

# Netricity PLC and the IEEE P1901.2 Standard

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# Netricity by HomePlug

- ▶ A certification and branding program created by the HomePlug Alliance
  - Compliance to the IEEE 1901.2 Standard
  - Interoperability between IEEE 1901.2 devices
- ▶ Creates market confidence
  - Certification assures compliance with the Standard
  - Interoperability is verified among products
  - Certification program is managed by an experienced and successful HomePlug organization

# IEEE 1901.2 Standard - Overview

- ▶ Title: **“Standard for Low Frequency (less than 500 kHz) Narrow Band [NB-LF] Power Line Communications for Smart Grid Applications”**
- ▶ Designed to provide a new benchmark of performance and Reliability
- ▶ Supports interoperability with existing “PRIME” and “G3-PLC” OFDM technologies
- ▶ Already field verified by world’s largest energy suppliers
  - IBERDROLA (Spain)
  - ERDF (France)

# IEEE 1901.2 Standard - Overview

## ► Verification (courtesy of Iberdrola)

- Extensive stress tests
- Products from Multiple Vendors (4 silicon manufacturers, 7 meter vendors) based on PRIME
- Variety of System Test Cases – verified high performance connectivity
- Overhead and underground lines tested.
- 100,000 meters already installed.
- 300,000 meters to be deployed in 12 different areas in Q4 2011 and Q1 2012
- New RFQ for 1 million meters by the end of 2011 to be deployed in 2012

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# IEEE 1901.2 Standard - Overview

## ► Verification (continued)

- COSEM tests (“COmpanion Specification for Energy Metering” - IEC 62056 series - sets the rules, based on existing standards, for data exchange with energy meters)
  - Tests the availability of the data to the application, per access try
- Product certification
  - Independent labs (compliance to specs)
  - PHY implementation tested by chipset providers
  - MAC tested using a reference Data Concentrator

# IEEE 1901.2 Standard - Overview

## ► Verification (continued)

- 102,876 bills sent to suppliers based on PRIME PLC meter readings
- 1,238 disconnection orders executed
- 985 re-connection orders executed
- 635 on-demand readings
- 15,673 remote meter firmware upgrades
- 945 remote DC firmware upgrades

# IEEE 1901.2 Standard - Overview

- ▶ The IEEE Project was approved March 25, 2010
- ▶ Anticipated Sponsor Ballot 1Q2012

Note: “P1901.2” refers to the Project and “1901.2” refers to the Standard.

# IEEE 1901.2 Standard - Overview

- ▶ P1901.2's working group roster includes nearly all of the world's narrowband PLC experts

- ▶ Current 37 members:

ABB Ltd.

Accent S.p.A

Aclara/Esco

Technology, Inc.

Advanced Comm

Network

ADD Semi.

Alliander

Analog Devices

Cisco

devolo AG

Duke Energy

Echelon Corp

EDF/ERDF

EnVerv, Inc.

Freescale

HomePlug Powerline

Alliance

iAd GmbH, Germany

Ibedrola

Iskraemeco

Itron

Kawasaki

Microelectronics

Landis+Gyr

Lantiq

Marvell

Maxim

Mobix

Power Plus Communications

Princeton Technology Corp.

Realtek Semiconductor Corp.

Renesas

Sagemcom Energy & Telecom

Schneider Electric

Sermitech Semiconductor

Siemens

STMicroelectronics

Texas Instruments

Watteco

Yitran Communications



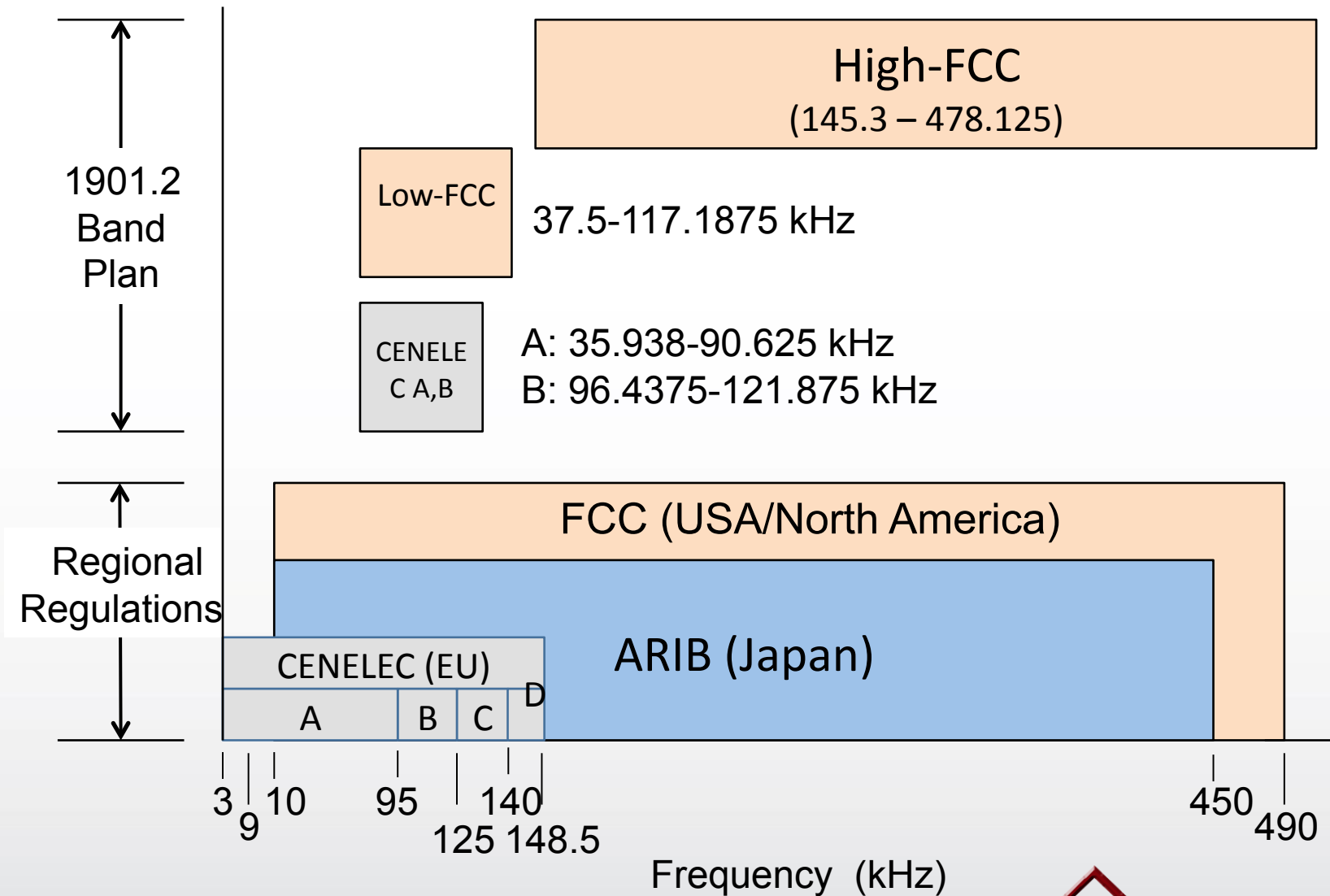
# IEEE P1901.2 Features

- 10 - 490 kHz frequency band, OFDM-based
- Data rates  $\leq$  500kbps
- Accommodates various country band regulations
- Low voltage between meter and transformer (<1,000 volts)
- Through low-voltage to medium-voltage transformer (1000 V up to 72 kV)
- Urban and in long distance (multi- kilometer) rural communications.
- AC and DC electric power lines
- Low Power consumption
- Low Cost

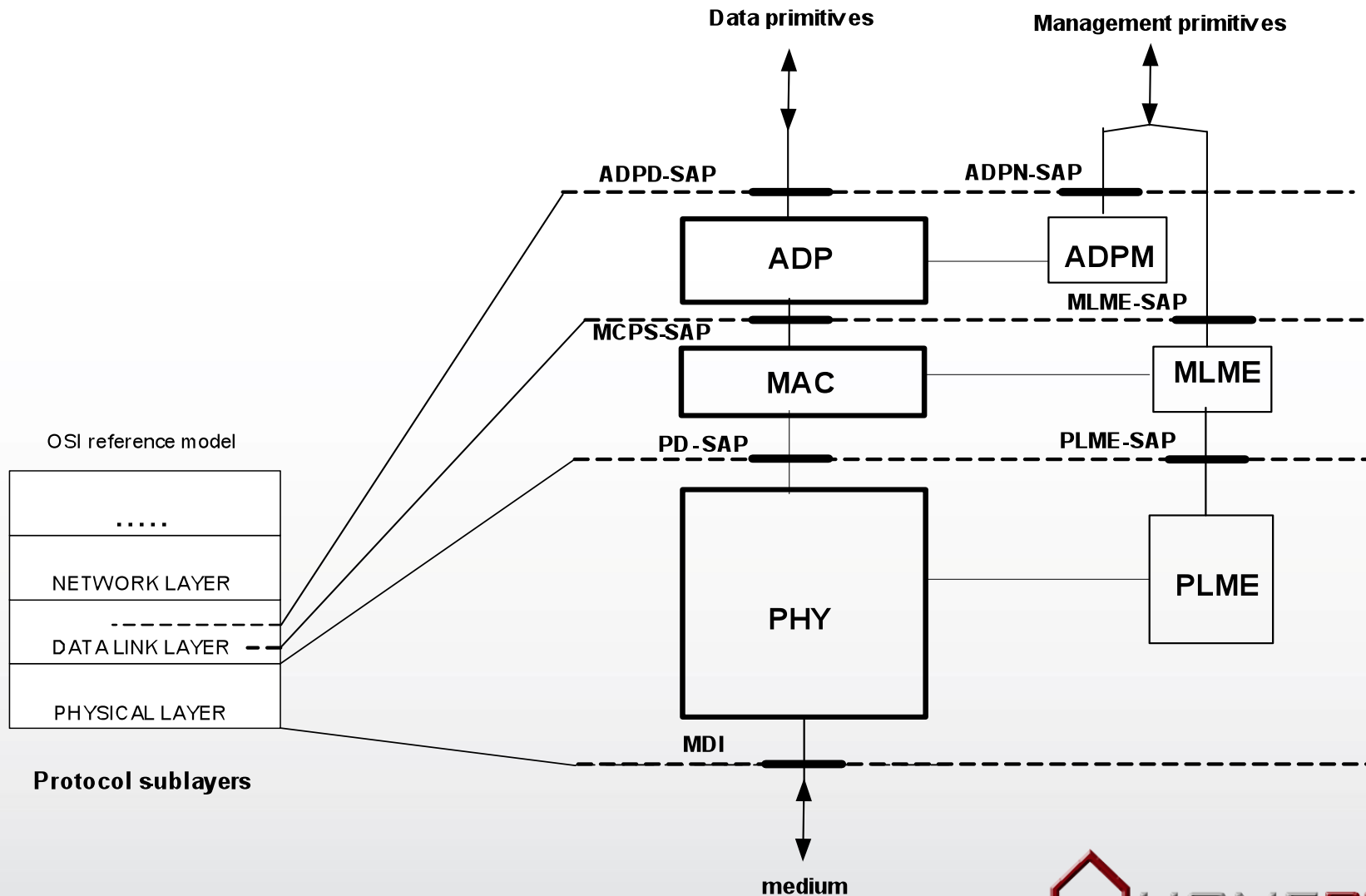
# IEEE P1901.2 Features (continued)

- New benchmark of performance and reliability
- Internet (IP) networking: IPv6 support
- Interoperable profiles with PRIME and G3 in CENELEC A band
- Coexistence with legacy single carrier technologies
- A coexistence mechanism meeting NIST/SGIP PAP 15 requirements
- Single PHY/MAC in main body
- Synchronous beacon
- Enabling interoperability between Differential and Coherent modes of operation

# IEEE 1901.2 Standard - Regulatory



# IEEE P1901.2 Standard - Architecture



# IEEE P1901.2 Standard - Details

## ▶ MAC

- Leverages IEEE 802.15.4-2006 MAC
- CSMA/CA modes:
  - Unslotted version of the CSMA/CA algorithm for the mandatory non-beacon PAN.
  - Slotted version of CSMA/CA for the optional beacon-enabled PAN
  - Supports QoS through several priority levels

# IEEE P1901.2 Standard - Details

## ▶ MAC

- Supports Upper layer functions
  - Routing, meshing, etc. are above the MAC
  - Supported through Adaptation layer Service Access Point (SAP)
  - API annex
  - Upper layer implementation examples and guidelines are included in annexes

# IEEE P1901.2 Standard - Details

## ► OFDM PHY

- Modulation
  - Mandatory DBPSK, DQPSK, and D8PSK (differential)
  - Optional BPSK, QPSK, 8PSK, 16-QAM (coherent)
- Sub-bands
  - Supports globalization
  - Simplifies coexistence mechanisms based on bands
  - Allows use of bands that meet noise/propagation objectives
- Reed-Solomon and Convolutional FEC encoding
  - 8 and 16 byte parity
  - Supports normal as well as 4x and 6x robust modes
- Sample frequencies are 0.4 and 1.2 MHz

# IEEE P1901.2 Standard - Details

## ▶ Security

- Supports IEEE 802.15.4-2006 security suite specification
  - Access control and authentication
  - Confidentiality and integrity
  - Anti-replay and Denial of Service (DoS) prevention
  - Authentication and key distribution protocol
  - EAP method
- The Authentication phase is fully dependent of the EAP method in place
  - Extensible Authentication Protocol (EAP) is very flexible
  - Support various EAP methods (EAP-MD5, EAP-AKA, EAP-TLS, etc.).



# IEEE P1901.2 Standard - Details

## ► Interoperability

- IEEE 1901.2 devices support interoperability modes with Prime and G3 Legacy specifications.
- A 1901.2 compliant device shall implement at least one of the PHY/MACs:
  - Main 1901.2 body
  - RIME CENELEC A
  - G3 CENELEC A

# IEEE P1901.2 Standard - Details

## ► Coexistence

- Developing mechanisms to coexist with other narrow band, low frequency technologies
- Working with the requirements consented by SGIP-PAP15.
  - Priority Action Plan 15 (PAP15) is PLC Coexistence
  - PAP 15 is a group within the SGIP (Smart Grid Interoperability Panel), sponsored by NIST.

# Get Involved!

- ▶ Narrow Band / 1901.2 PLC Task Force
  - Forum for discussing 1901.2 related items
- ▶ Compliance and Interoperability Working Group (C&I WG)
  - Develops compliance test plans
  - Develops interoperability text plan
  - Manages the certification process
- ▶ Marketing Working Group

# THANK YOU

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