



# Regulatory regime and G3-PLC deployments in FCC band in Europe

G3-PLC Alliance  
June 15<sup>th</sup> 2021

# A proven Powerline Communication technology offering lowest total cost of ownership and independency on telco operators

**Cost effective, reliable and secure communication...**

<b>Cost-effective</b>		<b>Long range communication</b>	<b>Real-time communication</b>
<b>ITU standard</b>	<b>Supports IPv6</b>	<b>Secure</b>	
	<b>High robustness</b>	<b>High data rate</b>	<b>Future proof</b>
<b>Routing</b>		<b>Plug and play</b>	

**... in a wide range of applications**



- ➔ **Mature technology with >80 million products in >30 countries worldwide**
- ➔ **Backed by international group of nearly 100 DSO's and industrial players**

## Some examples of G3-PLC roll-outs in Europe in FCC bandplan

Country	Utility	Meters installed	PLC Bandplan used
Austria		700k meters of 820k total	FCC bandplan with notching
Austria		200k meters of 470k total	FCC (150-500kHz) with notching (~49%)
Luxemburg		320k meters of 320k total	<ul style="list-style-type: none"> <li>Mainly FCC</li> <li>CENELEC-A only for special situations e.g. in proximity of public radio broadcasting antennas</li> </ul>
Latvia		500k of 1.1 million meters	FCC bandplan

## **In this webinar, we will answer the following four questions:**

1. What are the benefits of using FCC band?
2. What are the electromagnetic compatibility (EMC) aspects in Europe?
3. How do you get the CE-Marking with regards to EMC in FCC band?
4. How can utilities use FCC band for smart metering rollouts in Europe?

## Today's presenters, in order of appearance



**Cédric Lavenu**  
Chair Technical WG  
(EDF R&D)



**Anil Mengi**  
Chair Marketing  
(Devolo)

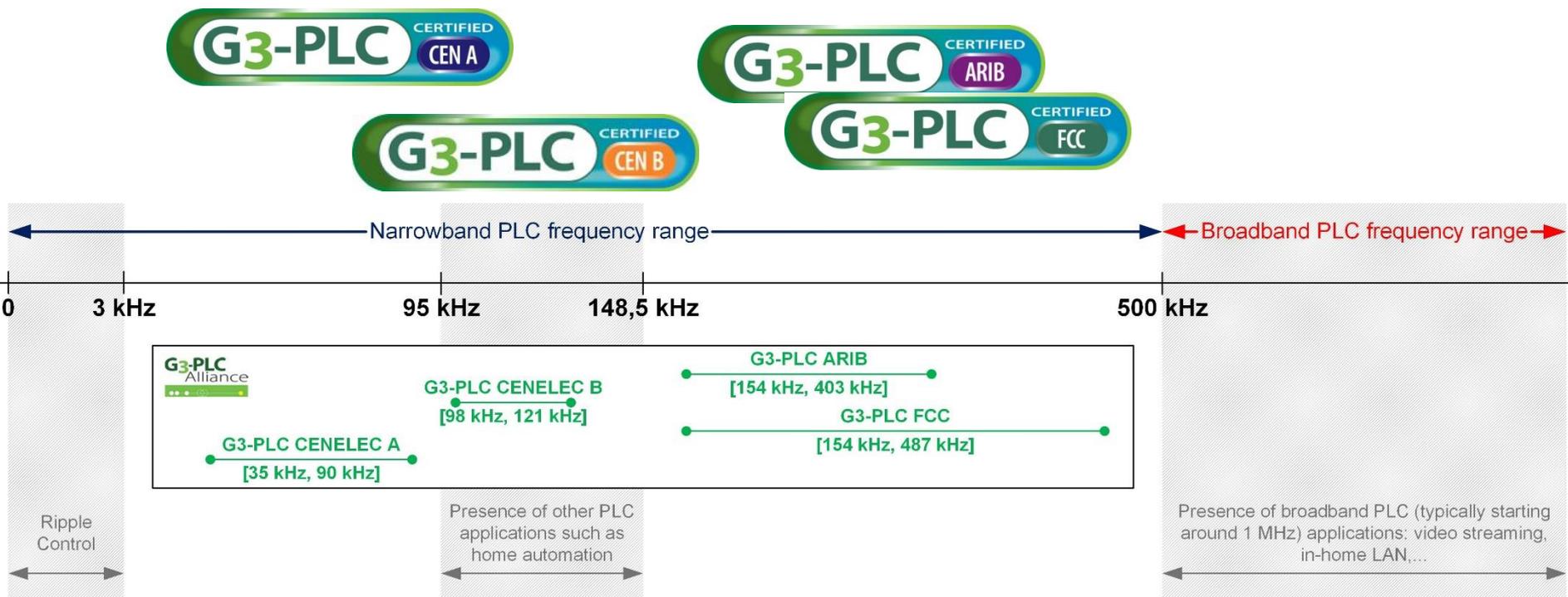


**Wolfgang Lehner**  
(Netz Nieder  
Osterreich)

# 1. What are the benefits of using FCC band?

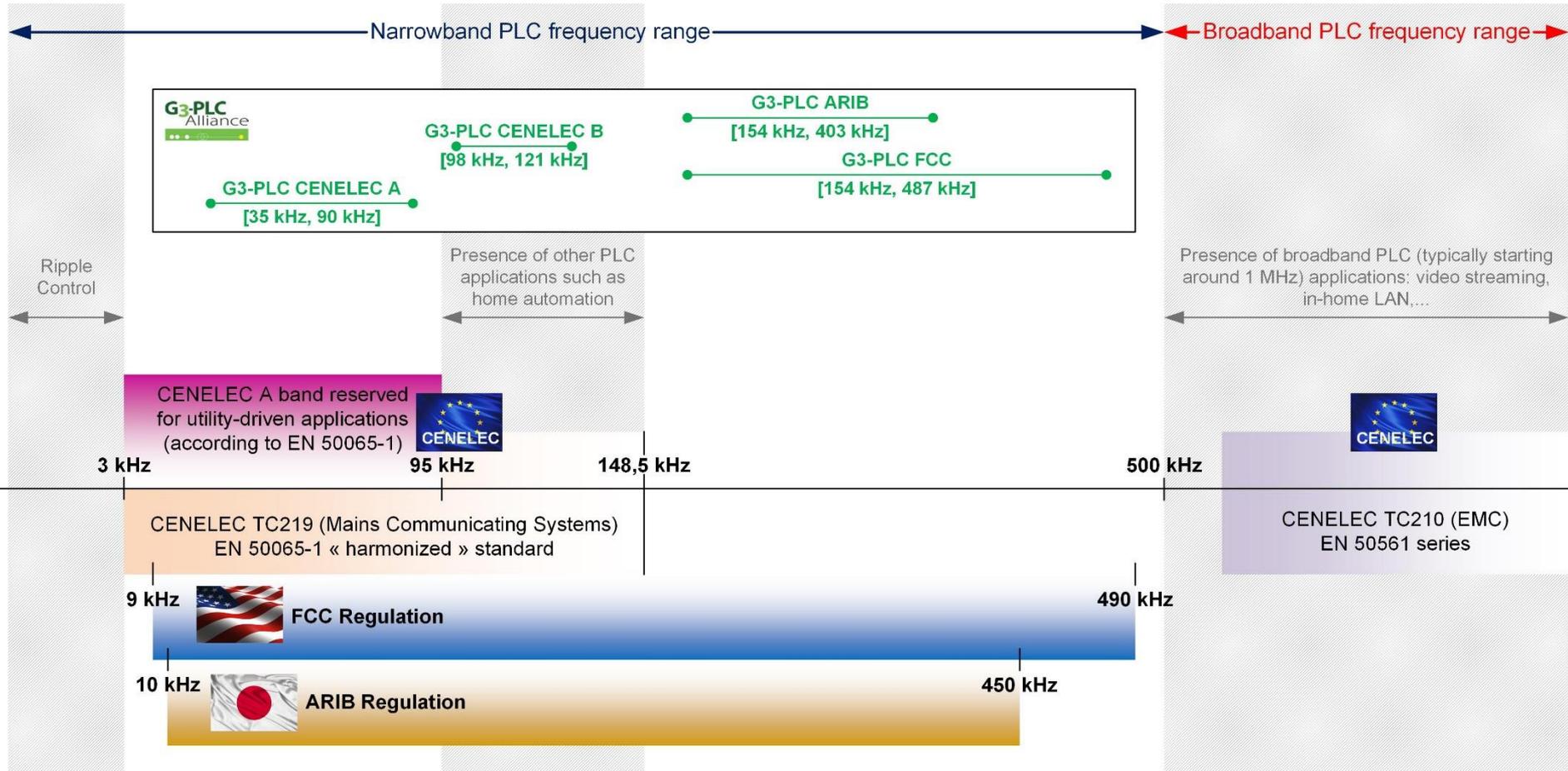
1: What are the benefits of using FCC band?

## G3-PLC operates in several bandplans



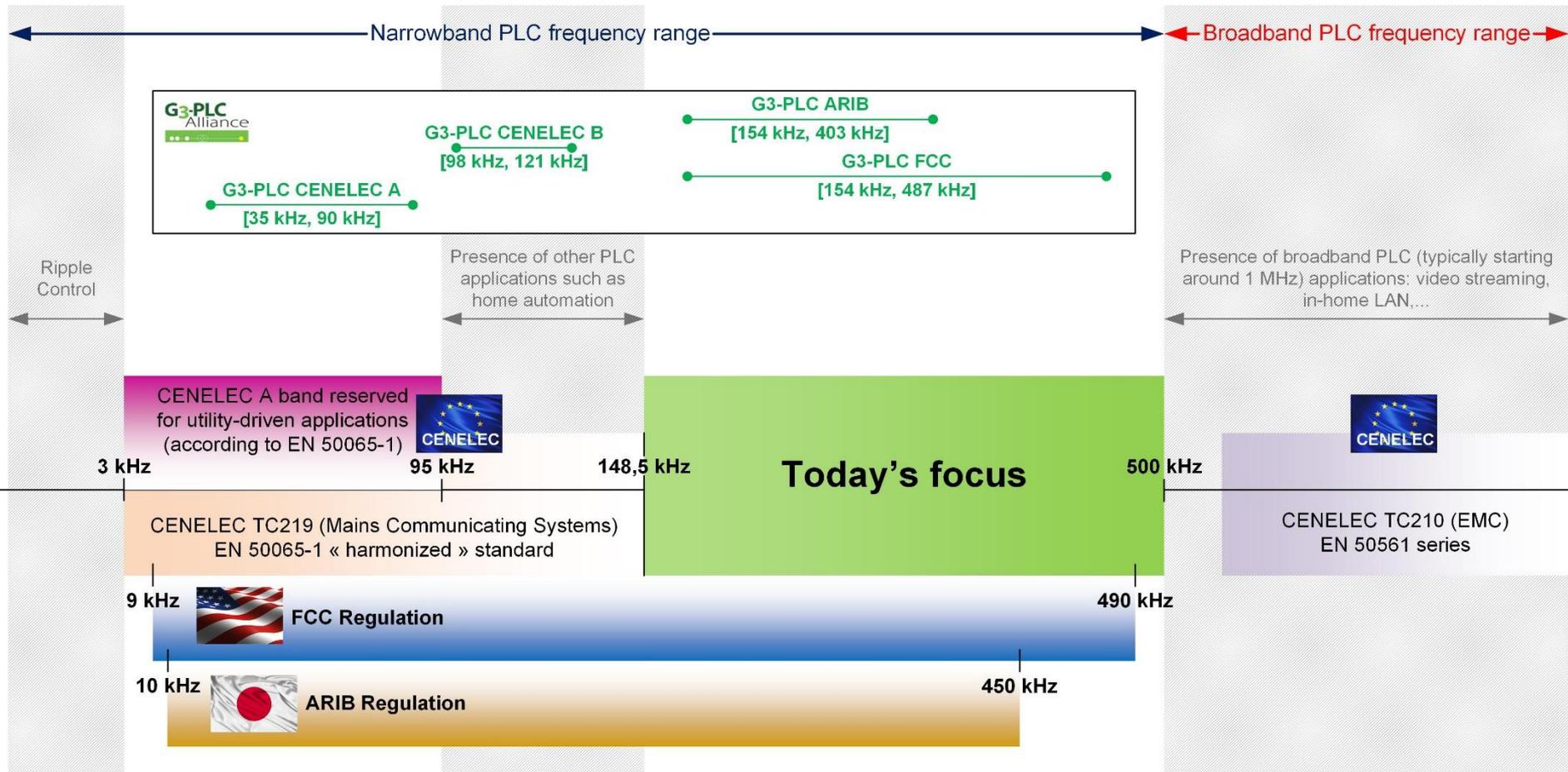
1: What are the benefits of using FCC band?

# G3-PLC operates in several bandplans ...to address different needs and to match regional regulation



1: What are the benefits of using FCC band?

# G3-PLC operates in several bandplans ...to address different needs and to match regional regulation

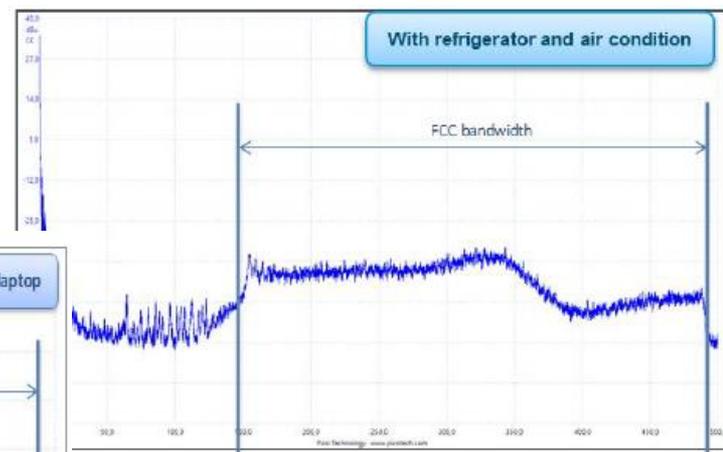
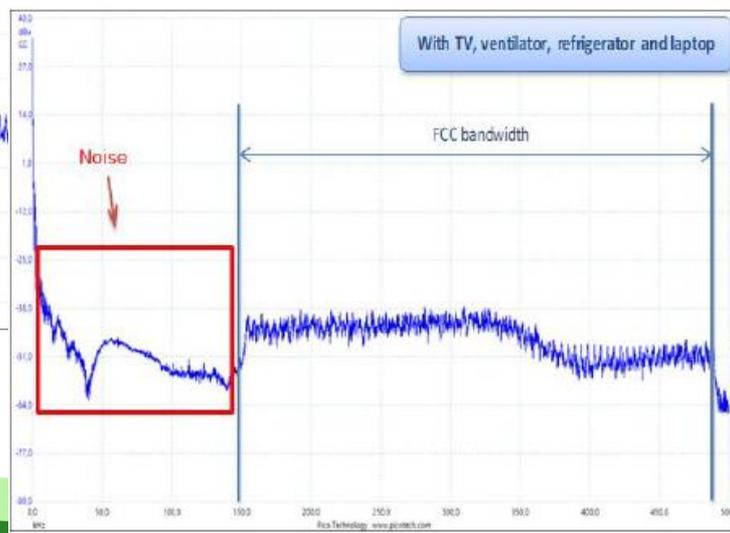
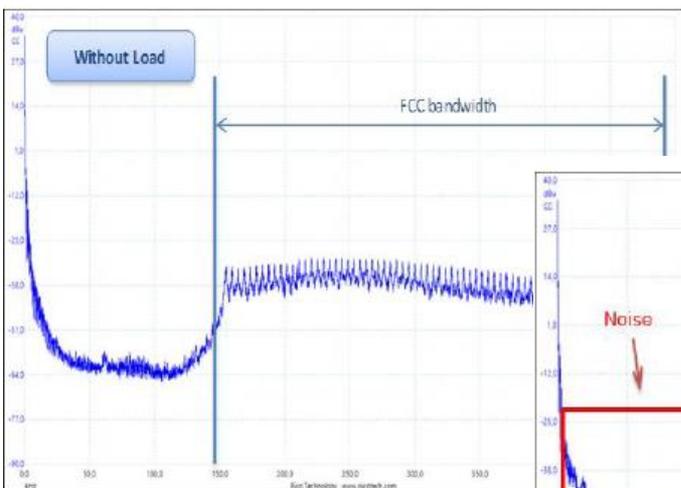


## Why use G3-PLC in the FCC bandplan in Europe ?

- G3-PLC FCC offers higher data rates than in CENELEC bands
  - **FCC:**  
**72 sub-carriers** between 154,6 and 487,5 kHz = **332,9 kHz bandwidth** (4,7 kHz carrier spacing)  
Theoretical PHY Data Rate (D8PSK) = **208 kbps**
  - **CENELEC-A:**  
**36 sub-carriers** between 35,9 and 90,6 kHz = **54,7 kHz bandwidth** (1,6 kHz carrier spacing)  
Theoretical PHY Data Rate (D8PSK) = **45 kbps**
  - **CENELEC-B:**  
**16 sub-carriers** between 98,4 and 121,8 kHz = **23,4 kHz bandwidth** (1,6 kHz carrier spacing)  
Theoretical PHY Data Rate (D8PSK) = **22 kbps**

## Why use G3-PLC in the FCC bandplan in Europe ?

- G3-PLC FCC operates in a band that offers a **cleaner channel (lower noise)** than in **CENELEC bands\***
  - **Limited number of EMC emission standards between 9 and 150 kHz** : CISPR 15 (lighting equipment)
  - **Ongoing work in IEC SC77A and CISPR/H** to limit non-intentional emissions of electrical appliances in generic EMC emission standards (IEC 61000-6-3 and IEC 61000-6-8).
  - **Above 150 kHz, limits already exist for a long time** : e.g. CISPR 11, CISPR 15, CISPR 32, etc.



Noise spectra: courtesy of SAGEMCOM

## Where do we stand with FCC band standardization ?

- **EN 50065-1** is the European reference standard for "Narrowband" PLC but it **is currently limited to the band 3 – 148,5 kHz**
- **ITU-T G.9901 defines maximum output levels** covering the different G3-PLC frequency bandplans
- **IEEE 1901.2 defines maximum output levels** covering the different G3-PLC frequency bandplans

## Where do we stand with FCC band standardization ?



### Standardization ≠ Regulation

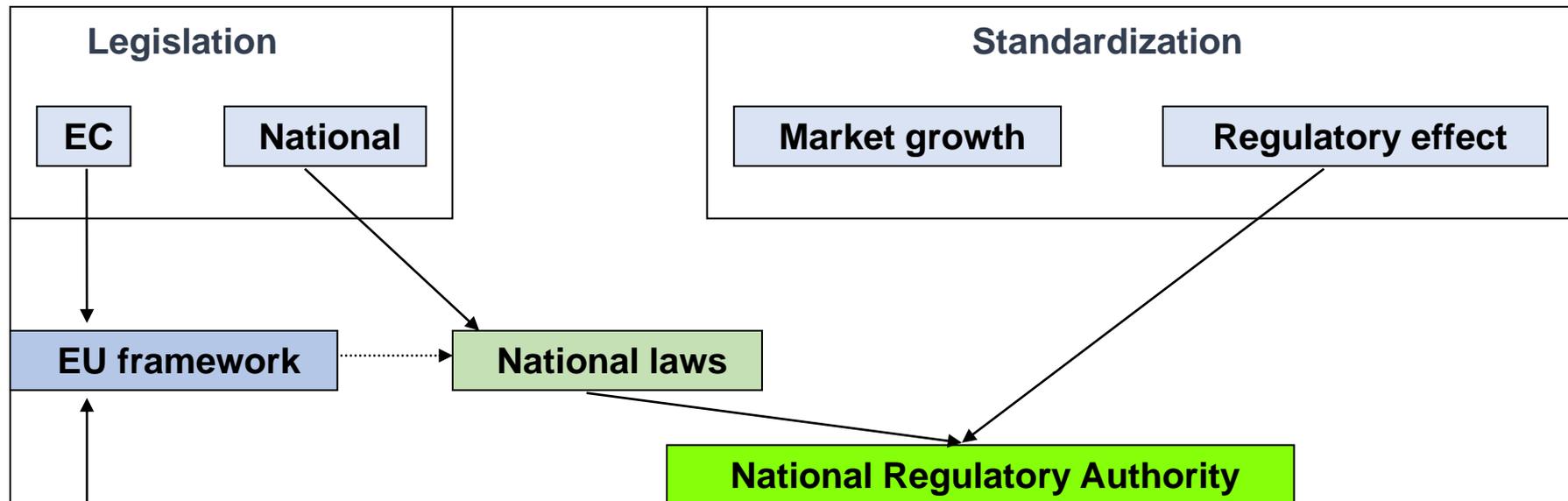
- The use of standards is voluntary
- Regulation refers to a set of mandatory requirements
- A standard may be referred to by regulation as to fulfil all or part of regulatory requirements

## Where do we stand with FCC band standardization ?

- **EN 50065-1** is the European reference standard for "Narrowband" PLC but it **is currently limited to the band 3 – 148,5 kHz**
  - EN 50065-1 is **harmonized** with the EU directive for EMC (2014/30/EU) = "EN 50065-1 can then be used to derive a presumption of conformity with the essential requirements of that directive"
  - **Preliminary work is ongoing** in CLC/TC219/WG9 to explore the extension of EN 50065-1 beyond 150 kHz
- **ITU-T G.9901 defines maximum output levels** covering the different G3-PLC frequency bandplans
  - Yet these limits are **recommendations recognized by ITU-R** which may or may not be used worldwide by national bodies
  - These limits are **not recognized by EU regulation**
- **IEEE 1901.2 defines maximum output levels** covering the different G3-PLC frequency bandplans
  - These limits are **not recognized by EU regulation**

## **2. What are the electromagnetic compatibility (EMC) aspects in Europe?**

## Standardization and regulation in the EU



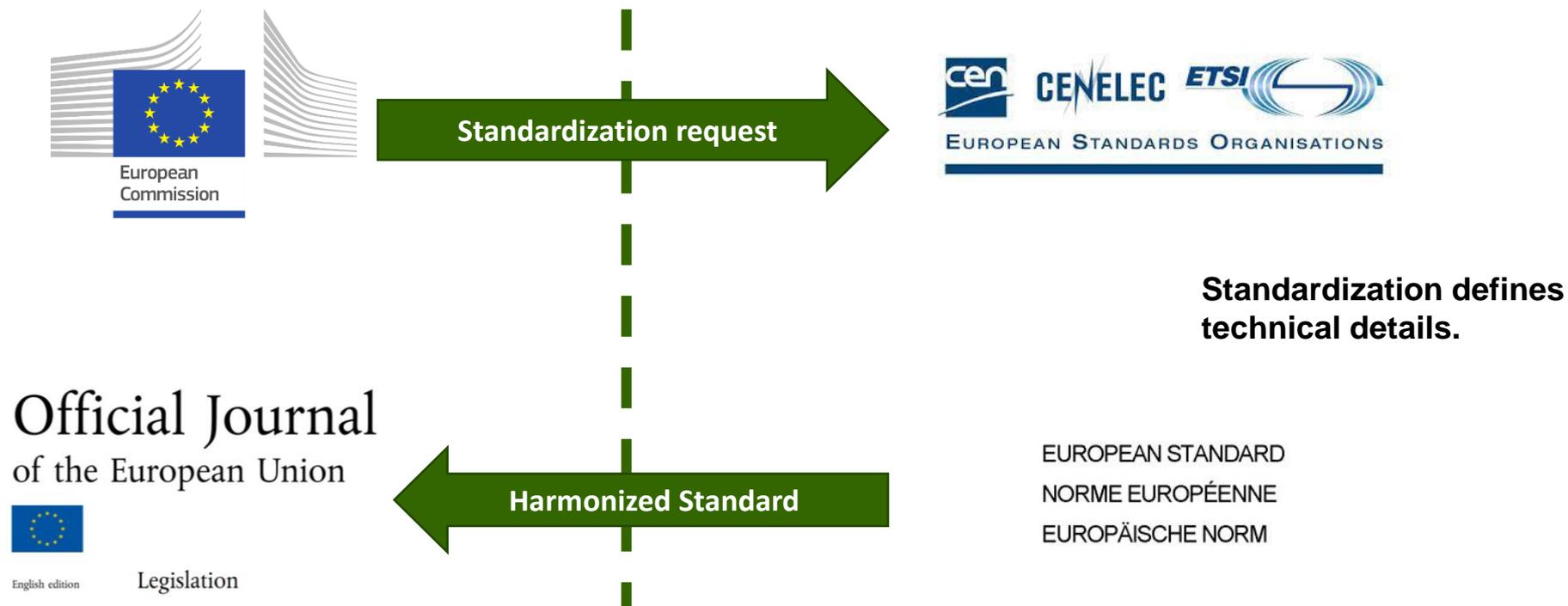
**DIRECTIVE 2014/35/EU (EMC directive)**

Examples:

- Standards for market growth: Interoperability, Co-existence
- Standard with regulatory effect: EN55022
- Executive in Germany: BNetzA
- Law in Germany: SchuTSEV
- EU Frame: PLC Recommendation, EMC Directive

## Standardization and regulation in the EU

Standards are developed in support of EU legislation



Presumption of conformity

## Regulation of Access PLC

PLC is a telecommunication network and is controlled in the EU under the framework of the EMC Directive 2014/30/EU

29.3.2014

EN

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L 96/79

DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

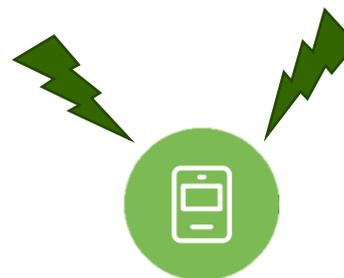
of 26 February 2014

on the harmonisation of the laws of the Member States relating to electromagnetic compatibility  
(recast)

### Protection Requirements



Emission



Immunity

## Market Access of PLC products

- Market access is granted, if products are compliant with the applicable regulations (e.g. EMC, safety, etc.)
  - Product specific compliance tests are required
- Directive 2014/30/EU provides 2 options to prove compliance:
  1. Either comply with an European Harmonized Standard
  2. Or be certified by the manufacturer according to his own specified measurement method
    - In this case a Technical Construction File (TCF) needs to be prepared
- The “CE” sign shows that market access is granted

**3: How do you get the CE-Marking with regards to EMC in FCC band?**

## Market access is granted, if products are compliant with the EMC regulation

Directive 2014/35/EU:

a manufacturer is allowed to assess the EMC of its products

- either by compliance with a European Harmonized Standard
  - EN 50065-1 in 3-148,5 kHz
  - EN50561-1 in 1.8-30 MHz (only applicable for in-house PLC)
  
- or by doing an EMC assessment based on own procedures and methods
  - Broadband PLC sold over 250 Million broadband adapters by doing so!
  - IEEE 1901.2 defines EMC limits in 150-500 kHz

Product compliance with all applicable directives (e.g. safety etc.)



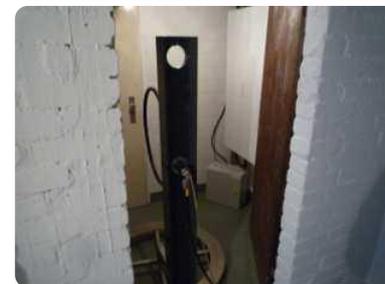
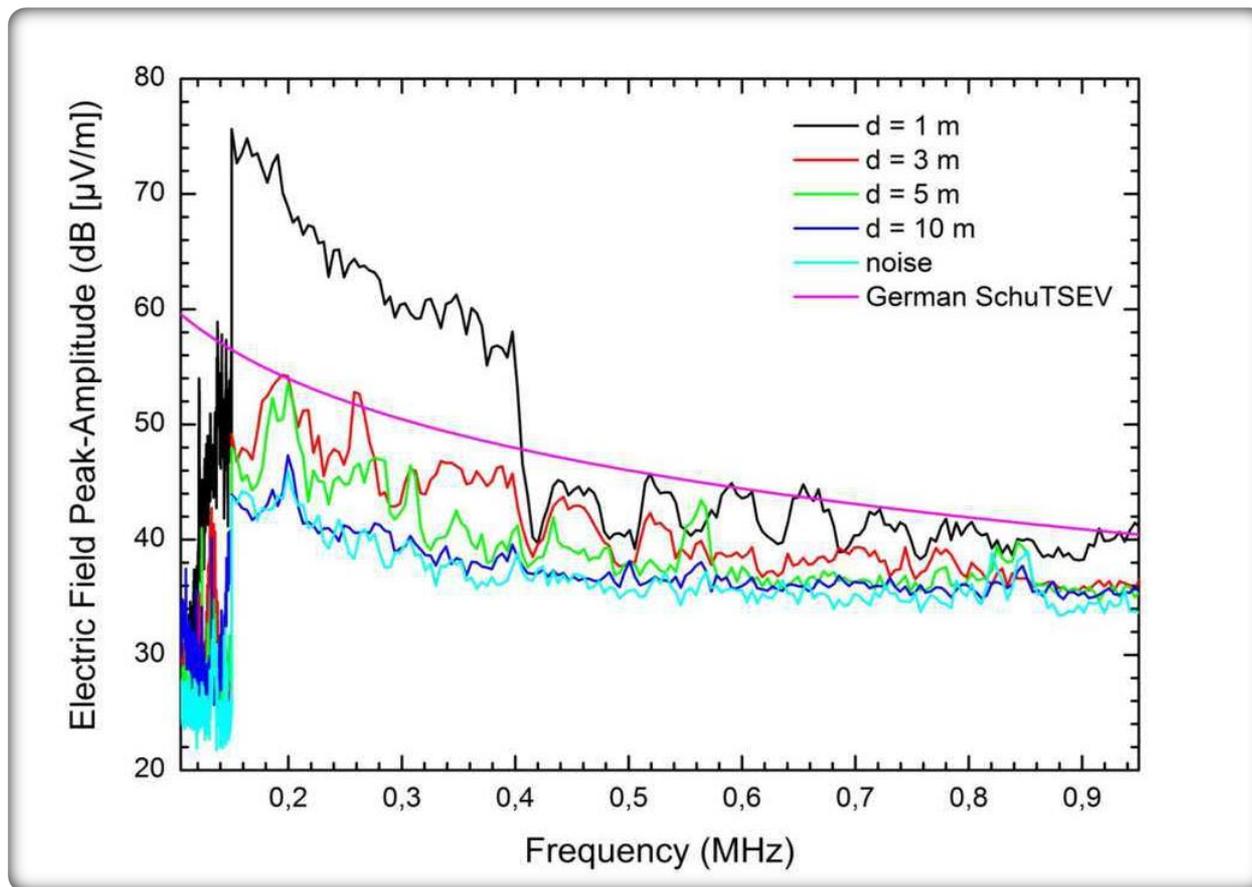
## Example: IEEE 1901.2 defines EMC limits in 150-500 kHz

Frequency range	Limits during PLC transmission	Out-of-band disturbance limits
3 kHz to 9 kHz	CENELEC EN 50065-1 2011, clauses 6.3.1.1; 6.3.2.1	CENELEC EN 50065-1 2011, clause 7.2.1
9 kHz to 95 kHz "CENELEC A"	CENELEC EN 50065-1 2011, clauses 6.3.1.2; 6.3.2.2	CENELEC EN 50065-1 2011, clause 7.2.2
95 kHz to 125 kHz "CENELEC B"	CENELEC EN 50065-1 2011, clauses 6.3.1.3 6.3.2.3	
125 kHz to 140 kHz "CENELEC C"		
140 kHz to 148.5 kHz "CENELEC D"		
150 kHz to 500 kHz	Class A: <ul style="list-style-type: none"> <li>-22 dBm/Hz Quasipeak</li> <li>-35 dBm/Hz Average</li> </ul> Class B: <ul style="list-style-type: none"> <li>(-35)-(-45) dBm/Hz Quasipeak</li> <li>(-45)-(-55) dBm/Hz Average</li> </ul>	CISPR 32:2015, Tables 1 & 2
>500 kHz to 30 MHz "BPL"	Out of scope	
30 MHz to 1000 MHz	Out of scope	CISPR 32:2015, Tables 5 & 6 (radiated)

## Risk assessment of interference complaints

- If an interference complaint is filed, the National Regulatory Authority has to assess the interference complaint and eventually mitigate it after examination
- In order to assess the risk of interference complaints, devolo together with University of Duisburg-Essen measured the radiation during its FCC band field trials at Vattenfall Hamburg

## EMC Test Results



- **Used spectrum: 150-500 kHz**
- **Measurements have been performed together with University of Duisburg-Essen**
- **Compliant with German SchuTSEV (measurement in 3m norm-distance as defined by SchuTSEV)**

# 4: FCC roll-out in Austria: characteristics and how did EVN proceed?

## FCC spectrum

Challenges in the FCC bandplan or used frequencies in the range from 150 to 500 kHz:

- Non-directional radio beacon (a radio transmitter at a known location, used as an aviation navigational aid)
- Amateur radio
- Avalanche transceiver

## Non-directional radio beacon

- The biggest challenge was to get approval from the Supreme Civil Aviation Authority
- Ministry: Climate Action, Environment, Energy, Mobility, Innovation and Technology
- Austro Control is responsible for a safe, reliable and efficient air traffic throughout Austrian airspace

## How did we get this approval?

- After joint measurements of the PLC signal in the frequency bands, we received a decision with the following conditions
  - Notching the frequency bands of all non-directional radio beacon in the area of Netz NÖ
  - Annual verification by an independent testing institute that the frequency bands of the non-directional radio beacon are not used
  - In case of proven disturbances, the orders of the authority must be followed

## Non-directional radio beacon

- Each non-directional radio beacon has his range and the used subcarriers

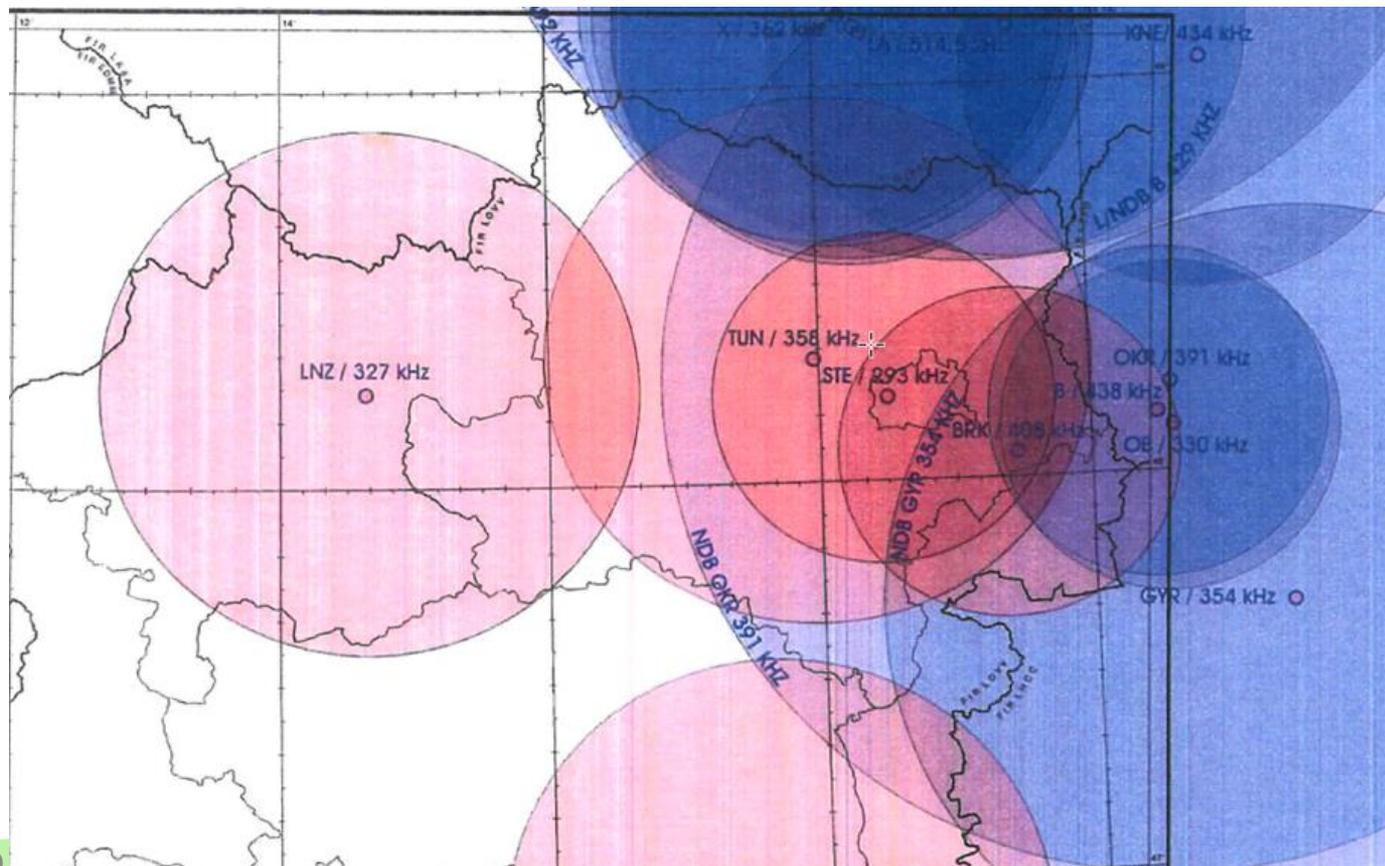
154,6875 kHz SD(1) First Subcarrier  
 487,5000 kHz SD(72) Last Subcarrier  
 332,8125 kHz delta

72 Number of Subcarriers  
 4,6875 kHz spacing  
 1,1719 kHz R'

SC(n)	f	Austrian Territory			Neighboring Countries			COMMENT
		Notch	NDB (f)	NDB (Name)	Notch	NDB (f)	NDB (Name)	
28	281,2500 kHz							
29	285,9375 kHz							
30	290,6250 kHz							
31	295,3125 kHz		293 kHz	STE			AUT 12	
32	300,0000 kHz							
33	304,6875 kHz							
34	309,3750 kHz							
35	314,0625 kHz							
36	318,7500 kHz							
37	323,4375 kHz							
38	328,1250 kHz		327 kHz	LNZ				
39	332,8125 kHz							
40	337,5000 kHz							
41	342,1875 kHz							
					330 kHz	OB	AUT 8, SVK 2	

## What do the requirements mean for Netz NÖ?

- Condition to notch the carrier of the non directional radio beacon (airport Linz, Vienna, Bratislava, Budapest)
- Area of Netz Nö: We can use only 45 of 72 subcarriers in the FCC band



## Amateur radio and Avalanche transceiver

- Additional 7 notched subcarriers for amateur radio and avalanche transceiver
  - Amateur radio 472 kHz and 479 kHz
  - Avalanche transceiver: 457 kHz
- In summary we use only 38 of the 72 subcarriers in the FCC band
- The biggest advantage of using FCC band is much less interference than the Cenelec A band

## Experience with G3 and FCC Band

### Status of the Rollout of Netz NÖ

- >725.000 Smart meters installed
- No interference to any customer device through the PLC signal
- No interference with any radio service
- In some cases, the power supply unit of modem and receiver made a lot of noise
- To reduce this noise we have installed 90 filters in front of such a device
- Expenses for the clean-up are very low
- Daily reading success rate > 99 %

#### Notes:

- The maximum transmission level of the PLC modem is 108 dB $\mu$ V, measurements show that we transmit in the range 85-95 dB $\mu$ V;
- Filters used by Netz NÖ are <https://eichhoff.de/produktuebersicht/plc> and <https://www.reo.de/produkte/auswahl-filter/>

# Discussion



**Thank you for attending this webinar today! Do not hesitate to get in touch!**



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