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Homodyne receiver with post-processing for optical communications

In high bit rate optical transmission, the use of a coherent homodyne receiver will largely increase the communication capacity and enhance the transmission performances. The proposed receiver is potentially large scale integrable, thus being useful for access network transceivers, and other applications which require low-cost and high performance receivers.

The Challenge

Broadband communication networks are nowadays based on optical fiber transmission, where the data signals are transported over a modulated optical carrier at a specific wavelength. To get best use of the optical fiber bandwidth and transmit as many wavelength channels as possible, it is convenient that they are placed with minimum spacing between them in the optical spectrum. This leads to ultra-dense wavelength division multiplexing (UD-WDM). At the receiver, to select a channel it is required to use a coherent receiver, as in wireless communications but now in the optical domain. However, it is much complex and costly than a direct-detection conventional one. The challenge is to design a coherent receiver that can be implemented with simple elements and can be cost competitive to conventional systems, even for Fiber-to-the-Home access networks.

The Technology

The proposed homodyne coherent receiver has two main parts: the first is a coherent balanced photo-receiver with added clock-synchronous phase switched (0-90°) local oscillator laser. The second part is an electronic post-processing performing the signal differential demodulation and a synchronous combination of the I&Q orthogonal components. This electronic post-processing can be implemented in both ways, analog and digital operations.

The local laser does not need to be phase-coherent with the incoming optical carrier, although an automatic wavelength controller is convenient to maintain the two wavelengths close each other. The local laser is directly modulated with the recovered clock signal.

Innovative advantages

- Reduces the optical channel spacing from 50 GHz to few GHz, enabling the allocation of a high number of WDM channels (> x10) in a single fiber.
- Highly tolerant to phase noise, allowing the use of standard DFB lasers.
- Avoids the use of the complex optical 90° hybrid.
- Low cost implementation, photonically integrable.
- Allows the use of advanced modulation formats, as xPSK.
- Increased bandwidth x distance reach
- Improved dynamic margin when used as PON receiver. Ideal for long-reach PONs.

Current stage of development

Experimental prototype and tests passed. Further information can be found at ECOC'07, paper 7.2.5, Berlin, Sept. 2007; and OSA Optics Letters, vol. 34, no. 4, Feb. 2009.

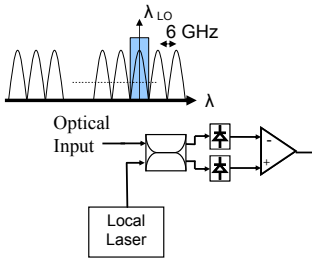
Applications and Target Market

- Optical transceiver manufacturers
- Broadband Telecom System Integrators
- Optical Communication networks: transport, metropolitan, access

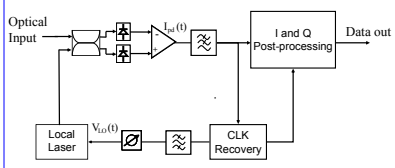
Reference number

MKT2013/0144_I

SIMPLE OPTICAL HOMODYNE RECEIVER FOR ULTRA-DENSE WDM NETWORKS



The design avoids the use of external cavity lasers and of optical hybrid



The I&Q ortogonal components of light are forward processed in switched time differentially

Business Opportunity

Technology available for licensing, transfering and technical cooperation

Patent Status

Granted

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