

DKT COMEGA



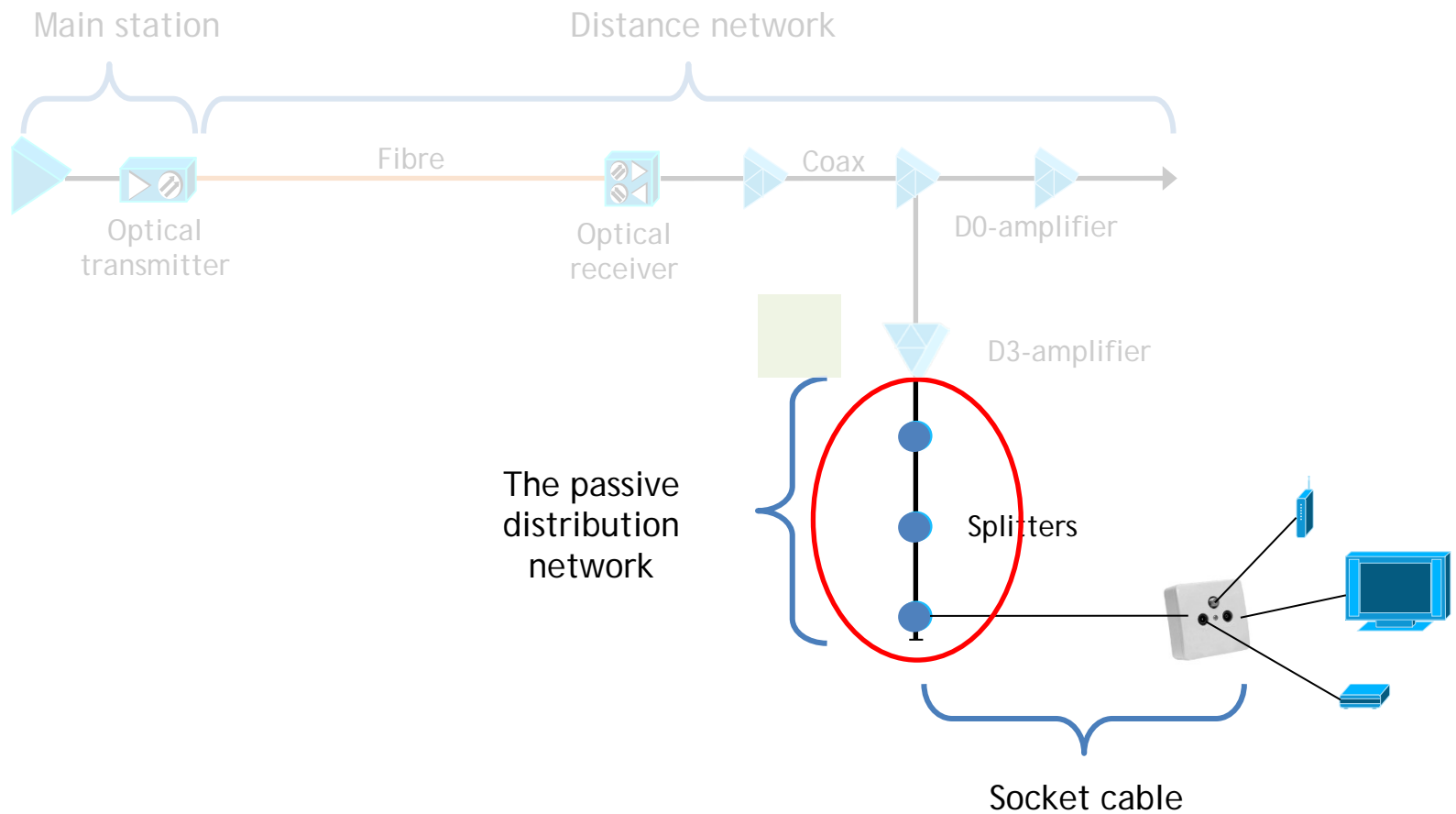
DKT Equalizer series for D3.1

Jesper Broszka, Senior Technical Advisor
Anders Møller-Larsen, Product Manager, Coax Networks, Ph.D. E.E.



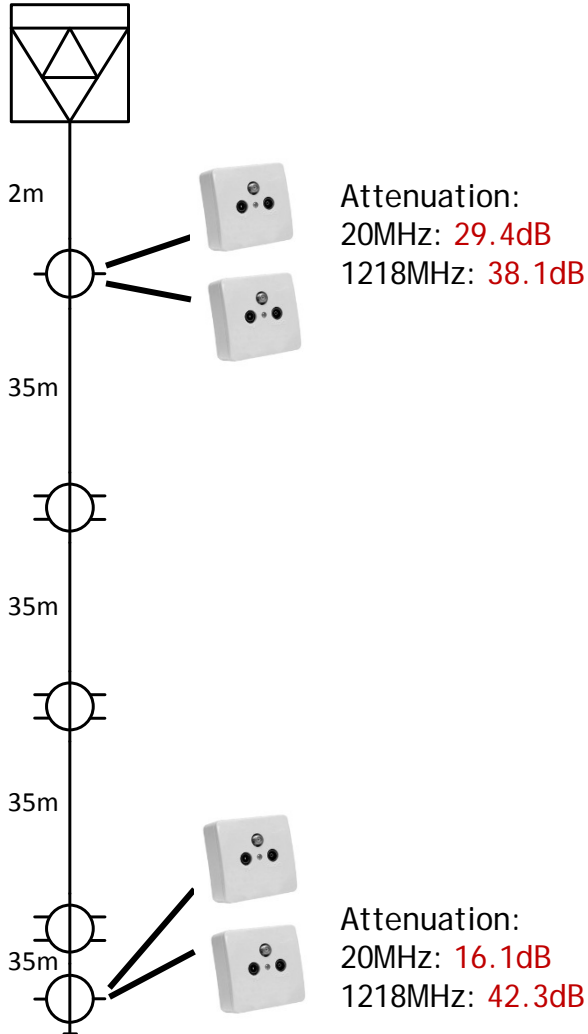
The passive distribution network

Adding of equalization in network is necessary





DKT COMEGA



Standard Distribution Network

The forward path is projected to have the signal level at each subscriber within a narrow window (5-10dB). So the attenuation from the amplifier to each subscriber must be equal.

The example shows 38.1dB and 42.3dB at 1218 MHz.

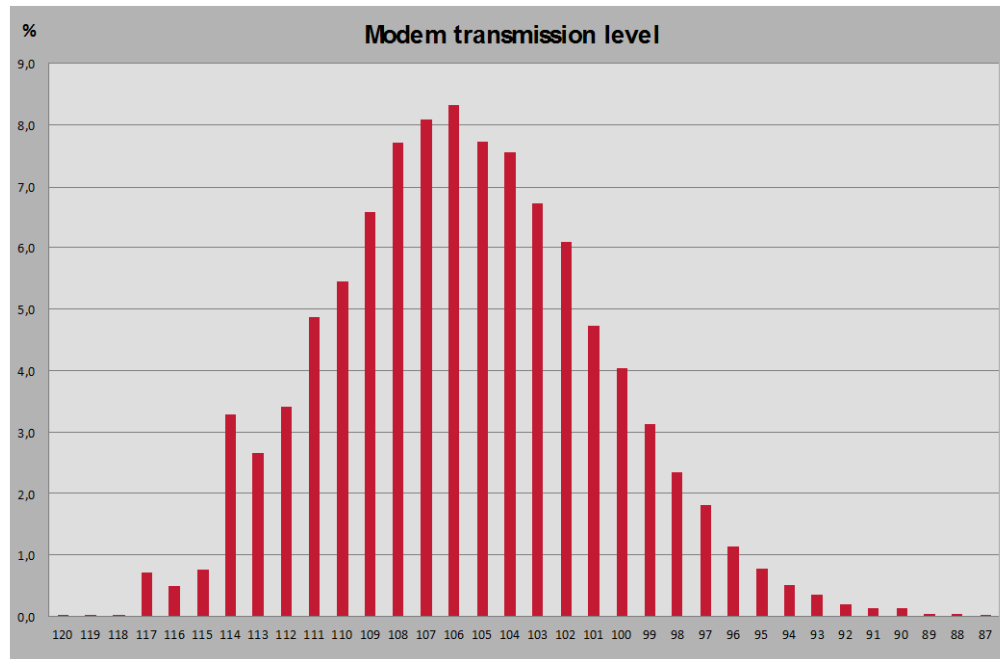
However, by projecting so the frequency dependent cable losses result in a large spread in the attenuation in the return path.

The example shows 29.4dB and 16.1dB at 20 MHz.



Modem Transmission Level

Return Path Signal Level



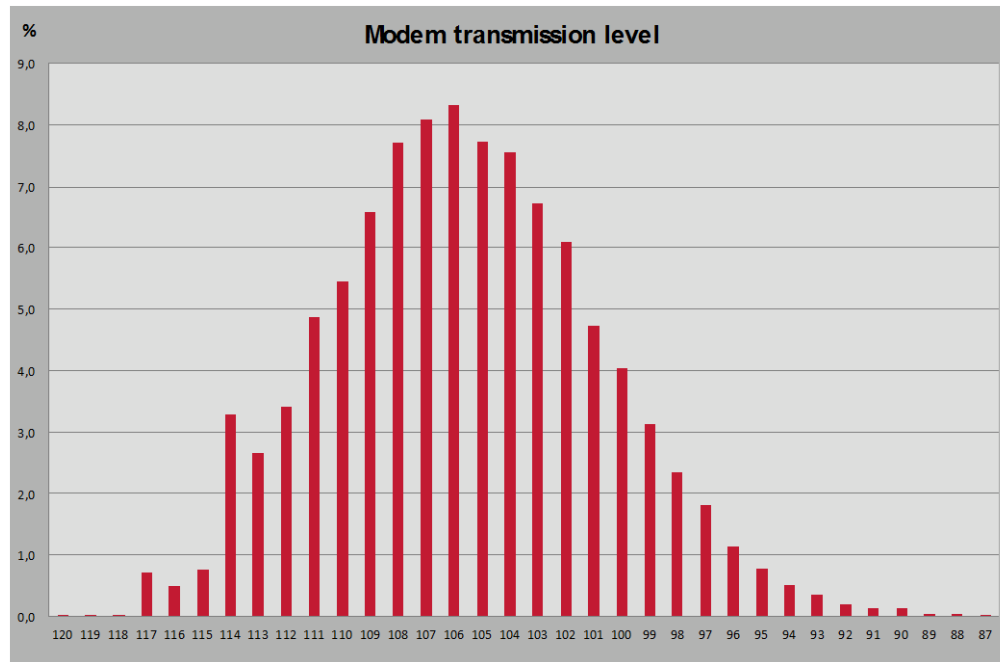
The large spread in the return path attenuation results in a large spread in transmission level from each modem as the CMTS controls the modem so the received signal level is equal from all modems.

The example shows a spread from 87dBµV to 117dBµV.



Modem Transmission Level Window

Return Path Signal Level



High return path attenuation ⇒ High transmission level

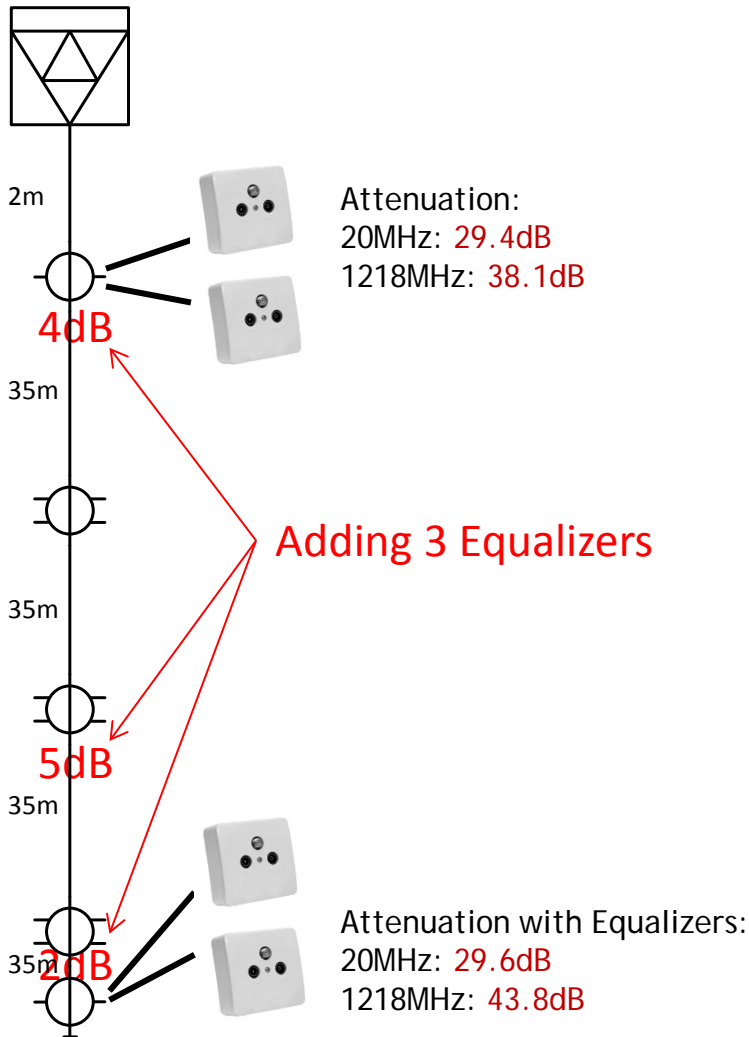
Low return path attenuation ⇒ Low transmission level

With a **low transmission level** the CNR is too low for QAM1024 modulation index, meaning the upload speed has to be reduced.

With a **high transmission level** the modem cannot increase its total transmission power level, so the bandwidth of the upstream signal cannot be enhanced, meaning the upload speed cannot be increased to the full DOCSIS 3.1 speed.



DKT COMEGA



Equalizer Impact of the network

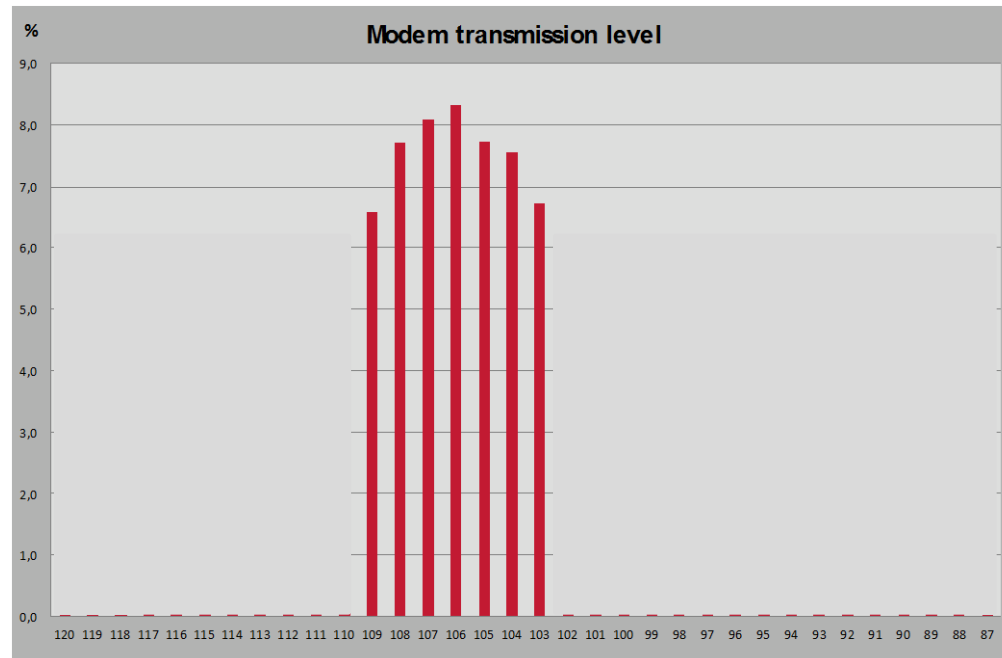
By adding Equalizers in the passive distribution network the attenuation at the low frequencies increases, but is almost unchanged at the highest frequencies.

The example shows 29.4dB and 29.4dB at 20 MHz, and 38.1dB and 43.8dB at 1218MHz.



Modem Transmission Level Window

Return Path Signal Level



Transmission
power window
with equalizers

Conclusion:

Equalizers force a higher attenuation for the far end subscriber's signal level (@lower frequencies)

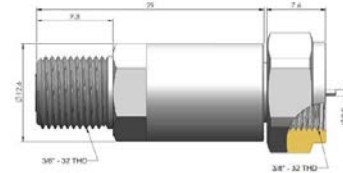
- Cable Modem to increase its output level
- Narrow Window size is meet, CNR improved, meets QAM requirements
- Possible to decrease modem transmission level giving margin to higher bandwidth



Introduction to DKT Equalizer series

DKT presents its robust Equalizer series:

- Freq range: 5-1218 MHz
- Att @ 1218MHz: 0.7 dB
- Att general: see formula
- Values: 2..10dB
- Tolerance: ± 0.5 dB
- Screening Att.: Min. CLASS A
- Connector: Male/Female, Brass EN61169-24



$$A(f) = A_{eq} \times \left(1 - \sqrt{\frac{f}{1218\text{MHz}}} \right) - A_{int}$$