EE 484
CDMA Notes

Reference: B. Sklar, *Digital Communications*, 2nd ed., Prentice Hall, 2001.

In a code-division multiple access (CDMA) system multiple signals using the same RF bandwidth can be transmitted at the same time. Each of N users is given a code, $g_i(t),\ i = 1, 2, \ldots, N$. The user codes are approximately orthogonal, that is, if orthogonal then for a code chip of duration T

$$\int_0^T g_i(t)g_j(t)dt = \begin{cases} 1, & i = j, \\ 0, & i \neq j. \end{cases}$$

Since all users can share the full spectrum the transition times of the different user's symbols do not need to coincide.

The output of the data modulator for user 1 is

$$s_1(t) = A_1(t)\cos[\omega_0 t + \phi_1(t)].$$

This signal is then multiplied by the spreading code, $g_1(t)$. This same procedure is utilized for all the users. The signal present at the input to the receiver is then

$$r(t) = \sum_{i=1}^{N} s_i(t)g_i(t).$$

If the signal $s_i(t)$ is relatively narrowband compared to the spreading signal $g_i(t)$ then $s_i(t)g_i(t)$ will have same bandwidth as $q_i(t)$. At the receiver, user 1 will compute $r(t)g_1(t)$ or

$$y_1(t) = \sum_{i=1}^{N} s_i(t)g_i(t)g_1(t)dt$$

and then $y_1(t)$ is passed to a conventional demodulator where the unwanted terms are easily rejected. Thus, only the portion of the spectrum of the unwanted signals that are in the information bandwidth of the desired signals will cause interference with the desired signal of user 1. The same procedure applies to the other users.