Product Safety Engineering Society

10 Things You Should Know About NEBS

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Overview

- What is NEBS?
- Ten Things You Must Know About NEBS
- References

NEBS is not to be confused with:

NEBS

NEBS
NEW ENGLAND BARBECUE SOCIETY

PSES
Product Safety Engineering Society

What is NEBS?

- NEBS stands for “Network Equipment – Building System”
- NEBS describes the environment of a typical Regional Bell Operating Company (RBOC) Central Office (CO)
- Developed by Bell Labs in the 1970s to standardize equipment in a phone company’s CO
- In order to sell equipment to the RBOCs, your product must comply with the NEBS requirements of Telcordia GR-63-CORE and GR-1089-CORE

1. NEBS is here to stay

- The Regional Bell Operating Companies (RBOCs) are the customer
- They control their own networks and they dictate the requirements
- The RBOCs require that products in their networks be NEBS Level 3 compliant
- It's up to you as the designer to give the RBOCs what they want
- An RBOC's central office is a specialized environment. Major cities have grown around these central offices, and the RBOCs are unlikely to give up this valuable real estate

Historical marker located Broadway, Albany, New York
(From http://en.wikipedia.org/wiki/File:1st_Telephone_Central_Office.jpg


verizon
LAST ONE OUT
MUST LOCK
GATE

This frame uses relays to test other frame circuits

Today the equipment is computerized and is uses digital components

Our modern computers are direct descendants of the switches developed for telephone circuits

The main distribution frame (MDF) is located in the central office (CO)

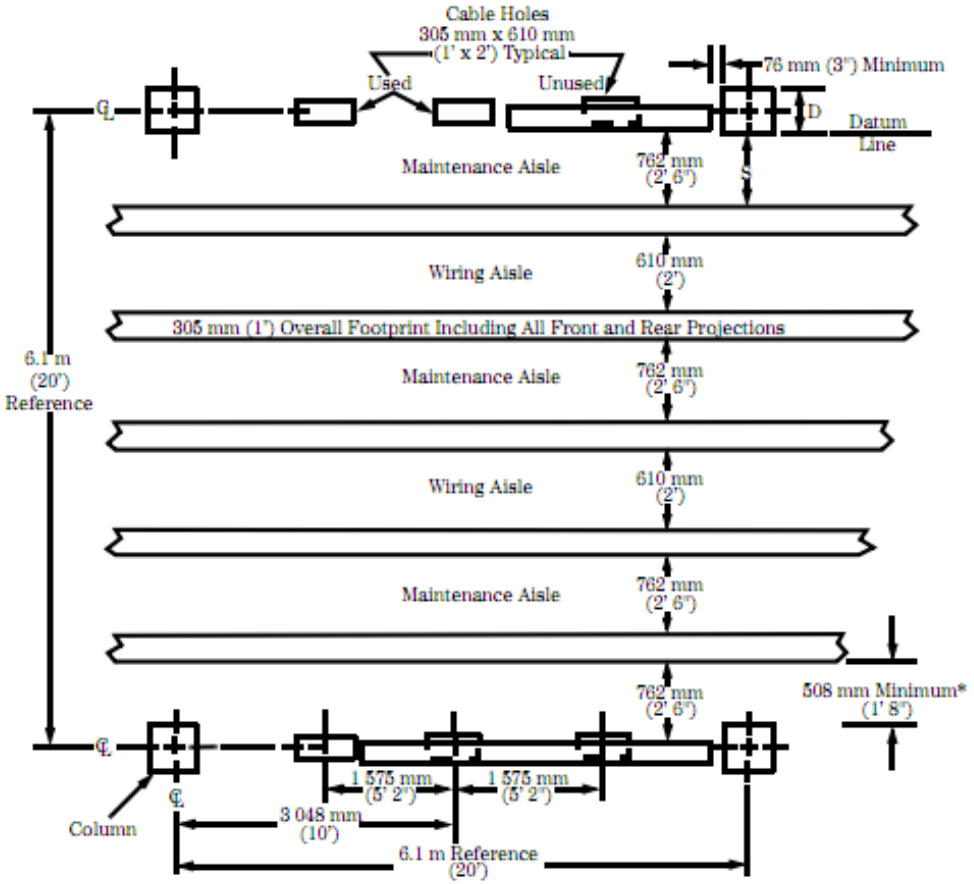
This frame terminates (connects) all the wires and cables that enter or exit the central office

The MDF contains fusible links to protect equipment from

damage from lightning or other voltage surges

From The Museum of Communications (http://www.museumofcommunications.org/coe.html)

Figure 2-2 Typical 6-Lineup Floor Plan for Nominal 300 mm (12-in) Deep Frames



Column Depth "D"	559 mm (1' 10") or Less	610 mm (2')	660 mm (2' 2")	711 mm (2' 4") or Greater
Space at Column Face "S"	762 mm (2' 6")	711 mm (2' 4")	660 mm (2' 2")	610 mm (2")

* For column depths greater than 711 mm (2' 4"), it may be necessary to omit some frames in the equipment lineup opposite columns (wiring aisle side).

Table 1-1 NEBS Levels Summary

NEBS - Level 1	NEBS - Level 2	NEBS - Level 3
GR-63-CORE • Surface Temperature Requirement • Heat Dissipation Documentation Requirements • Fire Resistance Criteria **GR-1089-CORE** • Radiated Emission (Closed Door Requirement) • Conducted Emission for Power, Signal, and Voiceband leads • Voltage Limiting Protection for CO Switching Systems • Short Circuit Tests for Telecom Ports • Second-Level Lightning and AC Power Fault Tests for Equipment with Telecom Ports • Second-Level Lightning for Equipment with AC Power Ports • Second-Level Lightning and AC Power Fault Tests for Equipment with Coaxial Cable Ports • Electrical Safety and Listing Requirements • Bonding and Grounding	**GR-63-CORE** • Temperature and Humidity (Operating Conditions) • Earthquake (Zone 2 Level) • Office Vibrations • Airborne Contaminants **GR-1089-CORE** • ESD (Normal Operation) • Radiated Emissions (Requirement) • Radiated Immunity (Closed Door Requirement) • Conducted Immunity for Power Ports and Signal Leads • First-Level Lightning and AC Power Fault Tests for Equipment with Telecom Ports • First-Level Lightning for Equipment with AC Power Ports • First-Level Lightning and AC Power Fault Tests for Equipment with Coaxial Cable Ports • Steady State Power Induction Requirements • DC Potential Difference • Bonding and Grounding, Compatibility to CBN • Corrosion	**GR-63-CORE** • Temperature Margin • Fan-Cooled Equipment Requirements • Temperature and Humidity (Short-Term Conditions) • Altitude Requirements • Transportation and Storage Environments • Packaged Handling Shock Requirements • Earthquake (Zone 4 Level) • Transportation Vibrations **GR-1089-CORE** • ESD (Install and Repair) • EFT • Radiated Emission (Open Door Objective) • Radiated Immunity (Conditional Requirement) • Conducted Emission for Broadband Leads • Conducted Immunity for Broadband and Voiceband Leads • Protection Coordination • Steady State Power Induction, Conditional Requirements

From Telcordia SR-3580 “NEBS Criteria Levels”

2. NEBS is expensive

- A full NEBS Level 3 test program can cost as much as $100,000.00
  - With that kind of investment, it's imperative to do it right the first time
  - If testing is done incorrectly, retesting adds to the cost
  - Delays caused by retesting in turn delay market entry
- Because NEBS must be designed into the product, there also are development costs that must be factored in
  - Designing NEBS into the product reduces overall cost because fixes are not being added to the end of the design

3. NEBS takes time

- How long the process takes depends on how well the product has been designed to NEBS
- The more samples you can spare, the more quickly you can get through the testing process
- It is important to keep in mind that providing more samples increases the cost of the test cycle. Cost and schedule must be balanced
- Plan on a minimum of three units for the NEBS test cycle: one unit for GR-63-CORE, one for GR-1089-CORE, and one for second-level lightning, ac power fault, and fire resistance tests
- Each unit follows a logical test path to minimize the time necessary to complete a NEBS Level 3 test program
- Problems and questions are inevitable during testing
- Having a knowledgeable person in the test lab to respond on the spot ensures a smooth NEBS test program
- A technical member of the staff or a NEBS Consultant should be present during testing

4. NEBS is complicated

- There are hundreds of requirements to satisfy before a product can become Level 3 certified
- If you miss just one, you cannot claim NEBS Level 3
- Each requirement needs to be compared with the overall design
- Having a NEBS design review at critical points in the development is critical to ensuring that a product is NEBS compliant
- Designers who are uncertain of all of the requirements should use a
- NEBS Consultant
- Considering the time and money required to develop a product for this specialized market, the investment is worth it
- A NEBS Consultant can help design the product to meet NEBS requirements
- Getting through all of the requirements takes a team effort

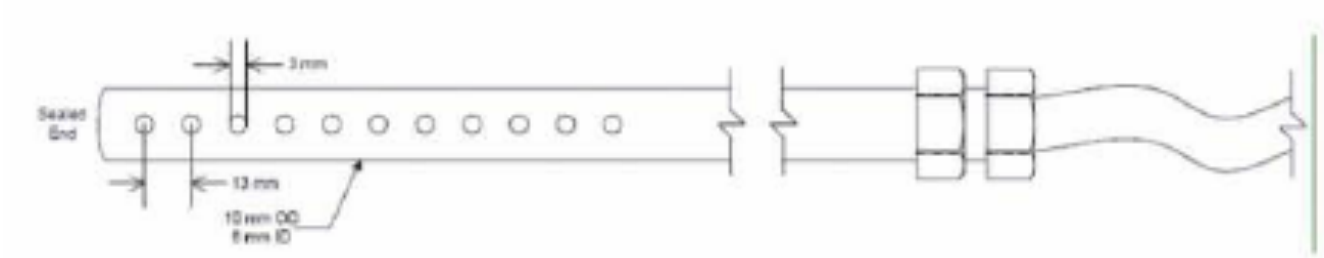
5. NEBS takes careful planning

- As in anything complex, planning makes the task manageable
- The process includes: concept reviews, design reviews, pre-compliance testing, scheduling external lab time, preparing the unit for testing, conducting actual testing, problem resolution, coordination between the test lab and the manufacturer, and preparing for other minute details
- Each step is crucial to a successful program. Without careful planning, minor problems can turn into major disasters
- NEBS certification will be a milestone in the development plan, and it needs its own schedule to ensure success

6. NEBS requires fire testing

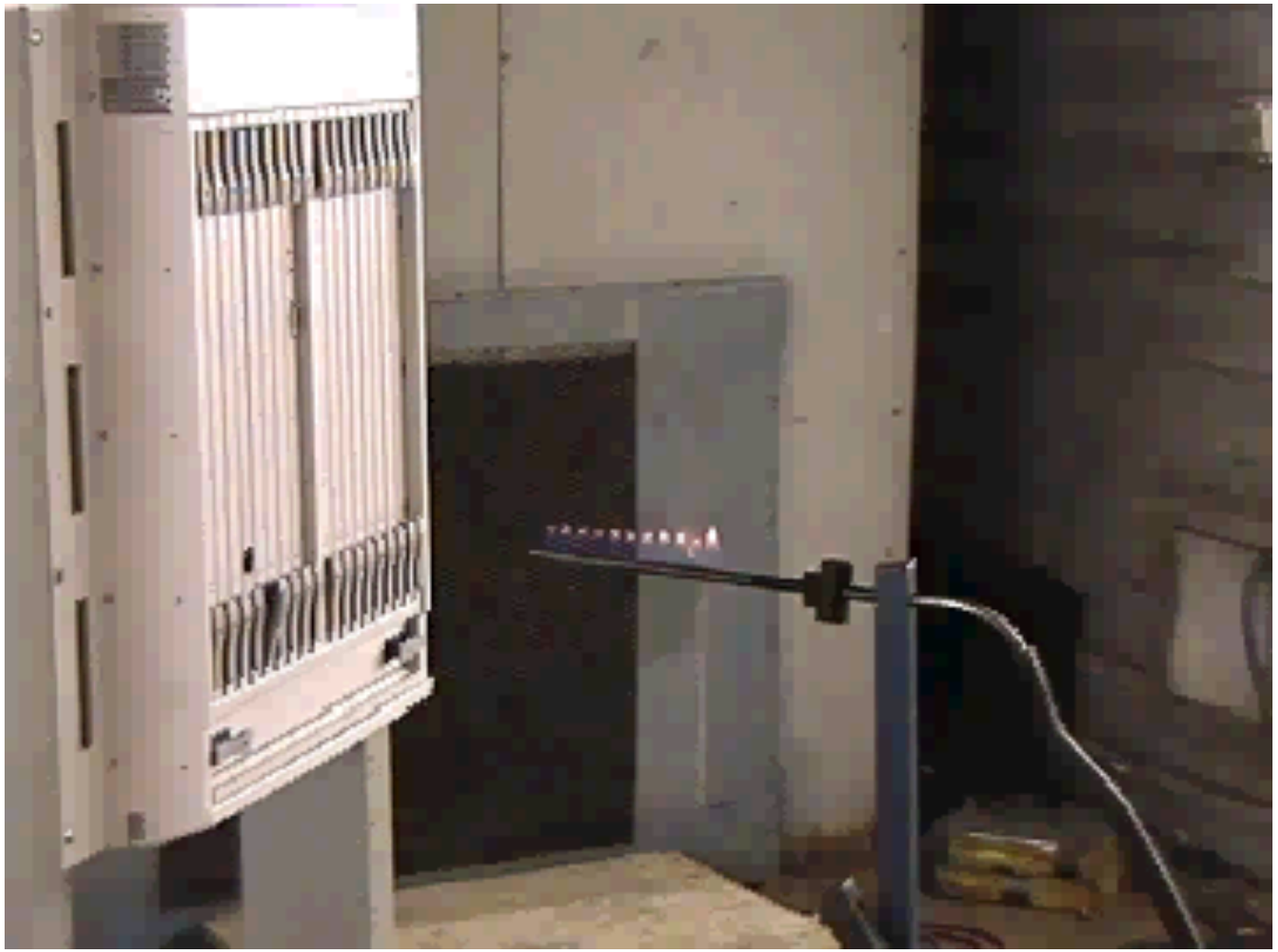
- Fire Resistance
- This test should be performed first on an early prototype
- GR-63-CORE requires that a product be set on fire from the inside
- A methane line burner (simulates a burning line card) is inserted into the product and allowed to burn for 5-1/2 minutes

Fire Resistance Test

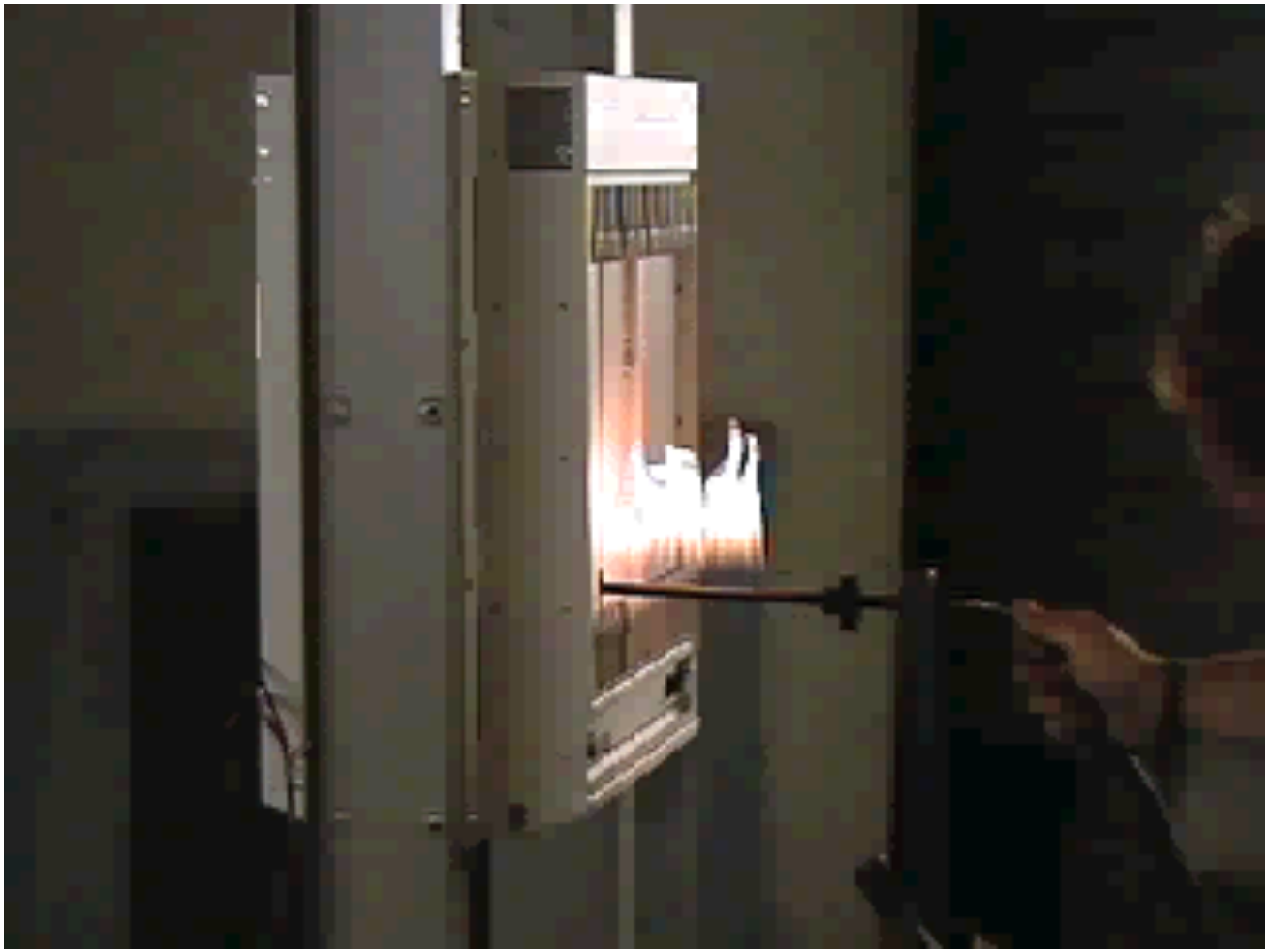


- Fire Resistance (continued)
- Cannot successfully simulate this test – the product must be set on fire and the results assessed
- Re-design due to failure affects EMC, cooling, packaging, and anything mechanically related

Line Burner Demonstration



Fire Resistance Test - Prototype



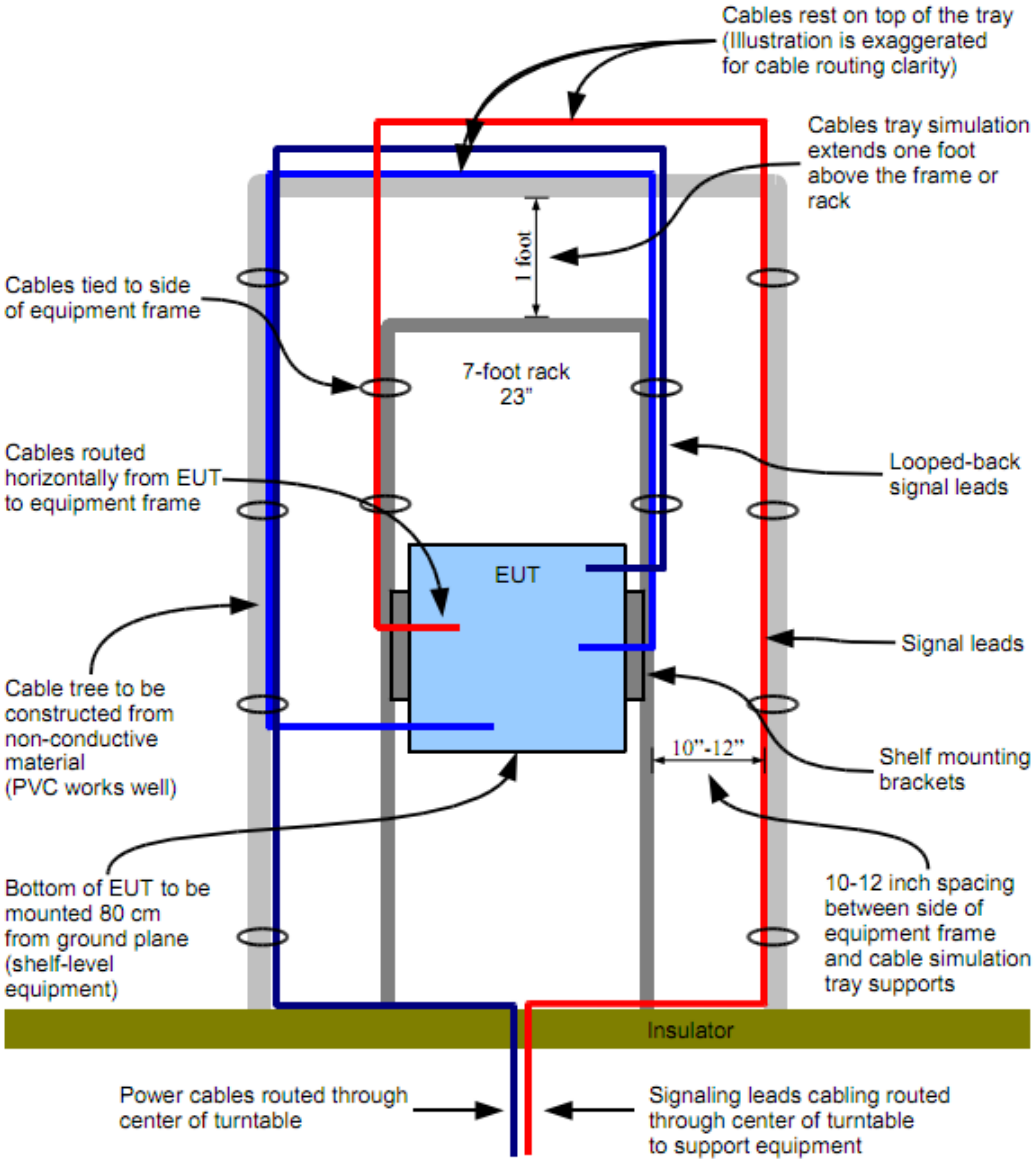
Fire Fighters – Second Test

Formal Fire Resistance Test

7. NEBS requires EMC testing

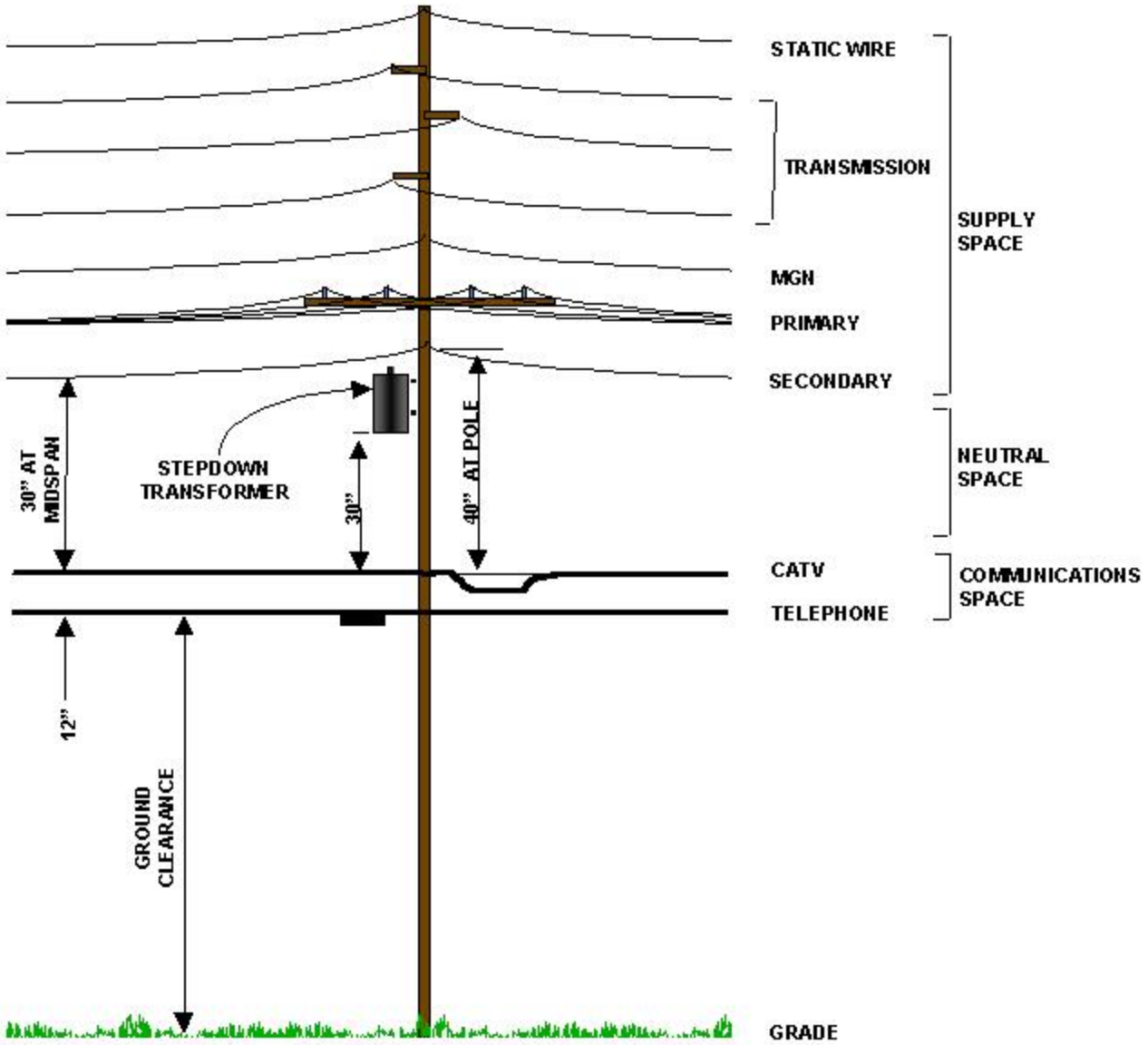
- Telcordia GR-1089-CORE Electromagnetic Compatibility and Electrical Safety—Generic Criteria for Network Telecommunications Equipment is the main standard covering EMC
- Section 3 covers Electromagnetic Interference - The goals of Section 3 are:
- EUT complies with Part 15 of the FCC Rules (even though it's exempt)
- EUT complies with Part 68 of the FCC Rules
- An EUT has intrasystem EMC with other equipment located in the same facility
- Intersystem EMC exists between the EUT and other electronic equipment in the surrounding environment
- The latter two goals are beyond the scope of the FCC Rules; limits are included on radiated and conducted emissions from a system, and levels of radiated and conducted noise to which the system should be immune
- A NEBS product must pass EMC tests from 10 kHz to 10 GHz. It must pass radiated and conducted emissions tests as well as radiated and conducted immunity tests over this broad range of frequencies

Figure 3-12 Cable Arrangement for EUTs With Overhead Cables



7. NEBS requires EMC testing

- Section 2 covers ESD and EFT
  - ESD testing is performed at 4 kV and 15 kV Air and 8 kV Contact
- Section 4 covers Lightning and AC Power Fault requirements
  - There are 93 pages alone covering lightning and AC power fault; almost a third of the standard
  - Even if the product doesn't have any signals going to outside plant (OSP), there are still Intra-Building surge and power-cross events that must be addressed
- Section 5 covers Steady-State Power Induction
  - Affects network equipment interfacing with OSP
  - Steady-state voltages and currents induced from nearby power lines during normal operation


STATIC WIRE
TRANSMISSION
SUPPLY SPACE
MGN
PRIMARY
SECONDARY
NEUTRAL SPACE
CATV
TELEPHONE
COMMUNICATIONS SPACE
30" AT MIDSPAN
STEPDOWN TRANSFORMER
30"
40" AT POLE
12"
GROUND CLEARANCE
GRADE

8. NEBS requires seismic testing

- The NEBS Seismic test simulates an 8.2 earthquake event
- Equipment must be operational before and after the test; there's an objective that it remain operational during the test
- Limited mechanical damage is allowed

Seismic Test

9. NEBS improves reliability

- Reliability is greatly improved with NEBS designed into the product. NEBS is the cornerstone of five-nines (99.999%) uptime
- When considering the environment the product will be used in, the tests a product must pass ensure that it will be highly reliable
- With increased reliability comes a lower warranty cost. In some ways, NEBS pays for itself over the life of the product

10. The customer is always right

- Meeting the strict requirements of GR-63-CORE and GR-1089-CORE is just the beginning
  - Each RBOC has its own requirements in addition to the requirements in these two standards
    - Verizon, for example, has a stricter pass criteria for fire resistance. Verizon also has its own guidelines for some of the EMC requirements
    - AT&T has unique dc power requirements
    - Because of Qwest's geographic locations, it is particularly interested in altitude requirements
    - These special requirements are detailed in each RBOC's NEBS checklist
- RBOC customers may request that a product meet NEBS requirements because they know the received product will be Carrier Class
  - Carrier Class means the product will be around for the long haul. These customers want an excellent return on their investment; they can get this with a product that meets NEBS Level 3 requirements

References

- www.nebs-faq.com Resource for NEBS Compliance information
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- Part 15 of the FCC Rules, 47 C.F.R. 15 link

About Dave Lorusso

Dave Lorusso has worked in the field of Compliance Engineering his entire career, 30 years. Dave started his career as an Approvals Engineer for Factory Mutual Research Corporation, Norwood, MA, a Nationally Recognized Testing Laboratory (NRTL). He worked for nine other companies as a Compliance Engineer, Compliance Manager, and Product Integrity Director, prior to starting Lorusso Compliance Services, LLC (www.lorusso.com), a consulting firm specializing in regulatory compliance.

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