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A 433 MHZ CMOS RF TRANSMITTER INTEGRATED SOC FOR INTERNET OF THINGS

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1. Introduction

The emerging wireless sensor network technologies are now leading the trend of Internet of Things (IoT), where the uniquely identifiable objects, devices, and things can be connected with each other through the internet [1]. In fact, one of the most important elements in the IoT paradigm is Wireless Sensor Networks (WSN). The benefits of connecting both WSN and other IoT elements go beyond remote access, as heterogeneous information systems can be able to collaborate and provide common services. This integration is not mere speculation, but a fact supported by several international companies. Rapid advancement in wireless communications systems has led to an increased demand for wireless devices which are compact, low-cost, and low-power. To meet this demand, integration of analog and digital blocks on the same chip are required [2].

This chapter presents the integration of 433 MHz CMOS RF (radio-frequency) transmitter in a SoC (System-on-Chip) design targeting on the IoT healthcare applications. The RF integrated SoC was designed in Silterra 180 nm process technology. The overview architecture of RF integrated SoC (RF-SoC) is illustrated in Figure 9.1. The major blocks of this chip include an 8-bits general-purpose

processor, internal memory, multiple peripheral modules (i.e. interrupt, timer, watchdog timer, General Purpose Input/Output (GPIO), UART and I^2C), and the radio transmitter. The incoming sensor data from external sensors via the serial interface will be processed and transmitted wirelessly through the GPIO and radio transmitter.

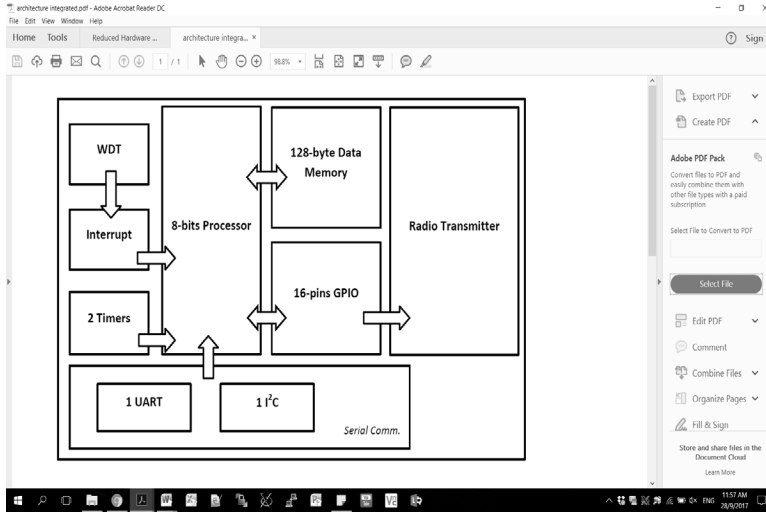

Figure 9.1. RF integrated SoC (RF-SoC) architecture overview.

2. Analog Design Approach

The design of 433 MHz RF transmitter was started with the RF telemetry link budgeting to calculate the architecture and circuit design needed in 180 nm process technology.

2.1 RF Link Budget

In RF telemetry link planning, the transmitter output power capacity and the system gains and losses were used to determine the level of power delivered to the receiver. To ensure reliable transmission through the link, the level of power available to the receiver should be in excess of that required for a minimum level of performance with the consideration of noises. Table 9.1 summarizes the calculation of RF link budget that required in designing a 433 MHz RF transmitter.