University "Stefan cel Mare" Suceava - Romania
Faculty of Electrical Engineering and Computer Science

Performance Measurements on Power Line Carrier Data Transmissions in Indoor Office Environments

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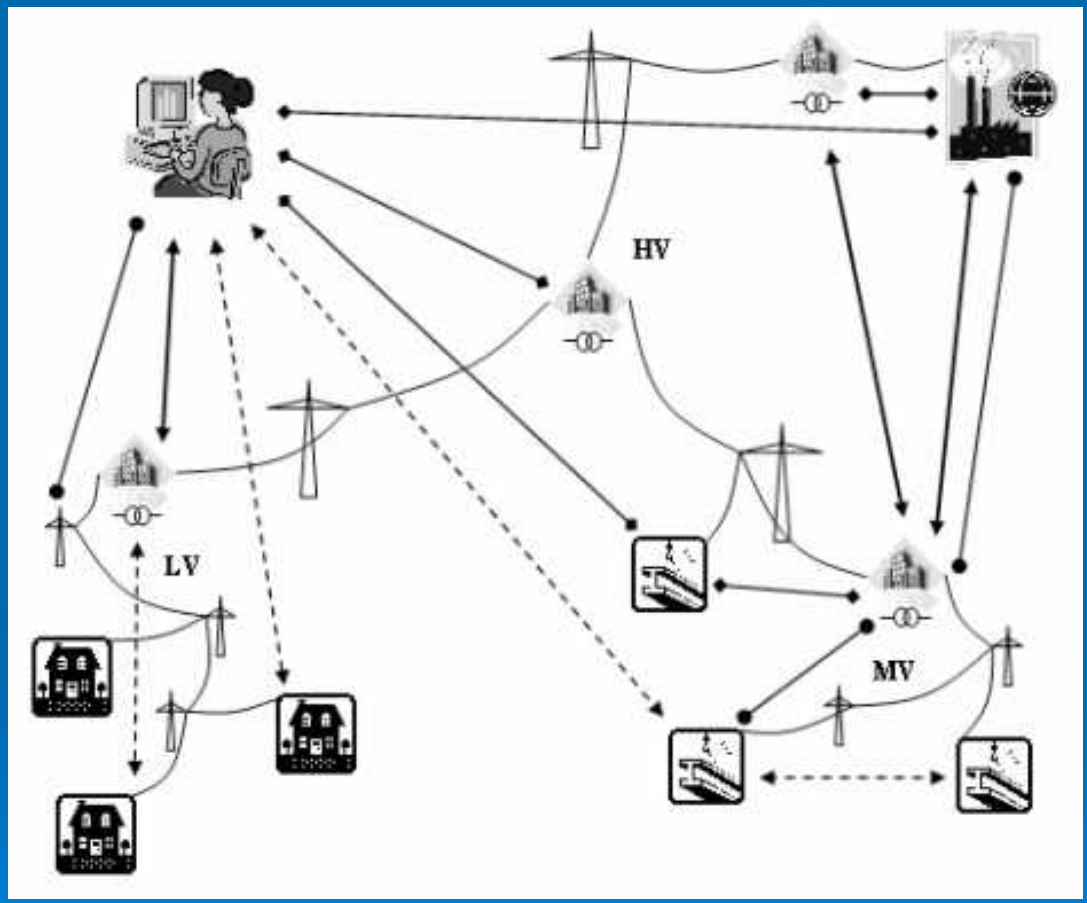
- Introduction
- Data communications over power lines
- Field measurements results
- Conclusions

PLC = Data over Power Lines

75 to 9600 bps

1950 - Data transmission on high voltage power lines

Performance Measurements on Power Line Carrier Data Transmissions in Indoor Office Environments



Radio link

Low Speed PLC

Leased Line

No Communication

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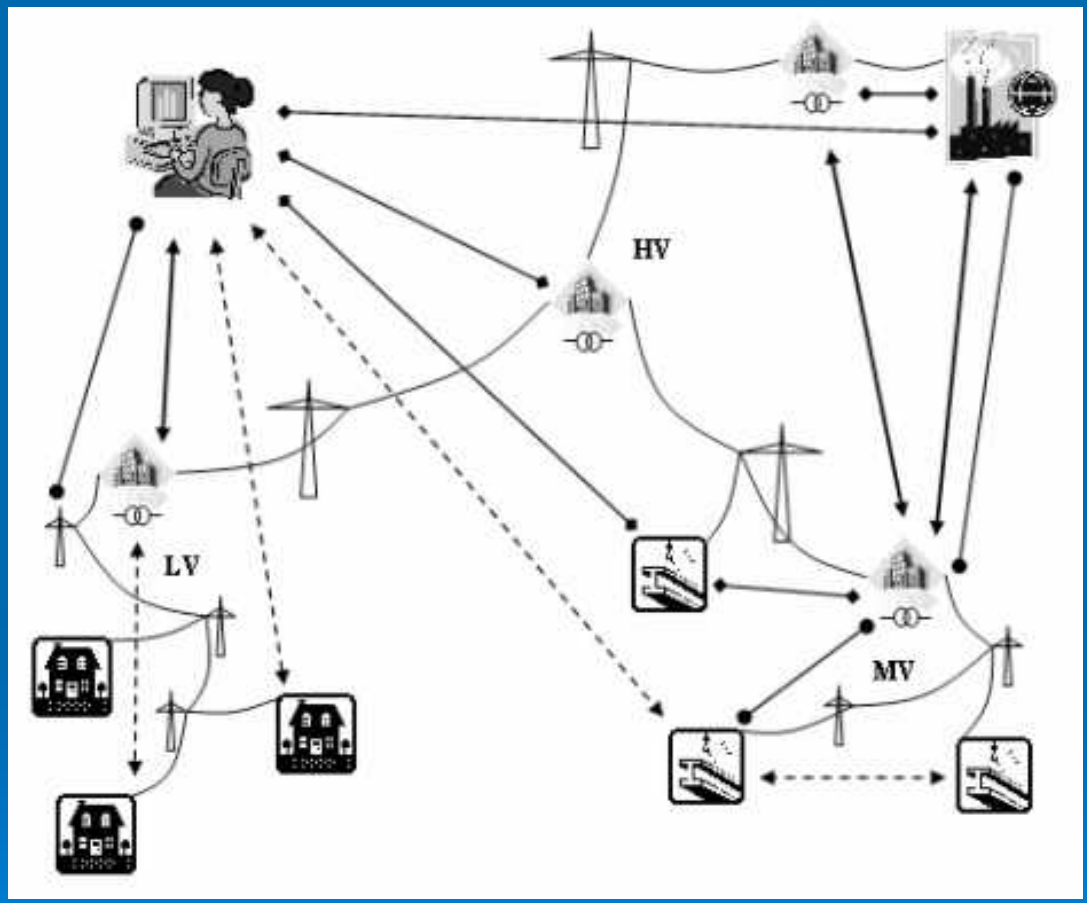

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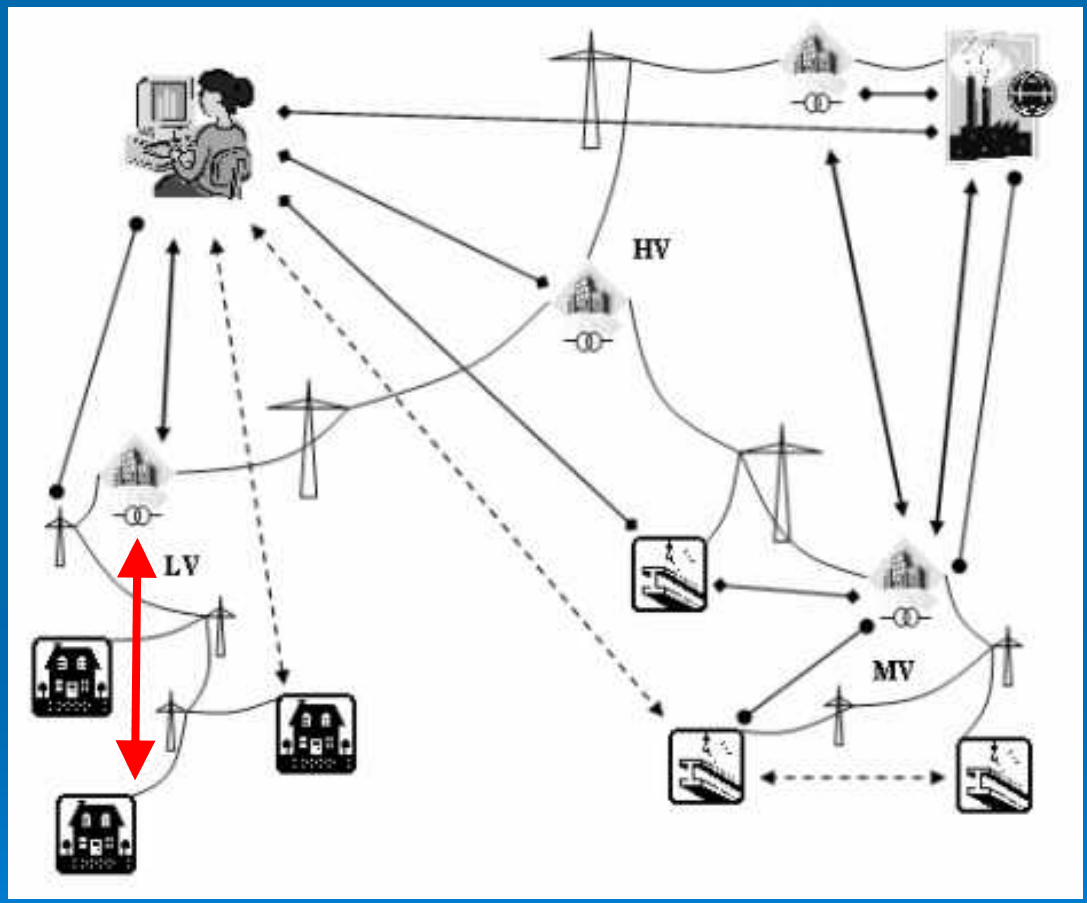

Radio link

Low Speed PLC

Leased Line

High Speed PLC

Low voltage solution providers

Country	Region	Technology	Speed (Mbps)	Users	Services
Spain	Saragossa	Ascom DS2	2 ... 12	3000	Internet VoIP
	Barcelona	Ascom	2 ... 3	25	Internet VoIP
	Seville	DS2	6 ... 12	25	Internet VoIP
Germany	Mannheim	Ascom	2 ... 3	2800	Internet VoIP
Austria	Innsbruck	n/a	1 ... 2	10 ... 25	Internet
	Vienna	n/a	1 ... 2	n/a	Internet VoIP
	Axams	n/a	2 ... 3	50 ... 100	Internet

Data valid on 03/2005

Low voltage solution providers

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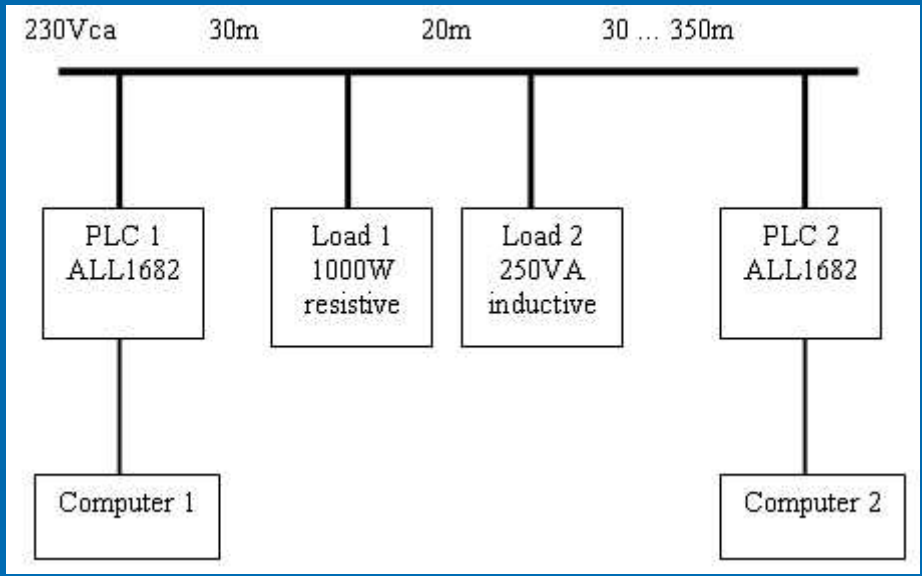
	Vienna	n/a	1 ... 2	n/a	Internet VoIP
	Axams	n/a	2 ... 3	50 ... 100	Internet

Data valid on 03/2005

Very high speed transmission tests announced late 2005 in Germany and Spain (100Mbps)

Field measurements results

- Power
- Devices
- Load 1
- Load 2
- Distance



Network topology used for our field tests

Field measurements results

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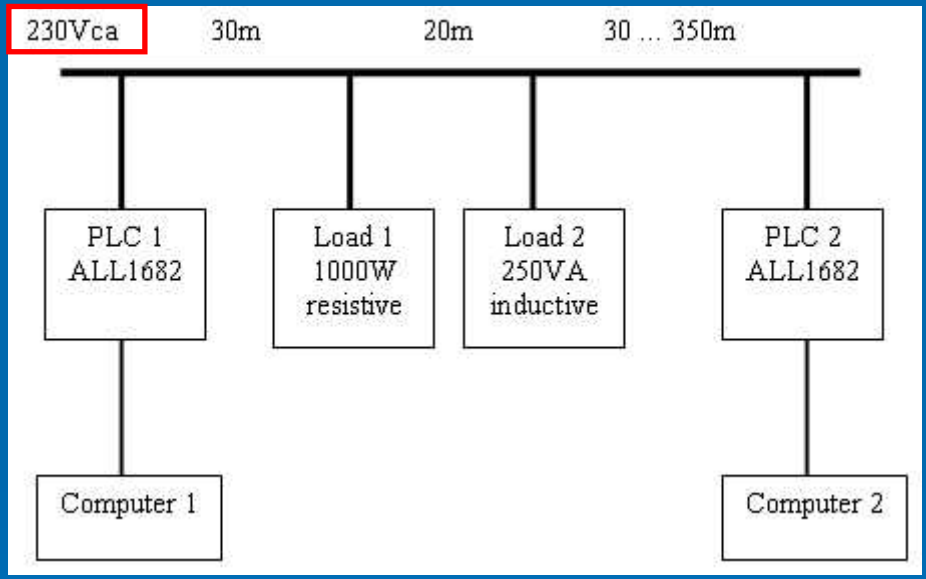

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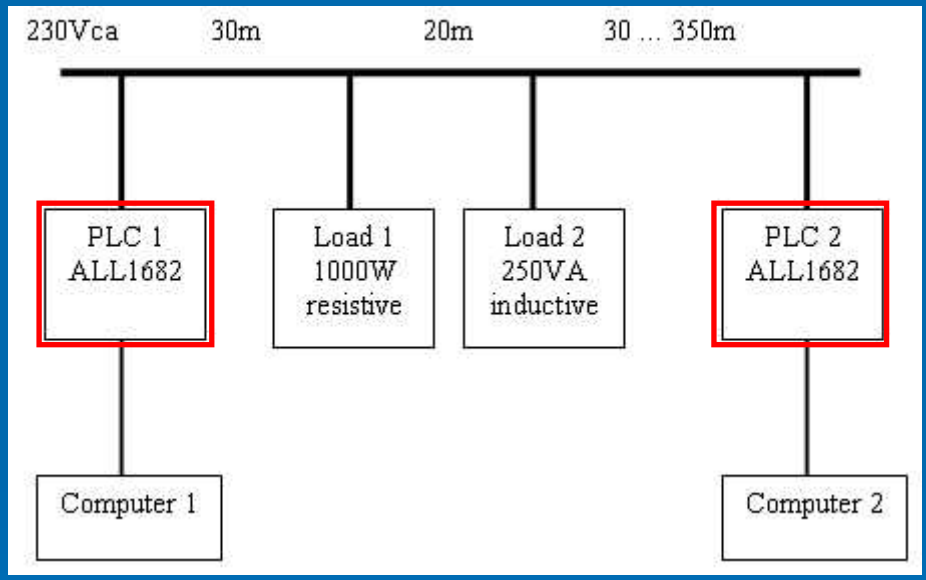

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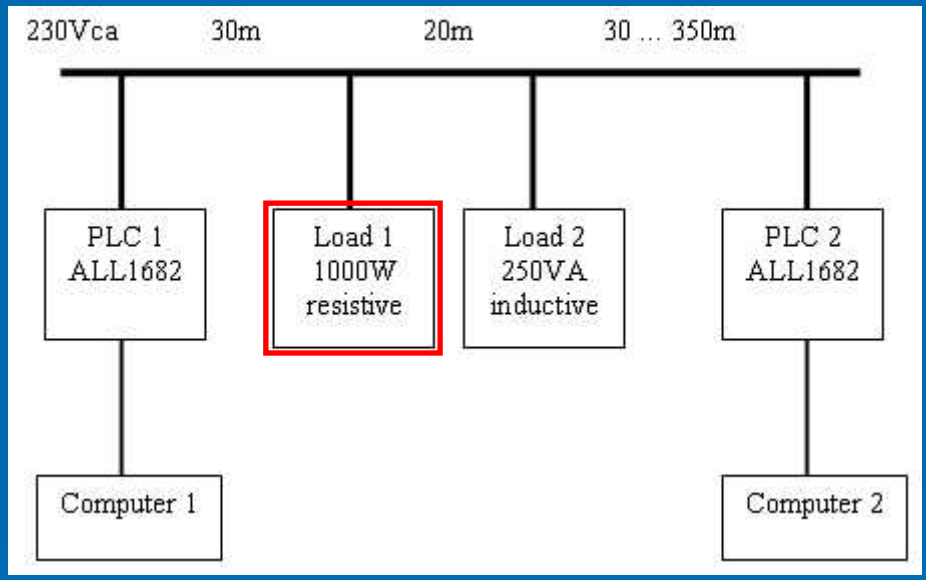

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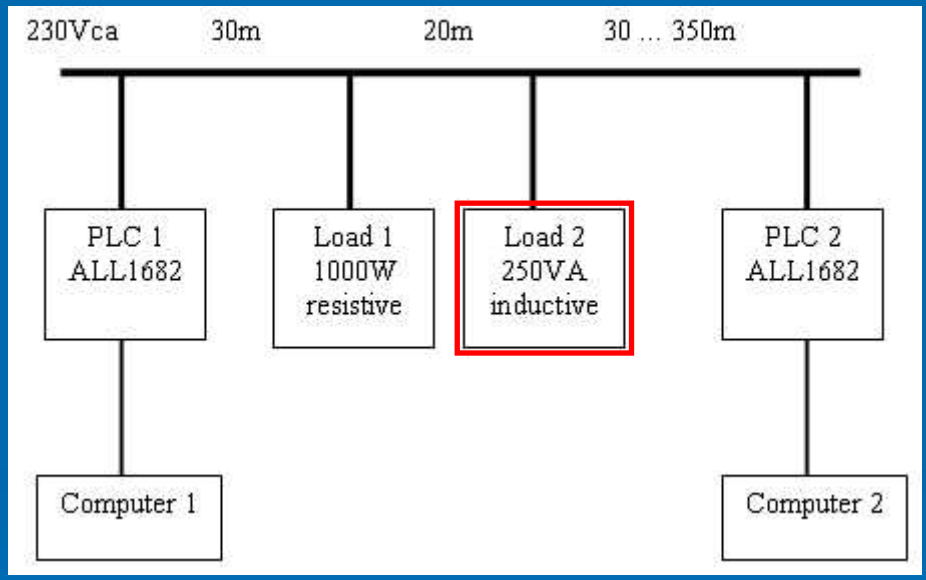

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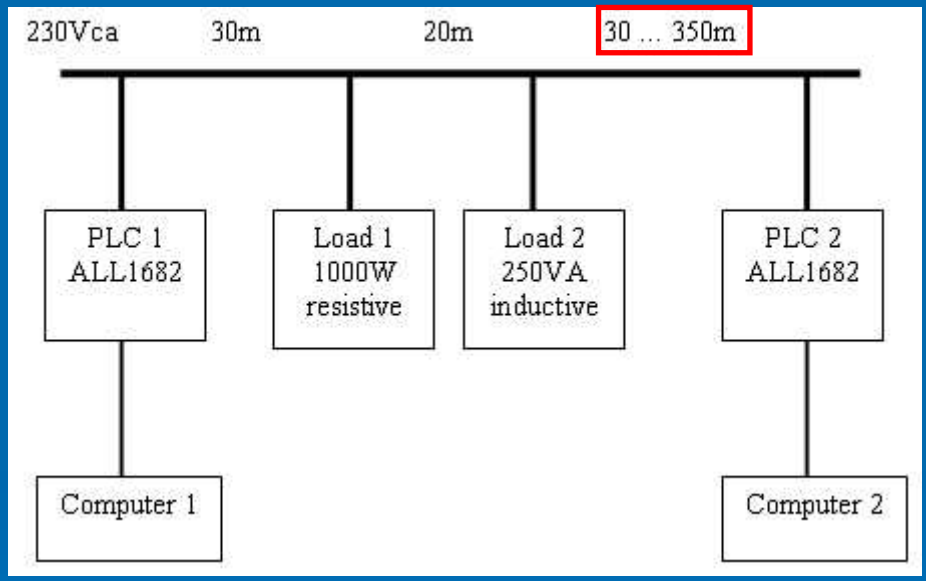

Network topology used for our field tests

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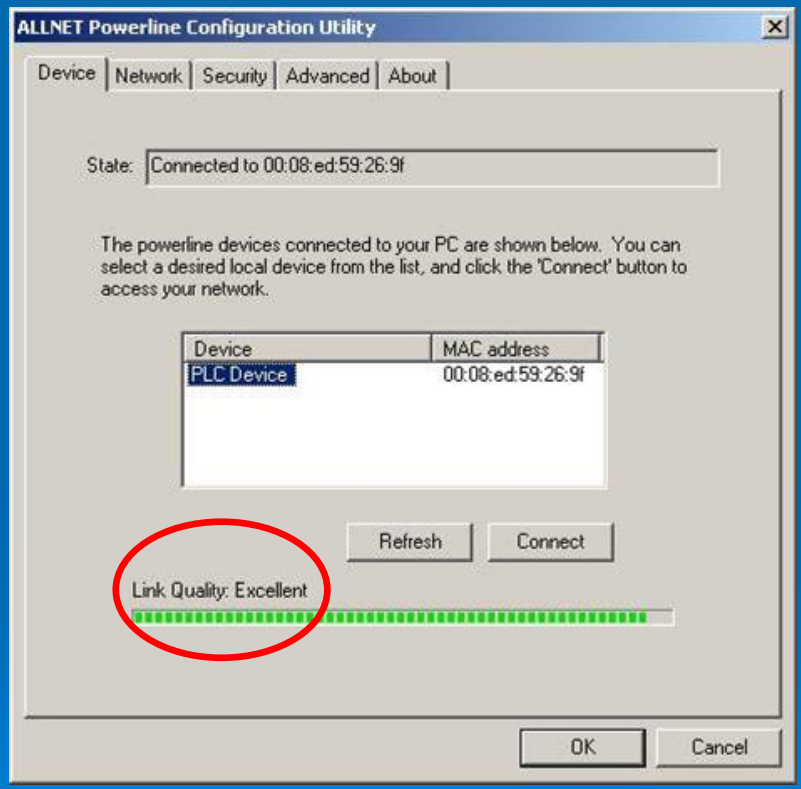
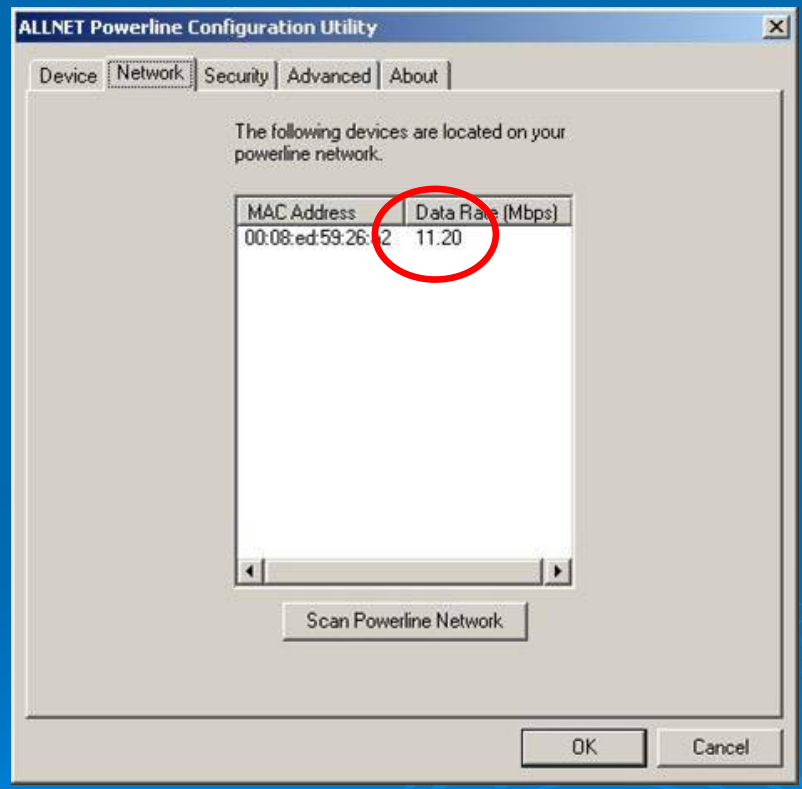
~ 50m

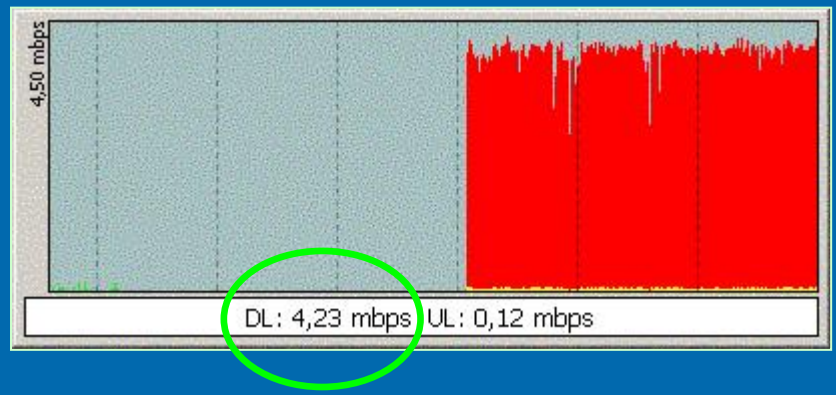
Test configuration - Low distance





~ 50m

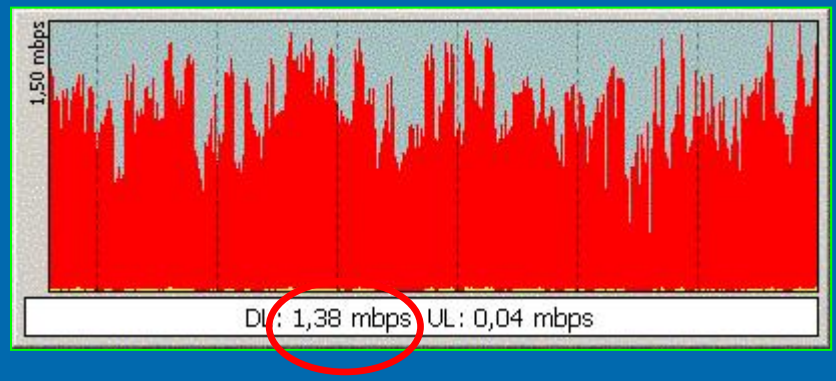
Low distance - **Excellent** transmission quality



Reply from 192.168.100.103 : bytes=32 time=16ms TTL=62
Reply from 192.168.100.103 : bytes=32 time<10ms TTL=62
Reply from 192.168.100.103 : bytes=32 time=15ms TTL=62
Reply from 192.168.100.103 : bytes=32 time<10ms TTL=62
Ping statistics for 192.168.100.103 :
Packets: Sent = 393, Received = 392, Lost = 1 (**0%** loss),
Approximate round trip times in mili-seconds:
Minimum = 0ms, Maximum = **23ms**, Average = **6ms**

~ 350m

Long distance - **Poor** transmission quality



Reply from 192.168.100.103 : bytes=32 time=126ms TTL=62
Reply from 192.168.100.103 : bytes=32 time=18ms TTL=62
Reply from 192.168.100.103 : bytes=32 time=156ms TTL=62
Reply from 192.168.100.103 : bytes=32 time=118ms TTL=62
Ping statistics for 192.168.100.103 :
Packets: Sent = 1567, Received = 1504, Lost = 63 (**4% loss**),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = **328ms**, Average = **124ms**

Conclusions

- Good performances for Web and Email services
- Energy supply blackout VoIP problems (no 112)
- EMC related problems (shortwave interferences)
- Future investigation and filed tests

SiSCON.usv.ro

PLC partnerships

through our Research Center

- Real world tests on low voltage power networks

- EMC related measurements in customer installations

- Worst conditions test

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Thank you !

Q u e s t i o n s ?

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