CITY OF ASPEN

Wireless Communications Facilities Design Guidelines

April 28, 2020

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1. Executive Summary

1.1 Background

The City of Aspen (City), as with communities across the country and around the world, is facing the next wave of communications technology. It has the potential to impact the safety, aesthetic values, and enjoyment of our community in a manner and to a degree that is far more extensive than cellular phones and other types of recent technology.

While most carriers closely hold their deployment schedules, Aspen due to its clientele and market potential will rank among the top 10-20% on the carriers' lists and can expect to see a significant increase in applications from most of the major carriers

Small cell communications can also include what is now known as 5G technology. 5G technology can sometimes utilize higher frequencies, or shorter, "millimeter wave" with the capability to accommodate significantly higher data needs than current 4G/LTE technologies. The physical limits of some of the higher frequencies require that the transmitters be installed at a much reduced spacing, and may ultimately be roughly 300 feet, which is similar to the spacing of streetlights or fire hydrants rather than 2+/- mile or greater distances that 4G/LTE technologies accommodate. The result of this physical need is that the public rights-of-way are often the optimal location to install the required equipment.

In September of 2018, the Federal Communications Commission (FCC) adopted the Declaratory Ruling and Third Report and Order, known as FCC 18-133. The Order outlines the extent to which local agencies may or may not regulate the installation of small cell facilities within the public rights-of-way and the use of existing public infrastructure.

In July of 2017, more than a year before the adoption of the FCC Order, House Bill 17-1193, the State of Colorado, Small Cell Facilities Permitting and Installation Act (the Act), became effective. In general, the Act specifies how local authorities throughout Colorado, may regulate the attachment of small cell facilities.

Similar to the advent of the telephone which required extensive wires, switch boxes, poles and other structures to provide these services, small cell communications technology will ultimately require a structure to mount a transmitter approximately every 300 to 600 feet most often with fiber optic cable and power conductor cable connections to each one.

Absent the adoption of standards to assure that installations are context sensitive, service providers would be free to install equipment with no concern for the visual impact that they create. This document seeks to accommodate the implementation of the new technology while assuring that the new infrastructure is installed using context sensitive solutions.

In addition, the equipment needs to be located where it will not interfere with visibility for drivers, interference with sidewalks, or other common amenities found in public rights-of-way.

Other issues such as safety, aesthetics, noise and accommodating multiple providers at each location are also addressed within these Guidelines. For more information on small cell background, please see **Appendix D**.

1.2 Regulatory Matters

The Order establishes fees, "shot clocks," and provides limits on local governments' control of small cell infrastructure.

The Act became effective July 1, 2017. In a similar manner to the FCC Order, the Act establishes "shot clocks" and provides limits on local governments' control of small cell infrastructure in public rights-of-way.

Various provisions of the Colorado and FCC actions provide similar but sometimes conflicting direction on issues such as fees, shot clocks, aesthetics and other considerations. The City has established the governing structures in Chapter 26.505 of its City Code, and all references to these items are governed by (a) Chapter 26.505 of the City Code and subsequently (b) by definition in this Design Guidelines manual.

The purpose of Chapter 26.505 is to regulate the placement, construction, and modification of towers and wireless communications facilities (WCFs) to protect the health, safety and welfare of the public, provide for managed development, installation, maintenance, modification, and removal of wireless communications infrastructure that is consistent with Aspen's small mountain town character, while at the same time not unreasonably interfering with the development of a competitive wireless communications marketplace in the City.

All applications for the installation or development of WCFs and/or equipment must receive building permits and/or right-of-way permits, as applicable, prior to installation. Prior to the issuance of appropriate building permits, WCFs and/or equipment shall be reviewed for approval by the Community Development Director and City Engineer to verify conformance with the provisions and criteria of Chapter 26.505 as well as other applicable sections of City of Aspen Code including Title 21 – *Streets, Sidewalks and Other Public Places*, Title 25 – *Utilities*, and Title 29 – *Engineering Standards*. WCFs and equipment subject to the provisions and criteria of Chapter 26.505 include without limitation, small cell facilities (SCF) within the Public Rights of Way, cellular telephone, paging, enhanced specialized mobile radio (ESMR), personal communication services (PCS), commercial mobile radio service (CMRS) and other wireless commercial telecommunication devices and all associated structures and equipment including transmitters, antennas, monopoles, towers, masts and microwave dishes, cabinets and equipment rooms.

1.3 Overview of Key Design Guidelines

The following is an overview of key elements of these design guidelines.

1) *Replacement of existing street lights* – the preferred location for small cell facilities in the right-of-way shall be in the location of an existing street light. The street light would be replaced with a small cell pole that would be fully paid for by the wireless provider.
2) *Height* – small cell facilities in the right-of-way shall be limited to **25 feet in height**. This is based on Aspen's recommended maximum height of structures allowed in residential zone districts.
3) *Minimum distance between facilities* – the **minimum distance** between facilities that contain the same wireless provider's equipment is **600 feet**. This includes both small cell facilities – and larger facilities that may be on rooftops of private or public buildings.
4) *Pole design features*:
    a. The pole will have a **fluted pattern** to reference our existing street lights
    b. The pole base **diameter is limited to 18"**
    c. The pole and antenna structure **will be painted to match the color** of our existing street lights
    d. A **luminaire** (street light fixture) will be mounted to the small cell pole in replacement of the existing street light fixture:
        i. The fixture will be mounted at a height consistent with best practices and requirements in street light design
        ii. The style of the fixture is "hockey puck" design, approximately 18 inches in diameter.
        iii. The fixture will be flush mounted to the pole (little or no armature)
        iv. The fixture will be downlit
        v. The fixture will meet City of Aspen B.U.G. (backlight, uplight, glare) standards – defined in a policy adopted in 2013.
5) *Concealment of related equipment* – all equipment related to small cell facilities shall be located **within the pole structure or in an underground vault**.
6) *Prohibited Locations*
    a. Relationship to Designated Historic Properties and Districts

No SCFs are allowed in the right-of-way along the property frontage adjacent to any street facing façade of these iconic Aspen buildings:

- Wheeler Opera House (320 E Hyman Ave)
- Wheeler/Stallard Museum (620 W Bleeker St)
- Elks' Building (510 E Hyman Ave)
- Independence Building (404 S Galena St)
- Pitkin County Courthouse (506 E Main St)
- Hotel Jerome (330 E Main St)
- City Hall (Armory Building) (130 S Galena St)
- St. Mary's Church (533 E Main St)
- Sardy House (128 E Main St)
- Red Brick School (110 E Hallam St)
- Yellow Brick School (215 N Garmisch St)
- Aspen Mountain Rescue (630 W Main St)
- Aspen Community Church (200 E. Bleeker St)
- Brand Building (205 S Galena St)
- Anderson Park (1101 E Cooper Ave)

No SCFs are allowed in the right-of-way of the Aspen Pedestrian Malls. However, they may be placed on private property along the Malls. These areas are described as Hyman and Cooper Avenues between Mill and Galena Streets, and Mill Street between Copper and Hyman Avenues.

b. Relationship to Designated Mountain View Planes

No SCFs are allowed in the foreground of a designated Mountain View Plane. See Aspen Land Use Code 26.435 for the identification of these areas.

c. Relationship to designated Open Space

No SCFs are allowed in the right-of-way adjacent to any designated Open Space parcels.

7) Relationship to Other Designated Historic Properties - All properties that are designated by ordinance to the Aspen Inventory of Historic Landmark Sites and Structures are considered significant to the City's historic and aesthetic character and require additional sensitivity. Applicants are encouraged to work with City staff to identify locations for small cell facilities in the right-of-way that do not detract from the contribution of these designated properties to Aspen's architectural heritage. An updated map, identifying Historic Landmark Sites and Structures, is available from City of Aspen GIS.

8) NIER/EME Reporting – this is a technical description of the specific radio frequencies that are expected as designed from a specific small cell facility – related to the FCC rules regarding maximum permissible exposure (MPE). This report will provide detailed, site specific information about the radio frequency emissions for a given facility. It will be required in the establishment of a new facility and any time a facility is upgraded.

9) Testing - testing and reporting of the actual frequencies and strength of frequencies being emitted following the installation or upgrade of a wireless facility is required. Additionally, annual audits of radio frequency signals from all facilities will be required. This will be the responsibility of the City or its representative with the assistance of the applicant.

1.4 Statement of Purpose

The City of Aspen Wireless Communications Facilities Design Guidelines which provide objective, technically feasible criteria applied in a non-discriminatory manner are hereby established with the goal of accommodating the installation of wireless communications facilities including small cells (4G, LTE, 5G, and other systems currently under development) technology within the City of Aspen, provided that the installations meet the following standards:

- Aesthetics
- Location
- Spacing of facilities
- Accommodation of multiple providers at each location
- Safety
- Noise

2. General Information

2.1 Introduction

These Wireless Communications Facilities Design Guidelines are intended to supplement the requirements of Aspen Land Use Code Chapter 26.505**,** *Wireless communications facilities and equipment* as well as Title 21 – *Streets, Sidewalks and Other Public Places,* Title 25 – *Utilities,* and Title 29 – *Engineering Standards*. They provide objective, technically feasible criteria consistent with Aspen's small mountain town character, applied in a non-discriminatory manner that reasonably match the aesthetics and character of the immediate area regarding all of the following, which the City shall consider in reviewing an application:

(a) The location of any wireless communications facilities (WCF) including their relationship to other existing or planned WCF sites regardless of provider

(b) The location of a WCF on a wireless support structure

(c) The appearance and concealment of WCFs, including those relating to materials used for arranging, screening, and landscaping

(d) The design and appearance of a wireless support structure including any height requirements adopted in accordance with these Guidelines

It is the goal of the City to allow the installation of a wireless communications infrastructure with a minimum foot print. This shall be accomplished by WCF siting and the use of multi-cell poles that can accommodate multiple service providers.

The City may revise, develop new, update, or amend these Guidelines as necessary to meet the goals of the City. The provisions of these Guidelines shall not limit or prohibit the City's discretion to promulgate and make publicly available other information, materials or requirements in addition to, and separate from these Wireless Communications Facilities Design Guidelines that do not conflict with state or federal law.

2.2 Definitions

The definitions in Aspen Land Use Code Chapter 26.505 shall apply to this document unless defined differently here. If a word is not defined here or in City Code, it shall have the usual and customary meaning as defined in a standard dictionary. The following words, terms and phrases, when used in this document, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Administrative Review means ministerial review of an Application by the City relating to the review and issuance of a Permit, including review by the designated staff to determine whether the issuance of a Permit is in conformity with the applicable provisions of these Guidelines and all City Codes.

Applicable Codes means any Code drafted and adopted by the City, including Title 21 – *Streets, Sidewalks and Other Public Places*, Title 25 – *Utilities*, and Title 29 – *Engineering Standards*, as well as uniform building, fire, safety, electrical, plumbing, Uniform Traffic Control or mechanical codes adopted by a recognized national code organization to the extent such codes have been adopted by the City, including any amendments adopted by the City, or otherwise are applicable in the jurisdiction.

Applicant means the person submitting an application that is proposing an action requiring review and approval by one or more of the sections in Chapter 26.505, as well as Title 21 – *Streets, Sidewalks and Other Public Places*, Title 25 – *Utilities*, and Title 29 – *Engineering Standards*. An applicant may subsequently become the developer once approval is granted, and in this case the terms shall be interchangeable.

Attached Wireless Facilities are those affixed to a structure except optical fiber, wires, coaxial cable and the mounting hardware used to attach optical fiber, wires, and coaxial cable. Examples of attached facilities include but are not limited to antennas, telephone boxes, power boxes, and other equipment boxes and cabinets on structures located.

Base Cabinet means a cabinet at the base of a SCF that houses the Base Station.

CDOT means the Colorado Department of Transportation.

City means the City of Aspen.

City Council means the Aspen City Council.

City Manager means the Aspen City Manager or designee.

Code means the Aspen City Code.

Development Code means Chapter 26 of the City Code, as amended.

Director means the City's Community Development Director or designee.

Facilities means any and all equipment, structures, materials or tangible components located in the rights-of-way and used to provide a service, including without limitation: all plants, whether inside or outside, fiber strands or optic lines, electronic equipment, amplification equipment, optic equipment, transmission and distribution structures, antennas of any type, lines, termination equipment, pipes, poles, ducts, mains, conduits, inner ducts, regenerators, repeaters, underground lines, vaults, manholes, pull boxes, splice closures, wires and cables, and all other like equipment, fixtures and appurtenances used in connection with transmitting, receiving, distributing, offering, and/or providing such service. Facilities shall include, as the context dictates, wireless communications facilities, as defined herein.

FCC means the Federal Communications Commission of the United States.

FCC Order means the FCC's Declaratory Ruling and Third Report and Order, WT Docket No. 17-79, WC Docket No. 17-84, FCC-18-133, released September 27, 2018, which is incorporated herein by this reference.

Height means maximum height of the WCF, including antenna, above established grade measured at the base of the structure.

House Bill 17-1193 or Act means Colorado's Small Cell Facilities Permitting and Installation Act, which became effective on July 1, 2017 and is incorporated herein by this reference.

Macro Wireless Telecom Facility or Macrocell means a cell in a mobile phone network that provides radio coverage served by a power cellular base station (tower). The antennas for macrocells are mounted on ground-based masts, rooftops and other existing structures, at a height that provides a clear view over the surrounding buildings and terrain. The term macrocell is used to describe the widest range of cell sizes.

Multi-User Facility means a facility that is designed to accommodate two or more service providers.

Ordinance means Aspen Land Use Code Chapter 26.505, *Wireless communications facilities and equipment*, as amended, which is incorporated herein by this reference.

Ordinary Maintenance and Repair means inspections, testing and/or repair that maintain functional capacity, aesthetic and structural integrity of a Communications Facility and/or the associated Support Structure, Pole or Tower, that does not require blocking, damaging or disturbing any portion of the Public ROW.

Structure means anything constructed or erected with a fixed location below, on, or above grade, including, without limitation, service cabinets, junction boxes, foundations, fences, retaining walls, awnings, balconies, and canopies.

Telecommunications means the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received.

Telecommunication service(s) means the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used.

Telecommunication service provider or *telecommunications applicant* means any provider of telecommunications services, except that such term does not include aggregators of telecommunications services (as defined in 47 U.S.C. Section 226).

Telecommunication system means the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used. A system that provides both cable and telecommunications or information services may be considered both as a cable system and a telecommunications system pursuant to this Code.

Toll – a pause in the progression of the shot clock due to an incomplete application.

Unreasonable Interference means any use of the Right-of-Way that disrupts or interferes with its use by the City, the general public, or other person authorized to use or be present upon the Right-of-way, when there exists an alternative that would result in less disruption or interference. Unreasonable interference includes any use of the Right-of-way that disrupts vehicular, bike, or pedestrian traffic, any interference with public utilities, and any other activity that will present a hazard to public health, safety, or welfare. This shall also apply to any violation of the Americans with Disabilities Act.

2.3 Application and Review Procedures

No new WCF shall be constructed and no Collocation or modification to any WCF may occur except after a written request from an applicant, reviewed and approved by the City in accordance with *Section 26.505.050* and *Section 26.505.060* in City Code.

Voluntary Preliminary Review: Because shot clocks greatly reduce staff's ability to help a submitted project through the process, the City strongly encourages applicants to submit voluntary preliminary review applications for any WCF project. Preliminary reviews are not a project and are not subject to any shot clock. Staff can then work with an applicant to address issues prior to submittal.

Shot Clock Processing Standards: To meet shot clock requirements, the City requires the concurrent submittal of Land use approval, Building/Electrical permit and ROW permits at the same time. If the applicant does not want this, they must toll the shot clock. Tolling applies to the whole project, including any ministerial construction permits. Tolled projects will still be processed diligently.

After acceptance of a completed application, the City will issue one set of corrections; if corrections are all not addressed by the second review, the applicant must toll the shot clock.

2.4 Additional Review Procedures

In addition to the applicable application and review procedures listed in the *Section 26.505.050* and *Section 26.505.060* in City Code, all applications shall be reviewed based on the following procedures:

A. All applicable requirements outlined in Title 21 – *Streets, Sidewalks and Other Public Places*, Title 25 – *Utilities*, and Title 29 – *Engineering Standards*.

B. Small cell facility applicants must execute a master license agreement with the City, granting a non-exclusive license to use the Public Right-of-Way.

C. Attachment of SCFs on an existing traffic signal, streetlight pole, or similar structure shall require written evidence of a license, or other legal right or approval, to use such structure by its owner.

D. The City of Aspen reserves the right to require an applicant to pay the fees and costs of any consultant retained by the City to assist in the review of plans, applications, reports, inspections, and/or testing.

E. Certification of compliance. The wireless provider shall certify that the WCF is in compliance with applicable FCC Maximum Permissible Exposure (MPE) regulations, by submitting a site specific non-ionizing electromagnetic radiation (NIER) or electromagnetic energy (EME) report for the WCF equipment type and model being installed at the site that is endorsed by a radiofrequency engineer

licensed in the State of Colorado, including a certification that the WCF complies with all radiation and electromagnetic standards. The report shall specify approach distances to the general public and occupational workers at the ground and antenna centerline levels. The report shall include instructions regarding powering off the equipment or contact information for a person who can power off the equipment. No significant changes to the power, location, RF emission patterns and/or emitting frequencies may be made without prior notification and approval. However, non-substantive changes, for example, in-kind replacements of transmitters of the same frequency, radiation patterns and power are permitted. The City retains the right to independently verify the RF patterns as installed.

F. Public Safety. The wireless provider shall comply with all applicable FCC, state, and local codes, provisions, or regulations that concern public safety. WCFs must not result in human exposure to radio frequency radiation in excess of applicable safety standards specified in 47 CFR Rule 1.1307(b). After transmitter and antenna system optimization, but prior to unattended operations of the facility, the wireless provider or its representative must notify the City, so the City or its representative can conduct on-site post-installation RF emissions testing to demonstrate actual compliance with the FCC OET Bulletin 65 RF emissions safety rules for general population/uncontrolled RF exposure in all sectors. For this testing, the wireless provider shall ensure that the transmitter is operating at maximum operating power. The testing shall occur outwards to a distance where the RF emissions no longer exceed the uncontrolled/general population limit. The City or its representative, with the assistance of the wireless provider, shall also conduct annual RF emissions testing.

G. Notice Requirements. At the issuance of a completeness letter for an application for a new SCF installation, the following procedures for public notice will be followed by the applicant:

Within 15 days of the completeness letter being issued, the following notice materials are required:

1) A 24x36 poster will be placed at the location of the proposed facility. The poster will include the following information:

- A photo simulation of the proposed facility.
- A brief description of the type of equipment and RF signal that is emitting from the facility.
- Contact information for the applicant.
- Contact information for City staff.

2) A mailed notice to all property owners within 300 feet of the proposed facility. The mailed notice will include the information required by the on-site poster – and shall additionally include text that better explains what a SCF is.

3) Newspaper Notice – City of Aspen Community Development will facilitate.

4) Location information shall be provided so that City of Aspen GIS can update the location in a layer on Map Aspen identifying Existing and Pending Wireless facilities.

The City of Aspen Community Development Department will assist the applicant in the provision of the notice. Any delays in the provision of necessary materials for public notice by the applicant will result in a hard stop on the shot clock tolling. All costs associated with the issuance of public notice shall be the responsibility of the applicant.

2.5 Conditions and Limitations

Except for Eligible Facility Requests or SCF applications, the City shall reserve the right to add, modify or delete conditions after the approval of a request in order to advance a legitimate City interest related to health, safety or welfare. Prior to exercising this right, the City shall notify the owner and operator in advance and shall not impose a substantial expense or deprive the affected party of a substantial revenue source in the exercising of such right.

Approval by the Community Development Director and City Engineer of a WCF application shall not be

construed to waive any applicable zoning or other regulations; and wherein not otherwise specified, all other requirements of City Code shall apply, including Title 21 – *Streets, Sidewalks and Other Public Places*, Title 25 – *Utilities*, and Title 29 – *Engineering Standards*. All requests for modifications of existing facilities or approvals shall be submitted to the Community Development Director and City Engineer for review under all provisions and requirements of these Guidelines. If other than minor changes are proposed, a new, complete application containing all proposed revisions shall be required.

Any changes to approved plans shall be subject to review and approval by the City in accordance with the process required above.

3. SCF Pole Design Guidelines

The following Design Guidelines are only for small cell facilities (SCF) in the public right-of-way. The Design Guidelines for all other wireless communications facilities (WCF), including SCFs not in the public right-of-way, can be found in other sections of this document.

3.1 General Pole Design Standards

Every small cell facility (SCF) in the public right-of-way shall comply with the following standards:

1. All SCF equipment and appurtenances shall be housed internally with regard to the pole or alternative tower structure which hosts the SCF antennas.
2. Top-mounted antennas and their enclosures shall not extend the diameter of the utility pole or wireless support structure at the level of the antenna attachment. SCFs shall be contained in a pole with a base diameter of no more than 18 inches. The maximum diameter indicated shall extend no more than five (5) feet from ground level. Above the base, the diameter of the pole shall be a maximum of 12" and tapered to a diameter of 8" at the top.
3. Side-mounted SCF antennas are not allowed.
4. SCFs located on street light poles or traffic control devices shall not block light emanating from the street light fixture or otherwise interfere with the purpose of the street light fixture or traffic control device.
5. All WCFs shall be installed in accordance with all applicable City Codes. No wiring or cabling shall interfere with any existing wiring or cabling installed by the City, a utility or a wireless services provider.
6. No guy or other support wires will be used in connection with a SCF unless the SCF is to be attached to an existing utility pole or wireless support structure that incorporates guy wires prior to the date the applicant has applied for a permit.
7. The SCF, including the antenna, and all related equipment when attached to a new pole or wireless support structure, must be designed to withstand a wind force and ice loads in accordance with the applicable standards established in Chapter 25 of the National Electric Safety Code for utility poles, Rule 250-B and 250-C standards governing wind, ice, and loading forces on utility poles, in the American National Standards Institute (ANSI) in TIA/EIA Section 222-G established by the Telecommunications Industry Association (TIA) and the Electronics Industry Association (EIA) for steel wireless support structures and the applicable industry standard for other existing structures. The evaluation must be prepared by a professional structural engineer licensed in the State of Colorado.
8. The minimum distance between SCFs that contain the same wireless provider's equipment is 600 feet.
9. Ground mounted enclosures, including backup power supply, and electric meters must be concealed within existing above-ground cabinets, or placed in a flush-to-grade underground equipment vault or within approved design standard treatments adopted by the City.
10. SCFs shall be located in a manner that meets the Americans with Disabilities Act (ADA) and does not obstruct, impede or hinder the usual bike, pedestrian or vehicular path of travel.
11. SCFs collocated on City-owned poles may not use the same power or communication source providing power and/or communication for the existing infrastructure. The City may permit a new SCF to use unused fibers within the same fiber cable if available. The wireless provider shall coordinate, establish, maintain and pay for all power and communication connections with private utilities.
12. SCF poles and associated equipment must meet minimum clearances from all utility infrastructure as specified in Title 25 – *Utilities* and Title 29 – *Engineering Standards.*

13. If required by a utility provider, a related electric meter shall not be contained within or adjacent to the SCF but will instead be located proximate to the transformer or underground with other related equipment. This requirement may be wholly or partially waived by the City's Electric Superintendent.
14. All related cabling shall connect to the SCF underground. Above ground connections to the facility are prohibited.
15. Concealment of all SCF equipment and appurtenances shall be required, pursuant to these Guidelines.
16. Unless required by the FCC, signage is prohibited on all SCFs and wireless support structures, except for a four (4) inch by six (6) inch plate with the wireless provider's name, location identifying information, and emergency telephone number shall be permanently fixed to the SCF equipment enclosure or shroud. The provider is required to update this information whenever it changes.

3.2 Utility Distribution Poles

All attachments to utility distribution poles that provide aerial support for overhead utility lines with or without a streetlight attached shall be approved by the City's Electric Superintendent or Holy Cross Energy prior to installation. All equipment shall meet the City's Electric Superintendent or Holy Cross Energy requirements and all of Aspen's permit requirements.

Antennas shall be located inside an enclosure of no more than three (3) cubic feet.

Ground mounted enclosures, including backup power supply, and electric meters must be concealed within an existing, previously approved above-ground cabinets, or placed in a flush-to-grade underground equipment vault unless otherwise demonstrated to the satisfaction of the City to not be feasible.

All wiring shall be concealed within the pole or in conduit. The color of conduit shall be approved by the City.

3.3 Streetlight Poles

No SCF shall be attached to any existing streetlight pole unless the existing streetlight pole was specifically designed to support SCF equipment or is approved by a licensed Colorado Professional Engineer. In all other cases, the applicant shall have the existing streetlight pole removed. The applicant shall be responsible for any and all costs for removal of the streetlight pole. The applicant shall place a new combined SCF and streetlight pole in place of the removed streetlight pole or within 5 feet of the removed streetlight pole.

1. The pole design in the City right-of-way shall match the aesthetics, spacing, and architectural characteristics of existing streetlights installed adjacent to the pole.
2. The color of the pole shall be Federal color 16187 from the Federal Standards 595C Colors book.
3. SCFs shall have a fluted pattern on the shaft of the pole – in reference to the existing street light design.
4. The pole shall be designed and located in accordance with all City requirements as specified in these Guidelines, and 2015 American Association of State Highway and Transportation Officials (AASHTO) LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, and approved by the City prior to submittal of the application. Designs will be in accordance with the design concepts shown in **Appendix A** or as otherwise approved by the City.
5. Pole caissons should be circular in nature and designed to minimize impact of adjacent and future utilities. Concrete must follow the latest Colorado Department of Transportation (CDOT) Road & Bridge Specification for applicable mix design. All designs must be stamped and signed by a registered Professional Engineer in the State of Colorado.
6. Pole caissons must be flush-to-grade and must show the number of conduits and their locations.

7. Geotechnical boring may be used to install pole caissons. A geotechnical report from a registered Professional Engineer in the State of Colorado must be provided for the general area of the proposed location. The report must detail soils observed, depths, soil strength and that the soil can support the entire proposed facility.
8. The applicant must provide a service letter for both electric and fiber.
9. All new conduits (fiber, electric, etc.) and appropriate information must be shown in the complete layout.
10. Location of existing electrical items must be shown on plans. The applicant shall coordinate with the City of Aspen Electric Department to properly restore power to the existing street light circuit. The applicant will be responsible for all new conduit, electric line, traffic rated vaults and associated construction activities to get power to street light circuit in proper working order.
11. The applicant shall furnish and install a *Gardco SlenderForm Hockey Puck LED* streetlight luminaire as shown in *section B.1* of **Appendix B**. Refer to *section 4.5* of this document for Gardco Luminaire Model Number ordering information.
12. If required, the applicant shall wire the SCF equipment to its own meter, with recurring monthly electric service and metering paid for by the applicant.
13. The applicant shall wire the LED streetlight luminaire to the previously existing power source, with recurring monthly electric service and metering (if applicable) continuing to be paid for by the City.
14. The new pole shall have space for at least one internal bay to house SCF equipment. If the new pole is capable of housing two collocated SCFs, the pole shall have space for two internal bays. The second bay will be available to another applicant with City approval and upon demonstrating no interference with the first occupant's SCF.
15. Support facilities and enclosures, backup power supply, and electric meters must be concealed within existing above-ground cabinets, or placed in a flush-to-grade underground equipment vault.
16. Antennas shall be located inside an enclosure of no more than three (3) cubic feet. Post-top "cantenna" style antennas shall be used.
17. All wiring shall be concealed inside the pole within a channel separate from municipal wiring within the pole.
18. If the new pole results in the removal of an existing streetlight pole, any existing caisson shall be completely removed. Landscaping, sidewalk or other surface treatment shall be restored above the removed caisson to the satisfaction of the City.
19. Due to the related street light service, unless otherwise provided for in the MLA or similar agreement, the City shall be the owner of all new poles in the right-of-way including streetlight poles and luminaires upon completion of construction. The applicant shall retain ownership of any SCF.
20. The new pole shall have secured safety shutoff controls within the pole base for the City to be able to turn off the SCF equipment for streetlight maintenance purposes.
21. Removed streetlights and luminaires shall be salvaged and returned to the City of Aspen.

3.4 Traffic Signal Poles

SCFs may be installed on CDOT-owned and City-owned traffic signal poles. This assumes that the traffic signal pole is not expected to be used for emergency communications or tolling equipment. No SCF shall be attached to any existing traffic signal pole unless the existing traffic signal pole was specifically designed to support SCF equipment or is approved by a licensed Colorado Professional Engineer. In all other cases, the traffic signal pole and mast arm shall be replaced with a traffic signal pole and mast arm designed to accommodate the SCF equipment in addition to the required traffic signal and street light equipment. An applicant may be limited to one traffic signal pole within 300 feet. For example, at a signalized intersection

there are generally 4 signal poles. A single applicant may be approved for only 1 of the 4 signal poles. Other applicants may be approved for the other poles. Span wire designs are not permitted.

1. New traffic signal poles, mast arms, and luminaires shall meet the City of Aspen adopted standards at the time the SCF application is made. The pole shall be designed and located in accordance with all requirements as specified by the standards and specifications of CDOT, these guidelines, and 2015 (as amended) American Association of State Highway and Transportation Officials (AASHTO) LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, and approved by CDOT and the City prior to submittal of the application.
2. Foundations shall be designed to meet the structural requirements of the pole. Concrete must follow the latest Colorado Department of Transportation (CDOT) Road & Bridge Specification (as amended) for applicable mix design. All designs must be stamped and signed by a registered Professional Engineer in the State of Colorado and shall be submitted to CDOT and the City.
3. The applicants shall provide their own power and fiber (or other communications medium) to their SCF attached to the traffic signal pole.
4. Support facilities and enclosures, backup power supply, and electric meters must be in existing above-ground cabinets, or placed in a flush-to-grade underground equipment vault.
5. Antennas shall be located inside an enclosure of no more than three (3) cubic feet. Post-top “cantenna” style antennas shall be used.
6. All wiring shall be concealed inside the signal pole within a channel separate from CDOT’s wiring within the pole.
7. Due to the function of the pole as an official traffic control device, the new traffic signal pole, mast arm, traffic signal equipment, and luminaire, upon completion of construction, shall be owned by either the City or CDOT. The applicant shall retain ownership of any SCF equipment.
8. The new traffic signal pole shall have secured safety shutoff controls on the pole for CDOT and the City to be able to turn off the SCF equipment for maintenance purposes.
9. Removed traffic signal poles, mast arms, luminaires, and equipment shall be salvaged and returned to the City or CDOT.

3.5 New Poles

1. If a replacement pole design is not possible, then a new wireless support structure shall be designed to minimize the visual and aesthetic impact of the new vertical element and associated SCFs upon the surrounding area and shall blend in with the surrounding streetscape with minimal visual impact. The City requires that new wireless support structures be constructed of a specific material that will enhance the stealth and concealment of the structure. New poles shall be designed as monopoles, consistent with the pole designs concepts detailed in **Appendix A**.
2. New wireless support structures shall match the design, type, and material of existing utility poles, including street light poles, within the immediate area, except as otherwise approved by the City.
3. The color of the pole shall be Federal color 16187 from the Federal Standards 595C Colors book.
4. New wireless support structures shall have a fluted pattern on the base and shaft of the pole.
5. On a case by case basis, applicants may be asked to provide brackets for the hanging of small banners on new poles. The poles shall be designed to accommodate the additional forces generated by the addition of these banners including wind loads.
6. New wireless support structures shall be equal distance from other utility poles based upon the average distance between existing utility poles within the designated area. If a new wireless support structure cannot be located the average distance from other utility poles, a new wireless support structure may be approved if such wireless support structure is designed as a stealth pole.
7. The centerline of a new wireless support structure shall be in alignment with existing utility poles

where present, or with street or parkway trees along the same side of the right-of-way.

8. New wireless support structures shall not exceed the heights as authorized by City Code and these Guidelines, which, unless otherwise specified by the City, is 25 feet above ground level.
9. New wireless support structures shall be context sensitive based on poles in the surrounding area of the City, which could include poles that are round in shape with a fluted pole shaft unless otherwise directed by the City.
10. New wireless support structures incorporating SCFs in an equipment enclosure within a base shall utilize poles tapered in diameter.
11. All new wireless support structures must be supported with a reinforced concrete foundation designed, stamped, sealed and signed by a professional engineer licensed in the State of Colorado, and subject to the City's approval.
12. All anchor bolts must be concealed from public view, with an appropriate pole boot or cover powder-coated to match the wireless support structure color, which shall be Federal color 16187 from the Federal Standards 595C Colors book.
13. For all new pole installations, the City reserves the right to require a second applicant for the same general space to install a new pole capable of collocating both applicants internally in the pole. The first applicant is required to allow the subsequent applicant to replace the pole with a multi-cell pole.
14. The applicant shall be responsible for meeting Subsurface Utility Engineering (SUE) Requirements and the City's Construction Mitigation Plan (CMP) where applicable.

4. SCF Pole Siting Requirements

The following Siting Requirements are only for small cell facilities (SCF) in the public right-of-way. The Siting Requirements for all other wireless communications facilities (WCF), including SCFs not in the public right-of-way, can be found in other sections of this document.

4.1 Location

The City reserves the right to approve all proposed pole locations and to modify those locations as necessary for future City needs, functional and/or aesthetic reasons. The City will work with the applicant to find a suitable location for both the City and the applicant.

The City of Aspen encourages location of small cell facilities (SCF) outside of designated Historic Districts, and on non-historically designated properties. SCFs shall not interfere with prominent vistas or significant public view corridors.

Where ever possible the poles shall be sited to take advantage of existing screening.

Poles shall not be located:

- Within 30 feet of a fire hydrant unless replacing an existing pole in the same location, reduced distances can be approved by the City.
- In any manner which would obstruct a public sidewalk or roadway including reducing vertical or horizontal clearances required by the City and shall not result in a change in the slope of any sidewalk adjacent to the SCF.
- Within a sight triangle. For small cells, replacing traffic signals or streetlights refer to City of Aspen Engineering Standards and AASHTO.
- Within the drip line of a tree without a required Tree Permit, as well as a meeting with the City Forester/Parks Department to determine feasibility of location. This will also include associated equipment and conduit.
- Within roadway medians due to non-breakaway design.

When located adjacent to a commercial establishment, such as a shop or restaurant, care should be taken to locate the SCF such that it does not negatively impact the business. SCFs shall not be located in-front of store front windows, primary walkways, primary entrances or exits, or in such a way that it would impede a delivery to the building. SCFs should be located between properties as much as possible.

SCFs shall not impede existing and future facilities, including sidewalks, stormwater infrastructure, water infrastructure, fiber optic infrastructure, and electric infrastructure, and other infrastructure included in adopted City plans, inclusive of the Capital Asset Plan, Fiber Master Plan and Bike-Ped Master Plan.

In areas of the City identified as parks and open space or designated as a historical district, or within 500 feet of a landmark, the applicant shall conduct a consultation with the applicable departments, divisions, or personnel of the City to discuss aesthetically significant structures, views, or community features and options to minimize any adverse aesthetic impacts of attaching or installing SCFs in such areas.

Except for equipment mounted in the base cabinet, no equipment, shelters, or cabinets, and no electrical distribution panels may be at ground level, except after all reasonable alternative pole locations have been explored and found unavailable or lacking in some substantial way, and only with the prior written approval of the City upon a good faith showing of necessity, and upon such conditions as the City deems appropriate under the circumstances. The City shall weigh such requests against historic preservation policies, aesthetic considerations, pedestrian, and disabled person access to sidewalks, public safety concerns, technical installation conflicts, and compliance with all applicable laws.

4.1.1 Site selection

Wireless communication facilities, including SCFs shall be located in the following order of preference:

1. Co-located on the rooftop of private property
2. Co-located on the rooftop of a City of Aspen building
3. New facility on the rooftop of private property
4. New facility on the rooftop of a City of Aspen building
5. Co-located on an already established or future small cell facility in the right of way.
6. New small cell facility established on the site and in replacement of an existing City of Aspen street light and including an attached luminaire or contained within the structure of existing or redesigned traffic signals, with cooperation of CDOT.
7. New stand-alone facility in a new location – this may or may not include a luminaire.
8. Alley locations may be considered on a case-by-case basis.

4.1.2 Prohibited Locations

1. Relationship to Designated Historic Properties and Districts

   No SCFs are allowed in the right-of-way along the property frontage adjacent to any street facing façade of these iconic Aspen buildings:

   - Wheeler Opera House (320 E Hyman Ave)
   - Wheeler/Stallard Museum (620 W Bleeker St)
   - Elks' Building (510 E Hyman Ave)
   - Independence Building (404 S Galena St)
   - Pitkin County Courthouse (506 E Main St)
   - Hotel Jerome (330 E Main St)
   - City Hall (Armory Building) (130 S Galena St)
   - St. Mary's Church (533 E Main St)
   - Sardy House (128 E Main St)
   - Red Brick School (110 E Hallam St)
   - Yellow Brick School (215 N Garmisch St)
   - Aspen Mountain Rescue (630 W Main St)
   - Aspen Community Church (200 E. Bleeker St)
   - Brand Building (205 S Galena St)
   - Anderson Park (1101 E Cooper Ave)

   No SCFs are allowed in the right-of-way of the Aspen Pedestrian Malls. However, they may be placed on private property along the Malls. These areas are described as Hyman and Cooper Avenues between Mill and Galena Streets, and Mill Street between Copper and Hyman Avenues.

2. Relationship to Designated Mountain View Planes

   No SCFs are allowed in the foreground of a designated Mountain View Plane. See Aspen Land Use Code 26.435 for the identification of these areas.

3. Relationship to designated Open Space

   No SCFs are allowed in the right-of-way adjacent to any designated Open Space parcels.

4.1.3 Relationship to Other Designated Historic Properties

All properties that are designated by ordinance to the Aspen Inventory of Historic Landmark Sites and Structures are considered significant to the City's historic and aesthetic character and require additional sensitivity. Applicants are encouraged to work with City staff to identify locations for small cell facilities in the right-of-way that do not detract from the contribution of these designated properties to Aspen's architectural heritage. An updated map, identifying Historic Landmark Sites and Structures, is available from City of Aspen GIS.

4.1.4 Public buildings, structures and rights-of-way

Leasing of public buildings, publicly owned structures and/or public rights-of-way for the purposes of locating SCFs and/or equipment is encouraged. In cases where a facility is proposed on City property that is not in the Public Right-of-Way, specific locations and compensation to the City shall be negotiated in lease agreements between the City and the provider on a case-by-case basis and would be subject to all of the review criteria contained in this Section. Lease agreements shall be executed prior to location approval under this Section. Such agreements shall not provide exclusive arrangements that could tie up access to the negotiated sites or limit competition and must allow for the possibility of Collocation with other providers as described in *Section 26.505.080.B*.

4.2 Height Requirements

SCFs within the City of Aspen's right-of-way are limited to 25 feet in height.

4.3 Noise

Noise generated on the site must not exceed the levels permitted, pursuant to Title 18 - *Noise Abatement*, of City Code, except that a SCF owner or operator shall be permitted to exceed Code noise standards for a reasonable period of time during repairs, not to exceed two hours without prior authorization from the City. Maintenance crews will not be allowed access between midnight and 6 AM unless emergency repairs are required and the City is notified. Crews shall manage construction impacts including noise and lighting to minimize impacts to residential land uses whenever they are working between dusk and dawn.

4.4 Related Accessory Equipment.

All equipment related to SCFs shall be located within the facility's pole structure or in an underground vault. Beyond the antenna, related shroud, and luminaire, no equipment may be attached to the exterior of the pole.

4.5 Lighting

SCFs shall not be artificially lighted, unless required by the FAA or other applicable governmental authority, or the SCF is mounted on a light pole or other similar structure primarily used for lighting purposes. If lighting is required, it shall conform to other applicable sections of the City Code regulating outdoor lighting.

Luminaires attached to SCFs shall have the following characteristics:

1. A LED, "hockey puck" design as shown in *Section A.2* of **Appendix A**.
2. The fixture shall be the *Gardco SlenderForm Hockey Puck LED* as shown in *Section B.1* of **Appendix B,** and shall match the following Model.

   Gardco Luminaire Model Number:

   SFRA-140L-450-NW-G2-AR-3-UNV-FAWS-TLRD5-16187

   The following are important notes for the applicant regarding this Gardco Model Number:

   AR – Designates an arm mount to a 4 inch O.D. pole. Since the City requires an approximate 7 to 8-inch round fluted pole, the applicant will need to work with the pole manufacturer to create an accommodation at the mounting height location.

FAWS – Designates a potentiometer device that will provide simple manual dimming adjustment to be factory installed in the luminaire.

TRLD5 – Designates a 5-pin photocell socket without a photocell. The socket will accept a three-pin photocell. The applicant shall purchase a photocell for the socket based on the City's recommendation, so that the photocell is the same as the ones used throughout the City. In addition, the photocell shall be a long-life model with a universal voltage rating.

16187 – Designates Federal Color 16187 from the Federal Standards 595C Colors book. This will ensure that the fixture is the same color of the pole to which it is attached.

3. The fixture shall be mounted at a height of 15 to 16 feet as approved by the City.
4. The fixture shall be designed to be modular – in that it could be easily replaced with an alternative fixture in the future.
5. The fixture shall comply with City of Aspen B.U.G. Standards.
6. The fixture shall be dark sky compliant.
7. All luminaires must be equipped with a dimmable driver regardless of output.

4.6 Signage

Signage is prohibited on all SCFs and wireless support structures, including stickers, logos, and other non-essential graphics and information with the following exceptions. If signage is required, it shall conform to other applicable sections of the City Code regulating signage.

1. Required by the FCC.
2. A required small placard identifying the service provider and providing a 24-hour contact number, which shall be placed facing away from the public rights of way.

5. Design Guidelines and Siting Requirements for Other WCFs

The following Design Guidelines and Siting Requirements are for wireless communications facilities (WCF) that are not small cell facilities (SCF) in the public right-of-way. WCFs and equipment subject to the provisions and criteria of this section include without limitation, small cell facilities (SCF) not within the public right-of-way, cellular telephone, paging, enhanced specialized mobile radio (ESMR), personal communication services (PCS), commercial mobile radio service (CMRS) and other wireless commercial telecommunication devices and all associated structures and equipment including transmitters, antennas, monopoles, towers, masts and microwave dishes, cabinets and equipment rooms.

The Design Guidelines and Siting Requirements for SCFs in the public right-of-way can be found in other sections of this document.

The following provisions apply to all WCFs and equipment applications, sites and uses, except for Small Cell Facilities in the Public Rights-of-Way

5.1 Prohibitions

1. Lattice towers (a structure, with three or four steel support legs, used to support a variety of antennae; these towers generally range in height from sixty (60) to two hundred (200) feet and are constructed in areas where great height is needed, microwave antennas are required or where the weather demands a more structurally sound design) are prohibited within the City.
2. Towers, excluding Alternative Tower Structures and Small Wireless Facilities attached to Towers, shall be prohibited in the following Zone Districts: Medium-Density Residential (R-6); Moderate-Density Residential (R-15, R-15A, R-15B); Low-Density Residential (R-30); Residential Multi-Family (RMF, RMFA); and Affordable Housing/Planned Unit Development (AH-1/PUD); Conservation (C); Agricultural (Ag); Park (P); Open Space (OS); Rural Residential (RR).
3. All WCFs and equipment not prohibited by the preceding statements shall be allowed in all other zone districts subject to review and approval by the Community Development Director pursuant to the provisions, requirements and standards of this Chapter, including consistency with the dimensional requirements of the underlying zone district.

5.2 Site Selection

Except for Small Cell Facilities in the Public Rights-of-Way, Wireless communication facilities shall be located in the following order of preference:

First: Collocated on existing structures such as buildings, communication towers, flagpoles, church steeples, cupolas, ball field lights, non-ornamental/antique street lights such as highway lighting, etc.

Second: In locations where the existing topography, vegetation, buildings or other structures provide the greatest amount of screening.

Least: On vacant ground or highly visible sites without significant visual mitigation and where screening/buffering is difficult at best.

5.3 Historic sites and structures

In addition to the applicable standards of Chapter 26.415, all of the foregoing and following provisions and standards of this Chapter shall apply when wireless telecommunication services, WCFs and equipment are proposed on any historic site or structure or within any historic district.

5.4 Public buildings, structures and rights-of-way

Leasing of public buildings, publicly owned structures and/or public rights-of-way for the purposes of locating WCFs and/or equipment is encouraged. In cases where a facility is proposed on City property that is not in the Public Right-of-Way, specific locations and compensation to the City shall be negotiated in

lease agreements between the City and the provider on a case-by-case basis and would be subject to all of the review criteria contained in this Section. Such agreements would not provide exclusive arrangements that could tie up access to the negotiated sites or limit competition and must allow for the possibility of Collocation with other providers.

5.5 Design Guidelines for all WCFs that are not SCFs in the ROW

5.5.1 Camouflage/Concealment

All WCFs and any Transmission Equipment shall, to the extent possible, use Camouflage Design Techniques including, but not limited to the use of industry best practices materials, colors, textures, screening, undergrounding, landscaping, or other design options that will blend the WCF into the surrounding natural setting and built environment.

1. Camouflage design may be of heightened importance where findings of particular sensitivity are made (e.g. proximity to historic, natural, or aesthetically significant structures or areas, views, and/or community features or facilities). In such instances where WCFs are located in areas of high visibility, they shall (where possible) be designed (e.g., placed underground, inside of existing structure, depressed, or located behind earth berms) to minimize their profile.
2. The camouflage design may include the use of Alternative Tower Structures should the Community Development Department determine that such design meets the intent of this Code and the community is better served thereby.
3. All WCFs, such as Antennas, vaults, equipment rooms, equipment enclosures, and tower structures shall be constructed out of non-reflective materials (visible exterior surfaces only). Coloring of welds, bands, bolts, and the like, shall be of a similar color to the main WCF.
4. When located adjacent to a commercial establishment, such as a shop or restaurant, care should be taken to locate the WCF such that it does not negatively impact the business. WCFs shall not be located in-front of store front windows, primary walkways, primary entrances or exits, or in such a way that it would impede a delivery to the building. WCFs should be located between properties as much as possible.
5. When located within a City right-of-way, deployment shall not impede existing and future facilities, including sidewalks, stormwater infrastructure, water infrastructure, and electric infrastructure, and other infrastructure included in adopted City plans, inclusive of the Capital Asset Plan, and Bike-Ped Master Plan.

5.5.2 Collocation

Collocation of facilities with other providers is encouraged. Collocation can be achieved as either building-mounted, roof-mounted or ground-mounted facilities. In designing or retrofitting Towers, applicants are strongly encouraged to consider the possibility of present or future co-location of other WCFs by structurally overbuilding in order to handle the loading capacity of additional WCFs, for the use of the applicant and for other wireless service providers to use as well. Applicants shall use good faith efforts to negotiate lease rights to other users who desire to use an approved WCF site. Collocation on an existing support structure shall be permitted as an accessory use. Projections of any type on the monopole, which are not antennas, are strongly discouraged.

1. Multiple use facilities are encouraged as well. WCFs and equipment may be integrated into existing, replacement of existing, or newly developed facilities that are functional for other purposes, such as ball field lights, flagpoles, church steeples, highway lighting, etc. All multiple use facilities shall be designed to make the appearance of the antennae relatively inconspicuous.
2. The collocation requirement may be waived by the Community Development Director upon a showing that either federal or state regulations prohibit the use, the proposed use will interfere with the current use, the proposed use will interfere with surrounding property or uses, the proposed user will not agree to reasonable terms, such co-location is not in the best interest of the public health, safety or welfare or collocation is not reasonably feasible from a technological, construction

or design perspective. Time needed to review a collocation request shall not greatly exceed that for a single applicant.

5.5.3 Setbacks

All WCFs shall comply with setback requirements. At a minimum, except for WCFs in the Public Right-of-Way all WCFs shall comply with the minimum setback requirements of the underlying zone district; if the following requirements are more restrictive than those of the underlying zone district, the more restrictive standard shall apply.

1. All WCFs (except for WCFs in the Public Right-of Way) shall be located at least fifty (50) feet from any property lines, except when roof-mounted (above the eave line of a building) or wall mounted. Flat-roof mounted facilities visible from ground level within one-hundred (100) feet of said property shall be concealed to the extent possible within a compatible architectural element, such as a chimney or ventilation pipe or behind architectural skirting of the type generally used to conceal HVAC equipment, and shall comply with any applicable design requirements of Chapter 26.412, Commercial Design Review, and 26.415, Historic Preservation. Pitched-roof-mounted facilities shall always be concealed within a compatible architectural element, such as chimneys or ventilation pipes.
2. Monopole towers (except for monopole towers in the Public Right-of-Way) shall be set back from any residentially zoned properties a distance of at least three (3) times the monopole's height (i.e., a sixty (60) foot setback would be required for a twenty (20) foot monopole) and the setback from any public road, as measured from the right-of-way line, shall be at least equal to the height of the monopole.
3. No WCF may be established within one-hundred (100) feet of any existing, legally established WCF except when located on the same building or structure.
4. No portion of any antenna array shall extend beyond the property lines or into any front yard area. Guy wires shall not be anchored within any front yard area but may be attached to the building.
5. Any Alternative Tower Structure utilizing existing facilities shall meet all Right-of-Way design guidelines, pursuant to adopted standards in Title 21 - *Streets, Sidewalks, and Other Public Places*, Title 25 – *Utilities*, and Title 29 - *Engineering Standards*. Considerations should be given to the general safety of the traveling public.

5.5.4 Height

The following restrictions shall apply:

1. WCFs not attached to a building shall not exceed twenty-five (25) feet in height or the maximum permissible height of the given Zone District, whichever is more restrictive.
2. Whenever a WCF antenna is attached to a building roof, the antenna and support system for panel antennas shall not exceed ten (10) feet above the highest portion of that roof, including parapet walls and the antenna and support system for whip antennas shall not exceed ten (10) feet in height as measured from the point of attachment.
3. The Community Development Director may approve a taller antenna height than stipulated in 2. above if it is his or her determination that it is suitably camouflaged, in which case an administrative approval may be granted.
4. If the Community Development Director determines that an antenna taller than stipulated in 2. above cannot be suitably camouflaged, then the additional height of the antenna shall be reviewed pursuant to the process and standards (in addition to the standards of this Section) of Chapter 26.430 (Special review).
5. Support and/or switching equipment shall be located inside a building, unless it can be fully screened from view as provided in the "Screening" standards (26.475.130 and 26.505.080.F-G) below or no building exists in which to locate the equipment.

5.5.5 Architectural compatibility

WCFs shall be consistent with the architectural style of the surrounding architectural environment (planned or existing) considering exterior materials, roof form, scale, mass, color, texture and character. In addition:

1. If such WCF is accessory to an existing use, it shall be constructed out of materials that are equal to or of better quality than the materials of the principal use and shall exhibit compatible architectural characteristics to the principal use.
2. WCF equipment shall be of the same color as the building or structure to which or on which such equipment is mounted, unless otherwise required by Chapter 26.412, Commercial Design Review or 26.415, Historic preservation, or as required by the appropriate decision-making authority (Community Development Director, Historic Preservation Commission, Planning and Zoning Commission or City Council, as applicable).
3. Whenever WCF equipment is mounted to the wall of a building or structure, the equipment shall be mounted or a dark, neutral tone, whichever is found to provide better camouflage, in a configuration designed to blend with and be architecturally integrated into a building or other concealing structure, be as flush to the wall as technically possible and shall not project above the wall on which it is mounted. Variations to this standard in order to meet applicable requirements of Chapter 26.412, Commercial Design Review or 26.415, Historic Preservation, may be approved during the review.
4. Monopole support buildings, which house switching devices and/or other equipment related to the use, operation or maintenance of the subject monopole, must be designed to match the architecture of adjacent buildings. If no recent and/or reasonable architectural theme is present, the Community Development Director may require a particular design that is deemed to be suitable to the subject location.
5. All utilities associated with WCFs shall be underground (also see "Screening" below), unless the applicant demonstrates that it is not reasonably feasible from a construction, design, and engineering perspective.

5.5.6 Compatibility with the natural environment

WCFs shall be compatible with the surrounding natural environment considering land forms, topography and other natural features and shall not dominate the landscape or present a dominant silhouette on a ridge line. In addition:

1. If a location at or near a mountain ridge line is selected, the applicant shall provide computerized, three-dimensional, visual simulations of the WCF and other appropriate graphics to demonstrate the visual impact on the view of the affected ridges or ridge lines; an 8040 Greenline Review, pursuant to the provisions of Section 26.435.030, may also be required.
2. Site disturbances shall be minimized and existing vegetation shall be preserved or improved to the extent possible, unless it can be demonstrated that such disturbance to vegetation and topography results in less visual impact to the surrounding area.
3. Surrounding view planes shall be preserved, as required in Section 26.435.050, Mountain View Plane Review.

5.5.7 Screening

All WCF equipment, including accessory equipment, shall be screened from adjacent and nearby public rights-of-way and public or private properties placing equipment internal to the structure, by paint color selection, parapet walls, screen walls, fencing, landscaping and/or berming in a manner compatible with the building's and/or surrounding environment's design, color, materials, texture, land forms and/or topography, as appropriate or applicable in a given zone district. In addition:

1. Whenever possible, if monopoles are necessary for the support of antennas, they shall be located near existing utility poles while maintaining National Electric Safety Code clearance and/or other governing regulations, trees or other similar objects; consist of colors and materials that best blend

with their background; and, have no individual antennas or climbing spikes on the pole other than those approved by the appropriate decision-making authority (Community Development Director, Historic Preservation Commission, Planning and Zoning Commission or City Council, as applicable).

2. For ground-mounted facilities, landscaping may be required to achieve a total screening effect at the base of such facilities or equipment in order to screen the mechanical characteristics; a heavy emphasis on coniferous plants for year-round screening may be required. Landscaping shall be of a type and variety capable of growing within one (1) year to a landscape screen which satisfactorily obscures the visibility of the facility. This requirement may be waived by the Community Development Director if it is determined it is not necessary or reasonably feasible.
3. Unless otherwise expressly approved, all cables for a WCF shall be fully concealed from view underground or inside of the screening or monopole structure supporting the antennas; any cables that cannot be buried or otherwise hidden from view shall be painted to match the color of the building or other existing structure.
4. All screening shall meet the requirements of applicable Historic Preservation Design Guidelines and Commercial Design Guidelines. Additionally, all fence screening shall meet the requirements of 26.575.050, Fence Materials.
5. Notwithstanding the foregoing, the WCF shall comply with all additional measures deemed necessary to mitigate the visual impact of the facility. Also, in lieu of these screening standards, the Community Development Director may allow use of an alternate detailed plan and specifications for landscape and screening, including plantings, fences, walls, sign and structural applications, manufactured devices and other features designed to screen, camouflage and buffer antennas, poles and accessory uses. The plan should accomplish the same degree of screening achieved by meeting the standards outlined above.

5.5.8 Lighting and Signage

WCFs shall not be artificially lighted, unless required by the FAA or other applicable governmental authority, or the WCF is mounted on a light pole or other similar structure primarily used for lighting purposes. If lighting is required, it shall conform to other applicable sections of the code regulating signage or outdoor lighting. The following standards shall apply to WCFs and equipment:

1. The light source for security lighting shall feature down-directional, sharp cut-off luminaries to direct, control, screen or shade in such a manner as to ensure that there is no spillage of illumination off-site.
2. Light fixtures, whether free standing or tower-mounted, shall not exceed twelve (12) feet in height as measured from finished grade.
3. The display of any sign or advertising device other than public safety warnings, certifications or other required seals on any wireless communication device or structure is prohibited.
4. The telephone numbers to contact in an emergency shall be posted on each facility in conformance with the provisions of Chapter 26.510, Signs, of this Title.

5.5.9 Noise

Noise generated on the site must not exceed the levels permitted, pursuant to Title 18 - *Noise Abatement*, except that a WCF owner or operator shall be permitted to exceed Code noise standards for a reasonable period of time during repairs, not to exceed two hours without prior authorization from the City.

5.6 Additional design requirements

The following requirements shall be applicable to the various types of WCFs as specified below:

5.6.1 Base Stations

If an antenna is installed on a structure other than a Tower or Alternative Tower Structure, such as a Base Station (including, but not limited to the antennas and accessory equipment) it shall be of a neutral, non-reflective color that is identical to, or closely compatible with, the color of the supporting structure, or uses other camouflage/concealment design techniques so as to make the antenna and related facilities as visually unobtrusive as possible, including for example, without limitation, painting the Antennas and accessory equipment to match the structure. Additionally, any ground mounted equipment shall be located in a manner necessary to address both public safety and aesthetic concerns in the reasonable discretion of the Manager, and may, where appropriate, and reasonable feasible from a technological, construction or design perspective, require a flush-to-grade underground equipment vault.

5.6.2 Alternative Tower Structures not in the Public Right-of-Way

1. Alternative Tower Structures shall be designed and constructed to look like a building, facility, or structure typically found in the area.
2. Be camouflaged/concealed consistent with other existing natural or manmade features near the location where the Alternative Tower Structure will be located.
3. Such structures shall be architecturally compatible with the surrounding area;
4. Height or size of the proposed alternative tower structure should be minimized as much as possible;
5. WCFs shall be sited in a manner that evaluates the proximity of the facility to residential structures and residential district boundaries;
6. WCFs should take into consideration the uses on adjacent and nearby properties and the compatibility of the facility to these uses;
7. Compatibility with the surrounding topography;
8. Compatibility with the surrounding tree coverage and foliage;
9. Compatibility of the design of the site, with particular reference to design characteristics that have the effect of reducing or eliminating visual obtrusiveness; and
10. Impact on the surrounding area of the proposed ingress and egress, if any.

5.6.3 Towers

1. Towers shall be painted a neutral color so as to reduce visual obtrusiveness as determined by the City;
2. Tower structures should use existing land forms, vegetation, and structures to aid in screening the facility from view or blending in with the surrounding built and natural environment;
3. Monopole support structures shall taper from the base to the tip;
4. All Towers, excluding Alternative Tower Structures in the Right-of-Way, shall be equipped with an appropriate anti-climbing device.

5.7 Related Accessory Equipment.

Accessory equipment for all WCFs shall meet the following requirements:

1. All buildings, shelter, cabinets, and other accessory components shall be grouped as closely as technically possible;
2. The total footprint coverage area of the WCF's accessory equipment shall not exceed 350 square feet per carrier;
3. No related accessory equipment or accessory structure shall exceed 12 feet in height;

4. Accessory equipment, including but not limited too remote radio units, shall be located out of sight whenever possible by locating behind parapet walls or within equipment enclosures. Where such alternate locations are not available, the accessory equipment shall be camouflaged or concealed.

5.8 Access ways

In addition to ingress and egress requirements of the Building Code, access to and from WCFs shall be regulated as follows:

1. No WCF shall be located in a required parking, maneuvering or vehicle/pedestrian circulation area such that it interferes with or in any way impairs, the intent or functionality of the original design.
2. The WCF, except for Small Wireless Facilities in the Public Right-of-Way, must be secured from access by the general public but access for emergency services must be ensured. Access roads must be capable of supporting all potential emergency response vehicles and equipment.
3. The proposed easements for ingress and egress and for electrical and telecommunications shall be recorded at the County Clerk and Recorder's Office prior to the issuance of building permits.

6. Safety Requirements

Prevention of failures and accidents. Any Person who owns and/or operates any Wireless Communications Facility, including a small cell facility in the right-of-way, and/or Wireless Support Structure shall at all times employ ordinary and reasonable care, and install and maintain using industry standard technology for preventing failures and accidents, which are likely to cause damage, injury, or nuisance to the public.

Compliance with fire safety. Wireless Communications Facilities, including small cell facilities in the right-of-way, Wireless Support Structures, wires, cables, fixtures, and other equipment shall be installed and maintained in substantial compliance with the requirements of the National Electric Code, all state and local regulations, and in such manner that will not interfere with the use of other property.

Compliance with FCC regulations. The wireless provider shall comply with all applicable FCC, state, and local codes, provisions, or regulations that concern public safety. All wireless communications facilities must not result in human exposure to radio frequency radiation in excess of applicable safety standards specified in 47 CFR Rule 1.1307(b).

Changes in state or federal standards and regulations. If state or federal standards and regulations are amended, the owners of Wireless Communications Facilities, including small cell facilities in the right-of-way, and/or Wireless Support Structures governed by this document shall bring any facilities and/or structures into compliance with the revised standards and regulations within six months of the effective date of the standards and regulations, unless a different compliance schedule is mandated by the regulating agency. Failure to bring Wireless Communications Facilities, including small cell facilities in the right-of-way, and/or Wireless Support Structures into compliance with any revised standards and regulations shall constitute grounds for removal at the owner's expense.

Appendix A: Design Concepts

A.1 SCF pole without an attached light fixture

NOTE: 5G ANTENNAS WILL BE SMALLER THAN THE 4G ANTENNAS.

POLE WITH NO FIXTURE

HRGreen

ASPEN SMALL CELL PROJECT

ASPEN, CO

SCALE: 1" = 2'

JANUARY 30, 2020

A.2 SCF pole with a hockey puck light fixture

NOTE: 5G ANTENNAS WILL BE SMALLER THAN THE 4G ANTENNAS.

POLE WITH HOCKEY PUCK FIXTURE

HRGreen

ASPEN SMALL CELL PROJECT

ASPEN, CO

0 2 4 8
SCALE: 1" = 2'
JANUARY 30, 2020

Appendix B: Lighting Fixture Specifications

B.1 Gardco SlenderForm Hockey Puck LED

GARDCO by signify

Site & Area

SlenderForm

SFRA LED round arm mount with comfort optics

Gardco SlenderForm LED arm mount comfort SFRA features a distinct styling to provide outdoor area lighting that is both energy efficient and aesthetically pleasing. Comfort optics are designed to enhance visual comfort by reducing glare. Type 1, 2, 3, and 5 optical distributions are available with lumen output up to 9,500 lumens.

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

Ordering guide

example: SFRA-140L-450-NW-G2-T3-1-UNV-DGY

Prefix	No. of LEDs	Drive Current	LED Color - Generation	Mounting	Distribution	Voltage
SFRA	140L	450	NW-G2	AR	3	UNV
SFRA SlenderForm Round Arm Mount, comfort optics	**140L** 140 LEDs	**450** 450 mA **650** 650 mA **1150** 1150 mA **1675** 1675 mA **2100** 2100 mA	**WW-G2** Warm White, 3000K, 70 CRI, Gen 2 **NW-G2** Neutral White, 4000K, 70 CRI, Gen 2 **CW-G2** Cool White, 5000K, 70 CRI, Gen 2 **WY-G2** Warm Yellow, 2700K, 80 CRI, Gen 2[1] **AM-G2** Amber (~590nm), Gen 2[1]	**AR** Arm Mount (standard)[2] The following mounting kits must be ordered separately (See accessories) **WS** Wall mount with surface conduit rear entry permitted	**1** Comfort Type 1 **2** Comfort Type 2 **3** Comfort Type 3 **5** Comfort Type 5	**120** 120V **208** 208V **240** 240V **277** 277V **347** 347V **480** 480V **UNV** 120-277V (50/60Hz) **HVU** 347-480V (50/60Hz)

Options

Dimming controls	Motion sensing	Photo-sensing	Electrical	Luminaire	Finish
FAWS		TLRD5			16187
DD 0-10V External dimming (by others)[2] **SW** Interface module for SiteWise[2,4,6] **BL** Bi-level functionary w/motion sensor[2,5] **DynaDimmer:** Automatic Profile Dimming[2,5] **CS50** Security 50% Dimming, 7 hours **CM50** Median 50% Dimming, 8 hours **CE50** Economy 50% Dimming, 9 hours **DA50** All Night 50% Dimming **CS30** Security 30% Dimming, 7 hours **CM30** Median 30% Dimming, 8 hours **CE30** Economy 30% Dimming, 9 hours **DA30** All Night 30% Dimming	**IMRI2** Integral with #2 lens **IMRI3** Integral with #3 lens **IMRO** Pole mounted motion sensor (see accessories)	**PCB** Photocontrol Button[5,7] **TLRD5** Twist Lock Receptacle 5 Pin[8] **TLRD7** Twist Lock Receptacle 7 Pin[8] **TLRPC** Twist Lock Receptacle w/Photocell[7,9]	**Fusing** **F1** Single (120, 277, 347VAC)[8] **F2** Double (208, 240, 480VAC)[8] **F3** Canadian Double Pull (208, 240, 480VAC)[8] **Pole Mount Fusing** **FP1** Single (120, 277, 347VAC)[8] **FP2** Double (208, 240, 480VAC)[8] **FP3** Canadian Double Pull (208, 240, 480VAC)[8] **Surge Protection** (10kA standard) **SP2** Increased 20kA	Mounts to a 4" OD pole as standard **SPA** Square Pole Adapter	**Textured** **BK** Black **WH** White **BZ** Bronze **DGY** Dark Gray **MGY** Medium Gray **Customer specified** **RAL** Specify optional color or RAL (ex: RAL7024) **CC** Custom color (must supply color chip for required factory quote)

1. Extended lead times apply. Contact factory for details.
2. Mounts to a 4" OD round pole.
3. Not available with other control options.
4. Not available with motion sensor.
5. Not available with photocontrol.
6. Not available in 347 or 480V.
7. Available only in 120 or 277V.
8. Must specify input voltage.
9. Dimming will not be connected to NEMA receptacle if ordering with other control options.
10. Not available in 480V.

Slenderform_SFRA_comfort 11/19 page 1 of 5

SFRA SlenderForm

LED round arm mount – with Comfort Optics

SlenderForm Accessories (order separately, field installed)

Controls Accessories

Pole Mount Motion Sensor

MS-A-120V [1]	120V Input
MS-A-277V [1]	277V Input

Wireless systems – Remote mount module

LLCR2-(F) [1]	#2 lens
LLCR3-(F) [1]	#3 lens

Central Remote Motion Response

MS2-A-FVR-3
MS2-A-FVR-7
(used connected to SiteWise main panel)

1. DD option required.

Mounting Accessories

SlenderForm PTF2 (pole top fitter fits 2 3/8-2 1/2" OD x 4" depth tenon)

PTF2-SFRA-1-90-(F)	1 luminaire at 90°
PTF2-SFRA-2-90-(F)	2 luminaires at 90°
PTF2-SFRA-2-180-(F)	2 luminaires at 180°
PTF2-SFRA-3-90-(F)	3 luminaires at 90°
PTF2-SFRA-4-90-(F)	4 luminaires at 90°
PTF2-SFRA-3-120-(F)	3 luminaires at 120°

SlenderForm PTF3 (pole top fitter fits 3-3 1/2" OD x 6" depth tenon)

PTF3-SFRA-1-90-(F)	1 luminaire at 90°
PTF3-SFRA-2-90-(F)	2 luminaires at 90°
PTF3-SFRA-2-180-(F)	2 luminaires at 180°
PTF3-SFRA-3-90-(F)	3 luminaires at 90°
PTF3-SFRA-4-90-(F)	4 luminaires at 90°
PTF3-SFRA-3-120-(F)	3 luminaires at 120°

SlenderForm PTF4 (pole top fitter fits 3 1/2-4" OD x 6" depth tenon)

PTF4-SFRA-1-90-(F)	1 luminaire at 90°
PTF4-SFRA-2-90-(F)	2 luminaires at 90°
PTF4-SFRA-2-180-(F)	2 luminaires at 180°
PTF4-SFRA-3-90-(F)	3 luminaires at 90°
PTF4-SFRA-4-90-(F)	4 luminaires at 90°
PTF4-SFRA-3-120-(F)	3 luminaires at 120°

SFRA-WS-(F)	Wall mount with surface conduit rear entry permitted
SFRA-BD	Bird deterrent
(F) = Specify finish	

LED Wattage and Lumen Values for 3000K, 4000K & 5000K fixtures

Ordering Code:	Total LEDs	System current (mA)	Ave. System Watts (W)	1			2			3			5		
				Lumen Output	BUG rating	Efficacy (LPW)	Lumen Output	BUG rating	Efficacy (LPW)	Lumen Output	BUG rating	Efficacy (LPW)	Lumen Output	BUG rating	Efficacy (LPW)
SFRA 3000K															
SFRA-140L-450-WW-G2-x-UNV	140	450	22	2286	B1-U0-G1	104	2148	B1-U0-G1	98	2314	B1-U0-G1	105	2361	B1-U0-G1	107
SFRA-140L-650-WW-G2-x-UNV	140	650	31	3274	B2-U0-G2	106	3076	B2-U0-G2	99	3314	B2-U0-G2	107	3381	B2-U0-G1	109
SFRA-140L-1150-WW-G2-x-UNV	140	1150	51	5365	B2-U0-G2	105	5041	B2-U0-G2	99	5431	B2-U0-G2	106	5541	B3-U0-G2	109
SFRA-140L-1675-WW-G2-x-UNV	140	1675	75	7519	B3-U0-G3	100	7065	B3-U0-G3	94	7611	B3-U0-G3	101	7765	B3-U0-G2	104
SFRA-140L-2100-WW-G2-x-UNV	140	2100	95	9023	B3-U0-G3	95	8478	B3-U0-G3	89	9134	B3-U0-G3	96	9318	B3-U0-G2	98
SFRA 4000K															
SFRA-140L-450-NW-G2-x-UNV	140	450	22	2332	B1-U0-G1	106	2191	B1-U0-G1	100	2360	B1-U0-G1	107	2408	B1-U0-G1	109
SFRA-140L-650-NW-G2-x-UNV	140	650	31	3339	B2-U0-G2	108	3138	B2-U0-G2	101	3380	B2-U0-G2	109	3449	B2-U0-G1	111
SFRA-140L-1150-NW-G2-x-UNV	140	1150	51	5473	B2-U0-G2	107	5142	B2-U0-G2	101	5540	B2-U0-G2	109	5651	B3-U0-G2	111
SFRA-140L-1675-NW-G2-x-UNV	140	1675	75	7669	B3-U0-G3	102	7206	B3-U0-G3	96	7763	B3-U0-G3	104	7920	B3-U0-G2	106
SFRA-140L-2100-NW-G2-x-UNV	140	2100	95	9204	B3-U0-G3	97	8648	B3-U0-G3	91	9317	B3-U0-G3	98	9505	B3-U0-G2	100
SFRA 5000K															
SFRA-140L-450-CW-G2-x-UNV	140	450	22	2282	B1-U0-G1	104	2144	B1-U0-G1	97	2310	B1-U0-G1	105	2357	B1-U0-G1	107
SFRA-140L-650-CW-G2-x-UNV	140	650	31	3269	B2-U0-G2	105	3071	B2-U0-G2	99	3309	B2-U0-G2	107	3375	B2-U0-G1	109
SFRA-140L-1150-CW-G2-x-UNV	140	1150	51	5356	B2-U0-G2	105	5033	B2-U0-G2	99	5422	B2-U0-G2	106	5531	B3-U0-G2	108
SFRA-140L-1675-CW-G2-x-UNV	140	1675	75	7506	B3-U0-G3	100	7053	B3-U0-G3	94	7599	B3-U0-G3	101	7752	B3-U0-G2	103
SFRA-140L-2100-CW-G2-x-UNV	140	2100	95	9009	B3-U0-G3	95	8464	B3-U0-G3	89	9119	B3-U0-G3	96	9303	B3-U0-G2	98

Actual performance may vary due to installation variables including optics, mounting/ceiling height, dirt depreciation, light loss factor, etc.; highly recommended to confirm performance with a layout - contact Applications at outdoorlighting.applications@philips.com.

Note: Some data may be scaled based on tests of similar. But not identical luminaires.

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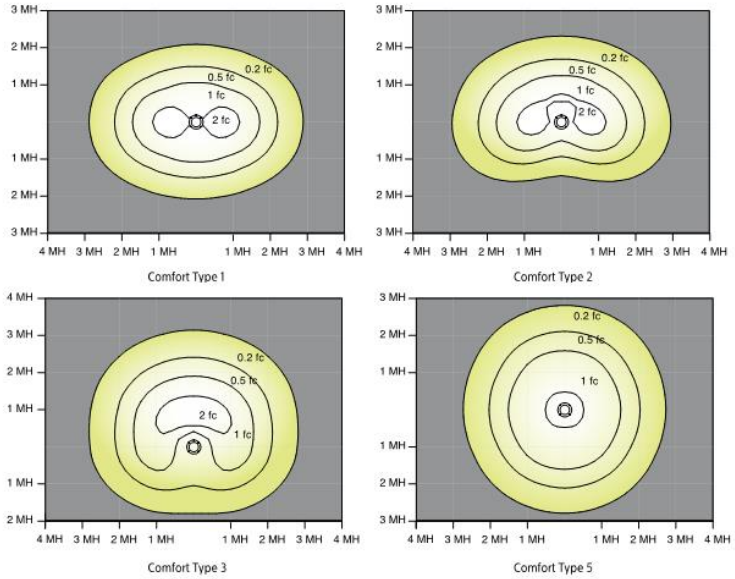
SFRA SlenderForm

LED round arm mount – with Comfort Optics

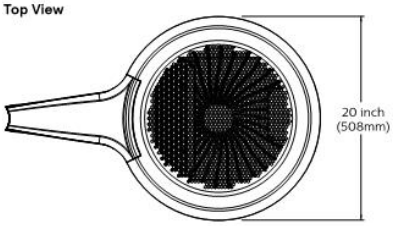
Optical Distributions

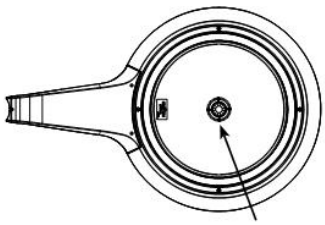
Based on SFRA-140L-2100 at 20' mounting height



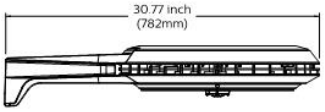
Dimensions – Arm Mount Luminaire (SFRA)

Top View





Side View



Approximate Luminaire Weight:
28.1 Lbs (12.75 Kg)

Type	Single	Twin @ 180	3/4
SFRA	0.66 / 0.062	1.32 / 0.123	1.60 / 0.149

Slenderform_SFRA_comfort 11/19 page 3 of 5

SFRA SlenderForm

LED round arm mount – with Comfort Optics

Specifications

Housing

All die-cast parts are made of die-cast aluminum alloy. Luminaire housing rated to IP66, tested in accordance to Section 9 of IEC 60598-1.

Light engine

Light guide technology provides low-glare, uniform illumination. Composed of 140 LEDs strategically positioned on the edge of the optical plate. Light engine luminous opening size optimized to best achieve a balance between lumen output and optical performance with the need to provide visual comfort. Light engine frame ensures contact with housing to provide heat conduction and sealing against the elements. Light engine is RoHS compliant. . Standard color temperatures: 3000K +/- 130K, 4000K+/- 130K, 5000K +/- 225K. Minimum CRI of 70. Also available in 2700K and Amber (Dominant wavelength 589nm, peak wavelength 633nm, and minimum wavelength 486nm) with extended lead times. Contact factory for details.

Energy saving benefits

System efficacy up to 111 lms/W with significant energy savings over Pulse Start Metal Halide luminaires. Optional control options provide added energy savings during unoccupied periods.

Optical systems

The advanced LED comfort optical system provides Types 1, 2, 3, and 5. Composed of high performance UV-stabilized optical grade lens with micro-optics to achieve desired distribution optimized to get a exceptional lighting uniformity. Performance tested per LM-79 and TM-15 (IESNA) certifying its photometric performance. Luminaire designed with 0% uplight (U0 per IESNA TM-15).

Mounting

Standard luminaire arm mounts to 4" round poles. Square pole adapter needs to be ordered separate. Also optional are wall mounting accessories.

Control options

0-10V dimming (DD): Access to 0-10V dimming leads supplied through the yoke of the luminaire (for secondary dimming controls by others). Cannot be used with other control options.

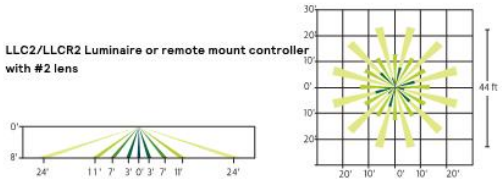
SiteWise (SW): SiteWise system includes a controller fully integrated in the luminaire that enables the luminaires to communicate with a dimming signal transmitter cabinet located on site using Philips patented central dimming technology. A locally accessible mobile app allows users to access the system and set functionalities such as ON/OFF, dimming levels and scheduling. SiteWise is available with motion response options in order to bring the light back to 100% when motion is detected. Cannot be used with other control options or photocell options. Additional functionalities are available such as communication with indoor lighting and connection to BMS systems. Complete information on the control system can be found on the SiteWise website at philips.com/sitewise.

Automatic Profile Dimming (CS/CM/CE/CA): Standard dimming profile of 30% or 50% provide flexibility towards energy savings goals while optimizing light levels during specific dark hours. When used in combination with not programmed motion response it overrides the controller's schedule when motion is detected. After 5 minutes with no motion, it will return to the automatic diming profile schedule. Automatic dimming profile scheduled with the following settings:

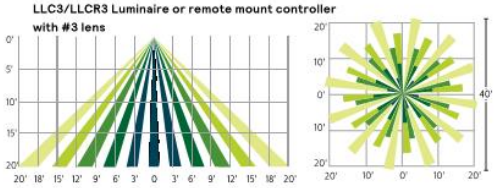
- **CS50/CS30:** Security for 7 hours night duration (Ex., 11 PM - 6 AM)
- **CM50/CM30:** Median for 8 hours night duration (Ex., 10 PM - 6 AM)
- **CE50/CE30:** Economy for 9 hours night duration (Ex., 9 PM - 6 AM)
- **CA50/CA30:** for all night (during all dark hours)

Cannot be used with other control options.

LLC2/LLCR2 Luminaire or remote mount controller with #2 lens



LLC3/LLCR3 Luminaire or remote mount controller with #3 lens



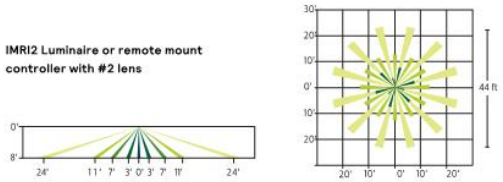
Motion response options

Bi-Level Infrared Motion Response (BL-IMRI3): Motion Response module is mounted integral to luminaire factory pre-programmed to 50% dimming when not ordered with other control options. P50-IMRI is set/operates in the following fashion: The motion sensor is set to a constant 50%. When motion is detected by the PIR sensor, the luminaire returns to full power/ light output. Dimming on low is factory set to 50% with 5 minutes default in "full power" prior to dimming back to low. When no motion is detected for 5 minutes, the motion response system reduces the wattage by 50%, to 50% of the normal constant wattage reducing the light level. Other dimming settings can be provided if different dimming levels are required. This can also be done with FSIR-100 Wireless Remote Programming Tool (contact Technical Support for details).

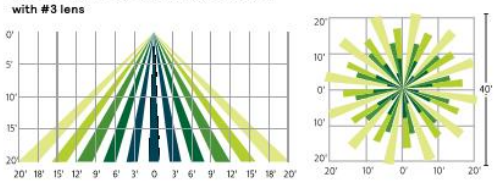
Infrared Motion Response with Other Controls (SW-IMRI3): When used in combination with other controls (Automatic Dimming Profile and SiteWise), motion response device will simply override controller's schedule with the added benefits of a combined dimming profile and sensor detection. In this configuration, the motion response device cannot be re-programmed with FSIR-100 Wireless Remote Programming Tool. The profile can only be re-programmed via the controller.

Infrared Motion Response Lenses (IMRI3): Infrared Motion Response Integral module is available lens #3 (IMRI3), which is designed for mounting heights up to 20' with a 40' diameter coverage area. See chart for approximate detection patterns:

IMRI2 Luminaire or remote mount controller with #2 lens



IMRI3 Luminaire or remote mount controller with #3 lens

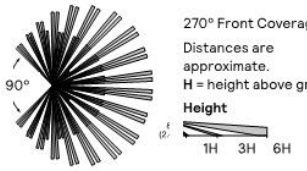


SFRA SlenderForm

LED round arm mount – with Comfort Optics

Specifications (continued)

Infrared Motion Response Outboard (IMRO): Infrared Motion Response Outboard combines the benefits of both automatic profile dimming and motion response. PIR sensor features a pole mounted motion sensor per pole (order MS-A-120 or MS-A-277 separately). IMRO sensors require single voltage 120V or 277V input. If motion is detected during the time that the luminaire is operating at profile dimming mode specified, the luminaire returns to 100% power and light output. The luminaire remains on high until no motion is detected for the duration period, after which the luminaire returns back to automatic profile dimming. Duration period is factory set at 15 minutes, and is field adjustable from 5 minutes up to 15 minutes. The area motion detector provides coverage equal to up to 6 times the sensor height above ground, 270° from the front-center of the sensor (see chart for approximate detection patterns).



Pole Details: IMRO requires that the pole include additional hand hole 15 feet above the pole base, normally oriented 180° to the standard hand hole. For Philips Gardco poles, order the pole with the Motion Sensor Mounting (MSM) option which includes the hand hole and a special hand hole cover plate for the sensor with a 1/2" NPT receptacle centered on the hand hole cover plate into which the motion sensor mounts. Once the motion sensor is connected to the hand hole cover plate, then wiring connections are completed in the pole. The plate (complete with motion sensor attached and wired) is then mounted to the hand hole. If poles are supplied by others, the customer is responsible for providing suitable mounting accommodations for the motion sensor in the pole (see Gardco Poles specification sheets for more information).

Electrical

Twist-Lock Receptacle (TLRD5/TLRD7/ TLRPC): Twist Lock Receptacle with 5 pins enabling dimming or with 7 pins with additional functionality (by others) can be used with a twistlock photoelectric cell or a shorting cap. Dimming Receptacle Type B (5-pin) and Type D-24 (7-pin) in accordance to ANSI C136.41. Can be used with Philips or third-party control system. Receptacle located on top of luminaire housing. When specifying receptacle with twistlock photoelectric cell, voltage must be specified.

Driver: Driver efficiency (>90% standard). 120-480V available (restrictions apply). Open/short circuit protection. Optional 0-10V dimming to 10% power. RoHS compliant.

Button Photocontrol (PCB): Button style design for internal luminaires mounting applications. The photocontrol is constructed of a high impact UV stabilized polycarbonate housing. Rated voltage of 120V or 208-277V with a load rating of 1000 VA. The photocell will turn on with 1-4Fc of ambient light.

Surge protection (SP1/SP2): Each luminaire is provided as standard with surge protection device tested in accordance with ANSI/IEEE C62.45 per ANSI/ IEEE C62.41.2 Scenario I Category C High Exposure 10kV/10kA waveforms for Line-Ground, Line-Neutral and Neutral-Ground, and in accordance with DOE MSSLC Model Specification for LED Roadway Luminaires Appendix D Electrical Immunity High test level 10kV/10kA. 20kV / 10kA surge protection device that provides extra protection beyond the SP1 10kV/10kA level.

Vibration resistance

Luminaire is tested and rated 3G over 100,000 cycles conforming to standards set forth by ANSI C136.31-2010. Testing includes vibration to 3G acceleration in three axes, all performed on the same luminaire.

Listings

UL/cUL wet location listed to the UL 1598 standard, suitable for use in ambient temperatures from -40° to 40°C (-40° to 104°F). Most SlenderForm SFRA comfort configurations are qualified under Standard DesignLights Consortium® category. Consult DLC Qualified Products list for more details.

Finish

Each standard color luminaire receives a fade and abrasion resistant, electrostatically applied, thermally cured, triglycidal isocyanurate (TGIC) textured polyester powdercoat finish. Standard colors include bronze (BZ), black (BK), white (WH), dark gray (DGY), and medium gray (MGY). Consult factory for specs on optional or custom colors.

Warranty

SlenderForm luminaires feature a 5-year limited warranty.
See signify.com/warranties for complete details and exclusions.

Predicted Lumen Deprecation Data

Ambient Temperature	Driver mA	Calculated L_{70} [1,2]	L_{70} per TM-21 [2,3]	Lumen Maintenance %
25°C	Up to 2100 mA	>100,000 hrs	>60,000 hrs	84%

1. Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions.
2. L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output.
3. Calculated per IESNA TM21-11. Published L_{70} hours limited to 6 times actual LED test hours.

Signify North America Corporation
200 Franklin Square Drive,
Somerset, NJ 08873
Telephone 855-486-2216

Signify Canada Ltd.
281 Hillmount Road,
Markham, ON, Canada L6C 2S3
Telephone 800-668-9008

Appendix C: SCF Construction Plan Review Checklist

Small Cell Facility Construction Plan Review Checklist

SITE PLAN SHALL INCLUDE:

One set of plans shall be prepared per small cell facility and submitted electronically in accordance with the following requirements:

- ☐ 11” x 17” minimum sized plans.
- ☐ Site Plan drawn to scale 1”=10’ to 1”=40’.
- ☐ Legend to define map signals, identify dimensions of original drawing.
- ☐ Vicinity Map.
- ☐ North arrow.
- ☐ Location information in a latitude / longitude format shall be provided so that City of Aspen GIS can update the location in a layer on Map Aspen identifying Existing and Pending Wireless facilities. Show all properties and buildings with addresses and parcel numbers adjacent to the project site.
- ☐ Identify location of any window or door openings facing the right-of-way adjacent to the project site.
- ☐ Proposed pole location with dimensions to surface infrastructure and nearest property line.
- ☐ Electronic connection location.
- ☐ Data cable connection.
- ☐ Any Designated Historic Property or District within the area shown on the site plan.
- ☐ Any Designated Mountain View Plane point of reference within the area shown on the site plan.
- ☐ Any National Forest Property within the area shown on the site plan.
- ☐ Identify right of way line, sidewalk, curb line, and street centerline.
- ☐ Identify street names.
- ☐ Identify all existing public and private improvements within the parkway area where excavation is proposed, such as driveways, utility boxes, fire hydrants, trees, curb ramps, street signs, etc.
- ☐ Identify the curb to property line distance and sidewalk width.
- ☐ Show designated bike lanes.
- ☐ When excavating in a bike lane, please add a note for contractor to grind and overlay full width of bike lane.
- ☐ Identify all existing utilities (wet and/or dry) within the street with dimensions to the nearest proposed pole, conduit, meter, etc.
- ☐ Identify the horizontal distances from edge of trench of proposed utility line to face of curb, water lines, sewer lines, and any other dry utilities near the vicinity of the project.
- ☐ Identify vertical clearance between proposed utility line(s) and existing utility line(s) at each crossing location.
- ☐ Identify all traffic visibility areas as described in the City of Aspen Engineering Standards.
- ☐ Identify all existing traffic loops/sensors.
- ☐ Identify separation distance (from edge to edge) between existing improvements and proposed utility conduit/box.
- ☐ Identify the separation between proposed trench and the face of curb.
- ☐ Identify the minimum 4’ wide ADA Path of Travel between above ground structure(s) and the edge of Path of Travel/sidewalk.
- ☐ Handholes shall not be in the Path of Travel.

- Identify the minimum required 24” clearance between the replacement/new pole and face of curb in accordance with Standard Drawings.
- Any above grade obstruction 3 ft or greater in height that are placed at intersections or driveway shall evaluate sight distance requirements per AASHTO Standards and Land Development Code
- Identify any existing pole or other structure to be removed.
- Identify area to be disturbed and the proposed repairs and replacements including any landscape, irrigation lines or other appurtenances being removed and replaced.
- Survey in accordance with the requirements of the Survey City of Aspen Engineering Department Survey Checklist in Appendix A of the City of Aspen Engineering Standards.

NON-IONIZING ELECTROMAGNETIC RADIATION (NIER) REPORT SHALL INCLUDE:

- One site specific NIER report is required for each Small Cell Facility (SCF).
- Include: % Maximum Permissible Exposure Simulations at Antenna Face and Ground Level + 5 Feet.
- Color Photo Simulation to scale for each configuration/pole location with dimensions.
- Show simulation of antenna, beam, nearest structure(s), topography.
- Show separate % MPE estimate for each transmitter.
- Cover letter stamped and sealed by a structural engineer licensed in the State of Colorado.
- Report drawings shall include:
    - Page numbers on every page of the NIER report.
    - Indicate Scale on every graphic of the NIER report.
    - Acronyms should be spelled out/defined for improved interpretation by the general public.
    - State the general purpose and type of transmitter(s) (i.e., “…Omni-directional cellular 4G LTE, Point-to-multipoint backhaul microwave hop,” etc.)
- Provide separate simulations noting limits and % of MPE:
    - At antenna level – Show plan and profile/elevation views.
    - At ground level – Show plan and profile/elevation views.
    - Calculate square feet of private property exceeding 100% MPE at antenna at any level.
    - Graphically illustrate MPE values considering the topography beyond the nearest potentially affected residence. For example, if an antenna radiates a high-power beam to the north from 20 feet above ground level at the horizon over irregular terrain, include graphically the distance the beam(s) will pass from the nearest potentially affected residence on the plan and profile.

LIGHTING PLAN SHALL INCLUDE:

- Photometric footprint over the site plan demonstrating that the proposed fixture is consistent with the City standards for maximum footcandles per square foot.
- Sufficient documentation to document that the proposed lighting is in accordance with the City of Aspen Lighting Standards for Small Cell Facilities which is:

    - A LED, “hockey puck” design as shown in *Section A.2* of **Appendix A** of the City of Aspen *Wireless Communications Facilities Design Guidelines*.
    - The fixture shall be the *Gardco SlenderForm Hockey Puck LED* as shown in *Section B.1* of **Appendix B** of the City of Aspen *Wireless Communications Facilities Design Guidelines***,** and shall match the following Model.

      Gardco Luminaire Model Number:

SFRA-140L-450-NW-G2-AR-3-UNV-FAWS-TLRD5-16187

The following are important notes for the applicant regarding this Gardco Model Number:

AR – Designates an arm mount to a 4 inch O.D. pole. Since the City requires an approximate 7 to 8-inch round fluted pole, the applicant will need to work with the pole manufacturer to create an accommodation at the mounting height location.

FAWS – Designates a potentiometer device that will provide simple manual dimming adjustment to be factory installed in the luminaire.

TRLD5 – Designates a 5-pin photocell socket without a photocell. The socket will accept a three-pin photocell. The applicant shall purchase a photocell for the socket based on the City's recommendation, so that the photocell is the same as the ones used throughout the City. In addition, the photocell shall be a long-life model with a universal voltage rating.

16187 – Designates Federal Color 16187 from the Federal Standards 595C Colors book. This will ensure that the fixture is the same color of the pole to which it is attached.

- The fixture shall be mounted at a height of 15 to 16 feet as approved by the City.
- The fixture shall be designed to be modular – in that it could be easily replaced with an alternative fixture in the future.
- The fixture shall comply with City of Aspen B.U.G. Standards.
- The fixture shall be dark sky compliant.
- All luminaires must be equipped with a dimmable driver regardless of output.

ELECTRICAL PERMIT SHALL INCLUDE:

- Must be submitted by a City of Aspen licensed Electrical Contractor.
- Contractor must be in possession of a valid City of Aspen business license.

THE STRUCTURAL INTEGRITY REPORT SHALL INCLUDE:

- Geotechnical report.
- Caisson design to support the proposed pole designed to accommodate a pole which will accommodate two small cell transmitters.
- Calculations supporting the proposed design.
- Cover letter stamped and sealed by a structural engineer licensed in the State of Colorado.

CONSTRUCTION MITIGATION PLAN SHALL INCLUDE:

(Construction Mitigation Plan (CMP) information and requirements are available on the City's website at https://www.cityofaspen.com/906/Construction-Mitigation)

- Apply for all associated permits:
- Right-Of-Way Permit including:
  - Site plan.
  - Traffic Control Plan provided by a certified traffic controller.
  - Maintenance Bond.
  - CDOT Permit (if applicable).
- Temporary Encroachment Permit.
- Permanent Encroachment Permit.

- Parking Permit.
- Provide Narrative CMP with graphical representations of the work site that includes acknowledgement of the following:
  - City of Aspen Work Hours (7:30-5:30 M-F / 9-5 Sat no loud work / Sun no work)
  - City of Aspen Noise Restrictions and Limitations (See CMP Manual)
  - Traffic Control Plan (Vehicle and Pedestrian) submitted by certified TCS.
  - Ensure the use of wet saws or drills when working with masonry or concrete.
  - Proper protection for passersby as well as adjacent structures.
  - Stormwater protection in the gutter if any excavation is to occur or if concrete / asphalt is to be cut with a demo saw or similar.
  - Concrete washout if new concrete is to be placed.
  - Identify staging location.
  - Identify parking areas.
  - Identify trash and or recycling containers.
  - Identify any existing damage in the vicinity of the proposed SCF.
  - Identify area of disturbance including infrastructure, landscaping, and irrigation.

NOTICE REQUIREMENTS SHALL INCLUDE:

At the issuance of a completeness letter for an application for a new SCF installation, the applicant will follow the following procedures for public notice:

- Within 15 days of the completeness letter being issued, the following notice materials are required:
  - A 24x36 poster will be placed at the location of the proposed facility. The poster will include the following information:
    - A photo simulation of the proposed facility.
    - A brief description of the type of equipment and RF signal that is emitting from the facility.
    - Contact information for the applicant.
    - Contact information for City staff.
  - A mailed notice to all property owners within 300 feet of the proposed facility. The mailed notice will include the information required by the on-site poster – and shall additionally include text that better explains what a SCF is.
  - Newspaper Notice – City of Aspen Community Development will facilitate.
  - Location information shall be provided so that City of Aspen GIS can update the location in a layer on Map Aspen identifying Existing and Pending Wireless facilities.

City of Aspen Community Development Department will assist the applicant in the provision of notice. Any delays in the provision of necessary materials for public notice by the applicant will result in a hard stop on the shot clock tolling. All costs associated with the issuance of public notice shall be the responsibility of the applicant.

Appendix D: Small Cell / 5G Background Information

D.1 Small Cell Definition

Small cells are low-powered cellular radio access facilities that provide a small radio footprint, which can range from 10 meters (approximately 30 feet) within urban locations to 2 km (approximately 6500 feet) for rural locations depending upon the radio frequencies being used. They are "small" compared to a mobile macrocells, primarily because they have a shorter range. They make the best use of available spectrum by reusing the same frequencies over and over again within a geographical area. Fewer macrocell sites are being built, with a larger number of small cells being built as an important method of increasing cellular network capacity, quality and resilience. Small cells support both today's 4G/LTE technologies and tomorrow's 5G technologies, as well as potentially supporting other technologies that might be developed in the future. [3]

Small cells complement today's macrocell network to improve coverage, add capacity, and support new services and user experiences. There are various types of small cells, with varying ranges, power levels and form factors. While the smallest units are for indoor residential use, the largest are for urban or rural outdoor uses. [3]

On September 27, 2018, the Federal Communications Commissions (FCC) adopted a Declaratory Ruling and Third Report and Order, titled "Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment" (the Order). The FCC Order defines Small Cell Facilities as facilities that meet each of the following conditions [6]:

(1) The facilities—

  i. are mounted on structures 50 feet or less in height including their antennas, or

  ii. are mounted on structures no more than 10 percent taller than other adjacent structures, or

  iii. do not extend existing structures on which they are located to a height of more than 50 feet or by more than 10 percent, whichever is greater;

(2) Each antenna associated with the deployment, excluding associated antenna equipment, is no more than three cubic feet in volume;

(3) All other wireless equipment associated with the structure, including the wireless equipment associated with the antenna and any pre-existing associated equipment on the structure, is no more than 28 cubic feet in volume;

(4) The facilities do not require antenna structure registration under part 17 of the FCC Order;

(5) The facilities are not located on Tribal lands, as defined under 36 CFR 800.16(x); and

(6) The facilities do not result in human exposure to radiofrequency radiation in excess of the applicable safety standards.

D.2 5G Definition

5G refers to the fifth generation of mobile phone networks. 5G will enable significantly greater mobile speeds to enable real-time connectivity for mission-critical devices and applications. In the near future, 5G networks will connect billions of IoT devices that will require a wide variety of speed and large volumes of data. [2]

The industry continues looking to the future as the uses and demands for mobile data keep expanding. 5G, which was rolled out in 2019 and will continue to grow for years to come, is being designed to provide higher speeds, while offering improved capacity, scale, latency, and reliability. [2]

As was the case with earlier steps along the way to faster mobile data, 5G will require new hardware at the network and device level that is compatible with the 5G New Radio (NR) standards. There are reportedly just a handful of commercially available handheld mobile 5G devices in the US today, with new 5G devices continuously being developed and released. [2]

Latency

Latency is the lag or delay between when data is sent and when it is received. Low latency becomes essential for critical control in certain situations such as autonomous vehicles and remotely controlled surgical procedures. [2]

Spectrum

An analogy that could be used to best describe spectrum is to think about it as a highway. The amount of spectrum determines how many lanes a highway has. With more data (cars on the highway), the more lanes (spectrum) the better. [2]

The bandwidth that is available within a spectrum determines how much network performance is available to network users. In low-band spectrum, bandwidth is typically limited, so data rates tend to be low. In mid-band and high band spectrum, the available bandwidth can be many times greater than what is available in low-band, which results in higher data rates. [2]

In some 5G solutions, high-band spectrum offers higher capacity and speed. However, the high-band spectrum has an extremely short range of just a few hundred meters. Due to its short range, this spectrum requires massive network densification. [2]

Although mid-band and high-band spectrum have reduced range, the higher frequencies involved mean that antennas can be smaller. [2]

Capacity

One of the best ways to describe capacity is to examine one of the more popular uses of wireless networks, streaming a movie. When trying to stream a 4K movie over today's 4G/LTE wireless network, people probably encounter an on-screen-spinning disk or other message indicating that the movie is buffering. That is because existing wireless networks often do not have enough capacity to handle demands such as streaming 4K movies due to lack of spectrum. In part, this lack of capacity stems from the relatively low frequencies used by existing networks. [2]

On the other hand, 5G will use higher frequencies and a variety of technologies to allow, for example, users to watch 4K high definition movies without being bothered by that annoying little spinning disk in the center of their screen. [2]

Speed

Because 5G will use higher frequencies, it will provide much higher data speeds. 5G is designed to incorporate a number of technologies that will enable users to do things like download an entire HD movie in a couple of seconds. [2]

Coverage

In addition to capacity and speed, coverage is another very important factor in determining how usable any wireless network may be. If a user cannot get a signal, the potential capacity and speed are meaningless. [2]

5G wireless networks will use a much broader range of frequencies than were utilized in earlier networks. While higher frequencies can deliver much higher bandwidth and data rates, higher frequency radio waves can only be effective over much shorter distances, so small cells only supply a few hundred feet of coverage. [2]

Densification

Densification is adding more cell sites to an area. Network densification is being implemented due to the growing number of devices and increasing demand for data. When more cell sites exist in an area, users will most likely be closer to one of those sites, which means that coverage and capacity become less of a problem. [2]

Deploying a large number of low powered small cells is a solution for network densification. A network of small cells can be deployed anywhere needed as a complement to the existing network of macro cells to increase capacity and data rates. [2]

Network densification needs to be complemented by fiber optic backhaul.

Uses

Remote workers / off-site job locations

5G can be used to replace traditional wireline connections by increasing data bandwidth available to devices and minimizing latency. For remote workers, this increases flexibility in work locations, allowing for communication with the office, without being tied to a desk in a home office with a wireline connection. For situations that involve frequently changing off-site job locations, the lower technical requirements for 5G deployment allow for setting up a 5G connection to which existing devices can connect to a 5G router via Wi-Fi. [1]

Internet of Things (IoT) devices

Improving network connectivity for IoT devices is one of the priorities for the design of 5G networks. For some LTE capable IoT devices the limitations of battery sizes that can be included in these devices and the comparatively high-power requirements of LTE limit the usefulness of mobile network connectivity in these situations. 5G networks are focusing on reducing power requirements, making the use of IoT devices more feasible. [1]

City centers, office buildings, arenas, and stadiums

5G technologies can also be used to improve the quality of service for situations in which a large number of devices make use of the mobile network in densely populated areas. These benefits can be realized easily in situations with variable traffic and in areas where large numbers of employees work during the week. Densely populated city centers can also benefit from the ability of 5G networks to provide service to more devices in physically smaller spaces. [1]

Future

As technology advances, older devices will inevitably reach end-of-life. Much in the same way that the digital switchover occurred for over-the-air TV broadcasts, older mobile networks are actively being dismantled to free spectrum for LTE and 5G networks. [1]

In the US, AT&T disabled its 2G network on January 1, 2017, rendering countless phones unusable. Verizon planned to disable its legacy 2G and 3G networks by the end of 2019, which will render older

smartphones unusable, as well as IoT devices such as water meters. End-of-life plans for the 2G networks of Sprint and T-Mobile have not been publicly disclosed. [1]

As 5G is used to deliver wireless broadband, wireline broadband providers will face competition as the two-services approach feature parity. With many people using smartphones both as their primary computing device and for tethering a traditional computer to the internet, the extra cost of a traditional wireline network connection may become unnecessary for some people, and enable those outside the reach of traditional wireline networks to have affordable access to high-speed broadband for the first time. [1]

5G's low-power and low-latency attributes are expected to spark a revolution in IoT deployments. 5G will enable the deployment of billions of IoT devices by 2020, leading to the creation of the "industrial internet," which will affect a number of industries. This will also make 5G well suited for applications that require continuous response and data analysis, such as self-driving cars and traffic control. [1]

D.3 Sources

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