Test pattern characteristics

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Introduction

It has been proposed to add Pattern 1 and Pattern 2 defined in Table 52-20 to the list of test patterns available in 40 and 100 GbE. (See comments 562, 563). The current list of test patterns is:

- Scrambled idle
- PRBS31 per lane
- TBD Short pattern (expected to be PRBS9)
- Square wave - 8 ones followed by 8 zeros per lane

This contribution analyses the characteristics of Pattern 1 and Pattern 2 for baseline wander and variation in clock content and compares them to PRBS31 and scrambled idle.

Baseline wander

In order to be able to compare the effect of various encoding proposals on the low frequency and clock content characteristics of the signals, it is useful to define a low frequency content metric (Baseline Wander) and also a clock content metric (Clock Content).

Since it is highly likely that these signals will be AC coupled at some point, the baseline wander has been analysed by calculating the amount of offset due to AC coupling.

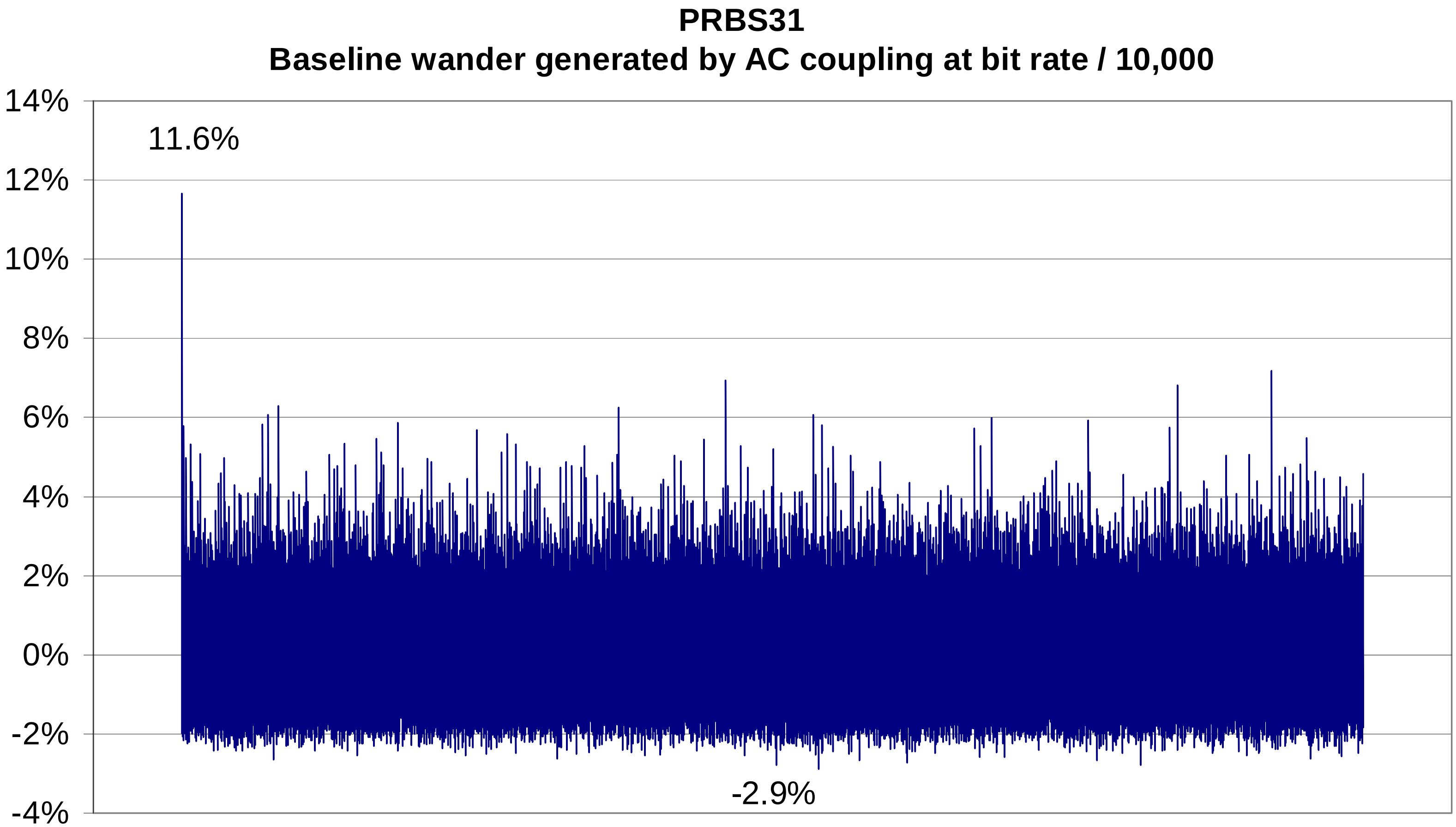
In order to make use of recent analysis done within OIF this is the same metric as was used in the OIF white paper:

http://www.oiforum.com/public/documents/OIF_WP_CEI_Short_Stress_Patterns.pdf

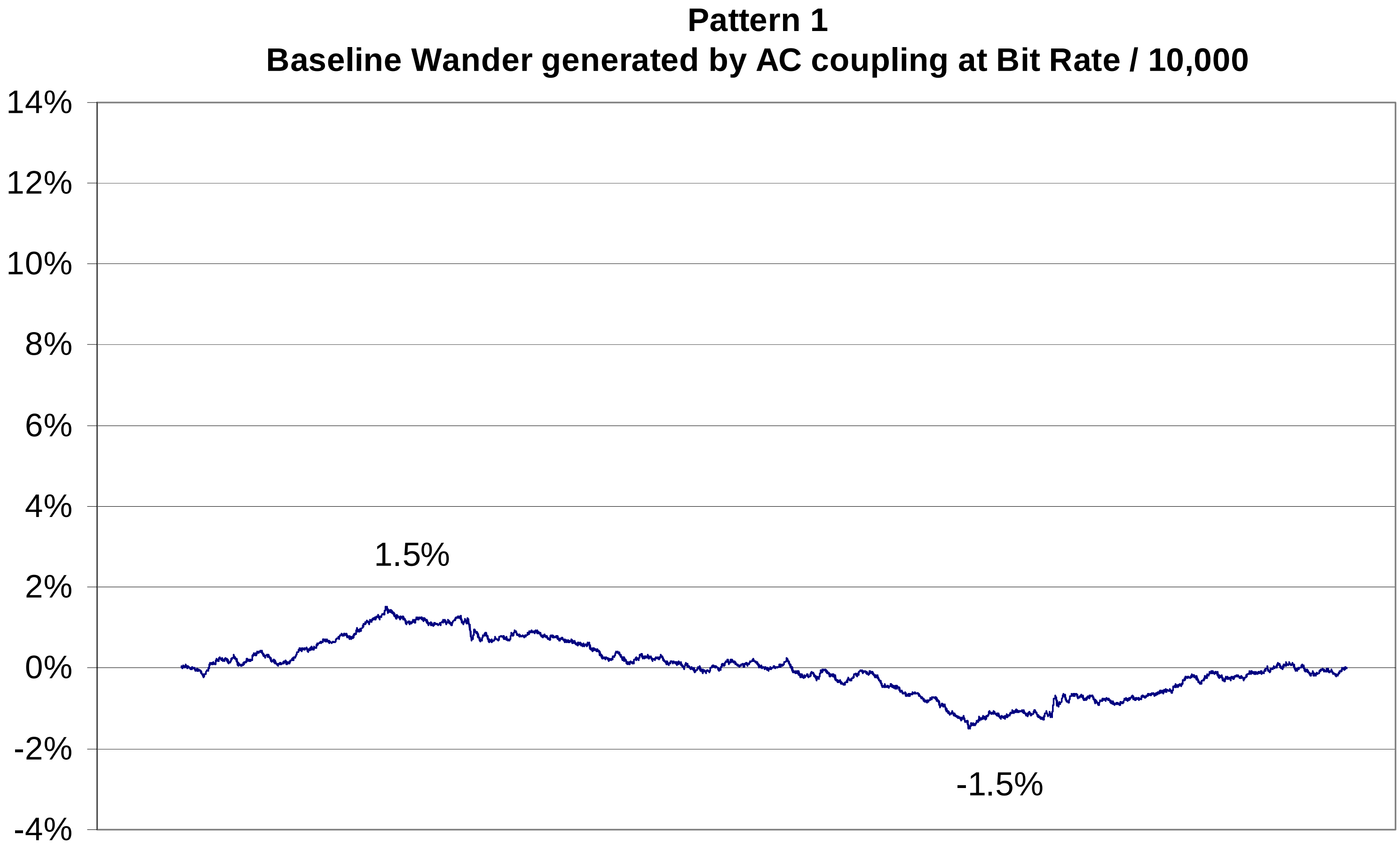
This is defined as:

Baseline Wander is the instantaneous offset (in %) in the signal generated by AC coupling at the bit rate / 10,000.

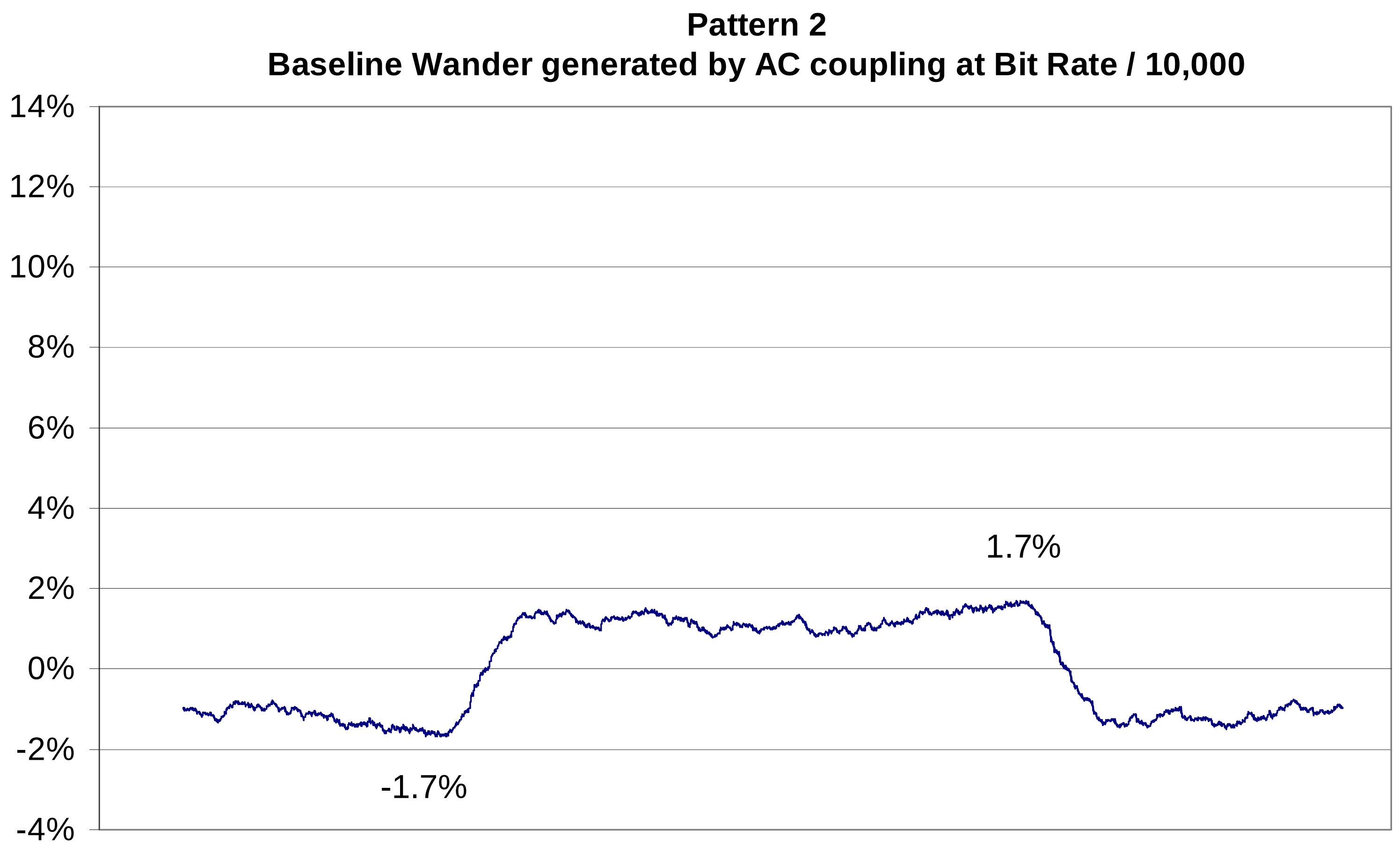
Baseline Wander of entire PRBS31 pattern



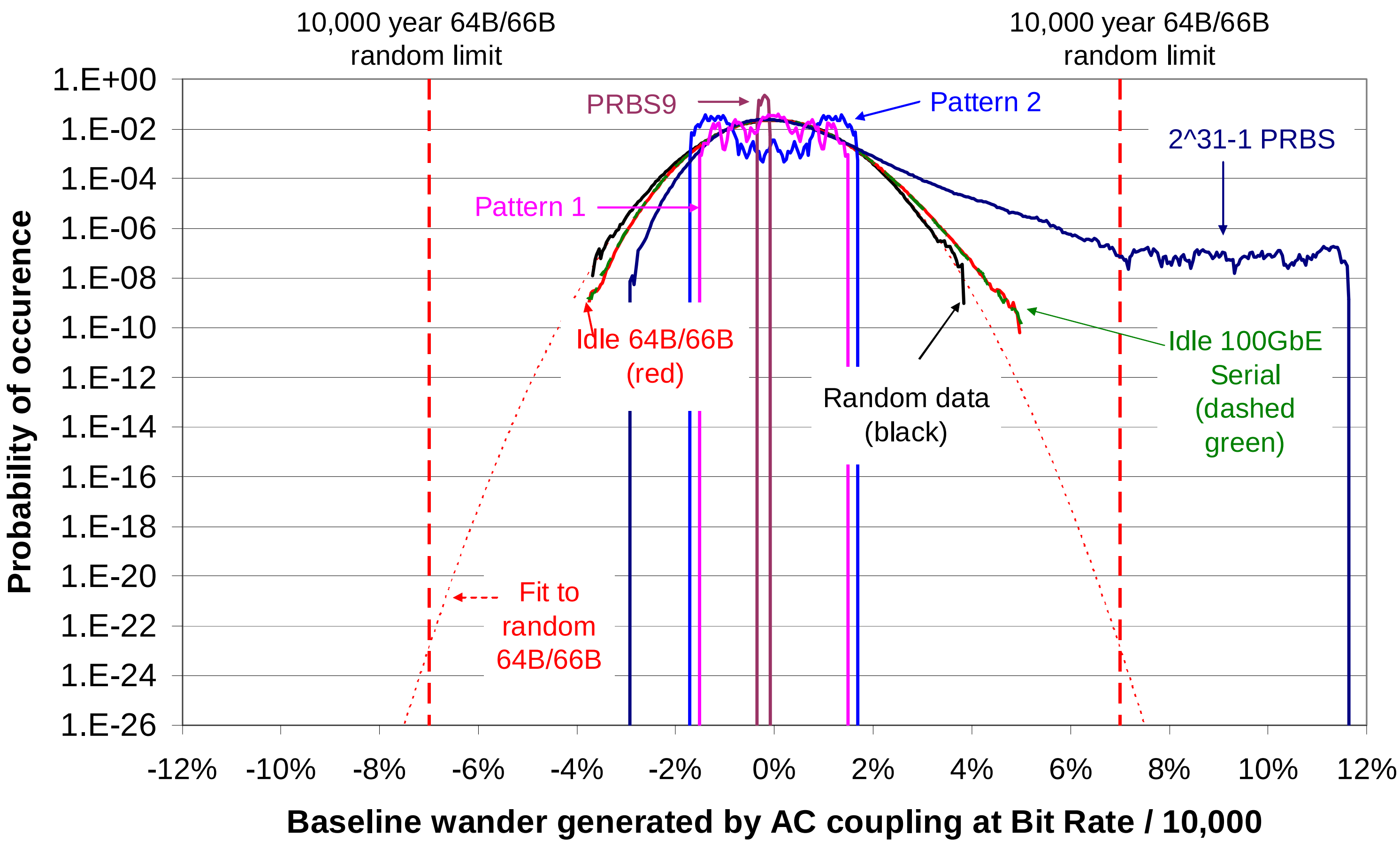
Baseline Wander of Pattern 1



Baseline Wander of Pattern 2



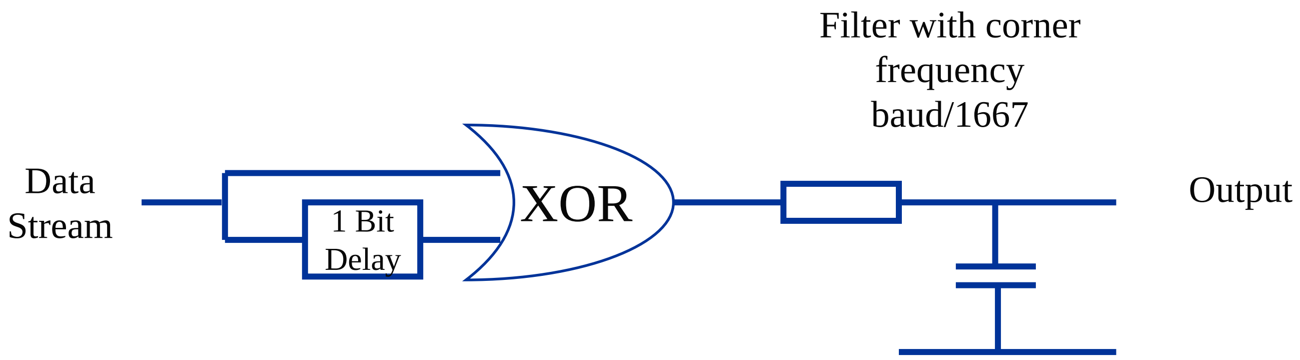
Baseline wander PDFs



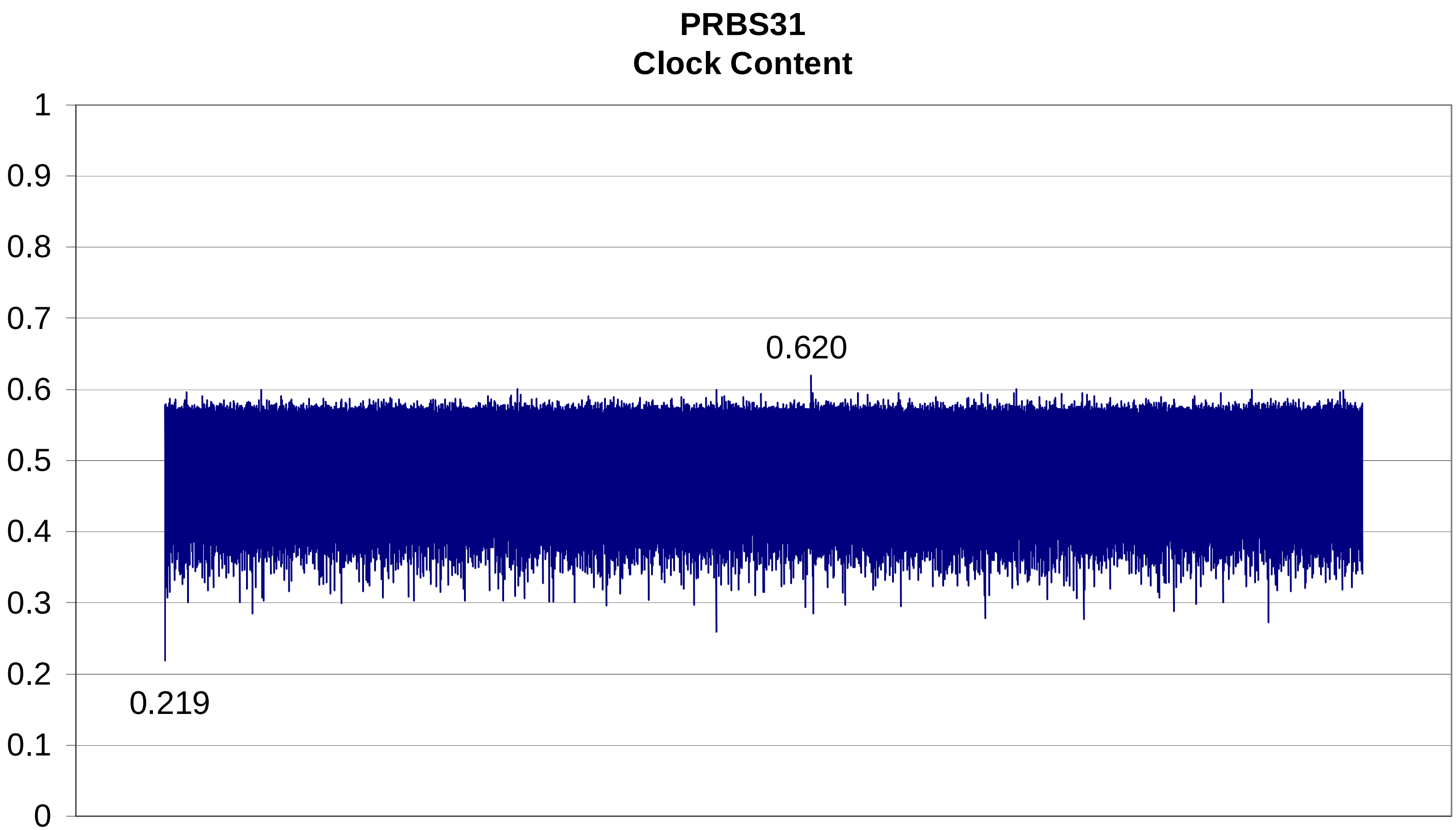
Clock content

Since many of the links that 40 and 100 GbE traverse require the clock to be extracted from the lane data at the receiver, a second metric to assess the time variation of the clock content is required. The function used in the OIF white paper (called “clock wander” there and re-named to “clock content” in this contribution) is:

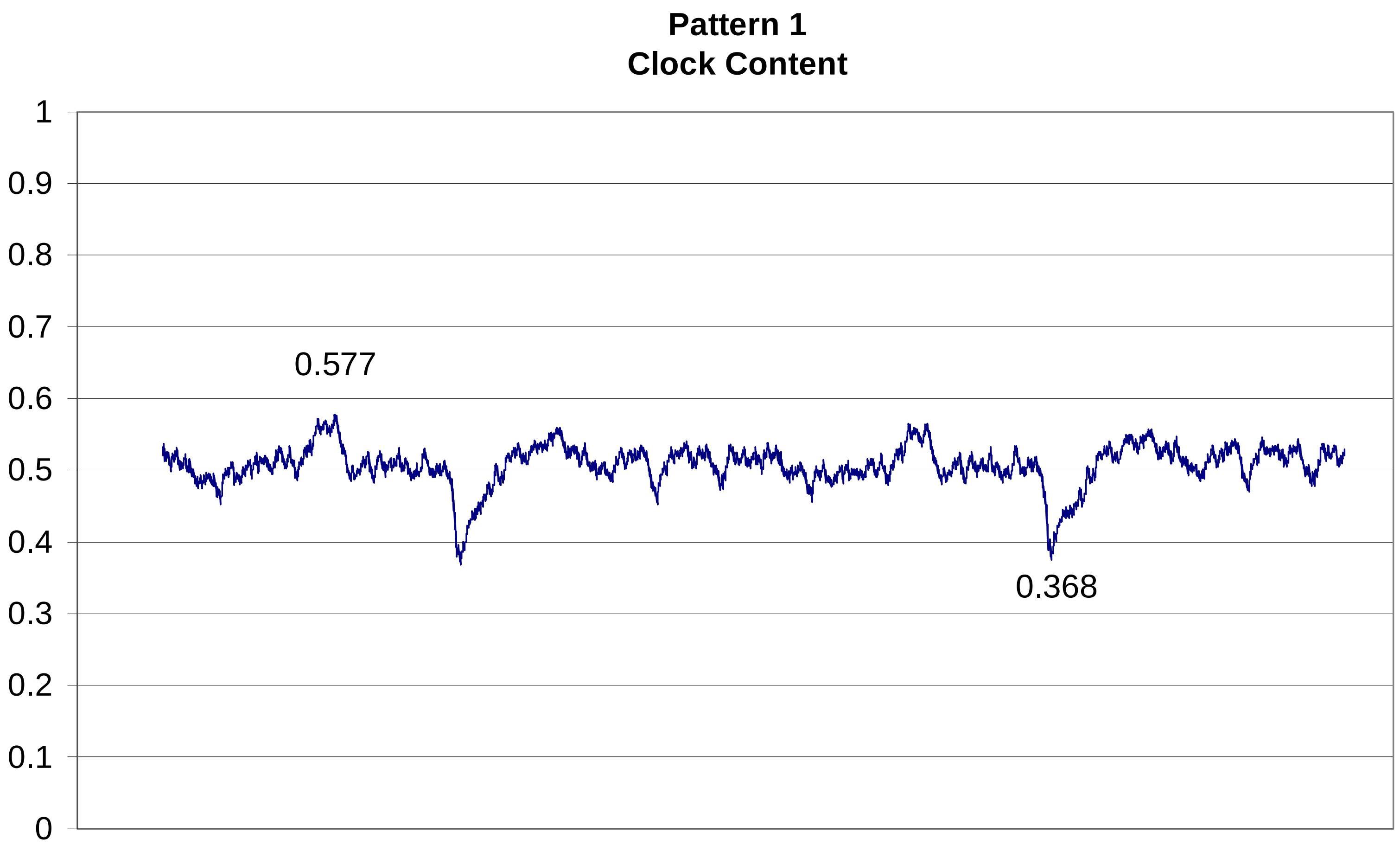
Create a function which is a 1 for a transition and a 0 for no transition and then filter the resulting sequence with a corner frequency of baud/1667 (6 MHz for 10.3125 GBd)



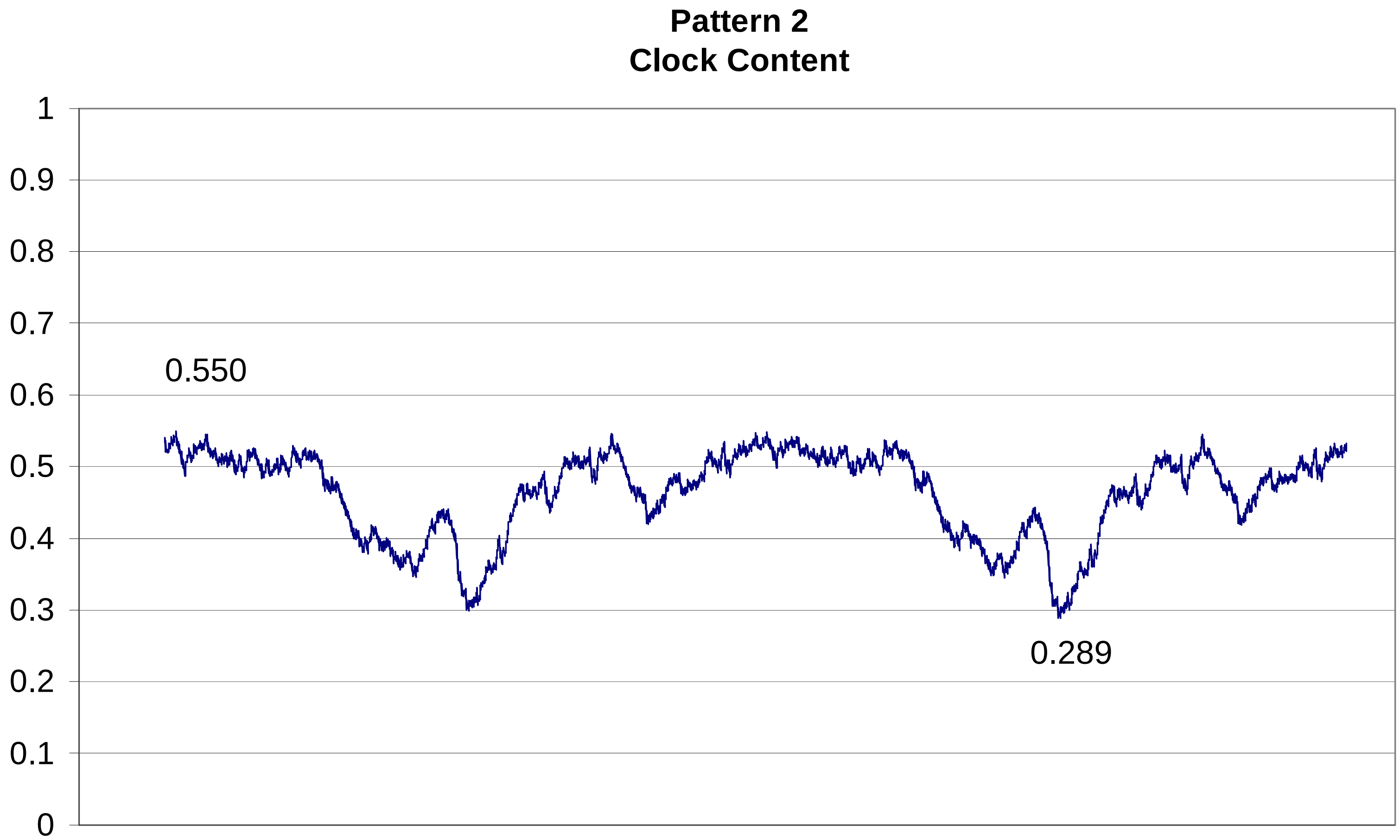
Clock content of entire PRBS31 pattern



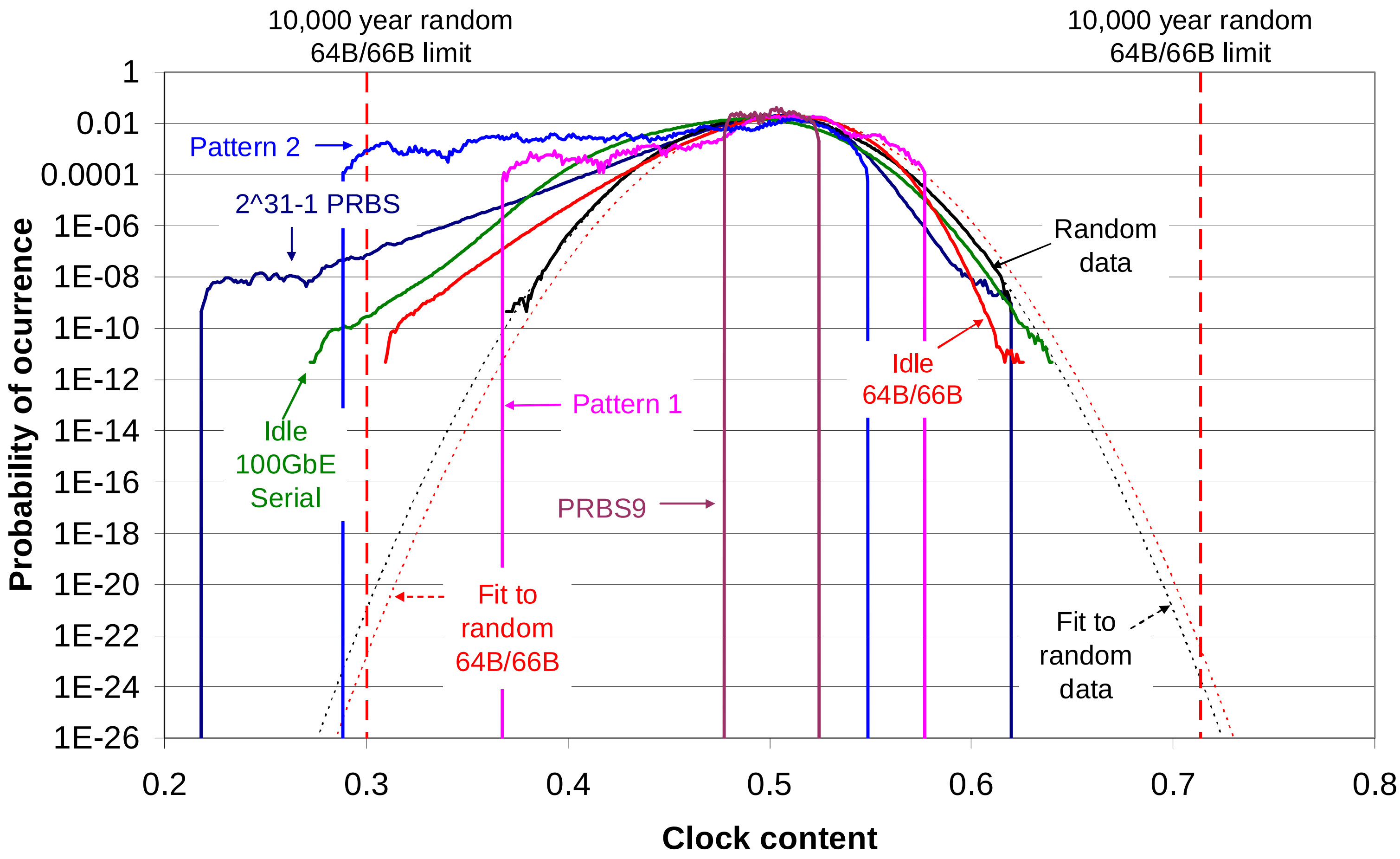
Clock content of Pattern 1



Clock content of Pattern 2



Clock content PDFs



Conclusions

Pattern 2 has slightly more Baseline Wander (BW) than Pattern 1.

However, even the BW of Pattern 2 is approximately a factor of 2 less stressful than the 2 seconds of scrambled idle shown on the PDF chart and factor of 6 less stressful than PRBS31.

The Clock Content (CC) of Pattern 2 is significantly more stressful than Pattern 1 (0.289 Vs. 0.386), although the two seconds of scrambled idle is slightly more stressful again. PRBS31 (with a minimum CC of 0.219) is the most stressful pattern and the only one to exceed the two seconds of scrambled idle.

For BW neither Pattern 1 or Pattern 2 are stressful enough to ensure that real data or idle will work satisfactorily.

For CC Pattern 1 is not stressful enough. Scrambled idle is a better pattern to use than Pattern 2 because while they are similar on the low clock side, Pattern 2 does not contain realistic high clock portions.

PRBS31 is the only pattern providing overstress on the low clock side compared to scrambled idle.

Thanks!

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With thanks to John Ewen for providing the Pattern 1 and Pattern 2 bit sequences