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Self-Powered Global Positioning System (GPS)-Synchronized Micro-Continuous Point-on-Wave (CPoW) Module

-Background

Electric power utilities have started using phasor measurement units (PMUs) to obtain time-synchronized measurements of the voltage and current magnitudes and phase angles, frequency, and rate-of-change frequency (RoCoF) throughout their systems. However, there are still several key measurements that PMUs are unable to provide. In particular, millisecond-scale transient events, higher-order harmonic content, and sudden phase-step events may be incorrectly measured or even missed entirely by existing synchrophasor equipment. In order to accurately observe these very fast events, it is necessary to leverage an even more granular measurement technology: continuous point-on-wave (CPoW).

CPoW technology captures instantaneous measurements of voltage and/or current, typically at hundreds or thousands of samples per second. This results in a point-by-point image of the desired waveform rather than a phasor approximation. However, CPoW technology has faced a number of limitations that have impeded the deployment of this technology on a larger scale, including high cost and an inability to implement into existing systems.

Invention Description

Researchers at Arizona State University have developed a novel time-synchronized micro-scale continuous point-on-wave (CPoW) module. This module is inductively powered and operates wirelessly by using the current flowing through a typical distributor conductor as its power source. This module uses a wireless data link for communication which has been configured to measure instantaneous line current at high frequency (3,000 samples per second) with 12-bit resolution.

This module can monitor the instantaneous electric current flowing through a distribution line conductor in real time. This measured information can be used for detection of harmonics, identification of incipient fault conditions, and general power quality monitoring. Because the device is wirelessly self-powered by the line current and communicates wirelessly, it can be installed without the need for ground-mounted instrument transformers, low-voltage power sources, or communications cabling. This module can also be installed directly on a power line without the need for external support equipment.

Potential Applications

- Evaluation of electric power line current at a high measurement frequency (monitoring of power line load, signs of incipient fault such as arcing, and the

presence of harmonics in the line current)

Benefits & Advantages

- Fully standalone operation with no external power source or communication wiring
- GPS synchronization and time-tagging of all data
- Wireless communication via 802.11 WiFi or 4G/5G cellular links
- Cost-effective for wide deployment, in addition to compact size, light weight and easy installation

Related Publication: An Inductively Powered Line-Mounted Time-Synchronized Micro Point-on-Wave Recorder

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