

**Verizon NEBS™ Compliance: NEBS
Compliance Clarification Document**
Verizon Technical Purchasing Requirements
VZ.TPR.9305
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CHANGE CONTROL RECORD:

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4	5/3/2011	Delete	Remove requirement for radiometers during flame spread testing
5	8/21/12	Change	Update for acceptance of GR-1089-CORE Issue 6 and GR-63-CORE Issue 4
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7	3/3/2021	Change	Remove VZ-ITL Program Requirements Add Reporting Guidelines Editorial Edits
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1.0 Purpose

The purpose of this Verizon Technical Purchasing Requirement document is to provide clarification to Verizon’s interpretations of NEBS testing requirements and pass/fail criteria.

Vendors are required to perform NEBS testing in order to ensure that the equipment placed within the Verizon Network, whether in a Verizon Central Office, outside plant network or within a customer’s premises, is safe, reliable and performs as intended. NEBS requirements not only ensure the safety of the network but also the safety of the personnel that come into contact with the equipment. NEBS testing helps to ensure that equipment placed within the Verizon network will function properly when external factors, including but not limited to temperature variations, vibration, airborne contaminants and electromagnetic interference are present in the area of the deployed equipment.

2.0 Scope

This document provides clarification to NEBS test requirements for equipment being tested to GR-63-CORE, GR-1089-CORE, GR-487-CORE and GR-3108-CORE. This document shall be used by equipment suppliers and Independent Test Laboratories as guidance to create the NEBS test plan. In all instances of test planning and test execution, the most recent and accepted versions of the GR standards shall be used. Verizon reserves the right to modify all or any of its NEBS processes to meet the needs of the business.

3.0 References

GR-63-CORE	NEBS™ Requirements: Physical Protection
GR-78-CORE	Generic Requirements for the Physical Design and Manufacture of Telecommunications Products and Equipment
GR-487-CORE	Generic Requirements for Electronic Equipment Cabinets
GR-3108-CORE	Generic Requirements for Network Equipment in the Outside Plant (OSP)
GR-1089-CORE	Electromagnetic Compatibility and Electrical Safety – Generic Criteria for Network Telecommunications Equipment

4.0 Acronyms

CO	Central Office
CLEC	Competitive Local Exchange Carrier
CPE	Customer Premises Equipment
DLC	Digital Loop Carrier
EFT	Electrical Fast Transient
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
EUT	Equipment Under Test
FOC	Fiber Optic Component
FTTP	Fiber To The Premises
GR	Generic Requirements
HOH	Horizontal Overhead Air-Distribution
ITL	Independent Test Laboratory
LBP	Line Burner Placement
OEM	Original Equipment Manufacturer
OSP	Outside Plant
VOH	Vertical Overhead Air-Distribution

5.0 NEBS Testing and Reporting

5.1 All equipment intended for deployment in Verizon networks shall be tested/evaluated by a Test Laboratory that is ISO 17025 Accredited with scope of testing covering the specific testing/evaluation to be performed.

5.2 All NEBS reports supplied to Verizon must contain the following information at a minimum:

- Every Requirement/Objective in the GR must be listed as Compliant, Non-Compliant, Not Applicable or Not Tested
 - Not Applicable and Not Tested need an explanation as to why
 - Marking entire Sections as NA or Not Tested with single explanation acceptable
- Make, Model and detailed configuration information down to the module level
- Date and location of each test and/or retest
- Photos/Diagrams of all test set-ups
- Physical equipment configuration for each test if different
- Software Version operating on system
- Pass/fail criteria
- Equipment physical dimensions
- Rational for configuration chosen/tested if less than worst case
- Description of equipment's functionality verification

- Support equipment used to verify operation of equipment including block diagrams, Connections, traffic flow, etc.
- Description of test equipment used for making measurements with calibration dates
- Pass/Fail Criteria
- Test Methods
- Deviations from standard
- Engineering rationale for any compliance by similarity statements
- All recorded test data including equipment verification/calibration runs (i.e. ESD, Surges, etc.)
- Detailed ESD Test Locations

6.0 Verizon NEBS Requirements by Location

- 6.1 For network equipment to be acceptable for deployment in Verizon, it must meet the applicable NEBS criteria. Since NEBS tests are influenced by the deployment locations, Verizon has reviewed the different categories of deployment locations and detailed the different requirements applicable to those locations. For a list of Verizon requirements by location, please refer to [VZ.TPR.9203](#).

7.0 Verizon Clarifications to NEBS Requirements

7.1 General

- 7.1.1 For all operational testing, Verizon's expects all equipment to be fully functional and operating as near to real world operations as can be accommodated in a test lab setting. Worse case configurations should be tested in all cases as possible.
- 7.1.2 The following requirements represent specific areas of concern that, in Verizon's opinion, require additional clarification to the GR requirements. The requirements listed in this section are either *specific clarifications* to the testing requirements listed in GR-63, GR-1089 and other documents or these clarifications are intended to address common questions from suppliers and test labs.

7.2 Power Requirements

- 7.2.1 DC equipment shall be powered by a -48 volt (nominal) DC power source and should be able to operate when between -40 and -57.5 volts DC is applied at the unit input power lugs for each individual power source feed.
- 7.2.2 AC powered equipment shall not be used in the Isolated Ground Plane.
- 7.2.3 Verizon does not want any AC convenience outlets in any equipment installed in the Isolated Ground Plane. GR-63, R3-21 [20] and R3-22 [21] do not require that

outlets be provided; they merely stipulate how to provide outlets if ordered by Verizon.

- 7.2.4 Threaded pressure mechanical connectors may not be used to terminate cable that is 12 AWG or larger on the network element.
- 7.2.5 Due to Verizon defined maximum allowable voltage drops between a power source and the equipment, the lug landings should be sized to allow the lug size determined by maximum current draw plus the next two larger sized lugs. For example, if the maximum current draw requires a #10 AWG cable and lug, the lug landing should be sized to accept up to a #6 AWG lug.

7.3 Spatial Requirements

- 7.3.1 Verizon requires that the supplier provide an accurate equipment width and depth. Depth measurements shall include space required for cabling. Equipment mounted in racks/cabinets shall be contained within the overall footprint of the rack/cabinet.

7.4 Thermal Requirements

- 7.4.1 Telcordia grouped certain risk and safety hazard data measurements into the thermal performance category. Verizon considers GR-63 items R4-29 [77], O4-30 [78] and R4-33 [159] to be risk and safety hazard requirements and requires testing for both Verizon and CLEC equipment.
- 7.4.2 Verizon requires that the supplier provide aisle facing surface temperature data (GR-63, R4-33 [159]). Aisle facing surface temperature of equipment shall not exceed 48 degrees C (118 degrees F) at an ambient room temperature of 23 degrees C (73 degrees F) when the exposure time is categorized as prolonged use per GR-63-CORE, Issue 5.
- 7.4.3 **Verizon Equipment and Room Cooling Class Preferences.**
 - 7.4.3.1 Combinations of Vertical Overhead Air-Distribution (VOH) and Horizontal Overhead Air-Distribution (HOH) room classes will be most prevalent going forward in traditional CO environments.
 - 7.4.3.2 Verizon requires equipment classes with the bottom front-to-top rear (EC-Class F1-R3) airflow protocol for equipment in the central office environment at both frame - and shelf - levels. Bottom front-to-top (EC-Class F1-T) and mid front-to-mid rear (EC-Class F2-R2) protocols are also acceptable. Protocols that exhaust air to the front, bottom, or side of the frame are strongly discouraged and must have a baffle system available to direct air flow into an acceptable protocol.
- 7.4.4 Verizon requires that the supplier provide accurate heat release information as described in GR-63 Section 4.1.6, R4-29 [77], O4-30 [78], and Table 4-5. Data

shall clearly note if values are for a steady-state maximum configuration or if typical heat release varies with traffic load or specific configuration.

- 7.4.5 If heat dissipation/release varies with load (e.g., talk-battery for subscriber lines), data shall show values for typical operational levels along with maximum operating levels.

7.5 Altitude Requirements

- 7.5.1 Verizon will accept any of the following three methods for demonstrating compliance to the NEBS Altitude Test criteria.

- 7.5.1.1 The ITL shall follow Option 1 test sequences of Section 5.1.3, using a hypobaric chamber.

- 7.5.1.2 The ITL shall follow Option 1 test sequences in Section 5.1.3, using the temperature compensation method to simulate lower atmospheric pressures, according to the rule of +1° C per 1000 feet increase in altitude. For example, if a test temperature should be 50° C and test pressure should be 80 kPa, then the temperature compensation method would require exposing the EUT to 56° C.

- 7.5.1.3 The ITL shall test to Objective O4-10 [137], and if the EUT passes, it is considered to meet NEBS criteria R4-7 [74], R4-8 [136], and O4-11 [76]. The chamber temperature shall be increased to 61° C (shelf equipment) or 56° C (frame equipment), at a ramp rate of 30° C/hour. After an eight-hour dwell at this temperature, the chamber temperature shall be decreased at a rate of 30° C/hour to ambient temperature. If using this abbreviated form of the Altitude Test, Verizon will accept the test running concurrently with the Operational Temperature and Humidity Test. To integrate these tests, the parameters for the shortened Altitude Test (61° /56° C for 8 hours) will be used during Step 3 of the Operational Temperature and Humidity Test. Step 3 must continue to maintain a minimum 12 hour dwell of at least 50°C and no more than 32% RH. However, functional degradation of the EUT during the high temperature extreme will be considered a failure of both tests.

- 7.5.2 The EUT shall continue to be functional throughout the Altitude Test, regardless of the test method used. Option 2 of section 5.1.3 remains unacceptable to Verizon for altitude testing, as it does not demonstrate conformance to objective criteria.

7.6 Fire Resistance Requirements

- 7.6.1 Verizon requires that supportive data be provided to warrant the pass/fail status of R4-39 [81] and R4-40 [162] for frame level equipment and R4-45 [86] and R4-46 [163] for shelf level equipment.

7.6.2 Tests are expected to identify any fire resistance, ability to self-extinguish, and fire-spread issues that must be corrected. Smoke analysis should be provided to indicate the particulate content and corrosivity.

7.6.3 **Generic Guidelines for Fire Spread Testing**

7.6.3.1 The equipment assembly must be configured as it will be configured for installation in a Central Office/Outside Plant environment for all NEBS tests.

7.6.3.2 A rack/shelf must be fully assembled with all components/shelves, cables, hardware, cable trays etc. All cables shall be dressed along the vertical uprights of the frame.

7.6.3.3 A non-working sample may be used.

7.6.3.4 The fans must be operational at the beginning of the fire test. The fans should be powered through their normal control circuitry, if possible; otherwise they must be powered from an external power source.

7.6.3.5 Verizon considers fans off as a worst-case test scenario. If the fans or fan controlling circuitry is no longer working after a specific test run, the subsequent test runs shall be performed with the fans or fan controller circuitry no longer operational. If the vendor wants to do subsequent runs with the fans and fan controlling circuitry operational, then the entire system (chassis, backplane, PCBs, etc.) shall be replaced.

7.6.3.6 EUT must be pre-conditioned to 23°C and a RH 50% (ATIS-0600319).

7.6.3.7 **GR-63 – Test Setup**

6.6.3.7.1 Fire test setup critical elements: GR-63 Test Configurations cover line burner placement (LBP) for typical switch configurations and do not address platform and some switch based designs. Most equipment will probably require multiple fire-spread tests.

6.6.3.7.2 Equipment test plan: The test plan should consider the fuel load of each card and compartmentalization within the equipment shelves and racks. All compartments must be tested unless the compartments are identically configured or contain little or no fuel. Multiple tests may sometimes be required in the same compartment depending on its size and fuel load. Control panels and fuse bays must be tested and raceways may not be removed. Testing should start from the lower-most section of the equipment and work vertically up the unit for each test. Follow GR-63 for the flame profile for each test.

- 7.6.3.8 Verizon uses the following smoke and self-extinguishing (fire) objective observation criteria to help minimize smoke hazards and fire spread from fires in equipment located in Central Office equipment spaces. Equipment assembly fire tests shall be done in accordance with ATIS-0600319, or any supplemental test configuration criteria that may be specific to Verizon on a case-by-case basis for certain equipment tests. ALL of the following specific criteria shall be included in all shelf and frame level equipment assembly tests:
- After the conclusion of the methane ignition line burn, the components in the equipment assembly should show evidence of beginning to self-extinguish.
 - At 10 minutes into the test, there should be a significant flame reduction (or extinguished) and a visible reduction in the smoke from the equipment assembly.
 - At 15 minutes into the test, flames shall be extinguished, and there shall be only minimal wisps of smoke from the equipment assembly as determined from Verizon review.
 - If the smoke density measurements show any increase after the ignition burner is turned off, the length of time shall be measured until the smoke is completely eliminated.
 - If the heat release measurements show any increase after the ignition burner is turned off, the length of time shall be measured until the equipment reaches ambient temperature.
- 7.6.3.9 Verizon considers O4-54 [167] of GR-63-CORE a requirement. No more than minimal wisps of smoke are permitted after 15 minutes from the start of the test.
- 7.6.3.10 In addition to the pass/fail requirements stated in GR-63-CORE, Verizon considers any flames extending outside the confines of the equipment under test (top, bottom, sides, front and rear) for more than 30 seconds to be a failure.
- 7.6.3.11 Color video recordings (standard image) of all required Fire Spread Tests (GR-63-CORE, Section 4.2) shall be included in the report documentation. The standard image recordings shall include at least two perspectives: one view facing the side of the EUT from which the line burner is inserted, called the 'front' view, and another view facing the side of the EUT opposite the line burner entry, called the 'rear' view. (Note: In situations requiring unusual burner placement, for example burner placement parallel to the plane of the framework, consult the carrier to review the proposed camera locations.) The standard image shall display the full perspective of the EUT, including the thermocouples and circuit board samples above the EUT. Standard video images must display at least two inches of ground in front of frame-level EUT and at least four inches below a shelf-level EUT. The height of all camera mountings shall be between the center and top of the EUT and approximately perpendicular to its front or rear surface. The resolution of the standard images must be sharp enough to identify the EUT and test setup. Zooming and panning the camera to identify the EUT and test setup before the start of the test is permitted.

- 7.6.3.12 Thermal imaging offers a fire spread test diagnostic tool to help identify and correct observed thermal anomalies. A thermal image video camera shall record the test from the front view and be aligned closely to the line-of-sight of the front color video camera. The thermal image must display the entire front view EUT surface, plus at least two inches of clearance around the EUT. Resolution of the thermal image video must be sharp enough to display fire and heat propagation within the EUT.
- 7.6.3.13 The fire spread test videos shall record all fire spread test burn trials in chronological order and shall match the descriptive text in the written report. The final videos delivered to the carrier shall include a split screen display of the front view standard image and the thermal image and a separate recording of the rear view video. It is not acceptable for more than two views to be displayed in split screen on the same video. A live timer display showing minutes and seconds from the time the burner is inserted into the EUT shall be provided in all views of each test and must not obscure the fire test.
- 7.6.3.14 For a Fire Risk Analysis, the equipment supplier shall provide, upon request by Verizon, a database detailing the flammability characteristics of all equipment, materials, components, and wire and cable per GR-63-CORE. An estimate of the maximum possible fuel load of polymeric materials in the fully equipped frame or subassembly should be documented (e.g., structural materials, electronic and electrical components, and associated wire and cable provided or specified by the equipment supplier). This estimate should identify, in tabular format, the constituent items. The estimate shall account for at least 95% of the maximum possible fuel load. The remaining 5% should be described qualitatively in terms of types of polymers present. A typical database should follow the format in the sample below. The Module/Part Number heading should identify constituent items such as shelves, circuit boards, back planes, etc. Integrated circuits, resistors, capacitors, LEDs, wiring, etc. should each have their own row with their part number and component description provided; column 7 should be totaled by component rating and for the complete module at the end of the table.

Table 1 – Flammability Database

Item #	Part Number	Component Description	Qty	Component Rating: UL-94 V0, V1	Oxygen Index If >28%	Total Polymeric weight in grams	Comments
1	WXY	LED	1	V0		0.016	
1	XYZ	Carbon Resistor	1	HB		0.006	
					>28%	0.008	
Totals				V0		0.016	
				HB		0.006	
					>28%	0.008	

- 7.7 Earthquake Requirements.** Compliance to NEBS Earthquake standards is required for all Verizon Central Office equipment, ironworks, frames and frame extenders. Verizon requires Central Office equipment to be tested to the minimal specification of the Earthquake Zone where the product will be installed. See GR-63 section 4.4.1 and GR-63 Figure 4-3 for detailed testing information. Earthquake videos should be provided with the test documentation.
- 7.8 Airborne Contaminants.** Mixed Flowing Gas testing shall be performed for duration of 14 days.
- 7.9 Acoustic Noise.** The equipment shall not independently, or as a part within a larger system, generate sufficient sound power as to violate OSHA requirements. Further, the sound power shall be low enough that a Hearing Conservation Program is not mandated. The time-weighted average sound power measured using the OSHA measurement techniques must be below 85 dB (A) over an 8-hour worst-case exposure and no sound of over 115 dB (A) shall be permitted. For a shelf-level system, the maximum permissible sound power is 78 dB (A) for equipment to be located in Telecommunications Room (attended).

7.10 ESD Immunity Requirements

- 7.10.1 Verizon requires that Severity Level 4 testing be done, as described in GR-1089 R2-3 [3] and R2-4 [4].
- 7.10.2 Wrist strap ground jacks must be external to any doors or removable covers to permit the wrist strap ground lead to be connected before any doors or covers are opened.
- 7.10.3 The lab test report shall list all components included in the test unit/system and shall specifically list or identify any functional abnormalities encountered during the sequence of test discharges. ESD testing must be done on a fully configured functioning unit.
- 7.10.4 The lab test report shall list all points tested and provide a picture of the test setup.
- 7.10.5 Test points used shall be representative of areas or points commonly expected to be exposed to manual handling during installation, setup, adjustment, circuit pack replacement, etc.
- 7.10.6 Verizon supports and encourages the use of wrist straps to minimize ESD. Verizon does not support, endorse, or permit the use of floor mats as abatement for ESD.
- 7.10.7 ESD waveform verification shall be performed prior to testing and included as part of the NEBS reporting.

7.11 EMI Emission Requirements

- 7.11.1 Verizon does not accept the use of externally mounted ferrites on cable interfaces for the purpose of EMI compliance. If used, ferrites shall form part of the products, not the cable, and shall be placed within the chassis enclosure.
- 7.11.2 Testing must be done through 10 GHz.
- 7.11.3 Frequency plots shall clearly show all emissions. Background emission evaluation and analysis is only required in the event the test results exceed the emission requirements or objectives.
- 7.11.4 Lab test reports shall include the measured emissions at the highest frequency tested.
- 7.11.5 In order to simulate normal operation, all cabling shall be connected and run in a vertical position, and dressed as shown in Figure 8. Once placed as shown, no cable movement or rearrangement in an attempt to maximize emissions should be made. An original picture and description of the test setup shall be included in the test report.

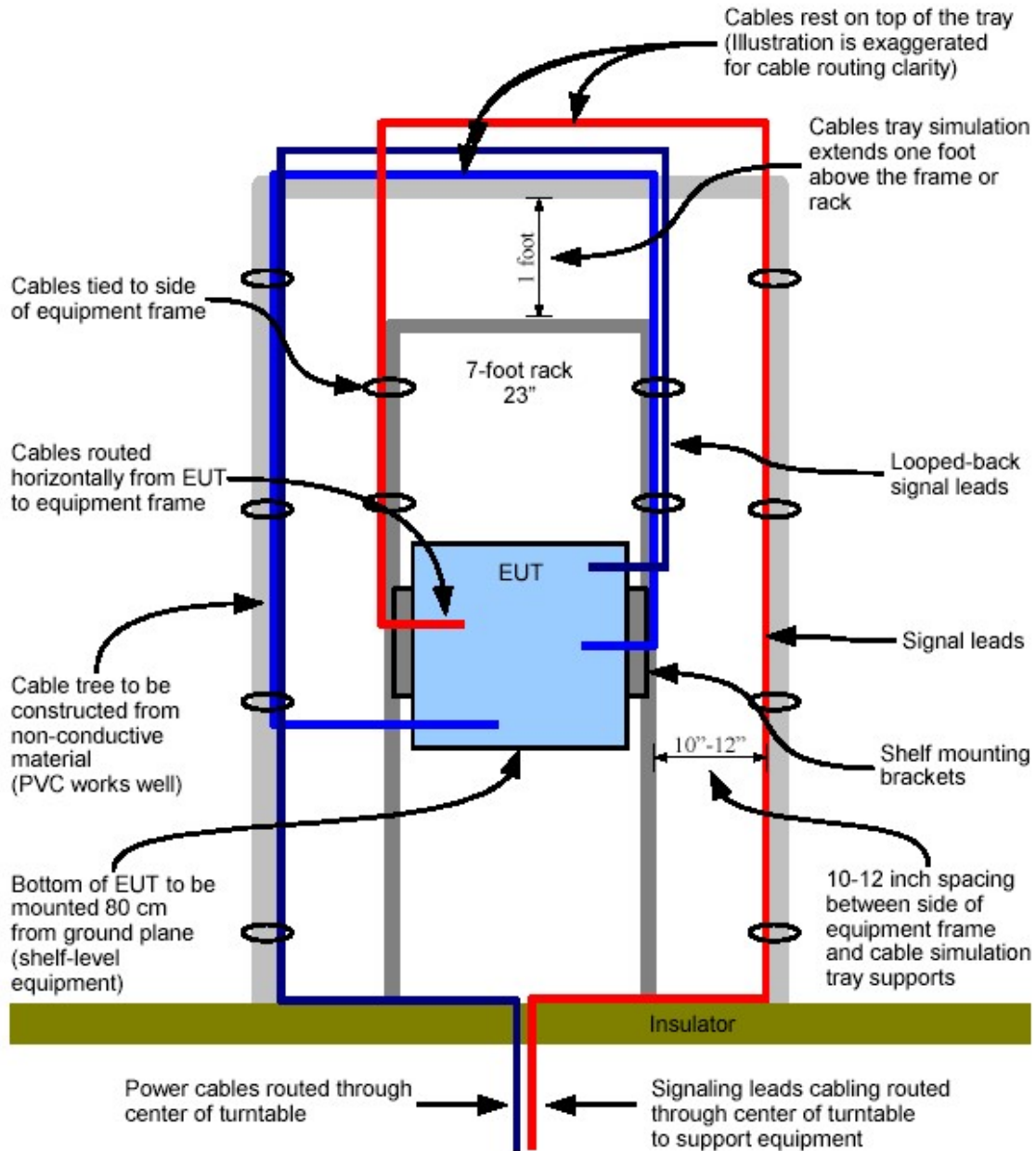


Figure 1 - EMI Emission Test Setup

7.12 EMI Immunity Requirements

- 7.12.1 Verizon requires that EMI testing be done with doors or covers, if equipped, open R3-16 [16] and R3-18 [18].
- 7.12.1 Cabling must use the same setup as in Figure 8. In order to simulate normal operation, all cabling shall be connected and run in a vertical position, and dressed as shown in Figure 8. Once placed as shown in Figure 8, no cable movement or rearrangement in an attempt to maximize emissions should be made. An original picture and description of the test setup shall be included in the test report.

7.13 Lightning Surge and AC Power Fault Test Connections

- 7.13.1 Verizon has revised its long-standing installation practices and now allows shielded cables to be grounded at both ends when in the common bonding network. Therefore, the GR-1089 Intra-building Lightning Surge Tests (Telecommunications Port) statement that "these tests do not apply if intra-building wiring (cabling) is shielded and the manufacturer's documentation states that both ends of the shield must be grounded" is now applicable for equipment that will be installed in the CBN.
- 7.13.2 AC power fault testing specified at 425 Vrms in Tables 4-4 and 4-5 shall be performed at the GR-1089-CORE Issue 5 levels of 600 Vrms.

7.14 Bonding and Grounding

- 7.14.1 To meet the Unit Bonding and Grounding safety connection requirements, GR-1089, R9-9 [79] proposes two acceptable methods.
 - Separate conductor(s) between the unit's chassis and the framework.
 - Thread-forming mounting screws with paint piercing washers that establish metal-to-metal contact. This is Verizon's preferred method.
- 7.14.2 The correct use of separate conductors requires that the conductor be sized to handle any fault current up to the limit of the circuit protection device feeding power to the equipment bay. Any conductor that is #6 AWG or larger *must* be connected using a listed two-hole compression type connector per GR-1089, R9-24 [89] and GR-295.
- 7.14.3 Thread forming screws *are not necessarily self-tapping or sheet metal screws*. Thread-forming screws are tri-lobular and establish threads by the plastic displacement of metal, instead of cutting threads, without creating metal chips or curls that could drop into other equipment.

- 7.14.4 Verizon’s preferred grounding method, thread-forming screws when used in lieu of a separate Grounding Conductor, must be used at all mounting positions and shall have an external tooth paint piercing lock washer between the head of the screw and the equipment unit. No lock washers shall be used between the equipment unit and the framework. Thread-forming screws shall also be used to attach any adapter/mounting brackets to the equipment unit.
- 7.14.5 The supplier shall provide installation instructions, with equipment shipments and with ITL NEBS test reports, that explain the purpose of the specific material provided and the correct use and installation.

8.0 Clarifications to Verizon Additional NEBS Requirements

8.1 GR-78 Requirements

- 8.1.1 General Requirements for all products.
- 8.1.1.1 All piece parts, components, wire, and cable shall, where practical, be marked to be traceable to their original manufacturer; this requirement does not apply to structural metalwork and machined hardware such as screws. On a temporary basis, part markings that fail to withstand assembly processing may be remarked with the original component markings. This does not apply to markings identifying program-related information for programmable devices such as Erasable Programmable read-only Memories (E-PROMs).
- 8.1.1.2 The electrical and mechanical integrity and the reliability of all components and assemblies shall be retained after exposure to all processes employed during manufacture and assembly (e.g., handling, fluxing, soldering, and cleaning). It is the responsibility of the equipment supplier to demonstrate that each assembly and generic component type meets this requirement. Proof of the electrical and mechanical integrity of both components and assemblies shall be made available to Verizon.
- 8.1.1.3 Unless otherwise specified in GR-78-CORE or supporting documents, materials and finishes shall meet approved industry standards such that product integrity is not compromised for:
- Whisker Growth – Tin, Zinc or Cadmium.
 - Fretting and Corrosion.
 - Dissimilar metal finishes.
 - Migrating silicon encapsulants near open contacts.
 - Material migration e.g., Solder.

8.2 GR-487 Requirements

- 8.2.1 Verizon requires that GR-487 testing be performed on all equipment cabinet assemblies that are for outdoor installation.
- 8.2.2 Requirement R3-4 [4] statement ‘Conformance is to be determined by supplier attestation’ is not acceptable. Conformance shall be determined by Verizon based on supplier provided data.
- 8.2.3 Figure 3-2 provides examples of openings in the cabinet to prevent insect intrusion. Verizon’s preference is for Example 1(hex pattern) and Example 2 (triangle pattern).
- 8.2.4 GR-487 cabinets containing a full complement of electronics (functional system) shall be evaluated to all applicable requirements of both GR-487 and GR-3108.

8.3 GR-3108 Requirements

- 8.3.1 Verizon requires that GR-3108 testing be performed on all electronic equipment assemblies that are intended for outdoor installation.
- 8.3.2 If the class of environment is undefined at the time of testing, Verizon preference is to test to worst case conditions.