Q1. Consider a transmitter which radiates a carrier of 1850 MHz. For a vehicle moving 60 mps, compute the received carrier frequency if the mobile is moving:

- Directly towards the transmitter.
- Directly away from the transmitter.
- In a direction which is perpendicular to the direction of arrival of the transmitted signal.

Refer to Example 4.1 in the book of Theodor Rappaport. (“Wireless communications, 2nd edition”)

Q2. When the vehicle speed is 96 km/hr and the operation frequency is 850 MHz, what is the fading frequency when the vehicle is traveling in a multipath environment?

\[
\lambda = \frac{3 \times 10^8 \text{m/sec}}{850 \times 10^6} = 0.353 \text{m}
\]

\[
f_f \leq f_{\text{max}} = \frac{V}{\lambda} = \frac{26.67 \text{m/sec}}{0.353 \text{m}} = 75.565 \text{Hz}
\]

\[
f_f \leq 75.565 \text{Hz}
\]

Q3. Determine the greatest symbol rate that may be sent through RF channel shown below without using equalizer.

![Graph of Pf(\tau)](image)
HW4_Solution

\[
\overline{\tau} = \frac{0.01 \times 0 + 0.1 \times 1 + 1 \times 10}{0.01 + 0.1 + 1} = 9.46 \text{ (\mu s)}
\]

\[
\overline{\tau^2} = \frac{0.01 \times 0 + 0.1 \times 1^2 + 1 \times 10^2}{0.01 + 0.1 + 1} = 92.34 \text{ (\mu s}^2)\]

\[
\sigma_\tau = \sqrt{\overline{\tau^2} - (\overline{\tau})^2} = \sqrt{92.34 - (9.46)^2} = 1.688 \text{ (\mu s)}
\]

\[
T_{\text{min}} = 10 \sigma_\tau = 16.88 \text{ (\mu s)}
\]

\[
R_{\text{max}} = \frac{1}{T_{\text{min}}} = 59.25 \text{ kbps}
\]