

Qualification of Smart Meter Connections for Power Line Communications (METEOR)



AIMS OF THE PROJECT

Analyze Low-Voltage Power Grid Connections in Terms of the Expectable Performance of Narrowband Power Line Communications (PLC)

Approach:

- Measurement Campaign in the Low-Voltage Grid
- Simulation-based Performance Evaluation of High-Data-Rate Narrowband Power Line Communication Technologies

MOTIVATION

Targeted Smart Meter Penetration of...

... **80% by 2020**

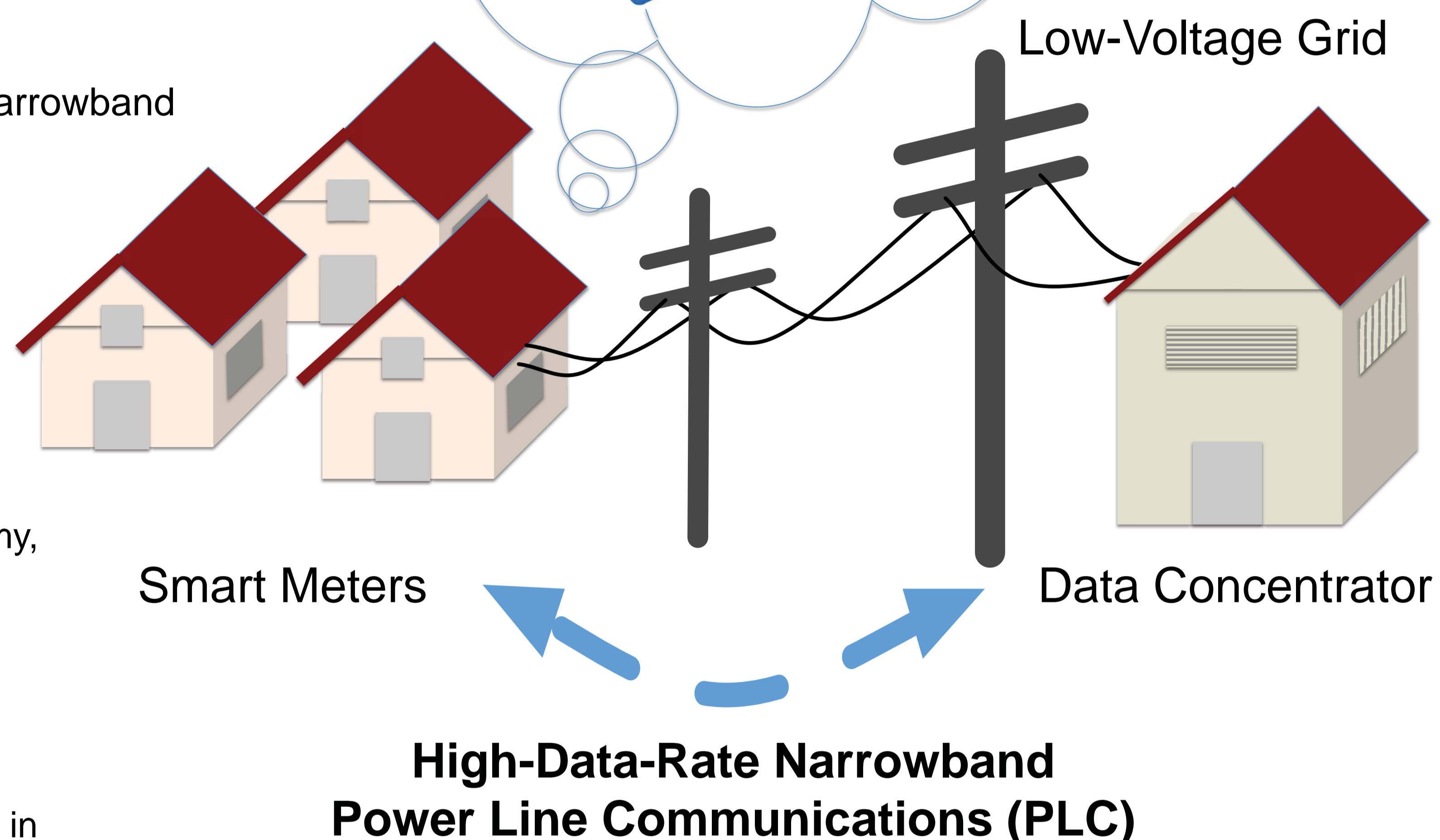
(Directive 2009/72/EC of the European Parliament)

... **10% / 70% / 95% by 2015 / 2017 / 2019**

(Edict IME-VO, 24.04.2012, by the Austrian Ministry of Economy, Family and Youth (BMWFJ))

Advantages of PLC for Smart Metering ...

- Communication Infrastructure owned by the Utility
- International Regulation (Europe: CENELEC EN 50065)
- Bidirectional Communication (allows for Fast Fault Restoration)
- Wireless Communication may suffer from Outage, especially in Metropolitan Areas / in case of Underground Smart Meters



BACKGROUND ON PLC

- Narrowband PLC in the Frequency Range 3 kHz – 500 kHz
- Cross-Transformer Communication Possible
- High Data-Rate by Multicarrier Modulation Technology (OFDM)
- Example Technologies: PRIME, G3-PLC, ITU-T G.hnem, IEEE 1901.2

Low-voltage grid PLC channel

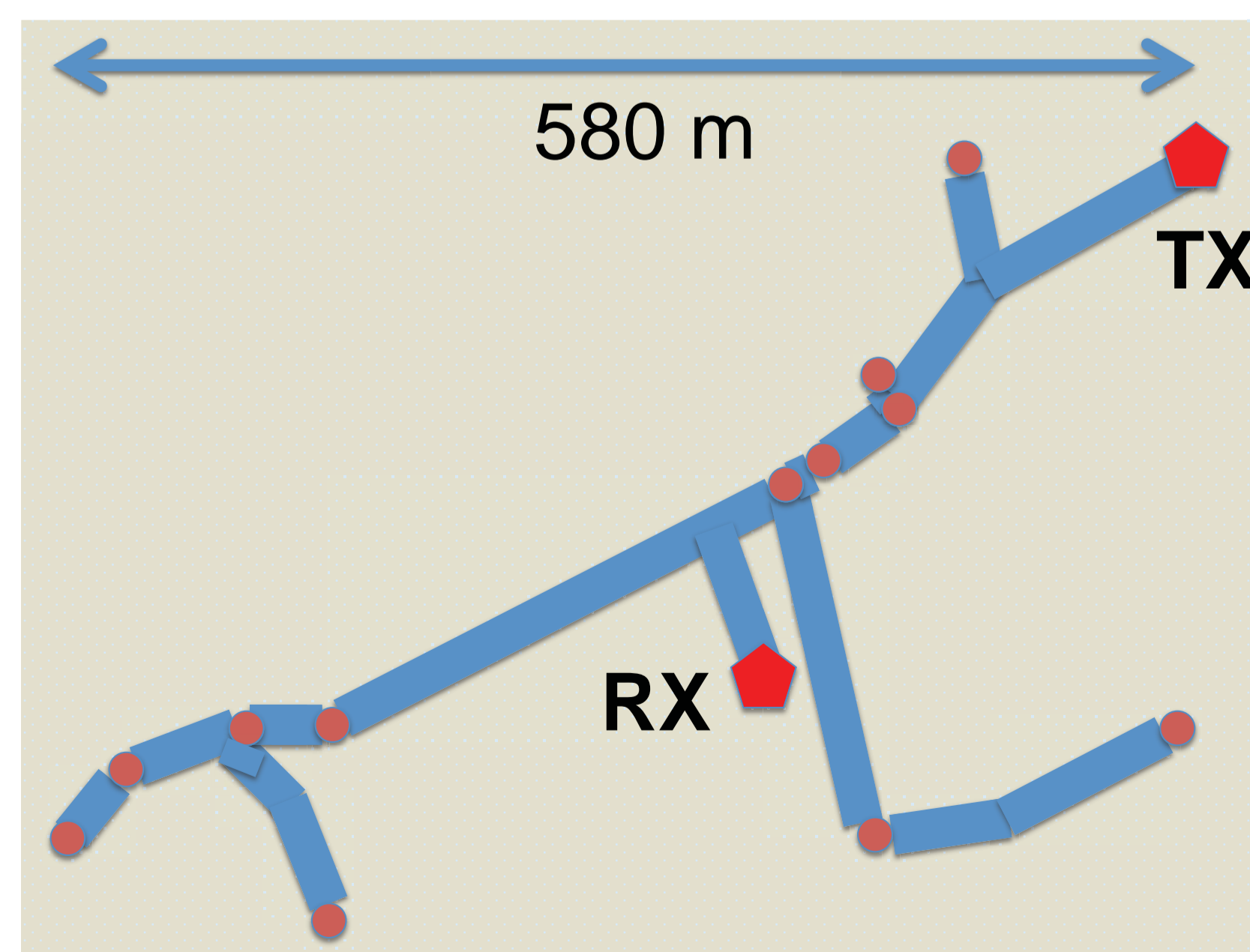
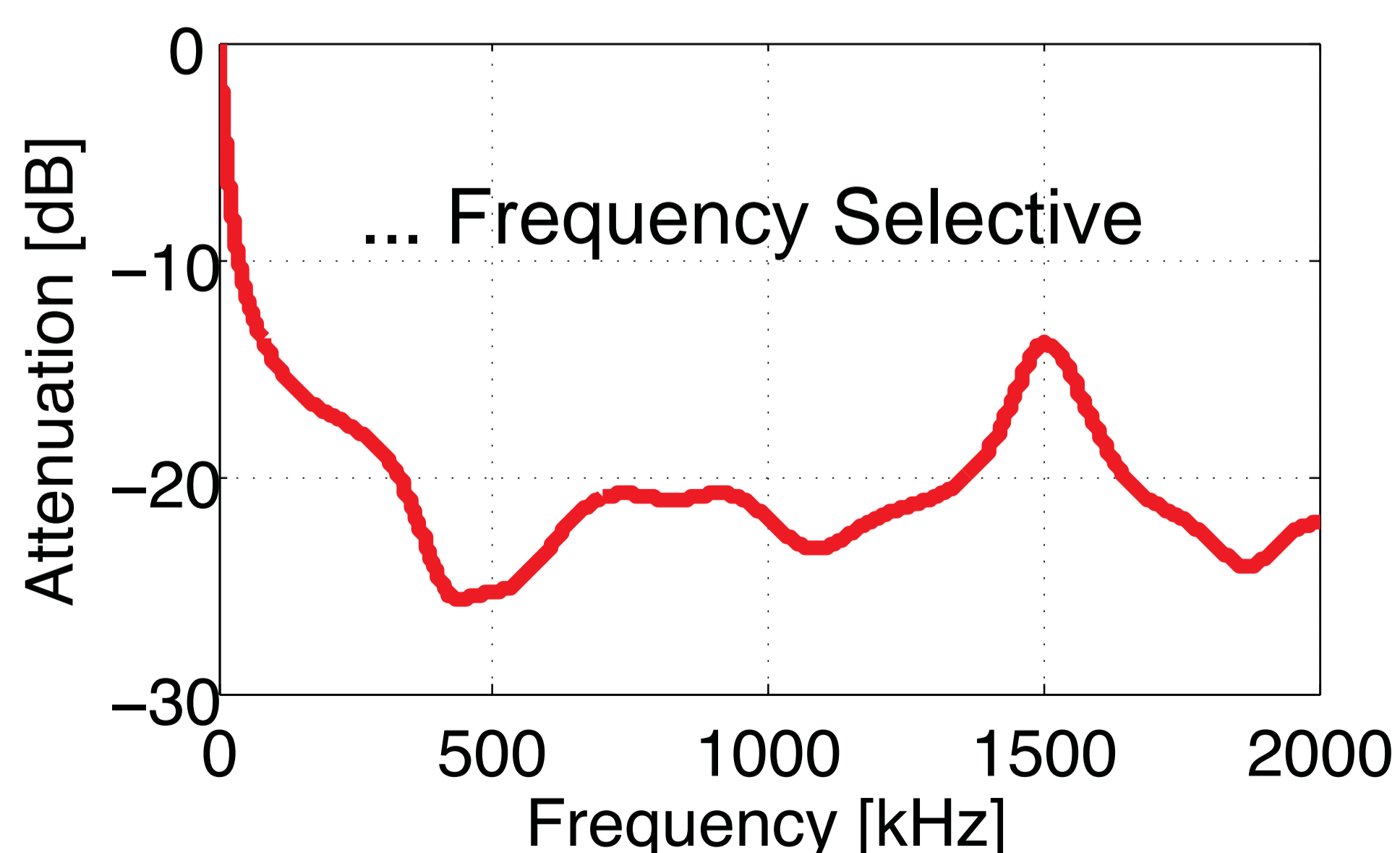
- Highly Scenario Dependent (Block of Homes, Houses, etc.)
- Time-Varying / Frequency-Selective / Non-Symmetric Attenuation / Noise / Impedance Properties (e.g., Synchronous to the mains frequency)
- Sensitive to Load Conditions

THEORETICAL EXAMPLE

Simulation Assumptions:

- Snapshot (Static Channel)
- Rural Test Grid Topology from [Berganza11]
- Transmit Limits from [EN50065]
- Lines Terminated by Characteristic Impedance
- Typical (Avg.) Noise Spectrum from [Hooijen98]

Result: Capacity in the CENELEC-A Band > 1 Mbps



[Berganza11] I. Berganza et. al., „PRIME on-field deployment“, IEEE SmartGridComm, Venice, Italy, pp. 297-302, 3-6 November, 2011.

[EN50065] ÖVE/ÖNORM, „Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148,5 kHz“, EN 50065-1, 2012.

[Hooijen98] O.G. Hooijen, „On the relation between network-topology and power line signal attenuation“, in Proc. ISPLC, Tokyo, Japan, pp. 45-56, March 24-26, 1998.

PROJECT FACTS

Funding: COMET (FFG)

Partner: Steweag-Steg GmbH, TU Graz, FTW

Project Duration: April – September 2014

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