Transponder Impact on Power Efficiency in WDM-Links Based on 10-40-100 Gbps Mixed-Line Rates

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The architecture of Wavelength Division Multiplexing (WDM) networks based on Mixed-Line Rate (MLR) concept in a cost-efficient manner scope with heterogeneity of constantly increasing traffic demands [1]. In the same time, the average power costs per transmitted bps (i.e., W/bps) of such WDM solution depends on the number factors (such as energy efficiency of transponders and regenerators, spectral efficiency, length of transmission distance etc.) and number of wavelengths operating with the particular bitrate and modulation format is one of them.

In [2, 3] authors explores the trade-off between power costs per each transmitted bps, spectral efficiency and the point-to-point transmission distance for the number of Single-Line Rate (SLR) and MLR solutions but none of these papers do not explore the wavelength assignment scheme that must be used to guarantee the lowest overall transponder power consumption regardless to the capacity that need to be transmitted with defined signal quality. Hence, this papers aims at exploring the power efficient 10 Gbps, 40 Gbps and 100 Gbps wavelength assignment approach as well as the minimum optical bandwidth required to allocate these wavelengths in an end-to-end WDM link where the signal quality threshold is fixed to Q≥6.

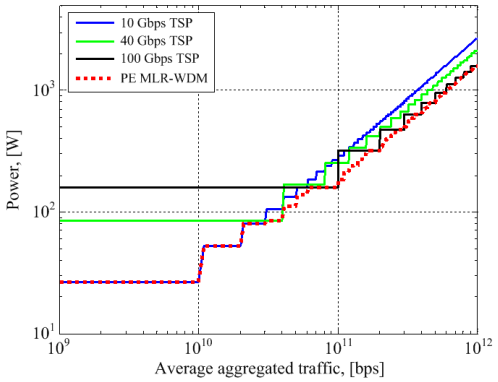

Fig.1. Total power consumption of different TSPs as a function of average aggregated traffic.

It is revealed that the lowest overall transponder power consumption is secured when not more than there 10 Gbps wavelengths are used to transmit the data and not more than one 40 Gbps wavelength is used regardless to the total capacity need to be transmitted, while the number of 100 Gbps wavelength should be increased as average aggregated traffic grows. This is explained with the highest energy efficiency of 100 Gbps transponders comparing to the 10 Gbps and 40 Gbps. If the number of each wavelength is selected using this proposed algorithm then the total power consumption required to ensure data transmission over one section of transmission line is: (i) the same as it would be for the 10 Gbps SLR solution and the capacity less than 30 Gbps; (ii) the lowest one for the traffic between 30 and 60 Gbps; (iii) not higher as it would be for 100 Gbps SLR solution.

References

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[3] A. Udalcovs et al., Spectral and Energy Efficiency Considerations in Mixed-Line Rate WDM Networks with Signal Quality Guarantee, ICTON 2013, pp. 1-6, 2013.