

IEEE Update

LPI Annual Meeting

March 16, 2007

William Bush
Director of Research – Power & Grounding

Panduit Labs
Panduit Corp, New Lenox, IL

wbu@panduit.com; wbush@ieee.org
815-485-1800 x2283

IEEE Activity

- ❖ **IEEE Std 1100TM-2005**
- ❖ **IEEE C62.72**
- ❖ **IEEE Guide – Protecting Residential**
- ❖ **IEEE SPDC (including 10x350 Forum)**

IEEE Activity - 2

- ❖ **IEEE papers**
- ❖ **IEEE meeting minutes**
- ❖ **Other**

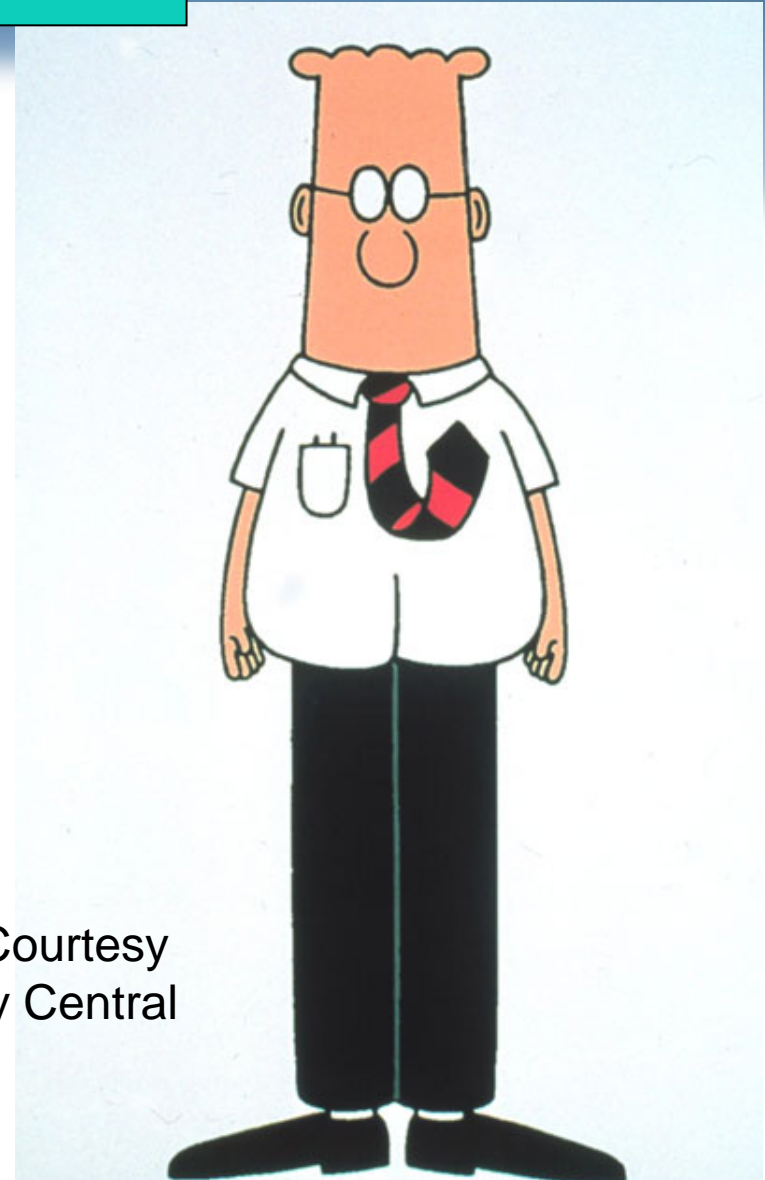
Human safety first



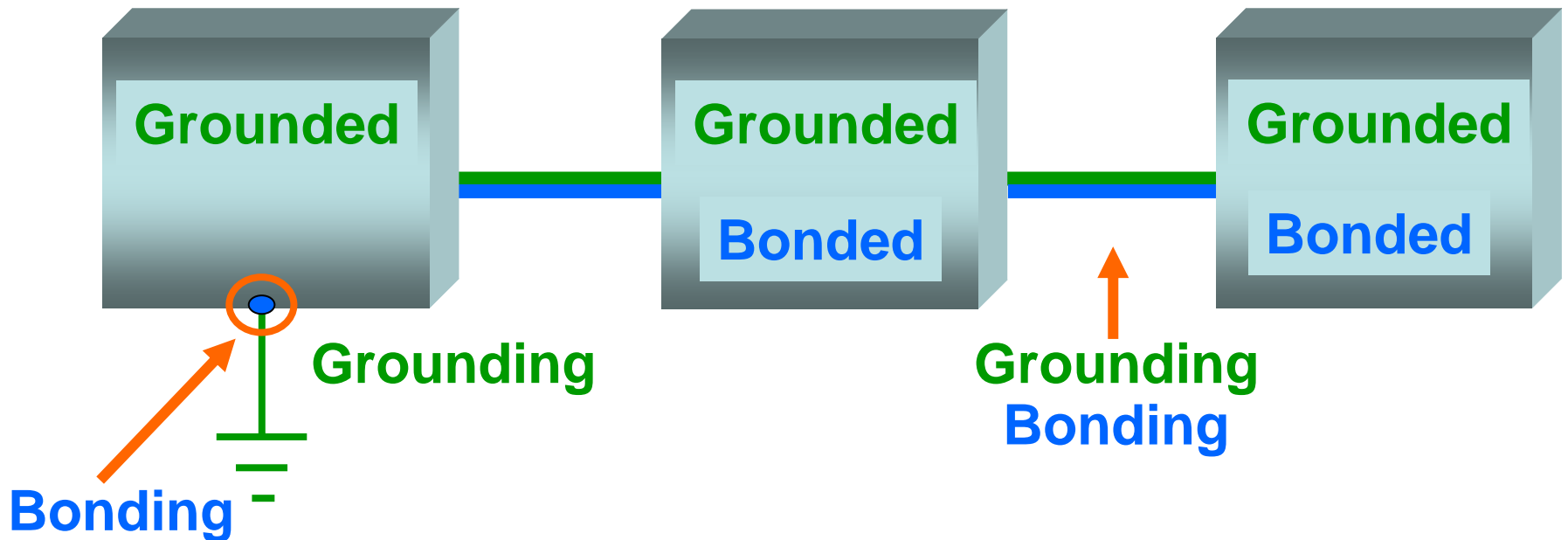
Engineers at work

❖ See clip

From Internet; Courtesy
Dilbert, Comedy Central



Grounding and bonding



Grounding frequencies

- ❖ **Power system sub-harmonics and offset (dc to 60 Hz)**
- ❖ **Power system harmonics (from 120 up to 3 kHz)**
- ❖ **Analog communication circuits (from a few up to hundreds of kHz)**
 - **Single point grounding for low voltage level circuits**
- ❖ **High-speed digital circuits (high kHz to GHz)**
 - **Single and multi-layer planes (common surface) on PCB**

Purposes of G&B

1) Safety

- ◆ Reduce fire hazard
- ◆ Prevent electric shock
- ◆ Avoid equipment damage

3) Performance

- ◆ Control current paths
- ◆ Equalize voltage reference
- ◆ Reduce communication noise

2) Lightning and Surge Mitigation

- ◆ Control transients
- ◆ Remove static charge
- ◆ Bond between all services
- ◆ Equalize surge reference points

Grounding myths

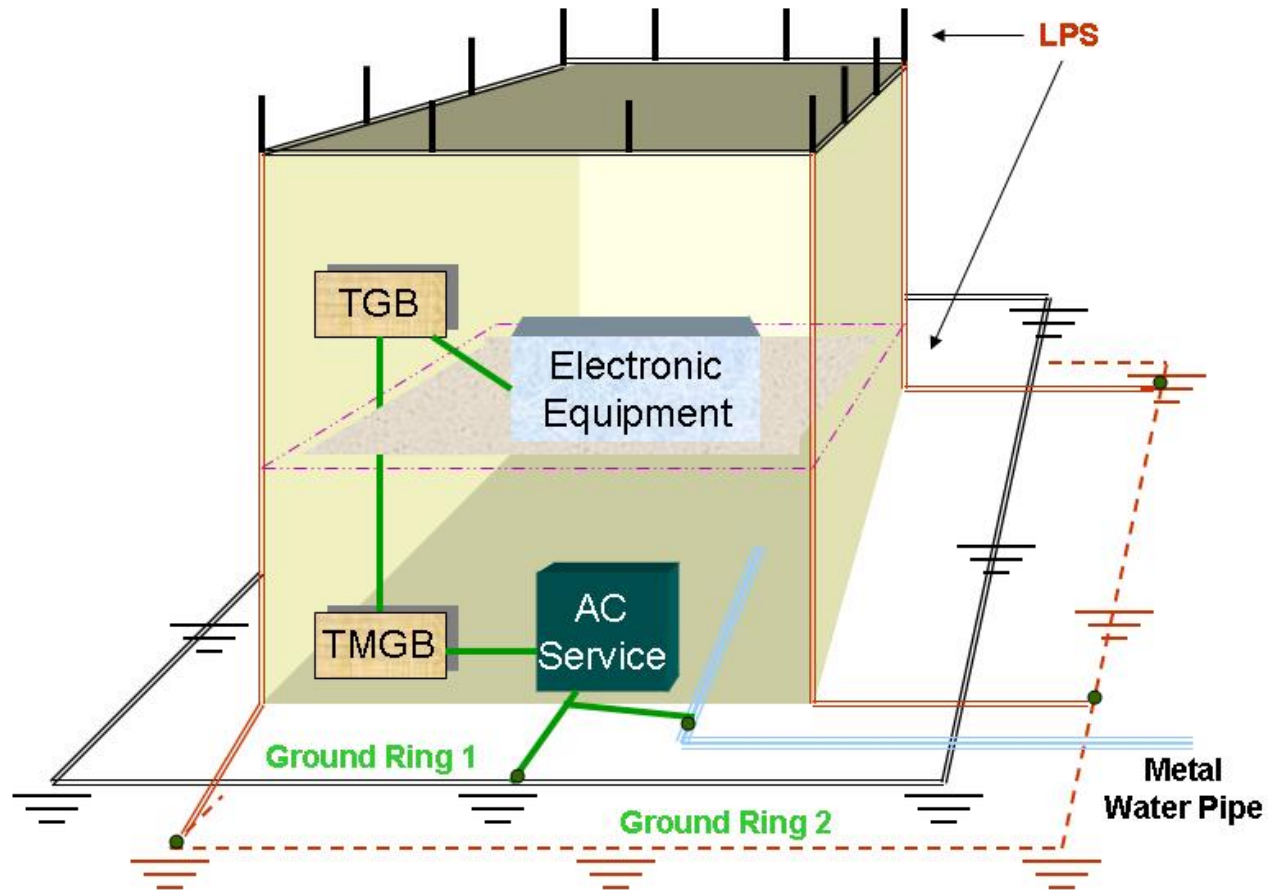
❖ Myth

1. Current takes the path of least resistance
2. Ac and dc “noise” goes into the earth ground and stays there
3. Lightning never strikes twice in the same place

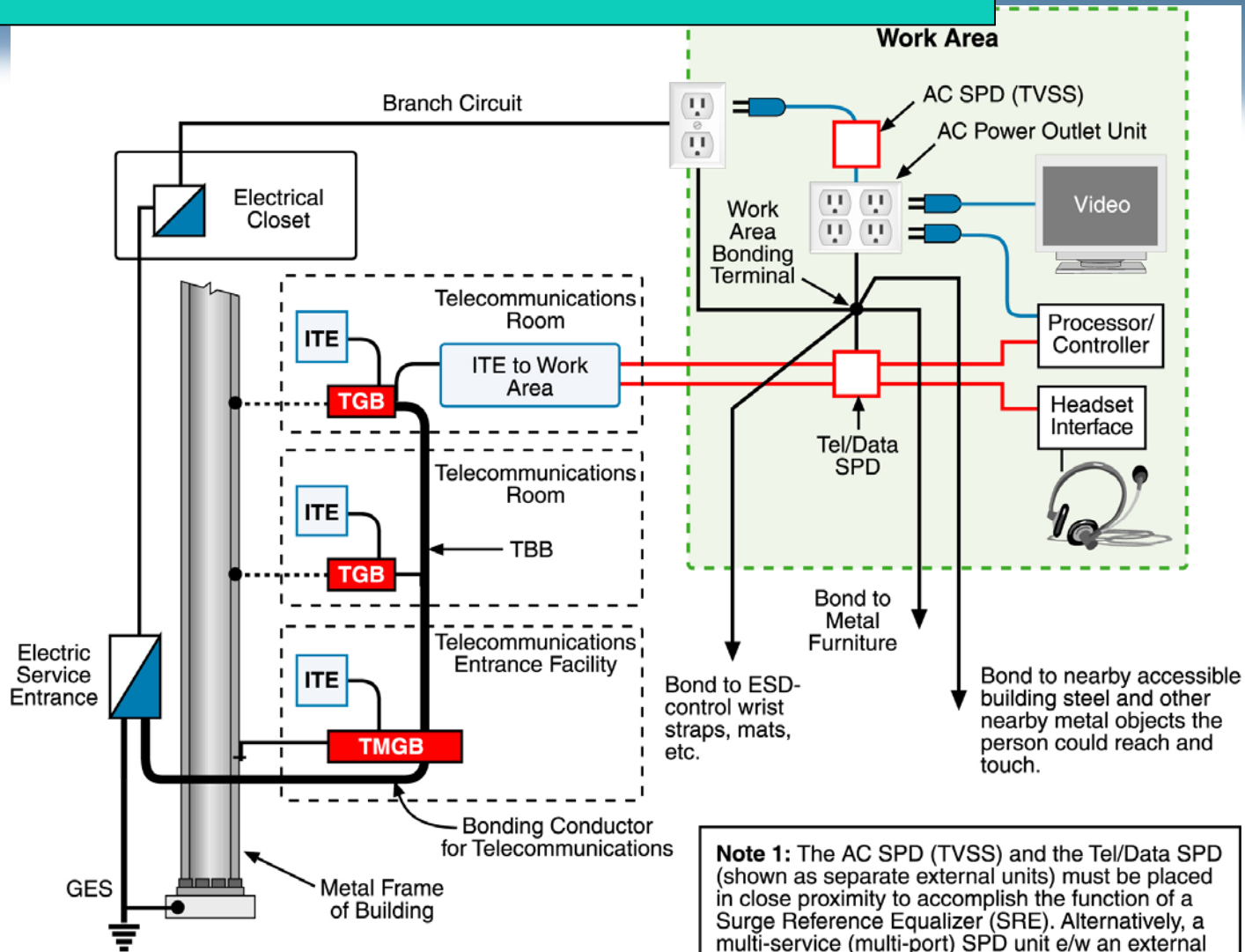
❖ Fact

1. Current paths are controlled by impedance
2. Currents into the earth always return to source (lightning and static discharge are a special large-scale case)
3. Lightning strike is an independent (probability) event

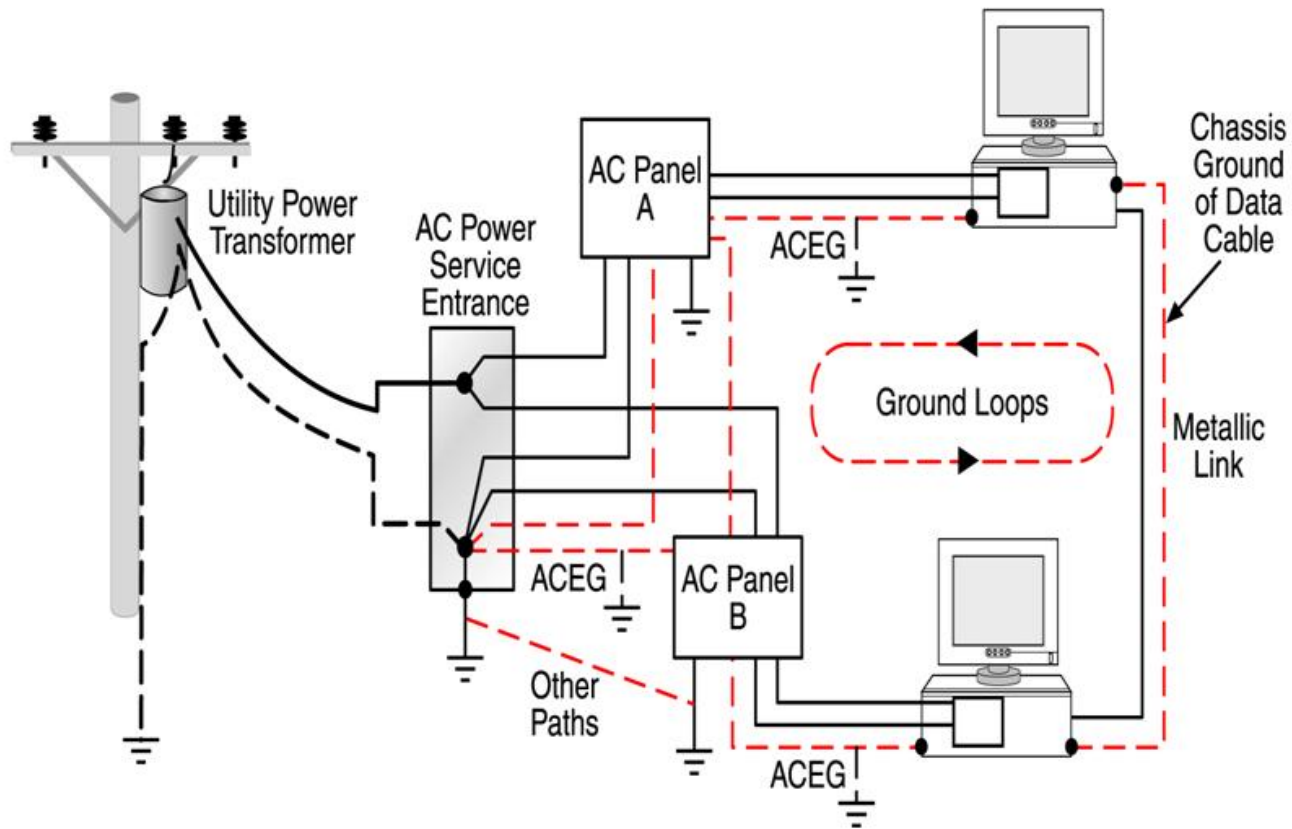
NFPA 70 vs. 780



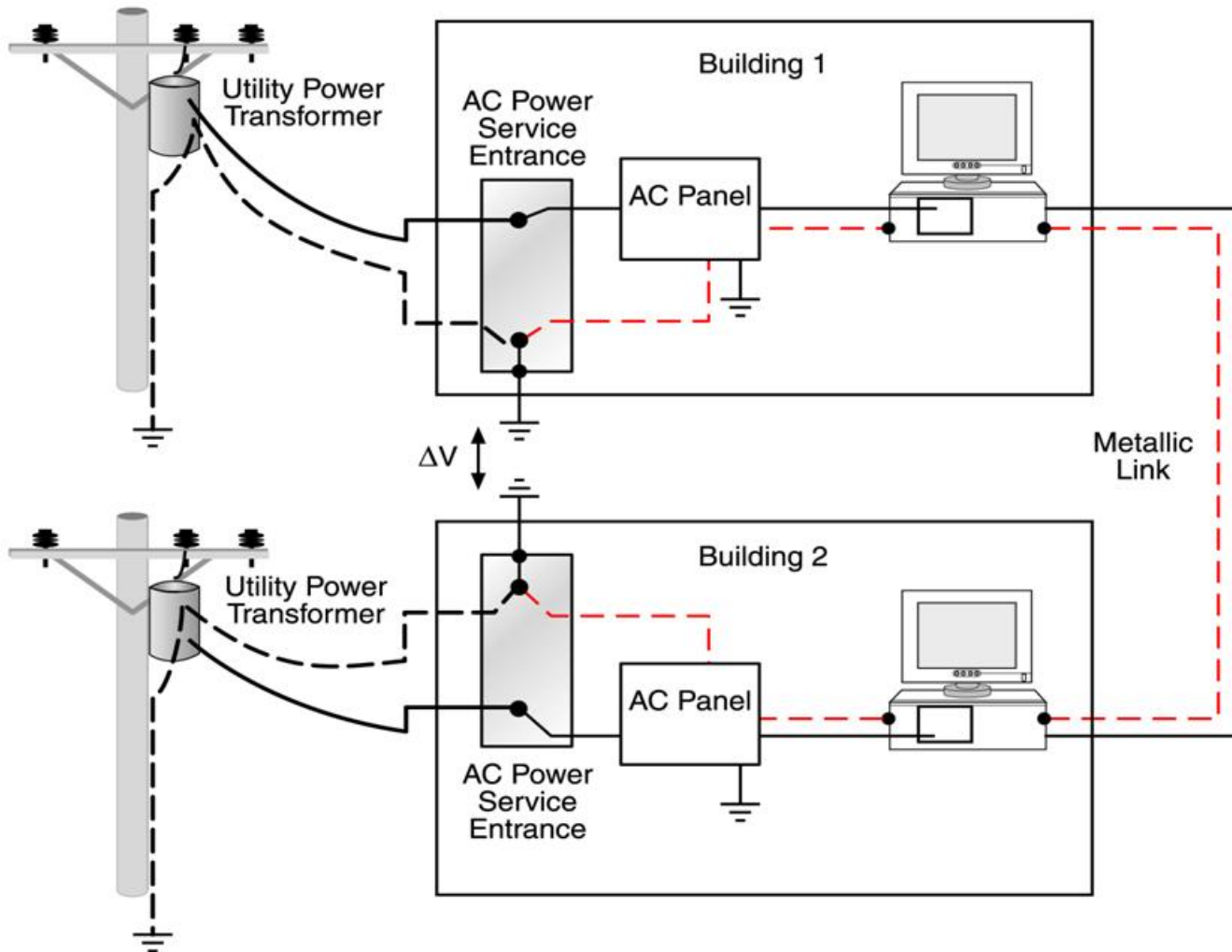
Special concern - headsets



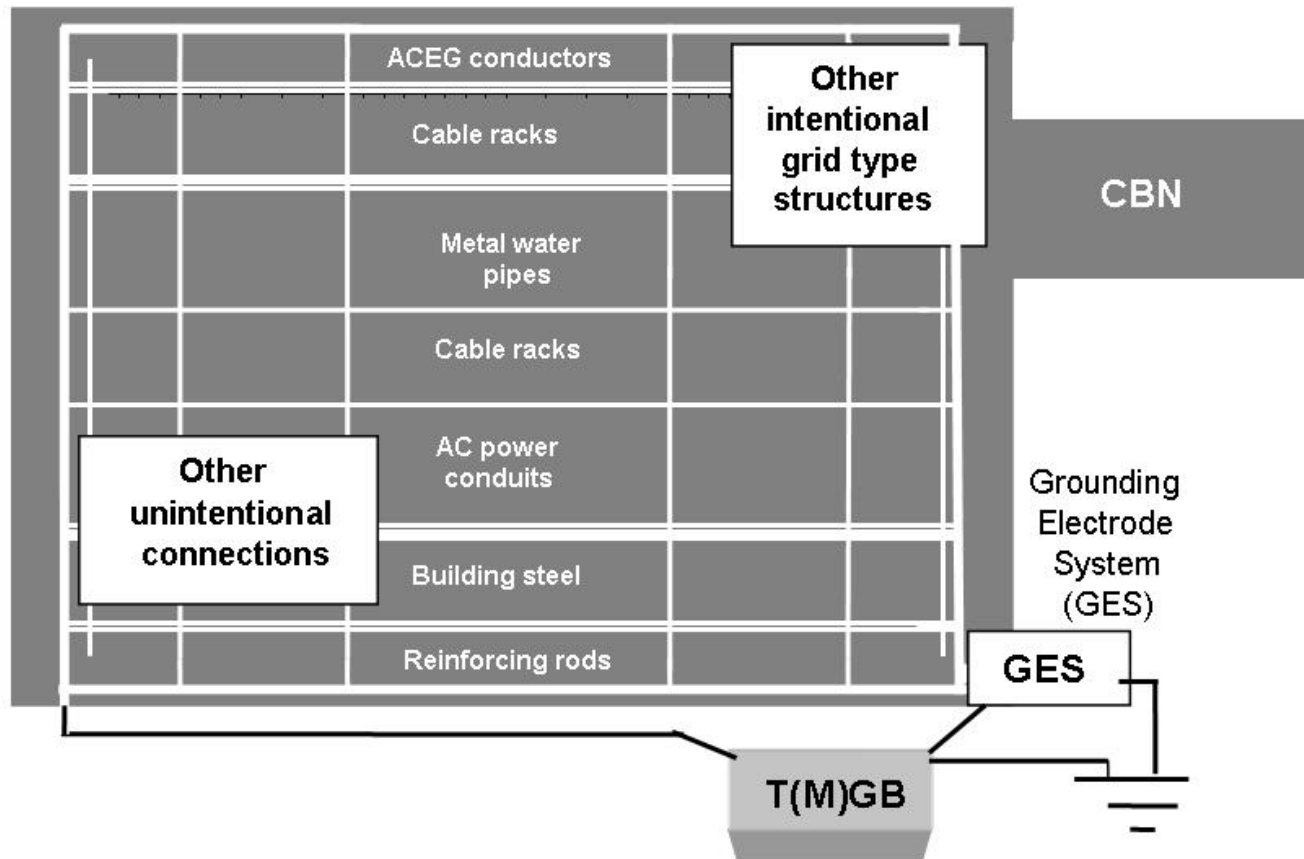
Ground loop



Ground loop - 2



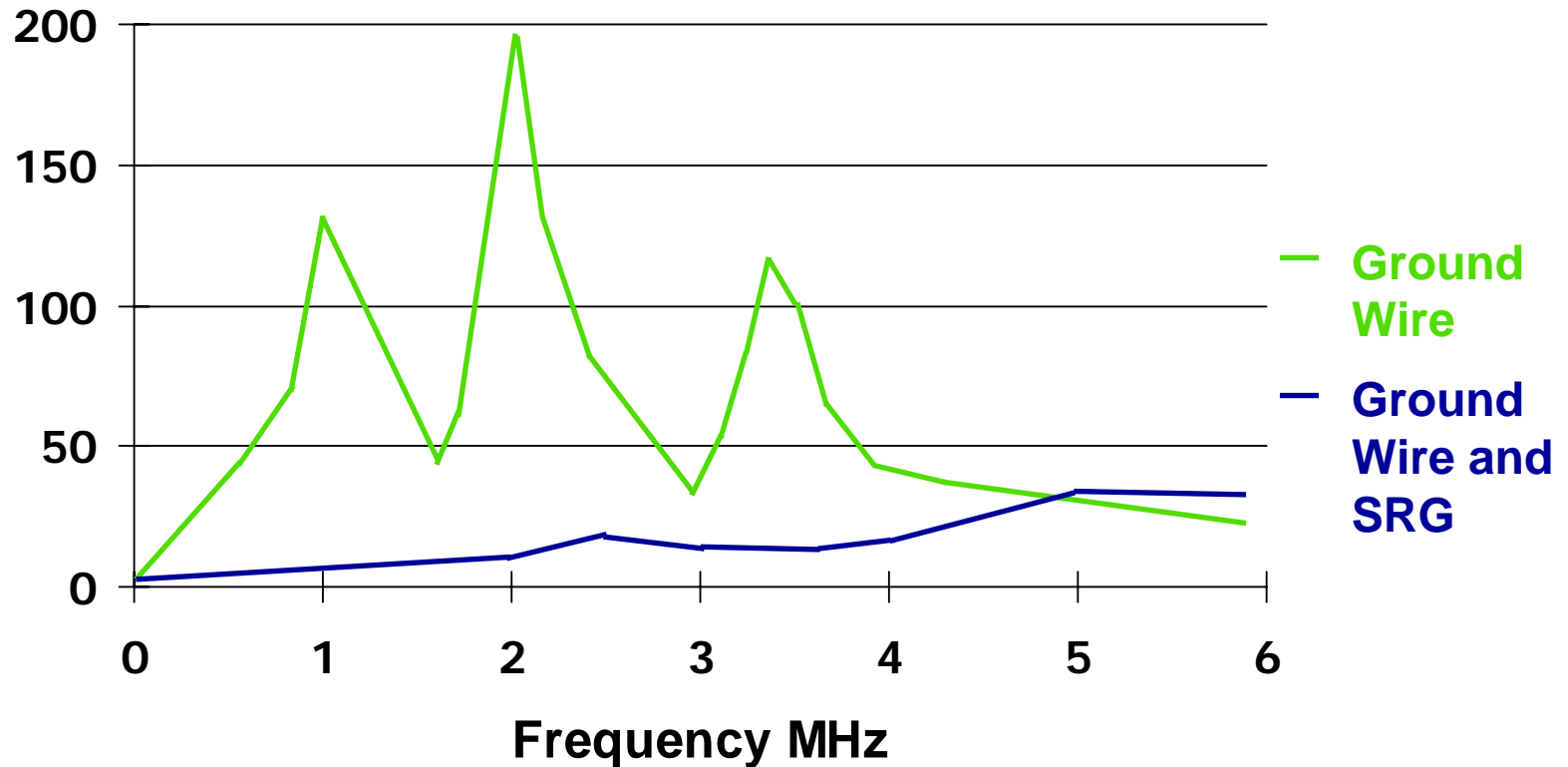
Common bonding network



Conducted Z variation

Impedance
OHMS

Inter-cabinet signal-common impedance



Ref. CDC

Reflection

