Introduction to OFDM and OFDMA

1.1 Motivation

People are increasingly accustomed to communicate anywhere, anytime, in any way they want, and this pattern of communication is accompanied by the ever-increasing demand for mobile broadband wireless access. As demand increases, wireless network access providers and network service providers are deploying next-generation systems that can support high-speed data. The International Telecommunication Union—Radiocommunication Sector/International Mobile Telecommunications (ITU-R/IMT)-Advanced group specifies the requirements for next-generation systems in Report ITU-R M.2134. Among the requirements specified, the cell spectral efficiency η is perhaps the most important and is defined as the ratio of the aggregate throughput of all users to the product of bandwidth and the number of cells. More specifically, it is (for either the uplink or the downlink) [1]:

$$\eta = \frac{\sum_{i=1}^{N} \chi_i}{TWM}$$

(1.1)

where

- χ_i is the number of correctly received bits (contained in service data units delivered to layer 3) for user i;
- N is the number of users in the system;
- W is the bandwidth;
- T is the time over which the bits are received; and
- M is the number of cells.

The first three requirements listed by Report ITU-R M.2134 are as follows:

- The cell spectral efficiencies are 2.2 bps/Hz/cell on the downlink and 1.4 bps/Hz/cell on the uplink (base coverage urban). These values assume a configuration of four transmit antennas and two receive antennas (4×2) on the