

$$e.) 10^{-4} \left[ \frac{\sin[\pi(f - 10^6) \cdot 10^{-4}]}{\pi(f - 10^6) \cdot 10^{-4}} \right]^2$$

$$\pi(f' - 10^6) \cdot 10^{-4} = \pi \Rightarrow$$

$$f' = 10^6 \pm 10^4 \Rightarrow \omega_{N2W} = 20 \text{ kHz}$$

d.) 205 kHz

e.) 307 kHz

1.) Overte Parseval-ova teorému pre harmonické signály

$$x(t) = A \sin 2\pi f_0 t \xleftrightarrow{FT} X(f) = \frac{A}{2} [\delta(f - f_0) + \delta(f + f_0)]$$

Parsevalova teoréma

$$P_x = \frac{1}{T} \int_{-T/2}^{T/2} x^2(t) dt = \sum_n |c_n|^2$$

$$P_x = \frac{A^2}{2} = 2 \text{ W}$$

$$P_R = 3,33 \text{ mW} \quad \frac{P_x}{R}$$

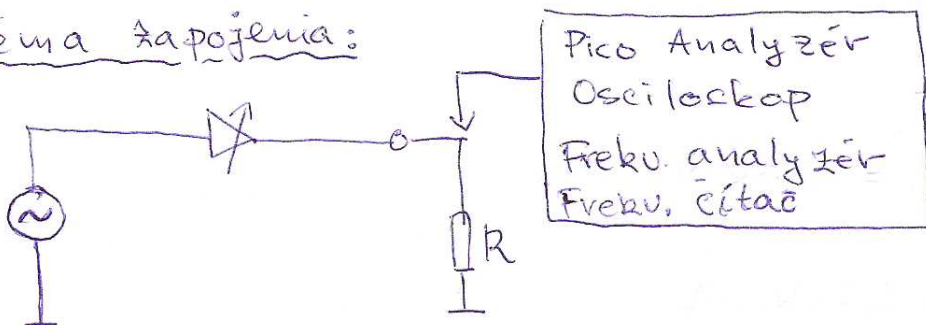
Parametre signálu:

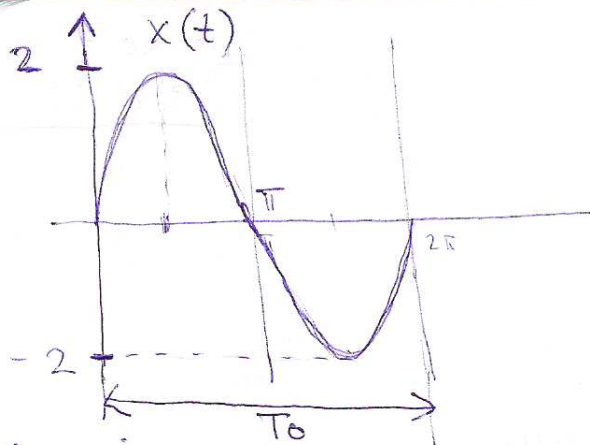
$$A = 2 \text{ Hz}$$

$$f_0 = 2,144 \text{ kHz} \rightarrow T_0 = 473,037$$

$$R = 600 \Omega$$

Schéma zapojenia:



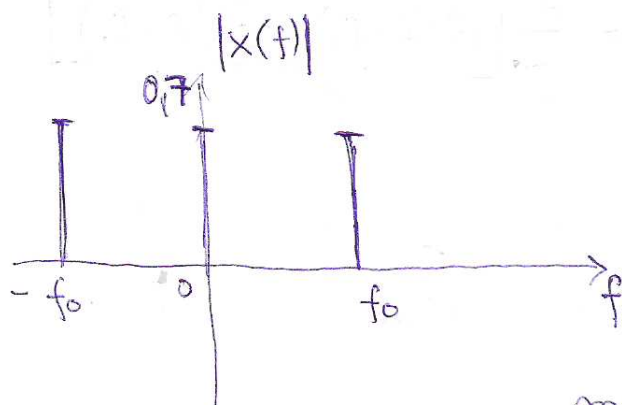


Meranie:

$$V_{\text{rms}} = \frac{V_{\text{PP}}}{2\sqrt{2}} \quad \text{— spicka / spicka}$$

$$U_R = 4,078 V_{\text{PP}} \hat{=} U_{R_{\text{ref}}} = 1,442 V_{\text{rms}}$$

$$P_{R_{\text{ref}}} = \frac{(U_{\text{ref}})^2}{R} = \frac{1,442^2}{600} = 3,465 \text{ mW}$$



ADC = 20/20

~~obrazok~~ <sup>meria</sup> efektívnu hodnotu dvojstranného spektra

$$f_0 = 2117 \text{ Hz}$$

$$\frac{A}{2} = 0,7 V_{\text{ef}} = 2\sqrt{2} \cdot 0,7 = \frac{A}{2} \Rightarrow 1,979 \text{ V}$$

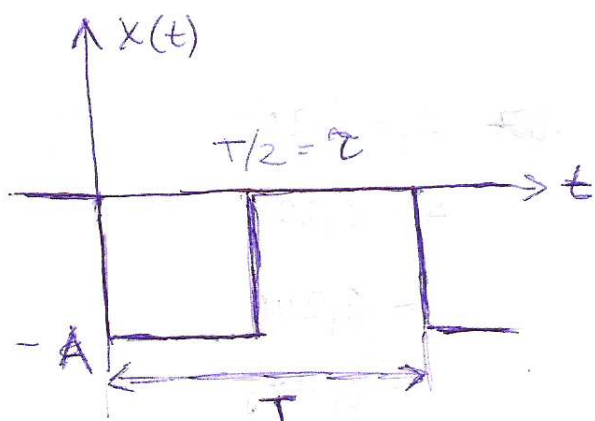
$$A = \cancel{0,7} \cdot 2 = 1,979$$

$$|c_1| = |c_{-1}| = \frac{A}{2} = \frac{1,979}{2}$$

$$P_x = 2|c_1|^2 = 2 \cdot \left(\frac{1,979}{2}\right)^2 = 1,958 \text{ W}$$

$$P_R = \frac{P_x}{P_0} = \frac{1,958}{600} \hat{=} 3,264 \text{ mW}$$

2. Ověřte Parsevalovu větu pro neharmon. signály



$$A = -3,995 \text{ V}$$

$$f_{\text{clk}} = \frac{100 \text{ kHz}}{12} \Rightarrow T = \frac{12}{100 \cdot 10^3} = 120 \mu\text{s}$$

$$x(t) = \begin{cases} -A & 0 \leq t \leq \tau \\ 0 & \tau < t \leq T \end{cases}$$

$$X(f) = \frac{1}{T} \int_0^{\tau} A \cdot e^{-j\omega t} dt = \frac{A}{j\omega T} (1 - e^{-j\omega \tau})$$

$$|X(f)| = \left| \frac{A}{\mathcal{H}} \operatorname{si} \left( \frac{\omega \tau}{\mathcal{H}} \right) \right|$$

$$\mathcal{H} = \frac{T}{2} = 2$$

$$X_0 = \frac{A}{\mathcal{H}} = \frac{-3,995}{2} \doteq -1,9975 \text{ V}$$

$$\cancel{8,33 \text{ kHz}}$$

$$X_1 = \left| \frac{A}{\mathcal{H}} \operatorname{si} \left( \frac{\pi}{2} \right) \right| = 1,271$$

$$\cancel{24,99 \text{ kHz}}$$

$$8,33 \text{ kHz}$$

$$X_2 = 0$$

$$X_3 = \left| \frac{A}{\mathcal{H}} \operatorname{si} \left( \frac{3\pi}{2} \right) \right| \doteq 0,423$$

$$24,99 \text{ kHz}$$

$$X_5 = \left| \frac{A}{\mathcal{H}} \operatorname{si} \left( \frac{5\pi}{2} \right) \right| \doteq \cancel{0,254}$$

$$58,33 \text{ kHz}$$

$$X_7 =$$

$$\doteq 0,182$$

$$X_9 =$$

$$\doteq 0,141$$

$$\cancel{74,97 \text{ kHz}}$$



## Namerané hodnoty:

$$A_0 = -1,9975V$$

$$c_1 \frac{A_1}{2} = 0,85V_{ef} \quad @ \quad 8,318kHz$$

$$c_2 \frac{A_3}{2} = 0,27V_{ef} \quad 25,03kHz$$

$$c_3 \frac{A_5}{2} = 0,17V_{ef} \quad 41,66kHz$$

$$c_4 \frac{A_7}{2} = 0,11V_{ef} \quad 58,37kHz$$

$$c_5 \frac{A_9}{2} = 0,09V_{ef} \quad 75,07kHz$$

$$A_1 = 1,202$$

$$A. \quad 0,381$$

$$= 0,240$$

$$= 0,155$$

$$= 0,127$$

$$P_x = \sum_{n=-9}^9 |c_n|^2 = A_0^2 + 2(|c_1|) = 7,365W$$

$$P_R = \frac{P_x}{R} = \frac{7,365}{600} = 12,275mW$$

$$P_x = \frac{1}{T} \int_{-T/2}^{T/2} x^2(t) dt = \frac{1}{T_0} \int_0^{T_0} A^2 dt = \frac{A^2}{T_0} [t]_0^{T_0} = \frac{A^2}{T_0}$$

$$P_R = \frac{P_x}{R} = \frac{7,98}{600} = 13,33mW$$

3 Zmevajte sirku pásma  $W_{020}$  pseudonál.

Schéma zapojenia

