Important Geostationary Orbit Formulas PDF

Formulas
Examples
with Units

List of 14
Important Geostationary Orbit Formulas

1) Acute Value Formula

Evaluate Formula

Formula

$$\angle\theta_{acute} = \angle\theta_S - \angle\theta_z$$

Example with Units

$$80° = 180° - 100°$$

2) Angle of Elevation Formula

Evaluate Formula

Formula

$$\angle\theta_{el} = \angle\theta_R - \angle\theta_{tilt} - \lambda_e$$

Example with Units

$$42° = 90° - 31° - 17°$$

3) Angle of Tilt Formula

Evaluate Formula

Formula

$$\angle\theta_{tilt} = \angle\theta_R - \angle\theta_{el} - \lambda_e$$

Example with Units

$$31° = 90° - 42° - 17°$$

4) Apogee Heights Formula

Evaluate Formula

Formula

$$H_{apogee} = r_{apogee} - [Earth\text{-}R]$$

Example with Units

$$2476.9912\,km = 8848\,km - 6371.0088\,km$$

5) Azimuth Angle Formula

Evaluate Formula

Formula

$$\angle\theta_z = \angle\theta_S - \angle\theta_{acute}$$

Example with Units

$$100° = 180° - 80°$$

6) Earth Station Latitude Formula

Evaluate Formula

Formula

$$\lambda_e = \angle\theta_R - \angle\theta_{el} - \angle\theta_{tilt}$$

Example with Units

$$17° = 90° - 42° - 31°$$

7) Geostationary Height Formula

Evaluate Formula

Formula

$$H_{gso} = R_{gso} - [Earth\text{-}R]$$

Example with Units

$$381.7912\,km = 6752.8\,km - 6371.0088\,km$$

8) Geostationary Radius Formula

Evaluate Formula

Formula

$$R_{gso} = H_{gso} + [Earth\text{-}R]$$

Example with Units

$$6752.8088\,km = 381.8\,km + 6371.0088\,km$$

9) Length of Radius Vectors at Apogee Formula

Evaluate Formula

Formula

$$r_{apogee} = a_{orbit} \cdot (1 + e)$$

Example with Units

$$8848\,km = 7900\,km \cdot (1 + 0.12)$$

10) Length of Radius Vectors at Perigee Formula

Evaluate Formula

Formula

$$r_{perigee} = a_{orbit} \cdot (1 - e)$$

Example with Units

$$6952\,km = 7900\,km \cdot (1 - 0.12)$$

11) Perigee Heights Formula

Evaluate Formula

Formula

$$H_p = r_{perigee} - [Earth\text{-}R]$$

Example with Units

$$580.9912\,km = 6952\,km - 6371.0088\,km$$

12) Power Density at Satellite Station Formula

Evaluate Formula

Formula

$$P_d = EIRP - L_{path} - L_{total} - (10 \cdot \log10(4 \cdot \pi)) - (20 \cdot \log10(R_{sat}))$$

Example with Units

$$922.9255\,W = 1100\,W - 12\,dB - 50\,dB - (10 \cdot \log10(4 \cdot 3.1416)) - (20 \cdot \log10(160\,km))$$

13) Satellite Geostationary Radius Formula

Evaluate Formula

Formula

$$R_{gso} = \left(\frac{[GM.Earth] \cdot P_{day}}{4 \cdot \pi^2}\right)^{\frac{1}{3}}$$

Example with Units

$$6752.8768\,km = \left(\frac{4E{+}14\,m^3/s^2 \cdot 353\,d}{4 \cdot 3.1416^2}\right)^{\frac{1}{3}}$$

14) Time of Perigee Passage Formula

Evaluate Formula

Formula

$$L_{perigee} = t_{min} - \left(\frac{M}{n}\right)$$

Example with Units

$$19.7934\,min = 20\,min - \left(\frac{31.958°}{0.045\,rad/s}\right)$$

Variables used in list of Geostationary Orbit Formulas above

- $\angle\theta_{acute}$ Acute Angle *(Degree)*
- $\angle\theta_{el}$ Angle of Elevation *(Degree)*
- $\angle\theta_{R}$ Right Angle *(Degree)*
- $\angle\theta_{S}$ Straight Angle *(Degree)*
- $\angle\theta_{tilt}$ Tilt Angle *(Degree)*
- $\angle\theta_{z}$ Azimuth Angle *(Degree)*
- a_{orbit} Major Orbital Axis *(Kilometer)*
- **e** Eccentricity
- **EIRP** Effective Isotropic Radiated Power *(Watt)*
- H_{apogee} Apogee Height *(Kilometer)*
- H_{gso} Geostationary Height *(Kilometer)*
- H_{p} Perigee Height *(Kilometer)*
- L_{path} Path Loss *(Decibel)*
- $L_{perigee}$ Perigee Passage *(Minute)*
- L_{total} Total Loss *(Decibel)*
- **M** Mean Anomaly *(Degree)*
- **n** Mean Motion *(Radian per Second)*
- P_{d} Power Density at Satellite Station *(Watt)*
- P_{day} Orbital Period in Days *(Day)*
- r_{apogee} Apogee Radius *(Kilometer)*
- R_{gso} Geostationary Radius *(Kilometer)*
- $r_{perigee}$ Perigee Radius *(Kilometer)*
- R_{sat} Range of Satellite *(Kilometer)*
- t_{min} Time in Minutes *(Minute)*
- λ_{e} Earth Station Latitude *(Degree)*

Constants, Functions, Measurements used in list of Geostationary Orbit Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[Earth-R]**, 6371.0088 *Earth mean radius*
- constant(s): **[GM.Earth]**, 3.986004418E+14 *Earth's Geocentric Gravitational Constant*
- Functions: **log10**, log10(Number) *The common logarithm, also known as the base-10 logarithm or the decimal logarithm, is a mathematical function that is the inverse of the exponential function.*
- Measurement: **Length** in Kilometer (km) *Length Unit Conversion*
- Measurement: **Time** in Day (d), Minute (min) *Time Unit Conversion*
- Measurement: **Power** in Watt (W) *Power Unit Conversion*
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion*
- Measurement: **Angular Velocity** in Radian per Second (rad/s) *Angular Velocity Unit Conversion*
- Measurement: **Sound** in Decibel (dB) *Sound Unit Conversion*

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