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Senior Vice President — Corporate Technology

August 12, 2008

BY HAND

Mr. Dennis F. Taratus
Mr. Daniel Whelan

New York Department of Public Service
Three Empire State Plaza
Albany, New York 12223-1350

Re: Response to August 5, 2008 Staff Letter on Grounding and Bonding Issues

Dear Mr. Taratus and Mr. Whelan:

Verizon New York Inc. ("Verizon") respectfully submits this response to your August 5, 2008 letter concerning electrical grounding requirements for FiOS[sm] Optical Network Terminals ("ONTs").[1] Having heard Staff's concerns, Verizon will utilize one of the grounding methods specified in Staff's letter for ONT installations in which conductive wire connected to the ONT is located in whole or in part outside of the

[1] Staff's August 5, 2008 letter stated that "compliance with the [NEC] is effectuated by adhering to the following: sections 770.100, 800.100 or 820.100 Grounding Methods . . . ." It went on to set forth four "general steps" that Verizon could take in order to comply with these NEC requirements, including bonding to a power company ground, bonding to a metallic cold pipe, bonding to structure steel, or bonding to a telephone ground rod that was itself "bonded [to] the primary grounding power with a 6 AWG copper wire." Finally, Staff concluded that "the NEC does not allow for the alternatives the company [has] presented . . ., specifically use of a three-prong cord or a grounding module."

customer's building ("outside" installations). Verizon respectfully disagrees, however, with Staff's conclusions concerning "inside" FiOS installations — that is, ones in which no conductive facilities outside of the customer's building are connected to the ONT — and encourages Staff to reconsider its position on such installations.

To ensure that its procedures are fully safe, adequate, and NEC-compliant, Verizon retained grounding and electrical protection experts Dan McMenamin and Associates, Inc. As a Senior Member of the IEEE,[2] a Professional Designer for the Lightning Protection Institute, and a member of the National Fire Protection Association ("NFPA"), the firm's principal, Daniel P. McMenamin, has led the industry in its efforts to protect people, systems and property.[3] Through Dan McMenamin and Associates, we were able to obtain the counsel of William J. McCoy, a Licensed Engineer, member of the NFPA, and Senior Member of the IEEE. Mr. McCoy's analysis was particularly valuable in this context because, since the 1996 NEC revision cycle, he has represented IEEE as a member of the National Electrical Code Committee. Specifically, Mr. McCoy is a member of Code-Making Panel No. 16, which drafted Articles 770, 800, 810, 820, and 830 of the National Electrical Code® (NEC®).

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[2] The IEEE is a professional association concerned with the advancement of technology, and is a leading authority on electric power, consumer electronics, and other engineering issues. *See* the IEEE web site at http://www.ieee.org/web/aboutus/home/index.html.

[3] Mr. McMenamin also served on the Technical Planning Group writing the Central Office Grounding course taught by Telcordia; served on the American National Standards Institute (ANSI) T1E1 committee setting grounding standards and physical and electrical protection standards for telecommunications systems; served on the IEEE Power and Electronics Society Technical Program Committees for the International Telecommunications Energy Conference (INTELEC) 90, 92, 94, 96, 98, 2000, 2002; was Technical Program Chairman for INTELEC 2004 and 2008; and served as General Chairman for INTELEC 2006. He is the author of more than 24 internationally published papers and articles.

By way of background, the cable that delivers FiOS services from Verizon's Video Serving Office to the ONT at the customer's premises is dielectric (non-conductive) fiber-optic cable. As a result, the only conductive elements connected to the ONT are wires or coaxial cables that connect the ONT to set-top boxes, telephones, routers, or power supplies, or that interconnect the ONT to a POTS NID. Where the ONT is mounted inside the building, these conductive elements may also be wholly inside.[4] This "fiber-to-the-premises" architecture for residential service was pioneered by Verizon, and is distinct from the conventional cable architecture in which the "drop" delivering service to the customer's premises is conductive (*i.e.*, coaxial cable).

Mr. McCoy recommended that any installations with outside conductive elements that enter the building and connect to the ONT utilize one of the grounding methods referred to in Staff's letter. Such grounding arrangements protect against the remote risk that lightning might strike an external conductive element (or that a power company cable might come in contact with such a conductive element) and induce a voltage surge inside the customer's building.

However, with respect to the inside configurations, Mr. McCoy believes—and Verizon concurs—that the intent of the NEC was *not* to require bonding to a power company ground (or to one of the alternative grounding sources mentioned in Staff's letter). Rather, Mr. McCoy informed the company that where the ONT is not connected

[4] In some of these cases, where the fiber drop cable is buried rather than aerial, it includes conductive "tracer" wire that can be located with a metal detector, so that the cable can be avoided when construction work is being undertaken near the customer's building. In such cases, Verizon intends to cut off the tracer wire before it enters the building, and ground it using one of the methods set forth in Staff's letter. Thus, the conductive tracer cable will not enter the building or connect to the ONT.

to any conductors exposed to the environment outside the customer's building (and thus where there is no risk of a lightning strike or power-line contact), NEC Article 770 and Chapter 8 do not apply. Grounding in such cases is required by the NEC only to protect against electrical faults in the ONT itself. Adequate and NEC-compliant protection against such situations can be obtained by connecting the ONT to an "equipment grounding conductor" under NEC Article 250. The standard, and NEC-compliant, means of accomplishing this is through a grounded three-pronged electrical outlet. Verizon makes such a connection either directly (*i.e.*, by plugging the ONT's built-in power cord into such an outlet), or through a TII-442 grounding module. The NEC does not require that the ONT provide a grounding path for other equipment or coaxial cable in the customer's premises.

An opinion letter setting forth McMenamin and Associates' analysis is attached to this letter, and clearly establishes the safety, adequacy, and NEC-compliance of Verizon's grounding arrangements for "inside" ONTs.

Ensuring the safety and adequacy of its FiOS facilities is of the highest priority for Verizon. Verizon will modify or clarify its M&Ps for outside ONT installations so that they utilize one of the grounding methods specified in Staff's letter. (As a result, there would appear to be no remaining areas of disagreement between Verizon and Staff concerning such installations.) We appreciate the opportunity to address the important remaining issues with you and we look forward a prompt resolution of those issues.

Respectfully submitted,

Mark A. Wegleitner /jp

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cc: Peter McGowan, Esq.
Brian Ossias, Esq.
Mr. Chad Hume
Mr. Charles Dickson

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August 11, 2008

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Dear Mr. Wegleitner:

Dan McMenamin and Associates has been engaged by Verizon to analyze its methods of grounding the optical network terminals (ONTs) that Verizon uses in provisioning FiOS[sm] service (FiOS). In particular Verizon has asked Dan McMenamin and Associates whether those arrangements comply with the provisions of the National Electrical Code® (NEC®).

Verizon has advised Dan McMenamin and Associates that there are various ONT configurations used in provisioning FiOS. In some single family unit (SFU) installations the ONT is mounted outside the home and in some installations it is mounted inside. When the ONT is inside the home, its connection to the "inside wire" may be entirely within the confines of the home, or the wiring may exit the structure for outside interconnection. The facility used to connect the ONT to the network can be buried or aerial. In multiple dwelling unit (MDU) installations, the ONT units can be in each individual apartment, or the entire building can be served from "common" ONT equipment, usually located in the basement. Dan McMenamin and Associates are familiar with the details of all the configurations used by Verizon, but focused most intensively on those configurations where there was a perceived disagreement between Verizon and the New York Department of Public Service Staff concerning the meaning and application of the NEC® requirements.

During the course of Dan McMenamin and Associates' analysis, we were provided with a copy of a letter dated August 5, 2008 from the Staff to Mr. Thomas McCarroll of Verizon. In the letter, Staff specifies which NEC® sections/articles they believe apply to the installation of FiOS ONTs.

Dan McMenamin and Associates are of the opinion that no particular Article of the NEC® specifically addresses the overall fiber-to-the-premises serving arrangement used by Verizon to deliver FiOS services, but that portions of several Articles could be applied to realize the intent of the NEC® for this particular type of service offering.

Dan McMenamin and Associates agrees with many of the conclusions set forth by Staff in its August 5, 2008 letter regarding required grounding practices for outside mounted SFU ONTs and for those SFU ONTs mounted inside with conductive service wire (twisted pairs and/or coaxial cable) located outside the building and for Building Intersystem Installations. In general, these installations require connection to the Primary Grounding Electrode.

Dan McMenamin and Associates also agrees with Staff that other provisions of the NEC® are applicable where external wiring enters the building and is connected to the ONT, including, Articles 770.93/800.93/820.93, 770.100(B)/800.100(B)/820.100(B), 770.100(D)/800.100(D)/820.100(D), 250.94, 250.70 and 250.64(C). Also, Dan McMenamin and Associates agrees that when an ONT is connected to a separate grounding electrode, it must be bonded to the Primary Grounding Electrode as specified in Article 800.100(D).

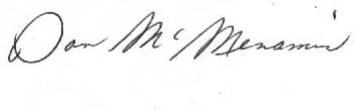
Finally, Dan McMenamin and Associates agree with Staff that in installations where obtaining a maximum overall length of 20 feet for the grounding conductor to the Primary Grounding Electrode is not possible, Article 800.100(A)(4) (Exception) and Article 820.100(A)(4) (Exception) do apply as well as Article 800.100(D).

However, Dan McMenamin and Associates disagrees with a two key aspects of the Staff letter. First, Dan McMenamin and Associates believes that where the serving fiber cable drop contains no metallic members or other non-current carrying metallic members and conducting service wire connection are internal to the building structure, the requirements of Article 770.100 and its sections do not apply for installations of ONTs at SFU, MDU, and Building Intersystem applications. The reason for this opinion is that nothing exists within the fiber cable drop that requires grounding. Dan McMenamin and Associates understands that in buried FiOS installations the fiber cable drop may contain a metallic tracer wire. In this case, Dan McMenamin and Associates' understanding is that Verizon intends to terminate the tracer wire before the fiber cable enters the building. This arrangement meets the NEC® grounding requirements for this conductor. In such cases there are no non-current carrying metallic members entering the building.

The clear intent of the grounding requirements of Articles 770.100, 800.100 and 820.100 is to address unwanted potentials that could be induced by nearby lightning strikes and/or power contacts onto conductive members (fiber cable equipped with a metallic strength member, telephone drop wire, and coaxial cable) that both (a) are exposed to the outside environment, and (b) enter or re-enter a building. Thus, Articles 770.100, 800.100, and 820.100 do not apply to Verizon's inside ONT installations when no conductive elements enter the building from outside. The possibility of induced potentials resulting from lightning and/or power contact are eliminated by using the all dielectric fiber cable drop or a fiber cable drop with a conductive tracer wire where that wire is properly terminated and grounded before entering the building. Similarly, the requirements of Article 770.93 (Grounding or Interruption of Non-Current-Carrying Metallic Members of Optical Fiber Cables) do not apply.

Secondly, when the ONT or MDU is mounted within the building Dan McMenamin and Associates find no reference in the NEC® requiring the grounding of the coaxial shield of a coaxial cable where the coaxial cable is derived within the building and run exclusively within the building. Grounding of the ONT should be done using the Equipment Grounding Conductor (EGC). Any other approach would be unprecedented in the Industry. This EGC installation is covered in Article 250.120 (Equipment Grounding Conductor Installation). Article 100 defines the Equipment Grounding Conductor as the conductive path installed to connect normally non-current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode. All ONTs are Listed for the Purpose and the EGC provides the appropriate means for grounding this equipment. The standard method for connecting equipment to an EGC, and the method used in Verizon's inside ONT designs, is through a grounded, three-pronged AC outlet. Verizon makes this grounding connection via the three-prong plug on the built-in ONT connector cord, or via the use of a TII-442 grounding module. The use of the TII-442 is a safe and adequate procedure for extending the EGC to the ONT.

Respectfully submitted,



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