NETTAN Solutions
Optimize your network quality
Train - Reefer monitoring application

Order of the day

01 **Who We Are – Nettan Solutions**

02 **Problem to Solve**

03 **Solution**

04 **How to Implement de Solution**

05 **Communications**

06 **Results**

01.
Nettan
Solutions
Who we are...

Who we are…

- Nettan Solutions is a PQ company based in Montreal, Qc, Canada

- We specialise in :

  - **Unique <u>turnkey</u> service in remote power quality**
    - **Custom Approach**
    - **Continuous Monitoring**
    - **Commissioning**
    - **Maintenance**
    - **Repair**
    - **Available in:**
      - **Remote**
      - **On-site**

Energy & Power Quality

- Monitoring & Analysis

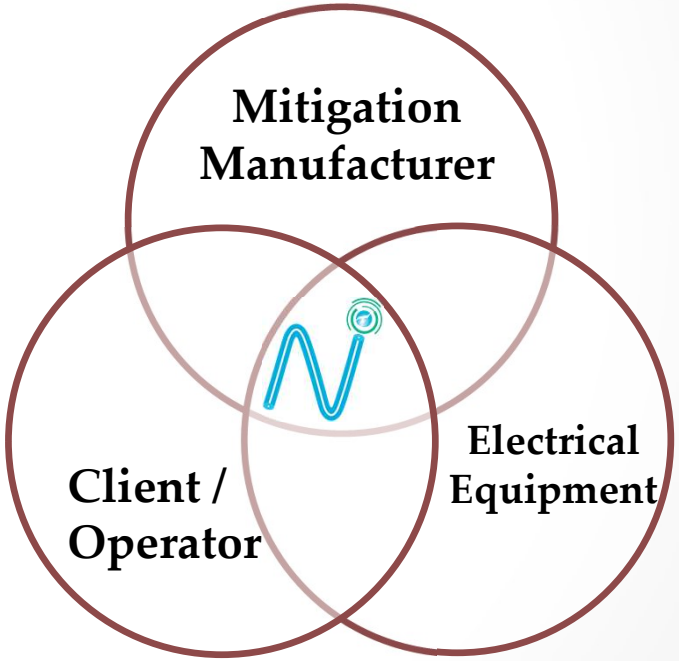
Harmonic Filters

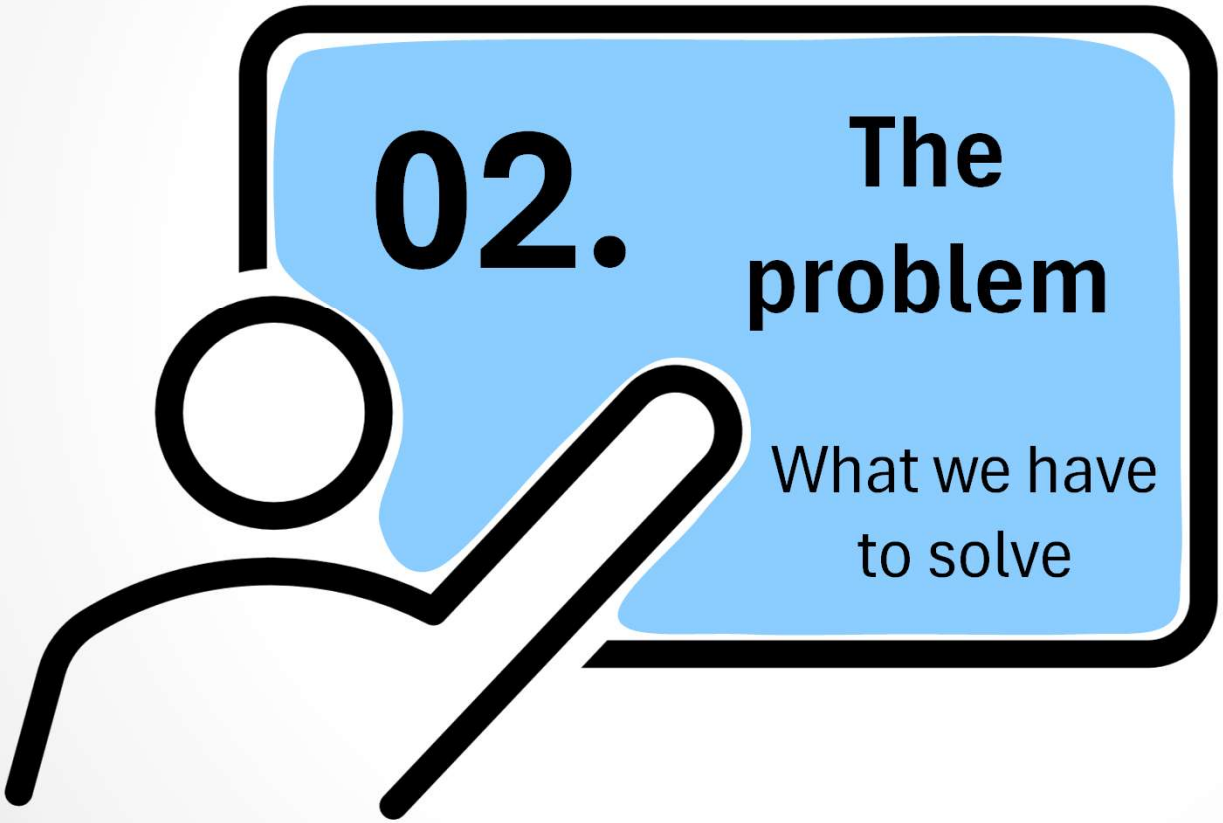
- Passive, Active or Dynamic

Capacitor Banks & Controllers

Why Monitor Power System ?

- Data availability
- Process Optimization
- Preventive Maintenance
- Operation
- Diagnostic
- Warranty





02. The problem

What we have to solve

Explanation of the Problem…

- Trains are widely used in Canada to transport goods of all kinds.
  - Coast to coast is around 6000 km

- Some of the products/goods need to be transported at specific temperatures
  - Food products (fresh)
  - Medication
  - Etc.

➔ That's where "reefer containers" are used.

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Explanation of the Problem…

- To feed the electrical system section for reefers in a train, Power Units are used with genset
  - Normally, one Power unit can feed up to 17 reefer containers.
  - Reefer containers are now using drive for compressors which are more sensitive to power quality issues.

- **The problem** : Due to the following issues, reefers were tripping :
  - Bad power quality on small electrical network
  - Hostile environment (Schocks, Temperature)
  - & other unknowns factors

This often resulted in complete loss of the goods, which was very costly for the operator (merchandise loss + insurance cost).

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The challenges we encountered relating to the solution

Harsh Weather

Temperatures varying from -40 to + 40 degrees celsius

Dead zones

No signals, no way of reaching the equipment

Not accessible

There was no way of having access to the merchandise trains that were constantly moving from coast to coast. We needed to find a way to be able to remotely change all the parameters and ensure the functionality (continuous monitoring and accessing the state of the filter)

Shocks

A lot of vibrations

How they impacted us…

These many challenges led us to constantly improving our monitoring and communication systems, where :

- ✓ Our systems are now fully functional and can bear extreme variation of temperatures.
- ✓ Changes and control of the parameters can be done completely remotely.
- ✓ We can access remotely to data and informations of the trains, while it is in motion.
- ✓ Vibration and shocks can quickly be detected and promptly handled.

03. The Solution

What we offer

The Solution

01

Active Filter

- First of all, the solution is to add an active filter to every Power unit (Genset) cars to avoid tripping of reefer containers.

02

Monitoring System

- Secondly, it is to install a power monitoring system to monitor and get :

✓State of islanded electrical network – Power Quality
✓Geoposition
✓Speed
✓G-force (acceleration)
✓Temperature
✓Humidity
✓Email notification

03

Communication System

- Finally, an effecient communication system is crutial.
- The communication system is part of the monitoring system.
  - ✓Low cost,
  - ✓Available everywhere,
  - ✓Precise with delays and positioning

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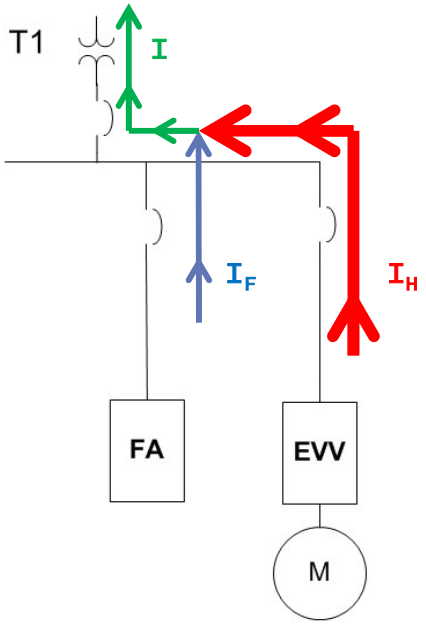
What is an active filter?



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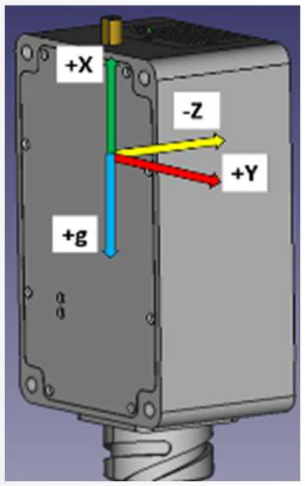
Monitoring System



Shock & speed detector

PQ meter

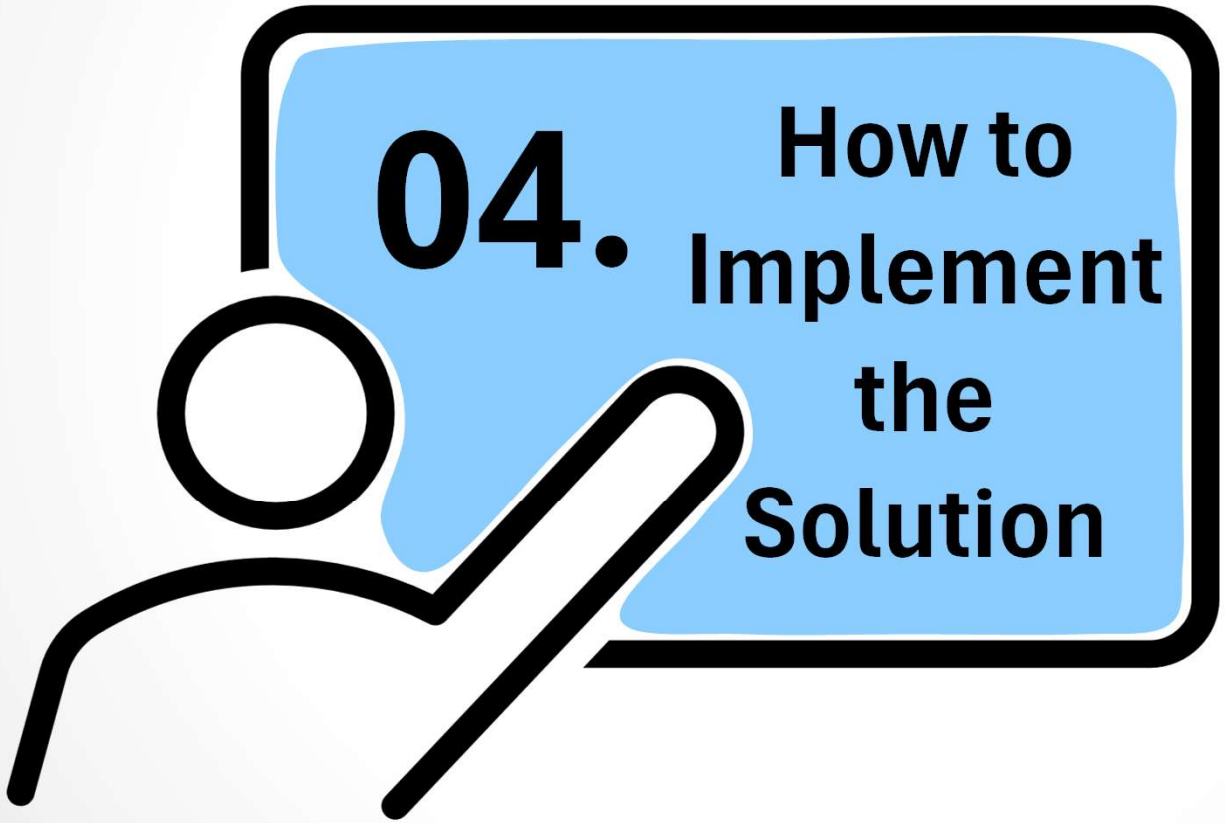
NSCOM Private cellular network

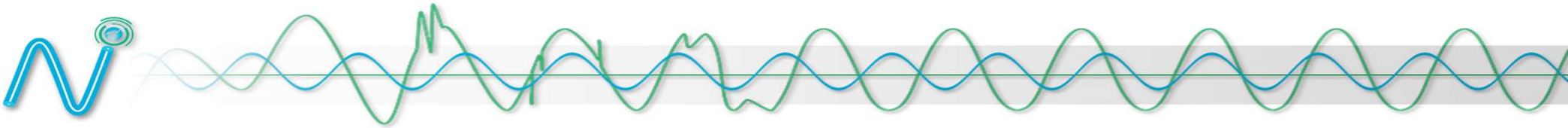
The Solution's Efficiency

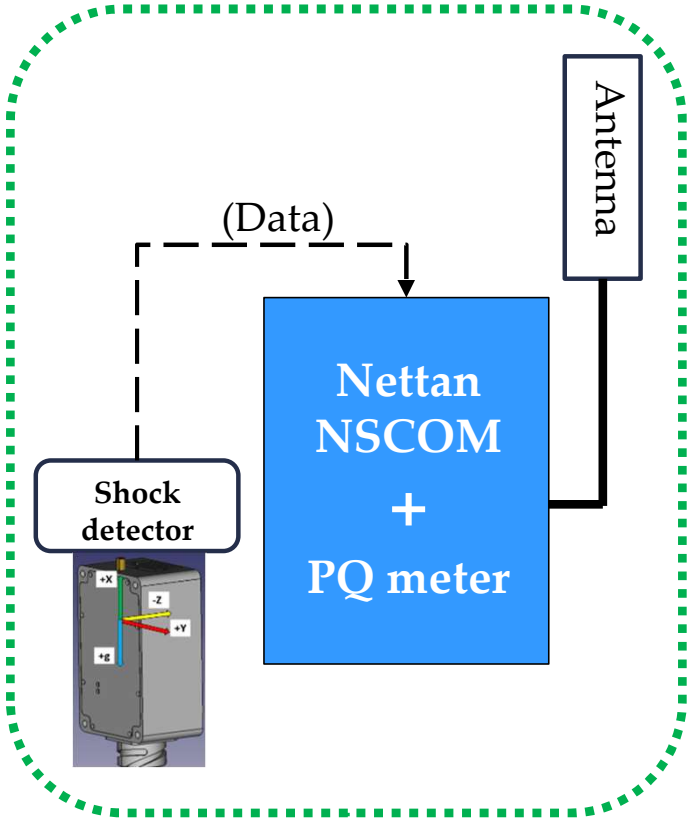
- The solution (Active filter + Monitoring system + Communication system) was implemented on more than 130 Genset (Power unit).
- Considering that :
  - ✓ The solution start to be implement 10 years ago.
  - ✓ The trains have consistently been running for past 10 years
  - ✓ Genset Power units have run millions of km since then
  - ✓ Average is based on 10 000 km / month / Genset

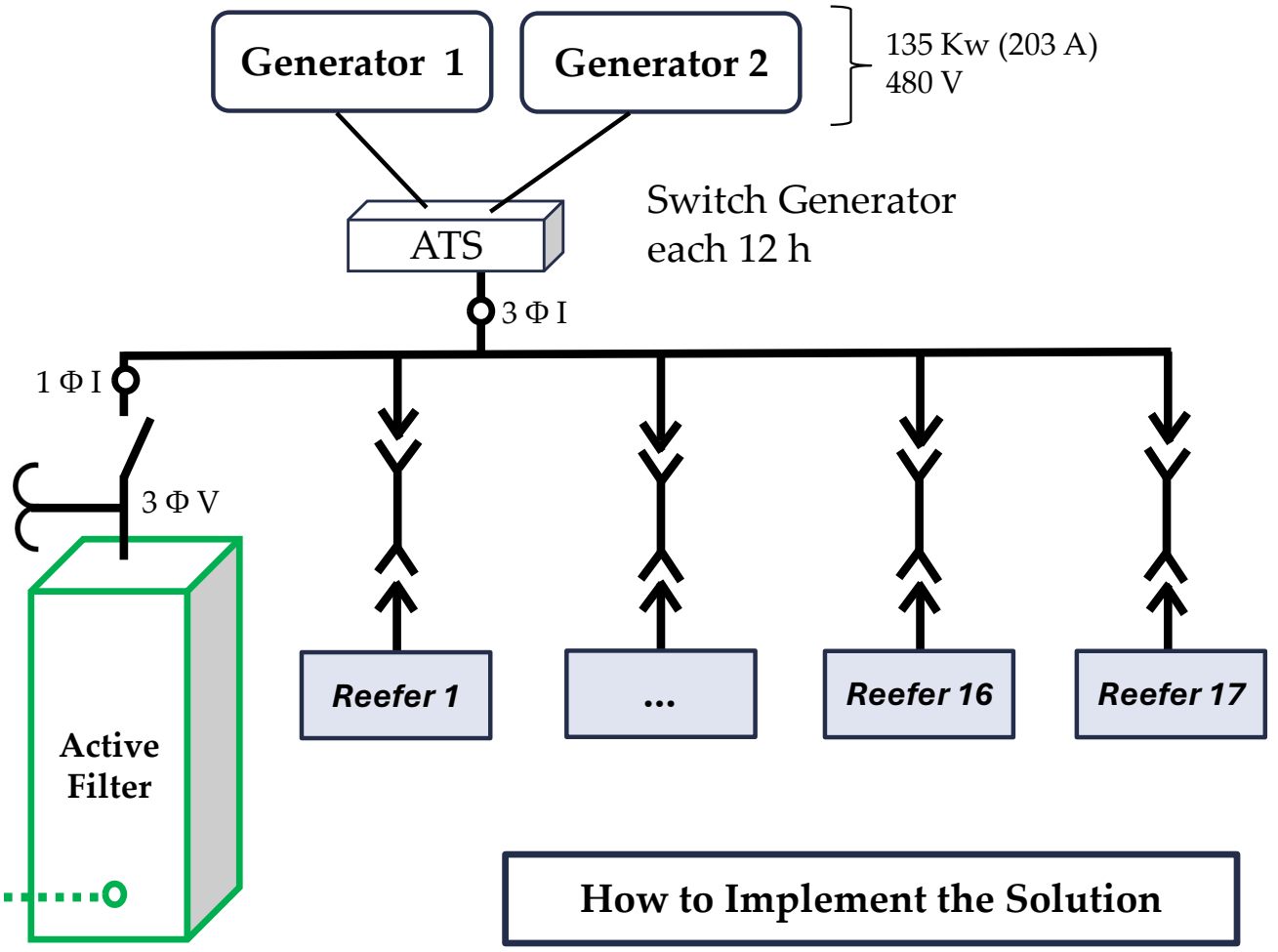
- For over 10 000 000 km of travels, the solution was proven to be **time resistent** and **resilient**. It withstood harsh canadian weather and retained its functionality, while allowing remote access and control.

04. How to Implement the Solution



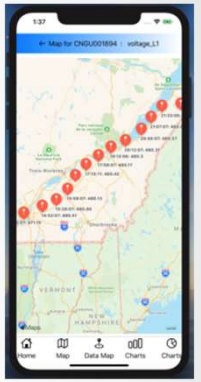


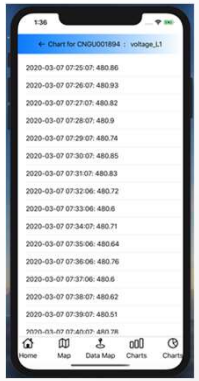


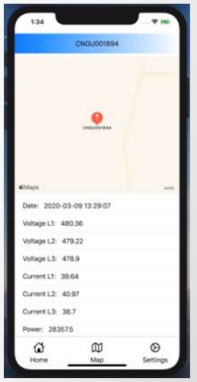


How to Implement the Solution

Train application - Nettan C.L.O.U.D. Services





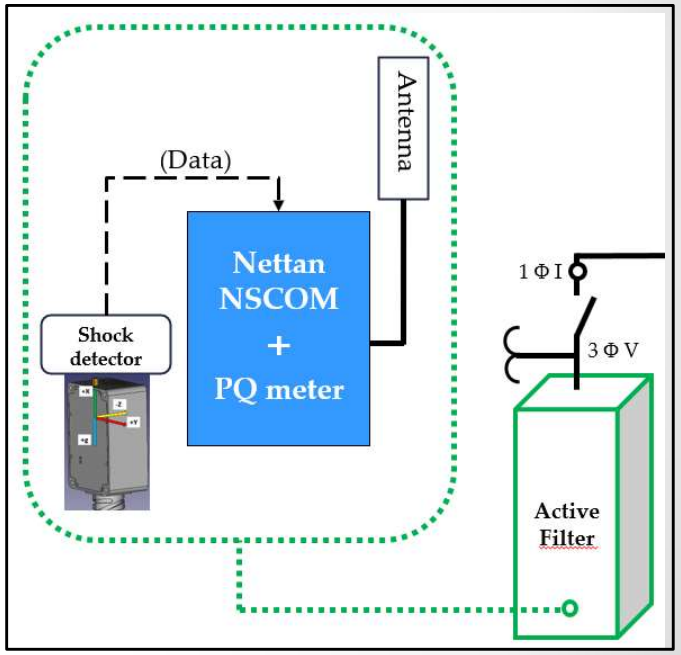


Active
Filter
PQFM

Antenna

Nettan Box
- NSCOM
- PQ meter

Shock
detector

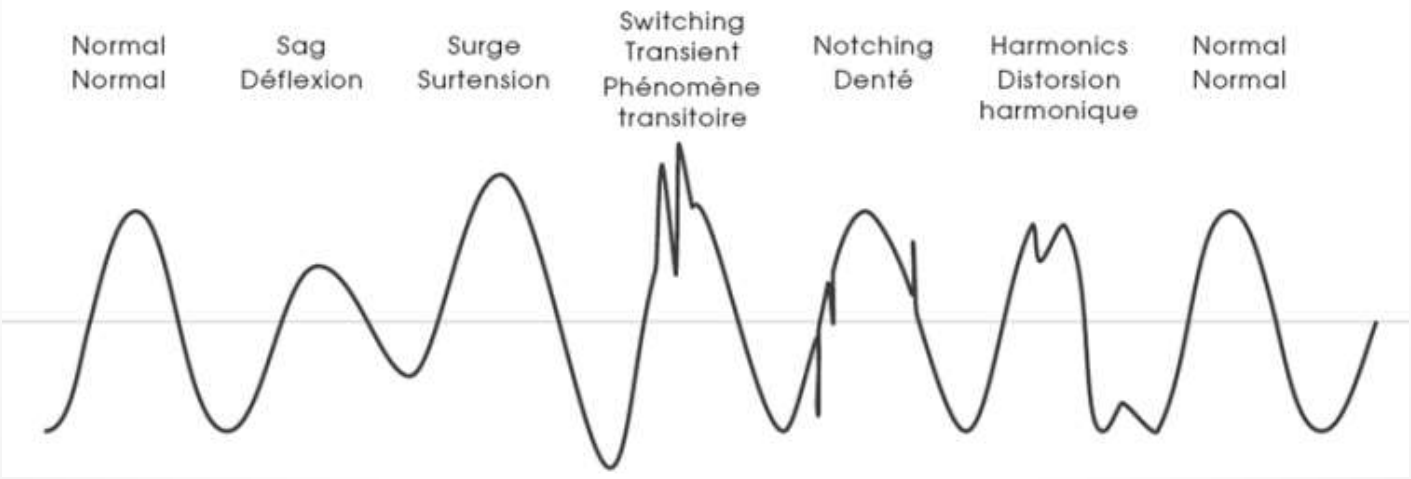


What do we monitor ?

- Electrical noises
- Power Factor (Cos ϕ)
- Unbalanced V & !
- Events with waveforms
- Active filter functionality

But also:

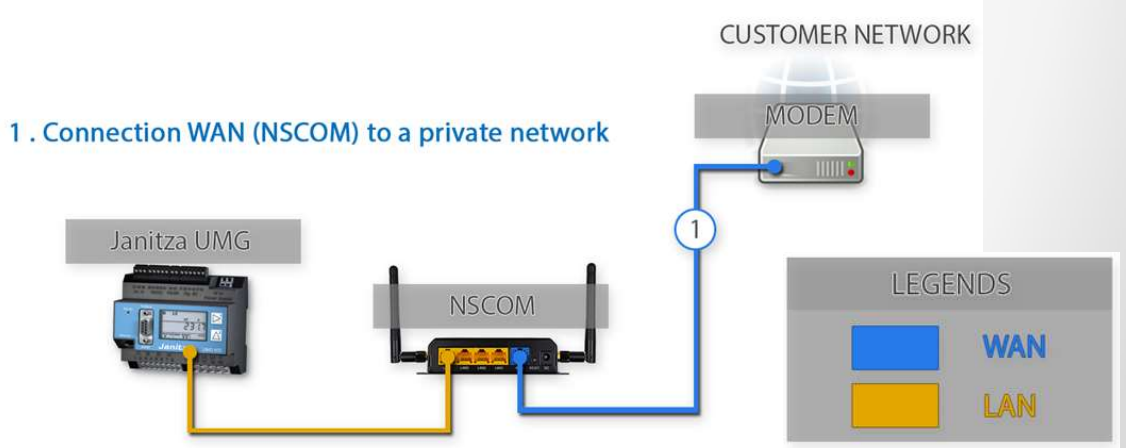
- Geopositionning
- Speed
- G-force (accelerator)
- Tempertures
- Humidity



05.
Communications

Communications

- **IP STATIC (Private Network)**
  - ✓ **Canada + US + Mexico**
- **SIMM local (Worldwide)**
  - ✓ **Access to Internet**
  - ✓ **Create IP static → VPN tunnel**



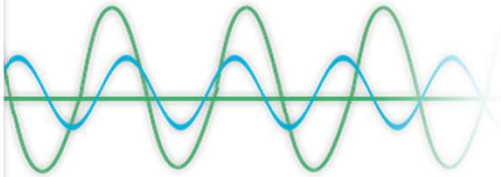
Nettan's PQ monitoring service

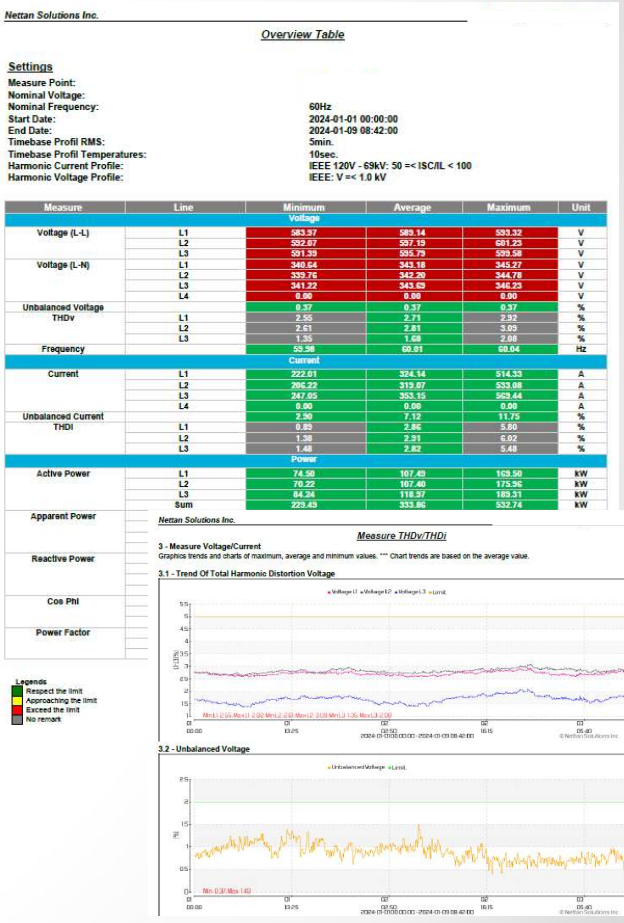
Ethernet

Wifi

LTE (option)

WEB server / reports





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Overview Table

Settings

Measure Point:	
Nominal Voltage:	
Nominal Frequency:	60Hz
Start Date:	2024-01-01 00:00:00
End Date:	2024-01-09 08:42:00
Timebase Profil RMS:	5min.
Timebase Profil Temperatures:	10sec.
Harmonic Current Profile:	IEEE 120V - 69kV: 50 =< ISC/IL < 100
Harmonic Voltage Profile:	IEEE: V =< 1.0 kV

Measure	Line	Minimum	Average	Maximum	Unit
Voltage					
Voltage (L-L)	L1	583.97	589.14	593.32	V
	L2	582.67	587.19	591.25	V
	L3	581.39	585.79	589.56	V
Voltage (L-N)	L1	340.64	343.18	345.27	V
	L2	339.76	342.29	344.78	V
	L3	341.22	343.63	346.23	V
	L4	0.00	0.00	0.00	V
Unbalanced Voltage		0.37	0.37	0.37	%
THDv	L1	2.55	2.71	2.92	%
	L2	2.61	2.81	3.05	%
	L3	1.35	1.68	2.08	%
Frequency		59.98	60.01	60.04	Hz
Current					
Current	L1	222.61	324.14	514.33	A
	L2	206.22	319.87	533.08	A
	L3	247.05	353.15	569.44	A
	L4	0.00	0.00	0.00	A
Unbalanced Current		2.90	7.12	11.75	%
THDI	L1	0.83	2.86	5.80	%
	L2	1.38	2.31	6.02	%
	L3	1.48	2.82	5.48	%
Power					
Active Power	L1	74.50	107.49	169.50	kW
	L2	70.22	107.40	175.96	kW
	L3	84.24	116.97	189.51	kW
	Sum	223.43	333.86	532.74	kW
Apparent Power					
Reactive Power					
Cos Phi					
Power Factor					

Legends
Respect the limit
Approaching the limit
Exceed the limit
No remark

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Measure THDv/THDi

3 - Measure Voltage/Current

Graphics trends and charts of maximum, average and minimum values. *** Chart trends are based on the average value.

3.1 - Trend Of Total Harmonic Distortion Voltage

3.2 - Unbalanced Voltage

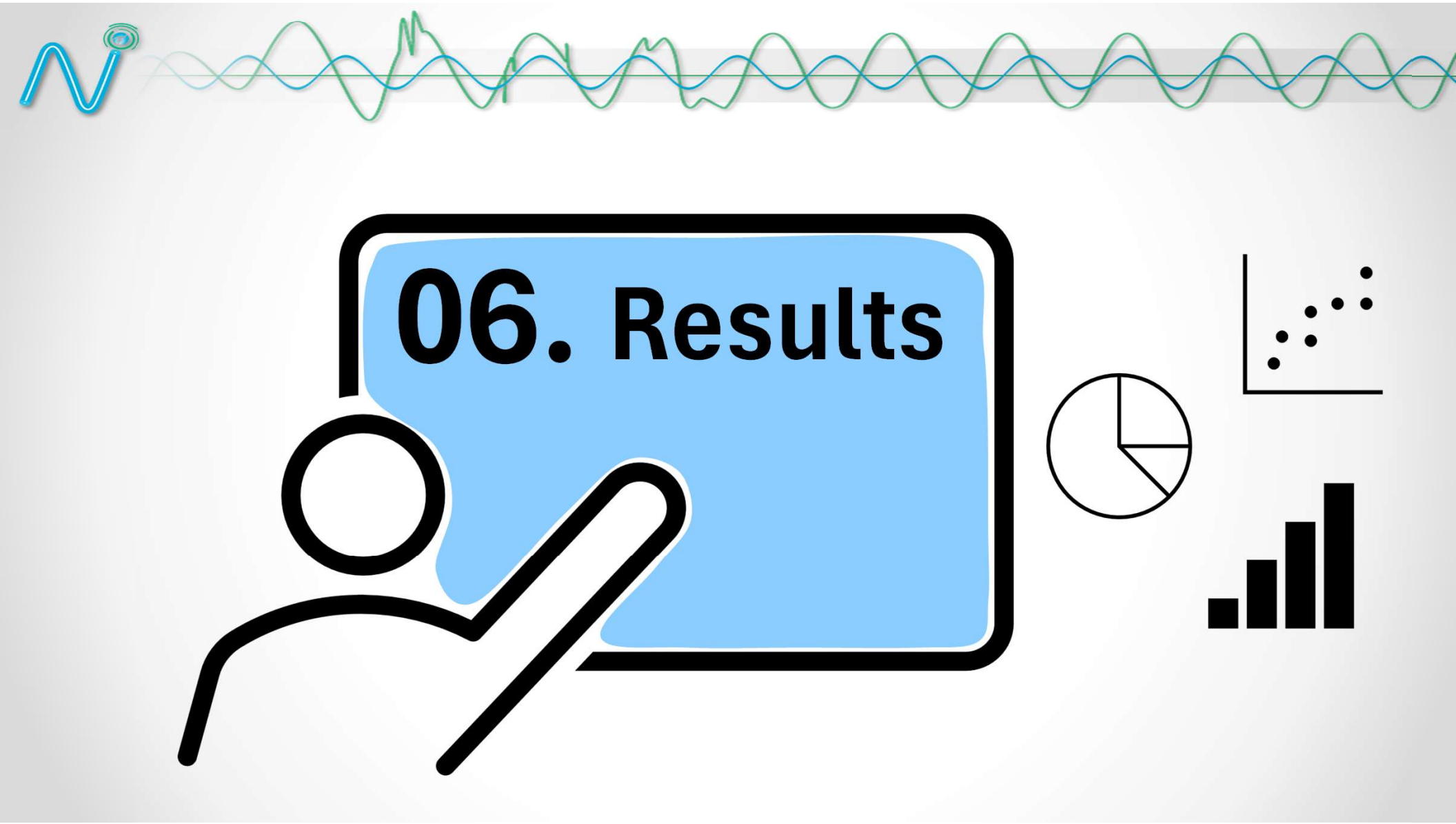
Intelligent monitoring of active filters

Ethernet

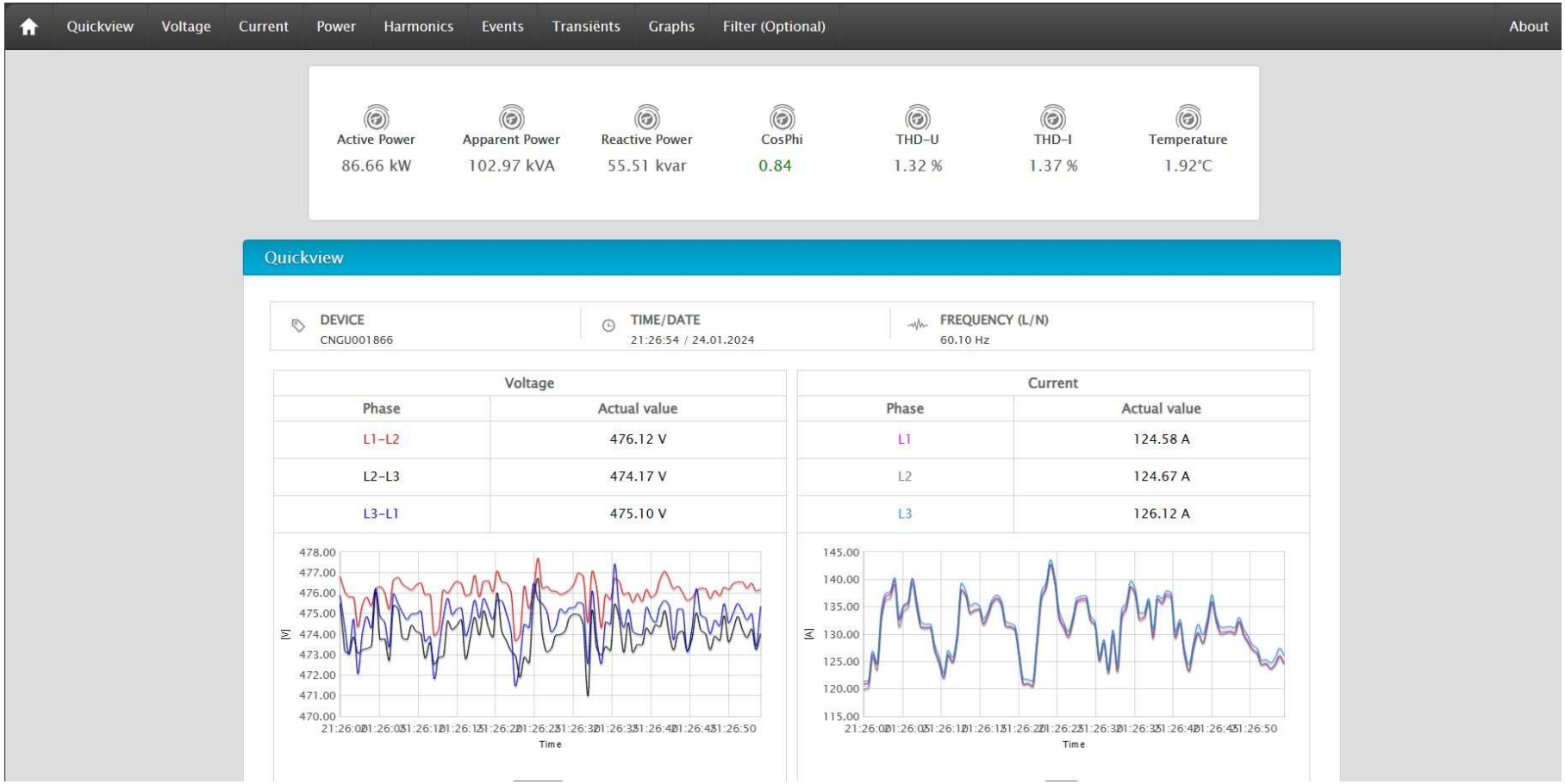
Wifi

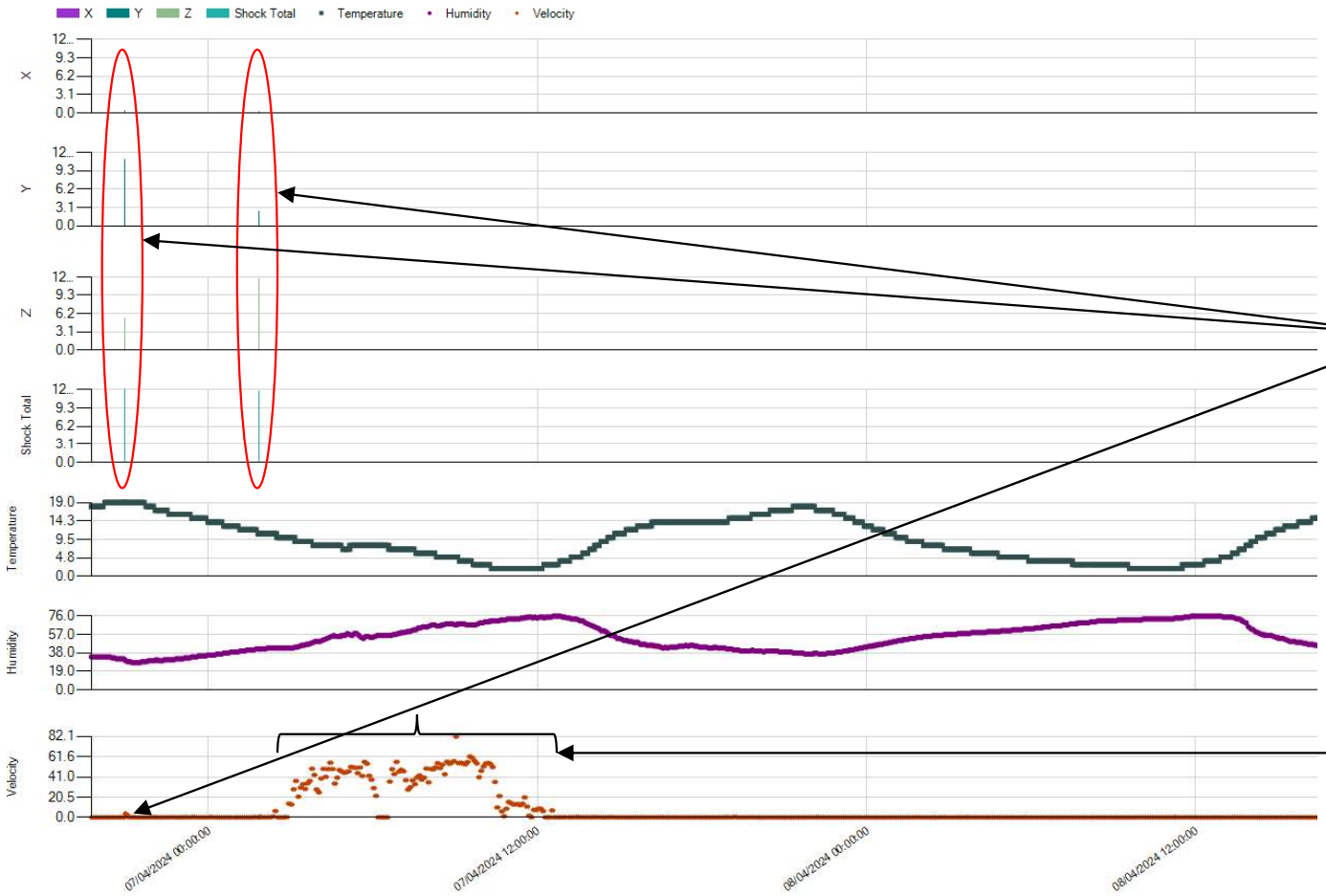
LTE (option)

PQF


06. Results

Results of Monitoring and Control access

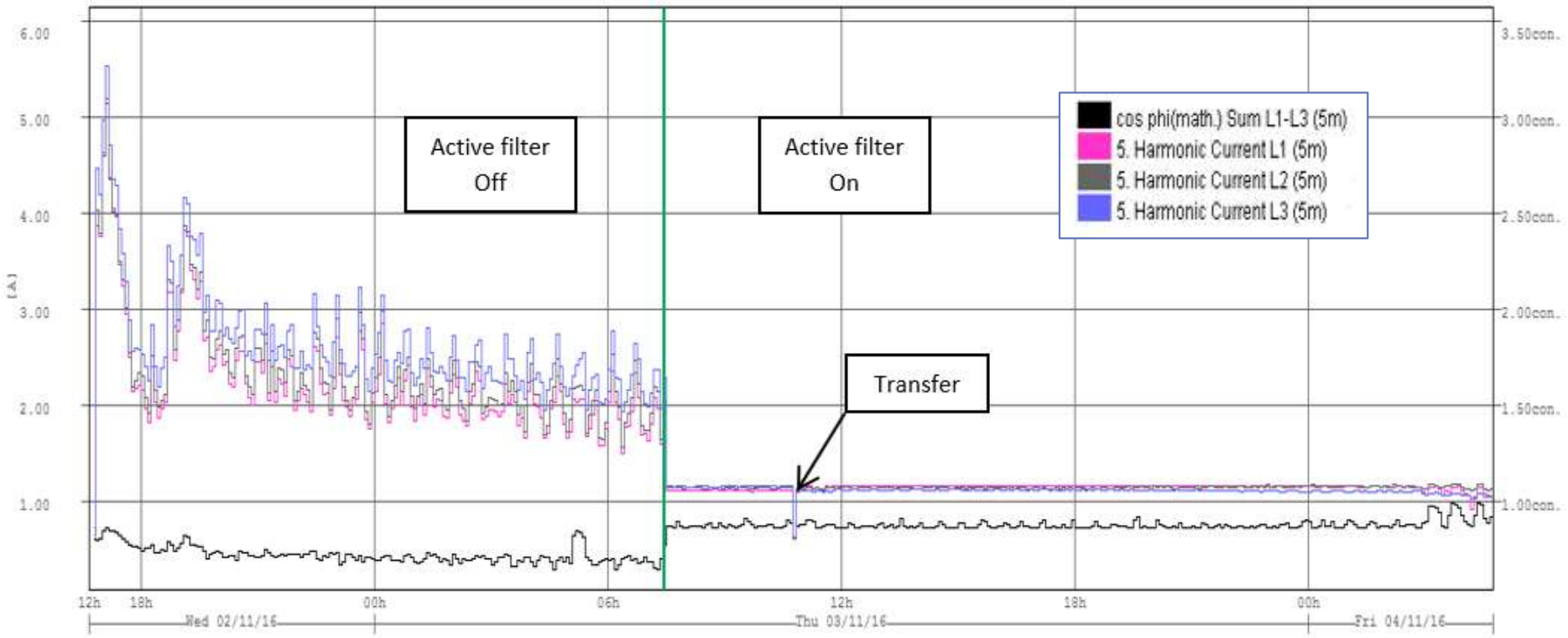


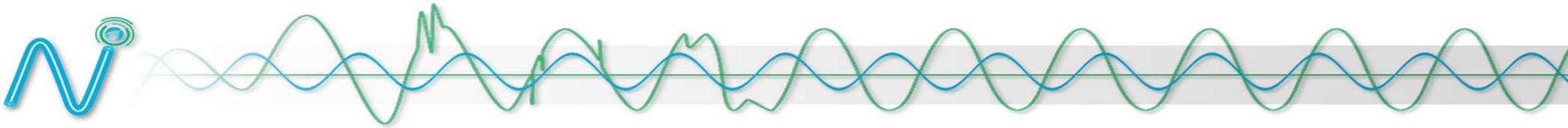


Schock detection while the Genset is stopped

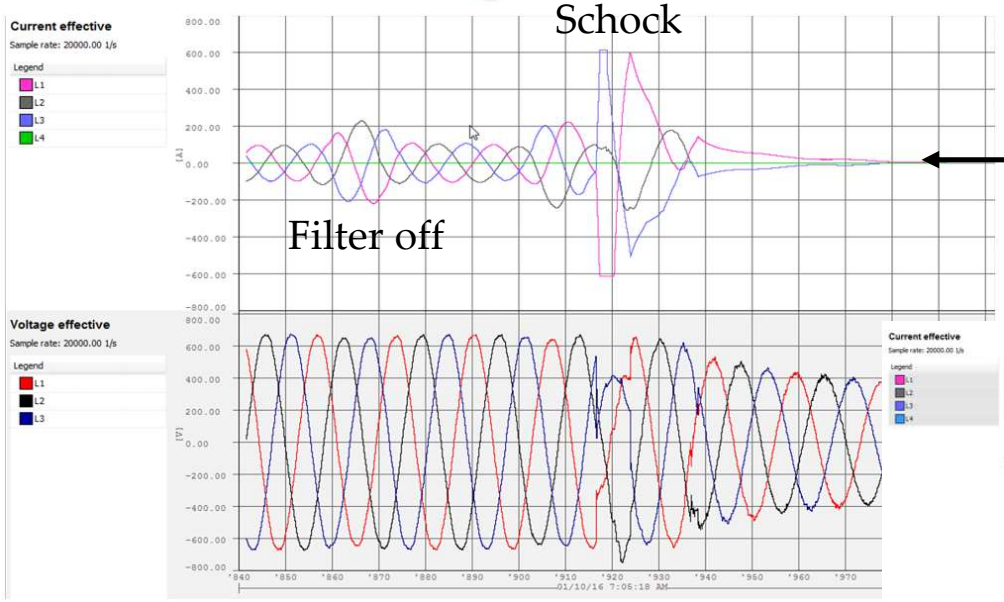
Genset is moving

Graphic 1. 5th harmonic current and Cos phi with and without the active filter





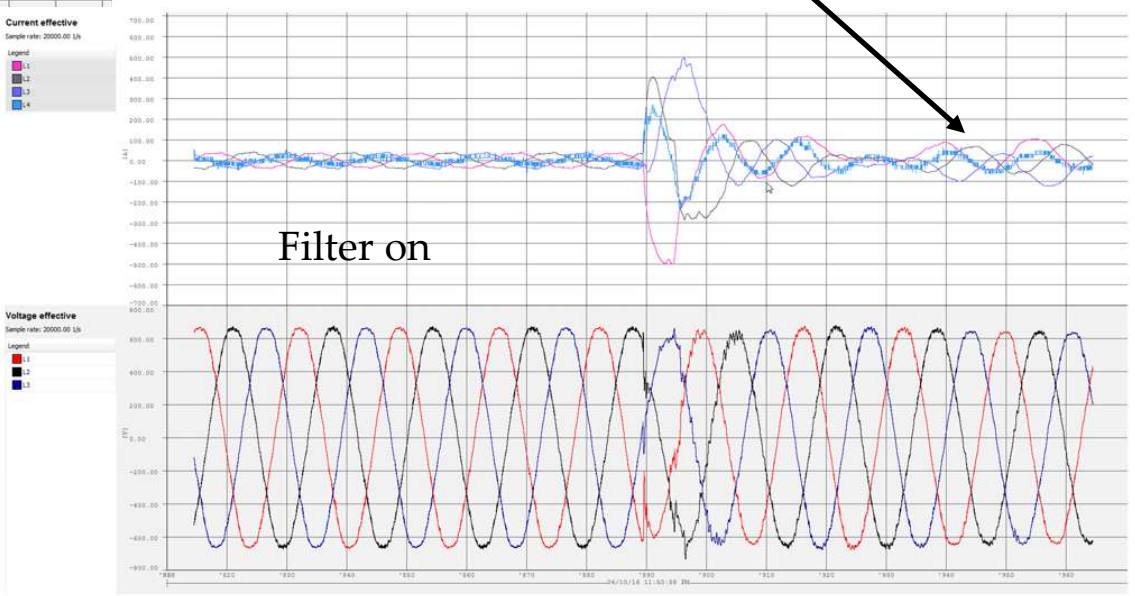
Schock



Filter off

Current to zero → Reefer trip

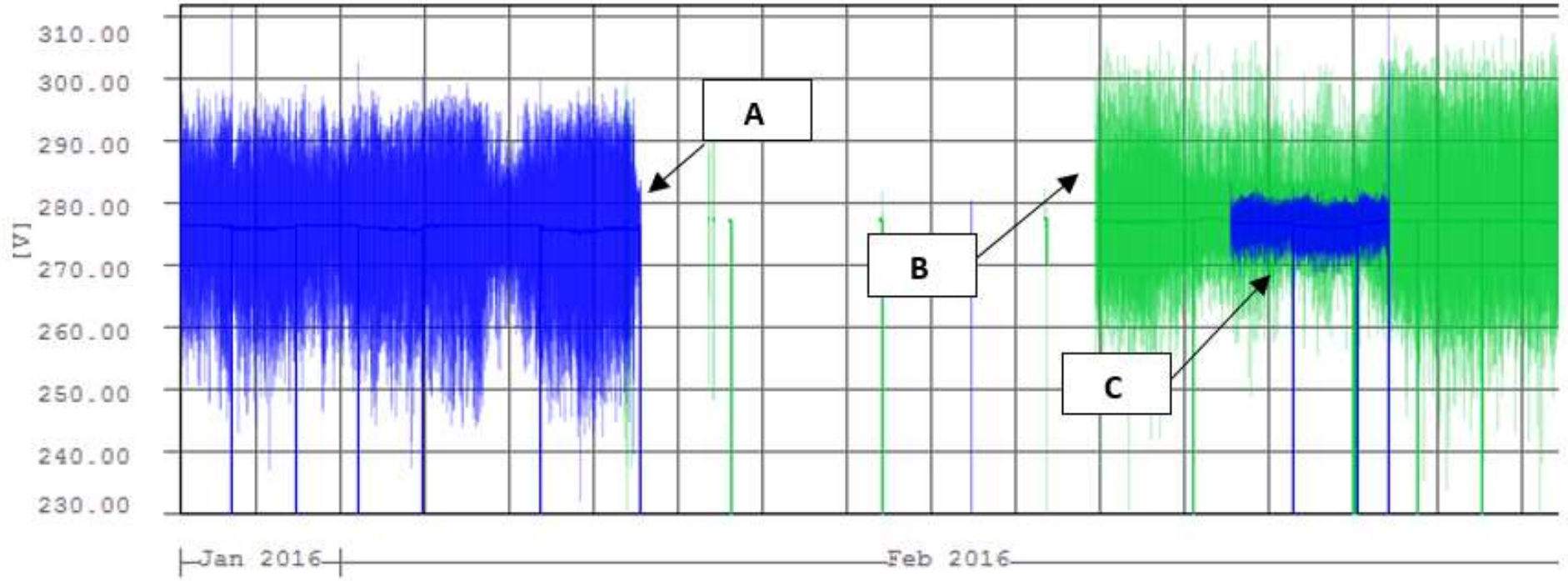
Current continu → No Reefer trip



Filter on

A - Genset 1 – AF Parameters not oprimized

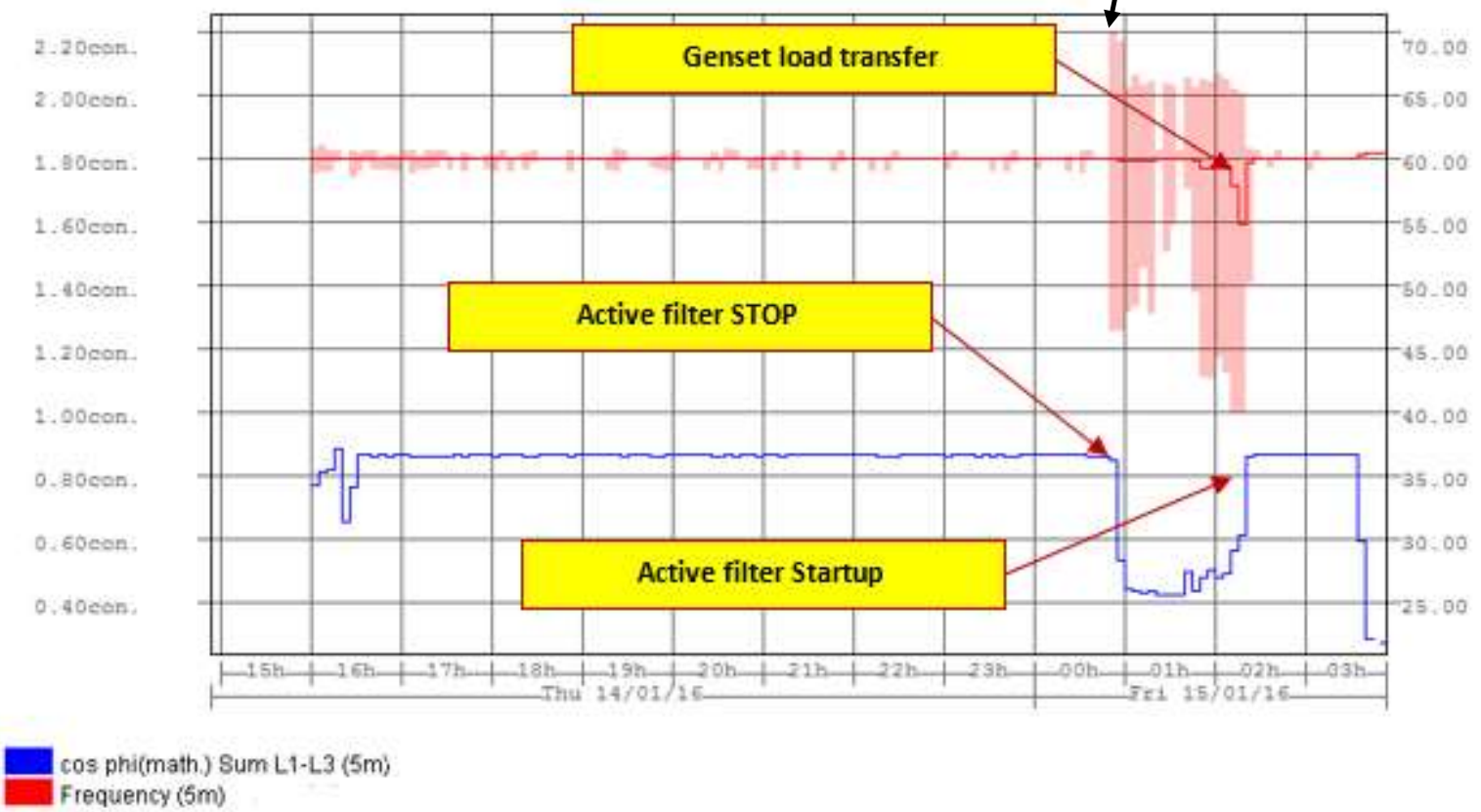
B - Genset 2 – AF Parameters not oprimized



C - Genset 1 – AF Parameters oprimized Remotely

Graph 6: Trend of Cos Phi (RMS value)

Frequency variation from Genset



Problem found with the Genset controler that was unstable.

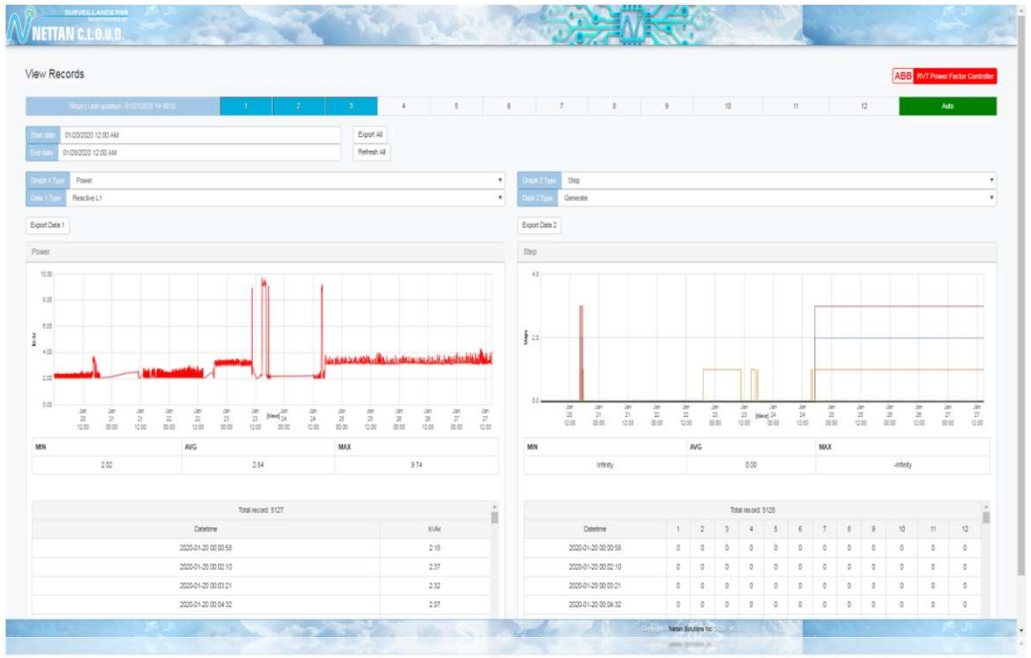
Example of a notification

From: genset@nettansolutions.com <genset@nettansolutions.com>
Sent: August 14, 2024 12:17 PM
To:
Subject: SHUTDOWN AT 2024-08-14, 11:32:04EST

Critical alert of a Genset stoppage while the train is in motion.

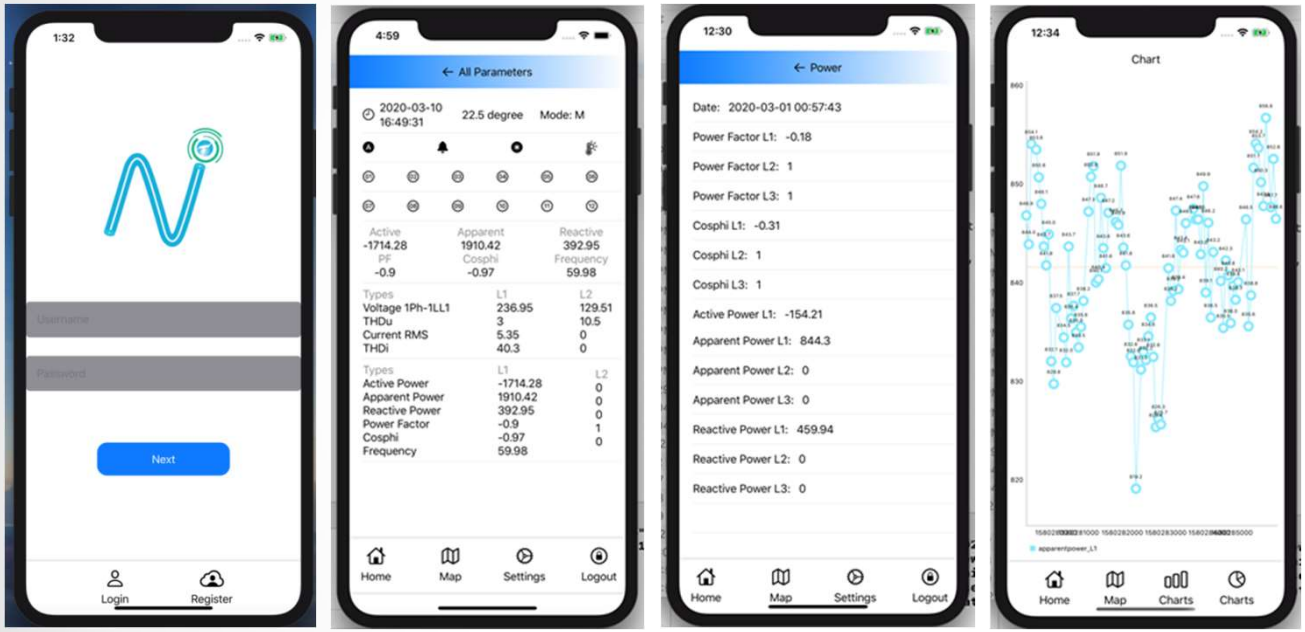
Date/Time	Voltage L1	Voltage L2	Voltage L3	Current L1	Current L2	Current L3	Cosphi	Speed
2024-08-09 11:25:05	480.07 V	480.02 V	480.03 V	50.1 A	50.1 A	50.1 A	0.85	26.1mph
2024-08-09 11:26:05	480.08 V	480.02 V	480.03 V	50.2 A	50.2 A	50.2 A	0.85	25.2mph
2024-08-09 11:27:05	480.07 V	480.03V	480.02 V	49.1 A	49.1 A	49.1 A	0.85	26.1mph
2024-08-09 11:28:05	0.07 V	0.08 V	0.06 V	0.0 A	0.0 A	0.0 A	1.0	24.7mph
2024-08-09 11:29:05	0.06 V	0.08 V	0.06 V	0.0 A	0.0 A	0.0 A	1.0	24.3mph
2024-08-09 11:30:05	0.06 V	0.08 V	0.06 V	0.0 A	0.0 A	0.0 A	1.0	23.4mph
2024-08-09 11:31:05	0.06 V	0.08 V	0.06 V	0.0 A	0.0 A	0.0 A	1.0	25.3mph
2024-08-09 11:34:05	0.06 V	0.09 V	0.06 V	0.0 A	0.0 A	0.0 A	1.0	24.7mph

Data Recording /w Nettan C.L.O.U.D Service



- Data Exportation
- Power Quality Report

MyNettan app - C.L.O.U.D Mobile Service



Direct connection with the end user:

- Full time access
- Direct alarm notification
- Maintenance reminder
- Service partners proximity
- Push Advertising
- And much more!

Nettan Solutions offers you a width variety of services for power quality applications with an unlimited potential.

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