PC_{max} →30% Pc_{max}*	-2250	-2269.0	0.25%	± 2.5% PS_{max}	PASS

Test applicable only for bidirectional converters.

Grafico Test 1: Limitazione della potenza attiva in risposta a comando esterno
/ Graph Test 1: Active power limitation in coincidence with external command coming from the Electricity Distributor

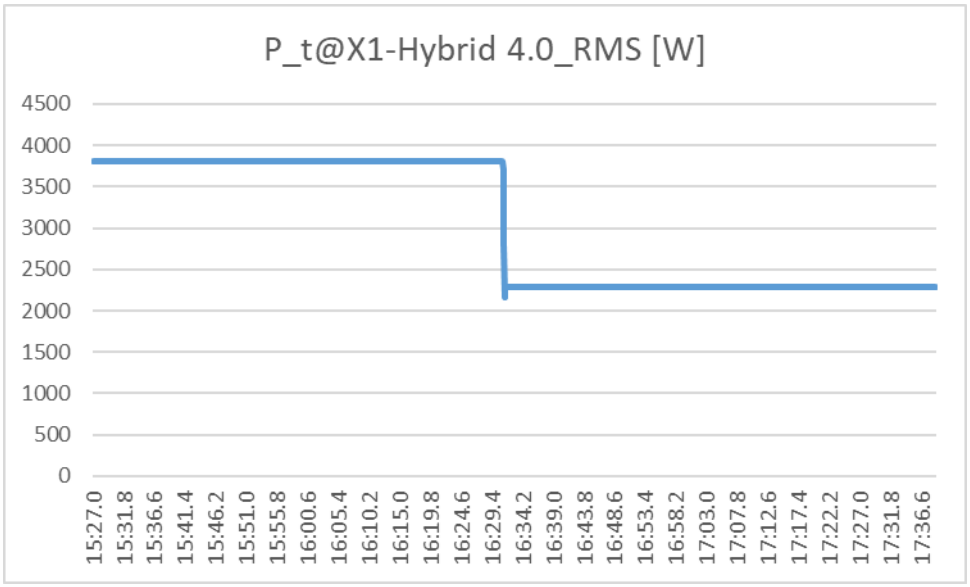
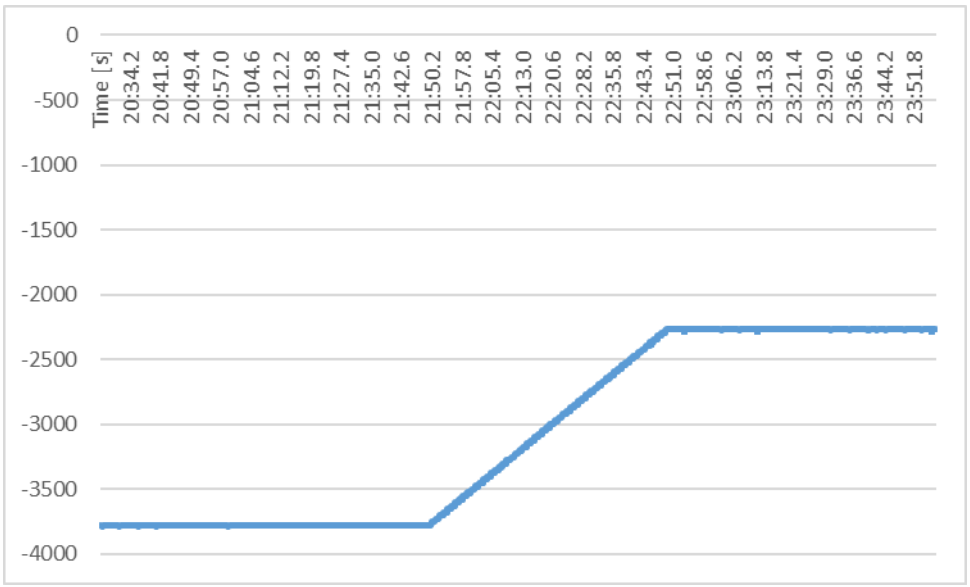


Grafico Test 2: Limitazione della potenza attiva in risposta a comando esterno
/ Graph Test 2: Active power limitation in coincidence with external command coming from the Electricity Distributor



Bbis.7.4.1	**TABLE: Verifica del tempo di assestamento ad un comando di incremento/riduzione di potenza** / ***Check the settling time with external command to increase/decrease the power***
Ambient temperature (°C) .....:	25 °C ± 5 °C
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list .....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Supplementary information:	
Operator .....:	See cover page
Supervisor .....:	See cover page
Test Date.....:	See cover page

Tabella A: Tempo di assestamento ad un comando di riduzione della potenza attiva

/ Table A: Time of allignment after an active power reduction command

Test	Set Point	Output Power expected [W]	Output Power measured [W]	Output Power limit [%]	Settling Time [s]	Settling Time limit [s]	RESULT
A.1*	100% Ps_{max} → 30% Pc_{max}	-2250	-2274	± 2.5% S_n	1.6	< 50	P
A.2	100% Ps_{max} → 30% Ps_{max}	2250	2267	± 2.5% S_n	0.6	< 50	P

Table B: Tempo di assestamento ad un comando di incremento della potenza attiva

/ Table B: Time of allignment after an active power increasing command

Test	Set Point	Output Power expected [W]	Output Power measured [W]	Output Power limit [%]	Settling Time [s]	Settling Time limit [s]	RESULT
B.1*	100% Pc_{max} → 50% Ps_{max}	3750	3772	± 2.5% S_n	2.4	< 50	P
B.2	0% Ps_{max} → 50% Ps_{max}	3750	3773	± 2.5% S_n	1.4	< 50	P

Test applicable only for bidirectional converters.

Bbis.8	**TABLE: Emissione di componente continua nella corrente di uscita** ***/Check of DC current injection***
Ambient temperature (°C) .....:	25 °C ± 5 °C
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Temperature test:	**Reference Conditions**

Bbis.8.1 **TABLE: Verifica della emissione di componente continua**
/ Check of DC current injection.

Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Injected value D.C. [mA]			Injected value D.C. [%In]			Limit [%In]
				R	S	T	R	S	T	R	S	T	
33± 5	2500	230.2	0.999	10.87	-	-	28.98	-	-	0.026%	-	-	0.5
66± 5	4992	230.0	0.999	21.69	-	-	27.31	-	-	0.013%	-	-	0.5
100 ± 5	7137	230.0	0.999	30.99	-	-	23.15	-	-	0.007%	-	-	0.5

Bbis.8.2 **TABLE: Verifica delle protezioni contro l’immissione di componente continua**
/ Check of protections against the DC current injection.

Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Intervention value D.C.			Trip Time [ms]	Limit [s]
				R	S	T	[mA]	[%In]	I_{dc} >		
33± 5	2503	230.9	0.999	10.84	-	-	143	1.32	0.5%In	674	1
66± 5	4993	232.2	0.999	21.51	-	-	151	0.70	0.5%In	670	1
100 ± 5	7558	233.3	0.999	32.38	-	-	198	0.61	0.5%In	666	1
Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Intervention value D.C.			Trip Time [ms]	Limit [s]
				R	S	T	[A]	[%In]	I_{dc} >>		
33± 5	2498.6	231.2	0.999	10.83	-	-	1.349	12.46	1A	171	0.2
66± 5	4998.4	232.2	0.999	21.53	-	-	1.372	6.37	1A	162	0.2
100 ± 5	7548.6	233.3	0.999	32.35	-	-	1.397	4.31	1A	141	0.2

Bbis.8	**TABLE: Emissione di componente continua nella corrente di uscita** ***/Check of DC current injection***
Ambient temperature (°C) .....:	25 °C ± 5 °C
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Temperature test:	**+55°C ± 2°C**

Bbis.8.1 **TABLE: Verifica della emissione di componente continua** ***/ Check of DC current injection.***

Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Injected value D.C. [mA]			Injected value D.C. [%In]			Limit [%In]
				R	S	T	R	S	T	R	S	T	
33± 5	2501	230.2	0.999	10.87	-	-	28.78	-	-	0.026%	-	-	0.5
66± 5	4994	230.0	0.999	21.71	-	-	27.51	-	-	0.013%	-	-	0.5
100 ± 5	7144	230.0	0.999	31.01	-	-	23.25	-	-	0.008%	-	-	0.5

Bbis.8.2 **TABLE: Verifica delle protezioni contro l’immissione di componente continua** ***/ Check of protections against the DC current injection.***

Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Intervention value D.C.			Trip Time [ms]	Limit [s]
				R	S	T	[mA]	[%In]	I_{dc} >		
33± 5	2501	230.9	0.999	10.88	-	-	137	1.26	0.5% In	684	1
66± 5	4994	232.2	0.999	21.51	-	-	141	0.66	0.5% In	654	1
100 ± 5	7555	233.3	0.999	32.38	-	-	189	0.58	0.5% In	664	1
Power [%nominal VA]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Intervention value D.C.			Trip Time [ms]	Limit [s]
				R	S	T	[A]	[%In]	I_{dc} >>		
33± 5	2497	231.2	0.999	10.81	-	-	1.349	12.48	1A	161	0.2
66± 5	4998	232.2	0.999	21.52	-	-	1.377	6.40	1A	152	0.2
100 ± 5	7522	233.1	0.999	32.27	-	-	1.383	4.29	1A	141	0.2

Bbis.8	**TABLE: Emissione di componente continua nella corrente di uscita** ***/Check of DC current injection***
Ambient temperature (°C) .....:	25 °C ± 5 °C
Humidity (RH %) .....:	65% ± 5% RH
Instrumentation list.....:	See table “Measurement equipment and instrumentation”
Uncertainty .....:	See table
Temperature test:	**-10 °C ± 2 °C**

Bbis.8.1 **TABLE: Verifica della emissione di componente continua** ***/ Check of DC current injection.***

Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Injected value D.C. [mA]			Injected value D.C. [%In]			Limit [%In]
				R	S	T	R	S	T	R	S	T	
33± 5	2504	230.2	0.999	10.88	-	-	28.66	-	-	0.026%	-	-	0.5
66± 5	5011	230.0	0.999	21.79	-	-	27.31	-	-	0.013%	-	-	0.5
100 ± 5	7287	230.0	0.999	31.68	-	-	23.11	-	-	0.007%	-	-	0.5

Bbis.8.2 **TABLE: Verifica delle protezioni contro l’immissione di componente continua** ***/ Check of protections against the DC current injection.***

Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Intervention value D.C.			Trip Time [ms]	Limit [s]
				R	S	T	[mA]	[%In]	I_{dc} >		
33± 5	2512	230.9	0.999	10.87	-	-	141	1.30	0.5% In	654	1
66± 5	5001	232.2	0.999	21.53	-	-	143	0.66	0.5% In	642	1
100 ± 5	7560	233.3	0.999	32.40	-	-	192	0.59	0.5% In	646	1
Power [%]	Power [W]	Rated Voltage [Vrms]	Cosφ	Rated Current [Arms]			Intervention value D.C.			Trip Time [ms]	Limit [s]
				R	S	T	[A]	[%In]	I_{dc} >>		
33± 5	2501	231.2	0.999	10.81	-	-	1.332	12.32	1A	162	0.2
66± 5	5001	232.2	0.999	21.54	-	-	1.365	6.34	1A	161	0.2
100 ± 5	7552	233.3	0.999	32.37	-	-	1.377	4.25	1A	142	0.2

Bbis.9	**TABLE: Verifica della insensibilità agli abbassamenti di tensione (LVFRT capability)** ***/ Check of the LVFRT capability***
Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

Tabella 8ter – Parametri relativi alla Figura 14b per la fault-ride-through capability dei parchi di generazione oltre 11,08 kW

Uret	0,05 [p.u.]	Tclear	0,2 s
Uclear	0,15 [p.u.]	Trec1	0,2 s
Urec1	0,15 [p.u.]	Trec2	0,2 s
Urec2	0,85 [p.u.]	Trec3	1,5 s

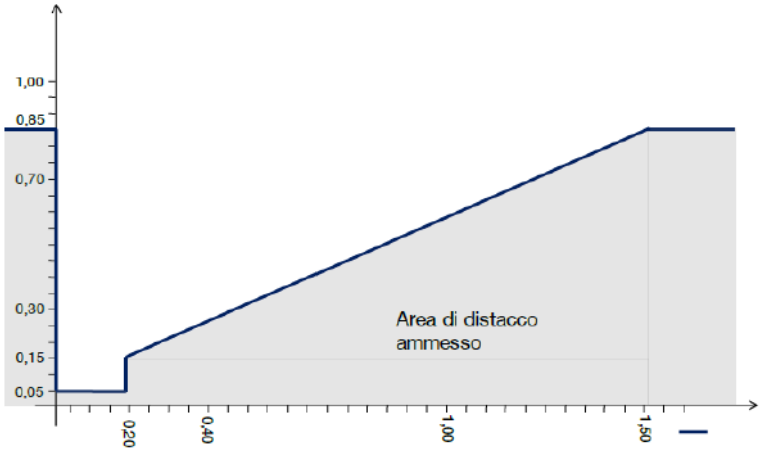


Figura 12Bbis – Requisiti per LVFRT.

Bbis.9.1 LVFRT – modalità di esecuzione e registrazione delle prove

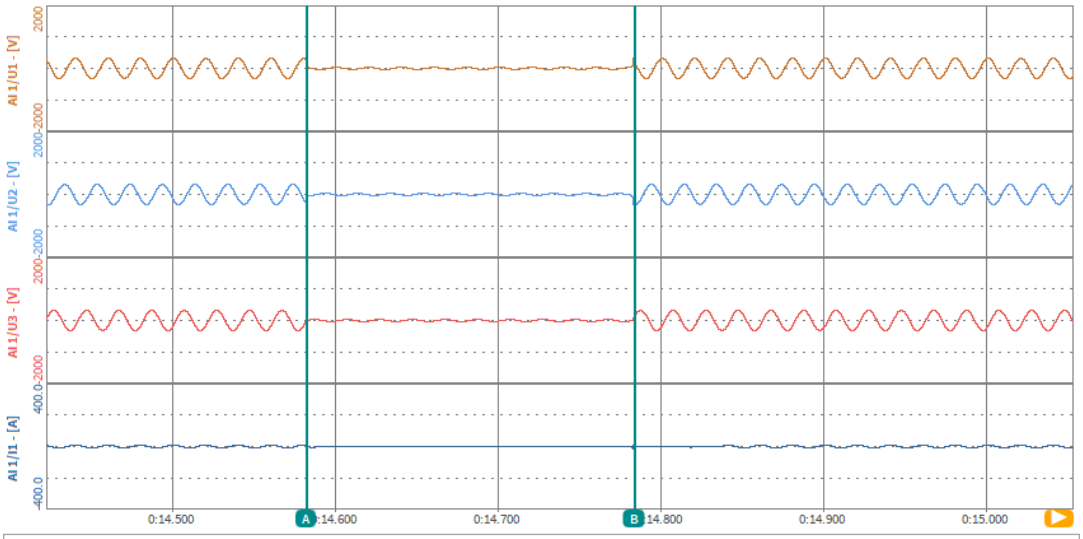
Supplementary information:

Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date ..... :	see cover page

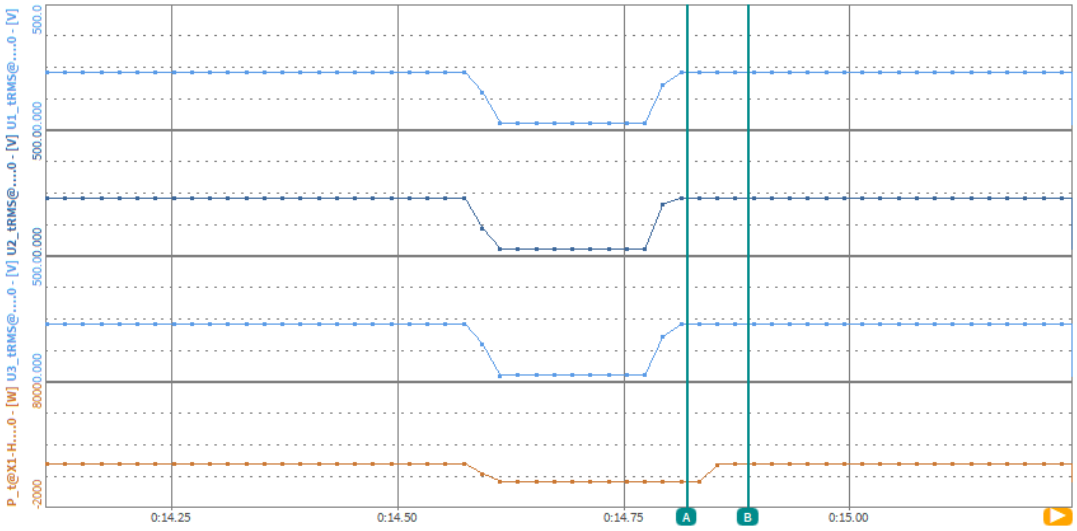
Output power: 2500W				**Limit: from 10 % to 30% Ps_{max}.**				
Test	**Residual magnitude [V/Vn]**			**phase angle [°]**			**Recovery time**	**Recovery time Limit**
	R	S	T	φ_1	φ_2	φ_3	[ms]	[ms]
1s -- guasto simmetrico trifase */ three phases symmetric failure*	0.10 ± 0.05	0.10 ± 0.05	0.10 ± 0.05	0°	-120°	120°	67.8	400
1a -- guasto asimmetrico bifase */ two phases asymmetric failure*	0.87 ± 0.05	0.87 ± 0.05	0.10 ± 0.05	27°	-147°	120°	71.7	400
2s -- guasto simmetrico trifase */ three phases symmetric failure*	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0°	-120°	120°	150.4	400
2a -- guasto asimmetrico bifase */ two phases asymmetric failure*	0.88 ± 0.05	0.88 ± 0.05	0.25 ± 0.05	22°	-142°	120°	66.7	400
3s -- guasto simmetrico trifase */ three phases symmetric failure*	0.50 ± 0.05	0.50 ± 0.05	0.50 ± 0.05	0°	-120°	120°	155.9	400
3a -- guasto asimmetrico bifase */ two phases asymmetric failure*	0.90 ± 0.05	0.90 ± 0.05	0.50 ± 0.05	14°	-134°	120°	186.1	400
4s -- guasto simmetrico trifase */ three phases symmetric failure*	0.75 ± 0.05	0.75 ± 0.05	0.75 ± 0.05	0°	-120°	120°	159.8	400
4a -- guasto simmetrico bifase */ two phases asymmetric failure*	0.94 ± 0.05	0.94 ± 0.05	0.75 ± 0.05	7°	-127°	120°	217.6	400
5 guasto asimmetrico bifase in BT */ two phases asymmetric failure*	0.10 ± 0.05	1.0 ± 0.05	0.10 ± 0.05	0°	-120°	120°	163.4	400
6 guasto asimmetrico bifase in BT */ three phases symmetric failure*	0.50 ± 0.05	1.0 ± 0.05	0.50 ± 0.05	0°	-120°	120°	382.5	400

Grafici: LVFRT
/ Graphs: LVFRT

Test 1s -- guasto simmetrico trifase
/ three phases symmetric failure

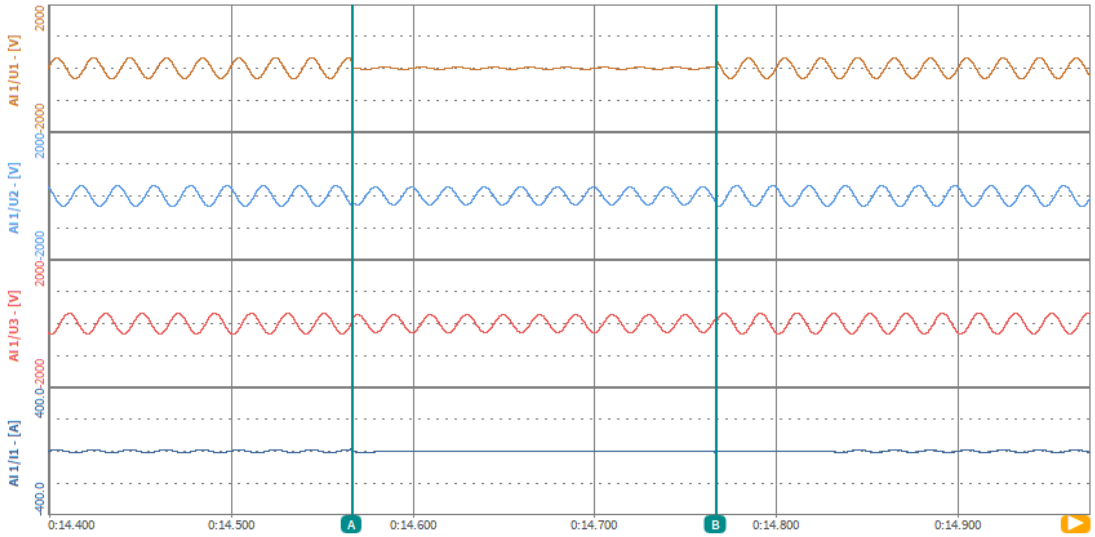


	A	B	Delta
Time [s]	0:14.5824802	0:14.7837694	0.2012892
AI 1/U1 [V]	294.0619	212.2152	-81.84672
AI 1/U2 [V]	-267.8404	-318.6119	-50.77148
AI 1/U3 [V]	-25.83575	104.8591	130.6949
AI 1/I1 [A]	8.267237	0.594259	-7.672978

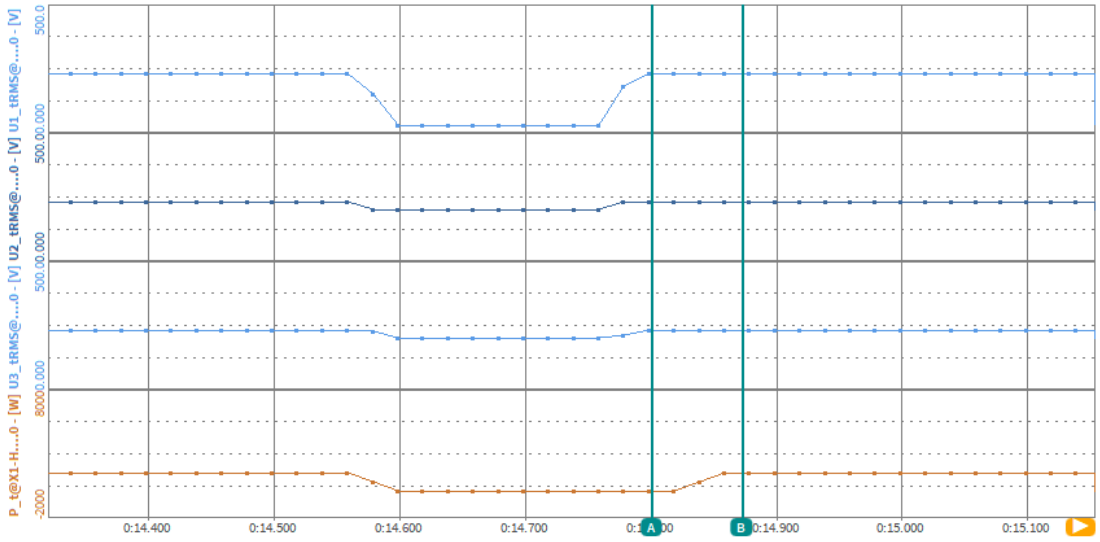


	A	B	Delta
Time [s]	0:14.820121	0:14.887963	0.067842
U1_tRMS@X1-Hybrid4.0 [V]	230.0348	230.3330	0.298203
U2_tRMS@X1-Hybrid4.0 [V]	230.3690	230.3444	-0.024582
U3_tRMS@X1-Hybrid4.0 [V]	230.1758	230.1405	-0.035294
P_t@X1-Hybrid4.0 [W]	-2.288081	1491.458	1493.746

Test 1a -- guasto asimmetrico bifase
/ two phases asymmetric failure

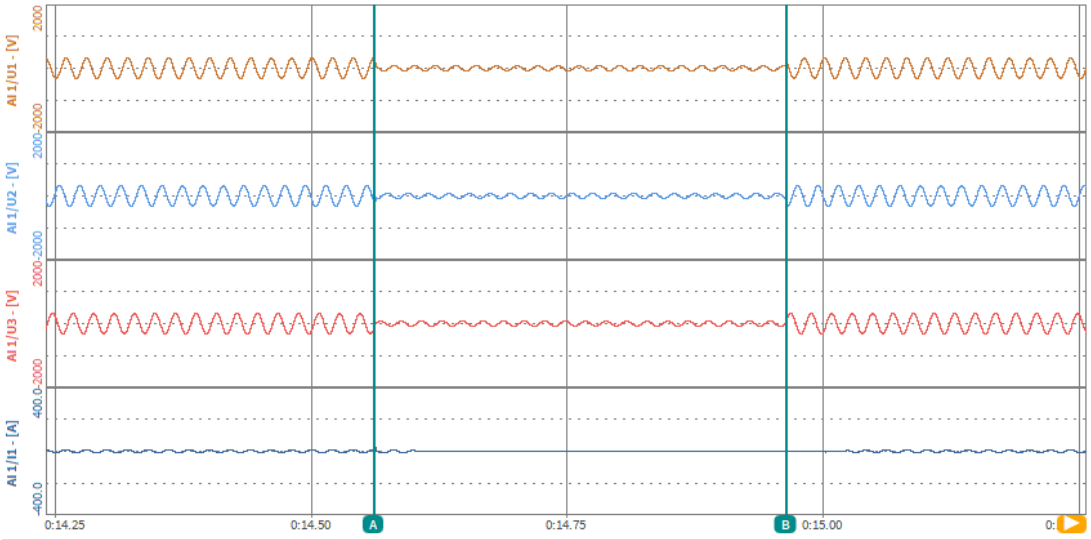


	A	B	Delta
Time [s]	0:14.5666838	0:14.7666963	0.2000125
AI 1/U1 [V]	151.0811	189.7524	38.67126
AI 1/U2 [V]	-209.1305	-240.7766	-31.64602
AI 1/U3 [V]	75.74130	46.26036	-29.48094
AI 1/I1 [A]	28.39668	-17.96029	-46.35697

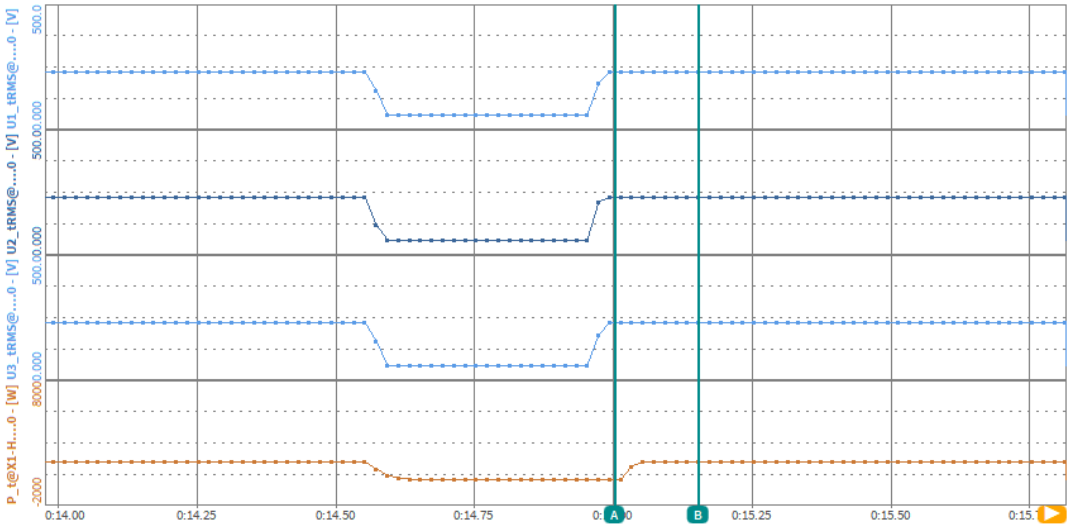


	A	B	Delta
Time [s]	0:14.8009932	0:14.8727077	0.0717145
U1_tRMS@X1-Hybrid4.0 [V]	230.0344	230.3405	0.306076
U2_tRMS@X1-Hybrid4.0 [V]	230.3680	230.3410	-0.026932
U3_tRMS@X1-Hybrid4.0 [V]	230.1783	230.1434	-0.034927
P_t@X1-Hybrid4.0 [W]	-2.556562	1480.288	1482.844

Test 2s -- guasto simmetrico trifase
/ three phases symmetric failure

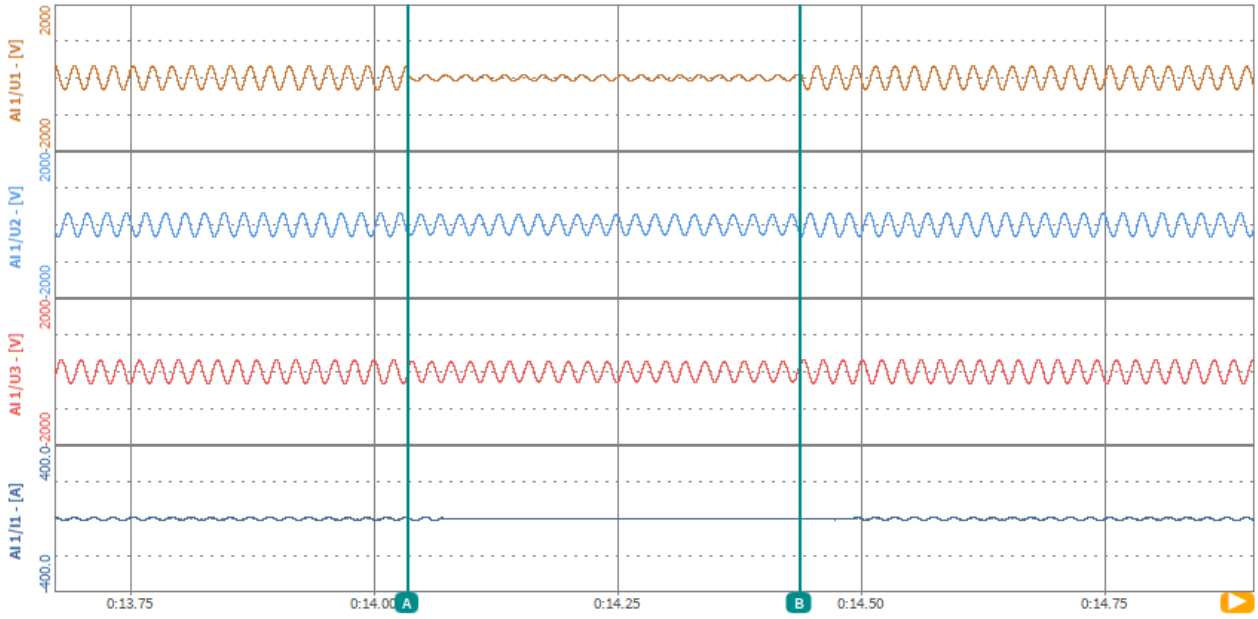


	A	B	Delta
Time [s]	0:14.561767	0:14.963848	0.402082
AI 1/U1 [V]	325.8772	238.5440	-87.33321
AI 1/U2 [V]	-154.2633	-286.3820	-132.1187
AI 1/U3 [V]	-170.9285	32.87077	203.7993
AI 1/I1 [A]	9.285665	1.415801	-7.869864

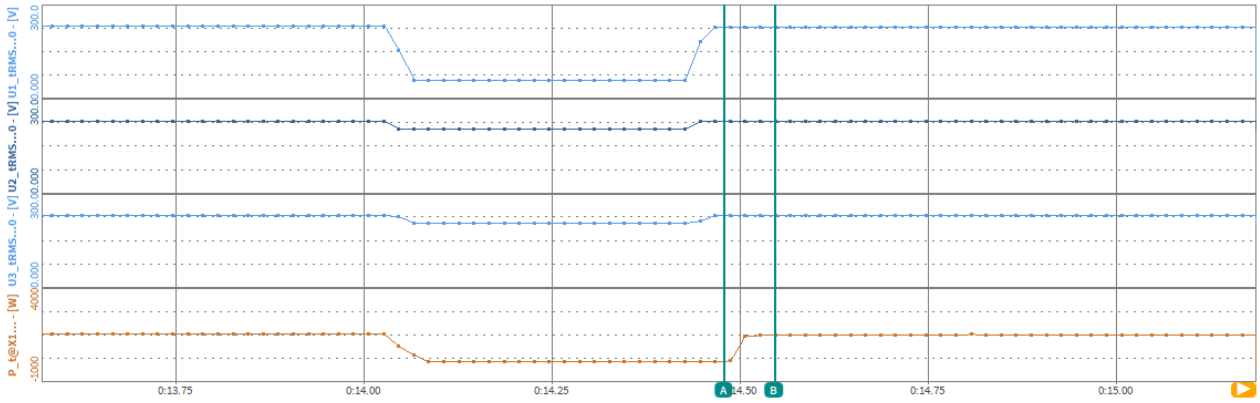


	A	B	Delta
Time [s]	0:15.002969	0:15.153409	0.150440
U1_tRMS@X1-Hybrid4.0 [V]	230.0329	230.3062	0.273315
U2_tRMS@X1-Hybrid4.0 [V]	230.3686	230.3477	-0.020950
U3_tRMS@X1-Hybrid4.0 [V]	230.1618	230.1222	-0.039642
P_t@X1-Hybrid4.0 [W]	-2.512414	1469.157	1471.669

Test 2a -- guasto asimmetrico bifase
/ two phases asymmetric failure

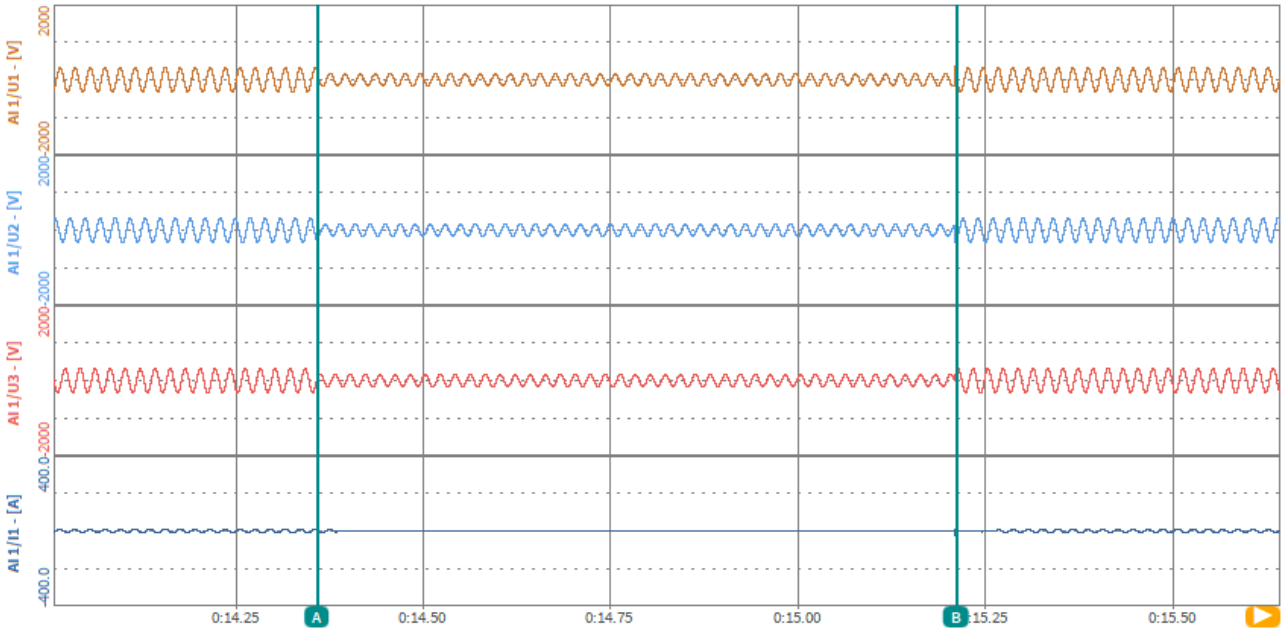


	A	B	Delta
Time [s]	0:14.034869	0:14.436247	0.401378
AI 1/U1 [V]	310.0448	234.0057	-76.03908
AI 1/U2 [V]	-240.9709	-310.1721	-69.20124
AI 1/U3 [V]	-68.28261	73.86256	142.1452
AI 1/I1 [A]	8.741499	-0.014901	-8.756400

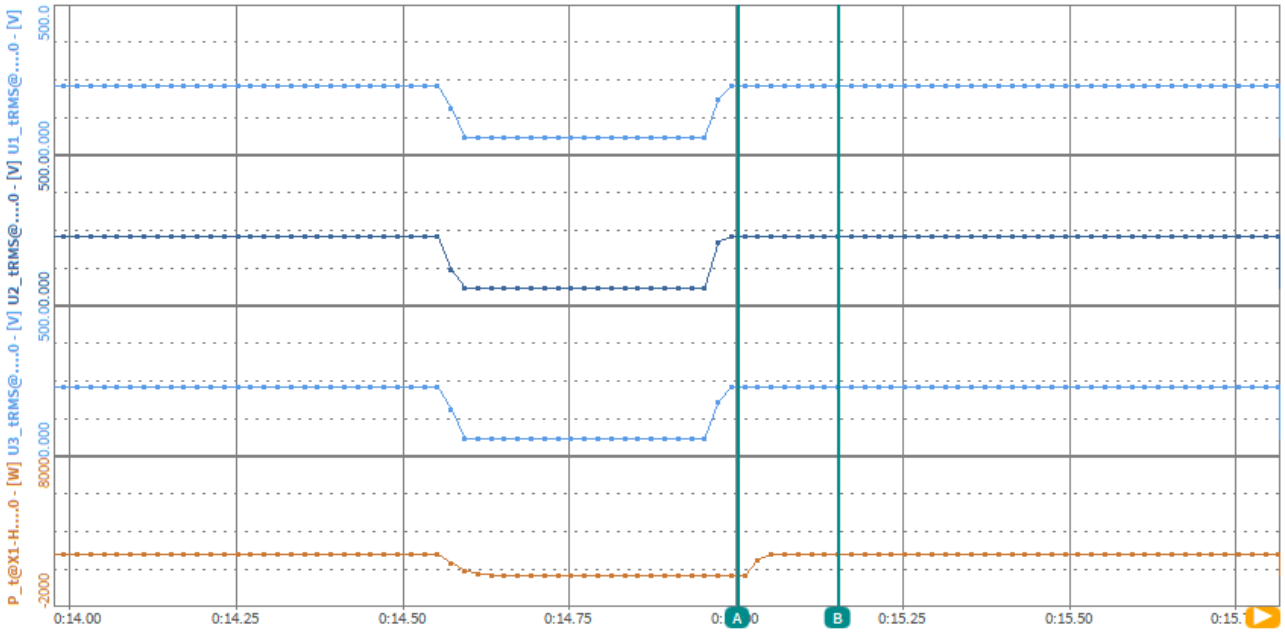


	A	B	Delta
Time [s]	0:14.47878	0:14.54546	0.06668
U1_tRMS@X1-Hybrid4.0 [V]	230.0697	230.3266	0.256836
U2_tRMS@X1-Hybrid4.0 [V]	230.3436	230.3212	-0.022430
U3_tRMS@X1-Hybrid4.0 [V]	230.1927	230.1584	-0.034271
P_t@X1-Hybrid4.0 [W]	-2.679912	1470.009	1472.689

Test 3s -- guasto simmetrico trifase
/ three phases symmetric failure

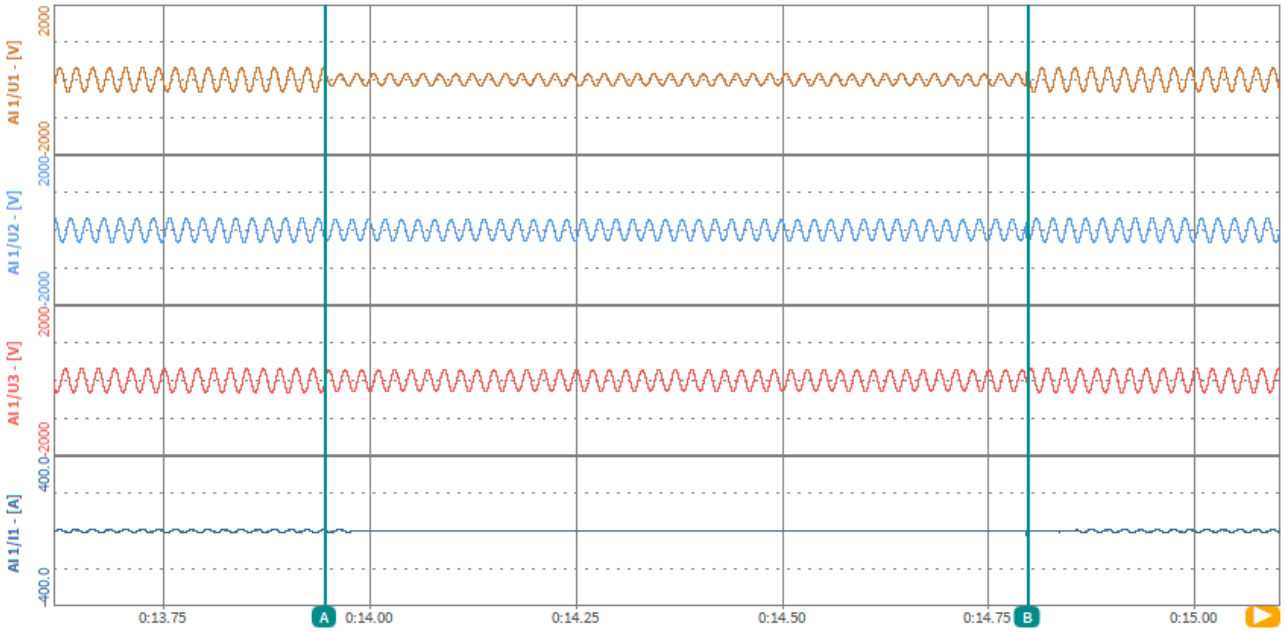


	A	B	Delta
Time [s]	0:14.360130	0:15.212071	0.851941
AI 1/U1 [V]	109.1325	49.61181	-59.52072
AI 1/U2 [V]	-158.8502	-303.4163	-144.5661
AI 1/U3 [V]	48.73252	254.0937	205.3611
AI 1/I1 [A]	1.227832	1.031423	-0.196409

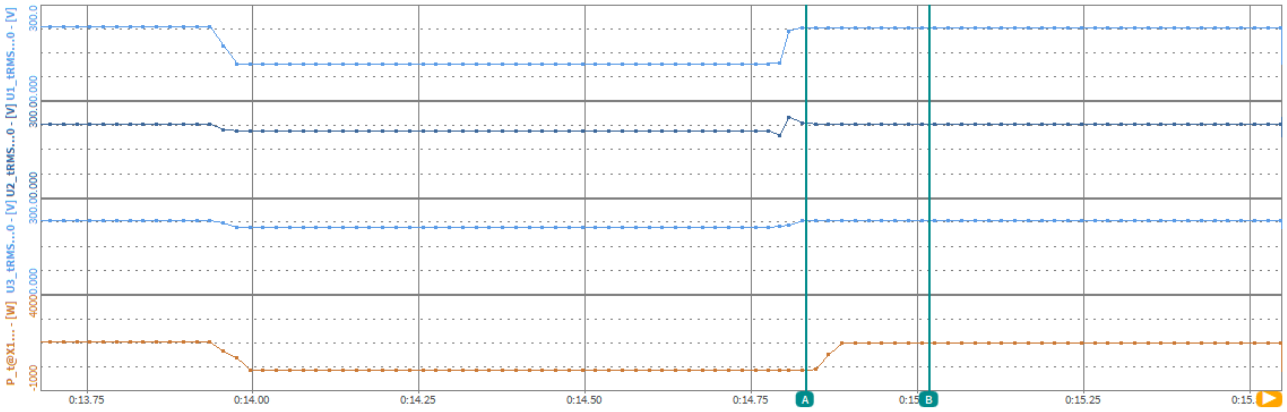


	A	B	Delta
Time [s]	0:15.002969	0:15.153409	0.150440
U1_tRMS@X1-Hybrid4.0 [V]	230.0329	230.3062	0.273315
U2_tRMS@X1-Hybrid4.0 [V]	230.3686	230.3477	-0.020950
U3_tRMS@X1-Hybrid4.0 [V]	230.1618	230.1222	-0.039642
P_t@X1-Hybrid4.0 [W]	-2.512414	1469.157	1471.669

Test 3a -- guasto asimmetrico bifase
/ two phases asymmetric failure

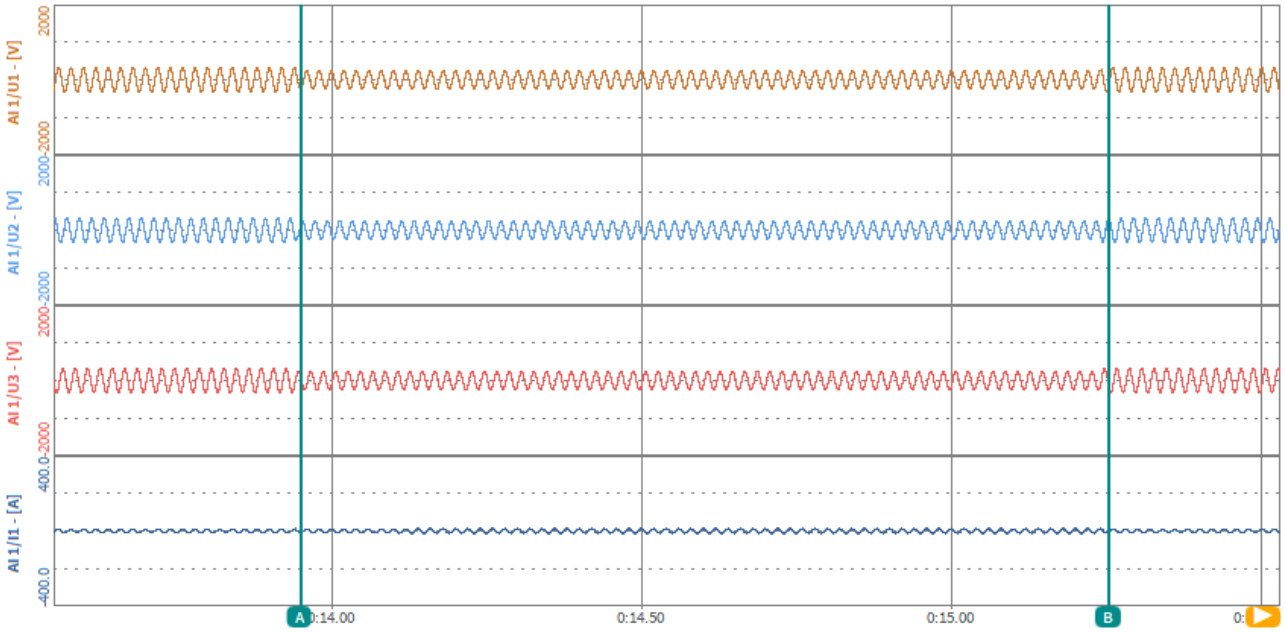


	A	B	Delta
Time [s]	0:13.945778	0:14.797535	0.851757
AI 1/U1 [V]	286.1641	163.7924	-122.3717
AI 1/U2 [V]	-272.9840	-325.5034	-52.51932
AI 1/U3 [V]	-11.43003	162.0536	173.4836
AI 1/I1 [A]	8.667732	0.955654	-7.712079

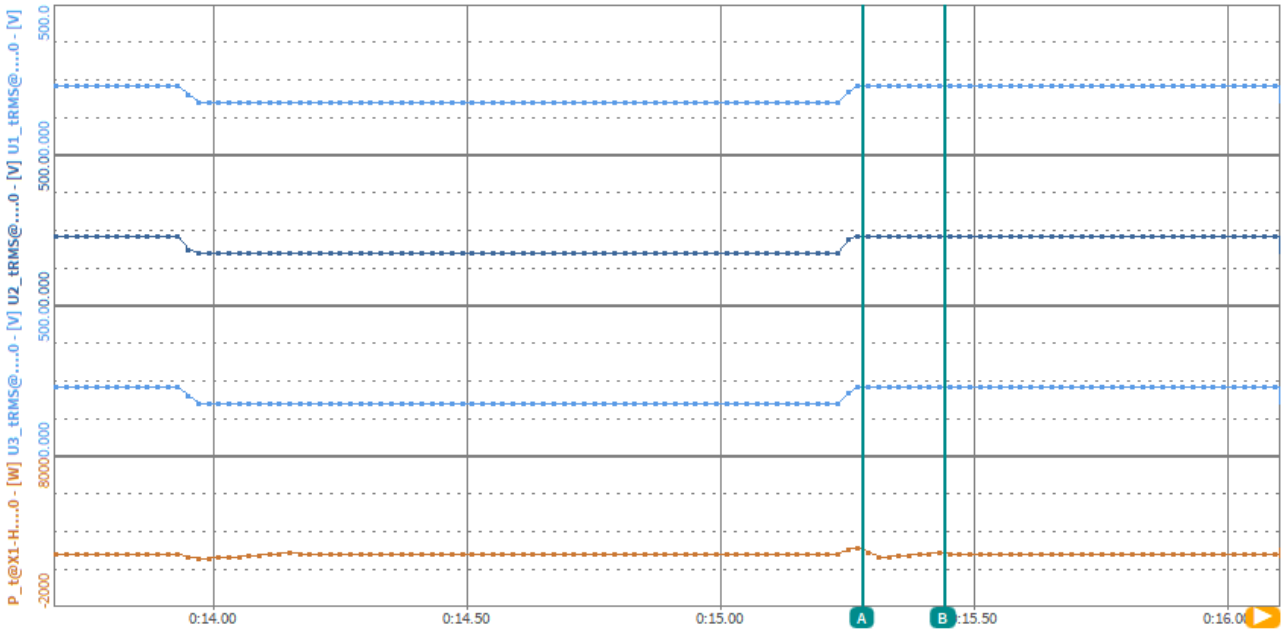


	A	B	Delta
Time [s]	0:14.831542	0:15.017643	0.186101
U1_tRMS@X1-Hybrid4.0 [V]	230.0747	230.3120	0.237305
U2_tRMS@X1-Hybrid4.0 [V]	230.3596	230.3465	-0.013138
U3_tRMS@X1-Hybrid4.0 [V]	230.1949	230.1523	-0.042557
P_t@X1-Hybrid4.0 [W]	-2.399261	1467.272	1469.671

Test 4s -- guasto simmetrico trifase
/ three phases symmetric failure

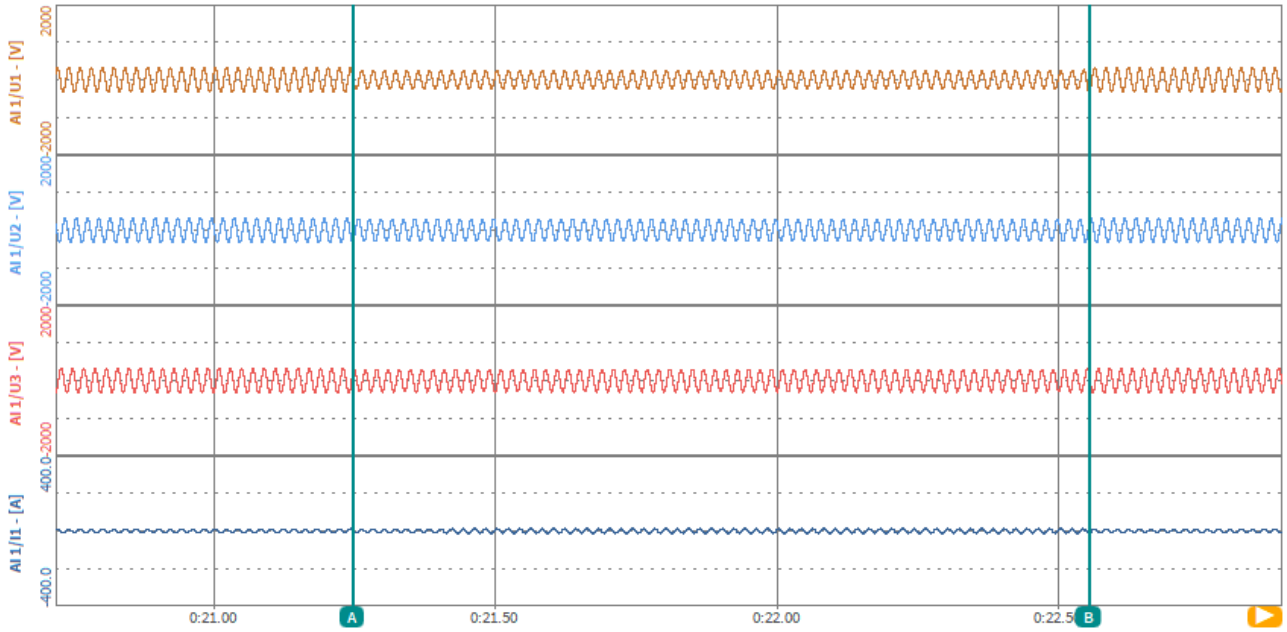


	A	B	Delta
Time [s]	0:13.950040	0:15.254806	1.304765
AI 1/U1 [V]	-202.2162	-202.6413	-0.425100
AI 1/U2 [V]	-18.21017	322.1908	340.4010
AI 1/U3 [V]	219.5034	-118.8011	-338.3045
AI 1/I1 [A]	-7.561469	-6.789947	0.771523

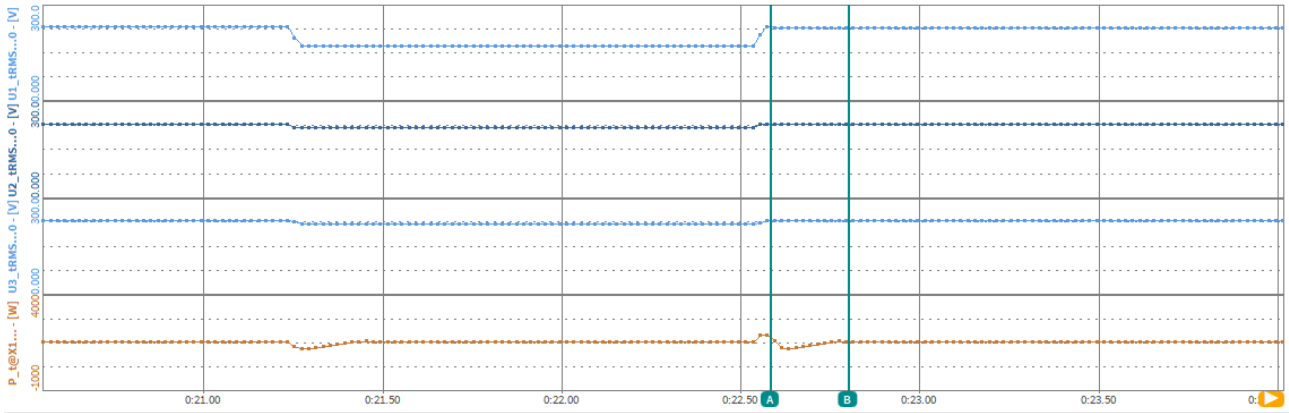


	A	B	Delta
Time [s]	0:15.280903	0:15.440666	0.159763
U1_tRMS@X1-Hybrid4.0 [V]	230.4013	230.3362	-0.065125
U2_tRMS@X1-Hybrid4.0 [V]	230.3069	230.3140	7.156e-3
U3_tRMS@X1-Hybrid4.0 [V]	230.1447	230.1532	8.499e-3
P_t@X1-Hybrid4.0 [W]	1898.354	1539.543	-358.8113

Test 4a -- guasto simmetrico bifase
/ two phases asymmetric failure



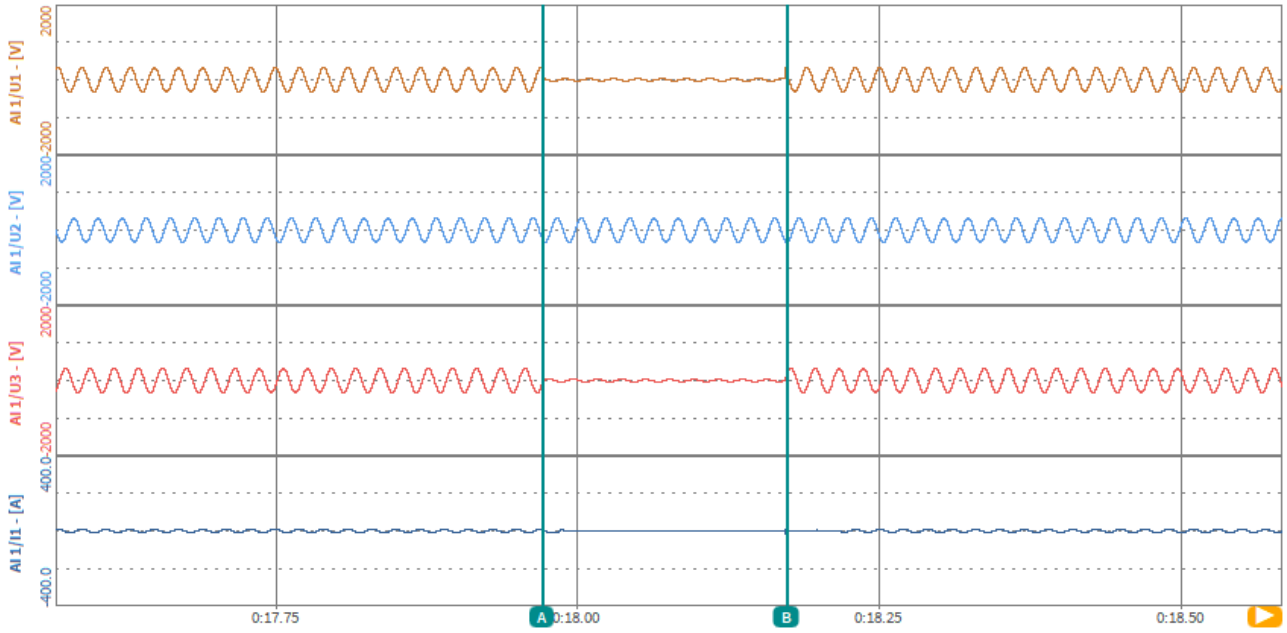
	A	B	Delta
Time [s]	0:21.248068	0:22.554382	1.306314
AI 1/U1 [V]	88.64785	-325.5530	-414.2008
AI 1/U2 [V]	-305.3792	169.7745	475.1537
AI 1/U3 [V]	218.7297	155.8819	-62.84786
AI 1/I1 [A]	1.073575	-12.32622	-13.39979



	A	B	Delta
Time [s]	0:22.582991	0:22.800544	0.217553
U1_tRMS@X1-Hybrid4.0 [V]	230.3760	230.3162	-0.059830
U2_tRMS@X1-Hybrid4.0 [V]	230.3138	230.3163	2.457e-3
U3_tRMS@X1-Hybrid4.0 [V]	230.1414	230.1501	8.743e-3
P_t@X1-Hybrid4.0 [W]	1870.767	1515.480	-355.2867

5 guasto asimmetrico bifase in BT

/ two phases asymmetric failure

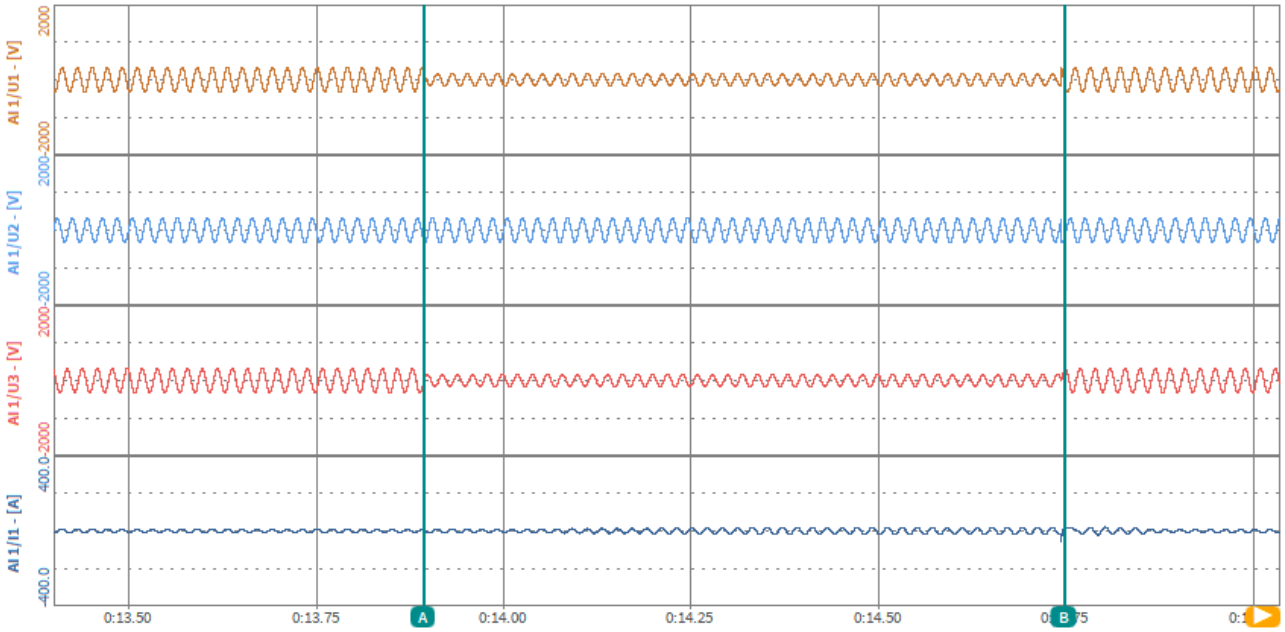


	A	B	Delta
Time [s]	0:17.971386	0:18.173683	0.202297
AI 1/U1 [V]	298.0228	138.3004	-159.7223
AI 1/U2 [V]	-262.1482	-324.4412	-62.29306
AI 1/U3 [V]	-35.45499	186.5246	221.9796
AI 1/I1 [A]	8.406378	0.970197	-7.436181

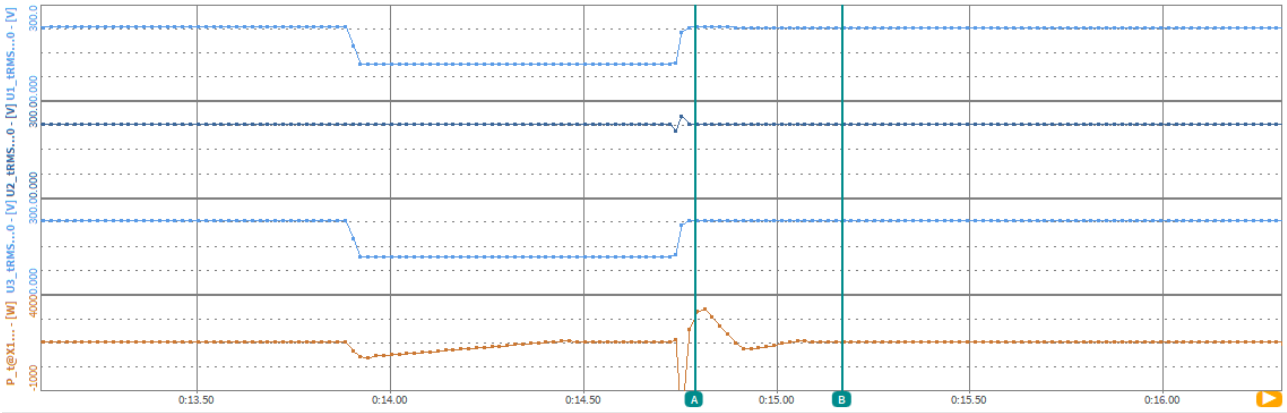
	A	B	Delta
Time [s]	0:18.205332	0:18.368779	0.163447
U1_tRMS@X1-Hybrid4.0 [V]	230.0822	230.3093	0.227173
U2_tRMS@X1-Hybrid4.0 [V]	230.3278	230.3152	-0.012619
U3_tRMS@X1-Hybrid4.0 [V]	230.1959	230.1526	-0.043274
P_t@X1-Hybrid4.0 [W]	16.91683	1467.975	1451.059

6 guasto asimmetrico bifase in BT

/ three phases symmetric failure



	A	B	Delta
Time [s]	0:13.894025	0:14.747990	0.853965
AI 1/U1 [V]	313.0288	24.08004	-288.9488
AI 1/U2 [V]	-233.8762	-292.5358	-58.65956
AI 1/U3 [V]	-78.47167	269.9888	348.4605
AI 1/I1 [A]	8.892752	13.19702	4.304266

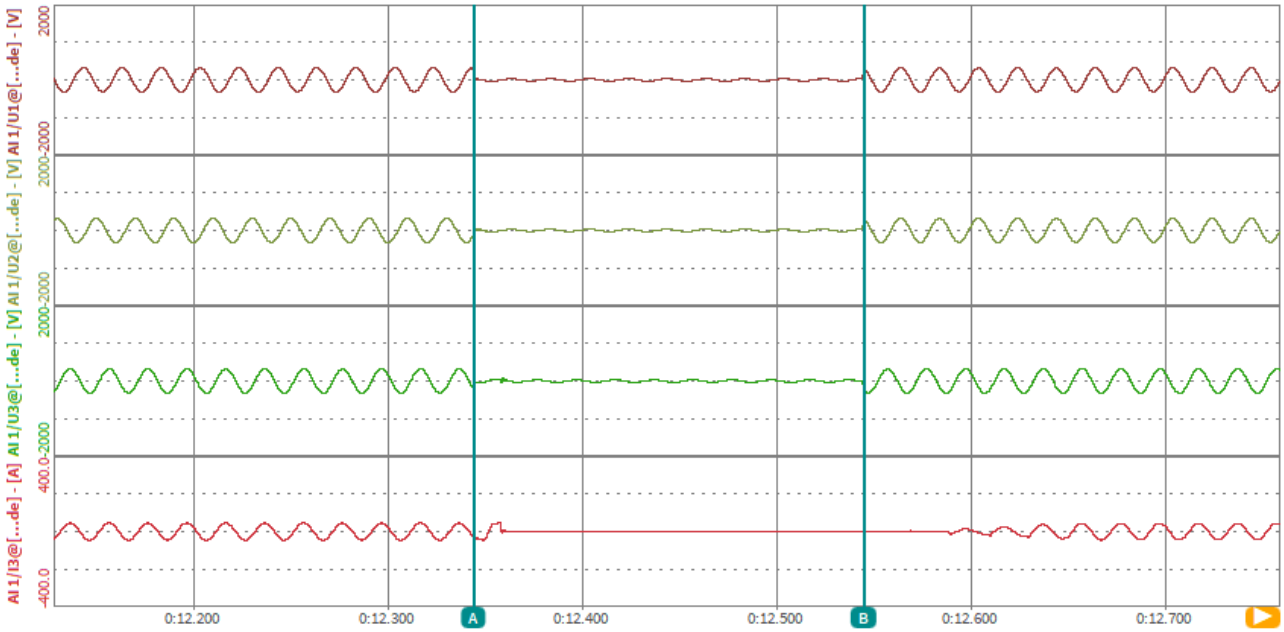


	A	B	Delta
Time [s]	0:14.787363	0:15.169897	0.382534
U1_tRMS@X1-Hybrid4.0 [V]	230.3353	230.3164	-0.018814
U2_tRMS@X1-Hybrid4.0 [V]	230.3335	230.3151	-0.018341
U3_tRMS@X1-Hybrid4.0 [V]	230.1125	230.1506	0.038025
P_t@X1-Hybrid4.0 [W]	2141.177	1500.168	-641.0085

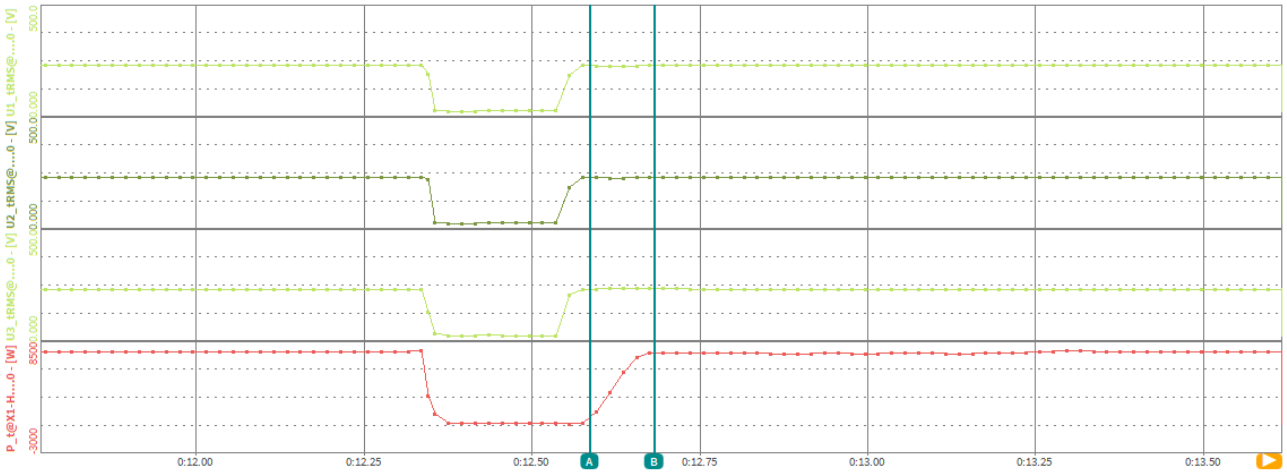
Output power: 7500W				**Limit: from > 90% Ps_{max}**				
Test	**Residual magnitude [V/Vn]**			**phase angle [°]**			**Recovery time**	**Recovery time Limit**
	R	S	T	φ_1	φ_2	φ_3	[ms]	[ms]
1s -- guasto simmetrico trifase */ three phases symmetric failure*	0.10 ± 0.05	0.10 ± 0.05	0.10 ± 0.05	0°	-120°	120°	95.7	400
1a -- guasto asimmetrico bifase */ two phases asymmetric failure*	0.87 ± 0.05	0.87 ± 0.05	0.10 ± 0.05	27°	-147°	120°	104.2	400
2s -- guasto simmetrico trifase */ three phases symmetric failure*	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0°	-120°	120°	113.5	400
2a -- guasto asimmetrico bifase */ two phases asymmetric failure*	0.88 ± 0.05	0.88 ± 0.05	0.25 ± 0.05	22°	-142°	120°	94.8	400
3s -- guasto simmetrico trifase */ three phases symmetric failure*	0.50 ± 0.05	0.50 ± 0.05	0.50 ± 0.05	0°	-120°	120°	123.2	400
3a -- guasto asimmetrico bifase */ two phases asymmetric failure*	0.90 ± 0.05	0.90 ± 0.05	0.50 ± 0.05	14°	-134°	120°	131.2	400
4s -- guasto simmetrico trifase */ three phases symmetric failure*	0.75 ± 0.05	0.75 ± 0.05	0.75 ± 0.05	0°	-120°	120°	97.2	400
4a -- guasto simmetrico bifase */ two phases asymmetric failure*	0.94 ± 0.05	0.94 ± 0.05	0.75 ± 0.05	7°	-127°	120°	98.9	400
7 guasto asimmetrico bifase in BT */ two phases asymmetric failure*	0.10 ± 0.05	1.0 ± 0.05	0.10 ± 0.05	0°	-120°	120°	105.9	400
8 guasto asimmetrico bifase in BT */ three phases symmetric failure*	0.50 ± 0.05	1.0 ± 0.05	0.50 ± 0.05	0°	-120°	120°	121.0	400

Grafici: LVFRT
/ Graphs: LVFRT

Test 1s -- guasto simmetrico trifase
/ three phases symmetric failure

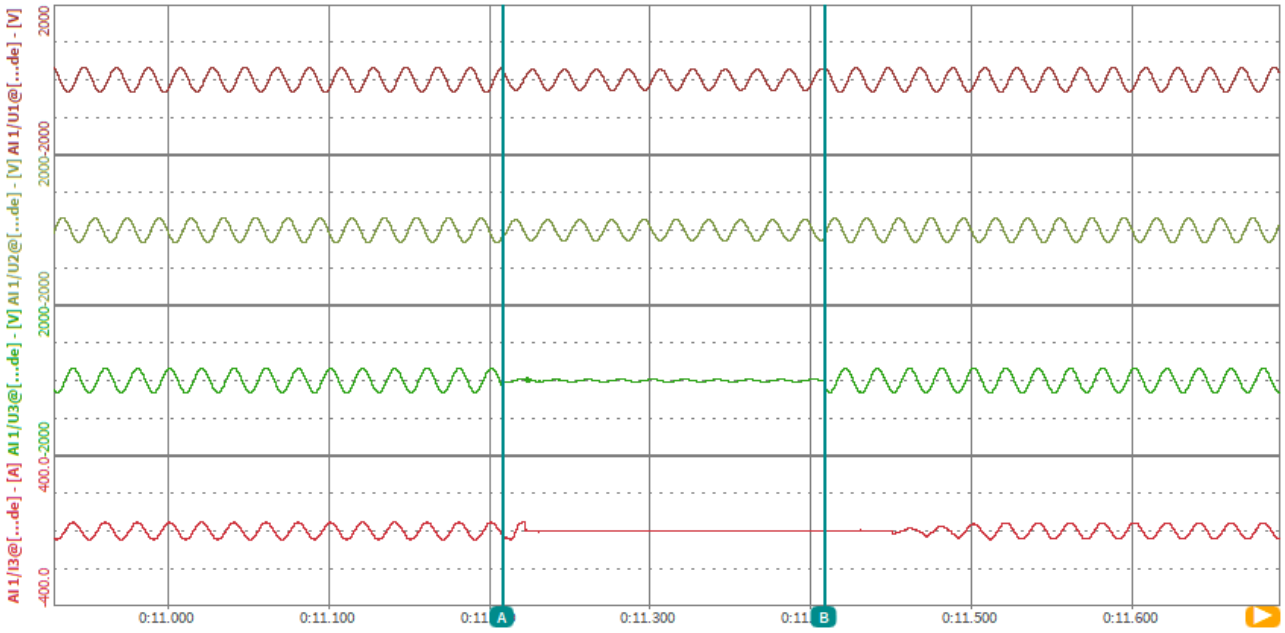


	A	B	Delta
Time [s]	0:12.3444207	0:12.5449297	0.2005090
AI 1/U1@[RemoteNode] [V]	184.4452	245.2152	60.77004
AI 1/U2@[RemoteNode] [V]	0.075340	245.5135	245.4381
AI 1/U3@[RemoteNode] [V]	-145.0620	-180.5666	-35.50458
AI 1/I3@[RemoteNode] [A]	-36.66411	2.057459	38.72156



	A	B	Delta
Time [s]	0:12.587061	0:12.682767	0.095706
U1_tRMS@X1-Hybrid4.0 [V]	229.6498	227.8007	-1.849106
U2_tRMS@X1-Hybrid4.0 [V]	230.7179	228.0587	-2.659225
U3_tRMS@X1-Hybrid4.0 [V]	231.6471	234.5689	2.921783
P_t@X1-Hybrid4.0 [W]	22.92665	7378.442	7355.515

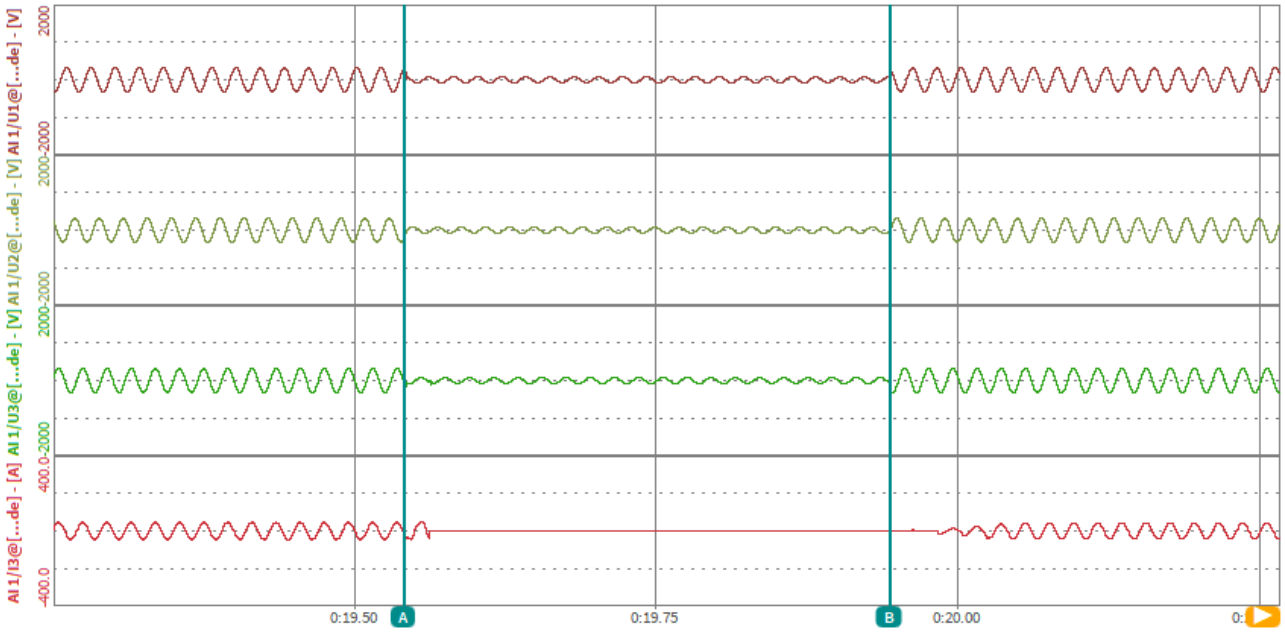
Test 1a -- guasto asimmetrico bifase
/ two phases asymmetric failure



	A	B	Delta
Time [s]	0:11.2085511	0:11.4086856	0.2001345
AI 1/U1@[RemoteNode] [V]	323.7987	263.1359	-60.66275
AI 1/U2@[RemoteNode] [V]	-194.3281	-248.7505	-54.42238
AI 1/U3@[RemoteNode] [V]	-142.1383	-15.00106	127.1372
AI 1/I3@[RemoteNode] [A]	-19.12322	0.158598	19.28182

	A	B	Delta
Time [s]	0:11.446542	0:11.550828	0.104286
U1_tRMS@X1-Hybrid4.0 [V]	226.0950	228.6757	2.580704
U2_tRMS@X1-Hybrid4.0 [V]	227.8943	229.2635	1.369263
U3_tRMS@X1-Hybrid4.0 [V]	231.4165	233.9930	2.576569
P_t@X1-Hybrid4.0 [W]	33.95898	7357.994	7324.035

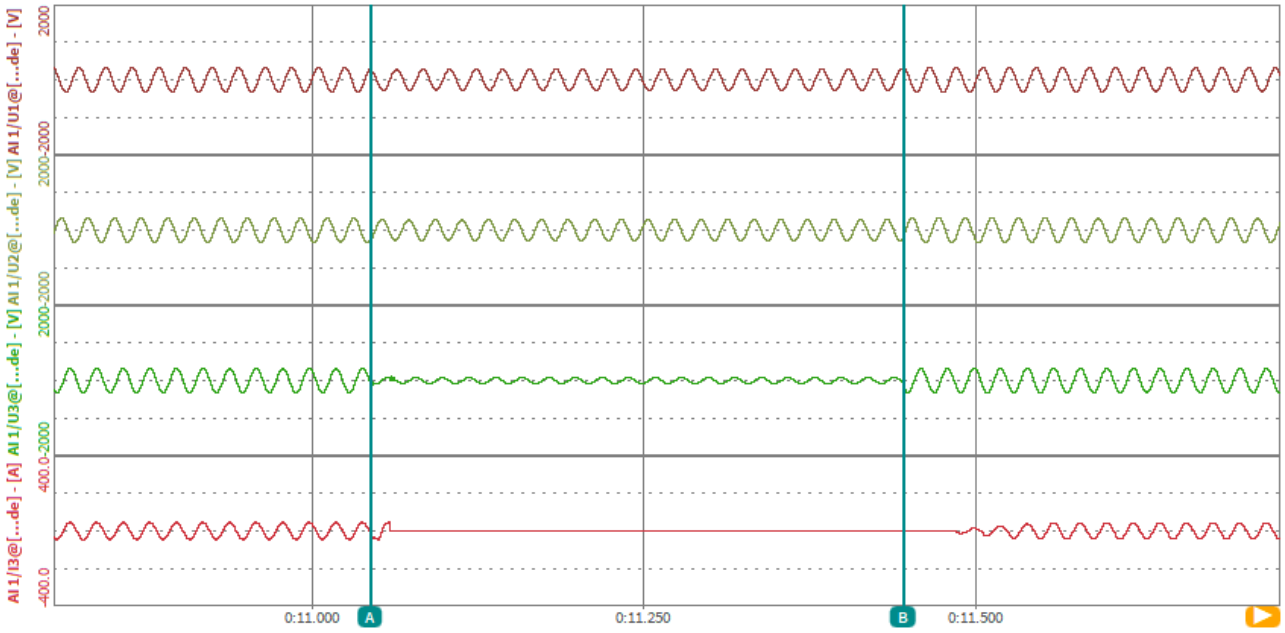
Test 2s -- guasto simmetrico trifase
/ three phases symmetric failure



	A	B	Delta
Time [s]	0:19.541554	0:19.943635	0.402082
AI 1/U1@[RemoteNode] [V]	270.9963	101.2430	-169.7533
AI 1/U2@[RemoteNode] [V]	-292.4421	-44.90829	247.5338
AI 1/U3@[RemoteNode] [V]	11.91878	-55.02487	-66.94365
AI 1/I3@[RemoteNode] [A]	0.923826	1.012661	0.088835

	A	B	Delta
Time [s]	0:19.97888	0:20.09235	0.11348
U1_tRMS@X1-Hybrid4.0 [V]	229.0968	228.1111	-0.985703
U2_tRMS@X1-Hybrid4.0 [V]	230.7085	228.8809	-1.827621
U3_tRMS@X1-Hybrid4.0 [V]	230.8671	233.9525	3.085403
P_t@X1-Hybrid4.0 [W]	49.46702	7363.618	7314.151

Test 2a -- guasto asimmetrico bifase
/ two phases asymmetric failure

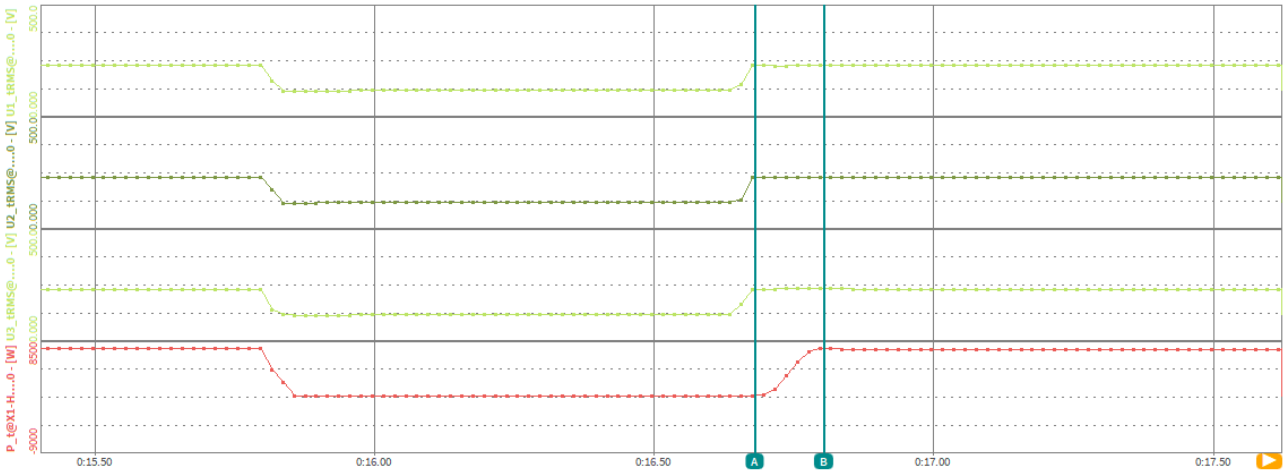


	A	B	Delta
Time [s]	0:11.044776	0:11.445715	0.400939
AI 1/U1@[RemoteNode] [V]	321.2271	311.5924	-9.634734
AI 1/U2@[RemoteNode] [V]	-205.1070	-87.53181	117.5752
AI 1/U3@[RemoteNode] [V]	-128.3517	-105.7675	22.58420
AI 1/I3@[RemoteNode] [A]	-17.14945	2.075912	19.22536

	A	B	Delta
Time [s]	0:11.487869	0:11.582659	0.094790
U1_tRMS@X1-Hybrid4.0 [V]	237.0731	230.0941	-6.978973
U2_tRMS@X1-Hybrid4.0 [V]	238.0753	231.2943	-6.780975
U3_tRMS@X1-Hybrid4.0 [V]	231.1248	234.0396	2.914810
P_t@X1-Hybrid4.0 [W]	52.11301	7378.569	7326.456

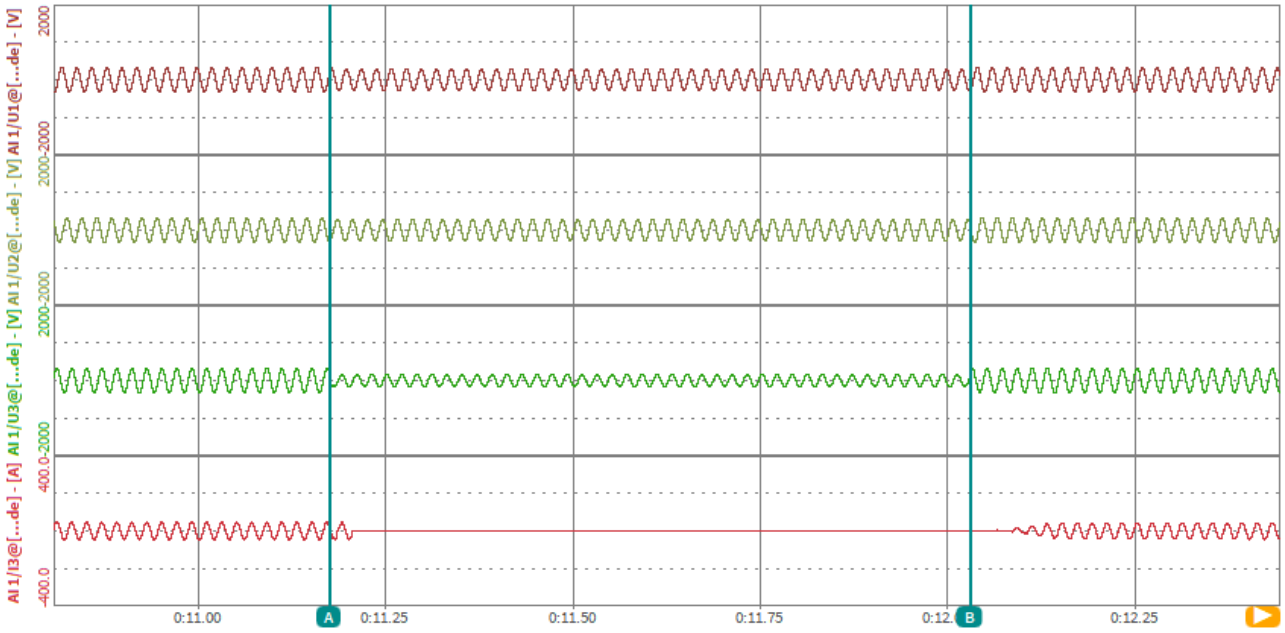
Test 3s -- guasto simmetrico trifase
/ three phases symmetric failure

	A	B	Delta
Time [s]	0:15.805234	0:16.656641	0.851408
AI 1/U1@[RemoteNode] [V]	173.1610	-236.2695	-409.4305
AI 1/U2@[RemoteNode] [V]	-53.97630	-29.16384	24.81246
AI 1/U3@[RemoteNode] [V]	-139.5724	264.3140	403.8863
AI 1/I3@[RemoteNode] [A]	-37.41260	-0.718068	36.69453



	A	B	Delta
Time [s]	0:16.681079	0:16.804313	0.123234
U1_tRMS@X1-Hybrid4.0 [V]	227.7671	228.6146	0.847488
U2_tRMS@X1-Hybrid4.0 [V]	229.4431	229.2036	-0.239487
U3_tRMS@X1-Hybrid4.0 [V]	229.3590	234.9704	5.611328
P_t@X1-Hybrid4.0 [W]	-1.011642	7389.299	7390.310

Test 3a -- guasto asimmetrico bifase
/ two phases asymmetric failure



	A	B	Delta
Time [s]	0:11.176325	0:12.030290	0.853965
AI 1/U1@[RemoteNode] [V]	183.8150	-312.3098	-496.1248
AI 1/U2@[RemoteNode] [V]	-324.9779	67.49154	392.4694
AI 1/U3@[RemoteNode] [V]	132.0329	176.0299	43.99705
AI 1/I3@[RemoteNode] [A]	17.59987	-1.873253	-19.47312

	A	B	Delta
Time [s]	0:16.681079	0:16.804313	0.123234
U1_tRMS@X1-Hybrid4.0 [V]	227.7671	228.6146	0.847488
U2_tRMS@X1-Hybrid4.0 [V]	229.4431	229.2036	-0.239487
U3_tRMS@X1-Hybrid4.0 [V]	229.3590	234.9704	5.611328
P_t@X1-Hybrid4.0 [W]	-1.011642	7389.299	7390.310

Test 4s -- guasto simmetrico trifase
/ three phases symmetric failure

	A	B	Delta
Time [s]	0:11.202146	0:12.507376	1.305231
AI 1/U1@[RemoteNode] [V]	288.0664	128.4769	-159.5895
AI 1/U2@[RemoteNode] [V]	-274.5924	134.4452	409.0376
AI 1/U3@[RemoteNode] [V]	-21.96622	-320.4191	-298.4529
AI 1/I3@[RemoteNode] [A]	-2.940987	-0.062464	2.878523

	A	B	Delta
Time [s]	0:12.573373	0:12.670556	0.097183
U1_tRMS@X1-Hybrid4.0 [V]	225.7985	229.0086	3.210083
U2_tRMS@X1-Hybrid4.0 [V]	226.5726	229.1993	2.626633
U3_tRMS@X1-Hybrid4.0 [V]	230.3393	233.5838	3.244537
P_t@X1-Hybrid4.0 [W]	1349.011	7338.361	5989.350

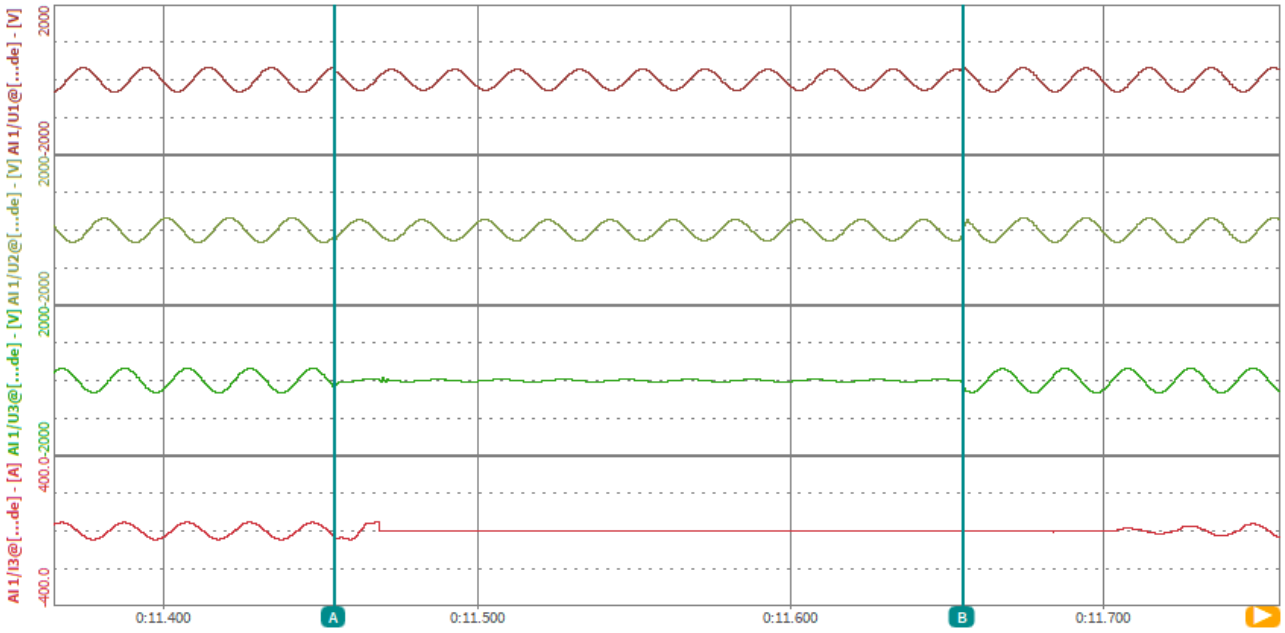
Test 4a -- guasto simmetrico bifase
/ two phases asymmetric failure

	A	B	Delta
Time [s]	0:11.286200	0:12.592847	1.306647
AI 1/U1@[RemoteNode] [V]	319.3963	-180.0821	-499.4784
AI 1/U2@[RemoteNode] [V]	-174.1510	-179.9359	-5.784989
AI 1/U3@[RemoteNode] [V]	-181.6411	-141.4518	40.18927
AI 1/I3@[RemoteNode] [A]	-28.15952	-0.896738	27.26278

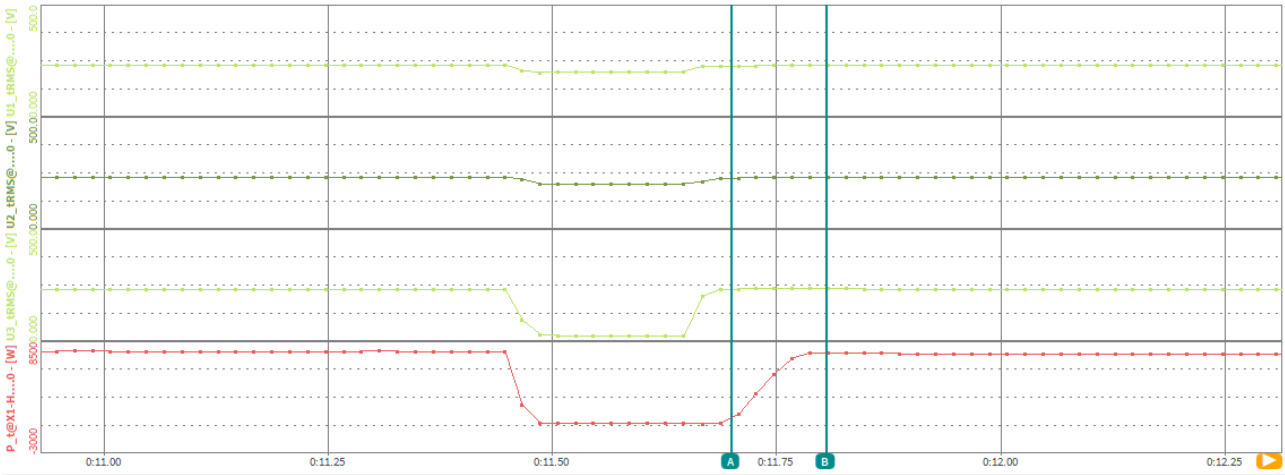
	A	B	Delta
Time [s]	0:12.634499	0:12.733447	0.098948
U1_tRMS@X1-Hybrid4.0 [V]	233.8117	229.6028	-4.208954
U2_tRMS@X1-Hybrid4.0 [V]	231.9899	230.3985	-1.591476
U3_tRMS@X1-Hybrid4.0 [V]	228.7623	234.6690	5.906677
P_t@X1-Hybrid4.0 [W]	31.88272	7358.706	7326.823

5 guasto asimmetrico bifase in BT

/ two phases asymmetric failure



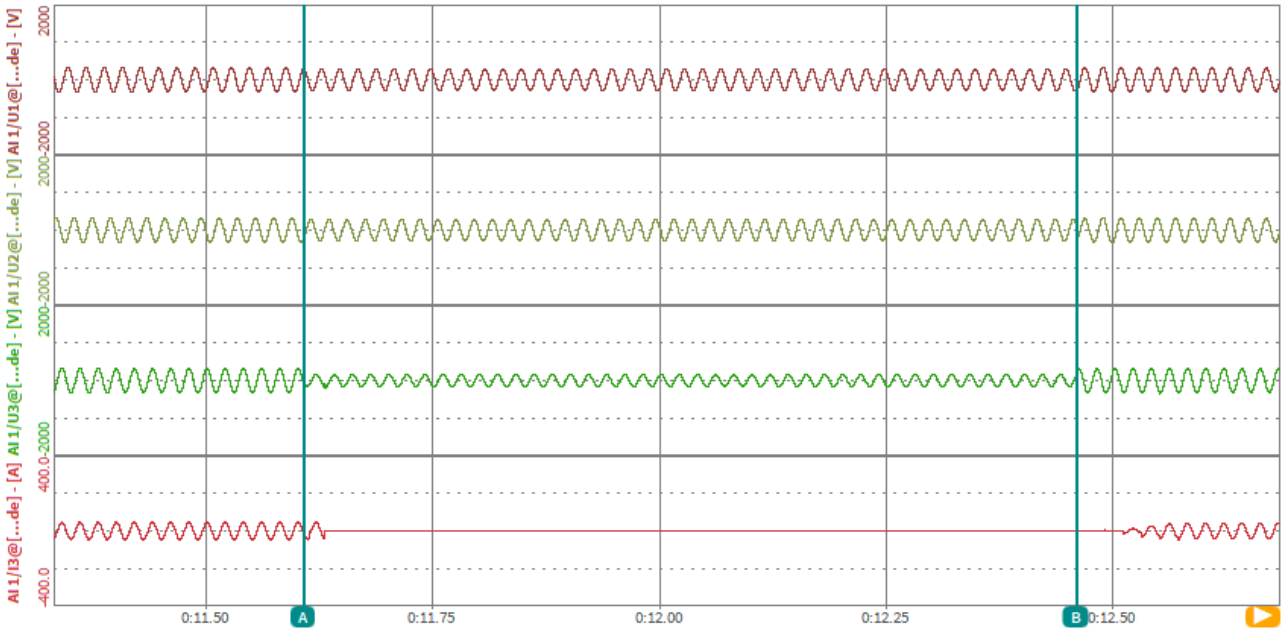
	A	B	Delta
Time [s]	0:11.4544630	0:11.6550200	0.2005569
AI 1/U1@[RemoteNode] [V]	324.0564	306.2489	-17.80748
AI 1/U2@[RemoteNode] [V]	-179.1487	-102.1512	76.99752
AI 1/U3@[RemoteNode] [V]	-161.2208	-56.59843	104.6224
AI 1/I3@[RemoteNode] [A]	-22.47391	1.690819	24.16473



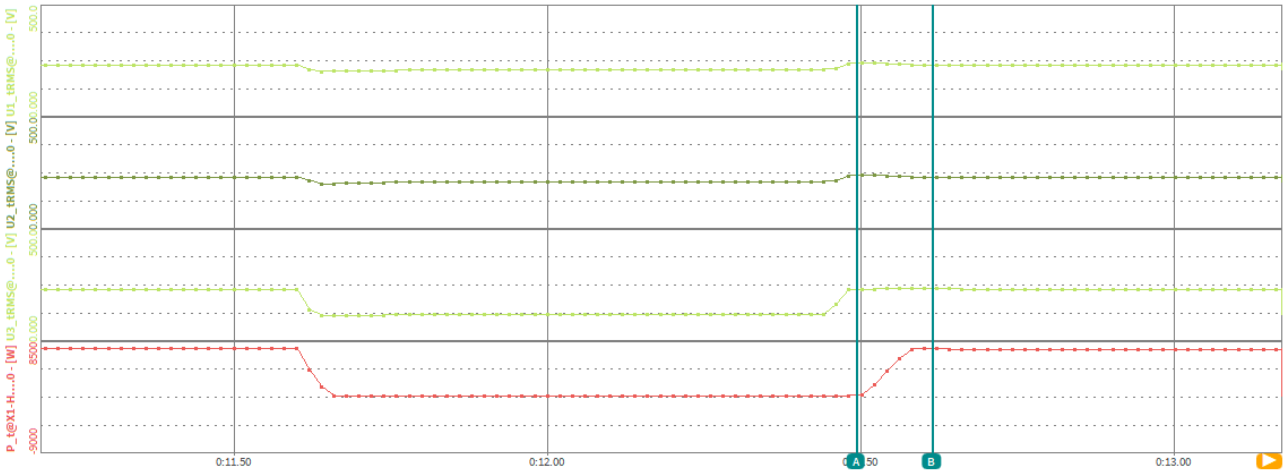
	A	B	Delta
Time [s]	0:11.699255	0:11.805196	0.105941
U1_tRMS@X1-Hybrid4.0 [V]	226.0197	228.4855	2.465775
U2_tRMS@X1-Hybrid4.0 [V]	225.3002	229.1632	3.862930
U3_tRMS@X1-Hybrid4.0 [V]	231.4941	234.9164	3.422348
P_t@X1-Hybrid4.0 [W]	9.505852	7378.253	7368.748

6 guasto asimmetrico bifase in BT

/ three phases symmetric failure



	A	B	Delta
Time [s]	0:11.608575	0:12.459831	0.851256
AI 1/U1@[RemoteNode] [V]	314.7295	-297.9207	-612.6502
AI 1/U2@[RemoteNode] [V]	-228.5137	90.82842	319.3422
AI 1/U3@[RemoteNode] [V]	-95.71624	121.3129	217.0291
AI 1/I3@[RemoteNode] [A]	-12.38356	-1.399897	10.98366

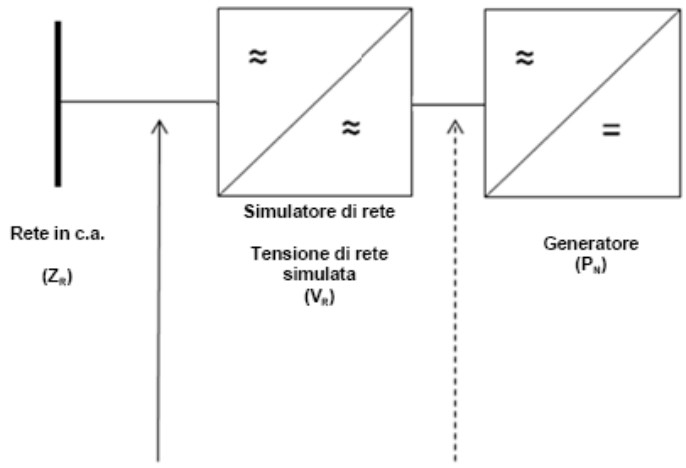


	A	B	Delta
Time [s]	0:12.492822	0:12.613781	0.120959
U1_tRMS@X1-Hybrid4.0 [V]	235.4536	229.8980	-5.555511
U2_tRMS@X1-Hybrid4.0 [V]	232.9793	230.7329	-2.246353
U3_tRMS@X1-Hybrid4.0 [V]	229.7841	234.5438	4.759659
P_t@X1-Hybrid4.0 [W]	0.044381	7377.736	7377.691

Bbis.10	**TABLE:** Verifica della insensibilità alle richiusure automatiche in discordanza di fase */ Check of the insensibility to the re-closures when phases are in discordance*		
☒ **Bbis.10.1 Test su rete simulata** */ Test on simulated grid* ☐ **Bbis.10.2 Test su rete di distribuzione tramite trasformatore di accoppiamento** */ Test on distribution grid through coupler transformer* ☐ **Bbis.10.3 Test su rete di distribuzione, simulazione della deriva di frequenza** */ Test on distribution grid, simulation of frequency deviation*			
	Ambient temperature (°C) ..... :	25 °C ± 2 °C	
	Humidity (RH %) ..... :	35 %	
	Instrumentation list ..... :	See table “Measurement equipment and instrumentation”	
	Uncertainty ..... :	See table	

Supplementary information:

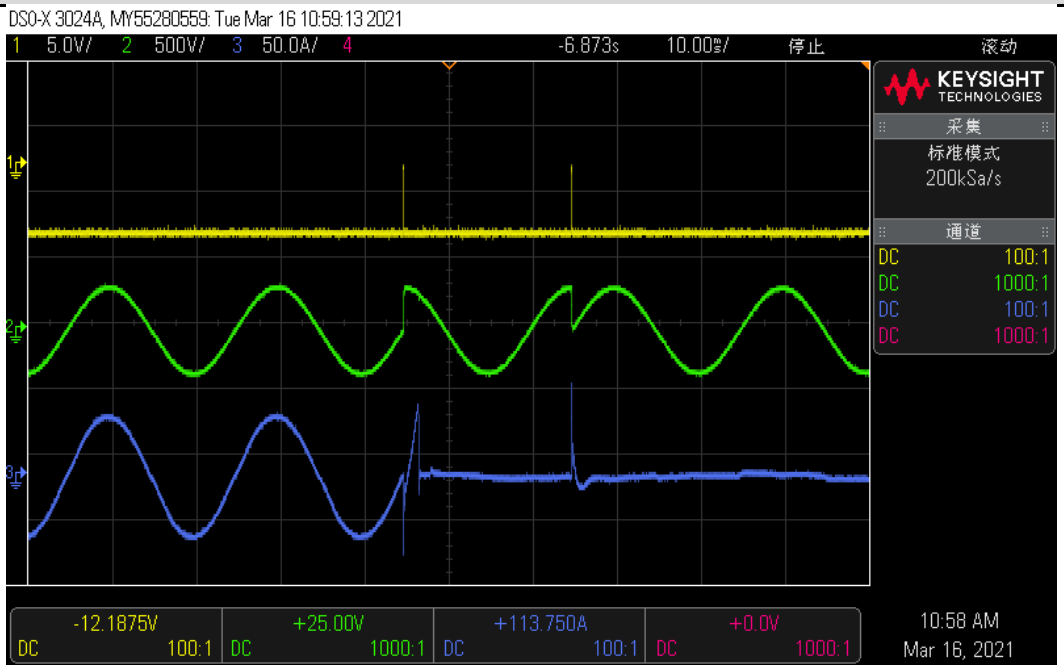
Test made with grid simulator as follow:



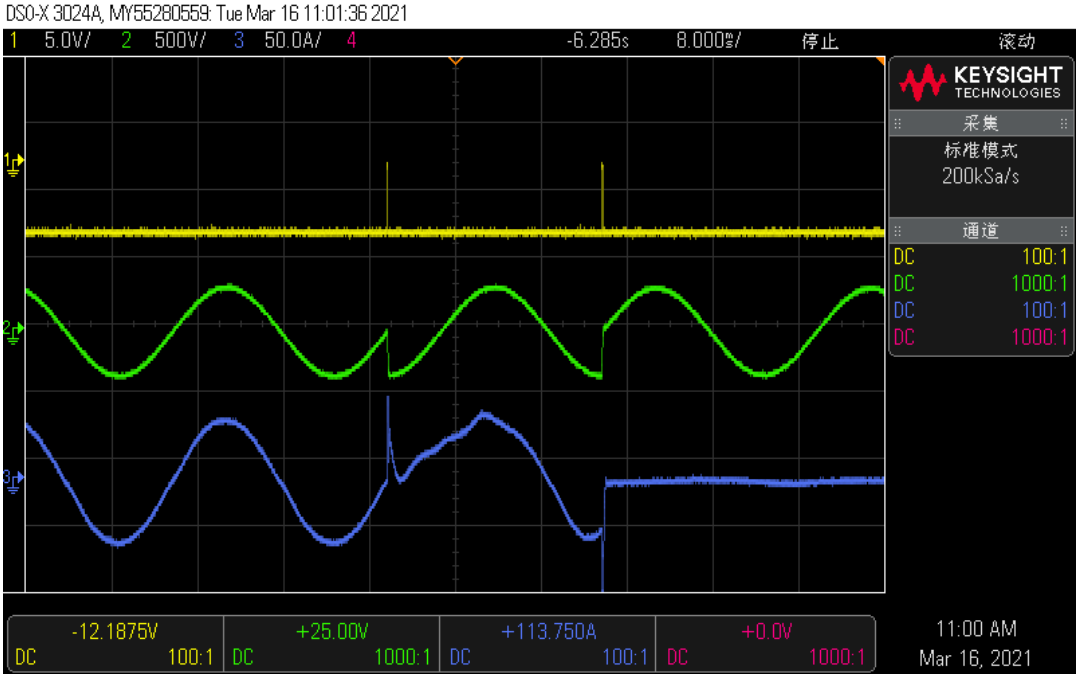
Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

Test	Output Power [W]	Output Current [A]	Phase displacement [°]	Phase displacement [°]	Result
1	7155	31.10	**+90°**	+90°	No damage inverter connected
2	7481	32.46	**-90°**	-90°	No damage Inverter connected
3	7510	32.58	**+180°**	+180°	No damage Inverter connected
4	7504	32.56	**180°**	180°	No damage inverter connected

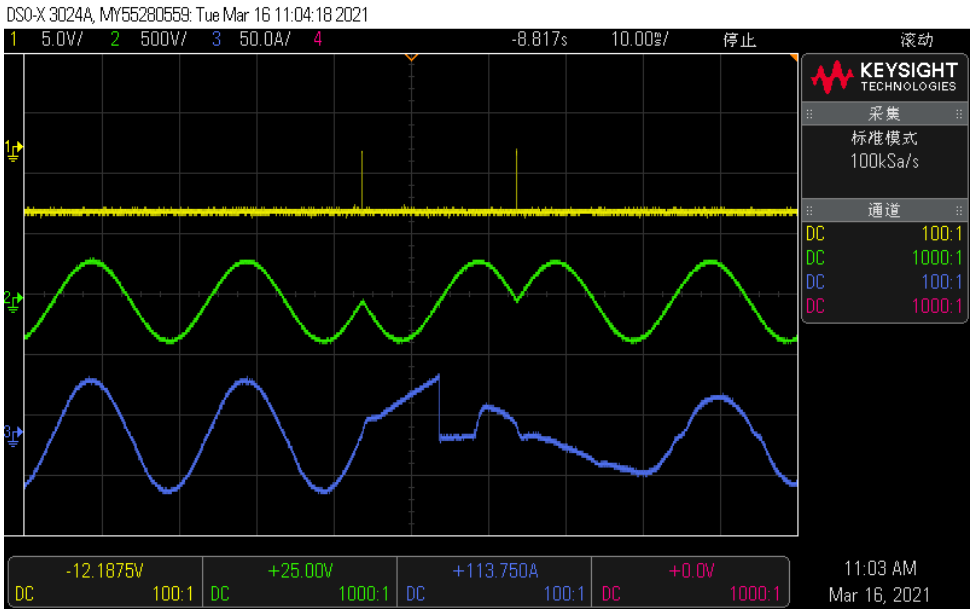
TEST#1: +90° phase displacement



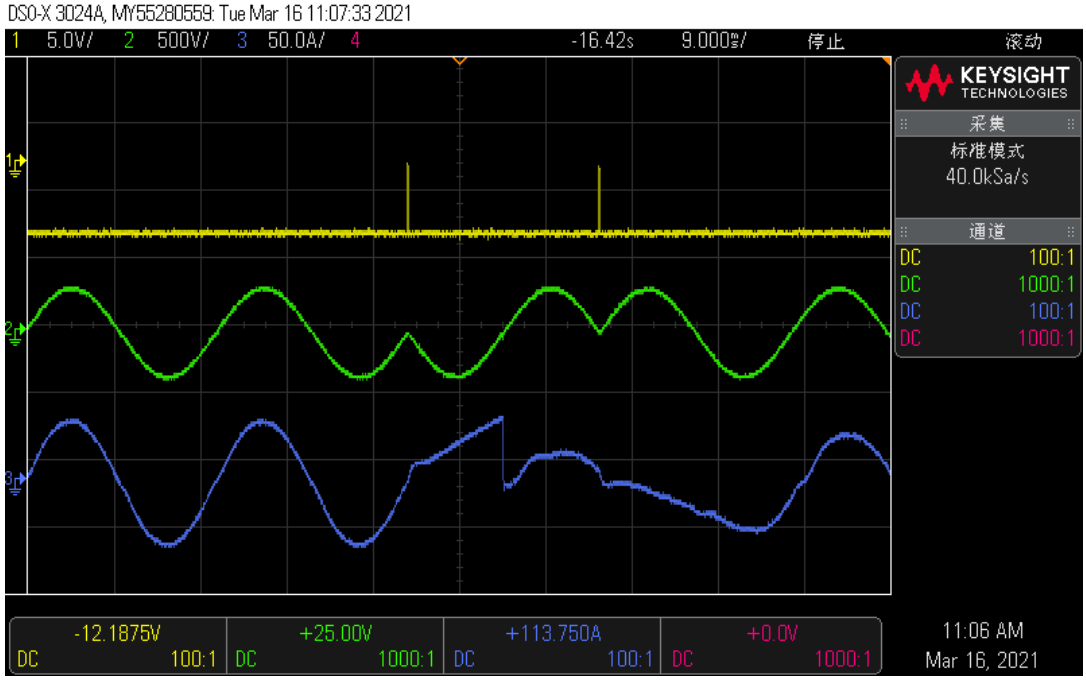
TEST#2: -90° phase displacement.



TEST#3: +180° phase displacement



TEST#4: -180° phase displacement



TESTING RESULTS
Allegato B bis: Prove Parziali sui sistemi di accumulo per i seguenti casi: */ Annex B bis: Partials Tests on Energy Storage Systems to following case:* ☐ **Case A** – P1 (P_{MIN}) and C1 (E_{MIN}) ☒ **Case B** – PN (P_{MAX}) and C (E_{MIN}) ☐ **Case C** – modeule base P (P_{MIN}) and C1 (E_{MIN}) ☐ **Case D** – module base P (P_{MIN}) and module base C (E_{MIN})

8.4.4.2 **Bbis.6.1** **Bbis.6.2**	**TABLE: check of the constructive requirements: reactive power production capability**
Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table
Max. cosφ declared..... :	☐ cosφ: 0.9 → Pout ≤ 11.08 KW (triangular) ☒ Q/Pn% = 48.43% →Pout > 11.08 KW (rectangular)

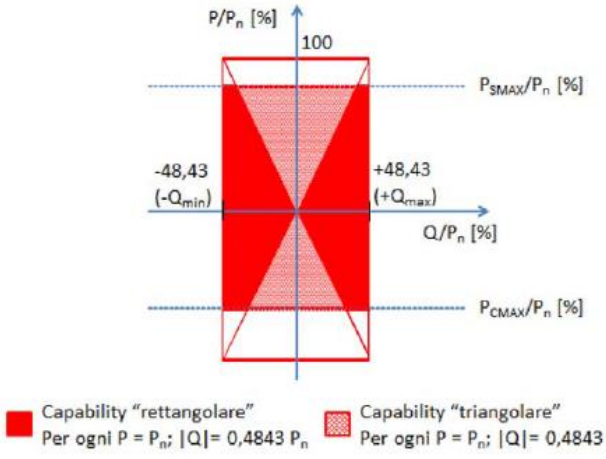


Figura 3Bbis – Capability per un sistema di accumulo con inverter bidirezionale.

Supplementary information:

For each of the 10 levels of active power, 1 value of inductive reactive power and 1 value of conductive reactive power shall be registered as average values in 1 min, based on the measurements at the fundamental in a window of 200ms.

Operator .....:	See cover page
Supervisor .....:	See cover page
Test Date.....:	See cover page

TABLE: Reactive power production with set point Q = 0

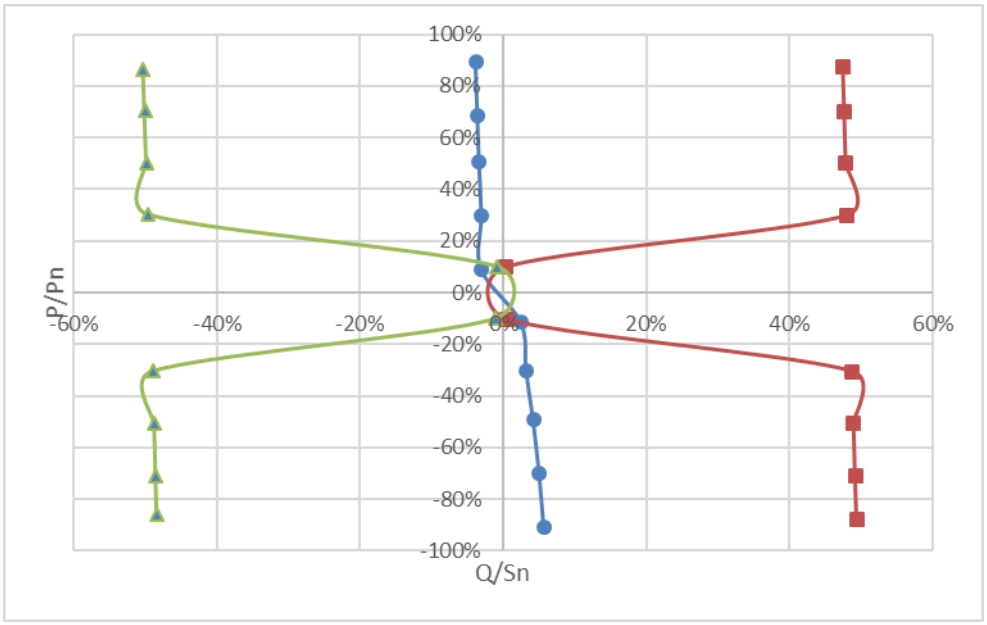
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Smax}	2944.8	89.24%	-127.2	-3.85%	2998.7	90.87%	0.999
70% - 80% P_{Smax}	2267.1	68.70%	-118.7	-3.60%	2301.1	69.73%	0.999
50% - 60% P_{Smax}	1663.3	50.40%	-110.6	-3.35%	1695.2	51.37%	0.998
30% - 40% P_{Smax}	983.1	29.79%	-100.2	-3.04%	1001.1	30.34%	0.995
10% - 20% P_{Smax}	302.7	9.17%	-101.5	-3.08%	313.8	9.51%	0.948
10% - 20% P_{Cmax}	-454	11.35%	-100	2.50%	-501	-12.53%	0.976
30% - 40% P_{Cmax}	-1210	30.25%	-130	3.25%	-1457.2	-36.43%	0.994
50% - 60% P_{Cmax}	-1967	49.18%	-169	4.23%	-2052.3	-51.31%	0.996
70% - 80% P_{Cmax}	-2801	70.03%	-203	5.08%	-2883.6	-72.09%	0.997
90% - 100% P_{Cmax}	-3638	90.95%	-229	5.73%	-3733.5	-93.34%	0.999

TABLE: Reactive power adsorbed with set point Q = Qmin							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Cmax}	-3435.3	-85.88%	-1936.0	-48.40%	-3547.2	-88.68%	-0.871
70% - 80% P_{Cmax}	-2835.8	-70.89%	-1940.9	-48.52%	-2896.6	-72.41%	-0.825
50% - 60% P_{Cmax}	-2022.3	-50.56%	-1949.2	-48.73%	-2110.3	-52.76%	-0.720
30% - 40% P_{Cmax}	-1211.3	-30.28%	-1957.8	-48.95%	-1286.5	-32.16%	-0.526
10% - 20% P_{Cmax}	-402.0	-10.05%	-45.9	-1.15%	-432.2	-10.80%	-0.200
10% - 20% P_{Smax}	334.0	10.12%	-26.8	-0.81%	357.0	10.82%	-0.201
30% - 40% P_{Smax}	997.9	30.24%	-1636.3	-49.59%	1066.2	32.31%	-0.521
50% - 60% P_{Smax}	1659.7	50.29%	-1644.8	-49.84%	1726.2	52.31%	-0.710
70% - 80% P_{Smax}	2322.1	70.37%	-1653.0	-50.09%	2385.8	72.30%	-0.815
90% - 100% P_{Smax}	2852.0	86.42%	-1660.0	-50.30%	2978.1	90.24%	-0.864

TABLE: Reactive power produced with set point Q = Qmax							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Cmax}	-3513.5	-87.84%	1975.2	49.38%	-3614.6	-90.37%	0.872
70% - 80% P_{Cmax}	-2845.2	-71.13%	1967.6	49.19%	-2926.1	-73.15%	0.822
50% - 60% P_{Cmax}	-2032.2	-50.80%	1959.3	48.98%	-2117.1	-52.93%	0.720
30% - 40% P_{Cmax}	-1221.8	-30.55%	1951.0	48.77%	-1283.8	-32.10%	0.531
10% - 20% P_{Cmax}	-413.5	-10.34%	22.3	0.56%	-435.7	-10.89%	0.208
10% - 20% P_{Smax}	324.3	9.83%	10.3	0.31%	364.4	11.04%	0.199
30% - 40% P_{Smax}	988.4	29.95%	1587.4	48.10%	1063.2	32.22%	0.529
50% - 60% P_{Smax}	1650.9	50.03%	1580.1	47.88%	1706.0	51.70%	0.722
70% - 80% P_{Smax}	2312.6	70.08%	1573.1	47.67%	2408.0	72.97%	0.827
90% - 100% P_{Smax}	2891.0	87.61%	1567.0	47.48%	2929.3	88.77%	0.879

Grafico: P/Q

/ Graph: Maximum reactive power adsorbed (Qmin) and produced (Qmax) as a function of the active power fed into the grid.



Bbis.6.6 **Bbis.6.7** *Annex E* **E.2**	**TABLE: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ= f(P)** ***/ Automatic production of reactive power according to a characteristic curve cosφ= f(P)***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table "Measurement equipment and instrumentation"
Uncertainty ..... :	See table
Max. cosφ declared..... :	☒ cosφ: 0.9 → Pout ≤ 11.08 KW ☐ Q/Pn% = 48.43% →Pout > 11.08 KW
Set value..... :	Lock-in: 1.05 Vn *(Vn and 1.1 Vn with steps of 0.01)* Lock-out: 230 V or 50%PS_{max} *(0.9 Vn and Vn with steps of 0.01)*

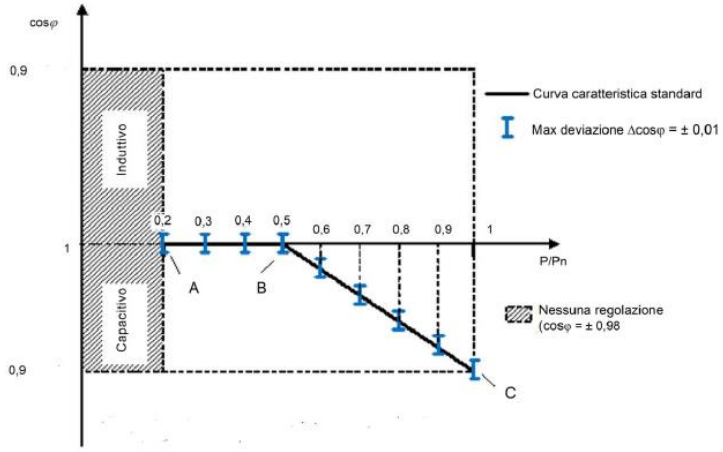


Figura 7Bbis – Curva caratteristica standard cosφ = f(P)

Supplementary information:

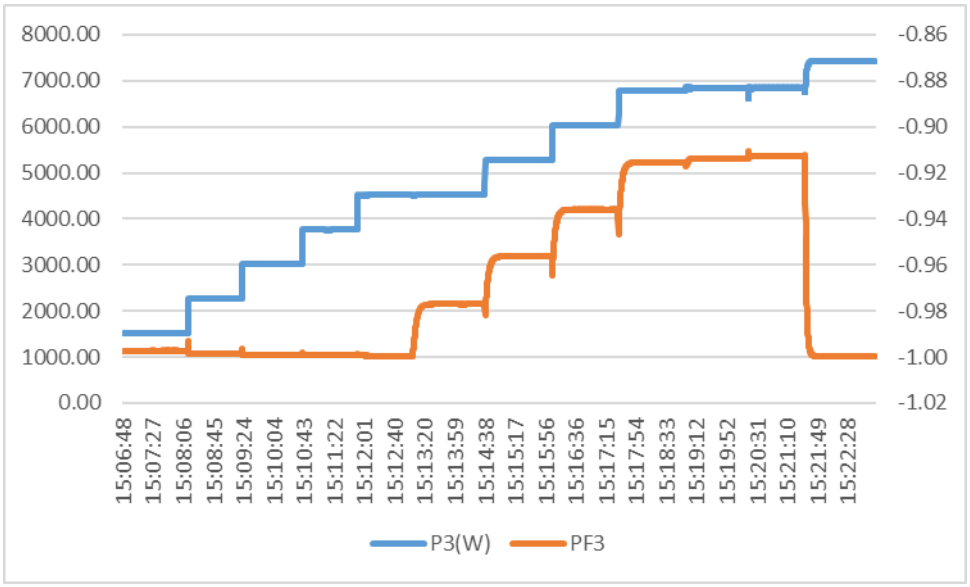
- Function must be anable by a local command of the converter.
- Each value must be reach in < 10s.

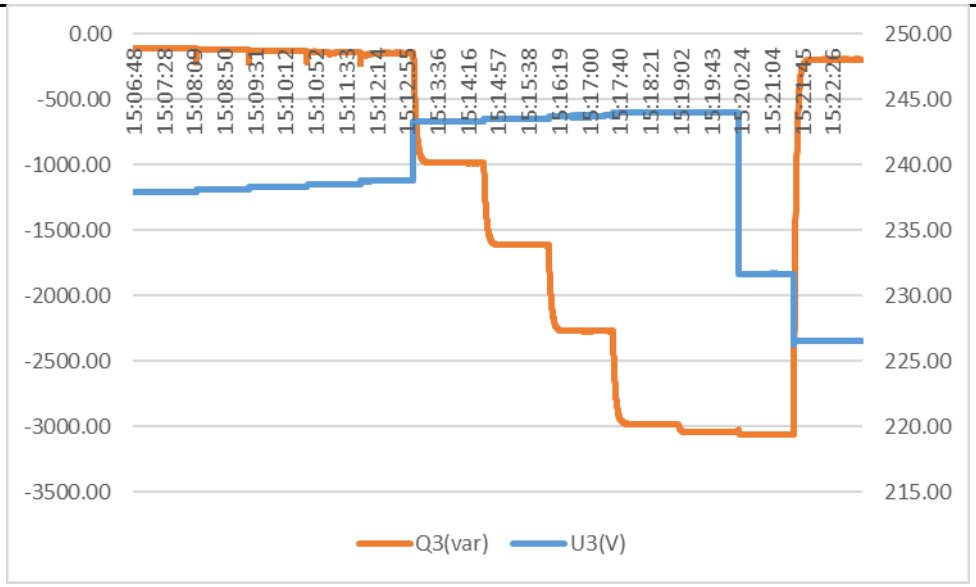
Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

Tabella Bbis.7: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ=f(P)
/ Table Bbis.7: *cosφ=f(P)*

P/Pn [%]	P [W]	Vout [V]	Q [Var]	Cosφ measured	Cosφ Set-point	Δ Q	Limit	RESULT
20	1513	237.9	-110	-1.00	1.000	0.00	Δ Q/Pn	P
30	2268	238.1	-117	-1.00	1.000	-110.00	± 2.5%	P
40	3020	238.3	-126	-1.00	1.000	-117.00	± 2.5%	P
50	3774	238.5	-137	-1.00	1.000	-126.00	± 2.5%	P
60	4527	238.8	-145	-1.00	1.000	-137.00	± 2.5%	P
60	4636	243.3	-986	-0.981	0.976	-145.00	± 2.5%	P
70	5282	243.5	-1610	-0.957	0.959	40.04	± 2.5%	P
80	6036	243.7	-2093	-0.945	0.939	-52.02	± 2.5%	P
90	6786	244.0	-2983	-0.916	0.919	116.94	± 2.5%	P
100	6853	244.0	-3045	-0.914	0.917	-72.57	± 2.5%	P
100	6846	231.7	-3064	-0.913	0.917	-69.18	± 2.5%	P
100	7434	226.5	-195	-1.00	1.000	-95.04	± 2.5% Pn	P

Grafico: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ= f(P)
/ Graph: Reactive power production according to a characteristic curve cos(phi) = f(P)




0.00
-500.00
-1000.00
-1500.00
-2000.00
-2500.00
-3000.00
-3500.00
250.00
245.00
240.00
235.00
230.00
225.00
220.00
215.00
15:06:48
15:07:28
15:08:09
15:08:50
15:09:31
15:10:12
15:10:52
15:11:33
15:12:14
15:12:55
15:13:36
15:14:16
15:14:57
15:15:38
15:16:19
15:17:00
15:17:40
15:18:21
15:19:02
15:19:43
15:20:24
15:21:04
15:21:45
15:22:26
Q3(var)
U3(V)

8.5.3.4 **8.5.3.5** **Bbis.7.2**	**TABLE: Verifica della riduzione automatica della potenza attiva in presenza di transitori di sovrafrequenza sulla rete** ***/Active power regulation in coincidence with transitory on the transmission grid***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

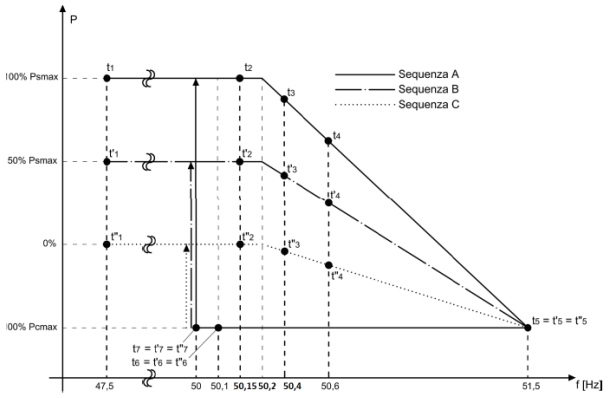


Figura 9Bbis – Curve di limitazione della potenza attiva per convertitori bidirezionali

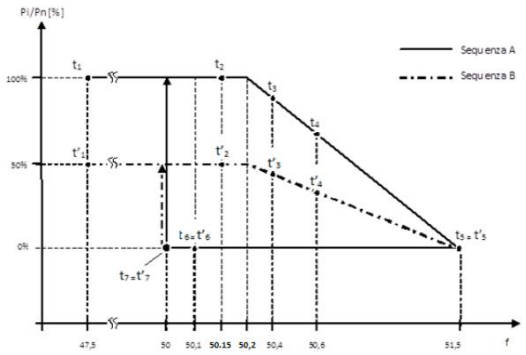


Figura 10Bbis – Curve di limitazione della potenza attiva per convertitori unidirezionali

Sequence test for Bi-directional EESS	*Sequence test for Uni-directional EESS*

Supplementary information:

Test shall be performed disabling the frequency threshold protection
Test was performed with a sampling time of 200ms
Sn is an active nominal power of the inverter

Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

Sequence A						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	100% Ps_{max}	50.00	3500.0	3264	± 2.5% S_n	t1
2	100% Ps_{max}	50.15	3500.0	3266	± 2.5% S_n	t2
3	100% Ps_{max}	50.40	2351.2	2120	± 2.5% S_n	t3
4	100% Ps_{max}	50.60	1202.4	987	± 2.5% S_n	t4
5	100% Ps_{max}	51.49	-3909.1	-4006	± 2.5% S_n	t5
6	100% Ps_{max}	50.11	-3909.1	-4033	± 2.5% S_n	t6
7	100% Ps_{max}	50.00	3500	3278	± 2.5% S_n	t7
Sequence B						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	50% Ps_{max}	50.00	1750	1662	± 2.5% S_n	t1’
2	50% Ps_{max}	50.15	1750	1662	± 2.5% S_n	t2’
3	50% Ps_{max}	50.40	870.3	760	± 2.5% S_n	t3’
4	50% Ps_{max}	50.60	9.3	-125	± 2.5% S_n	t4’
5	50% Ps_{max}	51.49	-3923.1	-4009	± 2.5% S_n	t5’
6	50% Ps_{max}	50.11	-3923.1	-4029	± 2.5% S_n	t6’
7	50% Ps_{max}	50.00	1750	1662	± 2.5% S_n	t7’

Sequence C*						
Step #	Set output power [%]	frequency [Hz]	Expected power value [W]	Actual power values [W]	limits	Graph point
1	0% PS_{max}	50.00	0	-3.0	± 2.5% S_n	t1''
2	0% PS_{max}	50.15	0	-3.0	± 2.5% S_n	t2''
3	0% PS_{max}	50.40	-637.5	--651	± 2.5% S_n	t3''
4	0% PS_{max}	50.60	-1458	-1268	± 2.5% S_n	t4''
5	0% PS_{max}	51.49	-4125	-4009	± 2.5% S_n	t5''
6	0% PS_{max}	50.11	-4125	-4015	± 2.5% S_n	t6''
7	0% PS_{max}	50.00	0	-3.0	± 2.5% S_n	t7''

Sequence C applicable only for bidirectional converters.

Grafico Sequenza A: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence A: Active power regulation in coincidence with transitory on the transmission grid

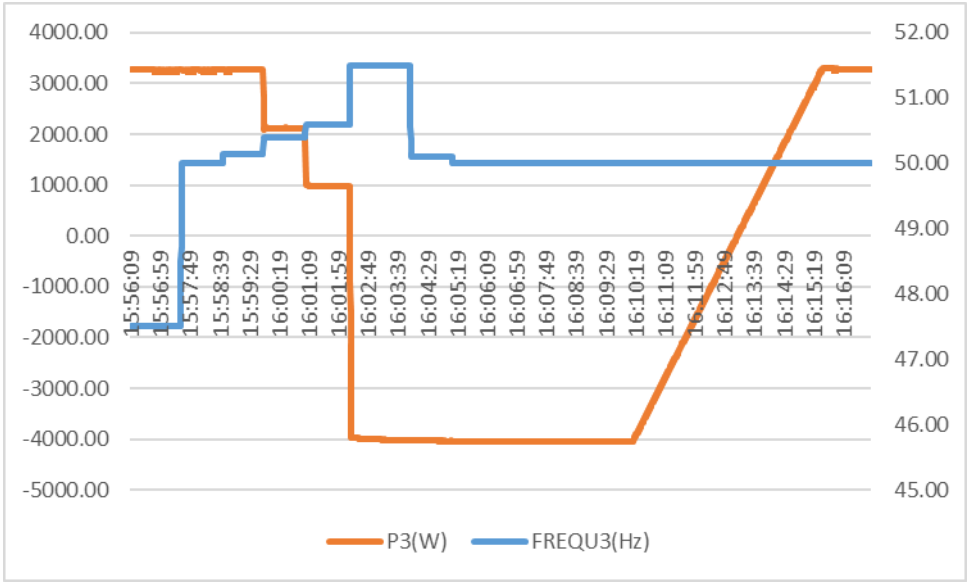


Grafico Sequenza B: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence B: Active power regulation in coincidence with transitory on the transmission grid

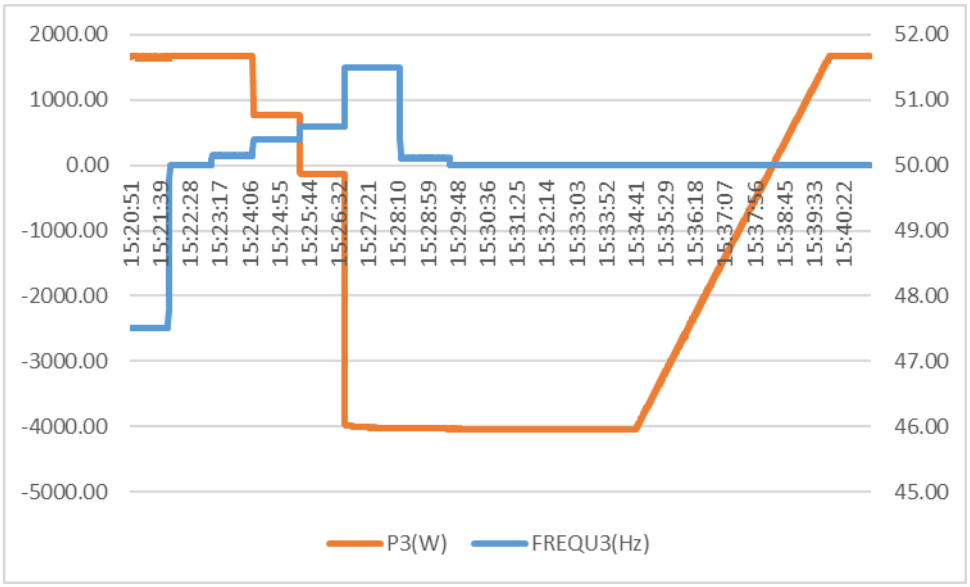
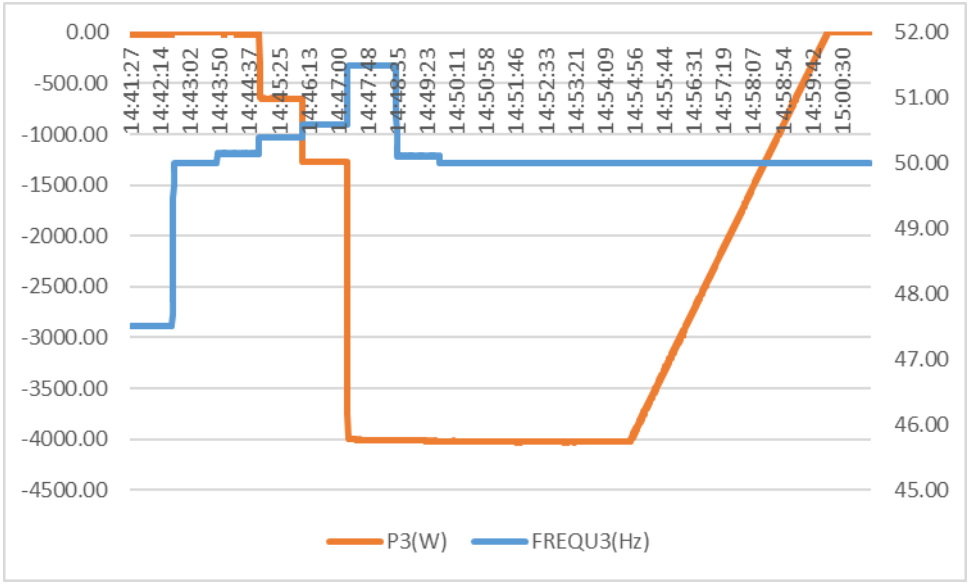


Grafico Sequenza C*: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence C: Active power regulation in coincidence with transitory on the transmission grid*



8.5.3.4 **8.5.3.5** **Bbis.7.3**	**TABLE: Regolazione della potenza attiva in presenza di transitori sulla rete di trasmissione** ***/Active power regulation in coincidence with transitory on the transmission grid***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

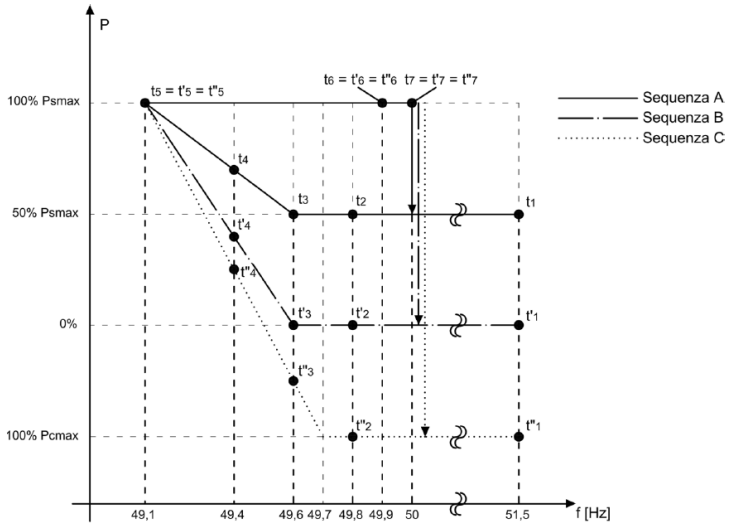


Figura 11Bbis – Curve di limitazione della potenza attiva

Supplementary information:

Test shall be performed disabling the frequency threshold protection
The storage needs an energy capacity of 20% of CUS

Test was performed with a sampling time of 200ms
Sn is an active nominal power of the inverter

Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

Sequence A						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	50% PS_{max}	50.00	1650	1662	± 2.5% S_n	t1
2	50% PS_{max}	49.85	1650	1663	± 2.5% S_n	t2
3	50% PS_{max}	49.60	2496	2153	± 2.5% S_n	t3
4	50% PS_{max}	49.40	2818	2627	± 2.5% S_n	t4
5	50% PS_{max}	49.11	3284	3247	± 2.5% S_n	t5
6	50% PS_{max}	49.89	3284	3245	± 2.5% S_n	t6
7	50% PS_{max}	50.00	1650	1663	± 2.5% S_n	t7
Sequence B						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	0% PS_{max}	50.00	0	3	± 2.5% S_n	t1’
2	0% PS_{max}	49.85	0	3	± 2.5% S_n	t2’
3	0% PS_{max}	49.60	911	1003	± 2.5% S_n	t3’
4	0% PS_{max}	49.40	1867	1935	± 2.5% S_n	t4’
5	0% PS_{max}	49.11	3252	3262	± 2.5% S_n	t5’
6	0% PS_{max}	49.89	3252	3249	± 2.5% S_n	t6’
7	0% PS_{max}	50.00	0	3	± 2.5% S_n	t7’

Sequence C*						
Step #	Set output power [%]	frequency [Hz]	Expected power value [W]	Actual power values [W]	limits	Graph point
1	100% Pc_{max}	50.00	-4000	-4028	± 2.5% S_n	t1''
2	100% Pc_{max}	49.85	-4000	-4030	± 2.5% S_n	t2''
3	100% Pc_{max}	49.60	-1936	-1872	± 2.5% S_n	t3''
4	100% Pc_{max}	49.40	159	265	± 2.5% S_n	t4''
5	100% Pc_{max}	49.11	3195	3276	± 2.5% S_n	t5''
6	100% Pc_{max}	49.89	3195	3266	± 2.5% S_n	t6''
7	100% Pc_{max}	50.00	-4000	-4008	± 2.5% S_n	t7''

Sequence C applicable only for bidirectional converters.

Grafico Sequenza A: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence A: Active power regulation in coincidence with transitory on the transmission grid

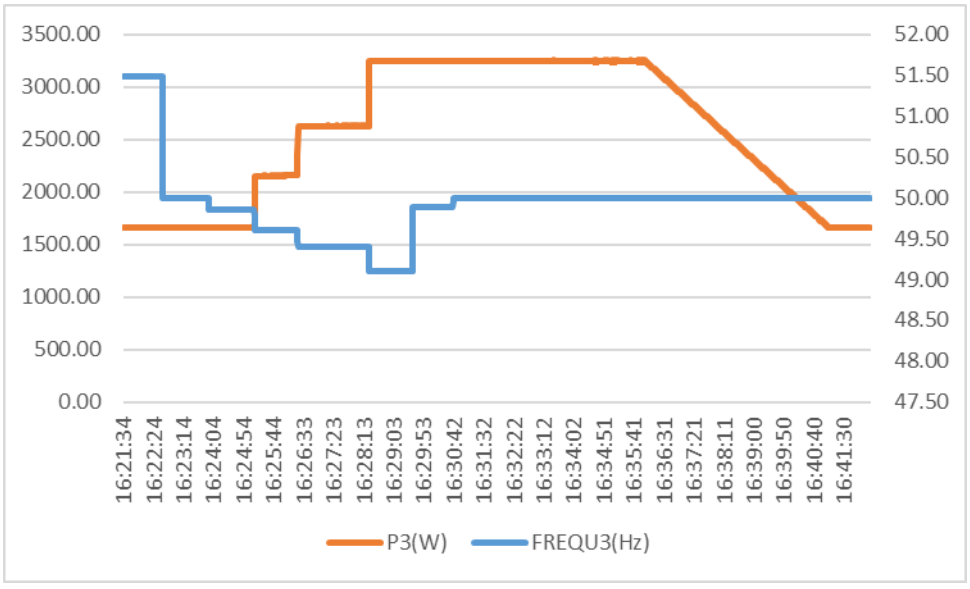


Grafico Sequenza B: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence B: Active power regulation in coincidence with transitory on the transmission grid

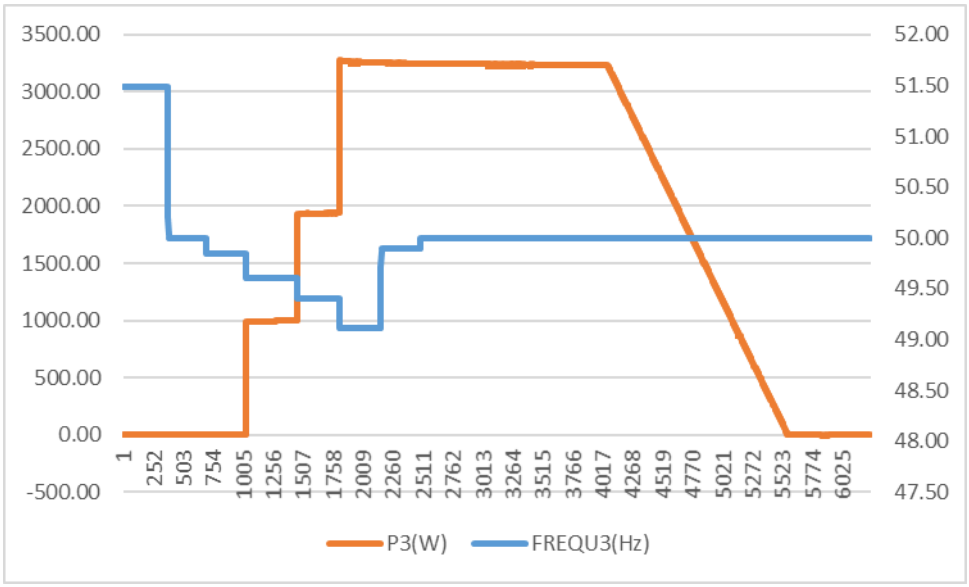
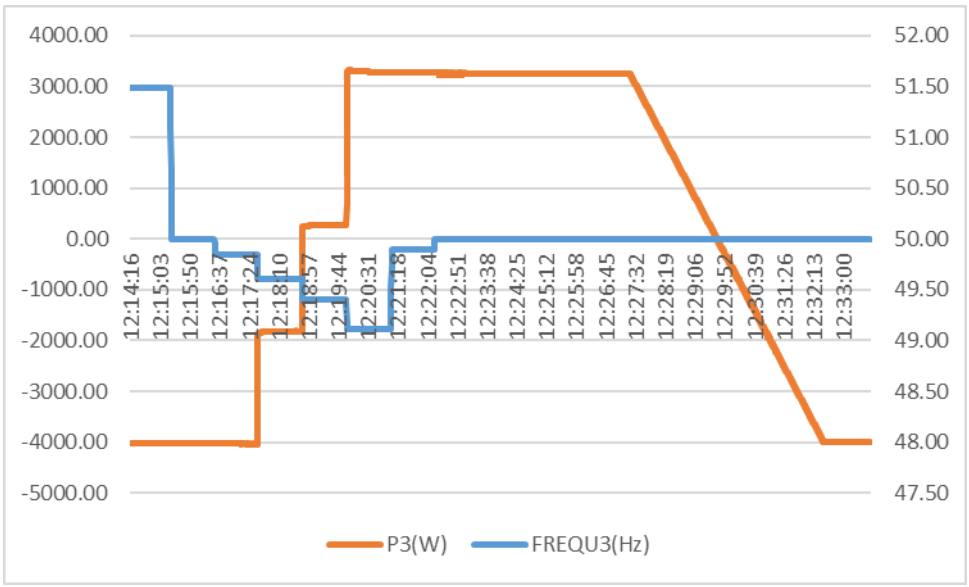


Grafico Sequenza C*: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence C: Active power regulation in coincidence with transitory on the transmission grid*



TESTING RESULTS	
Allegato B bis: Prove Parziali sui sistemi di accumulo per i seguenti casi: */ Annex B bis: Partials Tests on Energy Storage Systems to following case:* ☐ **Case A** – P1 (P_{MIN}) and C1 (E_{MIN}) ☒ **Case B** – P1 (P_{MIN}) and module base C (E_{MIN}) ☐ **Case C** – modeule base P (P_{MIN}) and C1 (E_{MIN}) ☐ **Case D** – module base P (P_{MIN}) and module base C (E_{MIN})	
8.4.4.2 **Bbis.6.1** **Bbis.6.2**	**TABLE: check of the constructive requirements: reactive power production capability**
Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table
Max. cosφ declared..... :	☐ cosφ: 0.9 → Pout ≤ 11.08 KW (triangular) ☒ Q/Pn% = 48.43% →Pout > 11.08 KW (rectangular)

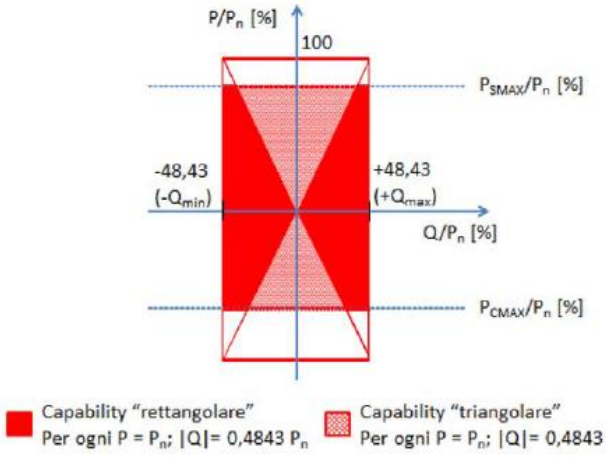


Figura 3Bbis – Capability per un sistema di accumulo con inverter bidirezionale.

Supplementary information:

For each of the 10 levels of active power, 1 value of inductive reactive power and 1 value of conductive reactive power shall be registered as average values in 1 min, based on the measurements at the fundamental in a window of 200ms.

Operator .....:	see cover page
Supervisor .....:	see cover page
Test Date.....:	see cover page

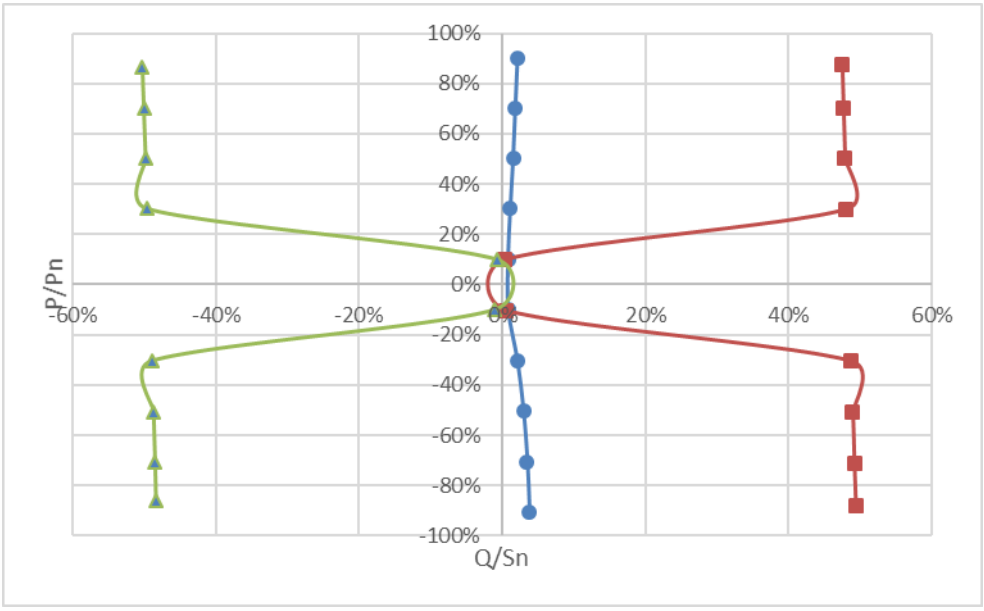
TABLE: Reactive power production with set point Q = 0							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Smax}	2713	90.43%	-114	-3.80%	2869	95.63%	0.999
70% - 80% P_{Smax}	2104	70.13%	-106	-3.53%	2224	74.13%	0.999
50% - 60% P_{Smax}	1495	49.83%	-97	-3.23%	1569	52.30%	0.998
30% - 40% P_{Smax}	885	29.50%	-91	-3.03%	921	30.70%	0.995
10% - 20% P_{Smax}	336	11.20%	-93	-3.10%	364	12.13%	0.964
10% - 20% P_{Cmax}	-302	-10.07%	-85	-2.83%	364	12.13%	0.963
30% - 40% P_{Cmax}	-906	-30.20%	-99	-3.28%	943	31.43%	0.994
50% - 60% P_{Cmax}	-1499	-49.97%	-139	-4.67%	1543	51.43%	0.996
70% - 80% P_{Cmax}	-2118	-70.57%	-153	-5.07%	2204	73.47%	0.997
90% - 100% P_{Cmax}	-2691	-89.70%	-171	-5.70%	2864	95.47%	0.998

TABLE: Reactive power adsorbed with set point Q = Qmin							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Cmax}	-2726	90.87%	-1495	-49.83%	2776	92.53%	0.877
70% - 80% P_{Cmax}	-2113	70.47%	-1501	-50.03%	2173	72.43%	0.816
50% - 60% P_{Cmax}	-1507	-50.23%	-1509	-50.30%	1557	51.90%	0.707
30% - 40% P_{Cmax}	-901	-30.03%	-1515	-50.50%	961	32.03%	0.512
10% - 20% P_{Cmax}	-298	-9.93%	-63	-2.10%	348	11.60%	0.192
10% - 20% P_{Smax}	313	10.43%	-75	-2.50%	373	12.43%	-0.201
30% - 40% P_{Smax}	892	29.73%	-1529	-50.97%	942	31.40%	-0.504
50% - 60% P_{Smax}	1501	50.03%	-1538	-51.27%	1561	52.03%	-0.699
70% - 80% P_{Smax}	2110	70.33%	-1545	-51.50%	2160	72.00%	-0.807
90% - 100% P_{Smax}	2691	89.70%	-1550	-51.67%	2751	91.70%	-0.866

TABLE: Reactive power produced with set point Q = Qmax							
Power Step	Active Power		Reactive Power		DC Power		Power Factor
	[W]	[%Sn]	[VAr]	[%Sn]	[W]	[%Sn]	Cosφ
90% - 100% P_{Cmax}	-2697	-89.90%	1469	48.97%	2740	91.33%	0.878
70% - 80% P_{Cmax}	-2091	-69.70%	1461	48.70%	2127	70.90%	0.820
50% - 60% P_{Cmax}	-1484	-49.47%	1454	48.47%	1527	50.90%	0.714
30% - 40% P_{Cmax}	-913	-30.43%	1450	48.33%	949	31.63%	0.533
10% - 20% P_{Cmax}	-308	-10.27%	44	48.13%	351	11.70%	0.209
10% - 20% P_{Smax}	298	9.93%	38	47.90%	334	11.13%	0.203
30% - 40% P_{Smax}	908	30.27%	1432	47.73%	951	31.70%	0.535
50% - 60% P_{Smax}	1518	50.60%	1429	47.63%	1554	51.80%	0.728
70% - 80% P_{Smax}	2096	69.87%	1426	47.53%	2139	71.30%	0.827
90% - 100% P_{Smax}	2705	90.17%	1421	47.37%	2741	91.37%	0.885

Grafico: P/Q

/ Graph: Maximum reactive power adsorbed (Qmin) and produced (Qmax) as a function of the active power fed into the grid.



Bbis.6.6 **Bbis.6.7** *Annex E* **E.2**	**TABLE: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ= f(P)** ***/ Automatic production of reactive power according to a characteristic curve cosφ= f(P)***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table "Measurement equipment and instrumentation"
Uncertainty ..... :	See table
Max. cosφ declared..... :	☒ cosφ: 0.9 → Pout ≤ 11.08 KW ☐ Q/Pn% = 48.43% →Pout > 11.08 KW
Set value..... :	Lock-in: 1.05 Vn *(Vn and 1.1 Vn with steps of 0.01)* Lock-out: 230 V or 50%PS_{max} *(0.9 Vn and Vn with steps of 0.01)*

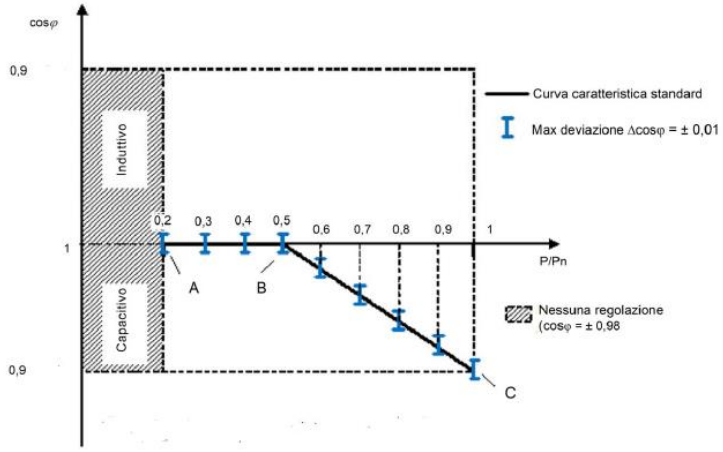


Figura 7Bbis – Curva caratteristica standard cosφ = f(P)

Supplementary information:

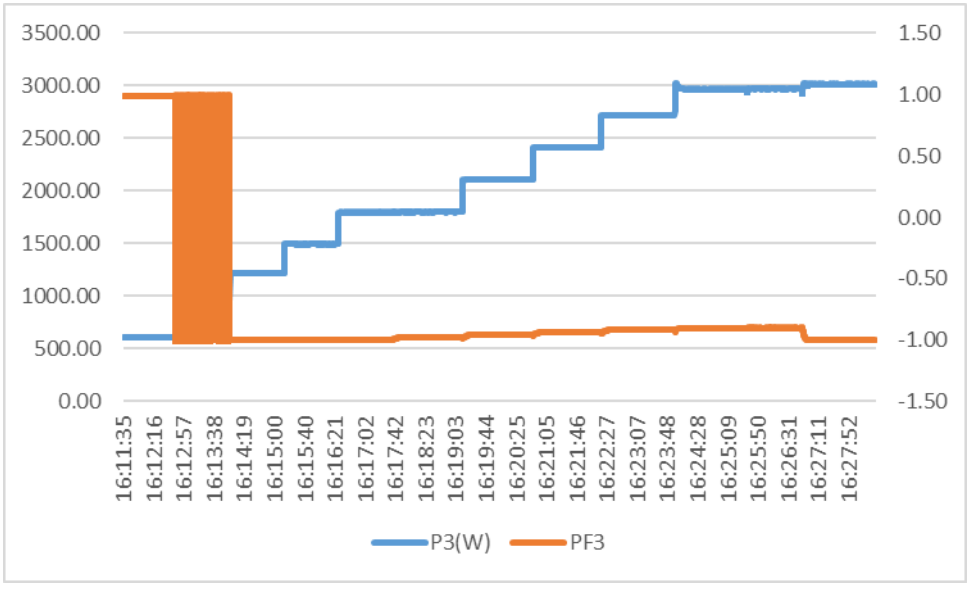
- Function must be anable by a local command of the converter.
- Each value must be reach in < 10s.

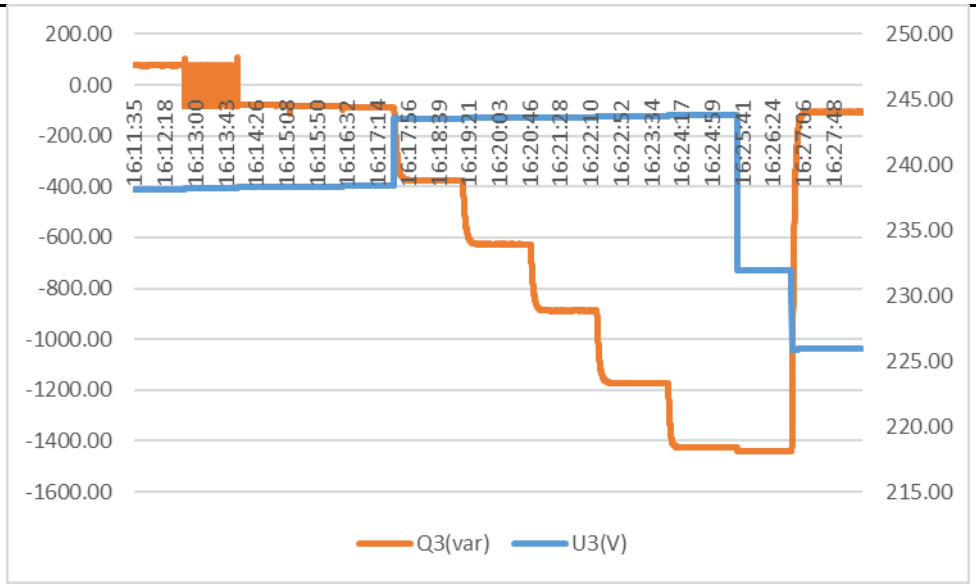
Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

Tabella Bbis.7: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ=f(P)
/ Table Bbis.7: *cosφ=f(P)*

P/PS$_{MAX}$ [%]	P [W]	Vout [V]	Q [Var]	Cosφ measured	Cosφ Set-point	Δ Q	Limit	RESULT
20	608	238.1	-70	0.992	1.000	-70.00	Δ Q/Pn	P
30	915	238.2	-71	0.999	1.000	-71.00	± 2.5%	P
40	1219	238.3	-67	0.999	1.000	-67.00	± 2.5%	P
50	1494	238.4	-70	0.998	1.000	-70.00	± 2.5%	P
60	1798	238.4	-70	0.999	1.000	-70.00	± 2.5%	P
60	1799	243.5	-372	-0.981	0.980	-7.33	± 2.5%	P
70	2104	243.6	-625	-0.96	0.960	-9.16	± 2.5%	P
80	2411	243.7	-889	-0.94	0.939	-8.07	± 2.5%	P
90	2719	243.7	-1171	-0.92	0.919	-2.35	± 2.5%	P
100	2969	243.8	-1378	-0.907	0.902	42.53	± 2.5%	P
100	2970	232	-1441	-0.9	0.902	-19.43	± 2.5%	P
100	3016	225.9	-70	-0.999	1.000	-70.00	± 2.5% Pn	P

Grafico: Erogazione automatica di potenza reattiva secondo una curva caratteristica cosφ= f(P)
/ Graph: Reactive power production according to a characteristic curve cos(phi) = f(P)




200.00
0.00
-200.00
-400.00
-600.00
-800.00
-1000.00
-1200.00
-1400.00
-1600.00
250.00
245.00
240.00
235.00
230.00
225.00
220.00
215.00
16:11:35
16:12:18
16:13:00
16:13:43
16:14:26
16:15:08
16:15:50
16:16:32
16:17:14
16:17:56
16:18:39
16:19:21
16:20:03
16:20:46
16:21:28
16:22:10
16:22:52
16:23:34
16:24:17
16:24:59
16:25:41
16:26:24
16:27:06
16:27:48
Q3(var)
U3(V)

8.5.3.4 **8.5.3.5** **Bbis.7.2**	**TABLE: Verifica della riduzione automatica della potenza attiva in presenza di transitori di sovrafrequenza sulla rete** ***/Active power regulation in coincidence with transitory on the transmission grid***
Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

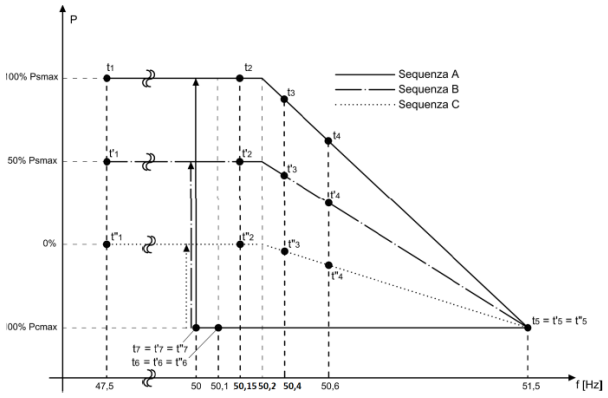


Figura 9Bbis – Curve di limitazione della potenza attiva per convertitori bidirezionali

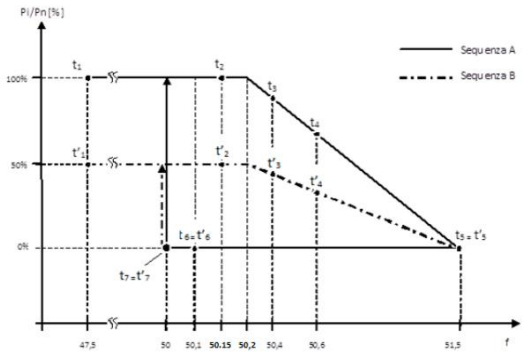


Figura 10Bbis – Curve di limitazione della potenza attiva per convertitori unidirezionali

Sequence test for Bi-directional EESS	*Sequence test for Uni-directional EESS*

Supplementary information:

Test shall be performed disabling the frequency threshold protection
Test was performed with a sampling time of 200ms
Sn is an active nominal power of the inverter

Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date ..... :	see cover page

Sequence A						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	100% Ps_{max}	50.00	3000	3016	± 2.5% S_n	t1
2	100% Ps_{max}	50.15	3000	3016	± 2.5% S_n	t2
3	100% Ps_{max}	50.40	2090	2063	± 2.5% S_n	t3
4	100% Ps_{max}	50.60	1165	1124	± 2.5% S_n	t4
5	100% Ps_{max}	51.49	-2954	-3009	± 2.5% S_n	t5
6	100% Ps_{max}	50.11	-2954	-3007	± 2.5% S_n	t6
7	100% Ps_{max}	50.00	3000	3014	± 2.5% S_n	t7
Sequence B						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	50% Ps_{max}	50.00	1500	1495	± 2.5% S_n	t1’
2	50% Ps_{max}	50.15	1500	1394	± 2.5% S_n	t2’
3	50% Ps_{max}	50.40	718	757	± 2.5% S_n	t3’
4	50% Ps_{max}	50.60	42	61	± 2.5% S_n	t4’
5	50% Ps_{max}	51.49	-2966	-3001	± 2.5% S_n	t5’
6	50% Ps_{max}	50.11	-2966	-3003	± 2.5% S_n	t6’
7	50% Ps_{max}	50.00	1500	1493	± 2.5% S_n	t7’

Sequence C*						
Step #	Set output power [%]	frequency [Hz]	Expected power value [W]	Actual power values [W]	limits	Graph point
1	0% PS_{max}	50.00	0	7	± 2.5% S_n	t1''
2	0% PS_{max}	50.15	0	7	± 2.5% S_n	t2''
3	0% PS_{max}	50.40	-456	-439	± 2.5% S_n	t3''
4	0% PS_{max}	50.60	-918	-909	± 2.5% S_n	t4''
5	0% PS_{max}	51.49	-2977	-3008	± 2.5% S_n	t5''
6	0% PS_{max}	50.11	-2977	-3011	± 2.5% S_n	t6''
7	0% PS_{max}	50.00	0	7	± 2.5% S_n	t7''

Sequence C applicable only for bidirectional converters.

Grafico Sequenza A: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence A: Active power regulation in coincidence with transitory on the transmission grid

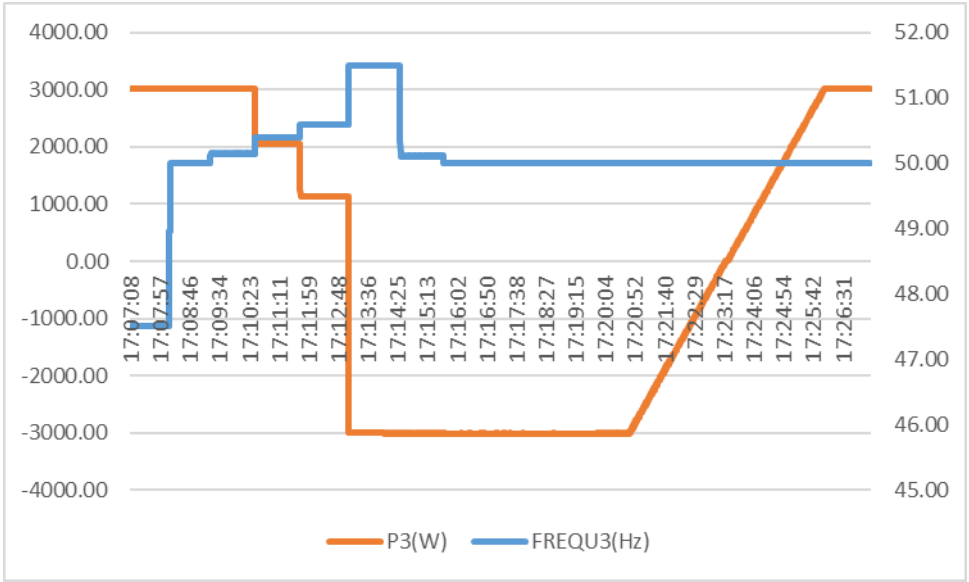


Grafico Sequenza B: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence B: Active power regulation in coincidence with transitory on the transmission grid

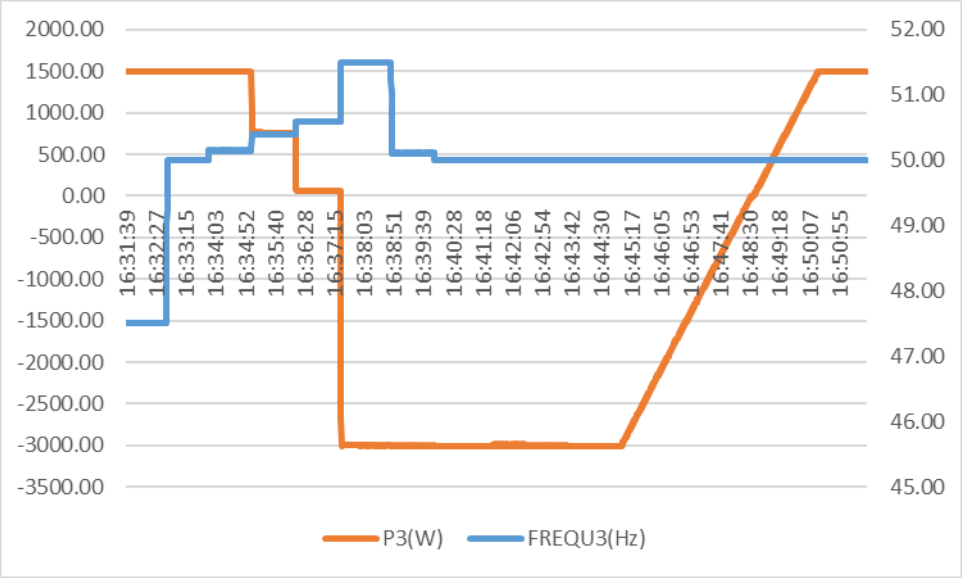
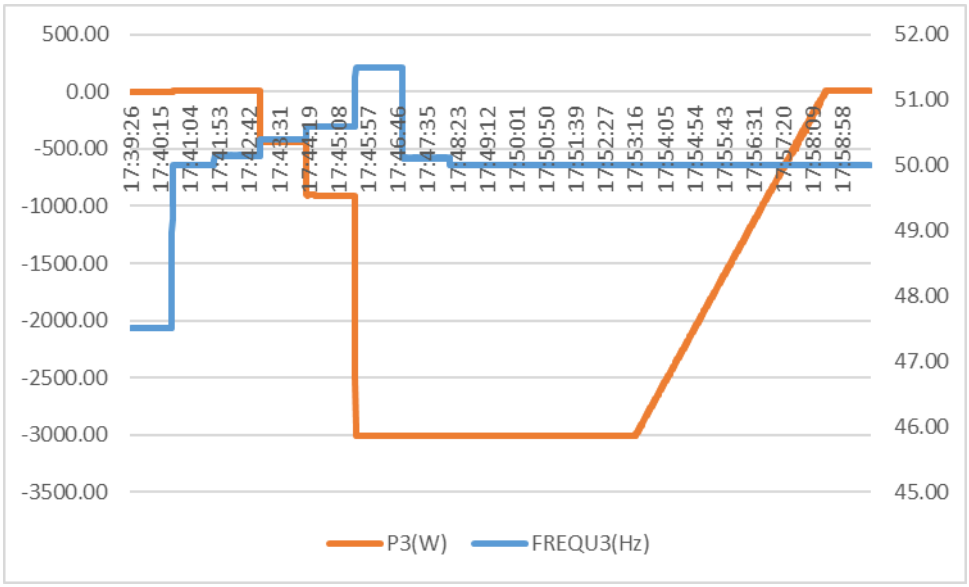


Grafico Sequenza C*: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence C: Active power regulation in coincidence with transitory on the transmission grid*



8.5.3.4 **8.5.3.5** **Bbis.7.3**	**TABLE: Regolazione della potenza attiva in presenza di transitori sulla rete di trasmissione** ***/Active power regulation in coincidence with transitory on the transmission grid***

Ambient temperature (°C) ..... :	25 °C ± 5 °C
Humidity (RH %) ..... :	65% ± 5% RH
Instrumentation list ..... :	See table “Measurement equipment and instrumentation”
Uncertainty ..... :	See table

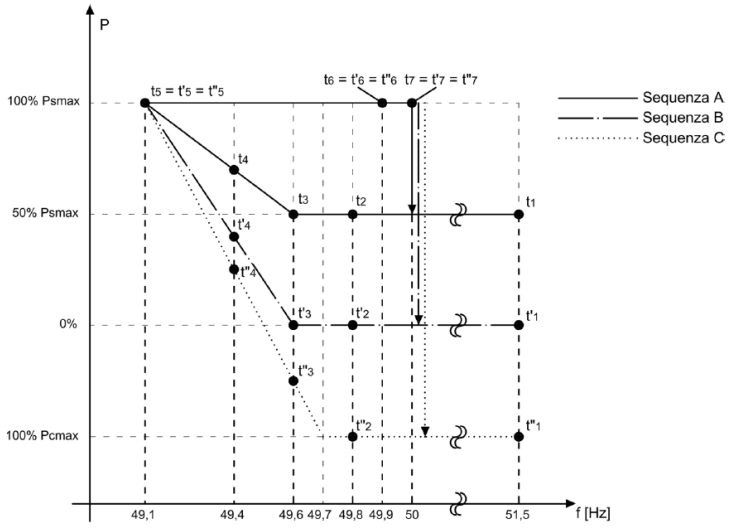


Figura 11Bbis – Curve di limitazione della potenza attiva

Supplementary information:

Test shall be performed disabling the frequency threshold protection
The storage needs an energy capacity of 20% of CUS

Test was performed with a sampling time of 200ms
Sn is an active nominal power of the inverter

Operator ..... :	see cover page
Supervisor ..... :	see cover page
Test Date..... :	see cover page

Sequence A						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	50% PS_{max}	50.00	1500	1525	± 2.5% S_n	t1
2	50% PS_{max}	49.85	1500	1525	± 2.5% S_n	t2
3	50% PS_{max}	49.60	1929	1955	± 2.5% S_n	t3
4	50% PS_{max}	49.40	2358	2390	± 2.5% S_n	t4
5	50% PS_{max}	49.11	2979	3019	± 2.5% S_n	t5
6	50% PS_{max}	49.89	2979	3021	± 2.5% S_n	t6
7	50% PS_{max}	50.00	1500	1525	± 2.5% S_n	t7
Sequence B						
Step #	**Set output power [%]**	**frequency [Hz]**	**Expected power value [W]**	**Actual power values [W]**	**limits**	**Graph point**
1	0% PS_{max}	50.00	0	11	± 2.5% S_n	t1’
2	0% PS_{max}	49.85	0	11	± 2.5% S_n	t2’
3	0% PS_{max}	49.60	858	873	± 2.5% S_n	t3’
4	0% PS_{max}	49.40	1713	1742	± 2.5% S_n	t4’
5	0% PS_{max}	49.11	2958	2989	± 2.5% S_n	t5’
6	0% PS_{max}	49.89	2958	2994	± 2.5% S_n	t6’
7	0% PS_{max}	50.00	0	11	± 2.5% S_n	t7’

Sequence C*						
Step #	Set output power [%]	frequency [Hz]	Expected power value [W]	Actual power values [W]	limits	Graph point
1	100% Pc_{max}	50.00	-3000	-3059	± 2.5% S_n	t1''
2	100% Pc_{max}	49.85	-3000	-3058	± 2.5% S_n	t2''
3	100% Pc_{max}	49.60	-1386	-1328	± 2.5% S_n	t3''
4	100% Pc_{max}	49.40	227	441	± 2.5% S_n	t4''
5	100% Pc_{max}	49.11	2566	2935	± 2.5% S_n	t5''
6	100% Pc_{max}	49.89	2566	2944	± 2.5% S_n	t6''
7	100% Pc_{max}	50.00	-3000	-3057	± 2.5% S_n	t7''
***Sequence C applicable only for bidirectional converters.**						

Grafico Sequenza A: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence A: Active power regulation in coincidence with transitory on the transmission grid

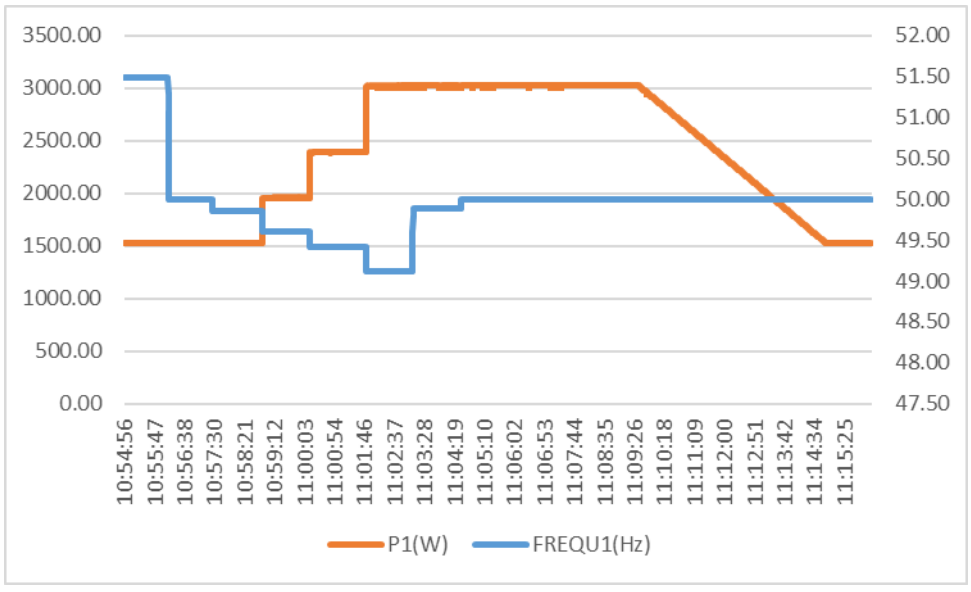


Grafico Sequenza B: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence B: Active power regulation in coincidence with transitory on the transmission grid

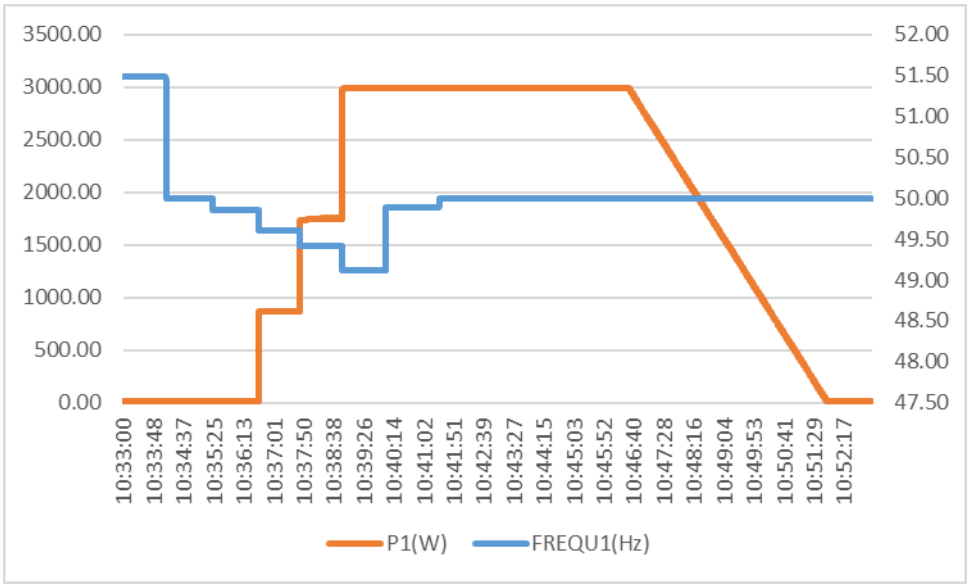
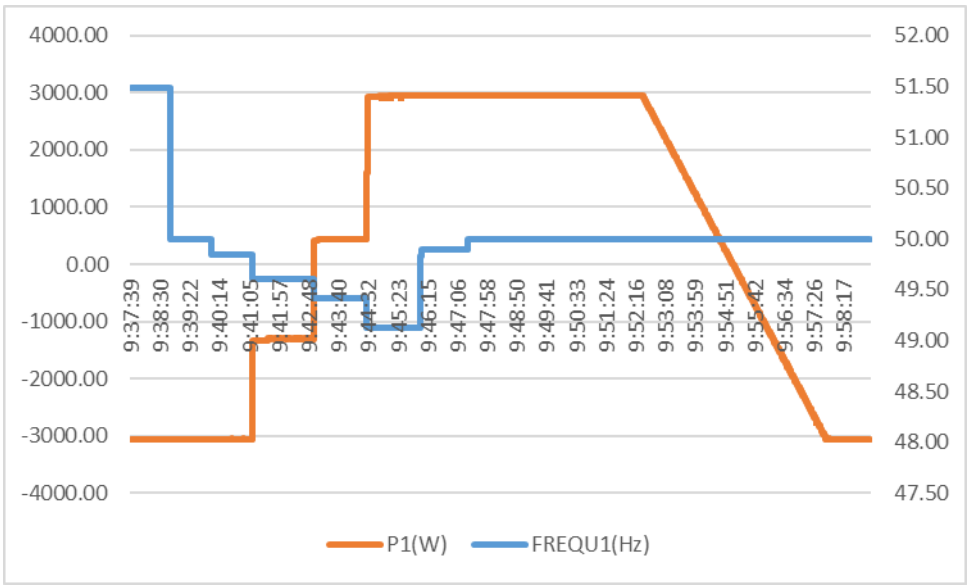


Grafico Sequenza C*: Curva di limitazione della potenza attiva rispetto alla frequenza

/ Graph Sequence C: Active power regulation in coincidence with transitory on the transmission grid*



TEST REPORT END

PHOTO DOCUMENTATION

CN21F5SR 001

X1-Hybrid-x-y
(x=3.0, 3.7, 5.0, 6.0, 7.5; y=D or M;)

SolaX Power Network Technology (Zhe Jiang) Co., Ltd.

This documentation consists of 5 pages (excluding this cover page).

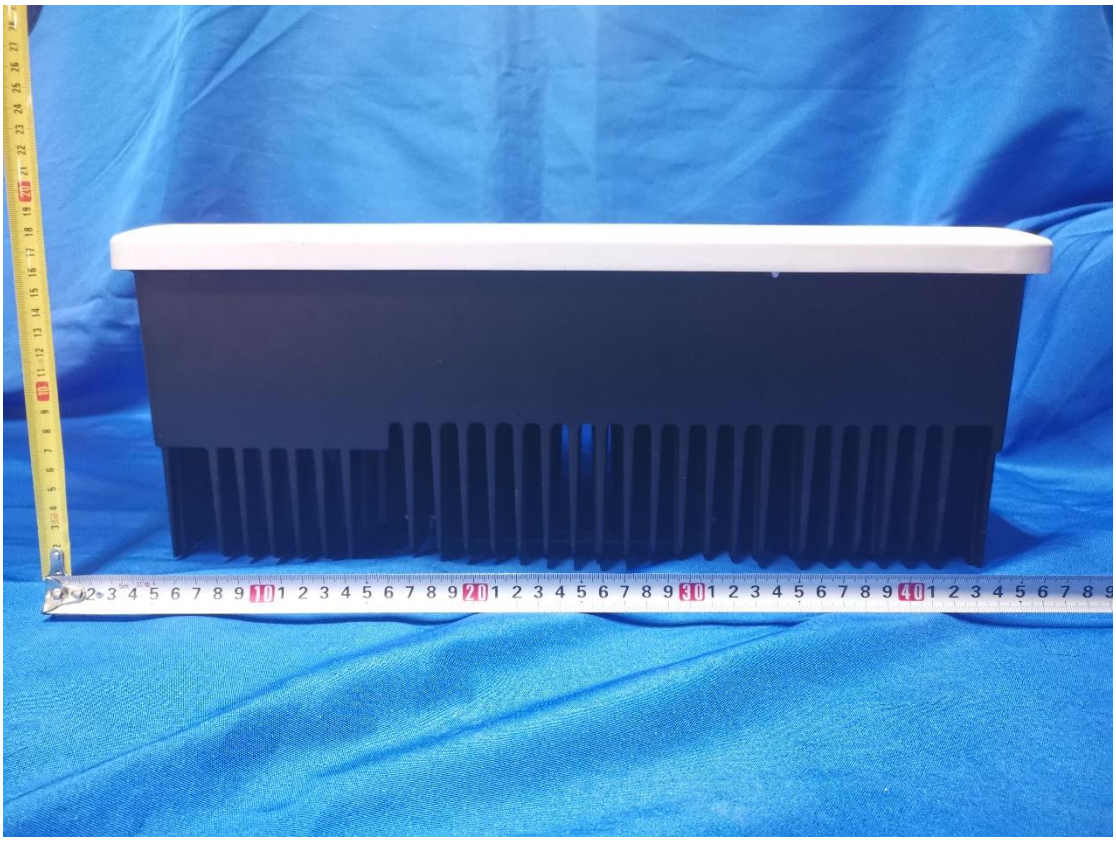
Photo Documentation

Report Number: CN21F5SR 001

Model: X1-Hybrid-x-y
(x=3.0, 3.7, 5.0, 6.0, 7.5; y=D or M;)

Top view

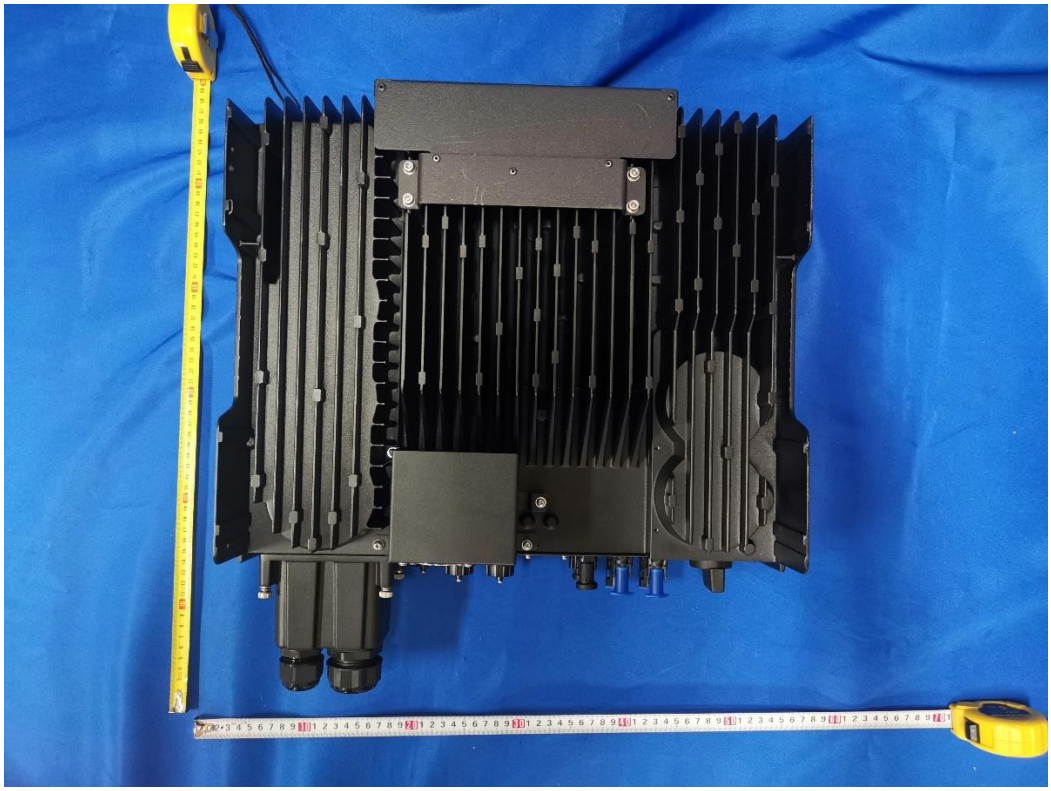
Side view



Side view

Side view

Side view

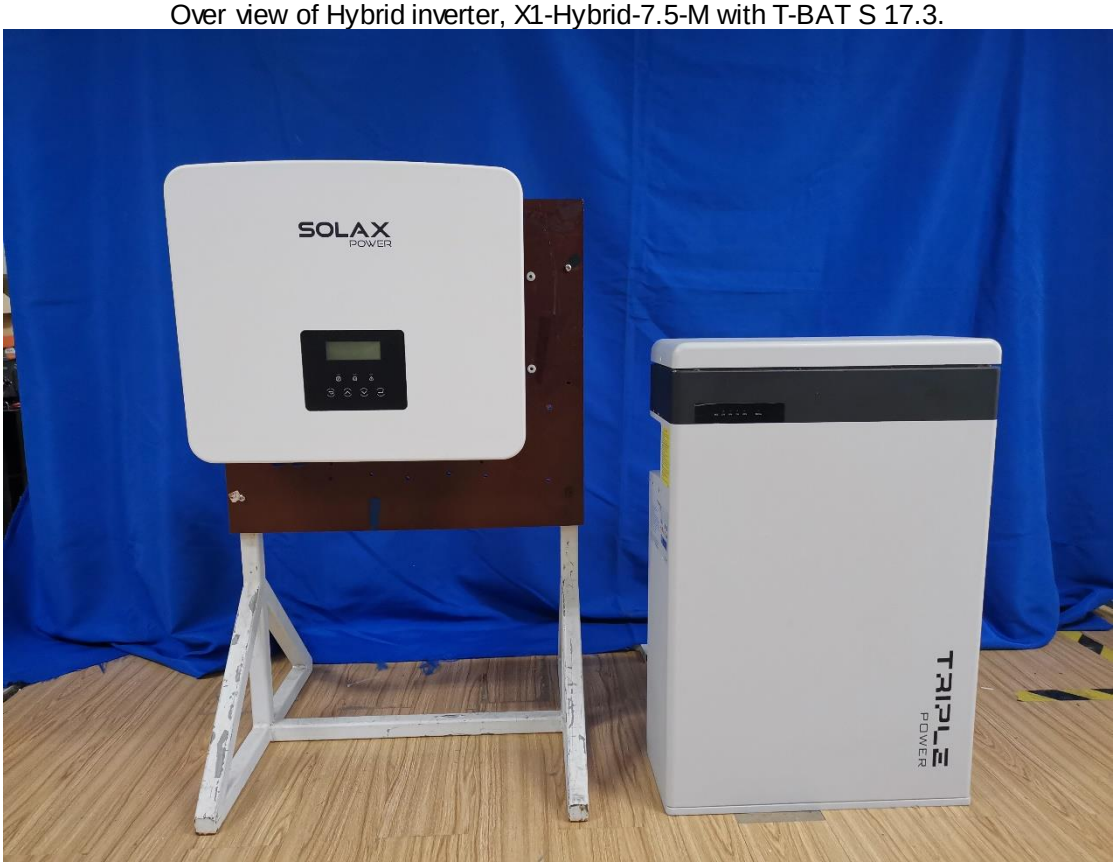


Back view

Inside view

Over view of Hybrid inverter, X1-Hybrid-7.5-M with T-BAT P 17.3.

Over view of Hybrid inverter, X1-Hybrid-7.5-M with T-BAT S 17.3.



Over view of Hybrid inverter, X1-Hybrid-7.5-M with T-BAT H 5.8.