

DR4 Tx 'off' specs

P802.3bs, SMF ad hoc

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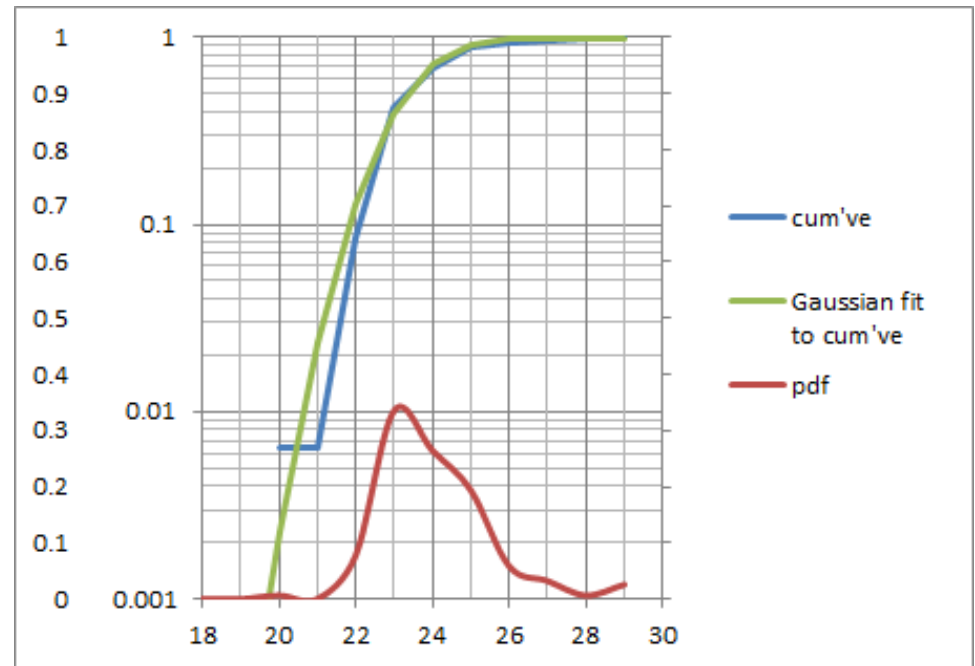
Tx 'off' spec for multi-lane SMF

- Global (all transmitters) Tx 'off' is required
 - easily met by turning off the master laser for PSM
- Individual Tx lane 'off' is optional
 - can't turn off master laser;
 - must use the extinction of an individual lane's modulator to attenuate the light on that lane in order to meet the Tx 'off' spec
 - The D3.0 Tx 'off' spec sets a per lane limit that is still hard to reach with a modulator that would otherwise be completely fit for purpose
 - Aim: find a spec value that is achievable

Tx 'off' power spec

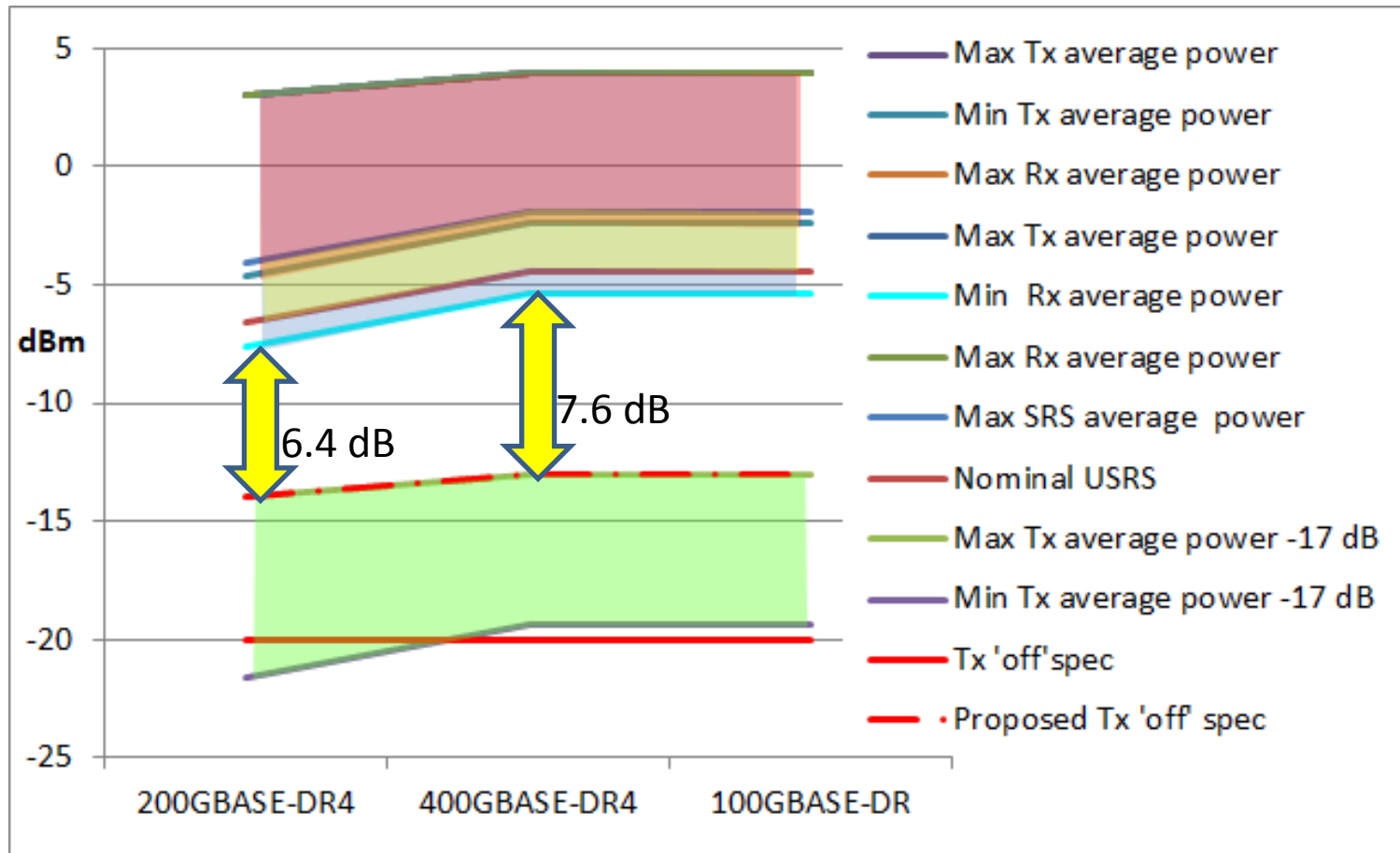
- DC modulator extinction data, 3 temperatures, 4 lanes, ~13 devices:

~99.8% yield for
20 dB DC Extinction



- The Tx average power 'uses up' 3 dB of ER (quadrature bias)
- The rest of the ER can be used to attenuate the power of individual lanes.

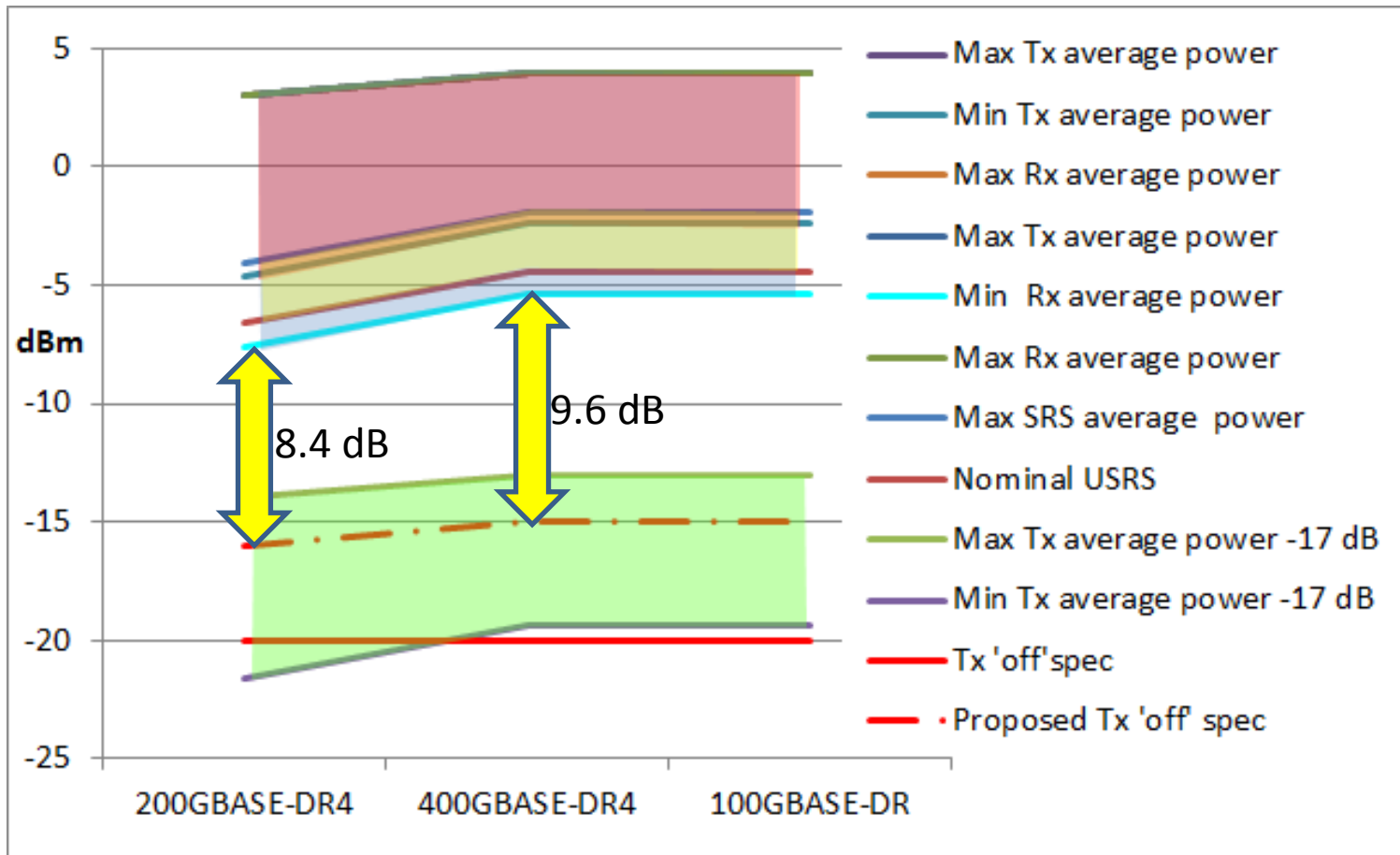
200G DR4, 400G DR4 & 100G DR specs, proposal A: -14, -13 and -13 dBm Tx 'off' spec



20 dB min extinction from modulator allows 17 dB reduction in average Tx power

200G DR4, 400G DR4 & 100G DR specs

proposal B: -16, -15 and -15 dBm Tx 'off' spec



20 dB min extinction from modulator allows 17 dB reduction in average Tx power
 Meeting Tx 'off' spec relies on controlling lane to lane Tx average power per lane very closely

Conclusion

- Based on the measured data, 17 dB is the minimum extinction available to turn down Tx average power on a per lane basis.
 - The available modulator extinction is still much higher than required to generate a high quality optical PAM4 signal.
 - Tx 'off' spec = -20dBm cannot be achieved reliably on a lane by lane basis

Two options:

- A. Tx 'off' specs of **-14 dBm** for 200GBASE-DR4, and **-13 dBm** for 400GBASE-DR4 and 100GBASE-DR, allow Tx 'off' spec to be met for the full Tx average power range per lane with anticipated good yield.
 - leaves >6 dB between min Rx average power spec and Tx 'off' spec.
- B. Tx 'off' specs of **-16 dBm** for 200GBASE-DR4, and **-15 dBm** for 400GBASE-DR4 and 100GBASE-DR. Tx 'off' spec can be met reliably **if** lane to lane average power variation can be controlled to better than 4 dB on any lane.
 - leaves >8 dB between min Rx average power spec and Tx 'off' spec.