



TDECQ results is function of the 4th-order B-T filter roll-off stop frequency. We are roposing to mandate the minimum roll-off stop frequency.

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Supporters

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Introduction...

- The measurement + calculation of TDECQ require a waveform acquisition by an oscilloscope system with a 4th order Bessel-Thomson roll off
- We show that the TDECQ result is a function of the 4th order Bessel-Thomson filter's roll-off end-of-compliance (stop) frequency
- We propose that in order to limit the variability of the TDECQ result between different measurement tools, the Bessel-Thomson roll-off should be mandated up to at least a certain frequency
- Ditto for SECQ

Specifically: (next page)

... introduction

- The calculation of TDECQ requires that:
 1. “The combination of the O/E and the oscilloscope used to measure the optical waveform has a fourth-order Bessel-Thomson filter response with a bandwidth of 11.2 GHz”
[138.8.5 Transmitter and dispersion eye closure - quaternary (TDECQ), line 43, 8023cd_D3p0]
 2. “The combination of the O/E and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 13.28125 GHz.”
[139.7.5.1 TDECQ conformance test setup, line 40, 8023cd_D3p0]
 3. “The combination of the O/E converter and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 26.5625 GHz”
[140.7.5 Transmitter and dispersion eye closure for PAM4 (TDECQ), line 30, 8023cd_D3p0]
- And the calculation of SECQ requires that:
 1. “...and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 13.28125 GHz”
[138.8.8 Stressed receiver sensitivity, line 26, 8023cd_D3p0]

The question

- How far (to how high a frequency) does the Bessel-Thomson filter need to comply ?
- We swept the B-T end-of-compliance:

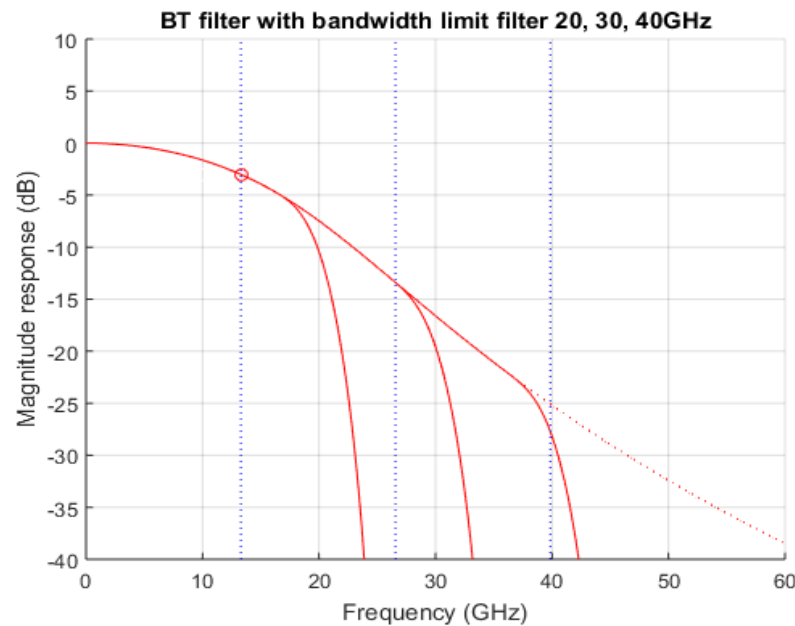


Figure 5 A 4th order Bessel-Thomson filters bandwidth of 13.28 GHz with different end frequencies



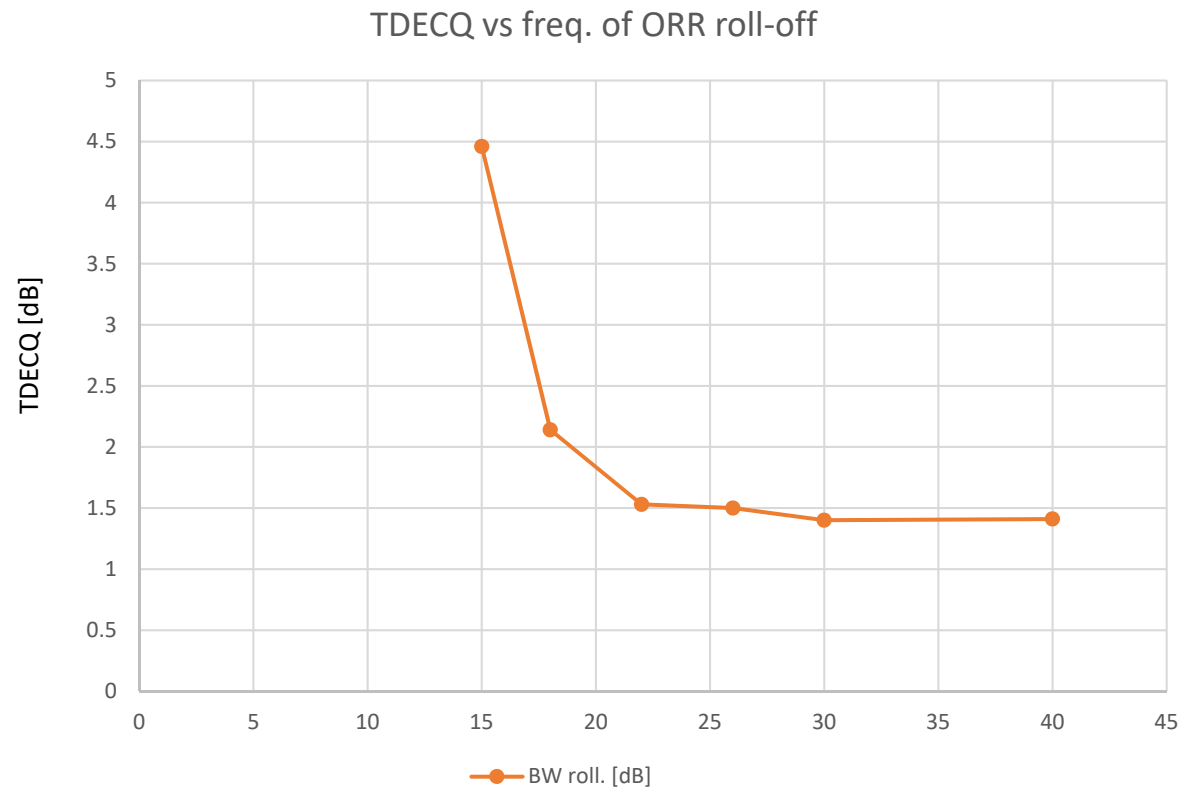
Experiment: setup

Setup

- PAM4 optical transmitter as signal source
- Signal bandwidth_el > 30GHz
- TDECQ is using 802.3bs defined FFE (5 taps optimized for best TDECQ value with floating timing, fixed thresholds)
- No fiber, no reflective mirror
- Oscilloscope controllable bandwidth swept from 15 GHz to 45 GHz (BW_el)

Experiment: results

results.





Proposal

- From our experiments (see the graph on previous page) it is obvious that severe BW limiting of the B-T compliance yields large penalty in TDECQ result
- It is also apparent that after $BW_{el} > f_{Bd}$ there is almost no dependency of TDECQ on the end-off-roll-off of the Bessel-Thompson filter
- Based on the following we propose that the B-T should be guaranteed to $BW_{el} = f_{Bd}$
- This matches the requirement on B-T compliance in ITU for 10 Gb/s and faster



Conclusion

- We've analyzed a known concern with the TDECQ result.
- We identified the difference between the minima and the sensitivity of the TDECQ results as at least part of the problem.
- We suggest an improved solution search strategy that can be adopted by 802.3bs .

Thank you

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