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**A Solution for the Transmission of the Teleprotection Commands  
Using Ethernet over SDH**

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**SYNOPSIS**

Transmission of the teleprotection signals must satisfy very stringent requirements such as dependability, security and transmission time in accordance with relevant standards (e.g. IEC 60834-1). Today, TDM network and transmission through the direct link over dedicated optical fiber are the most commonly used for these purposes. Packet network (Ethernet) has become a popular networking technology because of its low cost, high bandwidth, versatile support and has matured enough to meet requirements for transmission of the teleprotection commands.

The most stringent requirement is the dependability, defined as the ability to provide uninterrupted relay communication during a recovery in the communication network due to a fiber break or component failure. Dependability also relates to the ability to issue and receive a valid command in the presence of interference and/or noise, by minimizing the probability of missing a command. This requires the use of alternative communication path.

With the aim of increasing the availability of the communication path, optimal alternative communication paths for the teleprotection signals were considered within the company JP EMS (Serbian Transmission System and Market Operator). Telecommunication transport network of JP EMS is generally realized with optical fibre based SDH system. In order to reach the optimal solution taking into account the existing network infrastructure, several possibilities, which differ in the type of the communication path and interfaces on the teleprotection equipment, were analyzed. The main communication path currently used in JP EMS for the transmission of teleprotection commands is dedicated optical fiber in OPGW. Considering the existing JP EMS communication network, two solutions were implemented as the most suitable for the interfaces: E12 (ITU-T G.703-2 Mbps) or Ethernet interface. As a possible solution for the alternative communication path, TDM or Ethernet communication paths were considered.

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TDM technology provides a constant delay and a bit rate of services, as opposed to Ethernet, which has a better use of bandwidth. Also, TDM communications systems can provide Ethernet and IP services over TDM networks.

Improving packet networks (e.g. the introduction of VLAN, traffic separation, and labelling priority messages) navigation of packages is enabled, so that they can be quickly transmitted. Consequently, a packet network can be used for the transmission of teleprotection messages.

Taking into account the network structure of the JP EMS, using Ethernet interface with the transmission of the packets over the SDH network was concluded as the best solution for the redundant path in most cases. VLAN network configuration was used in order to separate teleprotection service from other services.

Tests were conducted to determine whether the proposed solution meets the requirements for transmission of the teleprotection signals. Test results showed that such the solution can meet the requirements expressed in the IEC-60834-1 standard.

This paper will present the main results of the measurements, as well as the implementation of the Ethernet interface module in the teleprotection equipment. The realized interface module based on the FPGA integrated circuit will be described, as well as the main properties of the teleprotection equipment.