Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of Implementation of Section 224 of the Act; A National Broadband Plan for Our Future	WC Docket No. 07–245 GN Docket No. 09– 51 FCC 10–84

To: The Commission

FURTHER NOTICE OF PROPOSED RULE MAKING
COMMENTS OF NEXTG NETWORKS, INC.

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Summary

The record in this and other proceedings before the Commission clearly reflect that Distributed Antenna System ("DAS") facilities are an important aspect of the deployment of wireless communications and broadband services throughout the United States. The National Broadband Plan has recommended establishing "the fastest and most extensive wireless networks" in the world.[1] Yet the National Broadband Plan's goal is not feasible unless the Commission takes the necessary action to ensure "network providers have easier access to poles, conduits, ducts and rights-of-way."[2]

In these comments, NextG describes the impediments it experiences with utilities, such as lengthy make-ready delays, and, for wireless attachments, refusal of access, demands for unreasonable "market-rate" pole rental fees, and categorical denials of access to pole tops. NextG requests the Commission take clear and concise action to ensure wireless equipment attachers are afforded the opportunity to deploy their facilities in a fair and timely manner by adopting rules that explicitly recognize and protect wireless attachments, including the following:

- a rule that utilities respond with a well-articulated list of concerns within 45 days after it receives a request for wireless equipment attachments and, after which, that both parties work in good faith in the following 90 days to put in place the proper agreement and construction standards, as necessary;

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[1] Omnibus Broadband Initiative, Federal Communications Commission, Connecting America: The National Broadband Plan 109 (2010), available at http://download.broadband.gov/plan/national-broadband-plan.pdf (last visited Aug 3, 2010) ("NBP").

[2] Id. at 109.

- a rule extending the proposed make-ready timelines to wireless equipment in an equal manner because there are no justifications for discriminating against one type of equipment over another;
- a rule against utilities making blanket prohibitions against pole top antennas and instructing them to work with the requesting attacher on an acceptable construction standard in line with the National Electric Safety Code;
- a rule clarifying that wireless attachments receive the regulated rate similar to telecommunications and broadband attachments, as stated by the Commission previously; and
- a rule adopting an executive level meeting into dispute resolution procedures.

With the adoption of these rules, wireless broadband and telecommunications infrastructure will be more rapidly deployable in the market place, thus providing consumers with improved services.

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NextG Networks, Inc., on behalf of its operating subsidiaries NextG Networks of NY, Inc., NextG Networks of California, Inc., NextG Networks Atlantic, Inc., and NextG Networks of Illinois, Inc. ("NextG"), respectfully submits these Comments in response to the Further Notice of Proposed Rulemaking ("FNPRM") released by the Federal Communications Commission ("Commission") in the above-captioned proceeding.[3]

I. INTRODUCTION

NextG appreciates the opportunity to relate its experiences attaching (or attempting to attach) its telecommunications facilities to distribution poles around the nation, in particular the wireless elements of NextG's networks. The Commission first confirmed that wireless devices qualify as attachments in 1998, and some progress has been made since that time.[4] Indeed, NextG has found some utilities to be cooperative and reasonable in responding to requests for

[3] *In the Matter of Implementation of Section 224 of the Act; A National Broadband Plan for Our Future*, WC Docket No. 07-245; GN Docket No. 09-51, Order and Further Notice of Proposed Rulemaking , FCC 10-84 (Wireline Bureau, May 20, 2010) ("*FNPRM*").

[4] *Implementation of Section 703(e) of the Telecommunications Act of 1996; Amendment of the Commission's Rules and Policies Governing Pole Attachments*, CS Dkt. No. 97-151, Report and Order, FCC 98-20, 13 FCC Rcd 6777 (Feb. 6, 1998) ("*1998 Implementation Order*"), *aff'd, Nat'l Cable Telecommunications Ass'n v. Gulf Power Co.*, 534 U.S. 327 (2002) ("*Gulf Power*").

attachments. Many more utilities have, however, responded initially to attachment requests by saying that they have no internal standards or guidance that would allow them to enter into such agreements and that such standards and agreements would need to be developed—through a lengthy adoption process. NextG also frequently encounters utilities that question, challenge, or outright reject that wireless devices are equally protected by and subject to access rights under Section 224. Because the Commission has never promulgated a set of wireless-specific pole attachment rules, the lack of such rules and clear guidance has created ambiguities and differing interpretations by utilities that have acted to impede, restrict or outright deny NextG access to utility poles. Accordingly, the *status quo* is not working in all cases, and the result is the failure of prompt and timely deployment facilities that are crucial to the deployment of next generation broadband and competitive telecommunications services.

In the Commission's 2007 Notice of Proposed Rulemaking In the Matter of Implementation of Section 224 of the Act; Amendment of the Commission's Rules and Policies Governing Pole Attachments ("NPRM"), the Commission requested specific comment on wireless attachment issues.[5] In response, NextG submitted comments,[6] reply comments,[7] and participated in several ex parte visits to the Commission and joined with other industry members to provide extensive and detailed evidence of the problems it regularly encounters with utilities

[5] *Implementation of Section 224 of the Act; Amendment of the Commission's Rules and Policies Governing Pole Attachments*, WC Docket No. 07-245; RM-11293; RM-11303, Notice of Proposed Rulemaking, 22 FCC Rcd 20195, 20209, ¶ 34 (2007) ("*NPRM*").
[6] Comments of NextG Networks, WC Docket No. 07-245, RM-11293, RM-11303 (filed Mar. 7, 2008) ("NextG Comments").
[7] Reply Comments of NextG Networks, WC Docket No. 07-245, RM-11293, RM-11303 (filed Apr. 22, 2008) ("NextG Reply Comments").

while attaching or attempting to attach its equipment.[8] Such problems as denial of access for wireless equipment, discriminatory and unreasonable pole attachment rates for wireless attachments, unreasonable make-ready delays for both wireline and wireless attachments, and unjustified denial of the use of pole tops for wireless antenna attachments have all been identified for the Commission. These issues have not improved since the NPRM, and NextG encourages the Commission to move expeditiously to address them in its decision now so that wireless attachments receive equal treatment in line with prior Commission and United States Supreme Court decisions.[9]

II. BACKGROUND REGARDING NEXTG

A. NextG's Telecommunications Service and DAS Networks

NextG provides telecommunications service, primarily radio frequency transport services via Distributed Antenna Systems ("DAS") and also fiber optic backhaul. As a result, it is at the cutting-edge of the provision of telecommunications services using advanced technologies and capabilities—both wireless and wireline. At its most basic level, NextG is a "carrier's carrier" and provides telecommunications services to wireless providers that enable those entities to provide next-generation wireless broadband and telecommunications services and achieve greater coverage and capacity for their wireless services. Although NextG's deployment is frequently focused initially on a specific customer's needs, NextG's DAS networks can, and in many cases do, host multiple carriers and are therefore an efficient, cost-effective alternative for

[8] Letter from PCIA/The DAS Forum; Sunesys, LLC.; NextG Networks, Inc.; ExteNet Systems, Inc.; NewPath Networks, LLC; Sprint-Nextel Corporation, WC Dkt. 07-245; RM-11293; RM-11303 (filed Mar. 27, 2009) ("Wireless Pole Attachment Letter").

[9] *See generally 1998 Implementation Order*; *Gulf Power*; *Wireless Telecommunications Bureau Reminds Utility Pole Owners of Their Obligations to Provide Wireless Telecommunications Providers with Access to Utility Poles at Reasonable Rates*, Public Notice, 19 FCC Rcd. 24930 (Wireless Telecom. Bureau 2004) ("*2004 Wireless Reminder*").

the deployment of multiple wireless telecommunications facilities. In other words, NextG enhances the performance of existing mobile wireless infrastructure with minimally intrusive installations using, to the extent possible, existing infrastructure.

As wireless providers seek to deploy the next generation of wireless services and meet the demands for improved capacity and coverage for existing services, one of the key obstacles they face is the technical limitations of traditional "high site" antenna towers and local management of their placement. Although traditional towers and rooftops may sometimes serve as reasonable solutions for providing low capacity, wide-area coverage, often these sites are not available. As demand for capacity on wireless networks grows, however, more and more sites must be added to networks to reuse existing radio frequency spectrum.[10]

NextG believes that one of the most effective ways to add sites is through the use of "low" site antennas. These types of antennas facilitate a greater reuse of the wireless spectrum because the relatively low height antennas can be more easily isolated from each other, thus resulting in a much higher capacity and quality network that is not possible with a network consisting entirely of high-site antennas. In addition to capacity benefits, a network of low-sites in an urban area can provide coverage in many "dead-spots" that would be "shadowed" under the traditional antenna locations or where zoning laws simply prohibit the installation of high-site facilities. Higher capacity and greater coverage, in turn, are the necessary building blocks for broadband wireless services.

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[10] Capacity in a cellular network comes, in general, from reusing spectrum. The greater the number of radiating elements, the more often spectrum can be reused and the more capacity the network will have. Of course, this general statement varies somewhat depending on the type of technology used, *i.e.*, variants of TDMA or CDMA gain capacity and system performance in different ways. NextG's wireless solution is "protocol agnostic" and can accommodate all forms of wireless technologies.

The architecture of DAS facilities consists of fiber optic cable lines leading to and connecting various equipment and antennas at remote locations called "nodes" with a central "hub," which typically is located in a building on private property. While NextG installs its fiber optic lines either underground, in conduits, or aerially on poles, it must install its node equipment (antennas and related equipment boxes) on poles. NextG's service requires a contiguous grid of relatively closely spaced low-site antennas. For these reasons, access to poles in the public right-of-way and utility easements (*e.g.*, utility, street light or traffic signal poles) is critical from both a technical and economic perspective for the deployment and operation of DAS networks. NextG uses either poles owned by the local utility company or poles owned by the municipality, or a combination of both. Attachment 1 shows a diagram of a typical outdoor DAS network using utility poles with aerial fiber optic cable.

The DAS networks where NextG seeks to install facilities on distribution poles typically consist of: (1) fiber optic cable, which is attached horizontally to utility poles in the traditional manner; (2) small pole-mounted antennas; and (3) small pole-mounted equipment, containing transmission electronics for the system, that is connected to the fiber optic cable and antennas. While NextG serves wireless providers and incorporates antennas into its network, its system consists primarily of wireline (fiber optic cable) attachments to existing poles. The antennas and cabinets (*i.e.*, nodes) typically are attached on seven percent (7%) or less of the total poles utilized in any given DAS network.

The equipment NextG is deploying for its current DAS networks typically includes either an omni-directional antenna or a directional panel antenna, as well as an equipment box located on the pole's unusable space (box sizes vary depending on the particular deployment). Pictures of typical installations of NextG's equipment on utility poles are provided in Attachment 2.

NextG's antennas are installed in some cases in the "communications space" on the pole (*i.e.*, mid-pole), but in most cases on the pole top. Indeed, pole top space is often the only feasible location to install the antennas in some markets.[11] In cases where necessary to maintain proper space clearances, NextG has been required to install pole top extensions that are 4 to 6 feet in length or replace an existing pole with a taller pole.

B. NextG's Experience with Utilities

Even though NextG's DAS networks are chiefly composed of wireline facilities, NextG nevertheless has encountered significant obstacles to the placement of its facilities on utility poles throughout the country. In particular, NextG is concerned with timely negotiation of agreements, timely action throughout the attachment cycle, access to the pole top for wireless antennas, equal rates for attachment of wireless equipment, and expeditious dispute resolution.

When NextG negotiates pole attachment agreements, it frequently encounters utilities that insist NextG provide indemnification for the utility's own negligence. Working through this one issue often adds months to the contract negotiation process even though the Commission has clearly directed utilities to bargain in good faith and extend "just and reasonable terms" to attachers.[12] NextG regularly reminds utilities that in *Georgia Power*, the Commission's Enforcement Bureau found that a nonreciprocal indemnification clause was unjust and unreasonable.[13]

NextG also encounters resistance to wireless attachments, particularly at the pole top. As discussed in greater detail below, utilities often refuse to allow pole top access for wireless antennas without providing detailed reasons for their concerns. This is not uncommon even

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[11] *See NextG Networks of NY, Inc. v. Public Service Electric & Gas*, EB-07-MD-004, Reply Declaration of Norine Luker at ¶¶ 9–11 (filed Feb. 11, 2008).

[12] *The Cable Television Association of Georgia v. Georgia Power Company, Order*, 18 FCC Rcd 16333, 16334 (Enf. Bur. 2003) (hereinafter "*Georgia Power*").

[13] *Id.* at 16345–46.

when neighboring utilities with the same climates and weather patterns allow pole top attachments. NextG typically allows at least six months to a year to negotiate a pole attachment agreement involving wireless attachments, but in some cases it has taken up to five (5) years to negotiate an attachment agreement. Most of the time in these negotiations involves waiting for a utility response to NextG's emails and phone calls regarding progress.

Once pole attachment agreements are in place, NextG still experiences long delays in the process of applications. It is not uncommon for a utility to take up to 90-120 days to prepare a make-ready estimate. NextG has experienced delays of a year or longer to complete make-ready and 5–6 months is very common. The need for equal make-ready timelines for both wireline and wireless attachments is discussed at length below.

The following comments respond to specific areas where the Commission seeks comments, but NextG also requests that the Commission ensure its decision is explicit regarding the equal treatment of wireless facility attachments throughout the final order on this matter.

III. WIRELESS ATTACHMENTS ARE CRITICAL TO THE NATIONAL BROADBAND PLAN

President Obama has made wireless broadband a priority of his administration, stating, "[w]e are now beginning the next transformation in information technology: the wireless broadband revolution."[14] Recently, the President stated, "Expanded wireless broadband access will trigger the creation of innovative new businesses, provide cost-effective connections in rural areas, increase productivity, improve public safety, and allow for the development of mobile telemedicine, telework, distance learning, and other new applications that will transform

[14] Presidential Memorandum: Unleashing the Wireless Broadband Revolution (June 28, 2010), available at: http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution (last visited Aug 3, 2010) ("Presidential Memo").

Americans' lives."[15] However, as the Commission has already recognized, the goal of providing ubiquitous wireless broadband access cannot be achieved without a massive increase in the infrastructure supporting those networks.[16]

The ever-increasing demand for wireless products and services is putting significant pressure on existing wireless infrastructure, which in turn requires the construction of addition wireless infrastructure at rapid speeds. Wireless carriers are looking to the public right-of-way for microcell and picocell installations on existing utility poles; DAS companies, such as NextG, likewise use existing utility poles to the greatest extent possible. Because wireless pole attachments are an essential part of expanding wireless networks, the Commission's determinations under this FNPRM are critical to the success of the President's goals and the National Broadband Plan.

The National Broadband Plan recognized that the "use of wireless broadband is growing rapidly" as consumers rely more heavily on wireless devices to provide traditional wireline telephone and broadband internet services.[17] It cited specific figures for rapidly expanding wireless broadband data traffic and future infrastructure projections for AT&T, Verizon, and Clearwire, all of whom are customers of NextG and thus rely both directly and indirectly on wireless pole attachments.[18]

The National Broadband Plan also acknowledged the current "rollout of advanced 4G networks using new versions of LTE and WiMax technologies" that "support higher data

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[15] Presidential Memo.
[16] Omnibus Broadband Initiative, Federal Communications Commission, Connecting America: The National Broadband Plan 109 (2010), available at http://download.broadband.gov/plan/national-broadband-plan.pdf (last visited Aug 3, 2010) ("NBP").
[17] NBP at 76.
[18] NBP at 76-77.

throughput rates, lower latencies and more consistent network performance."[19] These 4G networks require not only more wireless infrastructure, but will need to rely particularly on DAS networks because DAS increases data throughput rates by using multiple low power nodes that are closer to mobile devices, such as handsets and laptops. This radio-frequency engineering also allows for "cell splitting," which the National Broadband Plan mentions as a way to use limited spectrum more efficiently.[20]

In the Notice of Inquiry issued Fall, 2009, the Commission asked for comment specifically regarding DAS networks.[21] The Commission recognized that "DAS antennas may lend themselves to collocation" because they are small and can be easily attached to utility poles.[22] The technological advantage of DAS to provide coverage with multiple low power antennas, rather than one high-powered antenna, improves reliability and efficiency of wireless broadband networks.[23]

The Commission and the National Broadband Plan have emphasized reliance on existing utility infrastructure for wireless networks.[24] This FNPRM is intended to address many of the items outlined in the National Broadband Plan, such as, uniform rental rates, make-ready processes, and access to infrastructure.[25]

To achieve the goals of the National Broadband Plan, it is critical that the Commission adopts rules imposing the same timelines for wireless pole attachments as it adopted for wireline

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[19] NBP at 77.
[20] NBP at 77.
[21] *In the Matter of Fostering Innovation and Investment in the Wireless Communications Market; A National Broadband Plan For Our Future*, GN Docket No. 09-157; GN Docket No. 09-51, Notice of Inquiry, FCC 09-66, ¶ 53 (Aug. 27, 2009) ("*Wireless NOI*")
[22] Wireless NOI at ¶ 53.
[23] Wireless NOI at ¶ 53 n.62.
[24] NBP at 109.
[25] NBP at 109.

attachments. As demonstrated below, contrary to the smoke screen arguments of utilities, there is no basis for excluding wireless attachments from the timelines set for other wireline attachments.

Likewise, while existing Commission decisions and Supreme Court precedent make clear that wireless facilities are entitled to the same regulated pole attachment rates as any other attachment,[26] the FNPRM is not explicit that wireless attachments will receive equal rates, nor does it explicitly ask for comment on pole top attachments for wireless antennas. It may be that the Commission believes that the issue is already clear, and therefore not in need of comment. While NextG agrees the law is clear, it requests that the Commission set the record straight in its forth-coming order on this matter.

Failure to give timeline and rate protection to wireless attachments would run counter to the National Broadband Plan's instructions to "advance the deployment of both wireline and wireless broadband services."[27] NextG requests that the Commission not overlook equal access, rates, and make-ready timelines for wireless devices when it crafts its final order.

IV. TIMELINES SHOULD BE ESTABLISHED FOR WIRELESS ATTACHMENT AGREEMENTS AND MAKE-READY

The National Broadband Plan recommends the Commission to implement rules regarding timelines for access to utility infrastructure and the Commission seeks comments regarding the appropriate timelines.[28] For wireless attachments, there are two prominent timeline issues: initial negotiation of a pole attachment agreement for wireless attachments and reasonable make-ready timelines when permit applications are submitted.

[26] *See generally 1998 Implementation Order*; *Gulf Power*; *2004 Wireless Reminder*.
[27] NBP at 111.
[28] *See* NBP at 111; FNPRM at ¶ 19 & 29.

A. Utilities Need to Negotiate Wireless Pole Attachment Agreements in a Timely Manner.

NextG provided significant detail during the NPRM docket outlining the problems it encounters with utilities in its attempts to obtain a pole attachment agreement for wireless attachments, particularly at the pole top.[29] NextG supports the Commission's clarification that the requirement that utilities respond to a request to attach within 45 days extends to wireless attachments.[30] However, the Commission conditions this requirement stating, "where a utility has no master agreement with a carrier for wireless attachments requested, such as pole top attachments, the utility may satisfy the requirement to respond with a written explanation of its concerns with regard to capacity, safety, reliability, or engineering standards," and then seeks comment on whether the response should "be sufficiently detailed to serve as a basis for negotiating a master agreement, which would dictate a timely process for future attachments."[31]

The FNPRM is vague regarding whether a utility's concerns would be sufficient to completely deny wireless attachments in the communications space or pole top. Clearly, a utility cannot deny access based on general "concerns" about wireless attachments that are unsupported and unreasonable. This runs counter to the Commission's consistent reiteration and previous assertions that attachments may only be denied "where there is insufficient capacity, or for reasons of safety, reliability, and generally applicable engineering purposes."[32] The Commission has never suggested that a blanket denial of wireless attachments or restriction of their placement would be permitted.

If a utility has "generalized" concerns about wireless attachments, those concerns should be presented to the wireless attacher so that they may be worked through during the negotiation

[29] *See generally*, NextG Comments at 15–21.
[30] FNPRM at ¶ 52.
[31] FNPRM at ¶ 52.
[32] *2004 Wireless Reminder* (citing 47 U.S.C. § 224(f)(2)).

of the wireless attachment agreement and any accompanying construction standards, if required. A utility always retains the ability to deny a specific pole attachment application pursuant to 47 U.S.C. § 224(f)(2) on a pole by pole basis, but complete denial of a type of telecommunications attachment is contrary to established law and precedent.[33]

In its comments, NextG provided detailed accounts of the obstacles it faces when approaching utilities for a wireless attachment agreement, particularly for pole top attachments, which is discussed below in Section V.[34] NextG regularly spends months working with the engineering groups within the utility, addressing their concerns and installing mockup installations so that they can become comfortable with this new type of attachment—the antenna. Equipment box installations are similar in size, if not smaller, than equipment boxes regularly attached by cable and telephone companies or the utility itself and typically much lighter than electric transformers. Attachment 3 provides photos of equipment and transformers attached by utilities. Some electric have existing engineered construction standards for wireless antennas. However, for utilities with less experience with wireless attachments, NextG provides example engineering drawings of antenna attachments that are in full compliance with the National Electric Safety Code ("NESC").[35]

As NextG has explained in prior submissions, there should be no blanket "concerns" with attachment of wireless antennas to distribution poles. As a threshold matter, the NESC contains rules governing the safe installation and maintenance of antenna attachments. Rule 235I specifies that "[c]ommunications antennas located in the supply space [be] installed and

[33] *See generally, Gulf Power*; *2004 Wireless Reminder*.
[34] NextG Comments at 15–20.
[35] *National Electric Safety Code* (2007 ed.) ("*NESC*")

maintained only by personnel authorized and qualified to work in the supply space . . . ."[36] Rule 236 outlines climbing space requirements.[37] Rule 237 outlines working space requirements.[38] Rule 238 outlines "vertical clearance between certain communications and supply equipment located on the same structure."[39] These rules read in combination with certain other rules, sections, and tables in the NESC provide utilities and wireless attachers with guidelines on developing construction standards for the attachment of wireless antennas on the pole top and in the communications space.

If a utility has no previous experience with wireless attachments, it is reasonable for a utility to provide a detailed list of it concerns regarding wireless antennas within the 45 day timeline, as suggested in the FNPRM.[40] The Commission asks whether "we should require that the response be sufficiently detailed to serve as a basis for negotiating a master agreement, which would dictate a timely process for future attachments."[41] Clearly, the Commission should adopt such requirements to prevent a pole owner from simply identifying "concerns" and thereby effectively rebuffing a request for attachment. Once the utility provides the list to the requesting attacher, both parties should be required to work in good faith on establishing a construction standard for the wireless antenna.

Based on NextG's experience developing construction standards with many different utilities, big and small, 90 days is a reasonable length of time to address and alleviate a utility's concerns and the Commission should adopt 90 days as a maximum reasonable time for adopting

[36] *NESC* at 142.
[37] *NESC* at 158–161.
[38] *NESC* at 162–3.
[39] *NESC* at 163–5.
[40] FNPRM at ¶ 52.
[41] FNPRM at ¶ 52.

construction standards for wireless attachments where the utility has not previously adopted such standards or permitted attachment of wireless facilities.

The Commission should also adopt a rule requiring both parties to simultaneously negotiate in good faith a wireless attachment agreement, again assuming the utility has no agreement template available. The utility may ask to have the terms and conditions particular to wireless attachment incorporated into its standard pole attachment agreement or do a second attachment agreement exclusive to wireless agreements. NextG has worked with utilities on agreements both ways. If negotiations break down or the utility does not negotiate in good faith then the parties should enter into dispute resolution talks, some suggestions for which are outlined in Section VII below.

When both parties are working in good faith by meeting regularly to develop a construction standard and exchanging agreement drafts, it is not unreasonable to expect a construction standard and master wireless attachment agreement to be finalized within 135 days (45 days for the utility to evaluate, and 90 days to develop the construction standard and attachment agreement) from making an initial request.[42] From a speed-to-market perspective, this will give wireless broadband providers confidence that they will be ready to submit permits approximately four and a half months after approaching a utility. The time it takes to put the network on air and begin providing services to customers will depend heavily on the make-ready process, which is discussed below. Given the importance of wireless broadband infrastructure, the Commission should adopt the timelines suggested above.

[42] *See* Letter from PCIA/The DAS Forum, WC Dkt. 07-245; RM-11293; RM-11303, 11–12 (filed Apr. 19, 2010) (discussing industry experience working with utilities on construction standards for wireless attachments).

B. Wireless Attachments Should Receive the Same Make-Ready Timelines as Wired Attachments

As the Commission acknowledges, make-ready delays plague all types of attachments equally.[43] However, once a construction standard and wireless attachment agreement (if required) are in place, the make-ready process for attachment of wireless equipment should be the same as for other traditional wireline attachments.

During the NPRM docket, NextG requested specific make-ready timelines for wireless attachments and proposed 45 days for a survey and 45 days after payment for completion of the make-ready because those intervals were "reasonable and yet, will not permit utilities to needlessly delay the implementation of NextG's DAS installations" that serve wireless carriers and their end user customers.[44] NextG also described the make-ready issues encountered by wireless carriers and other DAS providers, which results in months to years of delays for additional wireless infrastructure installation.[45]

Make-ready delays are a significant problem for wireline and wireless attachments. NextG has encountered numerous types of delays in the make-ready process. For example, any make-ready involving a pole that fails structural analysis requiring a complete pole replacement often results in extended delays for a number of reasons, including utilities insisting that NextG pay for the full cost of the pole replacement even though it required replacement prior to the addition of NextG's attachment. If NextG were to wait for the normal schedule of pole replacement, it could take months or a year to be replaced, so NextG tries to negotiate a cost-sharing agreement with the utility, which may take months or a year to negotiate in and of itself.

[43] FNPRM at ¶ 25.
[44] NextG Comments at 21.
[45] NextG Reply Comments at 8.

In one major deployment, it took over a year to get the make-ready survey and construction completed.

NextG is not alone; other DAS providers have experienced similar problems. The DAS Forum, a membership section of PCIA, works with all of the DAS providers, including NextG. In its comments under the NPRM docket, it noted:

> DAS Forum members have experienced similar problems. Parties seeking to attach DAS antennas to utility poles face make-ready processes that are long, unpredictable, and expensive. DAS Forum members report that make-ready work usually takes between four and nine months to complete, depending on the number of nodes involved. By contrast, in the very rare cases where the DAS operator is permitted to perform the make-ready work itself, the process only takes between two and three weeks for a DAS network with relatively few nodes (i.e., ten to fifteen). In egregious cases, DAS Forum members report waiting as long as one year for the completion of make-ready work.[46]

The DAS Forum also emphasizes that wireless carriers look to DAS networks because they often provide "Speed to Market" advantages over traditional macro-site installations when wireless equipment is installed on existing utility poles.[47] However, this advantage risks complete elimination if make-ready timelines are not extended to wireless attachments equal to those of other wireline attachments. NextG thanks the Commission for recognizing the evidence NextG provided in the NPRM proceeding regarding the need for make-ready timelines similar to those adopted in several states in order to expedite network deployment.[48] However, right now, the Commission's suggested timelines for make-ready only applies to wired attachments.[49] The Commission asks:

> We seek comment on considerations that would affect a timeline tailored to suit requests for attachment of wireless equipment after a utility and the carrier have

[46] Comments of the DAS Forum, a Membership Section of PCIA-The Wireless Infrastructure Association, WC Docket No. 07-245, RM-11293, RM-11303, 9 (filed Mar. 7, 2008) ("The DAS Forum Comments").
[47] The DAS Forum Comments at 4.
[48] FNPRM at ¶ 31 n.112.
[49] FNPRM at ¶ 31.

> reached a master agreement. Attachment of wireless equipment may complicate engineering analyses, but may also avoid the multiparty notice and coordination issues that characterize rearrangement of wired facilities. Also, wireless carriers using a distributed antenna system (DAS) attach to relatively few poles compared to cable operators and wireline carriers that attach to every pole that their network passes. Should a timeline for requests for wireless equipment reflect these circumstances, and if so how?[50]

NextG submits that the appropriate timeline for attachment of wireless equipment after a utility and the provider have reached a master agreement should be the same as the timeline for wireline attachments.

The timelines suggested by the Commission in the FNPRM are reasonable for a few simple reasons.[51] First, the suggested timelines only apply when there is no pole replacement.[52] DAS providers sometimes place small antenna attachments in the communication space, which requires only typical types of make-ready similar to what is performed when installing an additional wireline attachment. Even some pole top attachments require little or no make-ready because attachers use utility-approved pole extensions. In the rare event that pole replacement is required in order to achieve NESC clearances, it is not unreasonable to apply the make-ready timelines currently contemplated by the Commission. However, the most important goal is to encourage timely make-ready, and the suggested timelines should not differ simply because the type of attachment is "wireless."

Second, as the Commission recognizes, make-ready timelines only arise after a wireless master agreement and construction standard are established. Once the appropriate agreement is in place, there is no basis for delay. The Commission notes that, "Utilities assert that wireless

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[50] FNPRM ¶ 53.
[51] FNPRM at ¶¶ 31–43 (describing the five stages for make-ready: (1) survey (45 days); (2) estimate (14 days); (3) attacher acceptance (14 days); (4) performance (45 days); and, if needed, (5) multiparty coordination (30 days).
[52] FNPRM at ¶ 32.

attachment presents different safety, reliability, and engineering concerns . . . ."[53] The Commission cites the comments of a number of utilities voicing vague and undocumented claims against wireless attachments.[54] However, these "concerns" are remedied during the development of the agreement, far before an application is submitted, thus negating the need for longer make-ready timelines later because engineering analysis proceeds in a typical manner based on existing construction standards.

One reason a utility would have for needing longer timelines for both wireless and wireline equipment is that it does not have an existing construction standard for what the attacher proposes, but this circumstance is not unique to wireless equipment. For example, ILECs have been deploying larger equipment boxes as they bring fiber optic cable to individual homes. These equipment boxes were often not previously used, and there may be a period of time working with a utility on a new construction standard for attachment. Wireless equipment should not be singled out for disadvantaged and discriminatory treatment when the issues it encounters are not unique to being "wireless" equipment.

Third, the same make-ready timelines should apply because a relatively few number of poles are typically submitted when entities request wireless attachment. NextG's wireless equipment requests are typically only seven percent (7%) of the total permit applications. A wireless carrier deploying a microcell may have only one (1) permit application. Consider a company with an existing wireless attachment agreement and construction standard for wireless attachment and an established history attaching the same equipment configuration with the utility. When that company needs an additional one or two locations, which is often the case as wireless carriers face increasing capacity demands in certain areas, the suggested timelines

[53] FNPRM at ¶ 52.
[54] FNPRM at ¶ 52 n. 154.

provided more than adequate time for make-ready survey, estimate preparation, and make-ready construction.

Wireless attachments should not be put in a discriminatory, competitively disadvantaged make-ready situation under the Commission's make-ready timelines simply because of the word "wireless" is attached to a certain type of equipment. Utilities across the nation attach their own wireless antennas to utility poles routinely as they deploy automatic meter reading technology. Other telephone companies have been installing equipment boxes that are equal to or bigger and heavier than most of the NextG's equipment boxes. Yet, if wireless attachments do not receive equal make-ready timelines, virtually identical pieces of equipment will languish with extended make-ready delays while others are permitted to attach.

Equal treatment is a cornerstone of the Telecommunications Act of 1996 ("1996 Act").[55] Section 224 requires utilities treat attachers in a nondiscriminatory manner for both rates and access.[56] Section 253 requires municipalities to provide access to the public right-of-way to telecommunications providers in "a competitively neutral and nondiscriminatory basis."[57] The United States Supreme Court upheld the Commission's equal treatment of wireless attachments in *Gulf Power*, stating, "[a] provider of wireless telecommunications service is a 'provider of telecommunications service,' so its attachment is a 'pole attachment.'"[58]

Establishing separate make-ready timelines for wireless attachments would unreasonably and unnecessarily discriminate based on the type of technology being used to provide competing

[55] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996) (codified as amended in scattered sections of 47 U.S.C.).
[56] 47 U.S.C. § 224(d)(3)(e)(1) ("Such regulations shall ensure that a utility charges just, reasonable, and nondiscriminatory rates for pole attachments."); 47 U.S.C. § 224(f) ("A utility shall provide a cable television system or any telecommunications carrier with nondiscriminatory access to any pole, duct, conduit, or right-of-way owned or controlled by it.")
[57] 47 U.S.C. § 253(c).
[58] *Gulf Power*, 534 U.S. at 340.

services. In addition, discriminatory treatment is not supported by the record. The Commission cannot take the utilities' vague references to wireless attachments being unsafe as evidence when there are thousands of wireless attachments, many of them belonging to the utility companies, on utility poles across the nation.[59] NextG recently completed installation of its 5000th DAS node and has more than 1500 nodes currently in the process of being installed.[60] The proven track-record of wireless attachments show that these attachments are not novel, but vital to wireless broadband infrastructure, and do not present unprecedented, unusual, or unmanageable issues. Thus they deserve equal make-ready timelines.

V. THE COMMISSION SHOULD CLARIFY THAT UTILITIES MAY NOT HAVE BLANKET PROHIBITIONS AGAINST POLE TOP ATTACHMENTS FOR ANTENNAS

A significant issue for NextG and wireless attachers is the opportunity to place antennas at or near the top of the pole. For NextG, there are several reasons why this is a particularly important issue. Pole top placement of antennas provides greater coverage by the simple fact that it is higher than a mid-pole attachment, which provides better coverage. By increasing the coverage area, increased antenna height, in turn, may significantly reduce the total number of antennas needed for an installation, thereby decreasing total network cost and minimizing the potential community "impact."[61]

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[59] FNPRM ¶ 52 n.154.

[60] NextG Networks Achieves Major Milestone, Extending Its National Reach to 5,000 DAS Sites (Feb. 24, 2010), available at: http://www.nextgnetworks.net/corporate/release18.html (last visited Aug. 6, 2010).

[61] NextG frequently encounters opposition or difficulty from local governments. In many communities, each of its Node attachments to utility poles, simply because they involve a wireless device, are subject to complex, burdensome, lengthy, and wholly discretionary "zoning" approvals. While NextG believes that many of these municipal processes are preempted by Section 253 of the Communications Act, 47 U.S.C. § 253, nonetheless, they are far too frequent, and thus, since denial of access to pole tops could double of the number of Nodes subject to zoning and at the same time double the "impact" that will be identified by local authorities it poses an multi-layered potential barrier to NextG's deployment.

As a threshold matter, the Commission should recognize that attachment of wireless facilities to the top of utility poles can be accomplished safely, consistent with recognized engineering standards, and without any negative impact on reliability. In the Public Notice released in 2004, the Wireless Telecommunications Bureau reminded utilities that pole top attachments cannot be categorically prohibited, stating "the only recognized limits to access for antenna placement by wireless telecommunications carriers are those contained in the statute: 'where there is insufficient capacity, or for reasons of safety, reliability, and generally applicable engineering purposes.' 47 U.S.C. § 224(f)(2)."[62] However, the fact remains that many utilities continue to make carte blanche prohibitions on all or certain types of pole tops, even though the installations on many utilities demonstrates that pole top antennas can be safely installed, maintained, and operated on all types of distribution poles.

NextG has pole attachment agreements that allow wireless attachments with approximately 67 utilities. Out of these, 59 allow some type of pole top attachment with the large majority (53) allowing pole top over both primary, secondary and guy poles, but seven (7) limit pole top attachments to only secondary distribution and guy poles. These numbers demonstrate that many utilities are able to develop internal construction standards without any impact on safety, reliability or engineering. These numbers do not reflect the many utilities NextG does not have agreements with, nor should it undercut the importance of being able to have pole top installations as an option with those utilities that continue to refuse to work with companies like NextG to develop a pole top installation construction standard acceptable to utility.

[62] *2004 Wireless Reminder*.

Pole top installations standards are regularly developed by looking at the NESC for guidance because it contains rules that govern the placement of wireless antennas on pole tops.[63] For example, Rule 238B prescribes clearance specifications between antenna equipment attached in the supply space and electrical conductors.[64] Rule 235I ensures that "[c]ommunications antennas located in the supply space [be] installed and maintained only by personnel authorized and qualified to work in the supply space . . . ."[65] NESC Rules 222 (Joint Use Structures), 224A (Communications circuits located within the supply space and supply circuits located within the communications space), 230A(3)–(4) (Measurement of clearance and spacing; Rounding of calculation results).[66] Rules 236–238 (Climbing Space; Working Space and Vertical clearance between certain communications and supply facilities located on the same structure) also apply to wireless attachments, as do all of the loading and strength rules in Sections 24–26 and all of the worker safety rules in Sections 42–44, among others.[67] Utilities follow these rules when allowing pole top installations, and those utilities trying to justify their blanket denial of access based on nebulous and meritless safety concerns ignore the fact that these guidelines—established by the electric utility-dominated NESC—exist specifically to address their concerns.

[63] The NESC has been adopted by 49 states and the District of Columbia. California follows GO-95. Since California is certified state for purposed of 47 U.S.C. § 224, it is reasonable to presume that all "FCC states" follow the NESC.
[64] *See* Attachment 4, NESC Rule 235I(2)-(4).
[65] *See* Attachment 4, NESC Rule 235I(1).
[66] *See* Attachment 4, NESC Rules 222, 224A, 230A(3)-(4).
[67] *See* Attachment 4, NESC Rules 236-238; Attachment 5, Declaration of David Marne, submitted to the New York Public Service Commission with NextG's comments in the NY PSC's *Proceeding on Motion of the Commission Concerning Wireless Facility Attachments to Utility Distribution Poles*, NY PSC Case No. Case 07-M-0741 (filed Sept. 10, 2007); Attachment 6, Reply Declaration of David Marne, submitted to the Commission by NextG in the FCC complaint proceeding *NextG Networks of NY, Inc. v. Public Service Electric & Gas Co.*, File No. EB-07-MD-004 (filed Feb. 11, 2008).

NextG is encouraged that the Commission proposes giving a utility 45 days to articulate these concerns.[68] As addressed above in Section IV.A, NextG suggests that utilities be required to provided a detailed list of concerns, including any regarding pole top installations of wireless antennas, so that both parties may work together to remedy them. For example, one electric utility in Florida insists it can not allow pole top antennas, without identifying clear safety or reliability reasons for its refusal. Meanwhile, many of the neighboring electric utilities, after reviewing local conditions, took the opposite approach and allowed antennas only at pole top.

In the development of a wireless installation standard, the utility may always include narrow grounds for certain types of distribution poles where pole top installations are infeasible for safety, reliability or engineering reasons in line with 47 U.S.C. § 224(f)(2). For example, some utilities prohibit pole top wireless installation on certain types of primary distribution poles, such as switch poles or capacitor poles, but these are narrowly tailored restrictions of access that remove a virtually negligible number of poles from use after careful consideration of safety, reliability and engineering practices. By contrast, a blanket prohibition of the use of primary and/or secondary distribution poles for pole top installations is an abuse of the justifications for restricting access under 47 U.S.C. § 224(f)(2).

NextG recognizes that utility poles come in a variety of sizes and configurations. However, NextG can adjust its attachment designs to accommodate the different pole characteristics in a manner that complies with governing standards, including the NESC. Currently, utilities are still fighting the idea that wireless attachments should be permitted *at all*. To promote the deployment of wireless broadband, advanced services, and expanded competitive

[68] FNPRM at ¶ 52.

service, the Commission should once and for all make clear that wireless attachments must be presumed permitted.

VI. WIRELESS EQUIPMENT SHOULD RECEIVE THE SAME POLE ATTACHMENT RATE AS OTHER TYPES OF TELECOMMUNICATIONS AND BROADBAND ATTACHMENTS

A number of utilities throughout the United States continue to subject wireless attachments to higher rates even after *Gulf Power* made clear that wireless attachments "fall within the heartland of the Act."[69] The record under the NPRM is replete with examples of utilities trying to extract unreasonable rates for wireless attachments.[70] The National Broadband Plan recommends that the Commission establish a close to uniform and fair attachment rate for all types of equipment in Recommendation 6.1.[71] The FNPRM references the confusion of rates regarding "wireless" facilities.[72] However, it is not as clear that any rate determination made under this FNPRM will apply equally to wireless attachments.[73] NextG requests the Commission clarify that wireless telecommunications attachments receive equal pole attachments rates in order to clear up any confusion on this matter.

Regardless of whether or how the Commission addresses some of the other pole attachment rate issues raised in this docket, the Commission should re-affirm that wireless equipment attachments are entitled to the same regulated rental rate formula as applies to other attaching entitles providing the same services (whether it be cable, telecommunications,

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[69] *Gulf Power*, 534 U.S. at 340.

[70] *See, e.g.*, Comments of ExteNet Systems, Inc., WC Docket No. 07-245, RM-11293, RM-11303, 4 (filed Mar. 7, 2008) (describing a Florida investor owned utility that charges $12.94 for a wireline attachment, but demands $1,564.50 per year for a wireless antenna).

[71] NBP at 110. Moreover, this seems to be consistent with the Commission's clear directive to develop a regulatory framework that may be applied in a "simple and expeditious" manner with "a minimum of staff, paperwork and procedures consistent with fair and efficient regulation." S. Rep. No. 95-580, 1978 U.S.C.C.A.N. 109, at 21.

[72] FNPRM at ¶¶ 115–16.

[73] FNPRM ¶¶ 118 (the FNPRM says that a uniform pole rate with help with wireless infrastructure, but does not state that a uniform pole rate will apply to wireless infrastructure).

broadband, or otherwise). In 1998, the Commission held that wireless telecommunications providers are entitled to the same protections under Section 224 as all other telecommunications providers.[74] In 2002, the Supreme Court affirmed this determination.[75] Yet, even after the Commission's ruling, and the Supreme Court's affirmation, many utilities continue to take the indefensible position in negotiations with wireless providers that such providers are not entitled to the protections of Section 224, including the right to access utility poles at reasonable rates.

Since that time, the Wireless Bureau has recognized that utilities continue to fail to provide reasonable attachment rates for wireless providers.[76] Notwithstanding this unambiguous reminder of utilities' obligations, many utilities continue to flout the rules and ignore their obligations with respect to pole attachment rates for wireless providers. Accordingly, the Commission needs to ensure in this proceeding that it clearly mandates wireless providers are entitled to the same pole attachment rates as all other attaching entities providing the same services (whether it be cable, telecommunications, broadband, or otherwise).

The utilities' claims that wireless attachments are different from a typical wireline attachment and that they somehow impose different or greater costs is factually unsupported on this record and has previously been rejected by the Commission. In the 2000 Report and Order, the Commission rejected arguments by utilities that when attachments impose different weight or wind loading factors they should be subject to different rates because they impose different

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[74] *1998 Implementation Order*, 13 FCC Rcd at 6798-99 (¶¶ 39-41), *aff'd Gulf Power*.
[75] *See Gulf Power*.
[76] Wireless Telecommunications Bureau Reminds Utility Utilities Of Their Obligations To Provide Wireless Telecommunication s Providers With Access To Utility Poles At Reasonable Rates, DA-04-4046, *Public Notice*, 19 FCC Rcd 24930 (Dec. 23, 2004) ("*2004 Reminder Notice*").

burdens.[77] The same is still true. If NextG installs an equipment box in the unuseable space, it should not be subject to rental payments any more than the cable, CLEC, or ILEC boxes using the same space on the pole. Likewise, the one foot (or two feet if that is the case) actually occupied by a NextG antenna attachment should not and cannot be subject to a different per foot rental rate simply because the equipment emits radio signals.

NextG assumes that the Commission is not explicitly addressing the issue of wireless equipment attachment rates because any rates developed will apply equally to all telecommunications attachments. Nonetheless, NextG requests that the Commission make such clarification in its final order in order to stop utilities from subjecting wireless equipment to unreasonable discriminatory rents.

VII. THE COMMISSION SHOULD ADOPT AN "EXECUTIVE LEVEL NEGOTIATION" RULE AS PART OF THE DISPUTE RESOLUTION PROCESS

Finally, as part of its dispute resolution process, NextG suggests the Commission consider adopting an "executive level negotiation" requirement similar to that adopted by the California Public Utility Commission ("CPUC"). Under the CPUC requirements, the following prerequisites must be satisfied as evidence of good faith negotiations prior to the CPUC's acceptance of a request for resolution of a pole attachment dispute:[78]

> 1. The party seeking access to another party's facilities must first submit its request to the utility in writing. The CPUC has a default deadline of 45 days for a utility to confirm or deny whether space is available to grant requests for access to support structures. If the request is denied, the utility shall state the reasons for the denial

[77] *In re:* Amendment of Rules and Policies Regarding Pole Attachments, *Report & Order*, 15 FCC Rcd. 6453 ¶¶ 27-30 (2000).

[78] Order Instituting Rulemaking on the Commission's Own Motion Into Competition for Local Exchange Service, Dec. No. 98-10-058 (Oct. 22, 1998)

or explain why the space is not available, and include all the relevant evidence supporting the denial.

2. In the event of denial, the CPUC requires the parties to escalate the dispute to the executive level within each company to attempt to negotiate alternative access arrangement to accommodate the parties' mutual needs.

3. If the parties are unable to reach a mutually agreeable solution after five days of good-faith efforts at negotiation once the matter has been elevated to an executive level, any party to the negotiations may request the Commission arbitrate the dispute.

NextG has found that in dealing with pole attachment issues in California the requirement to elevate the matter to executive level personnel often moves the dispute toward resolution where it otherwise would have been unattainable or where the matter simply did not get the appropriate level of attention previously.

VIII. CONCLUSION

Based on the foregoing comments, NextG respectfully submits that the Commission should affirm the importance of wireless broadband infrastructure by ordering equal treatment of wireless attachments regarding rates, make-ready timelines, and access to poles, including the pole top. Without such protections, wireless attachments will suffer continued discriminatory treatment by utilities, which will hinder the expansion of broadband services to the public contrary to the goals of the President and the Commission.

[Signature on the following page]

Respectfully submitted,

_____

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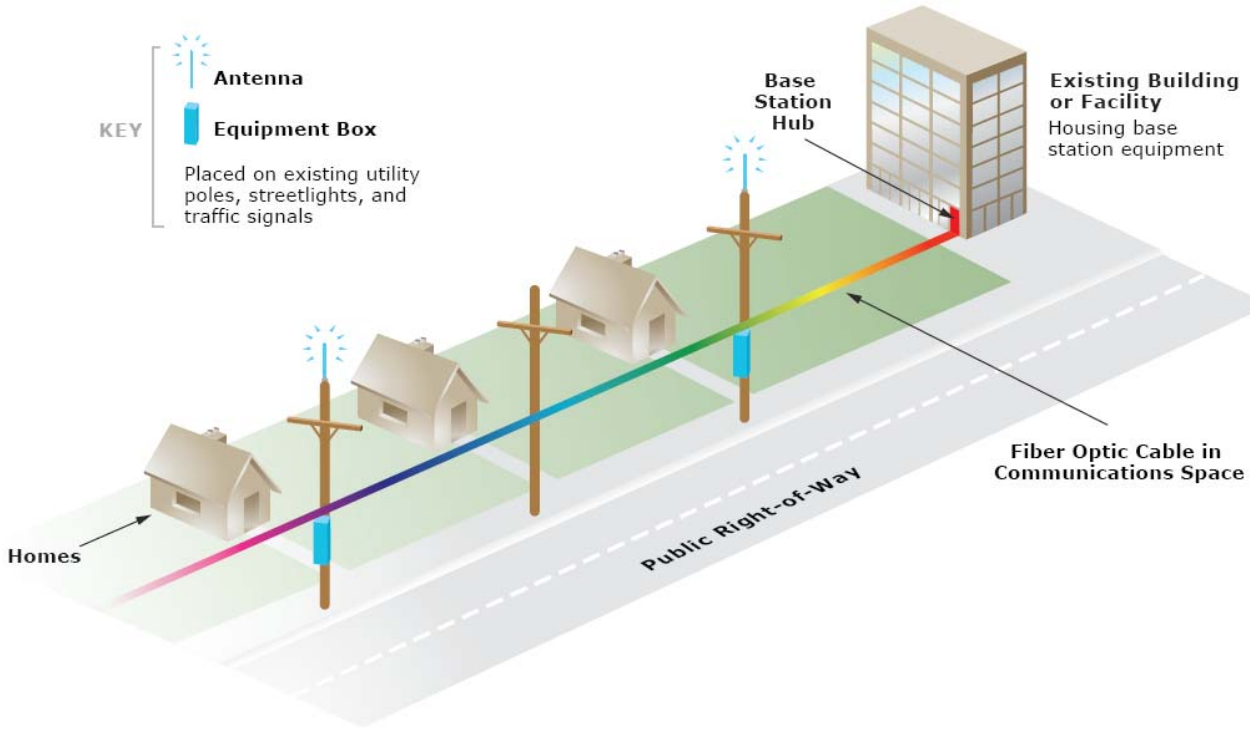
August 16, 2010

Attachment 1
Distributed Antenna System
Construction Diagram on Utility Poles



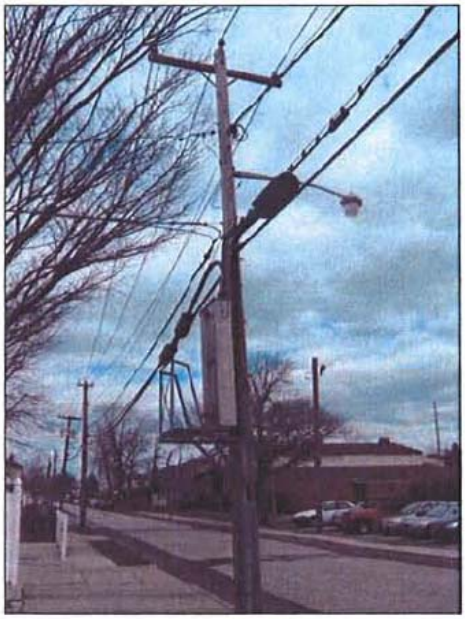
Attachment 2
Pictures of Representative NextG DAS Installations


PRETZEL FACTORY
Giggles


MIRA MESA BL

Attachment 3
Example Utility Equipment

ILEC equipment box in Nassau County, NY



Electric company transformers in Arlington, VA

Attachment 4
Pertinent Rules of the
National Electrical Safety Code ("NESC")

Accredited
Standards
Committee
C2-2007

National Electrical Safety Code®

Secretariat
Institute of Electrical and Electronics Engineers, Inc.

Approved 20 April 2006
Institute of Electrical and Electronics Engineers, Inc.

Approved 16 June 2006
American National Standards Institute

2007 Edition

Abstract: This standard covers basic provisions for safeguarding of persons from hazards arising from the installation, operation, or maintenance of (1) conductors and equipment in electric supply stations, and (2) overhead and underground electric supply and communication lines. It also includes work rules for the construction, maintenance, and operation of electric supply and communication lines and equipment. The standard is applicable to the systems and equipment operated by utilities, or similar systems and equipment, of an industrial establishment or complex under the control of qualified persons. This standard consists of the introduction, definitions, grounding rules, list of referenced and bibliographic documents, and Parts 1, 2, 3, and 4 of the 2007 Edition of the National Electrical Safety Code.

Keywords: communications industry safety; construction of communication lines; construction of electric supply lines; electrical safety; electric supply stations; electric utility stations; high-voltage safety; operation of communications systems; operation of electric supply systems; power station equipment; power station safety; public utility safety; safety work rules; underground communication line safety; underground electric line safety

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Section 1.
Introduction to the
National Electrical Safety Code®

010. Purpose

The purpose of these rules is the practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment.

These rules contain the basic provisions that are considered necessary for the safety of employees and the public under the specified conditions. This Code is not intended as a design specification or as an instruction manual.

011. Scope

A. These rules cover supply and communication lines, equipment, and associated work practices employed by a public or private electric supply, communications, railway, or similar utility in the exercise of its function as a utility. They cover similar systems under the control of qualified persons, such as those associated with an industrial complex or utility interactive system.

B. The NESC covers utility facilities and functions up to the service point.

NOTE: The National Electrical Code® (NEC®) (NFPA 70, 2005 Edition)① covers utilization wiring requirements beyond the service point.

C. NESC rules cover street and area lights (supplied by underground or overhead conductors) under the exclusive control of utilities (including their authorized contractors) or other qualified persons (such as those associated with an industrial complex).

NOTE: Luminaires not under such exclusive control are governed by the requirements of the NEC.

D. NESC rules do not cover installations in mines, ships, railway rolling equipment, aircraft, or automotive equipment, or utilization wiring except as covered in Parts 1 and 3.

012. General rules

A. All electric supply and communication lines and equipment shall be designed, constructed, operated, and maintained to meet the requirements of these rules.

B. The utilities, authorized contractors, or other entities, as applicable, performing design, construction, operation, or maintenance tasks for electric supply or communication lines or equipment covered by this Code shall be responsible for meeting applicable requirements.

C. For all particulars not specified in these rules, construction and maintenance should be done in accordance with accepted good practice for the given local conditions known at the time by those responsible for the construction or maintenance of the communication or supply lines and equipment.

013. Application

A. New installations and extensions

1. These rules shall apply to all new installations and extensions, except that they may be waived or modified by the administrative authority. When so waived or modified, safety shall be provided in other ways.

①Information on references can be found in Section 3.

Communication circuits other than those used in connection with the operation of the supply circuits shall not be carried in the same cable with such supply circuits.

f. Where such supply conductors are carried below communication conductors, transformers and other apparatus associated therewith shall be attached only to the sides of the support arm in the space between and at no higher level than such supply wires.

g. Lateral runs of such supply circuits carried in a position below the communication space shall be protected through the climbing space by wood molding or equivalent covering, or shall be carried in insulated multiple-conductor cable, and such lateral runs shall be placed on the underside of the support arm.

C. Relative levels: Supply lines of different voltage classifications (0 to 750 V, over 750 V to 8.7 kV, over 8.7 kV to 22 kV, and over 22 kV to 50 kV)

1. At crossings or conflicts

Where supply conductors of different voltage classifications cross each other or structure conflict exists, the higher-voltage lines should be carried at the higher level.

2. On structures used only by supply conductors

Where supply conductors of different voltage classifications are on the same structures, relative levels should be as follows:

a. Where all circuits are owned by one utility, the conductors of higher voltage should be placed above those of lower voltage.

b. Where different circuits are owned by separate utilities, the circuits of each utility may be grouped together, and one group of circuits may be placed above the other group provided that the circuits in each group are located so that those of higher voltage are at the higher levels and that any of the following conditions is met:

(1) A vertical clearance of not less than that required by Table 235-5 is maintained between the nearest line conductors of the respective utilities.

(2) Conductors of a lower voltage classification placed at a higher level than those of a higher classification shall be placed on the opposite side of the structure.

(3) Ownership and voltage are prominently displayed.

D. Identification of overhead conductors

All conductors of electric supply and communication lines should, as far as is practical, be arranged to occupy uniform positions throughout, or shall be constructed, located, marked, numbered, or attached to distinctive insulators or crossarms, so as to facilitate identification by employees authorized to work thereon. This does not prohibit systematic transposition of conductors.

E. Identification of equipment on supporting structures

All equipment of electric supply and communication lines should be arranged to occupy uniform positions throughout or shall be constructed, located, marked, or numbered so as to facilitate identification by employees authorized to work thereon.

221. Avoidance of conflict

Two separate lines, either of which carries supply conductors, should be so separated from each other that neither conflicts with the other. If this is not practical, the conflicting line or lines should be separated as far as practical and shall be built to the grade of construction required by Section 24 for a conflicting line, or the two lines shall be combined on the same structures.

222. Joint use of structures

Joint use of structures should be considered for circuits along highways, roads, streets, and alleys. The choice between joint use of structures and separate lines shall be determined through

cooperative consideration of all the factors involved, including the character of circuits, the total number and weight of conductors, tree conditions, number and location of branches and service drops, structure conflicts, availability of right-of-way, etc. Where such joint use is mutually agreed upon, it shall be subject to the appropriate grade of construction specified in Section 24.

223. Communications protective requirements

A. Where required

Where communication apparatus is handled by other than qualified persons, it shall be protected by one or more of the means listed in Rule 223B if such apparatus is permanently connected to lines subject to any of the following:

1. Lightning
2. Contact with supply conductors whose voltage to ground exceeds 300 V
3. Transient rise in ground potential exceeding 300 V
4. Steady-state induced voltage of a hazardous level

Where communication cables will be in the vicinity of supply stations where large ground currents may flow, the effect of these currents on communication circuits should be evaluated.

NOTE: Additional information may be obtained from IEEE Stds 487™-2000 [B34] and 1590™-2003 [B54].

B. Means of protection

Where communication apparatus is required to be protected under Rule 223A, protective means adequate to withstand the voltage expected to be impressed shall be provided by insulation, protected where necessary by surge arresters used in conjunction with fusible elements. Severe conditions may require the use of additional devices such as auxiliary arresters, drainage coils, neutralizing transformers, or isolating devices.

224. Communication circuits located within the supply space and supply circuits located within the communication space

A. Communication circuits located in the supply space

1. Communication circuits located in the supply space shall be installed and maintained only by personnel authorized and qualified to work in the supply space in accordance with the applicable rules of Sections 42 and 44.
2. Communication circuits located in the supply space shall meet the following clearance requirements, as applicable:
   a. Insulated communication cables supported by an effectively grounded messenger shall have the same clearances as neutrals meeting Rule 230E1 from communication circuits located in the communication space and from supply conductors located in the supply space. See Rules 235 and 238.
   b. Fiber-optic cables located in the supply space shall meet the requirements of Rule 230F.
   c. Open-wire communication circuits permitted by other rules to be in the supply space shall have the same clearances from communication circuits located in the communication space and from other circuits located in the supply space as required by Rule 235 for ungrounded open supply conductors of 0–750 V.

      EXCEPTION: Service drops meeting Rules 224A3a and 224A3b may originate in the supply space on a line structure or in the span and terminate in the communication space on the building or structure being served.
3. Communication circuits located in the supply space in one portion of the system may be located in the communication space in another portion of the system if the following requirements are met:

a. Where the communication circuit is, at any point, located above an energized supply conductor or cable, the communication circuit shall be protected by fuseless surge arresters, drainage coils, or other suitable devices to limit the normal communication circuit voltage to 400 V or less to ground.

NOTE: The grades of construction for communication conductors with inverted levels apply.

b. Where the communication circuit is always located below the supply conductors, the communication protection shall meet the requirements of Rule 223.

c. The transition(s) between the supply space and the communication space shall occur on a single structure; no transition shall occur between line structures.

EXCEPTION: Service drops meeting Rules 224A3a and 224A3b may originate in the supply space on a line structure or in the span and terminate in the communication space on the building or structure being served.

d. The construction and protection shall be consistently followed throughout the extent of such section of the communications system.

B. Supply circuits used exclusively in the operation of communication circuits

Circuits used for supplying power solely to apparatus forming part of a communications system shall be installed as follows:

1. Open-wire circuits shall have the grades of construction, clearances, insulation, etc., prescribed elsewhere in these rules for supply or communication circuits of the voltage concerned.

2. Special circuits operating at voltages in excess of 90 V ac or 150 V dc and used for supplying power solely to communications equipment may be included in communication cables under the following conditions:

a. Such cables shall have a conductive sheath or shield that is effectively grounded, and each such circuit shall be carried on conductors that are individually enclosed with an effectively grounded shield.

b. All circuits in such cables shall be owned or operated by one party and shall be maintained only by qualified personnel.

c. Supply circuits included in such cables shall be terminated at points accessible only to qualified personnel.

d. Communication circuits brought out of such cables, if they do not terminate in a repeater station or terminal office, shall be protected or arranged so that in the event of failure within the cable, the voltage on the communication circuit will not exceed 400 V to ground.

e. Terminal apparatus for the power supply shall be so arranged that the live parts are inaccessible when such supply circuits are energized.

EXCEPTION: The requirements of Rule 224B2 do not apply to communication circuits where the transmitted power does not exceed 150 W.

225. Electric railway construction

A. Trolley-contact conductor fastenings

All overhead trolley-contact conductors shall be supported and arranged so that the breaking of a single contact conductor fastening will not allow the trolley conductor live span wire, or current-carrying connection, to come within 3.0 m (10 ft) (measured vertically) from the ground, or from any platform accessible to the general public.

Span-wire insulation for trolley-contact conductors shall comply with Rule 279B.

Section 23.
Clearances

230. General

A. Application

This section covers all clearances, including climbing spaces, involving overhead supply and communication lines.

NOTE: The more than 70 years of historical development and specification of clearances in Rules 232, 233, and 234 were reviewed for consistency among themselves and with modern practice and were appropriately revised in both concept and content for the 1990 Edition. See Appendix A.

1. Permanent and temporary installations

   The clearances of Section 23 are required for permanent and temporary installations.

2. Emergency installations

   The clearances required in Section 23 may be decreased for emergency installations if the following conditions are met.

   NOTE: See Rule 14.

   a. Open supply conductors of 0 to 750 V and supply cables meeting Rule 230C; and communication conductors and cables, guys, messengers, and neutral conductors meeting Rule 230E1 shall be suspended not less than 4.8 m (15.5 ft) above areas where trucks are expected, or 2.70 m (9 ft) above areas limited to pedestrians or restricted traffic only where vehicles are not expected during the emergency, unless Section 23 permits lesser clearances.

      For the purpose of this rule, trucks are defined as any vehicle exceeding 2.5 m (8 ft) in height. Areas not subject to truck traffic are areas where truck traffic is neither normally encountered nor reasonably anticipated or is otherwise limited.

      Spaces and ways subject to pedestrians or restricted traffic only are those areas where riders on horseback, vehicles, or other mobile units exceeding 2.5 m (8 ft) in height are prohibited by regulation or permanent terrain configurations or are otherwise neither normally encountered nor reasonably anticipated or are otherwise limited.

   b. Vertical clearances of open supply conductors above 750 V shall be increased above the applicable value of Rule 230A2a as appropriate for the voltage involved and the given local conditions.

   c. Reductions in horizontal clearances permitted by this rule shall be in accordance with accepted good practice for the given local conditions during the term of the emergency.

   d. Supply and communication cables may be laid directly on grade if they are guarded or otherwise located so that they do not unduly obstruct pedestrian or vehicular traffic and are appropriately marked. Supply cables operating above 600 V shall meet either Rule 230C or 350B.

   e. No clearance is specified for areas where access is limited to qualified personnel only.

3. Measurement of clearance and spacing

   Unless otherwise stated, all clearances shall be measured from surface to surface and all spacings shall be measured center to center. For clearance measurement, live metallic hardware electrically connected to line conductors shall be considered a part of the line conductors. Metallic bases of potheads, surge arresters, and similar devices shall be considered a part of the supporting structure.

4. Rounding of calculation results

Unless otherwise specified in a table or rule within Section 23 that requires a calculation, the resultant of the calculation shall be rounded up to the same level of decimal places as the basic value shown in the rule or table, regardless of the numbers of significant digits of individual values required to be used in the calculation.

EXCEPTION: Rules or tables with values in millimeters are shown in units of 5 mm; as a result, resultants of calculations to be expressed in millimeters shall be rounded up to the next multiple of 5 mm.

EXAMPLES: If the basic value shown in a rule or table has no decimal places, such as 3 in, the resultant will be rounded up to the next whole number. If the basic value shown in the table or rule is shown as having one decimal place, such as 18.5 ft, the resultant of the calculation will be rounded up to one decimal place. If the table or rule contains a basic value expressed in two decimal places, such as 1.27 m, the resultant will be rounded up to two decimal places.

B. Ice and wind loading for clearances

1. Three general degrees of loading due to weather conditions are recognized and are designated as clearance zones 1, 2, and 3. Figure 230-1 shows the zones where these loadings apply.

NOTE: The localities are classified in the different zones according to the relative simultaneous prevalence of the wind velocity and thickness of ice that accumulates on wires. Zone 3 is for places where little, if any, ice accumulates on wires. See Appendix B.

2. Table 230-1 shows the radial thickness of ice to be used in calculating sags for clearance purposes. See applicable clearance rules in Section 23.

3. Ice and wind loads are specified in Rule 230B1.

a. Where a cable is attached to a messenger, the specified loads shall be applied to both cable and messenger.

b. In determining wind loads on a conductor or cable without ice covering, the assumed projected area shall be that of a smooth cylinder whose outside diameter is the same as that of the conductor or cable. The force coefficient (shape factor) for cylindrical surfaces is assumed to be 1.0.

NOTE: Experience has shown that as the size of multiconductor cable decreases, the actual projected area decreases, but the roughness factor increases and offsets the reduction in projected area.

c. An appropriate mathematical model shall be used to determine the wind and weight loads on ice-coated conductors and cables. In the absence of a model developed in accordance with Rule 230B5, the following mathematical model shall be used:

(1) On a conductor, lashed cable, or multiple-conductor cable, the coating of ice shall be considered to be a hollow cylinder touching the outer strands of the conductor or the outer circumference of the lashed cable or multiple-conductor cable.

(2) On bundled conductors, the coating of ice shall be considered as individual hollow cylinders around each subconductor.

d. It is recognized that the effects of conductor stranding or of non-circular cross section may result in wind and ice loadings more or less than those calculated according to assumptions stated in Rules 230B3b and 230B3c. No reduction in these loadings is permitted unless testing or a qualified engineering study justifies a reduction.

4. Table 230-2 shows the radial thickness of ice, wind pressures, temperatures, and additive constants to be used in calculating inelastic deformation.

The load components shall be determined as follows:

a. Vertical load component

The vertical load on a wire, conductor, or messenger shall be its own weight plus the weight of conductors, spacers, or equipment that it supports, ice covered where required by Rule 230B1 and Table 230-2.

b. Horizontal load component

The horizontal load shall be the horizontal wind pressure determined under Rule 230B1 and Table 230-2, applied at right angles to the direction of the line using the projected area of the conductor or messenger and conductors, spacers, or equipment that it supports, ice covered where required by Rule 230B1 and Table 230-2.

c. Total load

The total load on each wire, conductor, or messenger shall be the resultant of components in a) and b) above, calculated at the applicable temperature in Table 230-2, plus the corresponding additive constant in Table 230-2.

5. Final sag calculations shall include the effects of inelastic deformation due to both (a) initial and subsequent combined ice and wind loading, and (b) long-term material deformation (creep). See applicable **sag** definitions. Ice is assumed to weigh 913 kg/m^3 (57 lb/ft^3).

C. Supply cables

For clearance purposes, supply cables, including splices and taps, conforming to any of the following requirements are permitted lesser clearances than open conductors of the same voltage. Cables should be capable of withstanding tests applied in accordance with an applicable standard.

1. Cables that are supported on or cabled together with an effectively grounded bare messenger or neutral, or with multiple concentric neutral conductors, where any associated neutral conductor(s) meet(s) the requirements of Rule 230E1 and where the cables also meet one of the following:
   a. Cables of any voltage having an effectively grounded continuous metal sheath or shield
   b. Cables designed to operate on a multi-grounded system at 22 kV or less and having semiconducting insulation shielding in combination with suitable metallic drainage
2. Cables of any voltage, not included in Rule 230C1, covered with a continuous auxiliary semiconducting shield in combination with suitable metallic drainage and supported on and cabled together with an effectively grounded bare messenger.
3. Insulated, nonshielded cable operated at not over 5 kV phase to phase, or 2.9 kV phase to ground, supported on and cabled together with an effectively grounded bare messenger or neutral.

D. Covered conductors

Covered conductors shall be considered bare conductors for all clearance requirements except that clearance between conductors of the same or different circuits, including grounded conductors, may be reduced below the requirements for open conductors when the conductors are owned, operated, or maintained by the same party and when the conductor covering provides sufficient dielectric strength to limit the likelihood of a short circuit in case of momentary contact between conductors or between conductors and the grounded conductor. Intermediate spacers may be used to maintain conductor clearance and to provide support.

E. Neutral conductors

1. Neutral conductors that are effectively grounded throughout their length and associated with circuits of 0 to 22 kV to ground may have the same clearances as guys and messengers.
2. All other neutral conductors of supply circuits shall have the same clearances as the phase conductors of the circuit with which they are associated.

F. Fiber-optic cable

1. Fiber-optic—supply cable
   a. Cable defined as "fiber-optic—supply" supported on a messenger that is effectively grounded throughout its length shall have the same clearance from communications facilities as required for a neutral conductor meeting Rule 230E1.

b. Cable defined as "fiber-optic—supply" that is entirely dielectric, or supported on a messenger that is entirely dielectric, shall have the same clearance from communications facilities as required for a neutral conductor meeting Rule 230E1.

c. Fiber-optic—supply cables supported on or within messengers not meeting Rule 230F1a or 230F1b shall have the same clearances from communications facilities required for such messengers.

d. Fiber-optic—supply cables supported on or within a conductor(s), or containing a conductor(s) or cable sheath(s) within the fiber-optic cable assembly shall have the same clearances from communications facilities required for such conductors. Such clearance shall be not less than that required under Rule 230F1a, 230F1b, or 230F1c, as applicable.

e. Fiber-optic—supply cables meeting Rule 224A3 are considered to be communication cables when located in the communication space.

2. Fiber-optic—communication cable

Cable defined as "fiber-optic—communication" shall have the same clearance from supply facilities as required for a communication messenger.

G. Alternating- and direct-current circuits

The rules of this section are applicable to both ac and dc circuits. For dc circuits, the clearance requirements shall be the same as those for ac circuits having the same crest voltage to ground.

NOTE: Although the corresponding crest voltage for a common sinusoidal ac circuit may be calculated by multiplying its rms value by 1.414 (square root of 2), this may not be appropriate for other type ac circuits. An example of the latter is represented by non-sinusoidal power supplies such as used in some coaxial cable type communication systems.

H. Constant-current circuits

The clearances for constant-current circuits (such as series lighting circuits) shall be determined on the basis of their normal full-load voltage.

I. Maintenance of clearances and spacings

The clearances and spacing required shall be maintained at the values and under the conditions specified in Section 23 of the applicable edition. The clearances of Section 23 are not intended to be maintained during the course of or as a result of abnormal events such as, but not limited to, actions of others or weather events in excess of those described under Section 23.

NOTE: See Rule 13 to determine the applicable edition.

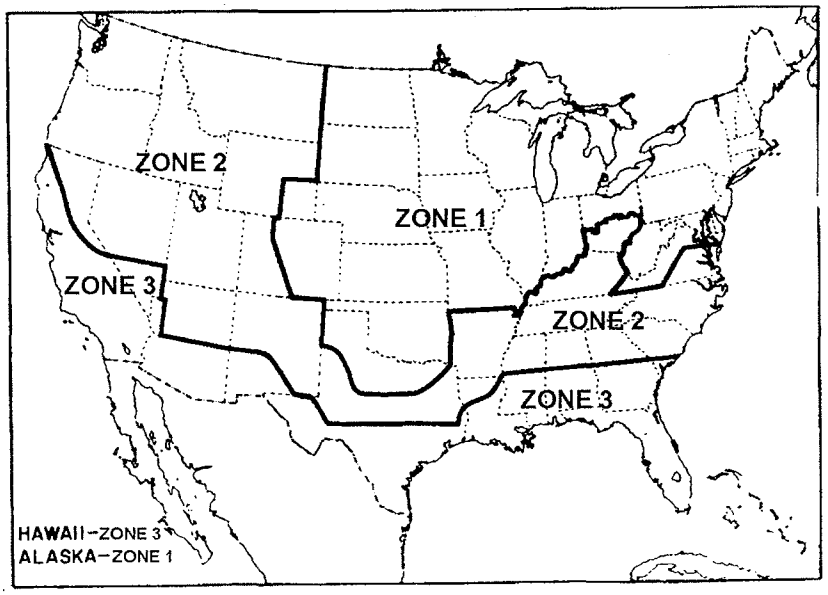


Figure 230-1—Clearance zone map of the United States

Table 230-1—Ice thickness for purposes of calculating clearances

	Clearance zone (for use with Rules 232, 233, 234, and 235)		
	Zone 1	**Zone 2**	**Zone 3**
Radial thickness of ice			
(mm)	12.5	6.5	0
(in)	0.50	0.25	0

Table 230-2—Ice, wind pressures, temperatures, and additive constants for purposes of calculating final inelastic deformation

	Clearance zone (for use with Rule 230B)		
	Zone 1	**Zone 2**	**Zone 3**
Radial thickness of ice			
(mm)	12.5	6.5	0
(in)	0.50	0.25	0
Horizontal wind pressure			
(Pa)	190	190	430
(lb/ft^2)	4	4	9
Temperature			
(°C)	–20	–10	–1
(°F)	0	+15	+30
Constant to be added to the resultant			
(N/m)	4.40	2.90	0.73
(lb/ft)	0.30	0.20	0.05

231. Clearances of supporting structures from other objects

Supporting structures, support arms, anchor guys, and equipment attached thereto, and braces shall have the following clearances from other objects. The clearance shall be measured between the nearest parts of the objects concerned.

A. From fire hydrants

Not less than 1.2 m (4 ft).

EXCEPTION 1: Where conditions do not permit, a clearance of not less than 900 mm (3 ft) is allowed.

3. Conductors shall be arranged so that the vertical spacing shall be not less than that specified in Table 235-8 under the conditions specified in Rule 235C2b(1)(c)
4. A supporting neutral conductor of a supply cable meeting Rule 230C3 or an effectively grounded messenger of a supply cable meeting Rule 230C1 or 230C2 may attach to the same insulator or bracket as a neutral conductor meeting Rule 230E1, so long as the clearances of Table 235-8 are maintained in mid-span and the insulated energized conductors are positioned away from the open supply neutral at the attachment.

H. Clearance and spacing between communication conductors, cables, and equipment

1. The spacing between messengers supporting communication cables should be not less than 300 mm (12 in) except by agreement between the parties involved.
2. The clearances between the conductors, cables, and equipment of one communication utility to those of another, anywhere in the span, shall be not less than 100 mm (4 in), except by agreement between the parties involved.

I. Clearances in any direction from supply line conductors to communication antennas in the supply space attached to the same supporting structure

1. General

   Communication antennas located in the supply space shall be installed and maintained only by personnel authorized and qualified to work in the supply space in accordance with the applicable rules of Sections 42 and 44. See also Rule 224A.

2. Communication antenna

   The clearance between a communication antenna operated at a radio frequency of 3 kHz to 300 GHz and a supply line conductor shall be not less than the value given in Table 235-6, row 1b.

   NOTE 1: The antenna functions as a rigid, vertical, or lateral open wire communication conductor.

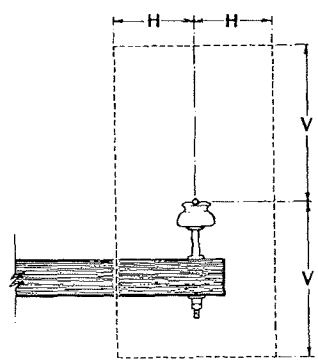
   NOTE 2: See Rule 420Q.

3. Equipment case that supports a communication antenna

   The clearance between an equipment case that supports a communication antenna and a supply line conductor shall be not less than the value given in Table 235-6, Row 4a.

4. Vertical or lateral communication conductors and cables attached to a communication antenna

   The clearance between a supply line conductor and the vertical or lateral communication conductor and cable attached to a communication antenna shall be not less than the value given in Rule 239.



V = Vertical clearance
H = Horizontal clearance

Figure 235-1—Clearance diagram for energized conductor

in

Table 235-6— *(continued)*
Clearance in any direction from line conductors to supports and to vertical or lateral conductors, span, or guy wires attached to the same support
[See also Rules 235E1, 235E3b(2), and 235I.]

Clearance of line conductors from	Communication lines in general (in)	Communication lines on jointly used structures; neutral conductors meeting Rule 230E1 (in)	Supply lines — Circuit phase-to-phase voltage		
			0 to 8.7 kV ⑭ (in)	Over 8.7 to 50 kV (in)	Over 50 to 814 kV ④ ⑨ (in)
4. Surface of structures:					
a. On jointly used structures	—	5 ② ⑥	5 ③ ⑧	5 plus 0.2 per kV in excess of 8.7 kV ⑧ ⑩	13 plus 0.2 per kV in excess of 50 kV
b. All other	3 ② ⑥	—	3 ⑧	3 plus 0.2 per kV in excess of 8.7 kV ⑧ ⑩	11 plus 0.2 per kV in excess of 50 kV

①For guy wires, if practical. For clearances between span wires and communication conductors, see Rule 238C.

On jointly used structures, guys that pass within 12 in of supply conductors, and also pass within 12 in of communication cables, shall be protected with a suitable insulating covering where the guy passes the supply conductors, unless the guy is effectively grounded or insulated with a strain insulator at a point below the lowest supply conductor and above the highest communication cable.

The clearance from an insulated or effectively grounded guy to a communication cable may be reduced to 3 in when abrasion protection is provided on the guy or communication cable.

②Communication conductors may be attached to supports on the sides or bottom of crossarms or surfaces of poles with less clearance.

③This clearance applies only to supply conductors at the support below communication conductors, on jointly used structures.

Where supply conductors are above communication conductors, this clearance may be reduced to 3 in.

④All clearances for line over 50 kV shall be based on the maximum operating voltage. For voltages exceeding 814 kV, the clearance shall be determined by the alternate method given by Rule 235E3.

⑤For supply circuits of 0 to 750 V, this clearance may be reduced to 3 in.

⑥A neutral conductor meeting Rule 230E1 may be attached directly to the structure surface.

⑦Guys and messengers may be attached to the same strain plates or to the same through bolts.

⑧For open supply circuits of 0 to 750 V and supply cables of all voltages meeting Rule 230C1, 2 or 3, this clearance may be reduced to 1 in. No clearance is specified for phase conductors of such cables where they are physically restrained by a suitable bracket from abrasion against the pole.

⑨The additional clearance for voltages in excess of 50 kV specified in Table 235-6 shall be increased 3% for each 1000 ft in excess of 3300 ft above mean sea level.

⑩Where the circuit is effectively grounded and the neutral conductor meets Rule 230E1, phase-to-neutral voltage shall be used to determine the clearance from the surface of support arms and structures.

⑪These clearances may be reduced by not more than 25% to a guy insulator, provided that full clearance is maintained to its metallic end fittings and the guy wires. The clearance to an insulated section of a guy between two insulators may be reduced by not more than 25% provided that full clearance is maintained to the uninsulated portion of the guy.

⑫Phase-to-phase voltages shall be determined according to Rule 235A3.

⑬These clearances apply to communication antennas operated at a radio frequency of 3 kHz to 300 GHz. Also see Rules 235I4 and 239.

⑭Does not include neutral conductors meeting Rule 230E1.

in

Table 235-6—
Clearance in any direction from line conductors to supports and to vertical or lateral conductors, span, or guy wires attached to the same support
[See also Rules 235E1, 235E3b(2), and 235I.]

Clearance of line conductors from	Communication lines in general (in)	Communication lines on jointly used structures; neutral conductors meeting Rule 230E1 (in)	Supply lines Circuit phase-to-phase voltage		
			0 to 8.7 kV ⑭ (in)	Over 8.7 to 50 kV (in)	Over 50 to 814 kV ④ ⑨ (in)
1. Vertical and lateral conductors:					
a. Of the same circuit	3	3	3	3 plus 0.25 per kV in excess of 8.7 kV	No value specified
b. Of other circuits ⑫ ⑬	3	3	6 ⑤	6 plus 0.4 per kV in excess of 8.7 kV	23 plus 0.4 per kV in excess of 50 kV
2. Span or guy wires,⑪ or messengers attached to same structure:					
a. When parallel to line	3 ⑦	6 ① ⑦	12 ①	12 plus 0.4 per kV in excess of 8.7 kV	29 plus 0.4 per kV in excess of 50 kV
b. Anchor guys	3 ⑦	6 ① ⑦	6 ⑦	6 plus 0.25 per kV in excess of 8.7 kV	16 plus 0.25 per kV in excess of 50 kV
c. All other	3 ⑦	6 ① ⑦	6	6 plus 0.4 per kV in excess of 8.7 kV	23 plus 0.4 per kV in excess of 50 kV
3. Surface of support arms	3 ② ⑥	3 ② ⑥	3 ⑧	3 plus 0.2 per kV in excess of 8.7 kV ⑧⑩	11 plus 0.2 per kV in excess of 50 kV

Table 235-8—Vertical spacing between conductors supported on vertical racks or separate brackets

Span length		Vertical spacing between conductors	
(m)	(ft)	(mm)	(in)
0 to 45	0 to 150	100	4
Over 45 to 60	Over 150 to 200	150	6
Over 60 to 75	Over 200 to 250	200	8
Over 75 to 90	Over 250 to 300	300	12

EXCEPTION: The vertical spacing between open wire conductors may be reduced where the conductors are held apart by intermediate spacers, but may not be less than 100 mm (4 in).

236. Climbing space

The following requirements apply only to portions of structures that workers ascend.

A. Location and dimensions

1. A climbing space having the horizontal dimensions specified in Rule 236E shall be provided past any conductors, support arms, or other parts.
2. The climbing space need be provided on one side or corner of the support only.
3. The climbing space shall extend vertically past any conductor or other part between levels above and below the conductor as specified in Rules 236E, F, G, and I, but may otherwise be shifted from any side or corner of the support to any other side or corner.

B. Portions of supporting structures in climbing space

Portions of the supporting structure, when included in one side or corner of the climbing space, are not considered to obstruct the climbing space.

C. Support arm location relative to climbing space

RECOMMENDATION: Support arms should be located on the same side of the pole.

EXCEPTION: This recommendation does not apply where double crossarms are used on any pole or where crossarms on any pole are not all parallel.

D. Location of equipment relative to climbing space

1. All supply and communication equipment such as transformers, regulators, capacitors, cable terminals (potheads), amplifiers, loading coils, antennas, surge arresters, switches, etc., when located below conductors or other attachments, shall be mounted outside of the climbing space.
2. All exposed ungrounded conductive parts of luminaires and their supports that are not insulated from current-carrying parts shall be maintained at not less than 500 mm (20 in) from the surface of their supporting structure.

EXCEPTION 1: This may be reduced to 125 mm (5 in) if located on the side of the structure opposite the designated climbing space.

EXCEPTION 2: This does not apply where the equipment is located at the top or other vertical portion of the structure that is not subject to climbing.

E. Climbing space between conductors

Climbing space between conductors shall be not less than the horizontal dimensions specified in Table 236-1. These dimensions are intended to provide a clear climbing space of 600 mm (24 in) while the conductors bounding the climbing space are covered with temporarily installed protective covering rated for the voltage involved. The climbing space shall be provided both along and across the line and shall be projected vertically not less than 1.0 m (40 in) above and below the limiting conductors. Where communication conductors are above supply conductors of more than 8.7 kV to ground or 15 kV line to line, the climbing space shall be projected vertically at least 1.50 m (60 in) above the highest supply conductors.

EXCEPTION 1: This rule does not apply if it is the unvarying practice of the employers concerned to prohibit employees from ascending beyond the conductors or equipment of a given line or structure unless the conductors or equipment are de-energized and grounded per Rule 444D.

EXCEPTION 2: For supply conductors carried on a structure in a position below communications facilities in the manner permitted in Rule 220B2, the climbing space need not extend more than 600 mm (2 ft) above such supply space.

EXCEPTION 3: If the conductors are owned, operated, or maintained by the same utility, the climbing space may be provided by temporarily moving the line conductors using live-line tools.

F. Climbing space on buckarm construction

Method of providing climbing space on buckarm construction

The full width of climbing space shall be maintained on buckarm construction and shall extend vertically in the same position at least 1.0 m (40 in) [or 1.50 m (60 in) where required by Rule 236E] above and below any limiting conductor.

A six-pin crossarm having pin spacing of 370 mm (14.5 in) may be used to provide a 750 mm (30 in) climbing space on one corner of a junction pole by omitting the pole pins on all arms, and inserting pins midway between the remaining pins so as to give a spacing of 185 mm (7.25 in), provided that all of the following conditions are met:

1. Circuits are less than 8.7 kV to ground or 15 kV line to line
2. Span lengths do not exceed 45 m (150 ft)
3. Sags do not exceed 380 mm (15 in) for wires of AWG No. 2 and larger sizes, or 750 mm (30 in) for wires smaller than AWG No. 2
4. Each conductor on the end of every arm is tied to the same side of its insulator
5. The spacing on the next pole is not less than 370 mm (14.5 in)

G. Climbing space past longitudinal runs not on support arms

The full width of climbing space shall be provided past longitudinal runs and shall extend vertically in the same position from 1.0 m (40 in) below the run to a point 1.0 m (40 in) above [or 1.50 m (60 in) where required by Rule 236E]. The width of climbing space shall be measured from the longitudinal run concerned. Longitudinal runs on racks, or cables on messengers, are not considered as obstructing the climbing space if the location, size, and quantity of the cables permit qualified workers to climb past them. This does not apply where communication conductors are above the longitudinal runs concerned.

EXCEPTION 1: If a supply longitudinal run is placed on the side or corner of the supporting structure where climbing space is provided, the width of climbing space shall be measured horizontally from the center of the structure to the nearest supply conductors on support arms, under both of the following conditions:

(a) Where the longitudinal run consists of neutral conductors meeting Rule 230E1, open supply conductors carrying not more than 750 V, or supply cables and conductors meeting Rule 230C, all voltages; and is supported close to the structure as by brackets, racks, or pins close to the structure

(b) Where the nearest supply conductors on support arms are parallel to and on the same side of the structure as the longitudinal run and within 1.20 m (4 ft) above or below the run

EXCEPTION 2: For supply conductors carried on a structure in a position below communications facilities in the manner permitted in Rule 220B2, the climbing space need not extend more than 600 mm (2 ft) above such supply space.

EXCEPTION 3: A service drop less than 750 V and meeting Rule 230C is not considered to obstruct the climbing space if all conductors concerned are covered by rubber protective equipment or otherwise guarded as an unvarying practice before workers climb past them, provided that such a service drop is (1) not closer to the longitudinal run at the point of attachment than the diameter of the pole plus 125 mm (5 in) measured horizontally, and (2) not closer than 950 mm (38 in) measured horizontally to the longitudinal run at a point 750 mm (30 in) on the run measured from the point of attachment at the pole. See Figure 236-1.

H. Climbing space past vertical conductors

Vertical runs physically protected by suitable conduit or other protective covering and securely attached without spacers to the surface of the line structure are not considered to obstruct the climbing space.

I. Climbing space near ridge-pin conductors

The climbing space specified in Table 236-1 shall be provided above the top support arm to the ridge-pin conductor but need not be carried past it.

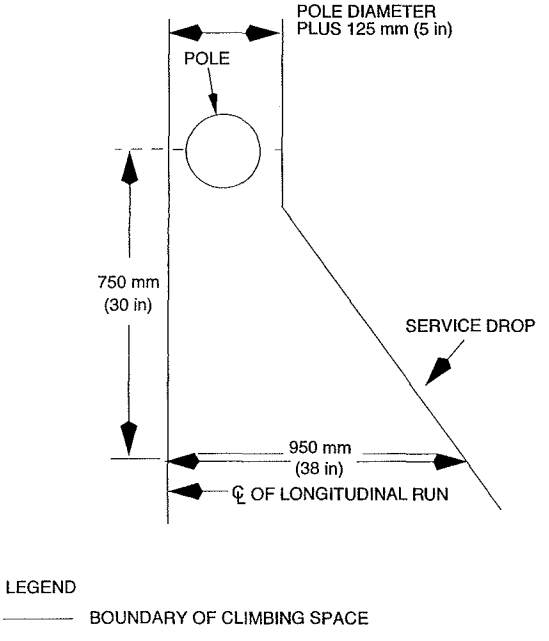


Figure 236-1—Rule 236G, *Exception 3*

Table 236-1— Horizontal clearance between conductors bounding the climbing space

(All voltages are between the two conductors bounding the climbing space except for communication conductors, which are voltage to ground. Where the two conductors are in different circuits, the voltage between conductors shall be the arithmetic sum of the voltages of each conductor to ground for a grounded circuit, or phase to phase for an ungrounded conductor. See also Rule 236E.)

Character of conductors adjacent to climbing space	Voltage of conductors	Horizontal clearance between conductors bounding the climbing space ③							
		On structures used solely by				On jointly used structures			
		Communication conductors		Supply conductors		Supply conductors above communication conductors		Communication conductors above supply conductors①	
		(m)	(in)	(m)	(in)	(m)	(in)	(m)	(in)
1. Communication conductors	0 to 150 V	0.60	No requirements		—		②	0.60	No requirements
	Exceeding 150 V		24 recommended		—		②		24 recommended
2. Supply cables meeting Rule 230C1	All voltages				—		②		No requirements
3. Supply cables meeting Rule 230C2 or 3	All voltages	—	—	0.60	24	0.60	24	0.75	30
4. Open supply line conductors and supply cables meeting Rule 230D	0 to 750 V	—	—	0.60	24	0.60	24	0.75	30
	750 V to 15 kV	—	—	0.75	30	0.75	30	0.75	30
	15 kV to 28 kV	—	—	0.90	36	0.90	36	0.90	36
	28 kV to 38 kV	—	—	1.00	40	1.00	40		
	38 kV to 50 kV	—	—	1.17	46	1.17	46		
	50 kV to 73 kV	—	—	1.40	54	1.40	54		
	Exceeding 73 kV	—	—	>1.40	>54				

①This relation of levels in general is not desirable and should be avoided.

②Climbing space shall be the same as required for the supply conductors immediately above, with a maximum of 0.75 m (30 in) except that a climbing space of 0.41 m (16 in) across the line may be employed for communication cables or conductors where the only supply conductors at a higher level are secondaries (0 to 750 V) supplying airport or airway marker lights or crossing over the communication line and attached to the pole top or to a pole-top extension fixture.

③Attention is called to the operating requirements of Rules 441A and 446C, Part 4, of this Code.

237. Working space

A. Location of working spaces

Working spaces shall be provided on the climbing face of the structure at each side of the climbing space.

B. Dimensions of working spaces

1. Along the support arm

The working space shall extend from the climbing space to the outmost conductor position on the support arm.

2. At right angles to the support arm

The working space shall have the same dimension as the climbing space (see Rule 236E). This dimension shall be measured horizontally from the face of the support arm.

3. Vertically

The working space shall have a height not less than that required by Rule 235 for the vertical separation of line conductors carried at different levels on the same support.

C. Location of vertical and lateral conductors relative to working spaces

The working spaces shall not be obstructed by vertical or lateral conductors. Such conductors shall be located on the opposite side of the pole from the climbing side or on the climbing side of the pole at a distance from the support arm at least as great as the width of climbing space required for the highest voltage conductors concerned. Vertical conductors enclosed in suitable conduit may be attached on the climbing side of the structure.

D. Location of buckarms relative to working spaces

Buckarms may be used under any of the following conditions, provided the climbing space is maintained. Climbing space may be obtained as in Rule 236F.

1. Standard height of working space

Lateral working space of the height required by Table 235-5 shall be provided between the crossing or tap line conductors attached to the buckarm and the main line conductors. This may be accomplished by increasing the spacing between the line support arms, as shown in Figure 237-1.

2. Reduced height of working space

Where no circuits exceeding 8.7 kV to ground or 15 kV line to line are involved and the clearances of Rules 235B1a and 235B1b are maintained, conductors supported on buckarms may be placed between line conductors having normal vertical spacing, even though such buckarms obstruct the normal working space, provided that a working space of not less than 450 mm (18 in) in height is maintained either above or below line conductors and buckarm conductors.

EXCEPTION: The above working space may be reduced to 300 mm (12 in) if both of the following conditions exist:

(a) Not more than two sets of the line arms and buckarms are involved

(b) Working conditions are rendered safe by providing rubber protective equipment or other suitable devices to insulate and cover line conductors and equipment that are not being worked upon

E. Guarding of energized equipment

Exposed energized parts of equipment such as switches, circuit breakers, surge arresters, etc., shall be enclosed or guarded if all of the following conditions apply:

1. The equipment is located below the top conductor support
2. The equipment is located on the climbing side of the structure
3. The requirements of Rule 441, Part 4, of this Code cannot be met

F. Working clearances from energized equipment

All parts of equipment such as switches, fuses, transformers, surge arresters, luminaires and their support brackets, etc., or other connections that may require operation or adjustment while energized and exposed at such times, shall be so arranged with respect to each other, other equipment, vertical and lateral conductors, and portions of the supporting structure, including supporting platforms or structural members, that in adjustment or operation no portion of the body, including the hands, need be brought closer to any exposed energized parts or conductors than permitted in Part 4, Rule 441 or 446 of this Code.

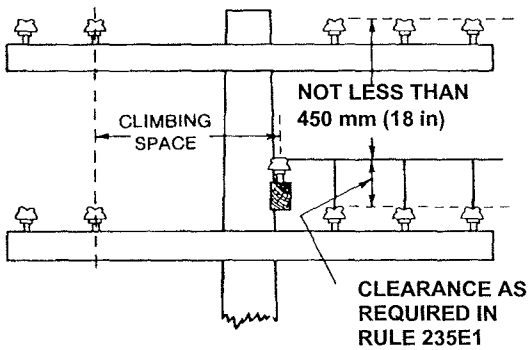


Figure 237-1—Obstruction of working space by buckarm

238. Vertical clearance between certain communications and supply facilities located on the same structure

A. Equipment

For the purpose of measuring clearances under this rule, equipment shall be taken to mean non-current-carrying metal parts of equipment, including metal supports for cables or conductors, and metal support braces that are attached to metal supports or are less than 25 mm (1 in) from transformer cases or hangers that are not effectively grounded.

B. Clearances in general

Vertical clearances between supply conductors and communications equipment, between communication conductors and supply equipment, and between supply and communications equipment shall be as specified in Table 238-1, except as provided in Rule 238C.

C. Clearances for span wires or brackets

Span wires or brackets carrying luminaires, traffic signals, or trolley conductors shall have at least the vertical clearances in millimeters or inches from communications equipment set forth in Table 238-2.

D. Clearance of drip loops of luminaire or traffic signal brackets

If a drip loop of conductors entering a luminaire bracket or traffic signal bracket from the surface of the structure is above a communication cable, the lowest point of the loop shall be at least 300 mm (12 in) above communication cable or through bolt.

EXCEPTION: The above clearance may be reduced to 75 mm (3 in) if the loop is covered by a suitable nonmetallic covering that extends at least 50 mm (2 in) beyond the loop.

E. Communication worker safety zone

The clearances specified in Rules 235C and 238 create a communication worker safety zone between the facilities located in the supply space and facilities located in the communication space, both at the structure and in the span between structures. Except as allowed by Rules 238C, 238D, and 239, no supply or communication facility shall be located in the communication worker safety zone.

Table 238-1—Vertical clearance between supply conductors and communications equipment, between communication conductors and supply equipment, and between supply and communications equipment

(Voltages are phase to ground for effectively grounded circuits and those other circuits where all ground faults are cleared by promptly de-energizing the faulted section, both initially and following subsequent breaker operations. See the definitions section for voltages of other systems. See also Rule 238B.)

Supply voltage (kV)	Vertical clearance	
	(m)	(in)
1. Grounded conductor and messenger hardware and supports	0.75	30
2. 0 to 8.7	1.00	40 ①
3. Over 8.7	1.00 plus 0.01 per kV in excess of 8.7 kV	40 plus 0.4 per kV ① in excess of 8.7 kV

①Where non-current-carrying parts of supply equipment are effectively grounded and the associated neutral meeting Rule 230E1 or supply cables meeting Rule 230C1 (including the support brackets) are bonded to communication messengers at intervals meeting Rule 92C through out well-defined areas and where communication is at lower levels, clearances may be reduced to 0.75 m (30 in).

Table 238-2—Vertical clearance of span wires and brackets from communication lines

(See also Rule 238C.)

	Carrying luminaires or traffic signals				Carrying trolley conductors			
	Not effectively grounded		Effectively grounded		Not effectively grounded		Effectively grounded	
	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
Above communication support arms	500	20 ①	500	20 ①	500	20 ①	500	20 ①
Below communication support arms	1000	40 ③	600	24	600	24	600	24
Above messengers carrying communication cables	500	20 ①	100	4	300	12	100	4
Below messengers carrying communication cables	1000	40 ④	100	4	300	12	100	4
From terminal box of communication cable	500	20 ①	100	4	300	12 ②	100	4
From communication brackets, bridle wire rings, or drive hooks	410	16 ①	100	4	100	4	100	4

①This may be reduced to 300 mm (12 in) for either span wires or metal parts of brackets at points 1.0 m (40 in) or more from the structure surface.

②Where it is not practical to obtain a clearance of 300 mm (1 ft) from terminal boxes of communication cables, all metal parts of terminals shall have the greatest possible clearance from fixtures or span wires including all supporting screws and bolts of both attachments.

③This may be reduced to 600 mm (24 in) for luminaires and traffic signals operating at less than 150 V to ground.

④This may be reduced to 500 mm (20 in) for luminaires and traffic signals operating at less than 150 V to ground.

239. Clearance of vertical and lateral facilities from other facilities and surfaces on the same supporting structure

Vertical and lateral conductors shall have the clearances required by this rule from other facilities or surfaces on the same supporting structure.

A. General

1. Grounding conductors, surge-protection wires, neutral conductors meeting Rule 230E1, insulated communication conductors and cables, supply cables meeting Rule 230C1 or 350B, insulated supply cables of 0 to 750 V, or conduits may be placed directly on the supporting structure. These conductors, wires, cables, and conduits shall be securely attached to the surface of the structure. Cables not in conduit shall be installed in such a manner as to avoid abrasion at the point of attachment.

2. Installation of supply cable and communication cable in same duct or U-guard type covering

   a. Supply cables 0 to 600 V may be installed together in the same duct or U-guard, if all of the cables are operated and maintained by the same utility.

   b. Supply cables exceeding 600 V meeting Rule 230C1 may be installed together in the same duct or U-guard if all of the cables are operated and maintained by the same utility.

   c. Supply cables 0 to 600 V and supply cables exceeding 600 V meeting Rule 230C1 may be installed together in the same duct or U-guard if all of the cables are operated and maintained by the same utility.

   d. Supply cables shall not be installed in the same duct or U-guard with communication cables unless all of the cables are operated and maintained by the same utility.

   e. Communication cables may be installed together in the same duct or U-guard provided all utilities involved are in agreement.

3. Paired communication conductors in rings may be attached directly to a structure or messenger.

4. Insulated supply circuits of 600 V or less and not exceeding 5000 W may be placed in the same cable with control circuits with which they are associated.

5. The term nonmetallic covering as used in Rule 239 refers to material other than a cable jacket that provides an additional barrier against physical contact.

6. Where guarding and protection are required by other rules, either conduit or U-guards may be used.

B. Location of vertical or lateral conductors relative to climbing spaces, working spaces, and pole steps

Vertical or lateral conductors shall be located so that they do not obstruct climbing spaces, or lateral working spaces between line conductors at different levels, or interfere with the safe use of pole steps.

EXCEPTION: This rule does not apply to portions of the structure that workers do not ascend while the conductors in question are energized.

NOTE: See Rule 236H for vertical runs in conduit or other protective covering.

C. Conductors not in conduit

Conductors not encased in conduit shall have the same clearances from conduits as from other surfaces of structures.

EXCEPTION: Vertical runs of effectively grounded supply conductors may have a clearance of 25 mm (1 in).

H. Requirements for vertical communication conductors passing through supply space on jointly used structures

All vertical runs of communication conductors passing through supply space shall be installed as follows:

1. Metal-sheathed communication cables

Vertical runs of metal-sheathed communication cables shall be covered with suitable nonmetallic material, where they pass trolley feeders or other supply line conductors. This nonmetallic covering shall extend from a point 1.0 m (40 in) above the highest trolley feeders or other supply conductors, to a point 1.80 m (6 ft) below the lowest trolley feeders or other supply conductors, but need not extend below the top of any mechanical protection that may be provided near the ground.

EXCEPTION 1: Communication cables may be run vertically on the pole through space occupied by railroad signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

2. Communication conductors

Vertical runs of insulated communication conductors shall be covered with suitable nonmetallic material, to the extent required for metal-sheathed communication cables in Rule 239H1, where such conductors pass trolley feeders or supply conductors.

EXCEPTION 1: Communication conductors may be run vertically on the structure through space occupied by railroad-signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

3. Communication grounding conductors

Vertical communication grounding conductors shall be covered with suitable nonmetallic material between points at least 1.80 m (6 ft) below and 1.0 m (40 in) above any trolley feeders or other supply line conductors by which they pass.

EXCEPTION 1: Communication grounding conductors may be run vertically on the structure though space occupied by railroad-signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

4. Clearance from through bolts and other metal objects

Vertical runs of communication conductors or cables shall have a clearance of one-eighth of the pole circumference but not less than 50 mm (2 in) from exposed through bolts and other exposed metal objects attached thereto that are associated with supply line equipment.

EXCEPTION: Vertical runs of effectively grounded communication cables may have a clearance of 25 mm (1 in).

I. Operating rods

Effectively grounded or insulated operating rods of switches are permitted to pass through the communication space, but shall be located outside of the climbing space.

J. Additional rules for standoff brackets

1. Standoff brackets may be used to support the conduit(s). Cable insulation appropriate for the intended service is required; non-metallic conduit shall not be used to meet basic insulation requirements.

NOTE: See Rule 217A2.

Attachment 5
Declaration of David Marne
Submitted to the New York PSC with NextG's comments in *Proceeding on Motion of the Commission Concerning Wireless Facility Attachments to Utility Distribution Poles*, NY PSC Case No. Case 07-M-0741 (filed Sept. 10, 2007);

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

CASE 07-M-0741 –	Proceeding on Motion of the Commission Concerning Wireless Facility Attachments to Utility Distribution Poles

DECLARATION OF DAVID MARNE

I, David Marne, do hereby state:

1. I am the company president and senior electrical engineer for Marne and Associates, Inc. in Missoula, Montana, where I specialize in National Electrical Safety Code ("NESC") training and engineering design. I am a registered Professional Engineer and I consult with both the electric and communication utilities on joint use pole attachment engineering issues, including with NextG.

2. I hold a bachelors of science degree in electrical engineering from Montana State University. Currently, I serve on NESC Subcommittee 4, which addresses overhead lines-clearances issues. I am a senior member of the Institute of Electrical and Electronic Engineers, Inc. ("IEEE"). The IEEE is the publisher of the NESC. I am also the author of "McGraw-Hill's National Electrical Safety Code 2007 Handbook," and frequently present seminars on the NESC to a variety of electric power and communication utility professionals. My associate at Marne and Associates, Grant Glaus, is also a registered professional engineer and is on NESC Subcommittee 5, which addresses overhead lines-strength and loading issues.

3. Prior to founding Marne and Associations, I worked as a consulting electrical engineer for 22 years. I have been involved in NESC training for over 10 years.

4. In my role as a consultant to NextG, my company provides consulting on an as requested basis helping NextG assure compliance with the NESC. In that capacity, my company has performed a "typical" pole attachment loading calculation dated Mar. 21, 2007, attached hereto as Exhibit A. A summary of the calculations, which is shown below, indicates that pole line conductors (power and communication) put substantially more load on a pole than vertical antenna and pole top extension structures. Independent of the values, all loads on the structure must be considered when designing a pole line.

Mwp	**3,682** ft-lb moment due to wind on pole
(Sh)(Mwc)	**53,352** ft-lb moment due to wind on conductor (for a 275' span length)
Mwt	**1,449** ft-lb moment due to wind on transformer
Mwa	**777** ft-lb moment due to wind on antenna
Mwpe	**632** ft-lb moment due to wind on pole extension
Mwe	**560** ft-lb moment due to wind on communication equipment box

5. The National Electrical Safety Code ("NESC") addresses communication antennas on the top of power poles and refers to these installations as communication antennas in the supply (power) space. The rules in the NESC, including the rules related to communication antenna installations, are for the safety of electric power and communication workers and the public.

I declare under penalty of perjury that the statements contained in this Declaration are true and correct.

David Marne

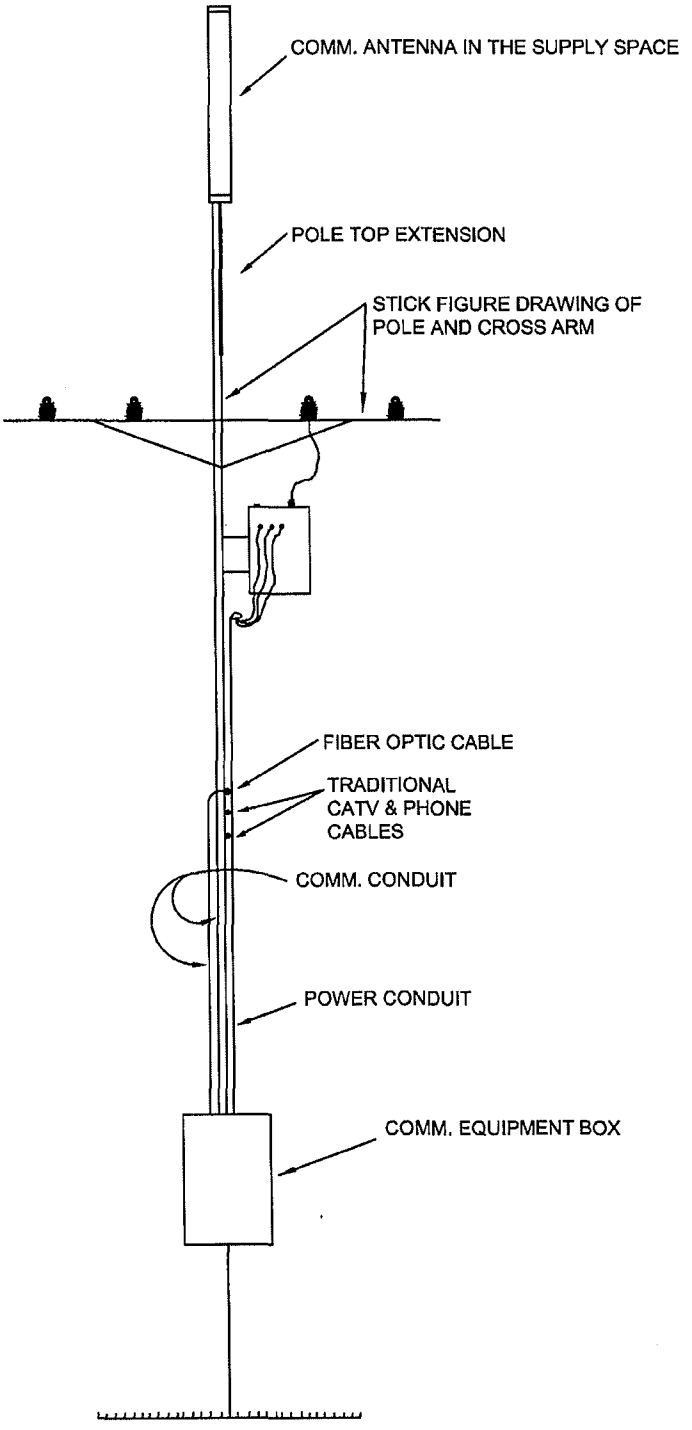
David Marne

Dated September 7, 2007

Exhibit A

POLE LOADING ASSUMPTIONS:

1. 45' CLASS 4 WOOD POLE BURIED 6.5' DEEP.
2. 336 ACSR CONDUCTOR WITH FULL NEUTRAL POSITIONED ON THE CROSS ARM.
3. 275' SPAN ON EACH SIDE OF THE POLE.
4. 57" HIGH, 6.25" DIAMETER ANTENNA WEIGHING 20 LBS.
5. 1-15 KVA TRANSFORMER ON THE POLE.
6. 1-288 COUNT FIBER OPTIC CABLE LASHED TO A 1/4" EHS MESSENGER (275' SPAN).
7. 1-.750 COAX CABLE TV CABLE LASHED TO A 5/16" EHS MESSENGER. (275' SPAN)
8. 1-200 PAIR TELEPHONE CABLE LASHED TO A 5/16" EHS MESSENGER. (275' SPAN)
9. TANGENT POLE (NO LINE ANGLE).
10. COMM. EQUIPMENT BOX SIZE: 48"H X 24"W X 12" D. WEIGHT: 250 LBS. LOCATION: CENTERED 10' ABOVE GROUND.
11. ASSUME EXISTING POLE (PRIOR TO ANTENNA MOUNTING) WAS FRAMED USING RUS "C1" POLE TOP FRAMING.
12. ASSUME THE SAME POLE WAS MODIFIED TO RUS "C9-1" POLE TOP FRAMING AND A 48" POLE TOP EXTENSION WAS ADDED TO THE POLE.
13. ASSUME NESC CLEARANCE ISSUES HAVE BEEN ADDRESSED AND MET (NESC RULES 232, 235C, 235I, 238, 239H, ETC.).
14. ASSUME NESC WORK RULES HAVE BEEN ADDRESSED AND MET (NESC RULES 420Q, ETC.).
15. ASSUME NESC GROUNDING RULES HAVE BEEN ADDRESSED AND MET (NESC SECTION 09).
16. ASSUME POLE TOP EXTENSION, ANTENNA, AND COMM. EQUIPMENT BOX MOUNTING HARDWARE ARE OF ADEQUATE STRENGTH.
17. ASSUME NESC GRADE "C" LOAD AND STRENGTH FACTORS, ASSUME NESC "MEDIUM" LOADING ZONE.
18. ASSUMPTIONS MUST BE MODIFIED TO REFLECT ACTUAL CONDITIONS WHEN CALCULATING ACTUAL INSTALLATIONS.



"TYPICAL" 45' POLE WITH ANTENNA MOUNTED ON POLE TOP
(Not to Scale)

Marne and Associates, Inc. Experts in Electrical Code	Eng/Dwn: DJM/CCM Scale: NOT TO SCALE Date: 3-21-07 Plot: 3-21-07 Proj. No: MA-0015	NEXTG NETWORKS POLE TOP ANTENNA REVIEW	File Name: ANTENNA REVIEW PGI.dwg Sheet 1 of 4 Drawing 1

45-4 Wood Pole with antenna

Load calculations per RUS Distribution Design Guides (Bulletins 1724E-150 through 154)
RUS "C9" Pole-top framing (all four wires on crossarm)
Antenna added on a four-foot pole extension with same diamter as top of pole
NESC Medium Loading District, Grade C

(a) Total ground line moment, including NESC load factors

(1) Pole circumference at ground line

$$C_g = \frac{(L_p - L_g)(C_b - C_t)}{L_p - L_b} + C_t$$

Cg	**38.28** in	pole circumference at ground line
Lp	45.0 ft	length of pole
Lg	6.5 ft	distance from pole bottom to groundline
Lb	6.0 ft	distance from pole bottom to classification point (6 ft per ANSI O5.1)
Cb	38.50 in	pole circumference at classification point (Lb)
Ct	21.00 in	pole circumference at pole top

(2) Moment due to wind on pole

$$M_{wp} = F_{OW} W_p \left(\frac{2C_t + C_g}{72\pi} \right) H_p^2$$

Mwp	**3682** ft-lb	moment due to wind on pole
Fow	1.75	NESC load factor for wind loads (Grade C, not at crossing)
Wp	4.00 lb/ft^2	wind pressure
Ct	21.00 in	pole circumference at pole top
Cg	38.28 in	pole circumference at ground line
Hp	38.5 ft	height of pole top above groundline

(3) Moment due to wind on conductors (per unit length)

$$M_{wc} = F_{ow} \left(\sum W_h H_c \right)$$

(Sh)(Mwc)	**53351.54** ft-lb	moment due to wind on conductor (for a 275' span length)
Mwc	**194.01** ft-lb/ft	moment due to wind on conductor (per unit length)
Fow	1.75	NESC load factor for wind loads (Grade C, not at crossing)
Whp	0.3947 lb/ft	horizontal wind force on phase conductor
Hcp	37.75 ft	height of phase conductor
Whp	0.3947 lb/ft	horizontal wind force on phase conductor
Hcp	37.75 ft	height of phase conductor
Whp	0.3947 lb/ft	horizontal wind force on phase conductor
Hcp	37.75 ft	height of phase conductor
Whn	0.3947 lb/ft	horizontal wind force on neutral conductor
Hcn	37.75 ft	height of neutral conductor
Wht	0.536 lb/ft	horizontal wind force on fiber-optic cables
Hct	29.67 ft	height of cable fiber-optic cables
Wht	0.521 lb/ft	horizontal wind force on cable TV cables
Hct	28.67 ft	height of cable TV cables
Whc	0.738 lb/ft	horizontal wind force on telphone cables
Hcc	27.67 ft	height of telephone cables

(4) Moment due to wind on transformer

$$M_{wt} = F_{ow} W_p A H$$

Mwt	**1449.0** ft-lb	moment due to wind on transformer
Fow	1.75	NESC load factor for wind loads (Grade C, not at crossing)
Wp	4.00 lb/ft^2	wind pressure
A	6 ft^2	cross sectional area
H	34.5 ft	mounting height (center of area)

(5) Moment due to wind on antenna

$$M_{wa} = F_{ow} W_p A H$$

Mwa	**777.1** ft-lb	moment due to wind on antenna
Fow	1.75	NESC load factor for wind loads (Grade C, not at crossing)
Wp	4.00 lb/ft^2	wind pressure
A	2.474 ft^2	cross sectional area
H	44.875 ft	mounting height (center of area)

(6) Moment due to wind on pole extension

$$M_{wpe} = F_{ow} W_p A H$$

Mwpe	**632.2** ft-lb	moment due to wind on pole extension
Fow	1.75	NESC load factor for wind loads (Grade C, not at crossing)
Wp	4.00 lb/ft^2	wind pressure
A	2.23 ft^2	cross sectional area
H	40.5 ft	mounting height (center of area)

(7) Moment due to wind on communication equipment box

$$M_{we} = F_{ow} W_p A H$$

Mwe	**560.0** ft-lb	moment due to wind on communication equipment box
Fow	1.75	NESC load factor for wind loads (Grade C, not at crossing)
Wp	4.00 lb/ft^2	wind pressure
A	8 ft^2	cross sectional area
H	10 ft	mounting height (center of area)

(8) Total ground line moment, including NESC load factors

$$M_g = 1.05\left(M_{wp} + S_h M_{wc} + M_{wt} + M_{wa} + M_{wpe} + M_{we}\right)$$

Mg	**63,475** ft-lb	total ground line moment, including NESC load factors
Sh	275 ft-lb	wind span

(b) Allowable resisting moment of pole, including NESC strength factors

(1) Permitted moment at ground line

$$M_r = F_s K_r F_b C_g^3$$

Mr	**75,499**	ft-lb	permitted moment at ground line, including NESC strength factors
Fs	0.85		NESC strength factor
Kr	2.64E-04	ft/in	calculation constant (2.64×10^{-4} ft/in)
Fb	6000	lb/in^2	designated fiber stress
Cg	38.28	in	pole circumference at ground line

(c) Strength requirement of pole

(1) Must be able to withstand expected loads, including load and strength factors

$$M_g \leq M_r$$

Mg ≤ Mr	**yes**		is the pole strength sufficient to withstand the loads?
Mg	63,475	ft-lb	total ground line moment, including NESC load factors
Mr	75,499	ft-lb	permitted moment at ground line, including NESC strength factors

(d) Pole loading summary

	Mwp	**3,682**	ft-lb	moment due to wind on pole
	(Sh)(Mwc)	**53,352**	ft-lb	moment due to wind on conductor (for a 275' span length)
	Mwt	**1,449**	ft-lb	moment due to wind on transformer
	Mwa	**777**	ft-lb	moment due to wind on antenna
	Mwpe	**632**	ft-lb	moment due to wind on pole extension
	Mwe	**560**	ft-lb	moment due to wind on communication equipment box
	Subtotal	**60,452**	ft-lb	
Total	Mg	**63,475**	ft-lb	total ground line moment, including NESC load factors and RUS 1.05 equipment factor

Attachment 6
Declaration of David Marne
Submitted to the FCC by NextG in the complaint proceeding
NextG Networks of NY, Inc. v. Public Service Electric & Gas
File No. EB-07-MD-004 (filed Feb. 11, 2008)

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

NEXTG NETWORKS OF NY, INC. *Complainant,* v. PUBLIC SERVICE ELECTRIC & GAS COMPANY, *Respondent.*	File No. EB-07-MD-004

REPLY DECLARATION OF DAVID J. MARNE, P.E.

I, David J. Marne, P.E., do hereby state:

1. I am a licensed Professional Engineer and President of Marne and Associates, Inc., an engineering consulting firm. I am a member of National Electrical Safety Code® (NESC®) Subcommittee 4, Overhead Lines-Clearances and I am the author of McGraw-Hill's National Electrical Safety Code® (NESC®) 2007 Handbook. Attached is my Curriculum Vitae (Attachment C).

2. I am executing this Declaration in support of NextG's Reply to the Response of PSE&G in the above-captioned case.

3. Mr. Anthony Ramirez, in his Declaration supporting PSE&G's Response, appears to indicate that safety and reliability concerns should prohibit NextG from mounting communications antennas on PSE&G's poles. The intent of this document is to address statements in Mr. Ramirez's Response. PSE&G appears to be citing National Electrical Safety Code® (NESC®) rules to prohibit the attachment of NextG's communication antenna while in

fact the NESC contains several rules recognizing and providing methods for the safe installation of a communications antenna in the supply space on a pole top. Attached is a point by point review of Mr. Ramirez's Declaration (Attachment A) which I incorporate into my declaration. Also attached are NESC Rules 235I, 239H, and 420Q (Attachment B).

4. It is my opinion that the safety, reliability, and other concerns outlined by Mr. Ramirez on behalf of PSE&G can be resolved or negated using the National Electrical Safety Code (NESC) rules and industry practice.

I declare under penalty of perjury that the information and statements contained in this Declaration are true and correct.

David J. Marne, P.E.

February 11, 2008
Date

Attachment A

REPLY DECLARATION OF DAVID J. MARNE, P.E.

Marne and Associates, Inc.
Experts in Electrical Code

February 11, 2008

REPLY DECLARATION OF DAVID J. MARNE, P.E.

Comments on "Affidavit of Anthony Ramirez in Support of Response" (Exhibit AR-1 and Exhibit AR-2)

Introduction

The intent of this document is to address statements in the, "Affidavit of Anthony Ramirez in Support of Response" (Exhibit AR-1 and Exhibit AR-2)." PSE&G appears to be citing National Electrical Safety Code® (NESC®) rules to prohibit the attachment of NextG's communication antenna while in fact the NESC contains several rules recognizing and providing methods for the safe installation of a communications antenna in the supply space on a pole top. More specifically, the following NESC rules address the installation of a communication antenna in the supply space.

NESC Rule 235I titled, Clearances in any direction from supply line conductors to communication antennas in the supply space attached to the same supporting structure

NESC Rule 239H titled, Requirements for vertical communication conductors passing through supply space on jointly used structures

NESC Rule 420Q titled, Communication antennas

Installation of a communications antenna on a power pole does take cooperation between the parties involved but the basic provisions for safety are addressed in the NESC.

Comments on "Safety Issues Relating to Pole Top Antennas"

1st Bullet:
Grounded equipment in proximity to energized power facilities is commonplace in the electric utility industry. A grounded transformer case, a grounded lightning arrestor, a grounded static wire, and even a grounded steel pole are common examples of grounded equipment in close proximity to energized power facilities. The same skill and care used around this equipment would be used by PSE&G crews around NextG's antenna and associated equipment. The statement that PSE&G is "one of few" utilities

in the country that performs maintenance and repairs on live (electrically energized) conductors and facilities by "gloving" is an exaggeration. Rubber gloving is used by electric utilities around the country. Power linemen are trained in rubber glove work and rubber glove techniques are covered in OSHA Standard 1910.269 and Part 4 of the National Electrical Safety Code.

2nd Bullet:
The NESC rule cited by PSE&G (NESC Rule 446) appears to apply to live-line bare-hand work and does not contain cover-up wording that the applicable OSHA standard (OSHA 1910.269) contains. The OSHA standard applicable to this work is shown below:

> **1910.269(q)(3)(xiii)**
>
> The minimum approach distances specified in Table R-6 through Table R-10 shall be maintained from all grounded objects and from lines and equipment at a potential different from that to which the live-line bare-hand equipment is bonded, unless such grounded objects and other lines and equipment are covered by insulating guards.

Independent of the application of the rule, NextG's antenna will be located a minimum of 40 inches away for the energized line and NextG's communication riser feeding the antenna will be covered with suitable nonmetallic material. The 40 inch requirement and the nonmetallic covering requirement are specified in NESC Rule 239H.

3rd Bullet:
NextG's antenna will be grounded bonded to PSE&G's ground (not separately grounded). The safe installation practice for the connection between the pole top antenna and the communications equipment near the base of the pole is covered in NESC Rule 239H.

4th Bullet:
The safe installation practices related to wind forces on equipment and weights of equipment are covered in NESC Sections 24, 25, and 26. The NESC rules in these sections are applicable to electric power lines and equipment as well as communications lines and equipment. It is possible for the pole top conductor on a power pole (energized phase or grounded static) to have more weight and a larger wind surface area (when considering the wind span length and weight span length) than a pole top antenna.

5th Bullet:
The safe installation practices related to wind forces on equipment and weights of equipment are covered in NESC Sections 24, 25, and 26. The NESC rules in these sections protect the general public from falling energized lines and equipment and from

falling communication lines and equipment. The grade of construction in the NESC is higher for energized lines and equipment (typically Grade C) compared to communication lines and equipment (typically Grade N) due to the higher danger that energized lines impose. However, when communications lines are attached to power poles the NESC requires that the communication lines be attached using the same grade of construction as the energized lines.

6th Bullet:
NESC Rule 420Q addresses worker exposure to radio frequencies. It is my understanding that NextG has hired a radio frequency (RF) expert to determine exposure levels and compare the levels to applicable regulatory standards.

Comments on "Reliability Issues With Pole Top Antennas"

1st Bullet:
No comment.

2nd Bullet:
As discussed above, the installation of a pole top antenna can be accomplished with the continued use of rubber gloving techniques.

3rd Bullet:
I do not have any comments on lightning strike data (number of times per year or percentages). Some electric utilities mount a static or neutral at the top position on their poles. This is very common with transmission lines but only common on distribution lines in very high lightning areas. Assuming PSE&G mounts a static or neutral at the top position of their distribution poles, it would be possible, but difficult, to mount the NextG antenna on the pole top. It is my understanding that in areas with distribution poles having a static or neutral at the top position of the pole, Next G agreed to find secondary and guy poles for mounting the antennas. From a reliability standpoint, a lightning strike to a transmission line could take out power to an entire city. A lightning strike to a distribution line could take out power to an entire neighborhood. A lightning strike to a secondary only pole could take out power to one or two houses. Since it is not common for electric utilities to do any special lightning protection or shielding on secondary only poles or guy poles, it seems reasonable to assume that mounting a NextG antenna on a secondary or guy pole will not have much of an impact on reliability.

4th Bullet:
It is my understanding that NextG recognizes that the NextG communication antenna installed in the supply space must be installed and maintained by supply workers (power lineman). This installation is being addressed by utilities around the country by the communication utility paying a fee to the electric utility for the time to install and maintain the antenna or by the electric utility supplying the communications utility a list of power line contractors that the electric utility uses or qualifies to work on their system. The

communication utility then contracts with the power line contractor to meets the qualified worker provision.

Comments on "Other Issue"

1st Bullet:
I am assuming NextG is willing to pay their fare share of a pole replacement for a pole that has a rotten pole top or NextG would work with PSG&E to select a neighboring pole that does not have a rotten pole top. I would also assume that the poles in question do not have a static or neutral in the top position of the pole or that the pole top rot has not extended down to the crossarm mounting position or else the pole would need to be replaced purely for electrical power use.

Attachments: NESC Rules 235I, 239H, and 420Q.

Attachment B

NESC® Rules 235I, 239H, and 420Q

3. Conductors shall be arranged so that the vertical spacing shall be not less than that specified in Table 235-8 under the conditions specified in Rule 235C2b(1)(c)
4. A supporting neutral conductor of a supply cable meeting Rule 230C3 or an effectively grounded messenger of a supply cable meeting Rule 230C1 or 230C2 may attach to the same insulator or bracket as a neutral conductor meeting Rule 230E1, so long as the clearances of Table 235-8 are maintained in mid-span and the insulated energized conductors are positioned away from the open supply neutral at the attachment.

H. Clearance and spacing between communication conductors, cables, and equipment

1. The spacing between messengers supporting communication cables should be not less than 300 mm (12 in) except by agreement between the parties involved.
2. The clearances between the conductors, cables, and equipment of one communication utility to those of another, anywhere in the span, shall be not less than 100 mm (4 in), except by agreement between the parties involved.

I. Clearances in any direction from supply line conductors to communication antennas in the supply space attached to the same supporting structure

1. General

   Communication antennas located in the supply space shall be installed and maintained only by personnel authorized and qualified to work in the supply space in accordance with the applicable rules of Sections 42 and 44. See also Rule 224A.

2. Communication antenna

   The clearance between a communication antenna operated at a radio frequency of 3 kHz to 300 GHz and a supply line conductor shall be not less than the value given in Table 235-6, row 1b.

   NOTE 1: The antenna functions as a rigid, vertical, or lateral open wire communication conductor.

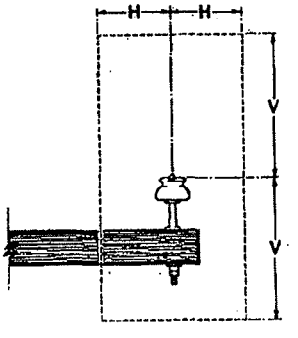
   NOTE 2: See Rule 420Q.

3. Equipment case that supports a communication antenna

   The clearance between an equipment case that supports a communication antenna and a supply line conductor shall be not less than the value given in Table 235-6, Row 4a.

4. Vertical or lateral communication conductors and cables attached to a communication antenna

   The clearance between a supply line conductor and the vertical or lateral communication conductor and cable attached to a communication antenna shall be not less than the value given in Rule 239.



V = Vertical clearance
H = Horizontal clearance

Figure 235-1—Clearance diagram for energized conductor

EXCEPTION: Vertical runs of effectively grounded supply conductors may have a clearance of 25 mm (1 in).

H. Requirements for vertical communication conductors passing through supply space on jointly used structures

All vertical runs of communication conductors passing through supply space shall be installed as follows:

1. Metal-sheathed communication cables

Vertical runs of metal-sheathed communication cables shall be covered with suitable nonmetallic material, where they pass trolley feeders or other supply line conductors. This nonmetallic covering shall extend from a point 1.0 m (40 in) above the highest trolley feeders or other supply conductors, to a point 1.80 m (6 ft) below the lowest trolley feeders or other supply conductors, but need not extend below the top of any mechanical protection that may be provided near the ground.

EXCEPTION 1: Communication cables may be run vertically on the pole through space occupied by railroad signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

2. Communication conductors

Vertical runs of insulated communication conductors shall be covered with suitable nonmetallic material, to the extent required for metal-sheathed communication cables in Rule 239H1, where such conductors pass trolley feeders or supply conductors.

EXCEPTION 1: Communication conductors may be run vertically on the structure through space occupied by railroad-signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

3. Communication grounding conductors

Vertical communication grounding conductors shall be covered with suitable nonmetallic material between points at least 1.80 m (6 ft) below and 1.0 m (40 in) above any trolley feeders or other supply line conductors by which they pass.

EXCEPTION 1: Communication grounding conductors may be run vertically on the structure though space occupied by railroad-signal supply circuits in the lower position, as permitted in Rule 220B2, without covering within the supply space.

EXCEPTION 2: Covering is not required in the supply space on metallic or concrete supporting structures.

4. Clearance from through bolts and other metal objects

Vertical runs of communication conductors or cables shall have a clearance of one-eighth of the pole circumference but not less than 50 mm (2 in) from exposed through bolts and other exposed metal objects attached thereto that are associated with supply line equipment.

EXCEPTION: Vertical runs of effectively grounded communication cables may have a clearance of 25 mm (1 in).

I. Operating rods

Effectively grounded or insulated operating rods of switches are permitted to pass through the communication space, but shall be located outside of the climbing space.

J. Additional rules for standoff brackets

1. Standoff brackets may be used to support the conduit(s). Cable insulation appropriate for the intended service is required; non-metallic conduit shall not be used to meet basic insulation requirements.

NOTE: See Rule 217A2.

O. Cable reels

Cable reels shall be securely blocked so they cannot roll or rotate accidentally.

P. Street and area lighting

1. The lowering rope or chain, its supports, and fastenings shall be examined periodically.
2. A suitable device shall be provided by which each lamp on series-lighting circuits of more than 300 V may be safely disconnected from the circuit before the lamp is handled.

EXCEPTION: This rule does not apply where the lamps are always worked on from suitable insulated platforms or aerial lift devices, or handled with suitable insulated tools, and treated as under full voltage of the circuit concerned.

Q. Communication antennas

When working in the vicinity of communication antennas operating in the range of 3 kHz to 300 GHz, workers shall not be exposed to radiation levels that exceed those set forth by the regulatory authority having jurisdiction.

NOTE: See OSHA 29 CFR 1910.97, Subpart G [B63]; OSHA 29 CFR 1910.268, Subpart R [B64]; FCC Bulletin No. 65 [B30]; IEEE Std C95.1™-2005 [B57].

421. General operating routines

A. Duties of a first-level supervisor or person in charge

This individual shall:

1. Adopt such precautions as are within the individual's authority to prevent accidents.
2. See that the safety rules and operating procedures are observed by the employees under the direction of this individual.
3. Make all the necessary records and reports, as required.
4. Prevent unauthorized persons from approaching places where work is being done, as far as practical.
5. Prohibit the use of tools or devices unsuited to the work at hand or that have not been tested or inspected as required.

B. Area protection

1. Areas accessible to vehicular and pedestrian traffic
   a. Before engaging in work that may endanger the public, safety signs or traffic control devices, or both, shall be placed conspicuously to alert approaching traffic. Where further protection is needed, suitable barrier guards shall be erected. Where the nature of work and traffic requires it, a person shall be stationed to warn traffic while the hazard exists.
   b. When openings or obstructions in the street, sidewalk, walkways, or on private property are being worked on or left unattended during the day, danger signals, such as warning signs and flags, shall be effectively displayed. Under these same conditions at night, warning lights shall be prominently displayed and excavations shall be enclosed with protective barricades.
2. Areas accessible to employees only
   a. If the work exposes energized or moving parts that are normally protected, safety signs shall be displayed. Suitable barricades shall be erected to restrict other personnel from entering the area.
   b. When working in one section where there is a multiplicity of such sections, such as one panel of a switchboard, one compartment of several, or one portion of a substation, employees shall mark the work area conspicuously and place barriers to prevent accidental contact with energized parts in that section or adjacent sections.

Attachment C

Curriculum Vitae of David J. Marne, P.E.

Curriculum Vitae

David J. Marne, P.E.

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Missoula, MT 59803
Phone: (406) 544-8997
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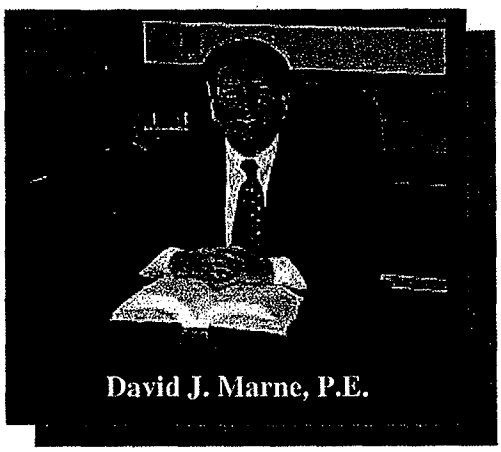
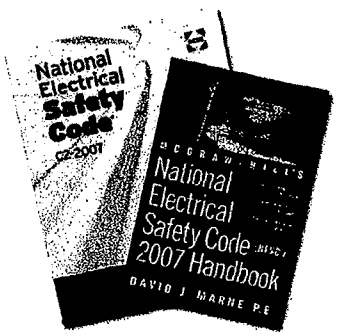

David J. Marne, P.E.

David J. Marne, P.E. is a registered professional electrical engineer. Mr. Marne is the author of *McGraw-Hill's National Electrical Safety Code® (NESC®) Handbook* and is a nationally recognized speaker on the NESC®. He serves on NESC® Subcommittee 4, Overhead Lines – Clearances. He is company president and senior electrical engineer for Marne and Associates, Inc. in Missoula, Montana where he specializes in National Electrical Safety Code® (NESC®) training, OSHA training, and engineering design. Mr. Marne has over 24 years experience engineering and managing transmission and distribution line projects, substation projects, electrical system planning studies, and joint use (power and communication) projects.



The 2007 National Electrical Safety Code® (NESC®) (above left) and McGraw-Hill's NESC® Handbook authored by David J. Marne, PE (above right)

Education

Montana State University, Bozeman, Montana
Bachelor of Science in Electrical Engineering (BSEE)
Graduation Date: June 1983

Various Continuing Education Courses, 1983-present
Transmission and Distribution Line Design and Staking, Substation Design, System Protection and Coordination, System Over-voltage Design, Engineering and Operations Conferences, Pole Conferences, Joint Use (Power and Communications) Conferences, Electromagnetic Fields (EMF), Corrosion Control, Project Management, Finance and Accounting, OSHA Compliance and Workplace Safety, OSHA 1910.269 Qualified Worker, National Electrical Safety Code® (NESC®) Sub-Committee Meetings.

Experience

Transmission and Distribution Line Engineering

Responsible for the engineering management and/or engineering design of over 40 transmission line related projects and over 225 distribution line related projects. Projects have involved a variety of voltage levels, conductor sizes, structure types, terrain types, right-of-way constraints, and environmental issues. Designs for transmission and distribution lines include both overhead and underground circuits (including underwater locations) in both urban and rural settings. Engineering services provided for transmission and distribution engineering projects include planning, cost estimating, design, bidding, construction administration, construction observation, right-of-way, and permitting.

Substation Engineering

Responsible for the engineering management and/or engineering design of over 60 substation related projects. Projects have involved a variety of voltage levels, transformer ratings, bus sizes, structure types, site plans, grounding issues, protection schemes, metering types, communication systems, ownership, and environmental issues. Designs for substations include both live front and dead front equipment in both urban and rural settings. Engineering services for substation projects include planning, cost estimating, design, bidding, construction administration, construction observation, site work, and permitting.

Electrical System Planning Studies

Responsible for the engineering management and/or engineering design of over 95 electrical system planning related studies. Projects have involved a variety of studies including long range plans, construction work plans, sectionalizing and coordination studies, voltage drop studies, fault current studies, motor starting studies, power factor analysis, electromagnetic field (EMF) reports, and environmental studies.

Experience (continued)

Joint Use (Power and Communication) Engineering

Responsible for the engineering management and/or engineering design of over 25 joint use (power and communication) related projects. Projects have involved a variety of power line voltage levels and communication line (phone, CATV, fiber) cable types. Engineering services include calculating and reviewing clearance, and strength and loading issues in accordance with the National Electrical Safety Code® (NESC®) and Joint Use Agreements. Services also include field data gathering, determining make-ready requirements, and field construction observation.

National Electrical Safety Code® (NESC®)

Nationally recognized expert on the National Electrical Safety Code® (NESC®). Author of *McGraw-Hill's NESC® Handbook* and presenter of NESC® seminars around the United States. (See Publications and Presentations for additional information.)

Knowledgeable of the National Electrical Code® (NEC®), Occupational Safety and Health (OSHA) Regulation 1910.269, 1910.268, and 1926.950 through 1926.960, California General Order 95 (GO95) and other codes and standards related to the electrical power and communication utility industries.

Electrical Investigations/Expert Witness Opinions

Electrical investigations and expert witness opinions for cases involving power line contacts, electrocution, lightning, power failure, process control systems damage, and electrical service failures resulting in loss of life, injury, and property damage. Electrical investigations related to electromagnetic field (EMF) concerns. Electrical investigations related to power theft and stray voltage complaints.

Management Experience

President and CEO of Marne and Associates, Inc. Responsible for all aspects of corporate management and company direction.

Branch Manager of SSR Engineers, Inc., Missoula, Montana office. Responsibilities included administration, marketing, and engineering. Reported directly to the company president of an 80+ employee firm spread across five offices. Elected to SSR Engineers, Inc. Board of Directors in 1998 and served as a trustee on the Board of Directors until SSR Engineers was purchased by HDR Engineering in 2003.

Department Manager of the Transmission and Distribution (T&D) group of HDR Engineering in Missoula, Montana. Similar management duties as described above in addition to maintaining relationships with other managers and corporate personnel throughout a 3200+ employee firm with over 80 offices.

Work History

Marne and Associates, Inc.

Missoula, Montana 2005-Present
President
President of Marne and Associates, Inc. which provides National Electrical Safety Code® (NESC®) training (public seminars, in-house seminars, and web based training), OSHA training, training aids (software, books, manuals, etc.), accident investigation, expert witness services, and engineering design.

HDR Engineering, Inc.

Missoula, Montana 2003-2005
Transmission and Distribution Department Manager/Senior Electrical Engineer
(HDR Engineering purchased SSR Engineers on 8/1/03)

Department manager and senior electrical engineer in charge of electrical engineering design for electric utility clients and National Electrical Safety Code® (NESC®) presentations.

SSR Engineers, Inc.

Missoula, Montana 1990-2003

Branch Manager/Senior Electrical Engineer

Branch manager and senior electrical engineer in charge of electrical engineering design for electric utility clients and National Electrical Safety Code® (NESC®) presentations.

Project Engineer 1988-1990

(SSR Engineers purchased General Engineers on 3/1/88)

Project electrical engineer involved with electrical power, lighting, and communication projects for utility, industrial, and commercial clients.

General Engineers, Inc.

Missoula, Montana 1985-1988

Design Engineer

Design electrical engineer involved with electrical power, lighting, and communication projects for utility, industrial, and commercial clients.

Mare Island Naval Shipyard

Vallejo, California 1983-1985
Design Engineer
Design electrical engineer involved with electrical power, lighting, and communication projects for the public works department of a naval shipyard.

Publications

Marne, David J., *McGraw-Hill's National Electrical Safety Code® (NESC®) 2007 Handbook*, Conforms to the 2007 NESC®, McGraw-Hill Publishing, New York, NY, 2007

Marne, David J., *McGraw-Hill's National Electrical Safety Code® (NESC®) Handbook*, Conforms to the 2002 NESC®, McGraw-Hill Publishing, New York, NY, 2002

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Presentations

- Applying the National Electrical Safety Code® (NESC®) to Day-to-Day Utility Work
  Presented at various utility associations and utility companies across the United States.
- Applying the National Electrical Safety Code® (NESC®) to Day-to-Day Utility Work – Transmission Voltage Focus
  Presented at various utility companies across the United States.
- National Electrical Safety Code® (NESC®) Rules for Joint Use Construction
  Presented at various utility associations and utility companies across the northwest.
- Major Changes and General Overview of the 2007 National Electrical Safety Code® (NESC®)
  Presented at various utility associations and utility companies across the United States.
- Major Changes and General Overview of the 2002 National Electrical Safety Code® (NESC®)
  Presented at various utility associations and utility companies across the United States.
- Major Changes and General Overview of the 1997 National Electrical Safety Code® (NESC®)
  Presented at various utility associations and utility companies around the northwest.
- OSHA 1919.269: Electric Power Generation, Transmission and Distribution
  Presented web seminars for various utility companies across the United States.
- OSHA 1919.268: Telecommunications
  Presented web seminars for various utility companies across the United States.
- Distribution Line Design
  Presented web seminars for various utility companies across the United States.

Awards

IEEE Senior Engineer Membership Award

SSR Engineers, Inc. 15 year service award

HDR Engineering, Inc. Professional Associates and Pathfinders Award

Professional Affiliations

Institute of Electrical and Electronics Engineers (IEEE), Senior Member Status

IEEE Power Engineering Society (PES)

National Society of Professional Engineers (NSPE)

Montana Society of Professional Engineers (MSPE)

Licensure

Professional Engineer, State of Montana, License Number 9428PE

Professional Engineer, State of Idaho, License Number 6426

Professional Engineer, State of Washington, License Number 39601