What's inside a smart meter? iFixit tears it down

Margery Conner - August 25, 2011

You can usually find the folks at iFixit tearing down electronics with an eye toward expanding your knowledge of how to repair your electronic devices and keep them out of landfills (see “iFixit's KyleWiens: extending electronics' life span,” EDN, Jan 21, 2010). When iFixit’s Chief Executive Officer Kyle Wiens had the opportunity to tear down an Elster smart meter, however, he jumped at it—not to produce a repair manual but to evaluate the health and safety issues that surround the utilities’ installation of smart meters.

The technicians at iFixit got their hands on an Elster Rex2 Watt-hour meter with features that an old-fashioned motor-driven meter lacks: nonvolatile memory with 1 million write cycles, advanced security with full 128-bit AES (Advanced Encryption Standard) encryption, the ability to make remote upgrades, and support for 900-MHz and 2.4-GHz ZigBee communication. The meter can also track overall power usage by time, which raises privacy concerns for some utility customers. On the other hand, some customers welcome the ability to parse their power usage to better manage it and, they hope, save money.

The communication protocol is proprietary, although Elster supports ZigBee for in-house communication. For example, if a customer wanted to track and parse power usage in the home, Elster could turn on the ZigBee-network feature to communicate with a home-energy-management box. This feature is not standard in the Rex2 meter, however, and points out a possible business model for meter companies, given that the utilities have thus far not offered power-management features to residential customers.
1. The pads within the royal-blue boxes take 240V ac from the large copper wires into the blue transformer that steps it down to about 10V ac. The device rectifies, converts, and regulates the power to adjust to the smart meter’s microcontroller and communications ICs.

2. Inside the red box is a Teridian 71M6531F SOC with a microprocessor core, a real-time clock, flash memory, and an LCD driver (see “Teridian smart-power meter-IC family offers alternative to current transformers,” EDN, Feb 3, 2010, and “Smart-power-meter-IC family offers alternative to current transformers,” EDN, March 18, 2010).

3. The orange box encompasses a Texas Instruments low-power LM2904 dual operational amplifier.

4. The yellow box surrounds a medium-power RFMD RF2172 amplifier IC.

5. The pale-blue box outlines a less-than-1-GHz Texas Instruments CC1110F32 SOC with a microcontroller and 32 kbytes of flash memory.

To address health concerns about radiated energy when the smart meter communicates with the utility, Elster programs the meters for the time and frequency of transmission. For example, Pacific Gas & Electric, which uses smart meters from General Electric, says that its smart meters transmit for only approximately 45 seconds per day. According to iFixit, if a device were always on, there might be a cause for concern. If what PG&E states about the limited transmission time is true, however, your cell phones, Wi-Fi Internet, and microwaves would probably cause more damage to your body than a smart meter would.