WILLIAM P. JOHNSON
RF ENGINEERING CONSULTANT
P.O. BOX 20263 ROCHESTER, NEW YORK 14602

August 18, 2021

Mr. Derek Severson, Senior Planner
City of Ashland, Department of Community Development
51 Winburn Way
Ashland OR 97520-2735

RE: Telecommunications Facility RF Site Review
351 Walker Ave, Ashland, OR 97520
GPS Coordinates: 42.188528/ -122.690097
Map Tax Lot: 391E10CD100

Dear Mr. Severson,

This preliminary report discusses the radio-frequency (RF) aspects of the proposed SmartLink / New Cingular Wireless (AT&T) (Applicant) project in the City of Ashland, OR. Subsequent reports, if needed, will address any remaining questions or issues that arise during public hearings at the request of the city. Appendix A is attached to this report as a summary of professional qualifications to render opinions regarding the application. Additional background information related to technical matters is included in Appendix B and following.

The following materials form the basis for this report:

1. Walker_351_PA-T1-2021-00158_Applicant's Submittal
2. 2021-ODA-S-568-OE Determination Letter_MF22 Southern Oregon University

Summary of Findings

1. While reviewing the permit application materials, three apparent discrepancies relating to the RF details were noted – namely the use of an assumed side-lobe level for Maximum Permissible Exposure (MPE) calculation purposes, lack of detail to support the use of the Effective Radiated Power used in the MPE calculations, and an outdated chart titled "Serving Sector Capacity – December 2018 to December 2019" within the RF justification section. These are likely not critical to municipal review, but we recommend that Applicant clarify, correct or supplement the record to assure the information is correct and complete. These are detailed later in this report.
2. The RF coverage levels upon which the proposed site is designed are reasonable values, but are taken at face value since no RF link budget information to support those levels is included in the application materials. The RF levels for RSRP (LTE

Reference Signal Received Power) and SINR (Signal and Interference Plus Noise Ratio) are consistent with those used by AT&T and other service providers in sites located in similar areas with in-building and in-vehicle service objectives, as is the case here.

3. Assuming the validity of the RF coverage thresholds for in-building and in-vehicle coverage, applicant has demonstrated need for RF coverage from a base station facility in the general area of the proposed project site to remediate "exhaustion" (over-utilization of neighbor sites) that leads to inadequate service. The proposed site will draw off traffic from existing sites during busy times and as wireless service demands increase. We note that the utilization data to support Applicant's claim is arguably outdated since it does not show the current situation other than with a "trend line" showing neighbor site exhaustion. See Applicant's RF narrative section. We recommend Applicant provide current data and trend lines for the neighbor sites.

4. The proposed height appears reasonable for a site situated as proposed, and as one would expect a height reduction tends to decrease RF coverage. However, Applicant's argument against a height reduction of 10' (to 85' antenna tip) is unsupported other than by a percent change in service in an undefined area since the specific "target area" is undefined for the purpose of comparing a 4% change in coverage. On this note, one should keep in mind that lowering the antennas would serve to bring the RF emissions closer to the ground. While the change will not be significant for FCC human exposure threshold purposes, this matter may be of concern to residents. If height reduction is desired, we recommend the city minimize the decision-making value of the percent change in coverage or request Applicant to supplement their materials to objectively state the specific details and assumptions, including a clear definition of the "target area" in less general terms, and how their height reduction analysis was achieved so as to allow independent evaluation by the city.

5. After review of the alternate sites presented by Applicant, we agree with Applicant that, of the alternate sites considered in their analysis, the proposed site is the only technically viable alternative. If the city is aware of other nearby sites where the antennas can be raised to approximately 95', we recommend these sites should be identified and Applicant should analyze them.

6. The proposed site is tower-mounted with antennas more than 10 m above ground. Therefore, we agree with Applicant that the site is categorically excluded under FCC regulations from mandatory human exposure analysis, as stated in the NIER analysis report in Applicant's materials. However, since the NIER report is included in the materials, we recommend supplementing or correcting the information as noted below.

7. Although the proposed site is categorically excluded from mandatory human exposure analysis, Applicant has provided an analysis that concludes the site is operating within general population exposure limits. Certain stated assumptions for this analysis do not comport with the antenna specification sheet. In addition, the use of 20,000 Watts ERP (32,800 Watts EIRP) lacks supporting detail. It is

unlikely that the discrepancies or omission of detail will change the conclusion that the site complies with FCC human exposure thresholds.

8. If the proposed site is ultimately approved it, like the existing neighbor sites currently in operation, will serve as a fixed area of coverage to which future neighbor sites must connect.
9. Wireless networks consist of individual cells that function as a whole. Approval of any one particular site should consider the future need for additional neighbor sites and the locations of those sites. A new tower in a more controversial area may be required to address the remaining coverage gaps, extend the coverage area, off-load traffic from future saturated sectors, and properly connect the proposed site into the larger network.
10. The proposed RF site will provide capacity relief to adjacent neighbor base station sites by providing a strong local signal to which nearby wireless devices can connect rather than drawing capacity from the limited 700 MHz spectrum of those neighbor sites. One anticipates continuing growth of wireless devices that will place additional demands on the proposed and neighbor sites. Those increasing demands imply the possibility that Applicant may decide to address those areas as part of their overall wireless network. At this time, the city should understand the potential need to serve Applicant's increasing service demands and how approval of the proposed site will influence the placement and height of future sites within its jurisdiction.

The information in this report concerns the RF engineering issues related to the proposed project to assist the city in weighing the alternatives and planning for the future of the community. Engineering design choices may also implicate aesthetic and legal issues. However, this report must not be relied upon for any legal advice or direction. Legal advice about action on these issues must be obtained from the city's counsel. The remainder of this report addresses the details that support the findings.

Site Details

Applicant proposes an extension/rebuild of a light stanchion at the Southern Oregon University athletic field at 351 Walker Avenue. The extension/rebuild will place Applicant's antennas at a tip-height of 95 feet (CellMax antenna 12032x is 72.4" or 6.03' high placing the Antenna Centerline, ACL, at 92' above ground elevation). The NIER analysis information shows a configuration that will include radio-frequency bands "LTE 700, LTE 1900, LTE AWS & 5G 850." The AWS band is 1695 to 2200 MHz, and Applicant will use a portion of this band. Applicant states use of "5G", it is in the 850 MHz band. The 5G millimeter-wavelength bands are not currently proposed at this site.

Site Justification

Subject to confirmation by the city's legal counsel and given the differences in local zoning law, area variances, special use permits and use variances for a proposed telecommunication facility are normally based upon an applicant showing essentially that

(1) its new construction is a public necessity, and (2) there are compelling reasons which make it more feasible to build a new facility than to use an alternative site. RF coverage gaps and user capacity limitations both affect delivery of adequate wireless service. Area-wide RF coverage gaps and existing site capacity exhaustion tend to show necessity. Feasibility generally relates to whether the proposed facility addresses the coverage and/or capacity needs, avoids unacceptable performance degradation, and avoids unreasonable community aesthetic impact. Considering the need to provide wireless service and the impact on the community, the proposed site should represent the most balanced and reasonable solution among all alternatives. Determination of reasonableness might also involve an analysis of whether a proposed site creates unacceptable precedents for or constraints upon the locations of other future sites in the area needed to provide additional area coverage where Applicant's future build-out plans are apparent. Additional considerations that weigh into the reasonableness of a site, for example, might include whether the proposed structure can be disguised as a "stealth" site, can accommodate additional antenna arrays, or has potential limitations for effective co-location at heights lower than that proposed by Applicant.

Telecommunication facilities fall into one of two categories based upon the status of the service provider's technology. The status must be determined by the municipality's legal counsel. Some facilities are deemed to be covered by the Telecommunications Act of 1996, 47 USC §332(c)(7), which limits some aspects of local zoning authority. Other facilities are deemed not included or their status is unclear because of the nature of the service provider's technology or lack of precedential decisions at the FCC or within the courts. Determination of the actual status of any particular applicant requires advice from the city's legal counsel and is beyond the scope of this report. This report will proceed on the assumption that 47 USC §332(c)(7) and related local zoning limitations apply and will, therefore, focus upon the areas of review permitted under those limitations. A subsequent contrary determination by the municipality will affect the application of the law to the facts and engineering opinions presented in this report, and such determination may open other areas of inquiry.

Subject to confirmation by the city's legal counsel, the federal Telecommunications Act of 1996 (Act) in 47 USC §332(c)(7) limits certain aspects of local zoning authority regarding wireless telecommunication services providers. Beyond the few explicit limitations, "…nothing [else] in this Act shall limit or affect the authority of a State or local government or instrumentality thereof over decisions regarding the placement, construction, and modification of personal wireless service facilities."[1] The main limitations imposed by the Act require that local regulation of "the placement, construction, and modification of personal wireless service facilities . . . (I) shall not unreasonably discriminate among providers of functionally equivalent services; and (II) shall not prohibit or have the effect of prohibiting the provision of personal wireless services."[2] The Act also states that "[n]o State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such

[1] 47 U.S.C. §332(c)(7)(A).
[2] 47 U.S.C. §332(c)(7)(B)(i).

facilities comply with the Commission's regulations concerning such emissions."[3] Otherwise, the Act leaves substantial and familiar local zoning authority in place balanced by the familiar conditions that local zoning decisions must be timely, based upon substantial evidence, and documented for potential judicial review.[4]

Public Necessity

Wireless service providers, such as Applicant, establish the radio-frequency (RF) coverage level and user capacity margin necessary for what they each unilaterally define as reliable service consistent with their business model. The business model involves a trade-off between the quality of service experienced by a subscriber and the cost of network deployment and operation. Several factors determine the level of subscriber service. Two important factors for base station site selection are the wireless RF signal level, the system capacity to support multiple users, and the potential interference from their own neighbor sites due to inappropriately close base station sites. The choices of site location, RF coverage, and system capacity directly affect service reliability.

Applicant's mobile wireless subscribers are often located inside buildings or vehicles that are screened by foliage from direct view of a base station. Foliage, buildings and vehicles are obstacles to radio wave penetration. In order to provide reliable service, the wireless RF signal must travel over the terrain in the coverage area, penetrate obstacles that block a direct path to the subscriber, and then arrive with sufficient signal level to achieve the desired level of service. Wireless telecommunication systems must operate simultaneously in both directions between the base station facility and the subscriber's mobile equipment. Therefore, the return signal from the subscriber's mobile or stationary equipment must also overcome the signal losses due to terrain and other obstacles. Generally, when a high level of service reliability or high user capacity are needed, network base stations must be placed closer together to provide both high RF signal levels and increased network user capacity over a smaller area. In less populated areas where user capacity is not as much an issue, the base stations can be spaced at greater distances where the separation is generally limited by path loss caused by terrain features, buildings, and other obstacles. For RF coverage considerations from a particular base station, the wireless service provider's choice of minimum RF signal level limits the extent of cell coverage. If the RF signal level requirement is high, then the acceptable coverage area is generally small. When a service provider adopts lower but acceptable reliability and uses a lower RF signal threshold for their network design, a single base station will cover more area at the reduced level.

Design engineers for wireless service providers use an RF link budget to quantify the RF signal level required for "safe and adequate" wireless network operation. The RF link budget ultimately establishes the maximum permitted path loss from base station to mobile. The RF link budget includes all relevant system design assumptions, including measures of dropped connections related to signal strength and ultimately quantifies maximum permissible path loss. Path loss, or signal attenuation during propagation, is the

[3] 47 U.S.C. §332(c)(7)(B)(iv).

[4] While not binding outside the jurisdiction of 2nd Circuit, this balance is discussed at length in *Sprint v Willoth* 176 F.3d 630 (2nd Cir 1999) and may be useful to counsel when advising the city.

reduction in RF signal as it travels from the base station to the subscriber's mobile device and, likewise, from the mobile device back to the base station. If the path loss is too high, then the received signal will be below the established minimum RF signal level threshold. When the received signal is below threshold, unreliable operation (i.e. dropped connections or reduced data transmission speed) may result.

After establishing the minimum RF signal threshold level the design engineer can analyze the area RF coverage path loss encountered from a proposed base station. The path loss analysis predicts the actual coverage area. Applicant here uses -85 dBm[5] RSRP in the as the minimum signal level for adequate service. As noted in the RF narrative, a weaker signal when noise and interference are also at lower levels may allow adequate service. However, interference from simultaneous users of Applicant's system and competitor wireless devices is only statistically possible and may, at times, exceed the more ideal conditions that would allow a weaker signal to provide more reliable service. Therefore, RF engineers design for a reasonable level of interference to assure a higher probability of adequate service. We will note at this point that an argument is often raised by opponents of new base station facilities that they have experienced good service in the area. On this point, we note that the metrics provided by Applicant, although out-dated to some degree, show that there are times when existing sites are not able to provide such service. The individual user may, due to location, time of day, and proximity to a base station experience good service most if not all of the time. However, there are locations shown in the RF propagation plot maps where poor service is predicted and especially so at times when many subscribers are trying to use their devices. The purpose of the currently-proposed facility is to assure reasonable service levels even when subscribers are not in the most ideal of locations. We will now discuss those maps.

Wireless system engineers use an RF propagation plot that is generated by computer modeling for area coverage analysis and prediction. An RF propagation plot shows predicted area signal power levels with respect to the minimum signal threshold for site performance analysis in units of dBm. Visually, an RF propagation plot maps the area surrounding a proposed base station using various colors to represent locations where the RF coverage levels meet or exceed the minimum RF signal levels as stated in dBm. By the absence of color, an RF propagation plot will also show locations where the base station cannot provide the minimum signal levels. These areas (called coverage "gaps") are a graphic indication of whether a particular site achieves RF design coverage levels for the given location and height. A gap could be only slightly below threshold or it might represent a deep lack of coverage. A designer usually anticipates slight gaps surrounding a cell because of difficult area terrain and clutter. When gaps are deep and located along critical roadways or near relatively high population areas, one can anticipate unreliable wireless service. A particular site may fail as a suitable location because of such unfilled gap areas.

[5] The unit "dBm" is decibels above 1 milliwatt and is calculated from the power level (in watts) as dBm=10Log(power/0.001). One milliwatt is 0.001 Watts. Negative values represent power levels that are less than 1 mW. Less negative values in dBm represent stronger signal levels (e.g. -7dBm is a stronger signal than -8dBm).

In support of the application, Applicant has provided a series of RF propagation plots that show existing RF coverage and how the proposed site fills the coverage need relative to provision of wireless service to their subscribers. The "existing" coverage plots show that there are locations in the vicinity of the proposed site where the RF signal level is below useable levels to reliably penetrate buildings and vehicles. In addition to penetration, additional documentation in Applicant's materials show the trend toward neighbor site exhaustion which, when it occurs, would have the same effect on users or, at least, a diminished data rate that would cause a poor user experience if not dropped voice calls.

The presence of RF coverage gaps predicted by the RF propagation plot for existing coverage and, when applicable, the actual and predicted trends toward maximum capacity tend to demonstrate need. Whether these gaps can be addressed by the proposed site or a less intrusive alternate site when balanced between the technical performance and aesthetic advantages serves to justify the proposed site.

Feasibility - Addressing the Need and Balancing of Impact

A service provider makes decisions to provide wireless RF coverage based on the location and travel habits of their subscriber base. Base stations are limited to coverage in areas surrounding the site since they must be able to communicate with the low-power wireless subscriber device. Design of wireless mobile devices include requirements for minimal output power to reduce likelihood of a user being exposed to excessive radio-frequency signal levels. Therefore, to achieve maximum effect, a base station facility generally should be placed near the center of the target coverage area when zoning, land use, and aesthetic considerations allow. After the location of a proposed base station is established, the terrain features and other "scatter" obstacles of the target area must be analyzed to determine how effectively the base station can cover the target area. In addition to area coverage, wireless service providers attempt to position their base station sites to achieve continuous coverage from one cell to the next with few intervening coverage gaps. Even if the area of the proposed project is relatively flat, it may still contain foliage and obstacles that can produce shadowing and absorption of the RF radio waves. Shadowing and scatter cause the jagged pattern shown on the RF propagation prediction plots. RF coverage becomes more uncertain at lower antenna heights because local obstacles in the area through which the signal must propagate are not individually modeled in the computer simulation.

The significance of visual impact from the tower and antennas and the significance of that impact to nearby residents and visitors are appropriate matters for the city's boards and commissions to consider. The city may also wish to consider the prospects for possible future co-location on the proposed site. While considering the local impact, consider that any nearby alternate site location would require at least the same antenna height because the proposed site is nearly central to the existing gap area. Generally, base stations at the center of a coverage gap area result in the shortest antenna height requirement. The proposed site is nearly central to the neighbor sites and would therefore likely be the lowest height, when so established, needed to provide reliable service. When a base station must

cover a gap from a non-central location, the height must usually increase to overcome obstacle, building, and terrain shadowing to provide comparable levels of RF coverage and maintain adequate connectivity to the adjacent neighbor cells. In the alternative, area coverage might be achieved from a non-central location by multiple shorter sites. Use of multiple sites increases the cost to cover the target area and presents multiple visual impacts which may or may not be significant.

Reasonableness of the Proposed Project

Approval of a base station facility usually requires review for use and area variances and/or site plan approval that considers similar concerns common to use and area variances. The review is governed by standards applicable to an applicant's status as a utility, broadcaster, telecommunication services provider or other category. Municipal decisions must not be arbitrary or capricious. Therefore an applicant should provide objective evidence of their need and, when weighing alternatives, objective evidence regarding the strengths and weaknesses of the alternative sites. The municipality then weighs that evidence to determine whether the site is reasonable and properly balances the interests of the community and the applicant.

Where an applicant is also classified as a public utility, a less restrictive standard for area and use variances may apply. Subject to confirmation by the city's legal counsel, a provider of wireless telecommunication services like Applicant is often considered a public utility. As a public utility, there may also be legal constraints on the whether a municipality can impose restrictions on Applicant that unreasonably increase project costs. Unreasonable costs may accrue when mandated co-location or use of sub-optimum sites causes the need for additional base stations to fill the existing coverage gap. Under some limited circumstances the need for multiple sites may also increases technical complexity beyond what might be considered reasonable. If the city determines that the proposed site as proposed cannot be approved, the alternatives for Applicant would include options that could increase network costs or decrease potential coverage area. These options include:

(1) modification of the proposed site to conform to zoning and visual impact requirements,
(2) identification of nearby sites that collectively meet both the RF coverage objectives and zoning and/or aesthetic requirements,
(3) construction of an alternate site that meets aesthetic and zoning requirements and provides some coverage even if it does not completely provide coverage to the gap area, or
(4) abandonment of the project.

The range of options is not particularly limited by the technology and engineering issues. However, the choice of a specific option could implicate the previously mentioned legal and land control issues. The legal implications are beyond the scope of the present report and, if necessary, should be discussed with the city's counsel. If one or more of these options are deemed viable by the city, a more focused analysis on the specific option(s) can be provided in a supplemental report.

Applicant has proposed co-location/replacement/modification of an existing light stanchion at the SOU athletic field. A set of other alternative sites were analyzed by Applicant. Applicant tabulated the results of said analysis in the RF narrative section of the materials. Most sites are buildings that are too short to service the area or are location too distant from the area where a strong base station signal will draw traffic from neighbor sites. After review of the alternate sites, we agree with Applicant that the proposed site is the only technically viable alternative. If the city is aware of other nearby sites where the antennas can be raised to approximately 95', these should be identified and Applicant should analyze them.

The proposed site plan and zoning analysis, if applicable, for any particular site usually considers the nature of the proposed site in the context of the surrounding area and the nature of other alternate sites that can provide adequate, even if not identical, RF coverage. The analysis also balances the impact of a new facility with the benefits derived from with availability of wireless services. The characteristics of the area in which the site is proposed, the proximity and visibility of the site to nearby residences, and accessibility of the site generally weigh into the analysis. In some circumstances, other considerations may include whether a particular site exceeds Federal Communications Commission (FCC) human exposure limits and whether it is necessary to illuminate the tower for aircraft safety even if not required by Federal Aviation Administration (FAA) requirements. In the present case, Applicant has provided an FAA determination that indicates there is no FAA concern for air navigation (see the list of reviewed materials at the top of this report).

Sometimes the objectionable aesthetics of a tower can be partially mitigated by use of stealth structures to blend into the area. The current proposal is added to an existing light pole. Stealth structures tend to limit the co-location opportunities for future wireless service providers because the structures are usually customized for reduction of aesthetic impact. Generally, the design of stealth structures attempts to minimize height and cross-section. Minimization of height and cross section usually limits RF coverage and reduces the mechanical load-bearing ability of the structure compared to other support technologies such as a monopole or lattice tower. The reduced cross-section limits the ability to host additional antenna arrays within the structure's envelope. However, where a stealth structure is appropriate to achieve the desired aesthetic goals, the trade-off between future co-location and acceptable appearance may be appropriate – and may be the case at the SOU proposed site.

Additional Considerations

FAA Marking and Lighting

The applicant is proposing a tower that <u>does not</u> exceed 200' and, therefore, FAA marking and lighting requirements <u>do not apply</u> this location. 47 U.S.C. § 303(q), 47 C.F.R §17.21. Generally, all towers in excess of 200' require FAA marking and lighting. Under certain circumstances such as proximity to airports or other critical facilities, towers below 200' may also require marking and lighting. The FAA determination provided by Applicant shows there is no such requirements for this site.

Informational Discrepancies for Applicant Resolution

1. NIER sidelobe discrepancy. Depending on the band in question, the NIER report uses a blanket 20 dB sidelobe reduction assumption. However, according to the specification sheet, the antenna sidelobe suppression could be as much as 7 dB <u>less</u> than stated.
    a. CMA-UBTLBHH/6516/21/21 spec sheet shows
        i. "First upper Sidelobe Suppression" which, we assume, is the first major sidelobe below horizon by band is:
            1. 698-896: >16 dB
            2. 880-960: >16 dB
            3. 1710-1880: 17 dB
            4. 1850-1990: 17 dB
            5. 1920-2170: 16 dB
            6. 2490-2690: 13 dB
        ii. "First Null Below Horizon" specifications, are not the necessarily the peak sidelobe reduction for purposes of computing a worst-case NIER analysis.
            1. 698-896: N/A dB
            2. 880-960: N/A dB
            3. 1710-1880: -24 dB
            4. 1850-1990: -21 dB
            5. 1920-2170: -20 dB
            6. 2490-2690: -16 dB
    b. As of the date of this report, we have not received the antenna pattern data requested from CellMax to allow comparison to the NIER report assumption of the assumed 20 dB sidelobe reduction, therefore we resort to use of the antenna specification sheet for the value.
2. NIER report uses the conservative FCC Bulletin 65 worst-case formula equation (6) that assumes a possible doubling of field strength (on which power density in the far-field is based) that results in a 6 dB (factor of 4x) increase in power density.
3. Taking into account the corrected "low band" first sidelobe of minimum 16 dB reduction from the antenna specification sheet, and using equation FCC Bulletin 65 equation (6), we calculate 8.484% of MPE compared to Applicant's value of 3.396% – still well within threshold requirements.
4. Use of 20,000 Watts ERP is not supported with details of RF power into antenna by operating band. Parseval's Theorem allows computation of total exposure by summing the unique-frequency contributions to a target on the ground (for General Population exposure). Lacking the actual values, it appears Applicant is using an estimated maximum value of 20,000 Watts ERP (32,800 Watts EIRP).
5. CellMax antenna pattern data is not available at this time to allow computation of worst-case location and exposure level at ground level.
6. Capacity chart in the RF narrative that shows "exhaustion" of neighbor site resources is outdated and should be updated with more current information.

Future Co-location

Many municipalities specify that, as a condition of approval, a tower must be designed to accommodate several additional wireless service providers. Generally a wireless service provider designs a cell for an antenna centerline that provides the required coverage but is not so high as to cause interference and excessive overlap to their own adjacent neighbor cells. Since each service provider builds their network to achieve their own reliability and service design requirements, the coverage maps for two wireless service providers can be remarkably different even for those operating in the same frequency band. Future build-out plans are closely guarded secrets based on proprietary customer demographics and technology deployment, so it is usually challenging to know what a given service provider will require in the years ahead and how those requirements will translate to co-location opportunities. Given the uncertainties, there are two views on the matter of co-location each having advantages and disadvantages.

First, some municipalities take the position that it is better to concentrate the co-locations at one site rather than conduct hearings for multiple shorter towers. Under this approach, the current tenant and each future service provider with an area coverage gap will ideally locate on the proposed tower. If co-location is agreeable to a service provider, it will force an approximately similar coverage grid to that of the existing carriers. In some cases the similar grid pattern can increase the likelihood that future neighbor tower sites will be required in a location that may be more controversial or in places where it may be undesirable to stack multiple service providers on the same tower. The concentration of a large number of service providers on the same tower can result in a visual impact that far exceeds that of the original tower as proposed even if the height remains unchanged.

Second, some municipalities prefer multiple shorter towers since the lower height may make them more easily buffered by surroundings and/or facilitate stealth structures. Stealth structures include structures designed to look like clock towers, church steeples, building facades, or trees. Stealth tree structures are generally effective when antenna centerline and tower height are within 15' of the existing tree canopy, so this generally precludes future co-location without additional height. When the tower height dramatically exceeds the existing tree canopy the advantages of a stealth tree are arguably diminished. Stealth structures are generally more expensive to implement and exhibit some structural limitations for future co-locations. An additional advantage to the multiple-shorter-site approach using more traditional tower structures is that it does provide co-location for capacity expansion when multiple shorter towers are already in place. As more wireless subscribers join the network, the need increases for smaller cells where each cell can handle approximately the same number of calls and will then relieve the burden of the additional subscribers on existing cells. This affect will be more likely in suburban or urban settings, but may occur in rural installations where population is concentrated in a specific sector and demand starts to reach capacity.

There are many variables that affect successful co-location. There is no guarantee that any future service provider will be interested in co-location at a specific site since their RF coverage requirements may be remarkably different than the service provider that proposed the tower in the first place. Given the advantages and disadvantages, some municipalities handle it with a compromise solution.

A compromise between multiple short towers and consolidation of service providers on a single tower is to build a proposed tower to the minimum required height as currently required but design the tower foundation and the lower superstructure to accommodate a future height increase if so justified by a future co-location application. Increases in height can generally be in 20' increments on a tower designed for expansion. Future expansion in height, unlike the mere addition of antennas to an existing tower, is arguably a *substantial change* and, if so, would likely fall outside of the Middle Class Tax Relief and Jobs Creation Act of 2012 (PL 112-96, February 22, 2012, 126 Stat 156) which includes Sec. 6409: Wireless facilities deployment. That law limits municipal review of an *eligible facility request* under specific circumstances. This matter and the implications for future site review of a tower designed for expansion should be discussed in more detail with counsel if or when needed.

Non-Ionizing Electromagnetic Radiation (NIER) Exposure Compliance

Wireless facilities like the one proposed by the applicant are generally found to comply with FCC Office of Engineering and Technology (OET) Bulletin 65, codified at 47 CFR 1.1307 and 1.1310. Bulletin 65 sets maximum permissible human exposure levels for Non-Ionizing Electromagnetic Radiation (NIER). When transmission antennas are installed in or near accessible or occupied areas of a building, it raises concern regarding occupants of the building and maintenance personnel who may need to access the rooftop. Thresholds for subjecting a wireless transmission facility to a more thorough emission analysis have been established by the FCC. These thresholds and the techniques for NIER evaluation are discussed in the Federal Communication Commission Office of Engineering and Technology Bulletin 65 (FCC OET Bulletin 65)[6]. Table 2[7] in FCC OET Bulletin 65 excludes

- *building-mounted* cellular sites ("cellular" sites are those described in 47 CFR 22 Subpart H) where the power transmitted from all channels is less than 1000 W ERP (1640 W EIRP) and
- *tower-mounted* sites that are more than 10m (32.8') from ground and, if not, where the power transmitted from all channels is less than 1000 W ERP (1640 W EIRP).

While technically not an issue for this application (since the proposed antenna height exceeds the height for mandatory analysis of tower-mounted antennas and therefore health effects are not to be considered when a proposed site will operate within FCC limits) Appendix B provides a summary and some additional background information regarding NIER.

[6] See http://ftp.fcc.gov/oet/info/documents/bulletins/
[7] FCC OET Bulletin 65, p69.

Aesthetic Segmentation

Like the more familiar subdivision and phased housing development project, an RF wireless network functions as a whole. In order to avoid inadvertent incremental impact segmentation, it may be appropriate that the design for Applicant's future neighbor sites required to address remaining RF coverage gaps and capacity needs within the jurisdiction be considered during the current site plan review. The lack of coverage that will exist after the proposed site is operational may indicate a need for future facilities in those areas to improve or expand Applicant's wireless network coverage in the area. It is recommended that Applicant discuss the entire proposed network build-out in the jurisdiction since approval of any single site, such as the proposed facility, creates a fixed area of RF coverage to which other neighbor sites must connect. Additional sites in the area may need to be located in other zoning-controversial locations in order for the applicant to properly meet their coverage objectives and connect to the currently proposed and existing sites. In the worst case, approval of the proposed site could force one or more future neighbor sites to require a tower in an area where such a structure may be even more controversial than the proposed location.

The overall area coverage map shows the existing network neighbor sites and can be used by the city to identify coverage gap locations where controversial zoning may be required for future sites. While Applicant is currently in municipal review, the city may choose to ask Applicant to estimate the height and location of structures needed to fill the remaining gaps and supplementation of capacity needs within and near the city's jurisdictional boundaries. This information could then assist the city in planning efforts and allow evaluation of whether the presently proposed site will later unduly restrict municipal planning goals or otherwise conflict with the comprehensive plan.

Distributed Antenna Systems and Micro Cells

The city may already be aware of other approaches to deliver wireless communications that could avoid tall towers in a given area. For example, on one extreme certain cellular-type systems can be implemented using low-Earth orbit satellites. On the other extreme, very small pico-cell systems can allow subscribers to connect to their own home or office network using technology similar to a cordless phone. Each approach has its advantages and disadvantages. One such system that fits between satellite systems and pico-cells is called a Distributed Antenna System (DAS). Another approach, similar to a DAS, is a micro-cell that implements functions of a regular base station in a localized are. DAS and micro-cell systems, including transport sites, are presented here for completeness because this issue can arise in zoning hearings for new towers.

Distributed Antenna Systems (DAS)

DAS systems are designed and deployed by companies such as NextG Networks[8], ExteNet Systems[9], and others who install and then lease use of the DAS to wireless service providers. Essentially a DAS involves an array of antennas mounted on existing telephone poles or shorter towers/structures that are otherwise unsuitable for a base station facility. The antennas and associated transceivers, sometimes called "nodes", are interconnected by fiber optic links. The cellular/PCS signals are converted at each node to optical signals which can then be routed to a hub site and converted back into the signals useable by a specific service provider.

Some wireless service providers use DAS technology to service tunnels, airport terminals and dense buildings where either signal penetration limitations or lack of ability to construct a tower would stop wireless services. When above-ground utilities exist in an area, a DAS may have the distinct advantage of allowing wireless services from short sites that would tend to alleviate certain aspects of aesthetic concern over tall towers. Unfortunately, the multiplicity of antenna sites, the interconnection of the nodes and the lack of contingency power tend to limit their practical use to very dense areas or areas that are not serviceable by other means. Examples of DAS limitations include:

- need for numerous closely-spaced above-ground utility poles or light stanchions in the service area
- potential lack of of E-911 location technology to allow emergency responders to know a more precise location of an outdoor emergency call (an in-building DAS would not present such a problem since it is localized to the building in question),
- the regulatory constraints and deployment/operating costs to negotiate outdoor pole attachments and ground equipment locations,
- the potential fragility of the fiber optic inter-node links that are usually more extensive and more exposed to falling trees or ice as in a conventional wireless base station topology, and
- lack of reliable/durable/cost-effective remote power at each node.

These limitations present significant potential reductions in performance and reliability that should be carefully weighed. Further, since the systems are sometimes deployed and operated by a third party the cost to use the system may be excessive. The limitations are real, but in situations where it is not feasible to approve a tower that provides the necessary RF coverage Applicant seeks, a DAS to supplement their network or one that replaces the proposed tower is a possible approach. If necessary, the city's prerogative in this matter should be thoroughly discussed with the city's counsel because it is subject to all the legal limitations associated with the Telecommunications Act and Applicant's legal standing as a public utility in New York.

For an example of where a DAS is currently operational and where new nodes are being installed, Lower Merion Twp in Pennsylvania has a twelve-node operational

[8] See http://www.nextgnetworks.net/
[9] See http://www.extenetsystems.com/

DAS.[10] The system is reported to be operational and, in the spring of 2009, there were zoning proposals before the municipality to increase the number of nodes in the system. Please refer to the township web site for the most up-to-date information. As of September, 2009, the City of Mount Vernon planning board had a joint application from ExteNet, a DAS system provider, and Metro PCS, a wireless service provider, for a special use permit for the installation of a DAS consisting of fiber optic cable and telecommunications equipment placed on utility pole structures located within the corridor of the public right of way throughout the city. Previously, the City of Yonkers granted pole attachment rights to ExteNet within that jurisdiction. A July 15, 2009 article that briefly discusses the use of the ExteNet DAS by MetroPCS is available online[11]. A more detailed news report dated March 31, 2009, is available from Reuters at their web site[12].

Micro-cells and Transport Sites

Micro-cells provide the functionality of a regular base station in a localized area. Depending on the deployment, the micro-cell communicates through a fiber optic or radio link backhaul, similar to a base station. Power backup and the reliability of fiber optic cable run between antennas above ground are similar to the issues described in the DAS system discussion. Micro-cells are particularly useful in applications where user demand is limited to a small area such as a shopping or business area where mobile users are concentrated. Micro-cells can also be used in more densely populated areas where a tower base station is impractical due to zoning constraints. The micro-cells can be mounted on existing above-ground utility poles or on buildings in the area. These sites use self-contained electronics and antennas that communicate with a transport site. The transport site can be an existing tower site, a tall structure, or a new tower either central to or within range of the micro-cells. A transport site will typically be in the range of 70' to 120'. The use of micro-cell "cantennas" provide localized service and avoid a tall tower central to the coverage area The transport site, a tall tower, can be located off-center from the coverage area to collect the traffic from the local micro-cell. The combination of the micro-cells and one or more transport sites potentially replace the use a tall tower in the center of the coverage or capacity gap area. A discussion of one municipality and their reaction to the use of micro cells can be found online.[13]

Both micro-cells and DAS installations have become more important in recent years as wireless service providers struggle to bring increased use capacity and bandwidth to their subscribers. This push has placed municipal boards and planning staff in the difficult position of determining how to handle zoning applications for these systems. Transport sites (75' – 120' or more) are sometimes proposed in right-of-way areas adjacent to roadways and pedestrian walkways where the potential for ice shedding can be a public safety issue. Beyond the obvious aesthetic and issues related to fall zones and proximity to vehicles and pedestrians, municipalities are still trying to develop a

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[10] See http://www.lowermerion.org/index.aspx?recordid=558&page=50 or search the base URL for "DAS" and "NextG" for multiple documents, including the January 22, 2009, press release.
[11] See http://www.govtech.com/gt/articles/702090 (available as of September 7, 2009)
[12] See http://www.reuters.com/article/pressRelease/idUS254010+31-Mar-2009+BW20090331
[13] See http://buffalonews.com/2017/04/22/towns-confronted-ever-shrinking-cell-antennas/

process to represent the financial impact incurred by use of municipal infrastructure (light poles, traffic light support poles, etc.) due to the installation of equipment on these structures that increase wind loading and can affect the galvanizing on steel poles that potentially will decrease the service life of the structure. On the positive side, the use of micro-cells can avoid the challenges of zoning a tall tower in areas where aesthetics of the tower can be deferred to the aesthetics of the numerous micro-cell DAS antennas throughout the area.

FCC Declaratory Ruling – Small Cell Deployment

The wireless personal communications regulatory landscape has changed dramatically since the 1980s. Recently, in response to industry concerns about the time it can take to gain approval for micro-cell, DAS, or more traditional macro-cell sites with the familiar tall tower, on September 27, 2018, the Federal Communication Commission (FCC) issued Declaratory Ruling, Report and Order FCC 18-133 that "removes barriers to wireless infrastructure deployment by clarifying scope of Sections 253 and 332 and establishing shot clocks for small wireless facilities."[14] The Order follows an earlier Notice Of Proposed Rulemaking and Notice Of Inquiry (NPRM and NOI respectively) described in FCC-CIRC1704-03. In that NPRM and NOI the FCC stated:

> Because providers will need to deploy large numbers of wireless cell sites to meet the country's wireless broadband needs and implement next generation technologies, there is an urgent need to remove any unnecessary barriers to such deployment, whether caused by Federal law, Commission processes, local and State reviews, or otherwise[15]

Both the NPRM and NOI were intend to address issues raised by the wireless industry related to the FCC "shot clock" and local zoning. On March 30, 2017, the FCC posted a fact sheet to summarize their intent prior to issuing the Order.[16]

Photo Simulation of Proposed Tower

Photographic simulation is one assessment technique offered by project sponsors to assess the visual impact of a proposed tower or tower modifications. The physical laws that govern propagation of radio waves at the frequencies used by wireless service providers requires elevation of the base station antennas are above the surrounding buildings, trees and natural terrain to facilitate reliable reception. Photo simulations of the elevated structures provide a two-dimensional photograph of a specific vantage point scene that shows the existing view and the same view with a superimposed likeness of the proposed tower or tower modification. This provides a pre-build "before" and "after" photograph to assist in assessing the potential visual impact. Photo simulations, like any assessment tool, have advantages and limitations.

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[14] See https://www.fcc.gov/document/fcc-facilitates-wireless-infrastructure-deployment-5g
[15] FCC-CIRC1704-03, paragraph 2.
[16] See http://transition.fcc.gov/Daily_Releases/Daily_Business/2017/db0330/DOC-344160A1.pdf

Photo simulation of a new tower structure is produced using a brightly-colored balloon tethered at the height of the proposed tower on a day when weather will allow observation of the balloon from a distance. Since the goal is to hold the balloon at a height representing the proposed tower, the wind velocity on the day of observation must be low. After the balloon is positioned, a photographer moves around the area to capture photographs of the balloon from critical vantage points. Later, the photographs are modified by stripping out the balloon and replacing it with an photo image of a tower like the one that is proposed. The tower image is properly scaled and post-processed into the photograph. This composite photograph that shows the expected scene that will result if the tower is constructed.

When viewing a tower scene, one's attention is generally drawn to visual discontinuities or abnormalities that result from a disruption of the horizon. As we walk around our own neighborhood we mentally process the foreground and background objects based on our previous experiences of size and proportion. When one views a visual discontinuity scene in-person, the viewer is usually able to mentally process the near-field "clutter" using three-dimensional visual clues and remove them from the scene to get an accurate proportional assessment of the situation. Two-dimensional photographs lack the three-dimensional clues we use to get a proper proportional assessment, so a viewer supplements their assessment by inferring the proportionality information. Generally that process provides a good appraisal of the visual impact provided care is taken when producing the photo simulations to avoid unintentional false clues.

False clues are often foreground clutter that appears to minimize the visual discontinuity of a proposed tower or tower modification. Objects such as telephone poles, trees, utility wires, and roadway signage in the foreground are a few of the possible clutter items that require a two-dimensional viewer to take special care in assessing visual discontinuities produced by a proposed tower or tower modification. Reasonable care should be taken to avoid photo simulations that include unnecessary items in the foreground because they can sometimes mask the assessment of the tower or tower modifications. Most of us have seen humorous photographs of friends holding their hands out in such a way as to make it appear an object in the background is resting on their hands in the foreground. This effect is possible when proportionality clues are misinterpreted by the viewer. An example is shown below.

1. Two examples of false visual clues in two-dimensional photographs.

In the first example, one eventually discerns that the person is located in the foreground and the Gateway Arch in St. Louis is some distance in the background – but

for most viewers it takes a few seconds to make that connection. Unless one knows the proportion of the arch, it would be easy to draw the false conclusion that the arch is fairly minimal in size.

2. Gateway Arch in St. Louis with minimal foreground objects

In the second example, the visual perspective is an arguably "accurate" depiction of the scene of view. Some viewers would conclude that the tower, although a dramatic visual continuity on the horizon, is in proportion to the surrounding scene. If that photograph had been produced with a perspective that excluded the building and foreground trees, the true visual discontinuity would be more apparent. In a worst-case example of photo simulations gone bad, a photograph showed a large tree in the foreground with the caption "Proposed tower buffered by existing vegetation" when, in fact, had the photograph been taken from a position only ten feet either side of the tree, the balloon would have been clearly visible from that street view. However, with careful scene selection and minimal editing, photo simulations can provide a good assessment of visual impact.

Conclusion

The information in this report concerns the RF engineering issues related to the proposed project to assist the city in weighing the alternatives and planning for the future of the community. Engineering design choices implicate aesthetic and legal issues as well. However, this report must not be relied upon for any legal advice or direction. Legal advice about action on these issues must be obtained from the city's counsel.

Thank you once again for the opportunity to assist the City of Ashland. Please feel free to let us know if there are additional questions or other concerns at this time.

Sincerely,

William P Johnson
Consultant

Appendix A: Summary of Qualifications

Appendix B: Human Exposure to NIER

Appendix A: Summary of Qualifications

I, William P. Johnson, certify that I:

1. am Professor Emeritus at Rochester Institute of Technology (RIT) and joined the faculty September, 1989;

2. served as Graduate Program Director for the Telecommunications Engineering Technology program at RIT until retirement from RIT on June 30, 2020;

3. have been regularly employed since 1972 in the radio-frequency (RF) and microwave industry holding positions prior to 1989 such as design engineer, staff engineer, and VP Engineering;

4. am actively involved in RF/microwave consulting;

5. hold graduate degrees in both electrical engineering and law;

6. am qualified to analyze radio-frequency design and performance documentation relevant to the justification of minimum radio antenna height and tower locations;

7. am qualified to comment upon alternate site analysis, aesthetic characteristics, and visual impact effects relevant to telecommunication towers by virtue of extensive involvement since 1997 in telecommunications site plan and New York SEQRA reviews and administrative agency and court litigation;

8. have consulted for over 80 municipalities and private organizations since 1997 in the area of broadcast and telecommunication facility tower review;

9. have a reputation in both the industry and among clients for being qualified and having the necessary relevant technical expertise needed to provide telecommunication facility tower review;

10. am the author of the technology content for the New York Department of State Land Use Technical Series publication *Planning and Design Manual for the Review of Applications for Wireless Telecommunications Facilities* (2001) (available at http://www.dos.state.ny.us/lgss/localgovt.html);

11. provided expert services and subsequent engineering testimony on behalf of defendant Town of Ontario, NY, during successful litigation defense in *Sprint v Willoth*, 996 F.Supp. 253 (WDNY 1998) and during petitioner Sprint's appeal in *Sprint v Willoth*, 176 F.3d 630 (2nd Cir. 1999).

Signed: 

William P. Johnson
Consultant

Appendix B: Human Exposure to Non-Ionizing Electromagnetic Radiation (NIER)

Federal law preempts local zoning authorities from considering environmental effects of and human exposure to cellular/PCS RF emissions as long as the proposed base station complies with Federal Communications Commission (FCC) emission standards.[17] Nonetheless, the matter is sometimes of concern to residents, municipal staff and board members. In response to those concerns, the following information is offered for your consideration.

The FCC is required by the National Environmental Policy Act of 1969 to evaluate the effect of emissions from FCC-regulated transmitters on the quality of the human environment.[18] Toward this end, a substantial effort has been made by the FCC and other agencies to provide information to both the public and the wireless/broadcast industries. Guidelines and information relevant to Non-Ionizing Electromagnetic Radiation (NIER) health and safety assessment are published by the Federal Communications Commission Office of Engineering and Technology (FCC-OET).[19] FCC-OET and the Federal Drug Administration (FDA) jointly maintain an internet web site that provides basic information to consumers regarding cell phone health effects.[20] FCC-OET also publishes detailed technical information for the industry that recommends calculations and field measurement methodology to demonstrate compliance with the NIER exposure guidelines.[21] At the international level, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), and the U.S. National Toxicology Program (NTP), which is formed from parts of several different government agencies, including the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA) provide on-going research and summary information regarding a wide range of RF emissions including emissions from cell phones and base stations.[22] To date neither IARC nor NTP have declared that the radio signals emitted from cellular 4G and 5G base stations that comply with FCC human exposure regulations cause human cancer or other human health abnormalities.[23]

In light of the information available, Congress and the FCC decided in the 1990s to exclude cellular/PCS and other base stations from mandatory NIER analysis when those sites meet certain emission and height requirements. In a recent study that spanned 13 counties and included 13,000 cell phone users, the World Health Organization (WHO) International Agency for Research on Cancer (IARC) Interphone Study Group published the results of a 13-country study in the International Journal of Epidemiology

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[17] 47 USC §332(c)(7)(B)(iv).
[18] See National Environmental Policy Act of 1969, 42 U.S.C. Section 4321, et seq.
[19] http://www.fcc.gov/oet/rfsafety/
[20] http://www.fda.gov/cellphones/
[21] http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf and updates.
[22] http://www.who.int/peh-emf/en/
[23] See a very user-friendly summary of research and issues at the American Cancer Society web site https://www.cancer.org/cancer/cancer-causes/radiation-exposure/cellular-phone-towers.html

on May 17, 2010.[24] According to the World Health Organization in June, 2011, "[a] large number of studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. To date, no adverse health effects have been established as being caused by mobile phone use."[25]

Commenting on the Interphone study, Dr. Christopher Wild, IARC's director, said that "[a]n increased risk of brain cancer is not established from the data from Interphone. However, observations at the highest level of cumulative call time and the changing patterns of mobile phone use since the period studied by Interphone, particularly in young people, mean that further investigation of mobile phone use and brain cancer risk is merited."[26]

Beyond the potential damage to tissue caused by exposure to high-intensity NIER fields, some individuals report symptoms they attribute to low level NIER exposure. One hypothesis is that symptoms are correlated with physiological changes. Measurable physiological changes include metrics such as heart rate, blood pressure, and skin conductance. A three-year study performed at the University of Essex, UK, published in July, 2007, failed to find a correlation between low-level NIER exposure and such physiological changes.[27] In the study, the number of symptoms reported during the double-blind portion of the experiments was not related to the actual presence of low-level NIER.[28] This result is in agreement with earlier more limited studies.

On the arguably more conservative side, a report released on August 25, 2009[29] by International EMF Collaborative entitled "Cellphones and Brain Tumors: 15 Reasons for Concern, Science, Spin and the Truth Behind Interphone" includes, according to the report, endorsement by Ronald B. Herberman, MD, University of Pittsburgh Cancer Institute. While serving as director, Dr. Herberman had previously urged his staff[30] and the general population to recognize and understand that, while research has not proved conclusively one way or the other and given the uncertainty about the ultimate long-term safety of wireless radio signals, there are precautions that one can take. The report urges a skeptical individual and public policy approach to NIER exposure and encourages the on-going study of radio emissions and health concerns. The report urges prudent defensive actions to protect one's self and to move public policy toward a conservative

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[24] Elisabeth Cardis et. al., *International Journal of Epidemiology* (2010;1–20) (Oxford University Press on behalf of the International Epidemiological Association) (May 17, 2010).
[25] "Electromagnetic fields and public health: mobile phones ", Fact Sheet No. 193 (updated June, 2011) http://www.who.int/mediacentre/factsheets/fs193/en/.
[26] CNET News at http://news.cnet.com/8301-27083_3-20005235-247.html (May 18, 2010).
[27] Stacy Eltiti et. al. "Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomised provocation study" (Environmental Health Perspectives, 7/25/2007) (University of Essex, UK) available at http://www.ehponline.org. The study is also available at http://www.essex.ac.uk/psychology/EHS/eltiti%20et%20al%20BEMS%20ON-LINE%20PUBLICATION.pdf
[28] *Ibid*.
[29] See http://www.radiationresearch.org/pdfs/15reasons.asp
[30] See http://www.post-gazette.com/downloads/20080722upci_cellphone_memo.pdf

approach to NIER exposure. More recently, Dr. Brenden Curley[31], a medical doctor who specializes in hematology and oncology, stated in an interview with a news reporter that

> There is currently no definitive scientific evidence that cell phone use causes cancer. Some people may worry that cell phones emit radio waves or radiofrequency energy that can damage nearby tissue, causing brain cancer. According to recent research, patients with brain cancer do not report more cell phone use than controls or people without brain cancer. However, current research does have limitations, mostly because cell phones are relatively new and we're using them more now. So it's difficult to give a definitive answer right now. However, evidence currently does not support cell phones causing cancer.[32]

A report of partial findings from the National Toxicology Program (NTP) released on May 26, 2016, and the draft reports for tests on lab mice and lab rats was released on February 2, 2018. These releases present initial and final data regarding development of tumors during a multi-year study of lab mice and rats[33]. The study exposed lab rats to high levels of whole-body electromagnetic radiation (CDMA and GSM modulation formats) for 9 hours a day over a two-year period. The level of exposure was chosen to avoid thermal issues beyond that which the animal could self-regulate body temperature.[34] While this level is far more than exposure allowed by the FCC for humans, the higher level was used to allow study of the impact on the animal's organs other than just the brain. After release of the initial report, a press briefing was held to allow reporters to ask questions about the incomplete study data and results[35]. The audio and transcript may be a useful way for the general public to hear answers to some of the complex issues raised by release of the initial report. Researcher Dr. John Bucher, when asked by a reporter for the "take away" from the initial report for the general public said:

> So this is a study that is looking at the plausibility, biological plausibility of carcinogenic effect due to cell phone radiation. The direct translation of these findings to the way humans are using cell telephones is not currently completely worked out and that's part of the evaluation that's going forward. This may have relevance, it may have no relevance.[36]

As of February, 2018, the NTP study has been released for peer review to establish independent credibility. We anticipate full publication of results, recommendations and application to understanding the effects of human exposure during or after 2018. The technical reports and related information is available on the NTP web site.[37] An updated summary of the NTP study of high-level and long-duration NIER exposure to rats and

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[31] See his bio at https://www.honorhealth.com/physicians/brendan-curley
[32] See http://www.12news.com/news/local/outreach/healthcheck/debunking-9-common-cancer-myths/452221027
[33] See http://biorxiv.org/content/early/2016/05/26/055699
[34] A 1-degree body temperature rise.
[35] Audio and transcript available at http://www.niehs.nih.gov/news/newsroom/releases/2016/may27/
[36] See transcript of press briefing available at http://www.niehs.nih.gov/news/newsroom/releases/2016/may27/ Page 24 of 36.
[37] https://www.niehs.nih.gov/news/newsroom/releases/2018/february2/index.cfm

mice is available online.[38] It should be noted that the NTP study used much higher exposure levels and duration than a human using a cell phone held to their head would experience. The human exposure from a base station that complies with FCC threshold regulations are orders of magnitude lower than that of a cell phone held to the head or near the body. While the information in the technical reports is highly technical and uses terminology unfamiliar to most readers who do not perform research or services in the medical field, NTP summarizes the study findings for the rest of us and its application to human health by answering this question: Do the rat and mouse findings apply to humans? The published answer is as follows.[39]

> The findings in animals cannot be directly applied to humans for two key reasons:
>
> - The exposure levels and durations were greater than what people may receive from cellphones.
> - The rats and mice received RFR across their whole bodies, which is different from the more localized exposures humans may receive, like from a cellphone in their pocket or next to their head.
>
> However, the studies question the long-held assumption that radio frequency radiation is of no concern as long as the energy level is low and does not significantly heat the tissues.

Without meaning to minimize concerns on the part of any individual on this matter, the scientific information to date as a whole seems to favor a conclusion that neither the biological effects of tissue heating nor symptoms allegedly due to low-level NIER DNA damage are likely caused by a base station facility that complies with FCC guidelines. If anything, the use of a hand-held mobile device held to one's head or in proximity to the body are more of a concern since the mobile device transmits radio signals while communicating with a base station. While it is possible to prove scientifically that something is "unsafe" (i.e. identifiable and repeatable conditions that lead to the undesired result) it is logically impossible to prove that something is "safe" by performing any number of tests that are limited in scope and time.

While it is undisputed that someday a peer-reviewed study and subsequent validation experiments *may* show that low-level NIER (as opposed to high-level and long-duration exposure of lab rats and mice) is problematic for a class of human population, such evidence does not currently appear to exist. The lack of such objective evidence tends to defeat the assertion that low-level NIER from base station facilities may be dangerous. Naturally, a person who experiences any health-related symptoms should consult with a heath care professional – not an RF engineer.

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[38] See https://www.niehs.nih.gov/health/materials/cell_phone_radiofrequency_radiation_studies_508.pdf
[39] Ibid.