

To Sweep or Not to Sweep

A recent exchange on the SCTE-List (a cable TV engineering forum on the internet – see www.scte.org for more information) sparked discussions on an age-old topic; system sweeping. Historically, cable television systems had long amplifier cascades that were challenging to maintain. When you had amplifier cascades of 30, 40, or even 50 amplifiers, failure or degradation of a single amplifier became the weak link in the chain causing problems to every subscriber downstream from that point. Due to the fragility of the network, it was critical to perform diligent, preventive-maintenance sweeping, typically covering the entire plant at least twice per year.

What is sweep? Basically, a sweep test produces a display of response over frequency of the cable plant known as frequency response or flatness. The goal is to have the lowest dB variation over the frequency bandwidth of the plant. In the days of long cascades, frequency response goals were expressed by formulas such as $\pm (1 + N/8)$, where N = cascade number. For a 32 amp cascade this would equal ± 5 db. $N/10$ and $N/12$ were commonly seen too.

Over the years, various products were manufactured to perform sweep testing. Most involve “sweeping” a frequency across the spectrum of interest with a transmitter located in the headend and receiving the result at a point in the plant. The received results are compared to the original transmitted signal. The difference is the frequency response to that point in the system. Sweeping, by its nature can be disruptive to received content.

Historically, sweeping was often the target of budget-cutting to easily provide a short-term reduction in operating expenses. Discontinuing sweeping might not have a noticeable effect for the first 6 to 12 months but after that it was a struggle to re-acquire the previous, well-maintained operating condition. Discontinuing the sweep program created a short-term cost savings but led to a long-term operating cost increase.

The need for added reliability and increasing bandwidth requirements up to 1002 MHz, led to the need for shorter amplifier cascades. System carrier-to-noise is a function of the noise contribution of a single amplifier times a logarithmic relationship of the number of amplifiers contributing noise. Distortions are based on the number of channels and the number of amplifiers in cascade.

In an effort to shorten cascades and reuse as much of the existing installed coaxial network, fiber optics technology was deployed. Nodes fed by fiber were placed throughout the existing coaxial system with the fiber delivering quality signals to the now shorter amplifier cascades. As the need to add more and more channels grew, increasing numbers of nodes were added continuing to decrease the number of amplifiers in cascade. An amplifier failure now affected fewer subscribers than it did during the days of the tremendously long cascade numbers.

So, the question recently came up as to the frequency or need for sweeping the coaxial amplifiers. Obviously, the coaxial network should be swept, to the full network

bandwidth (750, 860, 1002 MHz, as applicable), during initial set up when the fiber node is activated but how much maintenance is required after that initial set up?

One school of thought is that sweep should be continued on an annual or semi-annual basis in spite of the drastic cascade-length reductions. It's still necessary to periodically tweak the frequency response to maximize quality of service. Failure to do so will still cause gradual deterioration putting the operator into reactionary mode.

The other school's argument is that since the individual amplifiers affect fewer subscribers and the cascading of problems is minimal, the cost/benefit of sweeping may no longer make sense. Sweeping is the plant is disruptive and therefore should be done at night. The night work is costly and if the plant is working properly, making adjustments will not improve it. If it ain't broke, don't fix it.

As an operator, which approach do you take? I don't think there is any cut and dried answer; there are variables that must be considered. How stable has the coaxial plant been? How reliable are your amplifiers? What is the cost of doing the sweep? What is the impact of not sweeping? Is the cost and disruption offset by benefits to the customer?

I'd love to hear your thoughts. Contact me at Steve@JohnsonTelecom.com.