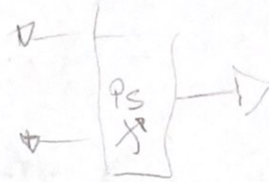
3) Cada usario

**Pure selection (PS)**




$$PDF_r = \begin{cases} 0{,}15 & r = 1/\sqrt{2} \\ 0{,}7 & r = 1 \\ 0{,}15 & r = \sqrt{2} \end{cases} \qquad PDF_{r^2} = \begin{cases} 0{,}15 & r^2 = 0{,}5 \\ 0{,}7 & r^2 = 1 \\ 0{,}15 & r^2 = 2 \end{cases}$$

* Principio de PS: o receptor pega sempre a sinal com maior SNR, isso implica estimar a sinal mas forte (maior $\frac{P}{N}$)

Tabela de visualiza

| $r_1 \backslash r_2$ | $1/\sqrt{2}$ | $1$ | $\sqrt{2}$ |
|---|---|---|---|
| $\frac{1}{\sqrt{2}}$ | $1/\sqrt{2}$ | $1$ | $\sqrt{2}$ |
| $1$ | $1$ | $1$ | $\sqrt{2}$ |
| $\sqrt{2}$ | $\sqrt{2}$ | $\sqrt{2}$ | $\sqrt{2}$ |

$\Rightarrow$ retorna o $\max(r_1 ; r_2)$

Probabilidad conjunto

| | 0,15 | 0,7 | 0,15 |
|---|---|---|---|
| 0,15 | 0,0225 | 0,107 | 0,0225 |
| 0,7 | 0,105 | 0,47 | 0,105 |
| 0,15 | 0,0225 | 0,105 | 0,0225 |

$\Rightarrow \max(r_i^2 ; r_j^2)$

| $r_i^2 \backslash r_j^2$ | $1/2$ | $1$ | $2$ |
|---|---|---|---|
| $1/2$ | $1/2$ | $1$ | $2$ |
| $1$ | $1$ | $1$ | $2$ |
| $2$ | $2$ | $2$ | $2$ |

$$\tilde{P}_e = \sum p(r)\, p(e/r) \qquad p(e/r) = M\, Q\left(\sqrt{r_j^2\, \xi\, \frac{E}{N_0}}\right)$$

(16-QAM)

Para o caso de puro selection, $r^2 = \max(r_i^2 ; r_j^2)$, $M = 3$ $\xi = 0{,}2$

$\frac{E}{N_0} = 10^{\frac{23}{10}} = 10^{2{,}3} \approx 199{,}52$ $\xi \cdot \frac{E_s}{N_0} \cong 39{,}9$

$P_e = 0{,}0225 \times 3\, Q\left(\sqrt{0{,}5 \cdot 39{,}9}\right) + 0{,}107 \times 3\, Q\left(\sqrt{39{,}}\right.$

Para
$r_{ij}^2 = 0{,}5 \quad Q\left(\sqrt{0{,}5\cdot 39{,}9}\right) = 3{,}9747\cdot 10^{-6}$

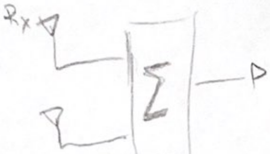
$r_{ij}^2 = 1 \quad Q\left(\sqrt{39{,}2}\right) = 1{,}33\cdot 10^{-10}$

$r_{ij}^2 = 2 \quad Q\left(\sqrt{2\times 39{,}2}\right) = 2{,}07\cdot 10^{-19}$

$$\bar{P}_e = 3\big[0{,}0225\cdot 3{,}97\cdot 10^{-6} + 0{,}107\cdot 1{,}33\cdot 10^{-10} + 0{,}0225\cdot 2{,}07\cdot 10^{-19} + 0{,}105\cdot 1{,}33\cdot 10^{-10} + 0{,}47\cdot 1{,}33\cdot 10^{-10} + 0{,}105\cdot 2{,}07\cdot 10^{-19} + 0{,}0225\cdot 2{,}07\cdot 10^{-19} + 0{,}105\cdot 2{,}07\cdot 10^{-19} + 0{,}0225\cdot 2{,}07\cdot 10^{-19}\big]$$

$$\boxed{\bar{P}_e \cong 2{,}6856\cdot 10^{-7}}$$

* **MRC**


$\bar{P}_e = \sum p(r)\cdot p(e/r)$

$P(r_i, r_j) \to$ continua igual

$P(e/r) = M\, Q\left(\sqrt{\text{Sum}\left(r_i^2 + r_j^2\right)\xi\,\frac{E_0}{N_0}}\right)$

| $r_i^2 \backslash r_j^2$ | 1/2 | 1 | 2 |
|---|---|---|---|
| 1/2 | 1 | 1,5 | 2,5 |
| 1 | 1,5 | 2 | 3 |
| 2 | 2,5 | 3 | 4 |

$\xi \frac{E}{N_0} = 39{,}9$

Para
$r_{ij}^2 = 1 \quad Q\left(\sqrt{39{,}2}\right) = 1{,}33\cdot 10^{-10}$

$r_{ij}^2 = 1{,}5 \quad Q\left(\sqrt{1{,}5\cdot 39{,}9}\right) = 5{,}118\cdot 10^{-15}$

$r_{ij}^2 = 2{,}5 \quad Q\left(\sqrt{2{,}5\cdot 39{,}9}\right) = 8{,}64\cdot 10^{-24}$

$r_{ij} = 2 \quad Q\left(\sqrt{2\cdot 39{,}9}\right) = 2{,}07\cdot 10^{-19}$

$r_{ij} = 3 \quad Q\left(\sqrt{3\cdot 39{,}9}\right) = 3{,}67\cdot 10^{-28}$

$r_{ij} = 4 \quad Q\left(\sqrt{4\cdot 39{,}9}\right) = 6{,}91\cdot 10^{-37}$

$\Rightarrow$ Pode ser aproximado a 0

Portanto

$$P_e = 3 \cdot 0{,}0225 \cdot 1{,}33 \cdot 10^{-10} = 8{,}97 \cdot 10^{-12}$$

* EGC

* Dado que o canal envolvido é real as análises de MRC e EGC são iguais. Ou seja, sendo um canal real o conjugado é elemento e a fase é 0 $\Rightarrow e^{j0} = 1 \Rightarrow$

Portanto

$$P_e = 8{,}97 \cdot 10^{-12}$$