P ower

L ine

C ommunication

Interferences
at the city of
Fribourg

- **Introduction**
- **Overview measurement campaign**
- **Results & Conclusions**

Objectives of the measurements campaign

- Assessement of the EMI produced by an installed PLC networks in a urban area.
- Assessement of the impacts on quality of radio reception in the short-wave band (4-26MHz)
- Comparison between the EMI levels produced by PLC networks and the german limit NB30

Cumulative effect

Overhead lines of buses/trains

Temporary sources

High voltage overhead lines

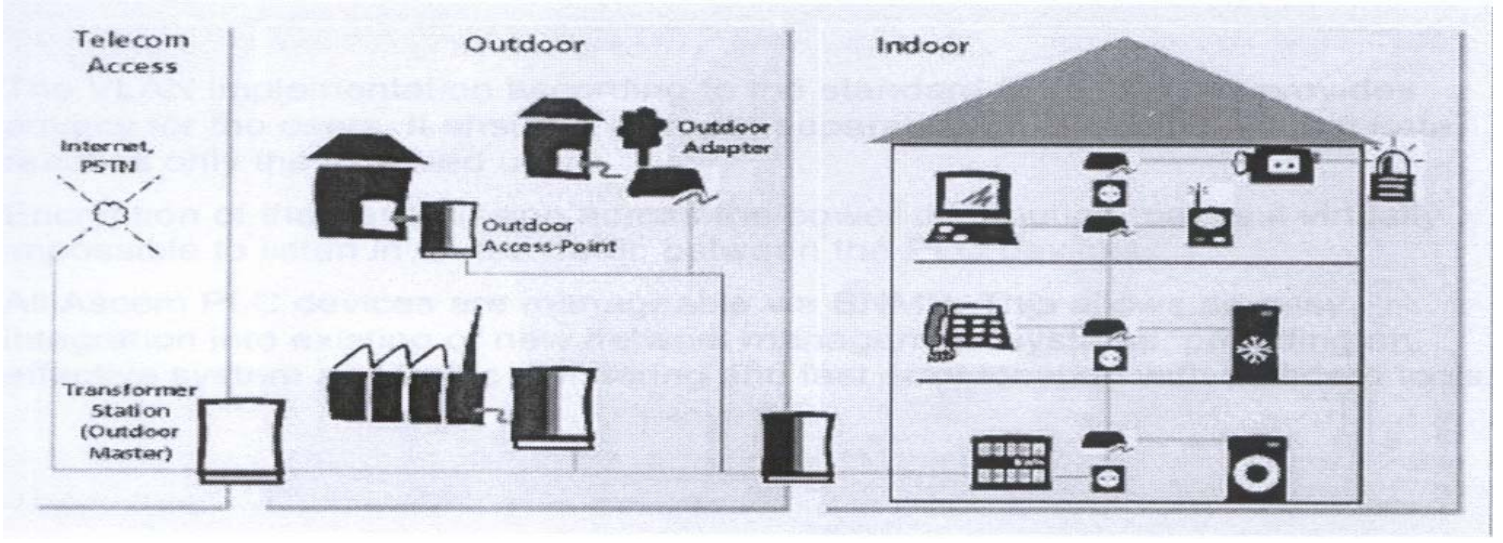
Mobile sources

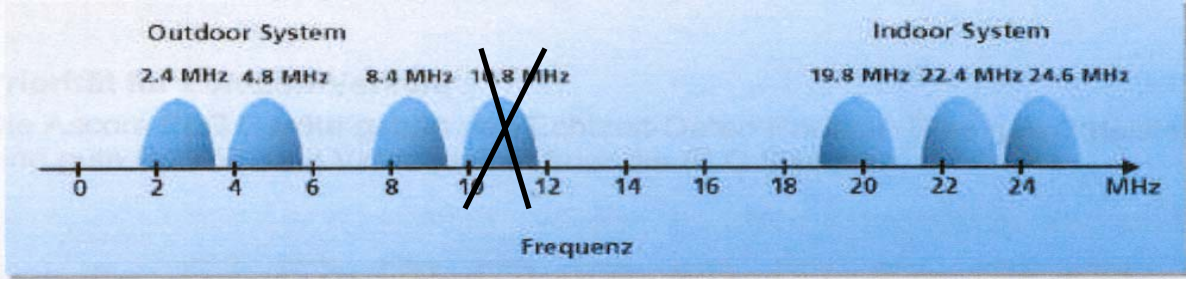
PLC, city of Fribourg

Statistical approach

- Random distribution of the measurement locations in different typical urban areas (Residential, Industrial, city-center)
- Short-term measurements in three time frames over a day
  Long-term measurements during 6 months
- Results are given under the so called CISPR 80% probability (defined as an upper limit for 80% of the measurements)

Powerline network under test





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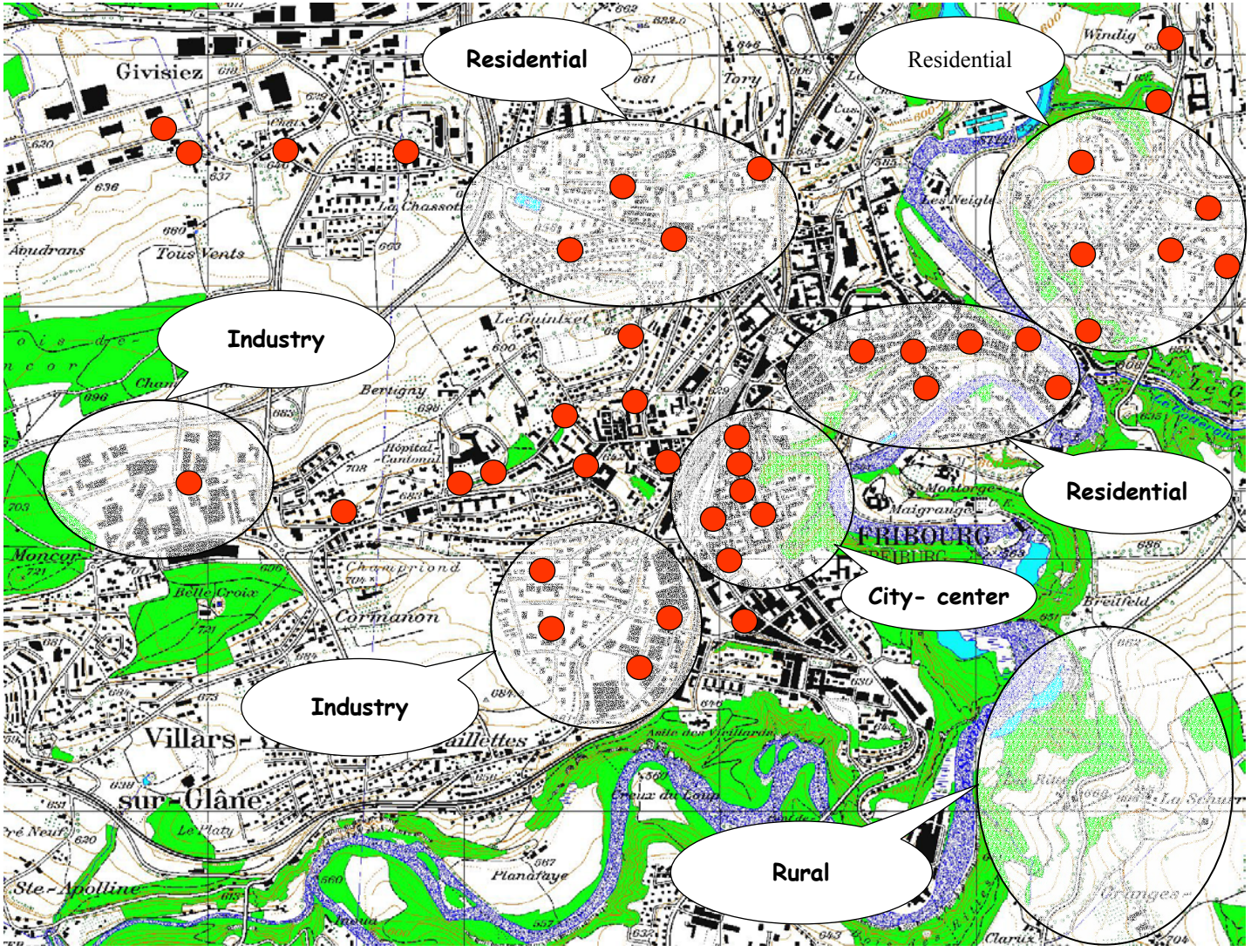


Swiss city of Fribourg

Points of data injection into PLC cells (34)

Measurement areas (7) (202 sites)

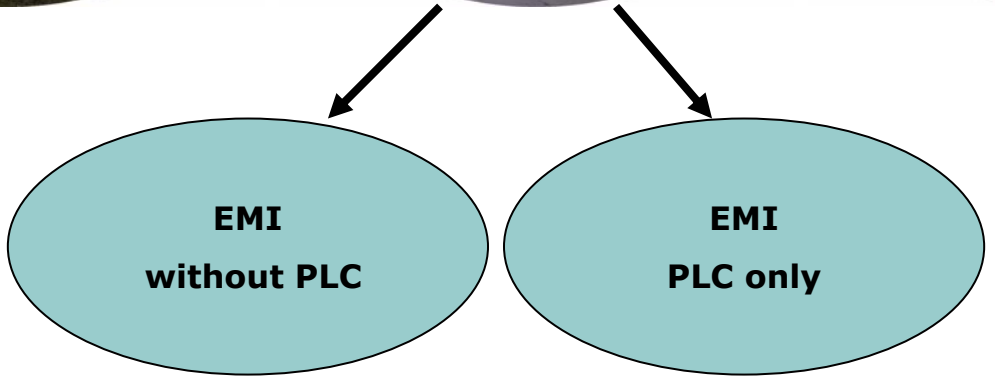
- Duration of measurement campaign: 6 months
- Number of measurement points : 4400

Statistical data entities

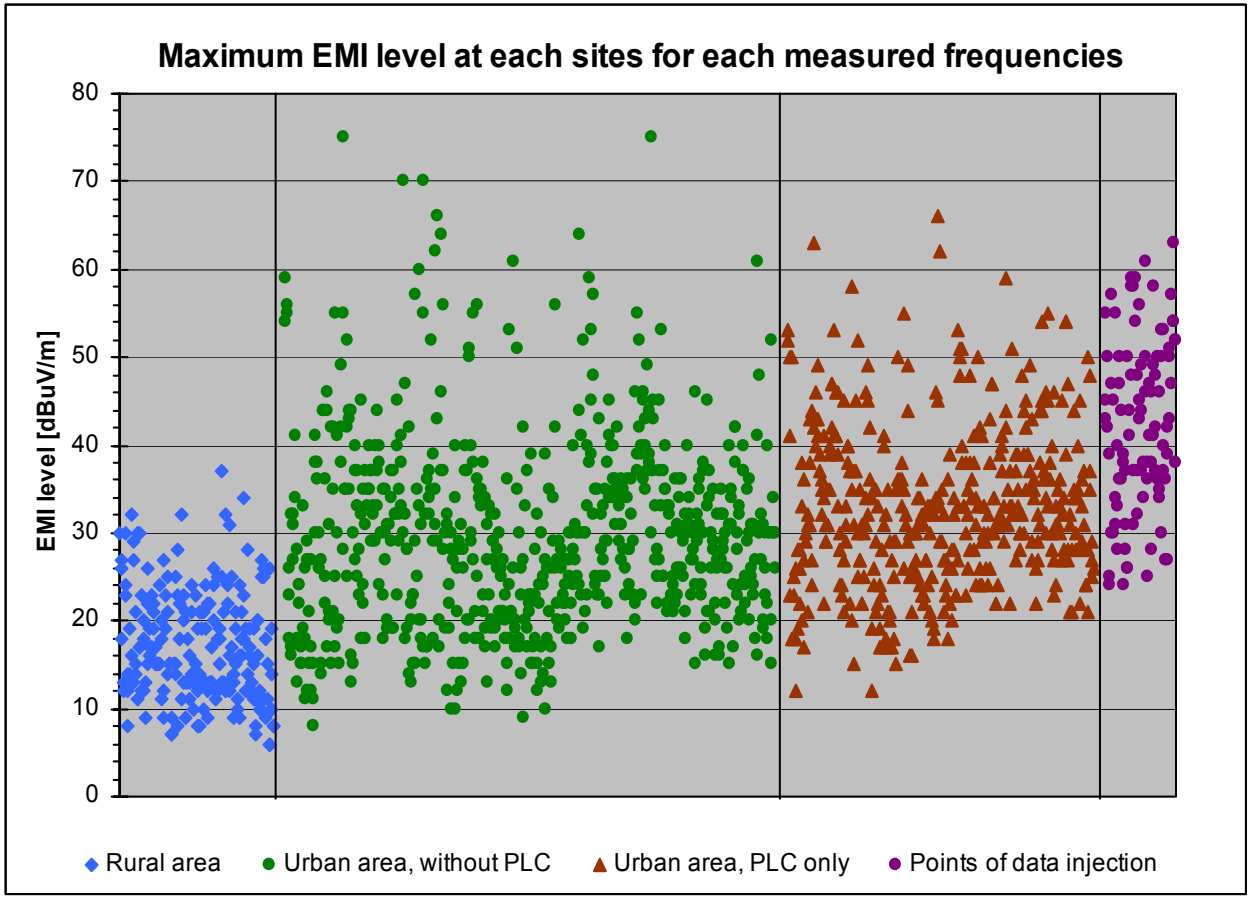
Rural Area

Urban Area

Points of data injection (trafo)



Measurements data



Rural area:

- 34 sites
- 730 measurements
- 210 statistical values

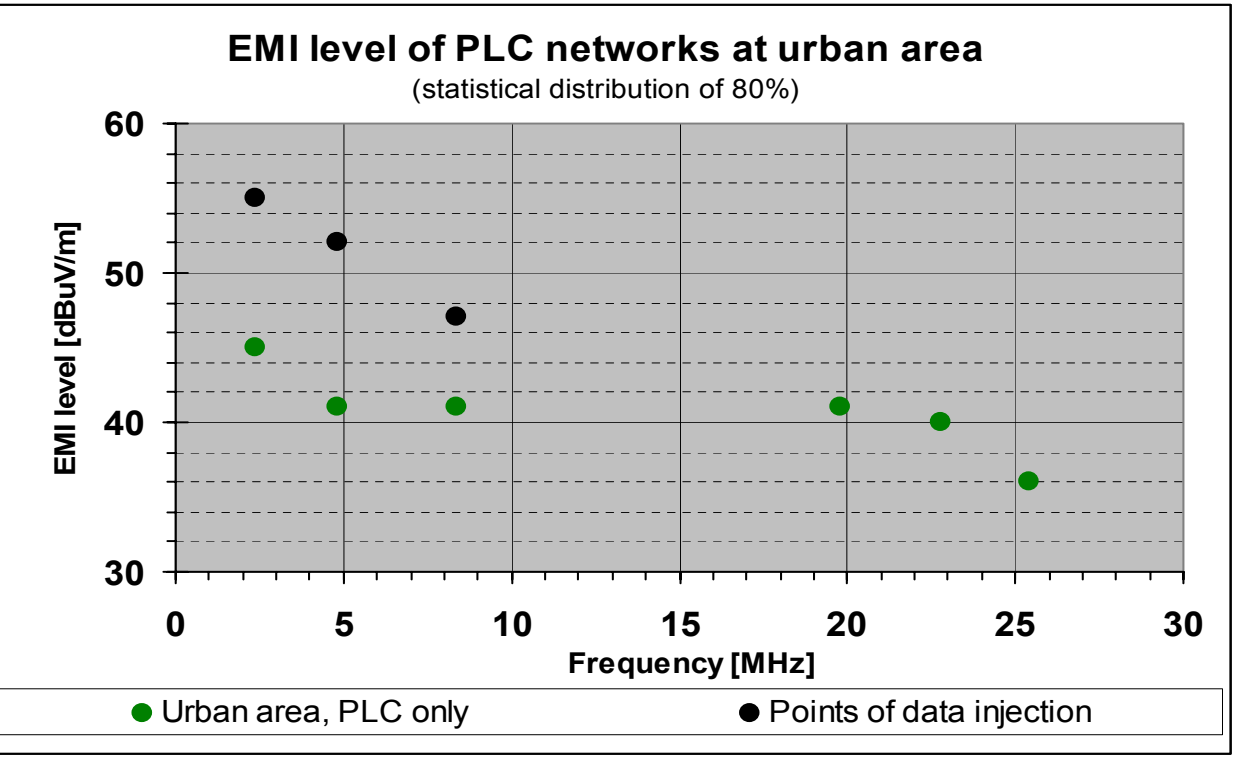
Urban area:

- 168 sites
- 2500 mesurements
- 670 statsitical values without PLC
- 420 statistical values PLC only

Points of data injection:

- 34 sites
- 612 measurements
- 126 statisticals values

EMI level produced by the PLC network



- EMI at data injection points to PLC cells: 47…. 55 dBuV/m (corrected QP at 3 meters distance)
- EMI in urban area: 36…45dBuV/m. (QP value)

- The 80% average value of EMI produced by PLC systems in an urban area remains rather constant over the whole frequency range at about 40dBuV/m.

- EMI level is maximum at points of data injection

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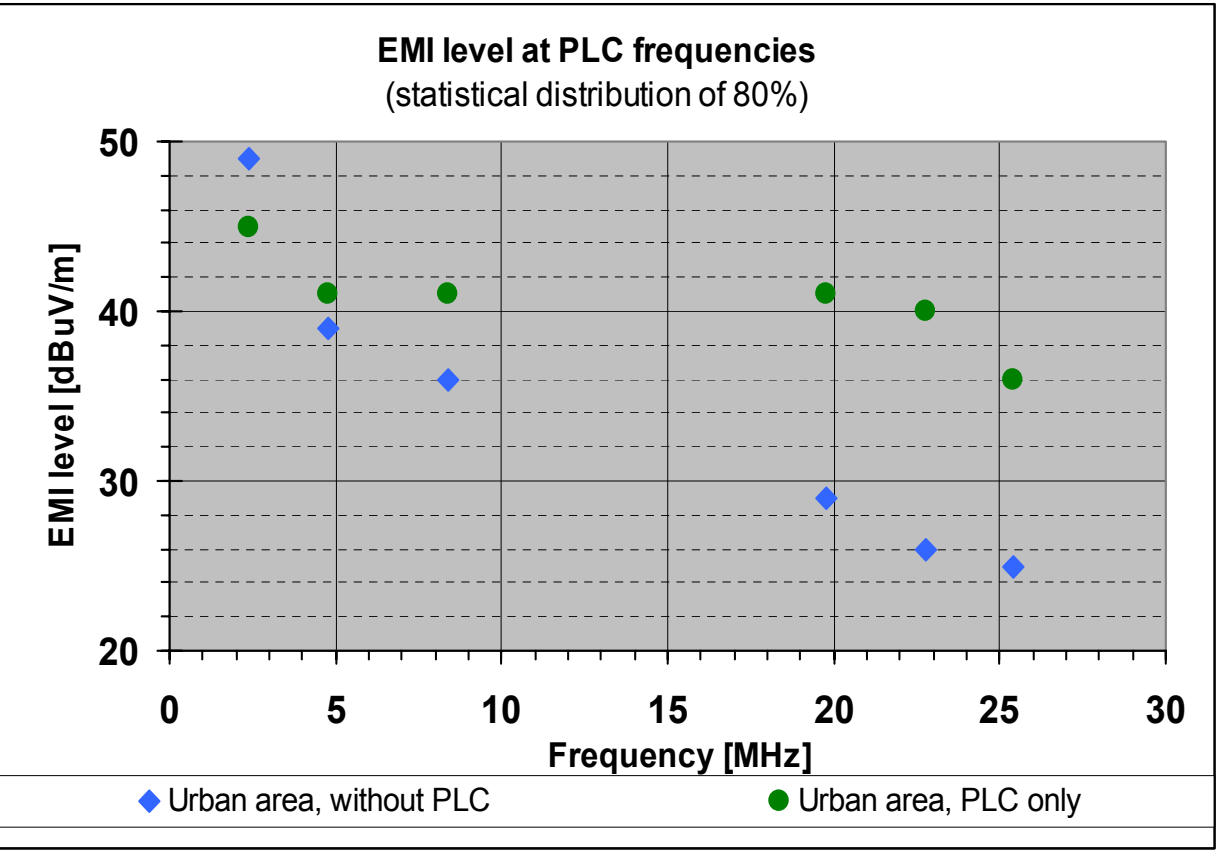
Raise of the noise floor due the installed PLC network at the city of Fribourg



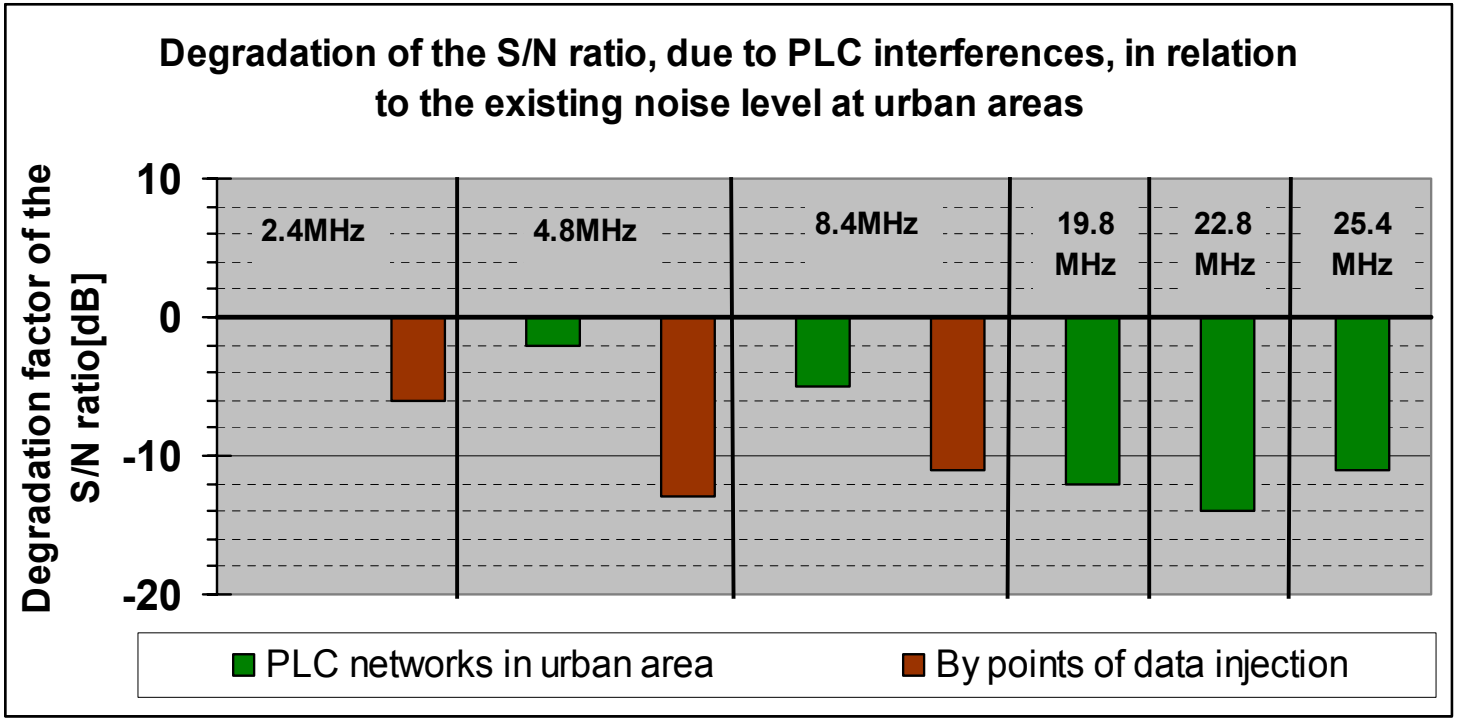
Maximum deviation

(f< 10MHz) : 5dB

(f>10MHz): 14 dB

- **Raise of the noise floor, due to PLC systems, mainly above 10MHz**

Degradation of radio reception



- **The degradation of the S/N ration may be expected mainly at frequencies above 10MHz, and at frequencies below to 10 MHz in the ultimate vicinity of injection data points**

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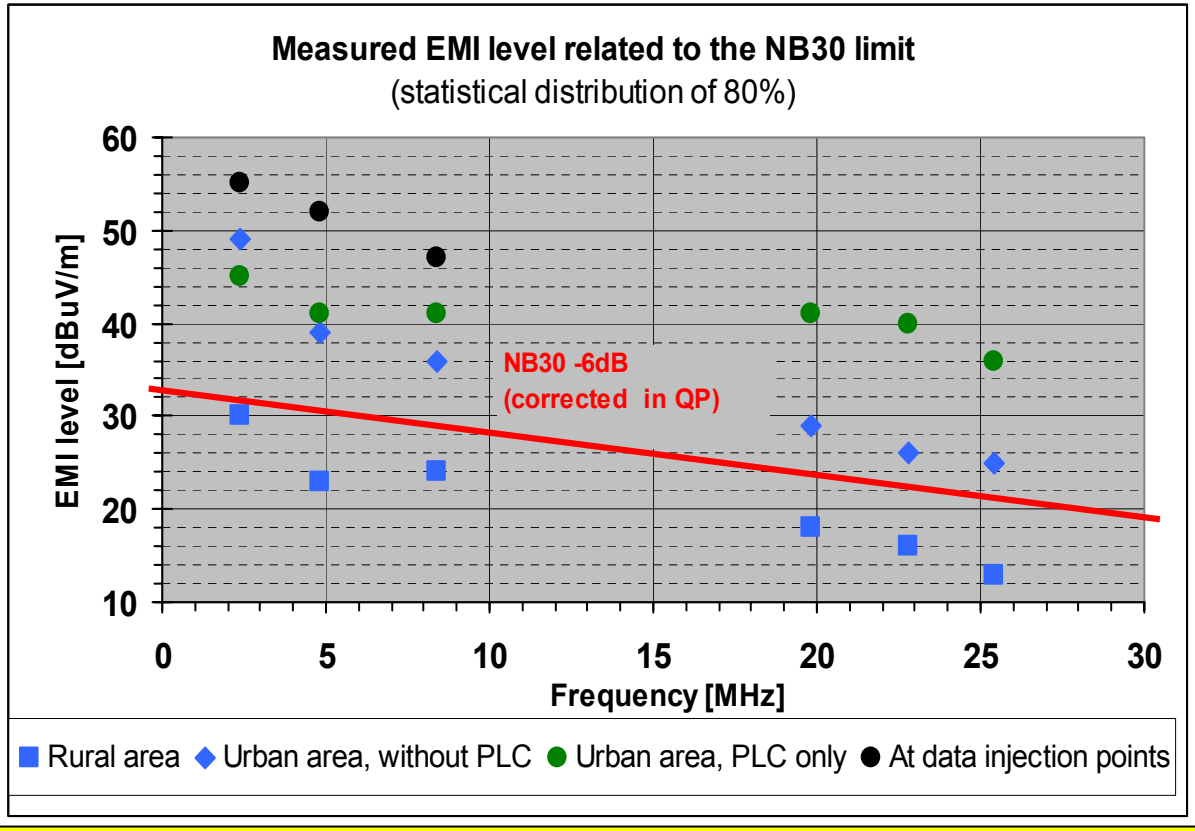
EMI level compared to the NB30 limit



- **EMI exceeding NB30:**
  - **up to 24dB by points of data injection**
  - **up to 18dB in urban area**

- **EMI of PLC systems clearly exceeds the NB30 limit.**
- **The noise floor, not taking into account the EMI of PLC systems, already exceeds the NB30 limit.**

Conclusions

- The interference level at urban areas (80% CISPR, Quasi-peak) of the PLC networks proofed to be rather constant over the whole frequency range: ~40dBuV/m

- The degradation of the S/N ratio at urban areas may reach 14dB at frequencies above 10MHz, below 10MHz little degradation has to be expected, except at the ultimate vicinity of points of data injection.

- At urban areas EMI due to PLC and other sources of interference exceeds the german standard NB30 over the whole frequency range