5 HIGH-LEVEL SYNTHESIS

5.1 INTRODUCTION

In chapter 4 the theoretical principles of high-level design have been introduced. An actual high-level design for a given application and a given architecture is given in this chapter with the GSM system taken as demonstrator. The complete high-level design of a highly integrated transceiver front-end will be performed for a mobile GSM handset. All the new techniques presented in chapters 3 and 4 will be used to propose a topology that achieves a level of integration and performance that goes far beyond present day state-of-the-art realizations. Starting from the specification for the GSM system and an architecture selection, the most optimimal building block specifications for the chosen architecture are derived.

Although a formal method for high-level design and optimization has been proposed in chapter 4, this method will not be used in the presented practical design example to its full extend. This design example is set to comply with the GSM standard as defined by the ETSI (European Telecommunications Standard Institute). This standard is given, more or less, as a number of situations under which each time a certain performance must be achieved. This is the same representation as is used in the formal high-level design method proposed in the previous chapter. The problem with
standards for present day applications is that they are simplified in such a way that they allow for hand calculation and experience driven high-level design, rather than structured high-level design. The number of possible situations and required performances is drastically reduced, resulting in an over-specification and a reduced possibility for optimization. The formal high-level design and optimization allows for a structured high-level design approach and a much better optimization and power consumption reduction, when a more elaborate description of the practical requirements for the GSM system would be available. The results given in this chapter are based on this structured high-level design methodology, but the nature of the GSM standard brings them close to an experience based high-level design.

5.2 DIGITAL WIRELESS APPLICATIONS

Today, many new digital wireless applications are being introduced. Some have to replace and improve existing, analog, applications, others are new applications for new markets. The following list gives only a brief and limited overview of some of these systems and their application:

- **GSM**: GSM (Global System Mobile) is the European digital wireless system for person-to-person voice and data communication around 900 MHz. It uses typically medium sized cells (radii of approximately 10 km) and a 2 Watt transmission power. Originally developed in Europe, it is now also very successful in Asia, Africa and South-America.

- **DECT**: The DECT system (Digital European Cordless Telephone) uses smaller cells than GSM for indoor and office use (radii of approximately 100 m) [McDon CICC92]. Its operating frequencies are situated at 1880 MHz.

- **NADC**: NADC stands for North American Digital Cellular. It is a North American alternative for the GSM system. Different from GSM, it uses spread spectrum techniques for channel multiplexing.

- **DCS 1800 and DCS 1900**: DCS 1800 and DCS 1900 are almost exact copies of the GSM system, implemented however at respectively 1800 MHz and 1900 MHz. They are used in countries where either the GSM band is already occupied by another application or where more bandwidth is needed than available in the GSM band.

- **ERMES**: ERMES is the European low cost system for paging applications (European Radio Messaging System). Base stations cover areas with radii of up to 100 km. Its operating frequencies are located at 170 MHz.

- **ISM**: The ISM band (Industrial-Scientific-Medical) is a North American frequency band reserved for small range unlicensed wireless communication [Hull ISSCC96].