Photonic Integrated Wavelength Router on SOI for Optical Fiber Communication Applications

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I. Introduction

Optical fiber communication networks require a large amount of optical manipulation tools for transmitting, routing and receiving optical data. Integration of photonic circuits on high index contrast platforms such as Silicon-on-Insulator (SOI) enables a major reduction in terms of cost, size and power consumption. We present an integrated wavelength router for Fiber-To-The-Home/Business/Premises/Curb (FTTx) using a Flexible Passive Optical Network (FlexPON) network technology.

II. FlexPON

FlexPON is a new concept for FTTx based on Dense Wavelength Demultiplexing (DWDM) developed to increase the bandwidth, dynamic re-configurability and resiliency of the network. A Central Office (CO) connects to a number of Remote Nodes (RNs) in the field using SSMF. Each RN serves several Optical Network Units (ONUs). The CO transmits multiple downstream (DS) data signals and multiple continuous wave (CW) signals. One DS-signal and one CW-signal form a wavelength channel pair. The CW-signal will be remotely modulated at the ONU. The FlexPON wavelength plan is based on the ITU-T wavelength grid for the C-band to enable the utilization of commercially available elements. In addition, the CO transmits out-of-band control information to the RNs.

III. FlexPON Router

The RN consists of a Wavelength Router (WR) and a controller to realize remote reconfiguration of the WR. The WR is a SOI integrated structure of thermally tuned micro-ring resonators. By applying heat, a change of refractive index in the material is created. This results in a change of the resonant wavelength of the micro-ring. The Free Spectral Range (FSR) is defined to fit the ITU-T wavelength grid, enabling the partial drop of a DS-signal and a CW-signal on a single drop port. With this concept, a wavelength channel pair can be dropped to multiple users. Chaining of RNs can be realized using the through port of the WR. Because the wavelength channels can be reconfigured over time, a colourless transceiver is required at the ONU. Upstream (US) and DS signals are separated using a Band Pass Filter (BPF). The DS-signal is received with a regular wideband photodetector, while for the US communication a Reflective Semiconductor Optical Amplifier (RSOA) is chosen. This element reflects the received CW-signal, modulates it with the data and provides gain to it.

IV. Conclusions

We realized an integrated wavelength router on Silicon-On-Insulator for FTTx optical networks based on a FlexPON network architecture.