



Modelling Smart Grids 2018
Modelling, Optimization and Detection
Prague September 20th - 22nd, 2018

AMI Solutions in Smart Grid

Needs, Requirements, Opportunities

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Solution Director for Energy Sector in CEE&Nordic Region

LEADING NEW ICT

About the presenter



2006-2010 APATOR SA (smart meters manufacturer)

R&D Director, Board Advisor

- *management and design supervision of AMI system, DCUs, smart meters & communication modems (electricity, heat, gas & water)*

2011-2016 ENERGA-Operator SA (DSO company)

AMI Project management, IT Architect

- *management of the biggest in Poland AMI system implementation (850.000 meters), technical specification of meters, DCUs and application layer protocols, IT systems architecture design*

2014-2016 PRIME Alliance

Board of Directors member

- *technical and promotional working groups support*

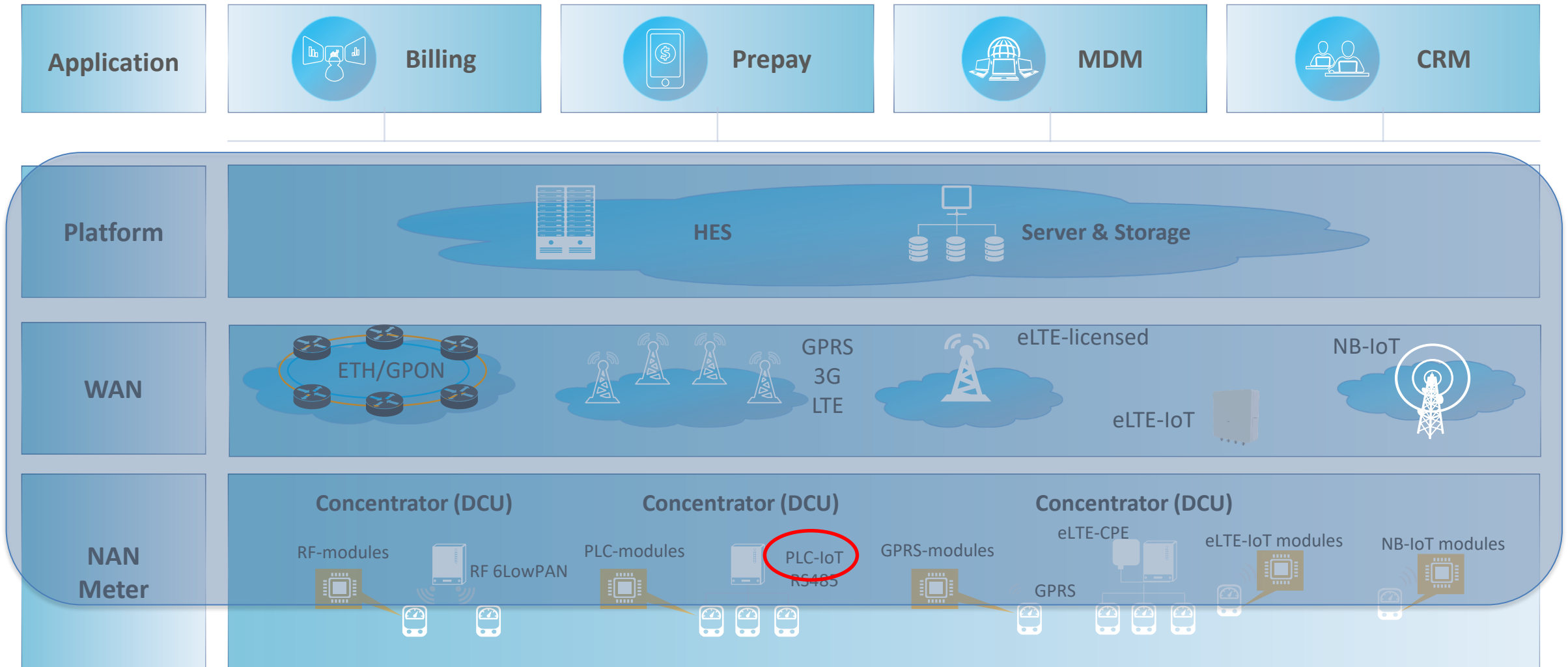
2017-... HUAWEI

Solution Director for Energy Sector in CEE&Nordic Region

Agenda

- AMI solutions in Huawei perspective
- broadband PLC-IoT
- PLC communication highlights
- summary

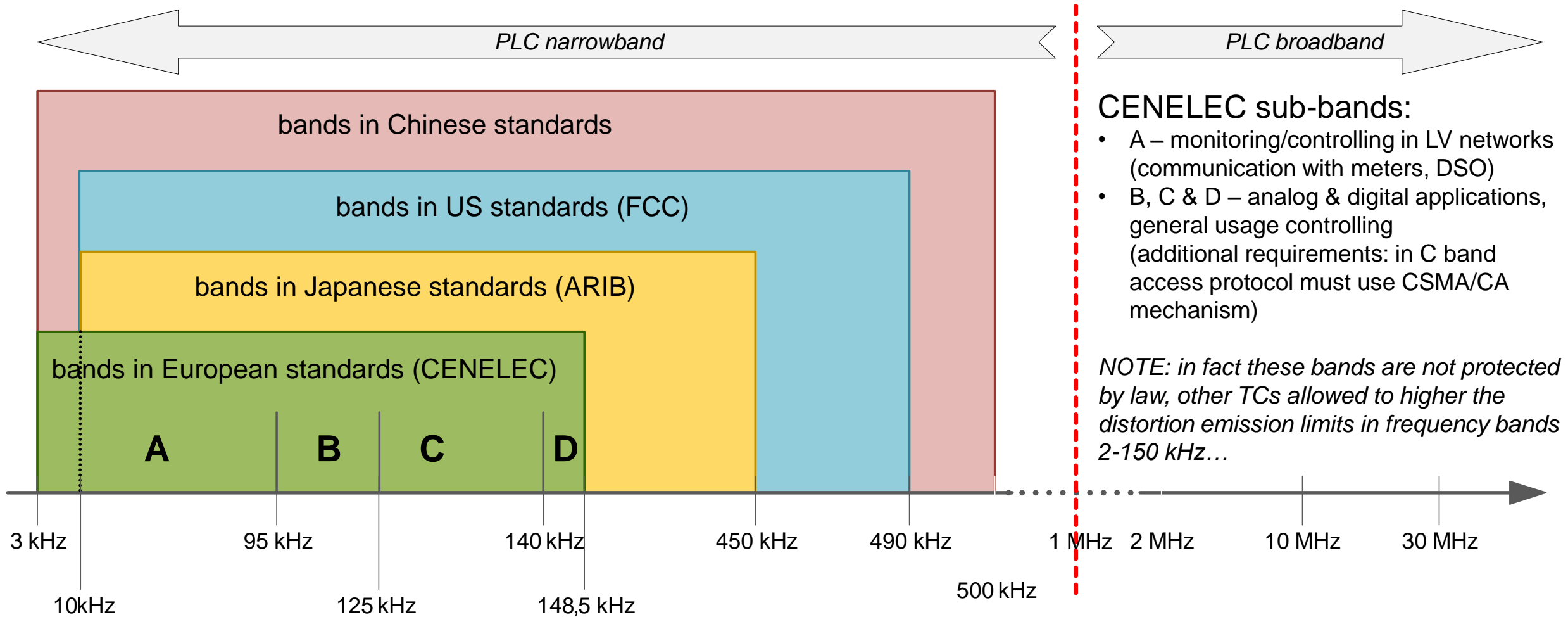
Huawei AMI solution makes power grids more efficient



Huawei broadband PLC-IoT – key messages

- PLC technologies brief review: narrowband vs. broadband
- technical performance and benefits of PLC-IoT
- standardization of PLC-IoT: IEEE P1901.1
- compliance with EU norms (EMC)
- EMC compatibility levels changes as narrowband PLC threats
- PLC-IoT products portfolio

PLC technologies evolution



Huawei PLC-IoT – basic information

- frequency range: 2 - 12MHz (broadband transmission)
- number of carriers:

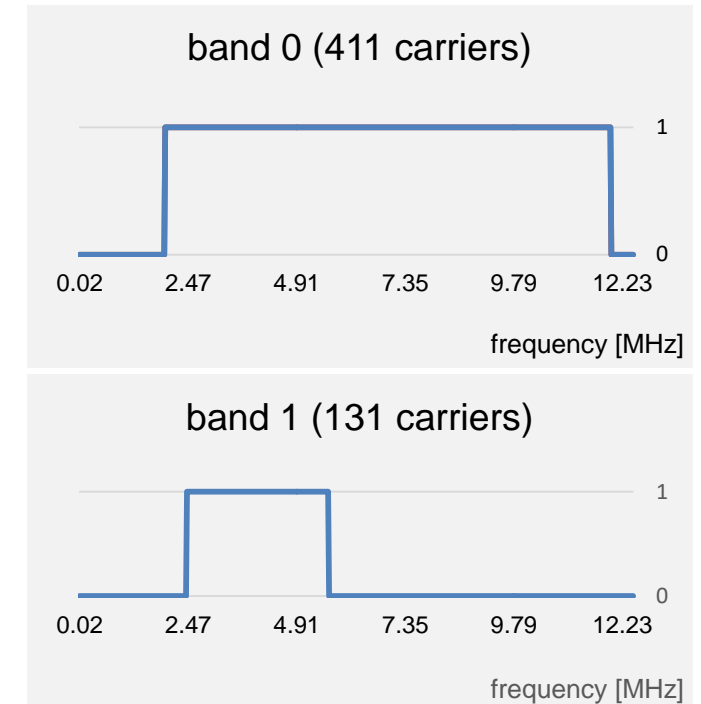
frequency band	frequency range [MHz]	start carrier ID	end carrier ID	no of carriers
0	1,953125 - 11,962891	80	490	411
1	2,441406 - 5,615234	100	230	131

- transfers (PHY):

- in ROBO basic mode: up to 3,47 Mbps
- in ROBO extended mode: up to 24,65 Mbps

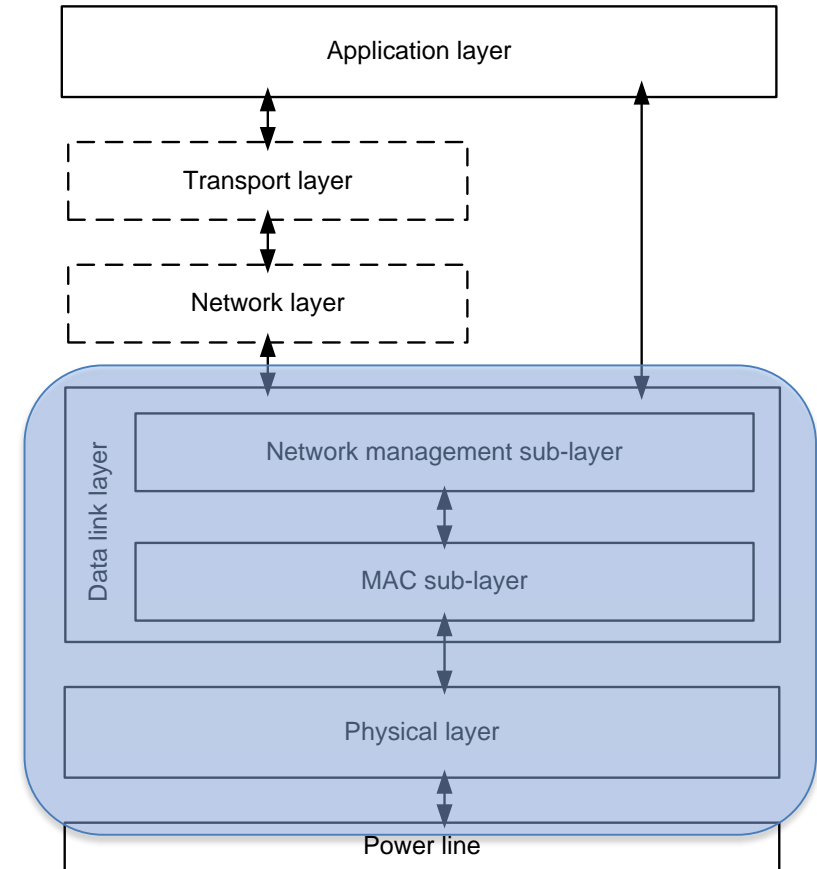
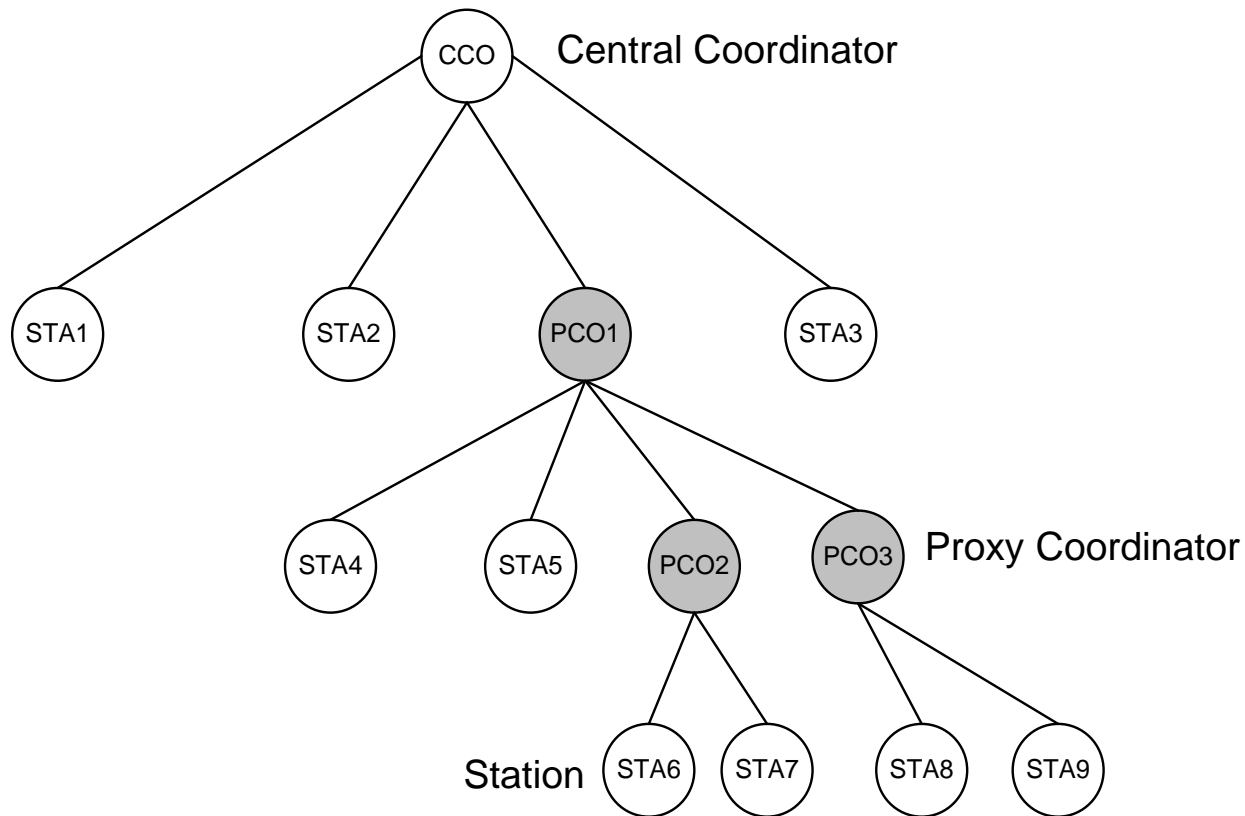
*(almost **200x faster** than fastest narrowband PLC in CENELEC A band...)*

- line distance in point-to-point communication: typically 100-300m, 700m maximum (2300m – longest noted...)
- security based on AES-256

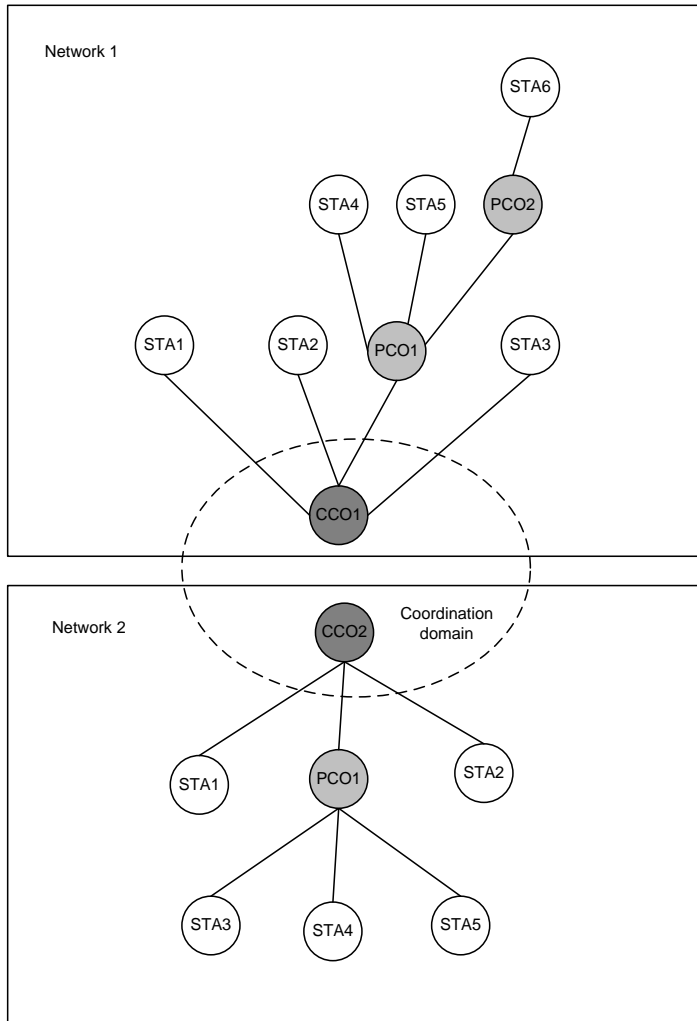


Huawei PLC-IoT – topology

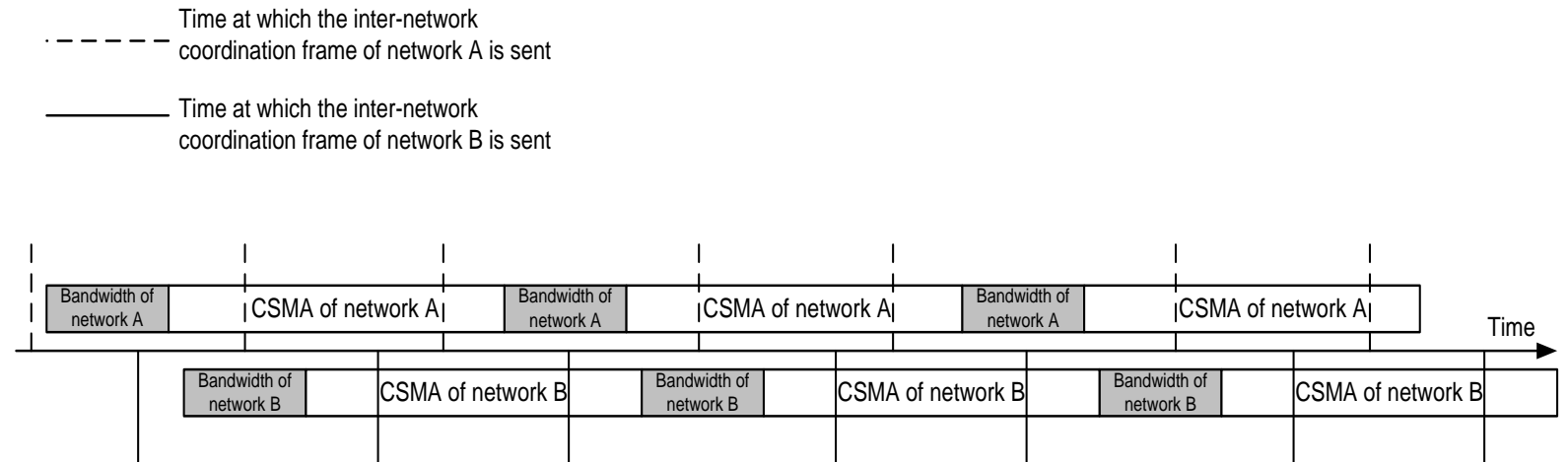
- tree topology with maximum 15 levels



Huawei PLC-IoT – multi-network support



- multi-network environment opportunity (many DCUs in single LV segment, automatic negotiation of different networks Ids) – for cross-talks but also for coexistence between non-interoperable protocols



multi-network bandwidth coordination

Huawei PLC-IoT as international standard IEEE P1901.1

- 7 formal meetings (first November 15th-16th 2016, last January 23rd 2018)
- draft of IEEE P1901.1 standard in version 8.0 approved for Sponsor Ballot (September 1st 2017)
- comments, corrections, clarifications: September-December 2017
- first voting (v.8.0): December 8th 2017 (95% approval)
- final voting after corrections (v.9.0) January 12th-22nd 2018 (95% approval)
- approval by IEEE Standards Association board at May 7th 2018
- May 14th 2018 – IEEE P1901.1 standard publication
 - final version already available from IEEE: https://www.techstreet.com/ieee/standards/ieee-1901-1-2018?product_id=1999129
- participants:
 - Huawei Technologies Co. Ltd, HiSilicon Technologies Co. Ltd., China Gridcom Co. Ltd., Wasion Group Ltd., Shenzhen Clou Electronics Co. Ltd., Vango Technologies, Power Plus Communications AG, NERC, Hitrend Technology Shanghai Ltd., Qingdao Eastsoft Communication Technology Co. Ltd., Leaguer MicroElectronics Corp., Alpen Adria Universitt Klagenfurt

Compliance with EU regulations

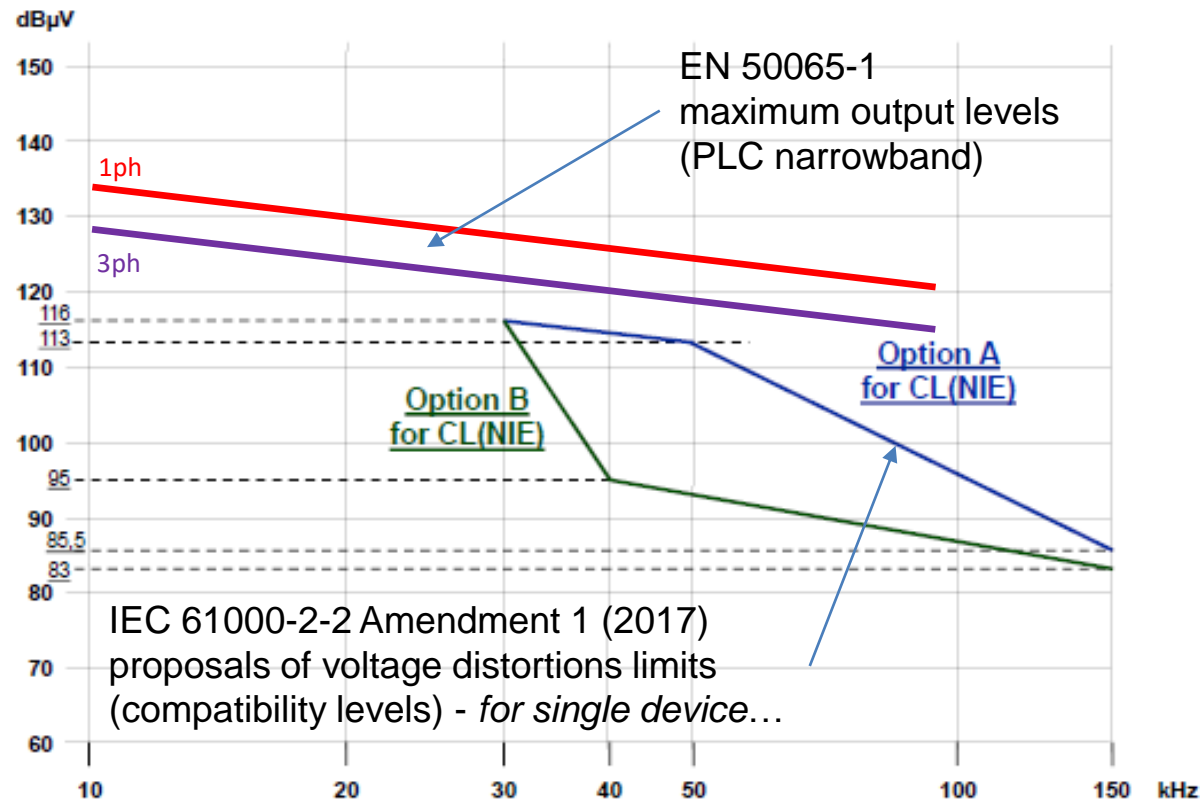
- existing regulations for CE / EMC conformity in relations to broadband PLC:
 - EN 50561-1:2013 „*Power line communication apparatus used in low-voltage installations. Radio disturbance characteristics. Limits and methods of measurement. Part 1: Apparatus for in-home use*”
 - EN 50412-2-1:2005 „*Power line communication apparatus and systems used in low-voltage installations in the frequency range 1,6 MHz to 30 MHz. Part 2-1: Residential, commercial and industrial environment. Immunity requirements*”
- work in progress:
 - EN 50561-2 „*Power line telecommunications modems. Radio disturbance characteristics. Limits and methods of measurement. Part 2: Modems for access networks*”

Noises in LV networks

- increase of compatibility levels limits for conducted disturbances
 - IEC 61000-3-x, 61000-4-x not covering the range 2-150 kHz,
 - only few classes of devices cover 2-150kHz range:
 - EN 50065 for mains communication systems over LV lines (narrowband PLC systems),
 - EN 55014 for inductive hobs,
 - EN 55015 for lighting.
- IEC 61000-2-2:2002 „*Electromagnetic compatibility (EMC) - Part 2-2: Environment - Compatibility levels for low-frequency conducted disturbances and signaling in public low-voltage power supply systems*” – compatibility levels for 20 kHz to 148,5 kHz not defined, but:
 - *Amendment 1*: 2017 (publication 2017-06-27) has introduced acceptable emission levels,
 - *Amendment 2*: 2018 (publication 2018-05-09) has extended acceptable emission levels...

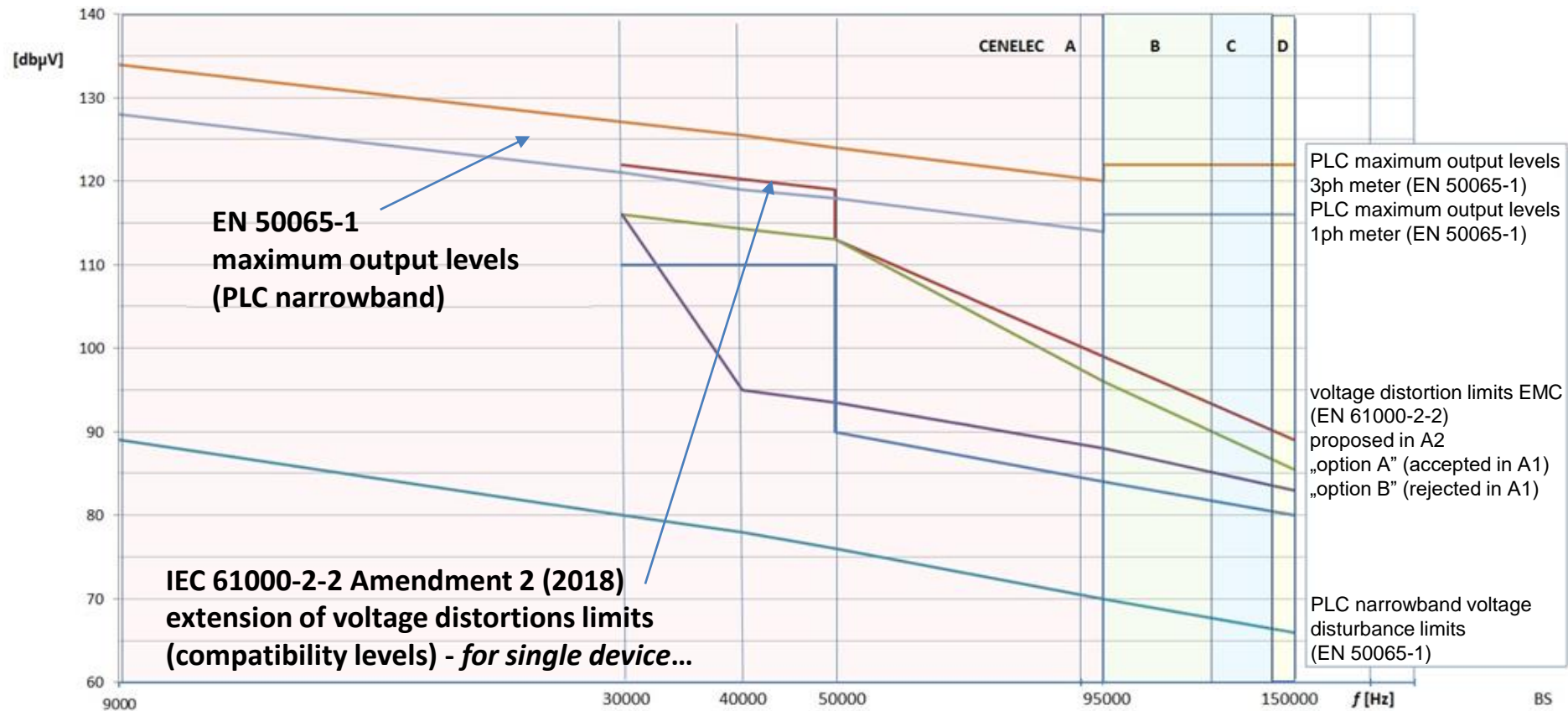
Noises in LV networks

- increase of compatibility levels limits for conducted disturbances (IEC 61000-2-2:A1)



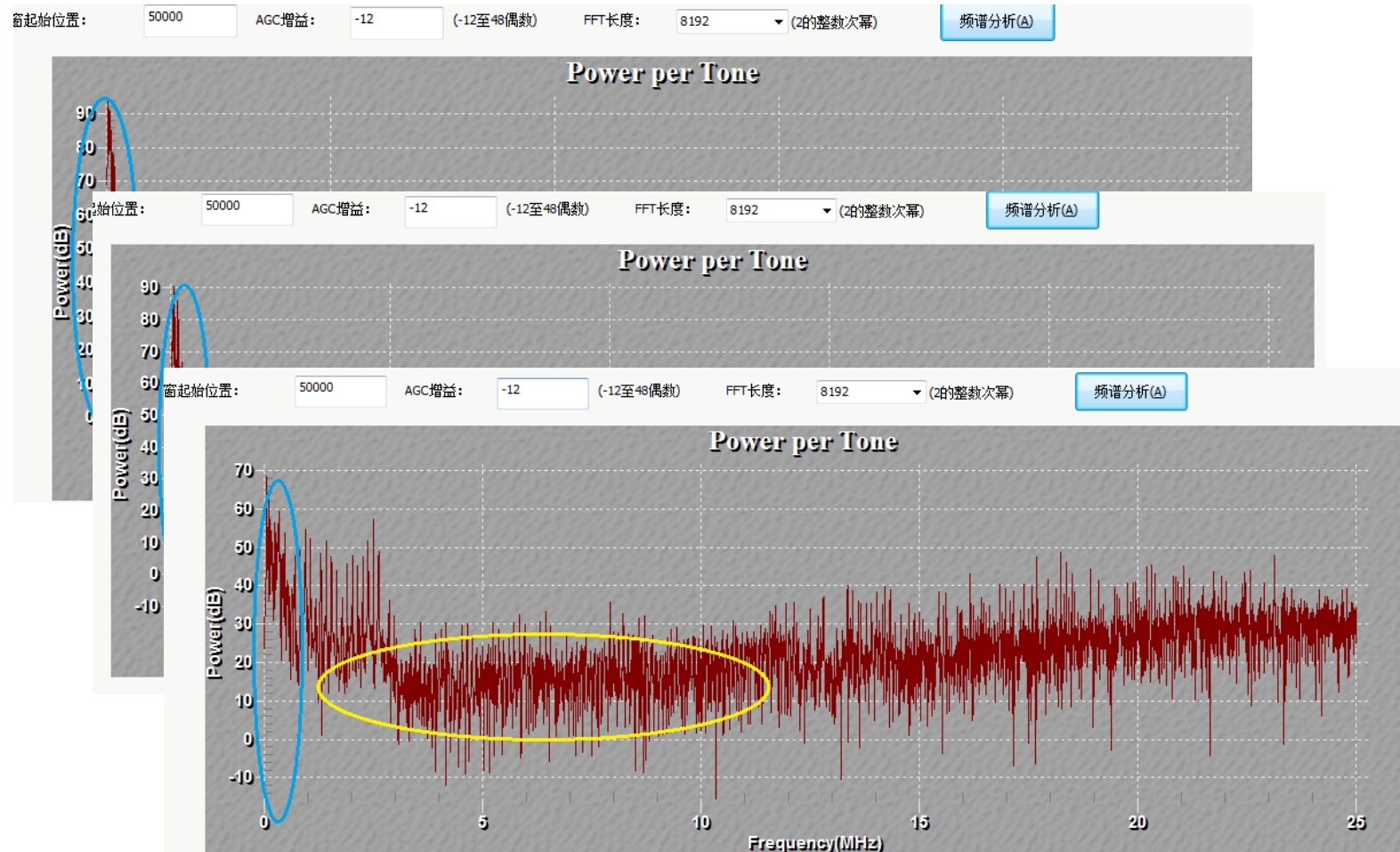
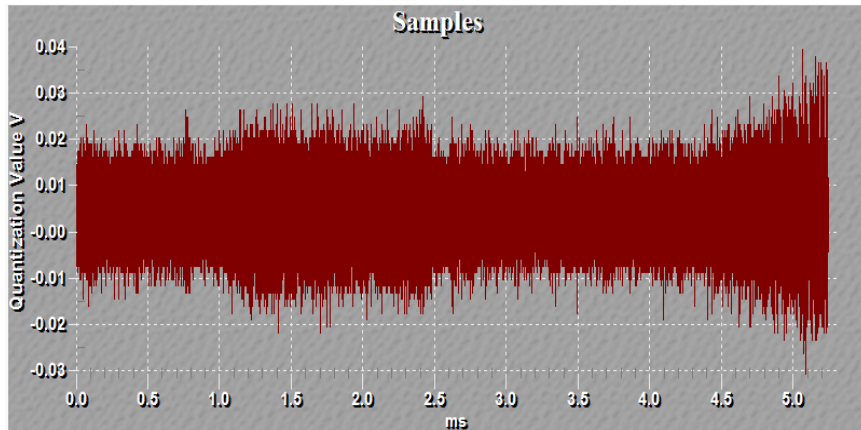
Noises in LV networks

- increase of compatibility levels limits for conducted disturbances (IEC 61000-2-2:A2)



increased EMC levels can seriously impact on narrowband PLC performance...!

Noises in LV networks



disturbances in narrowband vs. broadband frequency ranges

Huawei PLC-IoT products

Data Concentrator Unit



AR532

Hardware specification

Ethernet ports	1x GE / 1x GE Combo
uplink	3G/GPRS WCDMA (mini-SIM)
downlink	Huawei PLC-IoT
other interfaces	2x RS485, 2x DI/DO, 1x serial console port, and 1x USB2.0
temperature	-25° C to +70° C

Data Collector / Repeater



AR501C

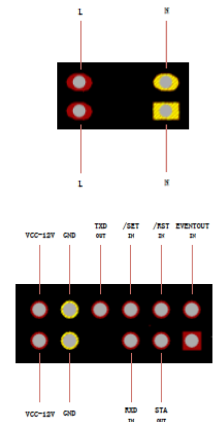
Hardware specification

meters support	up to 6 meters connected via RS485
uplink	Huawei PLC-IoT
downlink	1x RS485
other interfaces	1x DI
temperature	-25° C to +70° C

Huawei PLC-IoT – modems

- PLC-IoT modem boards ready for the integration:

	module with Hi3911Xv100	module with Hi3911Xv200
1-phase meter	ARDCM-PaS	ARDCM-PvS
3-phase meter	ARDCM-PaT	ARDCM-PvT
DCU	AR-DCM-PaT	AR-DCM-PvT



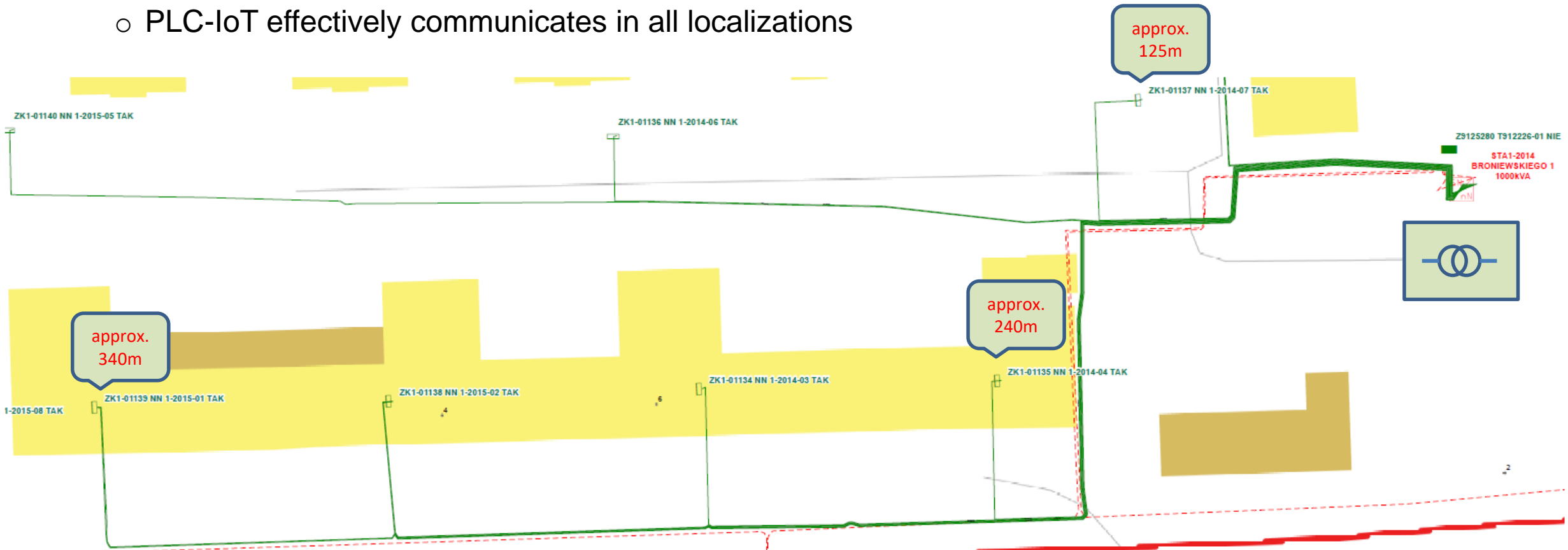
Huawei PLC-IoT CE certificates

- on the basis of Hi3911v200 chipsets – CE certificates for PLC-IoT modems has been achieved



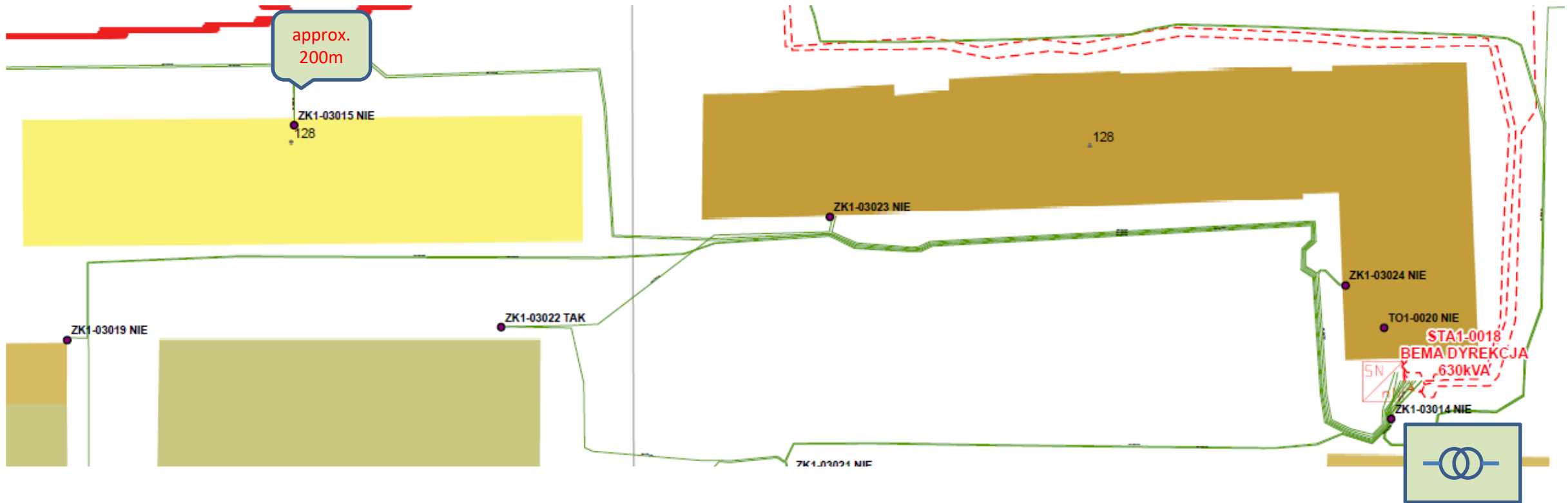
First Proof of Concept tests in Europe (Poland)

- Case 1 – high noises environment:
 - no narrowband PLC communication works
 - PLC-IoT effectively communicates in all localizations



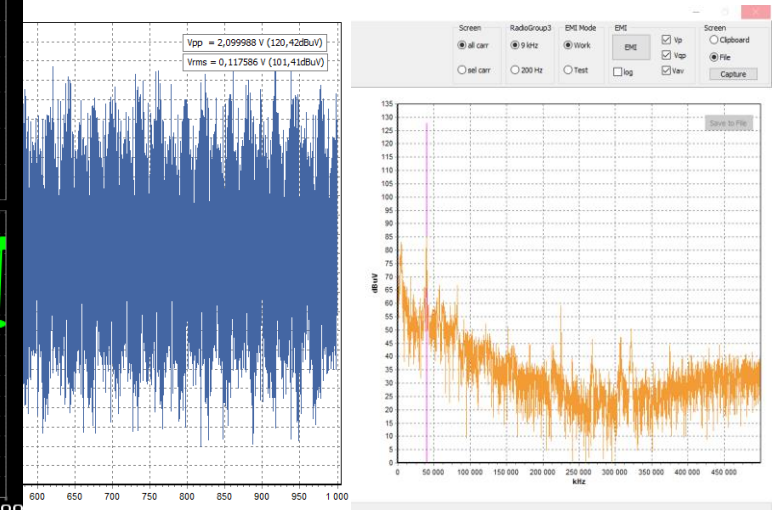
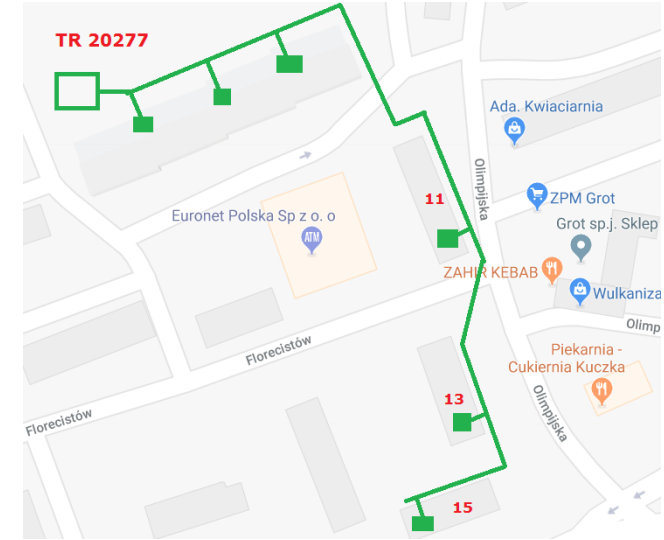
First Proof of Concept tests in Europe (Poland)

- Case 2 – high attenuation environment:
 - no narrowband PLC communication works
 - PLC-IoT effectively communicates

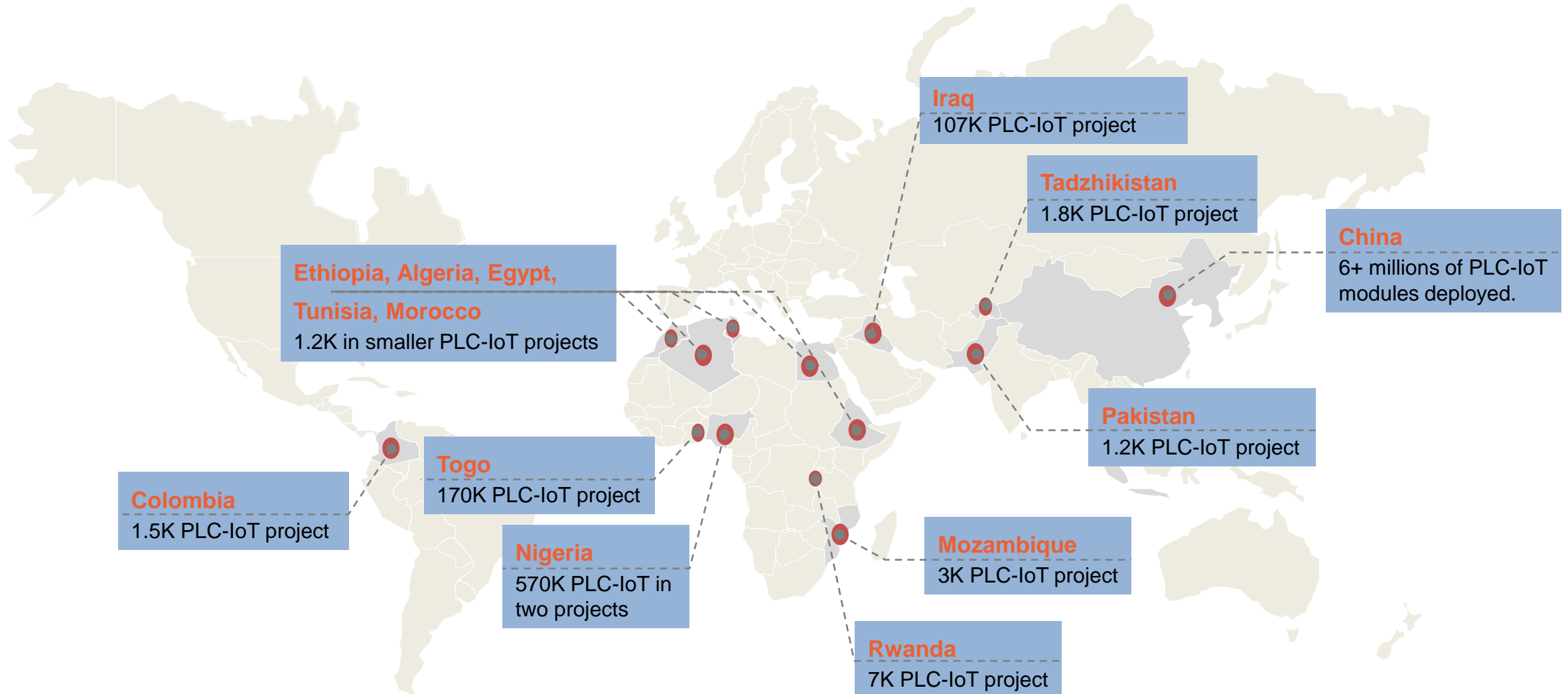


First Proof of Concept tests in Europe (Poland)

- Case 3 – high noises environment:
 - no narrowband PLC communication works
 - PLC-IoT effectively communicates in all localizations



Huawei PLC-IoT implemented in almost 7 million meters



Technology summary

- modern broadband PLC technology in 2-12MHz frequency band
- PHY transfers up to 25 Mbps raw bitrate (3,5 Mbps in robust mode)
- non-interoperable communication protocols coexistence support
- multi-network support
- international standard IEEE P1901.1
- regulated by European standards
- existing adaptation profiles for EMC regulations
- open for future growing needs...

An abstract graphic consisting of several thin, curved lines in orange, yellow, red, green, and blue, sweeping across the right side of the slide.

THANK YOU

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