

→ FCD - Ficha 2

2-

• $f_a \geq 2B$

$$a) 4n_1 \geq 2B \Rightarrow B = 22,05 \text{ GHz}$$

$$b) n_c = K f_a \times (\text{tempo})$$

$$K = 16$$

$$n_c = 16 \times 44 \times 10^3 \times 60 \times 10 \frac{\text{bytes}}{8} = 52920000 \rightarrow \text{2 canais} \\ = 105840000$$

3-

$$B = 15 \text{ kHz}$$

$$q \geq 200$$

$$M = 2^m$$

$$B_+ = 50 \text{ kHz}$$

$$A1 - \frac{f}{f \geq 2B} \Rightarrow f = 30 \checkmark$$

$$2B_+ \geq n_c$$

$$n_c = K f_a = 3 \times 30 \times 10^3 = 90000 \rightarrow F$$

$$2 \times B_+ = 2 \times 50 \times 10^3 = 100000$$

B2 - P

$$2 \times 30 \times 10^3 = 120000 \rightarrow F$$

$$2 \times B_+ = 2 \times 50 \times 10^3 = 100000$$

C3 - F

D4 - F

4-

$$B = 3 \text{ kHz}$$

$$S = 1/2 \text{ Watt}$$

$$(S/N_q)_{dB} \geq 40 \Rightarrow B_T = 16 \text{ kHz}$$

$$f_a = 6$$

$$f_a \times K \leq 2B_T \Leftrightarrow 6K \leq 2 \times 16 \Rightarrow K \leq \frac{16}{3} \approx 5.3$$

$$10 \log_{10} \left(\frac{1/N}{1/3q^2} \right) \geq 40 \Leftrightarrow q \geq 115.4$$

$$q \geq 115.4 \Rightarrow M^2 \geq q \Rightarrow N = 3$$

$$\Rightarrow q = 243 = 3^6$$

5-

$$N_q = \frac{1}{3q^2} \leq 12 \times 10^{-4}$$

$$\frac{1}{3q^2} \leq 12 \times 10^{-4} \Rightarrow 3q^2 \geq \frac{1}{12 \times 10^{-4}} \Rightarrow q^2 \geq \frac{1}{3 \times 12 \times 10^{-4}}$$

$$\Rightarrow q \geq \sqrt{\frac{1}{3 \times 12 \times 10^{-4}}} \Leftrightarrow q \geq \sqrt{16} \approx 16 \Rightarrow q = 16$$

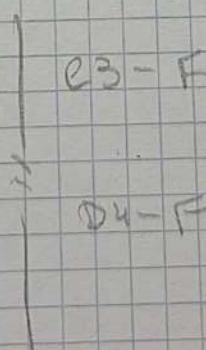
• digits carries

$$K = \log_2 \frac{M}{q} \Rightarrow K = 4$$

A1-V

B2-V

$$f_a \times K \geq 2B_T \Rightarrow 2 \times 4 \geq 2B_T \Rightarrow BT \geq 4$$



$$B = 12 \text{ kHz} \Rightarrow f_a = 24 \text{ kHz}$$

M=2

$$BT = 200 \text{ kHz}$$

$$N_g = \frac{1}{3q^2}$$

$$f_a \ll 2BT \Rightarrow K \leq \frac{400}{2\pi} \Rightarrow K \leq 16,7 \Rightarrow K=16$$

$$q = 2^K \Rightarrow q = 2^{16} = 65536$$

$$N_g = \frac{1}{3 \times (65536)^2} = 7,76 \cdot 10^{-11} \approx 77,61 \times 10^{-12} < 100 \times 10^{-12}$$

b)

$$Dc = K \times f_a \times \text{Tempo}$$

$$= \underline{26 \times 24 \times 10^3} \times \underline{32 \text{ days}} = 1536000 \text{ bytes}$$