Modal Noise Penalty for SR4.2

Re: Comment IDs 12, 38, and 39 against D2.0

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Review of previous presentations

- sun_3cm_01a_0119
  - 13 offset connections
  - 0.15-0.4 dB BER penalty BtB
  - no penalty over 150 m
- sun_3cm_01a_0319
  - 4 offset connections
  - < 0.25 dB BER penalty BtB and over 300 m
  - 0.5 dB SECQ penalty over 300 m
  - Underfilled transmitters
- king_3cm_01_0319
  - Estimate 0.08 dB penalty from Pepeljugoski_01_0108
  - Additional data in kolesar_3cm_adhoc_01_042519 leads to 0.2 dB penalty

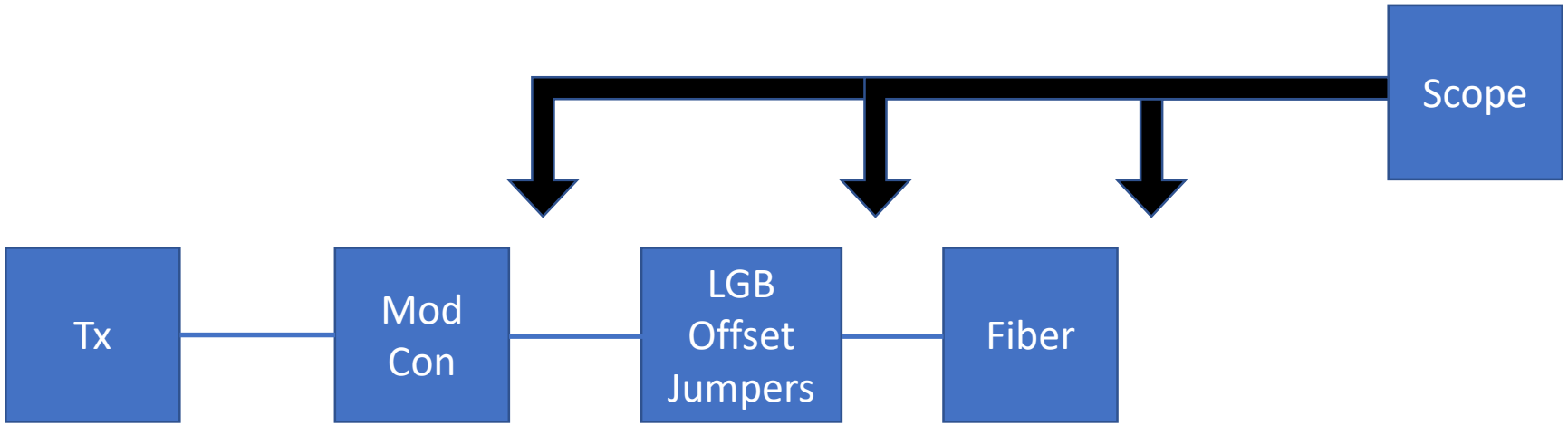
Review of relevant comments in D2.0

- #12 (Dawe) 0.1-0.2 dB for MN, use an equation
- #38 (Kolesar) Increase power budget by 0.2 dB for MN
- #39 (Lingle) Increase MN penalty by 0.2 dB

Similar setup to sun_3cm_01a_0319 with a ModCon inserted after the transmitter

- In sun_3cm_01a_0319 EF at 19 microns was 91-95%
- With ModCon EF was 88% for 850 nm channel and 90% for 910 nm channel, much closer to worst case 86%
- Measured loss through offset patch cords was 1.6-1.7 dB
- Measured modal noise penalty in SECQ and BER back to back and over 250-300 m fibers

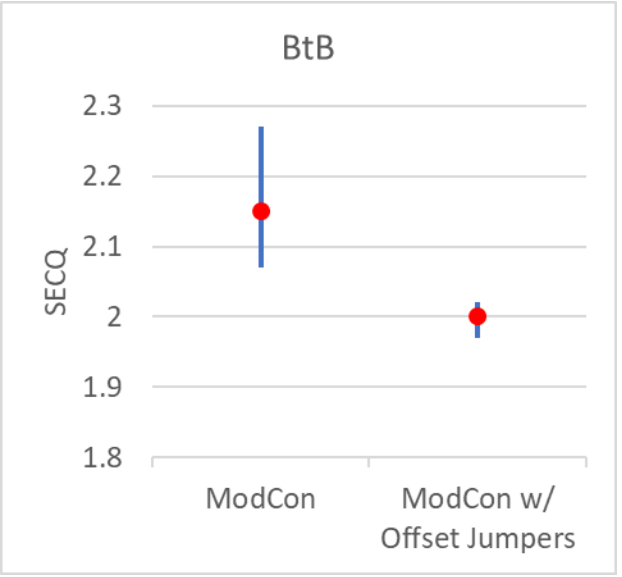
Experimental setup for SECQ measurement

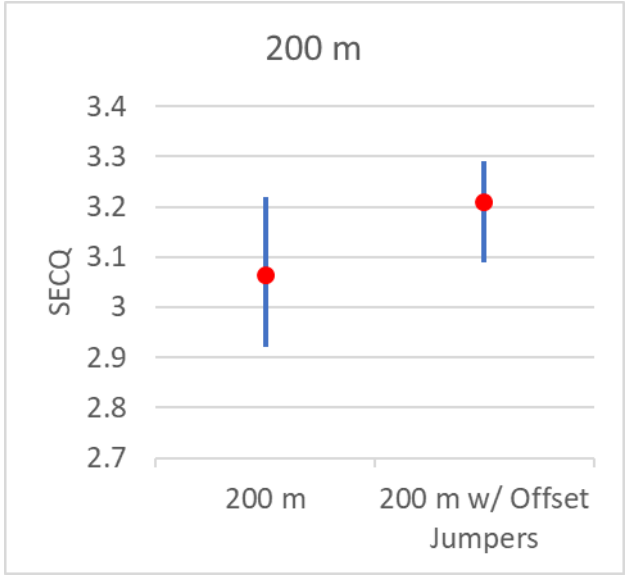


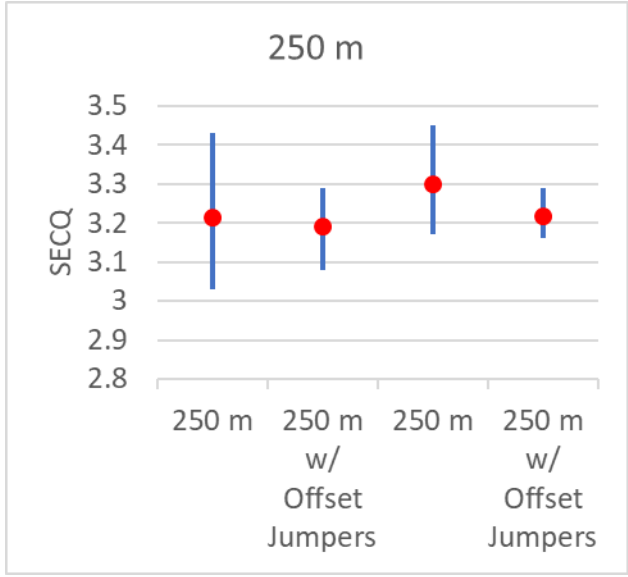
Measure SECQ at multiple points with and without offset jumpers in the path

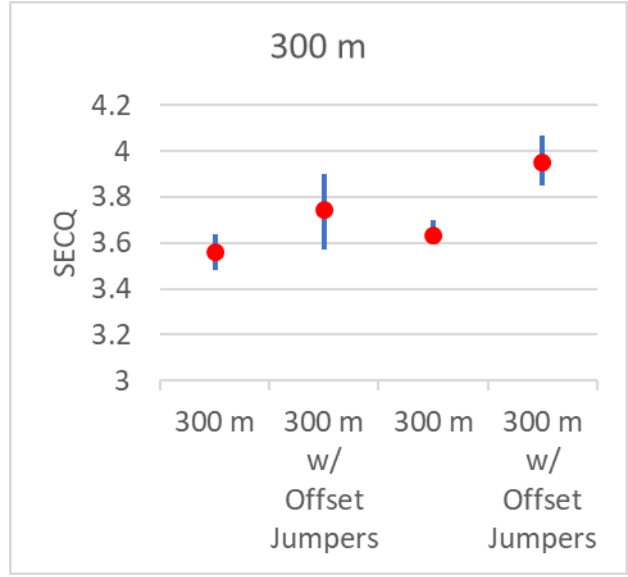
SECQ 850 nm Channel

For each configuration SECQ was measured 5 times sequentially
Blue bars illustrate range of SECQ values
Red dot is average of 5 measurements

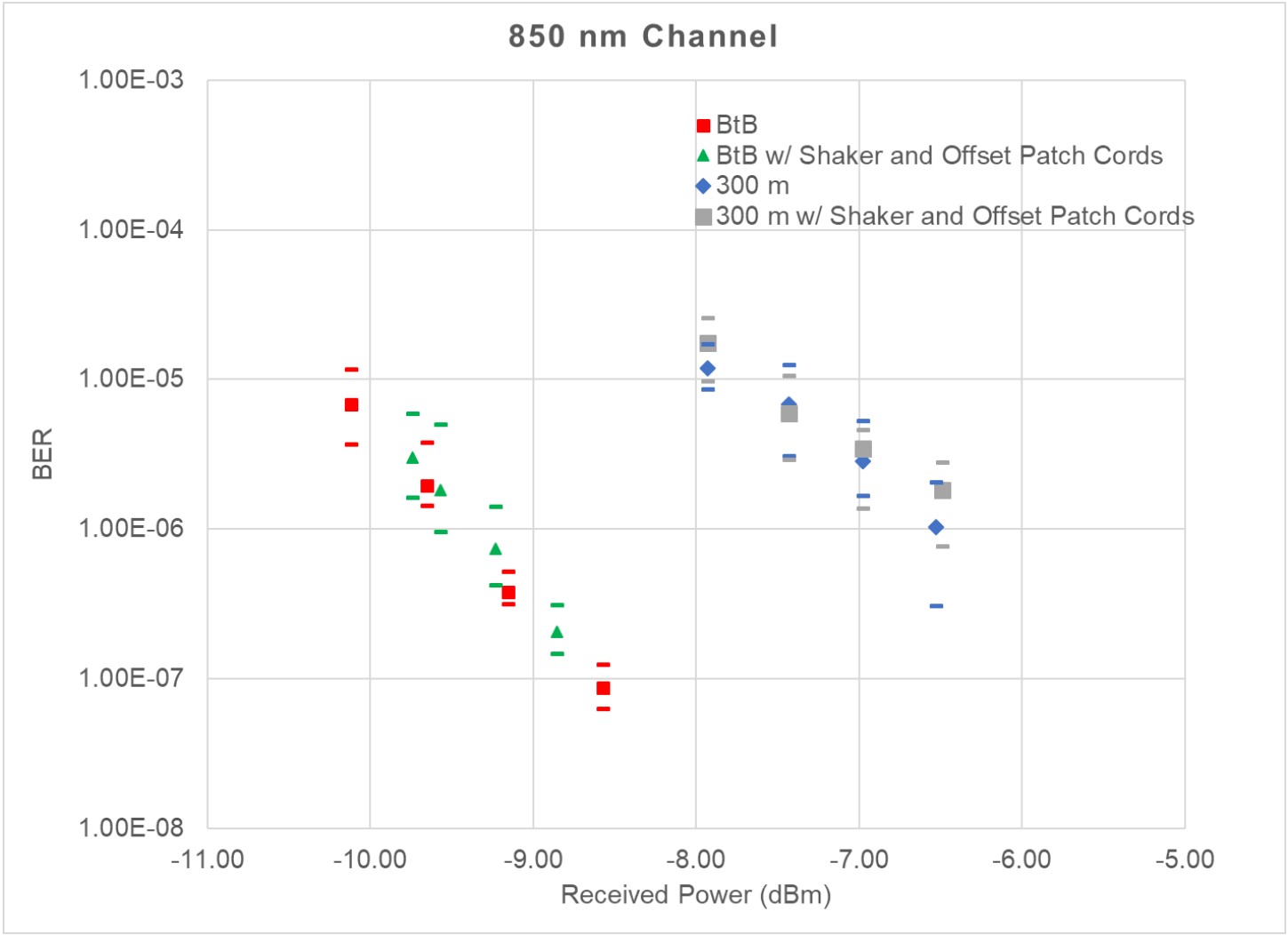






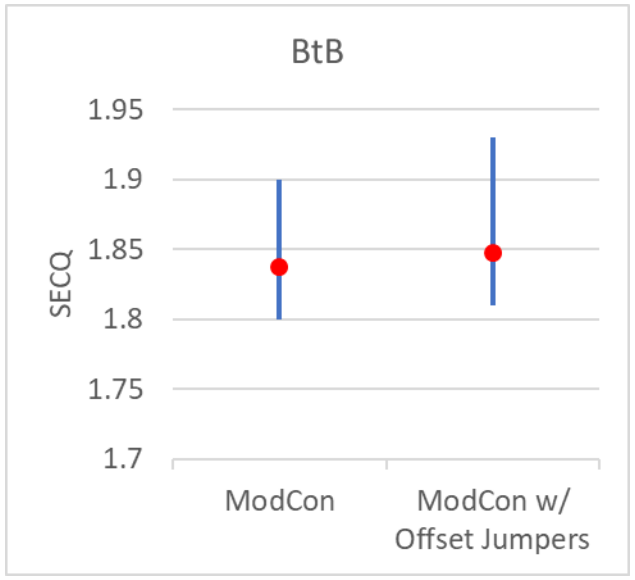


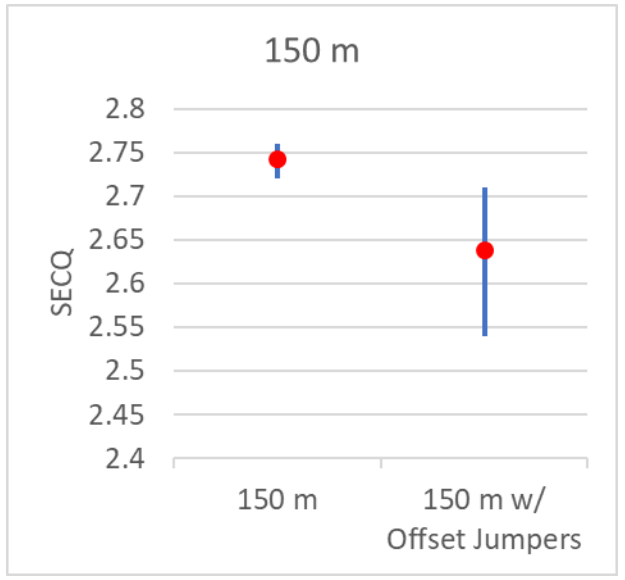
Modal noise penalty < 0.2 dB at 300 m with SECQ ~3.8 dB

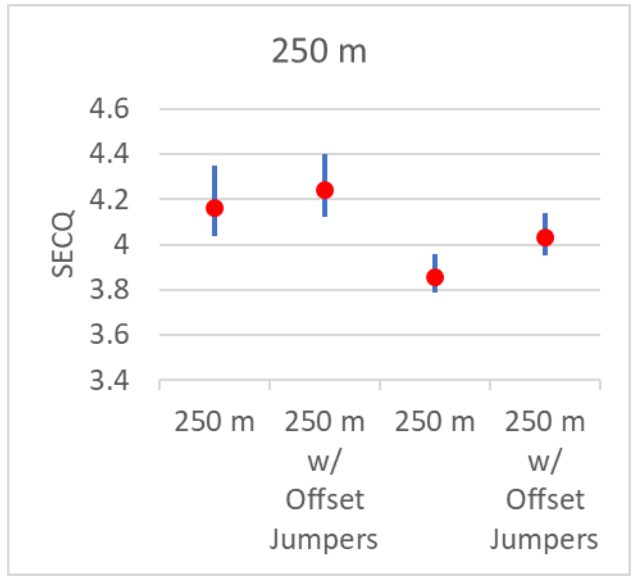


SECQ 910 nm Channel

For each configuration SECQ was measured 5 times sequentially
Blue bars illustrate range of SECQ values
Red dot is average of 5 measurements

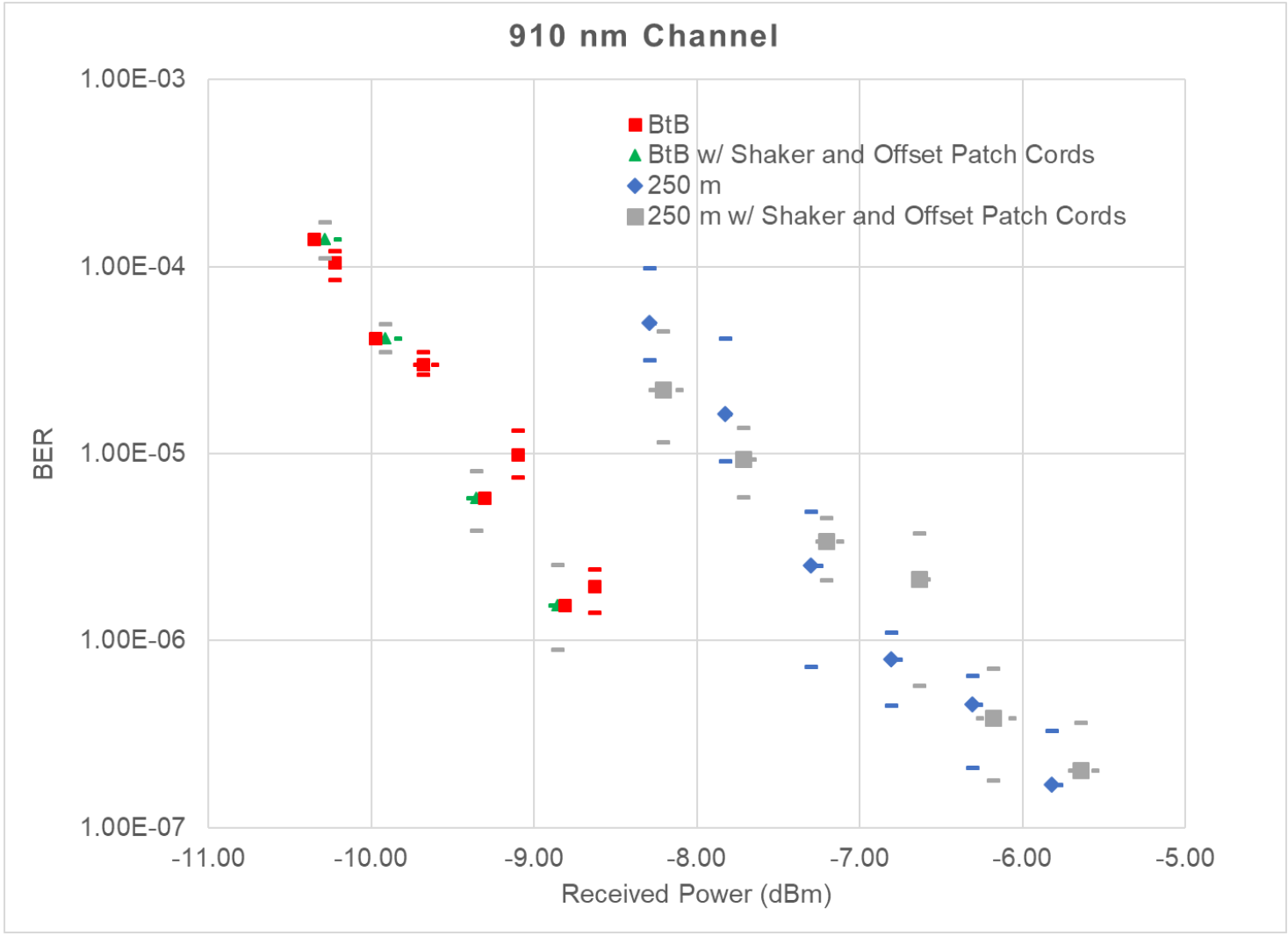






Near worst case SECQ at 250 m

Modal noise penalty < 0.2 dB even near worst case SECQ ~4.2 dB



Conclusions

- We have studied a couple examples of modal noise in highly stressed links: worst-case mode power distribution, beyond worst case offset connectors (1.7 dB with MODCON), worst-case CD*length*spectral width products, and near worst case eye closure
- Experiments show small modal noise penalty < 0.2 dB
- Experimental results support 0.2 dB modal noise allocation in comments 12, 38, and 39