CHARACTERISTICS of UNDERGROUND SECONDARY POWER DISTRIBUTION NETWORKS
For POWER LINE COMMUNICATION

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TYPICAL POWER DISTRIBUTION SYSTEM

Bulk Power Components

Switching Station

Inter Utility Tie

Hight Voltage Transmission Line

Area Substation

Feeders to Underground Network

Unit Substation

Customers

Distribution Components

Customers
AREA SUBSTATION
Double Syn Bus Arrangement

Legend
- Subtransmission Feeder
- Circuit Switches
- Transformer Bank
- Station Bus
- Breaker
- Distribution Feeders
- Distribution Feeder Breakers
SECONDARY DISTRIBUTION NETWORK

Legend
- 13/27/39KV Feeder
- Network Transformer
- Network Protector
- Secondary Network
- 120/208 V Service
- Spot Network
PROPAGATION LOSS INSTRUMENTATION

Transmitter

Oscillator → Power Amplifier → Matching Network

V & I Meter → HPF

To Secondary Network

Receiver

Spectrum Analyzer → Matching Network

From Secondary Network
SECONDARY LINE IMPEDANCE INSTRUMENTATION
BLOCK CELL TEST AREA
MEASURED PATH LOSS

T: V1  R: V2
MEASURED PATH LOSS

T: V1  R: V3
MEASURED PATH LOSS

T: V1  R: V4
MEASURED PATH LOSS

\[ T: \text{V1} \quad R: \text{LP2} \]
MEASURED PATH LOSS

T: V5  R: V1

![Graph showing measured path loss with frequency vs. path loss, with data points for phases A, B, and C.]
MEASURED PATH LOSS

$T: V5 \quad R: V2$
NOISE SPECTRUM

Noise R: LP2 Ph B

AMPLITUDE, dBm

FREQUENCY, KHZ

0

-20

-40

-60

-80

149.9

150.0

150.1
SIGNAL plus NOISE SPECTRUM

T: LP2 Ph B  R: LP3 Ph B
NOISE SPECTRUM

Noise  R: LP3 Ph B
SIGNAL plus NOISE SPECTRUM

T: LP2 Ph B  R: LP3 Ph B
LINE IMPEDANCE

At: V1
Protector Open, Network Side
LINE IMPEDANCE

At: V3
Protector Open, Network Side
LINE IMPEDANCE

At: V4
Protector Open, Network Side

![Graph showing line impedance measurements over frequency.](image-url)