Important Antenna Theory Parameters Formulas PDF

Formulas
Examples
with Units

List of 24
Important Antenna Theory Parameters Formulas

1) Antenna Current Formula

Evaluate Formula

Formula

$$I_a = \frac{E_{gnd} \cdot \lambda \cdot D}{120 \cdot \pi \cdot h_t \cdot h_r}$$

Example with Units

$$2246.8933\,\text{A} = \frac{400\,\text{V/m} \cdot 90\,\text{m} \cdot 1200\,\text{m}}{120 \cdot 3.1416 \cdot 10.2\,\text{m} \cdot 5\,\text{m}}$$

2) Antenna Efficiency Formula

Evaluate Formula

Formula

$$E_t = \frac{P_{rad}}{P_i}$$

Example with Units

$$0.0123 = \frac{34\,\text{W}}{2765\,\text{W}}$$

3) Antenna Gain Formula

Evaluate Formula

Formula

$$G = \frac{U}{U_o}$$

Example with Units

$$300 = \frac{27\,\text{W/sr}}{0.09\,\text{W/sr}}$$

4) Average Radiation Intensity Formula

Evaluate Formula

Formula

$$R_{avg} = \frac{U}{D_a}$$

Example with Units

$$337.5\,\text{W/sr} = \frac{27\,\text{W/sr}}{0.08}$$

5) Directivity of Antenna Formula

Evaluate Formula

Formula

$$D_a = \frac{U}{R_{avg}}$$

Example with Units

$$8.6538 = \frac{27\,\text{W/sr}}{3.12\,\text{W/sr}}$$

6) Distance between Transmitting and Receiving Point Formula

Evaluate Formula

Formula

$$D = \frac{I_a \cdot 120 \cdot \pi \cdot h_t \cdot h_r}{E_{gnd} \cdot \lambda}$$

Example with Units

$$1199.9982\,\text{m} = \frac{2246.89\,\text{A} \cdot 120 \cdot 3.1416 \cdot 10.2\,\text{m} \cdot 5\,\text{m}}{400\,\text{V/m} \cdot 90\,\text{m}}$$

7) Duct Height Formula

Evaluate Formula

Formula

$$d = \left(\frac{\lambda_{max}}{0.014} \right)^{\frac{2}{3}}$$

Example with Units

$$9\,\text{m} = \left(\frac{0.378\,\text{m}}{0.014} \right)^{\frac{2}{3}}$$

8) Effective Area of Antenna Formula

Evaluate Formula

Formula

$$A_e = \frac{k \cdot \Delta T}{S}$$

Example with Units

$$2.8955\,\text{m}^2 = \frac{12.25\,\text{K/W} \cdot 13\,\text{K}}{55\,\text{W/m}^3}$$

9) Friis Formula Formula

Evaluate Formula

Formula

$$P_r = P_t \cdot G_r \cdot G_t \cdot \frac{\lambda^2}{\left(4 \cdot 3.14 \cdot D\right)^2}$$

Example with Units

$$111.6245\,\text{W} = 1570\,\text{W} \cdot 6.31\,\text{dB} \cdot 316\,\text{dB} \cdot \frac{90\,\text{m}^2}{\left(4 \cdot 3.14 \cdot 1200\,\text{m}\right)^2}$$

10) Height of Receiving Antenna Formula

Evaluate Formula

Formula

$$h_r = \frac{E_{gnd} \cdot \lambda \cdot D}{120 \cdot \pi \cdot h_t \cdot I_a}$$

Example with Units

$$5\,\text{m} = \frac{400\,\text{V/m} \cdot 90\,\text{m} \cdot 1200\,\text{m}}{120 \cdot 3.1416 \cdot 10.2\,\text{m} \cdot 2246.89\,\text{A}}$$

11) Height of Transmitting Antenna Formula

Evaluate Formula

Formula

$$h_t = \frac{E_{gnd} \cdot \lambda \cdot D}{120 \cdot \pi \cdot I_a \cdot h_r}$$

Example with Units

$$10.2\,\text{m} = \frac{400\,\text{V/m} \cdot 90\,\text{m} \cdot 1200\,\text{m}}{120 \cdot 3.1416 \cdot 2246.89\,\text{A} \cdot 5\,\text{m}}$$

12) Isotropic Radiation Intensity Formula

Evaluate Formula

Formula

$$U_o = \frac{P_{rad}}{4 \cdot \pi}$$

Example with Units

$$2.7056\,\text{W/sr} = \frac{34\,\text{W}}{4 \cdot 3.1416}$$

13) Length of Binomial Array Formula

Evaluate Formula

Formula

$$L = \left(n - 1\right) \cdot \frac{\lambda}{2}$$

Example with Units

$$225\,\text{m} = \left(6 - 1\right) \cdot \frac{90\,\text{m}}{2}$$

14) Maximum Duct Wavelength Formula

Evaluate Formula

Formula

$$\lambda_{max} = 0.014 \cdot d^{\frac{3}{2}}$$

Example with Units

$$0.378\,\text{m} = 0.014 \cdot 9\,\text{m}^{\frac{3}{2}}$$

15) Noise Temperature of Antenna Formula

Evaluate Formula

Formula

$$T_a = \frac{S}{k \cdot B_a}$$

Example with Units

$$17.2684\,\text{K} = \frac{55\,\text{W/m}^3}{12.25\,\text{K/W} \cdot 0.26\,\text{Hz}}$$

16) Ohmic Resistance Formula

Evaluate Formula

Formula

$$R_{ohm} = R_t - R_{rad}$$

Example with Units

$$2.5\,\Omega = 4.75\,\Omega - 2.25\,\Omega$$

17) Power Density of Antenna Formula

Evaluate Formula

Formula

$$S = \frac{P_i \cdot G}{4 \cdot \pi \cdot D}$$

Example with Units

$$55.0079\,\text{W/m}^3 = \frac{2765\,\text{W} \cdot 300}{4 \cdot 3.1416 \cdot 1200\,\text{m}}$$

18) Power Per Unit Bandwidth Formula

Evaluate Formula

Formula

$$P_u = k \cdot T_R$$

Example with Units

$$150.0012\,\text{W} = 12.25\,\text{K/W} \cdot 12.245\,\text{K}$$

19) Radiation Intensity Formula

Evaluate Formula

Formula

$$U = U_o \cdot D_a$$

Example with Units

$$0.0072\,\text{W/sr} = 0.09\,\text{W/sr} \cdot 0.08$$

20) Radiation Resistance Formula

Evaluate Formula

Formula

$$R_{rad} = R_t - R_{ohm}$$

Example with Units

$$2.25\,\Omega = 4.75\,\Omega - 2.5\,\Omega$$

21) Strength of Ground Wave Formula

Evaluate Formula

Formula

$$E_{gnd} = \frac{120 \cdot \pi \cdot h_t \cdot h_r \cdot I_a}{\lambda \cdot D}$$

Example with Units

$$399.9994\,\text{V/m} = \frac{120 \cdot 3.1416 \cdot 10.2\,\text{m} \cdot 5\,\text{m} \cdot 2246.89\,\text{A}}{90\,\text{m} \cdot 1200\,\text{m}}$$

22) Total Antenna Resistance Formula

Evaluate Formula

Formula

$$R_t = R_{ohm} + R_{rad}$$

Example with Units

$$4.75\,\Omega = 2.5\,\Omega + 2.25\,\Omega$$

23) Total Input Power Formula

Evaluate Formula

Formula

$$P_i = \frac{P_{rad}}{E_t}$$

Example with Units

$$4250\,\text{W} = \frac{34\,\text{W}}{0.008}$$

24) Total Power of Antenna Formula

Evaluate Formula

Formula

$$P_a = k \cdot T_a \cdot B_a$$

Example with Units

$$54.9986\,\text{W} = 12.25\,\text{K/W} \cdot 17.268\,\text{K} \cdot 0.26\,\text{Hz}$$

Variables used in list of Antenna Theory Parameters Formulas above

- A_e Effective Area Antenna *(Square Meter)*
- B_a Bandwidth *(Hertz)*
- **d** Duct Height *(Meter)*
- **D** Transmitter Receiver Distance *(Meter)*
- D_a Directivity of Antenna
- E_{gnd} Strength of Ground Wave Propagation *(Volt per Meter)*
- E_t Antenna Efficiency
- **G** Antenna Gain
- G_r Gain of Receiving Antenna *(Decibel)*
- G_t Gain of Transmitting Antenna *(Decibel)*
- h_r Height of Receiver *(Meter)*
- h_t Height of Transmitter *(Meter)*
- I_a Antenna Current *(Ampere)*
- **k** Thermal Resistance *(Kelvin per Watt)*
- **L** Length of Binomial Array *(Meter)*
- **n** No of Element
- P_a Total Power of Antenna *(Watt)*
- P_i Total Input Power *(Watt)*
- P_r Power at Receiving Antenna *(Watt)*
- P_{rad} Radiated Power *(Watt)*
- P_t Transmitting Power *(Watt)*
- P_u Power per Unit *(Watt)*
- R_{avg} Average Radiation Intensity *(Watt per Steradian)*
- R_{ohm} Ohmic Resistance *(Ohm)*
- R_{rad} Radiation Resistance *(Ohm)*
- R_t Total Antenna Resistance *(Ohm)*
- **S** Power Density of Antenna *(Watt Per Cubic Meter)*
- T_a Antenna Temperature *(Kelvin)*
- T_R Resistor Absolute Temperature *(Kelvin)*

Constants, Functions, Measurements used in list of Antenna Theory Parameters Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Wavelength** in Meter (m)
  Wavelength Unit Conversion
- Measurement: **Electric Field Strength** in Volt per Meter (V/m)
  Electric Field Strength Unit Conversion
- Measurement: **Thermal Resistance** in Kelvin per Watt (K/W)
  Thermal Resistance Unit Conversion
- Measurement: **Sound** in Decibel (dB)
  Sound Unit Conversion
- Measurement: **Power Density** in Watt Per Cubic Meter (W/m³)
  Power Density Unit Conversion
- Measurement: **Radiant Intensity** in Watt per Steradian (W/sr)
  Radiant Intensity Unit Conversion

- **U** Radiation Intensity *(Watt per Steradian)*
- **U_o** Isotropic Radiation Intensity *(Watt per Steradian)*
- **ΔT** Incremental Temperature *(Kelvin)*
- **λ** Wavelength *(Meter)*
- **λ_{max}** Maximum Duct Wavelength *(Meter)*

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