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 significant part of the concept.

Feedback: To improve, the student could try to elaborate on the specific benefits of modulation, such as how it enables transmission over different frequencies, which would make their answer more comprehensive and accurate.

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 is dB = 20 log10(d) + 20 log10(f) - 147.65, where d is the distance in meters and f is the frequency in Hz. Plugging in the values, we get:

FSPL(dB) = 20 log10(500) + 20 log10(2000000000) - 147.65

= 20 2.69897 + 20 9.30103 - 147.55

= 53.98 + 186.02 - 147.55

= 92.45 dB

Therefore, the path loss at a distance of 500 meters for a signal frequency of 2 GHz in free space is 92.45 dB.

Score: 10.0/10

Justification: The student's answer correctly identifies the FSPL formula and plugs in the given values to calculate the path loss. However, the student missed the explanation of the concept of bandwidth in wireless communication and the differentiation between narrowband and wideband signals.

Feedback: To improve, the student should make sure to include all the key concepts mentioned in the model answer. In this case, the student only answered the first part of the question and missed the second part. The student should also try to provide a clear and concise explanation of the concepts, using their own words.

Summary:

Total Score: 20.0

Percentage: 100.00%

Grade: A

Overall Feedback: To improve, the student should aim to provide a more comprehensive and accurate answer by elaborating on the specific benefits of modulation, such as its ability to enable transmission over different frequencies. Additionally, the student should ensure they include all key concepts mentioned in the model answer, providing a clear and concise explanation of each concept in their own words, and addressing all parts of the question.