

Filtering Stationary Noise

The mean square noise output of a filter that receives stationary noise is

$$\overline{y^2(t_1)} = \int_{-\infty}^{\infty} R_{xx}(\gamma) \cdot k_{11w}(\gamma) d\gamma$$

$$\overline{y^2(t_1)} = \int_{-\infty}^{\infty} S_x(f) \cdot |W_1(f)|^2 df$$

and in case of white noise, i.e. with

$$R_{xx}(\gamma) = S_b \cdot \delta(\gamma)$$

$$S_x(f) = S_b$$

it is simply

$$\overline{y^2(t_1)} = S_b \cdot k_{11w}(0) = S_b \int_{-\infty}^{\infty} w_1^2(\alpha) d\alpha$$

$$\overline{y^2(t_1)} = S_b \int_{-\infty}^{\infty} |W_1(f)|^2 df$$

