



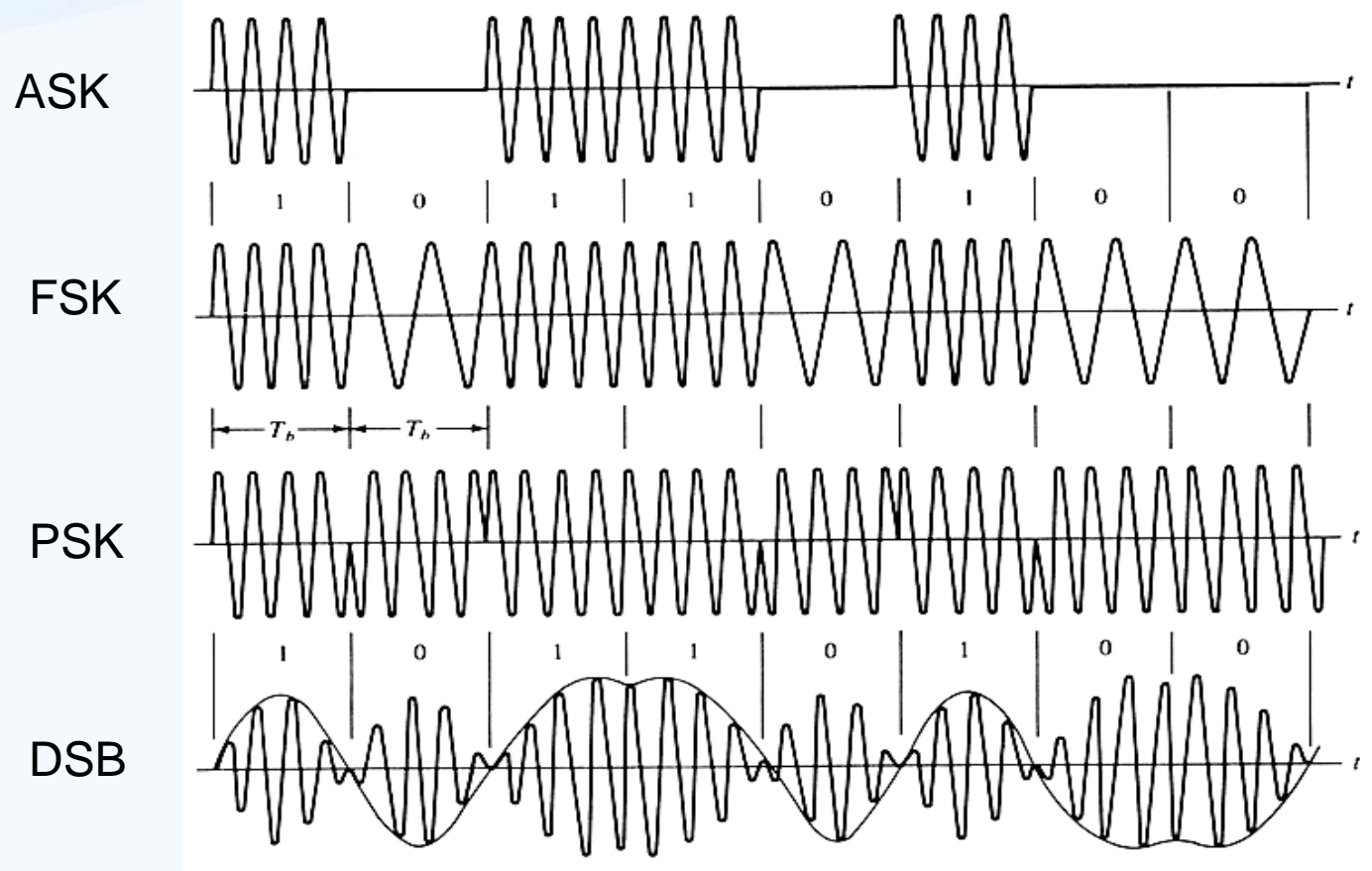
# MODULASI ASK (AMPLITUDE SHIFT KEYING)

*Sistem Komunikasi  
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# WHAT IS MODULATION?

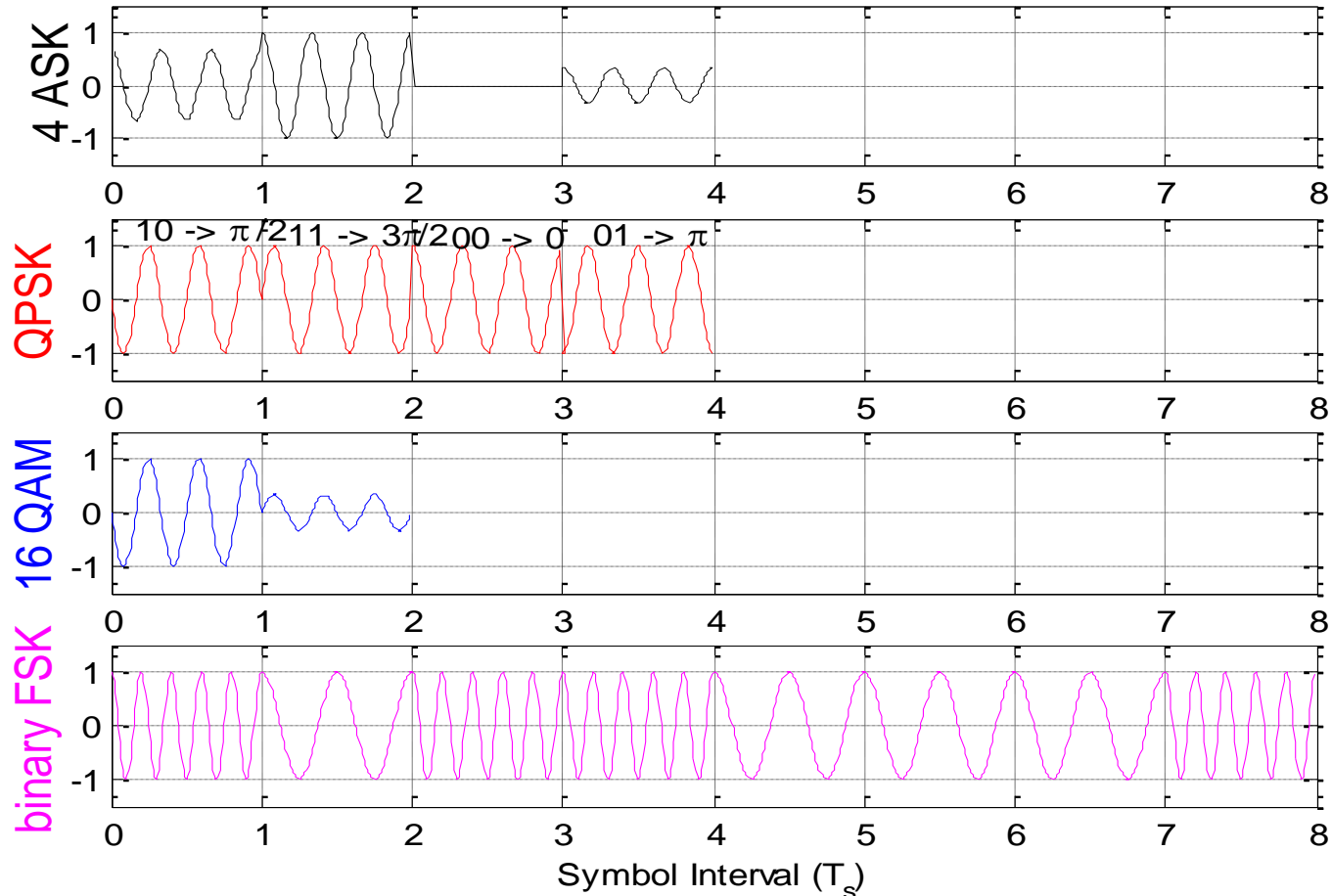
- *Encoding information in a manner suitable for transmission.*
  - *Translate baseband source signal to bandpass signal*
  - *Bandpass signal: “modulated signal”*
- *How?*
  - *Vary amplitude, phase or frequency of a carrier*
- *Demodulation: extract baseband message from carrier*

# Contoh modulasi Digital



# Cont' Contoh modulasi Digital

Compare Different Modulation Methods to transmit [1 0 1 1 0 0 0 1]



# AMPLITUDE SHIFT KEYING (ASK) MODULATION

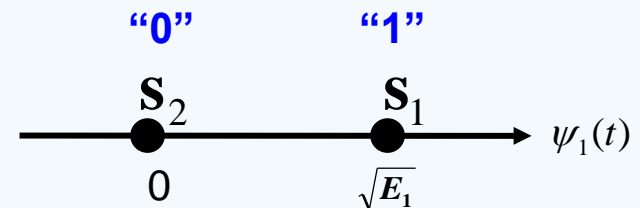
$$s_i(t) = \sqrt{\frac{2E_i}{T}} \cos(\omega_c t + \phi)$$

$$s_i(t) = a_i \psi_1(t) \quad i = 1, \dots, M$$

$$\psi_1(t) = \sqrt{\frac{2}{T}} \cos(\omega_c t + \phi)$$

$$a_i = \sqrt{E_i}$$

**On-off keying (M=2):**



# M-ary ASK

- M-ary ASK sering disebut M-ary Pulse Amplitude modulation (M-PAM)

$$s_i(t) = a_i \sqrt{\frac{2}{T}} \cos(\omega_c t)$$

$$s_i(t) = a_i \psi_1(t) \quad i = 1, \dots, M$$

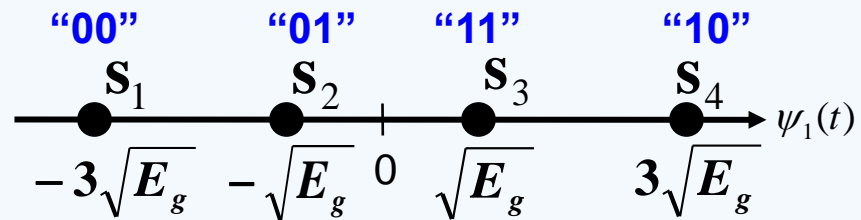
$$\psi_1(t) = \sqrt{\frac{2}{T}} \cos(\omega_c t)$$

$$a_i = (2i - 1 - M) \sqrt{E_g}$$

$$E_i = \|\mathbf{s}_i\|^2 = E_g (2i - 1 - M)^2$$

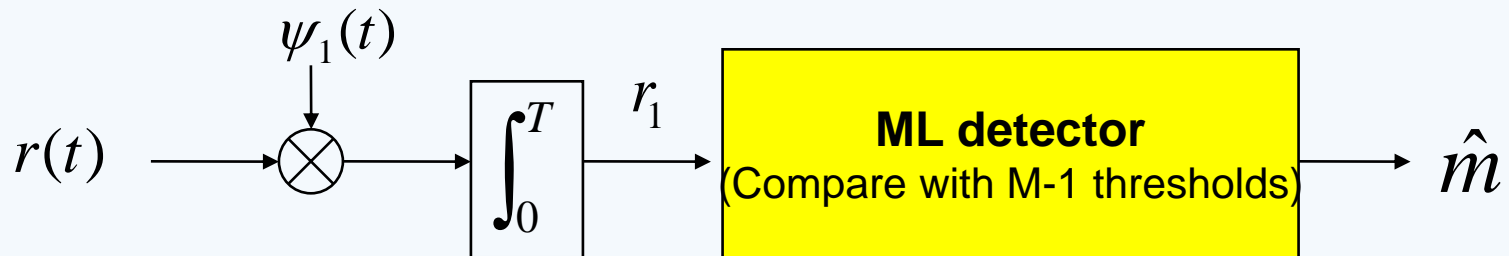
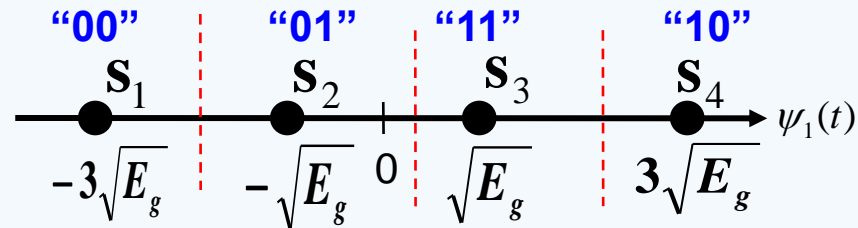
$$E_s = \frac{(M^2 - 1)}{3} E_g$$

**4-ASK = 4-PAM:**



# ERROR PROBABILITY

4-PAM



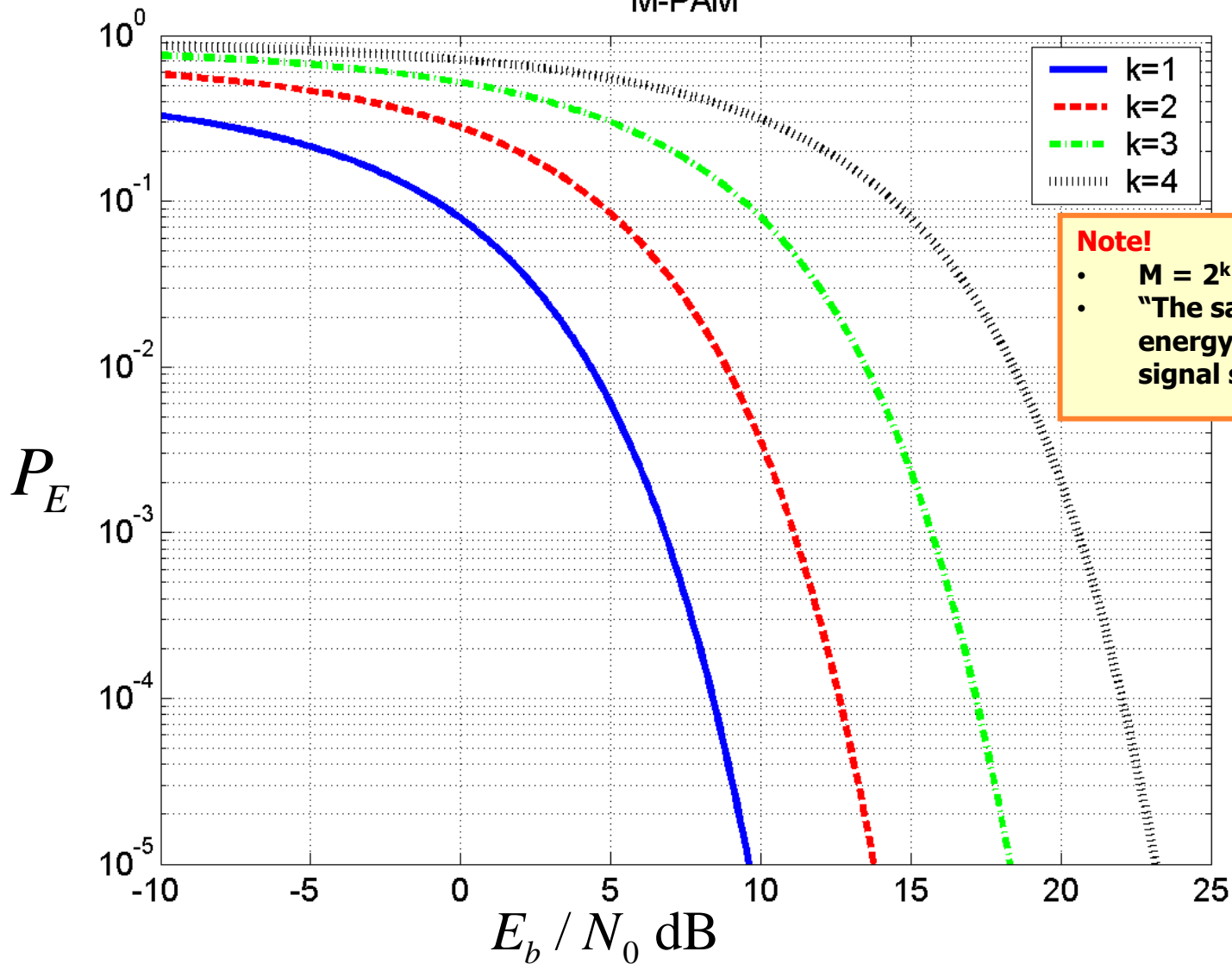
## ERROR PROBABILITY (CONT')

$$P_E(M) = \frac{2(M-1)}{M} Q\left(\sqrt{\frac{6 \log_2 M}{M^2 - 1} \frac{E_b}{N_0}}\right)$$



# Probability of symbol error for M-PAM

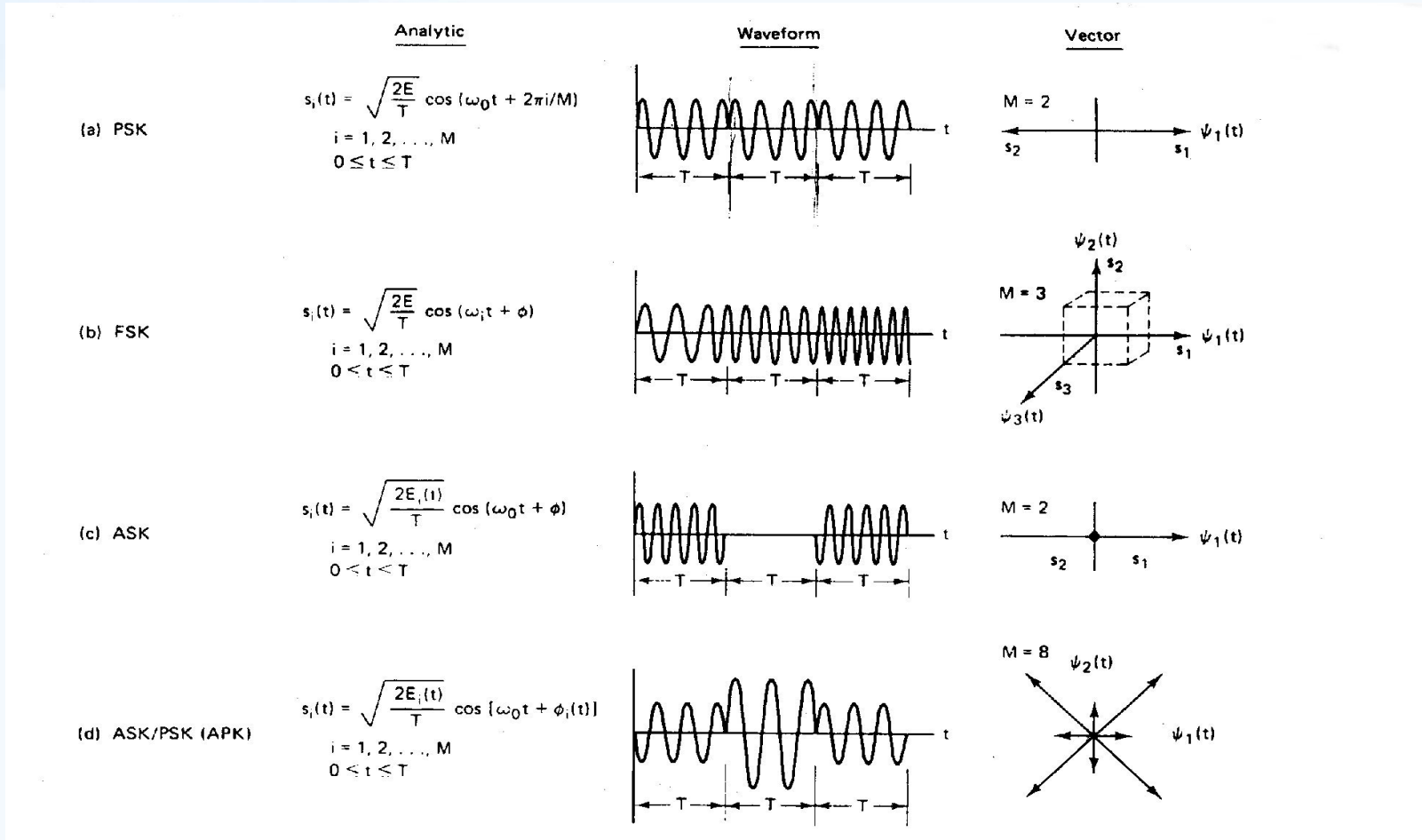
M-PAM



**Note!**

- $M = 2^k$
- "The same average symbol energy for different sizes of signal space"

# Signal Space of several modulation





TERIMA KASIH