Tx Jitter specs for Clause 92 and by reference Clause 93

In support of comment 165, and relevant to comments 223, 227, and 231

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Issues:

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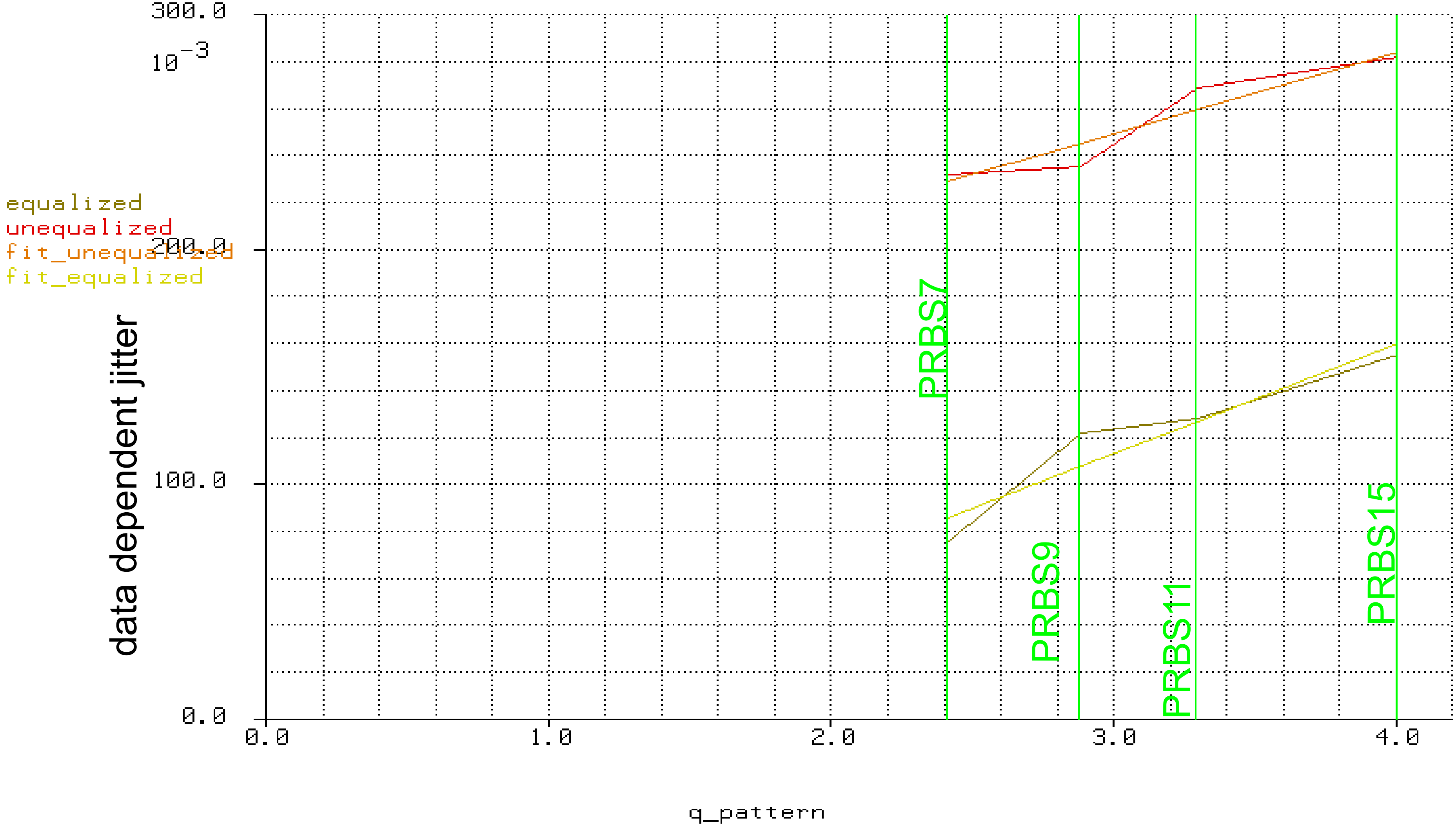
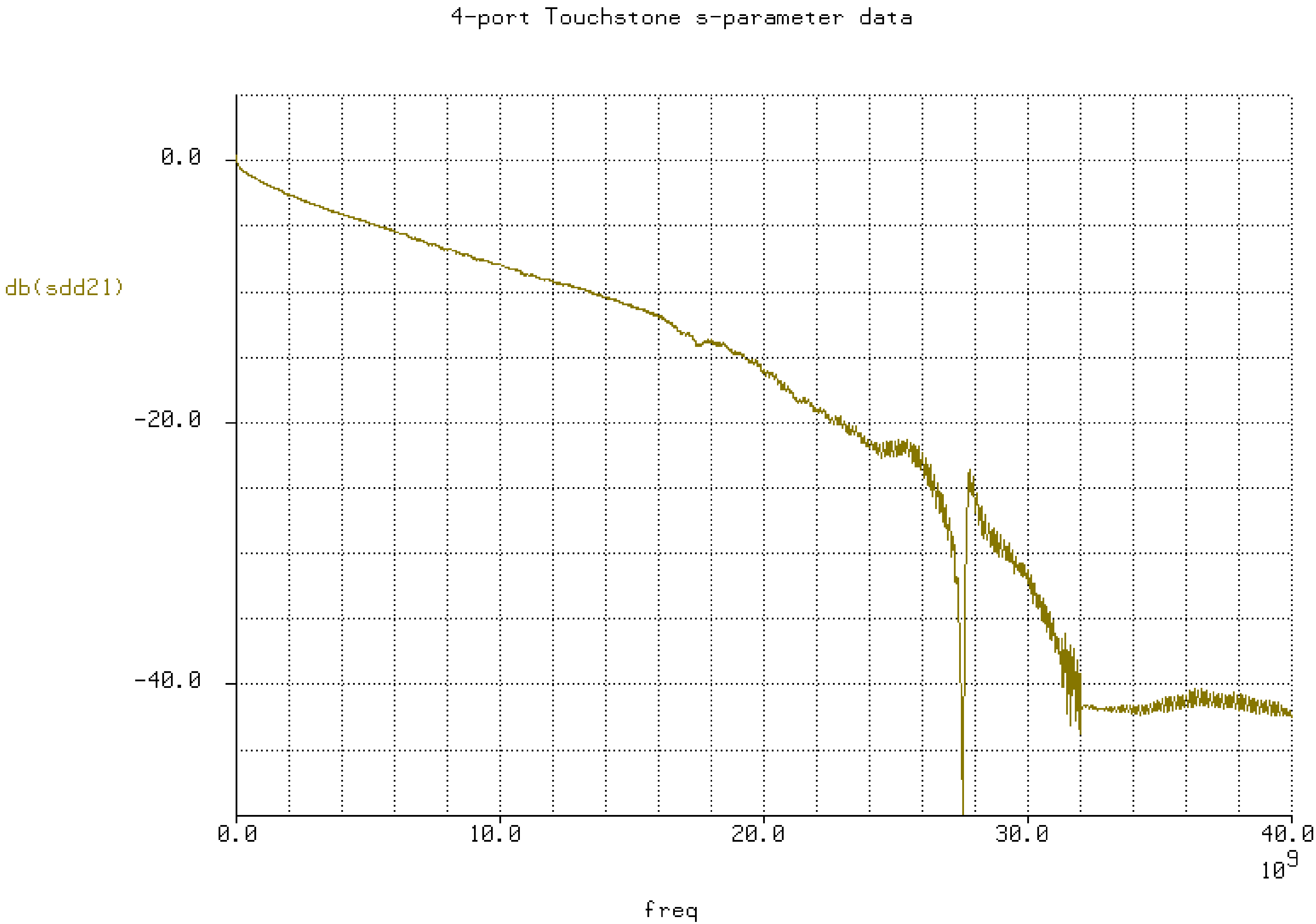
The spec treats data dependent jitter to be a constant, independent of data pattern as the plot in the next slide shows, this is not true

Measured data dependent jitter for PRBS7, PRBS9, PRBS11, and PRBS15 from clean instrument with 3 tap equalizer, plotted on a Q scale along with linear fits.



Channel for which data dependent jitter was measured



Issues:

1. It is really difficult to actually measure jitter to BER of 10^{-9} let alone 10^{-12}. Usually values in this range are estimated by extrapolation. There is a strong implication that J9 is measured and no statement that TJ at BER=10^{-12} can be estimated.
2. The transmitter will always be used in a system with FEC which can convert BER=10^{-5} to BER=10^{-18}. No need for TJ spec beyond 10^{-5} or anything beyond J6 for interpolation.

Issues:

As currently written there is no clear progression from measurement to measurement prerequisites sometime before and sometimes after measurements.

Proposed text:

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Proposed wording for clause 92.8.3.7 Transmitter output jitter

Five components of the transmitter output jitter are defined in this subclause: Even-Odd Jitter, Total Jitter (TJ), Data Dependent Jitter, Deterministice Jitter (DJ), and effective Random Jitter (RJ).

Jitter is defined after a clock recovery unit (CRU) with a high-frequency corner bandwidth of 10 MHz and a slope of -20 dB/decade. The CRU tracks acceptable levels of low-frequency jitter and wander.

The test pattern for TJ and RJ measurements is either PRBS31 (see 83.5.10) or scrambled idle (see 82.2.10). The voltage threshold for the measurement of BER or crossing times is the mid-point (0 V) of the AC-coupled differential signal.

All measurements are made with transmitter equalizer configured for minimum data dependent jitter.

92.8.3.7.1 Data dependent jitter

Data dependent jitter (DDJ) is defined in 85.8.3.8 . The measurement filter and bandwidth defined in 92.8.3 is used in place of the bandwidth defined in 85.8.3.8 .

Proposed text (continued):

92.8.3.7.2 Effective deterministic and random jitter

The effective random jitter (RJ_{rms}) of a signal and effective DJ is derived from the measured jitter distribution as follows.

a)Measure the jitter Jn which is defined to be the interval that includes all but 10^{-n} of the jitter distribution. If measured by plotting BER vs. decision time, it is the time interval between the two points with a BER of $10^{-n}/4$. Measure two values: J6 and J2.
b)For each Jn determine the associated Qn from the inverse normal cumulative probability distribution adjusted for an assumed transition density of 0.5. Q6 is 4.753 and Q2 is 2.326.
c)Calculate effective DJ as (Q6×J2–Q2×J6)/(Q6–Q2).
d)Calculate extrapolated random jitter (ERJ) as 0.5*(J6-J2)/(Q6-Q2)
e)Calculate RJ_{rms} as $\sqrt{ERJ^2 - 0.03004 \cdot DDJ^2}$ if $ERJ^2 > 0.03004 \cdot DDJ^2$ *otherwise* 0

Effective DJ shall be less than or equal to 0.15 UI. RJ_{rms} shall be less than or equal to 0.011 UI.

Note: $0.03004 = (0.5/Q(\frac{1}{511}))$ it coverts DDJ to estimated RMS value of RJ like component of DDJ.

Proposed text (continued):

92.8.3.7.3 Total Jitter TJ

Total jitter is computed from DJ and RJ_{rms} as follows:

$$TJ = DJ + RJ_{RMS} \cdot 8.530$$

Total jitter shall be less than or equal to 0.22 UI.

Proposed text (continued):

Modify Table 92.6 and Table 93.4 to comply with new specified values.