The *Picturephone*® System:

Line and Trunk Maintenance Arrangements

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New line and trunk maintenance arrangements have been developed for Picturephone® *service. A switched method of accessing lines and trunks by means of the No. 5 crossbar system has been developed. In addition a new local test desk (LTD No. 15) and testboard (TB No. 23) have been made available. In this article we discuss these arrangements which represent another application of the switched access concept as an integral part of line and trunk maintenance arrangements.*

I. INTRODUCTION

The wideband nature of the facilities for *Picturephone* service introduces a new degree of complexity in the methods used to maintain lines and trunks. Access methods acceptable in the telephone network are not applicable in this wideband network; in addition, testing capabilities are greatly expanded. The Local Test Desk No. 15 and Testboard No. 23 are designed to provide the required access and test capability. The equipments obtain access by means of the No. 5 crossbar system and it is suggested that the article on that switching system be read first.[1]

II. BACKGROUND

The objective of integrating the *Picturephone* service into the existing telephone plant requires that the maintenance arrangements should blend into and be absorbed by existing areas of responsibility in the operating companies. Line and trunk maintenance arrangements consequently are treated separately and distinctly, as they currently are, and they are compatible with the existing arrangements.

Figure 1 is a simplified illustration of the existing maintenance arrangements. Lines, in general, are tested on a centralized basis from

local test centers. The test centers are equipped with local test desks (LTD) which have access to a number of offices by the use of interconnecting test access trunks. Trunks, on the other hand, are tested on a decentralized basis with each office having a testboard or test frame for maintenance purposes. The integration of the new *Picturephone* service maintenance arrangements into the existing testing areas heavily influenced the physical design of the equipment. In the case of line testing a console type of LTD is used, and for trunk testing an upright frame type of testboard was developed.

III. LINE MAINTENANCE

3.1 *Current Arrangements*

A line provides the communication channel between a customer and his serving central office. The channel is physically outside the office and troubles in it will generally result in the dispatching of personnel for repair purposes. Consequently, there is no need to locate test desks physically in the office served. Each test center is equipped with a

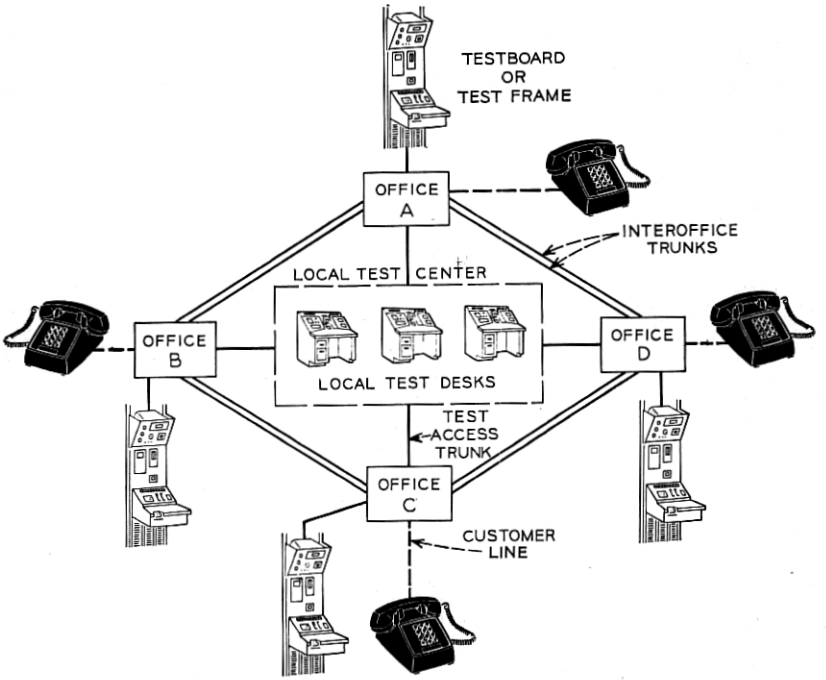

Fig. 1—Line and trunk maintenance arrangements.

number of LTDs as required by the maintenance load and the LTDs provide the necessary access facilities for the offices served. The access to lines in an office is obtained by seizing a trunk to the appropriate office and keying in the desired customer directory (four-digit) number.

For telephone plant, the lines are generally metallic pairs of wires and the tests are of a dc nature, e.g., tests for shorts, opens, grounds, resistance or foreign potentials. The introduction of *Picturephone* service drastically changes the make-up of the customer loop.[2] The signaling and audio information will continue to use a simple wire pair but the video information will be transmitted by two additional pairs, one for transmission in each direction. These pairs require the use of active devices (cable equalizers) to compensate for any losses across the frequency band. What was formerly a simple two-wire line now becomes a six-wire facility with the wideband four-wire portion requiring more sophisticated tests, measurements, and trouble detecting and isolating techniques.[3] The need for expanded test capability and the wideband nature of the facilities all contributed to the need for the development of the new Local Test Desk No. 15.

3.2 *Local Test Desk No. 15*

The LTD No. 15 is a cordless console which provides key-up access to circuits and test equipment (see Fig. 2). The test desk is functionally designed so that most of the *Picturephone* test equipment is on the left-hand side and the audio test equipment is on the right-hand side. The center of the console has a recessed opening for the *Picturephone* station set. In addition, keys and a visual readout associated with the access circuits are located in this area. The test equipment is shared between two access circuits. This allows for two different tests to be conducted on two circuits simultaneously. The console is equipped to serve up to five offices, each having varying quantities of six different types of interconnecting test access trunks. Due to transmission impairments that could be incurred in these trunks, it is necessary, initially, to restrict their length to less than 1500 feet. This in turn implies that the offices served must be in close proximity to the local test center. Figure 3 is a simplified illustration of the test-access trunk arrangements.

3.3 *Test Access Trunks*

The main functions of the LTD are to isolate line troubles, temporarily remove the line from service, and dispatch repair personnel. The six different types of test-access trunks provided permit test personnel

to perform the first two of these functions. The types of trunks and their function are as follows:

(*i*) *Six-wire wideband test trunks.* These trunks provide test personnel with the means for obtaining access and testing the audio and video portions of lines, PBX trunks, and remote switch unit (RSU) links.

(*ii*) *Two-wire test trunks.* These trunks allow tests to be performed on the audio portion of a line without requiring the use of a six-wire wideband test trunk.

(*iii*) *Two-wire MDF trunks.* These trunks permit test personnel to split or bridge the audio line at the main distributing frame (MDF) in order to determine if an audio trouble is in or out of the central office.

(*iv*) *Four-wire MDF trunks.* These trunks permit test personnel to split or bridge the video line at the MDF in order to determine if a video trouble is in or out of the office.

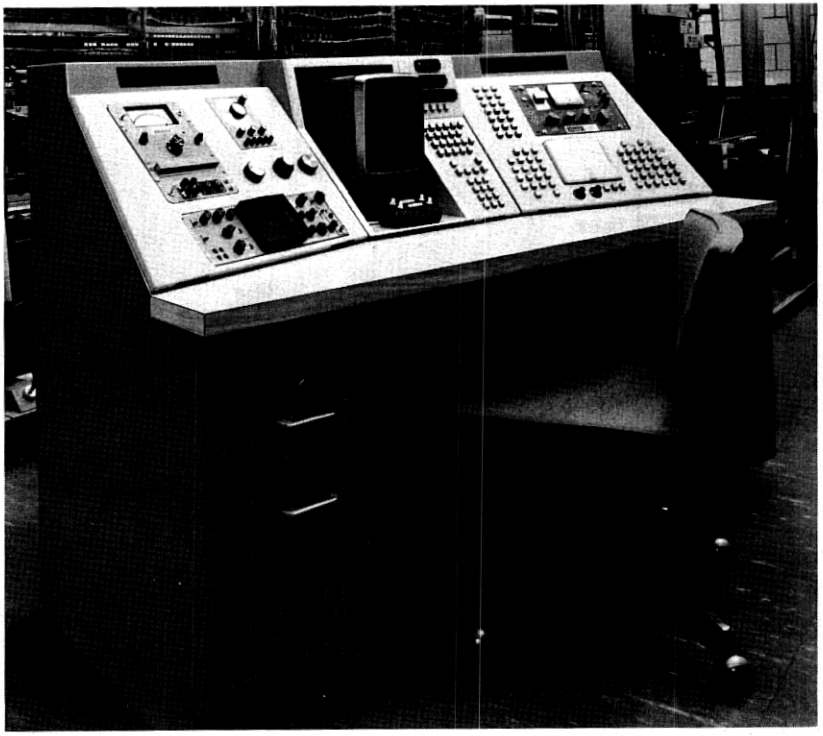

Fig. 2—Local Test Desk No. 15.

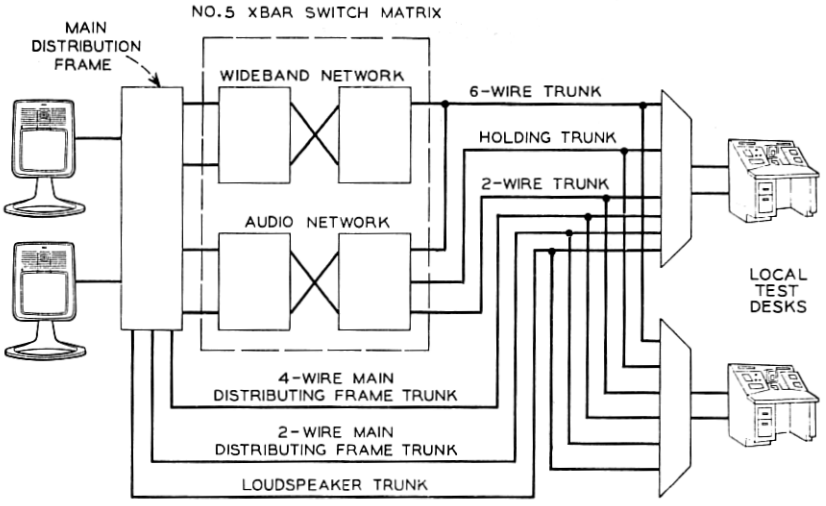

Fig. 3—Test access trunk arrangements, Local Test Desk No. 15.

(*v*) *Loudspeaker trunks.* These trunks are used for communication purposes and allow test personnel to call for assistance at the MDF location.

(*vi*) *Holding trunks.* These trunks allow test personnel to remove a PBX trunk or RSU link from service if trouble is encountered. The trouble would then normally be referred to personnel at the Testboard No. 23.

3.4 *Test Trunk Selection*

The test trunks to the various offices served by a test center equipped with LTDs No. 15 will be shared by each of the test desks in the test center. This is accomplished by providing each LTD with a small switching network. The trunks have multiple appearances on the office side of the network as shown in Fig. 3 and each LTD "bids" for a trunk by means of one of its two access circuits. The bidding for a test trunk involves the following key selections at the LTD:

(*i*) Select one of the two access circuits.
(*ii*) Select the office desired.
(*iii*) Select the type of trunk desired.

Upon the third selection, control circuits in the LTD test to determine which trunks are busy and return a display indicating the status (busy or idle) of each trunk in the group desired. One of the idle

trunks is then selected by a key operation and the LTD is cut through the network to the test access trunk which connects to an incoming test trunk in the desired office. This test trunk is in a loop-back mode, as far as its video pairs are concerned, and at this point looped measurements can be made from the LTD to check the continuity or quality of the looped test trunk to the designated office.

3.5 *Line Access*

Normally, having selected the test trunk, test personnel would key up the necessary digital information to make a line connection, observe a display of the information, and verify it. To access a line this information needs to be spilled forward to the distant office. This is accomplished by a key operation which results in opening the distant office trunk loop-back and bidding for a trunk-test register to receive the digits. The register is attached and a reversal of battery signal is returned to the test desk. This signal activates a temporary store in the test desk and results in the digits being spilled forward. The register receives them, passes the information to the marker, and a connection is made to the line. Figure 4 is a simplified illustration of the arrangement.

3.6 *Local Test Desk—Central Office Communication*

The digital information required by an office for testing in the telephone network is the directory (four-digit) number. With *Picturephone* service, however, additional digits are used to provide a number of desirable and necessary features. For example, if only the video portion of a customer line has been found in trouble, there is no need to bar service on an audio-only basis. Consequently, provision has been

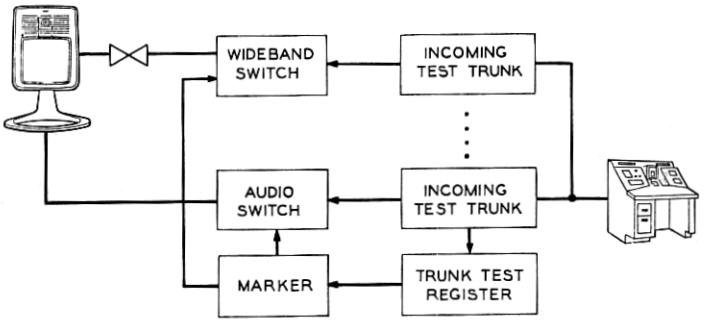

Fig. 4—*Picturephone* line maintenance arrangements.

made for the common control equipment in the office to recognize this and allow non-*Picturephone* calls to be completed. A line in this state is said to be in trap. The test desk needs the ability to place a line in trap, determine if a line is in trap, make a test call to a line in trap, and finally remove the line from trap following its repair. This requires that more than just directory information be passed between the test desk and the switching machine.

In accessing a group of PBX trunks or RSU links,[1] the normal function of the switching machine is to hunt over the group, select an idle one, and complete a connection. In testing *Picturephone* circuits, however, it is desirable to be able to select a particular trunk or link and this also requires passing more information to the switching machine.

As a result of these considerations and others, the No. 5 crossbar common control requires a maximum of 19 digits for completion of an LTD test call. The first five digits provide class information which indicates to the switching machine the type of call being made. Digits 6 through 8 cover special features such as canceling the continuity check, overriding a make busy or inhibiting hunting. Digits 9 through 12 identify the particular RSU link or PBX trunk to be used in the call and digits 13 through 19 identify the station being called. In cases where particular digits are not required for a call, a skip (SK) digit is sent.

Errors are minimized by a provision whereby the keyed digits are temporarily stored in a register and displayed for verification before being spilled forward. In many cases, only a few of the digits will change from test call to test call and for ease of operation a partial erase feature is provided.

3.7 *Trouble Isolation*

The primary function of local test centers is the detection and isolation of troubles in customer lines. Since personnel are ultimately dispatched to clear the trouble, it is essential that troubles be pinpointed as much as possible. The line facilities for *Picturephone* service will generally include active devices or cable equalizers with a loop-back at the key system or station set when it is in the idle mode.[2,3] With this arrangement, faults on the video pairs can be detected by transmitting test signals over the line and observing the returned signal. Should there appear to be a cable equalizer failure, a portable cable equalizer fault locating test set may be used at the LTD to isolate the trouble. With this test set, a major fault can be isolated by interrogating each equalizer with its own preassigned low-frequency signal. If operating,

the cable equalizer will return a signal one half the frequency of the interrogating signal.

Test terminations (Section VII) are also provided at RSUs and PBXs so that the LTD can test the individual links making up a connection. In this use, the test termination would be accessed from an LTD over a particular RSU link or PBX trunk. Upon seizure, the test termination returns a signal which tests the far-to-near condition of this link or trunk. After a timed interval, the test line will then establish the loop-back condition and the test desk can then send a signal over the line, testing the condition of the transmit portion of the link or trunk. These arrangements will enable test personnel at the LTD to analyze and diagnose troubles.

IV. TRUNK MAINTENANCE

4.1 *Planning Considerations*

Trunk testing facilities in the existing telephone network have generally used a dedicated jack arrangement whereby the various test-access points in a trunk circuit are wired to a set of jacks and lamps in a testboard. The lamps are used to provide the trunk status information while jacks provide access to particular leads or points for test purposes. Typically, the transmission and control leads (tip, ring, and sleeve) are brought over by a bridged connection from the trunk circuit and signaling leads are looped through testboard jacks to permit signaling tests. Access to the test equipment is generally made through a set of cords which are manually plugged into the jacks.

The jack access arrangement, normally used in testboards, is undersirable for *Picturephone* trunk maintenance. The use of a multiple off of a wideband pair could cause transmission difficulties because, electrically, it is equivalent to a high frequency bridge-tap stub. An effective method of minimizing this problem is to provide switched access for reaching these pairs. This method of access was provided for both the video and audio transmission pairs. In addition to the transmission testing, however, there is still the need to provide access to the control and signaling leads as well as to get trunk status displays. The most economical means of doing this was deemed to be the use of the direct cabled, jack access arrangement. The Testboard No. 23 was developed with these considerations in mind.

4.2 *Testboard No. 23*

The Testboard No. 23 comprises two individual test positions. One, the transmission test position (TTP) is cordless and key-ended; it uses

switched access through the No. 5 crossbar machine to gain access to the transmission pairs of trunks. The second position, the miscellaneous test position (MTP), is a cord type position which provides jack access to the control and signaling leads of the trunk circuits. The number of MTPs depends primarily on the number of trunks in an office while TTPs will be provided as required by the maintenance load.

4.2.1 *Transmission Test Position*

The TTP is a cordless, upright test position which provides key-up access to circuits and test equipments (see Fig. 5). Access to test trunks is obtained by selecting one of two access or position circuits and bidding for the test trunk by a key operation. The access to circuits to be tested is provided by keying-up the necessary digital information, observing a display of the keyed information, verifying, and then spilling the information forward to the switching machine. This is accomplished by a key operation which results in a trunk test register being attached to the incoming test trunk in the office (see Fig. 6). The register returns a reversal of battery signal which activates a temporary store in the testboard and results in the digits being spilled forward. The register receives these, passes the information to the marker, and a connection is set up. All audio and wideband transmission testing is done from this position and various test sets can be switched into the circuit through the use of associated keys. In addition, a jack-ended arrangement is provided to permit the use of miscellaneous, low frequency, portable test equipment at the position.

4.2.2 *Transmission Test Position—Central Office Communication*

The primary function of the testboard is the testing of the interoffice trunks, PBX trunks, and RSU links. To accomplish this, the testboard has access to the two sides (line link and trunk link) of the No. 5 crossbar network and more digital information is required by the switching machine to service test calls then in the case of the LTD. The information required for handling a test call from a testboard consists of a maximum of 27 digits. The first six digits provide class information which indicates to the switching machine the type of call being made. Digits 7 through 10 identify the particular office trunk to be used in the call. Digits 11 through 13 cover special features such as canceling the continuity check or overriding a make busy. Digits 14 through 17 are used to identify the particular RSU link or PBX trunk to be used in the call if the call is to an RSU or PBX. Digits 18 through 27 provide the destination address. In cases where a digit is not required for making a particular test call, a SK

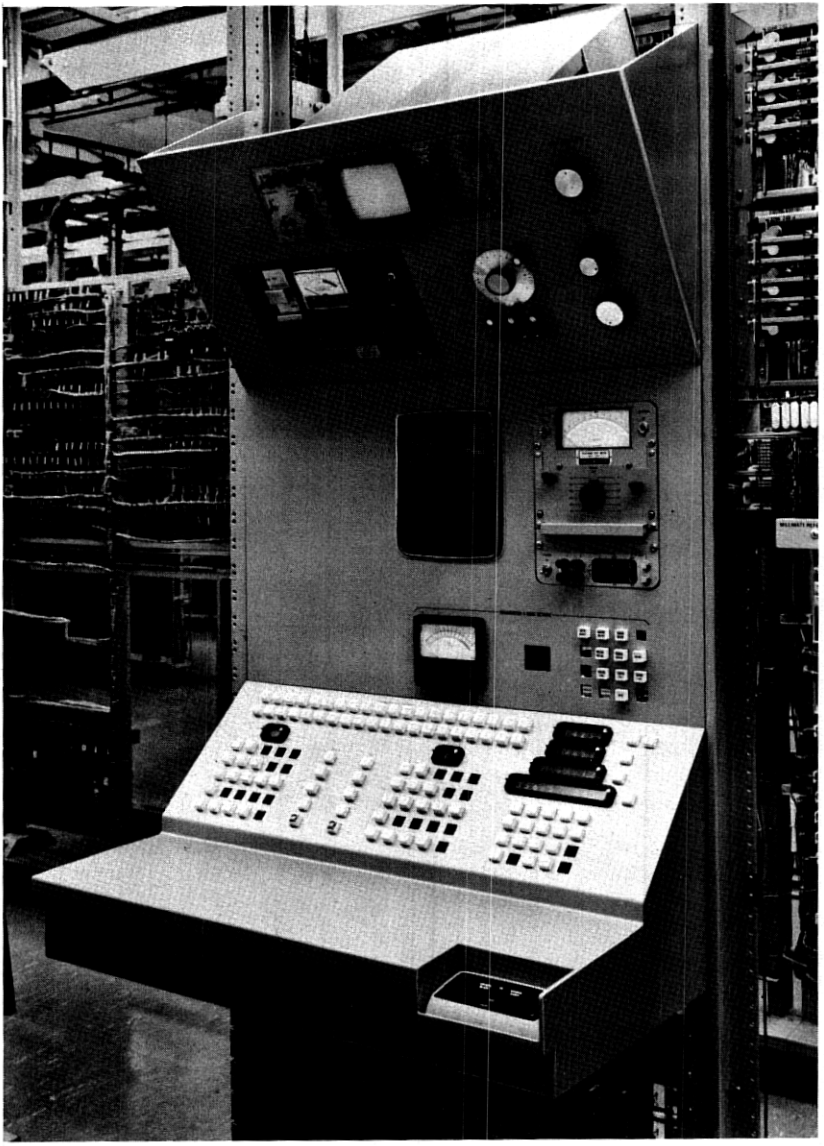

Fig. 5—Testboard No. 23, Transmission Test Position.

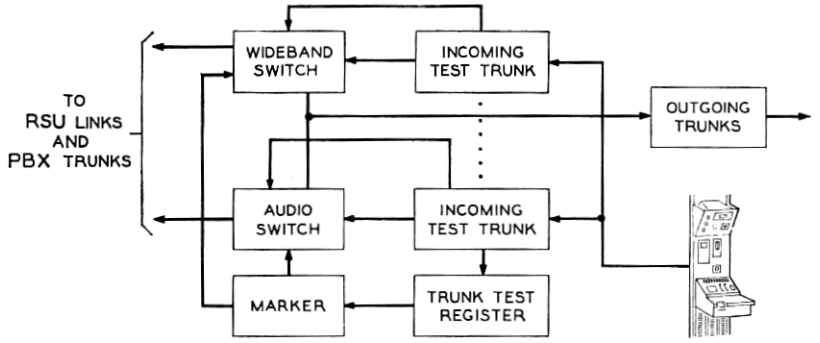

Fig. 6—*Picturephone* trunk maintenance arrangements.

digit is sent. If, for example, a test call is being made to a distant office, there are no RSU links or PBX trunks involved. In this case, digits 14 through 17 would be SK digits.

Errors are minimized by temporarily storing and displaying the digits before outpulsing. Provision is made to allow partial erasures of groups of digits in the event an error is made. This also reduces the number of digits that needs to be dialed when successive test calls are of a similar nature and where only the address information is changing.

4.2.3 *Miscellaneous Test Position*

The switched access to transmission pairs in the TTP is possible since these pairs have an appearance on the No. 5 crossbar network. In the case of lines, these pairs are the only access points needed for testing purposes. Trunks, however, are somewhat different for it is necessary to have access to additional points in order to perform signaling tests, remove from service, restore to service, and to obtain individual and group status displays. The access points necessary to provide these functions do not have appearances on the network and consequently another means of providing the access is necessary.

The MTP accomplishes this and provides the required access to the nonswitchable test points necessary for trunk maintenance. Access is provided by directly cabling, on a multiple or loop-through basis, the trunk leads required and by providing a set of dedicated jacks and lamps per trunk. The position is a manual one where access to test points is obtained by plugging cords in the proper jacks. The position is an upright frame type (see Fig. 7) with the same profile as the TTP.

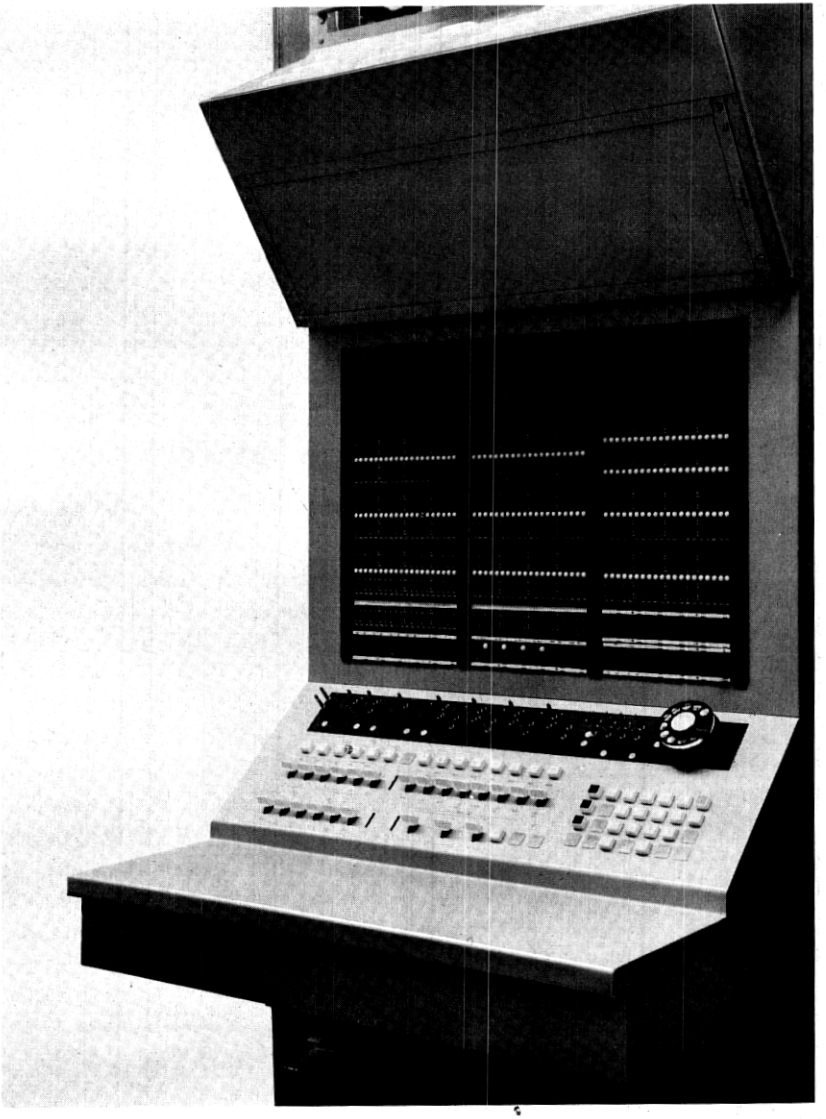

Fig. 7—Testboard No. 23, Miscellaneous Test Position.

V. WIDEBAND MOBILE TEST BAY

5.1 *Introduction*

In the early years of *Picturephone* service, there will be a need in some offices for an initial "get-started" maintenance arrangement until the standard line and trunk maintenance facilities (LTD No. 15 and TB No. 23) become available. The Wideband Mobile Test Bay (WBMTB) is intended to satisfy this need.

5.2 *Description*

The WBMTB (see Fig. 8) is a roll about type of cabinet containing the same wideband test equipment that is provided in the test desk and testboard. It is designed to provide a convenient, compact housing arrangement for the wideband test sets. The master test frame or other office equipment provides the means for the WBMTB to gain access to lines or trunks.

5.2.1 *Wideband Mobile Test Bay Arrangements*

The WBMTB will be used in three different arrangements. The first arrangement provides for using the WBMTB in the master test frame (MTF) area. In this case, the WBMTB uses the MTF to gain switched access to a line or trunk. Testing is done by connecting the WBMTB to the circuit by use of a cord. The various test sets are then connected by operating keys associated with the test sets. In some offices this arrangement may be undesirable due to the additional work load or demands on the MTF and also if the maintenance section is an area of high activity.

A second arrangement is provided where the work load is not a problem but where it would be desirable to do the testing at another location. In this arrangement, the MTF still provides the means for accessing the circuits. The circuits, however, are trunked over to an auxiliary test location where the WBMTB is located.

A third arrangement is provided for situations where the additional work load on the MTF is undesirable. In this arrangement the auxiliary test location has access to an incoming test trunk and is equipped with a priming set circuit and the WBMTB. The incoming test trunk is similar to the trunk used with the Testboard No. 23. This trunk is arranged to have access to the trunk test register in the office. The priming set circuit is designed to provide an equivalent means to keying up the digits necessary to access lines and trunks. This is accomplished by providing selector switches rather than a key set and regis-

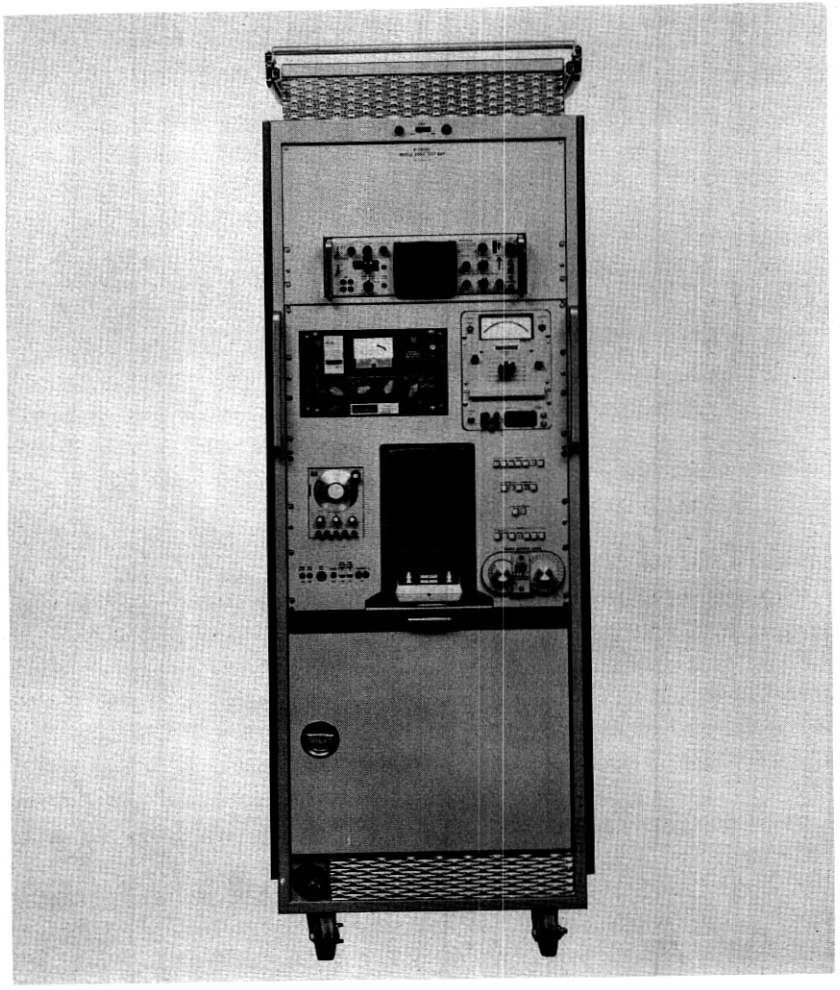

Fig. 8—Wideband mobile testbay

ter. A line or trunk is accessed by setting the priming set circuit switches to the proper digits and operating a start key. The incoming test trunk is then seized and when a register attached indication is returned, the digits are spilled forward on an MF basis and a connection is established. Testing can then proceed.

VI. TEST EQUIPMENT

6.1 *Background*

It is evident that considerable testing experience will be necessary

before an optimum set of tests or test equipments can be specified. In view of this and the desire to start service as early as possible, general purpose test equipment is specified which is deemed to be sufficient for system maintenance and to obtain the necessary experience. The test sets chosen are:

(*i*) A wideband oscillator,
(*ii*) A wideband voltmeter,
(*iii*) A video waveform oscilloscope,
(*iv*) A *Picturephone* test signal generator,
(*v*) A *Picturephone* noise measuring set, and
(*vi*) A *Picturephone* station set.

6.2 *Test Sets*

6.2.1 *Wideband Oscillator*

The wideband oscillator has a frequency response from 4 Hz to 2 MHz. In the frequency range of 30 Hz to 1 MHz the output is specified to be flat to within ±0.1 dB. This permits rapid measurements of transmission characteristics without constant need for readjustment of the output level. The oscillator is capable of delivering +3 dBV into 100 ohms with an output resolution on its level control of less than 0.05 dB. The distortion products in the output signal are less than −40 dB. The frequency accuracy is given as within ±3 percent of the dial setting.

6.2.2 *Wideband Voltmeter*

In the main, this instrument is used with the oscillator for gain-frequency measurements. The range of the voltmeter is specified as extending from −60 dBV to +10 dBV. While the signal levels, in general, will not be as low as −60 dBV it may be necessary to measure noise in this range. The upper range has been chosen on the basis of measuring signals on misaligned systems or running overload tests. The level accuracy of the instrument is ±0.1 dB in the range from 30 Hz to 600 kHz. Outside of this range the specification is relaxed in accordance with required low end and high end *Picturephone* roll-off characteristic. In addition, a "3 kHz Flat" filter may be selected. The instrument, with this filter, may be used for noise measurements in this frequency range. This will supplement the noise measurements made by the *Picturephone* noise measuring set which has a low frequency cutoff of 4 kHz.

6.2.3 *Video Waveform Oscilloscope*

One can select and display, (with the instrument being used for

waveform observation), either of the interlaced fields. A variable line select control is featured so that any line in a particular field can be observed. A discrete line select position is also available so that the eighth line in a field is displayed. It is intended that this feature be used with a specific signal generated by the *Picturephone* test signal generator (see part (*ii*) in Section 6.2.4). The amount of tilt observed on this eighth line is a measure of the low-frequency performance of an intervening transmission medium.

The horizontal linearity of the oscilloscope is ±0.5 percent of full scale. Multiplication of the horizontal sweep rate (time-scale magnification) by 5 or 25 is also available. In addition, external sync and free-run modes of operation are provided. (The free-run mode is useful for observation of noise or crosstalking signals.)

An internal calibration signal is available for checking the vertical display of this instrument. This calibration signal allows for a stated accuracy of ±1 percent of full scale deflection. The required range of input levels is from 0.2 V peak-to-peak to 2.0 V peak-to-peak. An additional 12-dB gain switch is provided. This permits vertical magnification of portions of the input signal. An internal graticule eliminates any parallax error when making measurements on the 8-cm by 10-cm display screen.

Since the video information portion of the *Picturephone* signal is preemphasized, and the sync pulses are not, a response switch has been provided to allow for:

(*i*) Viewing sync pulses (with video information still preemphasized).
(*ii*) Viewing the deemphasized video (with the sync pulses being distorted because of the deemphasis process).

In addition, this switch allows for:

(*iii*) Viewing the 512-kHz modulation stripped from a differential gain (modulated stair-step) signal.

6.2.4 Picturephone *Test Signal Generator*

The *Picturephone* test signal generator has been developed for transmission and CODEC testing. The generator provides seven selectable waveform patterns, some of which are shown in Fig. 9:

(*i*) A white centered window, as it will appear on a station set, is produced by the signal shown in Fig. 9a-1. Such a display makes ringing and overshoots evident. The generator can also modulate this signal with a 256-kHz square wave as indicated by Fig. 9a-2.

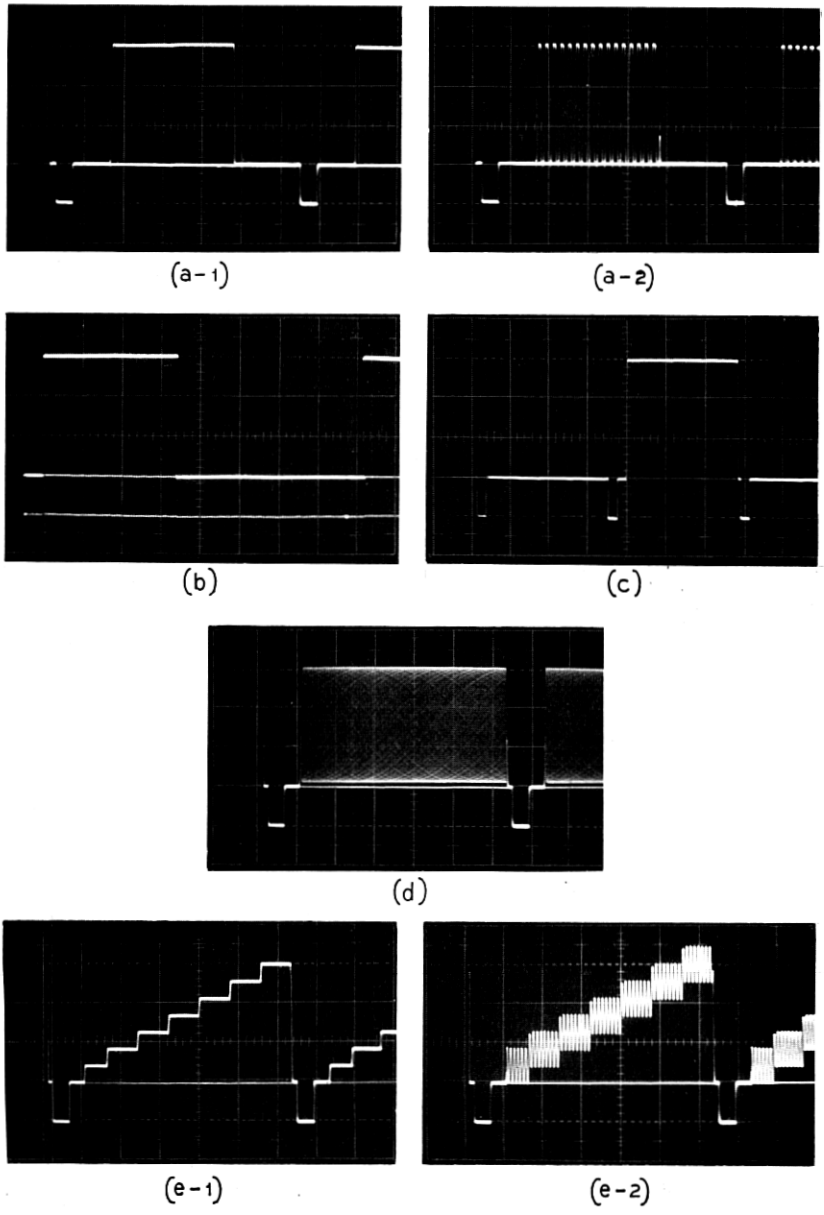

Fig. 9—(a-1) One-half white centered. (a-2) One-half white centered with 256-kHz modulation. (b) Half white, half black. (c) Interconnecting Unit test signal. (d) Externally modulated signal. (e-1) Stair step signal. (e-2) Stair step signal with 512-kHz modulation.

(*ii*) A field time modulation waveform which will produce a picture on the station set that is half white and half black (horizontal dividing line) is shown in Fig. 9b.

(*iii*) A signal which will produce a 4-kHz fundamental component for testing Interconnecting Units. See Fig. 9c.

(*iv*) A 256-kHz square wave without sync or blanking is provided for CODEC testing.

(*v*) A standard sync signal with the video containing a 1/2 white pedestal. This signal can be modulated by an externally derived signal. Fig. 9d illustrates this pattern with modulation.

(*vi*) A seven step-staircase signal with or without a 512-kHz locked sine wave modulation. This signal would provide a grey scale as viewed on a station set. See Figs. 9e-1 and 9e-2.

(*vii*) Sync format only.

Any of the above patterns can be transmitted either with or without preemphasis.[4]

One form of the *Picturephone* test signal generator permits it to be operated from a remote position. Such a unit is located on a miscellaneous equipment bay associated with the local test desk and testboard. The selection of patterns and necessary control functions is provided by switches and keys in the test desk and transmission test position.

6.2.5 Picturephone *Noise-Measuring Set*

In another paper[4], the system requirements are given in terms of percentage time that the noise exceeds a specified level. This can be translated to the number of peaks exceeding a preset threshold by assuming an average effective duration for the noise bursts. This test set counts the number of those noise peaks that exceed a preset threshold level within a preset time interval. It is used also for making background rms noise measurements in the range from 0 to 100 dBrn. The measurement range for impulse noise is from 30 to 100 dBrn in 1-dB steps. Its maximum counting rate is six counts/second on an internally contained mechanical counter. When used with an external electronic counter, it can give indications of 5000 counts/second. It contains a spring-driven timer adjustable from 0 to 15 minutes which shuts off the set at the end of a preset interval. A continuous hold position is also provided. Essentially, this instrument has a bandwidth extending from 4 kHz to 560 kHz. Other shaped bandwidths such as *Picturephone* noise weighting may be selected by means of plug-in filters. The longitudinal balance of this instrument is greater than 70 dB at 25 kHz and greater than 42 dB at 560 kHz. This instrument has an accuracy of ± 0.5 dB and contains an internal means for calibration.

6.2.6 Picturephone *Station Set*

This is a standard 2C video telephone station set used for communication purposes, for confirming trouble conditions, and for observing the effect of transmission impairments on any video test signal.

VII. TRANSMISSION TEST TERMINATIONS

7.1 *Background*

Transmission test terminations are circuits, which upon seizure, assume a particular state, or sequence through a number of states while returning preset signals for each of the states assumed. Test terminations may appear on the line or trunk side of a network. On the line side, seven digits are required to access the termination and they are referred to as test lines. On the trunk side, three digits of a 10X type are generally required to access the termination and they are referred to as test trunks or 10X trunks. The function of a test termination is to provide one-person transmission, signaling, or operational test capability.

7.2 *Wideband Transmission Test Terminations*

Three transmission test terminations are being provided for *Picturephone* service:

(*i*) The station video test termination,
(*ii*) The wideband 100 type test termination, and
(*iii*) The wideband 102 type test termination.

7.2.1 *Station Video Test Termination*

The station video test termination permits an installer to check the picture quality and *Picturephone* ringing feature of a station set. The test termination is accessed by dialing a special code from the station set being installed. Upon seizure the test termination transmits both a video and audio signal to the station. These signals are used to check the quality of the loop. A ringing test can be performed by flashing the switch hook and hanging up. Upon answer, the test termination establishes a loop-back condition only on the video pairs. The picture quality can be further observed by the installer viewing himself over this central office loop-back and comparing this with the picture that results when he views himself on a local loop-back in the station set.

7.2.2 *The Wideband 100 Type Test Termination*

The wideband 100 type test termination provides a means for mak-

ing far-to-near noise measurements on the video and audio pairs of trunks. This test termination is accessed by dialing a special code which may be 100 if it is on the trunk side of the network; seven digits if on the line side of the network. In either case, upon seizure the test termination will return a 10-second, 1-kHz, −10dBV tone over the video pair. At the end of this time the termination will remove the tone and terminate the audio and video pairs. The test termination will remain in this state while permitting a noise measurement to be made. After an automatic time out, it will return to its idle state with the video pairs looped-back and the audio terminated.

7.2.3 *The Wideband 102 Type Test Termination*

The wideband 102 type test termination provides a means for making loss measurements on the video and audio pairs of trunks. This test termination is accessed by dialing a special code which may be 102 if the termination is on the trunk side of the network; seven digits if on the line side of the network. In either case, upon seizure, this test termination will return a 20-second, 1-kHz, −10dBV tone over the video pair and a 40-second, 1-kHz, 0 dBm tone over the audio pair. These signals are used for far-to-near loss measurements. At the end of the 20-second interval, the signal on the video pairs is removed and a video loop-back condition is set up for 20 seconds. This permits a loop-back loss measurement to be made on the video pairs. At the end of 40 seconds, the video loop-back is removed along with the tone on the audio pair.

VIII. SUMMARY

The line and trunk maintenance arrangements for the initial years of *Picturephone* service have been designed to provide a high degree of flexibility. The test equipment is sufficiently general to individually and collectively provide a wide range of test capability. This is particularly important in the early years as experience is gained and improved test methods are evolved.

The switched method of accessing circuits provides a versatile arrangement for testing the audio portion of trunks as well as providing the necessary access to the video portion. Incorporated in this arrangement is the new capability of exercising some control over the switching machine by directing it to cancel or override certain normal machine actions. Overall, the arrangements provide not only wideband test capability but also greater flexibility in the maintenance of lines and trunks.

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