Collection of Formulas

$$C = W_C \cdot \log_2\left(1 + SNR\right)\ ,\ \begin{cases} r_{\max} = 2B_T = r_b / n = r_b / \log_2(L) \\ \Rightarrow r_b = 2B_T \log_2(L), L = 2^n \end{cases},\ r = n \cdot f_S$$

$$C = W_C \cdot \log_2\left(1 + SNR\right)$$

$$P_{dB} = 10\log(P_1 / P_2), P_{dB} = 20\log(V_1 / V_2), P_{dBm} = 10\log(P_1 / 1mW)\ ,\ \frac{V_g}{V_i} = \frac{Z_g + Z_L}{Z_L}$$

$$\begin{cases} \text{y(t)=Kx(t - t}_\text{d}\text{)} \\ \Rightarrow \text{Y(f)=F}\left[\text{y(t)}\right]=\underbrace{\text{Kexp}\left(\text{-j}\omega\text{t}_\text{d}\right)}_{H(f)} X(f) \\ G_y(f) = \left|H(f)\right|^2 G_x(f)\ \ (= \text{output PDF}) \end{cases},\ \begin{cases} l = d_{\min} - 1,\ t = \lfloor l/2 \rfloor, R_C = k/n \le 1 \\ d_{\min}\big|_{\max} = n - k + 1\ \ \text{(repetition codes)} \end{cases}$$

$$\begin{cases} N_R = \int_{-\infty}^{\infty} (\eta/2)\left|H_R(f)\right|^2 df \\ \quad = \int_{B_T} (\eta/2) df + \int_{B_T} (\eta/2) df = \eta B_T \end{cases} \quad \begin{cases} P\left(n,k\right) = \begin{pmatrix} n \\ k \end{pmatrix} \alpha^k \left(1 - \alpha\right)^{n-k} \\ \begin{pmatrix} n \\ k \end{pmatrix} = \dfrac{n!}{k!(n-k)!} \end{cases}$$

$$\begin{cases} B_T = 2\left|D - 1\right| W, 1 >> D >> 1 \\ \beta = A_m f_\Delta / f_m \big|_{A_m = 1, f_m = W} = f_\Delta / W \equiv D \\ B_{T,DSB} = 2W, B_{T,SSB} = W \end{cases}$$

$$\begin{cases} x_C(t) = A_C \cos(\omega_C t + \phi(t)) \\ \phi_{PM}(t) = \phi_\Delta x(t) \\ \phi_{FM}(t) = 2\pi f_\Delta \int_{t_0}^{t} x(\lambda) d\lambda, t \ge t_0 \end{cases} \quad \phi(t) = \begin{cases} \underbrace{\phi_\Delta A_m}_{\beta} \sin(\omega_m t), \text{PM} \\ \underbrace{(A_m f_\Delta / f_m)}_{\beta} \sin(\omega_m t), \text{FM} \end{cases} \quad \begin{cases} \gamma = S_R / (\eta W) \\ S_R / N_R = \gamma W / B_T \\ \gamma_b = E_b / N_0 \end{cases}$$

$$y(t) = \begin{cases} v_i(t) & \text{Synchronous detector} \\ A_v(t) - \overline{A_v} & \text{Envelope detector} \\ \phi_v(t) & \text{Phase detector} \\ d\phi_v(t)/dt & \text{Frequency detector} \end{cases},\ \begin{cases} x_{AM}(t) = A_C\left[1 + \mu x_m(t)\right]\cos(\omega_c t) \\ x_{DSB}(t) = x_m(t)\cos(\omega_c t) \end{cases}$$

$$\begin{cases} Q = R\sqrt{C/L} \\ f_0 = (2\pi\sqrt{LC})^{-1} \end{cases},\ \ H(\omega) = V_{out}(\omega)/V_{in}(\omega) = z_p / z_i$$

$$Q(k)=\frac{1}{\sqrt{2\pi}}\int_k^{\infty}\exp\left(-\frac{\lambda^2}{2}\right)d\lambda$$

$$\lambda=(m-x)/\sigma\Rightarrow Q(k)=\frac{1}{\sqrt{2\pi}}\int_{\sigma k+m}^{\infty}\exp\left(-\frac{(x-m)^2}{2\sigma^2}\right)dx$$

$$\begin{cases}P=UI=U^2/R=I^2R\\ R=U/I\end{cases},\ \frac{V_g}{V_i}=\frac{Z_g+Z_L}{Z_L},P_L=V_iI_i\cos\theta$$

$$\cos\theta=R_{tot}/Z_{tot}=R_{tot}/\sqrt{R_{tot}{}^2+X_{tot}^2},X_{tot}=X_g+X_L,R_{tot}=R_L+R_g$$

$$N_{D(PM)}=\int_{-W}^{W}\frac{\eta}{2S_R}df=\frac{\eta W}{S_R}\ ,\ N_{D(FM)}=\int_{-W}^{W}\frac{\eta f^2}{2S_R}df=\frac{\eta W^3}{3S_R}$$

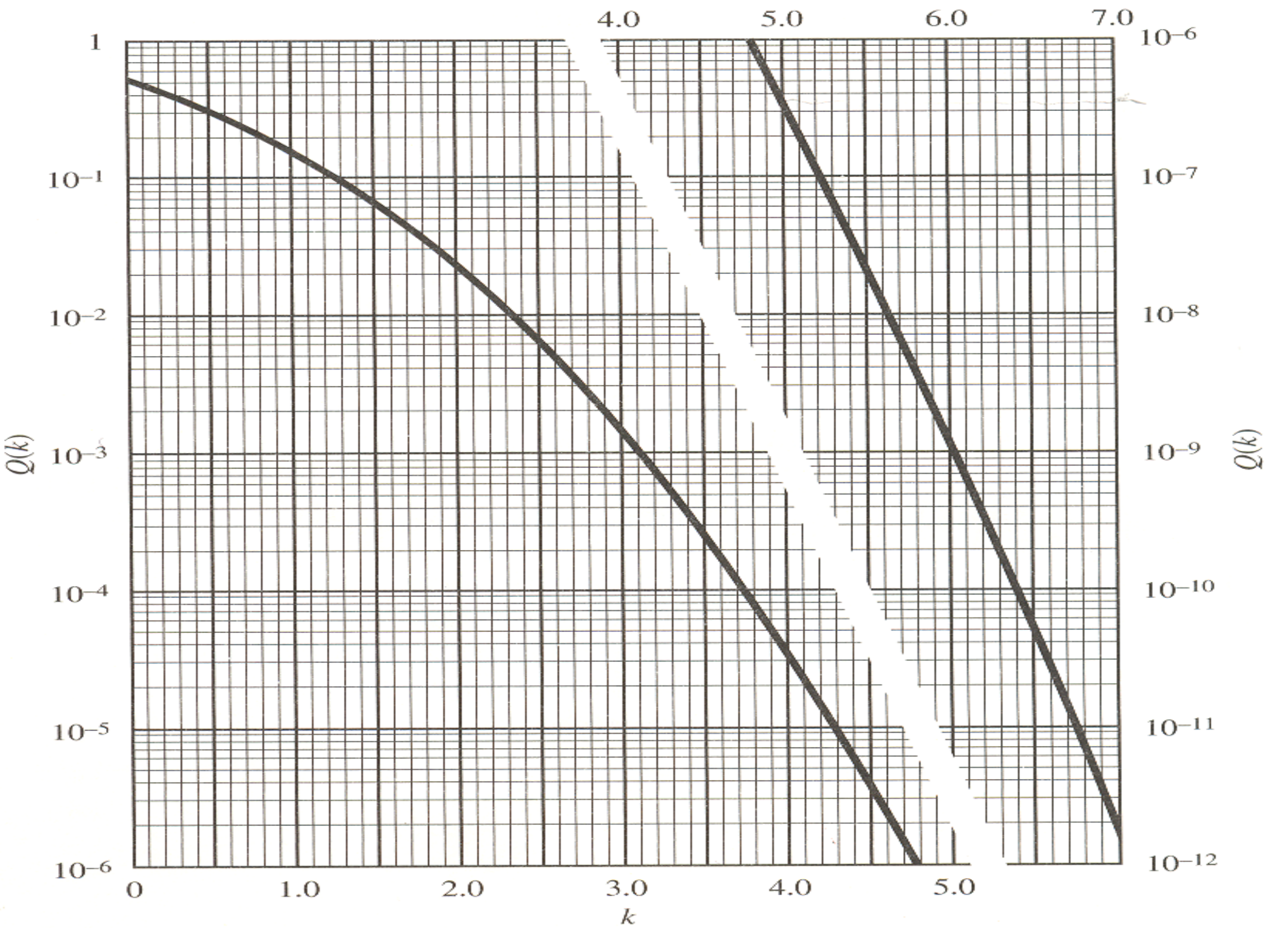
$$S_D/N_D\big|_{FM}=\frac{f_\Delta^2 S_x}{\eta W^3/(3S_R)}=3\underbrace{\left(\frac{f_\Delta}{W}\right)}_{D}^2 S_x\underbrace{\frac{S_R}{\eta W}}_{\gamma}=3D^2S_x\gamma\ ,\ S_D/N_D\big|_{FM,D>>1}=\frac{3}{4}\left(\frac{B_T}{W}\right)^2S_x\gamma$$

$$S_D/N_D\big|_{PM}=\frac{\phi_\Delta^2S_x}{\eta W/S_R}=\phi_\Delta^2S_x\gamma,\text{where }\phi_\Delta^2S_x\le\pi^2$$

$$\begin{cases}\int\frac{1}{1+x^2}dx=\arctan(x)\\ \int\frac{x^2}{1+x^2}dx=x-\arctan(x)\end{cases}\quad\begin{cases}\prod\left(\frac{t}{\tau}\right)\leftrightarrow\tau\,\text{sinc}\,f\tau\\ \Lambda\left(\frac{t}{\tau}\right)\leftrightarrow\tau\,\text{sinc}^2f\tau\end{cases}$$

$$\begin{cases}\frac{d^nv(t)}{dt^n}\leftrightarrow(j2\pi f)^nV(f)\\ \int_{-\infty}^{t}v(\lambda)d\lambda\leftrightarrow\frac{1}{j2\pi f}V(f)+\frac{1}{2}V(0)\delta(f)\end{cases}$$

$$\begin{cases}\sin\alpha\sin\beta=1/2\cos(\alpha-\beta)-1/2\cos(\alpha+\beta)\\ \cos\alpha\cos\beta=1/2\cos(\alpha-\beta)+1/2\cos(\alpha+\beta)\\ \sin\alpha\cos\beta=1/2\sin(\alpha-\beta)+1/2\sin(\alpha+\beta)\end{cases},\quad\begin{cases}\cos^2\alpha=(1+\cos2\alpha)/2\\ \cos^3\alpha=(3\cos\alpha+\cos3\alpha)/4\end{cases}\quad\begin{cases}(\alpha+\beta)^2=\alpha^2+2\alpha\beta+\beta^2\\ (\alpha+\beta)^3=\alpha^3+3\alpha^2\beta+3\alpha\beta^2+\beta^3\end{cases}$$



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Q(k)
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