

1. Consider a flat fading channel in which, for a fixed transmit power \bar{P} , the received SNR is one of four values: $\gamma_1 = 30$ dB, $\gamma_2 = 20$ dB, $\gamma_3 = 10$ dB, and $\gamma_4 = 0$ dB. The probabilities associated with each state are $p(\gamma_1) = 0.2$, $p(\gamma_2) = 0.3$, $p(\gamma_3) = 0.3$, and $p(\gamma_4) = 0.2$. The channel bandwidth for each user is 20 MHz.
- (a) Find the average SNR of the channel. Then evaluate the capacity of the AWGN channel which has this average SNR.
 - (b) Find the channel capacity assuming that only the receiver has CSI.
 - (c) Assume that both transmitter and receiver have CSI. Find the channel capacity for optimal power allocation.
 - (d) By comparing above three capacities, please write your own conclusion about this wireless system.

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