RLH Industries, Inc.

# RLH applications within the ZOI

**RLH Industries, Inc.** 936 N. Main Street Orange, CA 92867 **T** (866) 363-4237 **F** (714) 532-1885 joeboyles@fiberopticlink.com

# RLH applications Within the ZOI

## Overview

The understanding of ground potential rise (GPR) is a difficult concept to visualize for most people. For this reason, many installations of high voltage isolation (HVI) equipment are inherently flawed. When it is not practical to bring the dielectric fiber cable from the subscriber all the way to a point outside of the zone of influence (ZOI), the placement of the CO end of the fiber within the ZOI is a viable alternative and satisfies both the IEEE 487 and the IEEE 1590 requirements.

## The Concern

GPR occurs during fault conditions within the high voltage corridor (generation facilities, substations, and transmission towers). The value and calculation of GPR inherent at these facilities is a subject of some debate, but it is generally understand and accepted that GPR values in the thousands of volts at power substations or even tens of thousands of volts on high voltage power lines and towers are realistic in worst case scenarios. It is for the worst case scenario that we have to design the HVI.

Provisioning HVI equipment utilizing copper facilities entering the ZOI has been long accepted within the industry. Inherent to this application is the necessity to isolate the remote earth referenced ground of the dedicated cable, both the metallic shield and the pairs, from station ground referenced plant.

## IEEE 487

While IEEE 487 is primarily concerned with the application of high voltage isolation utilizing copper facilities, it does reference to placing optical fiber protection in those hybrid applications where both metallic cables and fiber cables are used. Annex F.1.1 states, “When both ends of a fiber-optic cable are to be installed within the zone of GPR, special consideration must be given to the CFJ interface end.” Annex G, **Theoretical verses actual field experience GPR and related ZOI profiles**, also provides additional information and insight regarding GPR profiles in non-homogeneous conditions with metallic infrastructure influences.

## The Solution

“Special consideration” is warranted due to the possible presence of GPR that may be present, though perhaps in a diminished degree, at the copper to fiber junction (CFJ). When applying the CFJ within the ZOI, but not directly within the station ground mat area, although there is not a direct connection to the station ground mat, the copper facility which serves the CFJ should be isolated from local ground due to the possibility of GPR voltage apparent in the earth at the CFJ. The copper facility serving the CFJ should be isolated from any local ground to a point outside of the ZOI.

Additional steps may be deemed warranted by either the telco or the power company or wireless provider to protect personnel working at the CFJ by the placement of permanent dielectric pads or temporary insulating blankets upon which the technician may stand while working directly with the remote referenced copper facility.

In addition, the telco may deem it advisable to utilize high dielectric strength copper facilities in provisioning service within the ZOI if it is determined that the GPR voltage in the earth at the CFJ or between the CFJ and the termination point between the dedicated facility and the general use cable may be subjected to a potential in excess of the dielectric strength of standard copper facilities.

Standard station protection is not recommended at the CFJ when placed within the ZOI, since there should be no local grounds introduced at this point. Instead, shunt protection could be utilized to minimize the impact of surges, such as are used in RLH cards.It is not recommended that the shield of the incoming facility be used to ground any standard station protection at the CFJ because currents flowing on the shield might introduce induced transients on the very pairs that are to be protected. In addition, caution should be taken to insulate the incoming copper facility shield from possible incidental touch by personnel working at the CFJ.

## Conclusion

The intent of high voltage isolation is to keep station ground referenced wiring and remote earth referenced wiring separated. While a copper installation can do this if installed and maintained correctly, a fiber optic solution, where the two potentials are separated by greater distances than the four inches provided by a copper based system, is a better solution from both an installation and a maintenance perspective. From an installation perspective, it is much more difficult to install the system incorrectly due to the increased distance between the CO- and subscriber- ends of the fiber. From a maintenance perspective, while it is possible to bypass the protection, it is difficult if not impossible to do so inconspicuously, thereby increasing the likelihood that the bypass will be noticed and corrected.

For installations where only dielectric fiber cable is routed through the ZOI, the recommendations of IEEE 1590 apply.

Prepared by:

**Joe Boyles**
Regional Manager – RLH Industries, Inc.

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