# INTEGRATED SMART RADIO:
AN EASY AND FAST CONNECTION TO THE GRID

By Cyril Zarader

Wirelessly connecting meters and equipment to the power grid is made easy thanks to Freescale's new MC12311 smart radio, an integrated system-in-package solution, which is part of the industry's leading wireless connectivity products portfolio.

To enable the smart management of power monitoring and distribution, flow of communications within a smart grid at a nationwide or region-wide level requires connection of various types of equipment together, with point-to-point distances between a few metres to a few thousand metres, and must always comply with local communications regulation (see Figure 1).
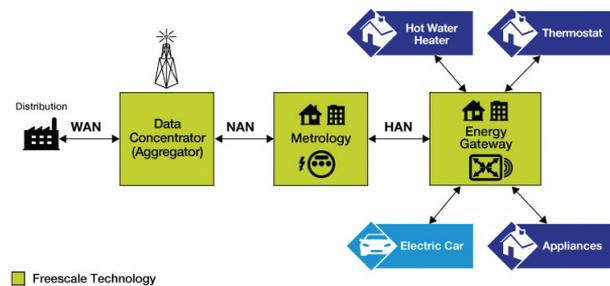
Figure 1 – Freescale smart grid and metering solutions

The new smart radio from Freescale enables an easy and fast solution to add connectivity to all types of equipment, like smart electricity meters, gas meters, water meters, appliances, thermostats and data concentrators/aggregators.

To address the different types of communications within the smart grid, from low data rate to higher data rate, the MC12311 smart radio supports various types of signal modulation such as OOK, FSK, GFSK and MSK to transmit information from 1.2 kbps to 300 kbps. The MC12311 smart radio operates over a wide frequency range including 315 MHz, 433 MHz, 470 MHz, 868 MHz, 915 MHz, 928 MHz, and 955 MHz in the licence-free Industrial, Scientific and Medical (ISM) frequency bands, operational in most countries and compliant with local radio regulatory requirements.

Powered by a very low power 8-bit microcontroller core running at up to 50 MHz, the MC12311 smart radio is a highly integrated system-in-package housed in a 8x8 mm package, embedding a rich set of peripherals such as a 10-channel 12-bit analogue-to-digital converter, two analogue comparators with selectable interrupt on rising, falling, or either edge of comparator output, two serial communications interface modules, one I2C interface, a real time counter for precise time base, time-of-day, calendar or task scheduling functions (Figure 2 shows a complete block diagram).

And embedded front end radio integrates full transmit and receive line-ups with high performance low noise amplifiers and power amplifiers to reach a sensitivity of -120 dBm at 1.2 kbps and an output power adjustable from -18 dBm to +17 dBm, to reach communication distances from metres to hundreds of metres.

The major radio communication parameters of the MC12311 transceiver are programmable and most can be dynamically set. This feature offers the key advantage of programmable narrowband and wideband communication modes without the need to modify external components.
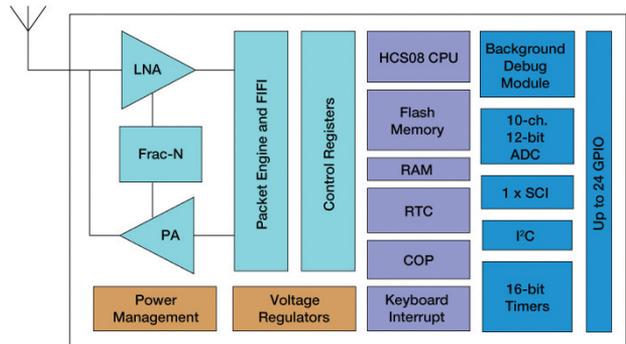

Figure 2 – MC12311 smart radio block diagram

The MC12311 smart radio comes with an on-chip memory of 32 KB of non-volatile flash memory and 2 KB RAM, for running various types of communications protocols, from fully proprietary protocols up to globally standardized protocols:

- SMAC (Simple Media Access Controller): This codebase provides simple communication and test apps based on drivers/PHY utilities available as source code. This environment is useful for hardware and RF debug, hardware standards certification, and developing proprietary applications.
- IEEE 802.15.4 MAC with custom PHY layer: The Freescale MAC is a robust, mature codebase useful for developing networking solutions. Freescale is implementing an IEEE 802.15.4 MAC-compatible custom sub-1 GHz PHY template that can be used across different frequency bands.
- Wireless M-Bus stack:- Freescale is porting an existing wireless M-Bus codebase to the MC12311 platform which will be available through an external partner.

The Freescale MC12311 protocol stack solutions are provided through a powerful software environment called the Freescale BeeKit Wireless Connectivity Toolkit. The BeeKit software tool is a comprehensive codebase of wireless networking libraries, application templates, and sample applications. The BeeKit Graphical User Interface (GUI), part of the BeeKit Wireless Connectivity Toolkit, allows easy wireless networking implementations.

To learn more about MC13211 smart radio and discover the comprehensive wireless connectivity portfolio for smart metering applications from Freescale, visit www.freescale.com/metering. MI

ABOUT THE AUTHOR:
Cyril Zarader graduated as an Engineer in 1994 from a French Electronics College and also obtained a Diploma in Electronics from Orsay University. He joined Motorola in 2001 as Product Marketing Manager for Communications Solutions. After 2004, he supported ZigBee technology and solutions as a product marketing manager for Europe. Since 2009, he has been Product Marketer in charge of Freescale's Wireless Connectivity Solutions in Europe, Middle East and Africa.

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