

4th Nov 2016



DECOM
LTD

FACTORY POWER QUALITY TESTS

Factory Power Quality Tests – D87771

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Introduction

Factory requested a Power Quality study to be performed on the Boiler switchboard. The primary purpose of the investigation was to check voltage harmonic levels.

Test Procedure

A Sonel PQM-702 was installed on the Boiler MCC 400V switchboard on the only incoming supply, switch XXXXXX. Period of recording was from 3-11-16 10:54 to 3-11-16 15:42.

The monitoring equipment was configured to record power quality events and disturbances in accordance with EN50160 (Voltage Characteristics of Public Distribution Systems). The limits for acceptable Harmonic Levels up to the 25th Harmonic are shown below in Figure 2 – Table 2 from Power Quality Application Guide – Voltage Disturbances Standard EN50160.

Parameters recorded are as per the following table.

Parameter	Time Plot Values	Events
Phase Volts	Min, Max, Ave, Inst	Swells >253V
		Dips <207 V
		Interruptions <207 V
Frequency	Min, Max, Ave, Inst	-
Voltage Crest Factor	Ave	-
Voltage Unbalance	Ave	>2%
Flicker		>1.00
Phase Current	Min, Max, Ave, Inst	
Current Crest Factor		>2.50, <1.00
Active Power	Min, Max, Ave, Inst	
Reactive Power	Min, Max, Ave, Inst	
Apparent Power	Min, Max, Ave, Inst	
Power Factor	Min, Max, Ave, Inst	
Voltage Harmonic THD	Min, Max, Ave, Inst	>8.00%
Voltage Harmonic Amplitudes 1-50th	Min, Max, Ave, Inst	as per EN50160

Figure 1 – Power Quality Monitoring Settings

Time plot data was sampled at 10 second intervals.

Odd harmonics				Even harmonics	
Not multiples of 3		Multiples of 3			
Order h	Relative voltage (%)	Order h	Relative voltage (%)	Order h	Relative voltage (%)
5	6	3	5	2	2
7	5	9	1.5	4	1
11	3.5	15	0.5	6 24	0.5
13	3	21	0.5		
17	2				
19	1.5				
23	1.5				
25	1.5				

Table 2 - Values of individual harmonic voltages at the supply terminals for orders up to 25, given in percent of U_n

Figure 2 – Table 2 from Power Quality Application Guide – Voltage Disturbances Standard EN50160.

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Summary

Power Quality exceeded the thresholds of standard EN50160 for the following categories.

- Voltage Total Harmonics Distortion (THD)
- Voltage Harmonics of the 5th, 12th, 15th, 21st, 23rd and 27th order.

Voltage Time Plot

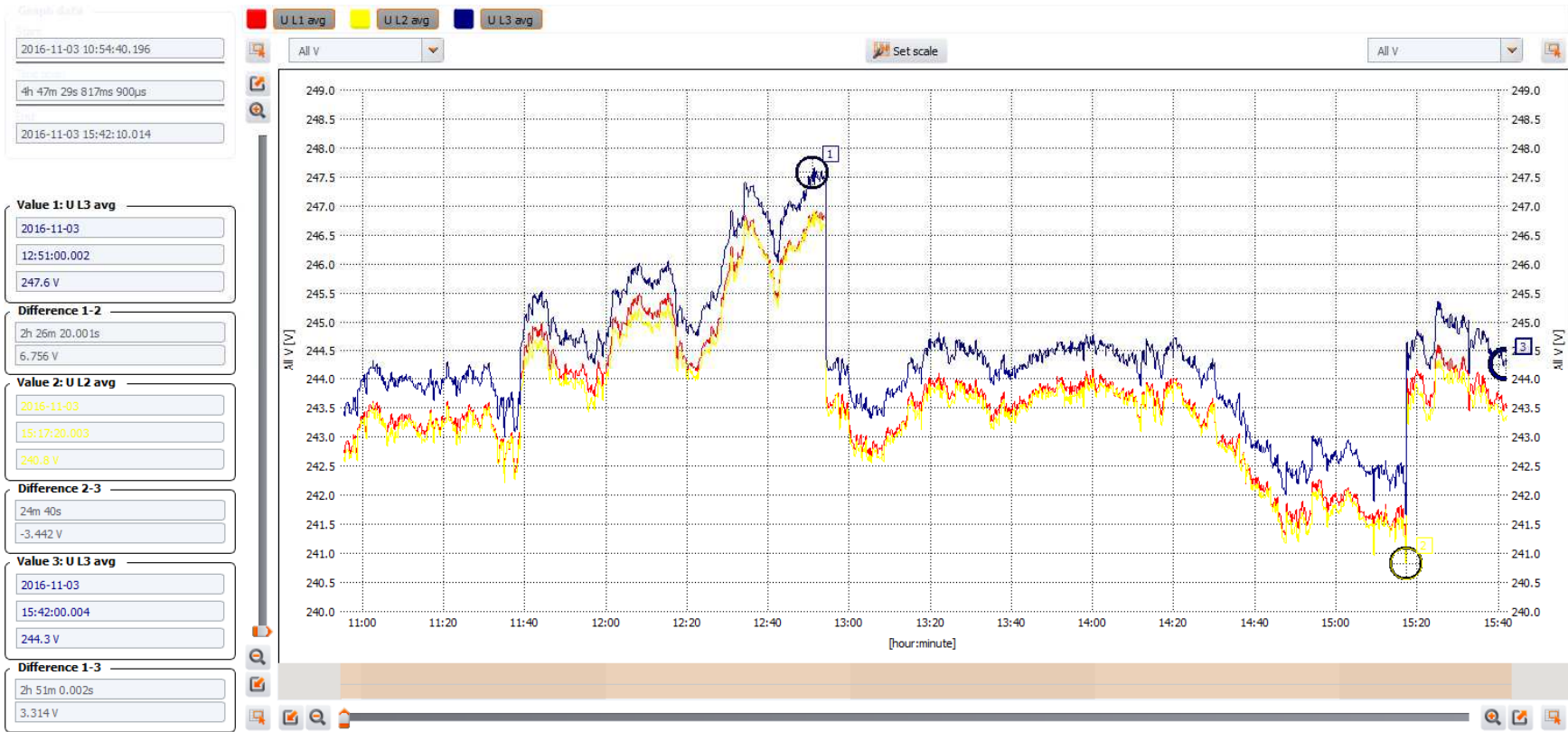


Figure 3 – L1, L2, L3 Voltage Time Plot (Average)

Current Time Plot

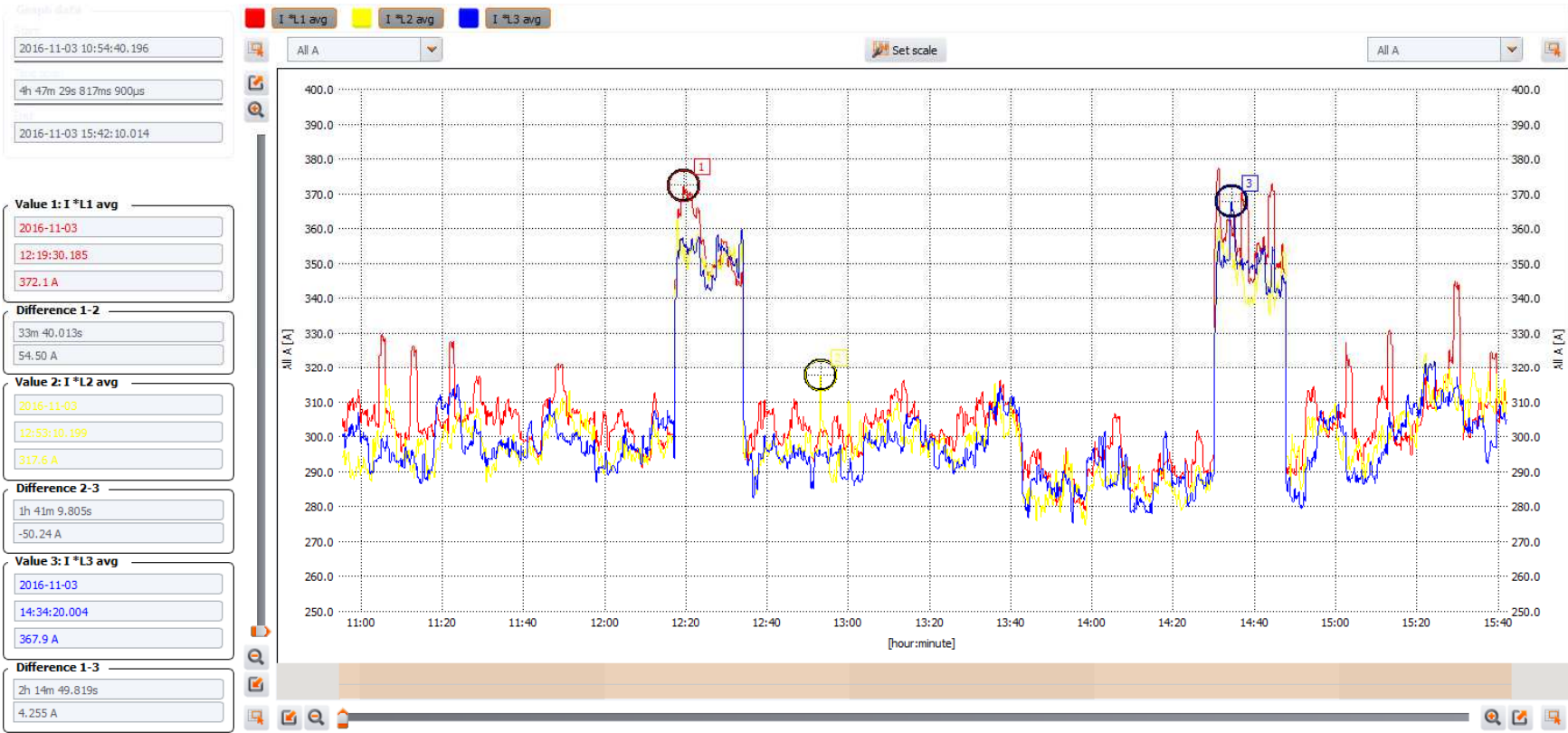


Figure 4 – L1, L2, L3 Current Time Plot (Average)

Active Power Time Plot

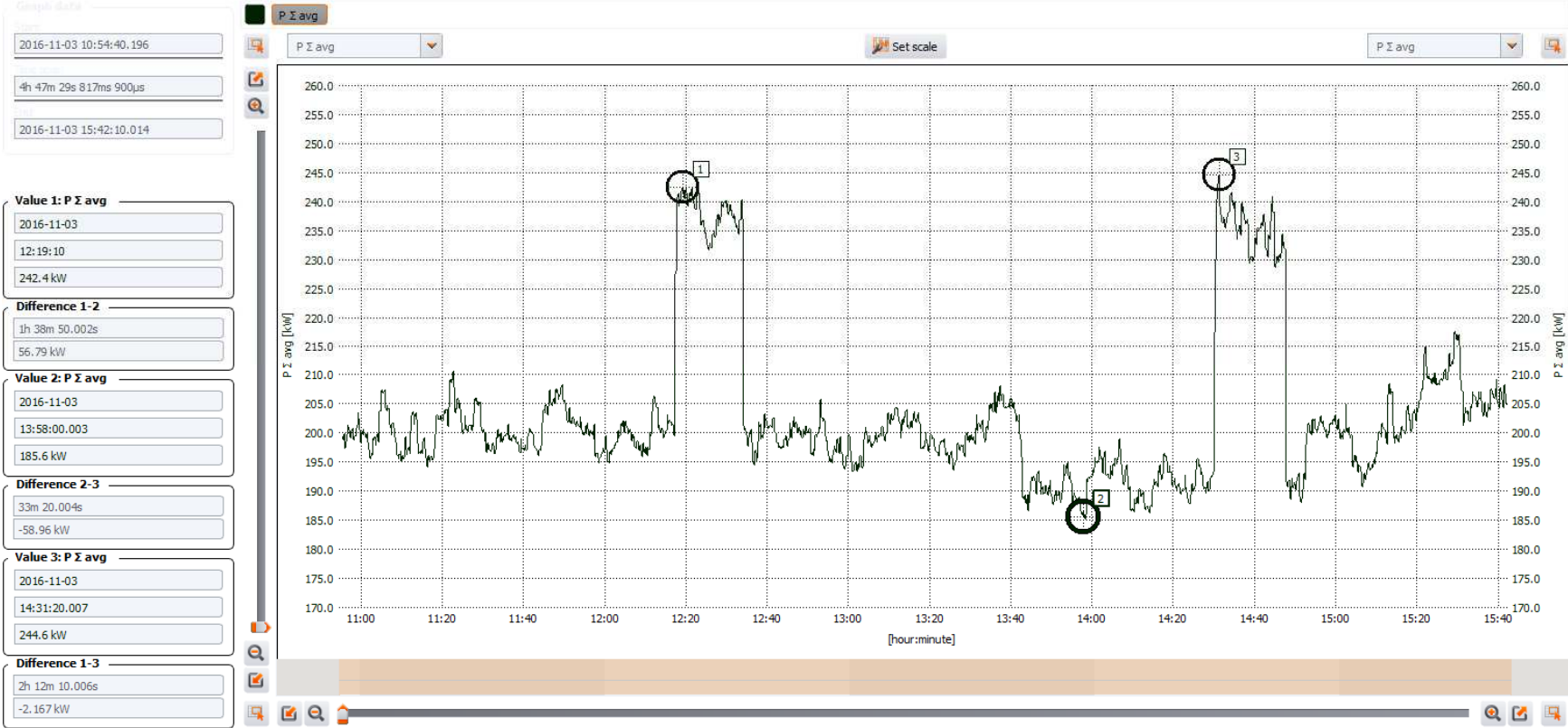


Figure 5 – Three Phase Active Power Time Plot (Average)

Power Factor Time Plot

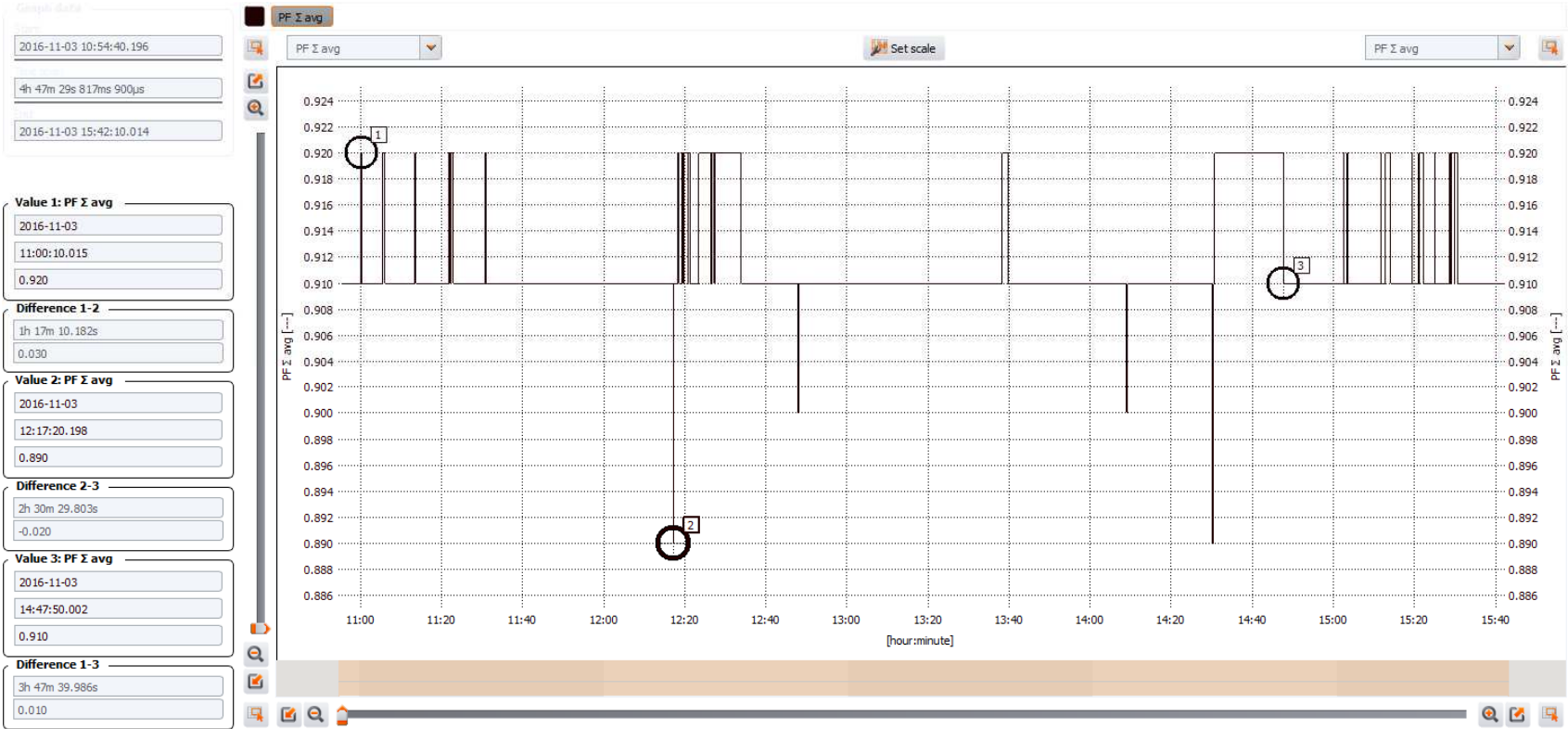


Figure 6 – Three Phase Power Factor Time Plot (Average)

Harmonics – Voltage THD

Note – THD exceeds EN50160 standard at 8%.

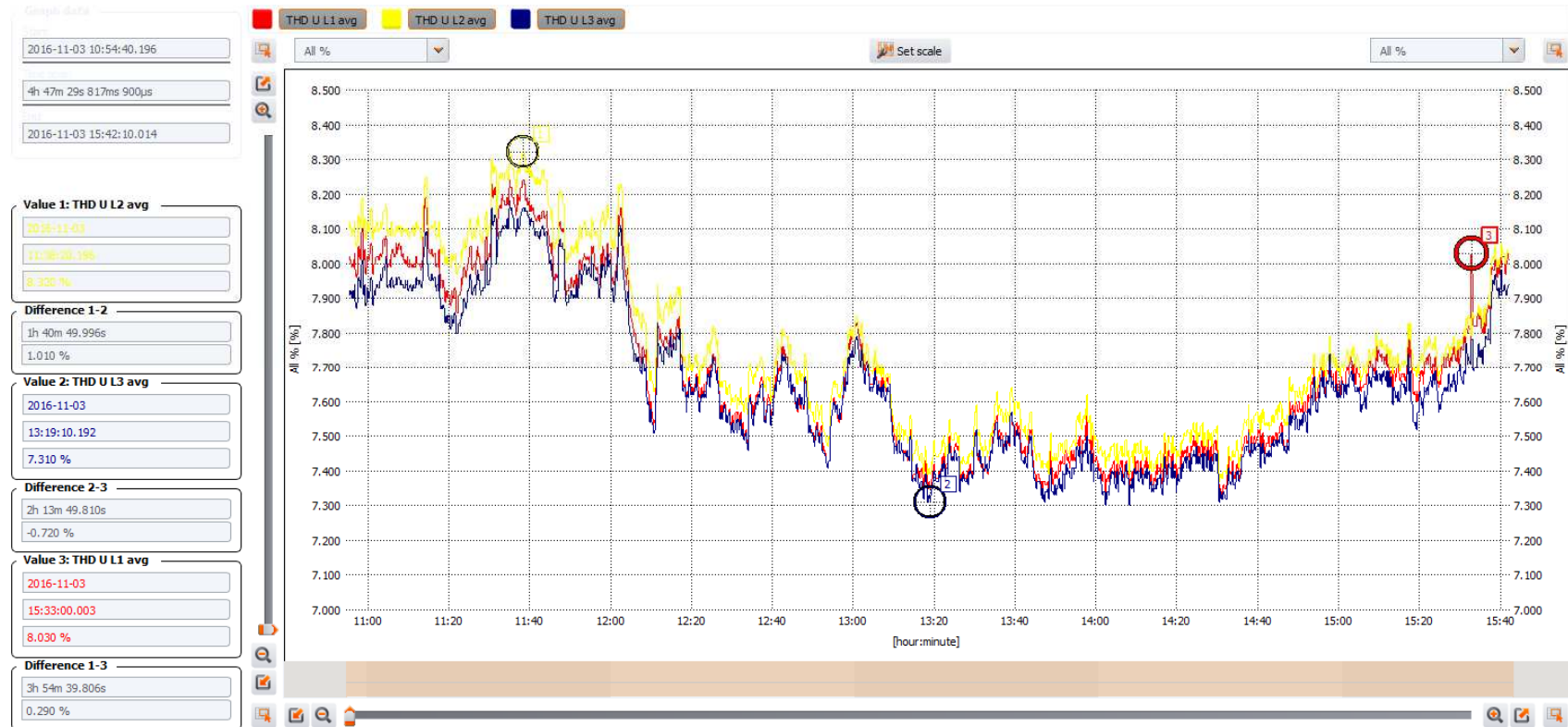


Figure 7 – L1, L2, L3 Voltage Total Harmonic Distortion Time Plot (Average)

Voltage Harmonic Spectrum

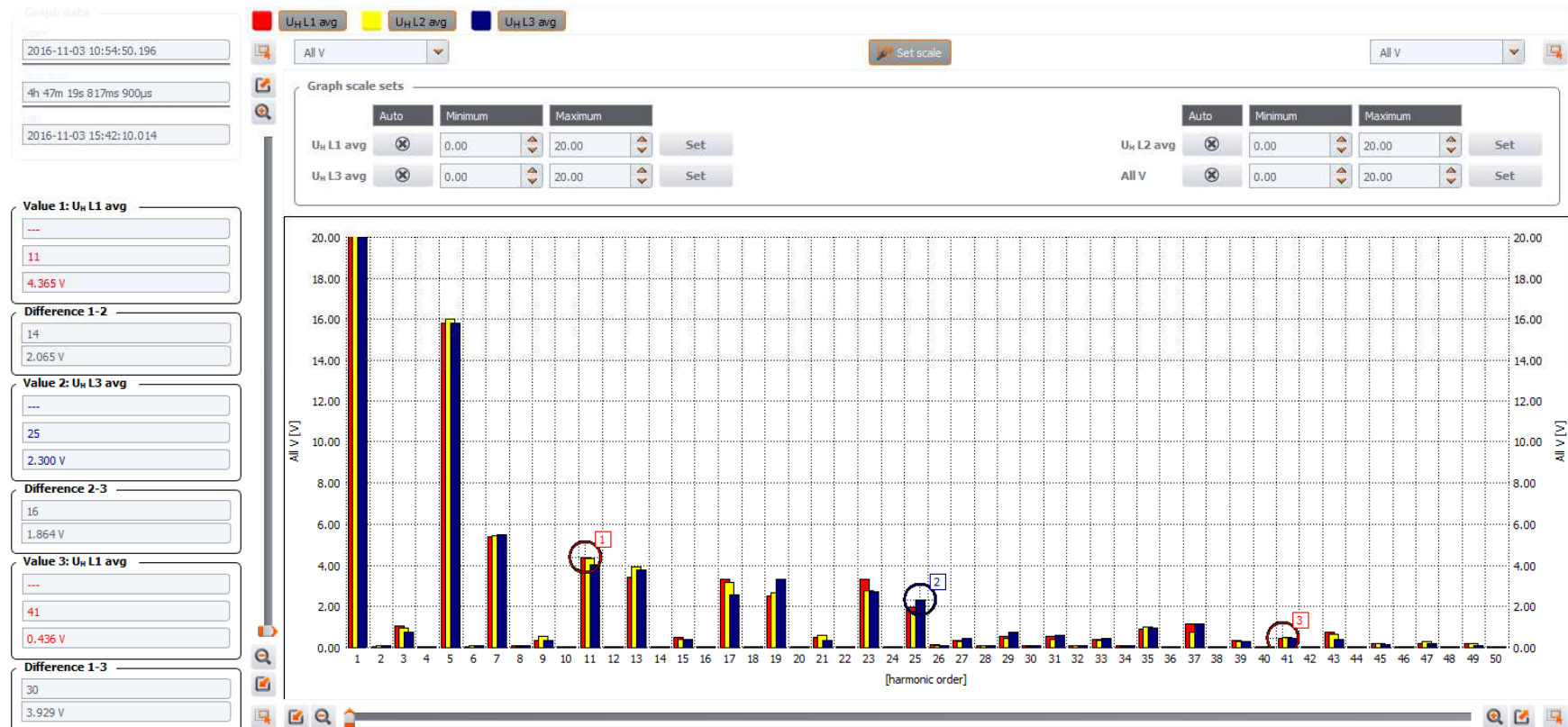


Figure 8 – Voltage Harmonic Spectrum H1 – H50 (Average)

Figure 8 illustrates the average distribution of Voltage Harmonic THD levels over the period of monitoring.

- 5th Harmonic THD EN50160 threshold of is 13.8 V.
- 19th Harmonic THD EN50160 threshold is 3.45 V.
- 23rd Harmonic THD EN50160 threshold is 3.45 V.

Voltage Harmonic THD Events

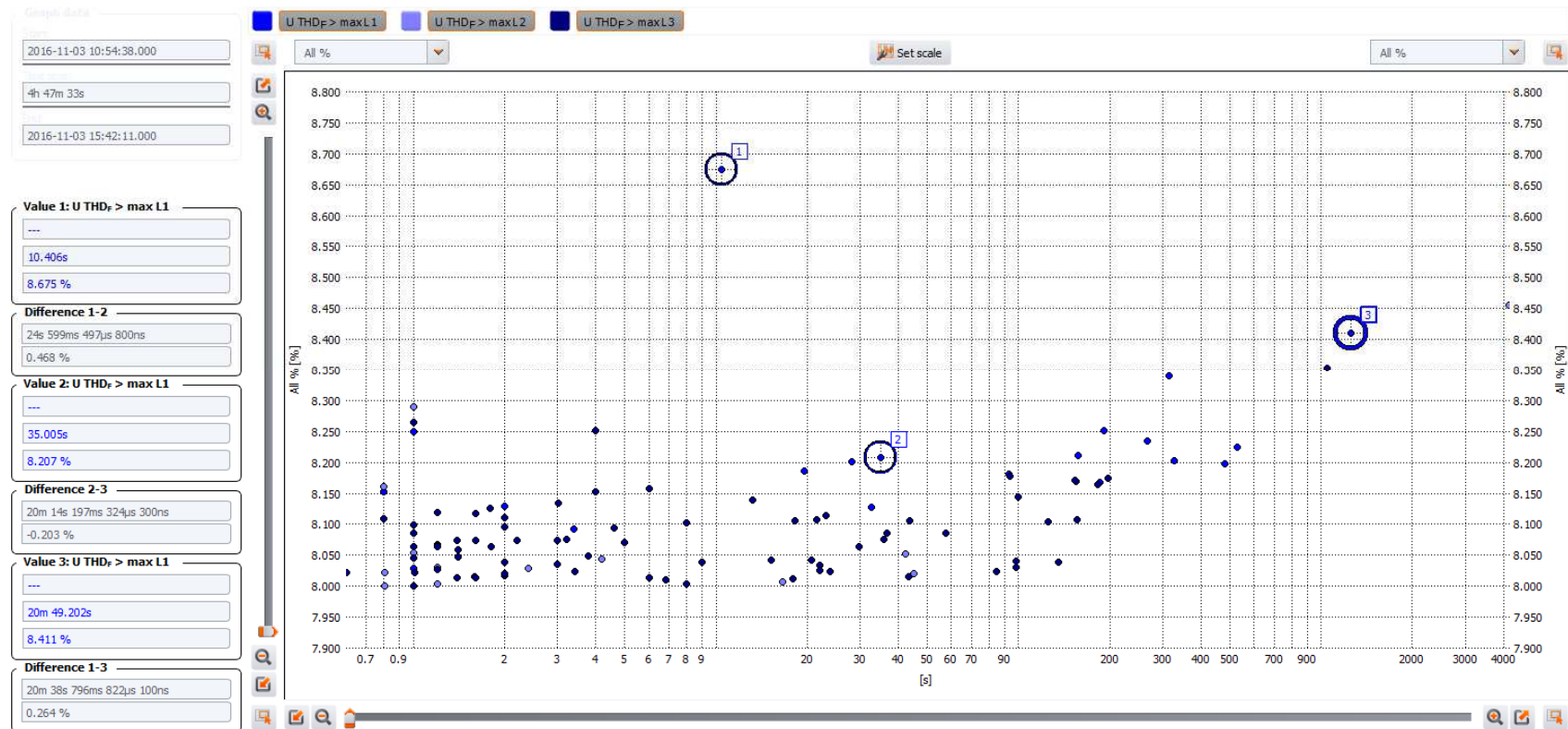


Figure 9 – Voltage Harmonic THD Events

Figure 9 indicates when Voltage Harmonic THD levels exceed EN50160 standard of 8% of fundamental value.

Voltage Harmonic Events L1

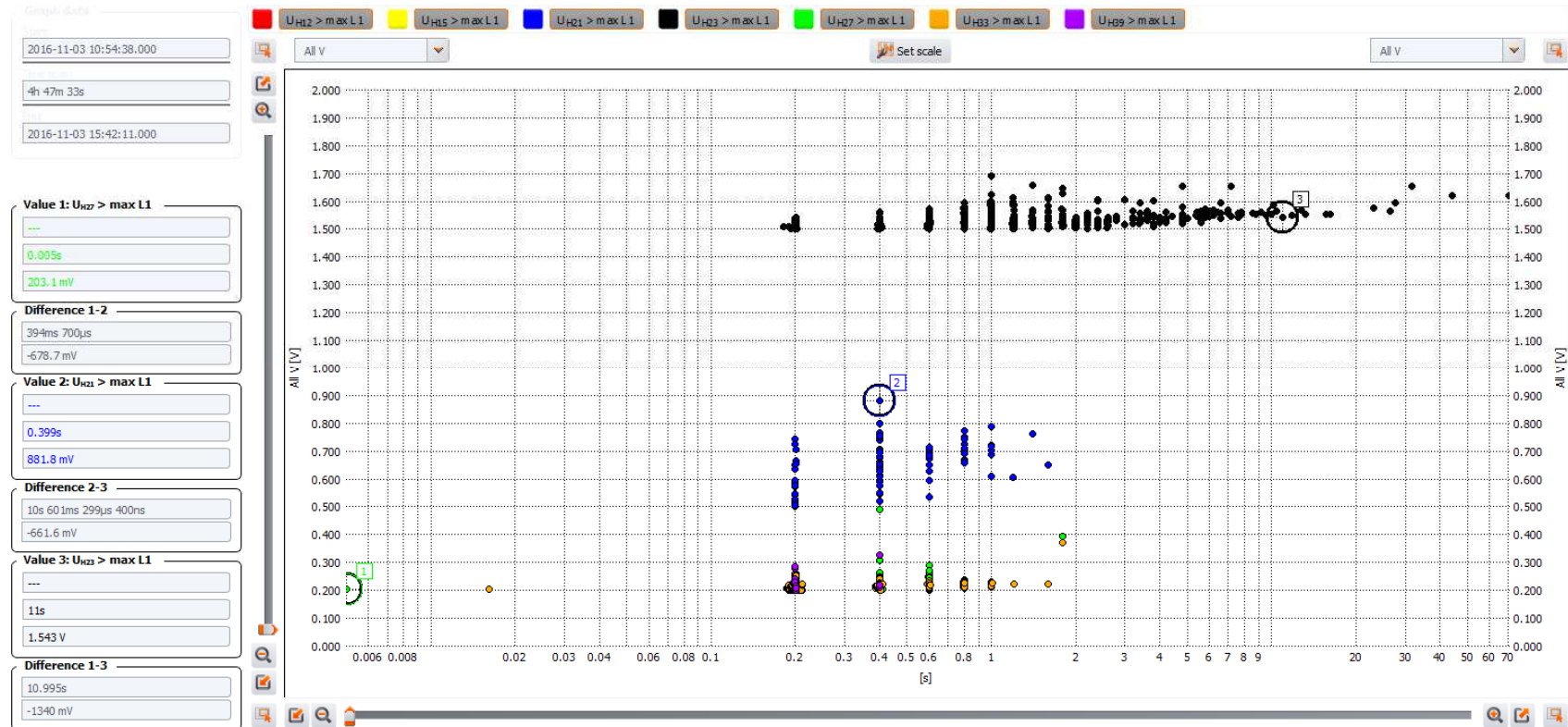


Figure 10 – Voltage Harmonic Events L1

Figure 10 illustrates the distribution of over 6000 voltage harmonic events recorded for L1. Each harmonic event (2nd to 50th) that exceeds EN50160 is recorded by duration and amplitude.

Voltage Harmonic Events L2

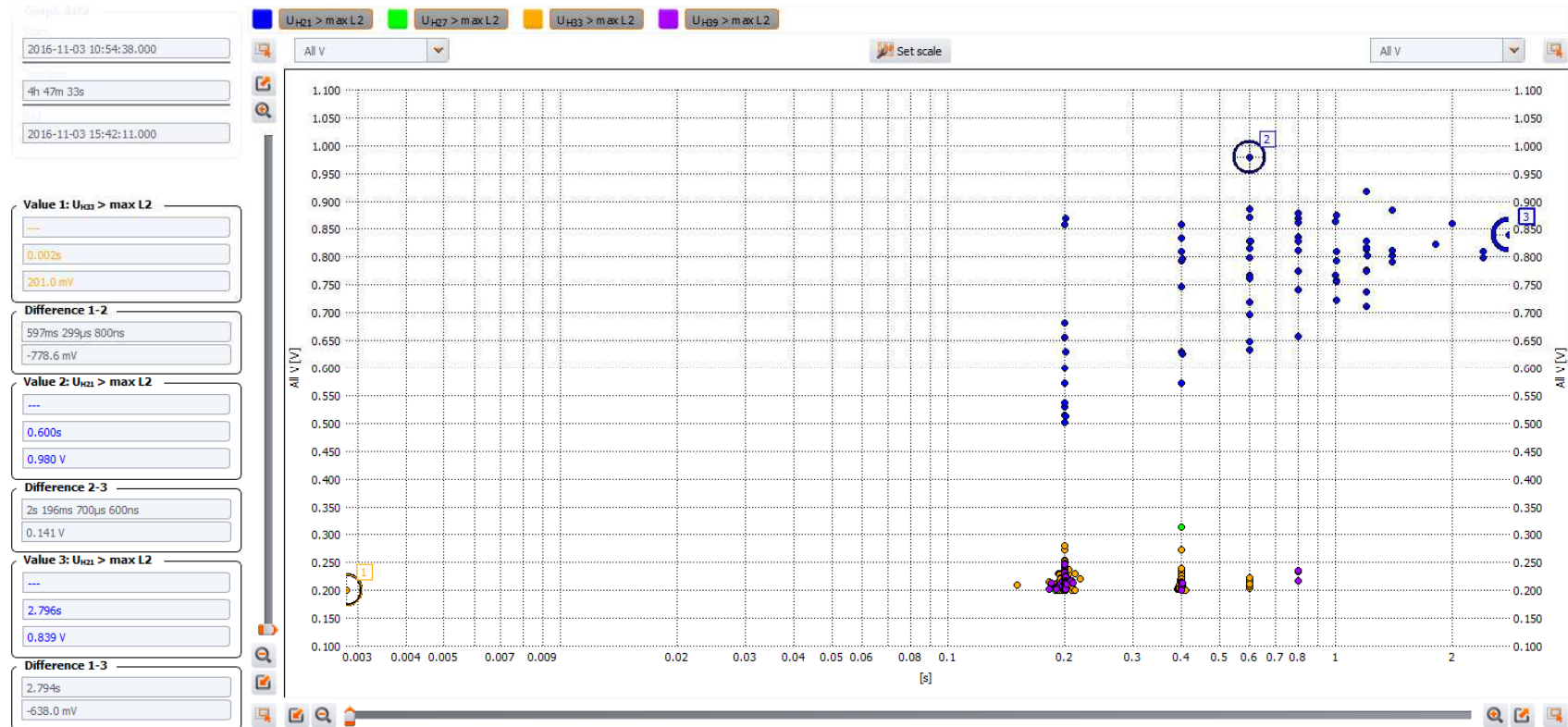


Figure 11 – Voltage Harmonic Events L2

Figure 11 illustrates the distribution of over 3800 voltage harmonic events recorded for L2. Each harmonic event (2^{nd} to 50^{th}) that exceeds EN50160 is recorded by duration and amplitude.

Voltage Harmonic Events L3

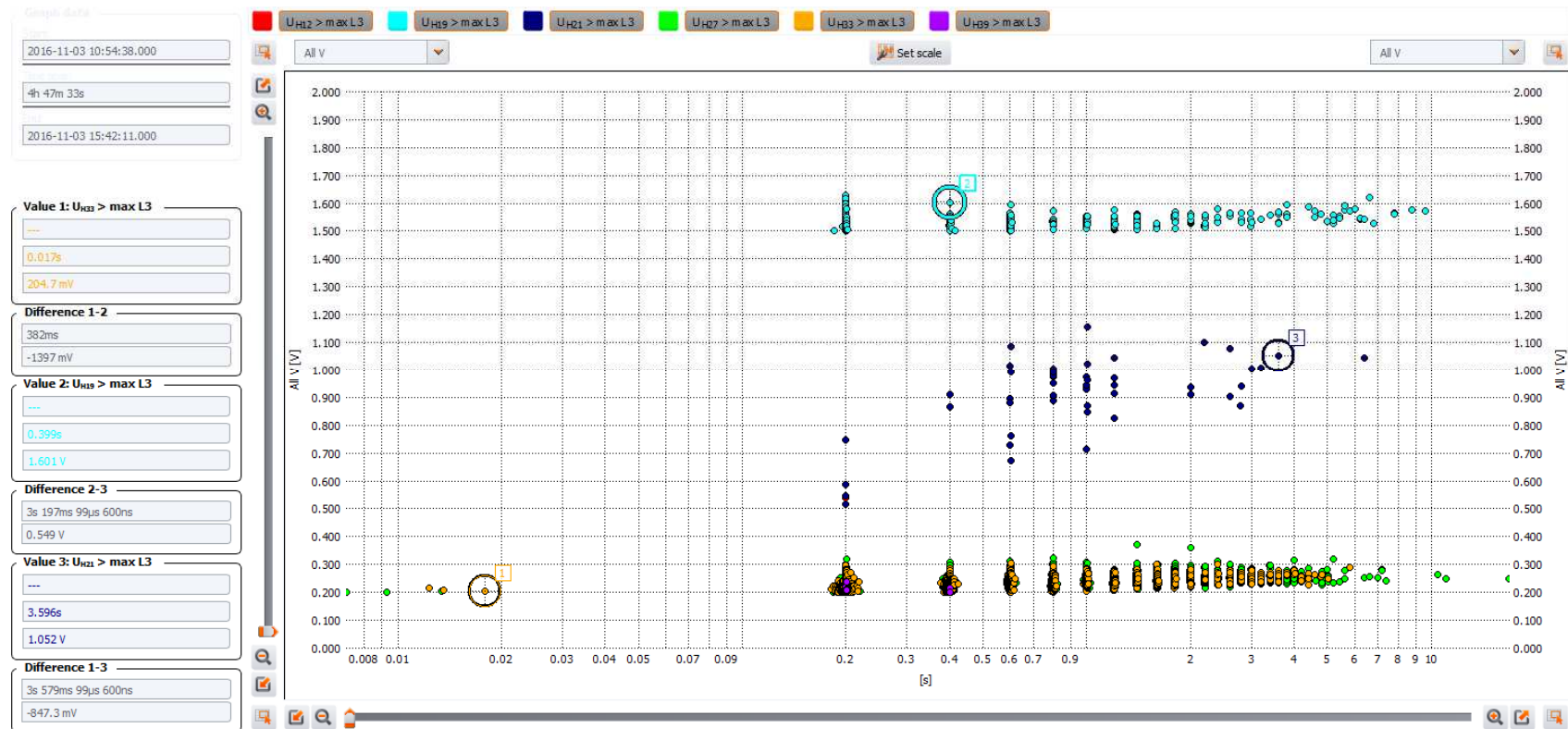


Figure 12 – Voltage Harmonic Events L2

Figure 12 illustrates the distribution of over 32000 voltage harmonic events recorded for L3. Each harmonic event (2nd to 50th) that exceeds EN50160 is recorded by duration and amplitude.

End of report.