PREVENTATIVE MAINTENANCE
A NEW LOOK

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ABSTRACT

Current methods of preventative maintenance for CATV systems are based on system sweep response and do not include signal leakage detection as an ongoing part of the program. Many system problems that can go unnoticed by system sweep can be detected by signal leakage activities.

Increasing the amount of sweep work in a system has not been able to reduce service call rates commensurately. Leakage detection and correction work, however, has been found to do so in a field trial. It is proposed that PM programs for CATV systems put more emphasis on signal leakage detection as a method to reduce service calls while improving service and reliability.

INTRODUCTION

Cable television systems have traditionally approached the topic of Preventative Maintenance (PM) with less than enthusiastic commitment. Other things always seem more pressing, and all the best laid plans and intentions seem to slip away in the hectic world of CATV operations.

Changes are underway in the CATV industry now, and competition from VCR's and tape rentals, new "super" tape formats, home TVRO's, DBS, and MMDS are to be reckoned with. The move is to better customer service, quality and satisfaction. To meet the competition, systems need to set goals for customer service that are attainable and measurable, then develop plans that can be used to reach them. PM is a cornerstone for any successful plan to improve quality and service.

A measurable goal for any PM program is a reduction in the number of service calls related to plant performance. Outside of level checks and standby power supply checking, most PM plans in use today are largely based on using system sweep response to monitor plant performance. Many system problems can go undetected by system sweep, and misleading results can be obtained--especially for long cascades.

Work carried out by CUC cable systems could not establish a correlation between increased sweep activity and a reduction in service calls, i.e. more sweep did not mean fewer service calls or increased subscriber satisfaction. It was recognized that if quality improvements were to be realized, new methods and approaches would be needed.

CURRENT PRACTICE

Cable systems are dynamic in nature and require ongoing attention for proper performance. A successful preventative maintenance program should minimize the number of service calls and have an increase in signal quality and system reliability. The best of equipment, cable and components does not guarantee success if ongoing maintenance is not carried out.

Standard preventative maintenance programs generally direct attention to the headend, trunk system, power supplies and amplifiers. Most involve electrical checks as well as an element of physical plant inspection. System sweep--both high and low level--and amplifier level balancing, are the most common forms of electrical preventative maintenance with system test point monitoring being the normal method of assessing a system's performance.

These methods have developed over the years, and with varying degrees of commitment, are undertaken by all systems. Most operators consider system trunk sweep to be the cornerstone of their preventative maintenance program.

THE PROBLEM

The picture on a subscriber's TV is the final measure of the performance of a CATV system. Proper plant design and installation should ensure that adequate S/N and distortion performance can be achieved. Routine maintenance keeps the plant operational, but preventative maintenance is required to limit service calls, increase reliability and improve quality. The reliance on system sweep as the main tool in the PM program to the exclusion of other methods limits the success of the program.

There are three main problems with the heavy use of system sweep for PM:

1. Sweep can overlook many problems that are or would soon visibly affect pictures.

2. Current practices are to sweep only the trunk lines, leaving the distribution lines untouched.

3. Most sweep systems create picture problems by interfering with TV's, VCR's and decoders.

Small cracks in cable sheaths and loose connectors do not usually show in an easily recognizable fashion on a sweep response display. Eventually, these defects become large enough to be seen, but in the meantime, the effects of ingress become apparent in the pictures.

The sporadic nature of mobile radio ingress can cause a large degree of customer dissatisfaction as does the moving video background on local VHF channels. These problems go generally unnoticed with sweep activities and result in service calls.

Typically, a CATV system will have three to four times more distribution plant than trunk. The economic implications of doing sweep work on all the trunk and distribution plant has resulted in the industry generally only sweeping the trunk plant. Usually, it is only the distribution lines feeding the system test points that garner any attention. The distribution plant is unattended except for perhaps a check of levels every few years or when there is a service problem. Hence, the majority of the cable system plant--the distribution network--receives little PM (as do the subscriber drops).

The shear volume of plant makes complete system sweep impractical. The heavy use of high level system sweep will create a large degree of customer dissatisfaction. The recurrent blip that causes some TV and VCR units to lose lock and create broad bands in the picture does not create a favourable impression with subscribers.

Problems with high level sweep and decoders used with premium services are more harmful given the cost of these services being paid by the subscriber.

It is not practical to do all system sweep work in the middle of the night when you consider the amount of 24-hour-a-day programming and the labour costs involved. Increased sweep simply causes more subscriber aggravation without a commensurate reduction in service calls.

LEAKAGE DETECTION AS A PM TOOL

CUC Broadcasting's CATV system at Scarborough, Ontario, has an active preventative maintenance program. Its goals were established to reduce service calls and improve customer satisfaction and service. As per industry norm, the program was primarily based on system sweep along with the usual attention to power supplies, headend and physical plant. Service call ratios were essentially static, and increasing system sweep did not reduce service calls.

In an effort to obtain authorization for the use of channels A-1, A-2, 41 and 42, an accelerated program of signal leakage detection and correction was undertaken to achieve a CLI of 64 dB. Constraints on personnel forced the suspension of the sweep program when the leakage project commenced. As work progressed through the system, it was noticed that service call rates related to plant performance were going down in areas where leakage correction work had just been completed. More surprising were the types of problems uncovered through leakage detection and

their significant influence on picture quality. These had not been discovered through normal preventative maintenance and service call requests. Finding these problems was exactly what the existing PM program, based on system sweep, was supposed to do.

Obviously, the leakage program was more successful at reducing service calls. An example of this was a totally severed 412 underground distribution cable which had been "repaired" by the subscriber (who had cut through it) with a piece of aluminum clothesline wire to join the center conductors only. This cable was having an effect on numerous channels, but it had not created any service calls. Apparently, the customers were used to the signal quality, and had developed a negative perception of the signal quality on the cable system. This creates a very negative influence on marketing programs.

Conventional preventative maintenance methods would not have detected this problem. No service calls were initiated, and distribution line sweeping was not feasible, thus, the problem could have gone undetected for a long period of time. The fact that it was readily found through a normal leakage detection program indicates the suitability of enhanced leakage detection activities as a useful, preventative maintenance and fault finding tool.

Since it would be impractical to sweep the total distribution network within a cable system constantly, due to the amount of plant, the use of signal leakage detection as a method of finding plant irregularities is apparent. All the problems uncovered through leakage detection are true system problems that require repairs. They have an effect on the pictures in the system. The efforts undertaken in the detection program are not wasteful of finances because they locate problems. Problems that must be fixed.

Every leak that is fixed prevents at least one and perhaps many service calls at a savings of the cost of these calls. In essence, we find something that needs to be fixed anyway. In the process, we catch problems before the pictures have deteriorated to the point which causes subscriber dissatisfaction.

There is no long-term extra cost with this approach--simply a reallocation of resources from expensive service call activities to appease dissatisfied customers, to preventative maintenance through improving plant performance. It is a net win-win situation with a reduction of service calls and an increase in subscriber satisfaction at the same cost. The ideal preventative maintenance situation.

The spin-off benefits of improved relations with the DOC/FCC over interference to other radio services and the increased channel availability due to A-1, etc., are a bonus.

A METHOD

A method is required to successfully reduce the amount of leakage in a system and then maintain it as part of a new preventative maintenance program. An initial push is needed, and this will require extra staff. A short-term increase in the use of subcontractors to allow experienced and knowledgeable system staff to work on leakage detection has been found to be a successful approach.

The system should be approached in a series of waves with ever-increasing threshold levels of leakage being sensed. It has been found that the first pass should use a leakage threshold of greater than 100 uV/m to isolate the really bad leaks. The second pass then uses a lower threshold limit of about 75 uV/m and the third about 50 uV/m. By breaking the problem down into manageable parts, the possibility of technicians being overpowered by "leaks everywhere" can be reduced.

Experience has shown that it is best to have the personnel detecting leaks do the actual correction at the same time if possible. The equipment used can vary from very elaborate to quite simple. It is the commitment that is most important. A high degree of job satisfaction has been noted in these programs, as the results of the effort are almost always immediate, apparent and positive.

Once the system has achieved a reasonable level of leakage control, the ongoing preventative maintenance

plan must carry on the work. Leakage detection and correction work must be given equal footing with system sweep programs if service call rate improvements are to be maintained. It is suggested that systems with a constant sweep program could significantly reduce the sweep resources and invest them in leakage work to obtain superior results.

RESULTS

A concerted effort to work on signal leakage problems in a cable system will reveal a startling number of plant problems that have gone undetected. One has to wonder what it takes for some subscribers to initiate a service call. The effect on the perception of service quality is no doubt significant and of value in the increasingly competitive market for entertainment dollars.

A comparison was made between the service call rates for the Scarborough system for a period before and after the commencement of increased leakage correction work. The Scarborough system has approximately 1,900 Km (1,200 miles) of plant and serves over 150,000 subscribers. The leakage work found over 1,200 faults in the system of which roughly 60 percent were distribution plant related with the remainder split between trunk and drops.

Over a comparable seven month period the average number of service calls per month dropped by almost 16 percent system wide. As the overall system cannot be said to be all at the same level of leakage correction, this number is indicative more of a trend than an absolute. However, in a portion of the system which represents about 25 percent of the total, a more uniform level of leakage performance was measured, and its service call rates for the same period had dropped an impressive 23 percent.

The results of these figures are that the system can operate with at least one service technician less than the year before while offering a higher level of service.

SUMMARY

A major program on signal leakage detection and repair was instituted, and a correlation with service call rates developed. Problems that were having noticeable affects on picture quality which had gone undetected with system sweep were uncovered. As leaks and ingress were eliminated in an area, a reduction in service calls was noted as well as an increase in subscriber satisfaction. The increased investment in personnel time required for leakage detection and correction was offset by a reduction in staff needed for service calls, and the quality of our service was improved.

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