PRIME v1.4:

EXTENDING THE BAND, INCREASING THE POSSIBILITIES

PRIME specification, version 1.4, has been now publicly (and freely) available for some months. With this backward compatible revision of the specifications, PRIME presents new features which allow for its use in all regions of the world.

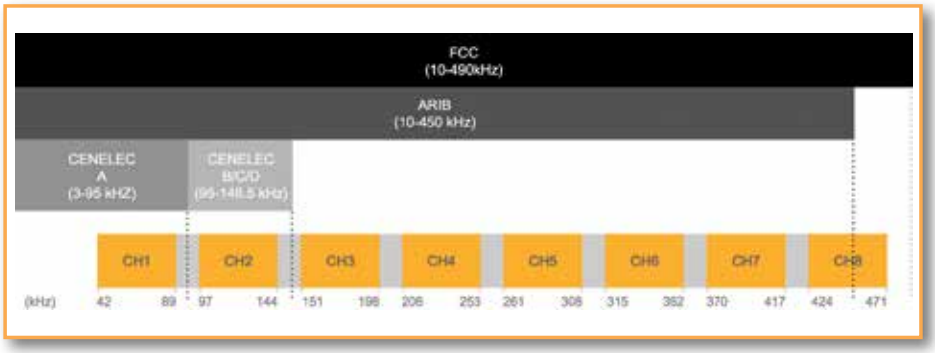
When talking about powerline communications (PLC) a distinction between *narrowband* (below 500 kHz) and *broadband* (above 2 MHz) technologies is usually made.Narrowband PLC in Europe, has historically followed harmonised standard EN 50065-1 which further constrains the frequency band to 9-95 kHz in the case of utilities employing PLC over their own public electricity grids. Outside Europe, on the other hand, narrowband PLC often uses the frequency band below 500 kHz to its full extent:

- In the US, FCC Part 15 under Title 47 of Code of Federal Regulations establishes the frequency range 9-490 kHz (§15.113) for 'power line carrier systems' used by an electric power utility entity on transmission lines for protective relaying, telemetry, etc. for general supervision of the power system. This does not include those electric lines which connect the distribution substation to the customer or house wiring (§15.3(t)); the latter would be covered by 'carrier current systems' (§15.3(f)) which in principle can use any frequency range.
- In Japan, ARIB STD-T84 sets conditions for operation of PLC equipment between 10 kHz and 450 kHz.
- Other regions of the world (South America, Asia) usually follow a similar approach.

PRIME v1.4 further extends the working band so that it can now transmit from 42 to 472 kHz. The whole range is divided into eight channels which may be used either as single independent channels or as any combination of 'n' of them concurrently for a uniquely defined transmission/reception band. This simple concept allows for very flexible configurations, so that PRIME v1.4 could be used for Medium Voltage (MV) and Low Voltage (LV) simultaneous parallel networks over the same grid on different bands, or specific dedicated channel(s) for certain critical smart grid applications, Figure 1 shows PRIME v1.4 channel allocation.

The basic PHY concepts of PRIME are kept for each channel: 97-subcarrier OFDM signal transmitted in 2.24 millisecond symbols. Adjacent channels are separated by guard intervals of fifteen subcarriers (7.3 kHz).

The maximum possible PHY data rate when using the eight channels is in excess of 1 Mbps. Furthermore, decreased noise levels are usually found at higher frequencies in the grid. This opens the application of the PRIME system to advanced smart grid services over medium and low voltage (LV) grids, such as accurate LV feeder identification, real-time interaction with smart meters, additional PLC network management/monitoring capabilities, direct control of communications with Home Area Networks etc.



To further ensure applicability to worldwide markets with specific grid characteristics, PRIME v1.4 couples the use of extended frequency range with the implementation of robust modes which enhance the resiliency of the communication under negative signal-to-noise-ratio (SNR) scenarios. PRIME v1.4 keeps, native support for IPv4 or IPv6 transport thanks to specifically defined, minimum overhead convergence layers which work directly on top of any PRIME MAC/PHY implementation. This is a powerful tool to integrate PRIME into smart grid networks.

State-of-the-art cybersecurity mechanisms have been added so that authenticated and encrypted packets can be exchanged at MAC layer. Two distinct security profiles allow users to optimize security and performance of their network. Both profiles utilize 128bit AES-CCM authenticated encryption and recognized standards for key management, distribution and generation.

Backed by the success of its earlier version in the European market (6M+ smart meters installed), PRIME v1.4 is a strong contender which maximizes the known benefits of PLC:

- Mature technology, proven under various real deployments
- Most cost-effective devices in the market (CAPEX and OPEX)
- Flexible, controlled rollouts (network fully owned by utility, can be tailored to specific requirements)
- Independent from 3rd party networks (Telco), specific vendors or proprietary solutions
- Open to evolution

Exciting opportunities lie ahead for a truly proven technology that enables new sets of added-value services, strongly improving the business case for vendors/utilities and catering to the needs of a continuously changing smart grid regulatory landscape. MI

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