Important Amplitude Modulation Characteristics Formulas PDF

Formulas
Examples
with Units

List of 18
Important Amplitude Modulation Characteristics Formulas

1) Amplitude of Each Sideband Formula

Evaluate Formula

Formula

$$A_{sb} = \frac{\mu \cdot A_c}{2}$$

Example with Units

$$3.06\,\text{V} = \frac{0.36 \cdot 17\,\text{V}}{2}$$

2) Amplitude Sensitivity of Modulator Formula

Evaluate Formula

Formula

$$K_a = \frac{1}{A_c}$$

Example with Units

$$0.0588 = \frac{1}{17\,\text{V}}$$

3) Average Total Power of AM Wave Formula

Evaluate Formula

Formula

$$P_t = P_c \cdot \left(1 + \frac{\mu^2}{2}\right)$$

Example with Units

$$1.2309\,\text{W} = 1.156\,\text{W} \cdot \left(1 + \frac{0.36^2}{2}\right)$$

4) Bandwidth Improvement of AM Receiver Formula

Evaluate Formula

Formula

$$B_{imp} = \frac{BW_{rf}}{B_{if}}$$

Example with Units

$$100 = \frac{90000\,\text{b/s}}{900\,\text{b/s}}$$

5) Bandwidth of AM wave Formula

Evaluate Formula

Formula

$$BW_{am} = 2 \cdot f_m$$

Example with Units

$$300\,\text{Hz} = 2 \cdot 150\,\text{Hz}$$

6) Coupling Factor of AM Receiver Formula

Evaluate Formula

Formula

$$cf = \left(\frac{f_{img}}{f_{rf}}\right) - \left(\frac{f_{rf}}{f_{img}}\right)$$

Example with Units

$$3.2634 = \left(\frac{195\,\text{Hz}}{55\,\text{Hz}}\right) - \left(\frac{55\,\text{Hz}}{195\,\text{Hz}}\right)$$

7) Image Frequency Bandwidth of AM Receiver Formula

Evaluate Formula

Formula

$$B_{if} = \frac{BW_{rf}}{B_{imp}}$$

Example with Units

$$900\,\text{b/s} = \frac{90000\,\text{b/s}}{100}$$

8) Local Oscillation Frequency of AM Receiver Formula

Evaluate Formula

Formula

$$f_{lo} = f_{rf} + f_{im}$$

Example with Units

$$125\,\text{Hz} = 55\,\text{Hz} + 70\,\text{Hz}$$

9) Magnitude of Modulating Signal Formula

Evaluate Formula

Formula

$$A = \frac{A_{max} - A_{min}}{2}$$

Example with Units

$$2.2032\,\text{V} = \frac{19.2032\,\text{V} - 14.7968\,\text{V}}{2}$$

10) Maximum Amplitude of AM Wave Formula

Evaluate Formula

Formula

$$A_{max} = A_c \cdot \left(1 + \mu^2\right)$$

Example with Units

$$19.2032\,\text{V} = 17\,\text{V} \cdot \left(1 + 0.36^2\right)$$

11) Minimum Amplitude of AM Wave Formula

Evaluate Formula

Formula

$$A_{min} = A_c \cdot \left(1 - \mu^2\right)$$

Example with Units

$$14.7968\,\text{V} = 17\,\text{V} \cdot \left(1 - 0.36^2\right)$$

12) Phase Deviation of AM Receiver Formula

Evaluate Formula

Formula

$$\Delta P = K_p \cdot A_m \cdot F_m$$

Example with Units

$$911.9908 = 3.3 \cdot 6.12\,\text{V} \cdot 45.157\,\text{Hz}$$

13) Post Detection Signal to Noise Ratio of AM Formula

Evaluate Formula

Formula

$$SNR_{post} = \frac{A_c^2 \cdot K_a^2 \cdot P_t}{2 \cdot N_0 \cdot BW_{tm}}$$

Example with Units

$$0.0226 = \frac{17\,\text{V}^2 \cdot 0.05^2 \cdot 1.4\,\text{W}}{2 \cdot 0.0056\,\text{W*s} \cdot 4000\,\text{Hz}}$$

14) Pre Detection Signal to Noise Ratio of AM Formula

Evaluate Formula

Formula

$$SNR_{pre} = \frac{A_c^2 \cdot \left(1 + K_a^2 \cdot P_t\right)}{2 \cdot N_0 \cdot BW_{tm}}$$

Example with Units

$$6.4735\,\text{dB} = \frac{17\,\text{V}^2 \cdot \left(1 + 0.05^2 \cdot 1.4\,\text{W}\right)}{2 \cdot 0.0056\,\text{W*s} \cdot 4000\,\text{Hz}}$$

15) Quality Factor of AM Receiver Formula

Evaluate Formula

Formula

$$Q = \frac{1}{2 \cdot \pi} \cdot \sqrt{\frac{L}{C}}$$

Example with Units

$$0.2194 = \frac{1}{2 \cdot 3.1416} \cdot \sqrt{\frac{5.7\,\text{H}}{3\,\text{F}}}$$

16) Radio Frequency Bandwidth of AM Receiver Formula

Evaluate Formula

Formula

$$BW_{rf} = B_{imp} \cdot B_{if}$$

Example with Units

$$90000\,\text{b/s} = 100 \cdot 900\,\text{b/s}$$

17) Total Current of AM Wave Formula

Evaluate Formula

Formula

$$i_t = I_c \cdot \sqrt{1 + \left(\frac{\mu^2}{2}\right)}$$

Example with Units

$$1.7026\,\text{A} = 1.65\,\text{A} \cdot \sqrt{1 + \left(\frac{0.36^2}{2}\right)}$$

18) Total Power of AM wave Formula

Evaluate Formula

Formula

$$P_t = P_c + P_{usb} + P_{lsb}$$

Example with Units

$$1.5675\,\text{W} = 1.156\,\text{W} + 0.037\,\text{W} + 0.37454\,\text{W}$$

Variables used in list of Amplitude Modulation Characteristics Formulas above

- **A** Modulating Signal Magnitude *(Volt)*
- A_c Amplitude of Carrier Signal *(Volt)*
- A_m Amplitude of Modulating Signal *(Volt)*
- A_{max} Maximum Amplitude of AM Wave *(Volt)*
- A_{min} Minimum Amplitude of AM Wave *(Volt)*
- A_{sb} Amplitude of each Sideband *(Volt)*
- B_{if} Image Frequency Bandwidth *(Bit Per Second)*
- B_{imp} Bandwidth Improvement
- BW_{am} Bandwidth of AM Wave *(Hertz)*
- BW_{rf} Radio Frequency Bandwidth *(Bit Per Second)*
- BW_{tm} Transmission Bandwidth *(Hertz)*
- **C** Capacitance *(Farad)*
- **cf** Coupling Factor
- f_{im} Intermediate Frequency *(Hertz)*
- f_{img} Image Frequency *(Hertz)*
- f_{lo} Local Oscillation Frequency *(Hertz)*
- f_m Maximum Frequency *(Hertz)*
- F_m Modulating Signal Frequency *(Hertz)*
- f_{rf} Radio Frequency *(Hertz)*
- I_c Carrier Current *(Ampere)*
- i_t Total Current of AM Wave *(Ampere)*
- K_a Amplitude Sensitivity of Modulator
- K_p Proportionality Constant
- **L** Inductance *(Henry)*
- N_0 Noise Density *(Watt-Second)*
- P_c Carrier Power *(Watt)*
- P_{lsb} Lower Sideband Power *(Watt)*
- P_t Total Power *(Watt)*
- P_{usb} Upper Sideband Power *(Watt)*
- **Q** Quality Factor

Constants, Functions, Measurements used in list of Amplitude Modulation Characteristics Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **sqrt**, sqrt(Number) *A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- Measurement: **Electric Current** in Ampere (A) *Electric Current Unit Conversion*
- 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: **Capacitance** in Farad (F) *Capacitance Unit Conversion*
- Measurement: **Inductance** in Henry (H) *Inductance Unit Conversion*
- Measurement: **Electric Potential** in Volt (V) *Electric Potential Unit Conversion*
- Measurement: **Bandwidth** in Bit Per Second (b/s) *Bandwidth Unit Conversion*

- SNR_{post} Post Detection SNR of AM
- SNR_{pre} Pre Detection SNR of SSB *(Decibel)*
- ΔP Phase Deviation
- μ Modulation Index

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