BANDWIDTH UPGRADE OF A WORKING CATV NETWORK

INTRODUCTION

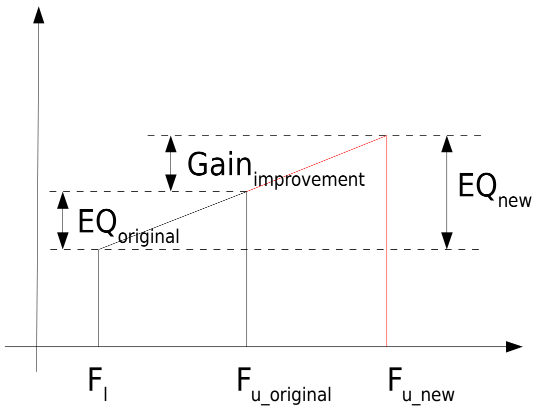
Since a few years future proofness is an overall catchword for CATV building works. Based on this it is common that in case of investments service providers aim to buy the most recent technology even if it is not necessary yet. A typical example for this trend is the forward path bandwidth of the choosen network element set. The 1.2 GHz and also the still popular 1 GHz ranges are not leveraged particularly in rural and suburban environment. The reason is that the analog-digital switch of television signals released band ranges for data traffic and the spectrum efficiency was proved by the new standards (DOCSIS 3.1). As a practical issue the growing of the subscribers' need for bandwidth can be satisfied with in smaller steps improved spectrum.

DIFFICULTIES IN BANDWIDTH UPGRADE

The above mentioned fact is recognized by many network element manufacturers so different nodes and amplifiers are available on the market having changeable tilt turning-point i.e. their frequency concerning the highest gain value can be configured by the user. Reconfiguration is done by passive module change or by switching. Both can be realized very fast and have very low expenses. But always must be considered that the coaxial cable have higher attenuation at higher frequencies.

As first upshot the amplifiers have to be releveled, because the maximal gain used for e.g. 750 MHz will not be sufficient at 1 GHz. If the network was configured with gain reserve, this will not be a problem in general. Nevertheless at 10 dB tilt in the above described example 4 dB reserve is needed what is not in all the cases available. At higher original tilt values and/or at a larger step even more reserve should be in service.

A much more serious problem is the degrading signal-to-noise ratio. To provide fixed amplitude footing, it is not enough to improve the gain with the calculated value (see figure 1), also the tilt should be improved. Since the tilt (EQ) circuit is placed before the output stage, the higher tilt is used the worse signal-to-noise ratio occurs at the input of the output stage. (Figuratively the lower frequency section of the spectrum is 'pushed' into the noise.) The degradation cannot be prevented without rebuilding the network: The only one solution is to ensure the same section attenuation and tilt for higher bandwidth, which is achievable by using shorter coaxial sections, i.e. the active elements should be closer to each other. The gain and tilt improvement will be splitted between the original and new placed amplifiers. The inconvenience of this is the largest from cost side in case of short lines with only one amplifier after the optical node, because the number of the amplifiers must be doubled by all. This rises the CAPEX as well as the OPEX in an unadmittable rate.



$$EQ_{new} = \frac{(F_{u-new} - F_l) * EQ_{original}}{F_{u-original} - F_l}$$

$$Gain_{improvement} = EQ_{new} - EQ_{original}$$

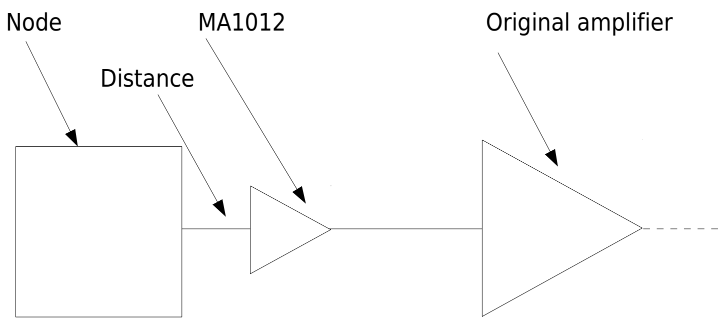
Figure 1

SOLUTION

It is clean and clear that the capabilities of a normal amplifier used for this purpose will not utilized, since only 4-8 dB gain is needed in forward path, and 0 dB is needed in return path, because the forward/return path splitting frequency is not involved.

Dedicated for this application Comtech developed the remote powered MA1012 type. This amplifier contains only one active stage with high enough output level. The very simple construction warrants the low consumer price and low power consumption at the same time to achieve affordable CAPEX and OPEX. The unit provides the possibility for gain improvement up to 10 dB as well as the availability of EQ. The device does not hinder the return path upgrades in the future thanks to the exchangeable diplex filter.

To determine the ideal position of the MA1012 in the network, the specific attenuation of the used coaxial cable at the new turning-point frequency must be considered. If this value is i.e. 14 dB/100 m and the desired gain improvement is 4 dB, the proposed position on the line is about 29 m from the optical node (see figure 2). Although this is very likely suitable, it is strongly recommended to verify that the output level will not exceed the maximal allowed value. Opposite case the distance between the node and MA1012 must be rised by all. Without calculations the best distance from the node is about the tierce of the whole section length.



$$Distance[m] = \frac{Gain_{improvement}[dB]}{Att_{specific}[dB/100\text{m}]} * 100$$

Figure 2