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Advanced Broadcast/Multicast Channel Capable Carrier Reuse WDM-PON

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Abstract **- Advanced broadcast/multicast carriers reuse WDM-PON is mainly used to provide the broadcast and unicast signal at the destination end. It uses the splitting capability of a power splitter and the cyclic property of arrayed waveguide grating at the middle remote node. The broadcast channel with the help of AWG and with a dedicated unicast channel can be overlaid and subsequently transmitted to each Optical network unit (ONU) simultaneously. Another advantage of this WDM-PON a very small interface between the broadcast channel and with the unicast channel and it is shared by all ONU. The optical carrier to subcarrier ratio on the bit error rate performance can be minimized by increasing the extinction ratio of the delay interferometer used at remote node. The result is implemented by opti-system 7.0 software tools.**

Keywords **– Broadcast/Multicast, Arrayed Waveguide, ONU.**

I. INTRODUCTION

WDM-PONs

WDM technologies are mainly used to provide high output compare than other PON methods the cost of the given circuit is high due to WDM components which is wavelength sensitive for access network. The other access network is mainly used to high wavelength to the residential users not to the business users, but on the given WDM access network we develop network architectures, subsystems and devices that reduce the cost of components and subscribe the thousand of business users in the large area network. Each transmitter-receiver pair is set at the wavelength band of the port multiplexing device which performs function of multiplexing and de-multiplexing, in case of Arrayed Waveguide Grating (AWG), to which the pairs is connected. In some cases especially when the expected load of the network is low and bursty, the array of transmitters may be replaced by a set of fast tunable transmitters that are dynamically shifted from one wavelength to the next one. Tunable transmitter is less required compare than number of ONUs.

II. MODIFIED PROPOSED WDM-PON

Fig shows the modified proposed WDM-PON. It has three units Central Office, Remote Node and ONU. In the remote node the broadcast signal is split into N equal parts and with cyclic property of AWG at the RN the broadcast signal is overlaid with each unicast channel and transmitted to each ONU, where, N is the number of ONU. AWG is also used to separate the unicast channel, No additional AWG is required, in the CO each NRZ downlink data is modulated on the radio frequency (RF) subcarrier which is modulated on Mach-Zehnder modulator (MZM) to generate the subcarrier modulated (SCM) signal. The N downlink SCM modulated unicast channels and one broadcast channel are wavelength division multiplexed by an (N + 1) x 1 WDM multiplexer (MUX) and the combine signal is transmitted into the remote node but the broadcast signal is split in to N equal parts at the RN. The semiconductor optical amplifier (SOA) or Erbium doped fiber amplifier (EDFA) can be develop to boost the power of the broadcast channel before it is multiplexed with the unicast channel SOA is less expensive and it is enable to integration with the transmitter.

The fiber brag grating (FBG) is used to reflect broadcast signal and it is used to separate the broadcast channel and the downlink modulated unicast channel reflect broadcast signal is split into N equal parts by an 1 x N optical splitter and then each port is launched in to an (N + 1) x (N + 1) AWG from 2^{nd} to the (N + 1) input port But a power splitter in the remote node splitting the broadcast signal and transmitted to all ONU but introduced a high insertion loss of the broadcast channel. An optical delay inferometer (DI) is used to separate all optical carriers and subcarriers of the SCM modulated downlink unicast signals it is more cost effective than the method of dedicated filtering for each unicast signal at each ONU .It has periodic frequency response whose period is known as free spectral range (FSR). The EI (extinction ratio) is the ratio of highest frequency response to the lowest frequency response. In fig the separated carrier are subsequently de-multiplexed in to individual carriers by a 1 x N WDM de-multiplexer (DMUX) are fed to the corresponding to each ONU. The uplink unicast signal and sent back CO for feeder back to uplink and data detection.

The subsequent subcarrier launch into the first input port of the AWG let h (i,j) denote the wavelength that converts the ith and the jth output port of the (N + 1) x (N + 1) AWG. h (i,j) can be expressed by eq (1)

$$h(I,j) = h_q \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where the subscript q is denoted by (2)

$$q = (i + j) \bmod (N + 1) \ldots\ldots\ldots\ldots..(2)$$

Due to the cyclic routing property AWG, all the output ports except the (N + 1)th port would have two channels, the common broadcast channel and a downlink unicast channel. In example of 16 x 16 AWG: - unicast wavelength for h1 and h15 while the broadcast wavelength is h16. The composite h1 to h15 entering input port1 and exit into output port 1 to 15; the broadcast wavelength h1 entering at i/p port 2 would exit at output 1. If wavelength

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h16 enter in input port 16 exits at port 15. So the each output port of AWG 1 to 15 of the AWG has a unicast channel and broadcast channel.

Simulation Setup: The proposed broadcast/multicast capable have transmission performance with sixteen 10 Gb/s downlink unicast channel one 10 Gb/s broadcast channel and sixteen 2.5 Gb/s uplink channels over 20 km by simulation using optisystem 7.0.

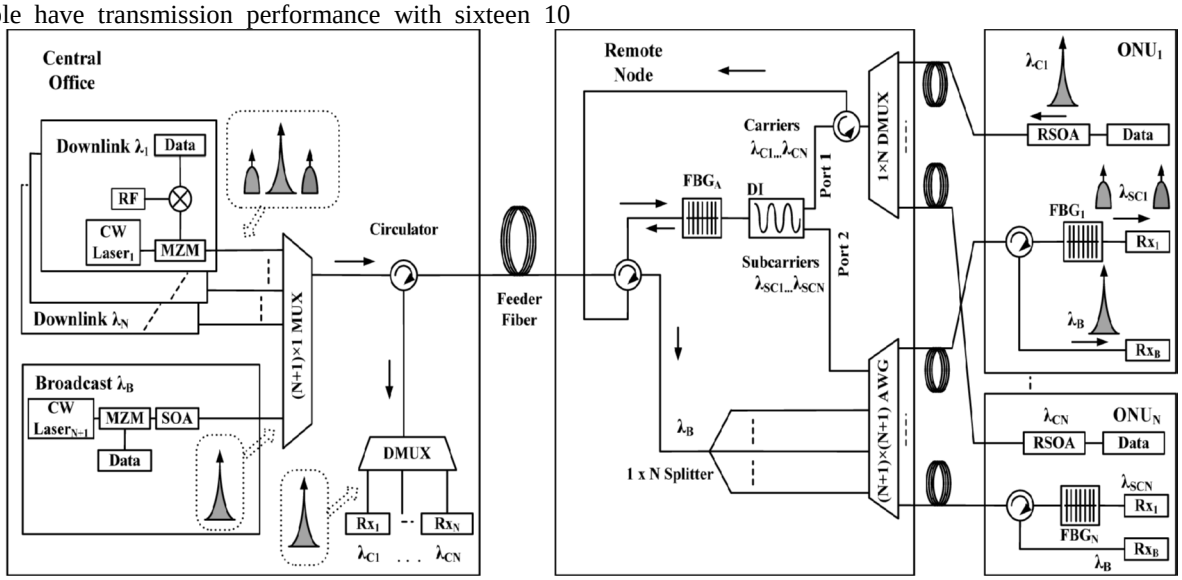

Fig.1. Proposed WDM-PON architecture

III. Performance Evaluation

(a) Receiver Sensitivity Analysis at Different ONUs: Receiver sensitivities are different for the broadcast channel, downlink unicast channel and uplink channel at different ONUs. The mean value of the receiver sensitivities of broadcast transmission, downlink transmission and uplink transmission are -25.59 dBm, -25.97 dBm and -30.29 dBm respectively

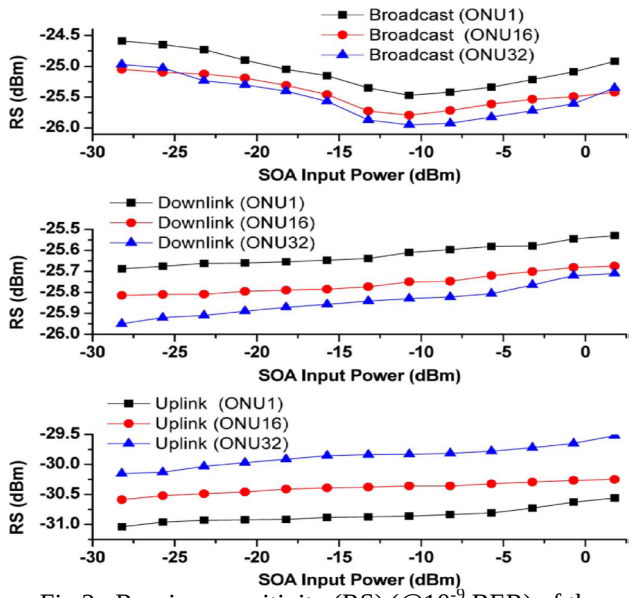

Fig.2. Receiver sensitivity (RS) (@10^{-9} BER) of the broadcast channel (top), downlink uni-cast channel (middle), and uplink unicast channel (bottom) versus the SOA input power for ONU1, ONU16 and ONU32

(b) Power Budget and Scalability Analysis: Use of an SOA or an EDFA to boost the power of the broadcast channel before it is multiplexed with the downlink unicast channels, ensuring its operation in the light gain saturation region, is a practical way to meet the power budget requirement for the broadcast channel. The receiver sensitivity of uplink transmission improves as the seeding power of RSOA increases.

(c) Interference from the broadcast channel to the unicast channel: In order to evaluate from the broadcast and unicast channels and balance the performance of between the downlink and uplink unicast transmissions with the help of simulates I/P OSCR at the transmitter and DI. ER is fixed at 10dBand 20dB respectively.

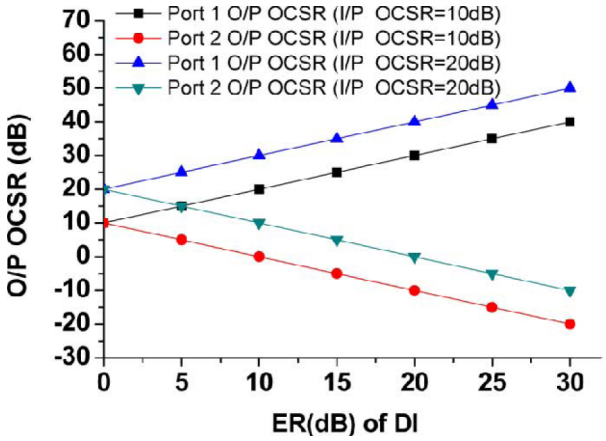

Fig.3. Output OCSR versus the extinction ratio (ER) of the DI

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