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Tarana Wireless Radio Surge Protection: Best Practices

White Paper

Lab Test Proves Transtector SPD Protects Tarana Radios from Extreme Surge

Tarana Wireless recently faced a big challenge. The California-based radio manufacturer needed to recommend effective surge protection to users of its radios. The radios, powered by DC cables running the length of the towers, were vulnerable to damage through lightning strikes and other surge events. The surge protection needed to be robust and reliable, as the radios are in areas with high exposure to lightning storms.

Tarana, with installations worldwide of its cutting-edge 5G wireless systems, sought out Transtector for a solution. Transtector ended up recommending its 1101-1110 DC Defender, an outdoor surge protection device (SPD). For added insurance before installation, the two companies partnered to put the DC Defender through its paces in a test trial. They used Transtector's test lab to subject Tarana radios to repeat surge events.

The verdict: the DC Defender came through with flying colors and is now recommended by Tarana for 24/7 protection.

This paper details some of the main power surge challenges faced by radio tower installations and explains how the test trial proved the mettle of the DC Defender. It concludes with a few Transtector-recommendations for how to protect radio installations such as Tarana's from power surges.

Vulnerabilities of Radio Towers

The lab test showed that the DC Defender meets the special challenges faced by operators of radio tower installations. Surges are notorious for not only damaging, degrading or destroying such electronic equipment, but interrupting, delaying and corrupting signal transmissions. Every piece of radio equipment operates at a specific nominal level, and the appropriate SPD, properly installed, will eliminate any amount of surge that is above that level.

Surges can compromise the DC power cables on a radio tower in several ways. A nearby lightning event can induce energy onto the cable or energize the earth around the equipment. Another common occurrence is a direct strike to a structure that is part of the radio installation.

DC Defender Lives Up to Its Name in Lab Test

A main concern of Tarana was that the surge protection would protect the radio repeatedly, even after being exposed to multiple surge events. Tarana and Transtector worked together to determine this through testing at Transtector's state-of-the-art surge lab. The testing showed that when properly installed and grounded, the recommended DC Defender would indeed protect radios from multiple strikes.

The testing involved subjecting two Tarana base node radios to repeated 5,000-amp 8/20µs surge events on all three modes of potential entry for surge energy:

- DC+ to DC−
- DC+ to GND
- DC− to GND

Using Transtector's ECAT surge generator, the radios were each subjected to three strikes of 10kV/5kA 8/20µs surges in all three modes of entry, with the DC Defender protecting them. Input and current-out of

the DC Defender were measured to determine the amount of energy the radios were exposed to under a 5kA surge event.

Even though 5kA is far higher than what the radio would typically see, it was chosen because it is the maximum surge rating of the DC Defender. If the Defender could protect the Tarana radio even after exposure to an extreme surge event, it would also protect the radio from more typical, lower-level events.

The first Tarana radio underwent nine tests, receiving three surge strikes in each of the three modes. The second radio then underwent an identical nine tests. Tarana performed functional testing in between each surge strike. They had defined the pass/fail criteria in their pre-test plan.

The two radios passed all 18 tests. They remained functional after repeated surge exposure on all three modes of protection. The DC Defender was completely intact and ready to continue protecting the radios from additional surge events.

Test 1 Results

(DC+) – (DC-) with DC Defender 1101-1110				
Shot #	**Iin (A)**	**Vin (V)**	**Iout (A)**	**Pass/Fail**
1	4,820	10,150	145	Pass
2	4,850	10,150	196	Pass
3	4,820	10,150	183	Pass

Test 2 Results

(DC+) – (GND) with DC Defender 1101-1110				
Shot #	**Iin (A)**	**Vin (V)**	**Iout (A)**	**Pass/Fail**
4	4,890	10,150	81	Pass
5	4,890	10,150	80.8	Pass
6	4,890	10,150	78.9	Pass

Test 3 Results

(DC-) – (GND) with DC Defender 1101-1110				
Shot #	**Iin (A)**	**Vin (V)**	**Iout (A)**	**Pass/Fail**
7	4,860	10,150	85.3	Pass
8	4,860	10,150	84	Pass
9	4,860	10,150	84.6	Pass

Test 4 Results

(DC+) – (DC-) with DC Defender 1101-1110				
Shot #	**Iin (A)**	**Vin (V)**	**Iout (A)**	**Pass/Fail**
10	4,560	10,150	162	Pass
11	4,860	10,150	168	Pass
12	4,860	10,150	180	Pass

Test 5 Results

(DC+) – (GND) with DC Defender 1101-1110				
Shot #	**Iin (A)**	**Vin (V)**	**Iout (A)**	**Pass/Fail**
13	4,860	10,150	88.5	Pass
14	4,860	10,150	86.6	Pass
15	4,890	10,150	87.8	Pass

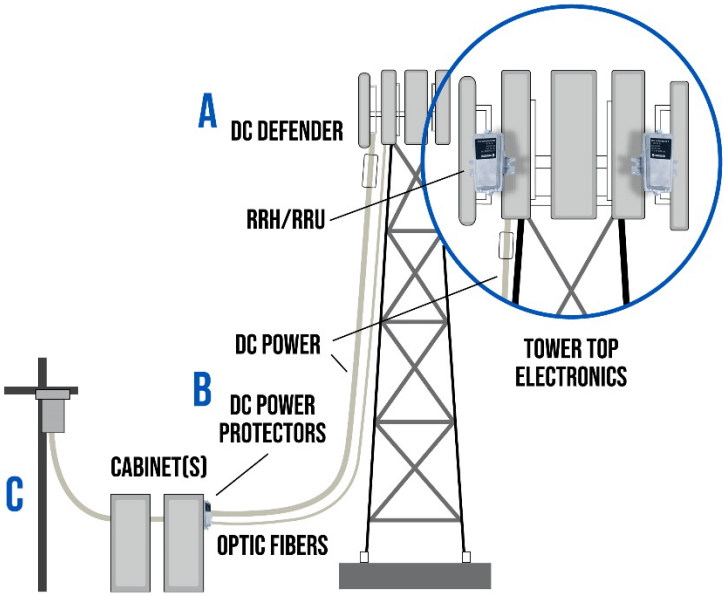
Test 6 Results

(DC-) – (GND) with DC Defender 1101-1110				
Shot #	**Iin (A)**	**Vin (V)**	**Iout (A)**	**Pass/Fail**
16	4,860	10,150	100.6	Pass
17	4,860	10,150	98.7	Pass
18	4,860	10,150	98.1	Pass

5 Surge Protection Best Practices

Having engineered SPDs for over four decades, Transtector knows how to prevent damage to electronic systems caused by lightning and other sources of power surge. The company recommends five practices.

- SPDs should be installed on both ends of a pair of DC power cables going up to a radio. This is because surge energy that couples with a cable will travel in both directions to find a path to ground and will enter any unprotected equipment on the line.



- SPDs guarding radio towers must be able to withstand repetitive surges without degrading. Transtector recommends using protectors with silicon avalanche suppression diode (SASD) circuits. They do not degrade or cause thermal runaway conditions and will function perpetually if their energy-dissipating capabilities are not exceeded. They also turn on faster than metal oxide varistor (MOV) circuits and respond more rapidly to overvoltage.
- Under extreme power quality events, SPDs should sacrifice themselves to protect the equipment on the line. After all, an SPD is easier to replace than expensive system components.
- Apply protection to the correct protection modes. DC surge protection on both (+) to ground and (−) to ground are critical. The addition of protection across the + to – (line to line) is a good approach for grounded DC systems.
- An SPD requires a ground connection to divert the surge energy away from the radio. In fact, poor grounding is the most common reason for radio failure even with surge protection installed. An SPD can be rendered ineffective by no ground connection, a high-impedance ground connection or an improperly installed ground.

Summary

Testing conducted by Transtector and Tarana at Transtector's surge lab proved that the 1101-1110 DC Defender will protect Tarana's radio equipment from extreme power surges caused by lightning and other power transients. Tarana now recommends the DC Defender to protect its DC-powered radio installations from damage that can occur due to surge energy coupling with the DC cables, energizing the earth around the equipment or striking structures near the radio installations.