FINDING INGRESS SOURCES

INTRODUCTION

It is a common expectation against a managed CATV system to allow adding extra attenuation in the return path direction for searching the ingress and noise sources. In practice two different attenuation value (4-8 dB and 50-60 dB i.e. switched off) can be set, this gives the possibility for localising the failure: if the extra attenuation improves significally the signal-to-noise ratio at the headend, the failure is located behind the controlled amplifier. If it is needed, the return path of the same amplifier can be switched off to keep out the interference source. A very serious disadvantage of this solution is that it hinders the communication by all, even if the interfering harmonics are located out of the useful band and it requires human actions for detaching the problematic network segment.

BACKGROUND

A part of the return path band covers the short wave range between 3 and 30 MHz. There are a lots of industrial and telecommunication originated noises in this range with high power. Normally they should not affect the data traffic of a CATV return path, but in case of injury (connector, shielding, open termination) the frequency range of them will be the mostly affected. The upstream spectrum bandwidth drawn by the subscriber needs in a segmented network is commonly narrower than return path bandwidth defined by the diplex filter. This makes possible to leave the 'most vulnerable' lower 20 MHz free. Even if this contains no carriers the infiltrating spectral components load the amplifier stages and drive them to overload, thus generate intermodulation distortion with the useful signals. If in this situation the attenuation is rised, the modems should step up the output power leading to worse distortion condition or collapsing of the communication. If the return path is switched off, the noises, ingresses and distortion product are kept away from the headend, but the communication in the affected segment will be stopped.

The Comtech RSW-HPF20 gives the possibility for switching on a 20 MHz ***high-pass filter*** in the return path beside the ordinary 6 dB and 60 dB attenuation. In the above described case this does not hinder the communication by a significant attenuation but blocks the unwanted signals and cancels the distortion. Although the communication can go on, a network failure is indicated - finding of the failure must be started, but the data traffic will not be restricted meanwhile. If this range contains carriers too, only a few carriers will be cancelled, so the service will be only limited but not stopped. (Switching on and off this filter or the attenuation helps finding the location of the problem too. See the following sections for details.)

The device contains also a ***power meter*** with a filter of 6 MHz center frequency. On this frequency there is never carrier placed so it is suitable for measuring noise level. The measured power in this range is indicated on the monitoring user interface for each network elements. Switching off, damping or filtering the return path band at a certain point, the measured noise at the devices between this point and the headend will be lower. By switching on and off the filtering combined with the damping at each element on the line the failure location can be found by using

the monitoring system only. Further also information can be achieved about the failure type without costly spectral analysis in each network element.

The described measurement takes the ***opportunity of doing the process automatically***. If the noise level exceeds a predefined value, the module can switch on the high-pass filter, the 6 dB attenuator or the 60 dB attenuator (blocking). This means, that the critical network section will be separated by the chosen way immediately and without the involvement of the operator. Since the monitoring transponder is connected to the amplifier containing the RSW-HPF20 sends an alarm to the monitoring server, a dispatcher gets information about the fact of the failure and the location of it. The ComMon monitoring solution allows to send this information to a predefined e-mail address too.

USING THE SOLUTION

Let us consider the simple network schematic detail on the figure 1. (Between two elements there are longer cable sections with direction couplers for feeding one or more household networks. Only the return path amplifiers are depicted.) At the location denoted by an arrow a cable shielding injury occurs, the ingress level in the 5-20 MHz rises considerably, and this will amplified too by the following elements. Distortion will occur that deteriorates the communication quality of all the modems connected to any amplifiers. The affected amplifier devices are denoted with red filling.

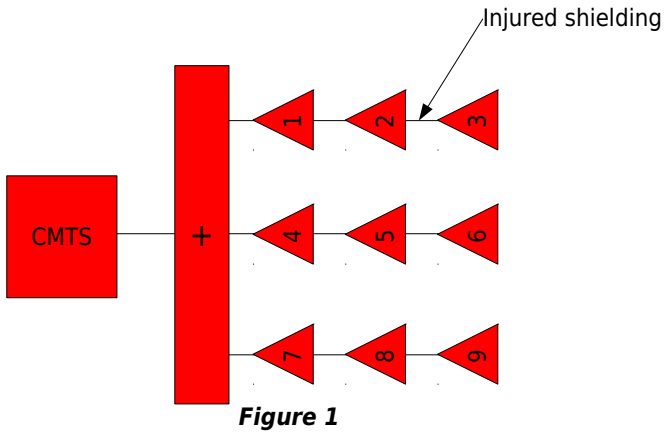

Figure 1

The communication quality is degraded in the whole segment., but the ComMon GUI gives the information, that only the amplifier 1 and amplifier 2 measures noise level higher than allowed. There is no need for the ordinary searching, because based on the alarms it is obvious that the failure position is between the amplifier 2 and amplifier 3. Using the solution manually first the 6 dB attenuation is switched on at the amplifier 2. Let us assume that this improves the quality but does not achieve the desired level. As second step the 60 dB attenuation should be switched on at the same device. The communication quality is restored for amplifiers 1-2 and 4-9, but the communication with the modems behind the amplifier 3 is stopped - this verifies the assumption concerning the failure location (see figure 2, where red filling denotes amplifier that's district cannot use the service). At last the high-pass filter should be used. In the described case this cancels the distortion, but does not hinder the communication, so the communication quality is restored for all the amplifiers - the service is available before the start of the repair works too (see figure 3).

The information, that a filter veils the failure suggests, that a connection, a cable section or a service access point should be repaired/changed.

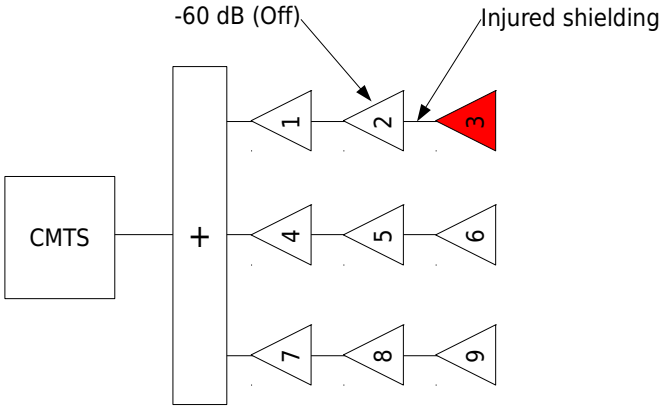

Figure 2

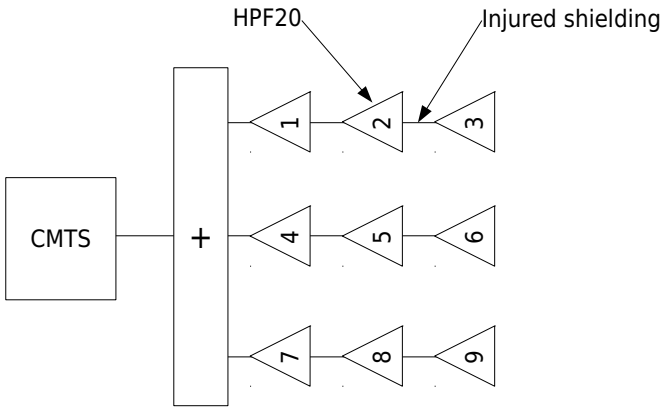

Figure 3

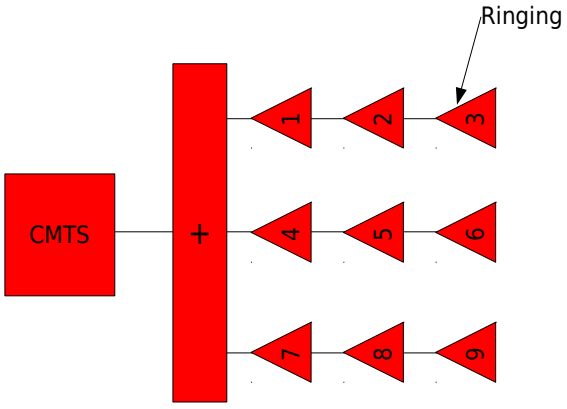

Figure 4

Figure 4 depicts a situation where the return path active stage of the amplifier 3 is ringing. At first sight the monitoring GUI gives the same information: The measured noise level is too high at amplifier 1 and amplifier 2. The difference is that the filtering in the amplifier 2 does not improve the communication quality. In this case the 6 dB or

the 60 dB (switched off) attenuation should be used up to the end of the repairment to preserve the remaining part of the network from the noise.

The fact that the HPF20 state does not solve the problem suggests, that an active device failure exists instead of an above like injury.

Exceeding a predefined noise limit, the system can realize a choosen involvement, such as 6 dB attenuation, switching off or filtering. Regarding the first example depicted on figure 1 the defined action concerns amplifier 1 and 2. Since the input noise level at amplifier 1 will fall to the normal value after both of the RSW modules are activated, the status of the switch returns to on (e.g. 0 dB) - at the end of the user configurable averaging time the condition depicted on figure 2 or 3 will turned out depending on that AutoOff or AutoHpf20 was preselected.

Certainly also failures can occur that do not concern the measured 6 MHz frequency band (e.g. a modem with unwanted harmonics). In these cases the failure search can be done manually by the same way as in the case of systems without noise measurement: The return path switching modules must be driven into 6 dB or switched off status one after the other. The failure will be after the last device, that's RSW module can block the interference.

CONCLUSION

The Comtech RSW module:

- gives information on the rough frequency range of the noise or ingress without costly spectral analysis in each network element
- gives information on the average white noise level measured in the return path of each network element
- can involve by the predefined way in case of too high measured noise/ingress to prevent the network from the influence of interference
- can be driven manually for failure finding by the same way as in case of normal ingress controll switches