

**UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF NEW HAMPSHIRE**

**Vertex Towers, LLC**

v.

Case No. 1:24-cv-45-PB-AJ  
Opinion No. 2026 DNH 013

**Zoning Board of Adjustment of the  
Town of Hampton, N.H. and  
Town of Hampton, N.H.**

**MEMORANDUM AND ORDER**

To resolve the remaining issues in this case, I must determine just how tall a cell tower needs to be to close a gap in wireless coverage along New Hampshire’s Seacoast. The plaintiff, Vertex Towers, LLC, seeks to construct a 150-foot cell tower on a wooded lot at 17R Barbour Road in Hampton, New Hampshire. As proposed, the tower would accommodate antenna arrays for up to four wireless carriers. The defendants, the Town of Hampton and its Zoning Board (together, “the Board”), contend that the coverage gap can instead be closed by a 110-foot tower on the same site that accommodates three carriers.

Vertex’s sole remaining claim is that, in refusing to grant the height and use variances it needs to construct a 150-foot tower on the Barbour Road site, the Board is effectively prohibiting Vertex from closing a significant gap in wireless coverage in violation of the TCA. [Doc. 34 at 30-36](#); [see 47 U.S.C.](#)

§ 332(c)(7)(B)(i)(II). On that claim, although the parties agree that a coverage gap exists that can only be rectified by a cell tower on the proposed site, they disagree as to how tall the tower must be to do so. See Doc. 25 at 37-43; Doc. 26-1 at 27-28. Because facts material to the resolution of that issue are in dispute, I held a bench trial to resolve the case. I detail my findings and conclusions from that trial below.

## I. FACTUAL BACKGROUND<sup>1</sup>

### A. Proposed Cell Tower

Vertex is a telecommunications infrastructure developer. Doc. 22-2 at 29. Not a wireless carrier itself, Vertex is instead in the business of building cell towers on which carriers can lease space for antenna arrays to broadcast their wireless signals. See id. In this way, Vertex's role in the telecommunications industry is largely akin to a conventional commercial real estate developer; relying on its own analysis of existing wireless coverage, it constructs cell towers largely on speculation that they will attract leases from individual carriers. See id.; Doc. 70 at 21.

To this end, Vertex shepherds its tower projects through each sequential stage of development involved in bringing them online. These

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<sup>1</sup> I detail the history of Vertex's proposal and its reception by the Board in a prior order. See Doc. 34 at 1-13. Recounted here are only those facts that are relevant to resolving Vertex's effective-prohibition claim.

include: identifying prospective sites for new cell towers; securing ownership or tenancy interests in those sites; designing the towers to maximize carrier co-location; steering the project through required municipal permitting; and ultimately erecting the approved towers. [See Doc. 69 at 14-19; Doc. 70 at 21-22](#). Once a new tower is online and its antenna capacity is leased up, Vertex generally liquidates its investment by selling the now-operational tower to other, larger telecommunications developers. [Doc. 69 at 14-15](#). To date, Vertex has completed over 100 tower projects. [Id. at 13](#).

As early as 2014, Vertex employees (then working for a different company) identified a region along the Seacoast that lacks reliable wireless coverage, presenting the opportunity to build one or more viable cell towers. [Id. at 73](#). The region in question spans a contiguous tract of Hampton and North Hampton. [See id. at 73-77](#). To remedy the coverage gap therein, Vertex eventually settled on what it coined a “two-site solution.” [Id. at 76](#). This solution requires construction of two towers, one in Hampton (“the Hampton Tower”) and one in North Hampton (“the North Hampton Tower”).<sup>2</sup> [Id.](#) Within the larger coverage gap, the “target area” for new coverage provided by the Hampton Tower is roughly bounded by U.S. Routes 1 and 1A to the

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<sup>2</sup> The North Hampton Tower, while incomplete, has been fully permitted for construction at a site on Mill Road. [Doc. 60 at 33](#).

west and east and New Hampshire State Routes 27 and 11 to the south and north, respectively. [See Doc. 22 at 83.](#)

Vertex identified 17R Barbour Road, a twenty-one-acre lot situated in a sparsely developed region of Hampton, as the optimal site for the Hampton Tower. [Doc. 22 at 30, 76, 93.](#) To the north, east, and west, the parcel abuts Twelve Shares, Hampton's municipal forest. [Doc. 22-4 at 63-64.](#) It is accessible from the road to its south. [Id. at 63.](#) Vertex plans to erect the tower in the parcel's northern half, which is heavily forested. [Doc. 22-2 at 38.](#)

There, Vertex is proposing to build a 150-foot tower<sup>3</sup> designed to accommodate antenna arrays for up to four carriers at 115, 125, 135, and 145 feet.<sup>4</sup> [See Doc. 22 at 97.](#) Each array will have three faces with three antennas each pointed outwards from the tower, totaling nine antennas per array. [Doc. 64 at 50.](#) Additionally, for the benefit of municipal emergency services and the like, Vertex will place a "public safety antenna" five feet above the centerline of the highest commercial array, topping off the tower at 150 feet. [Doc. 60 at 45.](#)

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<sup>3</sup> The tower will be topped with a six-foot lightning rod which would extend the total height of the proposed structure to 156 feet. [Doc. 22 at 97.](#) I follow the parties' lead in ignoring the lightning rod when discussing the tower's height.

<sup>4</sup> By industry standard, each antenna array must be spaced ten feet apart on center to ensure non-interference with one another. [Doc. 64 at 29-30.](#)

## **B. Procedural History**

With authorization from the owners of the Barbour Road site, Vertex applied to the Board in July 2023 for two variances from Hampton’s Telecommunications Facilities Ordinance. [Doc. 22 at 4-103](#). To build the tower, Vertex needed relief from the ordinance’s prohibition on the construction of telecommunications facilities outside of Hampton’s telecommunications district as well as its 100-foot maximum height for those facilities. [Id. at 31](#); [see Doc. 22-14 at 48](#). In support of its application, Vertex submitted an affidavit from Jose Hernandez, Vertex’s radio frequency engineer. [Doc. 22 at 82-83](#). Hernandez explained his view that the proposed tower was the “at the minimum height necessary to satisfy the coverage objectives of multiple wireless carriers.” [Id. at 83](#). Hernandez’s affidavit was accompanied by maps, detailed below, which modeled the propagation of generic wireless coverage in the target area from an antenna array on the Hampton Tower at 145 feet. [Id. at 84-88](#). Hernandez later supplemented his initial submission with similar maps modeling such coverage for each of the three major wireless carriers: AT&T, Verizon, and T-Mobile. [Doc. 22-3 at 5-33](#); [Doc. 22-4 at 13-26](#).

After multiple meetings with Vertex, the Board retained its own radio frequency expert, Ivan Pagacik of IDK Communications. [Doc. 22-9 at 2-3](#). The Board tasked Pagacik with reviewing Vertex’s materials and conducting his

own study of the same area. [Id. at 2-3, 6](#). At the Board's request, Vertex provided Pagacik with the input parameters Hernandez used to develop his propagation maps, which Pagacik then used to perform his own propagation study. [Doc. 65 at 90](#). In his ensuing report, Pagacik concluded that a shorter tower with antenna arrays at 85, 95, and 105 feet would rectify the coverage gap in a manner comparable to Vertex's proposal. [Doc. 22-9 at 10-20](#). Pagacik supported his analysis with his own propagation maps depicting each carrier's existing coverage, projected coverage with an array at 145 feet, and projected coverage with an array at one of the lower heights he suggested. [Id.](#)

Vertex responded to Pagacik's report with a letter from Hernandez identifying purported deficiencies in Pagacik's analysis. [Doc. 22-4 at 46-55](#). In his response, Hernandez included maps from his propagation software modeling the existing and projected coverage for T-Mobile and Verizon from antenna arrays at 75 and 85 feet. [Id. at 49-55](#). Using these maps alongside Pagacik's, Hernandez opined that Pagacik "over predicted the coverage on the existing sites in the [target] area" by failing to account for the effect of the tree canopy surrounding the proposed tower, which he contended would impede propagation of wireless coverage from arrays placed at the heights that Pagacik proposed. [Id. at 47](#). Hernandez also suggested that Pagacik's analysis failed to account for future tree canopy growth, which he asserted would only further exacerbate the forest's interference with coverage over

time. [Id.](#) As for AT&T, Hernandez noted by comparison to his own map of AT&T's existing coverage that Pagacik's analysis appeared to overpredict localized coverage within the target area generated by the carrier's C-RANs.<sup>5</sup> [Id. at 49.](#) By contrast, Hernandez remarked that "[t]he drive test data that [he] provided clearly shows" that AT&T's C-RANs "provide very little coverage to the areas of Hampton" where they are located. [Id. at 46.](#)

The Board ultimately denied Vertex's variance application. [Doc. 6-1 at 2.](#) Although the Board agreed with Vertex that a cell tower on the Barbour Road site would remedy the coverage gap in the target area, it was persuaded by Pagacik's conclusion that the tower only needed to be tall enough to accommodate antenna arrays for three carriers with the highest array placed at 105 feet. [Id. at 4-5.](#) The Board thus denied Vertex's application, reasoning that a 150-foot tower was unnecessary and, for other reasons irrelevant at this juncture in the case, undesirable. [Id. at 6.](#) Vertex requested a rehearing, which the Board denied. [Doc. 6-2 at 2.](#)

Vertex sought review of the Board's decision from this Court in February 2024, asserting that the Board's denial violated the TCA because it

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<sup>5</sup> C-RAN is an abbreviation of "compact radio access network," which refers to specialized telecommunications transmission devices typically mounted on telephone poles to broadcast wireless signal in their immediate vicinity. [See Doc. 64 at 99-102.](#)

was not supported by substantial evidence, see 47 U.S.C. § 332(c)(7)(B)(iii); constituted an effective prohibition of personal wireless service, see id. § 332(c)(7)(B)(i)(II); and was improperly grounded on Hampton residents' concerns with the health effects of the proposed tower's radio frequency emissions, see id. § 332(c)(7)(B)(iv). Doc. 6 at 22-25, 27-28. Vertex also claimed that the Board's decision was illegal and unreasonable under New Hampshire law, see N.H. Rev. Stat. Ann. § 677:4. Id. at 26-27. Vertex sought injunctive relief; namely, that the Board be ordered to grant its requested height and use variances along with "all other permits and approvals necessary" to complete the project. Id. at 28.

Following discovery, the parties filed cross-motions for summary judgment on all counts. Doc. 25; Doc. 26. I granted summary judgment to the Board and denied it to Vertex on all but the effective-prohibition claim. See Doc. 34 at 36. As to that claim, I concluded that there was a genuine dispute of material fact over whether the Board's refusal to grant Vertex necessary variances to build a 150-foot tower on the Barbour Road site, while leaving open the option to build a 110-foot tower on the same site, effectively prohibited the provision of personal wireless services. See id. at 34.

To resolve the effective-prohibition claim, I held a trial in two phases. The first phase dealt with technical questions common to any effective-prohibition claim: the precise contours of the significant gap in

wireless coverage in the target area and whether a cell tower at Vertex’s proposed height is the only feasible plan to rectify that gap. The parties’ evidence at this phase consisted of expert testimony by Hernandez and Pagacik centered on their respective propagation studies. [Doc. 60](#); [Doc. 61](#); [Doc. 63](#); [Doc. 64](#); [Doc. 65](#). The second phase, unique to an effective-prohibition claim brought by a non-carrier plaintiff, focused on whether Vertex could support its contention that up to four wireless carriers are likely to co-locate on the tower once constructed. To address that issue, Vertex called Stephen Kelleher, the company’s principal, who testified about the company’s leasing practices, its dealings with the major carriers at other sites, and its interactions with the carriers concerning the Hampton Tower project. [Doc. 69](#); [Doc. 70](#). The Board did not call any witnesses during the second phase. [Doc. 70 at 26](#).

## II. LEGAL BACKGROUND

### A. General Principles

The TCA provides that “[t]he regulation of the placement, construction, and modification of personal wireless service facilities by any . . . local government or instrumentality thereof . . . shall not prohibit or have the effect of prohibiting the provision of personal wireless services.” [47 U.S.C. § 332\(c\)\(7\)\(B\)\(i\)\(II\)](#). In short, a municipality (or one of its governing bodies, like the Board) may not issue a decision that “effectively prohibits” the

promulgation of wireless coverage. See id. To enforce this restriction, the TCA grants a private cause of action to “[a]ny person adversely affected” by a municipal action that is “inconsistent with” its limitations on local zoning authority. Id. § 332(c)(7)(B)(v). In other words, a municipal entity like the Board subjects itself to suit if one of its decisions—such as its refusal to grant a variance necessary to construct a new cell tower, as here—results in an “effective prohibition” of wireless coverage in a given area.

As the First Circuit has observed, the text of the TCA offers scant particulars to guide the adjudication of an effective-prohibition claim, leaving courts to fill in the gaps. See Omnipoint Holdings, Inc. v. City of Cranston, 586 F.3d 38, 48 (1st Cir. 2009) (“Beyond the statute’s language, the TCA provides no guidance on what constitutes an effective prohibition, so courts, including [the First Circuit], have added judicial gloss.”). Most courts, including the First Circuit, have settled on a two-element test to evaluate an effective-prohibition claim. See id. The plaintiff—who may be a wireless carrier, or just as well a landowner or lessee seeking to build a cell tower—bears the burden of establishing both elements. See id.; Green Mountain Realty Corp. v. Leonard, 688 F.3d 40, 57 n.13 (1st Cir. 2012) (“[A] landowner tower developer is in no better position than a carrier and has an equally heavy burden.” (quoting Second Generation Props., L.P. v. Town of Pelham, 313 F.3d 620, 629 (1st Cir. 2002))).

To establish the first element, the plaintiff must prove that the municipal defendant's action preventing construction of the proposed cell tower leaves "a 'significant gap' in coverage" somewhere. [Green Mountain](#), 688 F.3d at 57 (quoting [Omnipoint](#), 586 F.3d at 48). Though once described as a "significant geographic gap," [Second Generation](#), 313 F.3d at 624, a significant gap is not merely a geographic construct. Rather, to be legally significant, a gap "must be 'large enough in terms of [both] physical size and number of users affected' to distinguish it from 'a mere, and statutorily permissible, dead spot.'" [Green Mountain](#), 688 F.3d at 57 (quoting [id.](#) at 631). Identifying a significant gap is thus a "fact-bound" analysis, requiring courts to assess whether an asserted gap is qualitatively significant based on its physical size, the kind of area it encompasses, the number of users therein, and any available data on calls within its bounds that are unsuccessful, dropped, or experience insufficient service.<sup>6</sup> [Omnipoint](#), 586 F.3d at 48.

Second, after establishing the existence of a significant gap, the plaintiff must also show that the proposed cell tower is "the only feasible

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<sup>6</sup> It bears mentioning that a gap need not be one contiguous area. A significant gap might also exist where there is an overabundance of small areas without coverage in the same vicinity even if, on their own, they would otherwise constitute "mere . . . dead spot[s]," [Second Generation](#), 313 F.3d at 631. See [Nat'l Tower, LLC v. Plainville Zoning Bd. of App.](#), 297 F.3d 14, 18-20 (1st Cir. 2002) (agreeing that a "non-contiguous" gap satisfied the first element of an effective-prohibition claim).

plan” to remedy the gap. [Id.](#) at 50 (quoting [Town of Amherst v. Omnipoint Commc’ns Enters.](#), 173 F.3d 9, 14 (1st Cir. 1999)). If the municipal defendant can point to one or more feasible alternatives to the plaintiff’s proposal, there is no effective prohibition. [See Green Mountain](#), 688 F.3d at 57-58. Stated differently, a plaintiff cannot “insist on one, ideal way to provide service; the TCA require[s] it to consider alternatives more palatable to local zoning authorities.” [Omnipoint](#), 586 F.3d at 50. Like finding a significant coverage gap, whether a proposed alternative is a feasible way to close the gap is a practical, fact-intensive inquiry. [See id.](#) at 48. Particularly relevant to this case, the extent to which a feasible alternative may differ from a plaintiff’s plan can range from locating the new carrier facility on an entirely different site to slightly tweaking its proposed design. [See id.](#) (“[C]ourts may consider, ‘e.g., [if] the provider has considered less sensitive sites, alternative system designs, alternative tower designs, placement of antennae on existing structures, etc.’” (quoting [APT Pittsburgh Ltd. P’ship v. Penn Township](#), 196 F.3d 469, 480 (3d Cir. 1999) (second alteration in original))).<sup>7</sup>

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<sup>7</sup> Vertex has argued that a declaratory ruling issued by the FCC in 2018 displaced the First Circuit’s two-element effective-prohibition test. [See In re Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Inv.](#), 33 FCC Rcd. 9088, 9102-07 (2018). In that ruling, the FCC articulated a more carrier-friendly standard. To facilitate densification of wireless coverage (including where it already exists), the FCC’s new standard dispenses with a coverage-gap requirement and only requires the

## B. The Multiple-Provider Rule

Circuits are split on how to apply the effective-prohibition standard where multiple carriers are experiencing coverage gaps in the same area. Some circuits follow the “one-provider” rule, which forecloses effective-prohibition claims in any area where at least one carrier provides coverage. See [Sprint Spectrum, L.P. v. Willoth](#), 176 F.3d 630, 643 (2d Cir. 1999); [APT Pittsburgh](#), 196 F.3d at 480; [T-Mobile Ne. LLC v. Fairfax Cnty. Bd. of Sups.](#), 672 F.3d 259, 265-67 (4th Cir. 2012).<sup>8</sup> In contrast, the First Circuit is one of several to follow the “multiple-provider” rule. See [Second Generation](#), 313 F.3d at 632-35; [accord T-Mobile Cent., LLC v. Charter Township of West Bloomfield](#), 691 F.3d 794, 806-07 (6th Cir. 2012); [MetroPCS, Inc. v. City & County of San Francisco](#), 400 F.3d 715, 731-33 (9th Cir. 2005), [abrogated on other grounds by T-Mobile S., LLC v. City of Roswell](#), 574 U.S. 293, 299 (2015). Under this approach, coverage analysis is

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plaintiff to establish that the municipal defendant’s decision “materially inhibits the provision” of “wireless telecommunications services.” [Id.](#) at 9104. The First Circuit has not had occasion to address this declaratory ruling, and for reasons explained below, it would not affect the result of this case in any event.

<sup>8</sup> The one-provider rule has been rejected by the FCC. See [In re Petition for Declaratory Ruling to Clarify Provisions of Section 332\(c\)\(7\)\(B\) to Ensure Timely Siting Rev. and to Preempt Under Section 253 State and Loc. Ordinances that Classify All Wireless Siting Proposals as Requiring a Variance](#), 24 FCC Rcd. 13994, 14017-18 (2009).

carrier-specific; that is, the “provision of coverage by one carrier in a certain area does not insulate a regulatory decision denying other carriers the ability to provide service in the same area from a claim of effective prohibition.”

[Green Mountain](#), 688 F.3d at 58. Carriers thereby remain free to compete, and individual consumers are spared “a crazy patchwork quilt of intermittent coverage” by carriers with miniature monopolies in different areas. [Second Generation](#), 313 F.3d at 633. Accordingly, in assessing an effective-prohibition claim, courts in this circuit assess whether each step is satisfied as to the specific plaintiff-carrier—i.e., whether that carrier suffers from a significant gap in the area at issue, whether the plan to remedy that gap is the only feasible one for that carrier, and so on.

It follows that, to establish that a proposed multi-carrier cell tower is necessary to prevent effective prohibition of wireless coverage, the tower developer must establish that each carrier expected to co-locate on the tower would suffer from a significant coverage gap under any other plan. In effect, this approach has the developer stand in for the carriers, each of which could have brought their own effective-prohibition claim on the same facts. Since the developer’s right to build its preferred tower over a municipality’s objection derives from that tower’s standalone potential to ameliorate one or more carriers’ coverage gaps, the developer must show that its tower is the only feasible plan to resolve a significant coverage gap for those carriers. This

means the developer must establish the elements of its effective-prohibition claim for each and every carrier that it claims collectively justifies the tower's placement and design.

**C. Additional Considerations for a Non-Carrier Plaintiff**

One more issue arises when an effective-prohibition claim is brought by a non-carrier third party, like a tower developer, whose ability to close an asserted coverage gap is contingent on the eventual cooperation of one or more wireless carriers that will actually broadcast wireless signal. Vertex claims that the Hampton Tower needs to be 150 feet tall because four such carriers will co-locate on the tower to remedy their respective coverage gaps. The Board responds that Vertex has not established that the tower is a feasible means of remedying any such coverage gaps because it has not entered into leases with any carriers for the Hampton Tower.

Neither the Supreme Court nor the First Circuit has squarely taken this issue on—that is, whether a tower developer bringing an effective-prohibition claim must prove to some degree of certainty that one or more wireless carriers will, in fact, lease space on its proposed tower. Lacking binding authority on the question, the Board points to a recent decision in the District of Maine, in which the court dismissed an effective-prohibition claim based on the same tower developer's failure to allege "that any carrier has agreed to use its proposed tower to provide coverage." [Vertex Towers LLC v.](#)

[Town of York, 2023 WL 4868097, at \\*9 \(D. Me. July 31, 2023\)](#). So that court’s reasoning went, a tower developer cannot plausibly allege that its proposed tower is a feasible plan to close a carrier’s coverage gap without offering evidence that the carrier in question is committed to placing an antenna array on the tower in the first place. See id. Borrowing from that reasoning, the Board would have me require Vertex to prove that it has a “committed personal wireless carrier that plans to place an antenna on its proposed tower.” [Doc. 41-1 at 7](#).

The District of Maine’s answer to this vacuum of authority is not the only one, however. Take the Second Circuit’s approach as an example. In a recent decision resolving an effective-prohibition claim, the Second Circuit carefully avoided requiring a third-party developer to have “necessarily secure[d] a binding commitment from [a carrier with a coverage gap] before applying for a permit.” [Indus. Tower & Wireless, LLC v. Roisman, 2025 WL 3002379, at \\*2 n.3 \(2d Cir. Oct. 27, 2025\)](#) (summary order). Instead, the Second Circuit only required the developer to establish that the project would draw such a carrier based on “more than . . . speculation.” Id. As examples of evidence short of a “binding commitment” that might surmount this threshold, the court suggested that a developer could submit “evidence of the carrier’s existing coverage and facilities in adjacent areas, or evidence of the carrier’s plans to expand to the general coverage-gap area.” Id.

This approach is consistent with guidance the First Circuit has offered in “substantial evidence” challenges to municipal decisions under the corresponding provision of the TCA. See [47 U.S.C. § 332\(c\)\(7\)\(B\)\(iii\)](#). In ATC Realty, LLC v. Town of Kingston, for instance, the First Circuit cautioned against requiring tower developers to show firm commitments from lessee-carriers to secure municipal approval of proposed tower projects. See [303 F.3d 91, 96 n.4 \(1st Cir. 2002\)](#). Rather, the court noted that it would be “too speculative” to infer much from the developer’s inability to lease up its tower that early in that case, as “[t]he dearth of clientele [could have been] a product of the fact that wireless service companies are waiting to see the outcome of [the] litigation.” Id.

In my view, the prudent approach is to require tower developers to demonstrate a “reasonable likelihood” that a wireless carrier will lease space on a proposed tower. Such an approach captures the essential observation in Town of York that a tower cannot be a feasible solution to a coverage gap absent eventual cooperation of a carrier, see [2023 WL 4868097, at \\*9](#), while accommodating the reality recognized by the First and Second Circuits that, given tower developers’ anticipatory role in the telecommunications industry, they cannot be fairly expected to have in hand binding commitments from carriers to a tower project in the throes of pre-approval litigation, see [ATC Realty, 303 F.3d at 96 n.4](#); [Indus. Tower, 2025 WL 3002379, at \\*2 n.3](#).

Rather, to demonstrate that its proposal is feasible, a tower developer should merely be required to establish on more than abject speculation that a carrier is reasonably likely to lease space on the proposed tower.

There are numerous ways that a tower developer might prove up this subpart of an effective-prohibition claim's second element. Of course, a developer might most easily do so by offering direct evidence of a carrier's expression of interest in leasing space on the proposed tower. But alternatively, the point could be proved by circumstantial evidence, such as evidence of the course of dealing between the developer and carriers at other sites; evidence that carriers have existing antennas on other towers near the gap that the proposed tower will close; or evidence that a large number of a carrier's users travel through the gap on a regular basis.

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In summary, in the First Circuit, when a third-party tower developer like Vertex asserts an effective-prohibition claim for a tower designed to accommodate antenna arrays for multiple carriers, it must establish: (1) that each wireless carrier who will lease space on the tower faces a significant coverage gap that would be closed by broadcasting wireless signal from the tower; (2) that the proposed tower is the only feasible plan by which each carrier can remedy its coverage gap; and (3) that it is reasonably likely that

each carrier with a coverage gap will ultimately execute a lease for space on the tower once it is approved.

Importantly, unlike “substantial evidence” challenges to the reasoning of a municipality’s decision under 47 U.S.C. § 332(c)(7)(B)(iii), “[a]n effective prohibition claim presents questions that a federal district court determines in the first instance without any deference to the local regulatory authority.” [Green Mountain](#), 688 F.3d at 58 (citation modified). I am accordingly “free to consider additional evidence” in “determin[ing] de novo” whether the Board’s denial constituted an effective prohibition and thus whether Vertex is entitled to an injunction requiring the Board to grant its requested variances as a matter of federal law. [Second Generation](#), 313 F.3d at 629.

### **III. ANALYSIS**

As I have noted, the defendants stipulate that Vertex’s proposal to build a cell tower on the Barbour Road site is the only feasible plan to close a significant coverage gap in its vicinity. Where the parties remain relevantly at odds is over the height of the tower. Vertex contends that significant coverage gaps will remain unless it is permitted to build a 150-foot tower with space for antenna arrays at 115, 125, 135, and 145 feet. The defendants counter that the coverage gaps could be closed by a tower of 110 feet with arrays at 85, 95, and 105 feet. Both sides come armed with expert analyses

purportedly justifying their position, leaving me to assess which side has the better argument.

To render this assessment, I first compare the expert evidence offered by each side to determine the minimum height for an antenna array on the Hampton Tower that will close one or more carriers' significant coverage gaps in the target area. I then identify the number of carriers that Vertex has proved are reasonably likely to lease space on the tower.

What follows is a simple stacking exercise. Assuming that Vertex establishes a reasonable likelihood of at least one carrier leasing space on the tower, it is entitled to build to the minimum height for one viable antenna array that will rectify the carrier's coverage gap.<sup>9</sup> Then, for each additional carrier that Vertex establishes a reasonable likelihood of co-locating on the tower, the permissible tower height grows by the additional height necessary to add another array—in this case, the industry standard of ten feet, as stipulated by the parties. See Doc. 60 at 46, 55-56. Finally, also as stipulated,

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<sup>9</sup> In debating the tower's minimum necessary height, neither party developed an argument regarding the interval by which that lowest height should be adjusted according to the evidence presented. That said, both experts presented their analyses of antenna performance by heights in ten-foot increments offset by five feet (i.e., 75 feet, 85 feet, 95 feet, and so on), so I follow their approach. Thus, I assume that the minimum height should be the same as or a multiple of ten feet higher or lower than the heights considered by the experts.

five additional feet are added to the tower's height to accommodate the public safety antenna. [See Doc. 22 at 97; Doc. 60 at 66-67.](#)

I address the two factual findings that are required to complete this analysis and explain my conclusions below.

**A. Minimum Tower Height**

As discussed, both Vertex and the Board retained experts, Hernandez and Pagacik, respectively, who performed propagation studies of wireless coverage in the target area. The first phase of the bench trial consisted of their testimony, the results of their studies, and related exhibits.

1. A Primer on Propagation Studies

To appreciate how and why the conclusions drawn by Hernandez and Pagacik differ, one must first understand the basic principles behind propagation studies. Widely used in the telecommunications industry, these studies essentially model the current and projected strength of wireless coverage within a given area. [Doc. 64 at 55-56; Doc. 65 at 91-92.](#) To assess the impact of the proposed cell tower in this case, each expert performed such a study using similar, commercially available software programs; Hernandez used one called "Atoll," while Pagacik used another called "EDX Signal Pro." [Doc. 64 at 58; Doc. 65 at 93.](#) As deployed by the two experts in this case, both programs produce the same basic output: maps of the target area displaying

where the software predicts wireless coverage for a particular carrier meets a certain signal strength. [Doc. 64 at 71](#); [Doc 65 at 91-92](#).

To generate these visuals, both programs superimpose thousands of predictions about the wireless coverage at individual points across a map of the target area. [Doc. 65 at 97](#). The number, organization, and appearance of those predictions are largely determined by four parameters that the user sets. First, the user marks the location of any existing or proposed carrier facilities on the map. [See id.](#) Then, the user selects the number of “radials” that the program will draw from each carrier facility.<sup>10</sup> [Id. at 97-98](#). Next, the user sets the lateral interval along each radial that the software will measure projected signal—say, every 150 feet. [Id. at 99](#). Last, the user identifies a threshold signal strength at or above which the software will mark the measurement location with color.<sup>11</sup> [Id. at 97](#). To create a smooth, contiguous appearance, the software will also fill in the space between two points that

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<sup>10</sup> To conceptualize a radial, imagine a child’s rendering of the Sun, the bright light from which is represented by short, yellow lines pointing away from its center, evenly spaced around its entire circumference. The radials that emanate from carrier facilities on a propagation map look the same, except that where the child draws one or two dozen beams, the propagation software crams several hundred.

<sup>11</sup> Here, the parties agree that -95 dBm is the appropriate threshold for satisfactory signal strength and thus the level at which both experts’ propagation maps show color at individual measurement points. [See Doc. 22-13 at 57](#).

meet the threshold, essentially making an assumption that the signal is consistent over that interval. [See Doc. 61 at 29.](#)

To calculate predicted signal strength at each measurement point, these programs rely on two sets of inputs. First, they base their calculations on the attributes of antenna arrays at the existing and proposed carrier facilities that have been marked on the map, including the facilities' height, type, coordinates, and azimuth (in this context, the angle of their downward tilt).<sup>12</sup> [Doc. 65 at 90.](#) Second, the programs account for attenuations in signal strength across the diverse contours of the target area using consolidated data sets summarizing the target area's terrain, the locations of any three-dimensional obstructions in it like trees and buildings (referred to in the telecommunications industry as "clutter"), and the heights of those obstructions. [See Doc. 64 at 59-65; Doc. 65 at 94.](#) Captured using satellite and LiDAR technology, these data sets are usually available for purchase and uploaded to the program by the user. [See Doc. 64 at 65-66; Doc 65 at 94.](#)

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<sup>12</sup> The existing and proposed carrier facilities in and around the target area accounted for by the programs can include cell towers, smaller antenna arrays mounted on other structures, and C-RANs, so long as the user inputs the basic information about them described above. [See Doc. 60 at 5-6; Doc. 64 at 101-02.](#) Because C-RANs are not registered with the FCC, data on their locations within the target area must sometimes be collected in the field. [See Doc. 60 at 9; Doc. 63 at 99.](#)

Importantly, without more, these programs only model predicted coverage based on the user's selected assumptions and inputs. [Doc. 64 at 71, 83](#). Their results may be refined, however, with data collected by the user on a "real-life" drive-test. [Doc. 64 at 80-81](#). Radio frequency engineers collect drive-test data by driving a vehicle equipped with specialized sensor technology on roads within the target area which, along the way, measures the strength of a given carrier's signal. [Doc. 64 at 74-78](#). Simplified, the vehicle collects this information by running a continuous connection with the carrier, akin to a phone call, the changing strength of which is automatically recorded by location for later review and uploading to the propagation software. [See id.](#) Once uploaded, the resulting dataset valuably enhances the accuracy of the program's readout by adjusting the modeled existing coverage from carrier facilities to reflect "actual" point-specific measurements. [Doc. 60 at 26](#).

## 2. Expert Opinions

Hernandez and Pagacik disagree as to the minimum height at which an antenna array on the Hampton Tower will close the significant coverage gap for a single carrier. Hernandez contends that an array must be at least 115 feet high to close the gap, while Pagacik argues that the lowest array on the tower need only be 85 feet above the ground to do so. [See Doc. 22 at 83; Doc.](#)

[22-9 at 17](#). Each side relies on multiple maps from their respective propagation studies to support their opinions.<sup>13</sup>

As mentioned, Hernandez presented two sets of maps to the Board before Pagacik was retained. Hernandez's initial maps were not carrier-specific, did not include drive-test data, and only projected coverage for the Hampton Tower assuming a generic antenna array's placement at 145 feet.<sup>14</sup> [See Doc. 22 at 84-88](#). He later produced a second set of maps for the Board that separately modeled coverage for each of the three major carriers and included drive-test data that he collected for all three. [See Doc. 22-3 at 5-33; Doc. 22-4 at 13-26](#). Still, these maps only projected coverage from an array at 145 feet. [See Doc. 22-3 at 5-33; Doc. 22-4 at 13-26](#).

Pagacik responded to Hernandez's submissions by using his propagation software to generate his own carrier-specific maps using the same parameters and inputs as Hernandez, with the exception that his maps

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<sup>13</sup> Because the propagation maps marked as trial exhibits that are relevant to my analysis were also included in the certified record, I provide citations to that filing for ease of reference.

<sup>14</sup> Hernandez also generated a map he described as a "height analysis," which overlaid color-coded ranges of non-carrier-specific coverage generated by hypothetical antenna arrays on the Hampton Tower at 65, 95, 115, and 145 feet. [Doc. 22-2 at 61](#). That map did not include existing coverage, however, making it impossible to assess where gaps remain at each height, much less which carrier they pertain to. [See id.](#); [Doc. 60 at 59-60](#).

did not incorporate Hernandez's drive-test data. [Doc. 22-9 at 6-20](#); [Doc. 61 at 21](#). For each of the three major carriers, his maps purportedly showed their existing coverage; their coverage assuming antenna array placement at 145 feet; and the coverage for Verizon if its array were placed at 85 feet, T-Mobile if placed at 95 feet, and AT&T if placed at 105 feet. [Doc. 22-9 at 10-19](#). In Pagacik's view, these maps indicated that the carriers would have "similar coverage" at the three lower heights to their coverage at 145 feet. [Id. at 20](#).

In response, Hernandez generated a third set of carrier-specific maps, again incorporating drive-test data, for T-Mobile and Verizon. [Doc. 22-4 at 46-55](#). These maps were Hernandez's only ones to assume antenna array placement lower than Vertex's desired maximum height of 145 feet. [See id.](#) In Hernandez's view, these maps showed persisting coverage gaps in the target area for both T-Mobile and Verizon if their arrays were placed at 75 or 85 feet, contradicting Pagacik's maps. [Id. at 47, 51-52, 54-55](#). Hernandez also resupplied in his response a map of AT&T's existing coverage without the Hampton or North Hampton Towers to highlight what he viewed as Pagacik's overprediction of coverage generated by AT&T's C-RANs throughout the target area. [See id. at 46-47, 49](#).

Both experts relied on the same sets of maps at trial.

### 3. Analysis

Largely based on their candor with the Court and their forthrightness in acknowledging and explaining their analyses' technical limitations, I found both experts highly credible. Nevertheless, to the extent that the results of their propagation studies conflict, I find Hernandez's analysis more persuasive. I make this distinction based on his incorporation of drive-test data into his maps. By accounting for the wireless coverage as actually observed within the target area, Hernandez's study goes beyond a purely assumption-based, hypothetical model and is instead calibrated to more accurately reflect where existing coverage leaves gaps that could persist under different antenna-height scenarios. See Doc. 65 at 49. Pagacik's maps unfortunately lack this calibrating element, making them less reliable. Indeed, in his testimony, Pagacik agreed that drive-test data would provide a "useful refinement" to his analysis, and he attributed the disparities between his and Vertex's maps to that distinction. Doc. 61 at 21, 35-36. I accordingly resolve any conflict between the two experts' carrier-specific maps in favor of Vertex.

Turning back to Hernandez's maps, then, they make reasonably clear that, with an antenna array on the Hampton Tower at 85 feet, a significant coverage gap would persist inside the target area for both T-Mobile and Verizon. For T-Mobile, this gap would appear to run along U.S. Route 1A

roughly from State Route 27 to Appledore Avenue. [See Doc. 22-4 at 52.](#) Verizon's gap is in the same vicinity, though smaller. Thanks to a smaller-range array mounted on a condominium development nearby, its coverage gap would only run roughly from North Shore Road to Appledore Avenue. [See id. at 55; Doc. 63 at 29-31.](#) Regardless of their exact bounds, both carriers' remaining gaps in that area are legally significant, as situated squarely within them is at least one dense residential neighborhood and a major interstate artery, [see Doc. 63 at 21.](#) [See \*Omnipoint\*, 586 F.3d at 48.](#)

Complicating matters, Hernandez did not produce a similar map projecting AT&T's coverage for an antenna array at 85 feet. However, close examination of its map of AT&T's existing coverage, which Vertex [did](#) provide among its initial set of AT&T-specific maps, [Doc. 22-3 at 12](#), establishes that AT&T also experiences a gap in the same area as T-Mobile and Verizon that one would expect to go similarly unremedied by an array at 85 feet.

Specifically, AT&T's existing-coverage map shows a gap wholly encompassing the same dense neighborhood along U.S. Route 1A described above. [See id.](#)

This gap remains even on Hernandez's AT&T-specific maps that account for activation of the North Hampton Tower and, critically, is corroborated by drive-test data in that area along North Shore and Cusack Roads. [See id. at 18.](#) Moreover, AT&T's nearest C-RAN—the only carrier-specific coverage variable that could differentiate AT&T's existing localized coverage from that

of T-Mobile and Verizon—is located further from the gap than Verizon’s nearest antenna, suggesting that AT&T’s gap in that area is, if anything, wider. [See id. at 18, 30](#). Therefore, even absent a map of existing coverage directly demonstrating as much, the totality of the evidence in the record suggests that an array at 85 feet would more likely than not leave at least the same approximate gap in AT&T’s wireless coverage along U.S. Route 1A as T-Mobile and Verizon experience.<sup>15</sup>

Vertex has thus established that placing a wireless carrier’s antenna array at or below 85 feet on the Hampton Tower is not a feasible alternative by which any carrier can fully close its coverage gap in the target area. As a result, Vertex is entitled to build the Hampton Tower to a height that places its lowest array no lower than 95 feet.

As explained, however, for Vertex to build the tower to its proposed height—which would have the lowest antenna arrays at 115 feet—Vertex needs to establish that no lower tower as preferred by the Board, [see Doc.](#)

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<sup>15</sup> Notwithstanding the Board’s stipulation that a legally significant gap in coverage generally exists within the target area, at trial, the parties quibbled over its precise outer bounds. I need not resolve that dispute, as this unresolved gap for all three major carriers unquestionably falls within the Board’s narrower characterization. [See Doc. 41-1 at 5](#). Moreover, Vertex’s carrier-specific maps that assume array placement at 145 feet show that this undisputed gap can be at least partially ameliorated by Vertex’s proposed tower and is not an inevitability with any tower height. [See Doc. 22-3 at 7, 22; Doc. 22-4 at 14](#).

[41-1 at 7](#), would rectify all carriers' coverage gaps. Practically, this burden requires Vertex to establish that the lowest height at which an array would remedy a carrier's coverage gap is the proposed tower's minimum array height of 115 feet. Unfortunately for Vertex, however, its evidence falls short of this showing. By only providing carrier-specific propagation maps that model projected coverage at 85 and 145 feet, but no height between, Vertex has only established that an array at 85 feet would not fully rectify any of the three carriers' coverage gaps in the target area, while an array at 145 feet would offer a complete solution.

For its part, Vertex attempted to overcome the shortcomings of its cartographic evidence by eliciting testimony from Hernandez that a taller tower is required because the tree canopy surrounding the Barbour Road site will inevitably grow to obstruct antenna arrays at the next incremental heights above 85 feet. See Doc. 63 at 32-33. But all trees do not grow taller ad infinitum, and Vertex did not establish that Hernandez has the expertise to credibly opine on whether the particular species around the Hampton Tower will do so. Otherwise, Hernandez did not provide an explanation for his ultimate conclusion that "a 150' tower . . . is the minimum height necessary to . . . satisfy the significant gap in coverage" as opposed to a shorter tower, so long as it situates all arrays above 85 feet. See 22-4 at 48. Thus, while I credit Hernandez's opinion to the extent that he supported it with maps disproving

the viability of an array at 85 feet, I do not find persuasive his unsupported contentions about the performance of arrays placed higher than 85 feet.<sup>16</sup>

Accordingly, following the experts' lead in adjusting the starting height for the tower's antenna arrays by ten feet, Vertex has only established that, to feasibly remedy the coverage gap in the target area with a cell tower on the Barbour Road site, the tower's lowest array must be no lower than 95 feet. How much taller than that it may build will be determined by the number of wireless carriers who are reasonably likely to co-locate on the tower, which drives the number of additional arrays required.

**B. Likelihood of Co-Location**

During the trial's second phase, Vertex called Kelleher, the company's principal, to explain how his company selects sites for prospective cell towers and works with carriers to lease space on its towers. He also explained why

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<sup>16</sup> This deficit of evidence lays bare why Vertex would fare no better under the FCC's "material inhibition" standard. The FCC's declaratory ruling did not purport to shift the burden of proof, [see generally 33 FCC Rcd. at 9101-07](#), and the only respect in which my analysis turns on findings adverse to Vertex concerns tower heights for which it has not submitted any non-speculative evidence. Just as it has failed to offer evidence that its preferred minimum height for the tower is the "only feasible" minimum height, it has failed to show how a lower minimum height would "materially inhibit" any carrier's provision of wireless coverage. [See id.](#)

he believes that all three major carriers are reasonably likely to lease space on the Hampton Tower.<sup>17</sup>

1. Vertex's Course of Dealing

As Kelleher explained, Vertex generally selects and pursues sites for new cell towers on a quasi-speculative basis. Guided by data on each carrier's coverage obtained via drive-testing and propagation modeling, Vertex independently scouts areas with poor wireless coverage to identify potential sites for new cell towers that would improve coverage. See Doc. 69 at 18-19. Once Vertex identifies a suitable site, the company shepherds it from concept to completion, handling every phase of development. See id. at 14-17. This work includes, among other things, negotiating a lease with the site's owner; designing the cell tower and appurtenant structures; securing required approvals from government authorities; and constructing the tower itself. See id. Throughout these project phases, Vertex typically proceeds without a firm commitment from any carriers. See id. at 21. Rather, Vertex sites towers in large part based on its own assessments of carriers' unmet needs. See id.

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<sup>17</sup> Vertex originally sought permission to co-locate up to four carriers on the Hampton Tower. During the trial, however, the company did not offer any persuasive evidence at trial that a fourth carrier might lease space on the tower.

Still, Vertex does not usher its cell towers all the way to completion without engaging potential lessees—quite the opposite. Kelleher described an ongoing relationship between Vertex and individual carriers. For example, Kelleher circulates quarterly lists to each carrier of Vertex’s pending and completed towers with available leases. [Id. at 28](#). He also sends these lists to third-party intermediaries, called “site-acquisition firms,” which the carriers retain to identify wireless facilities that will remedy problematic coverage gaps within their networks. [Id. at 51-52](#). Either directly or through these site-acquisition firms, these status reports often trigger informal dialogue between Vertex and carriers about particular tower projects. [See id.](#) As discussions progress, a carrier may express more formal interest in leasing space on a pending cell tower by sending Vertex a non-binding site application. [Id. at 42, 54](#). Vertex will then respond in turn with a draft lease that the carrier can review internally, often followed by several rounds of back-and-forth negotiations before it is finalized. [Id. at 41-42, 55](#). According to Kelleher, Vertex usually has one or two leases in place by the time a tower is completed, but less often before pre-construction permitting is in place. [Id. at 62](#). In his estimation, such early commitments only come about in twenty to thirty percent of tower projects. [Id. at 61](#).

Importantly, Vertex leases space on its towers from the top down on a first come, first serve basis—a practice consistent with industry norms. [See](#)

[Doc. 64 at 51](#); [Doc. 69 at 55-56](#). According to Kelleher, the marginal benefit to a carrier's coverage of leasing a tower's top space for an antenna array as compared to its bottom one is usually nil, as Vertex typically seeks to build towers tall enough so that all of their arrays facilitate comparably strong performance. [See Doc. 69 at 57](#).

## 2. Carrier-Specific Evidence

Taken in turn, the evidence Vertex offered of each carrier's interest in co-locating on the Hampton Tower varies. Vertex's strongest evidence of interest is an application for co-location on the Hampton Tower that it received from a site-acquisition firm on behalf of AT&T. [See Doc. 29-3 at 3-6](#). Kelleher also testified that Vertex designed the height of the tower in light of input from AT&T, tailoring it to the carrier's preferences. [See Doc. 69 at 19-20](#). Since this litigation began, however, AT&T has shelved its interest, pending the case's outcome. [See id. at 28-29](#).

While non-binding, this level of early engagement from AT&T and its co-location application for the Hampton Tower provide particularly strong evidence that, recognizing its coverage gap in the target area, AT&T is reasonably likely to continue to negotiate for space on the tower once this case resolves and the project is fully permitted. To cinch the point, Kelleher further testified that AT&T is typically the most reticent to commit early to a particular tower, [see id. at 43](#), a course of dealing that even more so suggests

that the carrier's submission of this application is a relatively positive read on its future interest.

As for T-Mobile and Verizon, Vertex's evidence requires additional inference to reach the same conclusion, as Vertex does not present direct evidence of either carrier's interest in the Hampton Tower specifically. Instead, Vertex asks me to infer from their expressions of interest in the neighboring North Hampton Tower—specifically, an email to that effect from a site-acquisition firm on behalf of T-Mobile and an application submitted by a site-acquisition firm on behalf of Verizon—that both carriers are reasonably likely to pursue leases on the Hampton Tower as well. See id. at 38-41.

Under the particulars of this case, I find Vertex's reasoning persuasive. In other cases, mere expressions of interest in an adjacent project by a carrier might cut against a tower developer, as it could indicate that the carrier's unmet coverage need will be adequately addressed by the adjacent project. Here, however, the nature of Vertex's "two-site solution" suggests otherwise. As discussed, Vertex contemporaneously chose the Barbour Road and Mill Road sites for new tower projects because the two in tandem would enable carriers to close their gaps in the target area. See id. at 73-75. As made apparent by Hernandez's propagation studies, even after they mount antenna arrays on the North Hampton Tower, significant gaps will remain in T-Mobile's and Verizon's coverage within the target area. See Doc. 22-3 at 33;

[Doc. 22-4 at 25](#). The Hampton Tower thus presents a readily accessible opportunity for those carriers to render a complete fix to their coverage gaps in this part of the Seacoast.

T-Mobile's and Verizon's eventual interest is additionally foretold by the isolated nature of the coverage gap that would remain for both carriers along the Seacoast if they do not co-locate on the Hampton Tower. As each side's propagation studies show, once the North Hampton Tower is online, both carriers will have sufficient coverage immediately south and north of the target area. See [Doc. 22-3 at 33](#); [Doc. 22-4 at 25](#). Thus, by closing the gap between those two regions, T-Mobile and Verizon would create a contiguous corridor of sufficient coverage that corresponds with U.S. Route 1A, a heavily-trafficked travel artery. It would thus be a peculiar decision for either carrier to leave in place an unmitigated coverage gap along that route that diminishes the reliability of its coverage along the corridor overall.

Finally, the strong likelihood of AT&T locating on the Hampton Tower itself also provides reason to believe that T-Mobile and Verizon will follow suit. Kelleher testified, and the Board did not meaningfully dispute, a fact about the wireless industry with which we are all familiar: carriers compete on strength and scope of their coverage. As anyone who has seen advertising by one of these carriers can attest, they often boast of which has coverage of sufficient quality across the broadest geographic range. Following this axis of

competition is an incentive for each carrier to replicate the others' coverage where possible. [See Doc. 69 at 45](#). Thus, here, with AT&T likely to close its coverage gap in the target area via the Hampton Tower, T-Mobile and Verizon will have a competitive incentive to do the same or else risk losing customers who frequent that area to AT&T.

I thus conclude that Vertex has established a reasonable likelihood that all three major carriers will eventually co-locate on the Hampton Tower. Again accepting the parties' stipulation that ten feet is required between each antenna array, [Doc. 64 at 29-30](#), adding room for two additional carriers means adding twenty feet to the minimum height of the tower established above. This places the second array at 105 feet and the third at 115 feet. With the five additional feet required for the public safety antenna, Vertex is entitled to build a 120-foot tower on the Barbour Road site.

#### **IV. CONCLUSION**

Per the foregoing, I grant Vertex's requested relief on Count II, [see Doc. 6 at 23-25](#), to the extent that the Board is ordered to afford the zoning variances necessary to permit Vertex to construct a 120-foot cell tower on the proposed site at 17R Barbour Road. Vertex has established that it is entitled to construct a cell tower at that height and location to avoid the effective prohibition of wireless coverage in the target area in violation of 47 U.S.C.

§ 332(c)(7)(B)(i)(II). The clerk shall enter judgment accordingly and close the case.

SO ORDERED.

/s/ Paul J. Barbadoro  
Paul J. Barbadoro  
United States District Judge

February 23, 2026

cc: Counsel of Record