

1 Formulas

- **Signal to Noise Ratio:** $SNR = 10 \log_{10} \frac{P_s}{P_n}$
- **Shannon's Equation:** $C = B_c \log_2(1 + SNR)$
- **antenna size** $= \frac{1}{4} \text{wavelength}$
- **Energy of Signals:** $E = \int_{-\infty}^{\infty} |x(t)|^2 dt$
- **Parseval's Theorem:** $\int_{-\infty}^{\infty} |x(t)|^2 dt = \frac{1}{2\pi} \int_{-\infty}^{\infty} |X(\omega)|^2 d\omega$
- **Coherent Demodulator:** $m(t) \cos(\Delta\omega t + \theta_d)$
- **Modulation Index(AM):** $\mu = \frac{m_{max} - m_{min}}{2A + m_{max} + m_{min}}$
- **Time Constant of Envelope Detector:** $\frac{1}{\omega_c} < \tau < \frac{1}{2\pi B}$
- **Modulation Index(Angle Modulation):** $\beta = \frac{\Delta f}{B}$
- **Maximum Phase Deviation:** $\frac{Max(a) - Min(a)}{2}$
- **Maximum Frequency Deviation:** $\frac{Max(a') - Min(a')}{2}$
- **Narrowband Approximation:** $s(t) = A[\cos(\omega_c t) - ka(t)\sin(\omega_c t)], |ka(t)| \ll 1$

2 Concepts

2.1 Bandwidth

- **SSB:** B
- **VSF:** $B_{..} < 2B$
- **DSB:** $2B$
- **Narrow Band** ($\beta < 0.2$): $2B$
- **Angle Modulation(Effective Bandwidth):** $2(B + \Delta f) = 2B(1 + \beta)$

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