ST Smart Grid Products

Application overview
September 2018
ST Pioneered the Smart Grid

The Smart Meter

Broad system know-how thanks to 20+ years of proven partnerships with key players worldwide

Over 100 Million PLC and metering SoCs installed

Driving standards worldwide with market leaders

The most highly integrated, secure and flexible solutions in the market
Future-Proof Smart-Grid Solutions

To meet any application requirement

Metering

- Higher accuracy over extended current range
- Multi-sensor support, multi-phase scalability
- Integrated power quality parameter monitoring

Performance

- Widest PLC field-proven deployments
- Highest coverage of protocols and data rates
- Highly flexible with the most number of functions integrated (IS THIS CORRECT??)
PLC Frequency Bands Regulation

EUROPEAN REGULATION CENELEC EN 50065-1

<table>
<thead>
<tr>
<th>f (kHz)</th>
<th>NO REGULATION</th>
<th>CONSUMERS</th>
<th>CONSUMERS MEDIUM ACCESS CONTROL</th>
<th>INDUS/CONSUMERS</th>
<th>ELECTRICITY SUPPLIERS AND LICENCEES</th>
<th>ELECTRICITY SUPPLIERS</th>
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Industrial
Smart metering
Lighting

FCC
CENELEC
# ST PLC SOLUTIONS

For industrial and smart metering

<table>
<thead>
<tr>
<th>Order code</th>
<th>Modulation</th>
<th>Max. bit rate (kbit/s)</th>
<th>Band</th>
<th>Embedded Protocol Stack</th>
<th>Network Size</th>
<th>Application</th>
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<tbody>
<tr>
<td>ST7540</td>
<td>FSK</td>
<td>4.8</td>
<td>CENA, CENB, CENC</td>
<td>Point-to-Point PROPRIETARY</td>
<td>&lt; 50 nodes</td>
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</tr>
<tr>
<td>ST7580</td>
<td>FSK, BPSK, QPSK, 8PSK</td>
<td>28.8</td>
<td>CENA, CENB, FCC</td>
<td>Point-to-Point PROPRIETARY</td>
<td>From 50 to 100 nodes</td>
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</tr>
<tr>
<td>STCOMET</td>
<td>OFDM</td>
<td>50 G3 128 PRIME</td>
<td>CENA</td>
<td>PRIME, G3</td>
<td>Up to 1200 nodes</td>
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<tr>
<td>ST8500 + STLD1</td>
<td>OFDM</td>
<td>250 G3 128 PRIME</td>
<td>CENA, CENB, FCC</td>
<td>PRIME, G3</td>
<td>Up to 1200 nodes</td>
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</table>

*Smart metering, Industrial, Lighting*
ST7540 Power-line Transceiver

Narrowband power-line hardwired transceiver

- Point-to-Point communication
- 8 programmable channels from 60 to 132 kHz
- Integrated AFE and Power-line driver
- Carrier and preamble detection
• PLM communication compliant with EN50065-1
• FSK modulation with low frequency deviation
• Centre frequency 132.5 kHz ± 0.2%
• Bitrate: 4800 bits/s
• Microcontroller for interfacing PLM with other serial device through RS-232, SPI, USB
ST7580 Power-line Modem

Narrowband power-line communication platform

- Multiple CENELEC band compliancy
- Programmable frequency from 9 to 250 kHz
- Modulation FSK, BPSK, QPSK, and 8PSK
- Integrated AFE & Power-line driver

Diagram:

- Power-line Driver
- Analog Front End
- Memory
- DSP Engine PHY Processor
- 8-bit MCU Protocol Controller
- IOs + Peripheral
- ST7580
- STM32

[Diagram showing the components of the ST7580 modem]
• Expansion board for STM32 Nucleo based on ST7580
• Working on DC or AC with STEVAL-XPLM01CPL (coupling + isolation)
• Example firmware available for point-to-point communication, compatible with STM32Cube firmware (NUCLEO-F401RE and NUCLEO-L053R8)

SW available under X-CUBE-PLM1
STCOMET SoC Platform

Smart Meter / Power-line modem system-on-chip

STCOMET

- Programmable PLC DSP
- Multiple OFDM PLC standards (PRIME, G3)
- Embedded RX and TX PLC AFE & PLC Line Driver
- Cortex M4 @ 96 MHz
- Up to 1 Mbyte of Flash memory, 128 Kbytes of RAM
- AES-256 bit encryption engine
- Metering block with 3 measurement channels

Power-line Driver

Analog Front End

Memory

OFDM DSP Engine PHY Processor

Memory

32-bit Cortex M4 Protocol Controller

IOs + Peripheral

Energy metering Subsystem
STCOMET Evaluation Board

**EVLKSTCOMET10-1**

- Complete single-phase meter development kit based on the STCOMET smart meter SOC
- Suitable to evaluate PLC protocols in CENELEC A band
- Metering up to Class 0.2
- Up to 3 measurement channels
- Two LEDs for active and reactive energy signalling
- Two tamper-detect inputs
- Digital connector for 3-phase metering extension with the EVALSTPM34
- Relay driving circuit for unipolar and bipolar relay based on ST L2293Q monolithic driver device
- Power supply module based on ST VIPER26H
- JTAG debug (J-Link OB)
Programmable, ultra-low-power and compact PLC solution

- Fully programmable, high performance
  400 MHz DSP and 200 MHz ARM® 32-bit Cortex®-M4F core, 360 Kbytes of RAM
- Ultra-low power consumption
  <100 mW in Receive mode
- Embedded AES cryptography engine
  up to 256-bit key and multi-security modes
- Multi-standards, full 500 kHz bandwidth
  support any band: CENELEC, and FCC
- Extended temperature range
  -40 to 105°C
- Small footprint package
  QFN56 (7x7 mm)
**ST8500 Application Block Diagram**

**ST8500**
- Reprogrammable Power-line modem
- Integrated Analog Front-End (0 to 500 kHz)
- Full-duplex interface via UART
- Security: OTP, AES-128 and -256 with support for GCM, CCM, ECB, etc. modes
- A unique firmware solution for G3 to support device and coordinator, CENA/B & FCC

**STM32 Host MCU**
- Store firmware images in eFlash or external SPI Flash memory
- Download image to ST8500 & drive modem
- Manage customer firmware application

**STLD1 – Line Driver**
- Dual line driver 18 V p-p single ended, 36 V p-p differential output range
- Up to 1.5 \( A_{\text{RMS}} \) driving capability
- Thermal and current feedback
The kit includes three boards:

- the ST8500 PLC module including the companion STLD1 line driver
- the STM32 motherboard
- the power supply board based on the VIPER26H

- Suitable to implement PLC protocols in CENELEC A, B and FCC
- Enable CENELEC/FCC band selection through firmware control (automatic hardware tuning)
- Additional module interface for future development of hardware add-ons (e.g. Sub-GHz transceiver)
ST8500 Development ecosystem

**PC Tools**
- Firmware download
- PLC Protocol tests
- Performance tests and debug
- Graphical User Interface

**Evaluation Kit**
- Schematics and gerber files
- For evaluation purposes
- Enabling customer product development

**Technical documentation**
- Datasheets
- Application notes
- User manuals

**Software packages**
- G3 and PRIME Firmware deliveries
- Host API drivers for STM32 and Linux
- Documentation
A complete and scalable platform:

<table>
<thead>
<tr>
<th>Order code</th>
<th>Description</th>
<th>Package</th>
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<tr>
<td>ST8500TR</td>
<td>Programmable Modem + AFE</td>
<td>VFQFPN 56 (7x7x1 mm)</td>
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<tr>
<td>STLD1TR</td>
<td>Line Driver</td>
<td>QFN-24L</td>
</tr>
<tr>
<td>EVALKITST8500-1</td>
<td>Evaluation kit</td>
<td>NA</td>
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Further information and full design support available at:

www.st.com/powerline
ST Power-line software offer

Simple PLC applications

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<td>Host interface</td>
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<td>CTM App</td>
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<tr>
<td>Data link, encryption</td>
<td>Data link, encryption</td>
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</table>
ST Power-line software offer

Advanced smart grid solutions

ST

NOT ST

STM32

ST8500

STM32

ST8500

STCOMET

PRIME ALLIANCE

PRIME PHY (OFDM)

PRIME CL 4-32

PRIME MAC RT

DLMS/COSEM

Host interface

UDP

IPV6

6LowPAN

MAC

G3 PHY (OFDM)

Host interface

G3-PLC Alliance

6LowPAN
ST stands for life.augmented