

## Second generation IEEE802.11N performance for IEC61850-based substation automation system

### ABSTRACT

As the initial scope of supporting communications inside substation automation systems, IEC 61850 was defined to be mapped on Ethernet as the layer 2 communication network technology. It is because the Ethernet is the dominant technology for the Local area network – LAN and it brings significant advantages of high bandwidth and low latency especially with the use of optics fibers at the physical layer. Consequently, Ethernet is very appropriate for the substation indoor LAN with applications that require high bandwidth e.g. measurements and time-critical functions such as protection services. However, when IEC 61850 is extended to support large-scale communication networks between substations, control the centers to substations and DERs; Ethernet is no longer a good solution. The rapid emergence of DERs, the increasing amount of electric vehicles and smart meters reveal the shortcomings of Ethernet which rest in its high set-up cost and scalability problem following the use of cable for all connections. In this paper we focus on the use of the Wireless Local Area Network (WLAN) technology to support distribution substation applications. The advantages of this solution lie in the low cost of installation, enough data rates, and hassle-free deployment. However, it is not suitable for remote control communications in the distribution grid due to the limited coverage of the Wi-Fi radio. Some examples of using WLAN Compliance with IEC 61850 models to construct the SAS network as well as the network performance simulation results are also included in this paper based on the Opnet software.

**Keyword:** Distribution Energy Resources (DERs); IEC 61850; Optical fiber; Wireless local area network (WLAN); Substation Automation System (SAS)