

**APPENDIX 2 Type Test Certification Test Result Sheet****Micro-generator details**

MICRO-GENERATOR Type reference: <i>Fronius Symo 4.5-3-M</i>		
Maximum continuous rating:		4500W
Manufacturer:  <i>Fronius International GmbH</i>	Tel: +43-7242-241-0	Address:  <i>Guenter Fronius Str 1 4600 Wels-Thalheim, Austria</i>
	Fax: +43-7242-241-224	
Technical file reference No.:		

**Test house details**

Name and address of test house	<i>Fronius R&amp;D Laboratories, Fronius International GmbH, Guenter Fronius Str 1, A-4600 Wels-Thalheim, Austria</i>
Telephone number	+43-7242-241-0
Facsimile number	+43-7242-241-224
E-mail address	<i>pv@fronius.com</i>

**POWER QUALITY**

<b>Harmonic current emissions (A)</b> Maximum permissible harmonic current as per BS EN 61000-3-2								
Harmonic	2 <sup>nd</sup>	3 <sup>rd</sup>	5 <sup>th</sup>	7 <sup>th</sup>	9 <sup>th</sup>	11 <sup>th</sup>	13 <sup>th</sup>	15 <sup>th</sup> – 39 <sup>th</sup>
Limit	1,08	2,3	1,14	0,77	0,4	0,33	0,21	0,15x(15/n)
Test value (max value of Phase1,2,3)	0.027	0.060	0.088	0.043	0.049	0.035	0.040	PASS

Voltage Fluctuations and Flicker				
	Starting	Stopping	Running	
Limit*	4%	4%	$P_{st} = 1.0$	$P_{lt} = 0.65$
Test value	-0.06**	- **	0.1260 **	0.0957 **

\*Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100% power) and flicker. As per BS EN 61000-3-11.

\*\* The EUT itself does not produce flicker relevant variations of the line current, startup is made using a ramp function and does therefore not create relevant  $d_{MAX}$  values.  
Solar power variations naturally lead to variations of the electric power fed into the grid, however these variations are not significant for  $P_{ST}$  and  $P_{LT}$ .

	Power factor		
Protection Limit	+0.95 lag-0,95 at three voltage levels		
	210 V	230 V	250 V
Test value	0.9924	0.9878	0.9959

### Under / Over frequency tests

	Under Frequency		Over Frequency	
Parameter	Frequency (Hz)	Time (s)	Frequency (Hz)	Time (s)
Protection limit	48 Hz	0,5 sec	50,5 Hz	0,5 sec
Actual setting	48,02 Hz	0,48 sec	50,48 Hz	0,48 sec
Trip value	48,015 Hz	0,492 sec	50,493 Hz	0,498 sec

### Under / Over voltage tests (single stage protection)

	Under Voltage		Over Voltage	
Parameter	Voltage (V)	Time (s)	Voltage (V)	Time (s)
Protection limit	207 V	0,5 sec	253 V	0,5 sec
Actual setting	209,00 V	0,48 sec	250,40 V	0,48 sec
Trip value	207,98 V	0,498 sec	252,62 V	0,498 sec

### LoM test

Method used	Frequency shift		
Output power level*	10%	55%	100%
Trip setting clearance time	0,5 sec	0,5 sec	0,5 sec
Trip value clearance time	0,435 sec	0,498 sec	0,398 sec

\*indicative values are shown for minimum, medium and maximum power levels.

### Fault level contribution

Micro-generator short-circuit parameters					
For a directly coupled SSEG			For a Inverter SSEG		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	$i_p$	--	20ms	65,5V	13,7A
Initial Value of aperiodic current	$A$	--	100ms	30,0V	11,3A
Initial symmetrical short-circuit current*	$I_k$	--	250ms	19,7V	12,4A
Decaying (aperiodic) component of short circuit current*	$i_{DC}$	--	500ms	14,8V	12,4A
Reactance/Resistance Ratio of source*	$X/R$	--	Time to trip	537,8ms	In milliseconds

### COMMENTS

These tests have been carried out with specifications and parameters set to meet the requirements of CER/06/190. It is hereby declared by the manufacturer that all units shipped to Ireland will have identical parameter settings and that these parameters cannot be changed by a user, installer or by any person other than the manufacturer after the setup has been selected.