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Sideband and Frequency Modulation Formulas

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List of 21 Sideband and Frequency Modulation Formulas

Sideband and Frequency Modulation

1) Bandwidth in DSB-SC

Open Calculator

fx $$\mathrm{BW_{DSB}} = 2 \cdot \mathrm{f_{m\text{-}DSB}}$$

ex $$300\mathrm{Hz} = 2 \cdot 150\mathrm{Hz}$$

2) Bandwidth of FM by Carson Rule with Beta

Open Calculator

fx $$\mathrm{BW_{FM}} = 2 \cdot (1 + \beta) \cdot \mathrm{f_{mod}}$$

ex $$160\mathrm{Hz} = 2 \cdot (1 + 0.6) \cdot 50\mathrm{Hz}$$

3) Bandwidth of FM wave by Carson Rule

Open Calculator

fx $$\mathrm{BW_{FM}} = 2 \cdot (\Delta\mathrm{f} + \mathrm{f_{mod}})$$

ex $$160\mathrm{Hz} = 2 \cdot (30\mathrm{Hz} + 50\mathrm{Hz})$$

4) Bandwidth of VSB

Open Calculator

fx $$\mathrm{BW_{VSB}} = \mathrm{f_{m\text{-}DSB}} + \mathrm{f_{v\text{-}DSB}}$$

ex $$250\mathrm{Hz} = 150\mathrm{Hz} + 100\mathrm{Hz}$$

5) Bandwidth with respect to Modulation Index of FM

Open Calculator

fx $$\mathrm{BW_{FM}} = (2 \cdot \Delta \mathrm{f}) \cdot \left(1 + \left(\frac{1}{\beta}\right)\right)$$

ex $$160\mathrm{Hz} = (2 \cdot 30\mathrm{Hz}) \cdot \left(1 + \left(\frac{1}{0.6}\right)\right)$$

6) Carrier Swing

Open Calculator

fx $$\mathrm{f_{cs}} = 2 \cdot \Delta \mathrm{f}$$

ex $$60\mathrm{Hz} = 2 \cdot 30\mathrm{Hz}$$

7) Frequency Deviation

Open Calculator

fx $$\Delta \mathrm{f} = \mathrm{K_f} \cdot \mathrm{A_{m(peak)}}$$

ex $$30\mathrm{Hz} = 0.75\mathrm{Hz} \cdot 40\mathrm{V}$$

8) Frequency Deviation provided Modulation Index

Open Calculator

fx $$\Delta \mathrm{f} = \beta \cdot \mathrm{f_{mod}}$$

ex $$30\mathrm{Hz} = 0.6 \cdot 50\mathrm{Hz}$$

9) Frequency Sensitivity

Open Calculator

fx $$K_f = \frac{\Delta f}{A_{m(peak)}}$$

ex $$0.75\text{Hz} = \frac{30\text{Hz}}{40\text{V}}$$

10) Lower Sideband Frequency

Open Calculator

fx $$f_{LSB} = (f_c - f_{msg})$$

ex $$35.133\text{Hz} = (50.133\text{Hz} - 15\text{Hz})$$

11) Lower Sideband Power

Open Calculator

fx $$P_{lsb} = A_c^2 \cdot \frac{\mu^2}{8 \cdot R}$$

ex $$0.03738\text{W} = (17\text{V})^2 \cdot \frac{(0.36)^2}{8 \cdot 125.25\Omega}$$

12) Lower Sideband Power with respect to Carrier Power

Open Calculator

fx $$P_{lsb} = P_c \cdot \frac{\mu^2}{4}$$

ex $$0.037454\text{W} = 1.156\text{W} \cdot \frac{(0.36)^2}{4}$$

13) Modulating Frequency

Open Calculator

fx $$f_{mod} = \frac{\omega}{2 \cdot \pi}$$

ex $$50.13381\text{Hz} = \frac{315\text{rad/s}}{2 \cdot \pi}$$

14) Modulating Signal Amplitude of FM Receiver

Open Calculator

fx $$A_m = \frac{\Delta P}{K_p \cdot F_m}$$

ex $$6.120062\text{V} = \frac{912.0}{3.3 \cdot 45.157\text{Hz}}$$

15) Modulating Signal Frequency of FM Receiver

Open Calculator

fx $$F_m = \frac{\Delta P}{K_p \cdot A_m}$$

ex $$45.15746\text{Hz} = \frac{912.0}{3.3 \cdot 6.12\text{V}}$$

16) Modulation Index of FM Wave

Open Calculator

fx $$\beta = \frac{\Delta f}{f_{mod}}$$

ex $$0.6 = \frac{30\text{Hz}}{50\text{Hz}}$$

17) Pre Detection Signal to Noise Ratio

Open Calculator

$$\mathrm{SNR_{pre}} = \frac{\mathrm{A_{DSB}^2} \cdot \mathrm{P_{DSB\text{-}SC}}}{2 \cdot \mathrm{N_{0\text{-}DSB}} \cdot \mathrm{BW_{t\text{-}DSB}}}$$

$$0.468847\mathrm{dB} = \frac{(16.999\mathrm{V})^2 \cdot 129.8\mathrm{W}}{2 \cdot 10\mathrm{W*s} \cdot 4000\mathrm{Hz}}$$

18) Transmitted Power of DSB-SC

Open Calculator

$$\mathrm{P_{t\text{-}DSB}} = \mathrm{P_{U\text{-}DSB}} + \mathrm{P_{L\text{-}DSB}}$$

$$351\mathrm{W} = 250.5\mathrm{W} + 100.5\mathrm{W}$$

19) Upper Sideband Frequency

Open Calculator

$$\mathrm{f_{USB}} = (\mathrm{f_c} + \mathrm{f_{msg}})$$

$$65.133\mathrm{Hz} = (50.133\mathrm{Hz} + 15\mathrm{Hz})$$

20) Upper Sideband Power

Open Calculator

$$\mathrm{P_{usb}} = \frac{\mathrm{A_c^2} \cdot \mu^2}{8 \cdot \mathrm{R}}$$

$$0.03738\mathrm{W} = \frac{(17\mathrm{V})^2 \cdot (0.36)^2}{8 \cdot 125.25\Omega}$$

21) Upper Sideband Power with respect to Carrier Power

Open Calculator

fx $$P_{usb} = P_c \cdot \frac{\mu^2}{4}$$

ex $$0.037454\text{W} = 1.156\text{W} \cdot \frac{(0.36)^2}{4}$$

Variables Used

- A_c Amplitude of Carrier Signal *(Volt)*
- A_{DSB} Amplitude of Carrier Signal DSB-SC *(Volt)*
- A_m Amplitude of Modulating Signal *(Volt)*
- $A_{m(peak)}$ Peak Amplitude of Message *(Volt)*
- BW_{DSB} Bandwidth in DSB-SC *(Hertz)*
- BW_{FM} Bandwidth of FM Wave *(Hertz)*
- $BW_{t\text{-}DSB}$ Transmission Bandwidth DSBSC *(Hertz)*
- BW_{VSB} Bandwidth of VSB *(Hertz)*
- f_c Carrier Frequency *(Hertz)*
- f_{cs} Carrier Swing *(Hertz)*
- f_{LSB} Lower Sideband Frequency *(Hertz)*
- F_m Modulating Signal Frequency *(Hertz)*
- $f_{m\text{-}DSB}$ Maximum Frequency DSB-SC *(Hertz)*
- f_{mod} Modulating Frequency *(Hertz)*
- f_{msg} Message Maximum Frequency *(Hertz)*
- f_{USB} Upper Sideband Frequency *(Hertz)*
- $f_{v\text{-}DSB}$ Vestige Frequency *(Hertz)*
- K_f Frequency Sensitivity *(Hertz)*
- K_p Proportionality Constant
- $N_{0\text{-}DSB}$ Noise Density DSB-SC *(Watt-Second)*

- P_c Carrier Power *(Watt)*
- P_{DSB-SC} Total Power DSB-SC *(Watt)*
- P_{L-DSB} Lower Sideband Power DSB-SC *(Watt)*
- P_{lsb} Lower Sideband Power *(Watt)*
- P_{t-DSB} Transmitted Power of DSB-SC *(Watt)*
- P_{U-DSB} Upper Sideband Power in DSB-SC *(Watt)*
- P_{usb} Upper Sideband Power *(Watt)*
- R Resistance *(Ohm)*
- SNR_{pre} Pre Detection SNR of DSB-SC *(Decibel)*
- β Modulation Index in FM
- Δf Frequency Deviation *(Hertz)*
- ΔP Phase Deviation
- μ Modulation Index
- ω Angular Frequency *(Radian per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Energy** in Watt-Second (W*s)
  Energy Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Noise** in Decibel (dB)
  Noise Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Angular Frequency** in Radian per Second (rad/s)
  Angular Frequency Unit Conversion

Check other formula lists

- **Amplitude Modulation Characteristics Formulas**
- **Analog Noise and Power Analysis Formulas**
- **Frequency Modulation Formulas**
- **Fundamentals of Analog Communications Formulas**
- **Sideband and Frequency Modulation Formulas**

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