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Bit-rate maximization for elastic transponders operating in WDM uncompensated amplified links

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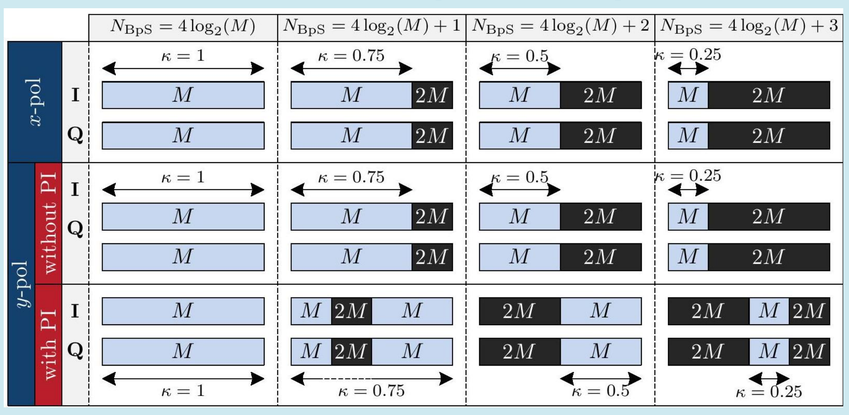
SUMMARY

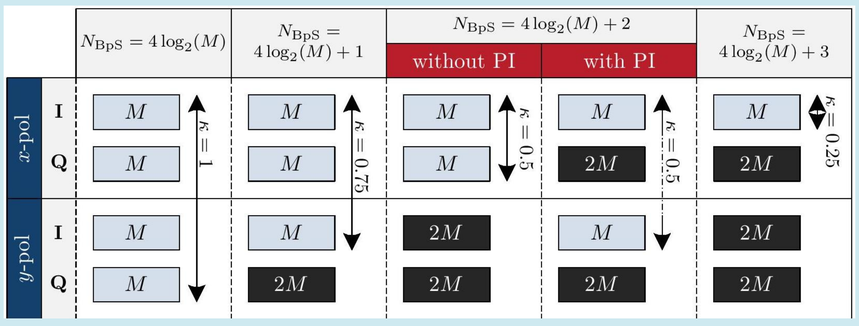
We maximize the bit-rate for elastic transponders operating on WDM uncompensated amplified links. We consider pure QAM modulation formats granting only discrete rate vs quality of lightpath tradeoff, and compare performances to time-division (TDHMF) and quadraure-division (FlexPAM) hybrid modulation formats, enebling continuty in rate choice. We show that with proper countermeasures hybrid format are reaching perfomances close to the GN-model predictions

HYBRID FORMATS

Time-Division Hybrid Modulation Formats (TDHMF)



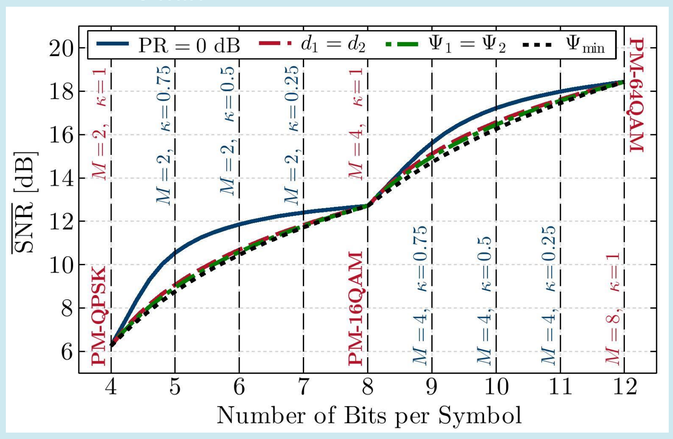
Quadrature-Division Hybrid Modulation Formats (FlexPAM)



BACK-TO-BACK

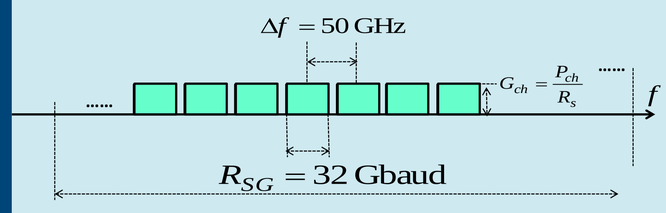
Four working-mode:

1. Same power (PR=0)
2. Same Euclidean distance (d1=d2)
3. **Same BER (ψ_1=ψ_2)**
4. Min BER (ψ_{min})

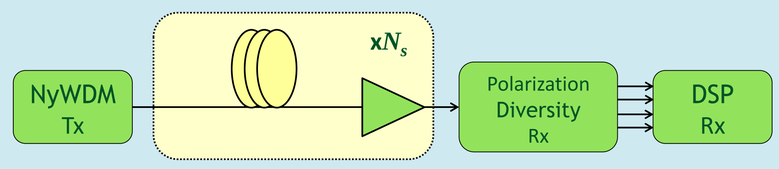


NONLINEAR PROPAGATION

Channel comb

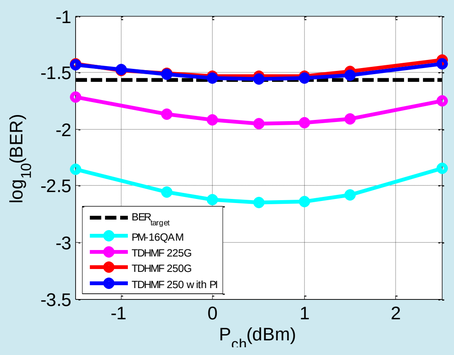


Uncompensated SSMF, L_s=100 km

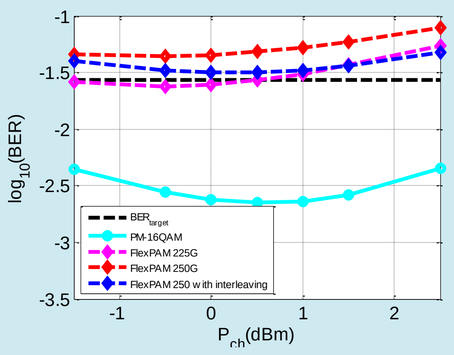


Benefits of PR tuning after L=1000 km (N_s=10)

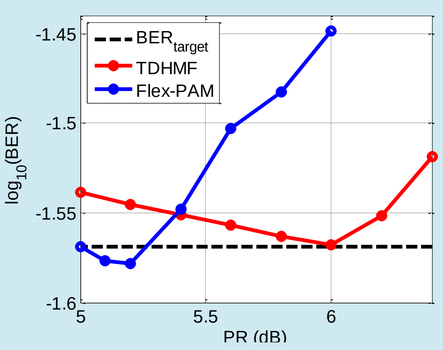
TDHMF



FlexPAM

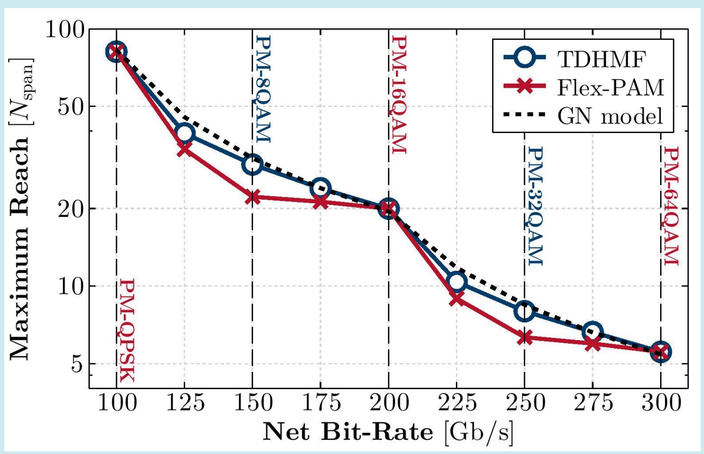


R_b=250G

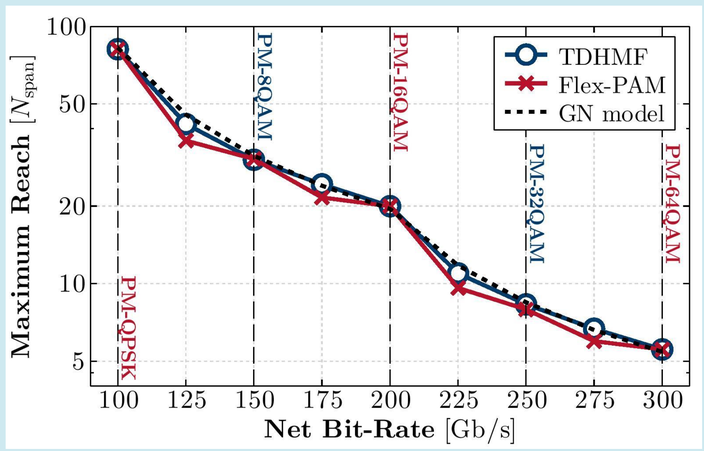


Benefits of PR tuning on maximum reach

With countermeasures



W/O countermeasures



CONCLUSIONS

We maximized the bit-rate per channel for a 1000 km SSMF uncompensated amplified link operated with a WDM system on a 50 GHz WDM grid. We show that using pure QAM formats bit-rate is limited to R_b=200 Gbps achieved using PM-16QAM. While using hybrid modulation formats we can operate at R_b=225 Gbps using either TDHMF or FlexPAM. We also tested the benefits of interleaving and fine-tuning of power ratio to mitigate nonlinear effects showing that FlexPAM can achieve a maximum bit-rate of 250 Gbps. We show benefits on maximum reach as well

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