

100GBASE-DMT Draft Update

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Introduction

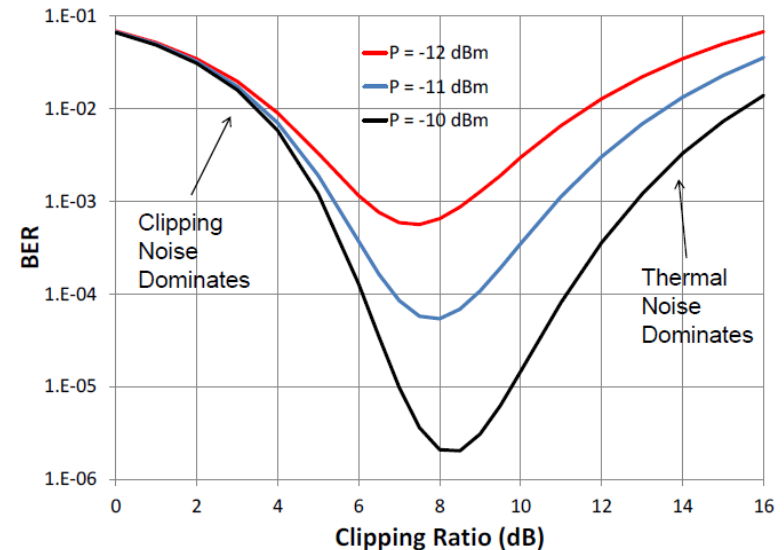
- Explanation of the updated key parameter in DMT draft
 - Specification of "crest factor" in the table of transmit characteristics
- Simulation for the impact of "Clipping level" related to "crest factor" in the case of our parameters, receiver input power, bandwidth, bit and power allocation

(Ref.: I. Lyubomirsky, IEEE802.3 Interim January,2013, lyubomirsky_01_0113_optx)

Monte-Carlo Simulation Parameters

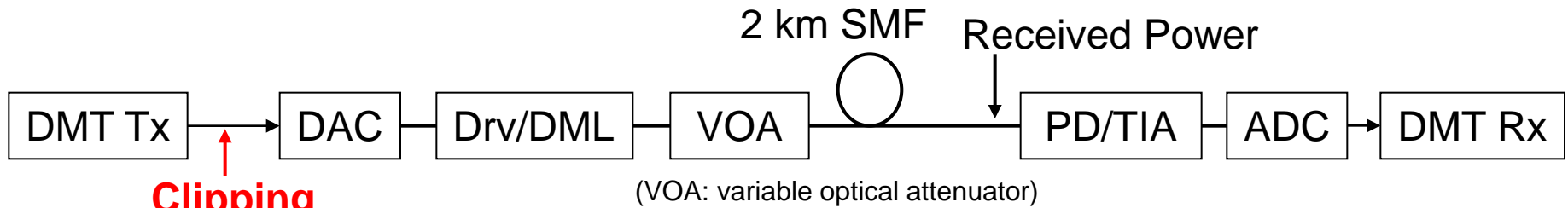
Parameter	Value
Sampling rate, F_s	60 Gs/s
FFT size, N	128
Number of nonzero subcarriers, N_{sc}	55
High freq. subcarriers padded to zero	8
DC subcarriers padded to zero	1
Cyclic prefix, CP	4
Clipping ratio, R_{cl}	8 dB
QAM modulation order, M	16
Noise bandwidth, Δf	25.8 GHz
Thermal noise density, S_{th}	16 pA/sqrt(Hz)
Photodiode responsivity, ρ	0.8 A/W

Optimization of Clipping Ratio

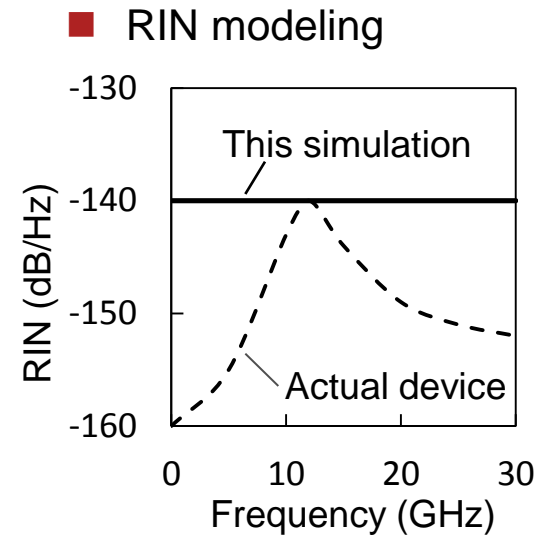


(*1) "Clipping Ratio" was defined as Clipping level.)

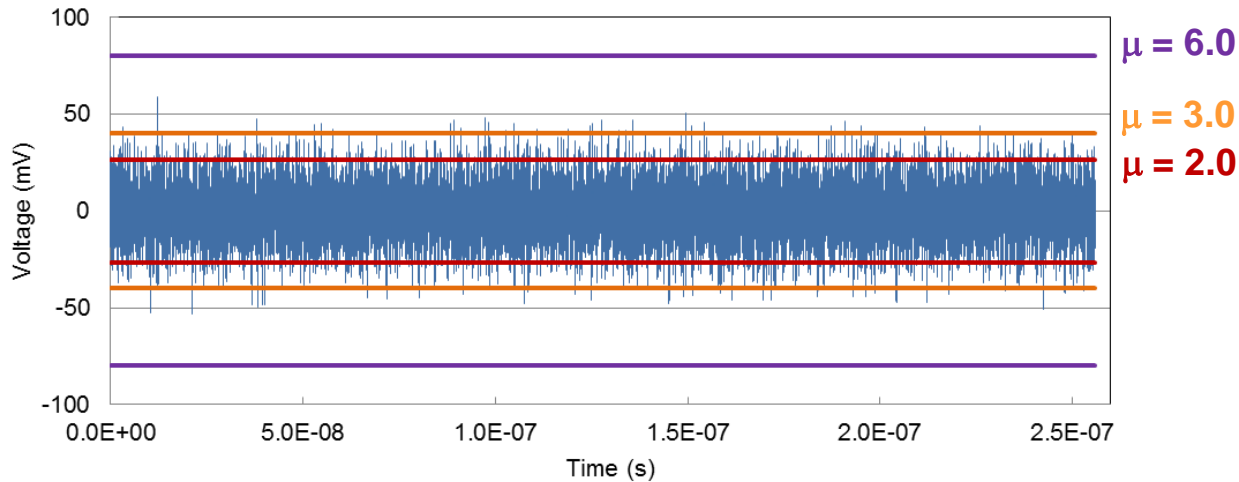
Simulation Model for Optical 100Gbps DMT



Parameter	Value	Note
DAC/ADC Sampling rate	64 GS/s	
DAC-bandwidth	15 GHz	4 th Bessel
ADC-bandwidth	18 GHz	4 th Bessel
Drv/10GDML-bandwidth	14 GHz	4 th Bessel
PD/TIA-bandwidth	18 GHz	4 th Bessel
Target capacity	116 Gbps	
DML-RIN	-140 dB/Hz	→
DML-linewidth	20 MHz	
DML-chirp	3.5	
PD responsivity	0.8 A/W	
PD/TIA-noise	15 pA/√Hz	
Subcarrier (SC) Number	256	Cyclic Prefix: 32



Clipping of DMT signal



$$X = -1 \cdot \mu \quad \text{if } x < -\mu, x < 0$$

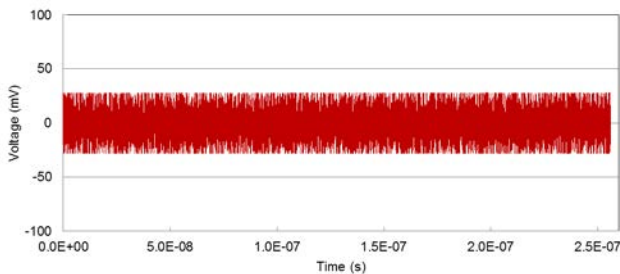
$$X = x \quad \text{if } |x| < \mu$$

$$X = \mu \quad \text{if } x > \mu, x > 0$$

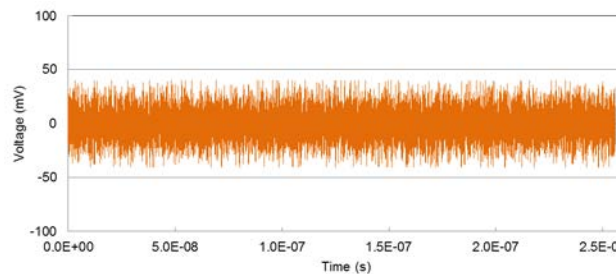
μ : Clipping level

Clipped DMT signal

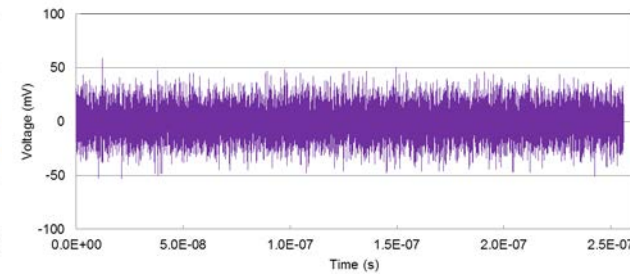
$$\text{Crest factor} = \frac{|x|_{peak}}{x_{rms}}$$



$\mu = 2.0$
Crest factor: 2.14

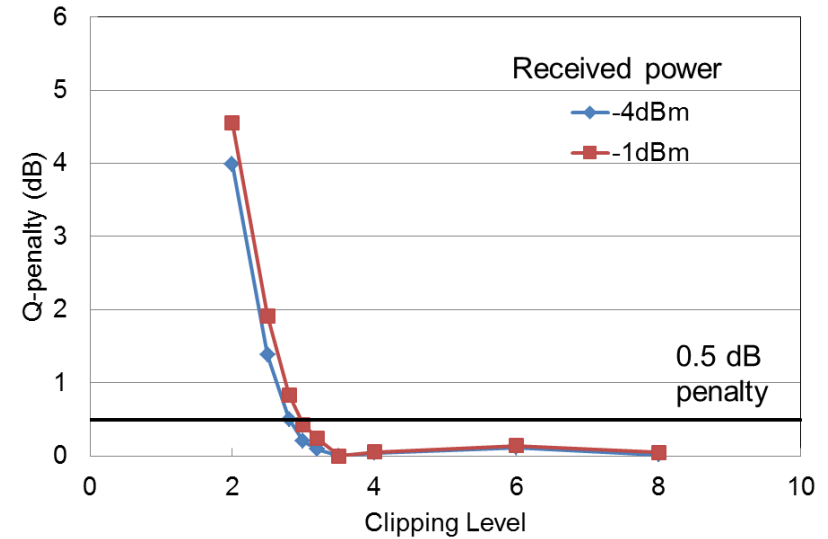
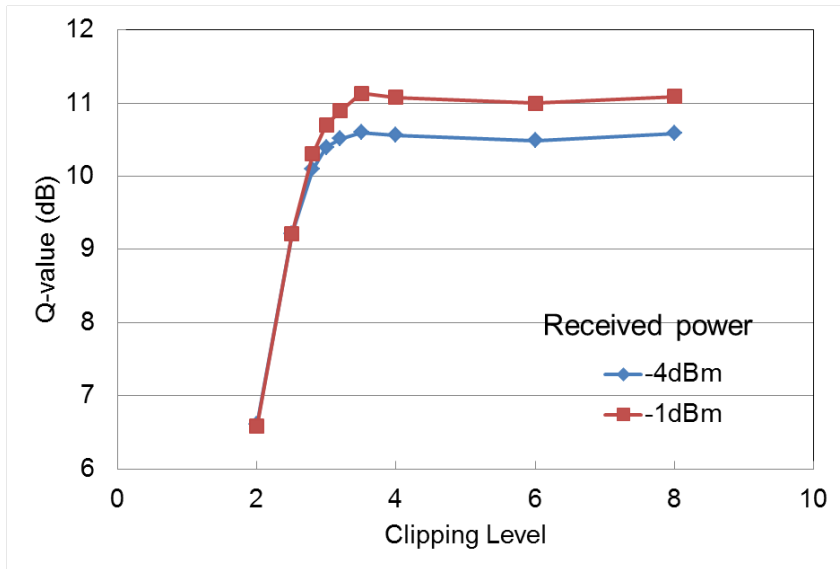


$\mu = 3.0$
Crest factor: 3.05



$\mu = 6.0$
Crest factor: 4.44

Impact of Clipping



- No degradation due to thermal noise as shown in “lyubomirsky_01_0113_optx” for minimum received power of -4dBm.
- Q penalty less than 0.5 dB is achieved by clipping level 3 or larger.

Summary

- Simulation of impact of clipping level on level diagram in optical 100Gbps DMT with 10G DML
- Q penalty less than 0.5 dB is achieved by clipping level of 3 or larger.

Thank you