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Frequency Reuse Concept Formulas

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List of 16 Frequency Reuse Concept Formulas

Frequency Reuse Concept 🗗

1) Carrier Frequency using Maximum Doppler Shift 🗗

Open Calculator 🗗

$$fx \quad F_c = \frac{F_m \cdot [c]}{V}$$

$$ex \quad 1898.686\text{kHz} = \frac{0.0551\text{kHz} \cdot [c]}{8700\text{m/s}}$$

2) Channel Reuse Ratio 🗗

Open Calculator 🗗

$$fx \quad Q = \sqrt{3 \cdot K}$$

$$ex \quad 3.24037 = \sqrt{3 \cdot 3.5}$$

3) Coherence Bandwidth for Multipath Channel 🗗

Open Calculator 🗗

$$fx \quad B_c = \frac{1}{5 \cdot \sigma_t}$$

$$ex \quad 0.000699\text{kHz} = \frac{1}{5 \cdot 0.286\text{s}}$$

4) Coherence Bandwidth for Random Phases of Two Received Signals ⬈

Open Calculator ⬈

$$fx \quad B_{c'} = \frac{1}{4 \cdot 3.14 \cdot \Delta}$$

$$ex \quad 7.8E^\wedge\text{-}5kHz = \frac{1}{4 \cdot 3.14 \cdot 1.02s}$$

5) Coherence Bandwidth for Two Fading Amplitudes of Two Received Signals ⬈

Open Calculator ⬈

$$fx \quad B_{fad} = \frac{1}{2 \cdot 3.14 \cdot \Delta}$$

$$ex \quad 0.000156kHz = \frac{1}{2 \cdot 3.14 \cdot 1.02s}$$

6) Coherence Time ⬈

Open Calculator ⬈

$$fx \quad T_c = \frac{0.423}{F_m}$$

$$ex \quad 0.007677s = \frac{0.423}{0.0551kHz}$$

7) Delay Spread ⬈

Open Calculator ⬈

$$fx \quad \Delta = \frac{1}{2 \cdot 3.14 \cdot B_{fad}}$$

$$ex \quad 1.020741s = \frac{1}{2 \cdot 3.14 \cdot 0.000156kHz}$$

8) Forward Frame ⎘

fx $\text{F.F} = \tau + \text{R.F} + 44 \cdot \text{T}_\text{s}$

ex $2213 = 8\text{s} + 5 + 44 \cdot 50\text{s}$

9) M-Ary PAM ⎘

fx $\text{P}_{\sqrt{\text{M}}} = 1 - \sqrt{1 - \text{P}_{\sqrt{\text{Q}}}}$

ex $0.9 = 1 - \sqrt{1 - 0.99}$

10) M-Ary QAM ⎘

fx $\text{P}_{\sqrt{\text{Q}}} = 1 - \left(1 - \text{P}_{\sqrt{\text{M}}}\right)^2$

ex $0.99 = 1 - (1 - 0.9)^2$

11) Maximum Doppler Shift ⎘

fx $\text{F}_\text{m} = \left(\dfrac{\text{V}}{[\text{c}]}\right) \cdot \text{F}_\text{c}$

ex $0.055138\text{kHz} = \left(\dfrac{8700\text{m/s}}{[\text{c}]}\right) \cdot 1900\text{kHz}$

12) Maximum Excess Delay ⎘

fx $\text{X} = \tau_\text{x} - \tau_0$

ex $7.65\text{dB} = 14\text{dB} - 6.35\text{dB}$

13) Reverse Frame 📲

fx $R.F = F.F - (\tau + 44 \cdot T_s)$

ex $5 = 2213 - (8s + 44 \cdot 50s)$

14) RMS Delay Spread 📲

fx $\sigma_t = \sqrt{\tau'' - (\tau')^2}$

ex $0.286313s = \sqrt{0.084s - (0.045s)^2}$

15) Symbol Time Period 📲

fx $T_s = \dfrac{F.F - (\tau + R.F)}{44}$

ex $50s = \dfrac{2213 - (8s + 5)}{44}$

16) Time Slots 📲

fx $\tau = F.F - (R.F + 44 \cdot T_s)$

ex $8s = 2213 - (5 + 44 \cdot 50s)$

Variables Used

- B_c Coherence Bandwidth *(Kilohertz)*
- $B_{c'}$ Coherence Bandwidth Random Phase *(Kilohertz)*
- B_{fad} Coherence Bandwidth Fading *(Kilohertz)*
- F_c Carrier Frequency *(Kilohertz)*
- F_m Maximum Doppler Shift *(Kilohertz)*
- F.F Forward Frame
- K Frequency Reuse Pattern
- $P_{\sqrt{M}}$ M-Ary PAM
- $P_{\sqrt{Q}}$ M-Ary QAM
- Q Co Channel Reuse Ratio
- R.F Reverse Frame
- T_c Coherence Time *(Second)*
- T_s Symbol Time *(Second)*
- V Velocity *(Meter per Second)*
- X Maximum Excess Delay *(Decibel)*
- Δ Delay Spread *(Second)*
- $σ_t$ RMS Delay Spread *(Second)*
- τ' Mean Excess Delay *(Second)*
- τ'' Variance Mean Excess Delay *(Second)*
- $τ_0$ First Arriving Signal *(Decibel)*
- $τ_x$ Excess Delay Spread *(Decibel)*
- τ Time Slots *(Second)*

Constants, Functions, Measurements used

- Constant: **[c]**, 299792458.0 Meter/Second
  Light speed in vacuum
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Time** in Second (s)
  Time Unit Conversion 🔗
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion 🔗
- Measurement: **Frequency** in Kilohertz (kHz)
  Frequency Unit Conversion 🔗
- Measurement: **Sound** in Decibel (dB)
  Sound Unit Conversion 🔗

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