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GAINING NETWORK PERFORMANCE THE PASSIVE WAY, WITH DISTRIBUTION PASSIVES.

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SMALL DIFFERENCES. BIG IMPACT.

EXECUTIVE SUMMARY

SIGNIFICANT BITRATE IMPROVEMENTS IN THE CATV NETWORK BY EXCHANGING PASSIVES

For the full benefit of the bitrates, offered by DOCSIS 3.1, the carrier-to-noise-ratio (CNR) must exceed minimum values. From a large scale (1 M subscribers) network upgrade, zooming in on a single segment shows MER (hence CNR) improvements above 4 dB, by exchanging the distributions passives only - with a minimum investment.

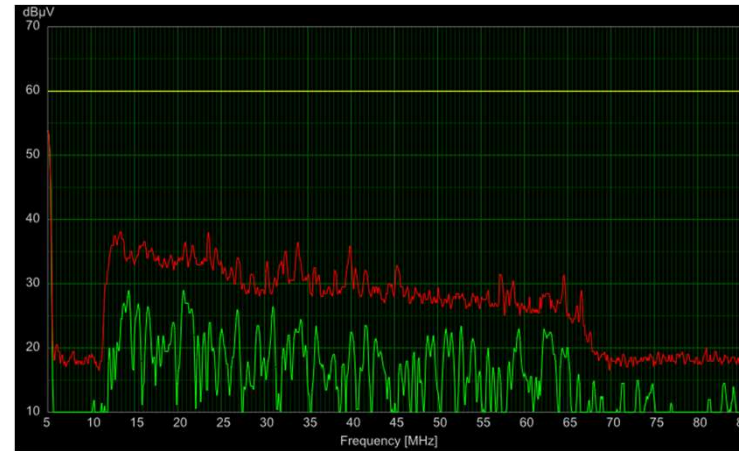
The **benefits** are improvements in the **network capacity**, the **subscriber satisfaction**, and reduced **maintenance cost**.



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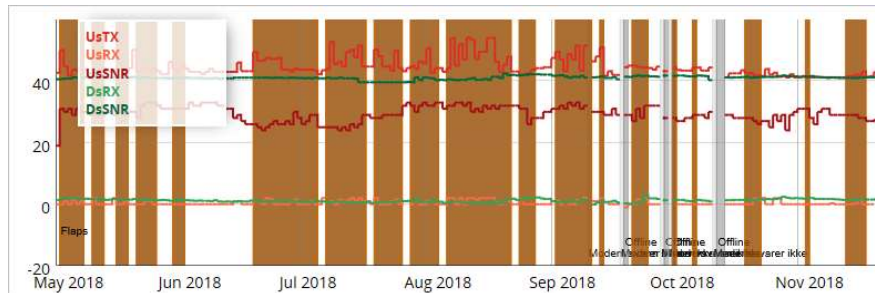
NETWORK PERFORMANCE

IN THE SEGMENT BEFORE EXCHANGE

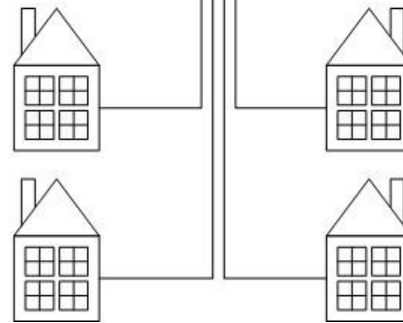
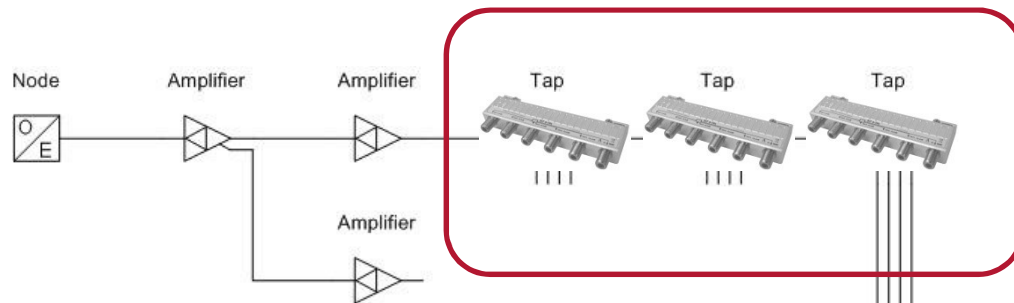


Upstream spectrum: Noise floor >30 dBµV

Modem stability: Vertical lines = connectivity problems



WHAT WE DID



EXCHANGE OF PASSIVES

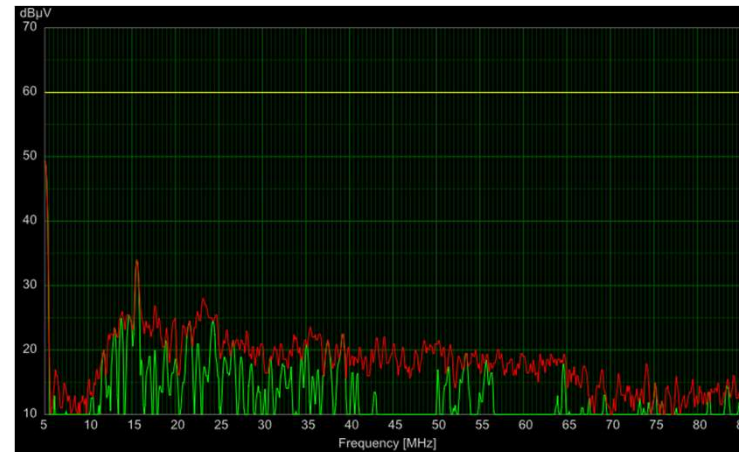
- 320 modems
- 380 homes connected
- Area 1.5 km²

All taps and splitters in the distribution network are replaced with 1300 MHz passives with nickel-tin plated brass connectors, in a one-to-one exchange; e.g. a 2-tap 16 dB is replaced by a 2-tap 16 dB.

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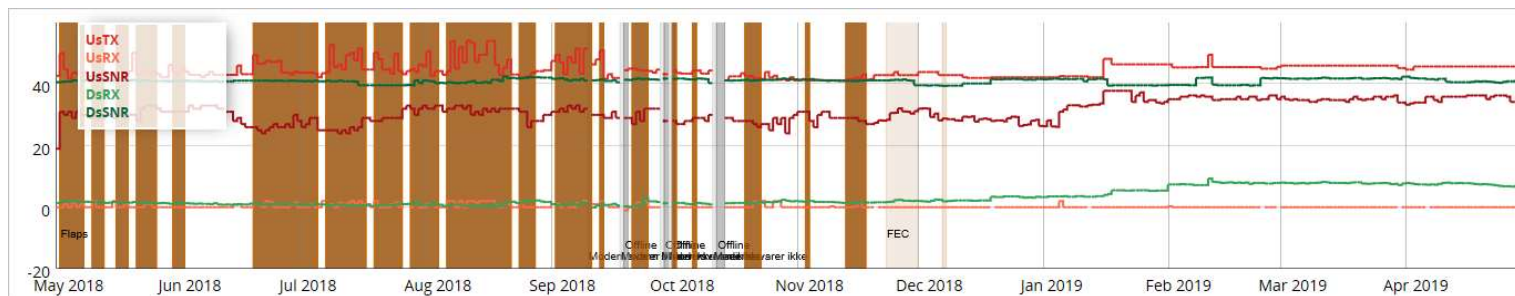
NETWORK PERFORMANCE

IN THE SEGMENT AFTER EXCHANGE

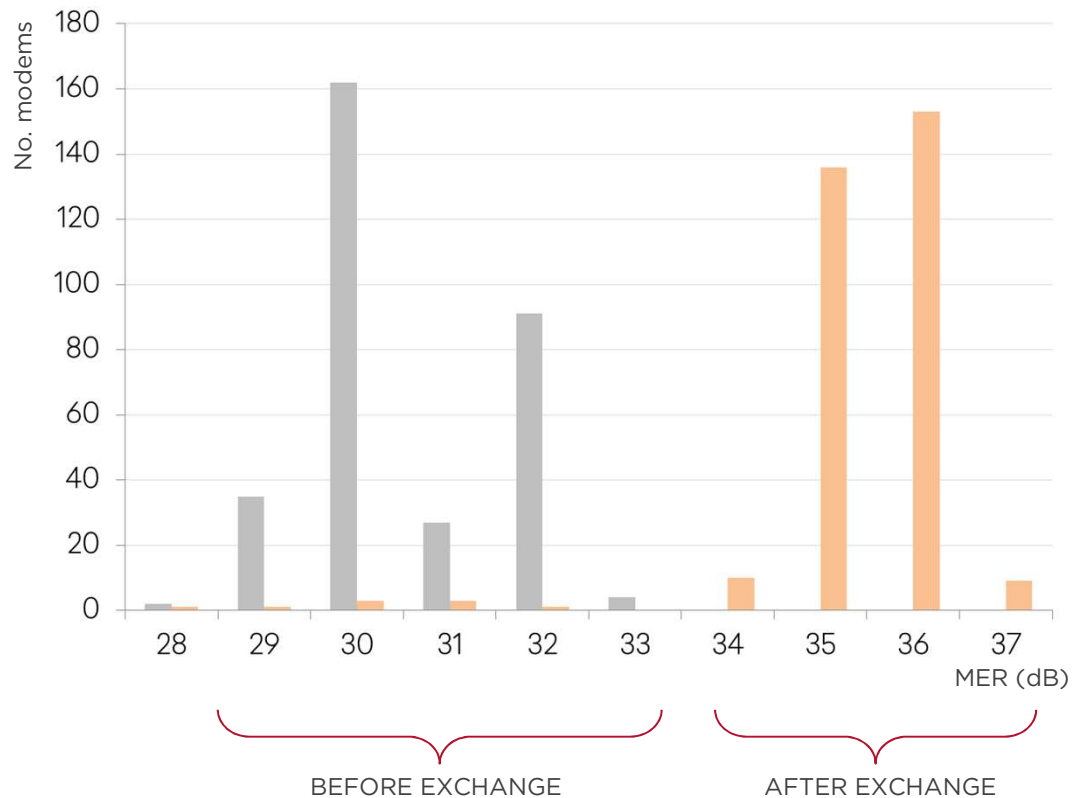


Upstream spectrum: Noise floor <25 dBuV

Modem stability: No connectivity problems after Dec 2018



UPSTREAM MER



The histogram shows the distribution of the modems against their reported upstream MER

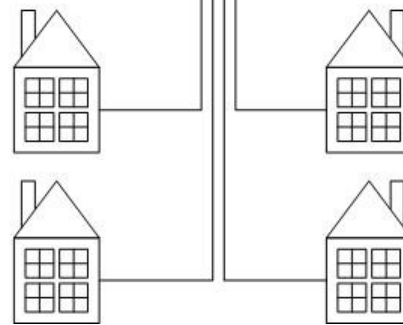
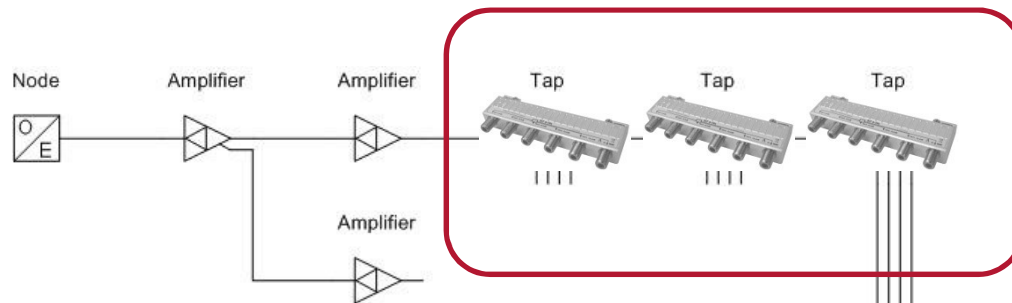
- Prior to the exchange (grey)
- After the exchange (orange)

Before the exchange most of the modems have an upstream MER in the range $31 \text{ dB} \pm 2 \text{ dB}$

After the exchange most of the modems have an upstream MER in the range $35.5 \text{ dB} \pm 1.5 \text{ dB}$

Note: MER=36 covers the interval 35.1-36.0 dB

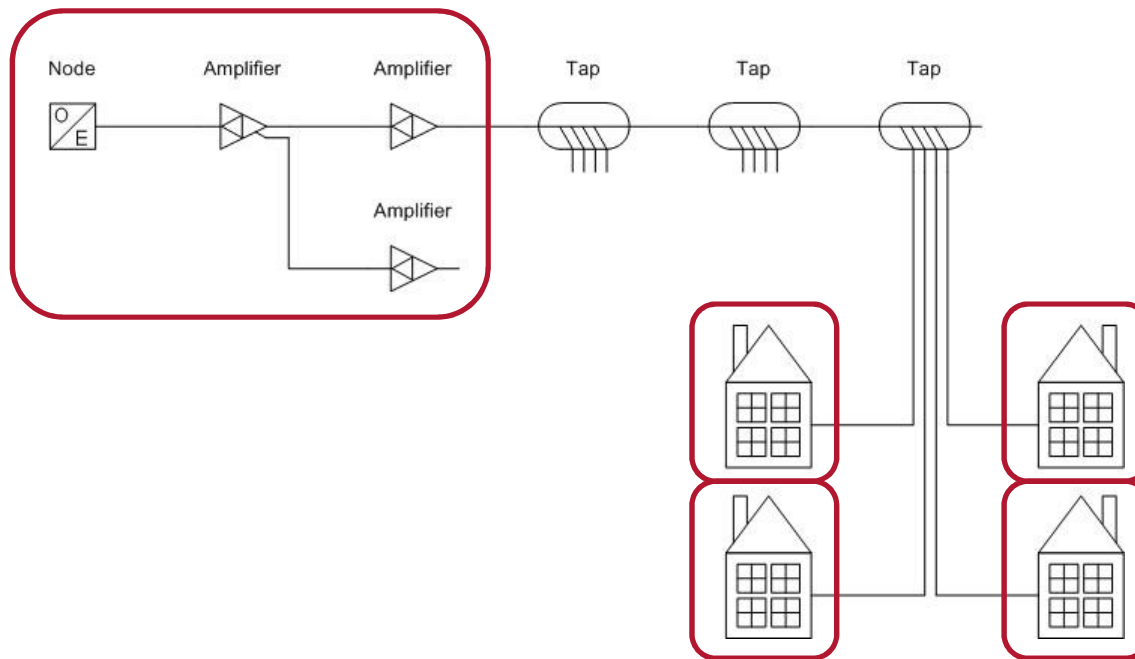
WHAT WE LEARNED



EXPENSES: 25 EUR/HOMES PASSED

- Improving the network capacity
- Increasing network up time
- Minimizing customer dissatisfaction
- Reducing maintenance cost by 60 %

WHAT TO DO NEXT



EXCHANGE THE NODE AND THE AMPLIFIERS

- Additional MER improvement
- Further connectivity stability
- Full DOCSIS 3.1 spectrum

SEPARATE THE IN-HOME MODEM PATH FROM THE DVB-C DISTRIBUTION

- Minimize upstream noise
- Control downstream connection
- Consider galvanic isolation
- Consider LTE noise

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CONCLUSION



1.1 million

Customers
upgraded



25€

Per homes
passed



+20%

Network
capacity



>60%

Reduced
maintenance

- Exchanging distribution passives in the CATV network gives **considerable improvements** in the upstream MER
- Customers experience a far more **stable connection**
- Full benefits are obtained by isolating the in-home modem connection from the in-home DVB-C distribution
- **Downstream MER improves** slightly by the same upgrade; the limiting factor being the in-home network
- Data analysis of modem parameters clearly highlights mediocre in-home networks needing improvements
- The obtained MER improvements enable **maximum DOCSIS 3.1 bitrates**
- Higher bitrates significantly **decreases** the need for investments in **nodes split**

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