

Frequency Hopping Spread Spectrum

Spread Spectrum

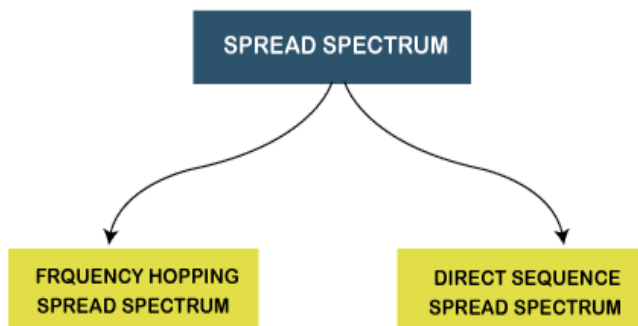
Spread Spectrum is a technique in which the transmitted signals of specific frequencies are varied slightly to obtain greater bandwidth as compared to initial bandwidth.

Spread spectrum technology is widely used in radio signals transmission because it can easily reduce noise and other signal issues.

Types of Spread Spectrum

Spread Spectrum can be categorised into two types:

- Frequency Hopping Spread Spectrum (FHSS)
- Direct Sequence Spread Spectrum(DSSS)



What is FHSS ?

- Frequency-hopping spread spectrum is designed for robust operation in noisy environments by transmitting short packets at different frequencies across wide portions of channel bandwidth.
- In many wireless networks, we use the frequency hopping spread spectrum for the purpose of improving communication quality and reliability. By using FHSS, it is possible to make communication more resistant to interference-causing noise.

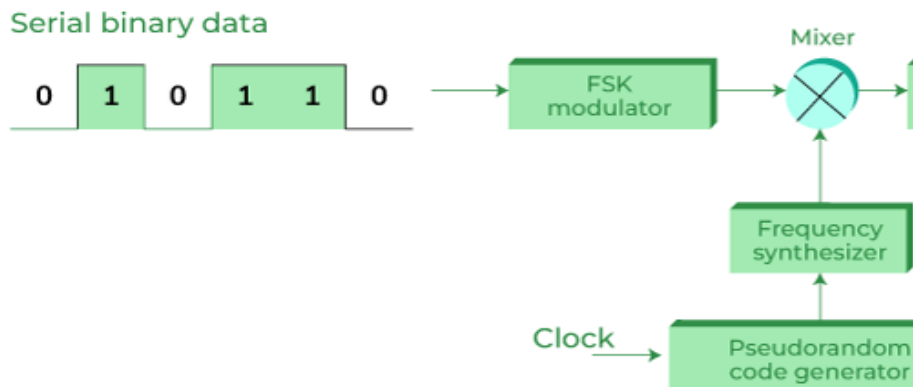
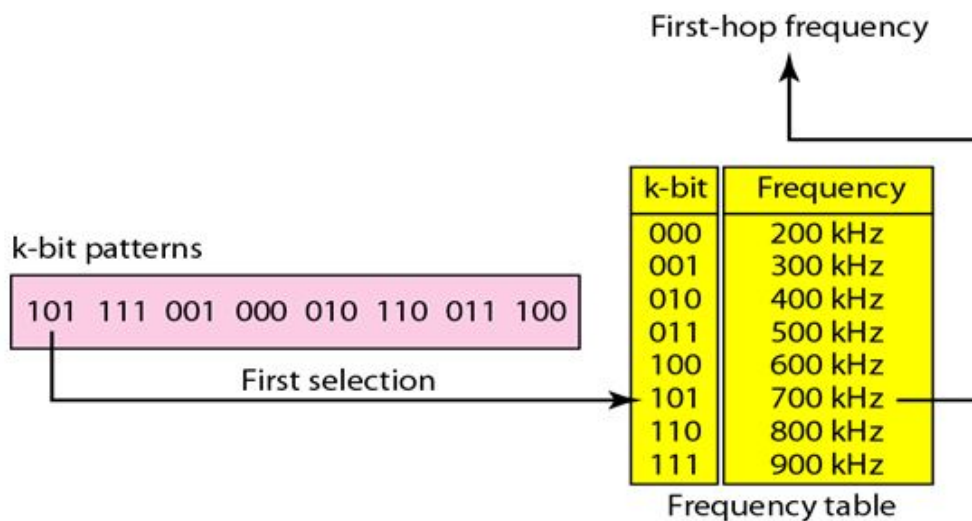


Fig. Block diagram of FHSS

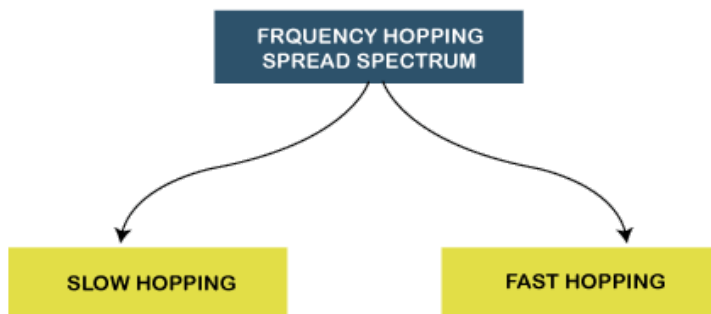


How does it work ?

- For transmission, binary data is fed into a modulator using some digital-to-analog encoding scheme, such as *Frequency Shift Keying (FSK)* or *Binary Phase Shift Keying (BPSK)*.
- A PN source serves as an index into a table of frequencies each K bit on the PN source specifies one of the 2^k carrier frequencies.
- At each successive interval, a new carrier frequency is selected.
- This frequency is then modulated by the signal produced from the initial modulator to produce a new signal with the same shape.

- On reception, the spread spectrum signal is demodulated using the same sequence of PN-derived frequencies and then demodulated to produce the output data.

Types of FHSS



Sr.No.	Slow Frequency Hopping (SFH)	Fast Frequency Hopping (FFH)
1	As the name suggests, frequency hopping takes place slowly.	As the name suggests, frequency hopping takes place at a fast rate.
2	In this case, one or more data bits are transmitted within one frequency hop.	In this case one data bit is divided over multiple frequency hops.
3	One or more data bits are transmitted over the same carrier frequency.	One data bit is transmitted over multiple carriers in different frequency hops.
4	A jammer can detect this signal if carrier frequency in one hop is known.	A jammer can't detect this signal because one symbol is transmitted using more than one carrier frequency.
5	It supports coherent data detection.	It does not support coherent signal detection. It is very difficult in FFH.

Advantages of FHSS

The following are some advantages of frequency hopping spread spectrum (FHSS):

- High efficiency.

- Highly resistant to narrowband interference
- Requires a shorter time for acquisition.
- Highly secure. Its signals are very difficult to intercept if the frequency-hopping pattern is not known.
- Provides a very large bandwidth.

Disadvantages of FHSS

- Less Robust, so sometimes it requires error correction.
- Needs complex frequency synthesisers.
- Supports a lower data rate of 3 Mbps as compared to the 11 Mbps data rate supported by DSSS.

Applications of FHSS

- Used in wireless local area networks (WLAN) standard for Wi-Fi.
- Used in the wireless personal area networks (WPAN) standard for Bluetooth.