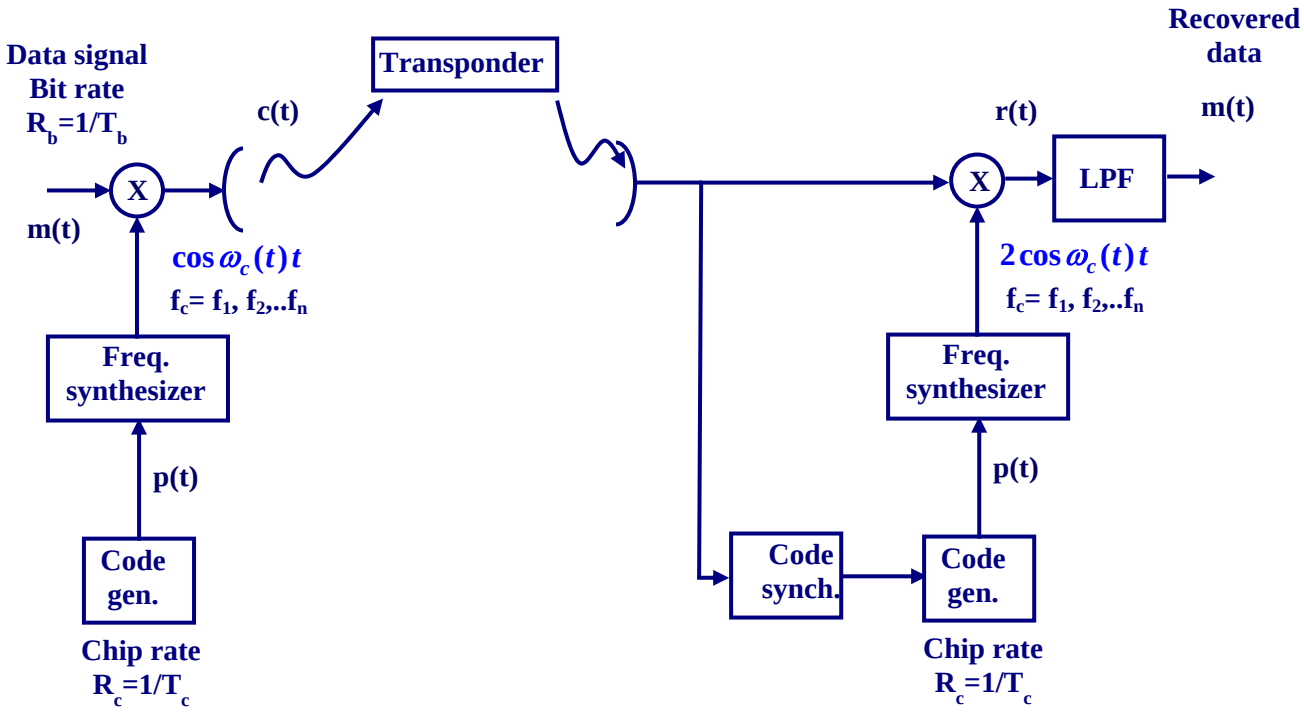
Multiple Access Techniques

Code Division Multiple Access (CDMA)

1. Frequency Hopping (FH – CDMA):



$$c(t)=m(t)\cos\omega_c(t)t$$

$f_c(t)$ is determined by a set of loge N chips.

Where N is the number of possible carrier frequencies.

f_c changes in hops, such that hop rate is given by:

$$R_H=\frac{R_c}{\log_2 N}$$

Coherent detection at the receiver will result in:

$$r(t) = m(t)\cos\omega_c(t)t \times 2\cos\omega_c(t)t$$
$$= m(t) + m(t)\cos 2\omega_c(t)t$$

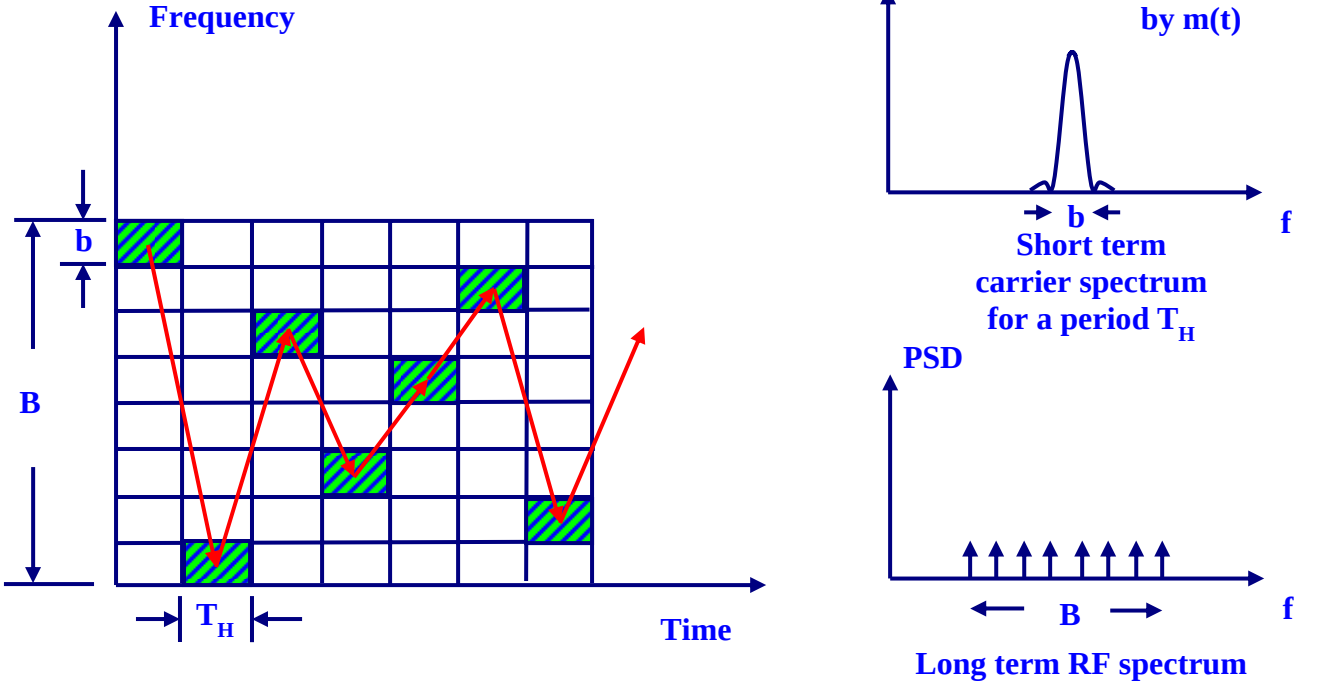
Second term is eliminated by the low pass filter.

Spectral Occupation:

Three types of systems can be considered:

- One frequency hop per information bit $R_H = R_b$
- Several frequency hops per information bit $R_H \rangle\rangle R_b$
- One frequency hop covers several bits $R_H \langle\langle R_b$

e.g. $R_H \langle\langle R_b$



The various network carriers follow different trajectories on the grid. Only the carrier whose trajectory coincides with that regenerated by the local synthesizer will be demodulated.

$$r(t)=\left[m(t)\cos\omega_c t+\sum m_i(t)\cos\omega_{ci}(t)t\right]\times 2\cos\omega_c t$$

$\therefore$ at the output of the low pass filter $\rightarrow$ m(t) plus noise caused by $\omega_{ci}(t)=\omega_c$ which has a small probability.

The spectrum spread factor is large and is equal to (B/b).

Features and advantages of CDMA

- $\Rightarrow$ Highly resistant to interference, $\therefore$ satellite spacing can be reduced considerably.
- $\Rightarrow$ Spread spectrum systems are resistant to multi-path noise which is common in mobile terminals.
- $\Rightarrow$ Small antennas can be used without problems of interference from adjacent satellites.
- $\Rightarrow$ Offers highly secure form of communications, suitable for military applications.