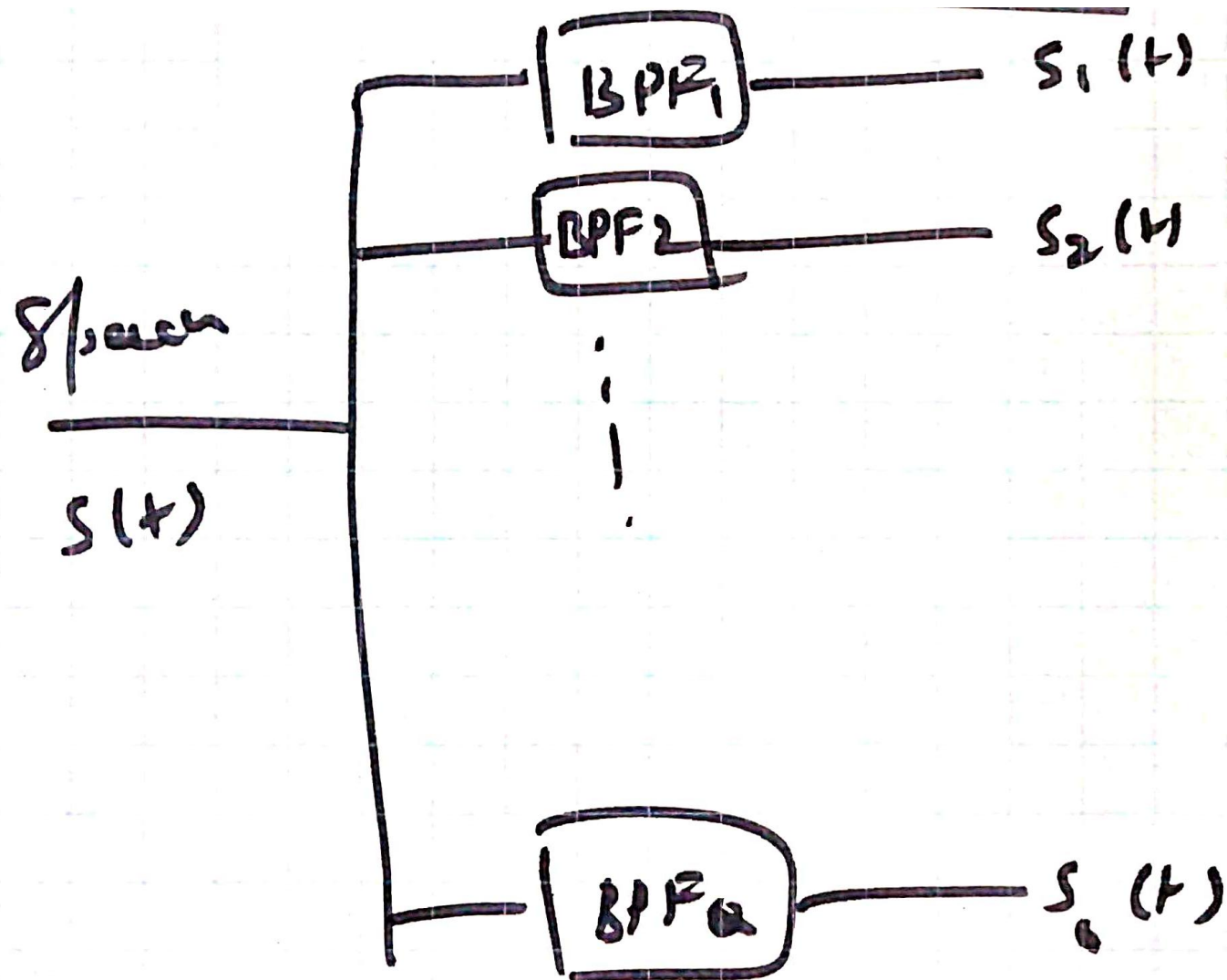


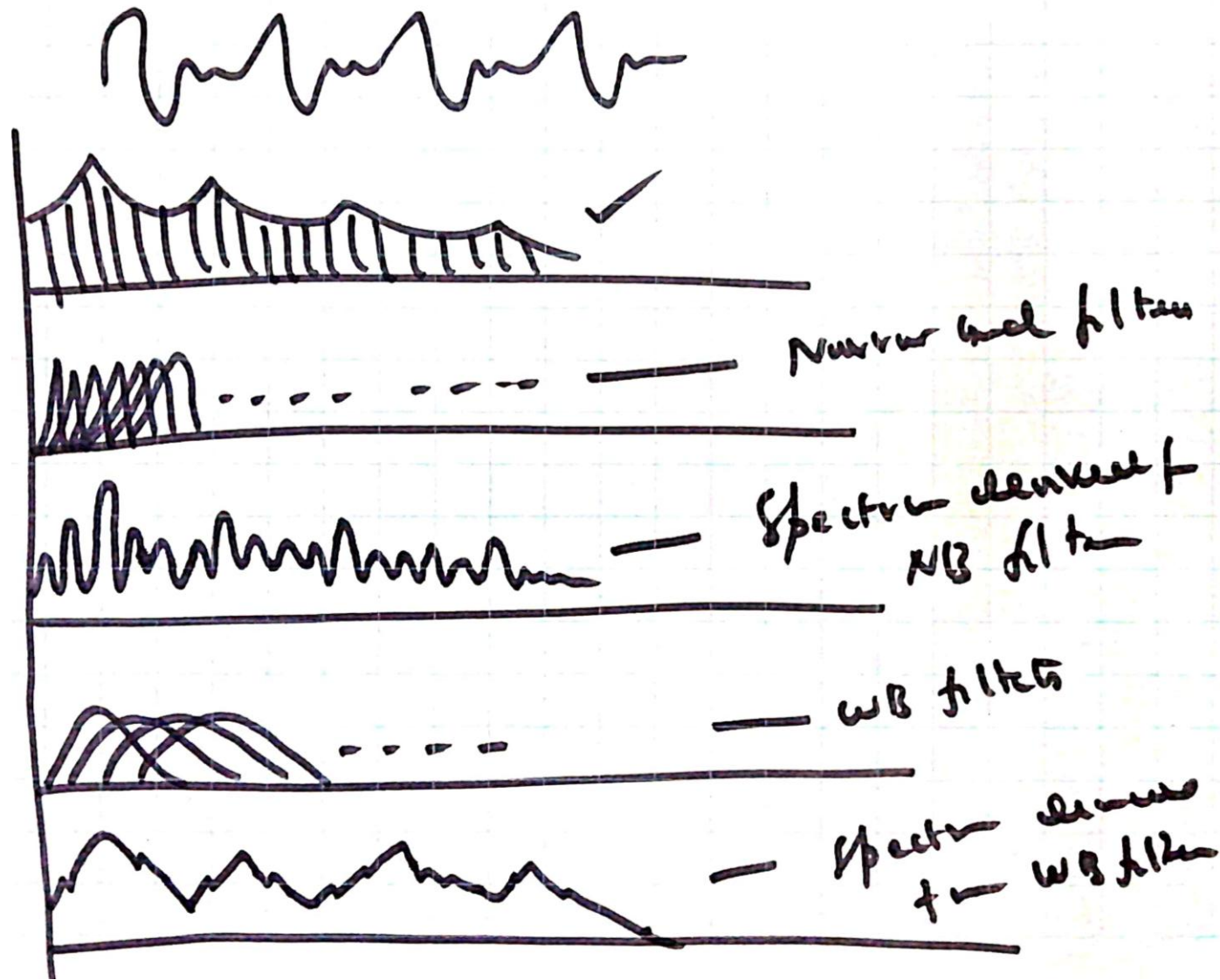
# Frequency Domain Analysis of Speech & Filter-Bank Analysis



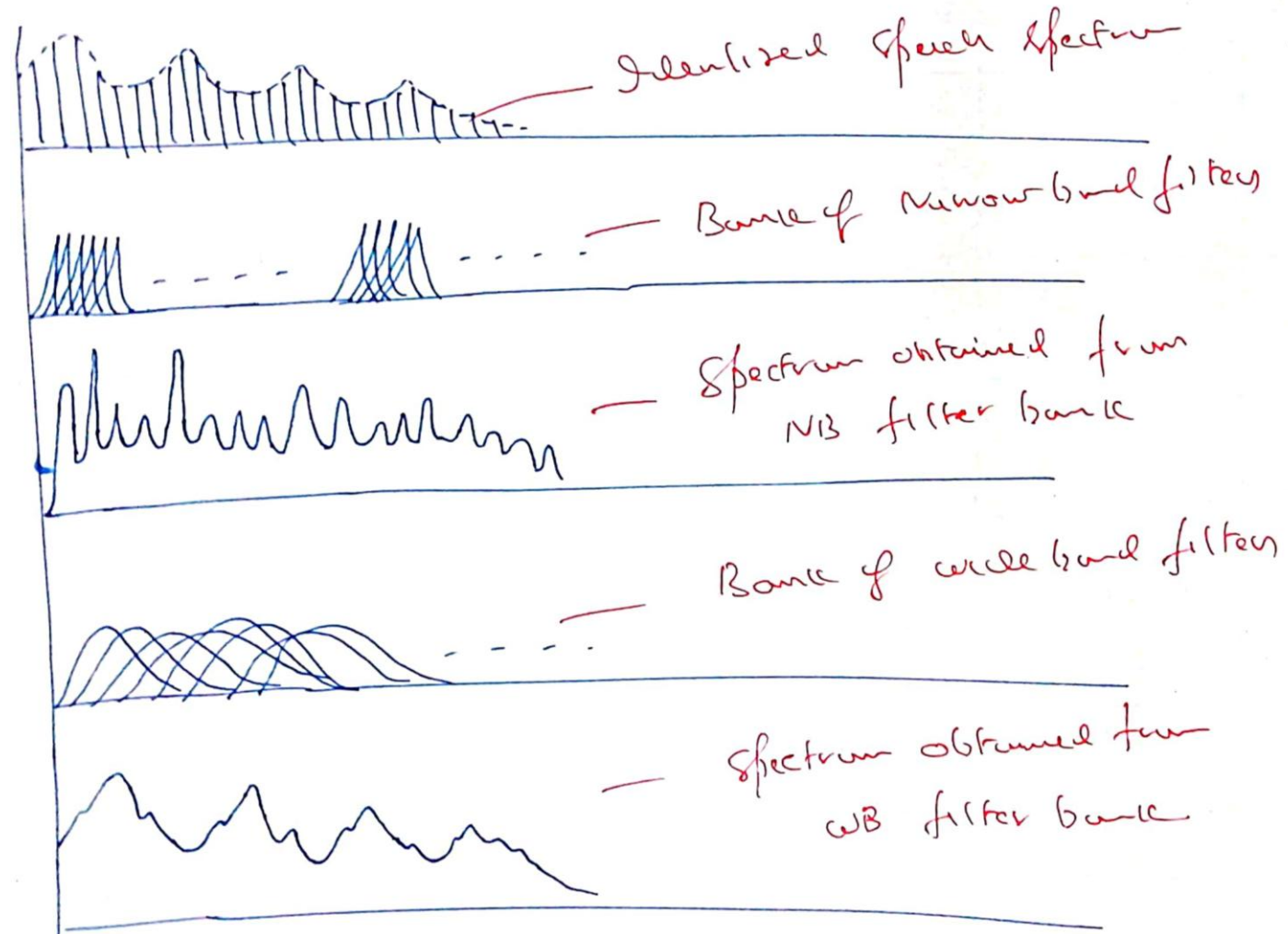
# Filter Bank Analysis of Speech



# Filter Bank Analysis of Speech (Cont..)



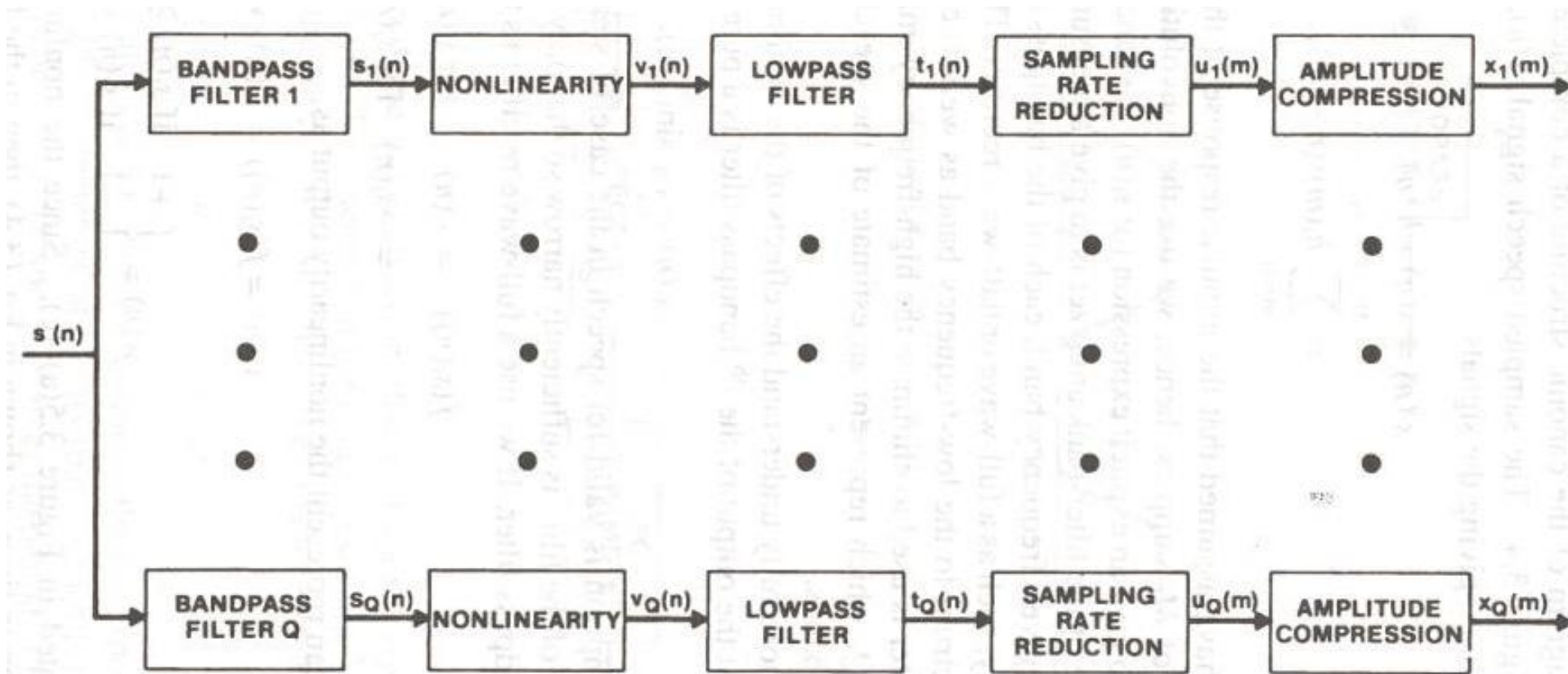
# Filter Bank Analysis of Speech (Cont..)



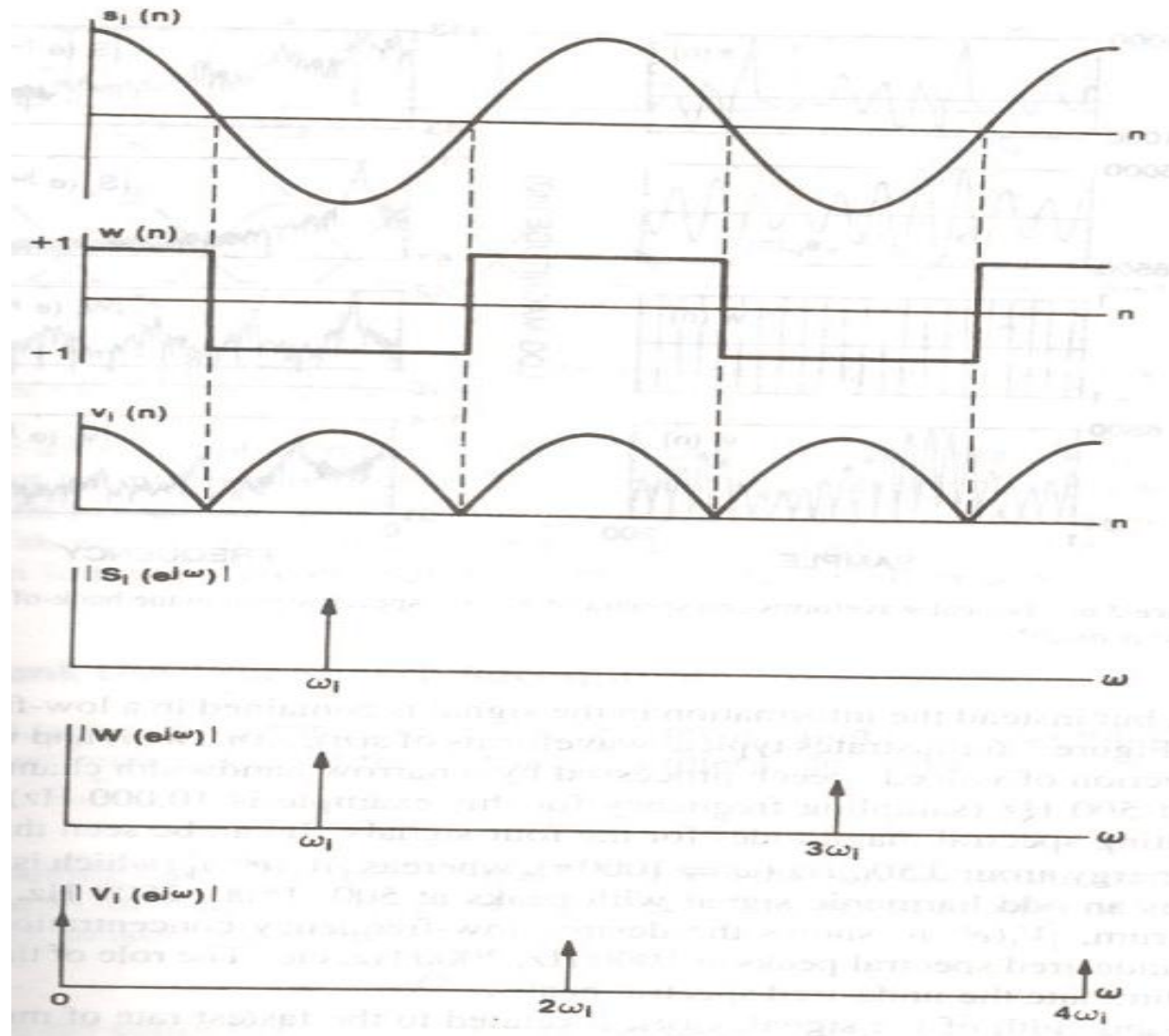
# Filter Bank Analysis for Speech Coding



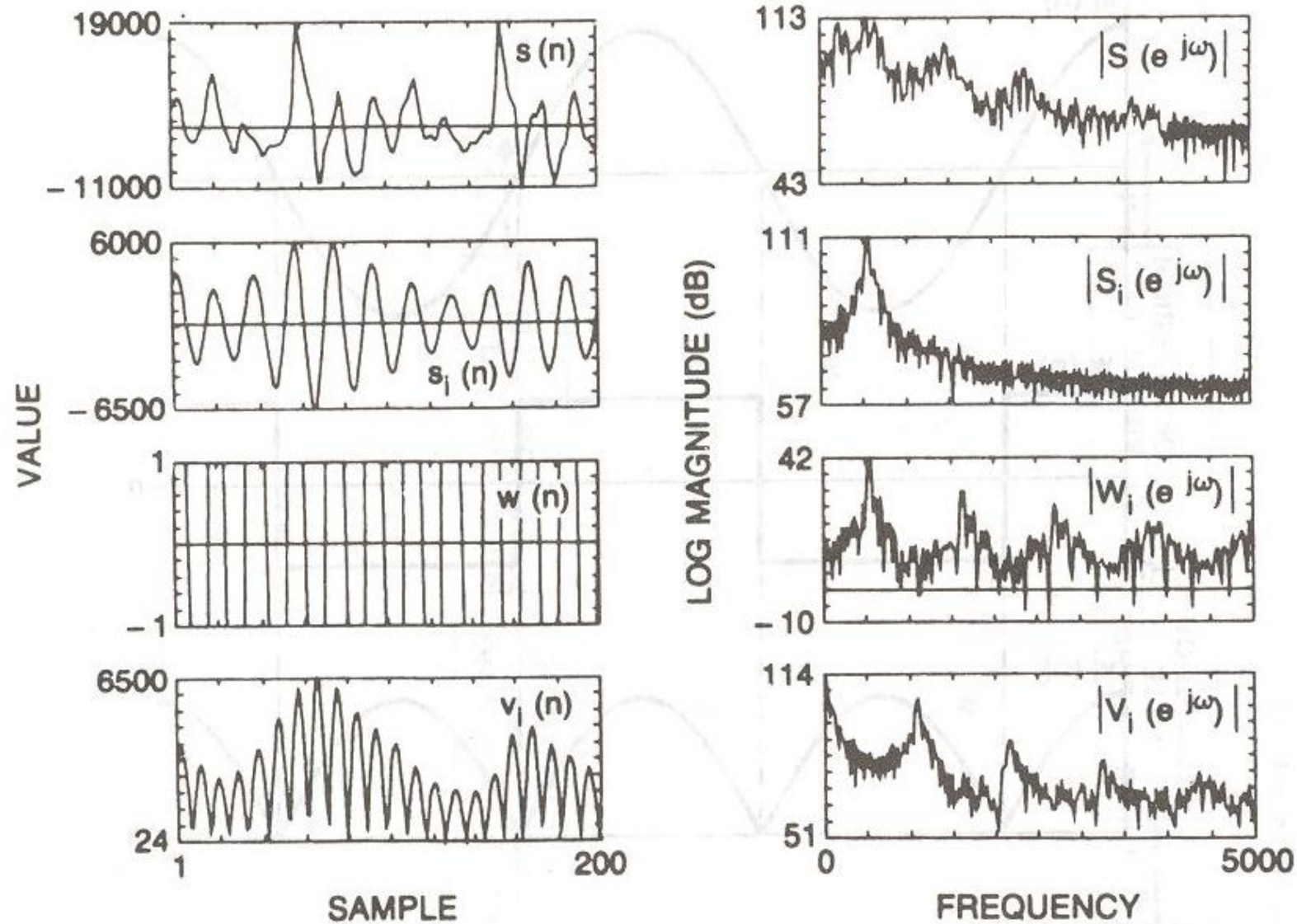
# Filter Bank Analysis Model for Speech Coding



# Translation of High Frequency to Low Frequency



# Translation of High Frequency to Low Frequency



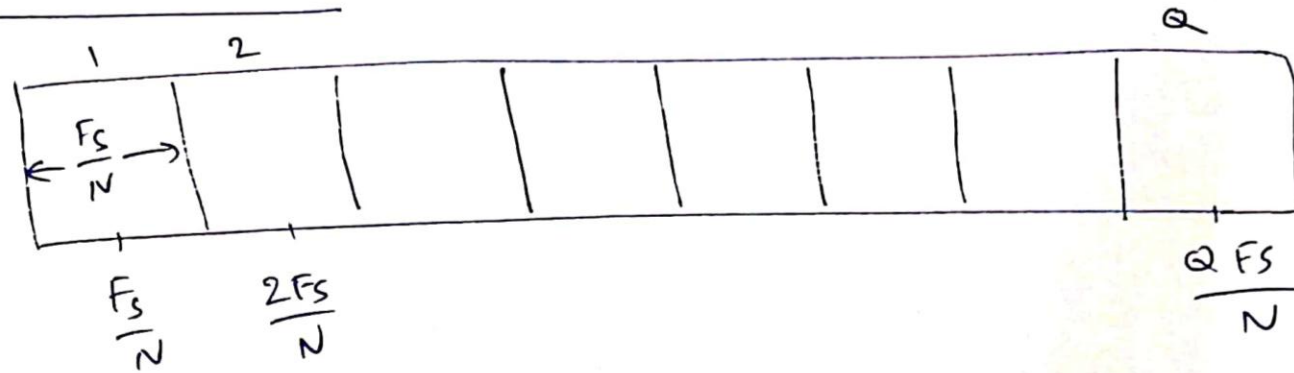


# Filter Bank Analysis for Speech Recognition

The slide features a white background with a large blue shape on the right side that resembles a stylized wave or a bell curve. At the bottom, there are two blue decorative elements: a horizontal bar on the left and a series of vertical lines on the right.

# Uniform Filter Bank

Uniform Filter Bank



$$f_n = \frac{F_s}{2} i \quad 1 \leq i \leq Q$$

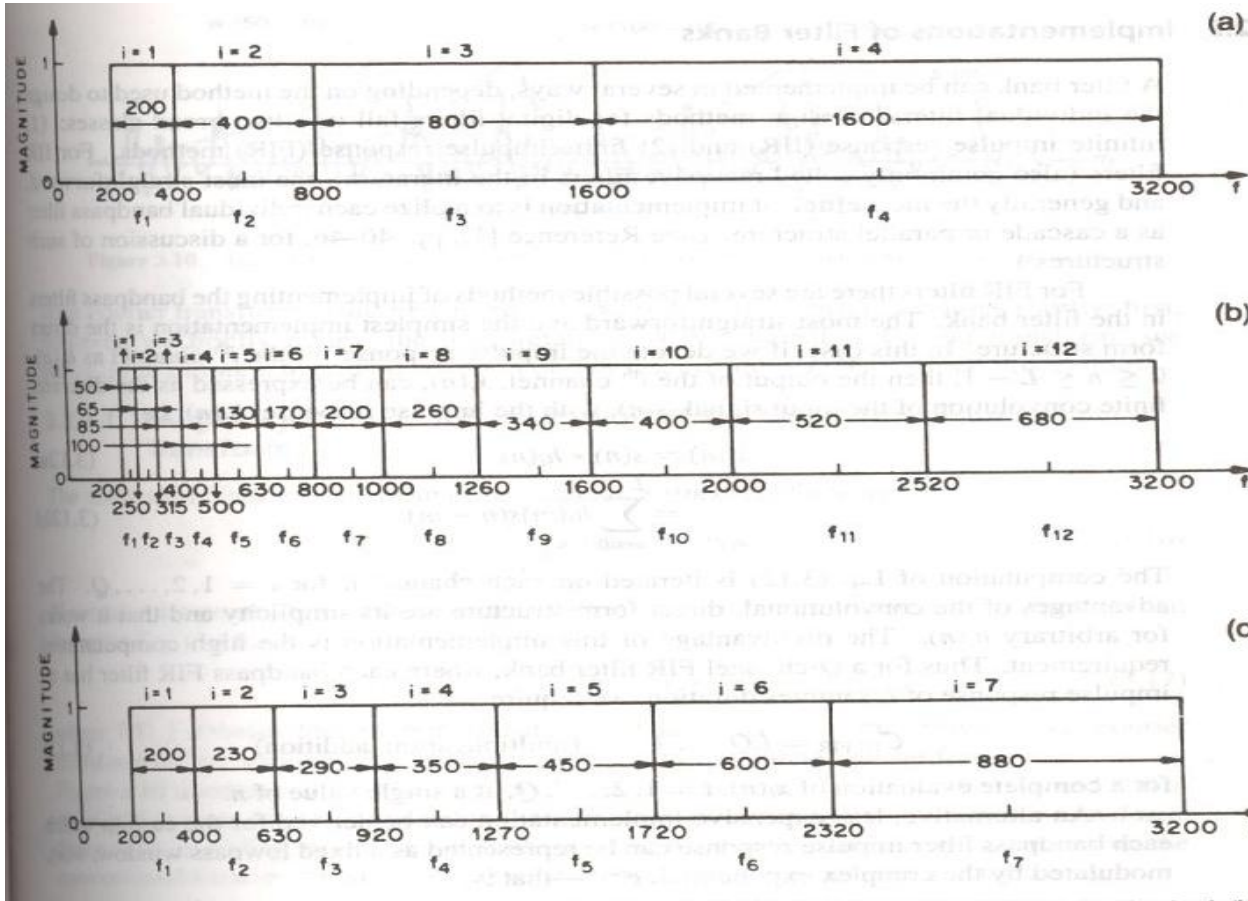
$$Q \leq \frac{2}{T}$$

$$b_n \geq \frac{1}{2} \frac{F_s T}{2}$$

$$b_n < \frac{F_s}{2}$$

(Non-overlapping, limiting of spectral details)

# Non-Uniform Filter Bank



$$b_1 = c$$

$$(a) \quad b_i = \alpha b_{i-1} \quad 2 \leq i \leq Q$$

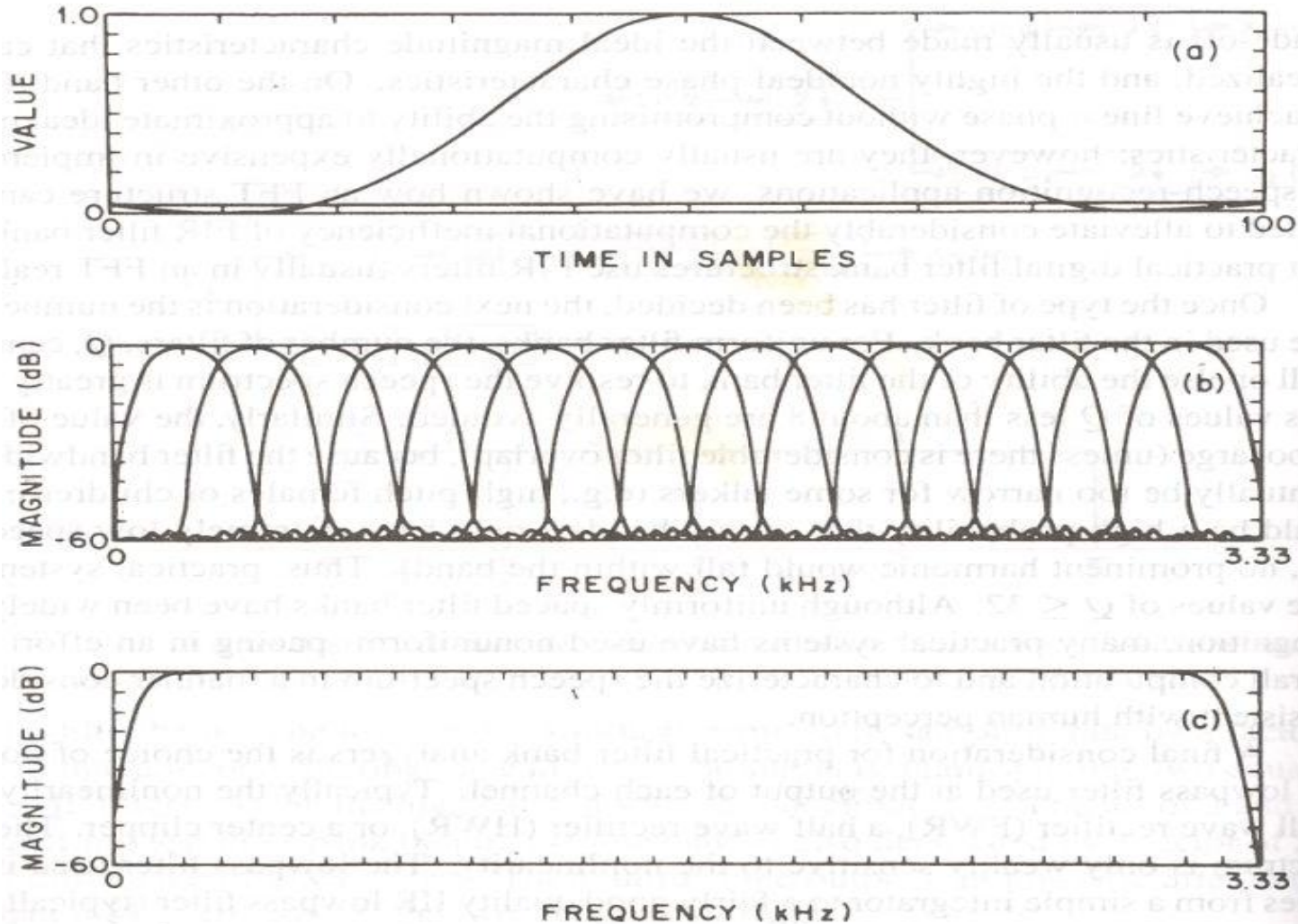
$$f_i = f_1 + \sum_{r=1}^{i-1} b_r + \frac{(b_i - b_1)}{2}$$

(b)  $c, f_1 \rightarrow$  arbitrary bandwidth & center frequency of first filter

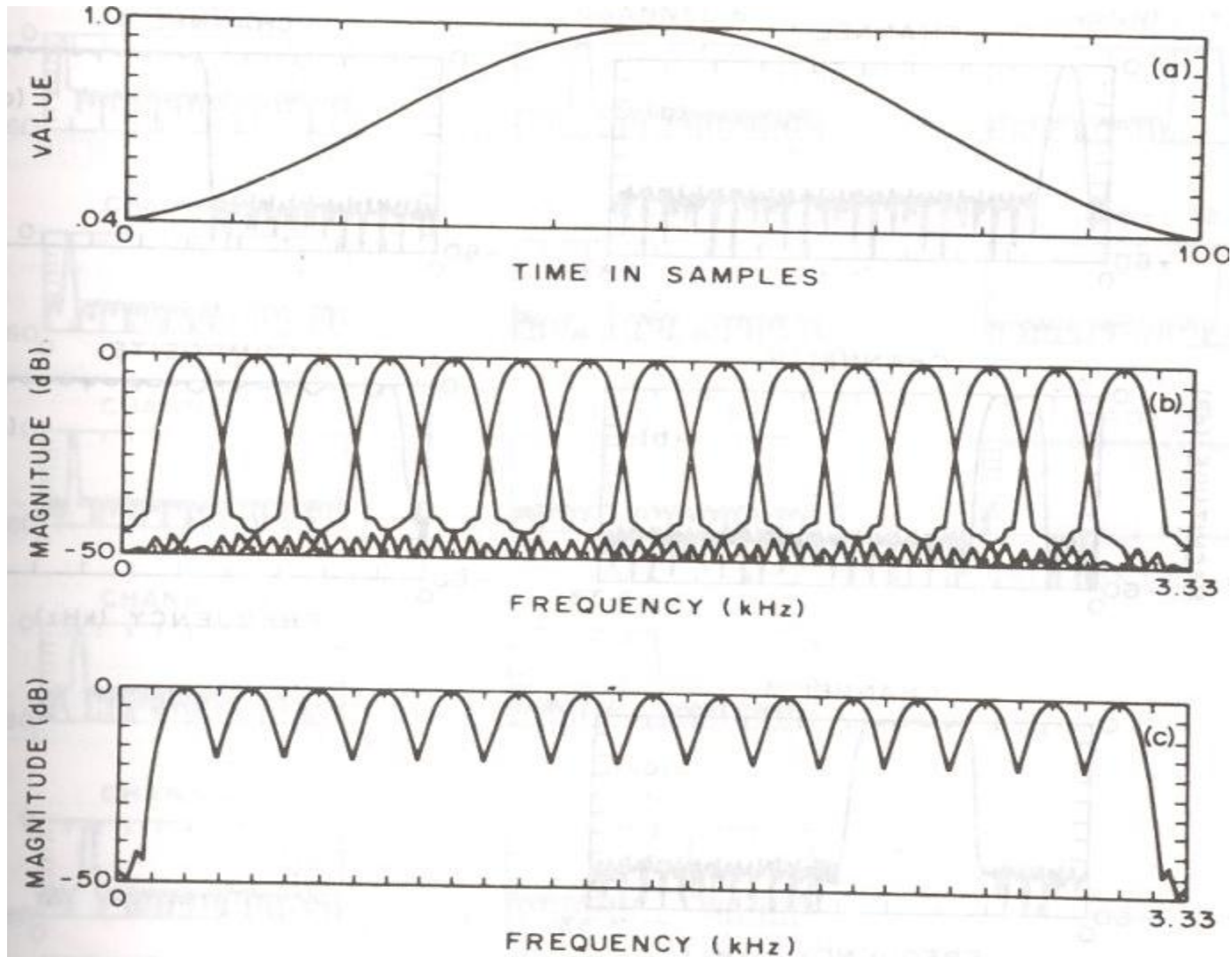
$\alpha = 2$  octave Band spacing filter

$= \frac{4}{3}$   $\frac{1}{3}$  octave spacing filter

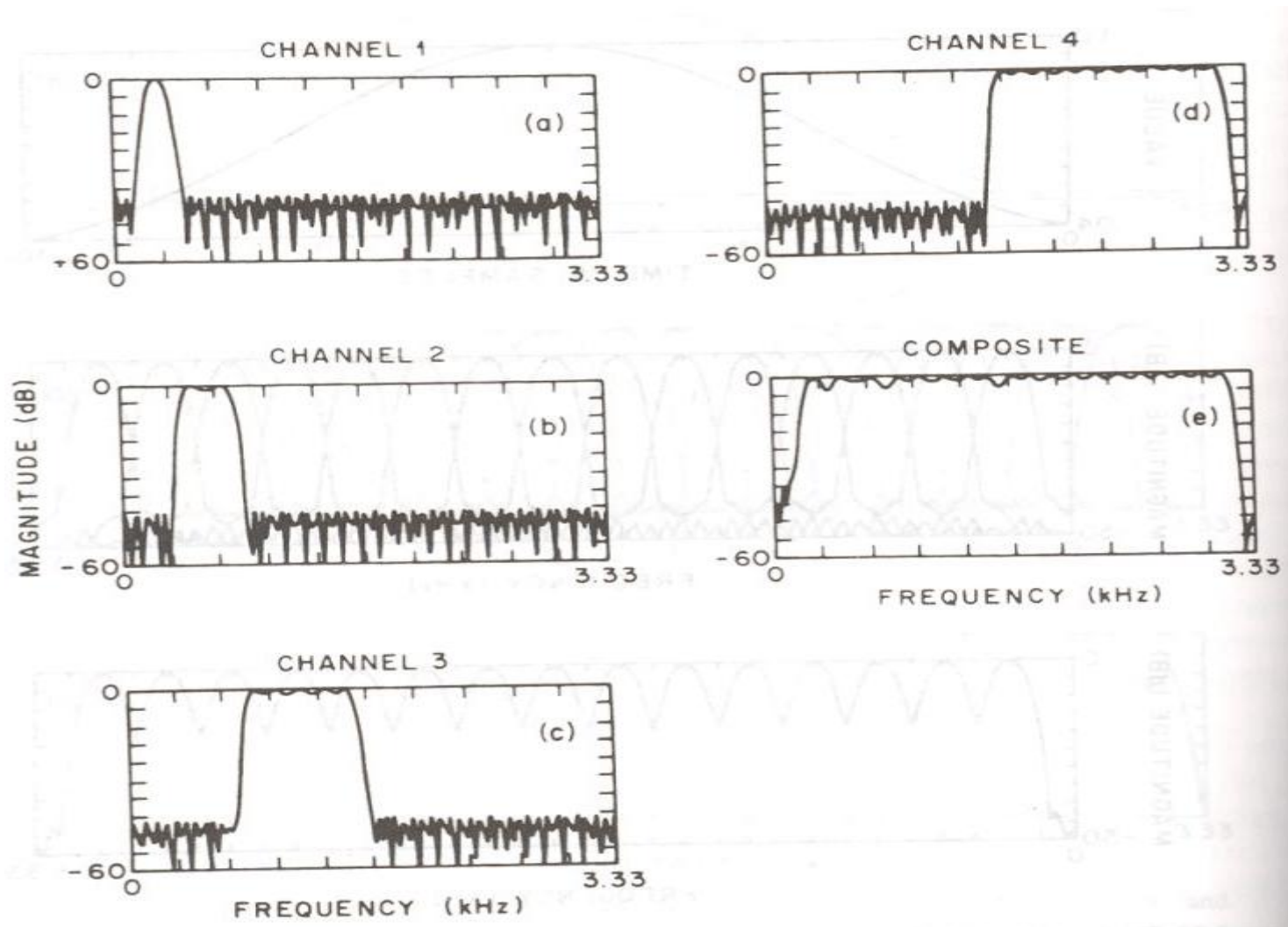
# Example: Uniform Filter Bank for SR



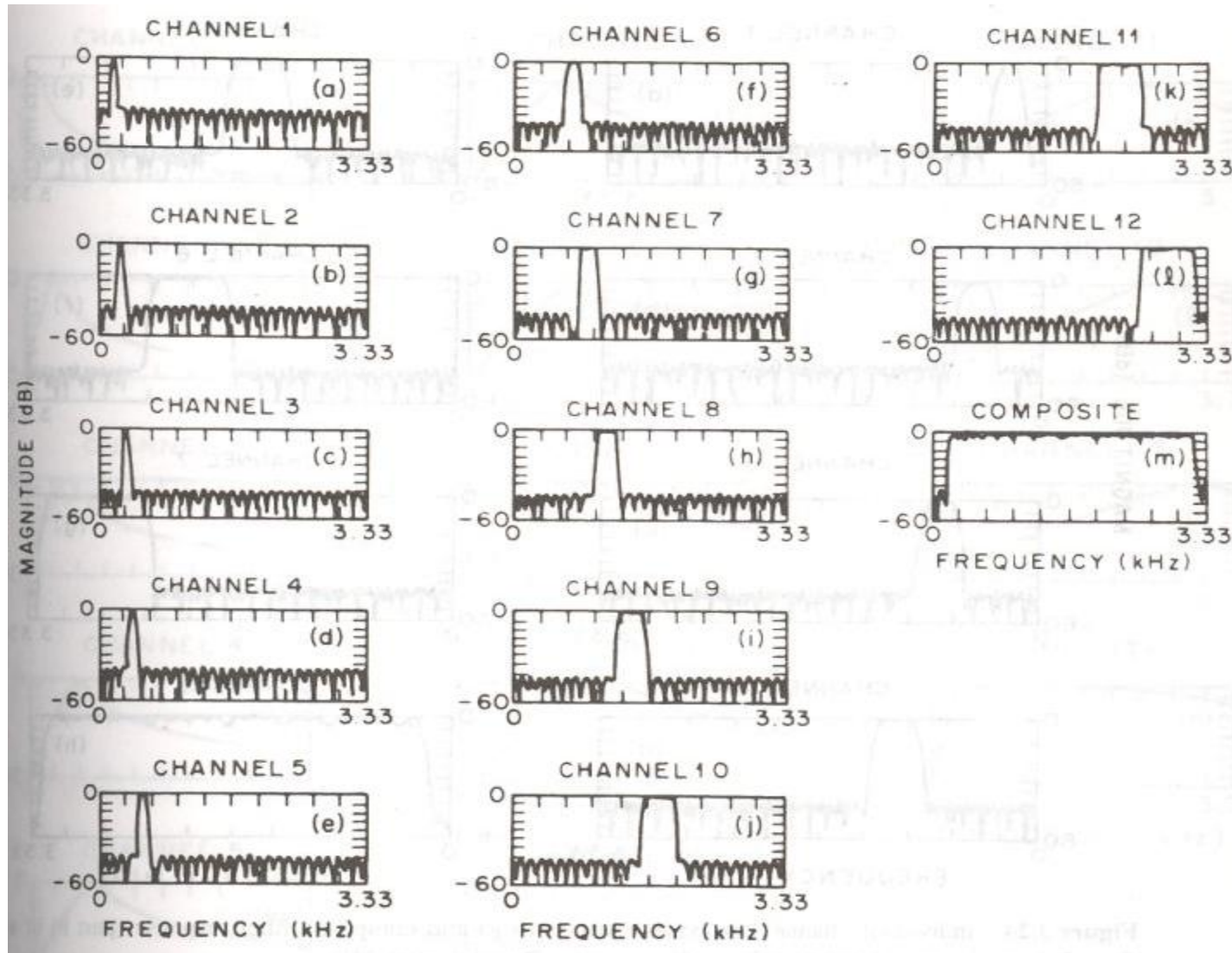
# Example: Uniform Filter Bank for SR



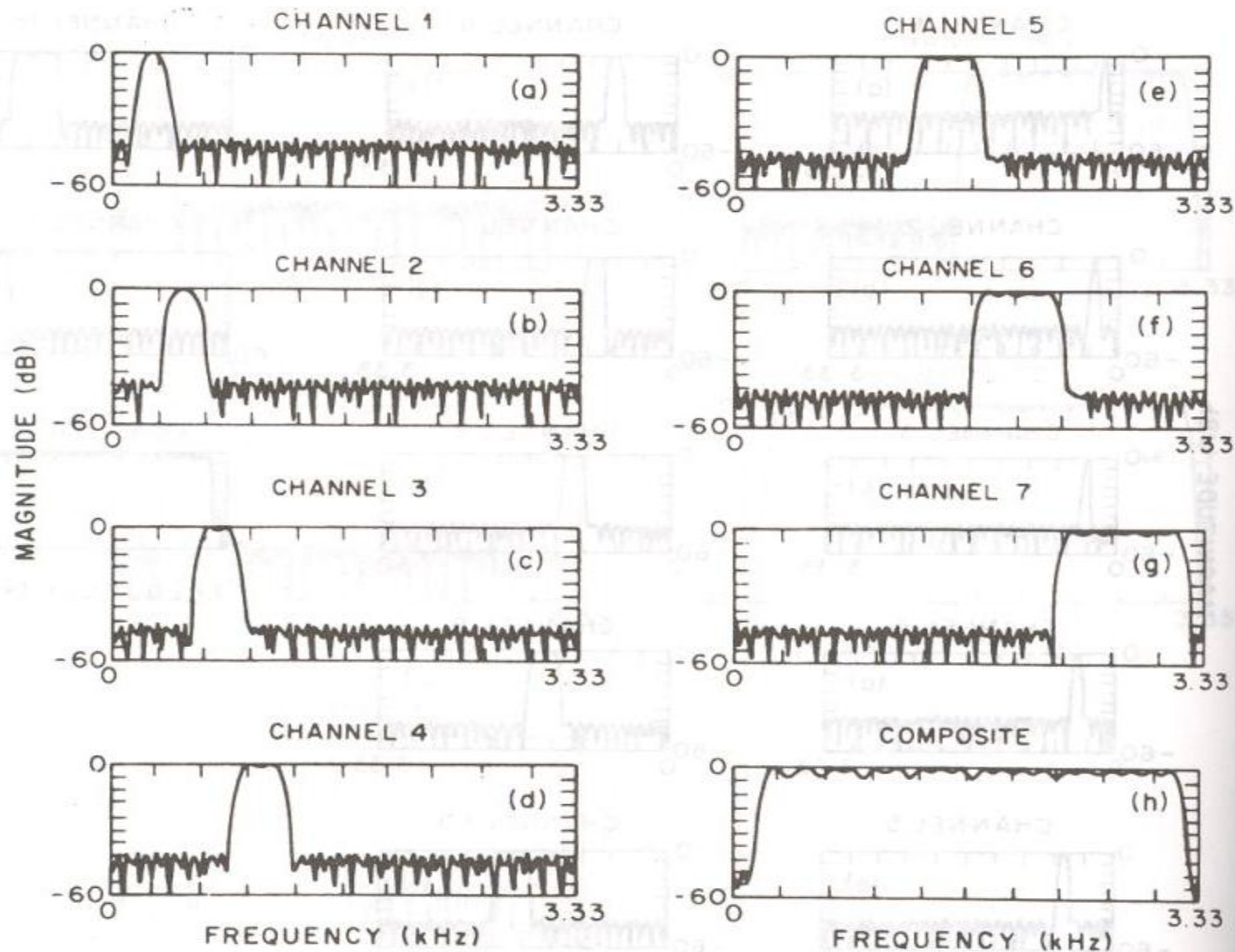
# Example: Non-Uniform Octave Filter Bank for SR



# Example: NU 12-Channel 1/3<sup>rd</sup> Octave Filter Bank for SR



# Example: NU 7-Channel Critical Band Filter Bank for SR





# Example: NU 13-Channel Critical Band Filter Bank for SR

