

Optoelectronică, structuri și tehnologii

Curs 10
2012/2013

Orar

▶ Curs

- marti, 13-16, P7
- $2C \Rightarrow 3C$
 - $(14-4)*2/3 \approx 6.66$
 - $4+6.66=11-0.33$

Zgomotul traductorilor electro-optici

Capitolul 10



Zgomotul emitatorilor optici

▶ LED

- este considerat o sursa lipsita de zgomot
- nu contamineaza semnalul cu zgomot suplimentar

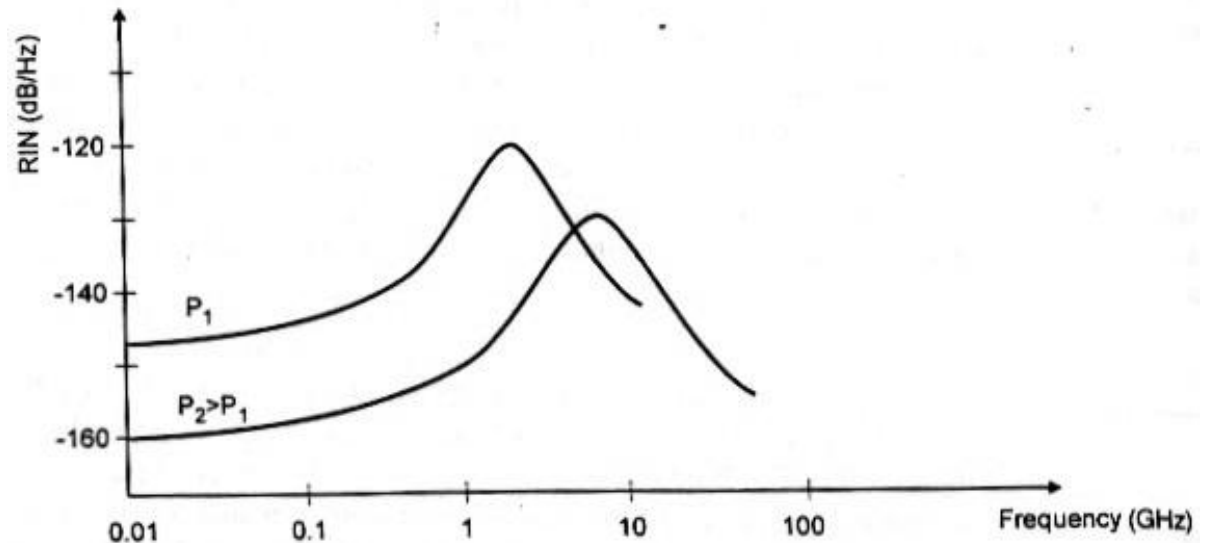
▶ Dioda LASER

- fluctuatii de faza, determina o largire a spectrului emis
- fluctuatii de intensitate, determina zgomotul de intensitate introdus de dioda
- RIN – Relative Intensity Noise

$$RIN[1/Hz] = \frac{\langle P_n^2 \rangle}{\langle P^2 \rangle \cdot BW}$$

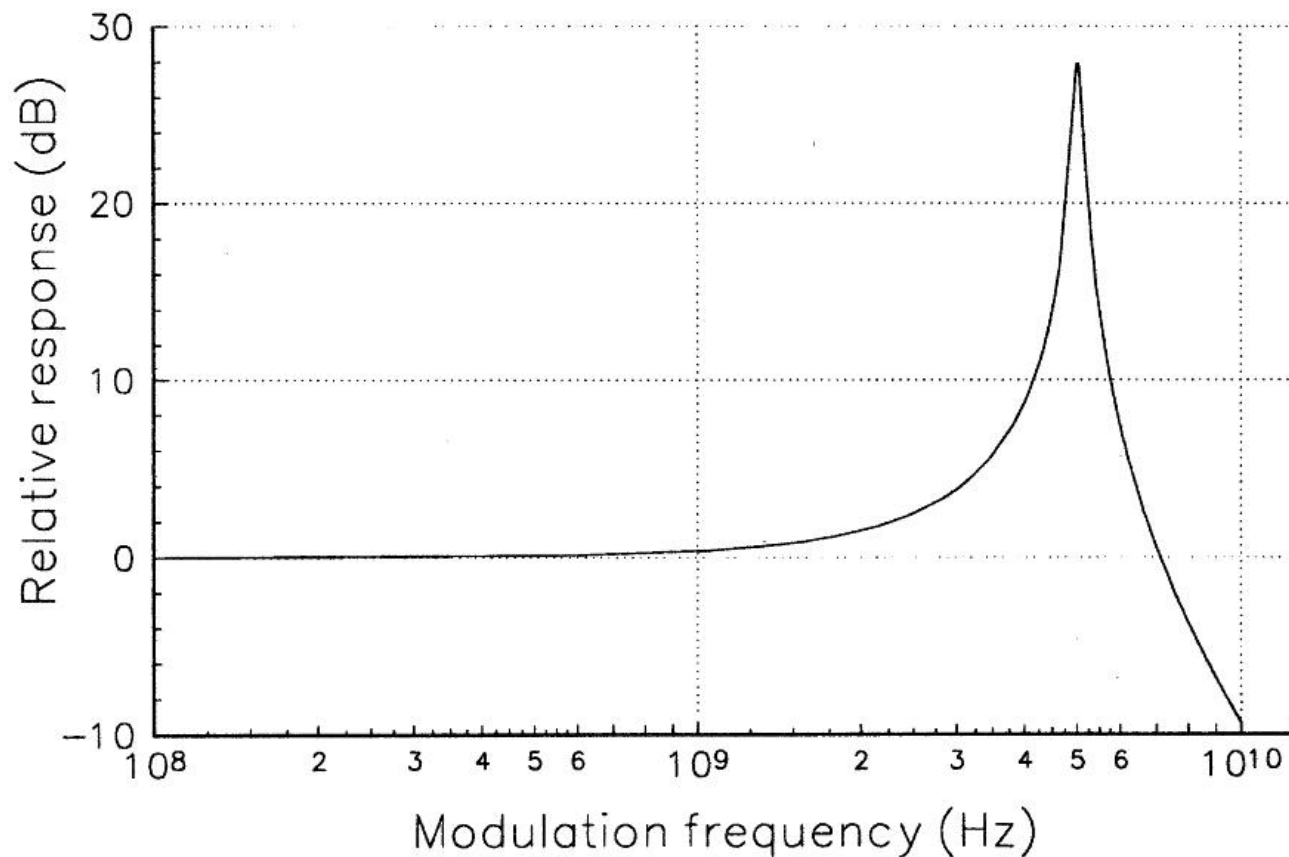
RIN

- ▶ reprezinta o densitate spectrala de zgomot
 - puterea de zgomot depinde de RIN si de banda semnalului
- ▶ Depinde de puterea semnalului
 - P^{-3} la puteri mici, P^{-1} la puteri mari



Raspunsul unei diode laser

- ▶ oscilatii de relaxare - x GHz



EIN

▶ Equivalent Input Noise

- R_i – rezistenta de intrare in circuitul de modulare a diodei
- Variatiile de putere (zgomot) echivalente unor variatii de curent (zgomot) prin dioda

$$\langle P_n^2 \rangle = r \cdot \langle I_n^2 \rangle$$

$$EIN[W] = R_i \cdot \langle I_n^2 \rangle \quad 1 \text{ Hz banda}$$

$$EIN[W / Hz] = RIN \cdot (I_0 - I_{th})^2 \cdot R_i$$

Zgomotul fotodiodei

▶ NEP

- Noise Equivalent Power
- r – rezonvizitatea diodei

$$NEP[W] = \frac{\int \sqrt{\langle i_n^2 \rangle} df}{r}$$

- r depinde de λ , implica NEP depinde de λ
- In cataloage apare de obicei densitatea spectrala

$$NEP[W / \sqrt{Hz}] = \frac{\sqrt{\langle i_n^2 \rangle}}{r} = \frac{NEP}{\sqrt{BW_{PD}}}$$

Zgomotul fotodiodei

▶ NEP

- cea mai mica putere detectabila

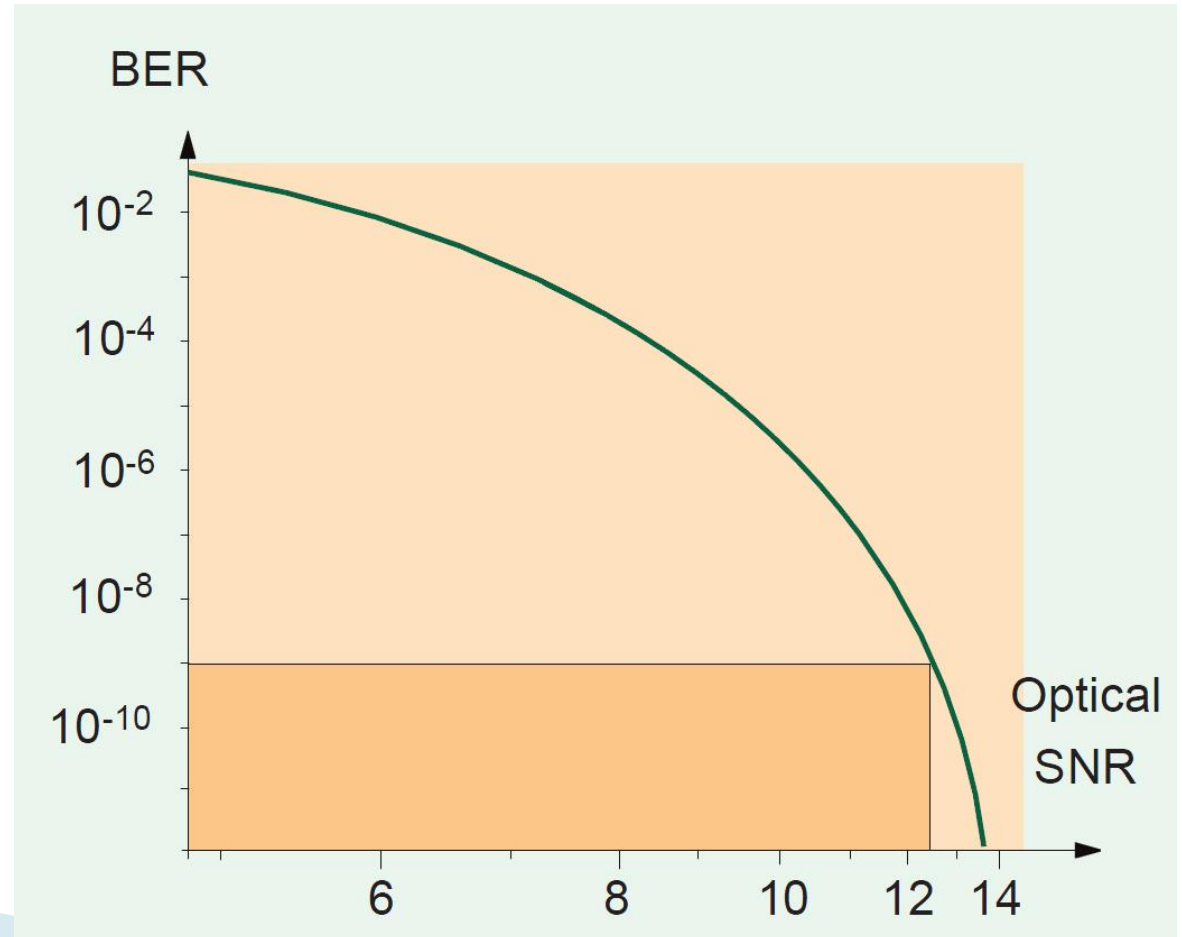
$$\langle i_n^2 \rangle = 2 \cdot e \cdot I \cdot BW_{PD} = 2 \cdot e \cdot (I_S + I_{dark}) \cdot BW_{PD}$$

$$P_{\min} = \frac{\sqrt{\langle i_n^2 \rangle_{\min}}}{r} = \frac{1}{r} \cdot \sqrt{2 \cdot e \cdot I_{dark} \cdot BW_{PD}}$$

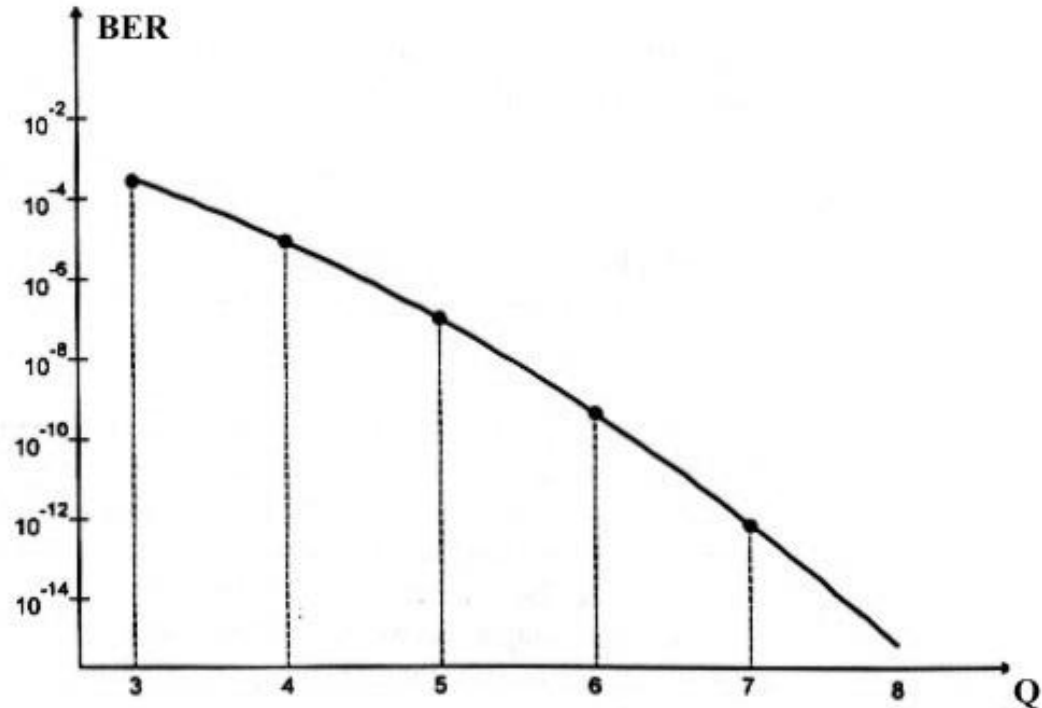
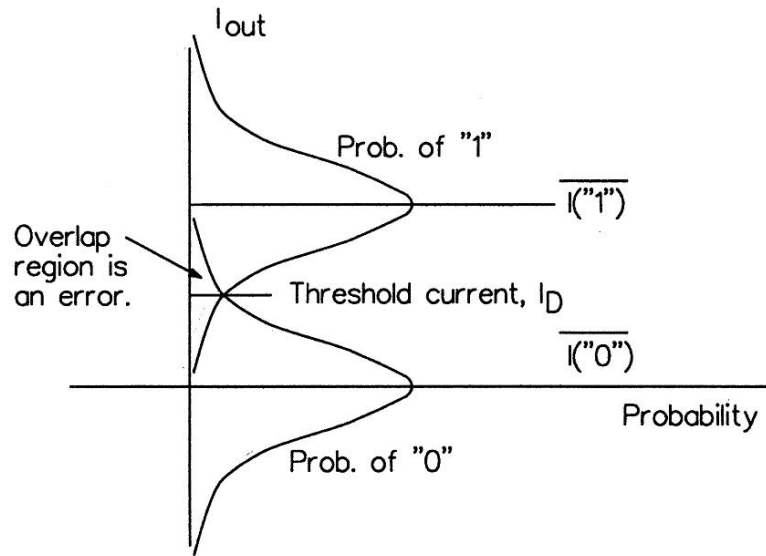
$$NEP[W / \sqrt{Hz}] = \frac{1}{r} \cdot \sqrt{2 \cdot e \cdot I_{dark}}$$

BER

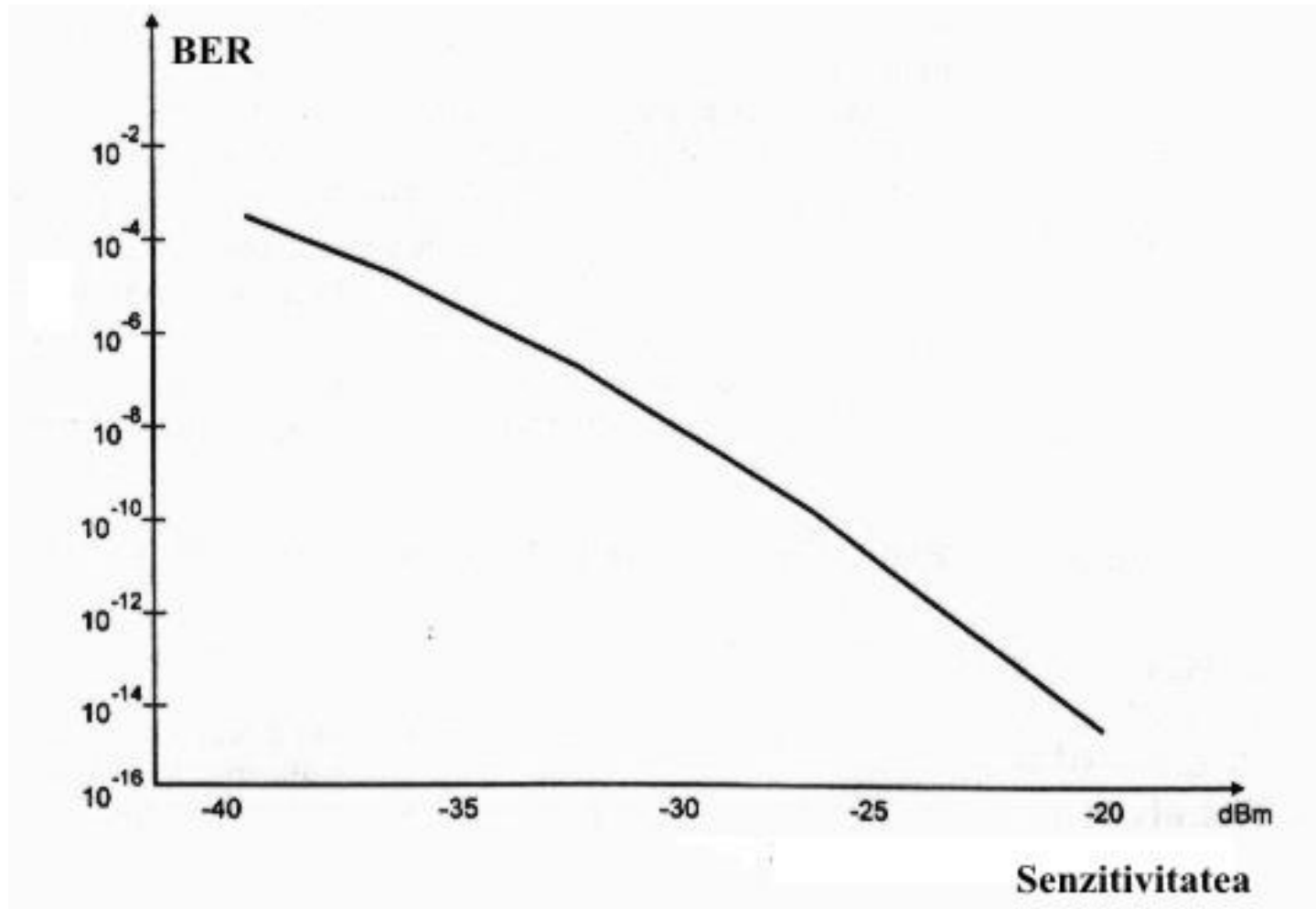
▶ Bit Error Rate



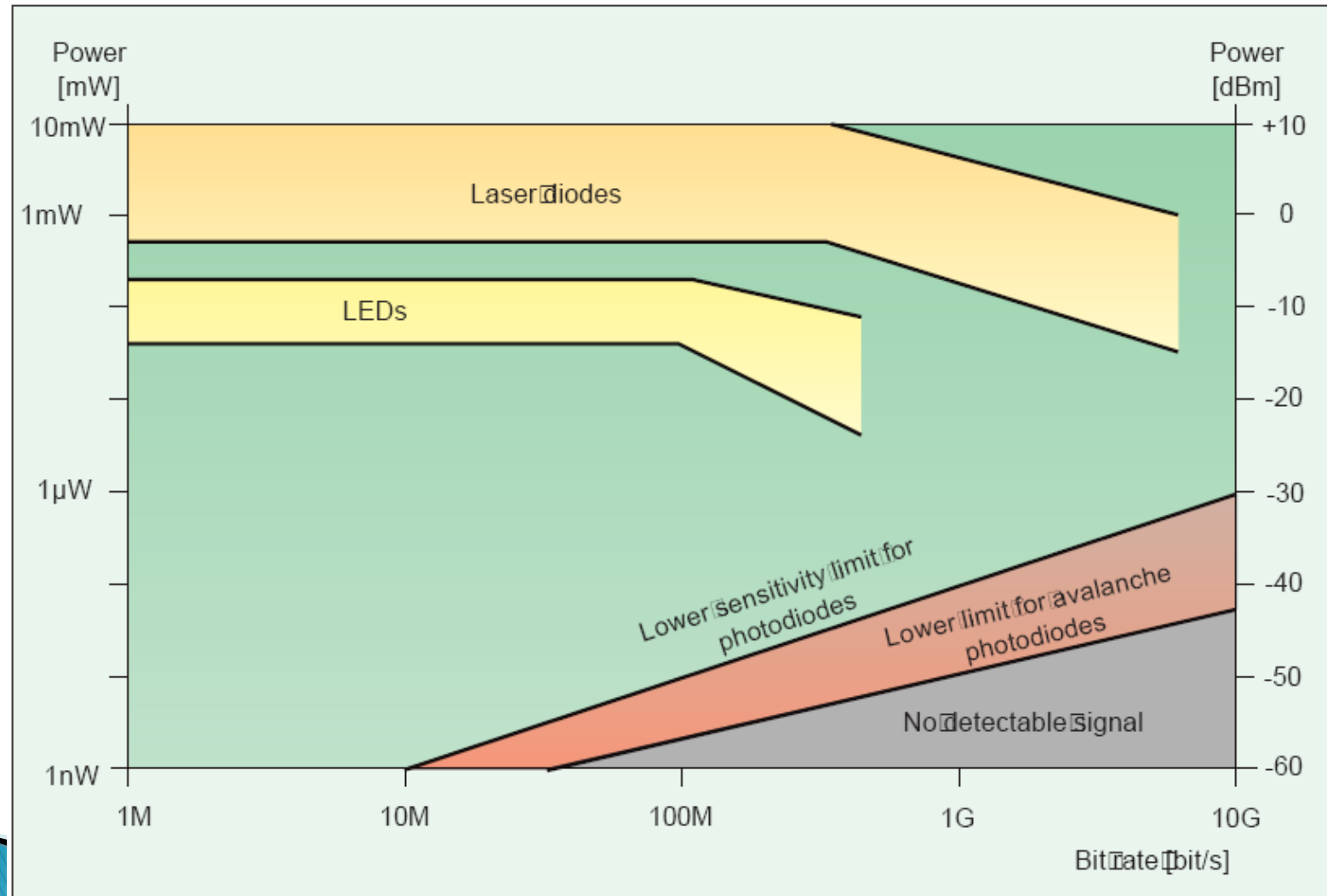
Probabilitate de eroare



Senzitivitatea unei diode



Limite putere/bandă a dispozitivelor optoelectronice



Contact

- ▶ Laboratorul de microunde si optoelectronica
- ▶ <http://rf-opto.etti.tuiasi.ro>
- ▶ rdamian@etti.tuiasi.ro