



Chapter 6

Bandwidth Utilization: Multiplexing and Spreading

6-1 SPREAD SPECTRUM

In spread spectrum (SS), we combine signals from different sources to fit into a larger bandwidth, but our goals are to prevent eavesdropping and jamming. To achieve these goals, spread spectrum techniques add redundancy.

Topics discussed in this section:

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

Spread Spectrum

- A signal that occupies a bandwidth of B , is **spread** out to occupy a bandwidth of B_{ss}
- All signals are spread to occupy the same bandwidth B_{ss}
- Signals are spread with different codes so that they can be separated at the receivers.
- Signals can be spread in the frequency domain or in the time domain.

Figure 6.27 *Spread spectrum*

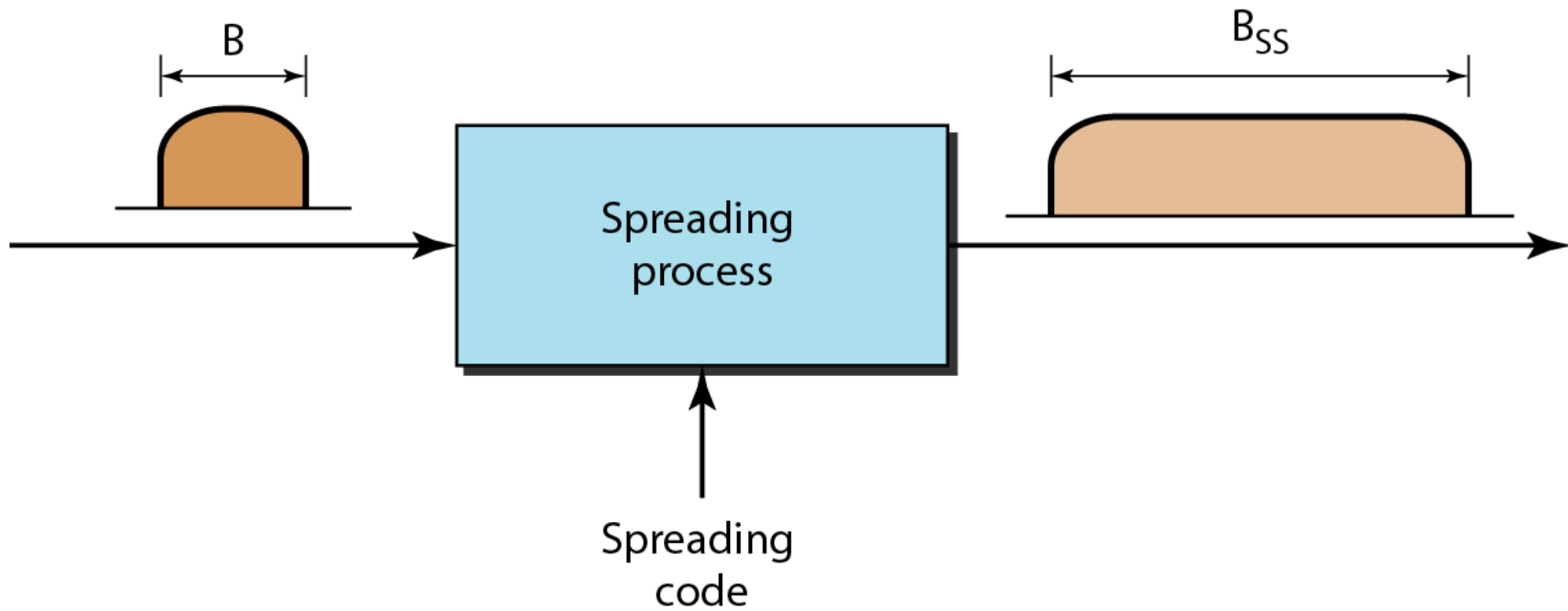


Figure 6.28 *Frequency hopping spread spectrum (FHSS)*

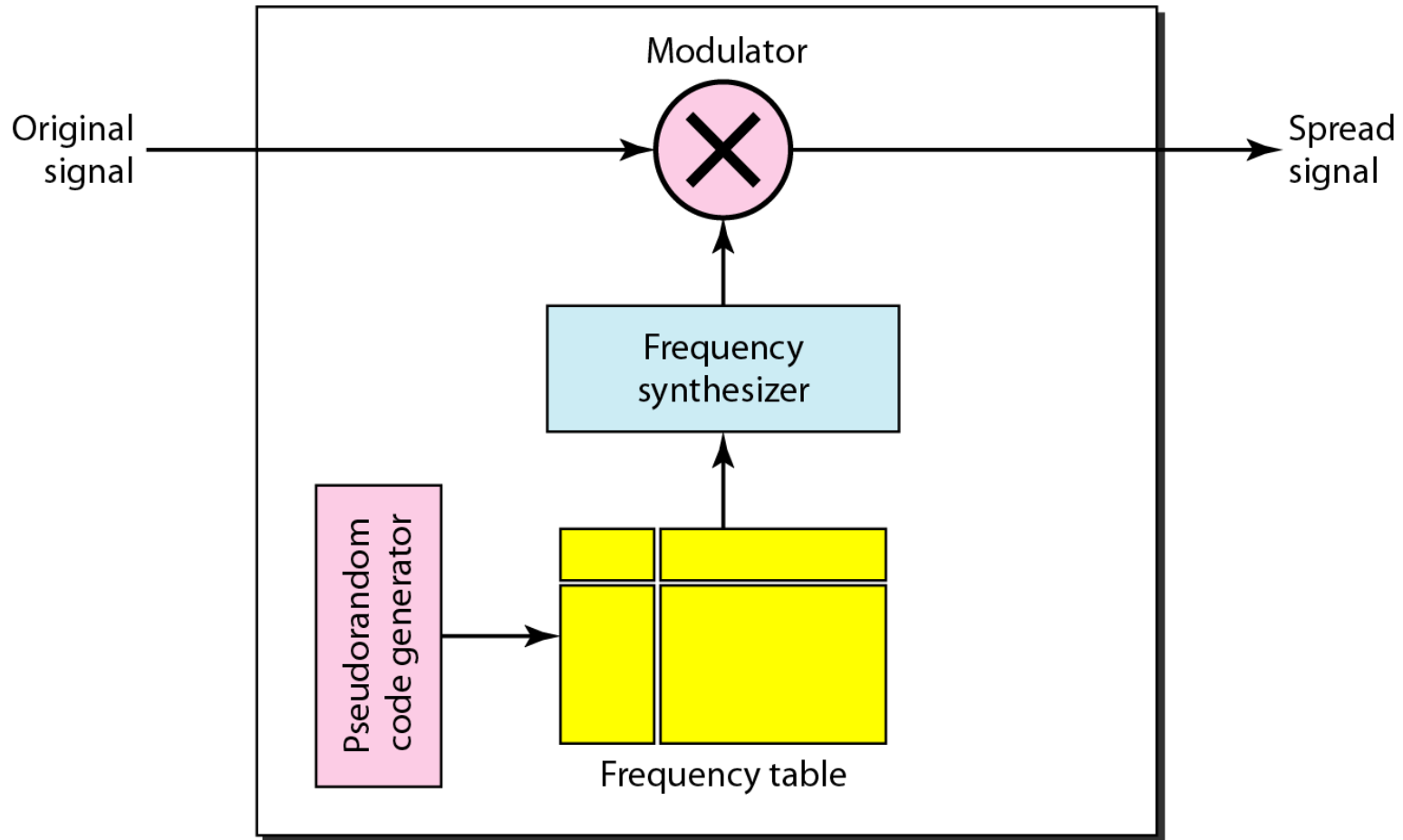


Figure 6.29 *Frequency selection in FHSS*

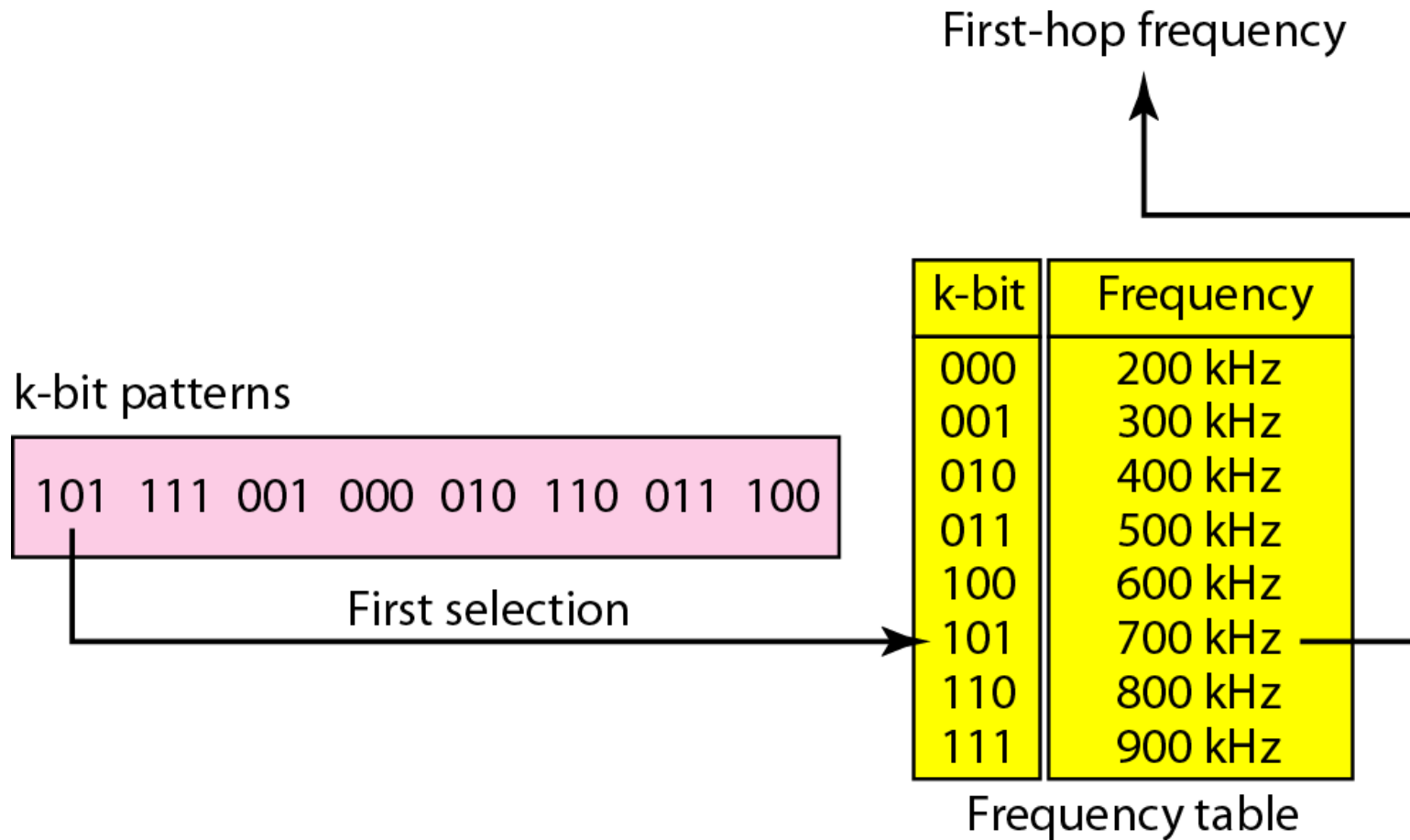


Figure 6.30 *FHSS cycles*

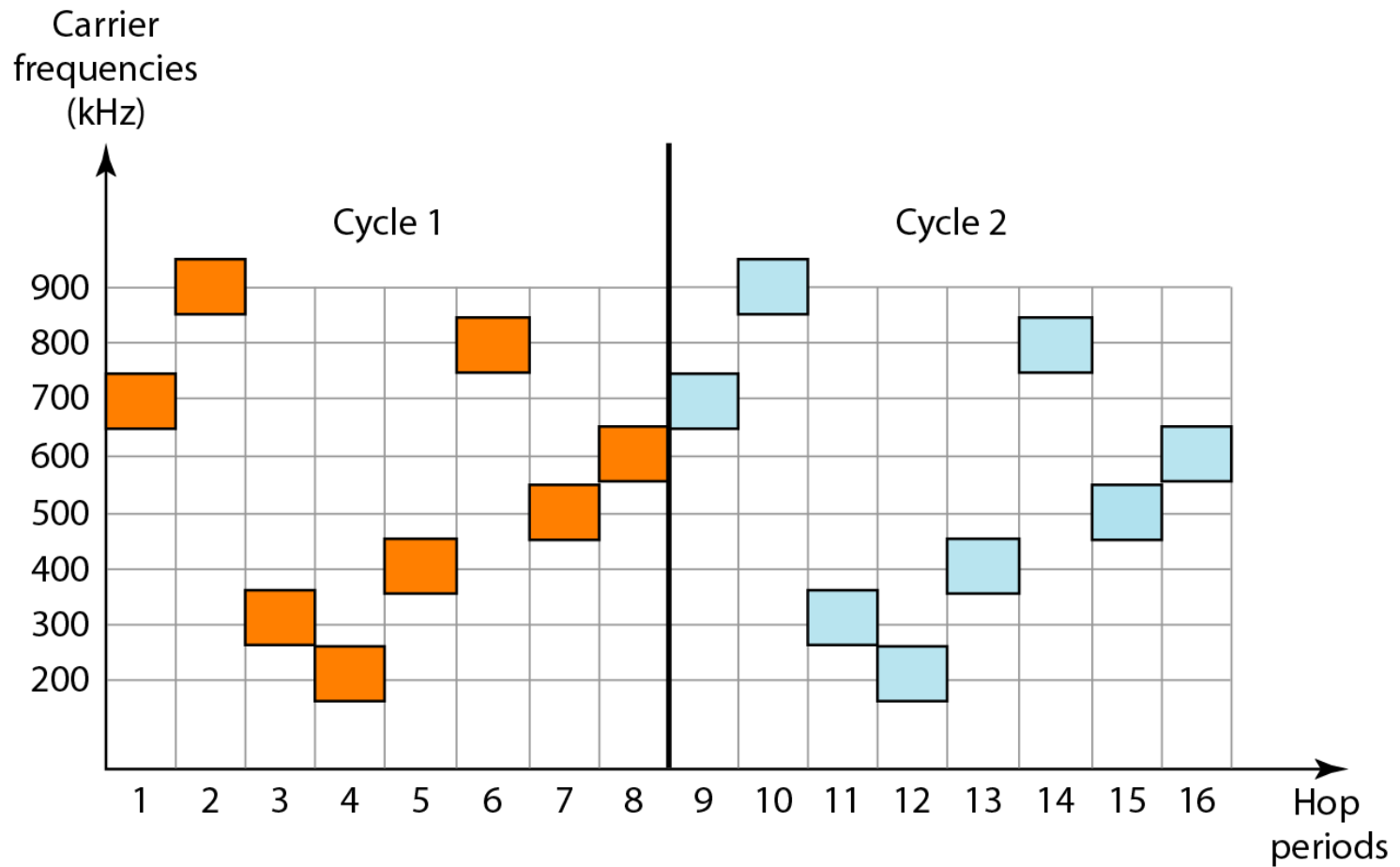
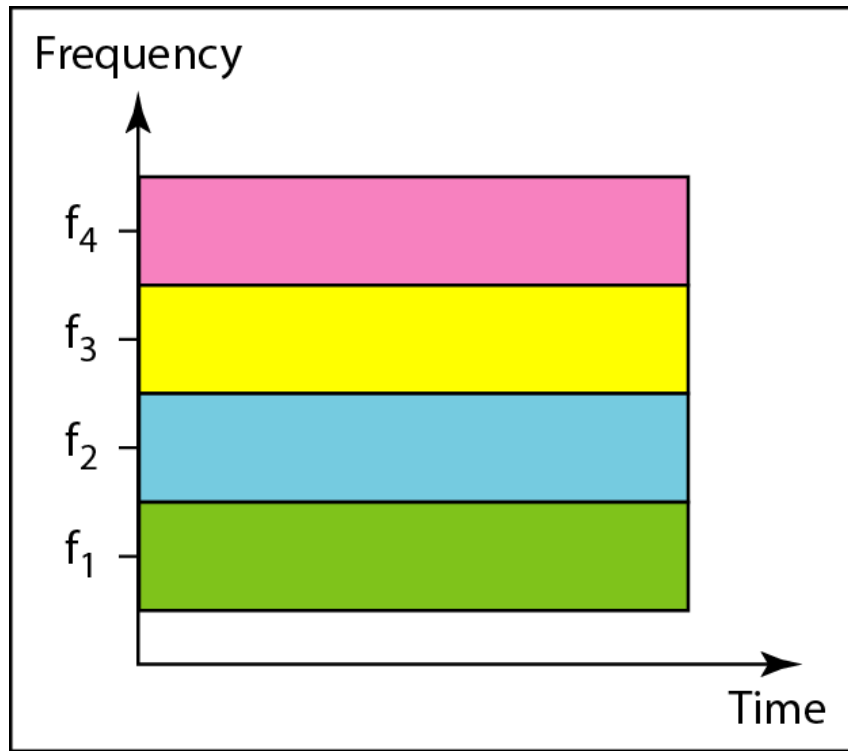
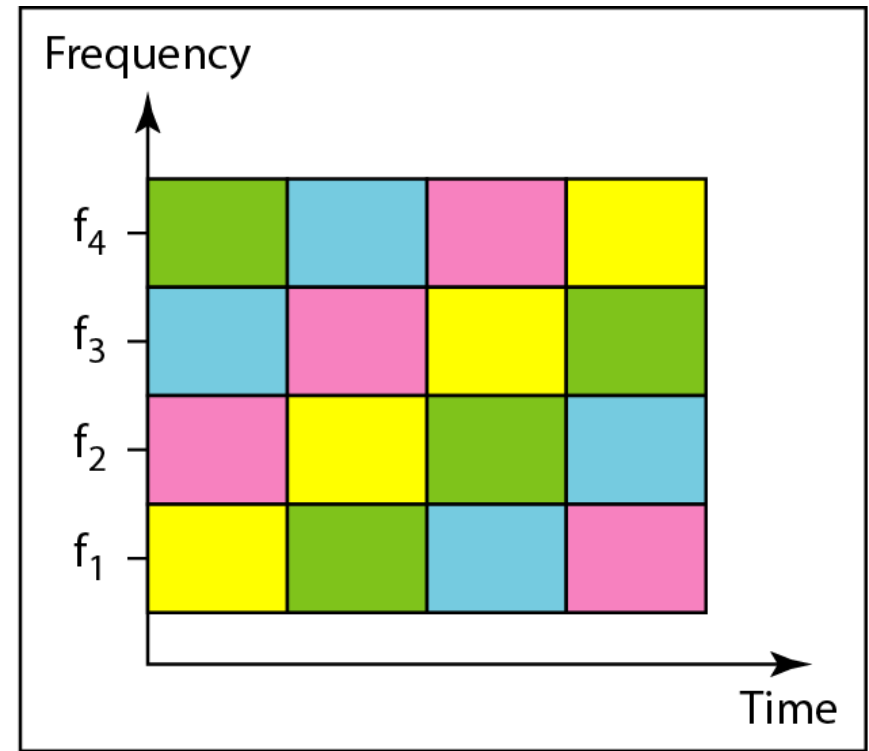


Figure 6.31 *Bandwidth sharing*



a. FDM



b. FHSS

Figure 6.32 *DSSS*

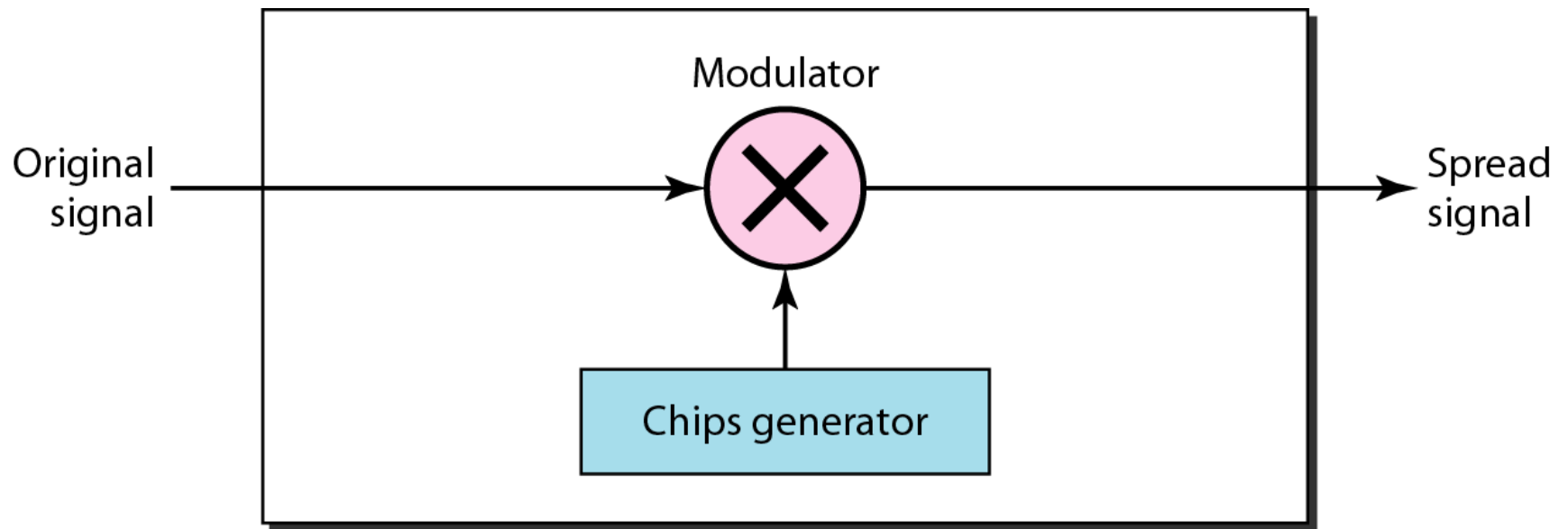


Figure 6.33 *DSSS example*

