



# **SNS COLLEGE OF TECHNOLOGY**

## **An Autonomous Institution**

### **Coimbatore-35**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECB301-ANALOG AND DIGITAL COMMUNICATION**

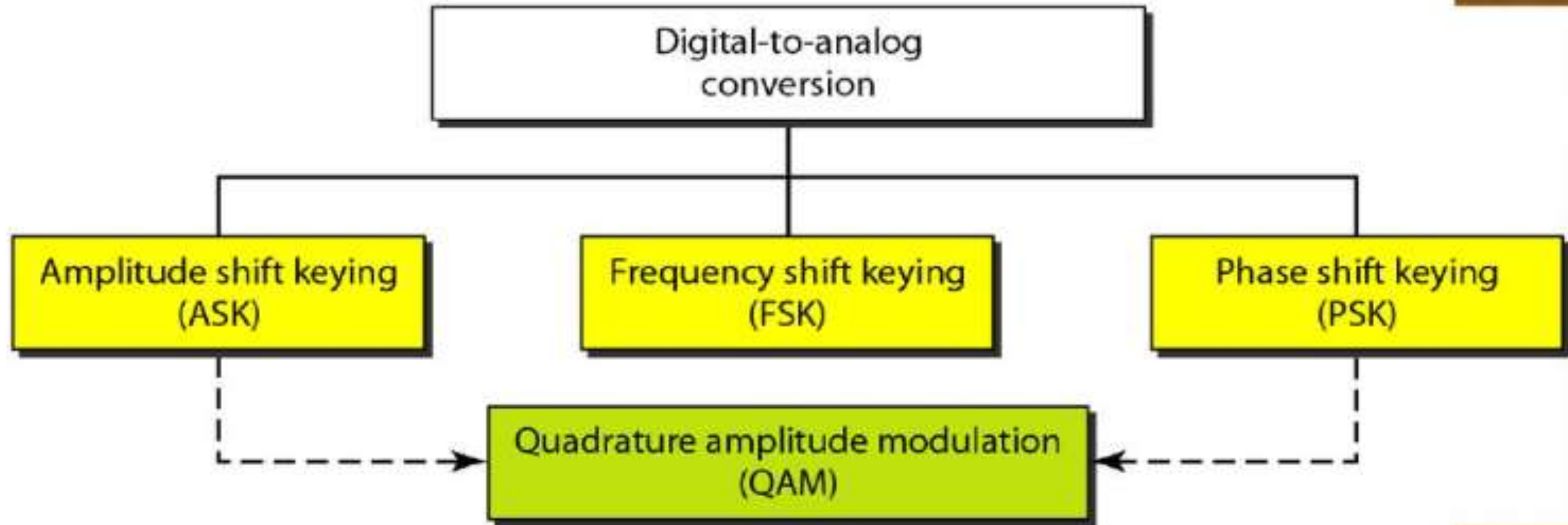
III YEAR/ V SEMESTER

### **UNIT 4 – DIGITAL MODULATION TECHNIQUES**

**TOPIC – Frequency Shift Keying (FSK)**



# OUTLINE





## Frequency Shift Keying (FSK) – Definition

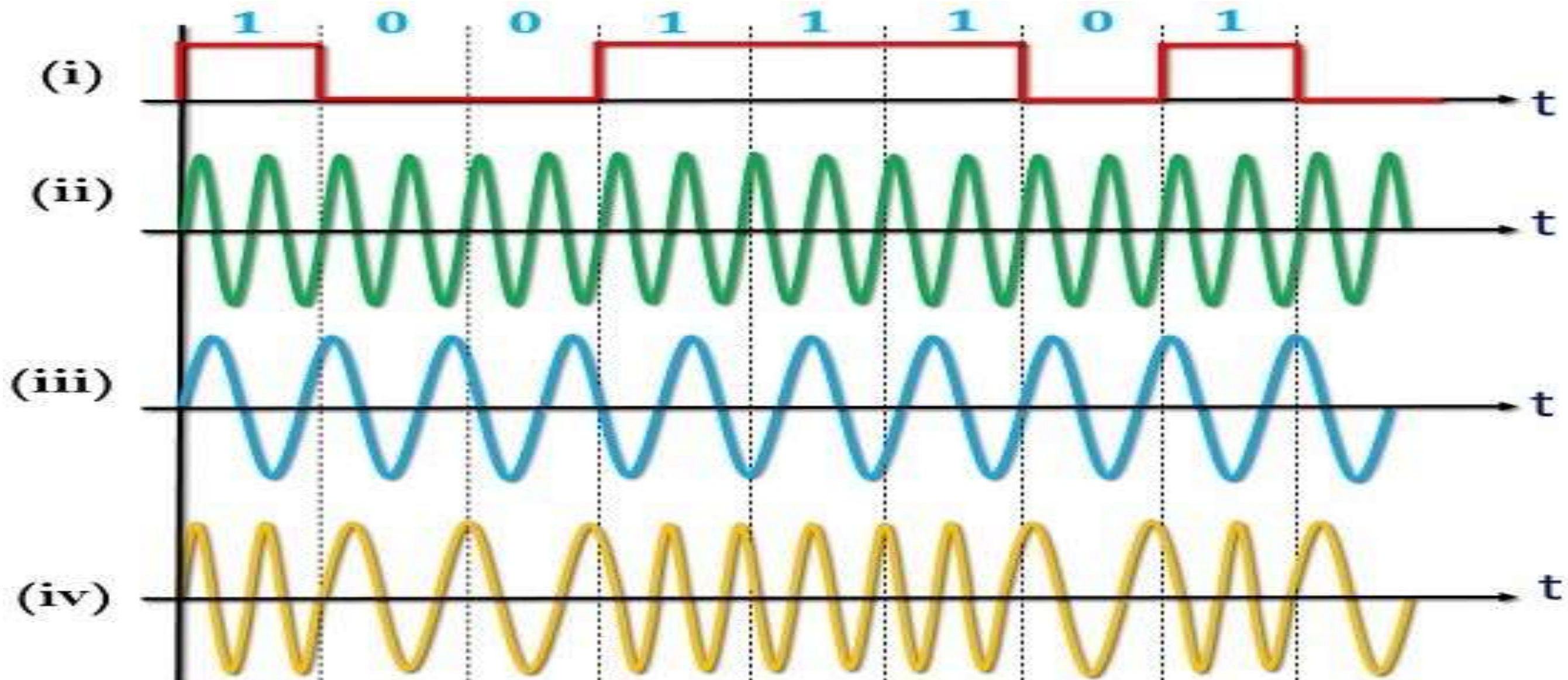


- A digital modulation technique that allows data transmission by changing the frequency of the carrier wave according to the digital modulating signal is known as **frequency shift keying (FSK)**.





# FSK - Waveform Representation



- (i) Digital bitstream
- (ii) High frequency carrier wave
- (iii) Low frequency carrier wave
- (iv) FSK modulated wave

Electronics Coach



$$\text{If } b(t) = '1' ; \quad s_H(t) = \sqrt{2P_s} \cos(2\pi f_0 + \Omega)t \quad \dots(4.6.1)$$

$$\text{If } b(t) = '0' ; \quad s_L(t) = \sqrt{2P_s} \cos(2\pi f_0 - \Omega)t \quad \dots(4.6.2)$$

Thus there is increase or decrease in frequency by  $\Omega$ . Let us use the following conversion table to combine above two FSK equations.

$b(t)$ Input	$d(t)$	$P_H(t)$	$P_L(t)$
1	+1 V	+1 V	0 V
0	-1 V	0 V	+1 V

**Table 4.6.1 Conversion table for BPSK representation**





We can write equation (4.6.1) and equation (4.6.2) combinely as,

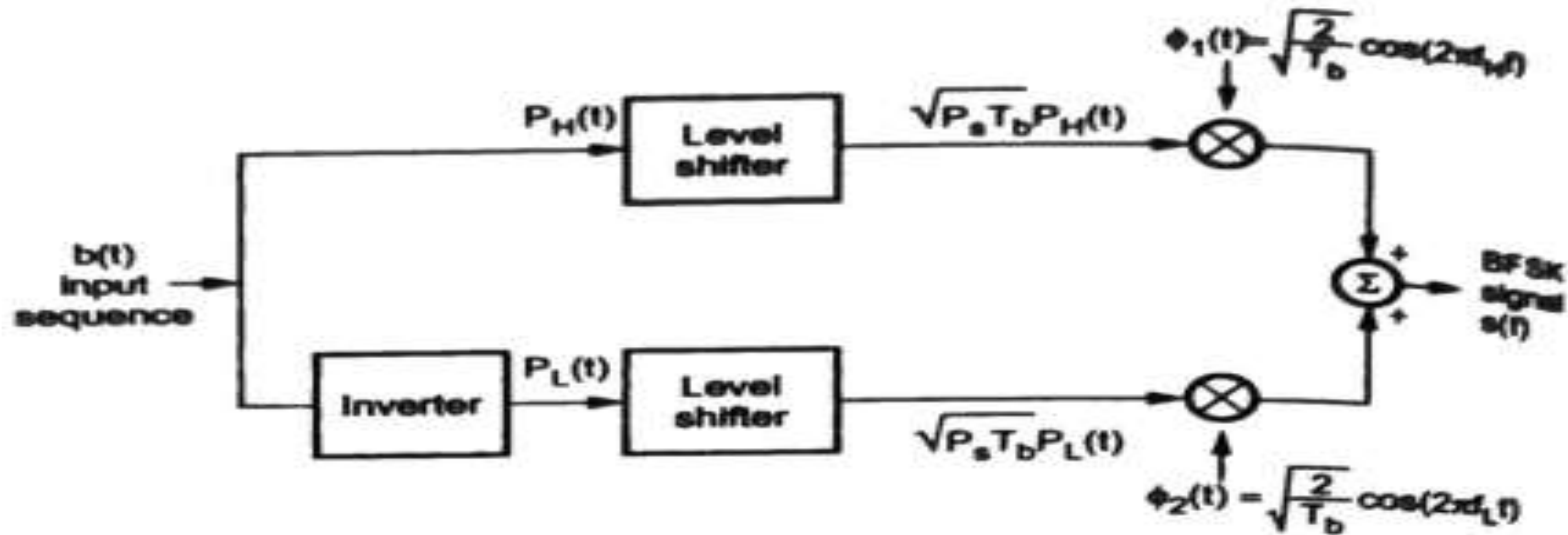
$$s(t) = \sqrt{2P_s} \cos [(2\pi f_0 + d(t)\Omega)t] \quad \dots (4.4.4)$$

Thus when symbol '1' is to be transmitted, the carrier frequency will be  $f_0 + \left(\frac{\Omega}{2\pi}\right)$ . If

symbol '0' is to be transmitted, the carrier frequency will be  $f_0 - \left(\frac{\Omega}{2\pi}\right)$ . i.e.,

$$f_H = f_0 + \frac{\Omega}{2\pi} \quad \text{for symbol '1'} \quad \dots (4.6.4)$$

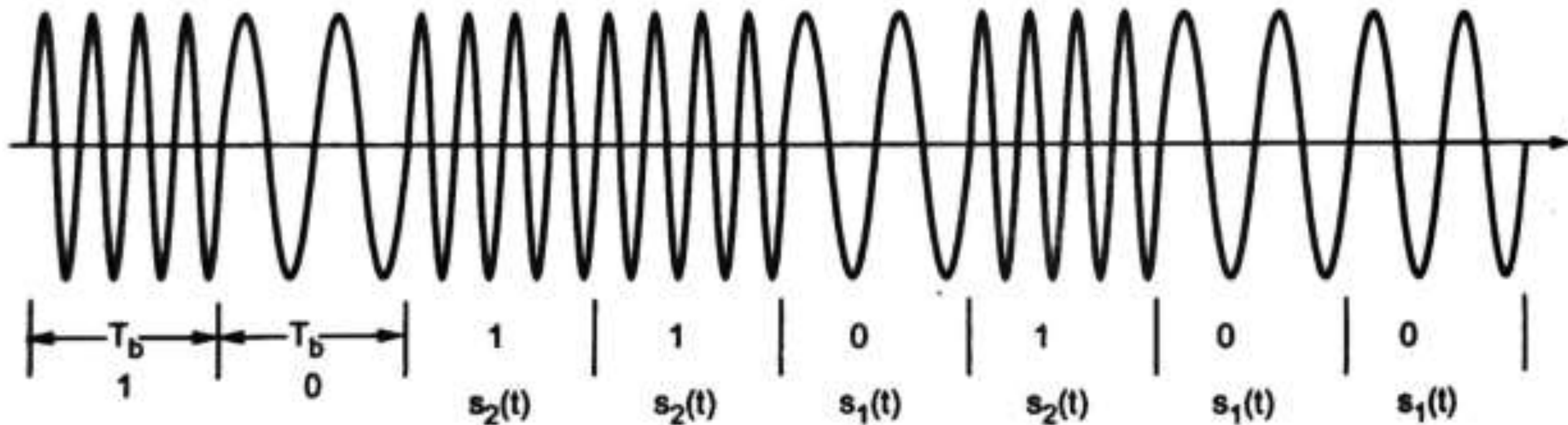
$$f_L = f_0 - \frac{\Omega}{2\pi} \quad \text{for symbol '0'} \quad \dots (4.6.5)$$



**Fig. 4.6.1 Block diagram of BFSK transmitter**

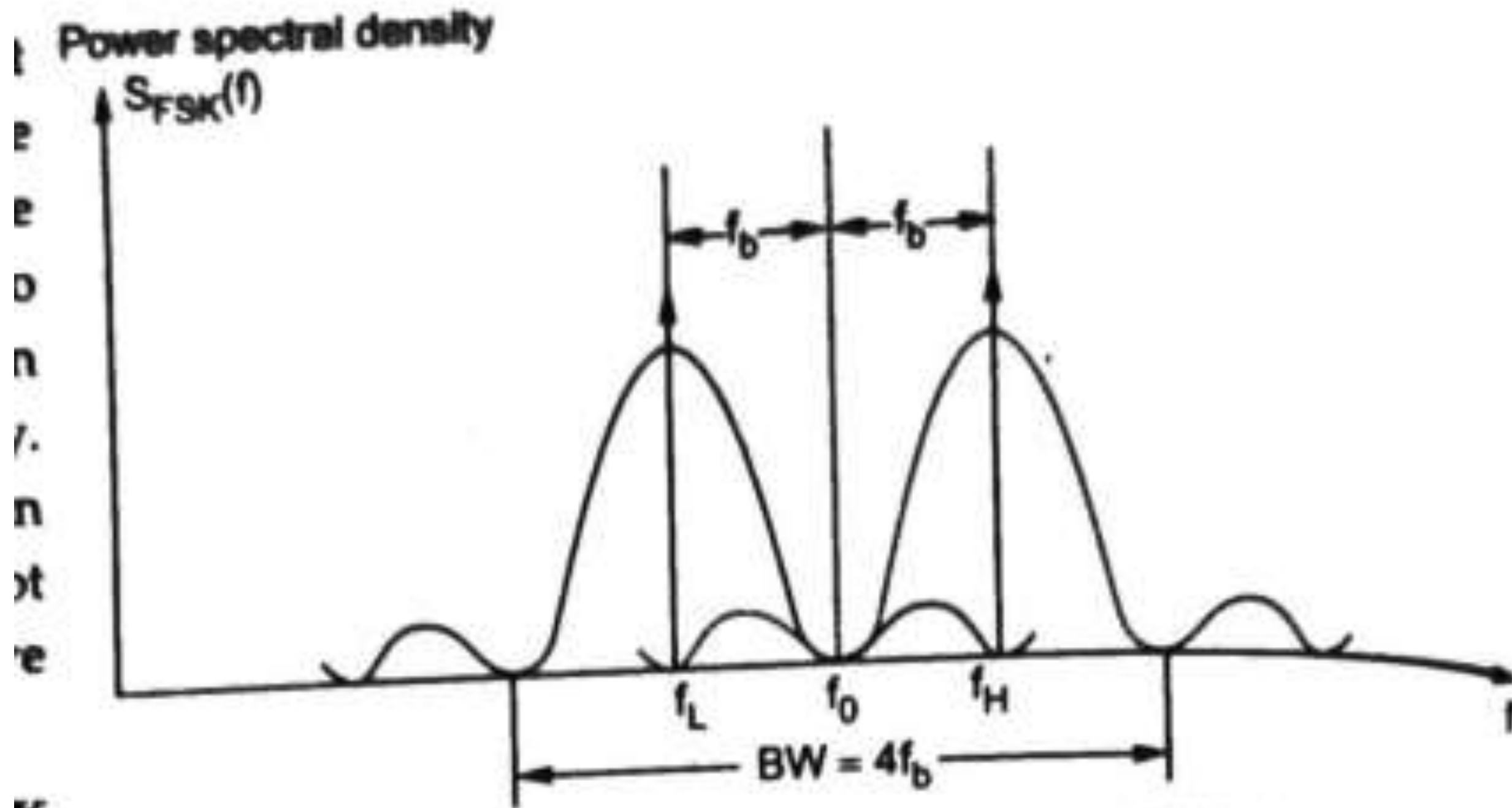


Therefore the modulated signal has continuous phase. Such BFSK signal is shown in Fig. 4.6.2. The adder then adds the two signals.

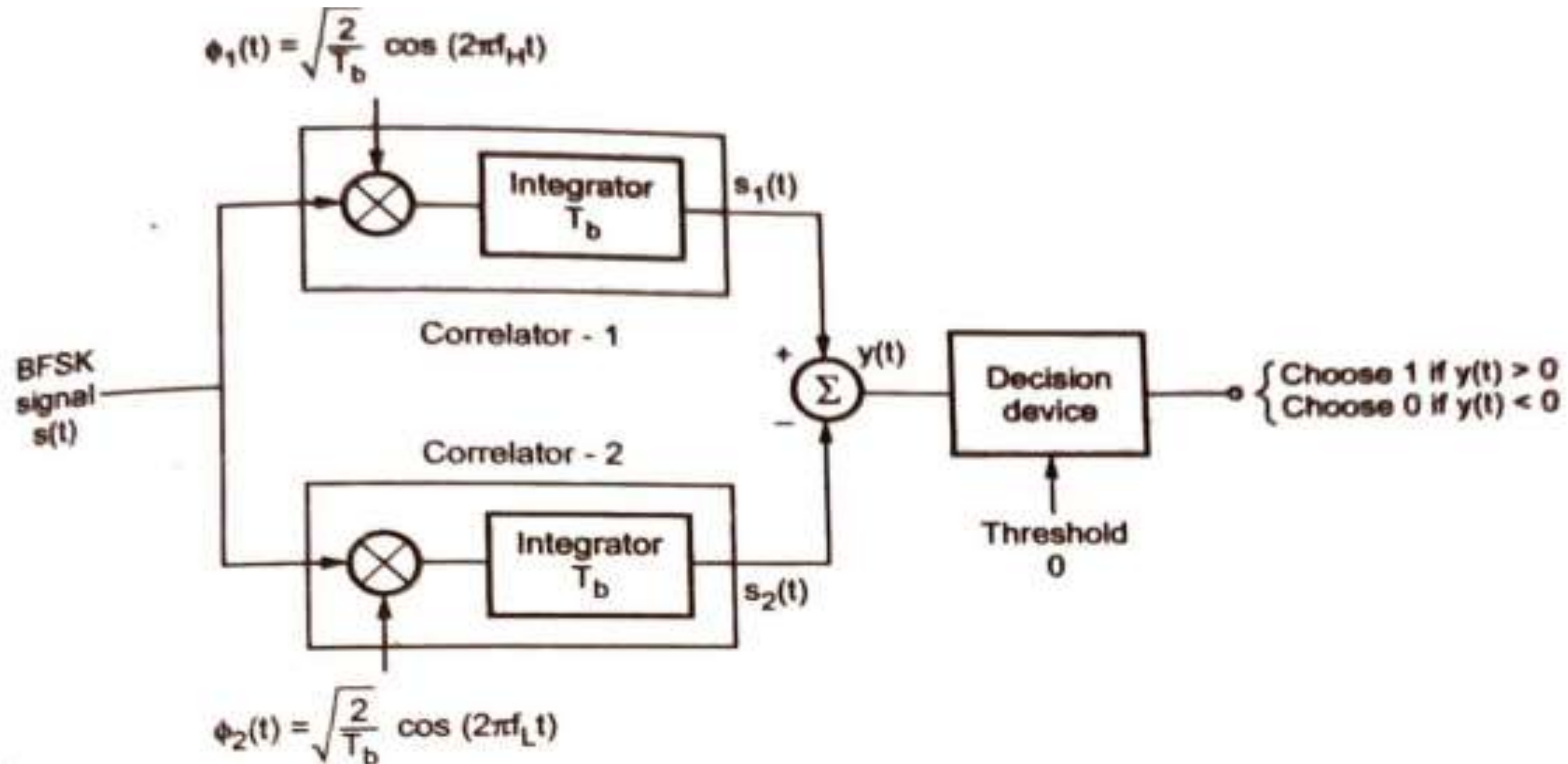


**Fig. 4.6.2 BFSK signal**

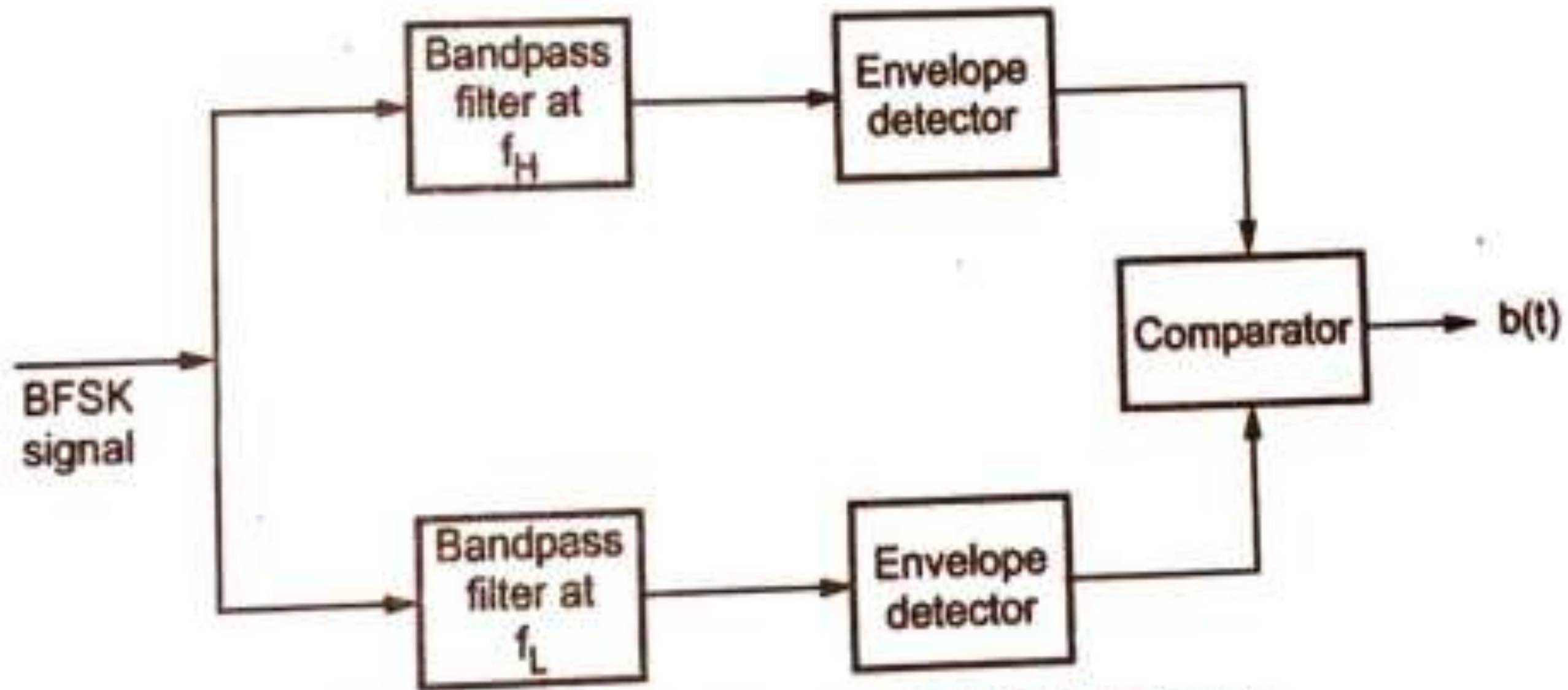




**Fig. 4.6.3 Power spectral density of BFSK signal**



**Fig. 4.6.4 Coherent BFSK receiver**

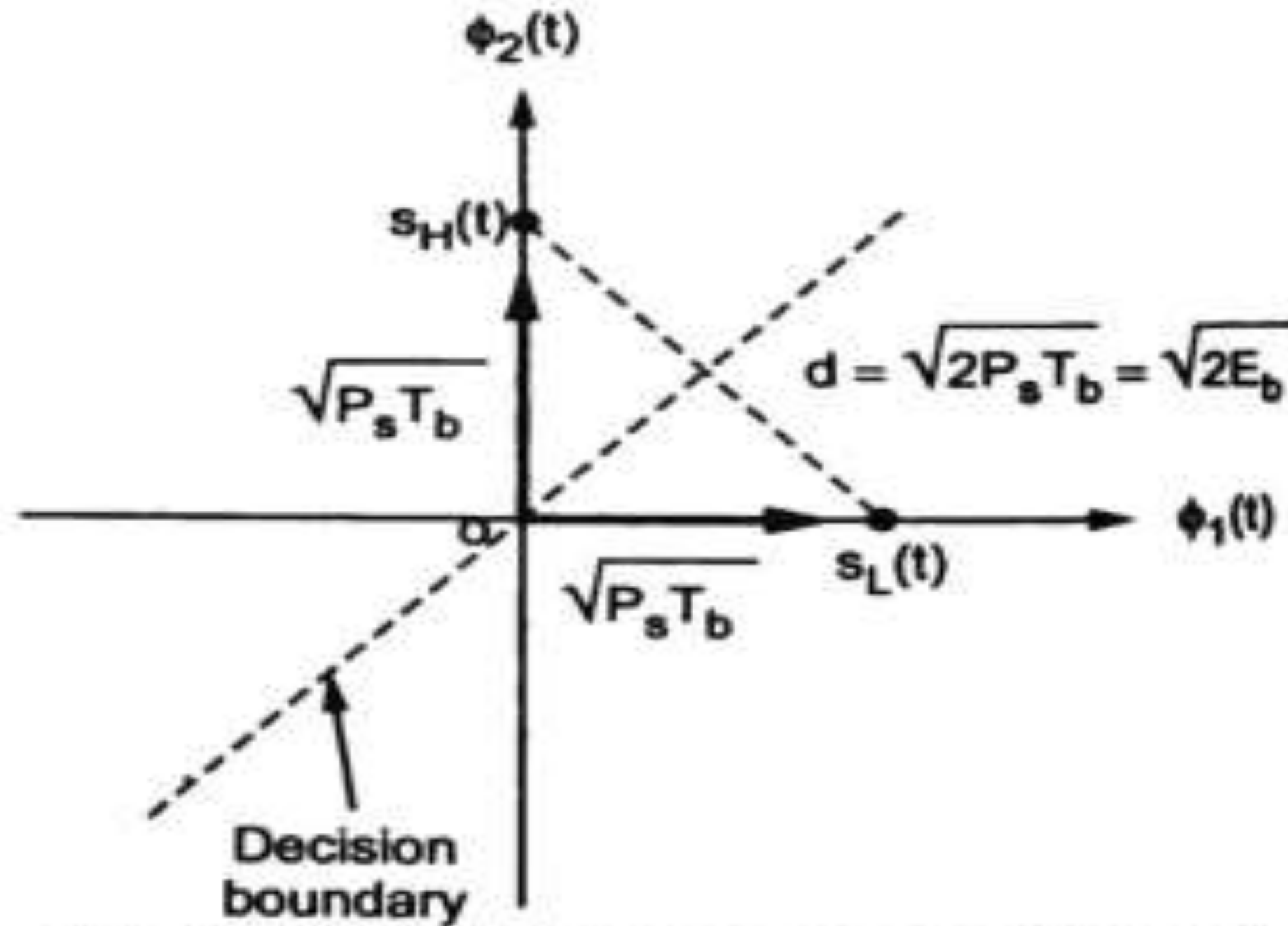


**Fig. 4.6.5 Block diagram of BFSK receiver**





... (4.6.19)



**Fig. 4.6.6 Signal space representation of orthogonal BFSK**



## Frequency Shift Keying (FSK) – Advantages



- ❖ FSK provides better noise immunity.
- ❖ The signal transmission through FSK is quite simple.
- ❖ It is suitable for long-distance data transmission.
- ❖ Bit error rate performance is better than ASK.



## Frequency Shift Keying (FSK) – Disadvantages



- It utilizes more bandwidth as compared to ASK and PSK thus is not bandwidth efficient.
- Detection of the signal at the receiver is somewhat complex





# Frequency Shift Keying (FSK) – Applications



- The technique is used in the high-frequency data transmission system.
- Extensively used in low-speed modems.



**THANK YOU**