TRANSNATIONAL ACCESS
USER PROJECT FACT SHEET

USER PROJECT	
Acronym	**SSM**
Title	**Soraytec Smart Meter**
ERIGrid Reference	Proposal number 06.010-2019, Grant Agreement Nº 654113, H2020 Research Programme [INFRAIA-1-2014/2015]
TA Call No.	**6**

HOST RESEARCH INFRASTRUCTURE			
Name	Power Networks Demonstration Centre (PNDC) – University of Strathclyde		
Country	**UK**		
Start date	**09/03/2020**	**Nº of Access days**	**5**
End date	**13/03/2020**	**Nº of Stay days**	**5**

USER GROUP	
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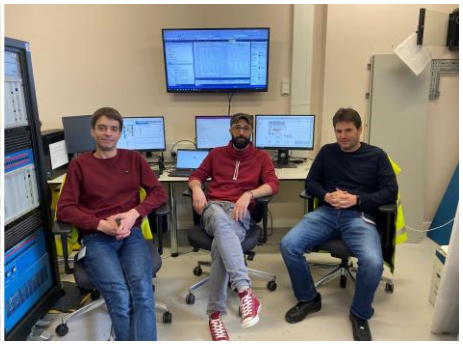
1. USER PROJECT SUMMARY (objectives, set-up, methodology, approach, motivation)

1.1 Motivation



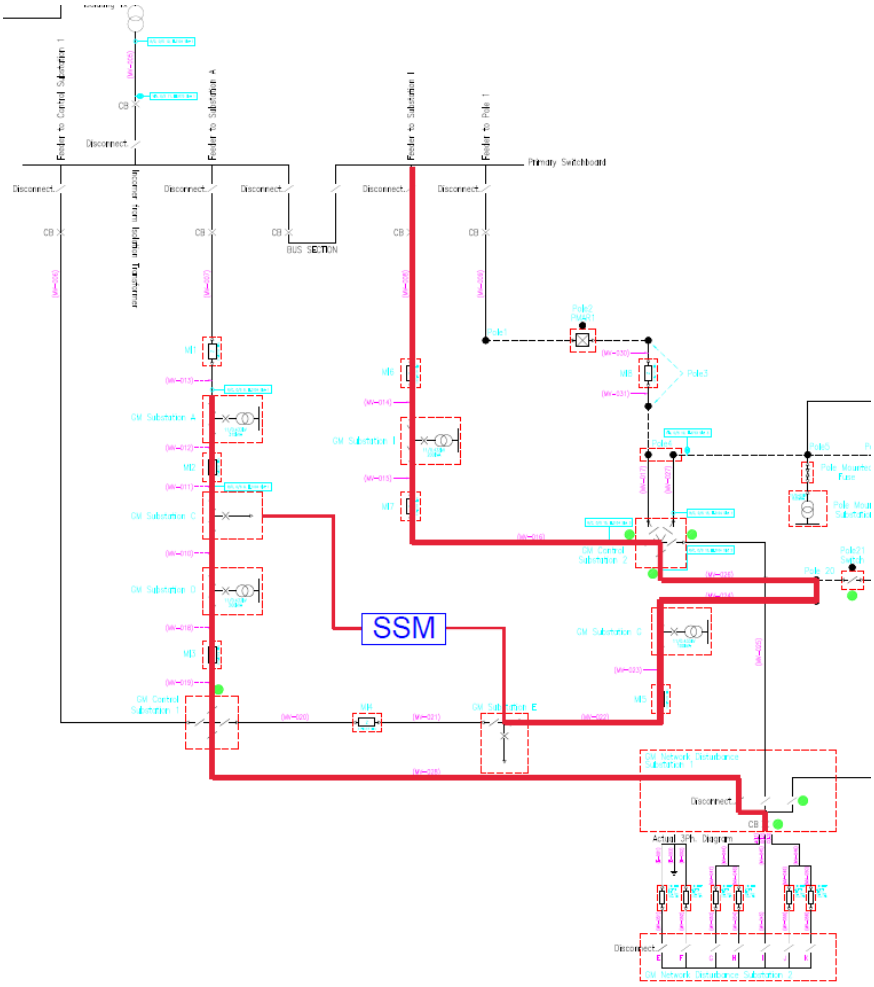
The need to demonstrate and validate the functionalities of the SSM arise from the conservative and risk averse nature of distribution network operators. It is close to impossible to convince any commercial entity to install a not rigorously tested and certified device such as the SSM in their networks for demonstration purposes. This is due to the overarching priority of the network operators to ensure that the grid is up and running at all times (and cost). The successful testing and validation allow Soraytec to provide reference data during the discussion with its partners/ clients establishing trust and proof of the functionality and benefits of the SSM.

1.2 Objectives

The SSM project was designed to demonstrate and validate key functions of the Soraytec Smart Meter (SSM), namely:

1. Basic functionality and accuracy of measured parameters (i.e. I, V, P, Q, F, PF)
2. Dynamic data collection and trigger responses
3. THD sensing
4. Power quality sensing (voltage sags, flickers, transients in MV grid)
5. Typical load profiles
6. Fault detection

1.3 Set-Up



The SSM (https://www.soraytec.com/product/) was installed in the MV network of the PNDC infrastructure indicated by the diagram on the left.

The network was powered by a 1 MVA generator. VTs and CTs connected close to the generator in combination with a Beckhoff three phase power measurement terminal were

used to collect the reference data. For linear load variations three 200 kVA load banks were switched in and out of the network. A Triphase unit was used as an additional power source in order to inject harmonics into the network. By using the Triphase as a power sink a non-linear load was simulated. For the fault simulation fault impedances of 60 Ohm for the phase to phase fault was used, 20 Ohm for one phase (B) to ground and 36 Ohm for phase to phase to phase faults were 'thrown'.

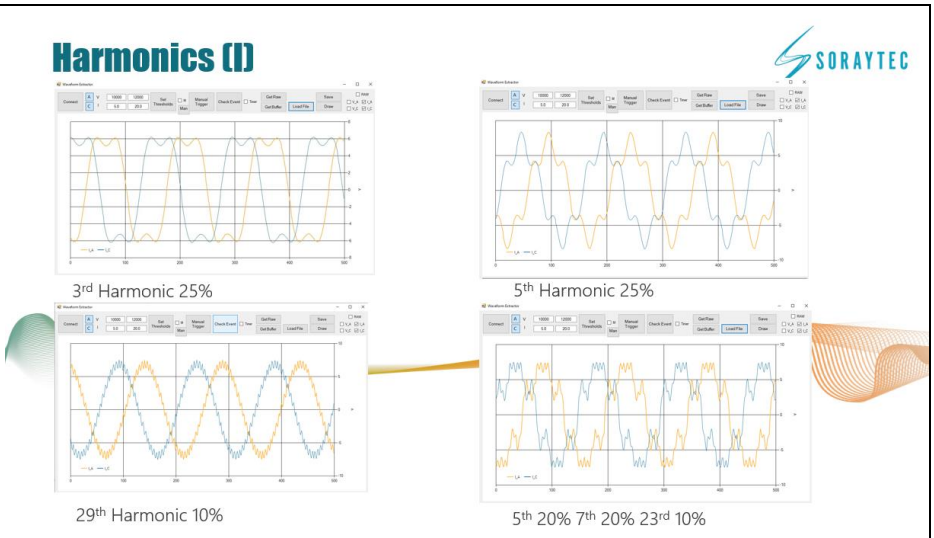
1.4 Methodology & Approach

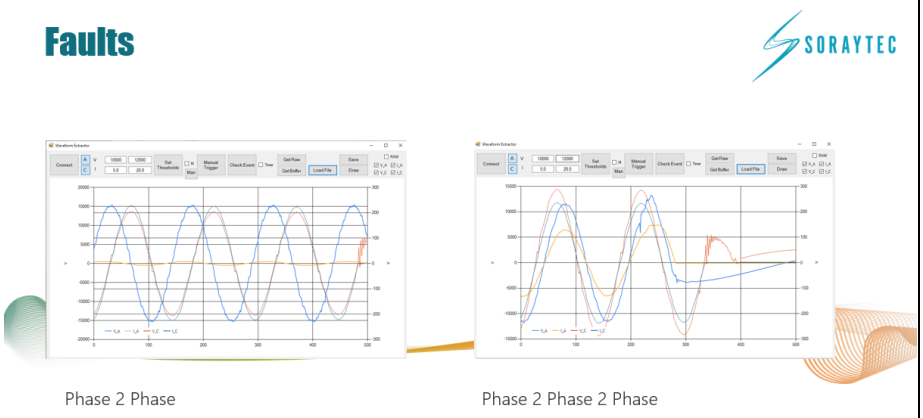
For the basic functionality and accuracy testing voltage, current, (linear) load and frequency variations were applied to the system and the rms values collected by the SSM and the Beckhoff terminal were calculated and compared. For dynamic data collection different loads for trigger response were applied. In order to test the capabilities of the SSM to detect harmonic distortions, different harmonics (up to the 29th) were injected and the impact on the network monitored in terms of rms THD and wave form analysis. In order to simulate transients in the MV network different linear and non-linear loads where applied (load banks & Triphase). Frequency shifts where simulated with the help of the generator. The Triphase and load banks where also used to simulate typical load profiles, such as ramp ups and ramp downs of industrial equipment. The fault thrower was used to create faults (i.e. phase-phase, phase-ground and phase-phase-phase).

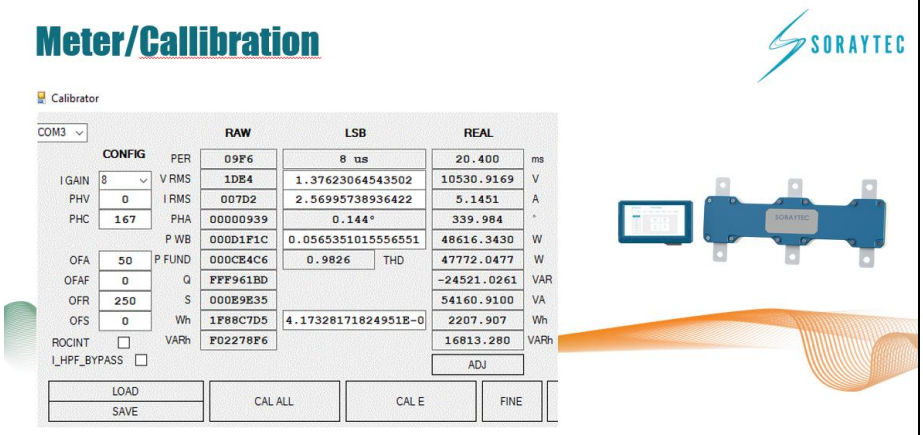
2. MAIN ACHIEVEMENTS (results, conclusions, lessons learned)

2.1 Results

While the basic functionalities and measurement capabilities were demonstrated, the reference equipment did not allow for a validation of the accuracy class of the device. However, this aspect was expected when the available equipment was analyzed. The dynamic data collection and trigger responses were confirmed during the test. Testing with regards to the capabilities of THD analysis and waveform extraction, which were the priority of the tests were confirmed. During the test very good results in terms of wave forms were captured showing the capability of the SSM to capture all details expected of the waveform up to and including the 29th harmonic. Independent of a combination of harmonics or single ones have been injected in the network, all details were captured and displayed in a satisfying way (see screenshots form actual test data). Fault testing led to good results in terms of capturing the event and triggered alarms.







2.2 Conclusion

The objectives of the project were achieved, especially the validation of capabilities of the SSM with

regards to sensing of harmonics in terms of rms and waveforms. While some testing with regards to accuracy and power frequency related events (i.e. flicker and transients) could only be simulated in a limited fashion or not at all, the recorded results are sufficient to derive and confirm the proper detection of the same by the SSM. Overall Soraytec can use the results to convince partners and clients and accelerate the time to market.

2.3 Lessons Learned

The tests have shown different areas of improvement in terms of the way data is collected, measurement techniques used by the SSM and features/ applications lacking. The main takeaway from the testing is, that the communication between device and receiver unit (data gateway) needs to be stabilized and in the case of faults the information needs to be sent before the sensor runs out of power. Other improvements are related to the type of measurements collected and synchronization of data.

Soraytec is considering the opportunity to reapply to carry out additional tests after these features are implemented. The next series of tests should focus mainly on the fault related data communication, synchronization of data and supra harmonics measurements including comparison to PMUs. A combination of phasor measurement and waveform analysis to create improved information is considered as well.

3. PLANNED DISSEMINATION OF RESULTS (journals, conferences, others)

Since the tests and data collected are related to a very specific used case and are intended to commercially exploit the SSM, Soraytec has to carefully evaluate what information in detail can be published. However, the results already helped Soraytec to be selected into the Free Electrons 2020 acceleration program cohort, which will enable Soraytec to test the solution with some of the world's largest utilities. Furthermore, Soraytec is considering to create a short paper or poster showcasing the results of the project either in a journal or at a relevant conference such as CIRED or European Utility Week.

4. PLANNED DISSEMINATION OF RESULTS THROUGH ERIGRID CHANNELS

Contact erigrid-ta@list.ait.ac.at to organise promotion of your results

Once the paper/poster is ready it would be great for Soraytec to leverage ERIGrid channels (digital or offline) to showcase the results to a relevant audience. Soraytec plans to contact the ERIGrid representatives through above contact email and start a discussion on the best and most beneficial way of doing so.