???

$C = \arg P_x(X) max I(X;Y)$

(1)

$$I(X;Y) = \sum_{x,y} p(x,y) \log_2 \frac{p(x,y)}{p(x)p(y)}$$

(2)

$I(X;Y)$

$$C = B \log_2 \left(1 + \frac{S}{N_0 B}\right) = B \log_2(1+\gamma)$$

(3)

$N_0 \gamma = \frac{S}{N_0 B}$

$H(f) S(f) N_0 B/N f_i H(f_i)$

$$C = \lim_{N\to\infty} \sum_{i=1}^{N} \Delta f \log_2 \left(1 + \frac{S(f)|H(f)|^2 \Delta f}{N_0 \Delta f}\right) = \int_B \log_2 \left(1 + \frac{S(f)|H(f)|^2}{N_0}\right) df$$

(4)

$$\int_B S(f) df = P$$

(5)

$$S(f) = \{ K - \frac{N_0}{|H(f)|^2}, |H(f)|^2 \geq \frac{N_0}{K} 0, |H(f)|^2 < \frac{N_0}{K}$$

(6)

??

??$N_0 |H(f)|^2/N_0$

$h_k = |H(k)|^2 (k = 0, 1, \cdots, N-1) \sigma^2 b_k$

p_k

$BER_{target} b_k p_k$

$$b_k = \log_2(1+\frac{h_k p_k}{\Gamma \sigma^2})$$

(7)

$$p_k = \frac{\Gamma \sigma^2}{h_k}(2^{b_k}-1)$$

(8)

Γ

ΓBER_{target}**?**

$$\Gamma = -\frac{\ln(5 \cdot BER_{target})}{1.5}$$

(9)

$b_k \in N N$

?

$b_k (k = 0, 1, \cdots, N-1) P = \sum_{i=0}^{N-1} p_k = 0 R = \sum_{i=0}^{N-1} b_k = 0 P R$

$$\Delta p_k = \frac{\Gamma \sigma^2}{h_k}(2^{b_k+1}-1) - \frac{\Gamma \sigma^2}{h_k}(2^{b_k}-1) = \frac{\Gamma \sigma^2}{h_k} 2^{b_k}$$

(10)

$k^\star = \arg 0 \leq k \leq N-1 \min \Delta p_k$

(11)

$P + \Delta p_{k^\star} \geq P_{total} b_{k^\star} = b_{k^\star} + 1 P = P + \Delta p_{k^\star}$ **2** $P + \Delta p_{k^\star} \geq P_{total} R + 1 \geq R_{target} b_{k^\star} = b_{k^\star} + 1 P = P + \Delta p_{k^\star} R = R+$