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RAYCAP ARTICLE

C-Band Auctions and New Small Cell Formats Drive 5G Expansion

"The FCC is making available mid-band spectrum with an ideal balance of high speeds and solid signal propagation."

The current FCC C-band auctions are offering prime mid-band spectrum that have a compelling balance of higher speeds with solid signal propagation to expand 5G coverage. This will spur increasing 5G deployments by carriers and tower companies across broader and more diverse geographies to improve their overall coverage. To continue to meet local municipal aesthetic requirements, they will need an expanding array of formats for small cells. In addition to familiar pole toppers, pole-mounted enclosures and integrated poles, carriers and tower companies can select from newer "clamshell" base formats, ground furniture and even trash receptacle knockoffs to move ahead with their new mid-band spectrum.

New FCC auctions open up mid-band for 5G

The FCC has been working to make available mid-band spectrum in the 3.0 GHz to 4.5 GHz frequency range that offers an ideal balance of high speeds with solid signal propagation to help network operators expand 5G coverage. C-Band comprises a portion of this frequency range, and this year the FCC has made 280 megahertz of this spectrum available for 5G through a public auction that began in December of 2020.

A new "5G land rush" has begun that will accelerate 5G deployment in the coming years. But the more carriers and tower companies expand, the more different kinds of urban and rural environments they will need to operate in. An expanding range of small cell enclosures and form factors will be key to moving fast in this era.

Figure 1: Streetlight poles are an obvious option for urban small cells, and the top of the pole provides the best line of sight for 5G coverage.

Current state of 5G deployment options

To date, 5G small cell sites are already appearing on busy city streets, historic sites and neighborhoods, co-existing on lighting poles and within other forms of street furniture on right of ways. To maximize coverage and avoid cluttering these urban areas, carriers, tower companies and municipalities have found that street lighting poles are obvious platforms for 5G small cell sites.

Typical small cell sites mount the 4G/5G antennas or radios at the top of the pole to optimize performance, often using concealment where possible. The overriding characteristic of pole toppers should be flexibility in configuration, so the radios can be positioned optimally (and eventually upgraded) depending on the needs of that particular site. To meet required coverage patterns, multi-tenant siting and future upgrades, the pole topper should have a uniform form factor that can host different brands of 5G mmWave radios, as well as be backwards compatible with lower frequency bands.

With one or more small cell sites destined for virtually every block, municipalities are concerned about the visible impact of this radio equipment suspended over the street. Fortunately, a unique concealment material called InvisiWave® is now available that can completely conceal 5G radios with minimal signal loss. It has been tested and approved for mmWave frequencies, which are commonly used for 5G networks. In addition, it is entirely backwards compatible with widely used frequencies for 4G and earlier technologies.

The electronics that support the radios are located below the top of the pole, most often in side-mounted enclosures. This familiar format encloses the electronics needed for a 4G/5G site: 4G radios, AC power and disconnect, fiber management and cooling equipment. This configuration can often run into resistance, as some municipalities may not like the aesthetic effect of an enclosure mid-way up the lighting pole. And in areas with high wind speeds, such as the gulf coast and eastern seaboard, placing the weight of the enclosure on the pole can present wind load problems.

Figure 2: Integrated small cell pole combines and conceals all the elements needed for a complete 4G/5G small cell site.

One elegant alternative to adding equipment to an existing pole is to replace it with an integrated small cell pole that combines and conceals all the elements needed for a complete 4G/5G small cell site. The STEALTH® integrated small cell pole products from Raycap, for example, can integrate AC- or DC-powered 5G mmWave and 4G radios as well as the supporting electronics all within the pole. The pole, in turn, can be engineered and manufactured to follow municipal guidance on appearance, finish and color.

Figure 3: Base "clamshell" enclosure keeps electronics close by without adding bulk, weight, and wind load to the pole.

Clamshell enclosures expand pole-based options

When a pole-mounted enclosure or an integrated pole do not meet requirements, one straightforward alternative is to move the enclosure to the base of the pole, creating a wider base as an integrated section of the pole. In the example in Figure 3, we see how an octagonal ("clamshell") enclosure installed around the base provides the necessary room for the electronics that would otherwise be mounted up the pole. The size and shape of the enclosure minimize the impact on the right of way.

Because the clamshell format encompasses the pole, it is important that the visual design be consistent with the pole. For this reason, Raycap engineers and manufactures clamshell enclosures to the pole's specific dimensions, with specified finish and color to match the pole and be consistent with aesthetic regulations.

Ground furniture expands street-level options

For situations in which the carrier does not have the option for a pole-mounted enclosure or the clamshell option, there are other ways to still employ an existing pole as a small cell site. For example, a carrier may deploy radios and electronics into a separate enclosure away from the pole and bury a connection to the pole in order to power the 4G antennas and 5G radios/antennas at the pole top. In less dense and more rural areas, this provides many more options for connecting a small cell site to the pole.

Figure 4: Cylindrical ground furniture can place support electronics up to 20 feet away from a pole with mounted 4G/5G radios.

Figure 5: This trash can enclosure is a clever example of a customized 5G small cell solution for a particular urban area.

For example, Raycap offers a cylindrical cabinet (Figure 4) that can be located up to 20 feet away from a pole that hosts 4G and 5G radios. This example enclosure measures 46.5 inches high and 14 inches in diameter and is attached to a 46-inch deep foundation that provides access for the buried power and fiber connections. Inside the cabinet, rectifiers, AC disconnect, surge protection and fiber management enclosures can be installed. Optional fans can be added to provide active cooling, if needed. As with the clamshell enclosure, this cylindrical ground furniture is manufactured to meet aesthetic requirements.

Bespoke enclosures for special circumstances

Another approach to siting small cells is to mimic other street furniture in the vicinity. One notable example is a trash receptacle that Raycap manufactured for various park sites (Figure 5). This enclosure, measuring 46 inches tall and 28 inches in diameter, was engineered to look nearly identical to other trash cans in the vicinity, and thereby blend into the park. In fact, the top section of the enclosure can be used as a trash can. This approach is very useful for pursuing approvals for siting in public areas.

Inside the trash receptacle, Raycap installs the AC disconnect, surge protection, fiber management and multiple 4G radios. Multiple fans provide active cooling. The electronics connect to 4G and 5G radios that exist on an adjacent pole. Like the other enclosures, these enclosures can be customized to the municipality.

Custom engineering and manufacturing at scale

This wide range of form factor options - integrated pole, clamshell, cylindrical cabinet, trash receptacle and others—gives carriers and tower companies great flexibility in siting small cells anywhere they are needed for expanding mid-band 5G services. While poles are ideal, they are not the only possible locations. For example, Raycap can build small cells into existing signage and rooftop formats, or create entirely new concealments that mimic these things. Using Raycap's new InvisiWave aperture panels, carriers can also retrofit 4G rooftop and wall-mounted sites to deploy 5G mmWave equipment as well.

No matter what format a carrier chooses, the decision is in large part determined by municipal codes and regulations. Having a variety of formats, and agile custom manufacturing to meet finish and color specifications, is the key to deploying 5G across a wider range of geographies. With innovative in-house design and engineering, and three North American manufacturing plants, Raycap is capable of providing many of the solutions that will form the infrastructure of 5G services to be unleashed by new mid-band spectrums.

About Raycap

Raycap is an international manufacturer and technology leader with decades of experience providing innovative infrastructure solutions for customers in the telecom, energy, defense, transportation, and other industrial markets. Its solutions protect mission-critical applications and ensure the best possible system availability. The company's product portfolio includes lightning and surge protection technologies, structured cabling and connectivity solutions, power management systems, custom enclosures, cabinets, and wireless network concealments. Since its founding in 1987, the company has experienced continuous growth. Its engineering expertise, extensive patents and IP, test laboratories, and multiple manufacturing facilities guarantee quality, reliability, and innovation. Product design, testing, and approval processes comply with all international safety standards. Raycap operates in the United States, Germany, Greece, Cyprus, Slovenia, and Romania.

Talk to Raycap about your various concealment options.

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