P802.3cd RIN_OMA specs (comment 140, 141)

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Summary

- Draft 1.2 RIN specs for 50GBASE-FR, 50GBASE-LR, and 100GBASE-DR are tighter than necessary for system operation.
- RIN requirements for 50 Gb/s and 100 Gb/s PAM4 were analyzed in the joint contribution '100Gb/s SMF PMD Alternatives Analysis', in terms of noise relative to the optical carrier power, RIN_c:

  www.ieee802.org/3/bm/public/nov12/lyubomirsky_01a_1112_optx.pdf
- For a 0.5 dB system penalty:
  - For 100Gb/s PAM4 the required RIN_c is ≤ -138.5 dB/Hz
  - For 50Gb/s PAM4 the required RIN_c is ≤ -135.5 dB/Hz
  - Independently, a similar value for 50Gb/s PAM4 was shown in: www.ieee802.org/3/100GNGOPTX/public/mar12/plenary/nicholl_01b_0312_NG100GOPTX.pdf
  - These values need to be converted to RIN_OMA:

    $RIN\_OMA = RIN_c + 20.\log((ER+1)/(ER-1))$

    where ER is the linear extinction ratio
  - For constant RIN_c, the highest RIN_OMA value is at minimum ER

Snapshot of lyubomirsky_01a_1112_optx

Required RIN vs. PAM-M Order

At 0.5 dB Q penalty:

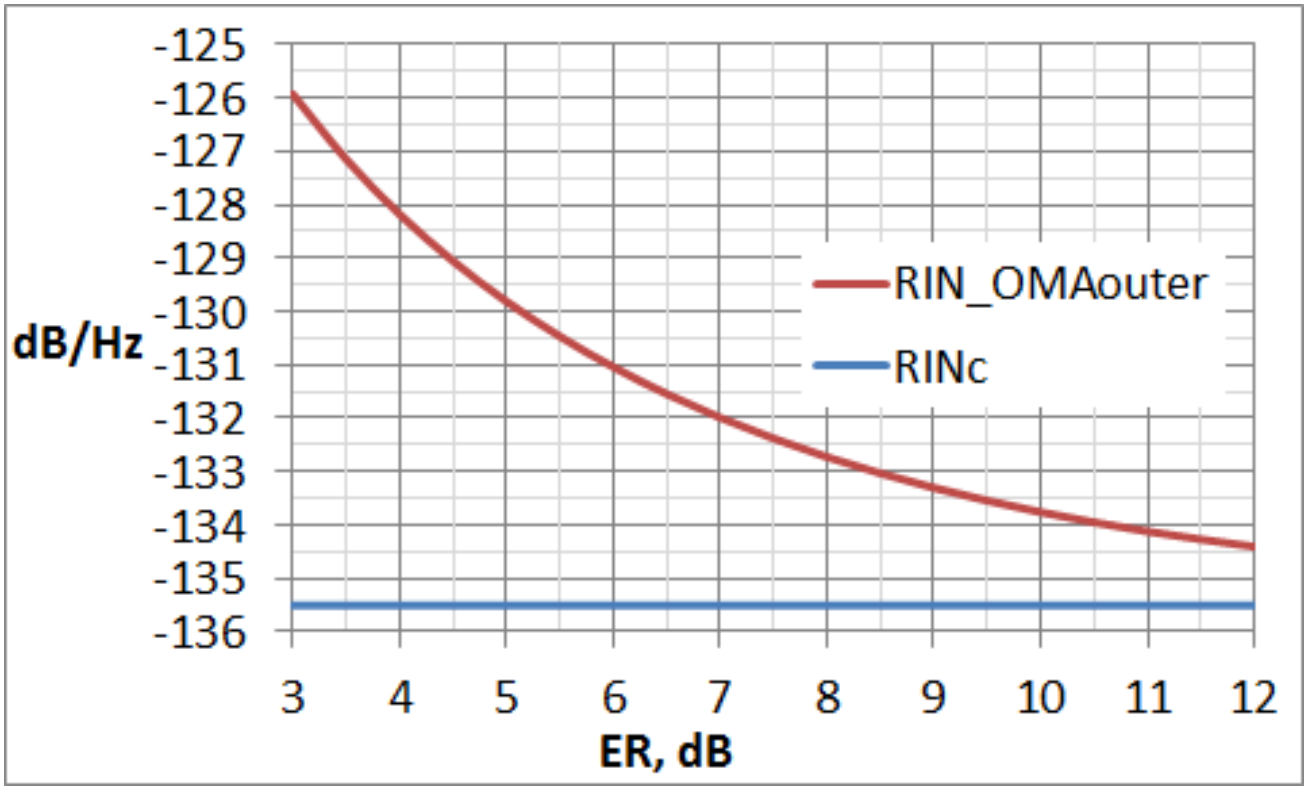
$$Q_0^2 10^{\frac{RIN}{10}} W\left((M-1)^2+(M-2)^2\right)=\frac{1}{8}$$

RIN (dB/Hz) Q_0 = 4.2 (BER = 1.e-5):

M	25GBuad nicholl_01b_0312	25GBaud	50Gbaud
2	-126	-124.5	-127.3
4	-135	-135.5	-138.5
8	-143	-143.8	-146.6
16	-149	-150.7	-153.6

NOTE- These were RIN dBc/Hz values, they need to be converted to RIN_OMA$_{outer}$

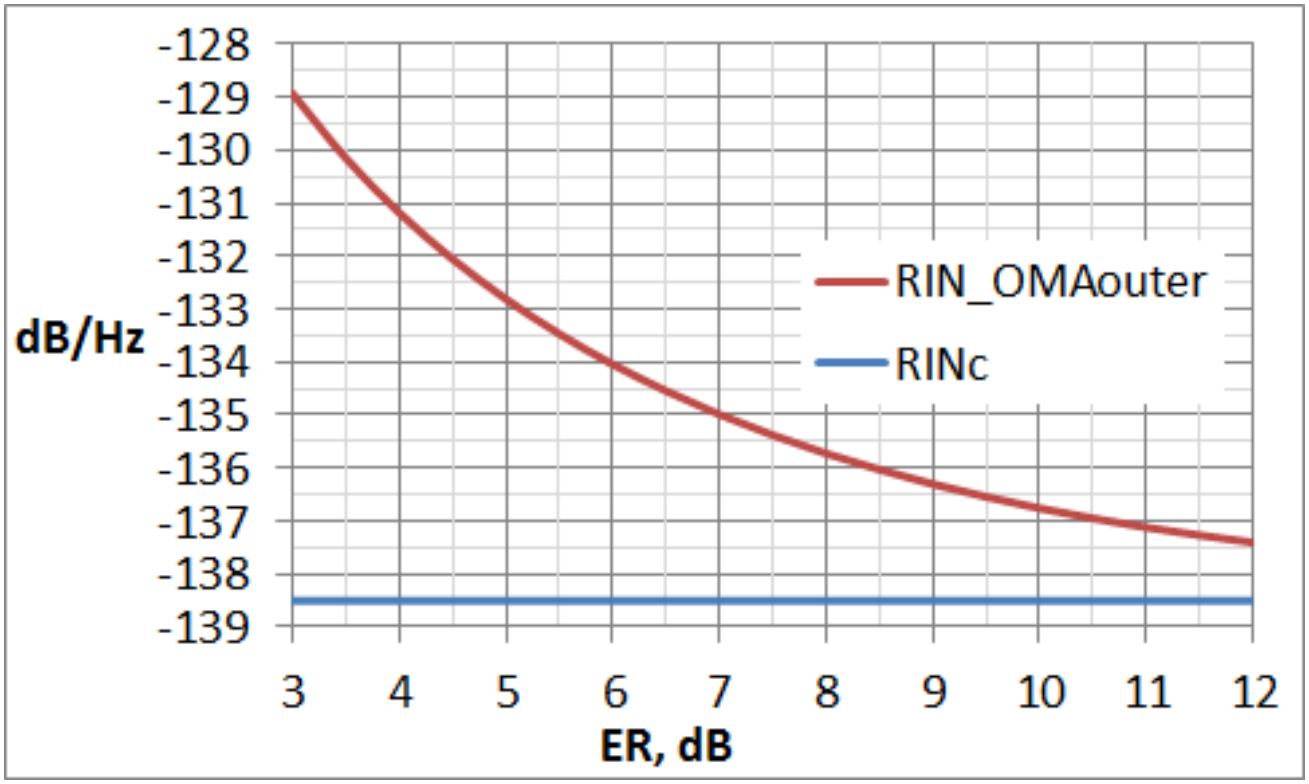
50GBASE-FR: RIN_OMA vs ER at RIN_c = -135.5 dB/Hz



At a min ER = 4.5 dB, the required RIN_OMA equivalent would be -129 dB/Hz for 0.5 dB RIN penalty.

Propose backing off by ~3 dB to set the RIN_OMA spec at -132 dB/Hz for 50GBASE-FR and 50GBASE-LR

100GBASE-DR4: RIN_OMA vs ER at RIN_c = -138.5 dB/Hz



At a min ER = 5 dB, the required RIN_OMA equivalent would be -133 dB/Hz for 0.5 dB RIN penalty.

Propose backing off by 3 dB to set the RIN_OMA spec at -136 dB/Hz for 100GBASE-DR

Proposals

- In 139.6.1, Table 139-6, change RIN_OMA max value to -132 dB/Hz for 50GBASE-FR and -LR
- In 140.6.1, Table 140-6, change RIN_OMA max value to -136 dB/Hz for 100GBASE-DR

- No changes to TDECQ or any other spec's

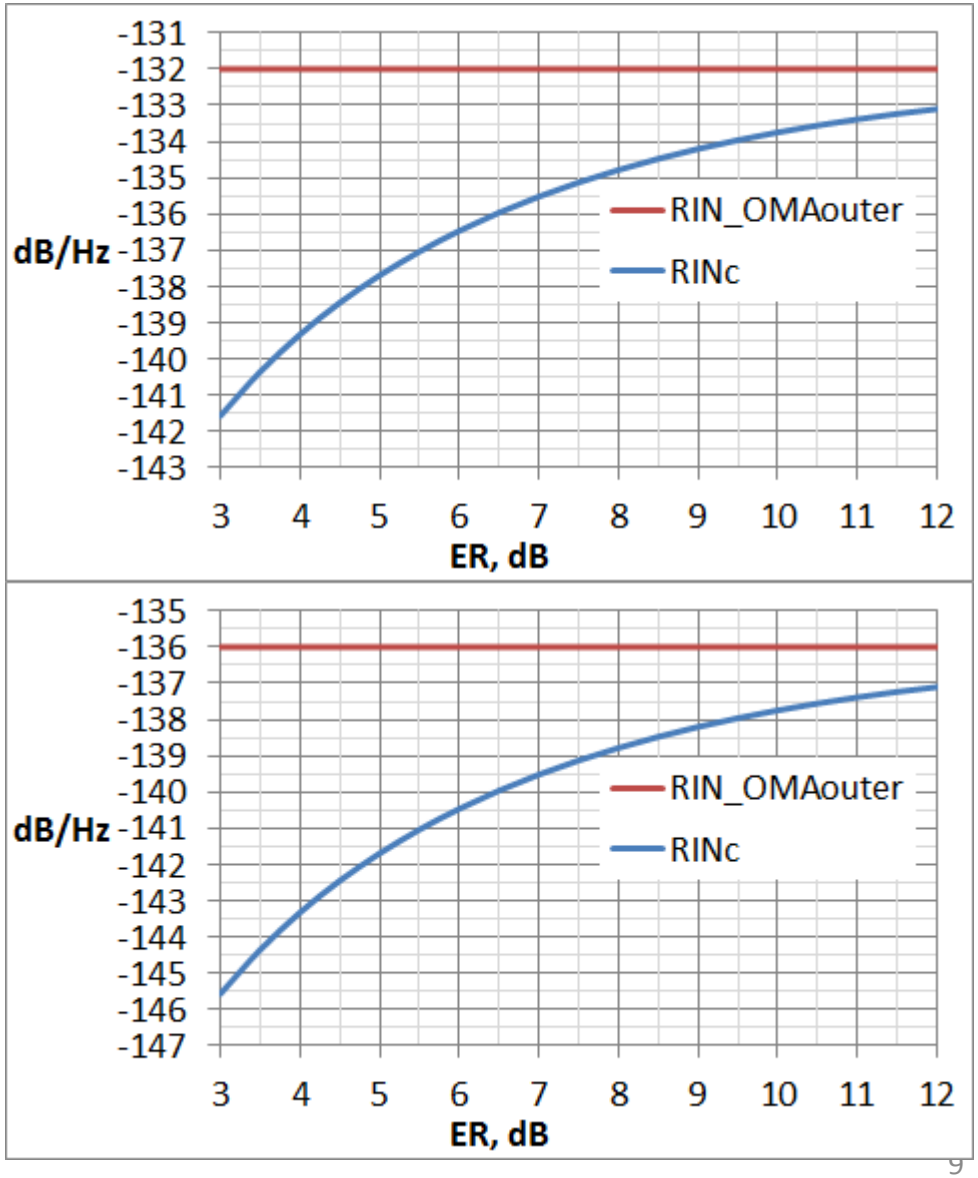
References

- PAM4: RIN values for 0.5 dB penalty:
  - www.ieee802.org/3/bm/public/nov12/lyubomirsky_01a_1112_optx.pdf
  - www.ieee802.org/3/100GNGOPTX/public/mar12/plenary/nicholl_01b_0312_NG100GOPTX.pdf
- Baseline proposal for 400GBASE-DR4
  - http://www.ieee802.org/3/bs/baseline_3bs_0715.pdf – see section welch_3bs_01a_0715.pdf
- Baseline proposal for 100GBASE-DR
  - http://www.ieee802.org/3/cd/public/Sept16/traverso_3cd_03a_0916.pdf

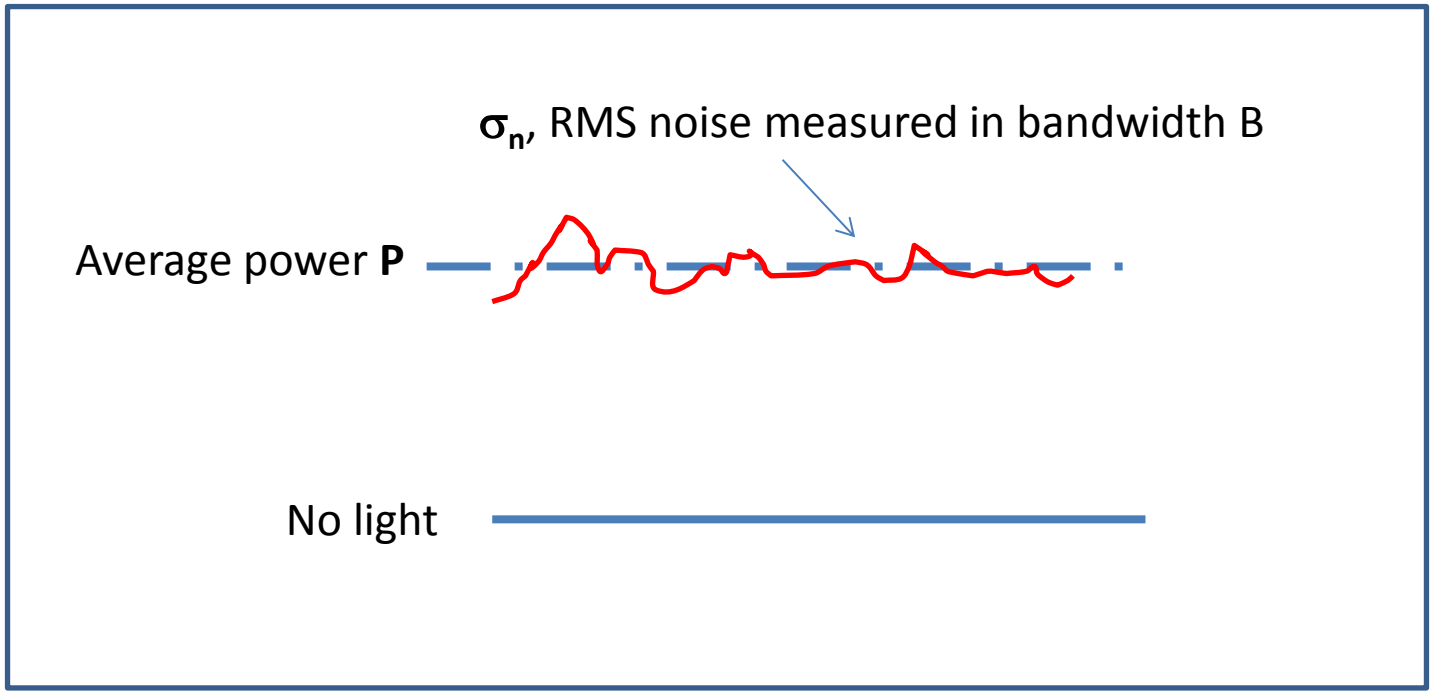
Back up

Fixed RIN_OMA$_{outer}$ spec

- For a fixed RIN_OMA$_{outer}$ spec, the RIN$_c$ required to maintain a given maximum RIN penalty is dependent on ER



RIN_c



$$RIN_c = 10.\log((\sigma_n/P)^2) - 10.\log(B) \ \ dB/Hz$$