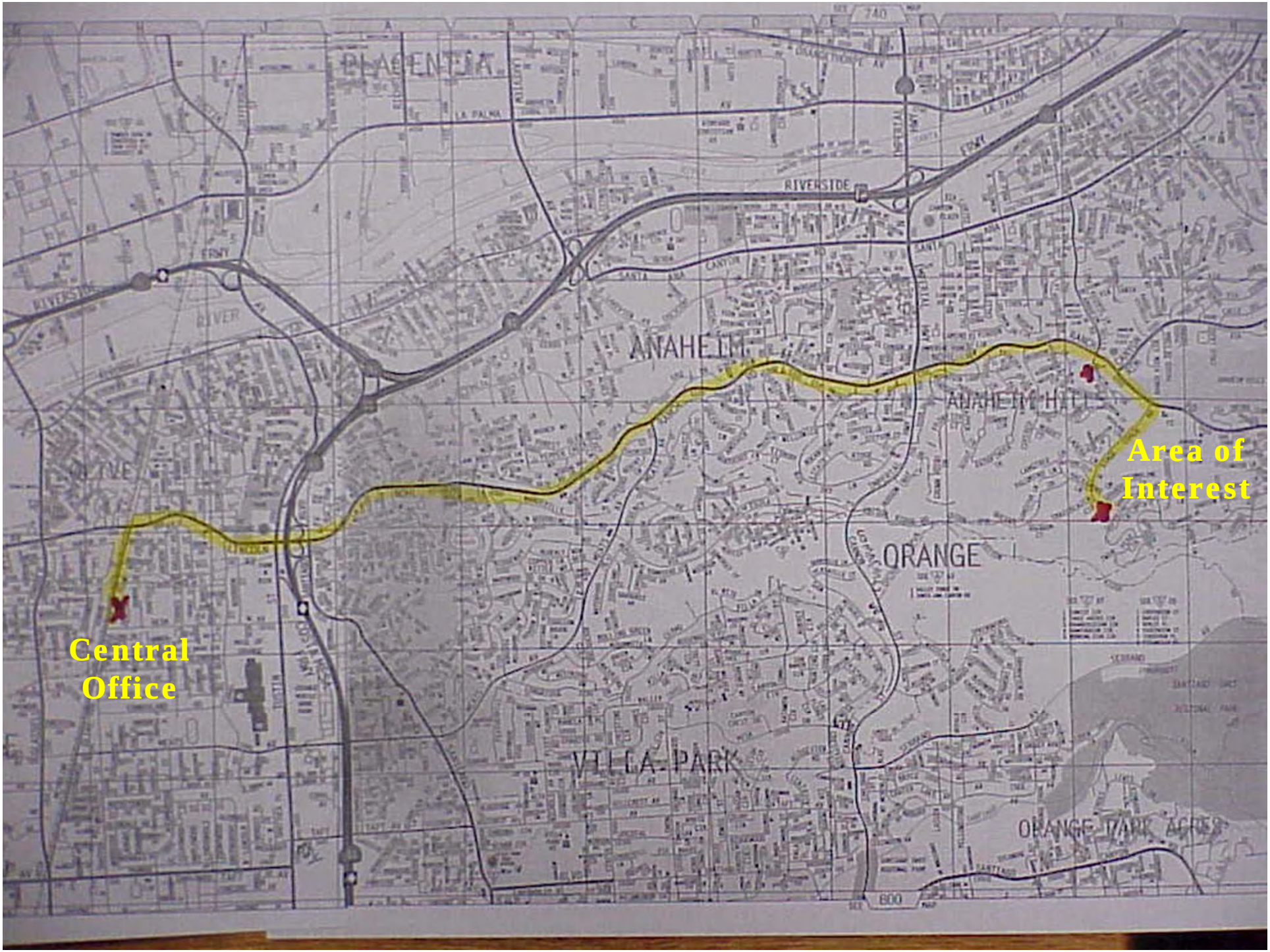
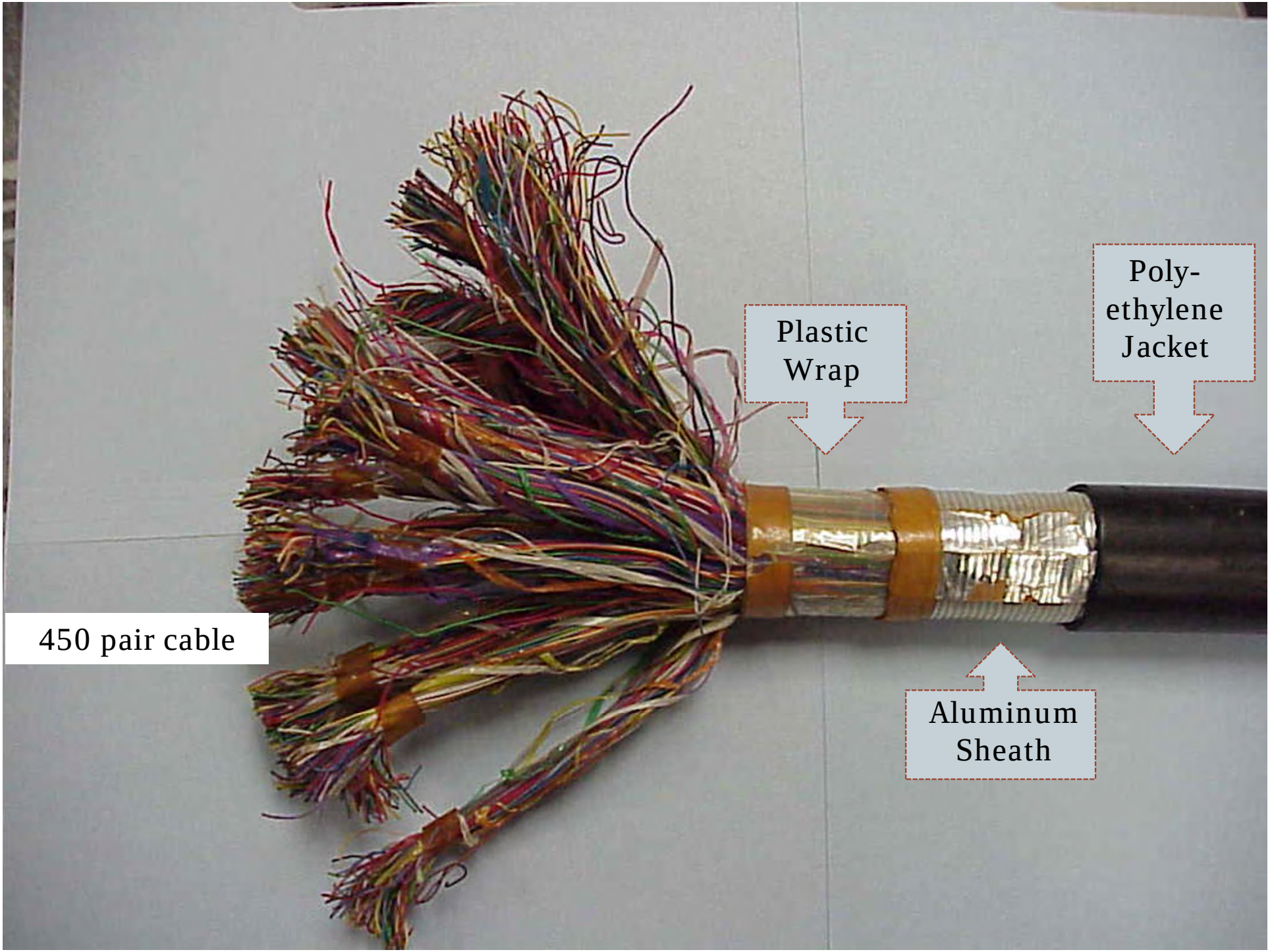
Case Studies of Inductive Coordination and Electrical Protection Issues in the Field

PEG GENERAL MEETING - 2013

DALE STEGMAIER – ICEP ENGINEER, CA
LARRY PAYNE – COMMON SYSTEMS STAFF


Stage
Coach
Current
Dale Stegmaier

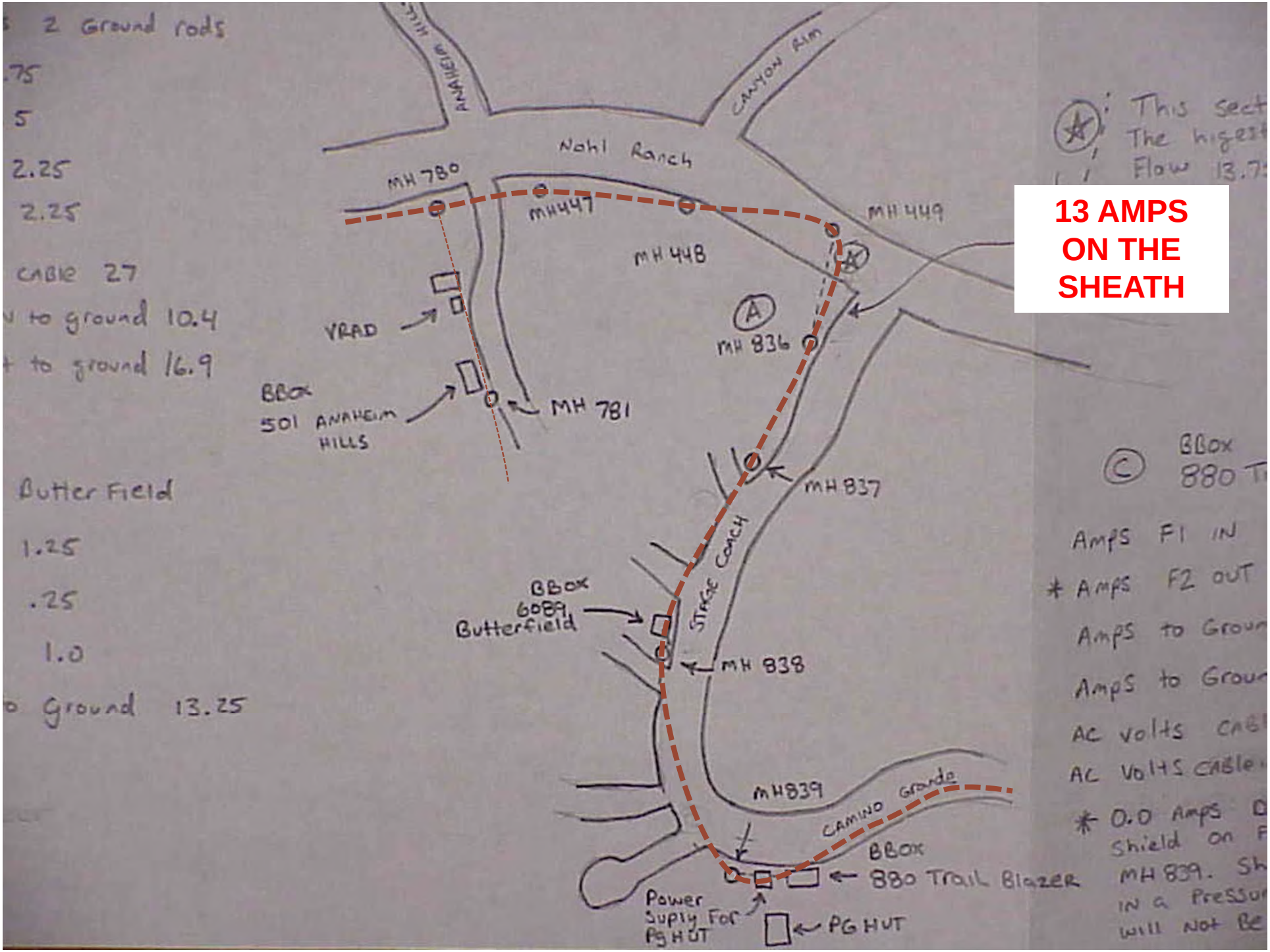

PLACENTIA
LA PALMA
RIVERSIDE
ANAHEIM
ANAHEIM HILLS
Area of Interest
ORANGE
Central Office
VILLA PARK
ORANGE PARK ACRES


Plastic Wrap
Poly-ethylene Jacket
450 pair cable
Aluminum Sheath

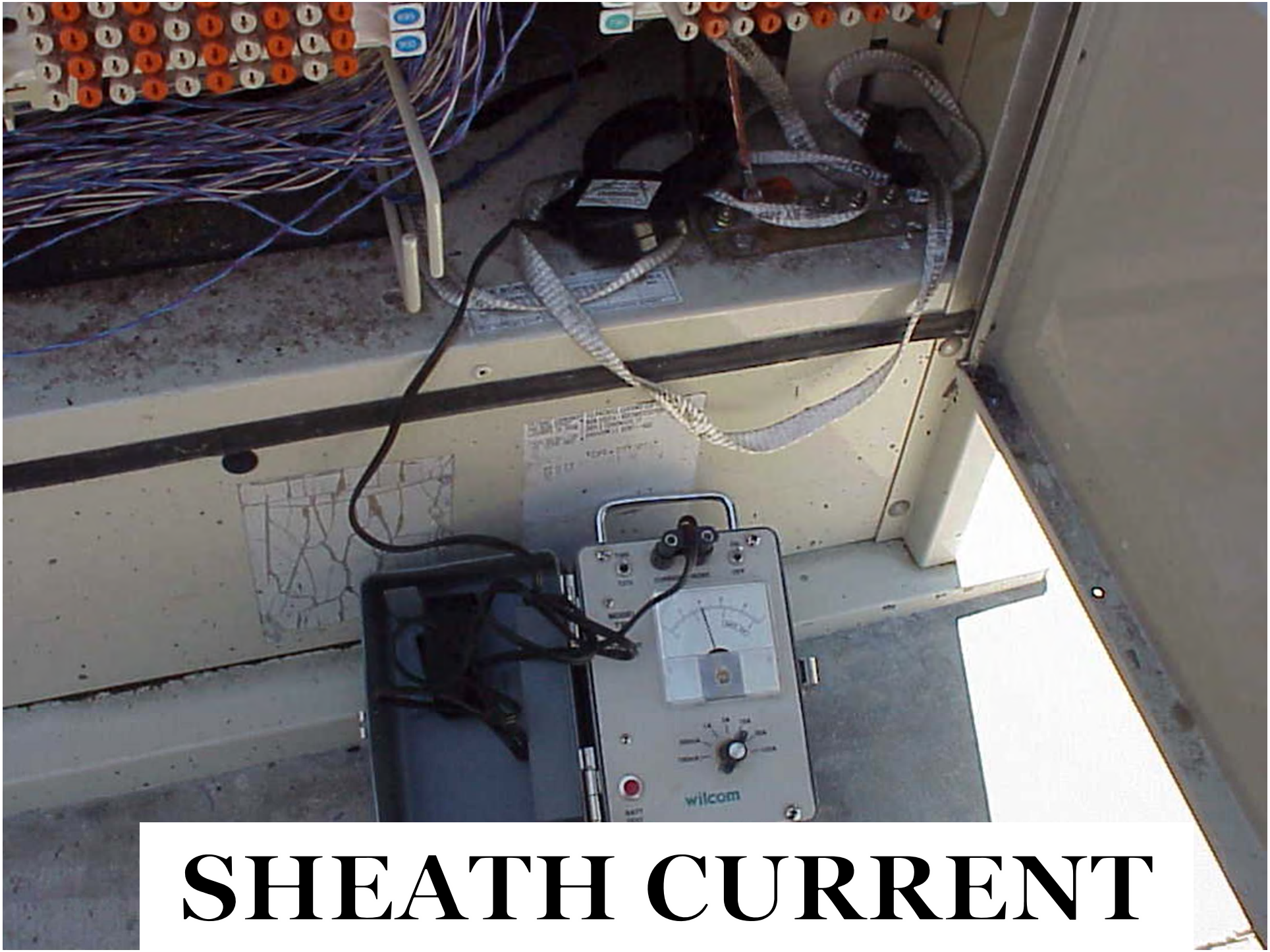

MEASURE SHEATH CURRENT
On Cable 17


MANHOLE GROUND ROD


NO
PARKING
ANY
TIME


2 Ground rods
.75
5
2.25
2.25
CABLE 27
V to ground 10.4
t to ground 16.9
Butter Field
1.25
.25
1.0
o Ground 13.25
ANAHEIM HILLS
CANYON RIM
Nohl Ranch
MH 780
MH447
MH 448
MH 449
YRAD
BBox
501 ANAHEIM HILLS
MH 781
A
MH 836
MH 837
STAGE COACH
BBox
6089
Butterfield
MH 838
MH839
CAMINO Grande
BBox
880 Trail Blazer
Power Supply For PG HUT
PG HUT
13 AMPS ON THE SHEATH
Amps F1 IN
* Amps F2 OUT
Amps to Groun
Amps to Groun
AC volts CAB
AC Volts Cable
* 0.0 Amps
Shield on
MH 839. Sh
IN a Pressur
will Not Be


CAUTION
880 BOX



SHEATH CURRENT


T305
T272
ON
OFF
BATT. OK
1A
3A
10A
300mA
30A
100mA
100A
BATT
TEST
wilcom

21 AT&T States

1. **Cable must have a continuous shield**
2. **Bonds to the MGN and at both ends**
3. **Normally carry from 500 mA to 5000 mA**

California

A. No bonds to MGN
B. Cable bond to ground bed every ¼ mile
C. Normally carry from 50 mA to 5000 mA

Readings less than 50 mA indicates an open shield
Readings more than 7000 mA *suggest* power system issues

PI (Power Influence) 80 – 90 dBrnC is Marginal
PI over 100 dBrnC *suggest* power system issues
Noise = Less than 20 dBrnC

AT&T ICEP

Date Printed 5/4/2007

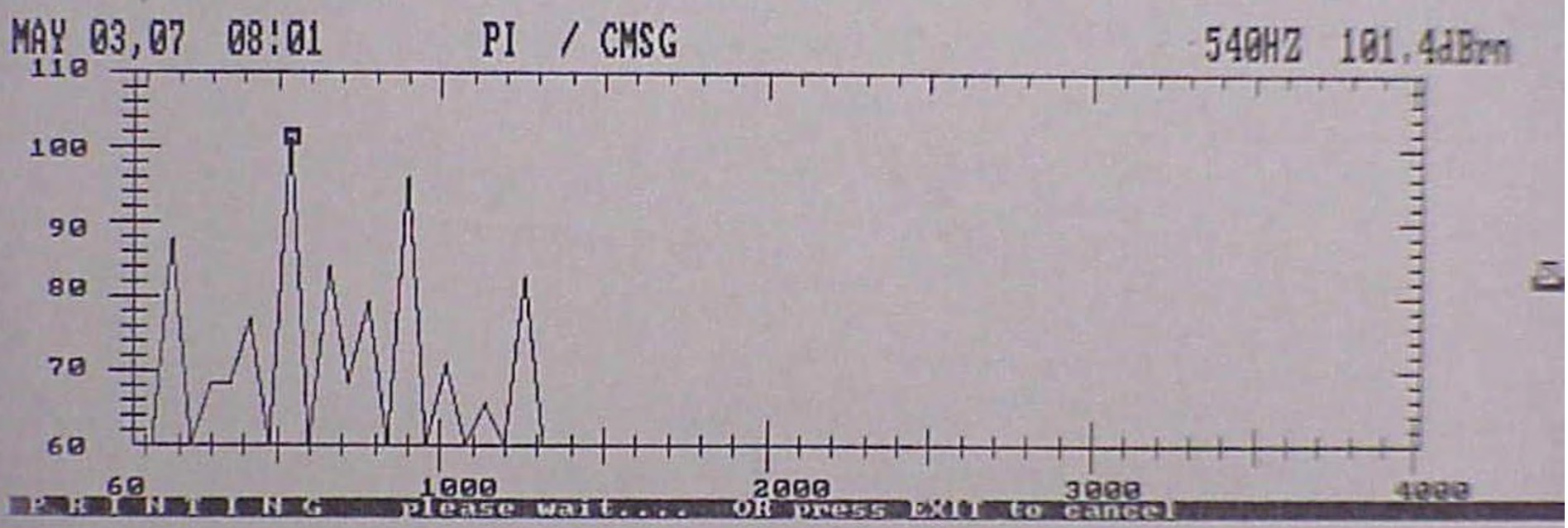
Location	Date 5/3/07		Current mA (21)	Loss dBM (8.5)	Noise dBrn Cmsg <20	Noise dBrn Flat	Power Influence Cmsg <85	Power Influence Flat	T-R Voltage AC Volts	Dominant Frequency
880 Box 880 Trail Blazer	Cable 17 Pair 416 BP 416	Dynatel	26.8	5.4	30		7106		T-R ⊖ R-G 16.75V T-G 16.75V	Plot 1 Plot 2 Plot 3
		Wilcom 132EZ	600 Termination Bridge							
B Box 501 Anaheim Hills	Cable 17 Pair 551 BP 701	Dynatel	28.8	4.9	19		94		T-R ⊖ R-G 2.0 T-G 2.0	Plot 4 Plot 5
		Wilcom 132EZ	600 Termination Bridge				540 HZ 90			
↓	Cable 17 Pair 501 BP 201	Dynatel	28.9	5.0	30		95		T-R ⊖ R-G 2.0 T-G 2.0	Plot 6 Plot 7
		Wilcom 132EZ	600 Termination Bridge				540 HZ 91			
	Cable Pair	Dynatel							T-R R-G T-G	
		Wilcom 132EZ	600 Termination Bridge							
	Cable Pair	Dynatel							T-R R-G T-G	
		Wilcom 132EZ	600 Termination Bridge							
	Cable Pair	Dynatel							T-R R-G T-G	
		Wilcom 132EZ	600 Termination Bridge							

C-Message

880 Trail Blazer

Plot 1

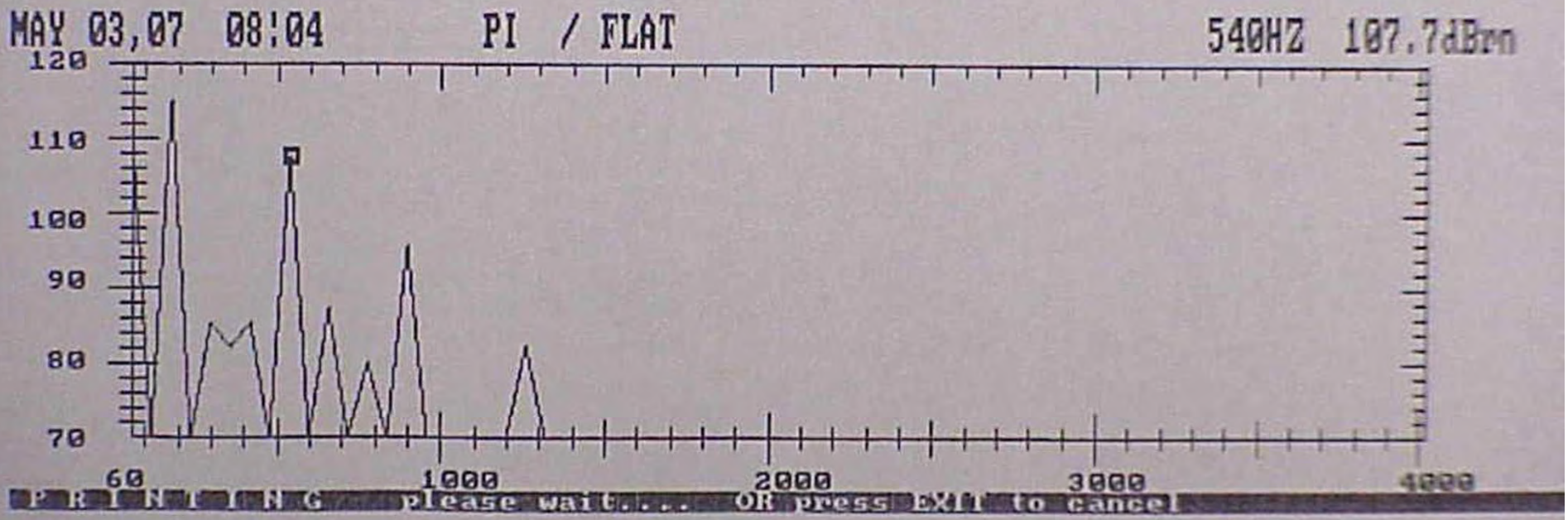
Alt 17
Pwr 416



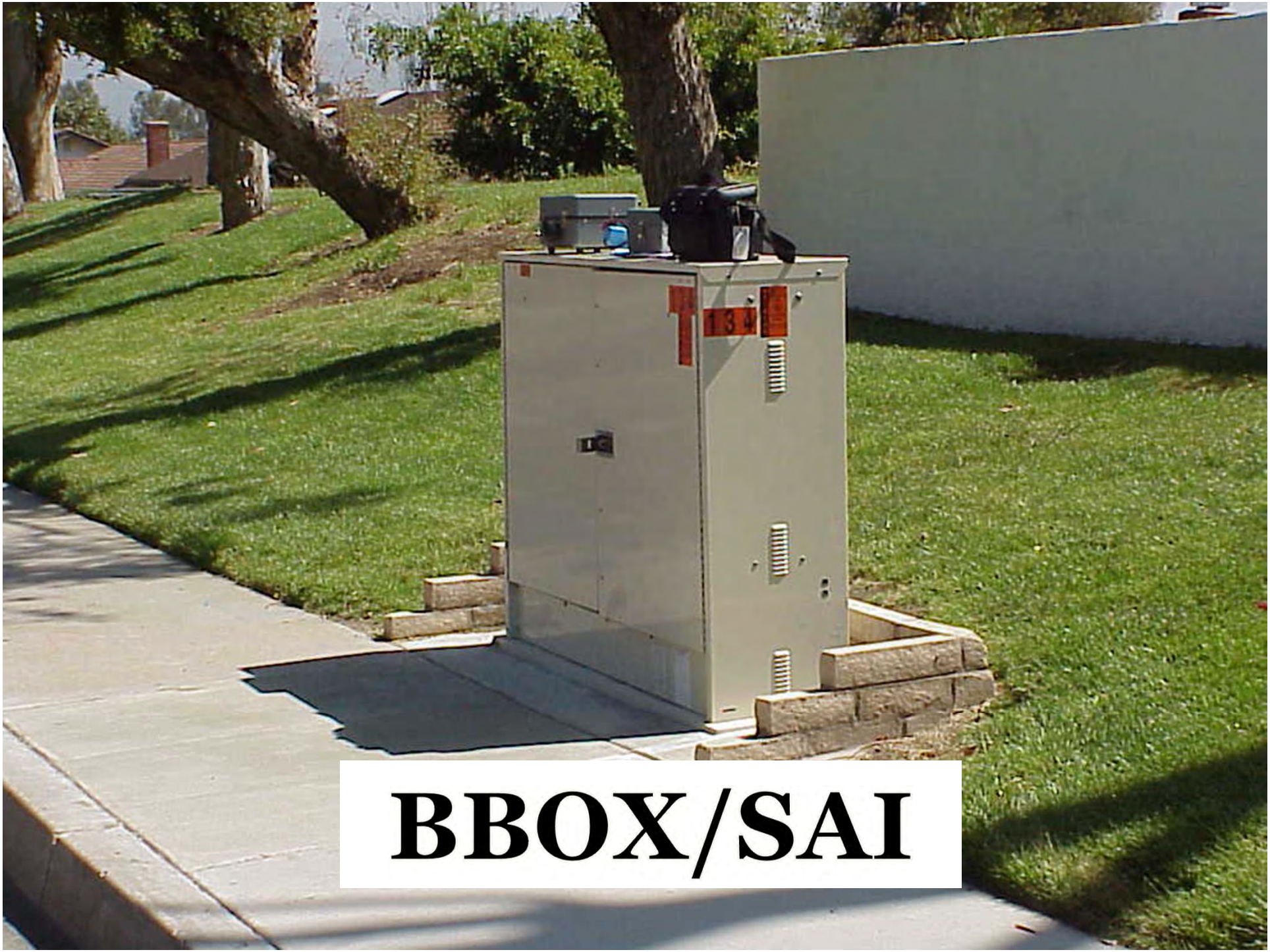
Flat

Plot 2

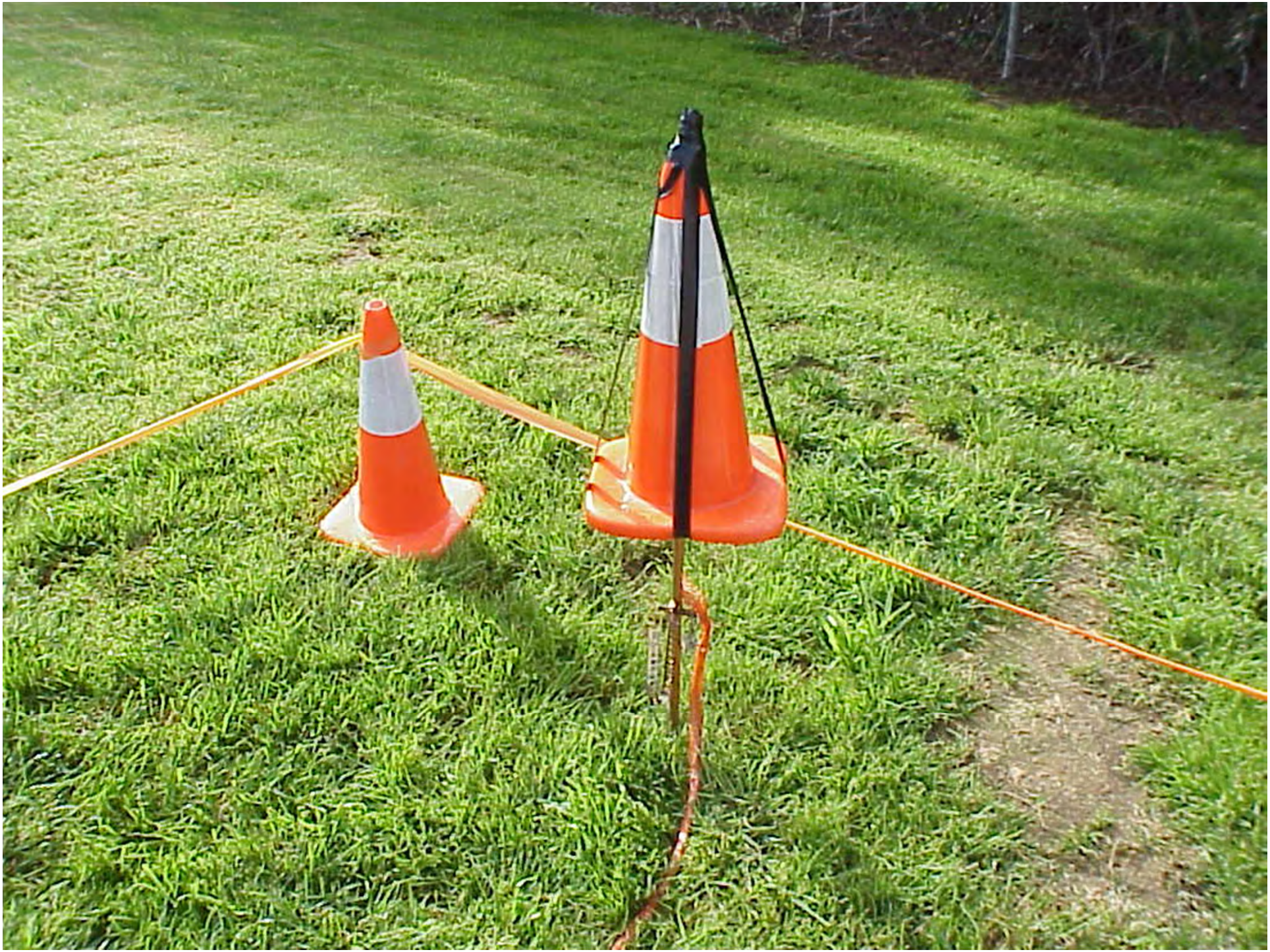
Cable 17
Pair 416




500 KV


BBOX/SAI


880 Box



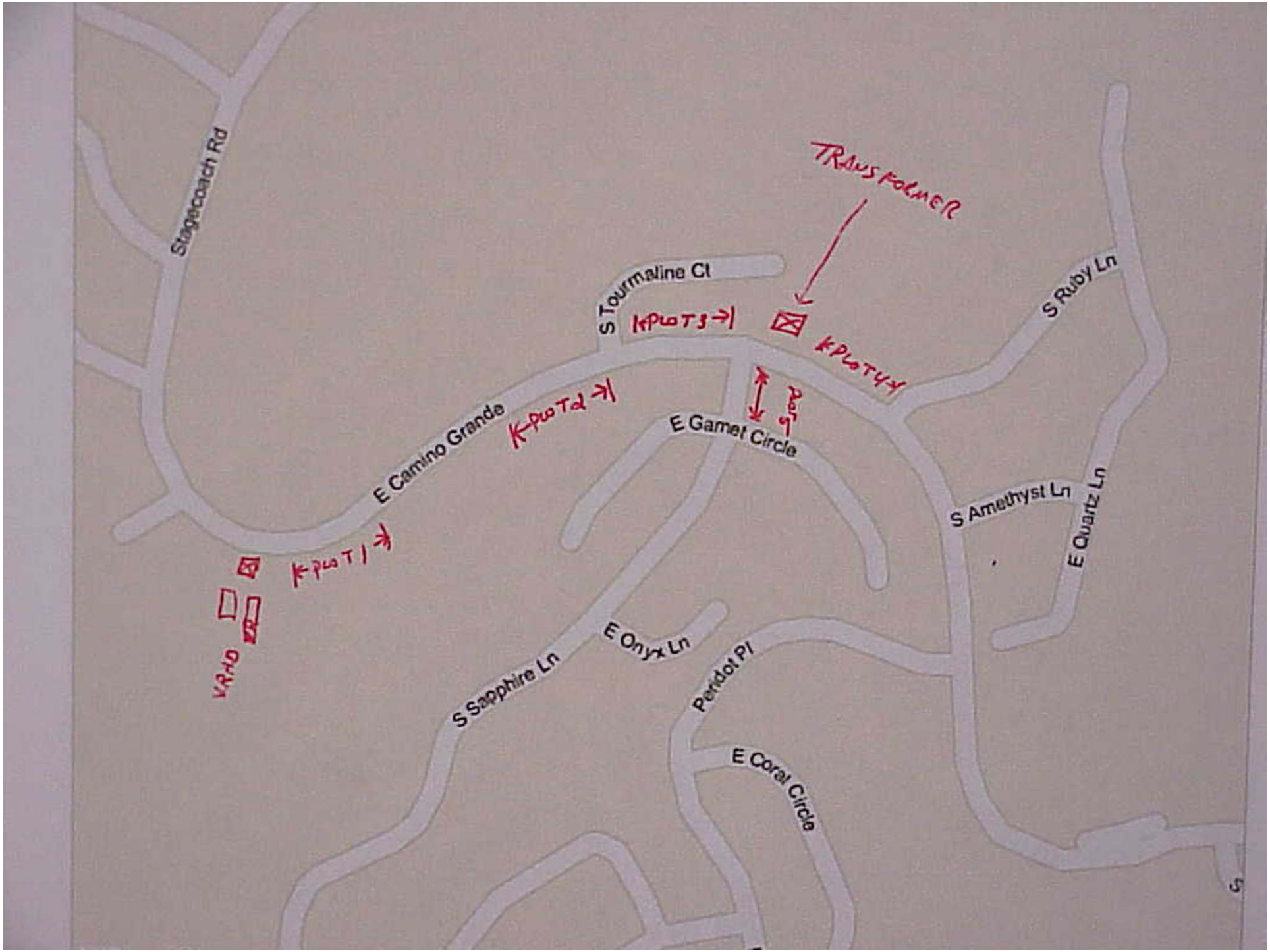

SD
880

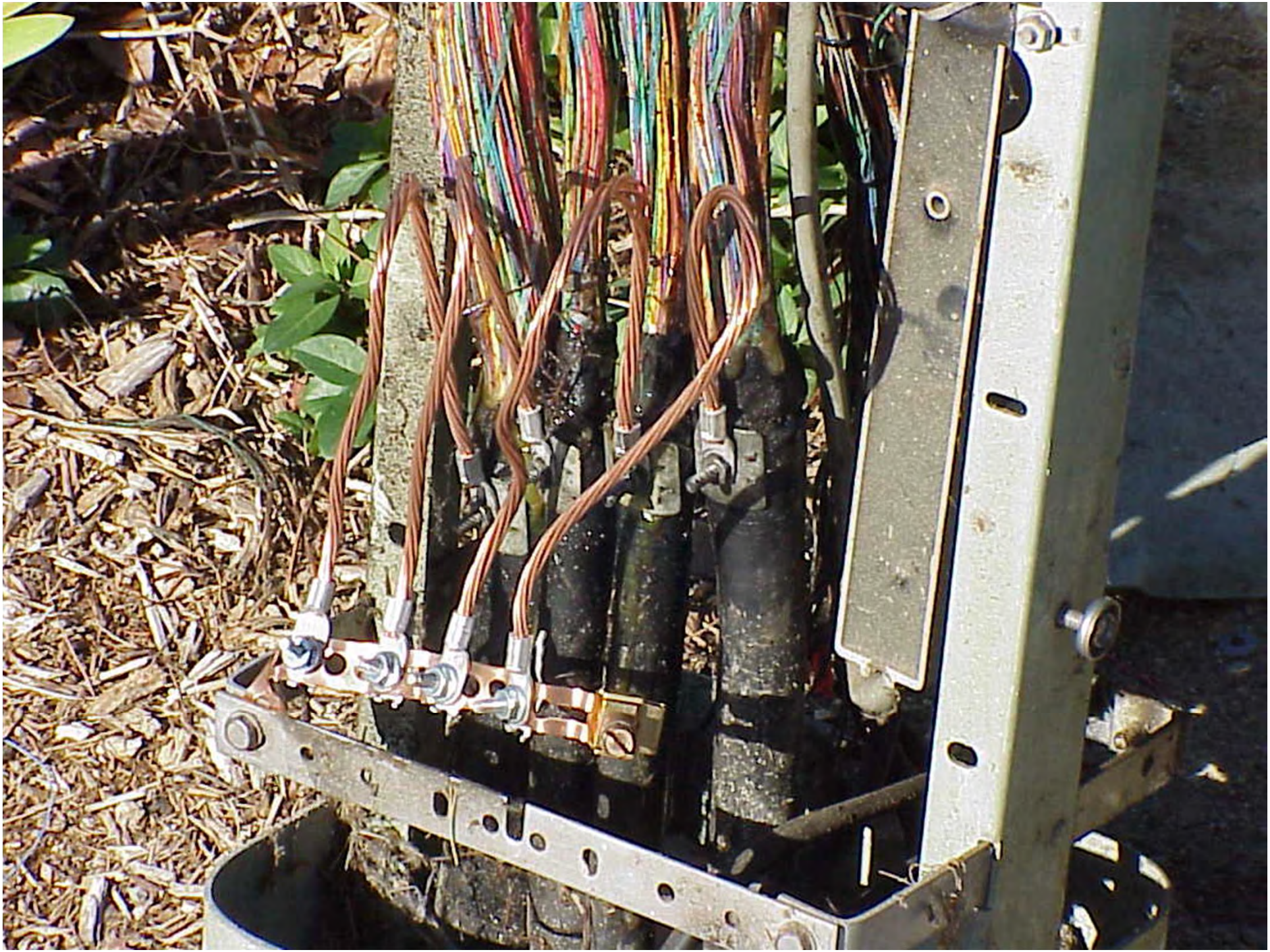

6120
PAIRGAIN


Bond To Ground Ring


H
C
I


START LOOKING UP
THE HILL


Stagecoach Rd
S Tourmaline Ct
S Ruby Ln
E Camino Grande
E Garnet Circle
S Amethyst Ln
E Quartz Ln
S Sapphire Ln
E Onyx Ln
Peridot Pl
E Coral Circle



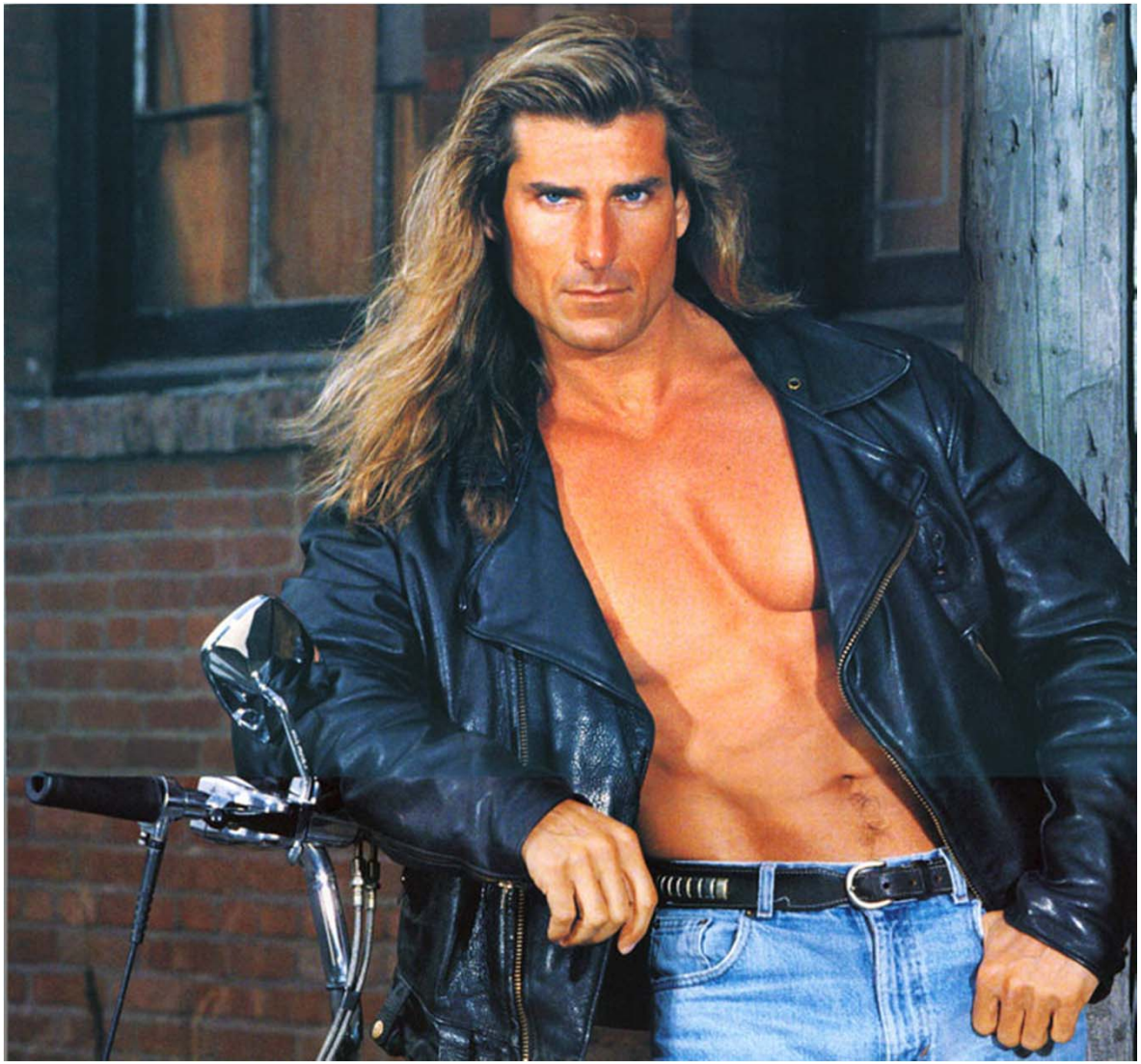

MH 839
Back To Box 880

NOISE REDUCED FROM 30 dBrnC TO 14 dBrnC

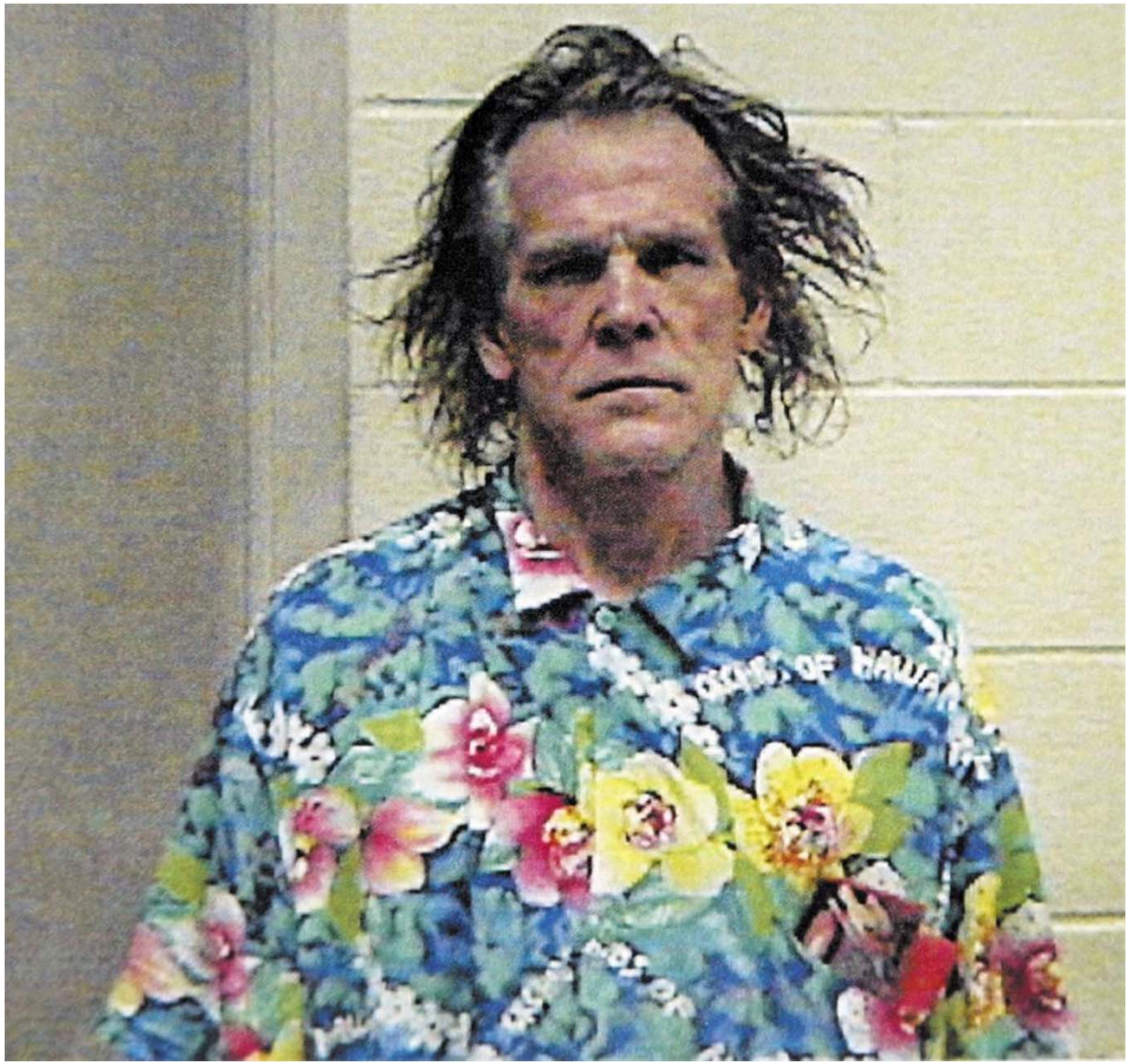
A Well Grounded Fence

Noise Analysis Using a Clampon Ammeter

HENRY RANDOLPH



Henry Before He Goes Out on the Town



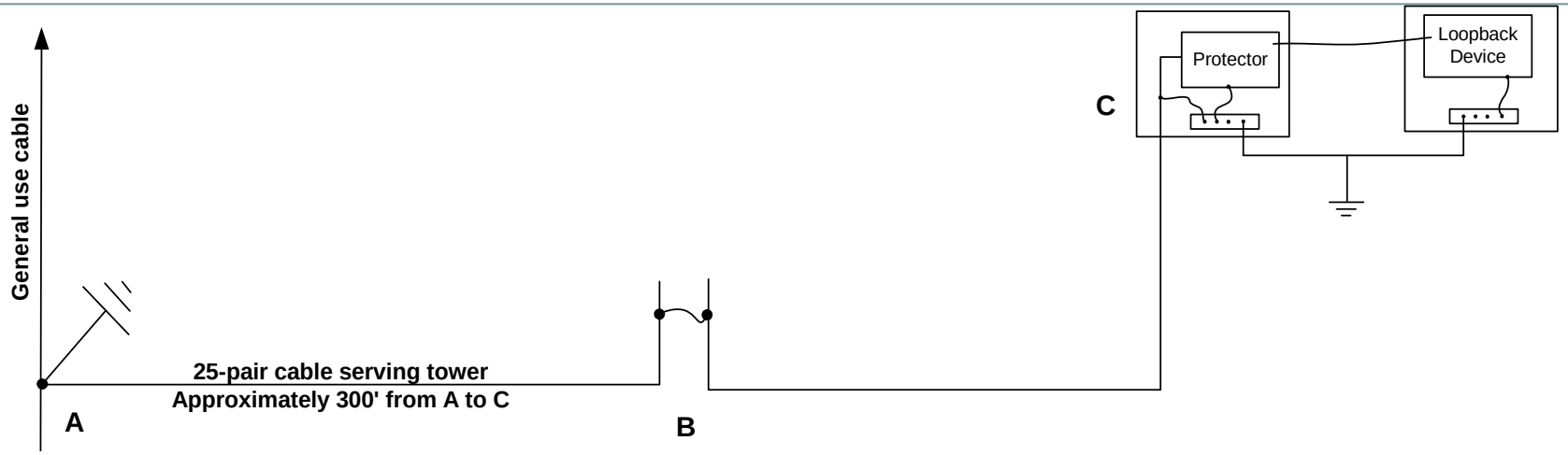
Henry After He comes Back Home

Henry at Work on Monday Morning

Trouble: when loopback device is grounded, the circuit begins taking errors.

Effects of High Resistance Shield

- Reduced Current Flow in Shield
- Induced Voltage on Cable Pairs Increases
- Results in Intermittent Firing of Secondary Protectors in the NCTE Card



This method works by measuring induced voltage and current flow on the shield

- Induced Current at the Bond Strap at Location C = 7 ma (Between the Grounds at Location A & C
- Induced Open Circuit Voltage at Point C with Bond Strap Removed = o.1 volts
- Calculating the Resistance of Shield Between A & C - 0.1 volts / .007 a = 14Ω
- This Resistance Should be < 1 Ω (25 Pair Cable Shield has ~ 1Ω per 1000 ft)
- The Only Bond Between Locations A & C was at the Splice at Location B
- Bond was corroded, when replaced, the Induced Current Flow at Location C Increased to 1.12 amps
- Indicating that the Resistance of the repaired shield was less than 1 Ω

Measuring Shield Current


Pedestal with
Corrosive Bond

Sections of Corroded Shield at Splice Location B

Effects of Lower Resistance Shield

- Increases Current Flow in Shield
- Decreases induced Voltage on Cable Pairs
- Sporadic Firing of Secondary Protectors in the NCTE Card is Eliminated
- Circuit Errors Stop

Telecommunications Protection by a Power Company

“Special Protector”

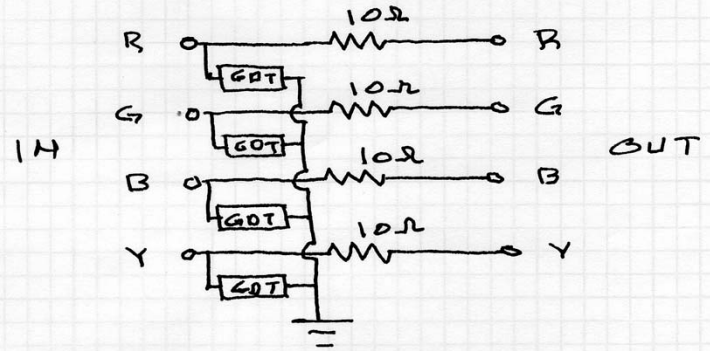
- Required by a Power Company for Warranted Protection from Damage
- Placing in series and on customer side of telephone protector
- Would not pass HPNA Signal
- NEC issues
- No listing mark
  - Primary Protector?
  - Secondary Protector?


GULF POWER
GULF POWER


G
Y
B

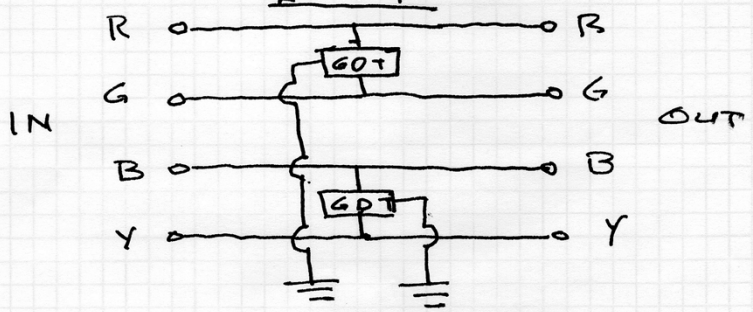
TELEPHONE LINE SURGE PROTECTOR COMPARISON

Power Co



TWO ELEMENT GDT

AT&T



THREE ELEMENT GDT

LCP

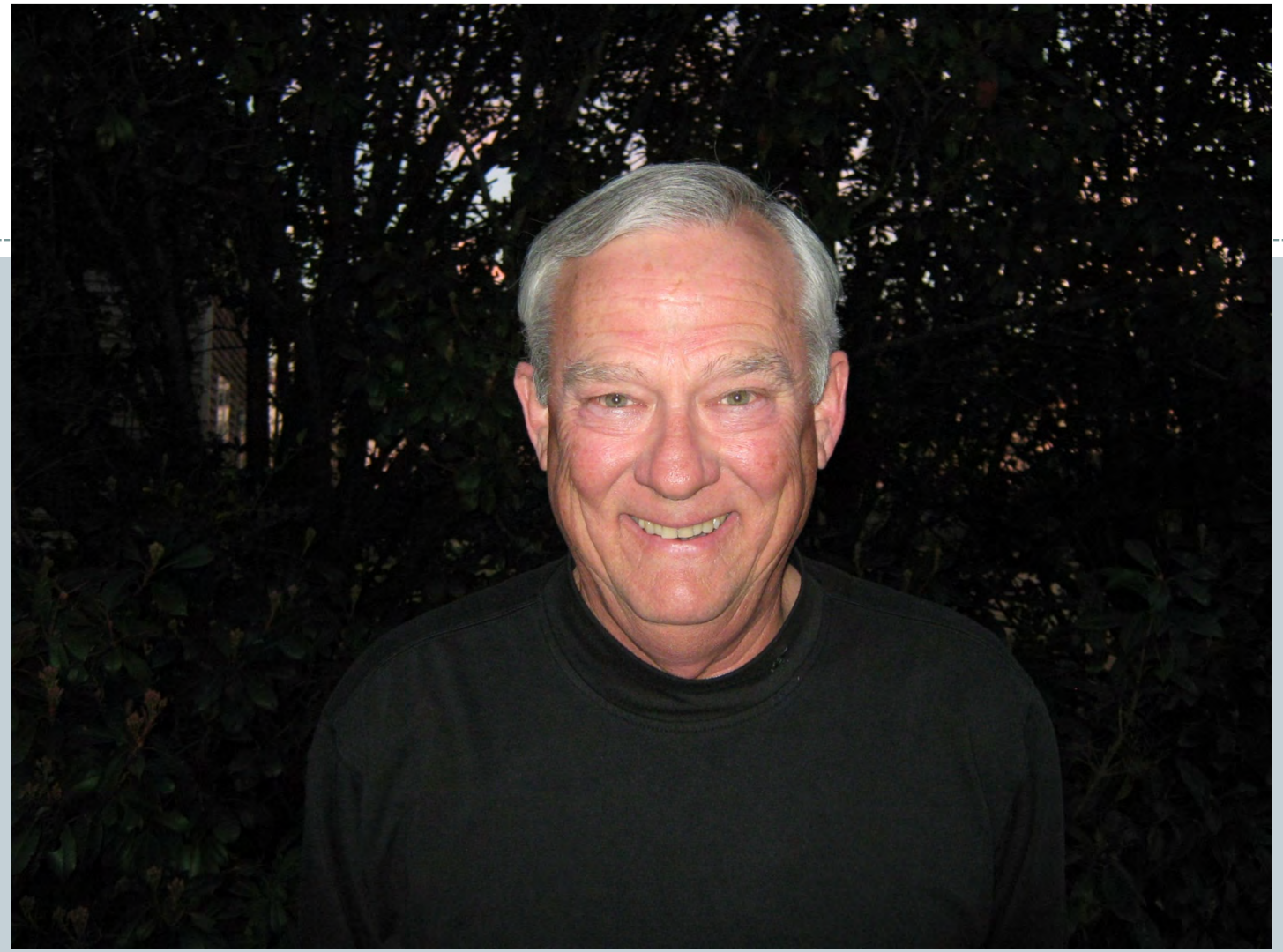
Design Question

- 10 Ohm resistors provides "coordination," …

  but not coordinated with AT&T equipment
- Two element gas tubes
  - A device for each conductor
  - Longitudinal to Metallic Conversion during a surge
- Standard AT&T Station Protectors - Three Element Gas Tubes
  - Minimal Longitudinal to Metallic Conversion during a surge event

Equipment Damage Claim in Mississippi

Bill Tucker




UN
OUNTRY

NEC Article 800.24 Mechanical Execution of Work. Communications circuits and equipment shall be installed in a neat and workmanlike manner.

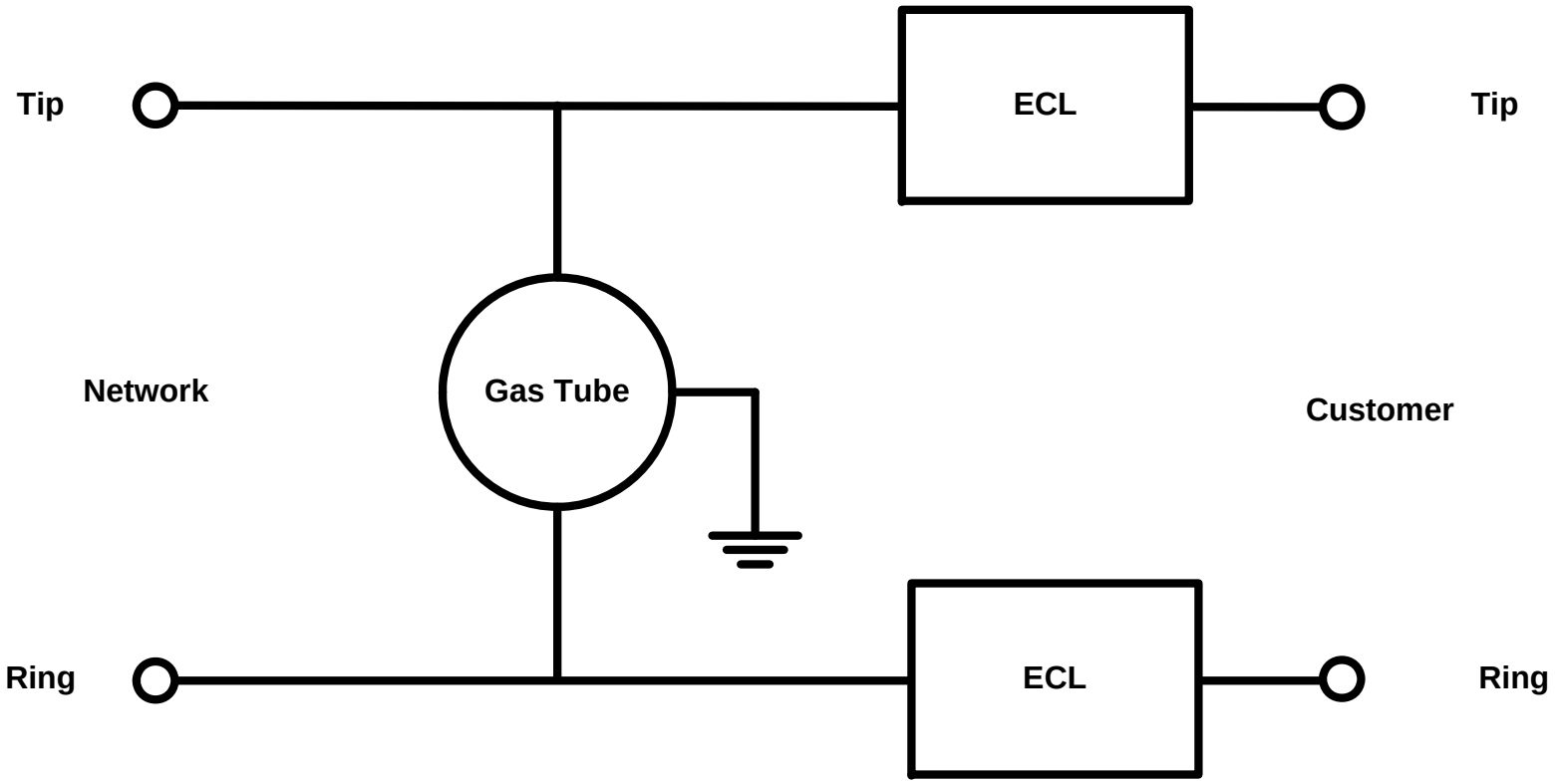

UN
OUNTRY

Electric Fence Controller Damage

Electric Fence Controller Damage

- Controller for electric fence damaged frequently by lightning storms.
- I Suggested using a special protector
- Originally designed for telecommunications equipment at customer premise.
- GDT and ECL

Three Element Gas Tube with ECL Station Protector Schematic



ECL / Gas Tube Function

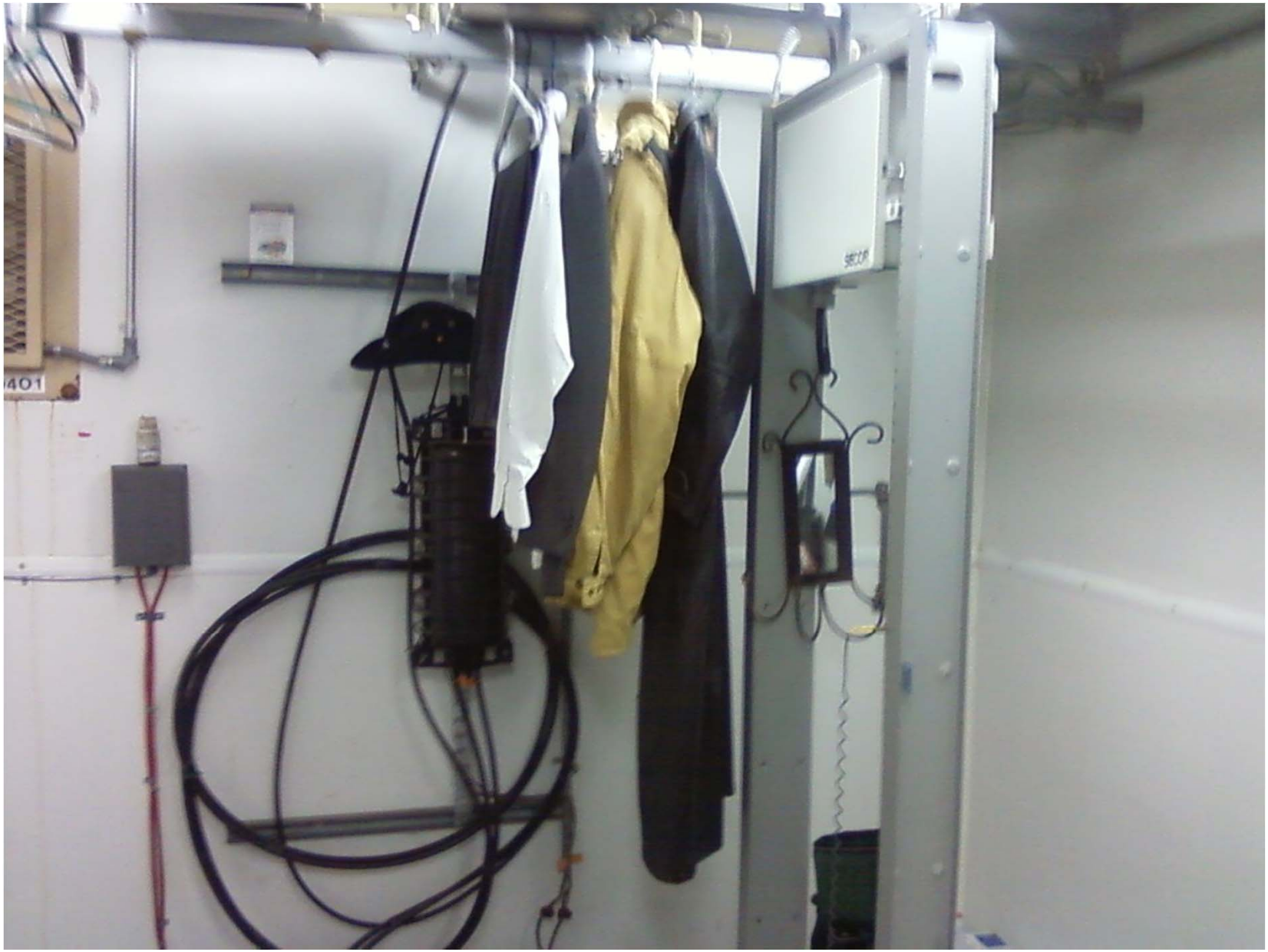
- Switches very quickly from a low resistance state – approximately 12Ω - to an open circuit when current threshold is exceeded
- Signal / surge path is opened until gas tube fires
- Signal / surge path is shorted to ground until surge is removed
- Critical to connect “Network” side to cable pair, “Customer” side to customer’s inside wiring
- Results – no more damage to electric fence controller in more than a year

Alternative and Creative Use of an RT Site

TRUE…


Soldering Gun


Lever
2000
GAMO
POWER PELLETS
25%
INCREASED VELOCITY
SUPERSONIC PRO
PERFORMANCE BALLISTIC ALLOY
LORAIN
RELIANCE COMM/TEC
LORAIN
RELIANCE COMM/TEC




FLM 2400 HS
FRAGILE
1401


HOUSE OF BLUES
Chicago