

**VERIFICATION**

STATE OF OHIO                            )  
  )  
COUNTY OF HAMILTON                )        **SS:**


The undersigned, Marc A. Bell, Lead Engineer, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

  
\_\_\_\_\_  
Marc A. Bell Affiant

Subscribed and sworn to before me by Marc A. Bell on this 10<sup>th</sup> day of January,  
2022.



  
**MERON BELAI BEYENE**  
Notary Public, State of Ohio  
My Commission Expires  
December 11, 2024

  
\_\_\_\_\_  
Meron Belai Beyene  
NOTARY PUBLIC

My Commission Expires: 12-11-2024

VERIFICATION

STATE OF OHIO                    )  
  )  
COUNTY OF HAMILTON        )        SS:

The undersigned, Michael J. Pahutski, Regional Director, Ohio-Kentucky Large Account Management, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

  
\_\_\_\_\_  
Michael J. Pahutski, Affiant

Subscribed and sworn to before me by Michael J. Pahutski, on this 5 day of Jan, 2022.

  
\_\_\_\_\_  
NOTARY PUBLIC

My Commission Expires: 06/24/2023

 NICHOLAS SPRAGUE  
Notary Public, State of Ohio  
My Commission Expires 06-24-2023

**VERIFICATION**

STATE OF OHIO                    )  
  )  
COUNTY OF HAMILTON        )        SS:

The undersigned, Michelle Basch, Manager Consumer Affairs, being duly sworn, deposes and says that she has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of her knowledge, information and belief.

Michelle Basch  
Michelle Basch, Affiant

Subscribed and sworn to before me by Michelle Basch, on this 13 day of January, 2022.

[Signature]  
NOTARY PUBLIC

My Commission Expires:



**ROCCO O. D'ASCENZO**  
**ATTORNEY AT LAW**  
Notary Public, State of Ohio  
My Commission Has No Expiration  
Section 147.03 R.C.

**VERIFICATION**

STATE OF OHIO                    )  
  )  
COUNTY OF HAMILTON        )        **SS:**

The undersigned, Mike Simms, Manager Grid Management, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

  
\_\_\_\_\_  
Mike Simms Affiant

Subscribed and sworn to before me by Mike Simms on this 13 day of JANUARY, 2022.

  
\_\_\_\_\_  
NOTARY PUBLIC

My Commission Expires:



**ROCCO O. D'ASCENZO**  
**ATTORNEY AT LAW**  
Notary Public, State of Ohio  
My Commission Has No Expiration  
Section 147.03 R.C.

**KyPSC Case No. 2021-00192**  
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**Duke Energy Kentucky**  
**Case No. 2021-00192**  
**STAFF Second Set Data Requests**  
**Date Received: December 27, 2021**

**STAFF-DR-02-001**

**REQUEST:**

Refer to Duke Kentucky's responses to Staff's First Request for Information (Staff's First Request), Items 1c and 2c.

- a. If Duke Kentucky and Northern Kentucky Water District (NKWD) have known about the voltage drop since 2017, explain why the Commission was not made aware until Duke Kentucky's application on May 6, 2021.
- b. Explain each basis for Duke Kentucky's belief that each pump start causes a voltage drop in excess of 4 percent on Wilder 46.
- c. Explain in detail how voltage variations are currently monitored on Wilder 46 on an ongoing basis.
- d. Explain how Duke Kentucky monitored voltage variations on Wilder 46 when it determined that the voltage drops were caused by NKWD starting its pumps.

**RESPONSE:**

- a. Duke Energy Kentucky and NKWD were cooperatively attempting to develop amicable solutions to alleviate the voltage drop in a fair and equitable way for our respective customers. Duke Energy Kentucky and NKWD were working in good faith in trying to identify, confirm, and attempt to resolve the issue. See Response to Staff DR-02-003. A capital-based solution is complex and expensive for the Company, and would not likely fix the problem entirely. Any solution necessarily required cooperation, time to evaluate, and the parties were committed to working

together to bring a solution to the Commisison once determined. Duke Energy Kentucky utilized a Ranger 7000T and Eagle 330 high resolution recorders at various locations, and documented the voltage drops coordinated with pump starts using arranged coordinated testing with NKWD.

- b. Duke Energy Kentucky has standard voltage monitoring on the bus of the substation and at a few electronic devices on the line itself. Standard monitoring is not always fast enough to accurately record events, such as flicker caused by a motor start. When there is an indication of an issue, a Company technician places a portable recording meter that has higher recording resolution.
- c. Duke Energy Kentucky utilizes a portable recorder with high recording resolution, at strategic locations to capture the data accurately. Multiple times we have completed this in coordination with NKWD to coordinate the timing with their motor starts using the Eagle 330.

**PERSON RESPONSIBLE:** Marc Bell

**Duke Energy Kentucky**  
**Case No. 2021-00192**  
**STAFF Second Set Data Requests**  
**Date Received: December 27, 2021**

**STAFF-DR-02-002**

**REQUEST:**

Refer to Duke Kentucky's responses to Staff's First Request, Item 2a. Describe all of the alternatives NKWD has evaluated or proposed to Duke Kentucky to alleviate the voltage drops on Wilder 46 caused by the initiation of NKWD's water pumps.

**RESPONSE:**

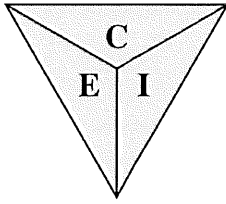
Duke Energy Kentucky is not aware of the alternatives NKWD may have evaluated.

Upon inquiry to NKWD, NKWD states as follows:

NKWD staggers pump starts at the Ohio River Pumping Station 1. Since 2017, the NKWD has made a concerted effort to also stagger pump starts with its smaller Ohio River Pumping Station 2, located less than a mile from Ohio River Pump Station 1 on the same circuit, so that only one pump starts at a time from either station. The NKWD installed motor soft starters on 2 of its 6 motors in 2019 at a total project cost of \$494,167. The NKWD conducted a test in 2020 to measure the voltage on pump starts. The report summaries are attached as STAFF-DR-02-002 Attachments (a) through (g). The NKWD has budgeted \$1,036,000 in its 5-year capital improvement budget to replace the other 4 existing motors starters with soft starters.

**PERSON RESPONSIBLE:** Mike Simms





## ***Electrical Certification Incorporated***

*P.O. Box 53368 \* Cincinnati, Ohio 45253  
Office: (513) 662-7500 \* Fax: (513) 662-6610  
Cell: (513) 604-2431 \* Email: ECInc@cinci.rr.com*

Report Summary 2020-400  
Date: July 21, 2020

Bill Speier  
Northern Kentucky Water Sewer District

Re: Northern Kentucky Water Sewer District – KCWW Ohio River Station  
Subject: Record Motor Starting Parameters

Mr. Speier,

On July 5, 2020, Electrical Certification Incorporated installed load monitoring equipment to monitor the load being supplied by the local utility. Continuous monitoring of the load was performed utilizing a Fluke 435II Energy Analyzer.

All data was recorded and is enclosed for your review and records. The following is a discussion of our observations and comments.

### **Equipment List**

4200V Rail Side  
4200V River Side

### **Summary**

Both T1 & T2 Transformers were connected to the same utility source for this testing.

#### **River Side Substation:**

##### **Test #1:**

No pumps running – start pump #4 (soft starter) – delay (10) mins. – start pump #6 (RVS auto transformer start). Only (1) transient event occurred.

07:42:15 Voltage dip on soft starter to 3726V

- Amp on soft starter 540. Approximately 3.75 seconds acceleration

07:53:01 Voltage dip on RVS to 3648V

- Amp on RVS 640. Approximately 2.5 seconds acceleration

##### **Test #2:**

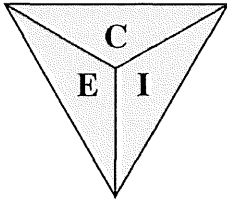
No pumps running – start pump #6 (RVS auto transformer) – delay (10) mins. – start pump #5 (soft starter). (2) swells and (1) transient event occurred.

08:23:27 Voltage dip on RVS to 3715V

- Amp on RVS 570. Approximately 2.5 seconds acceleration

08:39:00 Voltage dip on soft starter 3671V

- Amp on soft starter 640. Approximately 3.75 seconds acceleration



## ***Electrical Certification Incorporated***

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Cell: (513) 604-2431 \* Email: ECInc@cinci.rr.com*

Report Summary #2020-400  
Page #2

Electrical Certification Incorporated appreciates the opportunity to have provided this service. If you have any questions concerning this report, or have additional testing needs please call any time for prompt professional service.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jeffrey Jones', written over a faint printed name.

Jeffrey Jones  
General Manager



Filename  
MEAS 9 -- SD Card

Report Date/Time  
7/15/2020 11:33:44 AM

Page 1

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### Instrument Information

Model Number 435-II  
Serial Number 28453110  
Firmware Revision V04.01

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### Software Information

Power Log Version 5.4  
  
FLUKE 430-II DLL Version 1.2.0.13

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### General Information

Recording location KCWW OHIO RIVER STA  
Client SAME  
Notes

4200V RAILSIDE (3) RVS RUNNING



Filename  
MEAS 9 -- SD Card

Report Date/Time  
7/15/2020 11:33:44 AM

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### Measurement Summary

Measurement topology	3-element delta mode
Application mode	Volts/Amps/Hertz
First recording	7/15/2020 6:52:22 AM 533msec
Last recording	7/15/2020 7:31:02 AM 533msec
Recording interval	0h 0m 10s 0msec
Nominal Voltage	173 V
Nominal Current	30 A
Nominal Frequency	60 Hz
File start time	7/15/2020 6:52:12 AM 533msec
File end time	7/15/2020 7:31:02 AM 533msec
Duration	0d 0h 38m 50s 0msec
Number of events	Normal: 0 Detailed: 0
Events downloaded	No
Number of screens	0
Screens downloaded	Yes
Power measurement method	Unified
Cable type	Copper
Harmonic scale	%H1
THD mode	THD 40
CosPhi / DPF mode	DPF

### Scaling

Phase:	
Current Clamp type	i430Flex
Clamp range	N/A
Nominal range	30 A
Sensitivity	x1
Current ratio	1000:5
Voltage ratio	35:1
Neutral:	
Current Clamp type	i430TF
Clamp range	N/A
Nominal range	300 A
Sensitivity	x10 AC only
Current ratio	1:1
Voltage ratio	1:1

### Recording Summary

RMS recordings	233
DC recordings	0
Frequency recordings	233
Unbalance recordings	0
Harmonic recordings	0
Power harmonic recordings	0
Power recordings	0
Power unbalance recordings	0
Energy recordings	0
Energy losses recordings	0
Flicker recordings	0
Mains signaling recordings	0



Filename  
MEAS 9 -- SD Card

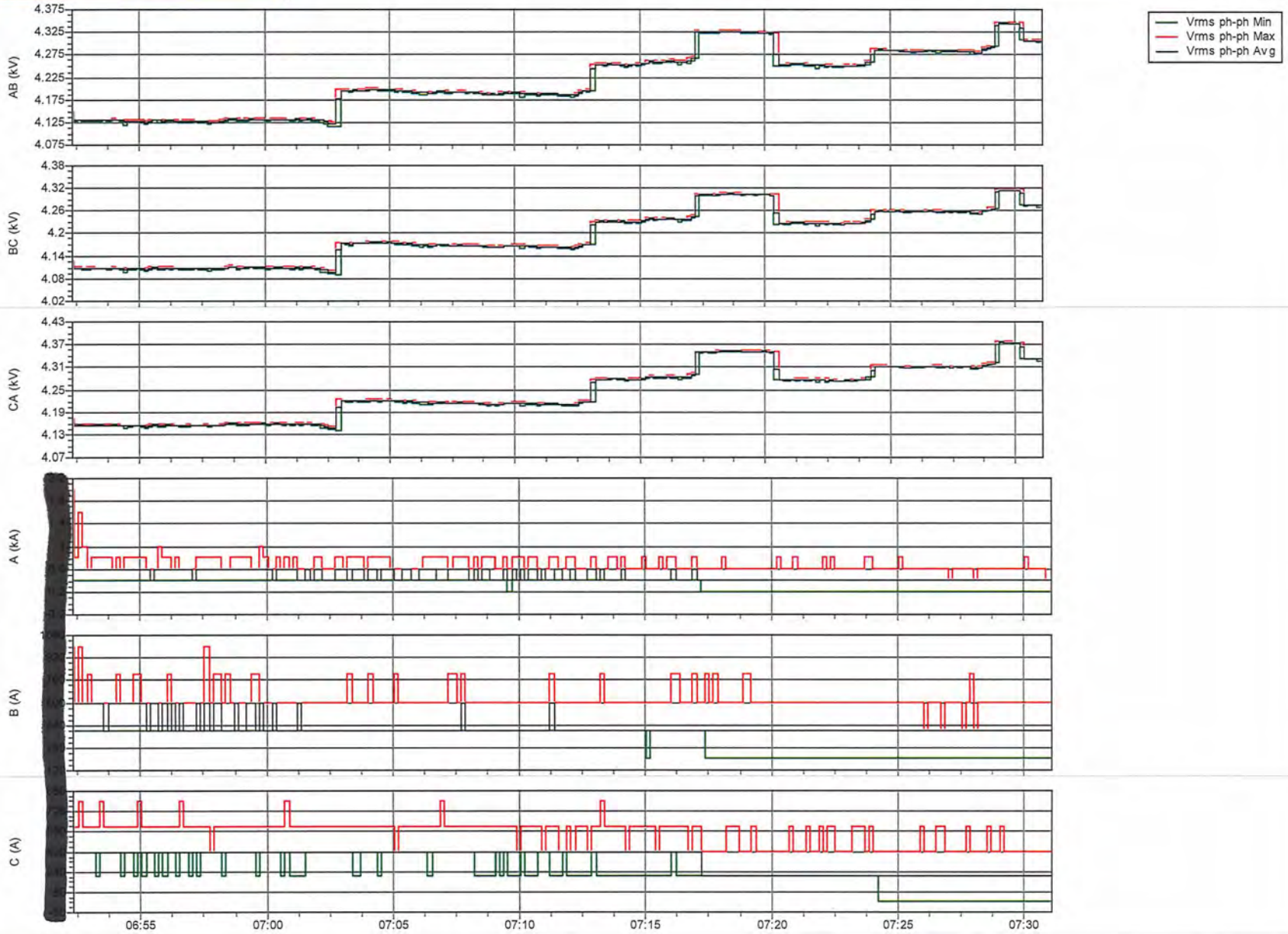
Report Date/Time  
7/15/2020 11:33:44 AM

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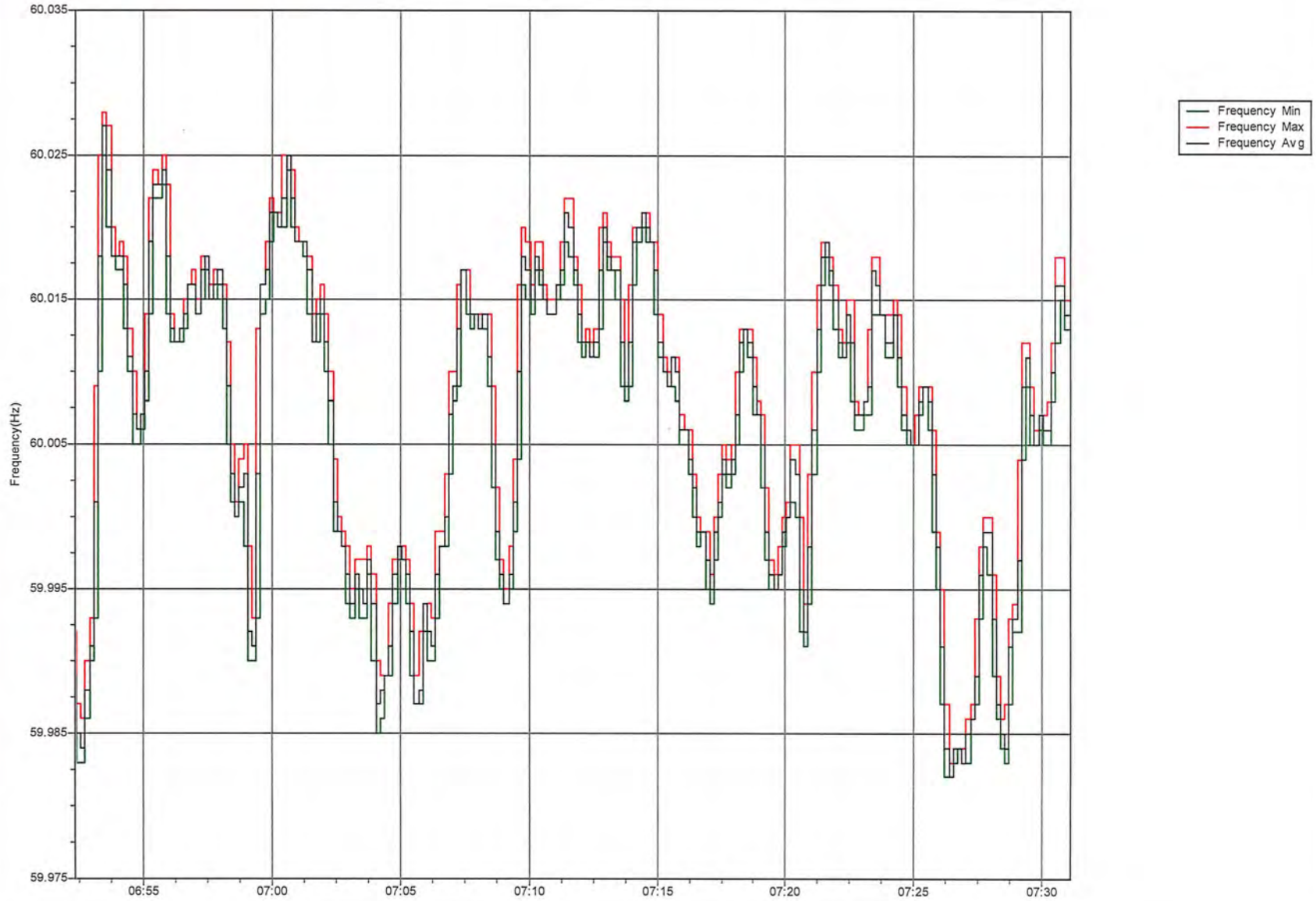
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**Events Summary**

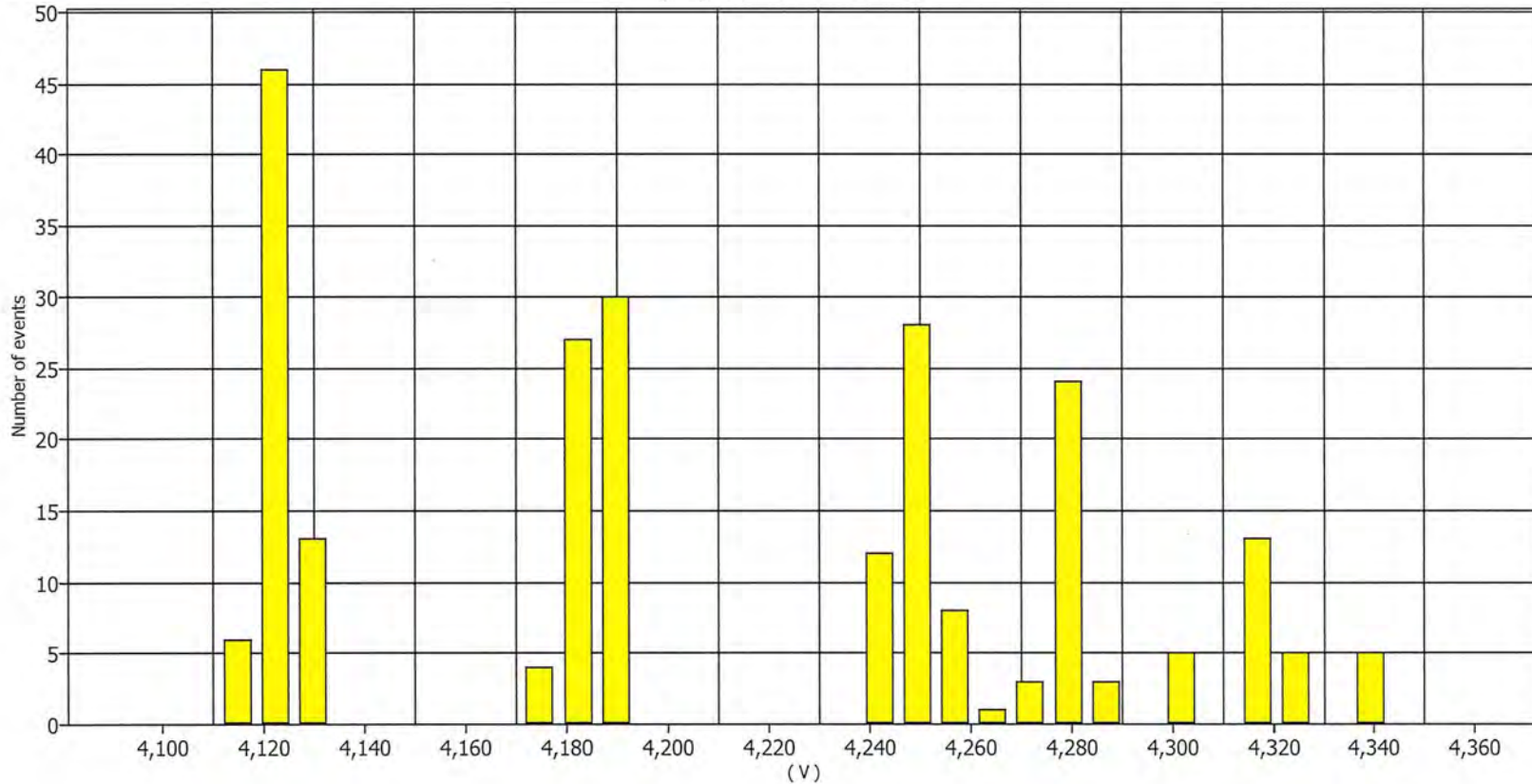
Dips	0
Swells	0
Transients	0
Interruptions	0
Voltage profiles	0
Rapid voltage changes	0
Screens	0
Waveforms	0
Intervals without measurements	0
Inrush current graphics	0
Wave events	0
RMS events	0







Vrms ph-ph - AB - Minimum



**Summary**

From	7/15/2020 6:52:22 AM	5% percentile	4125 V
To	7/15/2020 7:31:02 AM	95% percentile	4324 V
Maximum value	4343.15 V	% [85% - 110%]	0%
At	7/15/2020 7:29:32 AM	% [90% - 110%]	0%
Minimum value	4114.95 V		
At	7/15/2020 7:03:02 AM		
μ (Avg)	4213.38 V		
s	68.4327 V		

**Upper extreme values**

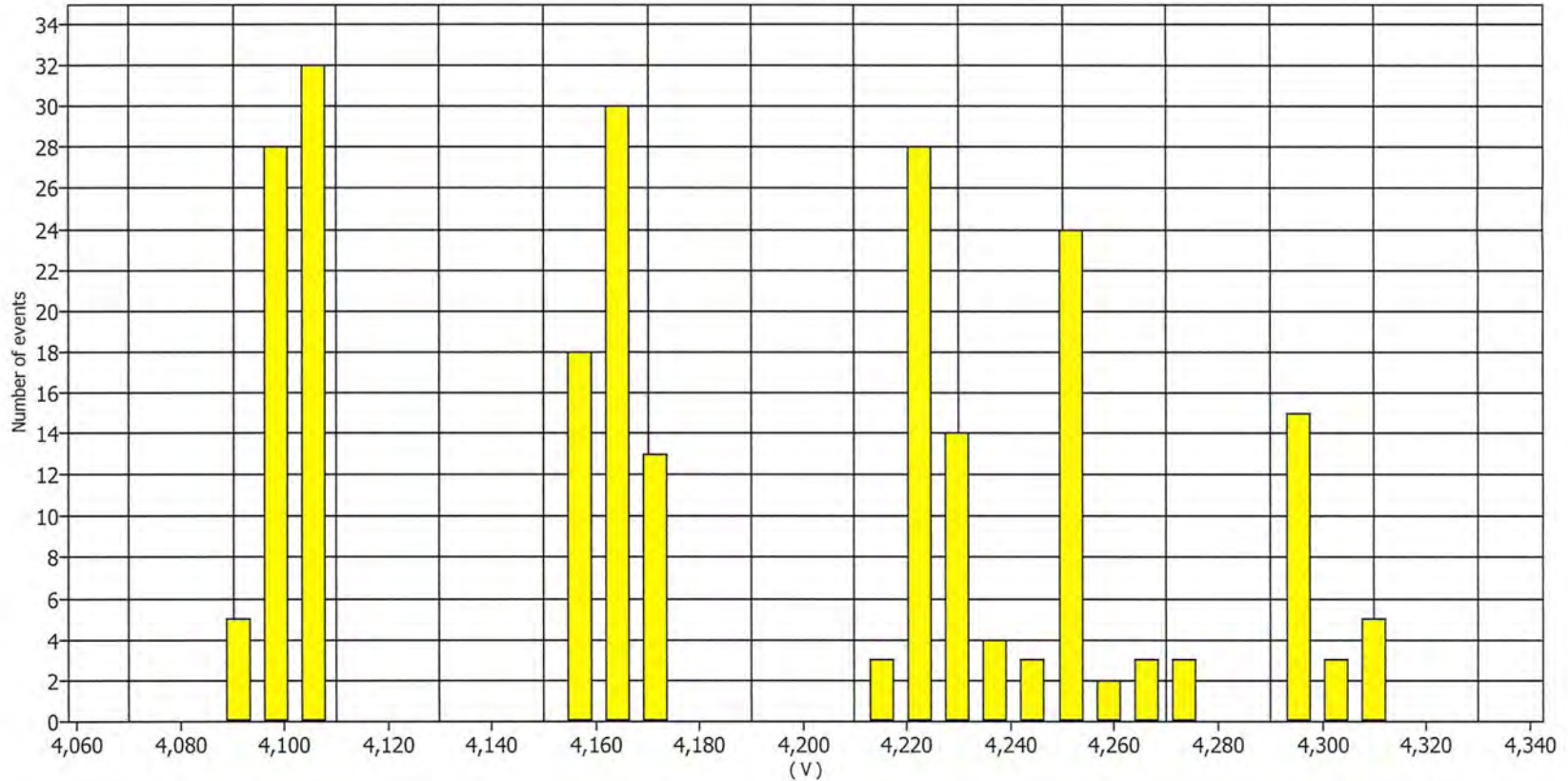
Date / Time	Value
7/15/2020 7:29:32 AM	4343.1499
7/15/2020 7:30:12 AM	4342.4502
7/15/2020 7:29:52 AM	4342.4502
7/15/2020 7:29:42 AM	4342.4502
7/15/2020 7:30:02 AM	4342.1001

**Lower extreme values**

Date / Time	Value
7/15/2020 7:03:02 AM	4114.9502
7/15/2020 7:02:42 AM	4116.3501
7/15/2020 7:02:52 AM	4117.0498
7/15/2020 6:54:32 AM	4119.8501
7/15/2020 6:55:22 AM	4121.6001



Vrms ph-ph - BC - Minimum



**Summary**

From	7/15/2020 6:52:22 AM	5% percentile	4103 V
To	7/15/2020 7:31:02 AM	95% percentile	4302 V
Maximum value	4313.75 V	% [85% - 110%]	0%
At	7/15/2020 7:29:52 AM	% [90% - 110%]	0%
Minimum value	4091.15 V		
At	7/15/2020 7:03:02 AM		
μ (Avg)	4189.97 V		
s	67.0431 V		

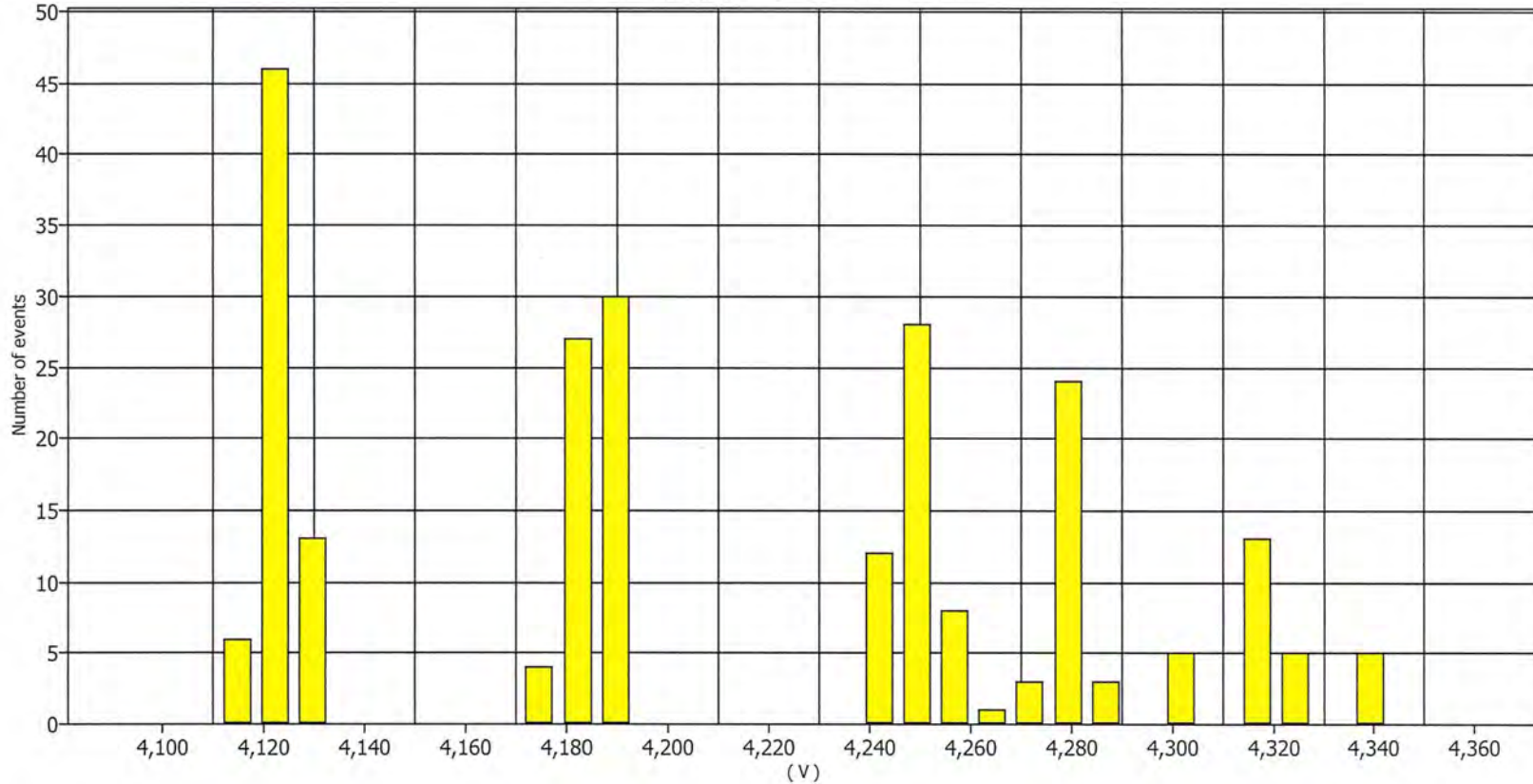
**Upper extreme values**

Date / Time	Value
7/15/2020 7:29:52 AM	4313.75
7/15/2020 7:29:32 AM	4313.0498
7/15/2020 7:30:12 AM	4312.7002
7/15/2020 7:30:02 AM	4312.7002
7/15/2020 7:29:42 AM	4312.7002

**Lower extreme values**

Date / Time	Value
7/15/2020 7:03:02 AM	4091.1501
7/15/2020 7:02:42 AM	4092.9001
7/15/2020 7:02:52 AM	4093.25
7/15/2020 6:54:32 AM	4097.7998
7/15/2020 7:02:32 AM	4098.1499

Vrms ph-ph - CA - Minimum



**Summary**

From	7/15/2020 6:52:22 AM	5% percentile	4125 V
To	7/15/2020 7:31:02 AM	95% percentile	4324 V
Maximum value	4343.15 V	% [85% - 110%]	0%
At	7/15/2020 7:29:32 AM	% [90% - 110%]	0%
Minimum value	4114.95 V		
At	7/15/2020 7:03:02 AM		
μ (Avg)	4213.38 V		
s	68.4327 V		

**Upper extreme values**

Date / Time	Value
7/15/2020 7:29:32 AM	4343.1499
7/15/2020 7:30:12 AM	4342.4502
7/15/2020 7:29:52 AM	4342.4502
7/15/2020 7:29:42 AM	4342.4502
7/15/2020 7:30:02 AM	4342.1001

**Lower extreme values**

Date / Time	Value
7/15/2020 7:03:02 AM	4114.9502
7/15/2020 7:02:42 AM	4116.3501
7/15/2020 7:02:52 AM	4117.0498
7/15/2020 6:54:32 AM	4119.8501
7/15/2020 6:55:22 AM	4121.6001



Filename  
MEAS 11 -- SD Card

Report Date/Time  
7/15/2020 11:56:49 AM

Page 1

**Instrument Information**

Model Number 435-II  
Serial Number 28453110  
Firmware Revision V04.01

**Software Information**

Power Log Version 5.4  
  
FLUKE 430-II DLL Version 1.2.0.13

*Test 2*

**General Information**

Recording location KCWW OHIO RIVER STA  
Client SAME  
Notes

4200V RAIL SIDE NO PUMPS RUNNING



### Measurement Summary

Measurement topology	3-element delta mode
Application mode	Logger
First recording	7/15/2020 8:22:08 AM 886msec
Last recording	7/15/2020 8:42:24 AM 386msec
Recording interval	0h 0m 0s 500msec
Nominal Voltage	100 V
Nominal Current	30 A
Nominal Frequency	60 Hz
File start time	7/15/2020 8:22:08 AM 386msec
File end time	7/15/2020 8:42:24 AM 386msec
Duration	0d 0h 20m 16s 0msec
Number of events	Normal: 0 Detailed: 0
Events downloaded	No
Number of screens	0
Screens downloaded	No
Power measurement method	Unified
Cable type	Copper
Harmonic scale	%H1
THD mode	THD 40
CosPhi / DPF mode	DPF

### Scaling

Phase:	
Current Clamp type	i430Flex
Clamp range	N/A
Nominal range	30 A
Sensitivity	x1
Current ratio	1000:5
Voltage ratio	35:1
Neutral:	
Current Clamp type	i430TF
Clamp range	N/A
Nominal range	300 A
Sensitivity	x10 AC only
Current ratio	1:1
Voltage ratio	1:1

### Recording Summary

RMS recordings	2432
DC recordings	0
Frequency recordings	2432
Unbalance recordings	2432
Harmonic recordings	0
Power harmonic recordings	0
Power recordings	0
Power unbalance recordings	0
Energy recordings	0
Energy losses recordings	0
Flicker recordings	0
Mains signaling recordings	0





Filename  
MEAS 11 -- SD Card

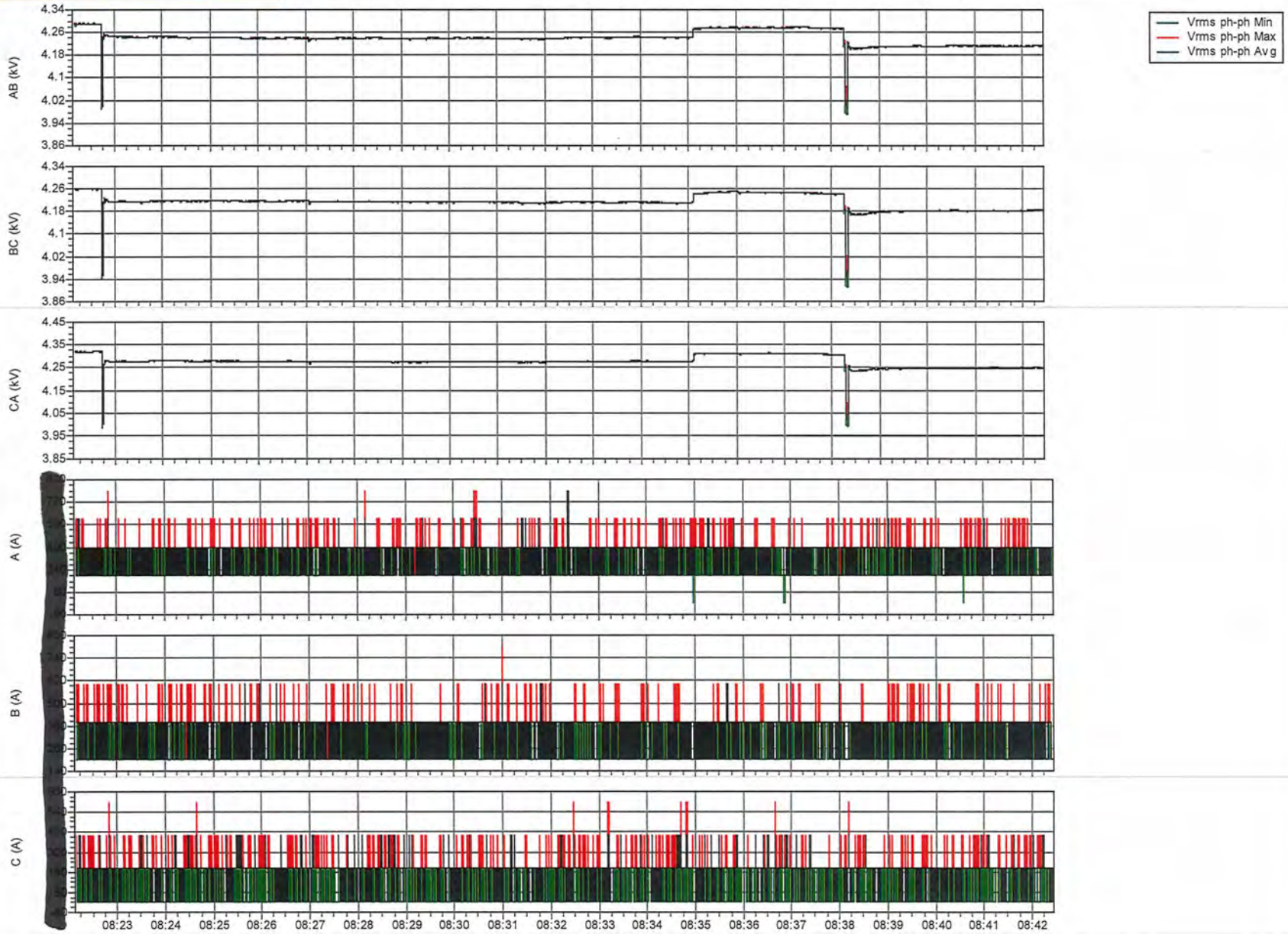
Report Date/Time  
7/15/2020 11:56:49 AM

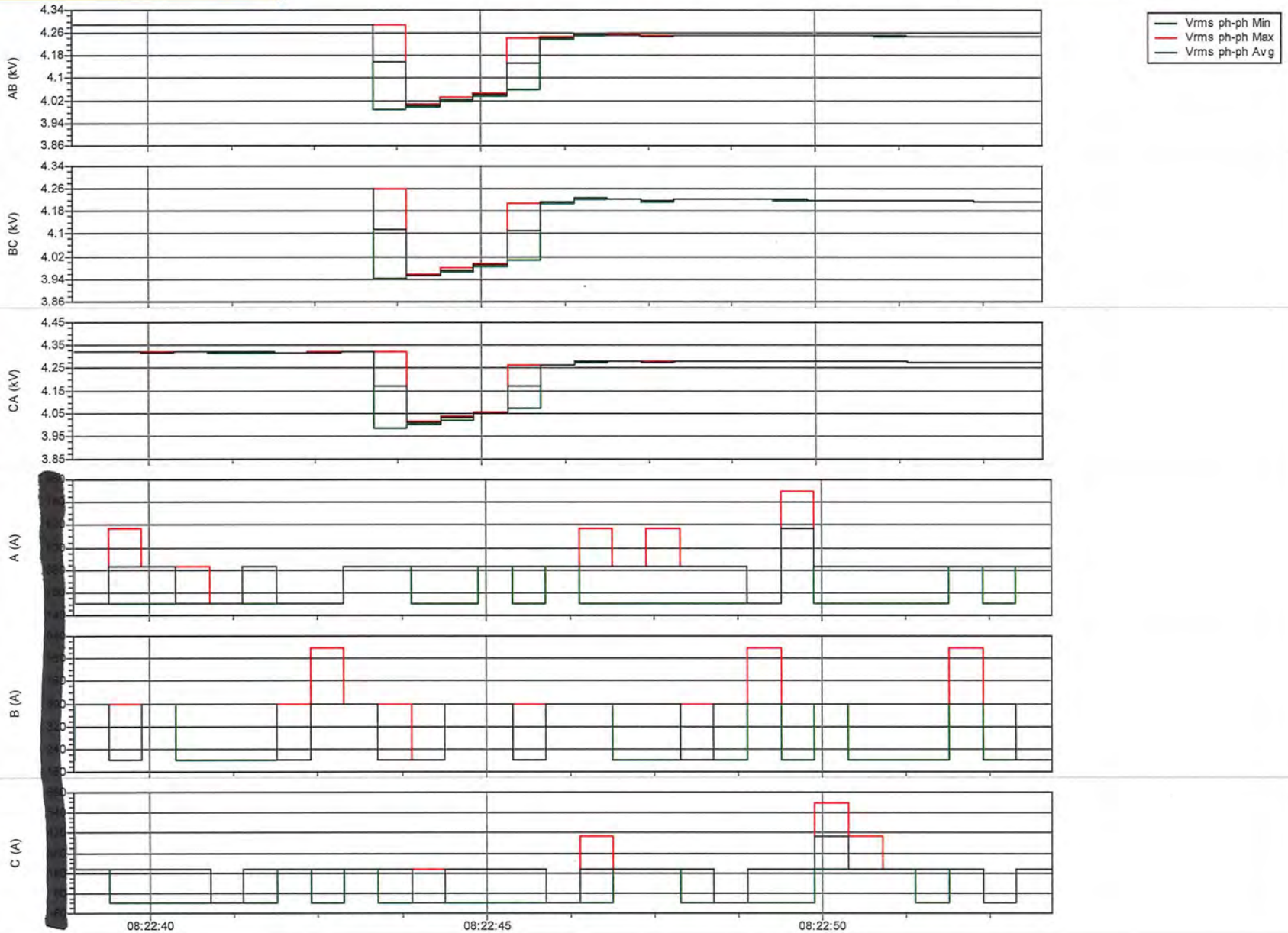
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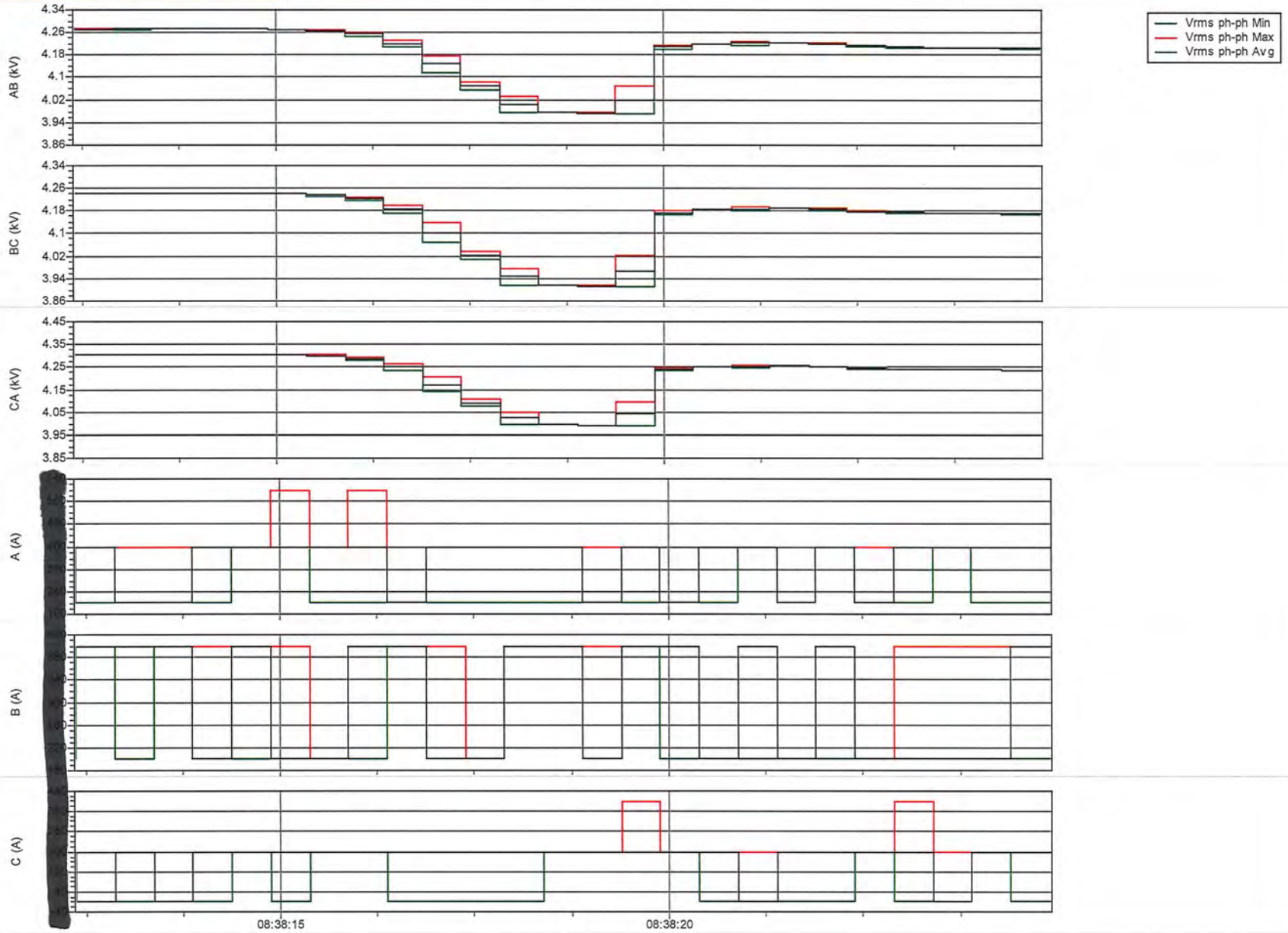
### Events Summary

Dips	0
Swells	0
Transients	0
Interruptions	0
Voltage profiles	0
Rapid voltage changes	0
Screens	0
Waveforms	0
Intervals without measurements	0
Inrush current graphics	0
Wave events	0
RMS events	0

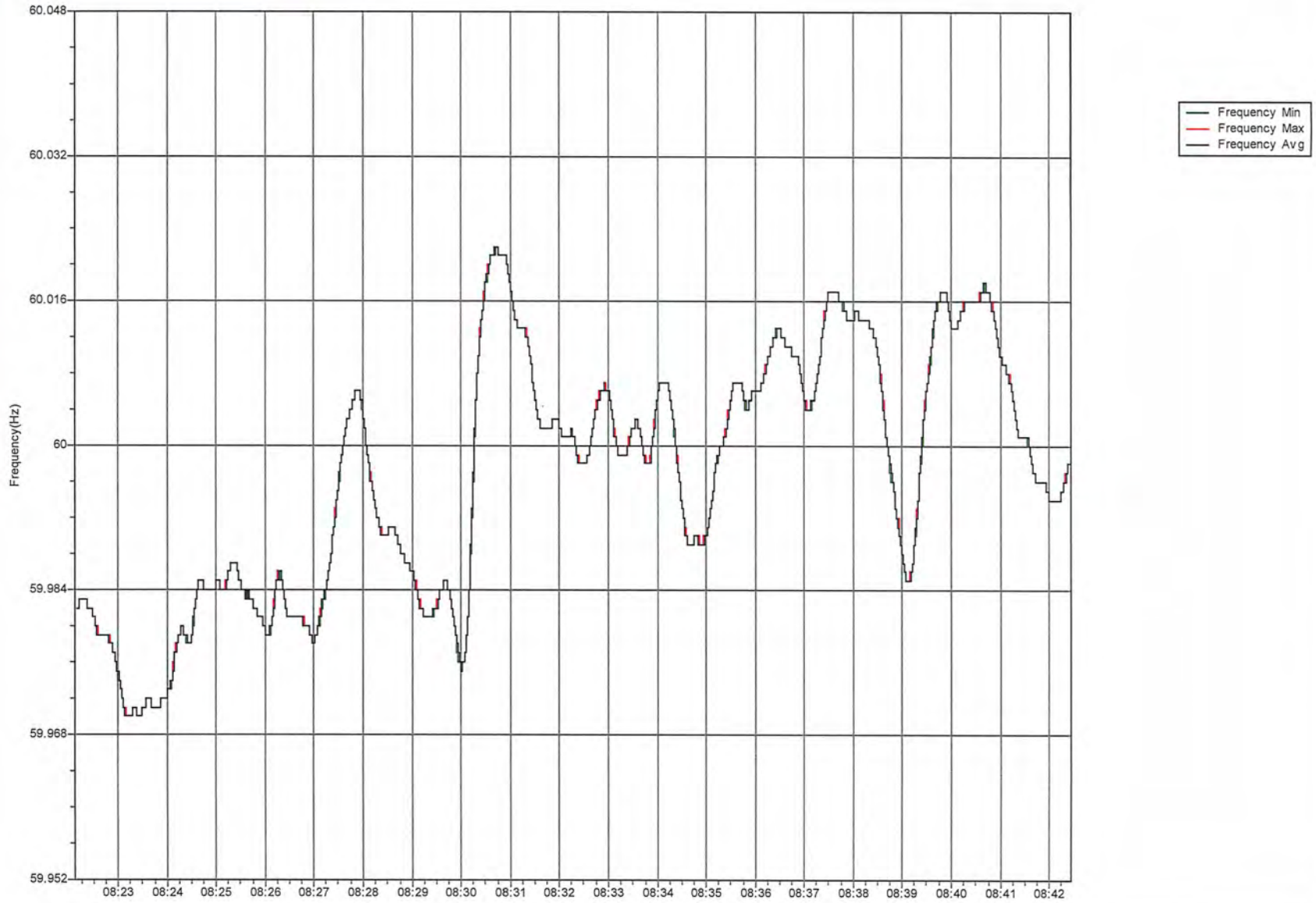




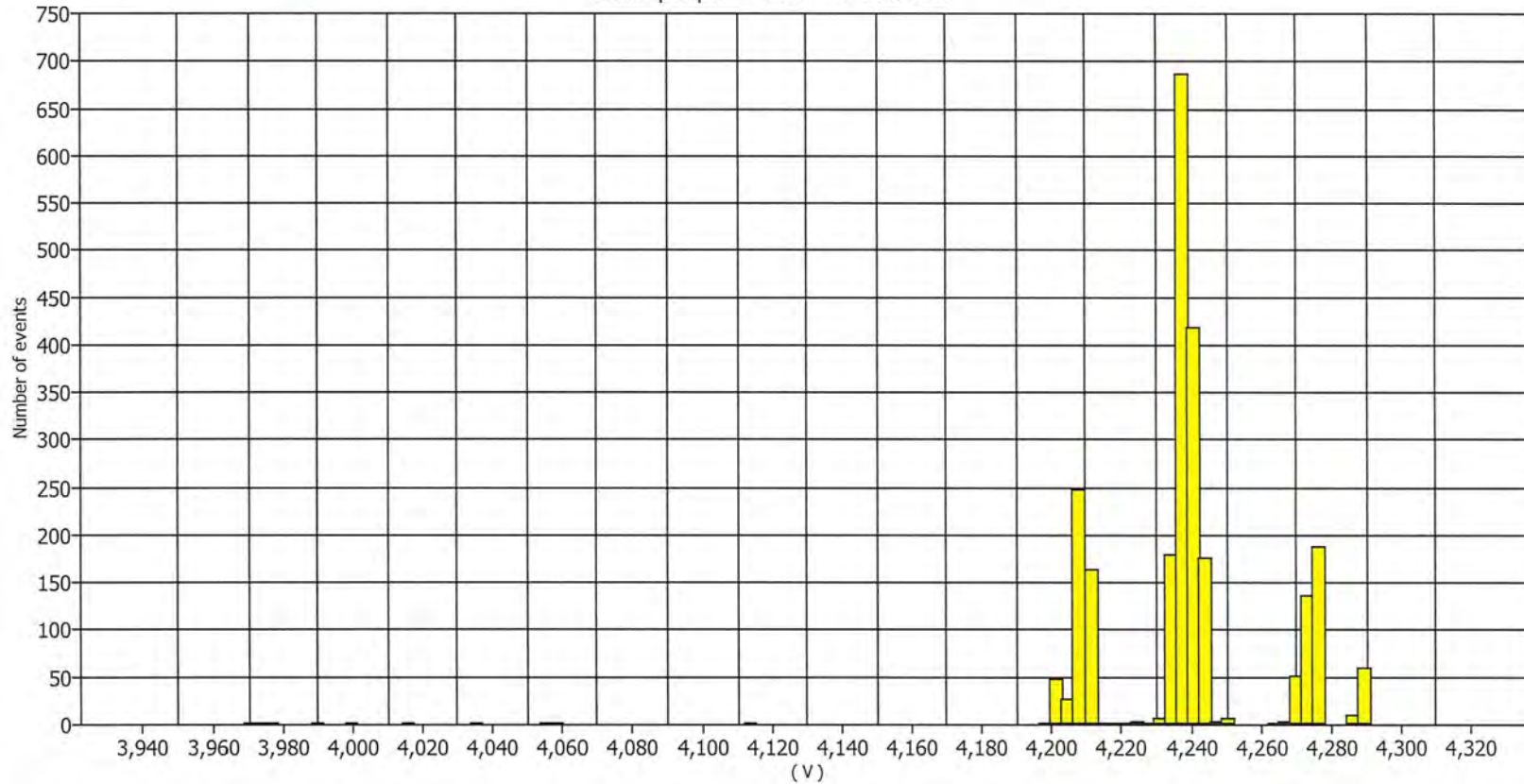








Vrms ph-ph - AB - Minimum



**Summary**

From	7/15/2020 8:22:08 AM	5% percentile	4209 V
To	7/15/2020 8:42:24 AM	95% percentile	4277 V
Maximum value	4291.35 V	% [85% - 110%]	0%
At	7/15/2020 8:22:15 AM	% [90% - 110%]	0%
Minimum value	3970.4 V		
At	7/15/2020 8:38:19 AM		
$\mu$ (Avg)	4240.05 V		
s	26.3379 V		

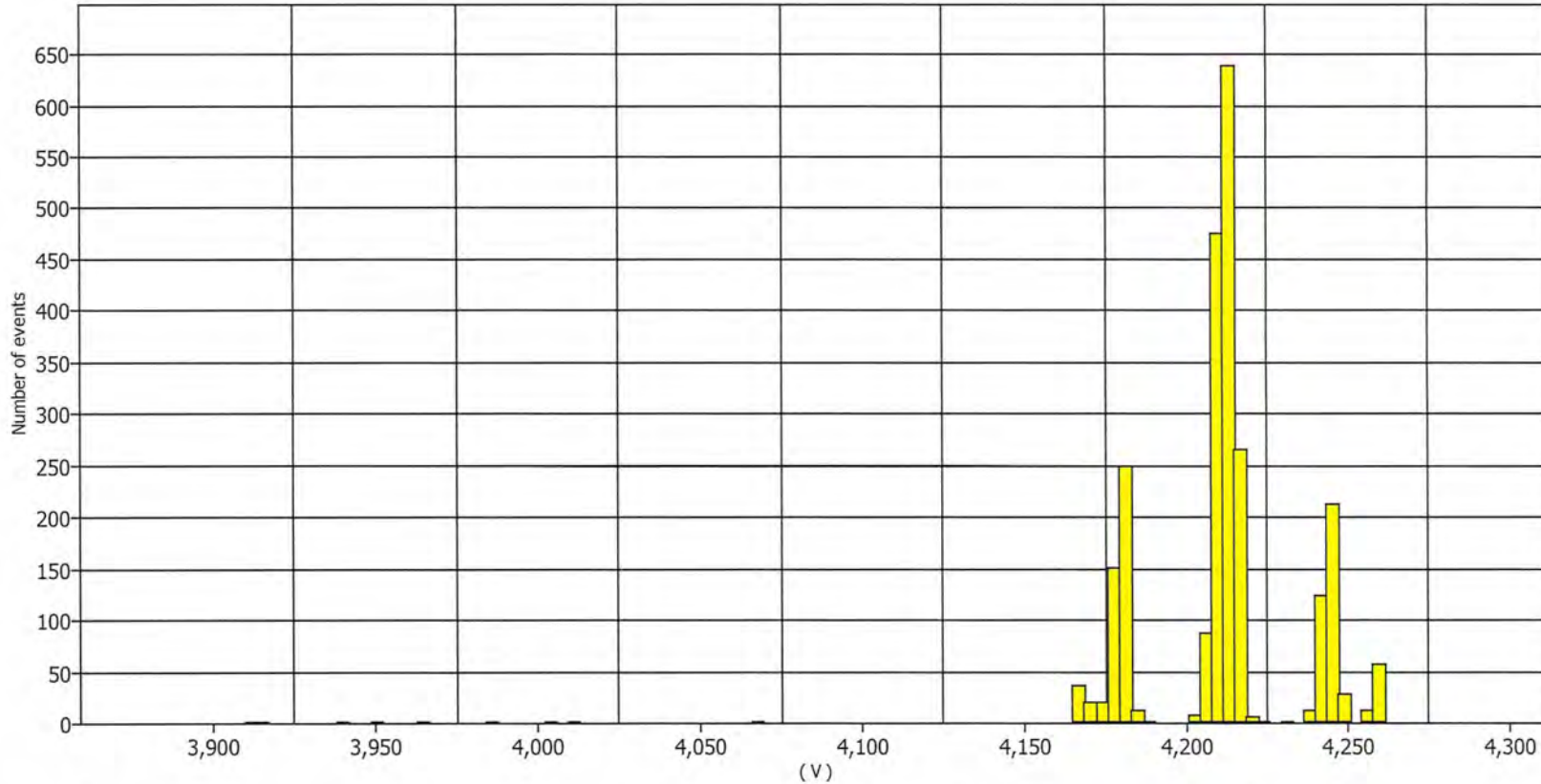
**Upper extreme values**

Date / Time	Value
7/15/2020 8:22:35 AM	4291.3501
7/15/2020 8:22:21 AM	4291.3501
7/15/2020 8:22:16 AM	4291.3501
7/15/2020 8:22:15 AM	4291.3501
7/15/2020 8:22:36 AM	4291

**Lower extreme values**

Date / Time	Value
7/15/2020 8:38:19 AM	3970.3999
7/15/2020 8:38:19 AM	3970.75
7/15/2020 8:38:18 AM	3976
7/15/2020 8:38:18 AM	3977.05
7/15/2020 8:22:43 AM	3991.75

Vrms ph-ph - BC - Minimum



**Summary**

From	7/15/2020 8:22:08 AM	5% percentile	4180 V
To	7/15/2020 8:42:24 AM	95% percentile	4248 V
Maximum value	4261.6 V	% [85% - 110%]	0%
At	7/15/2020 8:22:21 AM	% [90% - 110%]	0%
Minimum value	3911.6 V		
At	7/15/2020 8:38:19 AM		
$\mu$ (Avg)	4212.23 V		
s	27.3827 V		

**Upper extreme values**

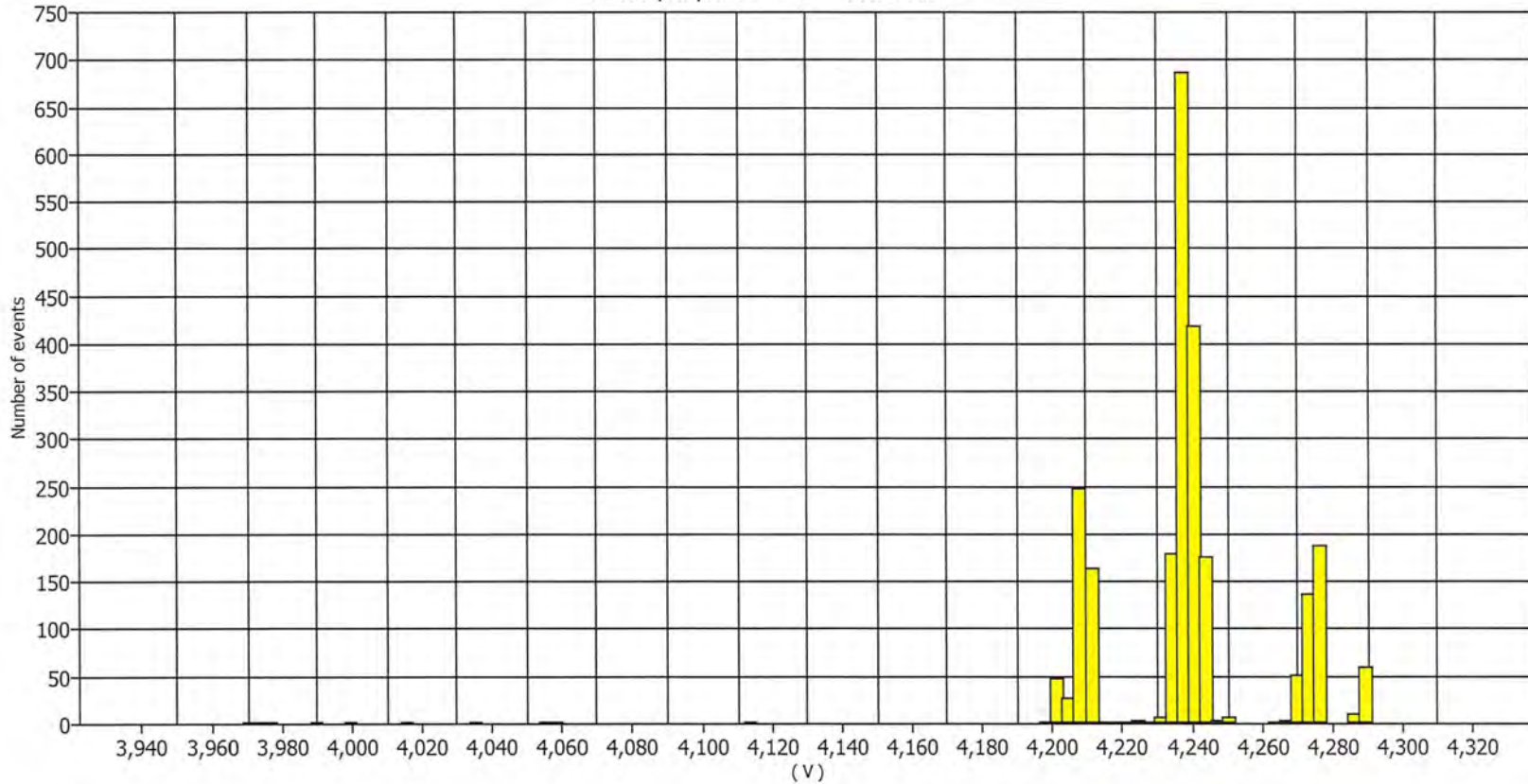
Date / Time	Value
7/15/2020 8:22:35 AM	4261.6001
7/15/2020 8:22:21 AM	4261.6001
7/15/2020 8:22:35 AM	4261.25
7/15/2020 8:22:34 AM	4261.25
7/15/2020 8:22:34 AM	4261.25

**Lower extreme values**

Date / Time	Value
7/15/2020 8:38:19 AM	3911.6001
7/15/2020 8:38:19 AM	3912.6499
7/15/2020 8:38:18 AM	3916.8501
7/15/2020 8:38:18 AM	3917.8999
7/15/2020 8:22:43 AM	3941.7



Vrms ph-ph - CA - Minimum



**Summary**

From	7/15/2020 8:22:08 AM	5% percentile	4209 V
To	7/15/2020 8:42:24 AM	95% percentile	4277 V
Maximum value	4291.35 V	% [85% - 110%]	0%
At	7/15/2020 8:22:15 AM	% [90% - 110%]	0%
Minimum value	3970.4 V		
At	7/15/2020 8:38:19 AM		
$\mu$ (Avg)	4240.05 V		
s	26.3379 V		

**Upper extreme values**

Date / Time	Value
7/15/2020 8:22:35 AM	4291.3501
7/15/2020 8:22:21 AM	4291.3501
7/15/2020 8:22:16 AM	4291.3501
7/15/2020 8:22:15 AM	4291.3501
7/15/2020 8:22:36 AM	4291

**Lower extreme values**

Date / Time	Value
7/15/2020 8:38:19 AM	3970.3999
7/15/2020 8:38:19 AM	3970.75
7/15/2020 8:38:18 AM	3976
7/15/2020 8:38:18 AM	3977.05
7/15/2020 8:22:43 AM	3991.75



Filename  
MEAS 10 -- SD Card

Report Date/Time  
7/15/2020 11:40:17 AM

Page 1

**Instrument Information**

Model Number 435-II  
Serial Number 28453110  
Firmware Revision V04.01

**Software Information**

Power Log Version 5.4  
  
FLUKE 430-II DLL Version 1.2.0.13

*TEST # 1*

**General Information**

Recording location KCWW OHIO RIVER STA  
Client SAME  
Notes

4200V RAIL SIDE NO PUMPS RUNNING



Filename  
MEAS 10 -- SD Card

Report Date/Time  
7/15/2020 11:40:17 AM

Page 2

### Measurement Summary

Measurement topology	3-element delta mode
Application mode	Logger
First recording	7/15/2020 7:40:32 AM 471msec
Last recording	7/15/2020 8:09:33 AM 971msec
Recording interval	0h 0m 0s 500msec
Nominal Voltage	173 V
Nominal Current	30 A
Nominal Frequency	60 Hz
File start time	7/15/2020 7:40:31 AM 971msec
File end time	7/15/2020 8:09:33 AM 971msec
Duration	0d 0h 29m 2s 0msec
Number of events	Normal: 0 Detailed: 0
Events downloaded	No
Number of screens	0
Screens downloaded	Yes
Power measurement method	Unified
Cable type	Copper
Harmonic scale	%H1
THD mode	THD 40
CosPhi / DPF mode	DPF

### Scaling

Phase:	
Current Clamp type	i430Flex
Clamp range	N/A
Nominal range	30 A
Sensitivity	x1
Current ratio	1000:5
Voltage ratio	35:1
Neutral:	
Current Clamp type	i430TF
Clamp range	N/A
Nominal range	300 A
Sensitivity	x10 AC only
Current ratio	1:1
Voltage ratio	1:1

### Recording Summary

RMS recordings	3484
DC recordings	0
Frequency recordings	3484
Unbalance recordings	3484
Harmonic recordings	0
Power harmonic recordings	0
Power recordings	0
Power unbalance recordings	0
Energy recordings	0
Energy losses recordings	0
Flicker recordings	0
Mains signaling recordings	0



Filename  
MEAS 10 -- SD Card

Report Date/Time  
7/15/2020 11:40:17 AM

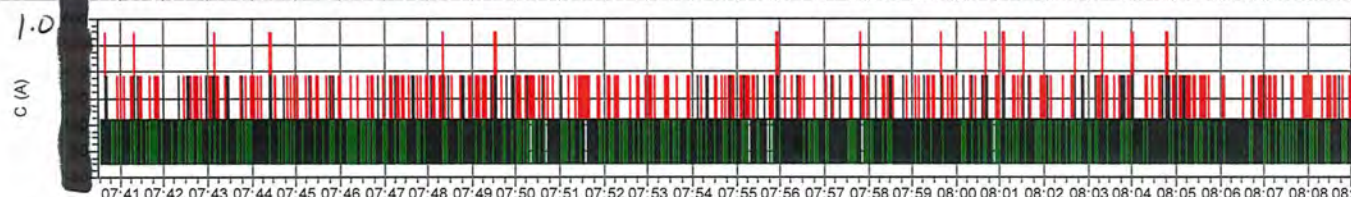
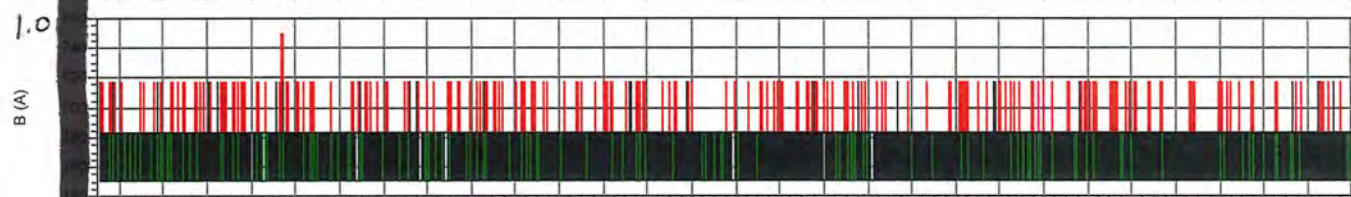
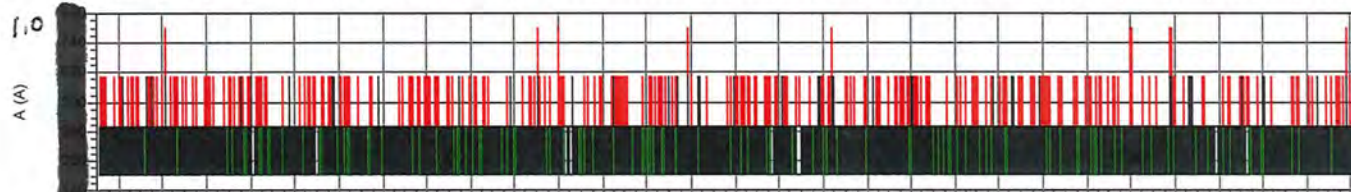
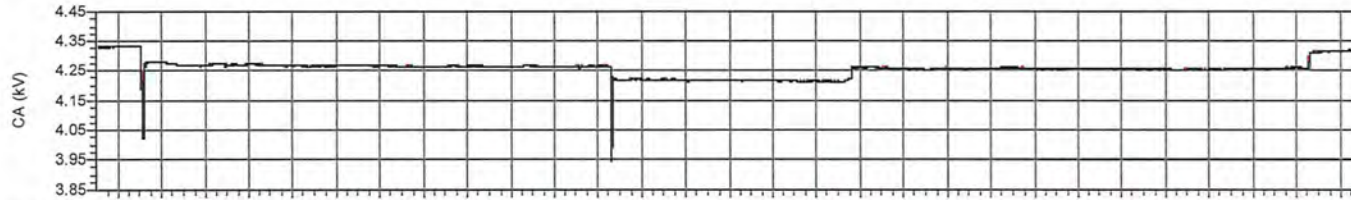
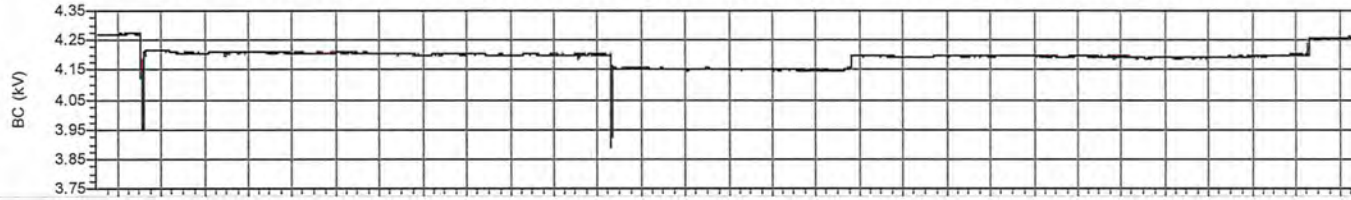
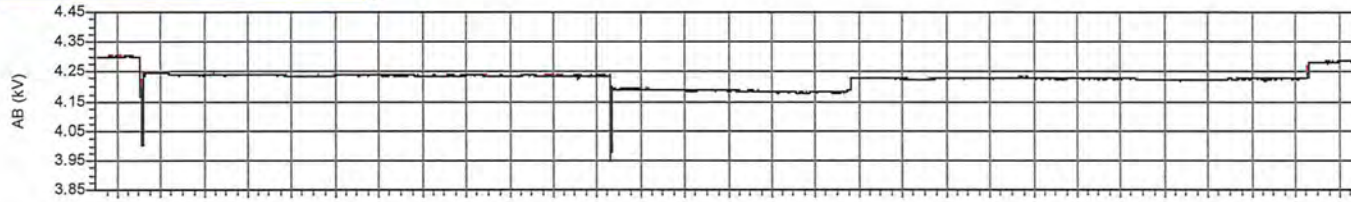
Page 3

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### Events Summary

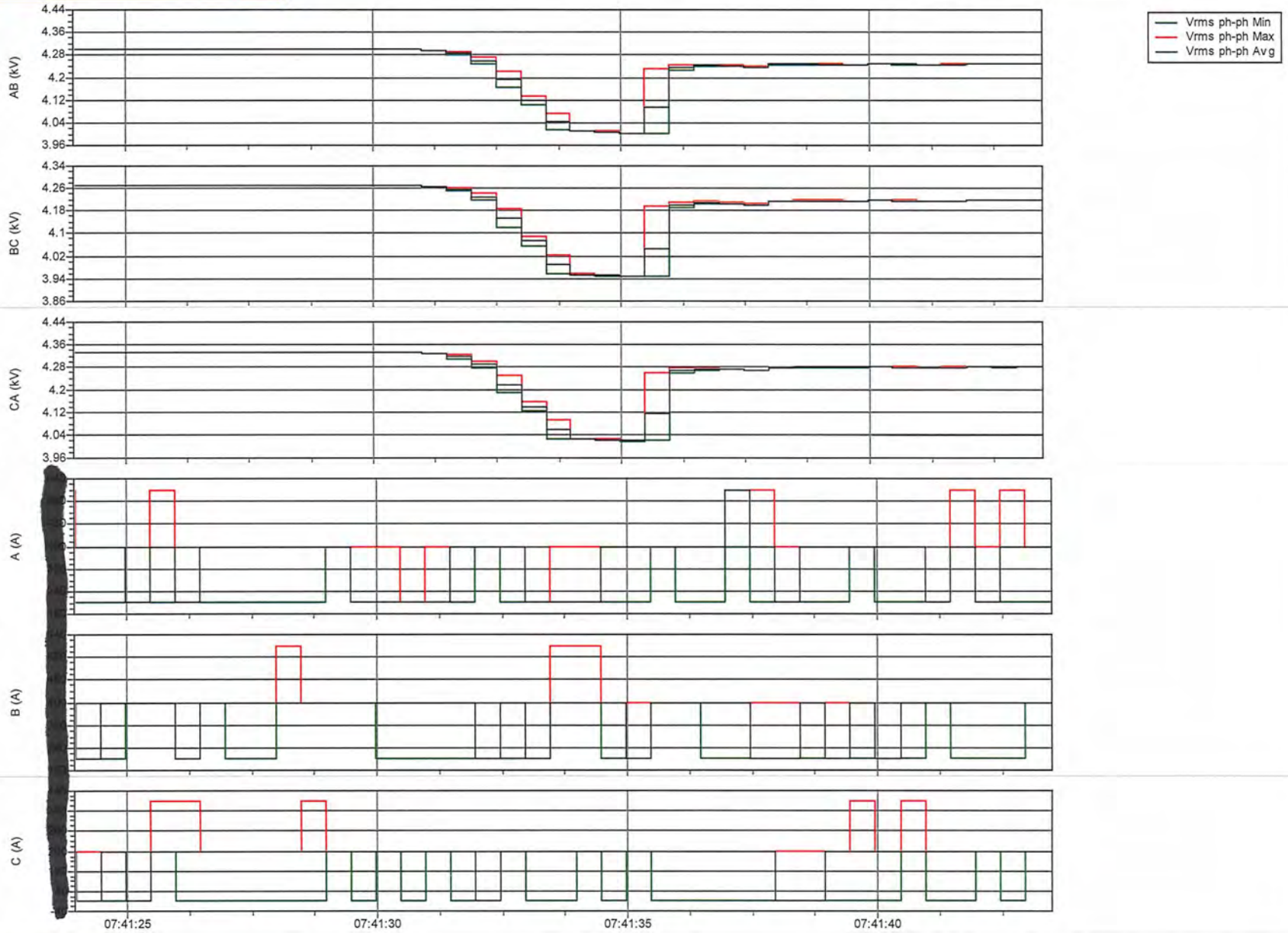
Dips	0
Swells	0
Transients	0
Interruptions	0
Voltage profiles	0
Rapid voltage changes	0
Screens	0
Waveforms	0
Intervals without measurements	0
Inrush current graphics	0
Wave events	0
RMS events	0

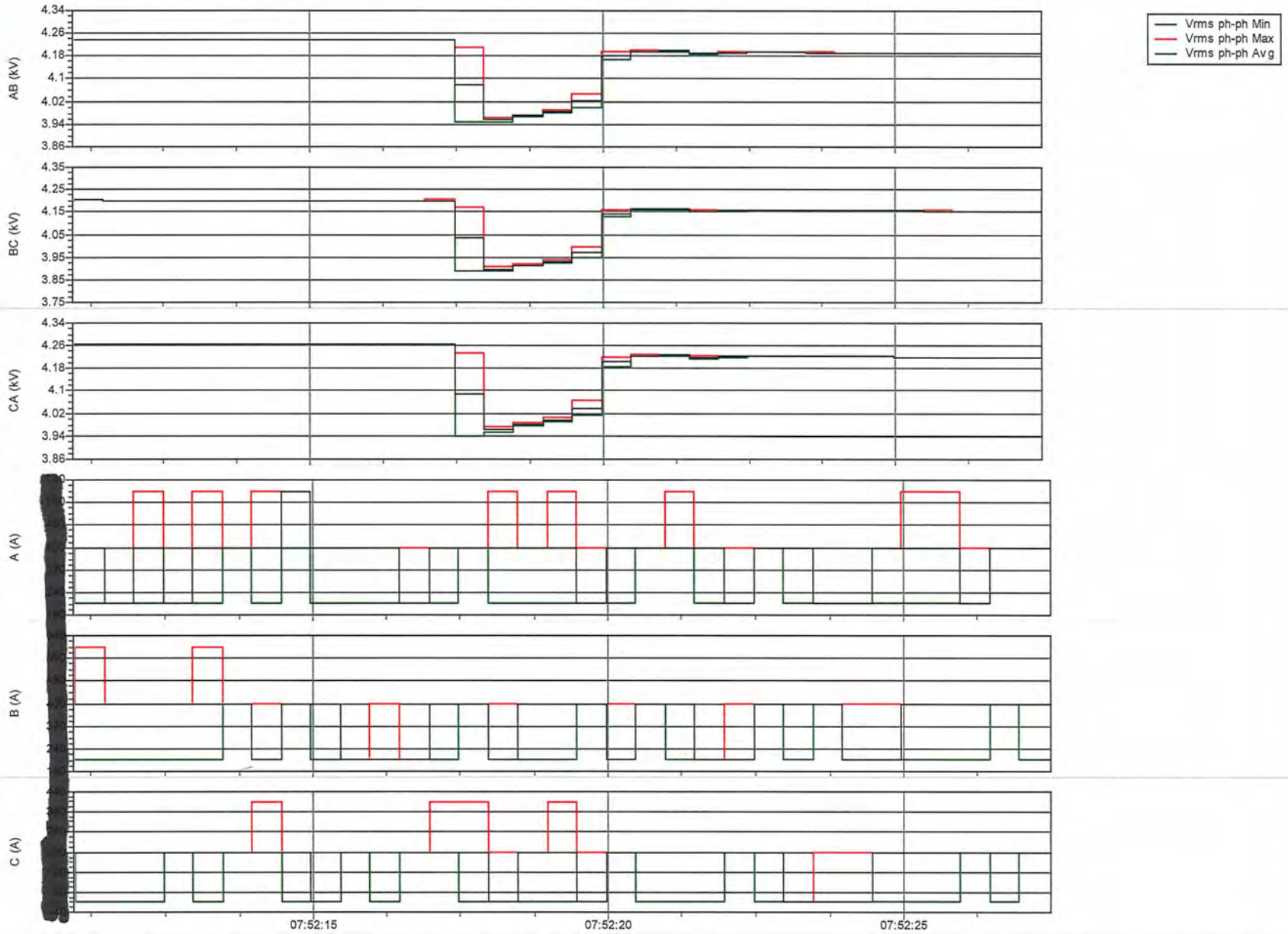


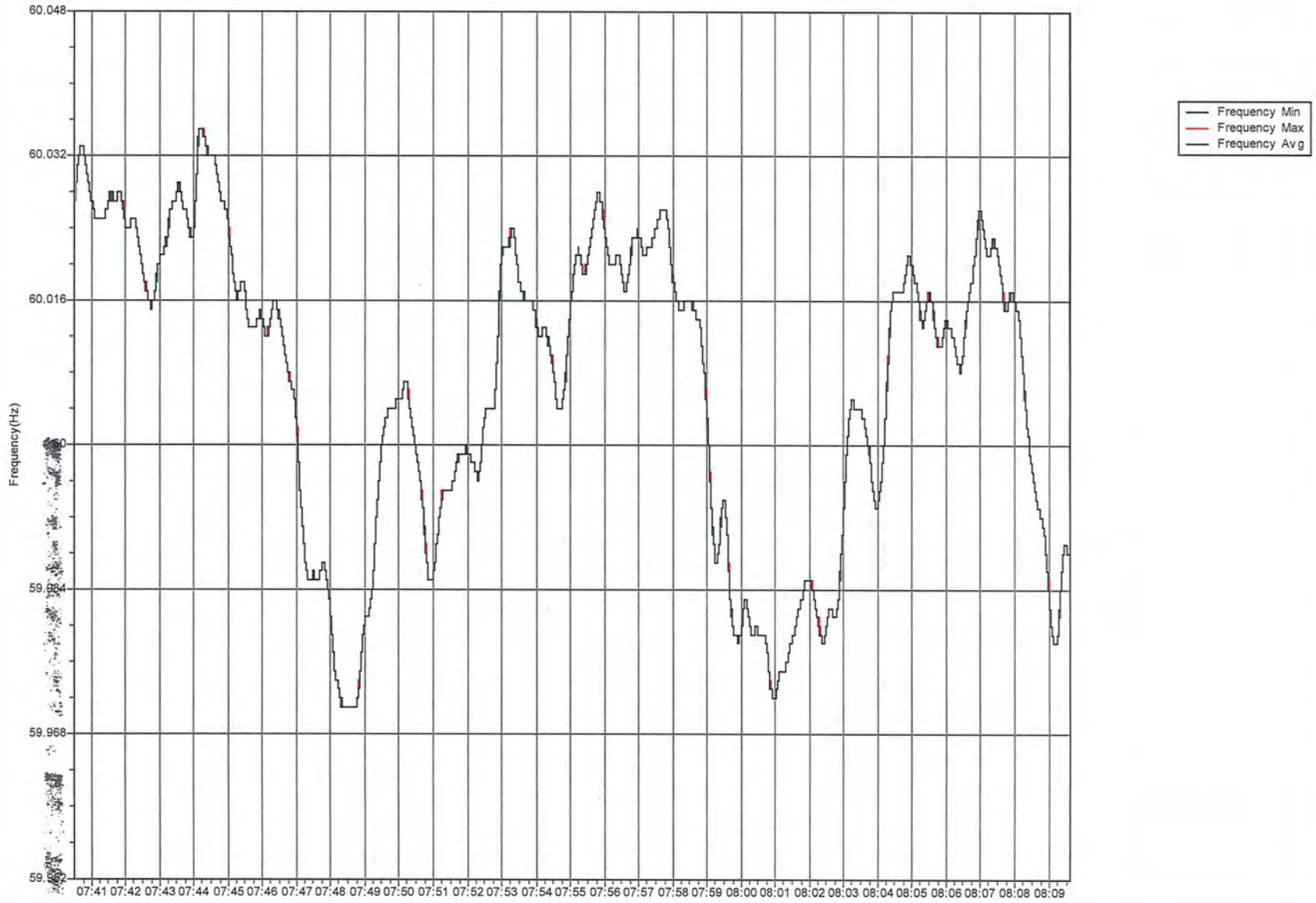


07:41 07:42 07:43 07:44 07:45 07:46 07:47 07:48 07:49 07:50 07:51 07:52 07:53 07:54 07:55 07:56 07:57 07:58 07:59 08:00 08:01 08:02 08:03 08:04 08:05 08:06 08:07 08:08 08:09



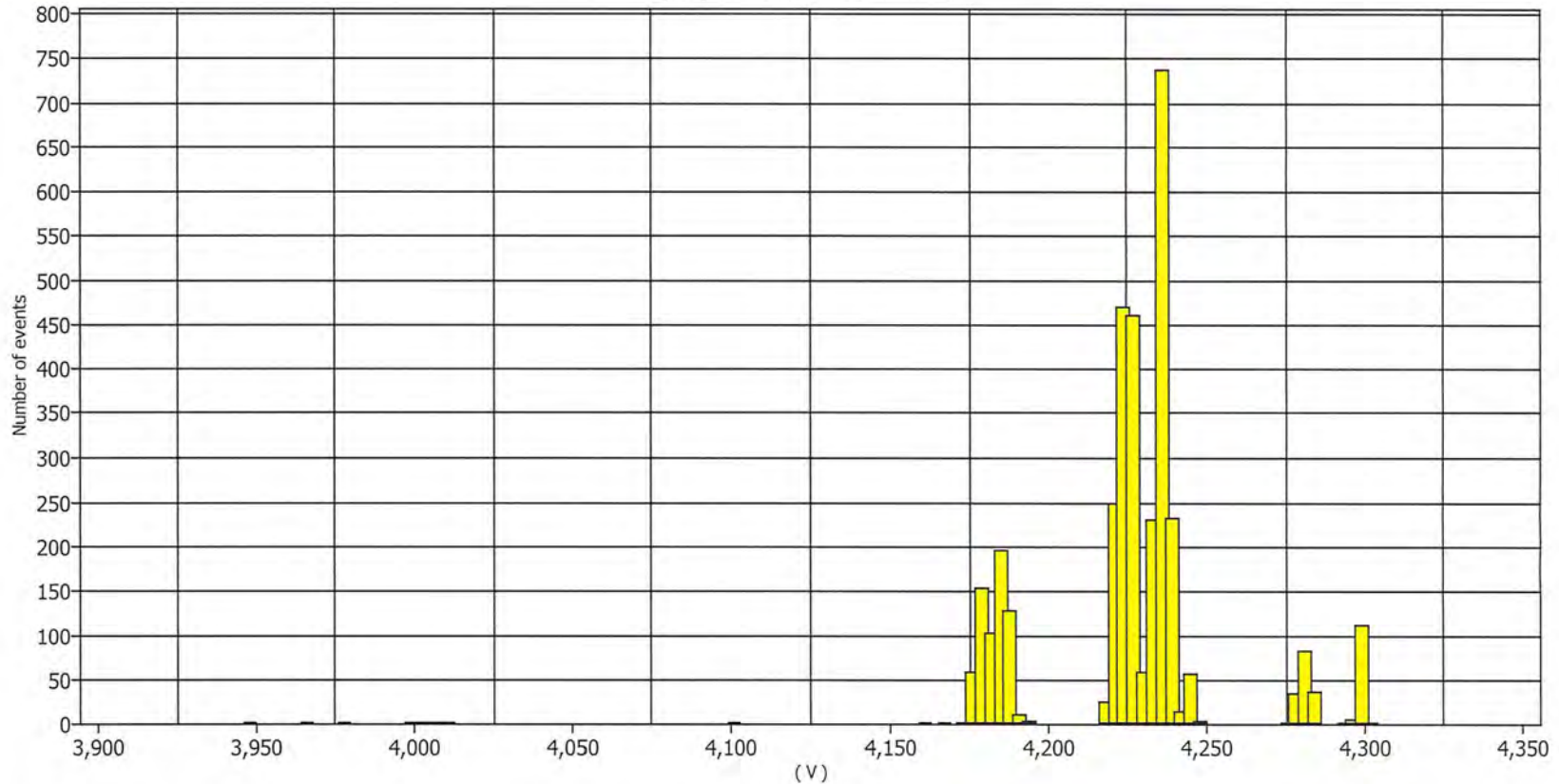








Vrms ph-ph - AB - Minimum



**Summary**

From	7/15/2020 7:40:32 AM	5% percentile	4180 V
To	7/15/2020 8:09:33 AM	95% percentile	4283 V
Maximum value	4302.2 V	% [85% - 110%]	0%
At	7/15/2020 7:41:14 AM	% [90% - 110%]	0%
Minimum value	3948 V		
At	7/15/2020 7:52:17 AM		
$\mu$ (Avg)	4227.01 V		
s	29.6908 V		

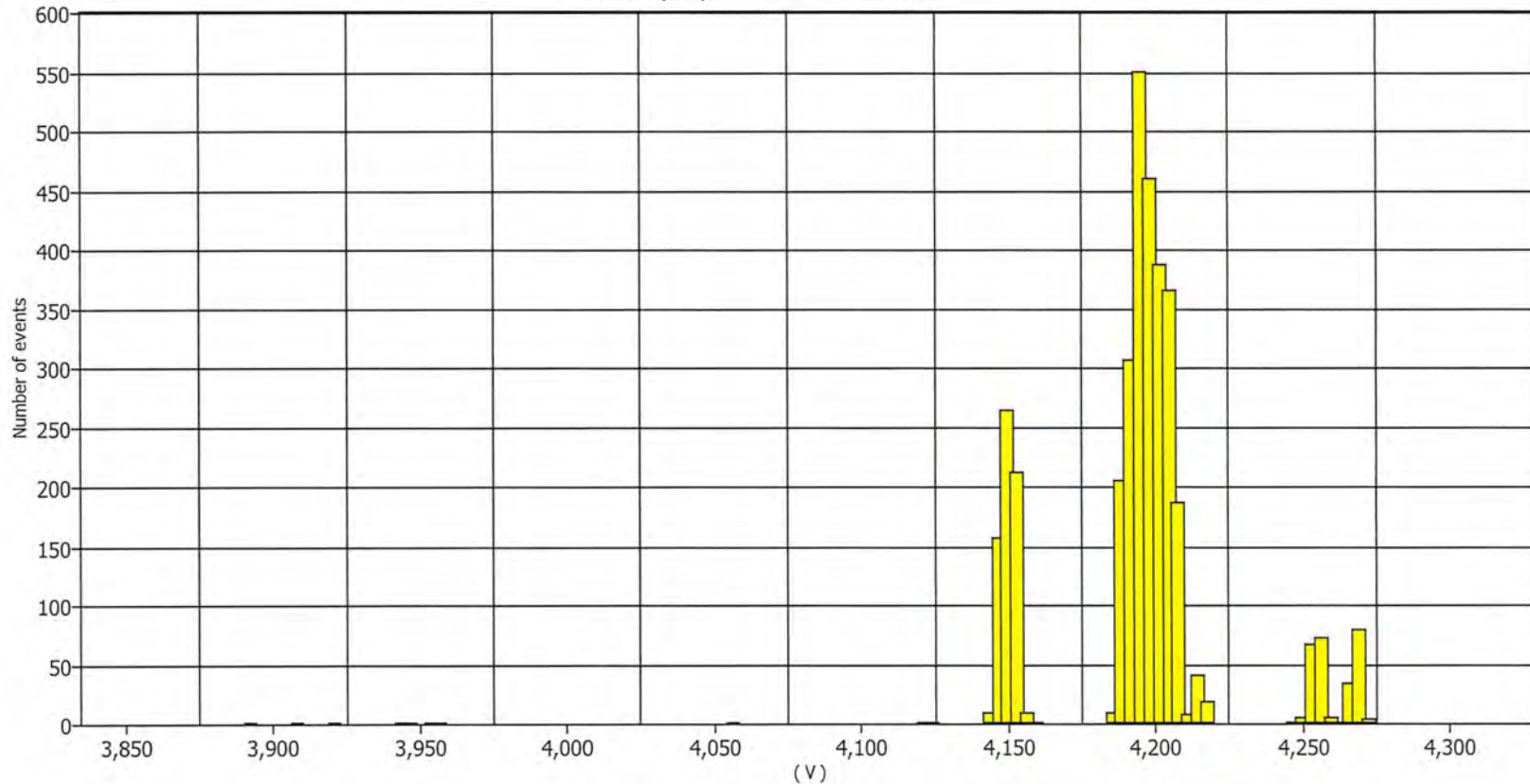
**Upper extreme values**

Date / Time	Value
7/15/2020 7:41:14 AM	4302.2002
7/15/2020 7:41:13 AM	4301.8501
7/15/2020 7:41:13 AM	4301.8501
7/15/2020 7:41:10 AM	4301.8501
7/15/2020 7:41:10 AM	4301.8501

**Lower extreme values**

Date / Time	Value
7/15/2020 7:52:17 AM	3948
7/15/2020 7:52:18 AM	3950.8
7/15/2020 7:52:18 AM	3968.3
7/15/2020 7:52:19 AM	3979.1501
7/15/2020 7:52:19 AM	3999.45

Vrms ph-ph - BC - Minimum



**Summary**

From	7/15/2020 7:40:32 AM	5% percentile	4150 V
To	7/15/2020 8:09:33 AM	95% percentile	4257 V
Maximum value	4272.45 V	% [85% - 110%]	0%
At	7/15/2020 7:41:14 AM	% [90% - 110%]	0%
Minimum value	3892 V		
At	7/15/2020 7:52:18 AM		
$\mu$ (Avg)	4194.99 V		
s	31.0974 V		

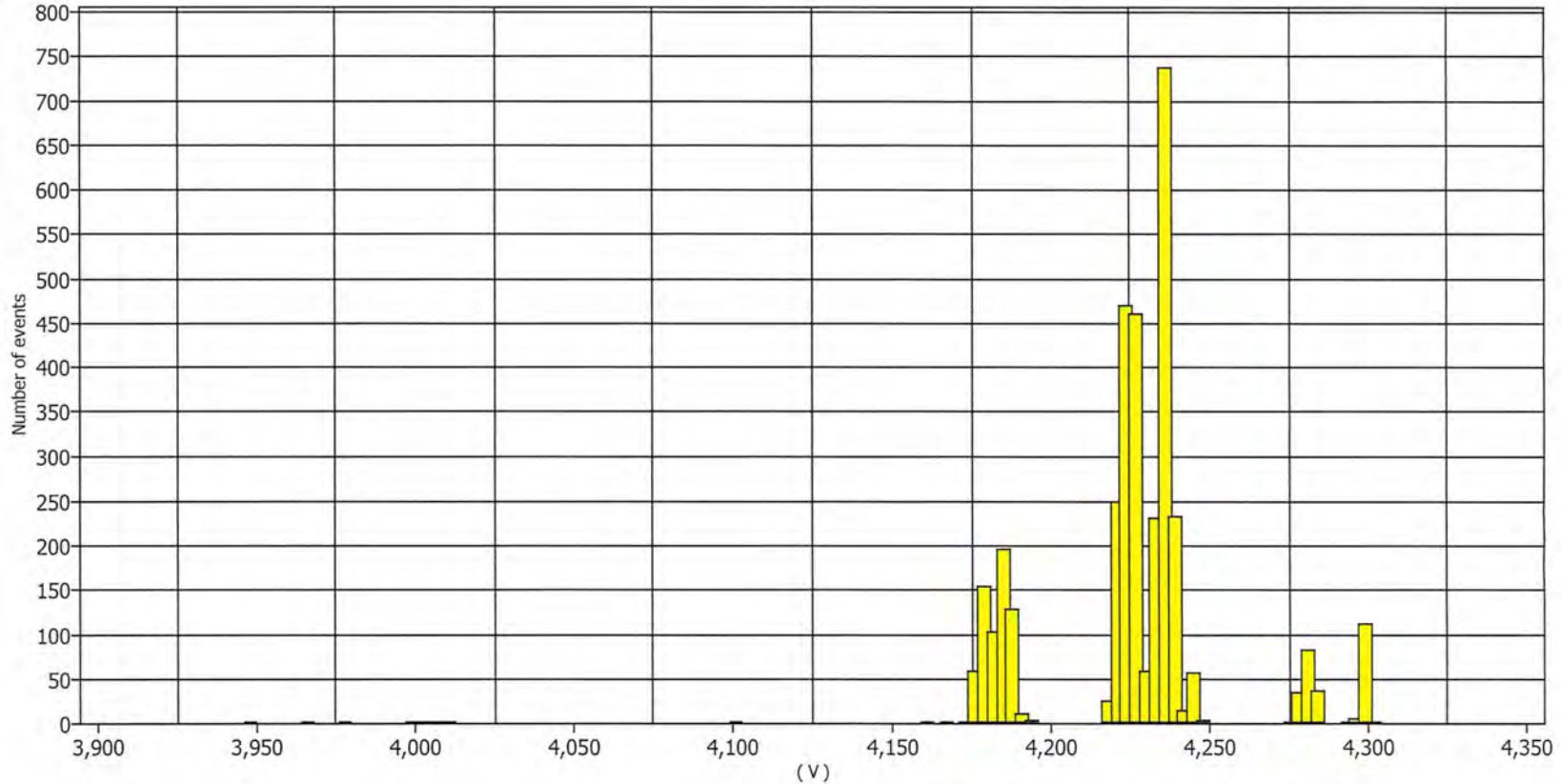
**Upper extreme values**

Date / Time	Value
7/15/2020 7:41:17 AM	4272.4502
7/15/2020 7:41:17 AM	4272.4502
7/15/2020 7:41:14 AM	4272.4502
7/15/2020 7:41:14 AM	4272.4502
7/15/2020 7:41:30 AM	4272.1001

**Lower extreme values**

Date / Time	Value
7/15/2020 7:52:18 AM	3892
7/15/2020 7:52:17 AM	3892.7
7/15/2020 7:52:18 AM	3910.55
7/15/2020 7:52:19 AM	3922.45
7/15/2020 7:52:19 AM	3945.2

Vrms ph-ph - CA - Minimum



**Summary**

From	7/15/2020 7:40:32 AM	5% percentile	4180 V
To	7/15/2020 8:09:33 AM	95% percentile	4283 V
Maximum value	4302.2 V	% [85% - 110%]	0%
At	7/15/2020 7:41:14 AM	% [90% - 110%]	0%
Minimum value	3948 V		
At	7/15/2020 7:52:17 AM		
μ (Avg)	4227.01 V		
s	29.6908 V		

**Upper extreme values**

Date / Time	Value
7/15/2020 7:41:14 AM	4302.2002
7/15/2020 7:41:13 AM	4301.8501
7/15/2020 7:41:13 AM	4301.8501
7/15/2020 7:41:10 AM	4301.8501
7/15/2020 7:41:10 AM	4301.8501

**Lower extreme values**

Date / Time	Value
7/15/2020 7:52:17 AM	3948
7/15/2020 7:52:18 AM	3950.8
7/15/2020 7:52:18 AM	3968.3
7/15/2020 7:52:19 AM	3979.1501
7/15/2020 7:52:19 AM	3999.45



Filename  
MEASUREMENT 16 -- SD Card

Report Date/Time  
7/15/2020 12:58:24 PM

Page 1

**Instrument Information**

Model Number           Fluke 430xII  
Serial Number           N/A  
Firmware Revision       N/A

**Software Information**

Power Log Version       5.4  
  
FLUKE 430-II DLL Version   1.2.0.13

*Test #1*

**General Information**

Recording location       KCWW OHIO RIVER STA  
Client                    SAME  
Notes

4200V RIVER SIDE TEST 1  
SOFT START PUMP #4  
RVS START PUMP #6





Filename  
 MEASUREMENT 16 -- SD Card

Report Date/Time  
 7/15/2020 12:58:24 PM

Page 2

### Measurement Summary

Measurement topology	3-element delta mode
Application mode	Logger
First recording	7/15/2020 7:40:57 AM 500msec
Last recording	7/15/2020 8:09:33 AM 0msec
Recording interval	0h 0m 0s 500msec
Nominal Voltage	173 V
Nominal Current	5 A
Nominal Frequency	60 Hz
File start time	7/15/2020 7:40:57 AM 0msec
File end time	7/15/2020 8:09:33 AM 0msec
Duration	0d 0h 28m 36s 0msec
Number of events	Normal: 1 Detailed: 0
Events downloaded	Yes
Number of screens	0
Screens downloaded	Yes
Power measurement method	Unified
Cable type	Aluminium
Harmonic scale	%H1
THD mode	THD 40
CosPhi / DPF mode	DPF

### Scaling

Phase:	
Current Clamp type	i5s
Clamp range	400 mV/A
Nominal range	5 A
Sensitivity	x1
Current ratio	1000:5
Voltage ratio	35:1
Neutral:	
Current Clamp type	i430TF
Clamp range	N/A
Nominal range	300 A
Sensitivity	x10 AC only
Current ratio	1:1
Voltage ratio	1:1

### Recording Summary

RMS recordings	3432
DC recordings	0
Frequency recordings	3432
Unbalance recordings	3432
Harmonic recordings	0
Power harmonic recordings	0
Power recordings	0
Power unbalance recordings	0
Energy recordings	0
Energy losses recordings	0
Flicker recordings	0
Mains signaling recordings	0

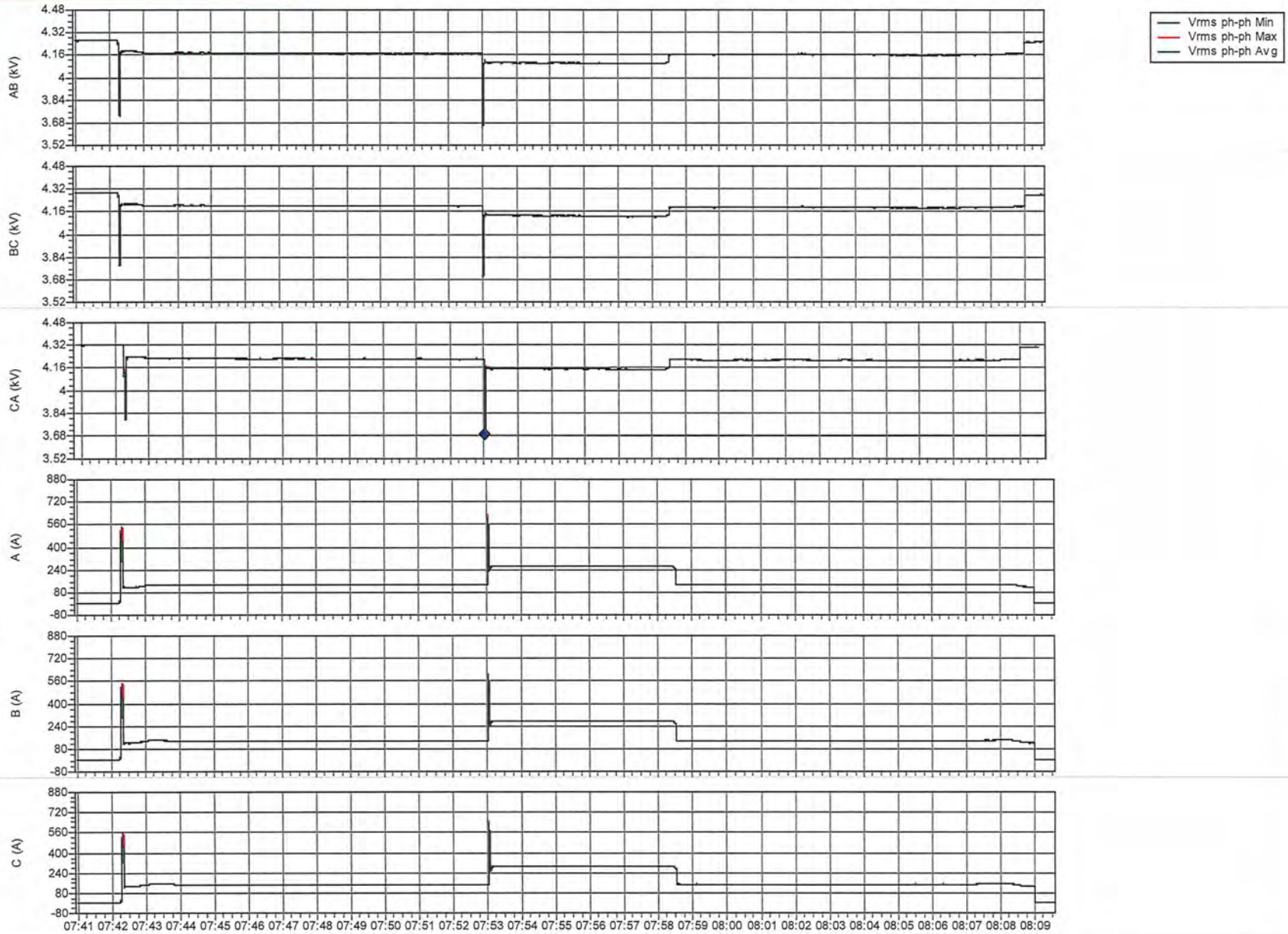


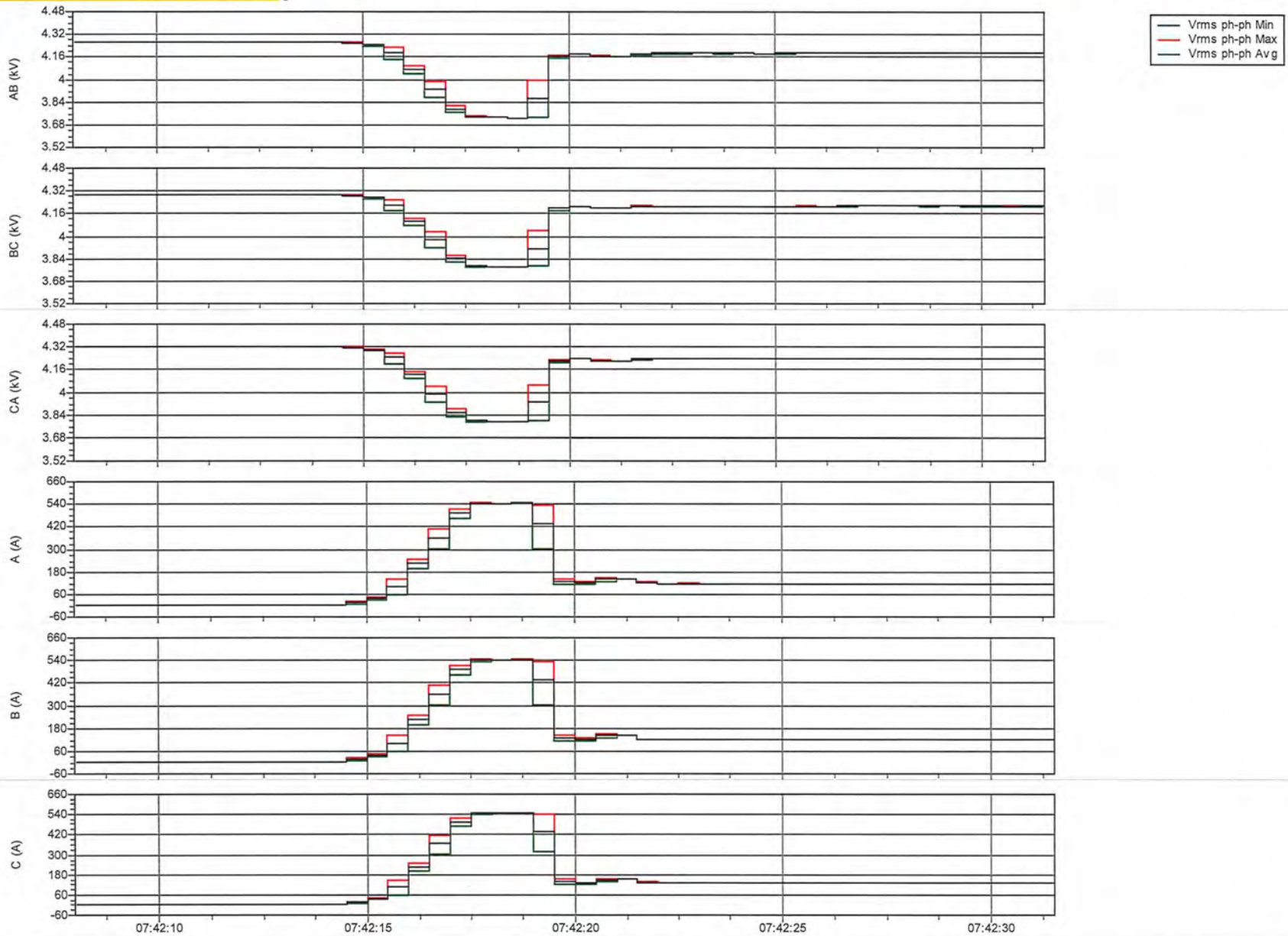


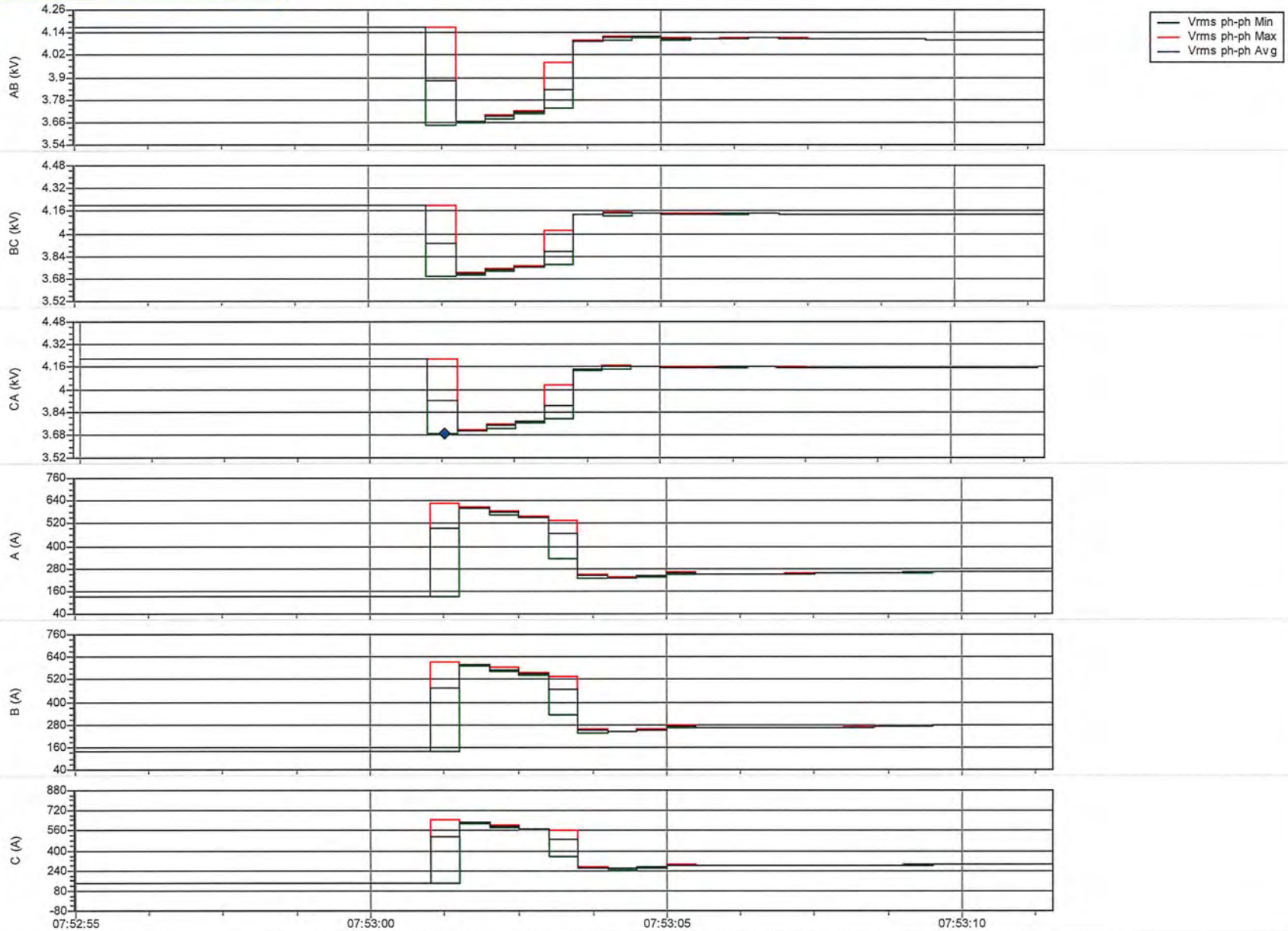
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**Events Summary**

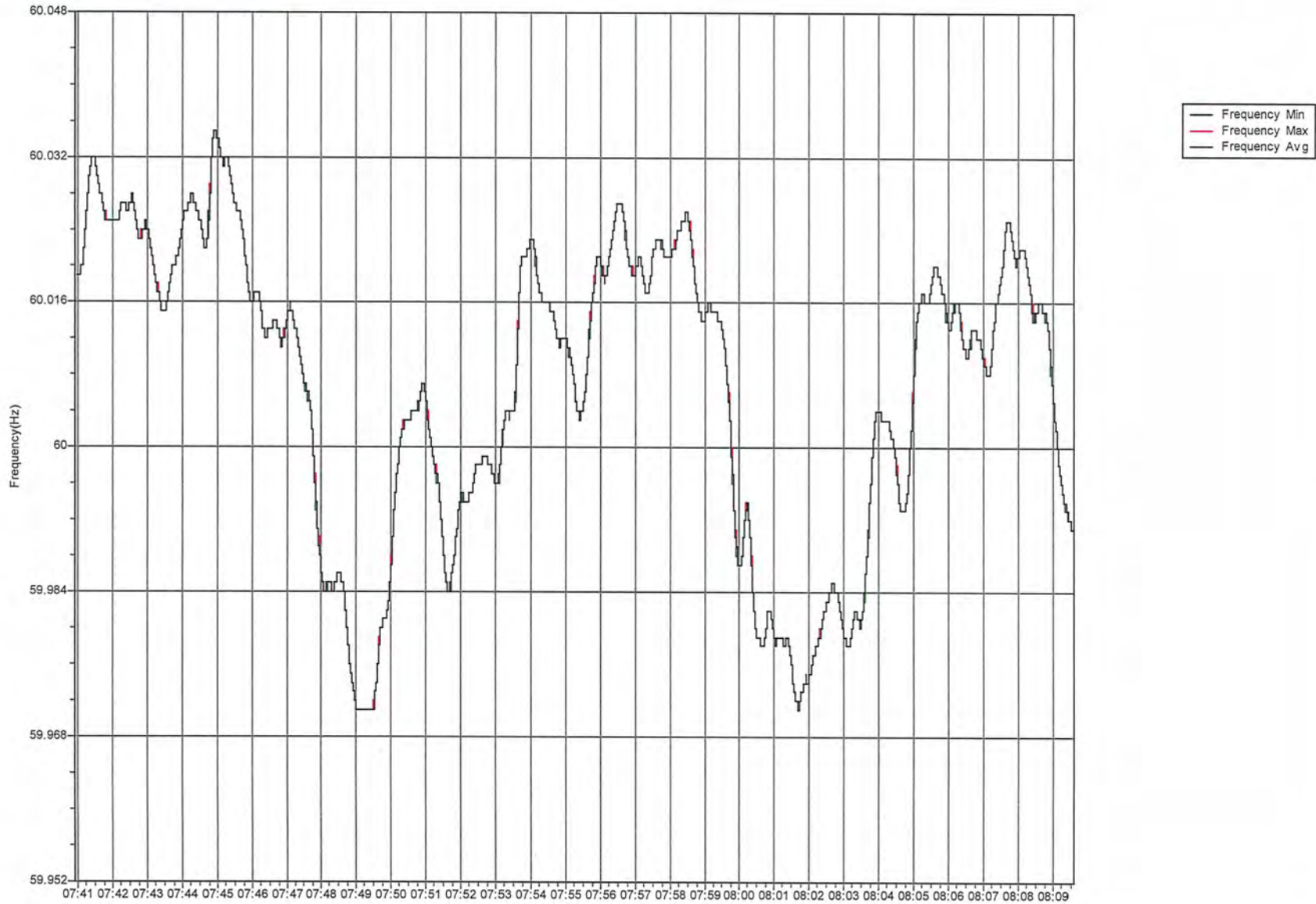
Dips	0
Swells	0
Transients	1
Interruptions	0
Voltage profiles	0
Rapid voltage changes	0
Screens	0
Waveforms	0
Intervals without measurements	0
Inrush current graphics	0
Wave events	1
RMS events	1

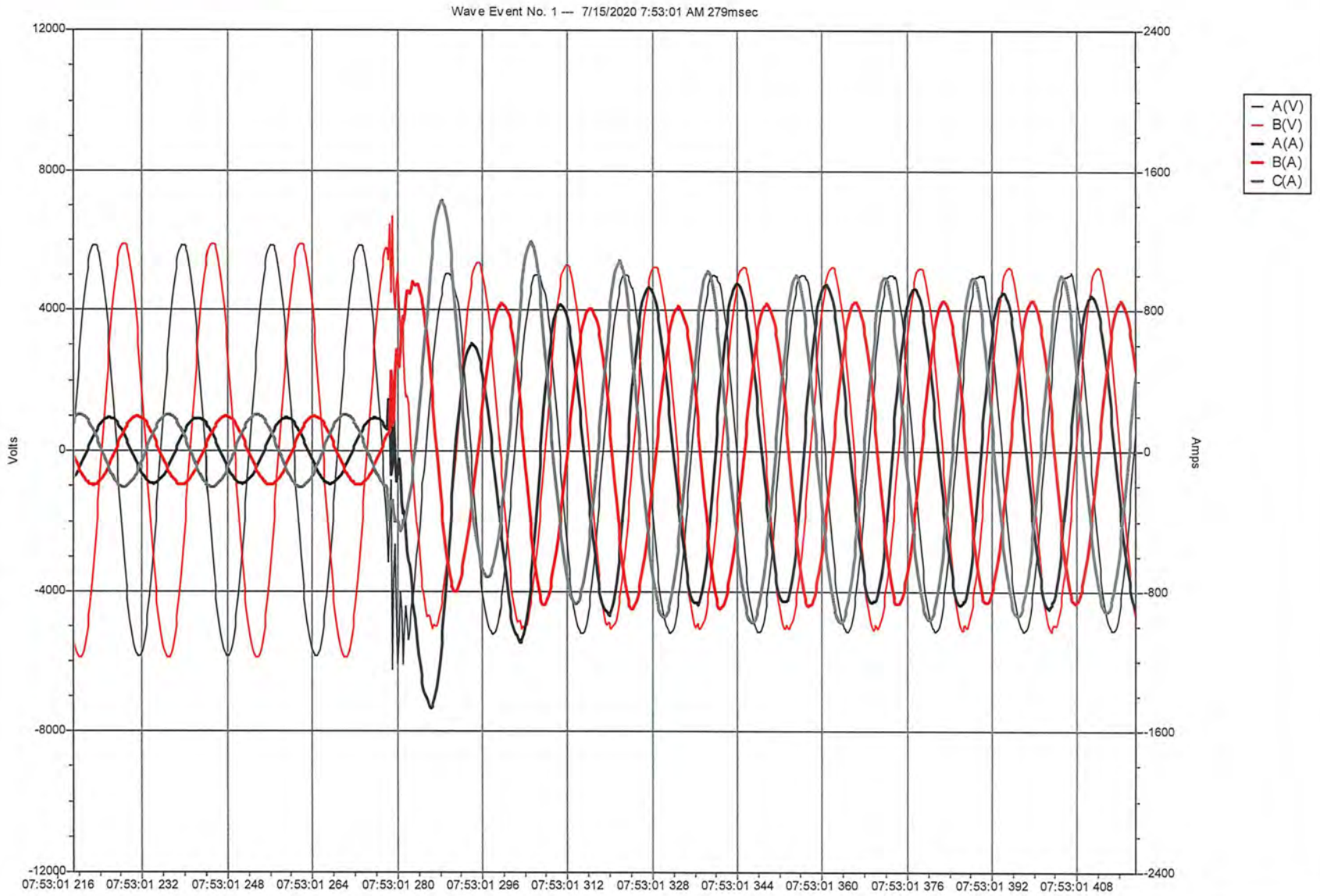




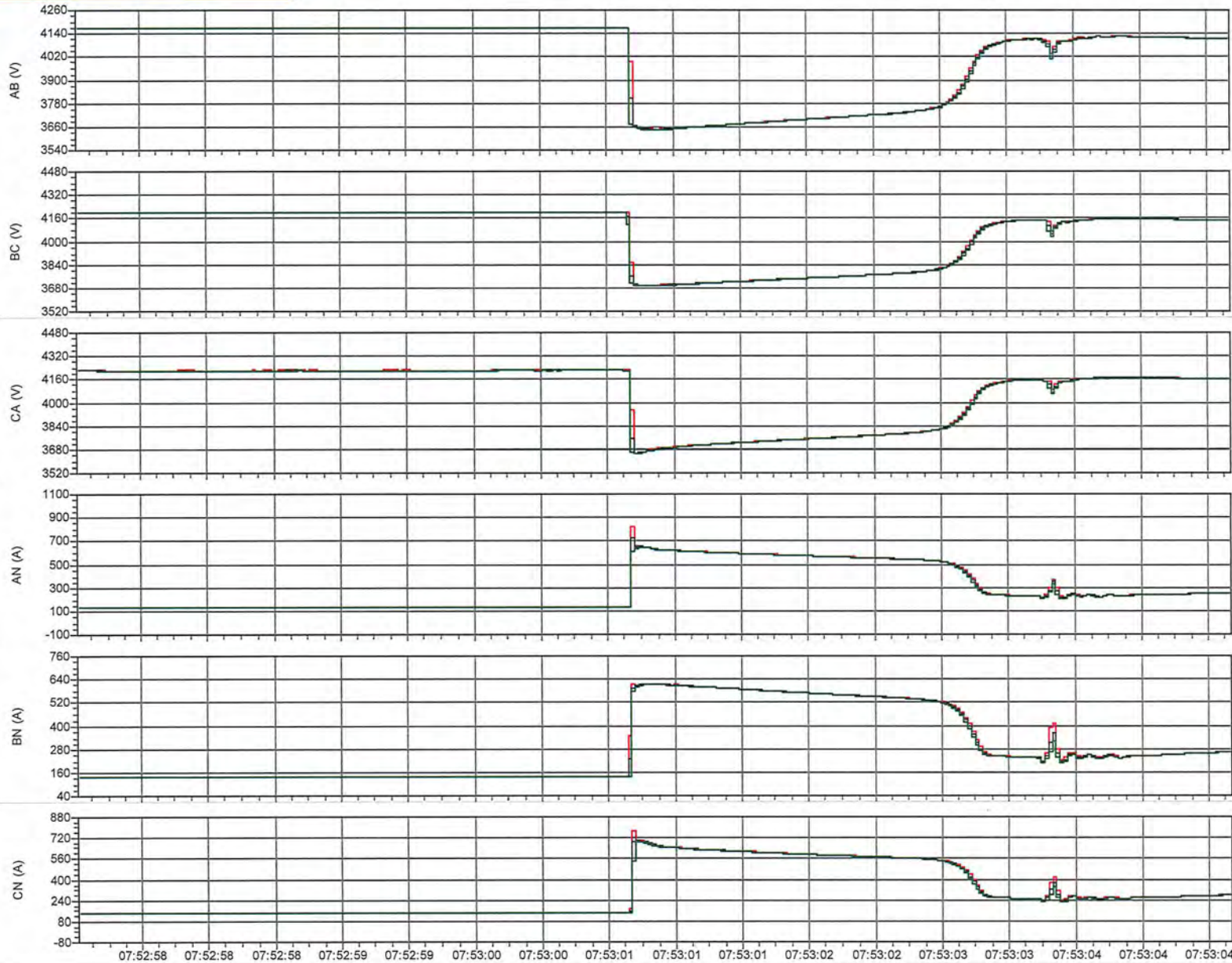




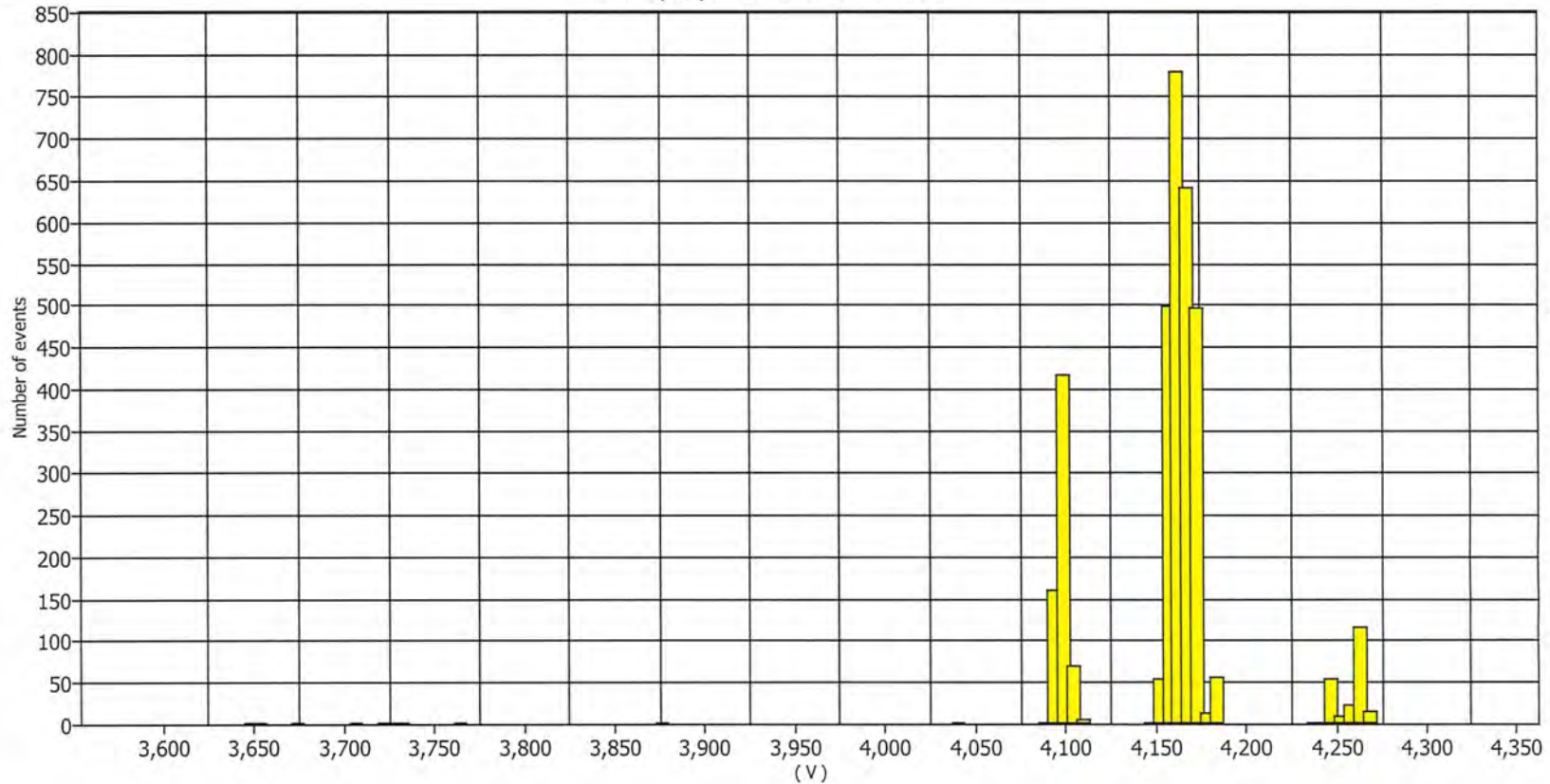








Vrms ph-ph - AB - Minimum



**Summary**

From	7/15/2020 7:40:57 AM	5% percentile	4099 V
To	7/15/2020 8:09:33 AM	95% percentile	4252 V
Maximum value	4269.3 V	% [85% - 110%]	0%
At	7/15/2020 7:41:58 AM	% [90% - 110%]	0%
Minimum value	3648.05 V		
At	7/15/2020 7:53:01 AM		
μ (Avg)	4159.37 V		
s	44.9538 V		

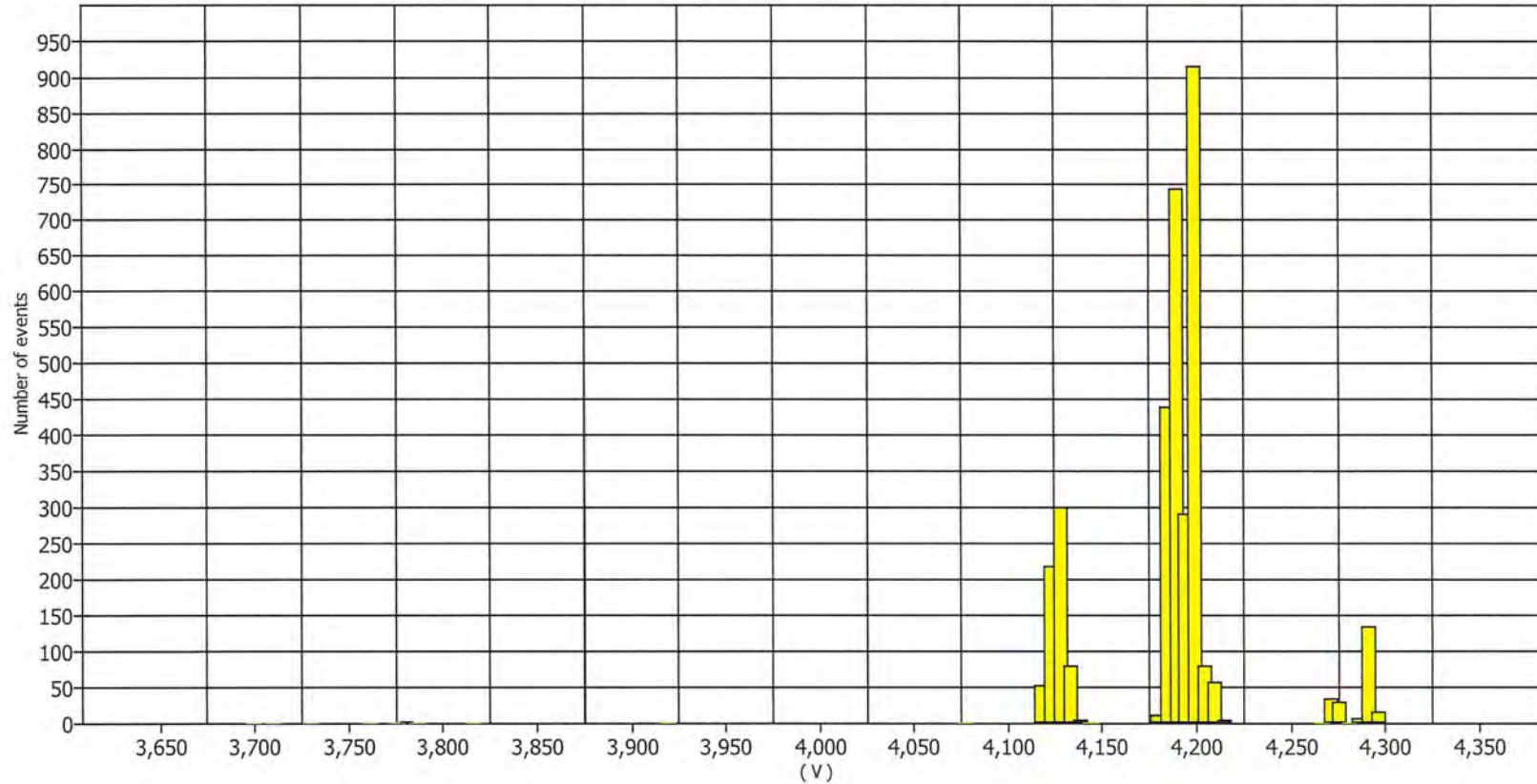
**Upper extreme values**

Date / Time	Value
7/15/2020 7:41:58 AM	4269.2998
7/15/2020 7:42:02 AM	4268.9502
7/15/2020 7:42:01 AM	4268.9502
7/15/2020 7:42:01 AM	4268.9502
7/15/2020 7:42:00 AM	4268.9502

**Lower extreme values**

Date / Time	Value
7/15/2020 7:53:01 AM	3648.05
7/15/2020 7:53:02 AM	3657.8501
7/15/2020 7:53:02 AM	3679.55
7/15/2020 7:53:03 AM	3711.05
7/15/2020 7:42:19 AM	3726.1001

Vrms ph-ph - BC - Minimum



**Summary**

From	7/15/2020 7:40:57 AM	5% percentile	4124 V
To	7/15/2020 8:09:33 AM	95% percentile	4278 V
Maximum value	4297.3 V	% [85% - 110%]	0%
At	7/15/2020 7:41:57 AM	% [90% - 110%]	0%
Minimum value	3698.8 V		
At	7/15/2020 7:53:01 AM		
μ (Avg)	4187.7 V		
s	44.511 V		

**Upper extreme values**

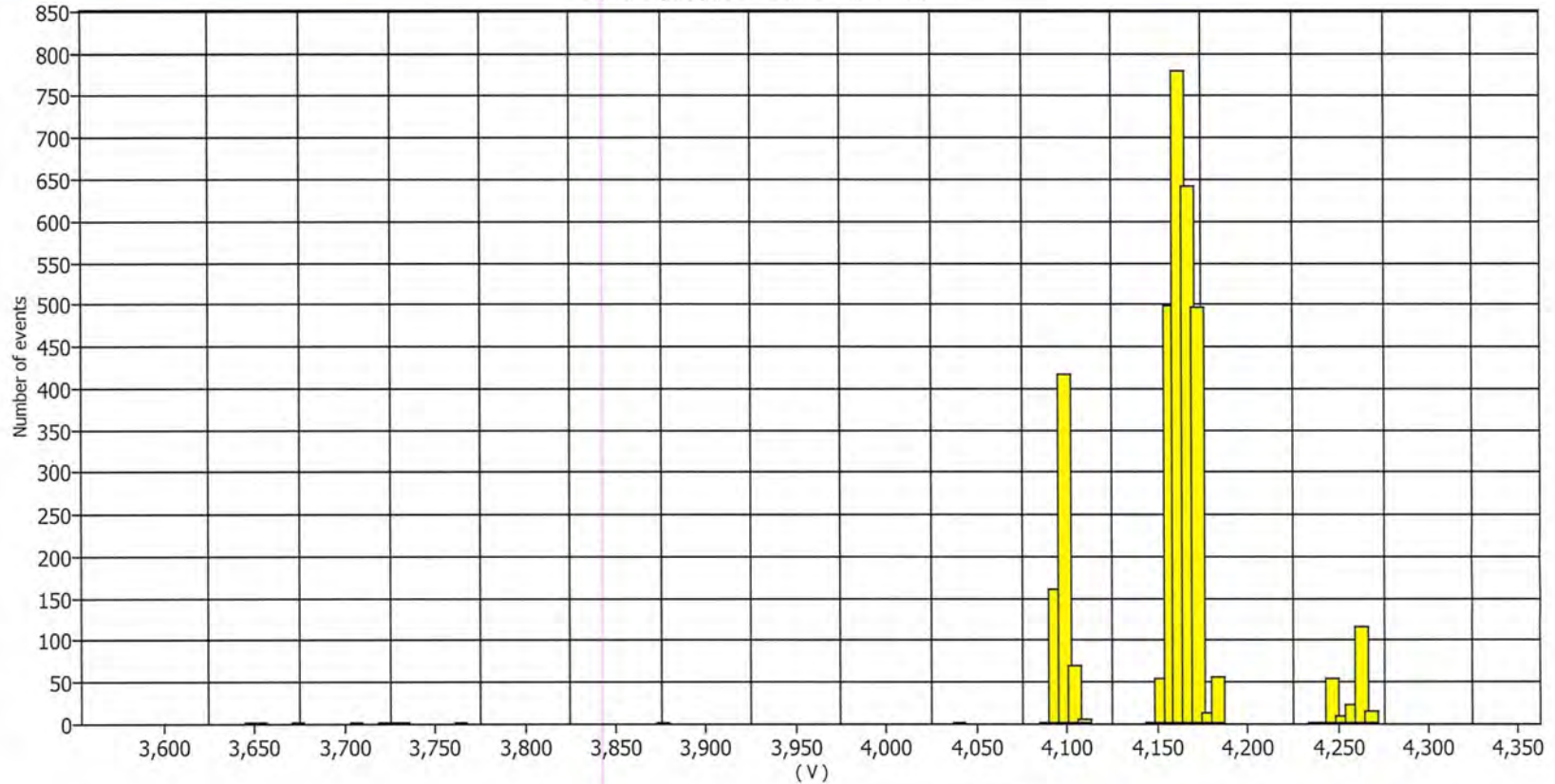
Date / Time	Value
7/15/2020 7:41:58 AM	4297.2998
7/15/2020 7:41:57 AM	4297.2998
7/15/2020 7:41:59 AM	4296.9502
7/15/2020 7:41:58 AM	4296.9502
7/15/2020 7:41:57 AM	4296.9502

**Lower extreme values**

Date / Time	Value
7/15/2020 7:53:01 AM	3698.8
7/15/2020 7:53:02 AM	3710
7/15/2020 7:53:02 AM	3730.6501
7/15/2020 7:53:03 AM	3760.75
7/15/2020 7:42:19 AM	3777.9001



Vrms ph-ph - CA - Minimum



**Summary**

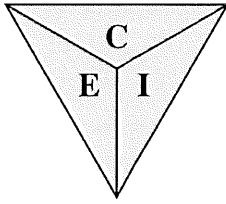
From	7/15/2020 7:40:57 AM	5% percentile	4099 V
To	7/15/2020 8:09:33 AM	95% percentile	4252 V
Maximum value	4269.3 V	% [85% - 110%]	0%
At	7/15/2020 7:41:58 AM	% [90% - 110%]	0%
Minimum value	3648.05 V		
At	7/15/2020 7:53:01 AM		
$\mu$ (Avg)	4159.37 V		
s	44.9538 V		

**Upper extreme values**

Date / Time	Value
7/15/2020 7:41:58 AM	4269.2998
7/15/2020 7:42:02 AM	4268.9502
7/15/2020 7:42:01 AM	4268.9502
7/15/2020 7:42:01 AM	4268.9502
7/15/2020 7:42:00 AM	4268.9502

**Lower extreme values**

Date / Time	Value
7/15/2020 7:53:01 AM	3648.05
7/15/2020 7:53:02 AM	3657.8501
7/15/2020 7:53:02 AM	3679.55
7/15/2020 7:53:03 AM	3711.05
7/15/2020 7:42:19 AM	3726.1001



## ***Electrical Certification Incorporated***

*P.O. Box 53368 \* Cincinnati, Ohio 45253  
Office: (513) 662-7500 \* Fax: (513) 662-6610  
Cell: (513) 604-2431 \* Email: ECInc@cinci.rr.com*

Report Summary 2020-400  
Date: July 21, 2020

Bill Speier  
Northern Kentucky Water Sewer District

Re: Northern Kentucky Water Sewer District – KCWW Ohio River Station  
Subject: Record Motor Starting Parameters

Mr. Speier,

On July 5, 2020, Electrical Certification Incorporated installed load monitoring equipment to monitor the load being supplied by the local utility. Continuous monitoring of the load was performed utilizing a Fluke 435II Energy Analyzer.

All data was recorded and is enclosed for your review and records. The following is a discussion of our observations and comments.

### **Equipment List**

4200V Rail Side  
4200V River Side

### **Summary**

Both T1 & T2 Transformers were connected to the same utility source for this testing.

#### **River Side Substation:**

##### **Test #1:**

No pumps running – start pump #4 (soft starter) – delay (10) mins. – start pump #6 (RVS auto transformer start). Only (1) transient event occurred.

07:42:15 Voltage dip on soft starter to 3726V

- Amp on soft starter 540. Approximately 3.75 seconds acceleration

07:53:01 Voltage dip on RVS to 3648V

- Amp on RVS 640. Approximately 2.5 seconds acceleration

##### **Test #2:**

No pumps running – start pump #6 (RVS auto transformer) – delay (10) mins. – start pump #5 (soft starter). (2) swells and (1) transient event occurred.

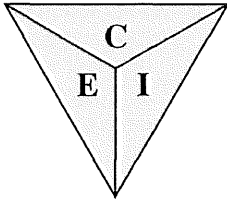
08:23:27 Voltage dip on RVS to 3715V

- Amp on RVS 570. Approximately 2.5 seconds acceleration

08:39:00 Voltage dip on soft starter 3671V

- Amp on soft starter 640. Approximately 3.75 seconds acceleration





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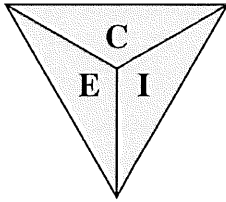
Report Summary #2020-400  
Page #2

Electrical Certification Incorporated appreciates the opportunity to have provided this service. If you have any questions concerning this report, or have additional testing needs please call any time for prompt professional service.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jeff Jones', written over the printed name.

Jeffrey Jones  
General Manager



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- Amp on RVS 640. Approximately 2.5 seconds acceleration

##### **Test #2:**

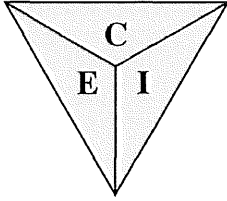
No pumps running – start pump #6 (RVS auto transformer) – delay (10) mins. – start pump #5 (soft starter). (2) swells and (1) transient event occurred.

08:23:27 Voltage dip on RVS to 3715V

- Amp on RVS 570. Approximately 2.5 seconds acceleration

08:39:00 Voltage dip on soft starter 3671V

- Amp on soft starter 640. Approximately 3.75 seconds acceleration



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Report Summary #2020-400  
Page #2

Electrical Certification Incorporated appreciates the opportunity to have provided this service. If you have any questions concerning this report, or have additional testing needs please call any time for prompt professional service.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jeffrey Jones', written over a faint, larger version of the signature.

Jeffrey Jones  
General Manager

**Duke Energy Kentucky**  
**Case No. 2021-00192**  
**STAFF Second Set Data Requests**  
**Date Received: December 27, 2021**

**STAFF-DR-02-003**

**REQUEST:**

Refer to Duke Kentucky's responses to Staff's First Request, Item 2c.

- a. Provide current cost estimates of the two substation solutions.
- b. Explain why the voltage drops would still occur even if Duke Kentucky or NKWD constructed a new substation, and explain the extent to which, if any, Duke Kentucky would expect a new substation to mitigate the voltage drops.

**RESPONSE:**

- a. Based on existing greenfield substation projects, it is estimated that the Substation and Transmission loop cost approximately \$10 million. That estimate does NOT include the cost of a useable site to locate the substation, provided one can be located. Additionally, the estimate does not include costs for installation of distribution lines. All-in costs could be \$13M- \$20M depending on location and land acquisition. The circuit area lies between a hillside and the river where real estate prices are significant.
- b. A new substation likely wouldn't shield all of the voltage fluctuation due to the amount of starting current.

**PERSON RESPONSIBLE:** Marc A. Bell



**Duke Energy Kentucky**  
**Case No. 2021-00192**  
**STAFF Second Set Data Requests**  
**Date Received: December 27, 2021**

**STAFF-DR-02-004**

**REQUEST:**

Refer to Duke Kentucky's responses to Staff's First Request, Item 3.

- a. State whether Duke Kentucky or NKWD will continue to track voltage variations following an approval of the special contract.
- b. If so, explain how Duke Kentucky will track voltage variations.
- c. If not, explain why Duke Kentucky will not track voltage variations.

**RESPONSE:**

- a. Duke Energy Kentucky will track NKWD's compliance with the terms of the contract to ensure that NKWD starts its pumps only between the hours of midnight and 4:00 am, except for emergency circumstances.
- b. The contract Duke Energy Kentucky has initiated allows for the variations during daytime, controlled starts. Therefore, no additional monitoring is planned.
- c. N/A

**PERSON RESPONSIBLE:** Marc Bell

**REQUEST:**

Refer to Duke Kentucky's responses to Staff's First Request, Item 4.

- a. Explain in detail what "soft start controls" and "voltage compensation" refer to and how they would be implemented.
- b. Provide the cost estimate of soft start controls and voltage compensation mitigation.
- c. Confirm that either of these two solutions would completely alleviate the voltage drops of more than 4 percent on Wilder 46, and explain in detail if it cannot be confirmed.

**RESPONSE:**

- a. "Soft start controls" are implemented by using reduced voltage motor starting which allows for the motor to come up to speed gradually resulting in less inrush current and less voltage drop. Reduced voltage motor starting technology must be installed by the customer and would be applied individually to each motor starting control.

Voltage compensation refers to a device that can detect and react to rapid voltage fluctuations and injects reactive power to compensate for excessive voltage drop. Voltage compensation technology must be installed by the customer and would be applied at each motor or on the primary supply to the motors.

- b. Cost estimates would require detailed engineering analysis.

- c. Reduced voltage motor starting can effective in reducing the motor starting voltage drop but require the motors be capable of starting with this method. Voltage compensation could more effectively reduce the motor starting voltage drop. Confirmation of elimination of voltage drop would be part of the engineering analysis.

**PERSON RESPONSIBLE:** Mike Simms

**Duke Energy Kentucky  
Case No. 2021-00192  
STAFF Second Set Data Requests  
Date Received: December 27, 2021**

**STAFF-DR-02-006**

**REQUEST:**

Provide the highest voltage drop recorded since 2017 on Wilder 46 when NKWD starts its pumps.

**RESPONSE:**

Since 2017, the highest voltage drop that has been recorded is 8.8%.

**PERSON RESPONSIBLE:** Mike Simms



**Duke Energy Kentucky  
Case No. 2021-00192  
STAFF Second Set Data Requests  
Date Received: December 27, 2021**

**STAFF-DR-02-007**

**REQUEST:**

Provide the typical voltage drop recorded on Wilder 46 when NKWD starts its pumps, and explain how Duke Kentucky determined the typical voltage drop.

**RESPONSE:**

The actual voltage drop associated with NKWD motor starts has been measured and documented to be between 6-8% depending on measurement location.

**PERSON RESPONSIBLE:** Mike Simms

**Duke Energy Kentucky  
Case No. 2021-00192  
STAFF Second Set Data Requests  
Date Received: December 27, 2021**

**STAFF-DR-02-008**

**REQUEST:**

Provide the standard nominal voltage for Wilder 46.

**RESPONSE:**

12.47kV

**PERSON RESPONSIBLE:** Mike Simms

**Duke Energy Kentucky  
Case No. 2021-00192  
STAFF Second Set Data Requests  
Date Received: December 27, 2021**

**STAFF-DR-02-009**

**REQUEST:**

State whether and, if so, how often NKWD's pumps result in variations in voltage that exceed 5 percent of the nominal voltage adopted for Wilder 46 in violation of 807 KAR 5:041, Section 6(2)(a), and explain each basis for Duke Kentucky's response.

**RESPONSE:**

Every NKWD motor start results in greater than 5% voltage drop from the voltage prior to starting. Each NKWD motor start creates a conflict with 807 KAR 5:041, Section 6(2)(c) exceeding a 4% drop in instantaneous voltage resulting in flickers in customers lighting. Data has been verified with measurements at customer premises.

**PERSON RESPONSIBLE:** Mike Simms

**Duke Energy Kentucky  
Case No. 2021-00192  
STAFF Second Set Data Requests  
Date Received: December 27, 2021**

**STAFF-DR-02-010**

**REQUEST:**

State whether NKWD's pumps result in total variations of voltage from minimum to maximum that exceed 6 percent of the nominal voltage for Wilder 46 in violation of 807 KAR 5:041, Section 6(2)(a), and explain each basis for Duke Kentucky's response.

**RESPONSE:**

NKWD's motor starts are in conflict with 807 KAR 5:041, Section 6(2)(c). The Company has measured the voltage variance during motor starts. See STAFF-DR-01-001 Confidential Attachment for an example of monitoring results.

**PERSON RESPONSIBLE:** Mike Simms

**Duke Energy Kentucky**  
**Case No. 2021-00192**  
**STAFF Second Set Data Requests**  
**Date Received: December 27, 2021**

**STAFF-DR-02-011**

**REQUEST:**

State whether Duke Kentucky contends that the requirement in 807 KAR 5:041, Section 6(2)(a) that the total voltage from minimum to maximum shall not exceed 6 percent of the nominal voltage applies at all hours of the day or only between 5 p.m. and 11 p.m., and explain each basis for Duke Kentucky's contention.

**RESPONSE:**

Duke Kentucky does not make this contention. The Company is seeking necessary waivers as described in its application to enable the parties to operate under this contract. The Contract is consistent with 807 KAR 5:041 Section 6(2)(c), which states "where the utility distribution facilities supplying customers are reasonably adequate and of sufficient capacity to carry actual loads normally imposed, the utility may require that the starting and operating characteristics of equipment on customer premises shall not cause and instantaneous voltage drop of more than four (4) percent of standard voltage nor cause objectionable flicker in other customer's lights. It is the Company's understanding that Section 6(2)(a) applies to steady state supply voltage ranges, whereas the issues here is instantaneous voltage fluctuations that affect customer lighting. The Contract will shift the starts (except for emergency purposes) to hours that should minimally impact other customers, if at all.

**PERSON RESPONSIBLE:** Mike Simms



**Duke Energy Kentucky**  
**Case No. 2021-00192**  
**STAFF Second Set Data Requests**  
**Date Received: December 27, 2021**

**STAFF-DR-02-012**

**REQUEST:**

State how often, if ever, Duke Kentucky has recorded voltage on Wilder 46 that exceeds the standard nominal voltage for that circuit by 2 percent or more in each year since 2017.

**RESPONSE:**

Duke Energy Kentucky's normal operating voltage range on Wilder 46 is +5% and -2.5%. The monitoring Duke Energy Kentucky maintains at the substation does not have the resolution to capture instantaneous voltage drops from motor starts. To investigate the light flickers that were occurring on the circuit, the Company installed temporary and specialized monitoring equipment. The last time the Company recorded the instantaneous voltage drops from NKWD motor starting was in 2017 when this more sensitive equipment was used. The Company properly characterized the motor starts and the system impact at that time as well as the customer impact. Each motor start will cause greater than 4% instantaneous voltage drop.

**PERSON RESPONSIBLE:** Mike Simms

**Duke Energy Kentucky  
Case No. 2021-00192  
STAFF Second Set Data Requests  
Date Received: December 27, 2021**

**STAFF-DR-02-013**

**REQUEST:**

Identify each complaint Duke Kentucky has received since 2017 from any customer served by Wilder 46 other than NKWD regarding voltage variation issues by identifying the type of customer that made the complaint, the date of the complaint, a description of the complaint, and how the complaint was resolved.

**RESPONSE:**

Since 2017, there have been zero complaints related to voltage variation issues on Wilder 46.

**PERSON RESPONSIBLE:** Michelle Basch