f_{min} f_{max} $B = f_{max} - f_{min}$ [Hz]

S S(f)

$p(t) = u(t) \cdot i(t)$

$i(t) = \frac{u(t)}{Z} \Rightarrow p(t) = \frac{u^2(t)}{Z}$

$p(t) = i^2(t) \cdot Z$

3,6 MW = $3,6 \cdot 10^6$ W

10^7 W

1 mW = 10^{-6} W

0,8 fW = $8 \cdot 10^{-16}$ W

$10 \cdot \log\left(\frac{10^{-6}}{10^{-3}}\right) = -30$ dBm

$10 \cdot \log\left(\frac{8 \cdot 10^{-16}}{10^{-3}}\right) = -121$ dBm

$\frac{8 \cdot 10^{-16}}{10^7} = 8 \cdot 10^{-16-7} = 8 \cdot 10^{-23}$

-221 dB

$\log(a \cdot b) = \log a + \log b$

$\log\left(\frac{a}{b}\right) = \log a - \log b$

-30 dBm $- (-121$ dBm$) = 91$ dB

- SNR [dB] = S [dBm] − N [dBm]
- $\frac{S\,[W]}{N\,[W]}$

$$\log_a(b) = \frac{\log_c(b)}{\log_c(a)}$$

$$\log_2(10) = \frac{\log_{10}(10)}{\log_{10}(2)} =$$

$$\frac{C}{B} = \log_2\left(1 + \frac{S}{N}\right)$$

DIGITAALNE
BINAARNE „0" „1"

— +5V
— 0V — +5V „3"
— +3V „2"
— -3V „1"
— -5V „0"

0 1 2 3
00 01 10 11

M

$\log_2(M)$

$$2 \cdot B \cdot \log_2(M) = B \cdot \log_2\left(1 + \frac{S}{N}\right)$$

$$\log_2(M^2) = \log_2\left(1 + \frac{S}{N}\right)$$

$$M^2 = 1 + \frac{S}{N}$$

a_j $\quad a_1 = A \quad p(a_1) = p(A)$

$a_2 = B \quad p(a_2) = p(B)$

$a_3 = C \quad I(a_j) = \log_2\left(\frac{1}{p(a_j)}\right) =$

⋮

A 100C 001

$a_j \Leftrightarrow c_j$

..