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Novel Field test design and initial result for AC and DC characterization for PV-panels

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***Abstract*—This work describes the design and initial test results of a field test for PV modules, where the PV modules the majority of the time operates to produce power at their maximum power point. Sequentially the individual modules are switched into a measurement circuitry for IV curves and impedance spectra, with the aim to correlate fault mechanisms to power loss.**

Keywords— Field testing, Silicon PV panels, Degradation

I. INTRODUCTION

Controlled field test of modules is important in order to estimate the impact on faults in the field [1], and correlate degradation mechanism to power loss under real operating conditions. In this work we describe a field test, where the modules under test the majority of the time delivers power to grid via commercially available power electronics for PV, and periodically the individual modules is switched into a measurement circuit where IV-curves and impedance spectra is recorded.

II. DESIGN

The overall objective of this work was to establish a field test that enables panel characterization during operation, to investigate how faults on PV modules develop during normal operation. The objective described above was achieved by connecting the modules to commercially available load electronics for grid connection. A relay system was made which can switch the modules into a "measurement bus" facilitating a measurement of an IV–curve and acquisition of an impedance spectrum. The overall principle is shown in Fig. 1. and the load system is designed with the aim to maximize the time each module is operating in its maximum power point.

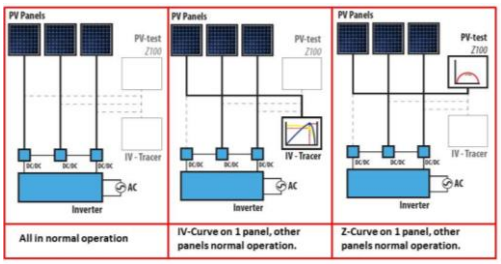

Fig. 1. Working principle of the field test.

III. EXPERIMENTAL PLAN

Modules that had undergone mechanical load test were mounted on the field test together with virgin modules of the same type and batch. Prior to mounting on the Field test indoor IV curves and electroluminescence images of the modules where acquired, Fig. 2.

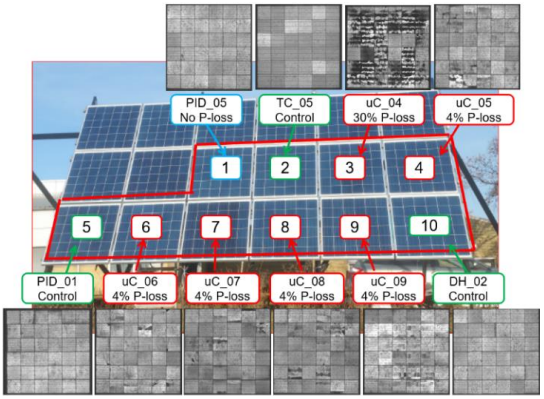

Fig. 2. The field station built at DTU Risø Campus for measuring current-voltage (IV) and IS spectra of PV panels along with weather conditions.

An initial result show that the indoor measurement at STC is generally 2-3 % higher compared to the outdoor clear sky measurements correct to STC before applying the spectral mismatch correction. The field test has now been running for more than a year, and future work includes investigation of the power loss and the development of the micro cracks during this year of field aging.

ACKNOWLEDGMENT

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