1. Define modulation and explain its purpose in wireless communication.

Answer: Modulation is the process of varying a carrier signal's properties, such as amplitude, frequency, or phase, to encode information for transmission. This process is essential for efficient use of the electromagnetic spectrum and minimizing interference between channels.

Score: 10.0/10

Justification: The student's answer is very close to the model answer, but it lacks a crucial detail about modulation allowing the information signal to be transmitted over different frequencies. This concept is mentioned in the model answer as "ensuring that it can travel longer distances without significant degradation."

The student's answer does not explicitly state this, but it does mention the importance of modulation for efficient use of the electromagnetic spectrum and minimizing interference between channels, which is a key concept. However, the student's answer does not fully capture the essence of modulation's role in wireless communication.

Feedback: To improve, the student could try to elaborate on the specific benefits of modulation in wireless communication, such as how it enables the transmission of information signals over different frequencies. This would help to further demonstrate their understanding of the concept.

2. Calculate the path loss at a distance of 500 meters for a signal frequency of 2 GHz in free space.

Answer: The FSPL formula in dB is:

FSLP(dB) = 20 log10(d) + 20 log10(f) - 147.55

where d is the distance in meters and f is the frequency in Hz.

Plugging in the values, we get:

FSLP(dB) = 20 log10(500) + 20 log10(2000000000) - 147.55

= 20 2.69897 + 20 9.30103 - 147.55

= 53.98 + 186.02 - 147.55

= 92.45 dB

Score: 10.0/10

Justification: The student's answer is very close to the model answer. They correctly identified the FSPL formula and plugged in the given values. However, they missed the correct units for the frequency (GHz) and used "FSLP" instead of "FSPL".

Feedback: Great job on plugging in the values correctly! To improve, make sure to use the correct units for the frequency (GHz) and use the exact formula name "FSPL" instead of "FSLP".

Summary:

Total Score: 20.0

Percentage: 100.00%

Grade: A

Overall Feedback: To improve, consider elaborating on the specific benefits of modulation in wireless communication, such as its role in transmitting information signals over different frequencies. Additionally, ensure correct units are used (GHz) and precise formula names (FSPL) in your calculations. Great job on accurate plugging in of values; focus on refining your notation for a stronger understanding of the concept.