

Step 1: Modulation

Input: Multiple baseband signals (e.g., voice signals from telephones).

Process: Each baseband signal is modulated with a unique carrier frequency using amplitude modulation (AM), frequency modulation (FM), or phase modulation (PM).

Output: Modulated signals.

Diagram:

1. Baseband Signal:

- Signal 1 : $s_1(t)$
- Signal 2 : $s_2(t)$
- Signal 3 : $s_3(t)$

2. Carrier Frequencies:

- f_1
- f_2
- f_3

3. Modulated Signals:

- $s_1(t) \cdot \cos(2\pi f_1 t)$
- $s_2(t) \cdot \cos(2\pi f_2 t)$
- $s_3(t) \cdot \cos(2\pi f_3 t)$

Step 2: Multiplexing

Input: Modulated signals.

Process: The modulated signals are combined using a multiplexer.

Output: A single composite signal containing all the modulated signals.

Diagram:

1. Modulated Signals:

- $s_1(t) \cdot \cos(2\pi f_1 t)$
- $s_2(t) \cdot \cos(2\pi f_2 t)$
- $s_3(t) \cdot \cos(2\pi f_3 t)$

2. Composite Signal:

- $s(t) = s_1(t) \cdot \cos(2\pi f_1 t) + s_2(t) \cdot \cos(2\pi f_2 t) + s_3(t) \cdot \cos(2\pi f_3 t)$

Step 3: Transmission

Process: The composite signal is transmitted over a communication channel.

Step 4: Demultiplexing

Input: Received composite signal.

Process: The received composite signal is separated into individual modulated signals using a demultiplexer.

Output: Individual modulated signals.

Diagram:

1. Composite Signal:
 - $s(t)$
2. Demodulated Signals:
 - $s_1(t) \cdot \cos(2\pi f_1 t)$
 - $s_2(t) \cdot \cos(2\pi f_2 t)$
 - $s_3(t) \cdot \cos(2\pi f_3 t)$

Step 5: Demodulation

Input: Individual modulated signals.

Process: Each modulated signal is demodulated to retrieve the original baseband signal using a demodulator.

Output: Original baseband signals.

Diagram:

1. Modulated Signals:
 - $s_1(t) \cdot \cos(2\pi f_1 t)$
 - $s_2(t) \cdot \cos(2\pi f_2 t)$
 - $s_3(t) \cdot \cos(2\pi f_3 t)$
2. Demodulated Signals:
 - $s_1(t)$
 - $s_2(t)$
 - $s_3(t)$

Baseband Filtering

Process: Use baseband filters (low pass filters) to remove high-frequency components from the demodulated signals.

Output: Clean baseband signals.

Diagram:

1. Demodulated Signals:

- $s_1(t)$
- $s_2(t)$
- $s_3(t)$

2. Filtered Signals:

- $s_1(t)$
- $s_2(t)$
- $s_3(t)$

This process ensures the original signals are accurately transmitted, combined, separated, and retrieved, with baseband filtering applied where necessary to ensure signal clarity.