

Transmit Jitter Requirements for 5G and 2.5GBASE-T

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Transmit Timing Jitter

- The timing jitter of a PHY transmitter has to meet certain limits so that it does not affect the performance of a remote receiver
- Test modes 2 and 3 in clause 126.5.3.3 are to ensure that the transmit jitter is within those limits in both Master and Slave modes
- The current limit in the 802.3bz draft is based on 10GBASE-T requirement
 - Because of differences in bandwidth and insertion loss, there is possibility of relaxing the jitter limit for 5G and 2.5G

Jitter and Sampling Error

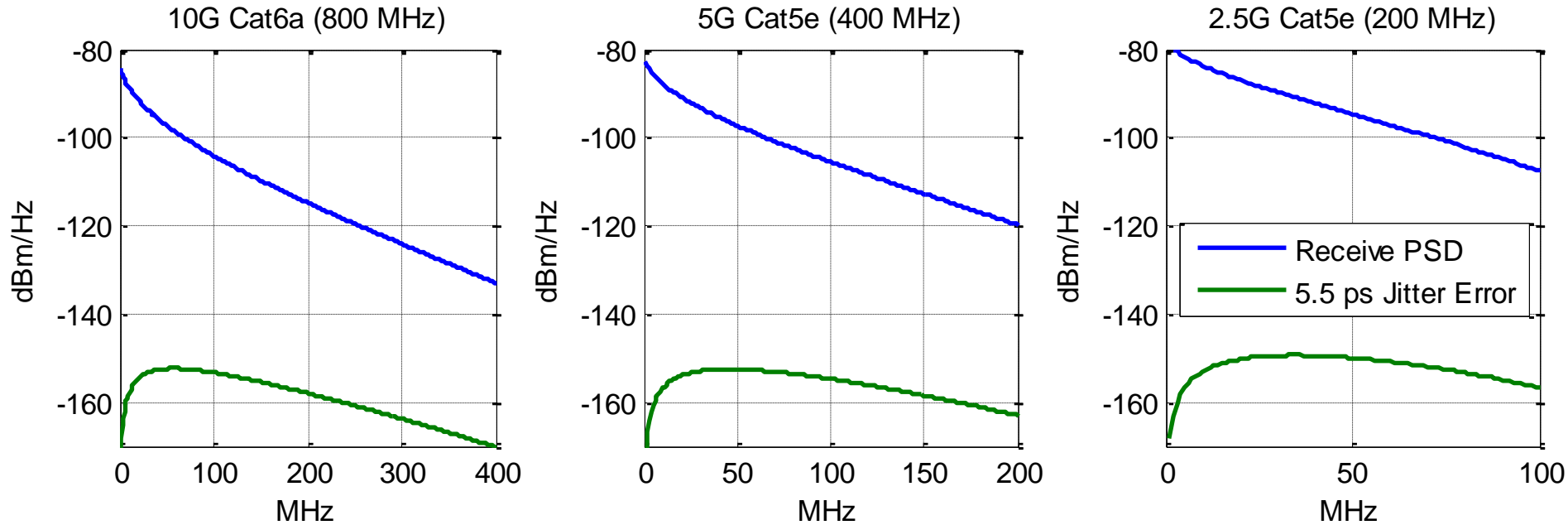
- Timing jitter of a remote transmitter causes sampling phase error at the local receiver which contributes to overall receiver noise
- There may be some other reasons to limit the timing jitter but only the factors that affect interoperability are considered in IEEE specifications
- The noise due to phase error
 - Is higher when the timing jitter is bigger
 - Grows linearly in frequency
 - Is higher when the signaling bandwidth is wider

Jitter and SNR

- The error due to sampling phase error adds to other receiver noise sources and limits the input SNR
- Set the limits of the jitter such that the SNR due to jitter remains at the same level of 10G
- The power of error due to jitter is proportional to signal power at the receiver and also to the second power of frequency

$$J(f) \propto PSD_{rx}(f) \times f^2$$

Signal and Jitter Error Power



Rate	Bandwidth	Cable Type	Cable Length	SNR for Jitter = 5.5 ps	Tolerated Jitter for SNR=57.5 dB
10G	400 MHz	Cat6a	100 m	57.5 dB	5.5 ps
5G	200 MHz	Cat5e	100 m	59.9 dB	7.2 ps
2.5G	100 MHz	Cat5e	100 m	62.7 dB	10.0 ps

Proposed Changes for Jitter Limits

126.5.3.3 Transmitter timing jitter

When in test mode 2, the PHY transmits {two +16 symbols followed by two -16 symbols} continually with the THP turned off and with no power backoff. In this mode, the transmitter output should be a $S \times 100$ MHz signal and the RMS period jitter measured at the PHY MDI output shall be less than ~~5.5~~ **7.2 ps for 5G and 10.0 ps for 2.5G**. The RMS period jitter is measured as per the test configuration shown in Figure 126-34 over an integration time interval of $2/S$ ms $\pm 10\%$.

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