Summary:

As the demand of wireless communication systems for high data rates rapidly increases, there is a substantial need for more frequency bandwidth and the efficient and flexible use of existing bands. Making use of the fact, that nowadays a significant part of the spectrum is unused due to the inflexible spectrum regulation, one approach to use the existing frequency gaps with a so-called overlay system is Cognitive Radio.

Orthogonal Frequency Division Modulation (OFDM) has recently been applied widely in wireless communication systems due to its high data rate transmission capability with high bandwidth efficiency and its robustness to multi-path fading and delay channels. It has been used in digital video broadcasting (DVB) systems, wireless LAN standards such as American IEEE802.11a and the European equivalent HIPERLAN/2 and in multimedia wireless services such as Japanese Multimedia Mobile Access Communications. It has also been proposed as the core technique for the fourth generation (4G) mobile communications.

The main advantage of the OFDM system is its ability to convert a frequency selective fading channel into several nearly flat fading channels as the entire available spectrum is divided into a number of narrow band sub channels. The high spectral efficiency in the system is obtained by overlapping the orthogonal frequency responses of the sub channels.

One of the most challenging problems of any spectral sharing system is the successful coexistence with the licensed systems in the same frequency band, i.e., the spectral sharing system should not degrade the performance of the systems already working in that band. Considering OFDM based overlay systems this problem is reflected by significant out-of-band radiation caused by high side lobes of the modulated subcarriers. Several techniques for the reduction of the high out-of-band radiation already exist; that in this paper these techniques have been introduced.

Another main disadvantage of OFDM is its sensitivity against carrier frequency offset which causes attenuation and rotation of subcarriers, and intercarrier interference (ICI). The undesired ICI degrades the performance of the system. It is not possible to make reliable data decisions unless the ICI powers of OFDM systems are minimized. Thus, an accurate and efficient Intercarrier Interference (ICI) reduction procedure is necessary to demodulate the received data. Several methods have been presented that will introduce in this paper.