

## APPLICATION NOTE

### Introduction

The rapid deployment of 5G network tower systems is revolutionizing telecommunications by providing faster and more reliable wireless communication. However, because these sensitive systems are placed in various outdoor environments, they can be exposed to harmful transient overvoltage events and other types of surges caused by lightning strikes, switching operations, and a range of electrical disturbances. To ensure the uninterrupted operation and longevity of 5G network towers, it is crucial to implement effective surge protection measures.

The advanced features now designed into Surge Protective Devices (SPDs) give engineers the capabilities to help safeguard these systems from potentially devastating surge threats, ensuring the integrity and functionality of the network infrastructure.

This application note outlines the reasons 5G network towers require effective surge protection. It also helps guide engineers in selecting the right SPD by determining potential risks, protection levels and standards required as well as the most important SPD characteristics to evaluate.

### Why Do 5G Network Tower Systems Need Surge Protection?

#### Protecting Sensitive Electronics

The sophisticated electronic components in 5G network towers are particularly susceptible to damage from transient overvoltage occurrences. These components include transceivers, power supplies, antennas, and assorted control units. Without adequate surge protection, a single surge event can lead to catastrophic failures, resulting in costly repairs, network downtime, and a reduced level of service quality.

#### Preventing Downtime and Service Disruptions

Network reliability is paramount for telecom operators. Service disruptions caused by surge-induced failures can lead to significant financial losses and equipment damage. SPDs are known as ideal protection solutions for exposed environment applications to help ensure continuous operation. The advanced features designed into today's SPDs aid in preventing surges from reaching critical components, thereby minimizing downtime and maintaining service quality.

#### Mitigating Lightning Risks

Often installed in elevated locations, 5G network towers are especially vulnerable to lightning strikes. Direct or nearby lightning strikes introduce extremely high surge currents into the tower infrastructure. SPDs offer the capability to reduce high voltage transients and can help divert any resultant surge currents safely to the ground, protecting both the tower and the connected equipment.

#### Compliance with Industry Standards

Telecom operators must adhere to stringent industry standards and regulations regarding surge protection. Standards such as UL 1449 for North America and IEC 61643 for international applications outline the requirements for SPDs. Ensuring compliance with these standards is essential not only to meet industry standards compliance, but give customers and workers peace-of-mind about maintaining network reliability and safety.

### What is the Best Approach in Selecting an SPD?

#### Assessing Surge Risk

The first step in selecting an SPD is to assess the surge risk for the specific 5G network tower location. Factors to consider include the frequency and intensity of lightning activity, the presence of overhead power lines, and the proximity to other tall structures. A thorough risk assessment helps determine the level of surge protection required.

#### Determining Protection Levels

SPDs are classified into different types based on their protection levels and intended applications. For 5G network towers, both AC and DC protection are necessary. Designers will specify an AC SPD to be used to protect the distribution system and AC equipment, while DC SPDs protect the power supply and equipment powered by DC, such as transceivers and antennas.

#### Selecting the Right SPD Characteristics

When choosing an SPD, it is important to consider key characteristics such as:

- **Voltage Rating:** Ensure the SPD is compatible with the system's operating voltage.
- **Current Capacity:** Select an SPD with a high enough current capacity to handle the maximum expected surge.
- **Response Time:** Choose an SPD with a fast response time so that it is able to react to supply immediate protection.
- **Mode of Protection:** It is important to specify a SPD that provides both common mode and differential mode protection.

## APPLICATION NOTE

### What is the Best Approach in Selecting an SPD? (Continued)

#### Compliance with Relevant Industry Standards

Designers will need to select a SPD that complies with relevant standards such as UL 1449 for North American installations and IEC 61643 for international installations. SPD compliance shows that it meets necessary performance and safety requirements.

#### Considering Environmental Conditions

Environmental conditions such as temperature, humidity, and exposure to corrosive elements can impact the performance of an SPD. Choose SPDs that are rated for the specific environmental conditions of the installation site.

### Application Example: Which Bourns® SPD is Best for 5G Network Tower AC and DC Power Protection?

#### Scenario Description

A telecom operator has plans to deploy a 5G network tower in an area prone to frequent thunderstorms and lightning strikes. The tower's power system includes a 48 V DC power supply for transceivers and antennas, and an AC power supply for auxiliary equipment such as cooling systems and control units.

The operator wants to implement the most robust surge protection for both AC and DC systems.

#### Step-by-Step Selection Process

- 1. Assess Surge Risk:** The high frequency of thunderstorms and lightning strikes indicates a high surge risk, necessitating strong surge protection measures.
- 2. Determine Protection Levels:** Both Type 1 and Type 2 SPDs are required. Type 1 SPDs provide protection from direct lightning strikes, while Type 2 SPDs offer protection from indirect surges and switching transients.
- 3. Select SPD Characteristics:**
  - AC Protection:** The Bourns® Model 1250A AC SPD is the right choice for the AC power supply. It has a voltage rating suitable for the local grid and a high surge current capacity to handle indirect lightning strikes.
  - DC Protection:** The Bourns® Model 1420A-PV-48-D DC SPD is recommended for the 48 V DC power supply. It offers a high current capacity and fast response time to protect sensitive transceivers and antennas.
  - Additional Option:** Designers may also want to evaluate other suggested Bourns® SPD models below:

- 4. Ensure Compliance:** Both SPDs selected for AC and DC protection comply with UL 1449 or IEC 61643 standards.
- 5. Consider Environmental Conditions:** The selected SPDs are rated for outdoor installation, with protection against harsh environmental conditions such as high humidity and temperature variations.

By selecting the appropriate SPDs for both AC and DC power systems, 5G network infrastructure can be effectively safeguarded against power surges providing critical protection that helps maintain uninterrupted, reliable network operation.



## APPLICATION NOTE

### Application Example: Which Bourns® SPD is Best for 5G Network Tower AC and DC Power Protection?

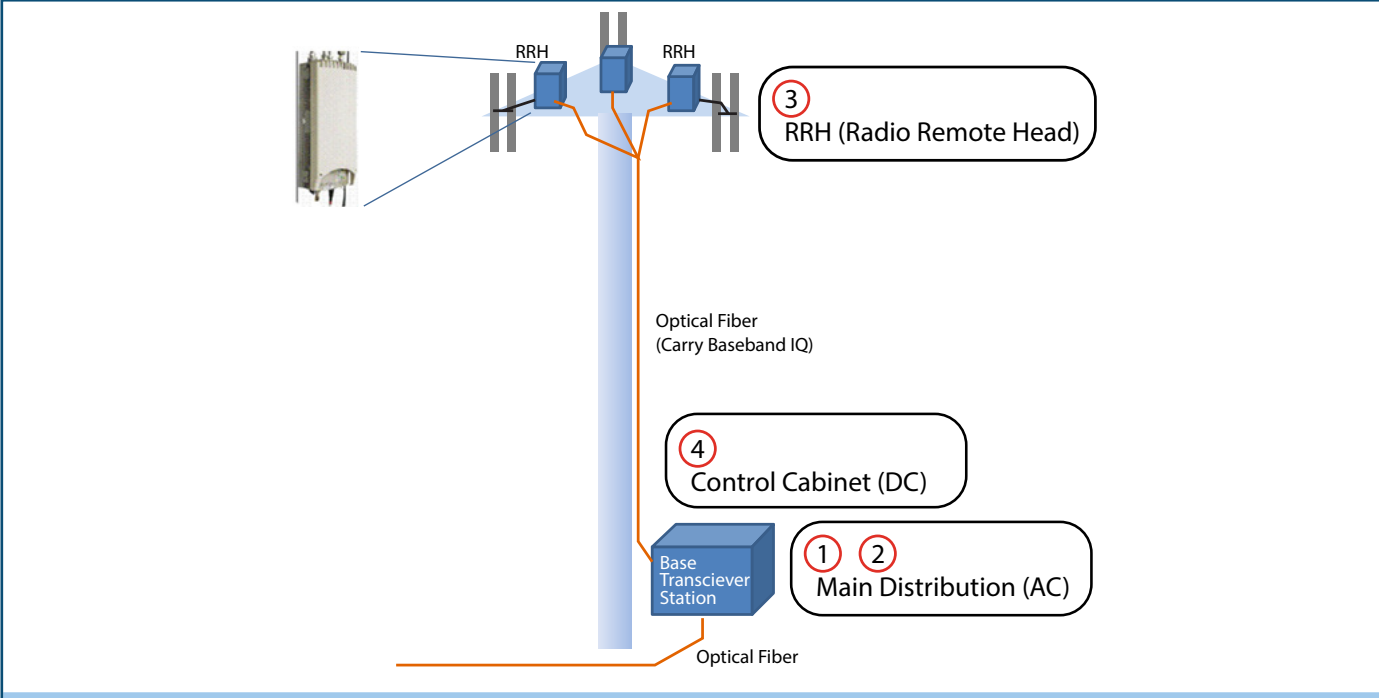


Table 1. 5G Network Tower Diagram with Suggested Bourns® SPDs

Key Components / Location	Function Description	Recommended Bourns® SPD Series	Certificate Category
<b>1. Main distribution (AC)</b>	Responsible for distributing electrical power from the primary power source to various components of the base station.	1210 Series 1260 Series 1270 Series	UL 1449 5th Ed. Type 1 IEC/EN 61643-11 Class I + II / T1 + T2 IEC/EN 61643-11 Class I / T1
<b>2. Main distribution (AC)</b>	Responsible for distributing electrical power from the primary power source to various components of the base station.	1250A Series 1280 Series	UL 1449 5th Ed. Type 2CA IEC/EN 61643-11 Class II / T2
<b>3. RRH (Radio Remote Head)</b>	These are critical for transmitting and receiving RF signals to and from mobile devices.	1430 Series	IEC/EN 61643-31 Class I / T1
<b>4. Control cabinet (DC)</b>	House the control electronics that manage the operation of the base station.	1420A Series 1440 Series	UL 1449 5th Ed. Type 2CA IEC/EN 61643-31 Class II / T2

### Conclusion

Surge Protective Devices are essential components in safeguarding 5G network tower systems from transient overvoltage and surge threats. By helping to prevent damage to sensitive electronics, SPDs provide crucial protection that minimizes downtime so these important networks can deliver fast, reliable continuous communications while guarding the telecom operator's investment.

Selecting the right SPD involves assessing the surge risk, determining the appropriate protection levels, and choosing devices that comply with industry standards. In the example scenario, the Bourns® Model 1250A AC SPD and 1420A-PV-48-D DC SPD are recommended to provide comprehensive protection for a 5G network tower, illustrating the importance of tailored surge protection solutions.

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