In many cases Power Line Communication (PLC) is ideal for the last mile, i.e. the path from the concentrator to the end user’s electricity meter. This technology does not require any separate medium, you don’t have to worry about the shading of radio signals, and the path length is manageable, at least in urban areas. Integration in the electricity meter is usually kept on a modular basis so that a straightforward PLC module should be considered here too. This includes a power supply for the PLC circuit, the PLC chipset, as well as the necessary coupling circuit to the power line.

Implementation options extend from the use of a DSP (Digital Signal Processor) with a pure software implementation of the MAC and an external PHY circuit, through to optimised SoCs (System on Chip), which include the complete PLC, MAC and PHY.

Usually either FSK (Frequency Shift Keying) technology or the more modern OFDM technique (Orthogonal Frequency Division Multiplexing) is applied. The first real standard for PLC with OFDM is the European PRIME (PoweRline Intelligent Metering Evolution) standard which is currently going out into the field in Spain.

**High input sensitivity as a key technical criterion**

The PLC, especially for use in the Smart Grid, must be an absolutely reliable basis for communication. The voltage, which can be modulated on the power line, is regulated in CENELEC EN 50065-1 and is therefore limited. So the input sensitivity remains the most important characteristic parameter for the quality of a PLC solution. It determines the path length attainable and is therefore essential for the quality of communication.

As a result of their integrated PHY with special sampling technique and dedicated filters, PLC modules based on Fujitsu SoCs attain sensitivities of 32 dB(μV).

**Bringing transmission power onto the power line efficiently**

If the maximum transmission level of 134 dB(μV) permitted by CENELEC is to be brought onto a line with 50 Ohm impedance, the output power required is 0.5W. SoCs from Fujitsu offer a digital output stage, so, at an efficiency of around 80 % only around 0.6 W has to be available. Other solutions usually work with analog output stages. At an assumed efficiency of 25%, at least 2 W have to be available to bring the same signal onto the power line.

**Prevent thermal problems intelligently**

In reality the impedance of the power line can also be 15 Ohm or less and it can constantly change too. A less efficient analog transmitter stage soon requires several Watts more than a digital end stage, a large part of which is converted unused into heat.

Real thermal problems can arise with integrated solutions, which, under certain circumstances, may even threaten the availability of the entire system.

**Keep an eye on the costs of the complete BOM**

The technical specialities above help to actively reduce the total costs of the PLC module.

The digital output stage of Fujitsu SoCs considerably reduces the costs for the necessary power supply. An additional function monitors the power supply and reliably identifies overloads in extreme cases.

Furthermore, the lower power loss helps to easily keep the module thermally under control.

The high degree of integration with the fully integrated PHY reduces the number of external components required. So no active filter circuits whatsoever are required, the coupling network is also extremely simplified and yet allows efficient coupling to the grid.

**The PLC solutions from Fujitsu Semiconductor Europe – everything from a single source**

Fujitsu’s highly integrated PLC SoCs excel by virtue of integration of the PHY, the MAC and a freely programmable MCU.

The MB87S2090 offers FSK modulation in the CENELEC A, B and C band. It can form the heart of a PLC module or even of a simple single-phase electricity meter. Besides three UARTs and two SPI interfaces, there are also several timers, PWMs and an LCD driver integrated. A 4-channel dimmer unit is also integrated, which can optionally provide PWM or phase angle control on four pins.

The MB87S2090-F for medium path lengths works exclusively in the C band and is used for intelligent street...
lighting, solar inverters or other PLC-based automation functions. This component also has almost all the above peripheral units at its disposal.

Fujitsu is one of the first manufacturers to offer a dedicated component - the MB87S2080 - for the new PRIME standard. This component masters the complete PRIME protocol with MAC and PHY.

Dedicated communication stacks are available both for FSK-based PLC, as well as for PRIME, which, together with the SoCs, considerably simplify the development of an optimised PLC module. The functions of the PRIME stack are defined by the current standard 1.3E and, among other things, cover all network functions, such as dynamic routing, automatic registration of new nodes, etc. The software stack for the FSK variants offers similar functionality, i.e. here too data can not only be exchanged between all network participants, but the stack also administrates the entire network independently. So the routes to the individual network nodes are automatically changed, if, for instance, any sudden faults occur. Similarly, new participants are automatically integrated into the network and the status of all nodes is regularly polled.

Then there is the customary Fujitsu technical support, which is not just restricted to providing starter kits, application notes and software. Manufacture on Fujitsu's own production lines – from the wafer process through to packaging – guarantees long-term availability.

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