of merit for the assessment of performance [8]. To compare the different equalizer realizations, a Q-factor gain was calculated from BER.

5 Experimental Results

The performance of flexible non-integer FSE for various SPS without TR was compared with SSE at its optimum sampling instance for optical transmission systems reaching up to 5500 km with 5% residual dispersion at the optimal launch power of -2 dBm into each fiber segment. In order to have a fair comparison, the anti-aliasing filter bandwidth and the number of averaging filter taps for carrier phase recovery (CPR) were optimized for each OSNR. Using FSE, the generated 10 GBaud QPSK signal was successfully transmitted over 3666 km, exceeding the hard decision (HD) FEC limit of $3.8 \cdot 10^{-3}$, as shown in **Figure 4**. The number of equalizer coefficients, ranging from three to 15, was optimized for all measurements respectively. For example, when transmitting over 3666 km the optimization yields 11 coefficients for 1.5 SPS, seven for 2 SPS and five for 1 SPS. The Q-factor performance was estimated from the BER for each measurement. The Q-factor gain of all FSE compared to SSE at the optimum sampling point with a DSP realization working at 1 SPS is depicted in **Figure 5**.

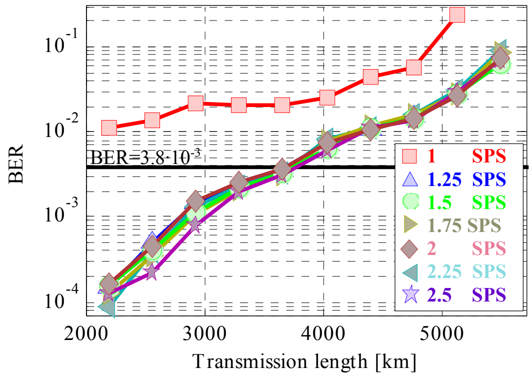

Figure 4 Measured BER vs. transmission length from 2000 up to 6000 km for various SPS. The HD FEC limit of 3.8·10-3 is marked as a reference.

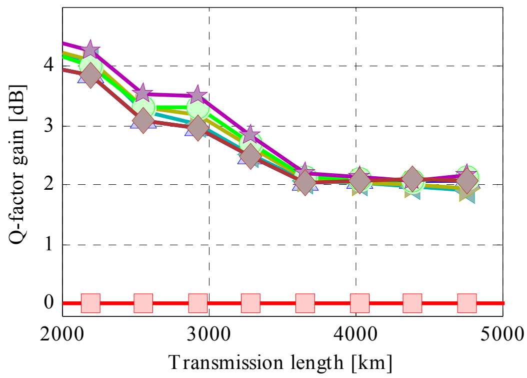

Figure 5 FSE gain in comparison to SSE with TR. For legend see Figure 4.

In all realizations, the EDC and the butterfly equalizer operate at f_{ADC}, using a sufficient number of equalizer coefficients for CD and PMD compensation. All FSE realizations show significantly better performance than the SSE (entirely working at 1 SPS). A FSE operating with more than 1 SPS shows a Q-factor gain of 2 dB after 5132 km and up to 4 dB after 2199 km of transmission, even if the ADC sampling rate is limited below $2 \cdot f_S$ up to a minimum of 1.25 SPS.

6 Conclusion

We experimentally demonstrated the ability of a flexible DSP including EDC and non-integer FSE to compensate for linear impairments in optical transmission systems, and successfully transmitted 10 GBaud QPSK signal over up to 3666 km SSMF. The non-integer FSE was shown to have similar performance with enhanced flexibility in the receiver DSP, with the capability of relaxing the required ADC sampling rates, compared with integer FSE. The non-integer FSE, even with less than two SPS, showed similar performance compared with an FSE realization with two SPS or more, as was expected from theory.

7 Acknowledgements

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8 Literature

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