Maps of OMA, TDP and mean power

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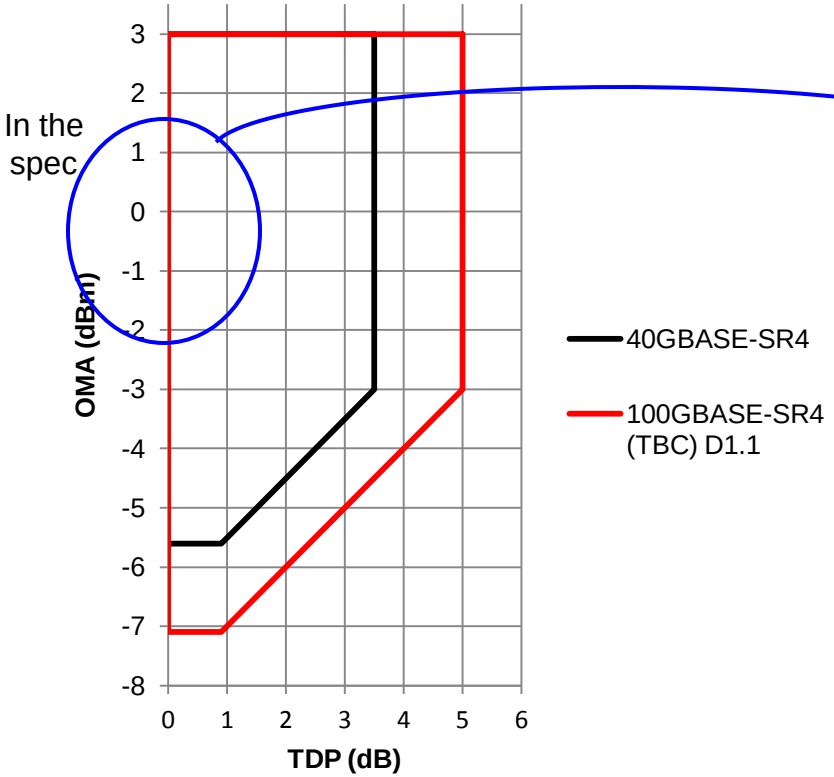
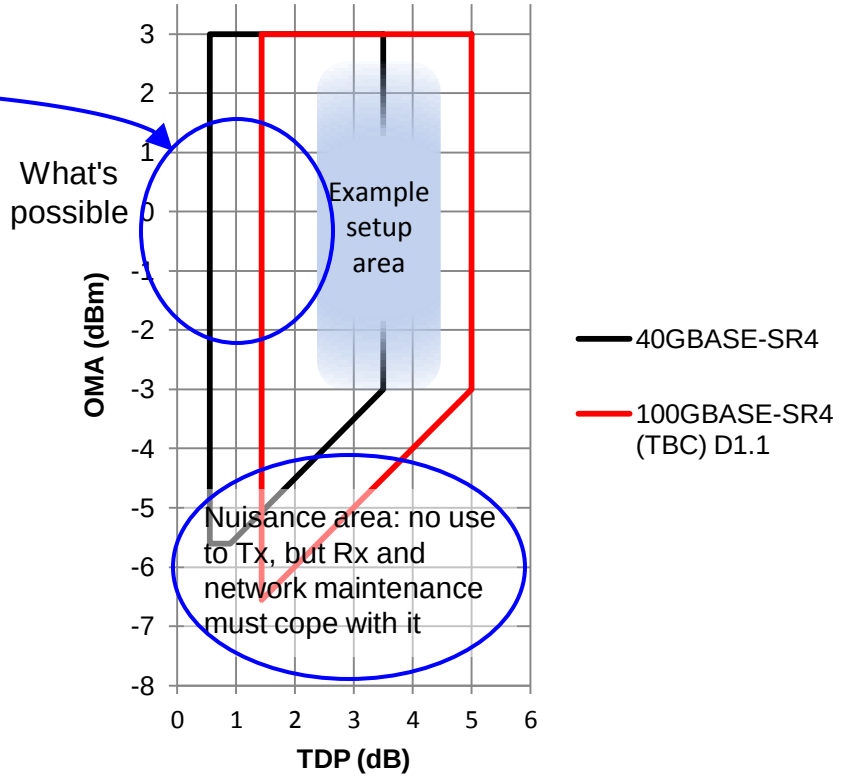
Introduction

- Comments 140,141, 130, 129, 66, 70 and 18 relate to parameters average power, OMA, peak power and extinction ratio that are best discussed with the appropriate maps in view
- This presentation provides the maps and some discussion and recommendations

Map of OMA vs. TDP

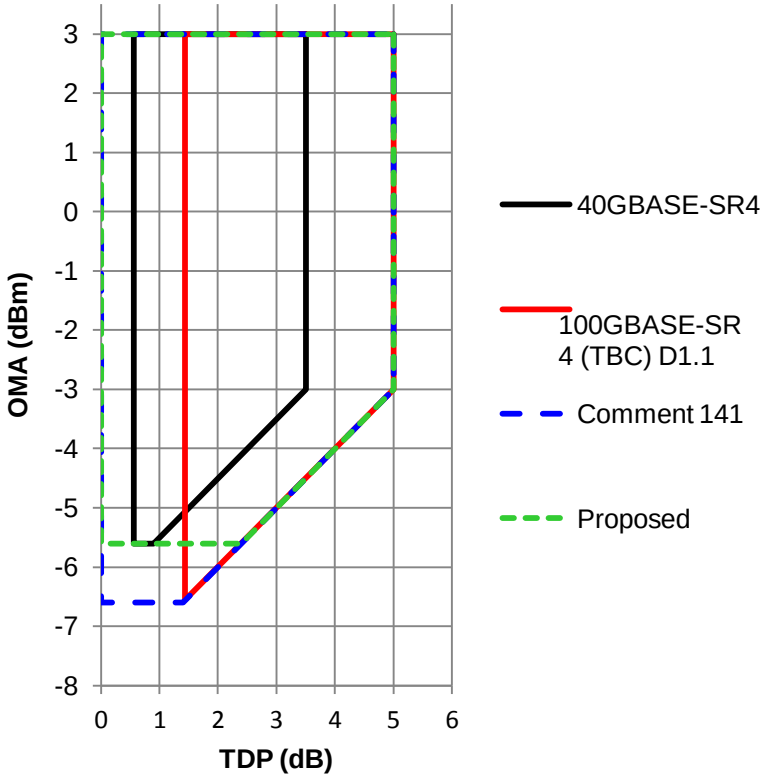




- Allowed Tx TDP and OMA in 40GBASE-SR4 and, for 100GBASE-SR4, in P802.3bm D1.1 (to be confirmed)
- Transmitter is not given credit for TDP<0.9 dB

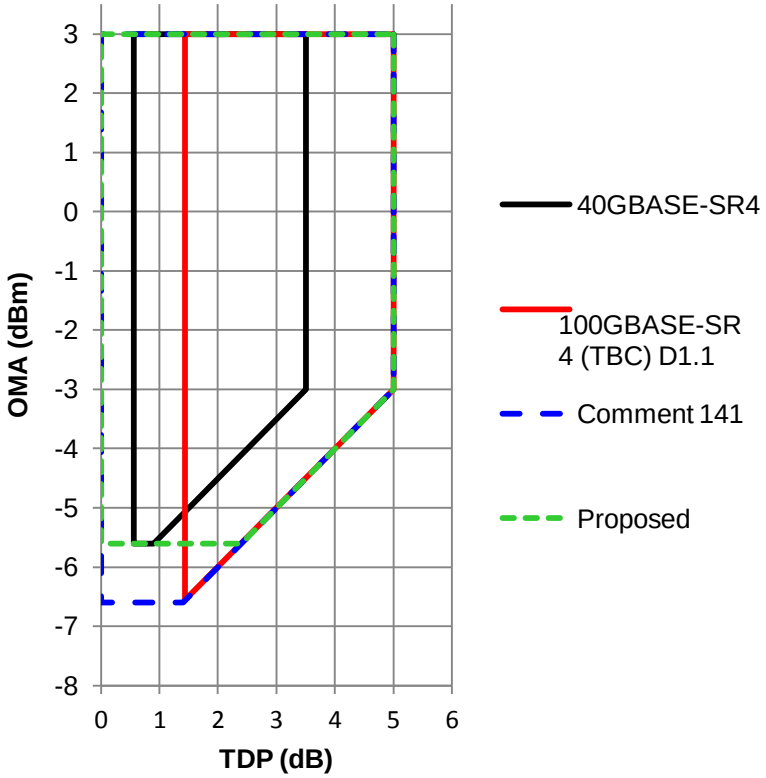
- A noiseless Tx with 1 ps risetime would have TDP of 0.44 dB for 40GBASE-SR4 and 0.76 dB for 100GBASE-SR4 (from spreadsheet model: ISI at decision timing offsets)
- For 12 ps, this becomes 0.56 dB or 1.44 dB (illustrated)
- TDP is not likely to be below 1.5 dB
- Cutoff line for TDP credit needs revision

Minimum OMA recommendation



- We should raise the minimum OMA for low-TDP Tx until there is a moderate flat region at the bottom
- Comment 141 proposed increasing the minimum OMA from -7.1 dBm to -6.6 dBm
- It turns out that isn't enough
- We might as well use the same limit as 40GBASE-SR4: -5.6 dBm
  - This makes operation and diagnostics of a mixed 40GBASE-SR4 / 100GBASE-SR4 network a little easier
  - No cost foreseen because this still offers an 8.4 dB tall setup window for any future low-TDP transmitter

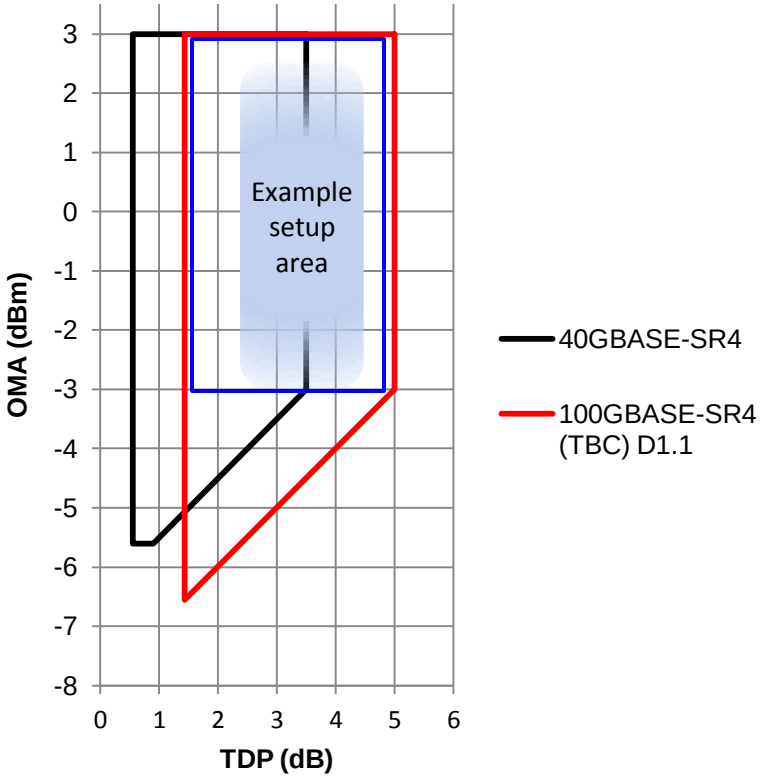
Associated changes



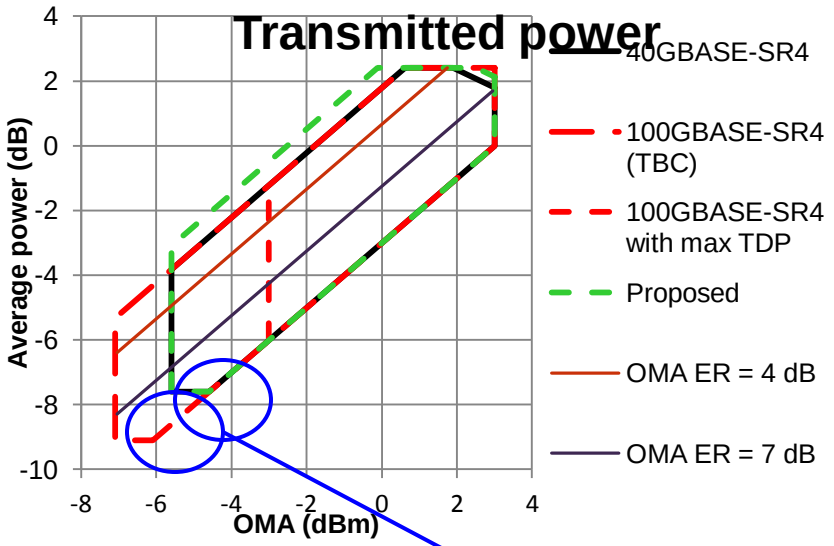
- Comment 18 proposes for Table 95–6, 100GBASE-SR4 transmit characteristics:
  - Insert note 'b' to spec line "Optical Modulation Amplitude (OMA), each lane (min)" : Even if the TDP < 0.9 dB, the OMA (min) must exceed this value.
- Instead of 0.9 dB, use 2.4 dB
- The minimum average power on each lane would also be increased
  - See next slide

Difference between lanes

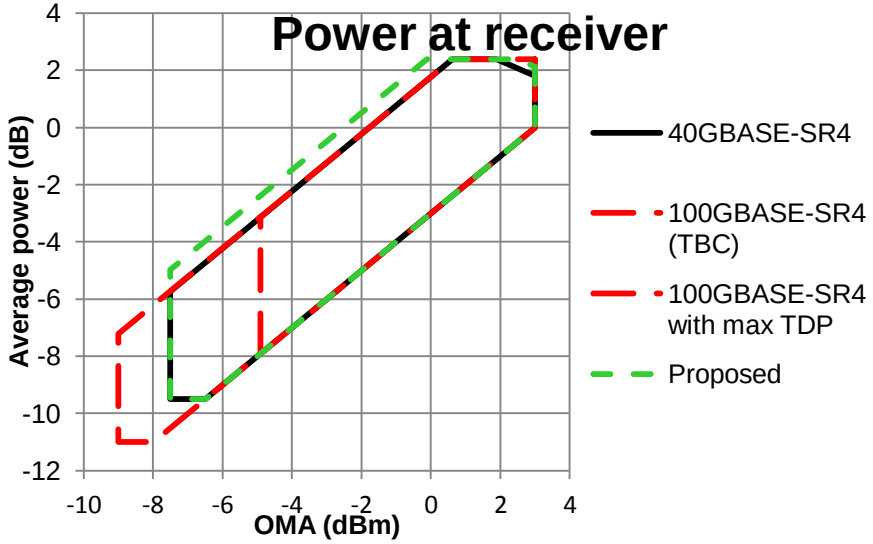
- Transmitters that make use of the maximum TDP spec can be set up by aiming within the blue rectangle
- Difference between max and min is 6 dB
  - Enough for setup
- This would also be the difference between any two lanes at the transmitter
- The difference at the receiver could be 1.9 dB more, because the loss of the lanes may not be equal
  - If the minimum attenuation is 0 dB/km
  - Total 3-(-3)+1.9=7.9 dB not 3-(-7.1)+1.9=12 dB (from slide 3)
- Use this to moderate the aggressor OMA in stressed receiver testing (comment 130)



Choosing minimum average input power at receiver



A directly modulated VCSEL is unlikely to have very high extinction ratio AND very low TDP

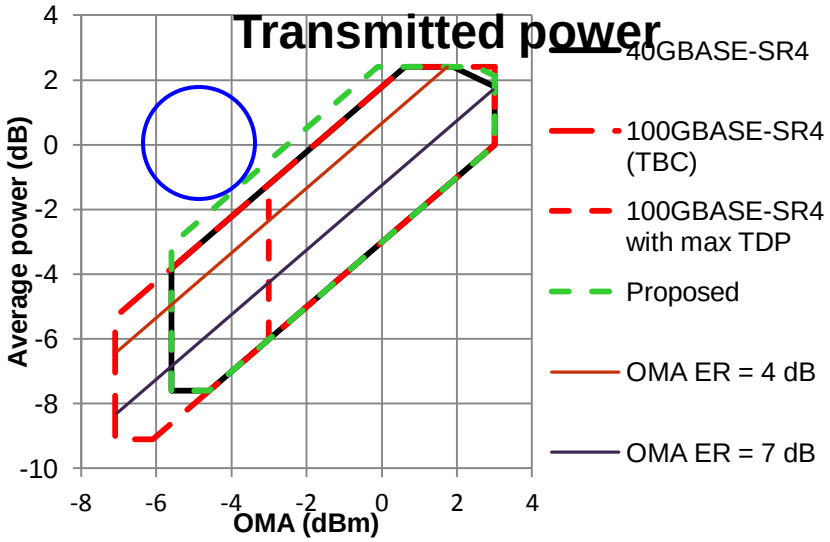


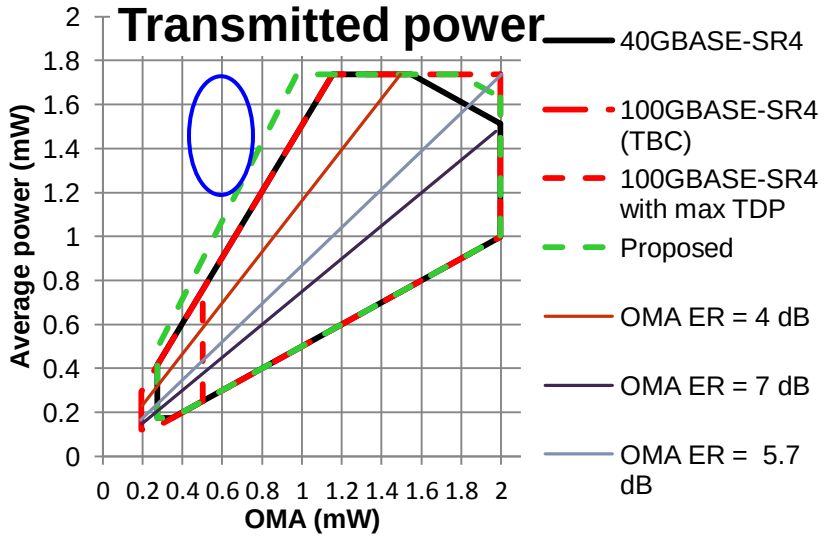
Power at receiver is 0 to 1.9 dB less than launch power

- Slide 4 shows that -5.6 dBm is a suitable Tx OMA minimum
- The draft -9.1 dBm minimum average launch power is unlikely to happen: it would need very high extinction ratio together with very low TDP
- -7.6 dBm, as in 40GBASE-SR4, looks suitable
- The minimum average input power at the receiver (TP3) would become -9.5 instead of -11 dBm

- Note: these maps assume that all ones and zeros are the same
  - No distinction between "OMA extinction ratio" and "SONET extinction ratio"
  - Peak power calculated as average power in ones – true peak can be higher because of overshoot

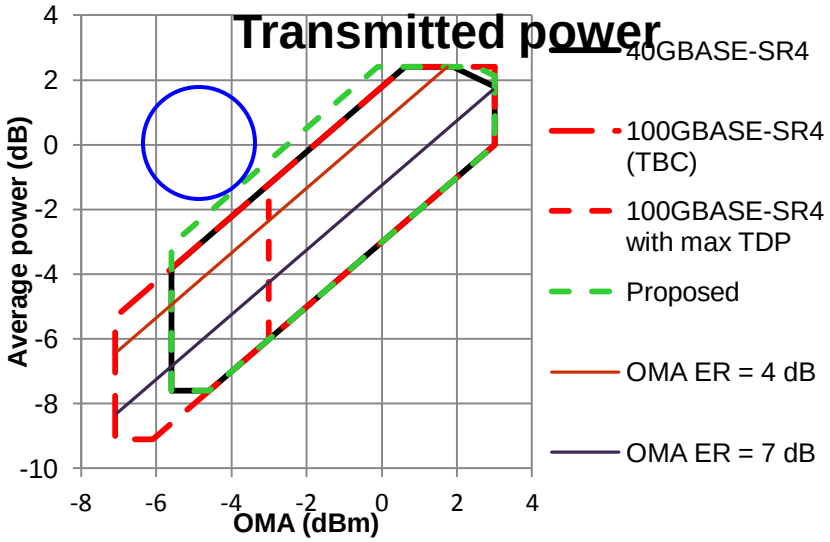
Revisiting minimum extinction ratio

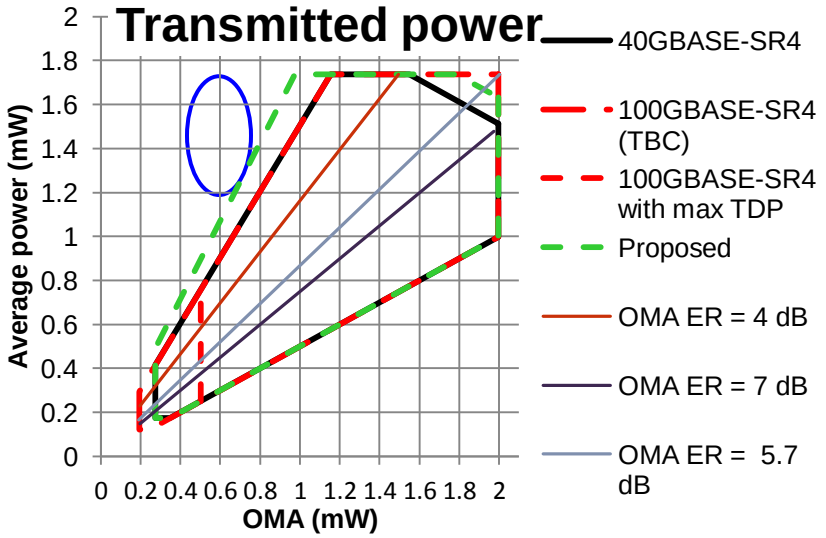




- For a relatively slow transmitter, "SONET extinction ratio" (as in 10G/40G/100G Ethernet as well as SONET and SDH) is lower than "OMA extinction ratio"
- Current draft spec is 3 dB minimum. Comment 66 and 70 criticise this
- Circled regions would have a very high ratio of average power to OMA (DC photocurrent to modulated photocurrent) which would put an unnecessary burden on the receiver's DC cancellation feedback loop (or equivalent)
- However, it may be advisable to relax the spec moderately, to 2.5 dB
- Note: in the plot on the right, straight lines are drawn between calculated vertices. If the intermediate points were calculated, the lines would be slightly curved

Revisiting peak power limit



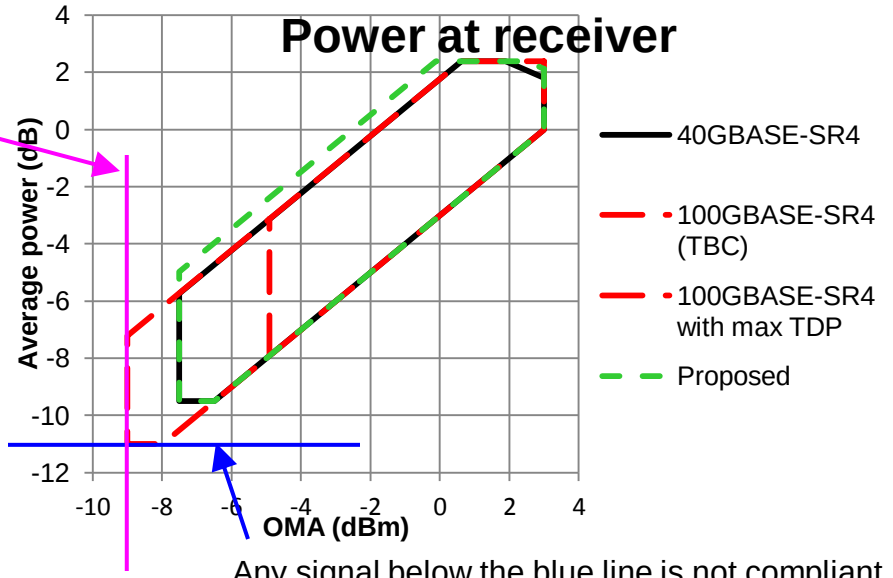


- 40GBASE-SR4 has a peak power limit of 4 dBm or 2.5 mW to protect the receiver from excessive photocurrent
- Without this, the peak power could be 4.37 dBm plus 0.8? dB or 20%? higher because of overshoot, giving about 4.8 dBm or 3 mW
- A transmitter would have to have high overshoot AND a particular extinction ratio to create this peak power
- A maximum peak power spec protects the receiver at little to no inconvenience to the transmitter
- The limit should be a little higher than 40GBASE-SR4's 4 dBm
- Comment 129 proposes 4.2 dB, as illustrated

Signal detect

Any signal to the left of the magenta line is not compliant. Signal detect should be allowed to flag it (SIGNAL_DETECT = FAIL)

- Signal detect must detect a compliant signal: one that is to the right of the magenta line, above the blue line, and 100GBASE-SR compliant (pattern).
  - It doesn't have to check all these things
- Signal detect should be allowed to flag any non-compliant signal as non-compliant
  - It doesn't have to do so, unless the average optical power at the receiver (TP3) is -30 dBm or less
- Comment 140:
- Change
  - [(Optical power at TP3 >= average receive power, each lane (min) in Table 95-7)
  - AND
  - (compliant 100GBASE-R signal input)]
- to
  - Compliant 100GBASE-R signal input at TP3 with OMA >= -9 dBm and average optical
  - power >= average receive power, each lane (min) in Table 95-7
    - (-9 would become -8.5 if another comment is accepted).



Any signal below the blue line is not compliant. Signal detect should be allowed to flag it (SIGNAL_DETECT = FAIL)

Thank You