



**Deliverable Report**

Deliverable No: **WP 2.4B**  
Dissemination level: Confidential  
Title: Field tested Junction Box and pre-certification (50-200 pcs)

Date: 30-05-2018  
Version: FINAL  
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Grant Agreement Number: 322425  
Project Type: FP7 – ENERGY.2012.2.1.2: Demonstrations of smart multifunctional PV modules  
Project acronym: SuMMiT  
Project title: Smart large lightweight long life Multifunctional PV Module Technology for large Power Installations and Distributed Energy Generation  
Project start date: 01/12/2013  
Project website: [www.summit-project.eu](http://www.summit-project.eu)  
Technical coordination: TULiPPS ([www.tulipps.com](http://www.tulipps.com)) (NL)  
Project management: TULiPPS / Uniresearch ([www.uniresearch.com](http://www.uniresearch.com)) (NL)



## Executive Summary

In task 2.4B we have joined the field testing of the SUMMIT consortium at the places where this was possible and the Solned materials have been mounted at the back of the solar modules in the field test. The first installation where our Solned SP2-SL905 junction box is used at the modules for field testing is at the University of Eindhoven. At this place we have the possibilities to do the field test together with the MWT modules of Eurotron in combination with standard technology H-pattern modules.

During this first field test with the SUMMIT modules and the Solned SP2-SL905 junction box we noticed already after a short period of time some strange phenomenon with the system. Several modules did not generate the full power during the complete day, some modules lose a part of the power during the day. This phenomenon occurred random through the system, it is not isolated to the same modules.

We started the root cause investigation on this together with Femtogrid. Our first idea was that the Femtogrid power optimizer is triggering the diodes inside of the junction box to go in conduction mode and by this bypass a sub-string in the module that will lead to the power loss. Femtogrid is doing all kind of software changes to try to get the diodes out of the conducting mode, but nothing seemed to work.

We start our own internal investigation and start testing the junction boxes in our laboratory. We are not able to reproduce the failing junction boxes at the laboratory, all materials behave as we have tested before, no failing components that can lead to power loss. In parallel we start up a test at solar modules in the outdoor conditions. After some hours we notice an solar module that seems to have the same problem as at the modules at the University. We are now able to measure the behaviour of the module and the components and found out that one of the diodes is in latch-up mode, so it is bypassing the sub-string of the module causing the power loss of one-third of the module. Also, we did find the method to trigger the diodes to go in the latch-up mode; by shading the modules very slowly, the diode will switch to the unwanted latch-up mode.

We share this information with ST Electronics, the manufacturer of the diodes and explain our findings. They do not recognise this phenomenon and do not believe it is a problem in their diodes. After sharing our findings and show them the results at our test-setup, they start their own investigation. The outcome of the investigation is that ST Electronics withdrawal the SPV1520D cool diode in the D2Pak packaging from the market due to quality issues. The diodes show delamination in materials that can cause short circuiting of the switching circuit.

Due to this defect SPV1520D diode of ST Electronics and the withdrawal of this version, we have to switch to another diode type, the SPV1520N in QFN package. We can assemble this diode on our PCB because we have the same footprint available on the PCB for another brand of cool diodes, the Microsemi. But we want to continue with the ST Electronics diodes due to the much lower costs of the material than the competition of the alternative cool diodes. We replace all the diodes at the field test site of the University of Eindhoven and after this the system works perfectly. No further defects are found on this system and it generates useful information for the rest of the consortium.

At the second field test at the roof of the consortium partner IBC, the diodes installed in the junction box were of the good working type of ST Electronics, the SPV1520N. After we had solved the problem with the SPV1520 diodes in the first field test, the Solned junction box and PV modules performed in a perfect way. A second field test was executed on the roof of IBC Solar. At this roof 6 modules with 60 back-contact cells

were installed as well as 3 modules with 120 H-pattern cells. The diodes, junction boxes and modules did perform flawlessly in the second field test installation.

We also finished in this task the design of the production tools and development of test equipment for the small series. The rework or production of these tooling is started. In the meantime Kiwa has successfully performed preliminary testing for the small SUMMIT modules and the Solned SP2-SL905 junction box.

# Acknowledgement



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 322425 (Project acronym: SUMMIT)

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This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 322425.

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