



Safely Manage Power in Small Cells with Transtector Power Distribution Cabinets

Compact, Configurable Design; Superior Surge Protection

[Application Note](#)

Introduction: Small Cell Significance

As end users continue to demand more data at greater speeds, network engineers and designers must seek ways to deliver high service levels efficiently, reliably, and cost-effectively. The move to 5G and other advanced network topologies means that this demand is greater today than it's ever been.

Small cells appear to be the answer to this challenge. Loosely defined, a small cell is a relatively low-power radio and antenna installation that can be placed on poles, the sides of buildings, street lights, or other existing platforms. A small cell can also be a fully configured system, integrated with other necessary on-street equipment or facilities, whether indoors or outdoors.

Most significantly, a small cell represents a more efficient and versatile method for delivering service compared to typical macro cells, often large cell towers. As a complement to the macro network, small cells help to improve coverage and increase capacity in specifically targeted areas. With small cell installation blocks apart rather than miles, the need for uniformity and repeatability is significant.

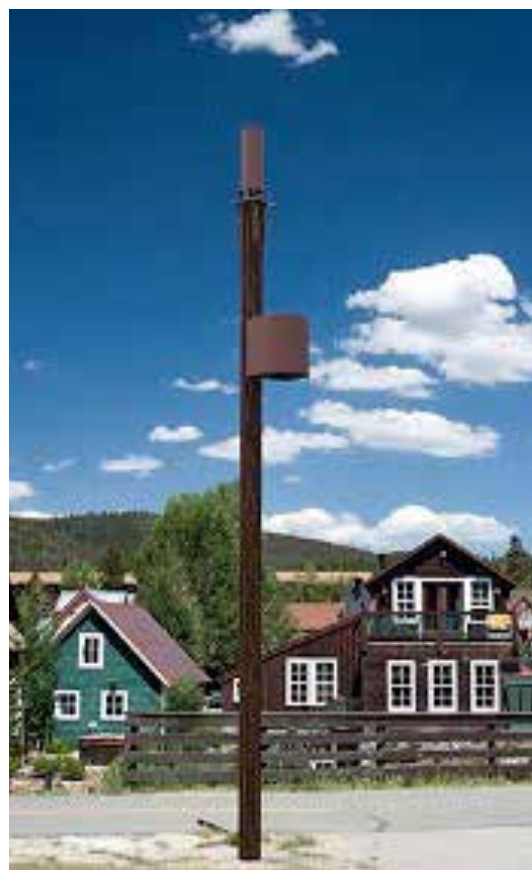
According to research by the Cellular Telecommunications Industry Association (CTIA), 80 percent of future wireless network installations will be small cells.¹ The Small Cell Forum estimates a 50 percent uptick in small cell installations overall as 5G networks come to life, adding that of the operators they surveyed, 40 percent “expect to deploy between 100 and 350 small cells per square kilometer” through the mid-2020s.² One of the leading tower operators in the U.S. exemplifies the growth of small cells, with more than 60,000 small cell sites on air or under contract today, despite the relative youth of the application compared to macro cell sites.³

Whatever the source, the general consensus is clear: Of all the applications and topologies in the communications world, small cells are among the fastest-growing, helping to deliver the services and data users demand through a dynamic network design.

Small Cell Challenges

Within the small cell installation, as in other locations, power plays a mission-critical role. Safe distribution of power to equipment and reliable protection against surges (e.g., lightning strikes, equipment issues, or other anomalies) can be the difference between seamless service delivery and lost revenue.

Yet when it comes to power distribution and protection, small cells present a broad yet unique set of challenges, including some of the following:



Pole-mount small cell cabinet

- *Limited space for equipment, often on poles or in a base.* By definition, a small cell is, in fact, small. In addition to housing equipment that delivers services (radios, antennas, etc.), fitting power management within a pole-mount configuration, on the outside of a building, or in an indoor closet or service room can be difficult.
- *One size does not fit all.* Ideally, network engineers can standardize on a single small cell configuration and deploy it repeatedly throughout the network. Unfortunately, in most communications networks, this isn't always the case. Required equipment may have varying load configurations, and power demands may differ from market to market. Simple, flexible solutions are best, but they're not always possible.
- *Power quality and grounding.* Some small cell installations may face power quality issues, or grounding may be a specific challenge given the physical setting.
- *Compliance—general and local.* Meeting code requirements for small cells often goes beyond UL and NEC standards (which should always be incorporated). Local codes, covenants, and physical footprint requirements may create additional challenges.
- *Safety is a must.* From installation to ongoing service, safety is always paramount with power. Providing safe access while maintaining security is a priority.



Concealment application in the base of a street lamp

Requirements and Standards

So how does power distribution fit into a small cell site? Looking at a typical small cell, power equipment must accommodate the following:

- Accept AC utility power directly from the utility transformer or meter, requiring a service entrance rating and provisions for a neutral-ground bond to meet code.
- A main circuit breaker to provide a single shutoff point for system power, with the option for an external power disconnect.
- Incorporate a field-configurable combination of branch circuit breakers that can evolve with the load requirements for system equipment.
- Integrate surge protection to safely and reliably protect all downstream system equipment from lightning and utility transients.

Other active equipment in the small cell can include radio gear, antennas, or additional equipment that drives wireless capabilities to end users, manages traffic, and performs other functions. But without properly managed AC power, this equipment is subject to downtime.

Within the small cell, several industry standards are crucial, in addition to any local building codes or other requirements in place for the specific location and installation.

- Panelboard: UL 67
- Main Disconnect: UL 98
- Circuit Breakers: UL 489
- Surge Protection: UL 1449
- NEC: NFPA 70E, NEC 100, NEC 230, NEC 250, NEC 285
- IEEE: Sections C62.41.1, C62.41.2, C62.45, C62.33, and C62.35

Perhaps most significantly, a small cell power box must be UL 67 listed and include a UL-rated disconnect to be service entrance rated. This critical standard ensures safety, with overcurrent protection, a main breaker, fused disconnect, proper short-circuit rating, and available neutral and ground bonding.

A Typical Small Cell

Because of the variety of small cell applications, not every installation requires the same feature and capability sets. However, in general terms, there are several power and cabinet related requirements that broadly apply to small cells.

- Compact footprint—standard 9-inch width
- Mounting flexibility—external pole-mount, internal integrated pole-mount, wall-mount, etc.
- Configurability—options can be selected to meet specific site requirements
- Multiple input voltages—120Vac and 120/240Vac as required
- Field-configurable branch breakers—allows for breakers to evolve with site over life cycle
- Support for up to 13 equipment loads
- Field serviceable—safe access to power
- Safety—external power shutoff feature option available
- Compliance—meets NEC code, and is suitable for use at service entrance
- Availability—industry best lead times support site rollout planning
- Technical support—access to experts to ensure designers and installers deploy the ideal solution

The Transtector Power Solution

Transtector Systems addresses all of these requirements with its line of Small Cell AC Power Distribution Cabinets (SC-2MMA9 Series). These field-configurable systems are service entrance rated, with 120Vac or

120/240Vac input voltages, a main disconnect, an external shunt trip button for emergency power shutoff, and configurable power management equipment inside the cabinet to meet the wide-ranging demands of small cells.

Many small cell applications utilize two power boxes—one for electrical disconnect and one for distribution. Transtector cabinets combine this functionality into a single, safe solution to streamline installation and minimize risk. This design also eliminates the cost and space usage of additional disconnect equipment; the combination cabinet meets all key industry standards.

Several significant features set the Transtector cabinet apart from other systems.

Key Differentiator: Field-Configurable Branch Breakers

The Transtector cabinet incorporates a branch breaker system that is truly field-configurable. Technicians can easily install or replace a circuit breaker if requirements change using only a screwdriver, compared to cumbersome traditional DIN rail configurations. Installation involves no contact with or removal of the power buss, which in some cases voids UL compliance. Expansion, equipment evolution, or other changes are simple.

Additionally, the cabinets support the industry's broadest range of circuit breaker values, with 1A to 25A options available. This enables safe power distribution to a comprehensive variety of equipment types, and flexibility to meet virtually any requirement. In many cases, OEM radio manufacturers mandate specific breaker amperages in the range of 1-10A in order to maintain the factory warranty. Typical field-configurable QO style breakers offer 15A as the smallest amperage, which does not support this OEM requirement. The Transtector SC-2MMA9 series cabinet provides four breaker amperages in the 1-10A range in order to right-size a breaker for each radio.

Field-configurable branch breakers enable staged implementation through the site's life cycle. Users need only pay for breakers required at the time of site commissioning, rather than additional breakers not required or defined. The simple access design minimizes time to support future co-location installations, as well as equipment configuration changes, thereby resulting in the lowest total cost of ownership through the complete life cycle of each site.

Key Differentiator: Superior Surge Protection

Each cabinet features integrated Transtector surge protection devices (SPDs), specifically I2R 75K Series SPDs. These UL 1449 4th Edition (Types 1 and 2) rated components feature 75kA maximum 8/20 μ s lightning surge protection for best-in-class capacity. A short circuit current rating of 200kA provides more than ample protection for small cells. In addition to UL, each SPD meets key IEEE and NEC standards for long-term reliability and minimized degradation.



Pole-mount small cell power configuration

Additional Important Factors

It's difficult to overstate the significance of a service entrance rating in small cell power distribution applications. Put simply, the cabinet must meet UL requirements for safe acceptance of power from the utility, with a single disconnect in case of emergency. Without this, safety is at risk; by integrating this capability into the distribution cabinet, users can save valuable space and reduce costs. Transtector cabinets can also feature an exterior emergency power shutoff button if required.

The service entrance rating also contributes to the significance of grounding. Without proper neutral and ground bonding, safety can easily be compromised. Transtector Small Cell AC Power Distribution Cabinets integrate these capabilities into the configured solution.

Finally, the cabinet's compact form factor is a must given the nature of small cell installations. Transtector engineered each cabinet to fit inside equipment poles (or bases) when concealment is required. The standard 9-inch width provides flexibility for physical location—whether on a street lamp pole, a wooden utility pole, hidden on a building side, or elsewhere. The dynamic design enables a scalable, repeatable deployment process to increase efficiency and minimize the potential for error.

Sample Configuration

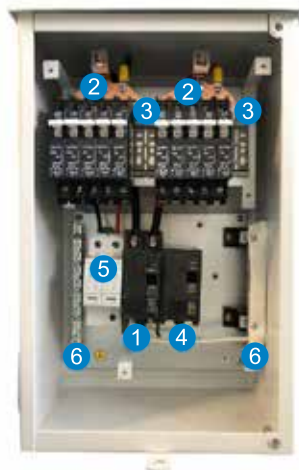
Extensive configurability means that there is a Transtector Small Cell AC Power Distribution Cabinet that fits the specifics of virtually any application. As an example, Transtector engineers recently developed a cabinet configuration deployed in the Chicago metropolitan area.

For small cells here, the construction engineer required a compact solution that could be conspicuously mounted externally on an existing pole structure, and be utilized as service equipment to directly receive utility power without the need for a separate disconnect box.

The AC power requirements for these sites included 10 individual pieces of equipment that operate at 120Vac, as well as a power-hungry rectifier designed to operate much more efficiently at 240Vac.

Surge protection was also specified to protect and support the reliability of each installation, as well as to follow the recommendations of the communications equipment suppliers.

- ① 100A main breaker
- ② 10 populated 120V field configurable branch breakers 7-20A
- ③ 2 open 120V field configurable branch breakers 1-25A
- ④ 240V 2-pole branch breaker 20A
- ⑤ 120/240V surge protection
- ⑥ Neutral, ground bars



Cabinet configuration deployed on a tower in Chicago

Leveraging the flexibility of the Transtector SC-2MMA9 series cabinet, engineers created a service-entrance rated configuration with the following specifications:

- 100A Main circuit breaker
- Combination of ten 7A, 10A, 15A and 20A 120Vac branch breakers
- 20A/240Vac two-pole breaker
- Integral 120/240Vac split-phase SPD to protect all power feeds

This configuration still leaves two available branch breaker positions open for field-configurable future expansion if required.

Conclusion: Meeting the Power Requirements of Small Cells

Network topologies are ever-evolving as end users demand more data and services, and as network administrators work to ensure safe, reliable operations. Power is often at the heart of many of these challenges.

Small cells represent a break from traditional network architectures, and require innovative solutions for power distribution and surge protection. Transtector Systems engineered its Small Cell AC Power Distribution Cabinets specifically for these applications.

When commissioning and deploying a small cell, network engineers must address the questions and challenges of service delivery, specifying equipment that consistently and reliably delivers optimized functionality. When it comes to small cell power, questions to consider include:

- Is the current power architecture meeting code? Are all industry standards met?
- Is the power cabinet—more specifically, are the branch breakers—truly configurable? Can future changes realistically be met?
- Does the power cabinet provide the flexibility to meet load requirements for a variety of equipment?
- How reliable is the surge protection? Does it meet a sufficient rating standard?

Whether the interface is 5G node or a DAS system; the application is labelled a small cell, femtocell, picocell or microcell; the physical location is a light, utility or concealment pole in a transport hub, urban downtown region, business park or elsewhere, Transtector Small Cell AC Power Distribution Cabinets provide the flexibility, reliability, safety, and lowest total cost of ownership that today's networks require.

¹“CTIA.” CTIA, 2019, www.ctia.org/the-wireless-industry/infographics-library?topic=60.

²Kinney, Sean. “Report: 50% Increase in Small Cells between 2018 and 2020.” RCR Wireless News, 12 Dec. 2017, www.rcrwireless.com/20171212/network-infrastructure/report-finds-major-increase-in-small-cell-deployments-tag17.

³Dano, Mike. “Editor’s Corner-What the Small Cell Market Looks like in 2018 (Hint: It Looks Good).” FierceWireless, Questex, LLC, 30 July 2018, <https://www.fiercewireless.com/wireless/editor-s-corner-what-small-cell-market-looks-like-2018-hint-it-looks-good>.