TELEVISION TRANSMISSION
GENERAL CONSIDERATIONS
FACILITIES, EQUIPMENT, AND TEST SIGNALS

CONTENTS PAGE

1. GENERAL

1.01 This section details the general considerations concerning facilities, equipment, and test signals used in furnishing television transmission service.

2. TELEVISION VIDEO FACILITIES

2.01 Interexchange video circuit layouts are obtained from coaxial, radio relay, and video cable facilities. The physical plant layout is established by the broadcast service engineer (BSE) for all video services, contract (full-time) and occasional (part-time). The BSE is located in the Program Sales District in New York City except for the Public Broadcast Service (PBS) network where the Customer Service Manager is located in Washington, D.C.

2.02 Video units are comprised of interexchange facilities extending from a serving television operating center (STOC) or television facility test point (TFTP) in one city to an STOC or TFTP in another city, or between an STOC or TFTP and a junction point, or between two junction points.

2.03 Video units are designated VUA for units on video cable facilities, VUC for units on coaxial cable, VUR for units on radio relay.

2.04 Video unit layout record card information will include all equipment and each facility or facilities used. Details and symbols used on unit layout record cards are covered in Section 682-300-014.

2.05 Television terminals (coaxial or FM) may not necessarily be assigned to a particular unit but may be patched or switched to units to set up video services as required by service or operation orders.

2.06 Television sections are established to simplify operating procedures. A television section, (TVS), consists of one or more video units in tandem, and may be operated as a section with or without intermediate STOCs or TFTPs.

2.07 For convenience of operation, sometimes a single video unit may be designated as a TVS. TVSs are numbered and the direction of transmission is shown by the sequence of city names. They are established by program circuit orders issued by the broadcast service engineer. A given TVS is controlled as part of the specific control territory assigned to one of the Control Offices as covered by Section 318-003-000.

3. TELEVISION LOCAL (VIDEO) CHANNELS

3.01 A video local channel includes all facilities and equipment from the demarcation point at the broadcasting location up to the jack field at the connecting point of the intercity channels. This point may be an STOC, TFTP, or a remote location video patch bay.

3.02 Where local channels are fed from STOCs in which oak-type switches are employed, or an office equipped with a PULSECOM switch, the local channels should be equalized to include all cables and equipment between the jacks in the STOC video patch bay and the termination at the customer's location. In the STOCs equipped with a J44107 switch, equalization should be to or from point "X" as described in Section 318-435-100.

3.03 Where local channels are not fed from the STOC or TFTP location, video cable trunks may be provided between the STOC or TFTP and the local channel terminal. In some cases equalized trunks (video cabling equipped with adjustable equalizers to correct for its own characteristics) may be utilized.

3.04 Where nonequalized trunks are provided, a measuring trunk having both ends terminated on jacks at the local channel terminal (equivalent in characteristics to the regular trunk) should be patched between the local channel terminal and the testing equipment when making local channel equalization tests. This is done to compensate for video trunk sections.

3.05 In general, the local operating companies maintain the video local channels. However, in some cases Long Lines personnel will assist by measuring and adjusting the local channel equipment if located in the Long Lines quarters and if such arrangements have been made locally.

3.06 Additional information regarding video local channels may be found in the following Sections:

SECTION	TITLE
318-100-100	A2 System
318-200-100	A2A System
318-020-000	A2AT System
318-220-100	A4 System

3.07 For ease of differentation, a video local channel having a transmission thruput between stations (referred to in FCC tariff NO. 260) shall be known as a "Local Tandem—Link Channel".

4. TRANSMISSION CONSIDERATIONS FOR FURNISHING TELEVISION SERVICE

4.01 FCC tariff NO. 260 contains the statement, "A video local channel of the telephone company is not designed for use where the through transmission video material between stations involve more than four video local channels furnished either by the telephone company or by others." Hence if services are ordered which use more than four local channels, video service may be impaired. This statement of course does not preclude furnishing such service when ordered. Information concerning the engineering of video local channels employing microwave radio is contained in Section 940-350-101.

4.02 For satisfactory video transmission, the number of intermediate offices operating on a through network service at video must be limited for a given network due to degradation of quality caused by demodulation and modulation processes. The BSE/CSM will specify the facility layout as well as the points to be operated normally at video frequencies on contract networks.

4.03 For occasional video services including any temporary rearrangements of contract networks, the following guides should be used.

(a) Coaxial cable video circuits should be fed through intermediate testrooms at carrier frequencies unless the television service is ordered to be fed in and out of a local television station. Similary, TD-2 radio relay circuits should be fed through intermediate testrooms at IF frequencies unless the service is ordered to be fed in and out of a local station. Based on information obtained from customer operation and service orders, the Control Offics should decide the duration and location of these in and out feeds.

(b) The maximum length of L3 carrier facilities in any television network should not exceed 1500 miles, and if practicable, should be limited to 1000 miles. Also, a network should not contain more than two links of L3 carrier facilities; that is, no more than two sending and receiving television terminals in tandem.

5. TEST SIGNALS AND MEASURING SETS

5.01 The following is a list of suggested test equipment for use on television services.

Should other comparable equipment be used, refer to specific instructions relating to that equipment.

J64047C-1	47C Receiving TMS
J64070B-1	70B Power Meter
J64009A-1	9A Video Distortion Meter
HP H01-653A	653A Oscillator
KS-19833-L1	Video Monitor
KS-19763-L1	Waveform Oscilloscope
124B Amplifier	Audio Amplifier
755A Loud Speaker	Loud Speaker and Volumn Ind.

In addition, it is suggested that each STOC be provided with a J64047B-1, 47B transmitter.

5.02 The J64047B-1 (47B) and J64047C-1 (47C) transmission measuring sets are designed to measure the amount of differential phase or gain at the color subcarrier frequency on facilities used for the transmission of color television signals. These sets make up a J64047A-1 (47A) transmission measuring system and are covered in Section 103-703-100.

5.03 The 9A (J64009A) video distortion meter is designed to measure the effects of amplitude and phase distortion at frequencies between 15 and 300 kHz. It measures in terms of dB below the transmitted signal and is covered by Section 103-735-100.

5.04 The Hewlett-Packard H01-653A oscillator provides a stable, flat, balanced or unbalanced, low distortion, sine-wave signal over a range of 10 Hz to 10 MHz. In addition to a sine-wave signal, the oscillator provides the following video signals: a 60-Hz square-wave signal, a video signal modulated by a 60-Hz square wave, and a "Sync-only" pulse. A 300-kHz internal reference frequency is provided with a fixed output level of 0 dBV. The 653A can be used at any point where the television signal is at video frequencies to provide signals for measuring power level with a 70B power meter or for observing the signal with a video monitor. Sine-wave frequencies in the 3000- to 3100-kHz and 4- to 7-MHz range should not be transmitted over L3 video channels. See Section 318-700-500. For set operation and description, see Section 103-321-000.

5.05 The solid-state KS-19833 L1 picture monitor is a 17-inch (nominal diagonal measurement) monitor intended for general use in monitoring and maintaining television facilities. The input signal can be from 0.25V to 2.0V P/P, either 75 ohm unblanced or 124 ohm balanced. See Section 103-747-000.

5.06 The KS-19763 L1/A oscilloscope is a solid-state device intended for use in monitoring and maintaining television transmission facilities. It is also referred to as an "A" scope or a television waveform monitor. It is designed to display the line and field waveforms of the standard monochrome or color television signals, particularly vertical interval test signals (normally referred to as VITS). See Par. 604. It accepts signals from 0.2V to 2.0V P/P, either 75 ohm unbalanced or 124 ohm balanced. The features of the oscilloscope make it useful for making different phase and gain, impulse noise, and video cable system test and measurements. See Section 103-748-000.

5.07 Test patterns are used by the various customers for testing between television stations and from pickup points. Interpretation of video test patterns is covered in Section 318-015-100. Test patterns should be accurately calibrated and adjusted by the transmitting point in order to permit true observations at the receiving points.

5.08 Voltages in television service are measured on a peak-to-peak (P/P) basis. (Refer to Section 318-015-000 for definition.) The composite video signal and the nomenclature for each part of the signal are also shown in Section 318-015-000. The Institute of Electrical and Electronic Engineers (IEEE) voltage scale has been adopted for industry-wide use and should be used on all telephone company "A" scopes. The IEEE scale (formerly the IRE scale) is an oscilloscope or waveform monitor scale used to assist in evaluating the performance of television transmission. The scale is still in IRE units. Setup value to be used for network transmission is normally 7.5 on the IEEE scale, as outline in the above referenced practices, for monochrome programs but varies with individual broadcaster's procedures.

5.09 The IEEE roll-off, IRE205 (58IRE23.S1) characteristic is the standard frequency

weighting for all sync, level, and setup measurements. This applies to both monochrome and color transmission except for observation of color burst and color bar levels.

5.10 The flat response is the characteristic that should be used for waveform analysis, single-frequency measurements, observation and measurement of color bursts, and for any other test requiring maximum available bandwidth. A calibration chart should be available with each scope to apply corrections to single-frequency measurements. The flat response also is the band switch setting that should normally be used during video monitoring. (However, for normal level measurements and adjustment for both monochrome and color signals including sync, setup, and video portions of the composite signal, the IEEE roll-off should be used as indicated in 5.09.)

5.11 When comparing "A" scope presentations with other testrooms, stations, etc., it is essential that the oscilloscope operators ensure that the same type of response characteristic is being used at all points comparing the same signal, and that wideband and IEEE roll-off responses are being used for the purposes discussed above.

5.12 Since there are two balanced video circuit impedances existing in plant, 110 and 124 ohms, television systems with combinations of these impedances frequently are encountered. Procedures for routine circuit adjustments of balanced transmission systems at present do not adequately take into account the co-existence of these two impedance values and hence some errors can be made in both frequency response and signal level. While the errors introduced in a lineup may be small, the increasingly narrow tolerances for good television transmission make it desirable to reduce them to negligible magnitude. Section 103-700-100 lists the impedances at various test points in video systems and describes the use of the 28A and 28B impedance-matching pads with testing equipment.

6. CUSTOMER TEST SIGNALS

6.01 Television network customers usually transmit test signals over the video networks daily during available time periods and photograph these signals at various points on the network. The schedules for these test signals are made available to the various Control Offices, who should notify other testrooms concerned in their respective control sections.

6.02 Occasionally, when necessary on a trouble condition, the General Control Office in their investigation may request Control, Subcontrol, STOCs or TFTPs, to observe, log and/or photograph these customer test signals. The offices involved should promptly report deficiencies through their Supervising Office to the General Control Office. Test signal photographs when requested should be mailed promptly to the General Control Office. The General Control should analyze the results and direct location and correction of the deficiencies.

6.03 Test signal observations during station break periods are invalid and can be misleading because of the likelihood of network switching. The broadcasters have been so informed.

6.04 A method, [called vertical interval test signal (VITS)], used by the broadcasters permits the transmission of test signals during the service period so that network transmission characteristics can be checked at almost any time, independently of the nature or content of the video program material. The selected signal (multiburst, window, stairstep, or color bars) is inserted in the vertical blanking interval about one or two lines above the top of the picture. The signals normally employ two horizontal lines, 18 and 19. When the signal is designed to show white and blank levels, the broadcasters refer to it as the vertical interval reference (VIR) signal.

7. LEVELS

7.01 An important factor in good television transmission is the maintenance of correct video levels. A conversion chart (dB vs volts) provides a ready means of changing dB values to volts and vice versa. Such a conversion chart is shown in Section 682-300-014.

7.02 The present standard is that a customer should transmit and receive a 1-volt P/P clamped signal to and from local channels. However, in some cases different arrangements may have been made between the customer and the local telephone company. For this reason each STOC or TFTP that has transmitting video local channels should be familar with the normal voltage level that the customer will feed to the local channel. Similarly, the normal voltage delivered to the

customer on receiving video local channels should be known in order to evaluate properly reports of level troubles.

7.03 If the customer is feeding his normal voltage level to the transmitting local channel and the level received at the STOC or TFTP deviates more than ± 1.0 dB from the proper value, it should be reported to the responsibile telephone company for local channel adjustment. Service can usually be provided by requesting the customer to make a special adjustment of the voltage fed to the local channel until the local channel can be lined up, or by a temporary adjustment at the STOC or TFTP.

7.04 The level at which video local channels are to be operated in the STOC or TFTP is 1-volt P/P clamped signal on a balance basis.

7.05 VUA, VUC, and VUR units should deliver a 1-volt P/P balanced flat video signal to the STOC or TFTP and conversely should be fed a 1-volt P/P balanced flat video signal.

7.06 Layout record cards should be consulted for the correct operating levels at various points on video units.

7.07 Gain variations may take place in video units and sections between lineups. Most standard STOC installations are provided with attenuators to permit a -2.5 dB service adjustment. A4 amplifiers located at STOC or TFTP location are equipped with attenuators to permit adjustment. However, any adjustment over 1.0 dB should be considered an indication of trouble and investigated at the earliest opportunity.

8. SWITCHING

8.01 Requirements for telephone company switching for television services are covered on operation orders and service orders and should be handled in accordance with Section 320-009-306 LL to the extent that this program transmission practice is applicable to video.

8.02 When switches are required at the television line patch bay (switches of video material at carrier frequencies), they should be made as quickly as possible so that the carrier line pilots will not be unnecessarily interrupted. There should be no hold-open period. High-frequency switches should always be used when available.

8.03 Each STOC and TFTP should prepare a daily switching and service operations schedule. All necessary information should be listed to permit performance of switches or rearrangement of television lines and local channels as covered by service orders, operation orders, or for plant operating purposes. When cue switches are required at a video TFTP location, the associated TV audio or cue line should be extended to the video TFTP location for that purpose (Section 318-010-302 Par. 5.01).

8.04 ***Pushbutton Video Switch Panel (Oak-Type):*** This type switch and method of operation is described in Section 318-115-100. Each panel is supplied with white plastic guard rings, green plastic guard rings, and red plastic operating buttons. These are provided to give protection against accidental operation, to permit visual preselection, and to give a visual indication of which pushbutton has been operated. Between switching periods, the green guard rings should be placed on the operated buttons and white guard rings should be placed on the remaining buttons. To preselect the button for a switch, the white guard ring on the proper button should be carefully replaced with a red operating button. After the switch operation has been completed, the green guard should be carefully replaced with a white guard; the red operating button should be replaced with the green guard removed from the previously operated button. The red operating buttons should be kept in a locally provided receptacle conveniently adjacent to the switch panel. If desired, the green guard rings may be cut down locally to a length of 15/16 inch which will then bring the top of the ring flush with the top of the operated switch button. New guard rings, prior to being used for the first time, should be checked for internal clearnace to ensure that there is no binding due to burrs.

8.05 Where remote switching equipment is employed for remotely controlling video or IF switches, the STOC having the control panel should make a daily check about 30 minutes prior t the start of service sufficient to assure continuity of facilities through the remotely controlled switches. These operations should be performed even though the indicator lamps on the control panel show that the desired connections are already made since any changes made at the remote point during the out-of-service period would not show on the STOC control panel.

8.06 ***Relay Video Switch Panel (J44107):*** This type switch and method of operation is fully covered in Sections 318-410-100 and 318-415-100.

8.07 ***TD Radio Control Circuit for Use with Intermediate Frequency Switching (J68364):*** This type of switch provides for controlling the radio relay intermediate frequency switches either locally or at a remote point. The method of operation for this type of switching is covered in Sections 318-420-100 and 410-914-100.

8.08 Key and lamp panel arrangements using the 36A control unit are covered by drawing 23834-SD.

8.09 ***PULSECOM Solid-State Video Switching System:*** The PULSECOM switching logic permits a selectable connection of a video input line to output lines in any desired combination. Switches are preselected and have a visual indication of the lines to be interconnected for each output. These preselected switches may be executed individually or as part of a salvo. Any number of individual preselections (up to all input lines in a matrix) may be transferred into any of ten salvos with a visual indication showing with which salvo the output lines are associated. "Switch executed" indicators are also provided for each output. All preselections, switch executions, and salvo transfers require 2-button (two-hand) operation to prevent errors. The PULSECOM is also provided with the ability to cancel an unwanted preselection. The basic switch module is a 10 $\times$ 10 matrix, expandable in multiples of the basic matrix up to a 1000 $\times$ 1000 matrix. Integrated wideband amplifiers are utilized to obtain limits of $\pm$0.05 dB on amplitude frequency response from 60 Hz to 6 MHz and $\pm$0.1 dB from 6 MHz to 10 MHz. The differential phase limit is 0.2 degrees or less than the differential gain limit is 0.1 dB or less. Input/output impedance is 124 ohms balanced and the signal level is 1 volt P/P.