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CONSEIL INTERNATIONAL DES GRANDS RESEAUX ELECTRIQUES
INTERNATIONAL COUNCIL ON LARGE ELECTRIC SYSTEMS

STUDY COMMITTEE D2
INFORMATION SYSTEMS AND TELECOMMUNICATION

2017 Colloquium
September 20 to 22, 2017
Moscow – RUSSIA

D2-PS3

Construction and operating experience of digital power-line carrier systems

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Introduction

Power Line Carrier became widespread since the beginning of XX century. For a long time PLC technology confirmed its viability, reliability and adequacy for managing the power grid, especially in critical situations such as natural disasters when the modern forms of communications are inoperative. Despite the long-predicted death of PLC technology, a leading manufacturers release new revisions of such equipment and the PLC channels remain a major means of communication in the electrical power industry.

Digital PLC

The use of digital PLC channels lets to accomplish data channels with speeds 9.6 – 115.2 kbit/s for SCADA data channels using IEC 870-5-101, 870-5-104 protocols. Moreover it allows to build dispatcher and technological communicational channels without specific noise of PLC link.

The most preferred is the use of digital channels on a non-backbone, dead-end channels on lines 35 – 110 kV. On the other hand MV lines are characterized by a large branching (HF bypasses and taps).

The disadvantage of using dPLC is the total loss of communication at low SNR levels. This places high demands on the design and principle of construction PLC equipment.

Retransmission.

Previously, data-port retransmission was used to solve the problem of building composite aPLC channels. But for dPLC links it bring to significant time delay, speech quality degradation because of using series-connected speech vocoders.

In order to solve the problem of insufficient overlapped attenuation and minimize time delay is recommended to use the equipment, which operates on two PLC directions with the organization of retransmission in base bands without signal decoding to data level (excluding modem, multiplexer, data and voice codecs).

This approach allows to build a robust sectors of digital PLC network with 3 – 4 retransmission links with total time delay not more than 200 ms. Today more than 30 such dPLC channels are built and successfully operated.



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Equipment requirements.

The PLC equipment requirements are well known (EMC compatibility in PLC spectrum, adaptation, echo canceller and so on) and are shown in [1]-[3].

In our opinion the AGC operation range is to be expanded to 60..80 dB for reliable operation in condition of ice on wires. Moreover, the ability to work when signal-noise ratio is very low (9...10 dB) must be added.

Conclusion

The use of dPLC channels is possible and necessary to improve the reliability of power system management. The optimal way is use of such channels as a primary and backup on lines 35 – 110 kV. It is recommended to use dPLC as backup channels on lines of the higher voltage. At least 400 digital PLC channels with data transmission rate 6.4 ... 102.4 kbit/s are operated in Russia, Kazakhstan, Kyrgyzstan nowadays including up to 30 digital PLC retransmission sectors.

Bibliography

1. STO FSK EES 56947007-33.060.40.177-2014 Technological communication. Technical requirements to PLC equipment
2. Report on Digital Power Line Carrier WG35.09, august 2000
3. IEC 60495 (1993-09). Single sideband power line carrier terminals.