particular point may vary from 73 to 77 ohms. It is quite possible that a 73 ohm end may be spliced to a 77 ohm end. This would give a reflection coefficient of 0.0267 or return loss of 31.5 db. Systems requiring better match would have to check such splices and select cable reels to give ends that match. The TDR when used with a suitable 75 ohm impedance standard can check cable impedance profiles with great accuracy.

Several problems have been encountered in application of the H-P instrument to CATV. The H-P TDR was designed for 50 ohm systems and has a source impedance of 50 ohms. When used in a 75 ohm system, there is a mismatch which causes some difficulty due to multiple reflections caused by reflection at the mismatch between TDR and 75 ohm cable. H-P have an adapter available which consists of a 25 ohm resistor in series with the cable. This back matches the cable since the reflected pulse sees the 25 ohms in series with the 50 ohm impedance of the TDR. This introduces a 6 db loss in sensitivity due to voltage divider action on both the incident and reflected pulses. A resistive minimum loss matching pad can be used with somewhat higher loss of sensitivity. For precise quantitative measurements, the instrument can be easily recalibrated to compensate for either adapter. I personally prefer to use the MLP or no adapter at all, making corrections for multiple reflections according to the formulas in H-P's application manual.

Some problem has been experienced with 60 cycle AC pickup particularly on cables on joint use poles. This is usally noticed on lines with low impedance shunts such as resistive terminations. The pickup seems to disappear when the line is completely opened. H-P is developing a unit called a "humdinger" to alleviate this problem.

We have found the TDR, particularly the version by H-P, to be a reliable, very useful instrument for routine use by CATV systems, large and small. In the words of one of our system managers - "I don't know how we ever got along without it".

CHAIRMAN TAYLOR: Thank you very much and I want to apologize first off for eliminating the punch line at my introduction. Mr. Switzer is a CATV consulting engineer in Lethbridge and also has been associated considerably with the famous players in their CATV systems throughout Canada.

Our next speaker, Mr. Isaac S. Blonder, Chairman of the Board of Blonder-Tongue Laboratories, Inc., will speak to us on the importance of technical training. Mr. Blonder.

MR. ISAAC S. BLONDER (BLONDER-TONGUE LABORATORIES, INC.): At the back of the room there is a table containing my speech and also another paper on CATV technical training that was prepared by Fred Schulz who is in charge of our sales training. I was delighted at the opportunity to be able to talk about technical training. I've done nothing else all my life.

Technical knowledge may be categorized as having four general divisions: scientist, engineer, technician, craftsman. Technical training is accomplished in these approximate areas: university, technical institute, high school, military, apprentice, self-study.

Measurement standards for the level of technical knowledge achieved are virtually non-existent. The CATV operator, and indeed every other employer

of technical labor, is left adrift to find his own way out of the maze of conflicting testimony on the state of technical training available to him in these United States.

No universal measuring stick in the form of national examination or universally accepted standards of performance for students can be used to match the job to the available job applicant. The problem is further obfuscated by the present shortage of trained personnel. Available figures show that we are training about 15,000 engineers and the same number of technicians each year in electronics with a comparable quantity coming from military programs and probably a smaller number graduating from industry schools. Not only are we faced with a level below our needs, but the ratio of technicians to engineers for maximum efficiency should be about 3-1, indicating a need for technicians about 200% over the present supply!

For purposes of identification and analysis let us define the scientist as the pure researcher not normally needed in CATV, the engineer as the creative planner who is needed in small but vital quantities, the technician on whom falls the principal burden for the day-to-day operation, and the craftsman who is the installer and repairman.

The scientist and engineer are probably available as needed. Our universities are expanding, funds from the military provide some 60% of the needed financial support, and the present high engineering salary levels are attracting our best students. If anything, medical schools complain about the far lower level of students they are attracting today as a result of the brain drain to the sciences! American technical science leads in the development of electronics. Most of the universities maintain high standards of selection and performance and the possession of a degree is usually a worthwhile indication of intelligence and knowledge. We must recognize, however, that no universal standards exist to measure engineers on a national level, and the employer has no figures to guide him in his choice of an engineer, indeed every employer today is forced to use the services of an industrial psychologist to measure the comparative value of a prospective employee, and finds the diploma and college grades much less of a guide in his selection.

It is in the technician area where our problems really exist. Some small beginnings have been made to establish standards for technician training schools. The American Society for Engineering Education - Washington, D.C., among others, has established standards for schools awarding an associate degree for the completion of accredited two years curriculum in engineering technology and now accredits schools meeting these standards. But how many of these qualified graduates have you met? Blonder-Tongue doesn't find them in our employment office! Other than such pioneer efforts in establishing standards for the schools-not the students, incidentally!-we face a vast garbage dump of schools and standards purporting to train technicians. Lowest on the ladder for achievement are our public high schools. Since they are forced by law to take everyone and hold them in bondage until released by chronological growth, academic standards are non-existent, and the good scholars compulsively avoid the stigma of an inferior technical education. Even the category of craftsman, who should take pride in his accomplishments of the menial tasks, is

not well served by our high schools where his sense of pride in doing well what he can do is degraded by the general atmosphere of a quasi-penal institution. It is too well known for repetition of the sordid facts, to point out in detail the non-existent standards of our privately owned technical training institutions, who advertise blatantly the financial opportunities in electronics for their graduates but fail to mention that no standards exist for admittance or graduation except the payment of tuition fees.

Faced with the never-ending shortage of electronic technicians, a school system incapable of producing them, and no immediate relief in sight, what can the CATV industry do?

1. Set standards of training and knowledge. If financially feasible for the parent NCTA, get up an examination and certification system to qualify both school and individual. The difficulty of this task should not be underestimated, since it has yet not been accomplished in the U.S., except for the certification of professional engineers by the individual states.

2. Set up your own training programs as most companies have had to do. Training is a never-ending task and is best done on a continuing basis with with regularly scheduled company time devoted to it. The more formal such a program the better, even to the extent of appointing a Director of Training and awarding of certificates.

3. Contract for outside training help. The U.S. Government has many areas in which they are striving to provide technical manpower for American industry and funds are flowing to local schools in your immediate vicinity. To review the present status of these programs would not only take time now but would serve no useful end since they are in such a maelstrom of change due to the fact that they are unsuccessful so far in meeting their stated objectives. As long as these emergency preliminary efforts can only deliver poorly trained craftsmen with questionable work motivations, our needs will go unfilled. But we should not criticize too harshly the first futile technical schools; the need is so urgent that wherever possible we should aid in the effort to train the untrained.

4. Look to industry for training courses and material. Blonder-Tongue, in its own sales interest, just as other manufacturers do, gives short training sessions to insure the proper use of its equipment. Our literature is technically oriented and the technician who is familiar with it can better accomplish his job even when he uses the products of another manufacturer.

We have passed out copies of a CATV training course given under the direction of Fred Schulz, Chief, Sales Engineering, and it will be our pleasure to describe how and when they are available to the CATV industry.

Technical training in this day and age is an absolute necessity in order to survive; the CATV technician is no exception. The following paragraphs intend to show the development of a training course for CATV technicians. A large number of successfully administered training courses, given by B-T in the last 15 years, particularly for MATV and CCTV technicians, furnished a wealth of practical experience.

The discussions are limited to a course intended to spread technical

knowledge to CATV technicians and excludes technical sales meetings designed to sell a product line. There are two basic ingredients in training:

THE GOAL AND THE STUDENTS

Let us set the goal in very brief words:

OUR TRAINING SHOULD PRODUCE MEN WITH A THOROUGH UNDERSTANDING OF TV PRINCIPLES, SYSTEMS ENGINEERING BASICS AND HARDWARE KNOWLEDGE, SO AS TO BE ABLE TO SUCCESSFULLY MAINTAIN, EXPAND AND TECHNICALLY RUN A CATV SYSTEM.

This is quite a tall order.

The student, our 2nd basic ingredient, does not lend himself to such a quick treatment. Students are human beings and, therefore, quite complex. In short, we have individuals in front of us.

The background our students are bringing with them varies greatly and it is this variation that we must take into account to run a successful program. This point is probably the single most significant difference between public school training and our programs. This realization automatically rules out the vast available program material from colleges and technical schools.

Course participants cannot be required to show evidence of successful completion of pre-requisite courses as is customary in colleges, nor can they be required to take an entrance examination.

The educational level may run from graduate engineer to the man with an intuitive feel for CATV, but with little solid educational foundation to build on.

It is highly desirable to get information on the background of participants before a course is started; let the company provide this information.

The learning capability of anyone is limited, keep in mind that many course participants are practical men, little accustomed to sitting still for any length of time or able to concentrate over extended periods. This factor can be taken into account by providing ample and frequent breaks, (coffee breaks are particularly well received). It should also be mentioned to the students that learning and a good night's sleep go together very well.

How much time are people willing to spend on a training seminar is still another factor to be considered. There is no magic formula, however, a 3-day seminar is optimal in many cases because it can, for instance, begin on Tuesday morning, allowing travel on Monday. Running full 8 hour sessions on Tuesday and Wednesday, and with a mid-afternoon breakup on Thursday, allow the participants to return home that same day.

Where should one hold courses? The choice depends on the course material. If much material and equipment is needed, the home office is a logical choice; for other courses keep in mind: the shorter the travel time the more participants. A hotel or a motel with restaurant and meeting room facilities, as well as close to transportation facilities can be found just about any place in the U.S.A.

When to hold a meeting? Keep in mind that in many areas there is a strong seasonal demand on the CATV technicians' time. State and national association meetings often bring technicians together and a course may be scheduled before or after such a gathering.

The cost of a course varies greatly. Factors to be kept in mind are:

a) who pays the participants travel expenses, food, lodging?
b) cost of instructional material
c) travel cost of instructor(s)
d) cost of meeting room

It has been found desirable to let the participants at least bear part of the expenses. The desire to "get their money's worth" creates an eager learning climate, and if the students' bosses pick up the tab, the results are just the same.

The instructor, the link between goal and student. A good instructor is not easy to come by because he must fulfill a number of tough requirements.

1) He must be knowledgeable technically, both from a theoretical and a practical experience standpoint.
2) He must have the ability to teach adults.

Unique is the individual that combines both requirements, because a good engineer may fulfill the first requirement, but most engineers unfortunately fall down badly when it comes to teaching.

The instructor must be able to step in front of a group of strangers, establish a rapport with the group and stay confident. We mentioned the necessary gift of being able to handle people of vastly different backgrounds. A subject must be presented interesting to people already knowledgeable, yet instructive to people learning it. Like a salesman, our teacher must speak from conviction; must have self assurance, yet be reassuring to the participants. The man must be able to get material across without talking down to participants. Obviously, he must be able to stay on the subject during class discussions.

Sometimes, particularly when sessions are held at the home office, it may be possible to have specialists teach certain portions of a course; but make sure they have proven teaching ability.

Reference Material

Start a course by handing out the course outline, technicians will appreciate seeing that a course is well organized and taught in logical sequence.

Often a participant may find additional subjects he wishes to hear about and it may be possible to include them in the course. Other printed material suitable for distribution are:

a) spec sheets
b) application notes
c) manuals
d) reprints of articles
e) tables

Teach Aids

The instructor should use notes in order to keep continuity. Large scale drawings, slides, overhead projectors are good aids, but it should be kept in mind that darkening a room keeps most people from taking notes. A blackboard is still one of the best teaching aids. One should not forget

that what is on the board goes in the students notebook; clear and clean sketches make the student's life easier.

Demonstration equipment is very valuable, allow enough time if it is necessary to hand it from student to student, or provide more than one unit.

Organizing a Training Course

Location and date should be proposed by the field men who know the area and the potential participants.

The home office should obviously coordinate the requests in accordance with a master schedule. Individual invitations should be sent by the field men, because it lends it a note of personal care. Invitations should be sent early. It should give lodging instructions. Hotels and motels are more than happy to furnish room reservation cards.

Conducting a Course

Start course sessions on time. The instructor should arrive early enough to familiarize himself with local conditions, setup demonstration gear and teaching aids. The student should feel that the company is expecting him and is prepared for him. After all technical training is still a means of winning customers (or keeping them).

Group lunches are desirable from a time standpoint as well as from a standpoint of getting the class to feel comfortable as a group. Encourage people to take notes, (provide pads), but allow time for writing, most people are not used to taking notes. Encourage questions.

Let participants know that they will benefit from increased knowledge, (prestige, greater satisfaction, advancement, better wages) this creates an "eager to learn" atmosphere.

Brief review of fundamentals always seems to help. Fundamentals are the most neglected part of courses, many people think they know, however do have only vague ideas. What's the use of knowing how a large CATV system functions, and not even know what makes up a TV channel? Review tools, like db and dbmv.

Main topics should be arranged logically, so as few assumptions as possible have to be made. Summarize at the end of each topic to detect blank spots in coverage. At the end of a course, encourage the technicians to practice self-development and give hints on how to go about it.

Course evaluation sheets filled out by the technicians (no name) can help to improve future courses. An attendance record is good for follow up and sales purposes. The issuance of a certificate will boost the ego of the participants.

CATV Technician Training Course Outline

The following course can be covered in 5 days, it could also be worked into approximately 20 lessons suitable for mailing or the most important topics may be covered in a 3-day seminar.

1. Greeting. Introduction of participants, purpose of course and outline.

2. TV-FUNDAMENTALS
   a) scanning standards
   b) synchronizing and blanking
   c) resolution
   d) composite TV signal
   e) modulation (AV modulator, standard TV-channel)
3. Portions of the frequency spectrum we work with; Video, Audio, AM Broadcast-Band, Sub-channels, VHF low band, FM, VHF - High Band, UHF, Microwaves.
4. The db and dbmv as tools in our work.
5. TV-Signal Propagation: signal strength, line of sight, etc.
6. Antennas; characteristics and applications
7. Signal quality at the antenna (S/N, ghosting co-channel, etc.) TASO- Standards.
8. Pre-amplifiers: Importance of low noise figure, maintaining good S/N etc.
9. Amplification and other means of signal processing:
   a) AGC, min. input
   b) adjacent channel; sound reduction
   c) amplification, conversion, trapping, mixing, equalizing
   d) demod. - remod. systems
   e) IF - type processors
10. Headend AC supply
   a) line voltage fluctuations
   b) voltage regulators
   c) surge protection
11. Cables: Distribution System
   a) need for cable (location of subscribers, radiation limitation, interference prevention, unauthorized use of signal, etc.)
   b) basics of coax cables
   c) types of available cables
   d) cable deficiencies (return loss, weather resistance, eccentricity, etc.)
12. Basic limitations of amplifiers
   a) noise figure
   b) max. output
13. Basic system limitations:
   Cascading amplifiers
   a) tolerable S/N
   b) tolerable cross-modulation
   c) system tolerance
   d) temperature compensation
14. Principles of CATV-signal distribution:
   The need for an untapped trunk.
15. Typical distribution systems.
16. Distribution Equipment:
   Splitting devices (asymmetrical and hybrid splitters)

Equalizers
Duplexers
Automatic level control
Automatic tilt control
Matching transformers
Home splitters
Tapoffs: Pressure taps, hybrid types, isolation, thruloss.

17. Accessories: housings mountings
18. Test instruments and their uses, particularly the field strength meter.
19. Servicing and installation:
Signal probing, checking of cables, grounding, weather proofing, use of test equipment, trouble shooting by symptoms, checking defective distribution lines, preventive maintenance.
20. Specifications: Interpretation and writing.
21. Cost estimates.
22. Pole line construction.

CATV - AUXILIARY PROGRAMS

23. Basics for closed circuit (CCTV) program origination.
a) lighting
b) lenses
c) types of cameras
24. Weather channel, sub-channels, microwaves

CHAIRMAN TAYLOR: Thank you very much. Does anyone want to ask Ike questions about this training program?

QUESTION: Is this training available to anyone, and on what basis?

MR. BLONDER: We have conducted seminars throughout the United States, usually in regions, conducted by our Regional Sales Manager. I must admit that we have concentrated much more on the NATV area in which we have had, in the past, a greater interest, but we are setting up a new program. If you will indicate to us your interest in participating, you will find that we will have a regional meeting in your area eventually to which you are certainly invited.

CHAIRMAN TAYLOR: Our next speaker is Mr. George Bates, Vice President of Engineering for DYNAIR Electronics, Inc. Mr. Bates will speak on the use of the sideband analyzer and its applications. Mr. Bates.

MR. GEORGE W. BATES (DYNAIR ELECTRONICS, INC.): The "sideband analyzer" is well-known to the television broadcast engineer; it's one of the basic tools of his trade. However, for some unknown reason, the average CATV engineer - who has even more need for this device - is not familiar with its application in CATV and, in many cases, doesn't even know it exists.