KEEPING MAINTENANCE RECORDS

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ABSTRACT

A preventative maintenance program requires adequate records to be succuessful. Keeping records can save your system money and can be accomplished with existing personnel. Intended for those involved in the management of cable systems, this paper discusses why records are important, lists six ground rules to be aware of before beginning a record keeping program, and presents a three-tiered system of record keeping for trunk lines that can be adapted to meet the needs of most any system. Sample forms are included for you to use in your own system.

INTRODUCTION

Is your cable system benefiting from a preventative maintenance program that uses a solid base of records to plan work? If so, congratulations; you are ahead in one of the toughest battles facing us in the cable industry. If, however, preventative maintenance and its associated recording tasks are things you support in theory but find impossible to fit into daily practice, take comfort in knowing you are not alone.

Why is it that few cable systems manage to run a successful on-going preventative maintenance program? Certainly, most systems possess the tecnical know-how and test equipment necessary to mount a successful campaign. What, then, gets in the way? Often, keeping system records is a large stumbling block that trips-up preventative maintenance efforts. Records are a mandatory component of any preventative maintenance program. Without records, it is impossible to spot and correct potential system problems before they become serious. In other words, without adequate records, the most genuine effort at preventative maintenance is doomed to failure.

What is the current overall state of the records kept at many systems today? Often poor and usually not too helpful, according to the five field engineers who work with me.

Just opinions you might say, but opinions worth listening to. Together, the six of us have a combined total of 89 years experience in the cable industry, and in our jobs we travel around the world visiting a total of about 175 systems each year. On the main points we all agree: Most systems do not keep adequate records. Some systems do not even keep any records. Many systems that do try to keep records, fail to record "useful" information or fail to turn to the records when they might be helpful.

WHY BOTHER?

No one would say they were just plain opposed to maintaining system records. It is fitting this activity into busy schedules already filled meeting immediate demands that creates the problem. Many would agree that in their day-to-day system activities keeping records is on the bottom of the priority list. It may even be considered something to do "in your spare time." Do many of your employees have spare time? So, why should you, as part of your system's management team, bother to make record-keeping a genuine priority on your system's daily to-do list? There are a few reasons.

To Meet Government Requirements

Requirements set by the FCC and other regulatory boards governing system performance are becoming tighter. Stricter monitoring requirements of Cumulative Leakage Index is one example. Keeping and using records will decrease your chances of not meeting regulations. And if you should fall short of the standards, complete and accurate records will probably make you able to locate and correct the problem more quickly. In addition, if your system's performance does not measure up, records that document your regular efforts to meet requirements are convincing proof that you are doing all you can to meet the parameters established by the regulatory boards.

To Retain Subscribers

Subscriber requirements have also gotten tougher. Other affordable substitutes for the entertainment service you offer--VCRs and home satellite dishes--are real options to which unhappy subscribers can turn. And once they have been disconnected chances are these subs will not return.

Other members of your client base are even more demanding. Local Area and Information Networks will not tolerate degradations in signal quality, let alone a complete outage; burglar alarms and medical alert services depend upon a coaxial system that can consistently provide high-quality signals.

To Save Money

Efficient use of staff, equipment, and inventory costs you less. A good base of records will make it possible for you to plan maintenance work when it is most economical and convenient for you and decrease the number of un-planned, expensive, emergency calls. Further, when you can control the time and conditions under which repairs are performed, the quality of the work will improve. You will have fewer follow-up visits, fewer truck rolls overall, and less unscheduled overtime to pay.

ESTABLISHING THE GROUND RULES

If you are ready to seriously consider making a genuine effort at keeping system records, read on. This paper offers some practical suggestions about the types of records you probably need to keep and suggests procedures to help you maintain these records.

To start us off on common ground, I have listed six strongly-held beliefs upon which my program of record keeping is based.

1. Any cable system that wants to make a profit and stay in business must be performing not only the maintenance necessary to keep the cable system going, but it must also be performing preventative maintenance. The entire record-keeping system exists to track both "trouble call" and PM work , with a goal of reducing the number of trouble calls.

2. You must be keeping records for a practical purpose: to use as a tool. State-of-the-art test equipment is only valuable to you when it can be applied in your system to help you accomplish your goals. The same is true of system records. They only have value if you can use them. Keep this in mind when establishing your recording-keeping system. Think of the types of information that would help you attack your problems, and then make up forms that ensure that the information gathered will be useful to you and that it is gathered in groupings convenient for your use.

3. A sincere committment to preventative maintenance and record keeping must be felt throughout your organization. You must truly see benefits for yourself and each member of your staff asked to participate or you will receive a half-hearted effort at best. To be successful, you need system-wide support. If you clearly do not have support or question your ability to whip-up support, save your time, energy, and money. Why set yourself up for failure?

Be sure you have the type of support that will manifest itself in actions. Can you make your subordinates allocate time to record keeping and check on the quality of the records they keep? Will your superiors say they support a maintenance/record keeping program, but then unconsciously undermine it by making staff assigned to maintenance/recording tasks abandon their work to add a new drop at the mayor's house or clean up around the office? Unfortunately, it happens.

Force yourself to maintain and use the records. If you do not intend to regularly examine and record the activities in your system, again stop reading now. A beautifully bound set of perfect sweep sheets never updated or never referred to is useless. In fact, if this is the case, you threw away money by paying a qualified technician to generate them in the first place.

Would you ever approve a cash outlay to acquire a piece of test equipment you had no intention of using? Would you invest in a piece of test equipment and never maintain it? Learn to look at your system records like another piece of test equipment. Do not make the intial investment unless you intend to use the records, and once the investment is made, be prepared to meet the demands of record up-keep.

System records can be maintained without increasing staff--if a system is appropriately staffed to begin with and if that staff is wisely allocated. Many people find this hard to believe, but it is true. Granted there will be an uncomfortable month or maybe even two at the beginning when you are still receiving enough trouble calls to keep your staff completely occupied and feel you cannot afford to "waste" time on maintenance and record keeping activities. But if you set aside a fixed percentage of each day for maintenance/recording tasks, in about a month you will see the number of trouble calls decrease.

Don't believe it? A program designed and implemented by Jones Intercable in 1984 at a system in Castro Valley reduced monthly service calls by 20% (from about 360 calls to 290 calls) in just several months. This reduction in service calls saved the system an estimated $21,000 annually and was accomplished without adding new employees.[1]

Regardless of system size some version of the basic three-tiered approach to record keeping for the trunk line described in this paper can be adapted to fit the needs of most systems.

A BASIC PLAN FOR TRUNK LINE RECORD KEEPING

Certainly you will benefit from keeping records on all the segments of your system (headend, feeder lines, trunk lines). However, to make this discussion managable, I have focused on a basic framework for maintaining records on just the trunk line of a cable system.

Although it is not mandatory, I strongly suggest that if possible you gather and store your system data on a computer. A simple personal computer and any software package that allows you to build up a data base and sort it according to different variables that you can name--like model numbers, attenuator values, or fault codes--will help you get the most mileage from your records. For example, sorting your data base by outage codes allows you to easily generate a report delineating the amount of down-time for any given time period. Of course this information could still be gathered using a manual method of record keeping, a computer just makes it possible to complete the task more efficiently.

With or without a computer, you should keep a master hard-copy of your records. The master copy should never leave your office, so I suggest you compile your master in binders that can be opened and closed. This way when a technician needs to take a copy of the record into the field, he can take a photcopy.

No matter how large or small your cable system, the key person involved in the record keeping system is the individual in charge of the cable plant's technical performance. This person will develop, institute, and oversee the maintenance program and its associated record keeping activities. This does not mean that he will have to generate and maintain all of the records personally. He will, however, have to determine who should be recording what, ensure that the approproiate recording is completed, and analyze the results to plan future maintnenace work.

At a minimum, you should be maintaining three types of records on your system's trunk line: 1) sweep sheets including proof-of-performance records 2) location logs, and 3) serial number logs.

Where to Begin

If you are fortunate enough to be developing the records for a new system or re-build, you can start with the system maps and accurate measurements of equipment performance taken at initial bench inspection and at initial installation.

If you are starting with existing records that are inaccurate and inconsistent, do not despair. Break the job down into managable bites. Begin with your backbone trunk line. Update this line on your map, and be prepared to keep your map up-to-date. You will be working to create "as-built" maps, a section at a time.

Sweep Sheets

Generate your sweep sheets first. A sample sweep sheet is shown in Figure 1. Each sweep sheet records the performance of a freshly-swept loaded mainstation at a particular location in your system. When pulled together, these sheets provide you with all the pertinent information you need on the daily operation of your system. In the future as work is performed at a mainstation, its performance should match that recorded on the sweep sheet. Having a clear record of the necessary performance to match is helpful, since the desired performance for each mainstation will vary. Being able to compare changed values to the original values for particuilar specifications can tip you off that a problem is developing before service is actually affected.

Regularly matching the performance listed on the sweep sheets will lenghten the life of your sweep. A sweep should last about one year. A crew dedicated to sweeping and collecting this information should be regularly working its way through your system. Establish a schedule to spread your sweeps out evenly over the year.

On each sweep sheet, include the installation date and ambient temperature at the time of installation. List the model number, model name, and serial number of every component in the mainstation. Include the number used to identify the location of this mainstation on your maps along with a street location. Record any pertinent information about each individual module in the station. For example, model number and value of any plug-ins installed. For the trunk amplifier, be sure to include input and output levels, reserve slope and gain range, peak-to-valley, and a response picture. Also record bridger module output levels along with the number of feeder lines served, number of feeder lines fused, and number of line extenders served. You will also find a record of the AC input voltage to the mainstation's power supply and the DC output voltage it creates useful. Finally, don't forget to include the location of the line power supply feeding this mainstation.

Along with sweep sheets, you should keep a proof-of-performance record for each trunk line. A sample proof-of-performance record is shown in Figure 2. This record helps you monitor trunk lines between sweeps by documenting the end-of-line performance once each month at various locations throughout the system. Establish several key test spots in your system, and once each month measure and record the composite-triple-beat, carrier-to-noise, and composite-second-order figures for each test location. Also, photograph the response at each test location. Like the individual sweep sheets, these proof-of-performance records can indicate potential trouble before it erupts.

This may seem like a lot of information, and it is. But taking the time to gather it all in one book now will save you time and money later, since it is cheaper, faster, and easier, to look through your sweep sheets than it is to send your crews out to open up mainstations.

Location Log

You will also need to establish and maintain a location log. This record enables you to develop a picture of performance at a particular location over time. Tracking and recording performance trends in this manner helps you spot problems specifically linked to location. Again, this record need not be elaborate to be useful; your location log can have just two columns: date and events. All you want to know is specifically what is happening at each manistation and when the events occur. For example, frequently struck poles or "killer locations" frequently affected by electrical storms become apparent in this log. Knowing that location and not equipment is the cause of a problem can save you a great deal of wasted time servicing amplifiers that are not at fault.

Useful information for your location log is probably already being generated in your system through "Outage Report Forms" and "Trouble Call Report Forms." Make use of these documents by requiring that they all be submitted to the person in charge of your record keeping system. This individual should read each form and then add it to his permanent records in the location log.

Further, I suggest that all staff members be coached on how to make meaningful comments on their reports. Meaningful does not necessarily mean long or formal. But a note that says "trunk amp broken" is not worth the effort it took to write. More useful comments would list specific symptoms, the on-the-spot diagnosis, the action taken, and the result of that action. For example, "trunk amp broken" could be replaced with "low output/correct input levels/could't adjust for proper output/ customer complaint-picture distortion." This note gives you much more to go on when diagnosing a problem.

Serial Number Log

Finally, you will want to develop a separate record tracking the performance of individual plug-in components that are being moved about in your system. The serial number log is your mechanism for doing this.

The first time a module is removed from your system because of a problem, that module should be added to your serial number log. Individual entries here are arranged by serial number and will tell you the module's previous location, date of removal, and reason for removal.

Then, when the module is examined and worked-on you should document its performance on such characteristics as composite-triple-beat, composite-second-order, cross modulation, and noise factor. Plots of the unit's frequency response and input/output return loss should also be included. A sample serial number record is provided in Figure 3.

Taking, recording, and examining these measurements ensures that the modules going back into your system meet factory specifications. For example, if a module is repaired with inferior substitute parts causing its performance to be degraded, you will see the degradation in your serial number log. And you will see it before the degraded module is re-introduced into your system. Monitoring the performance of the components in your system is an effective way to ensure your entire system operates to specification.

In addition, the serial number log helps you isolate modules with intermittent problems. Say, for example, that a module is removed from your system because of low gain. You should immediately turn to your serial number log. If no page exists for this particular serial number, then you know it has not been considered a problem source in the past. Proceed by adding the module to your log; then having the module examined. If, however, a page does exist on this serial number, take a few minutes to look over the existing entries. If previous entries list that this module has been examined twice before for the same problem and both times checked-out fine, you can conclude that the problem is intermittent, and you can adjust your testing and repair practices accordingly. Cycling modules with intermittent problems throughout your system is expensive; the serial number log helps you work to reduce this expense.

If you make entries to the serial number log each time a piece leaves and re-enters your system you will also develop an accurate account of how particular models perform over time. You can use the unit degradation you have tracked to project reasonable system degradation to expect, and then plan maintenance and upgrade work accordingly.

CONCLUSION

Maintaining accurate system records makes it possible for you to run your system, rather than having your system run you. If you are willing and courageous enough to deem preventative maintenance and record keeping "real" and worthy work in your system you will enjoy many rewards. You will have fewer expensive fires to fight and instead be able to intelligently schedule work that heads-off problems before they occur.

Like the saying goes, those who do not examine the past are doomed to repeat it. Why choose to repeat old problems? Record your system's history; study it; then take action so that old problems do not return.

REFERENCE

[1] Ron Hranac, Corporate Engineer, Jones Intercable Inc., "Establishing a PM Program," Communications Technology, December 1985, pp. 94-102.

Mainstation Sweep Sheet

System: _____ Date: _____

Franchise _____ Ambient Temperature: _____

Amplifier #: _____ Map # _____

Location: _____ Cascade _____

Voltage AC _____ Power Direction In Out Thru

Voltage DC _____ Power Program Card Lo Med Hi

Location of Line Power Supply feeding mainstation _____

Test Channels	Trunk Input Level (dBmV)	Trunk Output Level (dBmV)	Bridger Output Level (dBmV)
_____	_____	_____	_____
_____	_____	_____	_____

Pad _____ Equalizer _____ Response Equalizer _____

Slope _____ dB Up _____ dB Down

Reserve Range

Gain _____ dB Up _____ dB Down

Trunk Module _____ AGC/ASC Module _____ Bridger Module _____ Return Module _____ Power Supply _____

Serial Number _____ Serial Number _____ Serial Number _____ Serial Number _____ Serial Number _____

Chassis Model/Serial Number _____/_____ Housing Model _____

Place P/V Photo Here

Bridger Splitter model name/number _____

Number of line extenders the mainstation serves _____

Number of lfeeder lines served _____

Check feeder ports fused 1 2 3 4

Peak-to-Valley _____ dB

Comments _____

_____

_____

_____

_____

Technician's Signature

Figure 1. Sample Sweep Sheet Form

System End-of-Line Performance Sheet

System	Amplifier Serial Number	Date
	Amplifier Map Number	Time
Amplifier Model No. & Name (If line extender, note number in cascade.)	Amplifier Location	Temperature

Input Levels			Output Levels		
Low Ban	CH	dB	Low Ban	CH	dB
Mid Ban	CH	dB	Mid Ban	CH	dB
High Ban	CH	dB	High Ban	CH	dB
Super Ban	CH	dB	Super Ban	CH	dB
Hyper Ban	CH	dB	Hyper Ban	CH	dB

(Place an asterisk next to channels used as pilots.)

Flatness Photo

Distortion Report					
	Low Ban	Mid Ban	High Ban	Super Ban	Hyper Ban
Measured Frequency					
Carrier/Noise					
Composite-Triple-Beat					
Carrier/Cross Mod					

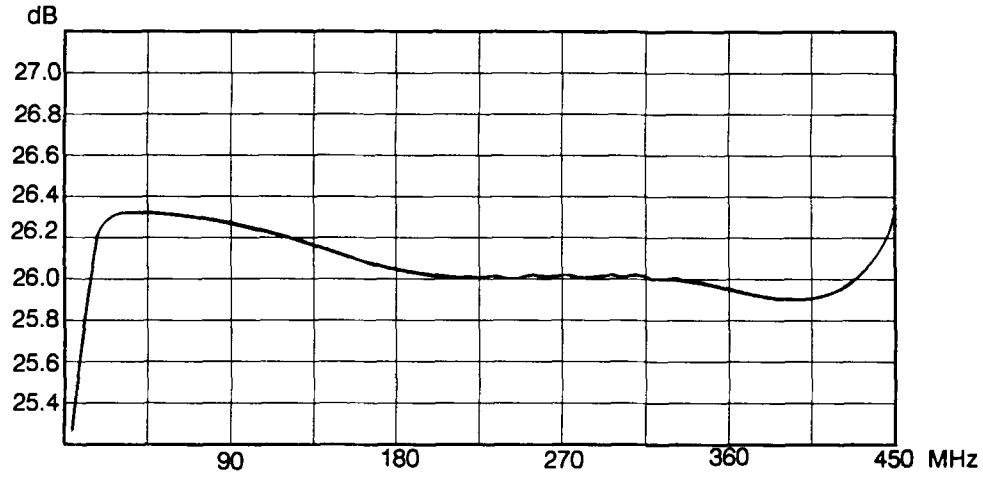
Figure 2. Sample Proof-of-Performance Record Form

AMPLIFIER ANALYSIS SHEET

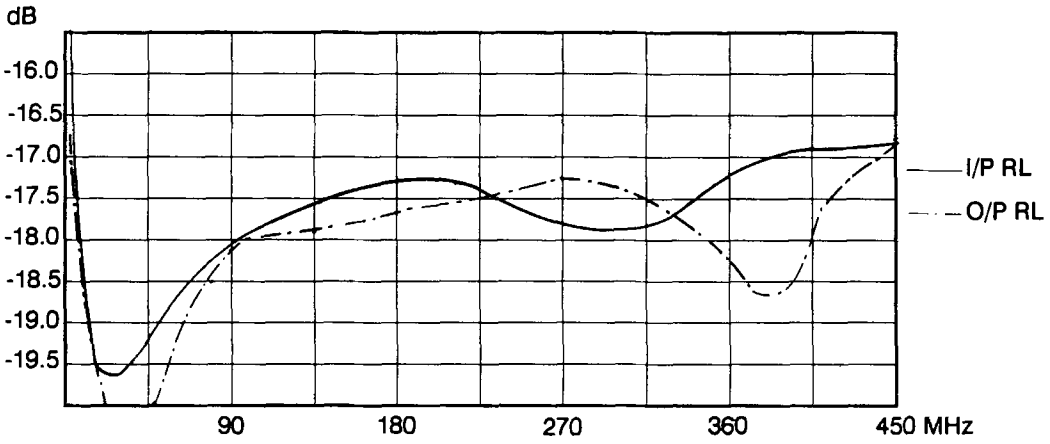
Model No. 6-T450 Trunk Amplifier
Serial No. 1232488

Date 3/8/88

Frequency Response



Input and Output Return Loss



Distortion Report

	CH 2	CH 13	CH R	CH HH	CH WW
CTB*	75	69	67	65	63
CSO*	82	81	81	78	74
XMOD**	72	78	70	72	73
NF**	7.5	6.3	6.1	5.9	6.0

*Test performed with 6 dB slope and 45 dBmV output.
**Test performed at operational gain.

Figure 3. Sample Serial Number Record