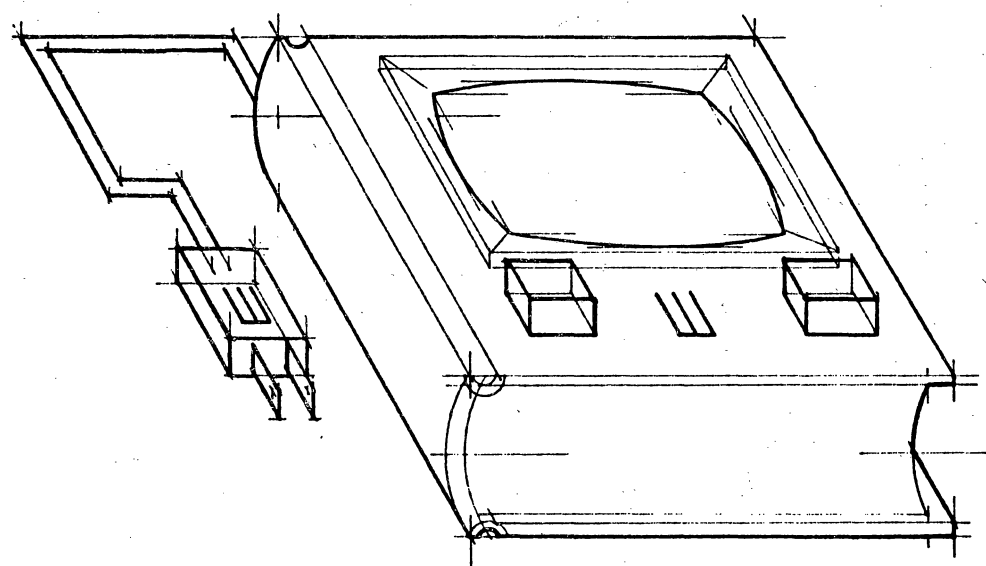


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Instructional Television in the Classroom: The Hardware



NEW JERSEY DEPARTMENT OF EDUCATION
NEW JERSEY PUBLIC BROADCASTING
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The importance of reception facilities is often overlooked or taken for granted when considering the use of instructional television in the classroom. The reception process includes the receiving antenna, the in-school cable distribution system, and the television image display devices.

In this brochure we have attempted to provide some concise information about the hardware that should be considered when preparing a school for ITV.

**IF YOU ARE IN NEED OF MORE SPECIFIC INFORMATION FEEL
FREE TO CONTACT ANY OF THE ABOVE AGENCIES.**

Most of this material was originally developed by the NORTH DAKOTA STATE DEPARTMENT OF PUBLIC INSTRUCTION — M.F. PETERSON, SUPERINTENDENT — and was funded through ESEA, Title V.

Master Antenna Systems for Schools

Rabbit ear or built-in antennas for television receivers are inadequate to receive quality pictures in the classroom. The steel used in the construction of most modern school buildings interferes with reception of the broadcast signal. Or, the school may simply be too far from the broadcasting station to receive programming without a master antenna system. Even in areas where rabbit ear antennas are usable MATV will give improved performance (no ghosts, more channels, better color) and simpler operation for the classroom teacher. The balance of this section will assume that rabbit ears are unacceptable.

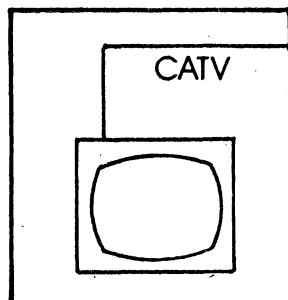
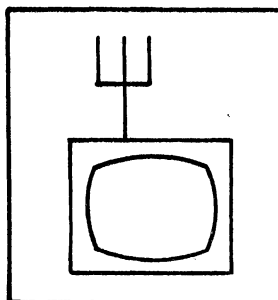
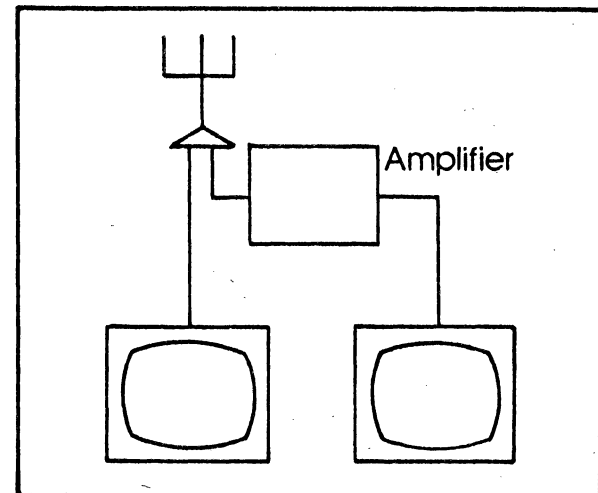
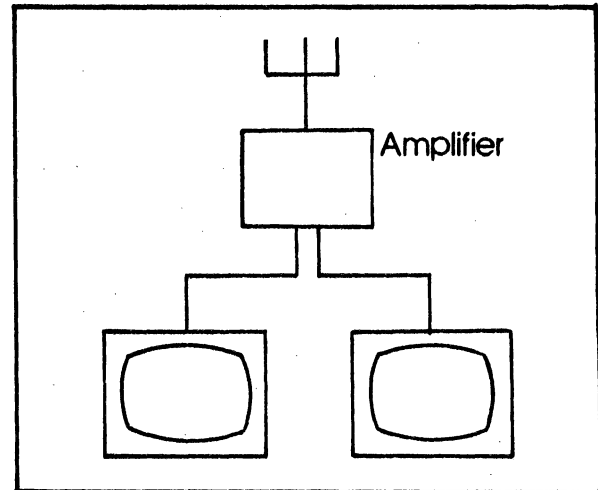
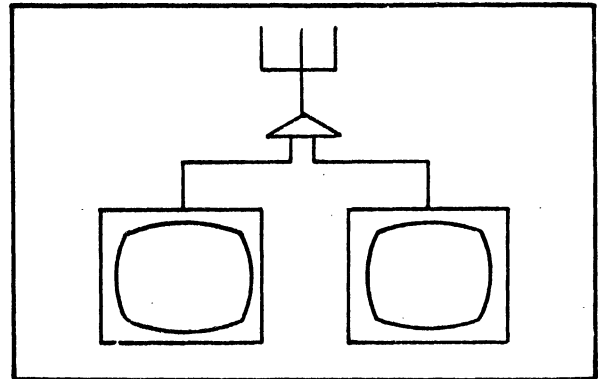
A master antenna system, then, is necessary for the utilization of broadcast television materials, commercial or educational, in more than one area within a school. How complex the system need be depends on the extent and manner of utilization of television within your school. Staff input plus the information contained in this guide will prepare you to talk with a firm that could install your system.

Subsequent pages contain complete specifications for bidding on MATV installations. Any deviation from these specifications could measurably affect the system performance and should be checked by technical authorities other than those bidding on the installation.

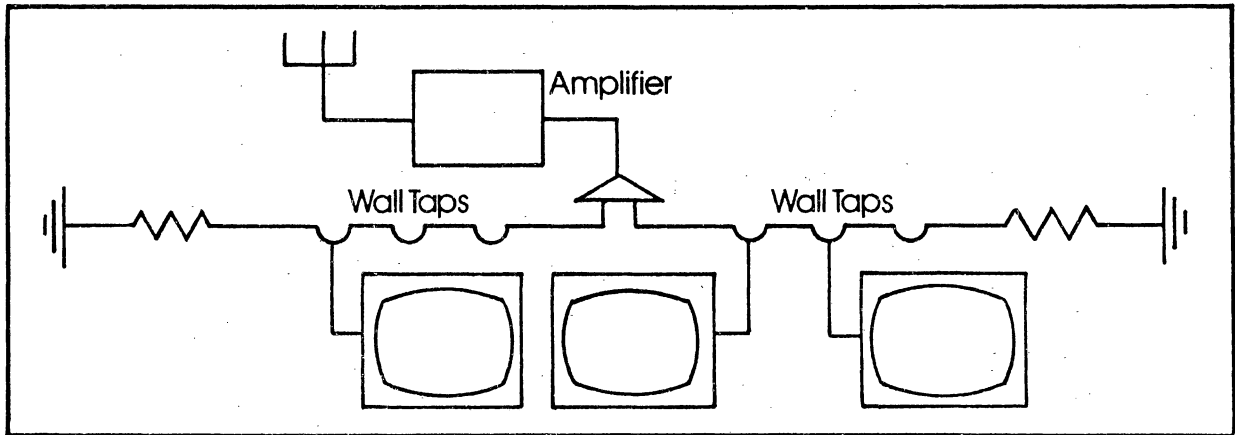
In communities served by cable television a hook-up from the cable company may be substituted for the antenna in the school. The cable system offers, in many cases, the advantage of more stations from which to choose. There is, however, a disadvantage in being dependent upon the quality and dependability of the cable television signal. Your local television repair service should be able to advise you on the reliability of the local cable system.

Looking at the four basic master antenna systems, we see the first and most simple is an antenna such as might be used in the home.

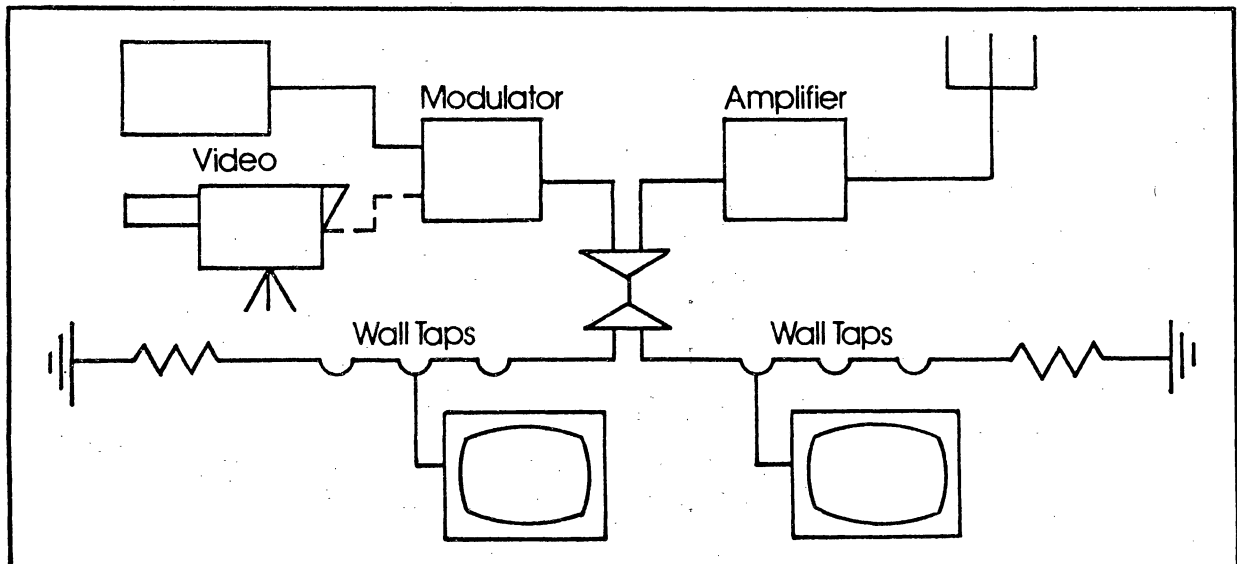
The second system is an expansion of the first, allowing for viewing of television in two different locations. If the two areas are distant from either the antenna or one another, an amplifier may be needed.



The third arrangement is the foundation for the system that will be used by most schools. By changing the size and number of amplifiers and wall taps, it is possible to provide television materials to any number of classrooms.



The last system is somewhat the ideal and is designed to transmit programming from one central location within the school, as well as receive broadcast television materials. This would allow, for example, the librarian to keep the videotape machine and videotapes and feed the material to one or many rooms upon request. It also allows for origination of materials from a live camera. This could be used to allow a journalism class to produce a news show for school viewing. Also, the system may be expanded to provide more than one local origination channel if necessary.



Suggested Specifications for MATV System

The contractor shall show evidence of the ability to install a successful system and/or evidence of completing other successful systems.

The specifications are to provide technical guidelines for the installation of a complete MATV System of acceptable performance.

These specifications are to be met or exceeded unless the contractor notifies at the time of the bid the specific specifications that will not be met and these exceptions are approved by the school.

The entire system will be guaranteed for acceptable performance for a period of no less than one year from final acceptance by the school. The contractor providing the installation shall also be capable of providing maintenance service after the warranty period, when needed by the school.

System Specifications

A block diagram of the system shall be supplied to the school system indicating system levels when bidding on installation.

Distribution Hardware

1. All taps and splitters shall be "BACK MATCHED" to minimizing reflections due to mismatches, etc.
2. All taps should provide a minimum of 9 db RF isolation between the receiver and cable.
3. All unused ports on splitters shall be terminated into 75 ohms.
4. All taps shall have a minimum output of 0 DBM (1 millivolt) and a maximum not to exceed 20 DBM.
5. All taps shall be of a 75 ohm type and the cable connecting the television receiver to the tap shall be of approved 75 ohm type RG59U foam.
6. All distribution shall be done with RG59/U or RG11 cable or approved equal with foam dielectric and non-contaminating jacket.
7. Each distribution cable shall be terminated into 75 ohms at the last tap per distribution leg.
8. All distribution amplifiers shall meet the following specifications:
 - a. Input and output shall be 75 ohms.
 - b. There shall be provision for gain and tilt control.
 - c. Frequency response shall be within $\pm 1/2$ db over any channel bandwidth.
9. Broadband amplifiers may be used in systems with less than 60 db systems loss.
10. Amplifiers for system losses greater than 60 db must be single channel amplifiers with AGC.
11. Input to any amplifier must be 6 db greater than the minimum required by specifications for that amplifier. Input to the same amplifier must not cause the amplifier to exceed its rated output capability nor cause crossmodulation.
12. All distribution amplifiers must be capable of providing a minimum of 6 db more output than the total loss in the system.
13. No more than 2 distribution amplifiers may be used in cascade.
14. Power outlets for amplifiers shall be on a separate 110 volt 3-wire service and the breaker or breakers shall be labeled.
15. The addition of "LOCAL ORIENTATION" television signals shall be achievable by adding a local modulator without other system changes.
16. The use of adjacent channels in the distribution system for "LOCAL ORIENTATION" is to be avoided unless the system is installed with the necessary filters for adjacent channel rejection.
17. The use of locally active commercial channels for local origination is also to be avoided to prevent RF radiation interference from the local station.
18. Each television receiver not equipped with a 75 ohm input shall be equipped with a 75 ohm - 300 ohm matching transformer. This transformer shall be secured to the receiver by clamp or screws.
19. The installer shall provide a RG59U foam cable with appropriate connectors 15 ft. long for each television receiver.

Antenna Systems

1. Antennas should provide a minimum of 1000 microvolt or 0 dbm signal at the input of the first distribution amplifier and free of all ghosting or co-channel interference.
2. Stacking of antennas is preferred in weak signal areas. However, in some conditions preamplifiers could be permissible. If a preamp is used, it shall be mastmounted in a weatherproof housing.
3. For antenna systems requiring single channel Yagi's, mixing must be done with a tuned antenna mixing unit.
4. Antenna mixing must be of a weatherproof type.
5. Antenna feed lines will be of approved coax and matched with weatherproof transformers where necessary.

General Construction Guidelines

6. Antenna mounting shall be accomplished with the use of galvanized steel mast or tower of sufficient height to ensure consistent good reception of the signals. The mounting base for this mast or tower shall be of such design as to securely hold the mast as well as to protect the roof from damage. At least three (3) guy wires shall be used for every ten (10) feet of mast height. All mounting components shall be of a rust-proof metal to ensure protection against the elements.
7. The mast or tower supporting the antenna system shall be grounded with not less than a No. 6 copper ground wire clamped to the mast or tower leg.
8. Ground rod for the antenna ground will be copper clad or solid copper and a minimum of 8 feet in length.

MATV System Operation

For the system to be accepted it must meet all of the above conditions plus the following operational conditions:

1. The quality of the received television signal must not be visually inferior at any point in the system compared to the quality obtained at the headend.
 2. The headend picture quality must be equal or superior to the quality normally available in the reception area or no less than A Grade 2 according to TASC Standards.
 3. The installer shall make the installation in accordance with the latest National Electric Code plus all local codes.
 4. A block diagram with real system levels will be supplied upon completion of the MATV System to the school system.
 5. All operating instructions shall be provided by the installer necessary for proper operation and maintenance of the system. (This information includes schematic diagrams.)
 6. All electronic equipment shall carry the Underwriter's Laboratories, Inc. label. This same equipment must be designed and rated for 24 hours a day continuous operation.
1. The location of each wall tap should be well coordinated by one school official, keeping in mind:
 - a. The convenience to teachers.
 - b. The least amount of interference from reflections caused by windows. (The television receiver should, for example, not face windows.)
 - c. It should not be necessary to use window shades or curtains to use the television receiver.
 - d. AC power should be available without the use of extension cords. (Preferably the AC outlet should be adjacent to the television wall tap.)
 2. Cables within the classroom or other public areas shall be protected from vandalism or accidental damage by conduit or wiremold.
 3. Cables in non-public areas shall be pulled in such a manner that they are secure and neat. (See Pt. 6)
 4. Cables shall not come into contact with steam pipes, hot water pipes, heaters, or radiators.
 5. Sharp bends in cables are not allowed. A bend must have a turning radius of not less than 6".
 6. Cables not run in conduit or wiremold shall be supported by plastic tiwraps or clamps every 2 feet. These wraps or clamps shall not deform or puncture the cable jacket.
 7. Cables entering or leaving rooms or buildings shall not interfere in any way with the operation of windows, doors, etc.
 8. Exterior entry points for cable (where cables enter and leave the buildings) shall be provided with drop loops and shall be carefully sealed and weatherproofed.
 9. Exterior cables shall be clamped or run in conduit above water, ice, and snow levels. If the cable is run in conduit it shall be provided with weep holes or other means of adequate drainage.
 10. Aerial spans shall be supported by an appropriately sized galvanized support wire.
 11. Cable splices that are not readily accessible are not allowed and splices are only allowed using standard connectors and a "barrel".
 12. Amplifiers and as much other distribution hardware as possible should be mounted in secure accessible cabinet or cabinets.

The Videotape Recorder: Getting the Most Out of Your Instructional TV Hookup

Video Tape

Given the fixed schedules of most educational broadcasting stations, the ability to record programs for use when convenient is a key to scheduling flexibility. Adding a videotape recorder makes possible the recording and storing of material for future use as well as the recording of commercial and ETV evening programming. The installation of a simple, inexpensive timing device allows unattended, after-hours recording of broadcast programs.

Choosing VTR hardware is no easy matter. There are more than a dozen formats using five different tape widths. There is also an unfortunate lack of interchangeability. We'll look at four basic machines:

½ inch EIAJ Type 1 Reel to Reel — The most popular recorder format in elementary and secondary education at this time. It is light, easy to thread as a standard reel to reel tape recorder and features low tape cost. Although it produces slightly poorer picture detail and stability than other formats, the ½ inch reel to reel offers reliably adequate performance.

½ inch EIAJ Type 1 Cartridge — With automatic threading and push-button control, this format is more convenient. The cartridge provides a clean environment for the tape, eliminating physical handling. (However, tape length is, at this time limited to 32 minutes.)

¾ inch Cassette — This format is beginning to compete strongly for popularity with the ½ inch reel to reel. It features better picture detail and stability and, again, the convenience of the cassette is a factor.

1 inch — The most advanced video format available within the average school budget. It provides the best technical stability and detail, excellent tape handling and editing capabilities. It is, however, higher in cost and less portable due to weight and size.

The quality of a video tape recording is controlled not only by the quality of the video tape machine and its condition, but also by the quality of video tape being used. Manufacturers usually recommend a video tape for use on their machines and often that tape is their own product. Other manufacturers' video tape may be used, however, if you purchase tape with care. It is a good policy to purchase name brand video tape such as 3M, Memorex, Sony, etc. You can buy other manufacturer's tapes but you run the risks of higher head wear, poorer signal-to-noise ratio (noisy or snowy playbacks or recordings), high dropout rates (random flashes in the picture), and poor warranty. So when you buy video tape, beware and be careful. You can have problems with name brand tape too, but the advantage is that the companies are well established and will usually replace defective tape (in some cases up to years after it was purchased). This can mean a savings of hundreds of dollars.

You may hear that old computer tape can be used for video tape. This is to be discouraged for several reasons, not the least of which is the very high rate of head wear that this tape causes. With video head replacements costs as high as they are (\$120-\$150), the low cost of such tape is counter-productive. When purchasing video tape you can usually get a discount on 10 reels or more. If you use as many as 100 reels in any one year you can negotiate for an even greater discount.

Video tape should be handled with care, stored and shipped on edge. This protects the tape from edge damage due to the sagging of the tape on the reel flange. It should be stored in the plastic bag and in the box in which it was purchased. You should also replace the tape tab holding the end of the tape. This is very important because it protects the tape from airborne dust and contamination as well as helping the tape maintain a stable environment. The storage area for video tape should be from 60-80 degrees in temperature and the humidity should remain in the 25% - 60% range. (The more stable the environment within this range, the better.)

The operational environment for video tape machines should be as free from dust as possible and of moderate temperature and humidity. This will provide better service from your video tape system as well as providing better video head and video tape life.

Television Receiver/Monitors

When purchasing television sets for the classroom, it is best to buy sets designed for classroom use. The basic differences between the consumer set and instructional sets are a) video and audio inputs for playing back video tapes without special equipment, b) video and audio outputs for use in recording television programs from the television set, c) longer power cords, d) extension speaker outputs, 3) isolation transformer operated to reduce the "shock hazard", f) and in some cases, an "8 pin VTR connector" allowing recording and playback using the television receiver with only one cable instead of four (this is very convenient, but it is not available on all instructional sets).

For a classroom of 20-25 students, a set in the 21" — 25" size is satisfactory with a 23" set being almost ideal. The only time a smaller set should be considered is for use in a carrel, in a small group, or for use in just recording material off the air. Purchase of black and white sets is not recommended even if you have only black and white video tape recorders. The monitors will outlive your recorders and they can still be used for viewing color broadcast programs.

Receiver/Monitor Purchasing Guidelines

1. A classroom receiver/monitor shall have a screen size of not smaller than 21" with 23" or 25" given preference.
2. It shall provide video and audio input as well as output jacks.
3. It shall be equipped with a Type F, 75 ohm VHF antenna input and a 300 ohm UHF antenna input, or if only a 300 ohm VHF input is available, it shall be equipped with a balun transformer providing a 75 ohm input. If the set must be equipped with a balun, the balun shall be secured with metal tapping screws to the receiver.
4. It is recommended that the picture tube be of a bonded faceplate type.
5. The speaker shall be no smaller than 5" in diameter and mounted on the front of the receiver parallel with the face of the picture tube.
6. It shall have a sensitivity of no less than 15 microvolts for VHF.
7. Its audio amplifier shall provide a minimum of 3 watts RMS audio output.
8. The power cable should be a minimum of 15 feet in length and should be equipped with 3 conductor grounding type cable and plug.
9. The receiver power supply shall be of transformer type or shall be operated from an internal isolation transformer and shall operate normally from 105-125 volts 60 HZ.
10. Metal cabinets are preferred.
11. Resettable circuit breakers for AC protection are preferred over fuses.
12. Receiver should be provided with "Tamper-proof controls" except for volume, on-off, and channel selector-fine tuning.
13. If rolling stands are to be used they shall be equipped with heavy duty wheels no smaller than 4 inches in diameter. There should also be an acceptable means of securing the receiver to the stand.
14. The receiver should be serviceable locally.
15. Each receiver will include a maintenance manual and an operation booklet for repair and operation.

New Jersey Public Broadcasting Educational Services

Approved in a bond referendum by citizens of the state in 1968, New Jersey Public Broadcasting (N.J.P.B.) was formally established by, and is supported by, the state legislature. The four UHF channels (50, 58, 52 and 23) assigned to New Jersey Public Broadcasting tie the state together through a modern mass media network never before available to the citizens of our state.

The Educational Services Division provides instructional programming for all New Jersey residents. A complete complement of ITV programs in all subject areas for pre-schoolers through adults are included in the programming schedule. Programs on the schedule are selected each year on the basis of input from educators throughout the state.

To encourage effective classroom utilization, a manual giving background on all programs is provided free of charge each year to New Jersey schools upon request.

Effective utilization, however, cannot occur without good reception of the broadcast signal. Therefore, the information contained in this brochure is essential for schools wishing to develop school television systems. The educational value of any such television system will be determined by the relationship between the goals set by the school, the plans made, the personnel involved, and the equipment purchased to achieve those goals.

Jerseyvision

CHANNELS: 23 WNJS Camden | 50 WNJM Montclair
52 WNJT Trenton | 58 WNJB New Brunswick

Questions and Answers About UHF Reception at Home

UHF and VHF . . . WHAT'S THE DIFFERENCE?

Ultra High Frequency television more commonly known as UHF, includes channels 14 through 83. It is more difficult to receive than the Very High Frequency channels (VHF) which includes channels 2 through 13.

WHY IS UHF MORE DIFFICULT TO RECEIVE?

This difference in reception is usually due to the inherent characteristics of the transmitting signal itself because the higher the frequency, the more easily the signal can be blocked by buildings, trees and hilly terrain.

WHAT CAN BE DONE ABOUT POOR RECEPTION?

This problem can be partially overcome by the UHF station itself radiating more power than a VHF station.

However, the ultimate reception of any TV channel, particularly UHF, lies in the correct and proper installation of an **ANTENNA**. This includes both indoor and outdoor **ANTENNAS**. In fact, the quality of color TV reception is determined to a much greater degree by the receiving **ANTENNA** than the brand name or the cost of the set itself.

This may sound strange until you stop to think that the set itself is actually only the receiver for the signals that the **ANTENNA** picks up.

Your set is only as good as your vital link to the image, the **ANTENNA**, the eyes and ears of your television set.

When man first walked on the moon and set up his TV camera there, the right **ANTENNA** system made it possible for people on earth to follow his every step.

WHAT KIND OF ANTENNA IS NECESSARY?

If you receive VHF stations well with only an indoor **ANTENNA** (rabbit ears), you can probably expect the same with only an indoor UHF **ANTENNA**. However, don't expect the piece of wire called a UHF loop that usually comes with a new television set to be equal to VHF rabbit ears.

There are indoor UHF **ANTENNAS** on the market that are equal to, or better than, the VHF rabbit ears. One is called a double bow-tie and retails somewhere in the vicinity of \$9.00.

WHAT ABOUT OUTSIDE ANTENNAS?

If you need an outside **ANTENNA** to receive the VHF station, you will most likely need an outside **ANTENNA** for UHF reception as well.

HERE ARE SOME THINGS TO REMEMBER ABOUT YOUR OUTSIDE ANTENNAS:

1. You will have better reception if you use separate UHF and VHF **ANTENNAS** each pointed at the different channels and positioned as high as possible.
2. Run two separate leads, one from the VHF **ANTENNA** and one from the UHF **ANTENNA**.
3. Keep leads as short as possible.
4. Do not make breaks or splices in lead from **ANTENNA** to receiver.
5. Attach only one television receiver to each set of **ANTENNAS** (VHF and UHF). Every time an additional set is added on, signal strength on the UHF band is decreased by fifty percent.
6. Keep the leads at least 6 inches away from metal objects.
7. Make sure the leads are attached to the appropriate terminals on the back of the receiver.

Hopefully this information will clear up some of your reception problems and make television viewing more enjoyable . . . for "U" in particular.

