2.22) 
\[ f_d = 66.67 \text{ Hz, } \tau_{av} = 4.322 \text{ ms, } N_A = 69.96 \text{ crossings/s} \]

2.23) Channel is flat and fast.

2.25) A histogram of the sum of 10000 pairs of squared random Gaussian distributed random variables is shown in the top graph in the figure below. The Gaussian variables have a mean value of 0 and a standard deviation of \( \sigma = 8 \). The bottom figure is a histogram of 10000 exponentially distributed random variables. The exponential random variables have a mean of \( 2\sigma^2 = 128 \). The similarity of the histograms verifies that the sum is exponentially distributed. The ratio of the mean to the standard deviation is 1.0099 for data in the top figure and 0.96054 for the data in the bottom figure. Theoretically this ratio should be equal to 1.

![Histogram of Sum of Squared Gaussian and Exponential Distributions](image)

2.43) With frequency selective fading there is time dispersion and transmitted pulses become broader. With flat fading this does not occur. Dispersive means that the channel either spreads the pulse in the time domain (pulse duration) or frequency domain (bandwidth).

S2.13) 
\[ \text{a) Prob}[P_r > (P_{av} + 10)] = 0.1056 \]
\[ \text{b) Prob } [P_{r(10)} > (P_{av(20)} + 10)] = 0.5299 \]
S2.14)

a) fade margin = 9.869 dB

b) $h_{BS} = 4870$ m. (This is unrealistic. I doubt the Hata model is valid for heights this large.)