BPL Presentation for CORF
25 April 2007

Jim Mollenkopf, CURRENT Group

Agenda

Overview of BPL

Basic Network Architecture

Overview of Potential Interference Issues

Benefits of BPL – Why Does Anyone Care?

Q&A

CURRENT Solutions - What BPL Can Do

Smart Grid Solutions

Solutions For:
Smart Metering
Customer Energy Management
Distribution Management
Substation Connectivity

Retail Broadband Services

Services For:
Smart Consumer
Up to 10 Mbps Broadband
Symmetric Service Offering
VoIP

Technology, Sensors, Management and Analytic Software

Distribution Point

Point of Presence "POP"

Utility Substation

nderground
istribution (URD)

CURRENT Overhead Distribution System

CURRENT BPL Modem

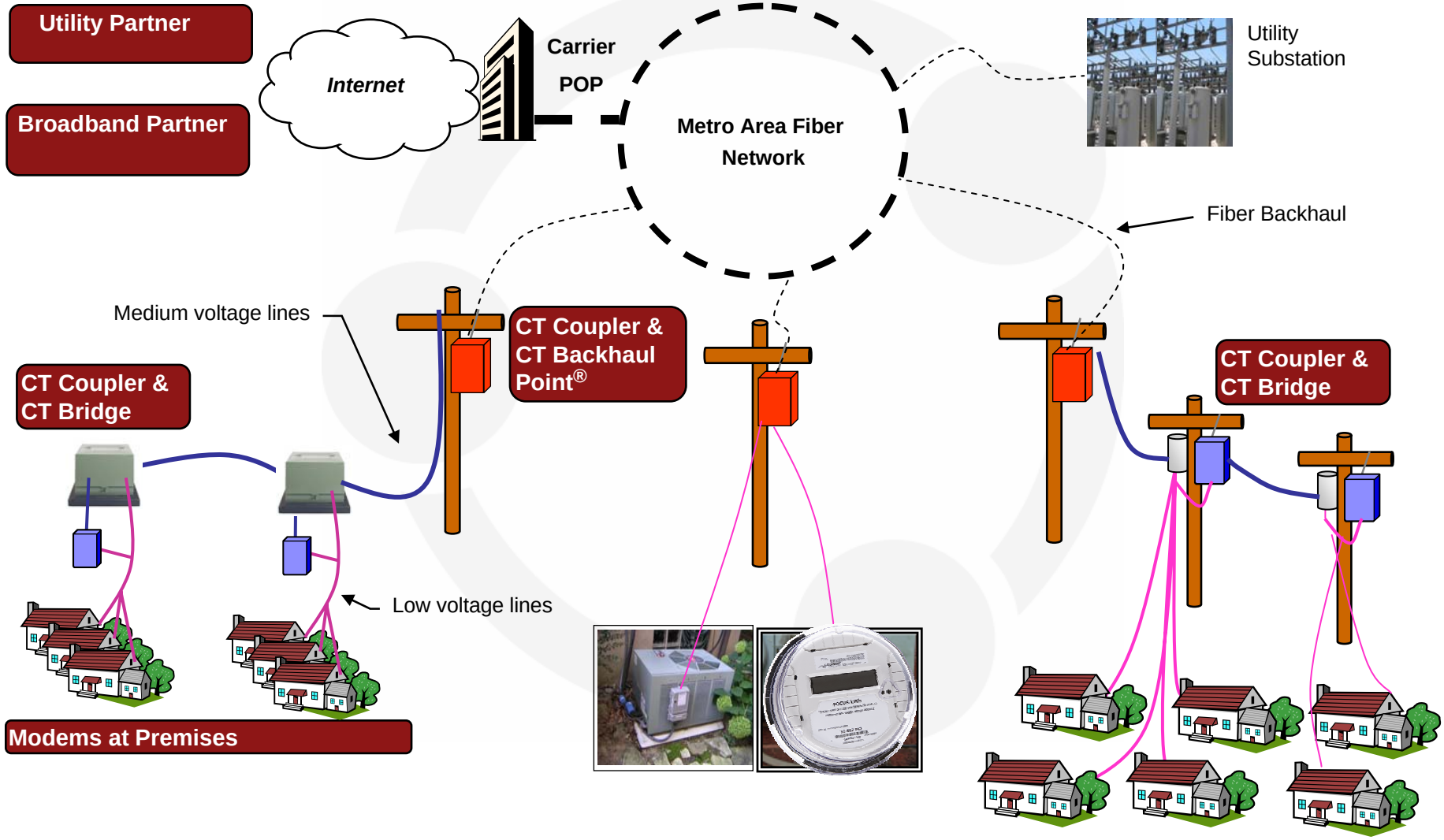
e® Pole Assembly
haul-Point® Pole Assembly
e URD Assembly

CURRENT URD System

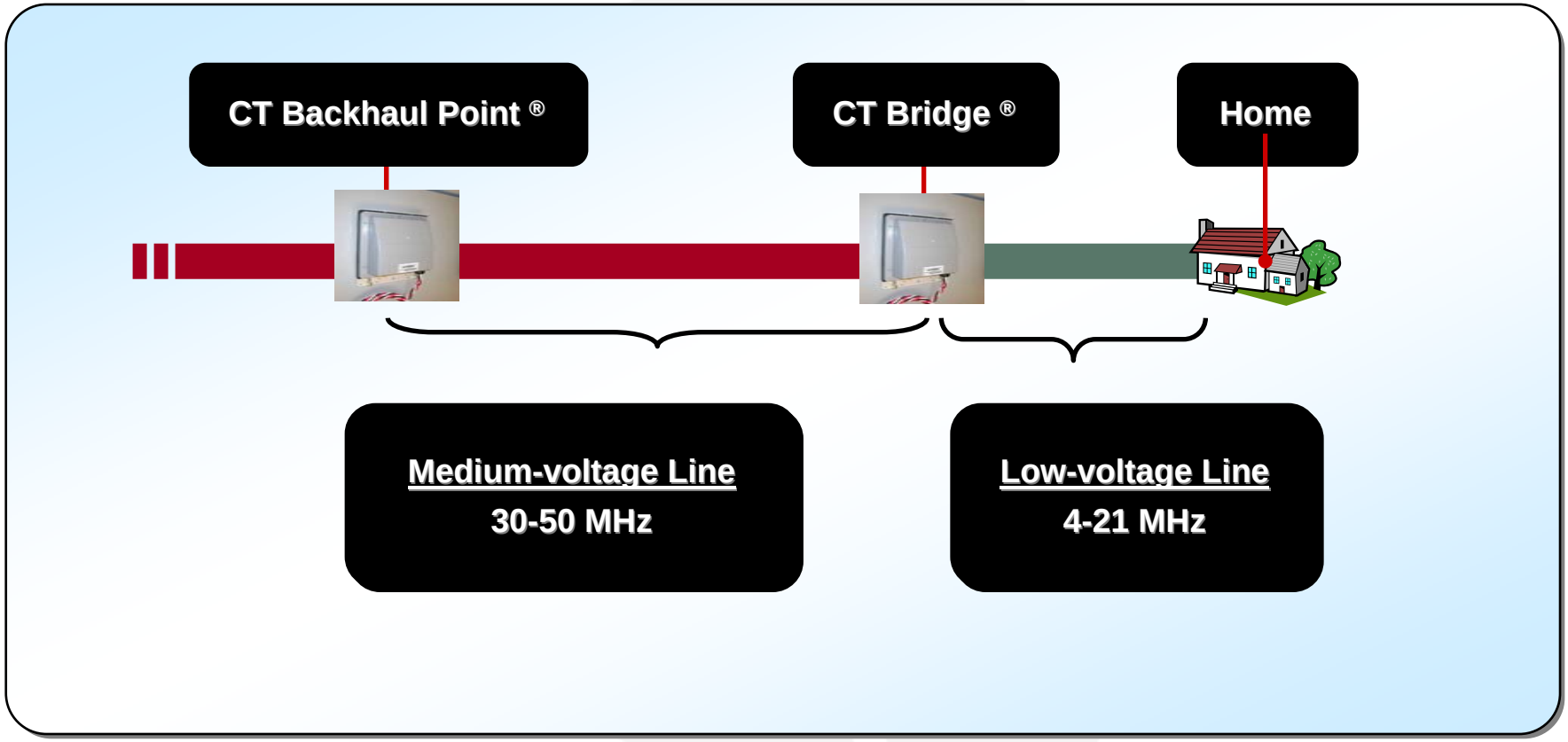
CURRENT OH System

Network Overview

”Toolbox” Solution for Design



Frequency view of the CURRENT system on medium- and low-voltage lines



Use of HF frequencies avoided on MV lines

What About Interference?

BPL power limits set by FCC Part 15 limits

- **Limits same as millions of other devices**
- **Verification must be done in situ**
- **Limits extremely low – nanowatts of radiated power**
- **Any resultant interference must be resolved by BPL operator**

FCC BPL Report and Order provides special protection to RA sites

- **Consultation areas around VLBA sites for both OH and UG for 73.0 – 74.6 MHz**
- **Consultation areas around specified RA sites for 1.7-38.25 MHz**
- **Establishes special interference mitigation requirements for BPL equipment**
- **Requires Certification for BPL equipment**

CURRENT BPL Has Strong Track Record of Deployment Without Interference Issues

CURRENT's Approach to Interference

- Avoidance is most effective mitigation technique
- Only one device on a link transmits at a time
- Two largest BPL deployments in North America
  - Cincinnati, OH and Dallas/Ft. Worth, TX
- Zero interference complaints

No Interference Complaints of Any Kind In Any CURRENT Deployments

- No amateur radio complaints
- No broadcast radio complaints
- No public safety complaints (273 licensees within 10 miles of our Cincinnati deployment)

CURRENT Equipment is FCC Certified

- Not experimental or operating under temporary authorization

Distribution Monitoring

Outage Notification Process

1

Tree falls on line causing a feeder outage

Old Way

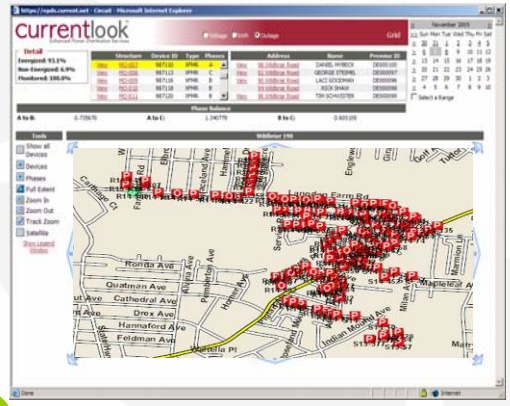
2

Customer calls outage in and Operations Center receives notification

3

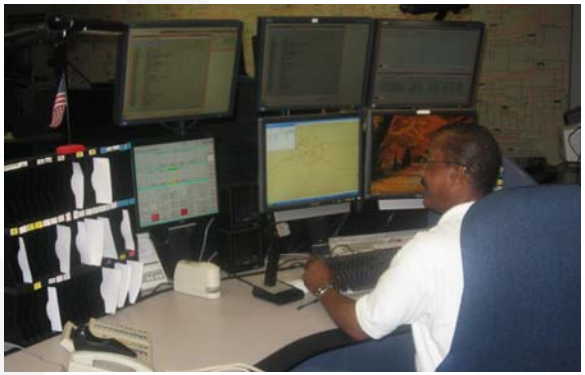
Dispatcher notifies field technician who inspects entire feeder for outage source

New Way



2

BPL dying gasp sends notification to outage management system



3

Disruption location pinpointed and field technicians dispatched to location of fault

Distribution Monitoring
Case Study – Neutral Failure

E-Mail Notification ➔

This Message is automatically generated. Do not reply to this email.

Click here to view the Secondary Neutral Failure Report for 12/10/2006 - 12/11/2006.

Thank you,
Smart Grid Support

current COMMUNICATIONS

Report ➔

currentlook Smart Grid Services

Secondary Neutral Failure Report

Service Area: ABRRD 0001, GAVSW 0001, GAVSW 0007

Start Date: December 2006 — End Date: December 2006

Voltage Difference (V): 16 — Range from 2x Nominal (V): 12

Failure Duration (seconds): 5

Run Report

Voltage Difference: The value in Volts that the two voltage legs must differ by to trigger the report
Range from 2x Nominal: The value in Volts that the sum of the two voltage legs must come to twice nominal to trigger the report
Failure Duration: The time in seconds that the voltage difference must persist to trigger the report

Report Start: 12/10/2006 12:00:00 AM
Report End: 12/11/2006 11:59:59 PM

Transformer	Time of Failure	Leg 1 Voltage (V)	Leg 2 Voltage (V)	Delta V
1226291	12/10/2006 1:34:29 AM	132.611	115.261	17.350

currentlook Smart Grid Services — Voltage / kWh — Logout

Transformer Properties

ID:	1226291	**Voltage:**		**Pole:**	05N03E-00334
Type:		**KVA:**		**Note:**	
Phase:	B	**Prot:**		**Premises:**	15

December 2006

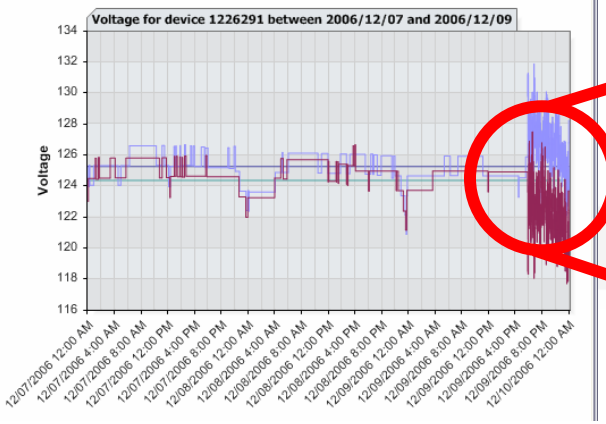
>>	Sun	Mon	Tue	Wed	Thu	Fri	Sat
>	26	27	28	29	30	1	2
>	3	4	5	6	7	8	9
>	10	11	12	13	14	15	16
>	17	18	19	20	21	22	23
>	24	25	26	27	28	29	30
>	31	1	2	3	4	5	6

Select a Range

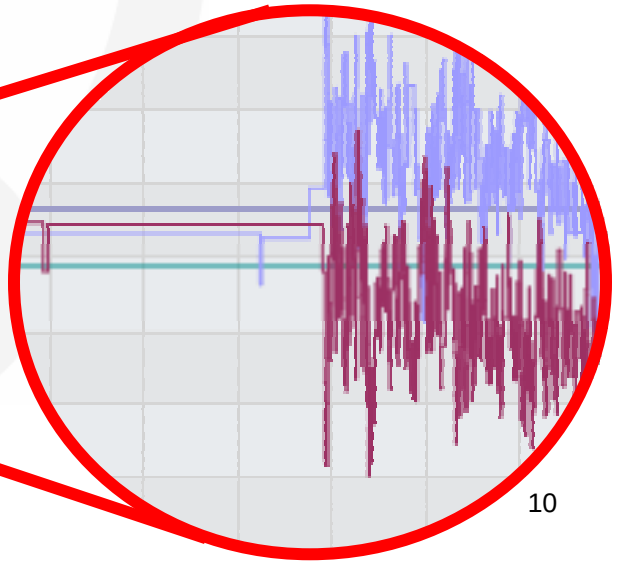
← Details

Date/Time	LV 1	LV 2
2006-12-07 00:00:00	124.013	123.051
2006-12-07 00:02:27		124.522
2006-12-07 00:05:24	125.268	
2006-12-07 00:07:13	123.989	
2006-12-07 00:07:35	125.361	
2006-12-07 00:15:02	124.070	
2006-12-07 00:49:06	125.334	
2006-12-07 01:04:08		125.814
2006-12-07 01:13:23		124.469
2006-12-07 01:31:02		125.864
2006-12-07 01:39:41		124.535
2006-12-07 03:17:45		125.827
2006-12-07 04:02:13		124.560
2006-12-07 04:29:40	124.080	
2006-12-07 04:53:18	125.341	
2006-12-07 05:39:21		125.824
2006-12-07 06:11:14	126.625	
2006-12-07 10:12:33	125.358	
2006-12-07 10:40:23		124.544
2006-12-07 11:03:46		125.845
2006-12-07 11:04:23	126.638	
2006-12-07 11:25:59	125.354	
2006-12-07 11:42:06		124.565
2006-12-07 12:02:30	123.990	
2006-12-07 12:12:40		123.292
2006-12-07 12:17:40		124.651
2006-12-07 12:18:24	125.305	

	Mean	Minimum	Maximum
LV 1:	125.285	120.920	131.904
LV 2:	124.380	117.734	127.517

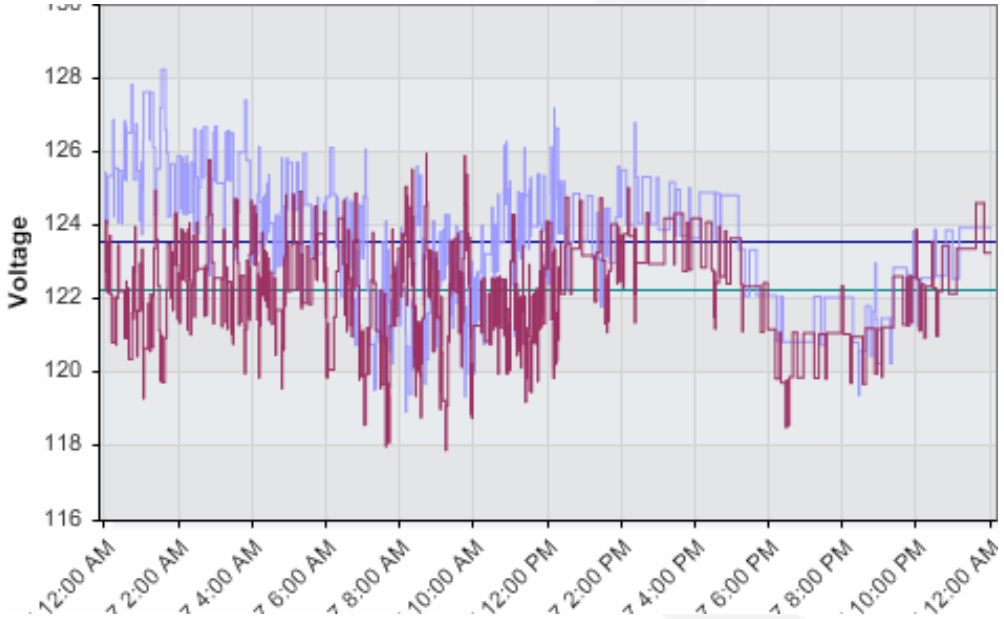


What happened here?



Distribution Monitoring
Case Study – Neutral Failure

"During our field investigation a loose split bolt connection was found. The bad connection was between the 2/0 and #4 copper neutral"



Voltage Data Before / After Repair

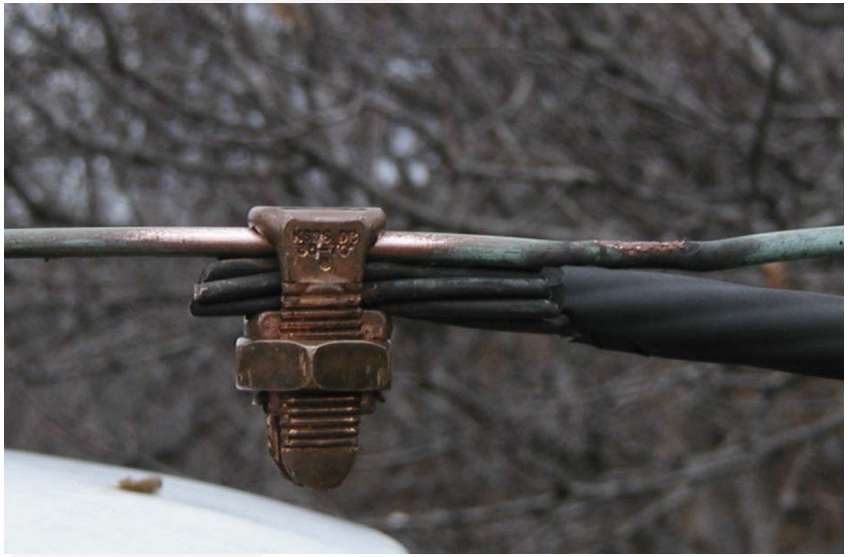
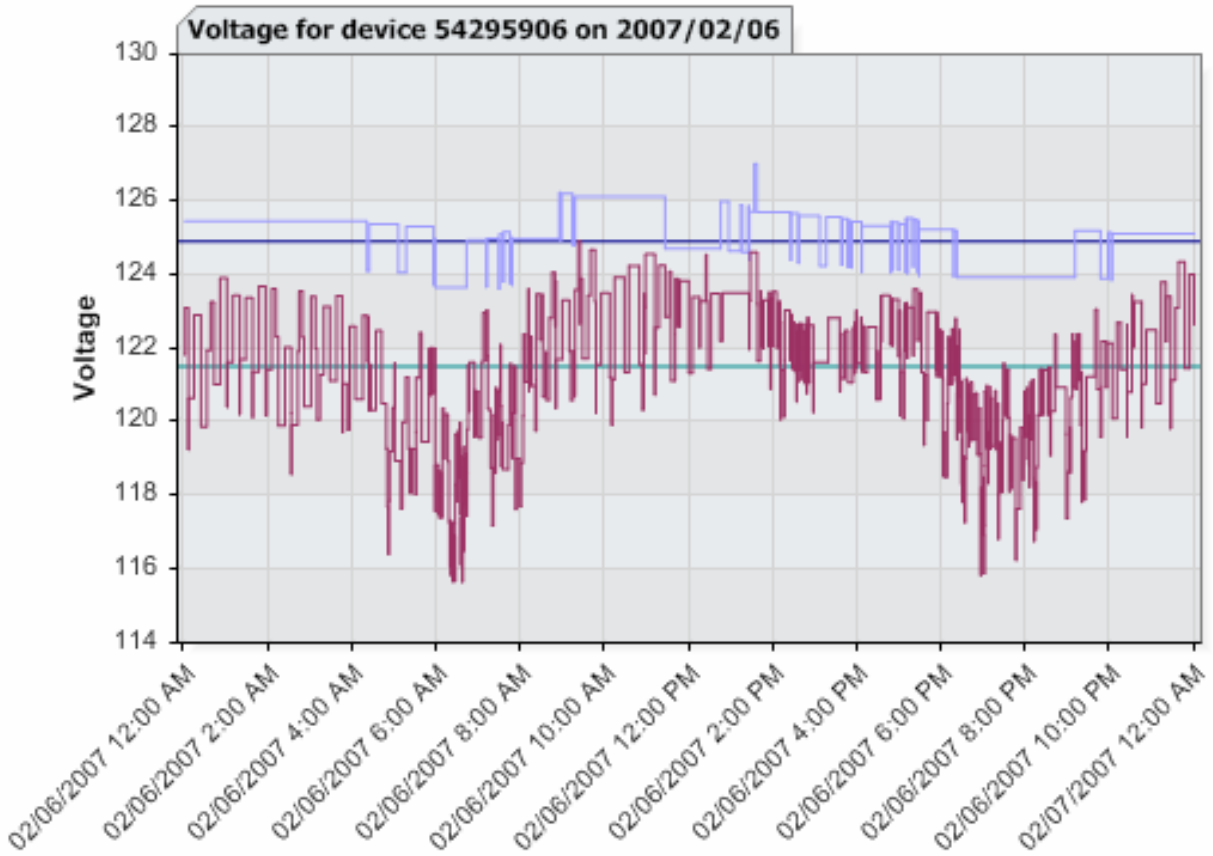


Photo of Connection

Distribution Monitoring
Case Study - Transient Secondary Fault



Investigation Trigger:
Current Look Low Voltage Notification

Distribution Monitoring
Case Study - Transient Secondary Fault

Detailed Findings

"This is a 37.5 KVA, 120/240v transformer with 2/0 copper conductor connecting it to the secondary bus. One conductor had rubbed against the cooling fin of the transformer and burned the conductor for about 10" back to the secondary bushing of the transformer. This leg was carrying no load at the time that it was checked.

Charred cooling fin of transformer

Thank You!

current®