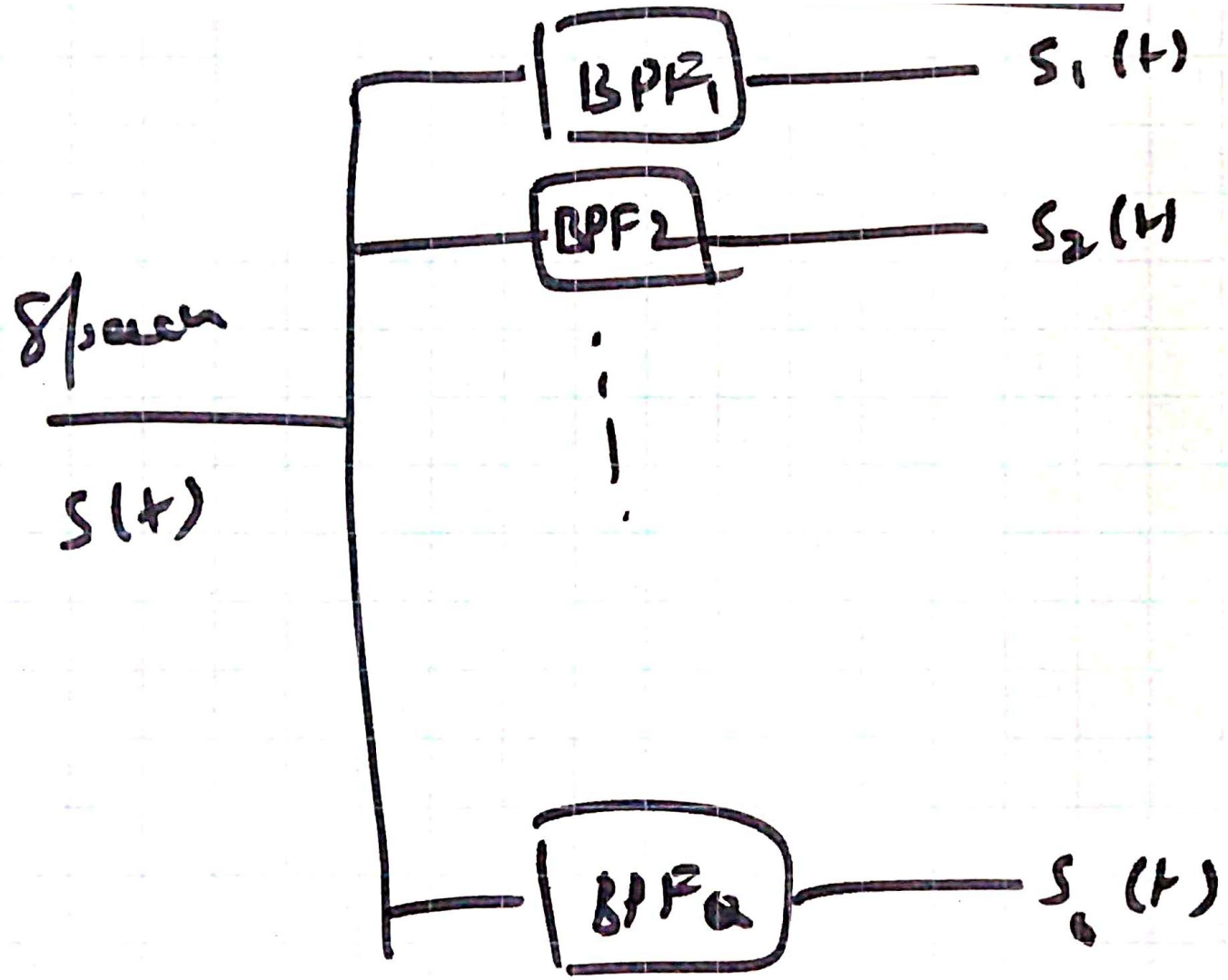
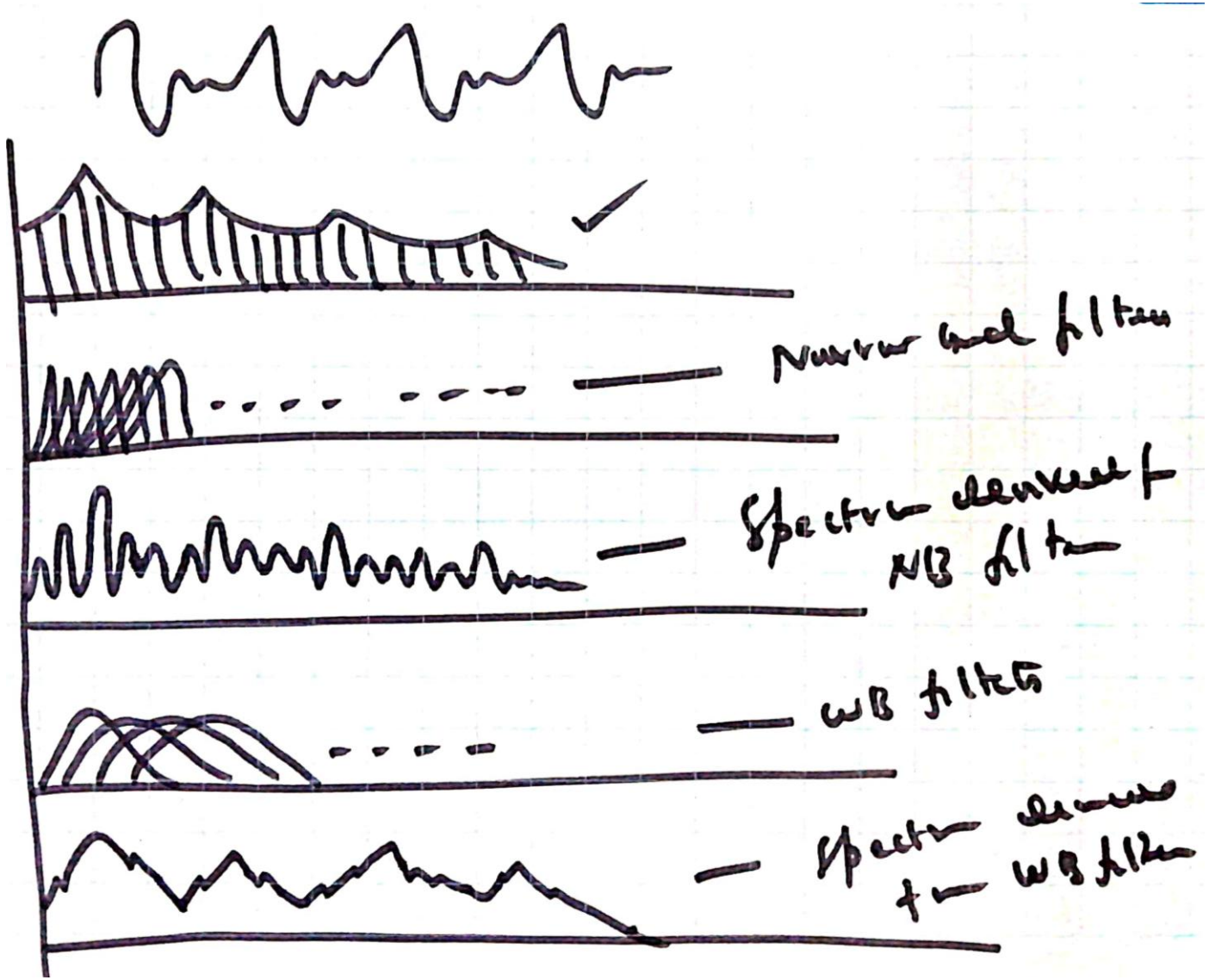
Frequency Domain Analysis of Speech
&
Filter-Bank Analysis

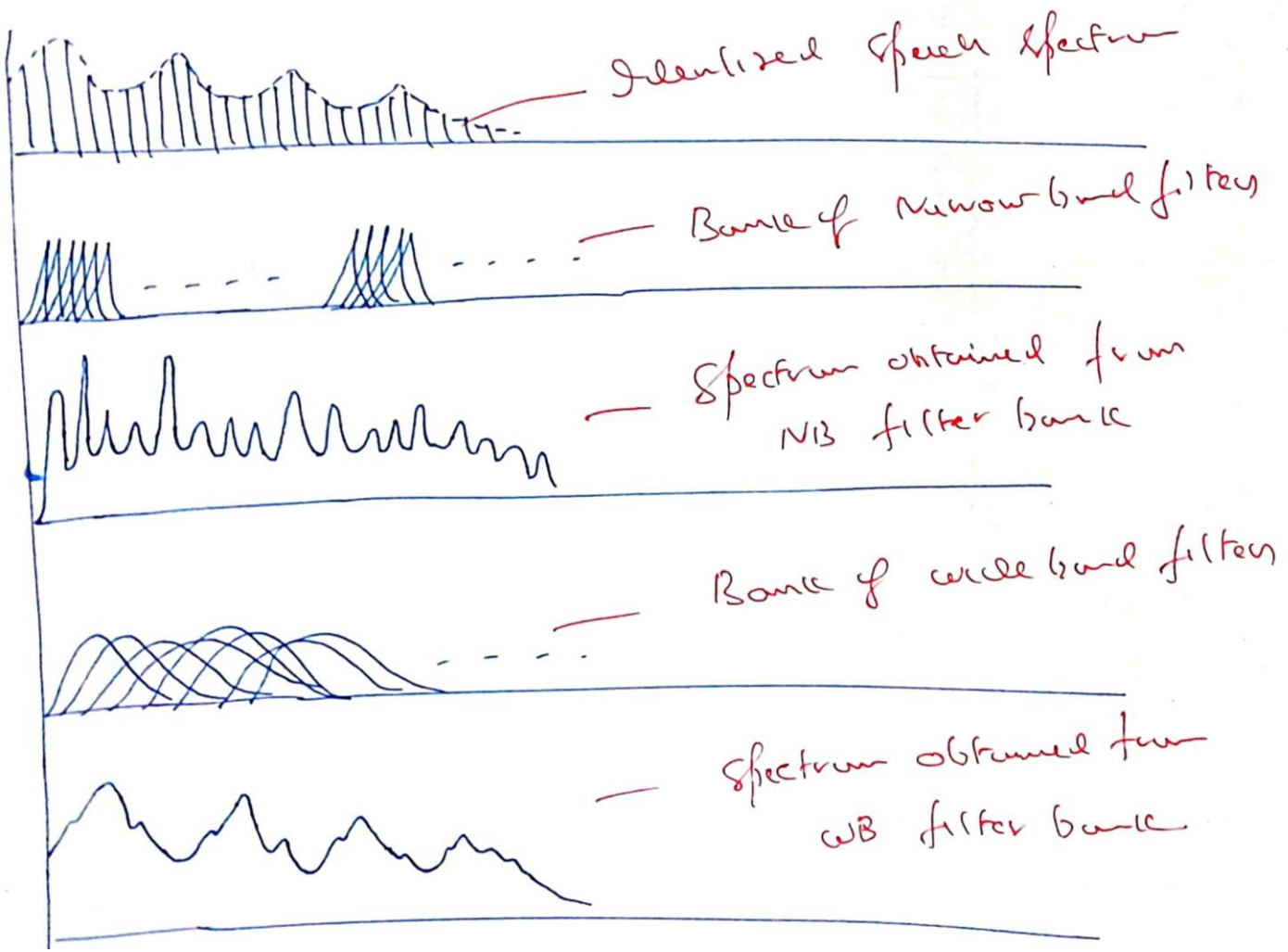
Filter Bank Analysis of Speech



Filter Bank Analysis of Speech (Cont..)

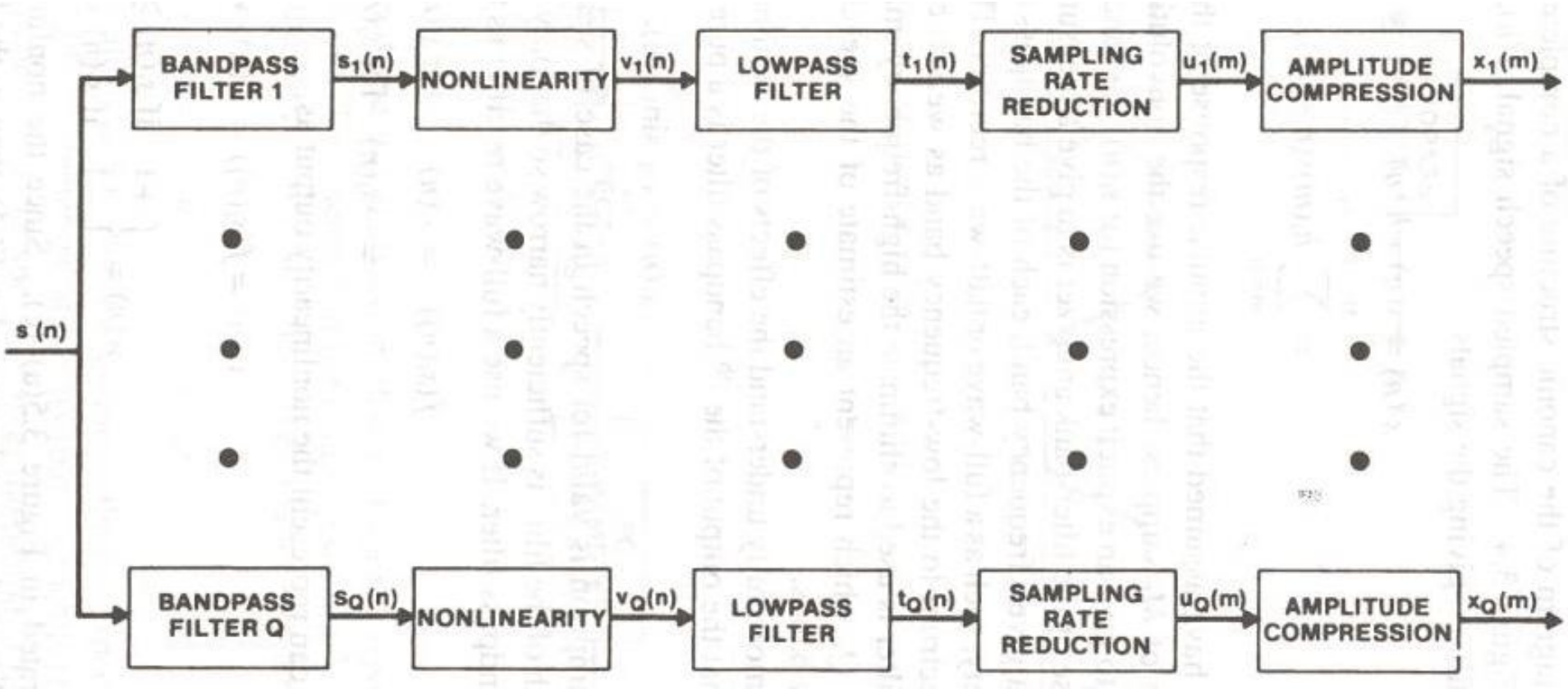


Filter Bank Analysis of Speech (Cont..)

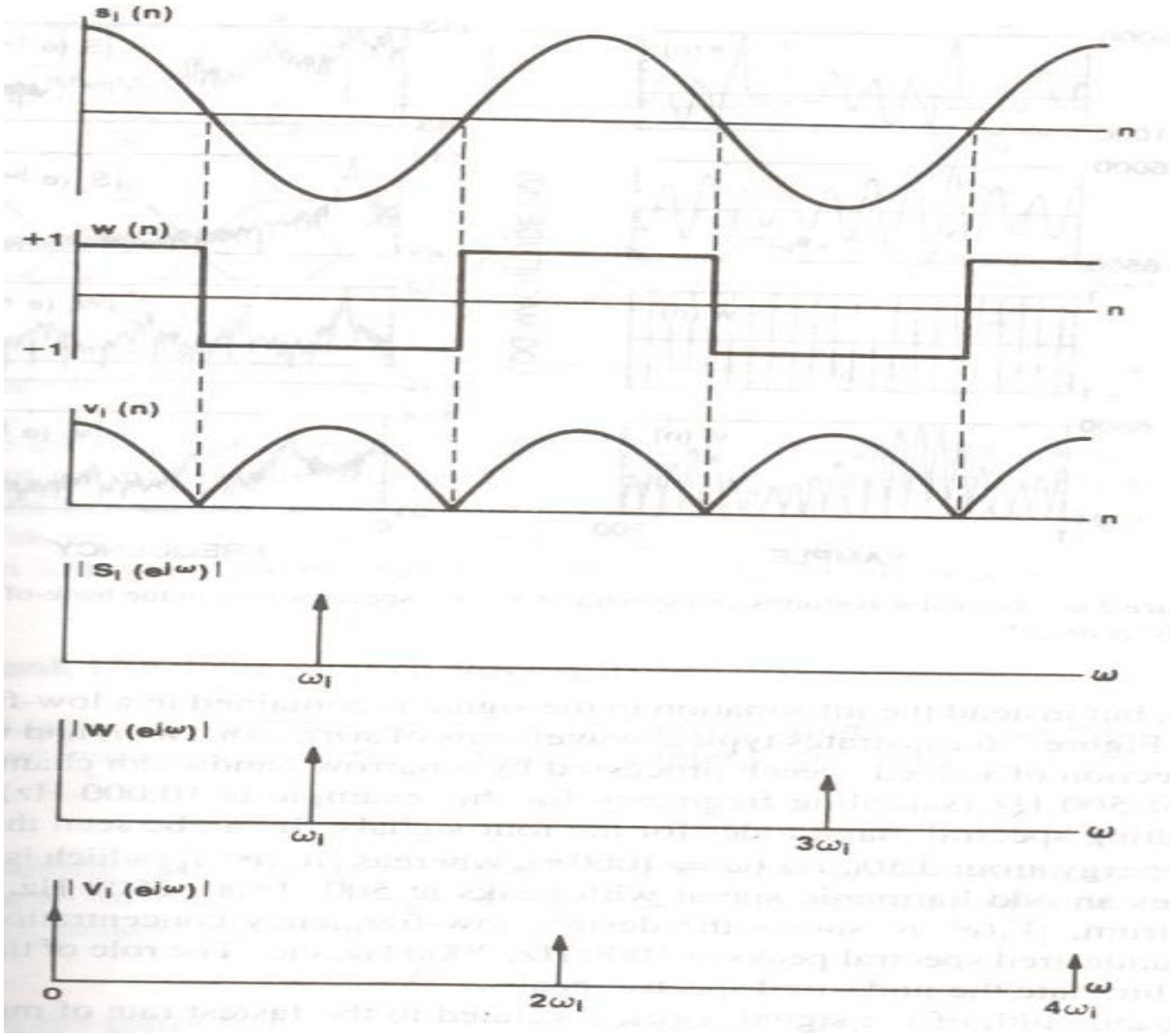


Filter Bank Analysis for Speech Coding

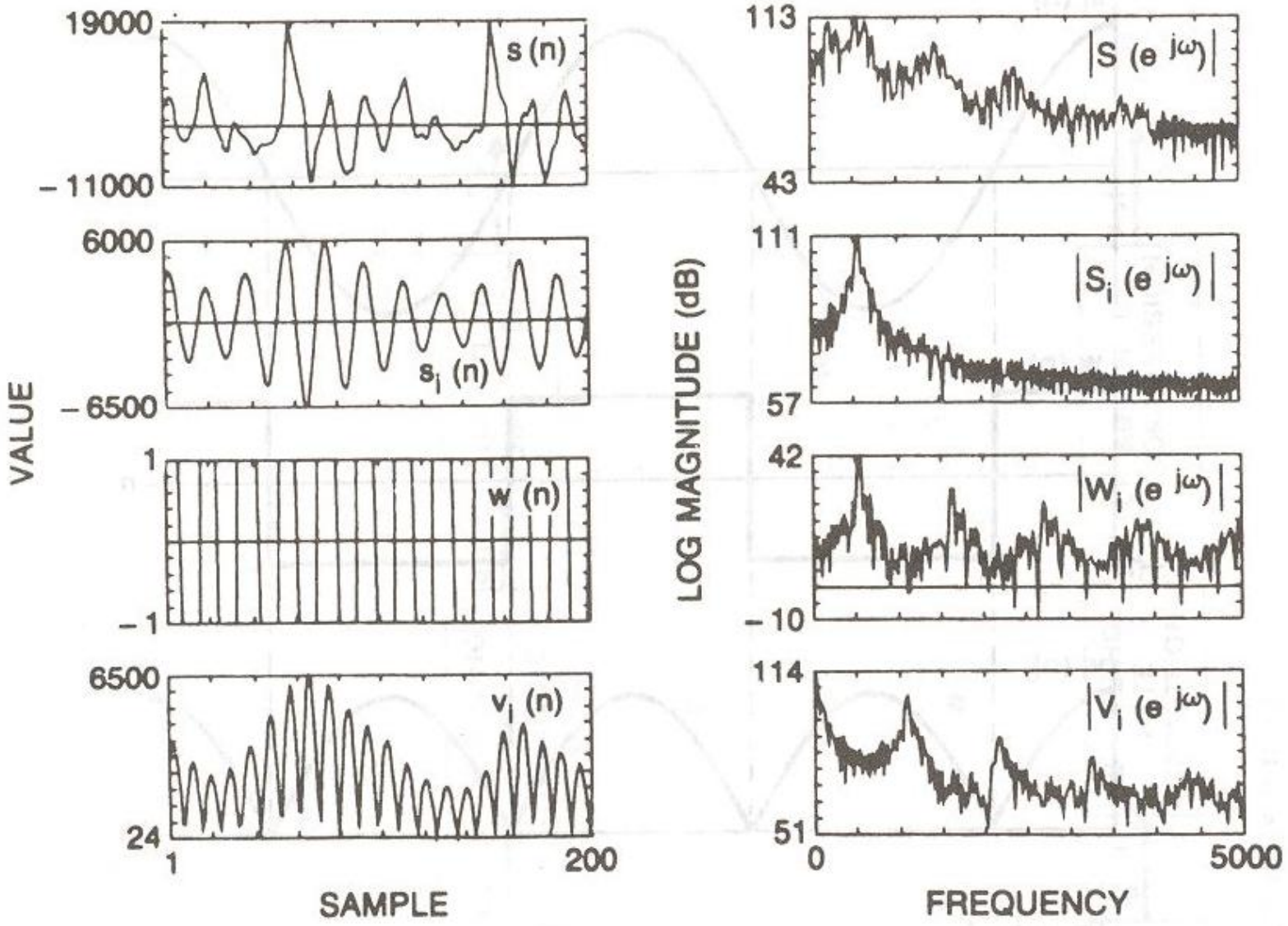
Filter Bank Analysis Model for Speech Coding



Translation of High Frequency to Low Frequency



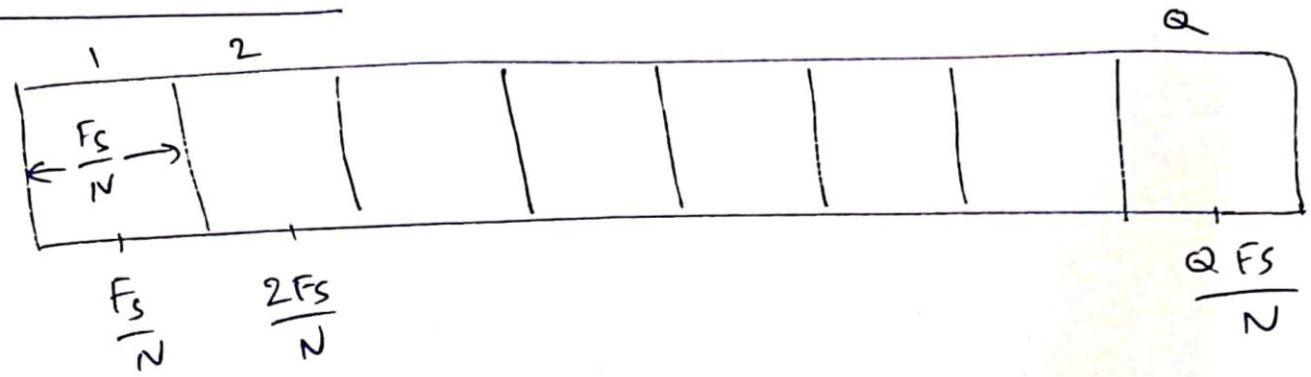
Translation of High Frequency to Low Frequency



Filter Bank Analysis for Speech Recognition

Uniform Filter Bank

Uniform Filter Bank



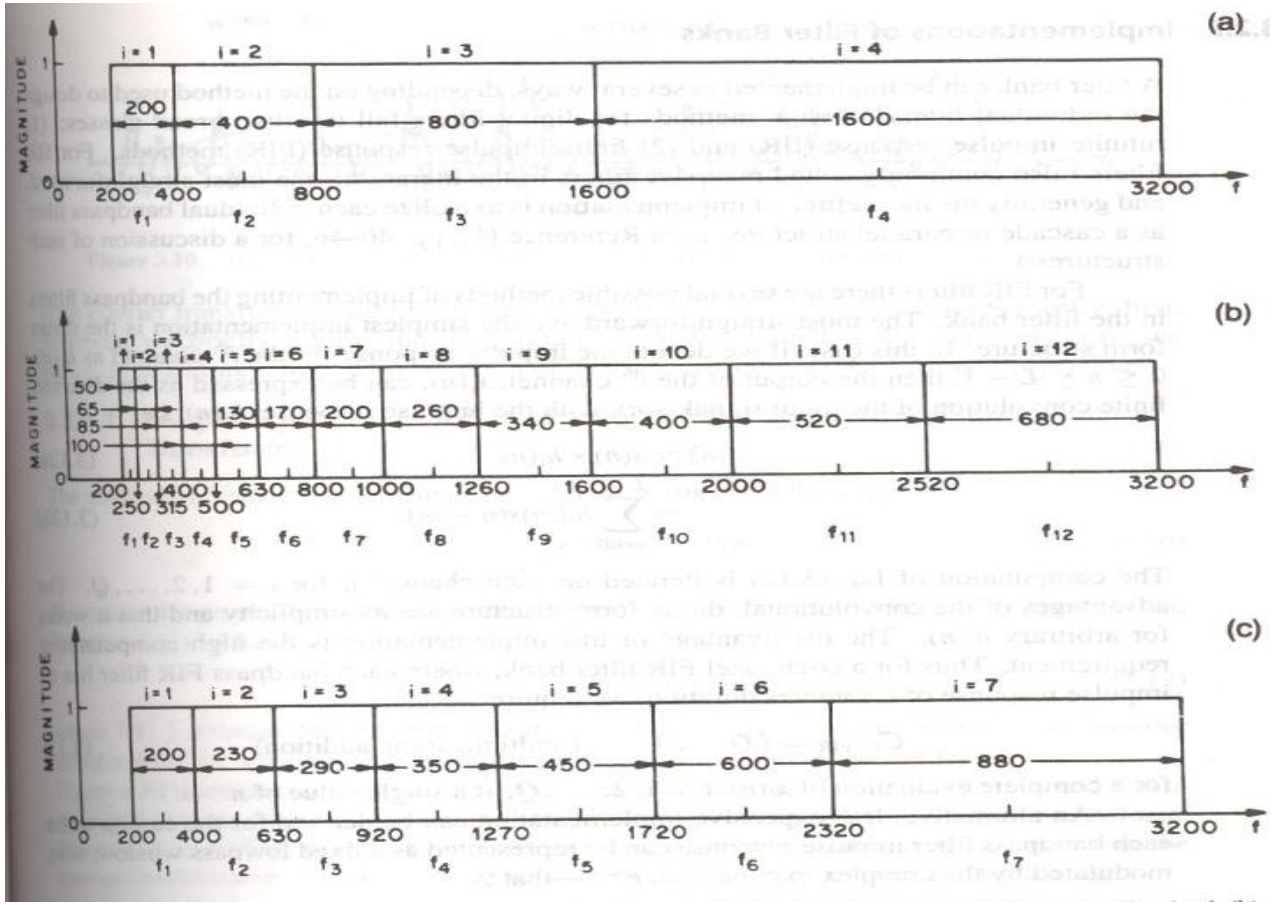
$f_i = \frac{F_s}{N} i \qquad 1 \le i \le Q$

$Q \le \frac{N}{2}$

$b_i \ge \frac{F_s}{N}$

$b_i < \frac{F_s}{N}$ (Non-overlapping, Mining of Spectral details)

Non-Uniform Filter Bank



$b_1 = c$

$b_i = \alpha\, b_{i-1} \qquad 2 \le i \le Q$

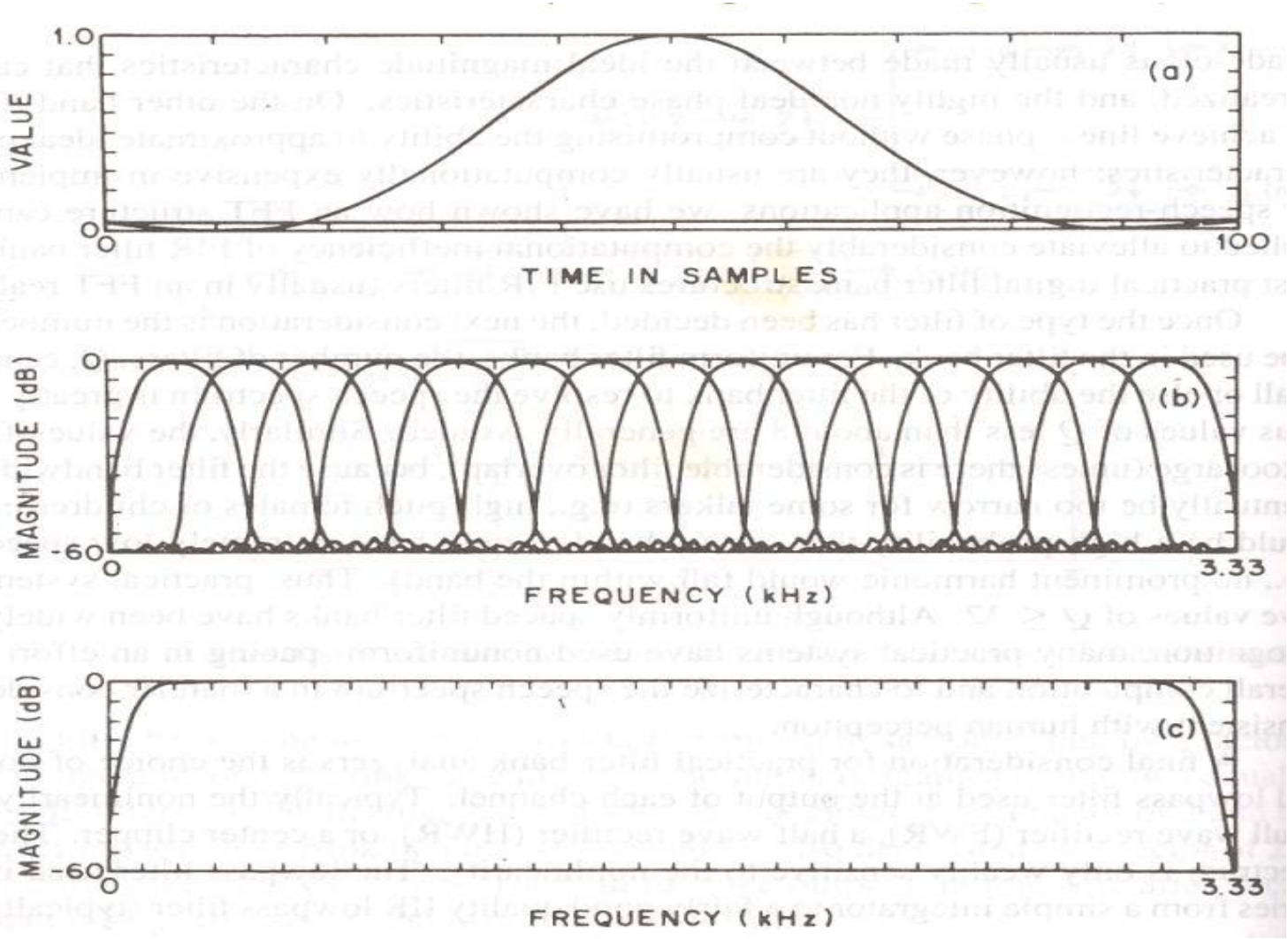
$f_i = f_1 + \sum_{r=1}^{i-1} b_r + \frac{(b_i - b_1)}{2}$

$c, f_1 \longrightarrow$ arbitary bandwidth & center freq of first filter

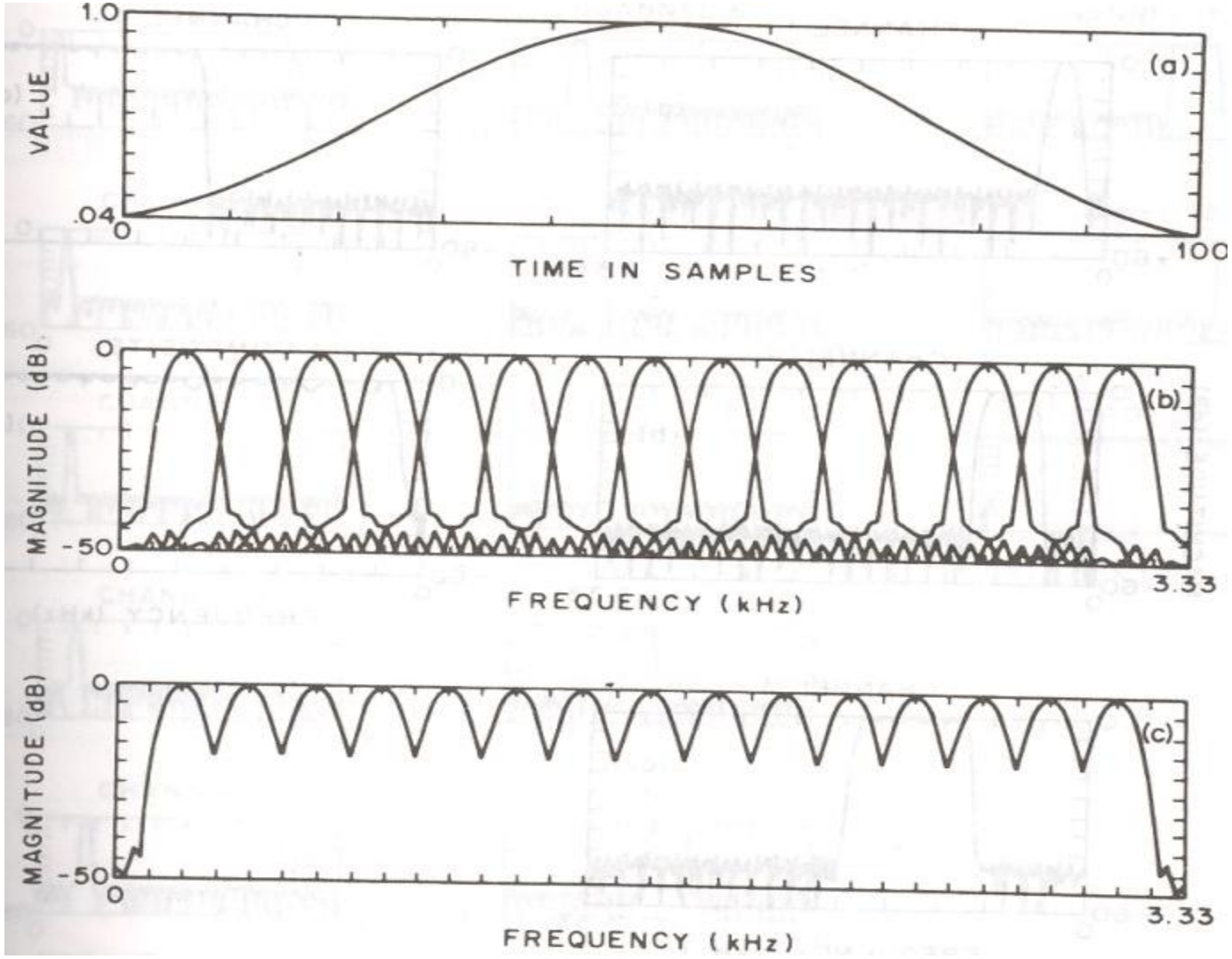
$\alpha = 2$ octave Band Spacing filter

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

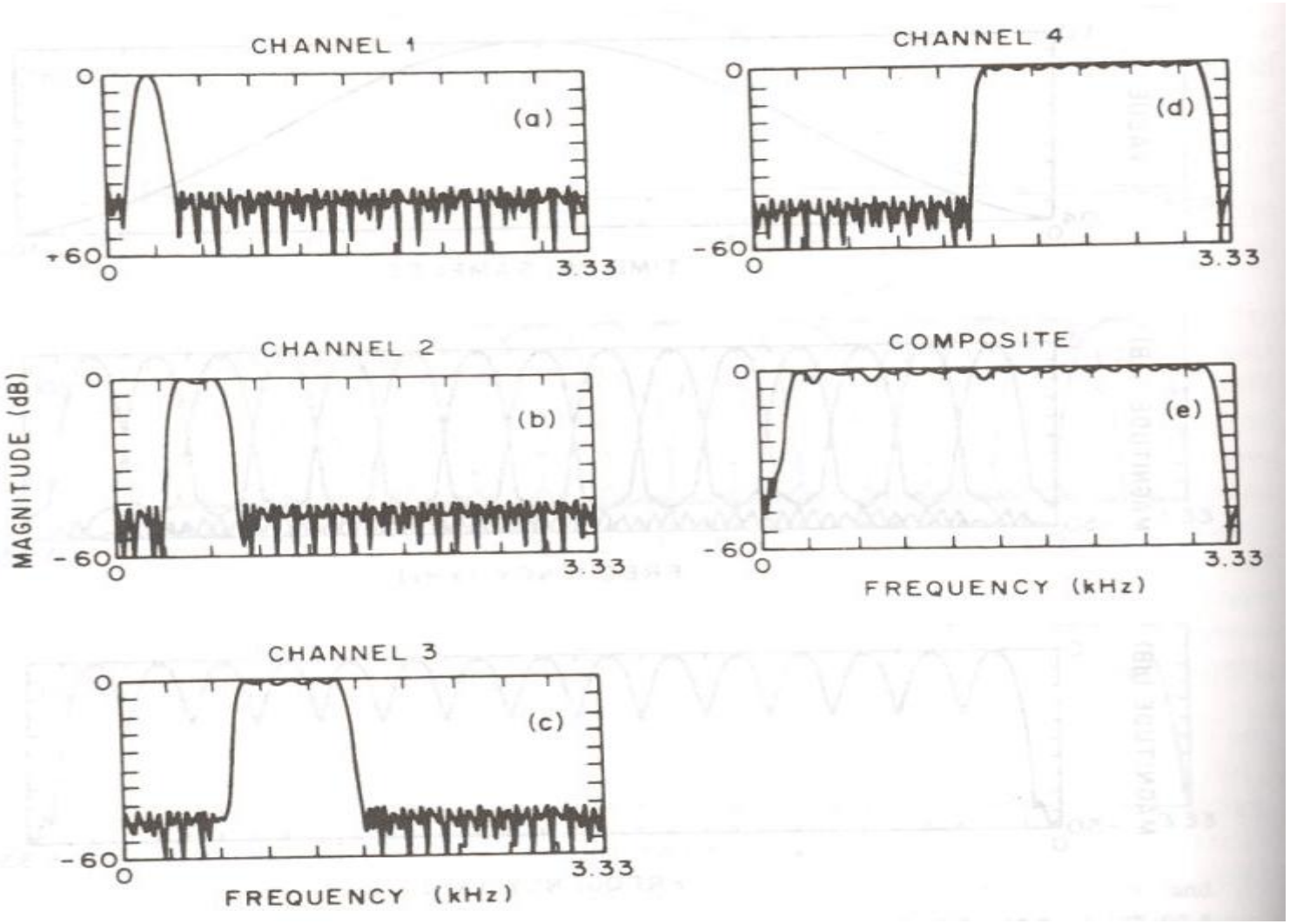
Example: Uniform Filter Bank for SR



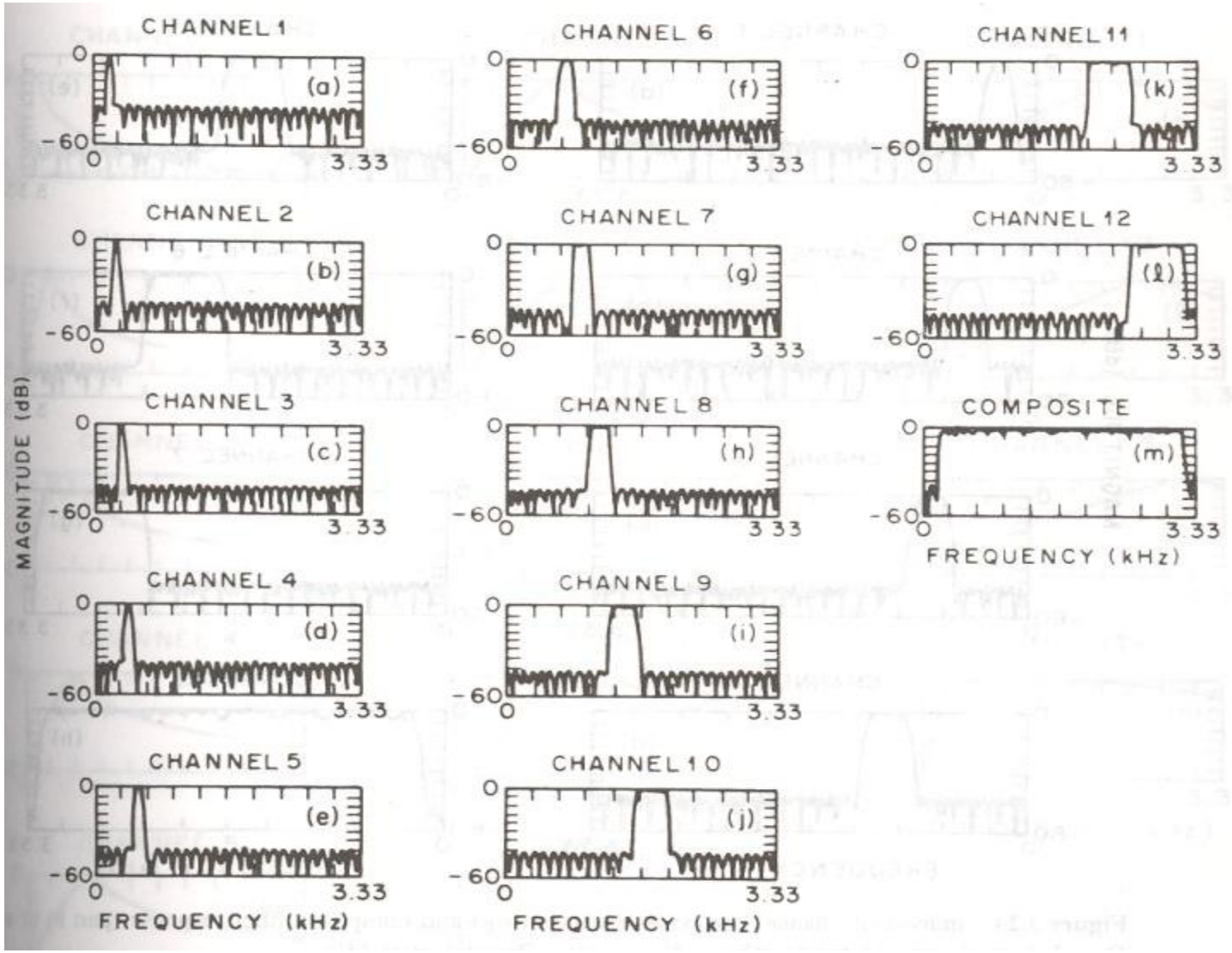
Example: Uniform Filter Bank for SR



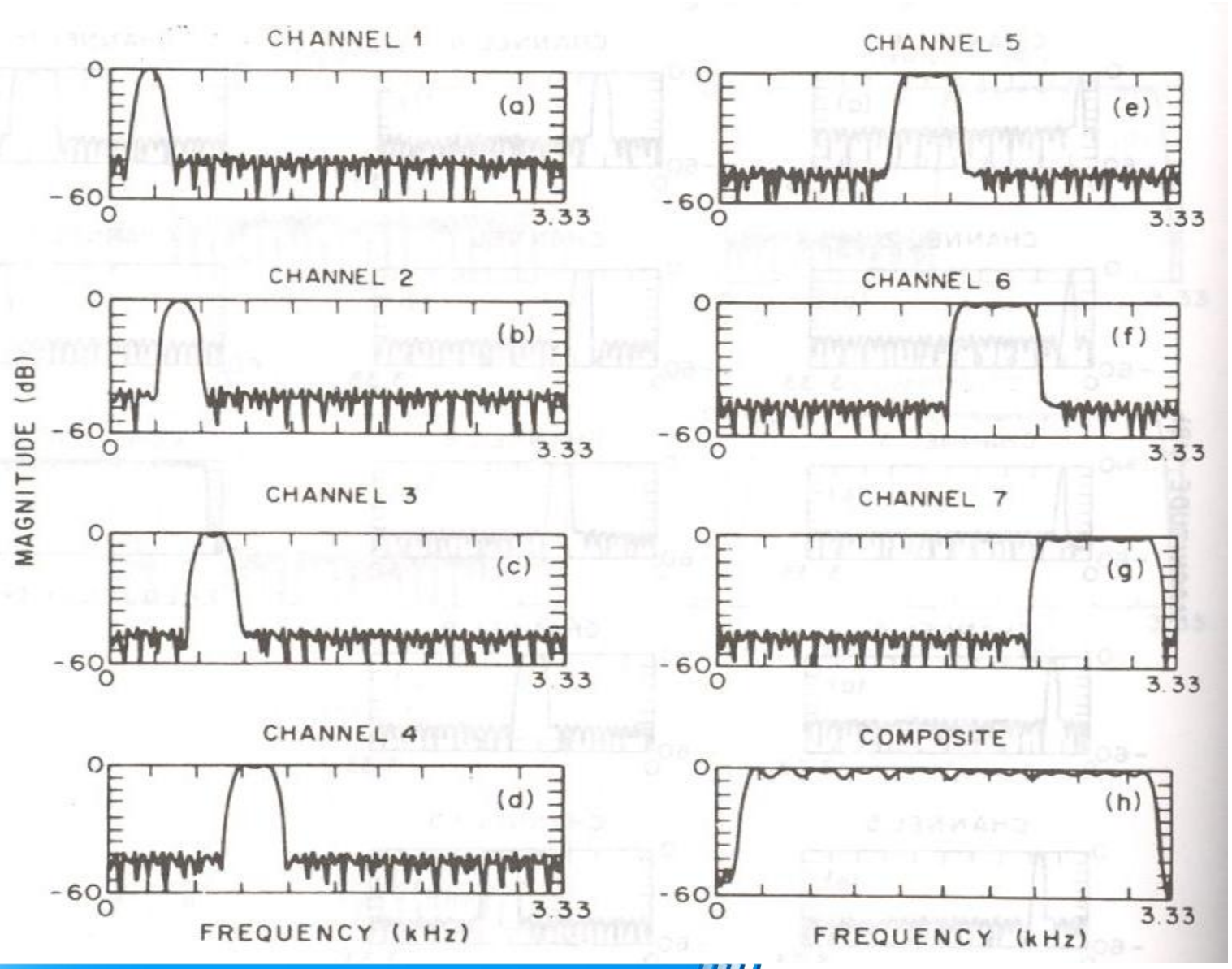
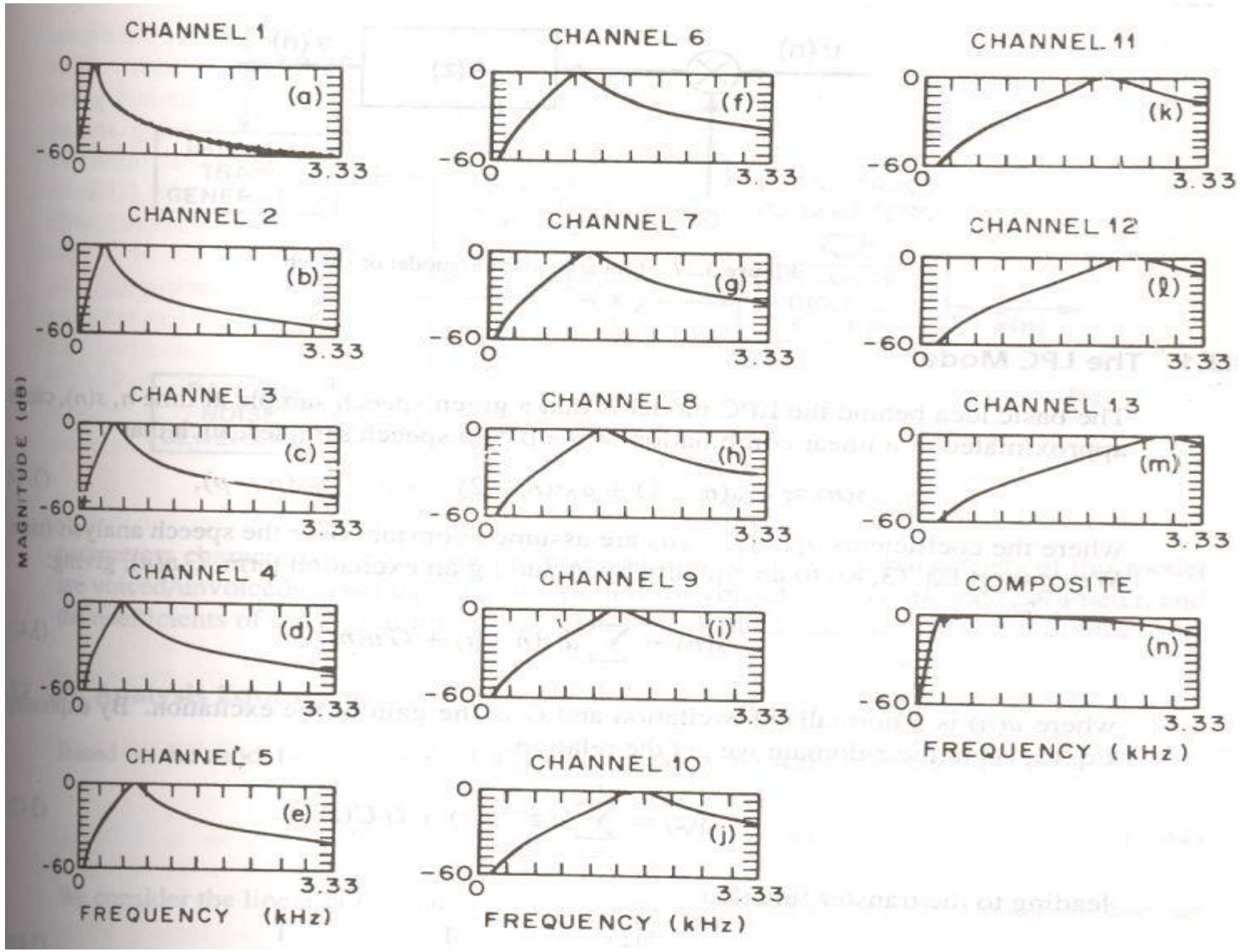
Example: Non-Uniform Octave Filter Bank for SR



Example: NU 12-Channel 1/3rd 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