SWITCHED SERVICES NETWORKS
USING CENTRAL OFFICE SWITCHING MACHINES
TRANSMISSION TESTING METHODS
IN 4-WIRE NO. 5 CROSSBAR OFFICES

CONTENTS PAGE

1. GENERAL

1.01 This section describes methods for transmission testing in 4-wire No. 5 crossbar offices used in Switched Services Networks. The methods are based on the use of the 19A testboard and associated facilities. The 4-wire No. 5 office may be a class SS-3 or higher office in the hierarchy type SSN or an inner or middle ring office in the hub type SSN. These arrangements are described in Section 310-200-100. The tests described in this section are performed to meet the requirements on circuit orders and at routine intervals as specified in Section 310-200-300.

1.02 Part 2 of this section dealing with transmission tests on network trunks describes the procedures to be used at a control office. The distant office, either 2-wire or 4-wire, may refer to this part of the section also when assisting with the tests.

1.03 Parts of this section dealing with tests on access lines and subscriber lines assume that the testman at the distant PBX or station will call in when ready for tests and will then assist in tests under the direction of personnel at the 19A testboard.

1.04 Description of the 19A testboard and its operation is found in Section 310-280-100 and associated sections. It is necessary that the milliwatt supplies and transmission measuring equipment be accurately calibrated in accordance with their associated sections, and that all test pads be adjusted carefully in accordance with Section 310-280-300.

1.05 The following test equipment may be required for the various tests covered by this section:

1. KS-19260 Oscillator and 23A TMS or KS-19353 Portable Oscillator and 23A TMS or 21A TMS or Northeast Electronics TTS-4 equipped with variable frequency cover.
2. 6D Noise Measuring Panel or 3A Noise Measuring Set and 6A Impulse Counter.
3. Envelope Delay Measuring Sets — KS-15877 Transmitter and KS-15877 Receiver or equipment.

The following sets may be useful:

4. 901A or B Data Test Set.
5. 902A or B Data Test Set.
6. 903A or B Data Test Set.

1.06 When making routine tests or trouble investigations requiring that a facility be taken out of service, a customer release of the circuit must be obtained in accordance with ad-

ministrative practices, before starting tests. When the circuit is returned to service, it should be reported in the proper manner and the customer notified if appropriate.

1.07 When a testman is required at a PBX or subscriber station, he may also refer to this section when assisting on tests. Additional information on testing methods at PBX's is contained in Section 310-200-502. Additional information testing methods at subscriber stations is provided in Section 310-200-503.

1.08 This section uses the terms expected measured loss (EML) and actual measured loss (AML) and these terms are applied in the same manner as in the DDD network. They are defined in Section A304.478.01/E26.040.01.

1.09 The use of balance test lines, as prescribed in this section for impulse noise measurements, assumes that the test line is modified to eliminate the pulses of noise due to timed disconnect. Where the test line is not modified, it will be necessary to make the measurements on a manual basis.

1.10 Dial test lines are referred to in this section by their 100 series code designation or an equivalent. When dial test lines are terminated on a line link frame, they will generally be reached by pulsing forward an AB+5 telephone number. When terminated on a trunk link frame, they may be reached by either an arbitrary NNX code or an NNX-XXXX telephone number. This arrangement is required in some offices to permit access and station lines to reach the dial test lines for testing purposes. In 4-wire offices serving more than one network, the test code is usually preceded by a digit to segregate the test lines for each network. A local directory of test lines should be kept at each office.

1.11 Transmission tests are made using the Transmission and Noise Measuring Circuit per SD-95900-01. Except as otherwise noted, circuits are connected to the TST MEAS, 101-MEAS or SUB-MEAS jacks as appropriate for testing. When portable or bay mounted test sets are to be used, they are connected through the VF IN jack or other jacks as specified. A simplified diagram of the arrangement is shown in Fig. 1. For detailed instructions on operation of the circuit, see Section 310-280-501. Delay distortion measurements require the use of the circuit patch bay. If the distant office is 2-wire and not equipped with a circuit patch bay, then it will be necessary to test at the 2W IN jack on their No. 1 type term set.

2. TESTS ON NETWORK TRUNKS

(A) General

2.01 Network trunks may interconnect two 4-wire No. 5 offices. Fig. 2 shows a typical arrangement of this type of circuit and the test points normally provided. Another type of trunk is one interconnecting a 4-wire No. 5 office and a 2-wire No. 5 office. A typical arrangement, with test points, is shown in Fig. 3.

2.02 When the trunk is of the type shown in Fig. 2, the higher class office will usually be assigned control of the trunk. If they are of the same rank, the control office is designated on the CLR card. When the trunk is of the type shown in Fig. 3, the 4-wire office will normally be designated the control office. In any event, the CLR card will always indicate the control office.

2.03 This part of the section is prepared to cover testing methods at a 4-wire control office. Additional comments are added to direct the noncontrol office, however, so that both offices may work from the same instruction. When a 2-wire No. 5 office is assigned as circuit control, the testing should be done in accordance with Section 310-200-501.

2.04 In addition to the normal work that is done on circuit orders in advance of transmission testing, certain other tests should be made which can have an effect on transmission. They are:

(a) Over-all pulsing tests, particularly when the circuit consists of various facilities in tandem, in accordance with Plant series practices, division 179.

(b) Echo Suppressor tests on circuits equipped with controlled echo suppressors. Call-Through tests should be made to insure that the suppressor functions properly in response to control signals in addition to tests prescribed in Sections E26.171 and E33.353.

(B) Over-All Transmission Tests

2.05 ***1000-Cycle Loss Measurements*** **—**

(a) On circuit Order Tests, proceed as follows:

Step 1 — Seize the trunk at its test jack and pulse forward the code to reach the distant code 101 trunk.

Step 2 — When the distant office answers, request 1000-cycle test tone to be sent for a few seconds. Measure the received level using the TEST-MEAS jack.

Step 3 — Request the distant office to measure. Send 1000-cycle test tone for a few seconds and obtain the distant office measurement.

Step 4 — Record the AML (Actual Measured Loss) in each direction. For this test the meter reading is equal to — (AML) dbm. Compare with the EML's shown on the CLR card.

(b) Routine tests may be made to code 104 or equivalent if available. Proceed as follows, using the TEST-MEAS jack for all tests:

Step 1 — Seize the trunk at its test jack and pulse forward the code to reach the distant code 104 test trunks.

Step 2 — Observe for the start signal. When received, send 1000-cycle test tone for 1-3 seconds.

Step 3 — Return to the measure condition. The distant test line will start to send 1000-cycle test tone. Read the received level. After a few seconds, the level will drop. Read the received level again.

Step 4 — Adjust the meter readings to AML. The first reading is the far-to-near measurement. The meter reading is — (AML) dbm. Subtract the second reading from the first reading. The result is equal to the AML for the near-to-far direction. Compare with the EML's shown on the CLR card.

For more detailed information on the methods of testing with code 104, see Section A702.685/-E40.752.

2.06 ***Attenuation-Frequency Tests*** — These tests are made on circuit order, if equalization is not required. When circuits are equalized, these tests are superseded by those in Par. 2.09. Proceed as follows:

Step 1 — Seize the trunk at its test jack and pulse forward the code to reach the code 101 trunk at the distant office. When the distant office answers, arrange to have test tone sent on each of the following frequencies in order — 300, 700, 1000, 2300, 3000 cps.

Note: (Anyone of several variable and step type oscillators may be used. Regardless of type, the output should be measured and adjusted to send 0 dbrn at the VF IN jack at each frequency.)

Step 2 — Measure and record the received level at each frequency, using the TEST-MEAS jack.

Step 3 — Arrange with the distant office to take measurements. Send test tone on each of the following frequencies in order — 300, 700, 1000, 2300, 3000 cps. (Check oscillator output at each frequency. It should be adjusted to send 0 dbrn at the VF IN jack.)

Step 4 — Record the meter reading taken on each frequency at the distant office.

Step 5 — Compare the meter reading at each frequency with the meter reading at 1000 cycles. Compare these difference figures with requirements. If there appears to be an irregularity, make additional tests at intermediate frequency steps to verify if there is trouble.

2.07 ***Steady Noise Measurement*** — Steady noise measurements must be made during the busy hour in both directions of transmission in order to show the worst after the 1000 cycle or attenuation frequency loss measurements, while the circuit is in the test condition. Simultaneously each office connects its noise measuring circuit. Both are properly terminated if the SEND-REC keys are in the REC position. Correct all readings as specified below. On routine

tests, the following procedure may be used, with the control office coordinating, if balance test lines are available:

Step 1 — Alternately at each office, seize the trunk at the test jack and pulse forward the code to reach the balance test line at the distant end.

Step 2 — When ringing is tripped, connect the circuit to the noise measuring circuit and make a noise measurement.

Step 3 — Record the meter reading in each direction. Correct it by adding the AML and compare with requirements.

2.08 ***Impulse Noise Measurements*** — These measurements are required in both directions of transmission. They require a half hour of testing time during the busy hours to determine the worst noise condition. The control office makes tests in one direction and coordinates the tests of the distant office in the opposite direction. The following procedure is used at either office:

Step 1 — Determine the correction of the noise measurement. The requirement is 59 dbrnc 0. The correction is equal to the 1000 cycle AML. Subtract it from 59 dbrnc 0 and set the level control on the 6A Impulse Counter to the corrected value. If the knob cannot be set to this value, use the next higher setting. It is connected to the CONN cord through conversion jacks.

Step 2 — Seize the trunk at its test jack and pulse forward the code to reach the distant balance test line. After the ring is tripped connect the 6A Impulse Counter.

Step 3 — Set the timer of the counter to 30 minutes and start it in operation per Section E40.467. The test will proceed automatically without attention from the testman. When the timer has stopped, read the counter.

2.09 ***Attenuation-Equalization Tests*** — When the trunk is equalized to adjust the attenuation-frequency characteristics, these tests supersede the attenuation-frequency tests of Par. 2.06. Section 310-200-300, Table 5 provides the requirements for several types of treatment. Other requirements may also be furnished by local instruction. The requirement to be met will be indicated by a code on the CLR card or by local instruction. The testman must know the requirements before proceeding. The procedure of Par. 2.06 may be used to set up the circuit and make measurements, with the following exception — test at 100-cycle intervals in the frequency range 300-1000 cycles and at 200-cycle intervals in the frequency range 1000-3200 cycles. Check the oscillator output at each frequency.

2.10 ***Delay Equalization Tests*** — Special treatment may be provided to equalize the effect of envelope delay distortion. This consists of the use of delay equalizers. The equalizers are specified on the CLR card. They may be fixed or variable. When the equalizers are variable, the setting may be specified, or a nominal setting may be used for initial tests. The requirements for several types of treatment are indicated in Section 310-200-300, Table 6, and other special treatment may be specified in local instructions. The set of requirements to be met is indicated by a code on the CLR card or by local instructions. The testman must know the specific requirements before beginning tests. The tests require the use of the KS-15877 Transmitter and the KS-15878 Receiver or equivalents. Instructions on measuring techniques with this equipment are provided in Section E40.673.1. The test procedure is as follows:

Step 1 — Connect the measuring equipment and allow it to stabilize for 30 minutes. Request the distant office to do the same.

Step 2 — Establish a talking circuit with the distant office via order wire and arrange to begin the tests.

Step 3 — Seize the trunk to be tested and pulse forward the code to reach the code 101 trunk at the distant office.

Step 4 — Request the distant office to connect a delay test receiver at their circuit patch bay. Connect the delay test transmitter to the LXMT jack at the circuit patch bay.

Step 5 — Proceed with delay measurements as specified in Section E40.673.1.

Step 6 — After completion of the tests, request the distant office to connect a delay test transmitter at their circuit patch bay. Connect a delay test receiver to the L-RCV jack at the circuit patch bay.

Step 7 — Repeat the delay measurements in the other direction of transmission.

If adjustable equalizers are provided, the tests are repeated with different settings until the requirements are met. If the requirements cannot be met with the equalizers specified on the CLR card, the equalizers should not be changed. The data should be forwarded through lines of organization for corrective action.

2.11 ***Emergency Transfer Tests*** — When an Emergency Transfer Circuit is provided in the control office, the control office makes the tests below. When it is furnished at the distant office, the distant office makes the same tests. The procedure is as follows:

Step 1 — Seize the trunk at the trunk test jack and pulse forward the code to reach the distant milliwatt test line. Measure the received level.

Step 2 — Operate the Emergency Transfer circuit.

Step 3 — Seize the trunk at its manual appearance and pulse forward the code to reach the distant milliwatt test line. Measure the received level. The circuit should function properly, and the second level measurement should be within ± 0.5 db of the first.

Step 4 — Request the distant office to originate a call over the trunk in the transferred condition. Verify that it functions properly.

3. TESTS ON ACCESS LINES

(A) General

3.01 Access lines interconnect the 4-wire No. 5 Crossbar office with the customers' PBXs. The PBX may be a No. 5 CENTREX, and the general arrangement of such a circuit, and its test points, is shown in Fig. 3. This arrangement utilizes a carrier channel. In some cases, the access line utilizes a carrier channel and is extended on cable facilities.

3.02 Other types of PBX are used. When the distance is short the access line may consist only of cable pairs as shown in Fig. 4. When the distance is great, the line may consist of a carrier channel extended on cable pairs as shown in Fig. 5. An arrangement for manual PBXs is shown in Fig. 6.

3.03 Tests to No. 5 CENTREXs' are made to dialable test lines or to a jack ended test trunk at the master test frame. Two-man tests are made in the usual manner if the office is attended or by prearrangement if the office is unattended.

3.04 When PBXs are not equipped with dial test lines, all tests are made on a two man basis by prearrangement to a listed number appearance or manual appearance in the PBX switchboard multiple. The termination jack is always used. The test procedures in this part of the section assume that prearrangements are made and that the distant testman calls in when available for testing.

3.05 In addition to the normal work associated with circuit orders in advance of transmission testing, certain other tests should be made which can have an effect on transmission. They are:

(a) Over-all pulsing tests, particularly when the circuit consists of various facilities in tandem.

(b) Echo suppressor tests in accordance with Sections E26.171 and E33.353 if suppressors are required.

(c) Balance tests at the PBX, if required, in accordance with Section 310-350-500.

3.06 The following procedures apply on all access lines with jack appearances at the testboard. Those not equipped with test jacks must be tested using the 7M jack at the master test frame.

(B) Over-All Transmission Tests

3.07 ***1000-Cycle Loss Measurements*** — Circuit order tests are made to terminations at the PBX as follows:

(a) No. 5 CENTREX — To a jack ended test line at the MTF.

(b) Dial PBX — To a jack ended test line terminated as extension or to listed number appearance in the switchboard multiple (terminating jack).

(c) Manual PBX — To switchboard appearance.

Proceed in the following manner using the TEST-MEAS jack:

Step 1 — Seize the circuit at the test jack and pulse forward the number to reach the PBX test jack or ring on the line.

Step 2 — When the distant testman answers, request that 1000 cycles be sent at 0 dbm. Measure and record the received level.

Step 3 — Request the distant testman to connect a TMS. Send 1000-cycle test tone. Record the level measured at the distant end.

Step 4 — Compute the AMLs. The measured level in each direction −(AML) dbm.

Routine tests to PBXs not equipped with dial test lines are made in the same manner as circuit order tests. When dial test lines are provided, make routine tests in the following manner:

Step 1 — Seize the access line at the test jack and pulse forward the number to reach the distant milliwatt test line. Record the received level.

Step 2 — In the same manner, measure the far-to-near direction on all other access lines in the group. Record the received levels.

Step 3 — Compute the far-to-near AML's as above.

Step 4 — Select an access line as a test circuit and pulse forward the number to reach the milliwatt test line again. Connect the test circuit to the measuring circuit.

Step 5 — Seize another access line in the same group and pulse forward the number to reach the distant loop-around test line. Send 1000-cycle test tone on the second line. This step must be done at an adjacent position. It may be done at the same position if the CONN cord of the second pair can be connected to a 600-ohm oscillator arranged to send 1000 cycles at −2 dbm.

Step 6 — Read and record the received level from the test circuit.

Step 7 — In the same manner test all other access lines, leaving the measuring circuit connected at all times to the test circuit. Record the received level for all access lines.

Step 8 — Compute the AML's for the near-to-far direction. Subtract the loop-around measurement for each access line from the measured received level of the test circuit when connected to the distant milliwatt supply. The difference is the AML in the near-to-far direction for each line.

3.08 ***Attenuation Frequency Tests*** — Circuit order and routine tests are made in the same manner. They are made to jack ended test trunks or switchboard appearances at the PBX as described at the beginning of Par. 3.07. If the facilities are to be equalized, these tests are superseded by those in Par. 3.11. Proceed in the following manner:

Step 1 — Seize the access line at the test jack and pulse forward the number or ring on the line to reach the distant PBX test jack or switchboard appearance.

Step 2 — When the distant testman answers, request that an oscillator be connected to the test jack and arranged to send at 0 dbm for several seconds on the following frequencies: 300, 700, 1000, 2300, 3000 cps. The oscillator output at the distant end should be checked at each frequency. Measure and record the received level at each frequency.

Step 3 — Request the distant testman to connect a TMS to the distant test jack. Send test tone for several seconds on each of the following frequencies: 300, 700, 1000, 2300, 3000 cps. Connect the oscillator through the TEST MEAS jack and VF IN jack. Set

the oscillator to 0 dbm at each frequency. Obtain and record the levels measured at the distant PBX.

Step 4 — Subtract the measurements at each frequency from the measurements at 1000 cycles and compare the differences with requirements.

3.09 ***Steady Noise Measurements*** — Steady noise measurements may be made on circuit order while the circuit is connected for 1000-cycle loss measurements. Proceed in the following manner:

Step 1 — Request the distant testman to connect a 900-ohm termination at the distant PBX. Connect the noise measuring circuit through the TEST MEAS jack and make a noise measurement.

Step 2 — Connect a 600-ohm termination to the test jack on the transmit side (SEND-REC key to REC). Request the distant testman to make a noise measurement with a 3 ANMS.

Step 3 — Record the meter readings. Correct them by adding the AML, and compare with the noise requirement.

Routine measurements are made in the same manner as circuit order tests, when dial test lines are not available at the PBX. When they have been provided, measurements may be made to the PBX balance test line. The distant testman may make tests to the office code 100 test line or equivalent and report the measurements.

3.10 ***Impulse Noise Tests*** — These measurements are required in both directions of transmission. They require a half-hour testing time during the busy hours to obtain the worst noise condition. When a balance test line is not provided at the PBX, the test is made on a two-man basis. To make measurements, proceed as follows, for both circuit order and routing measurements:

Step 1 — Seize the access line at the test jack and pulse forward the code to reach the distant milliwatt supply, or dial or ring on the line to reach the distant testman and request that 1000 cycles be sent at 0 dbm.

Step 2 — Measure the AML. Subtract the AML from 59 dbrnc 0. Set the 6A Impulse Counter to this value. If it cannot be set exactly, use the next higher setting.

Step 3 — Connect the 6A Impulse Counter to the circuit by patching the CONN cord through conversion jacks. Adjust it in accordance with Section E40.673.1 and set it to operate for 30 minutes. Note the counter reading at the end of this period.

Step 4 — Send 1000-cycle test tone to the distant testman. The distant testman obtains the AML and computes the setting for his 6A Impulse Counter in the same manner.

Step 5 — Connect a balance termination to the circuit (operate SEND-REC key to REC). The distant testman proceeds to make a 30-minute impulse count and report his measurement.

3.11 ***Attenuation Equalization Tests*** — When attenuation equalization is required, these tests supersede the tests of Paragraph 3.08. Proceed as specified in Paragraph 3.08, but make tests at 100-cycle intervals in the range 300 — 1000 CPS and 200-cycle intervals in the range 1000 — 3200 CPS. Subtract all readings from the 1000 CPS reading and compare the differences with requirements.

3.12 ***Delay Equalization Tests*** — When delay requirements are specified, these tests are made. The procedure is the same for circuit order and routine tests. Proceed as follows:

Step 1 — Seize the access line at the test jack and pulse forward the number or ring on the line to reach the distant testman.

Step 2 — Request the distant testman to connect a delay test transmitter. Connect a delay test receiver at the test jack through the L-RCV jack at the circuit patch bay. Be sure both units have stabilized for at least 30 minutes. Take measurements across the frequency ranges of interest.

Step 3 — Request the distant testman to connect a delay test receiver. Connect a delay test transmitter to the

L-TRSG jack at the circuit patch bay. Send toward the distant end across the frequency range of interest. Obtain the measurements made at the distant end.

Step 4 — If variable equalizers are provided, test on circuit order while making adjustments, until the requirements are met. If the requirements cannot be met with the equalizers specified on the CLR card, the equalizers should not be changed. The data should be forwarded through lines of organization for corrective action.

4. TESTS ON 4-WIRE SUBSCRIBER LINES

(A) General

4.01 4-wire subscriber lines interconnect the 4-wire No. 5 Crossbar office with 4-wire telephone and data sets. A line circuit is used at the subscriber station which provides E and M signaling and 600-ohm terminations.

4.02 When the distance is short the 4-wire subscriber line may consist only of cable pairs as shown in Fig. 7. When the distance is great, the line may consist of a carrier channel extended on cable pairs as shown in Fig. 8. A dual use arrangement which also provided for auxiliary terminations in data sets is shown in Fig. 9.

4.03 If the subscriber line is a dual use line, i.e., also terminated in a PBX as an access line, tests are made first to the PBX as described in Part 3. If the subscriber line has auxiliary terminations in data sets, tests are required to all terminations since they require different pad values. The distant testman cannot readily return the circuit to the talk condition. He may, therefore, request or make a call on another line to be used as an order wire.

4.04 The test procedures in this part of the section assume that prearrangements are made and that the distant testman calls in when available for testing.

(B) Over-All Transmission Tests

4.05 ***1000-Cycle Loss Measurements*** — Circuit order and routine tests are made to terminations in the 4-wire line circuit. (The distant testman has to clip on terminals for both sending and receiving tests.) Proceed in the following manner:

Step 1 — Seize the circuit at the LOOP jack and ring on the line.

Step 2 — When the distant testman answers, request that 1000 cycles be sent at the level specified on the CLR card. Measure and record the received level using the SUB-MEAS jack. (On circuit order, the distant testman has to adjust pads for the required loss.)

Step 3 — Request the distant testman to connect a TMS at his receiving test point. Send 1000-cycle test tone. Obtain and record the level measured at the distant end. (On circuit order, the distant testman has to adjust pads for the required loss.)

Step 4 — Compute the circuit losses.

4.06 ***Attenuation - Frequency Tests*** — Circuit order and routine tests are made in the same manner. They are made to the same test points used for 1000-cycle tests, and only to the main termination. When the facility is delay equalized, these tests are superseded by those in Par. 4.08. Proceed in the following manner:

Step 1 — Seize the subscriber line at the LOOP jack and ring on the line.

Step 2 — When the distant testman answers, request that an oscillator be connected to the test point and arranged to send specified levels for several seconds on the following frequencies: 300, 700, 1000, 2300, 3000 cps. The oscillator output at the distant end should be checked at each frequency. Measure and record the received level at each frequency using the SUB-MEAS jack.

Step 3 — Request the distant testman to connect a TMS to his receiving test point. Send at test tone for several seconds on each of the following frequencies: 300, 700, 1000, 2300, 3000 cps. Obtain and record the levels measured at the distant PBX. The oscillator should be adjusted to send 0 dbm at the VF IN jack.

Step 4 — Compare the measurements at each frequency to the measurements at 1000 cycles. The differences in db are compared with requirements.

4.07 ***Steady Noise Measurements*** — Steady noise measurements may be made on circuit order or routine while the circuit is connected for 1000-cycle loss measurements. Proceed in the following manner:

Step 1 — Request the distant testman to connect a 600-ohm termination at his sending test point. Connect to the noise measuring circuit through the SUB-MEAS jack and make a noise measurement.

Step 2 — Connect a 600-ohm termination to the test jack or operate the SEND-REC key to REC. Request the distant testman to make a noise measurement at his receiving test point with a 3 ANMS.

Step 3 — Record the meter readings. To correct measurements at the station, add the AML. The noise measurements at the testboard are corrected by adding 4 db. Compare the corrected readings with requirements.

4.08 ***Impulse Noise Tests*** — These measurements are required in both directions of transmission. They require a half-hour testing time during the busy hours to determine the worst noise condition. Tests are made on a two-man basis. They are not required if the line was also tested as an access line. To make measurements, proceed as follows, for both circuit order and routine measurements:

Step 1 — Seize the subscriber line at the LOOP jack and ring on the line to reach the distant testman.

Step 2 — Set the 6A Impulse Counter to 56 dbrn. Connect the 6A Impulse Counter to the CONN cord through conversion jacks. Adjust it in accordance with Section E40.673.1 and set it to operate for 30 minutes. Read the counter at the end of this period.

Step 3 — Send 1000-cycle tone to the distant testman. The distant testman measures AML and subtracts it from 59 dbrnc0. The result is set on his 6A Impulse Counter as specified in Section 310-200-503.

Step 4 — Connect a balance termination to the circuit or operate the SEND-REC key to REC. The distant testman proceeds to make a 30-minute impulse count.

Step 5 — Obtain and check the distant end reading.

4.09 ***Attenuation Equalization Tests*** — When attenuation equalization is required, these tests supersede the tests of Paragraph 4.06. Proceed as specified in Paragraph 4.06, but make tests at 100-cycle intervals in the range 300 — 1000 cycles and at 200-cycle intervals in the range 1000 — 3200 cycles. Subtract the readings at all frequencies with the 1000-cycle reading and compare the differences with requirements. When these tests are required to meet requirements for data transmission, the tests should be made at the distant end at the data set appearance.

4.10 ***Delay Equalization Tests (If required)*** — The procedure is the same for circuit order and routine tests. Proceed as follows:

Step 1 — Seize the subscriber line at the LOOP jack and ring on the line to reach the distant testman.

Step 2 — Request the distant testman to connect a delay test transmitter at his sending test point. Connect a delay test receiver at the test jack through the L-RCV jack at the circuit patch bay. Be sure both units have stabilized for at least 30 minutes. Take measurements across the frequency ranges of interest.

Step 3 — Request the distant testman to connect a delay test receiver at his receiving test point. Connect a delay test transmitter to the L-TRSG jack at the circuit patch bay. Send toward the distant end across the frequency range of interest. Obtain the measurements made at the distant end.

Step 4 — If variable equalizers are provided, test on circuit order and adjust until requirements are met. When these

tests are required to meet requirements for data transmission, the tests should be made at the distant end at the data set appearance.

5. TESTS ON KEY STATION LINES

5.01 When 4-wire subscriber lines are terminated in key equipment, such as 112A, on a 4-wire basis, they are tested in the same manner as 4-wire subscriber lines.

5.02 Occasionally lines will be terminated in 2-wire telephones to provide access to the network for isolated users. These lines should be tested in the same manner as 4-wire subscriber lines. There will be some difference in the manner in which the distant testman assists on tests, since the station is usually arranged for loop signaling rather than E and M signaling. These details are covered in Section 310-200-503.

6. TESTS ON SWITCHBOARD TRUNKS

6.01 When operator trunk circuits are provided per SD-27502-01 or similar at 5D switchboards, and amplifiers or echo suppressors are provided, transmission tests should be made.

6.02 The trunk circuit can be made busy by operating the associated MB key while the circuit is idle. Transmission tests should be made on the amplifiers and echo suppressors in accordance with their respective sections.

6.03 Over-all 1000-cycle tests should also be made to insure that the circuits operate at assigned losses. Test calls must be originated at the 5D switchboard position. A portable TMS and an oscillator or switchboard appearance of the MW supply are required.

6.04 Since the trunk circuit has no line link appearance, tests must be made to a line link frame equivalent code 101 test jack or to the TM jack at the master test frame.

7. TROUBLE INVESTIGATIONS

7.01 The procedure for trouble investigation will depend somewhat on the trouble indicated and the nature of the facilities making up a circuit. When the trouble report does not definitely indicate the source of trouble, the circuit order test procedure should be followed. When a test requirement cannot be met, the circuit should be sectionalized and the trouble isolated before proceeding further.

7.02 Some troubles may be located by checking the following:

(a) ***DC Tests on Cable Pairs*** — If cable facilities are included in the circuit, verify that tests have been made for opens, shorts, crosses, grounds, etc.

(b) ***Carrier System Tests*** — Verify that the carrier line, including repeaters, radio, etc, is lined up and satisfactory for service, or has been routined within proper intervals.

(c) ***Carrier Channel Net Loss Tests*** — Verify that the carrier channel net loss tests have been completed and the channel satisfactory for service, or that the channel has been routined within the specified interval.

(d) ***Repeater Tests*** — Verify that all repeaters have been tested or routined and adjusted for proper gain as specified on the CLR card.

(e) ***SF Unit Tests*** — Verify that SF Unit tests have been made or routines performed in accordance with appropriate practices.

(f) ***DX Unit Tests*** — Verify that DX Unit tests have been completed in accordance with Section A220.684.

(g) ***Over-All Pulsing Tests*** — Verify that over-all signaling and pulsing tests have been made in accordance with appropriate sections.

(h) ***Echo Suppressor Tests*** — If specified on the CLR card, verify that the echo suppressors have been cross-connected and that functional tests have been completed or routines made in accordance with Section E33.353 or E26.171.

(i) ***PBX Balance Tests*** — Verify that PBX balance tests on the circuit have been completed at the PBX when access lines are involved.

(j) ***Office Drop Loss Tests*** — Verify that all cross-connections, adjustments and pad settings have been correctly made by checking office drop loss tests at the near end of the circuit. They should be within ±0.2 db of CLR

card values. See Section 310-280-500 for methods using the 19A board. Section 310-281-500 covers the 17E board in 2-wire offices. P pad values or repeater gain settings should not vary from specified values by more than 1.0 db. If the office drop losses still remain out of limits and no trouble can be found, the problem should be reported through lines of organization.

7.03 When trouble reports are received concerning data transmission and it is not clear whether the trouble is in a circuit or in station equipment, it is advisable to make circuit tests using the 900 series portable test sets and attempt to isolate the trouble before starting the more extensive circuit order tests. The sets are covered by Sections 107-200-100 and 107-300-100.

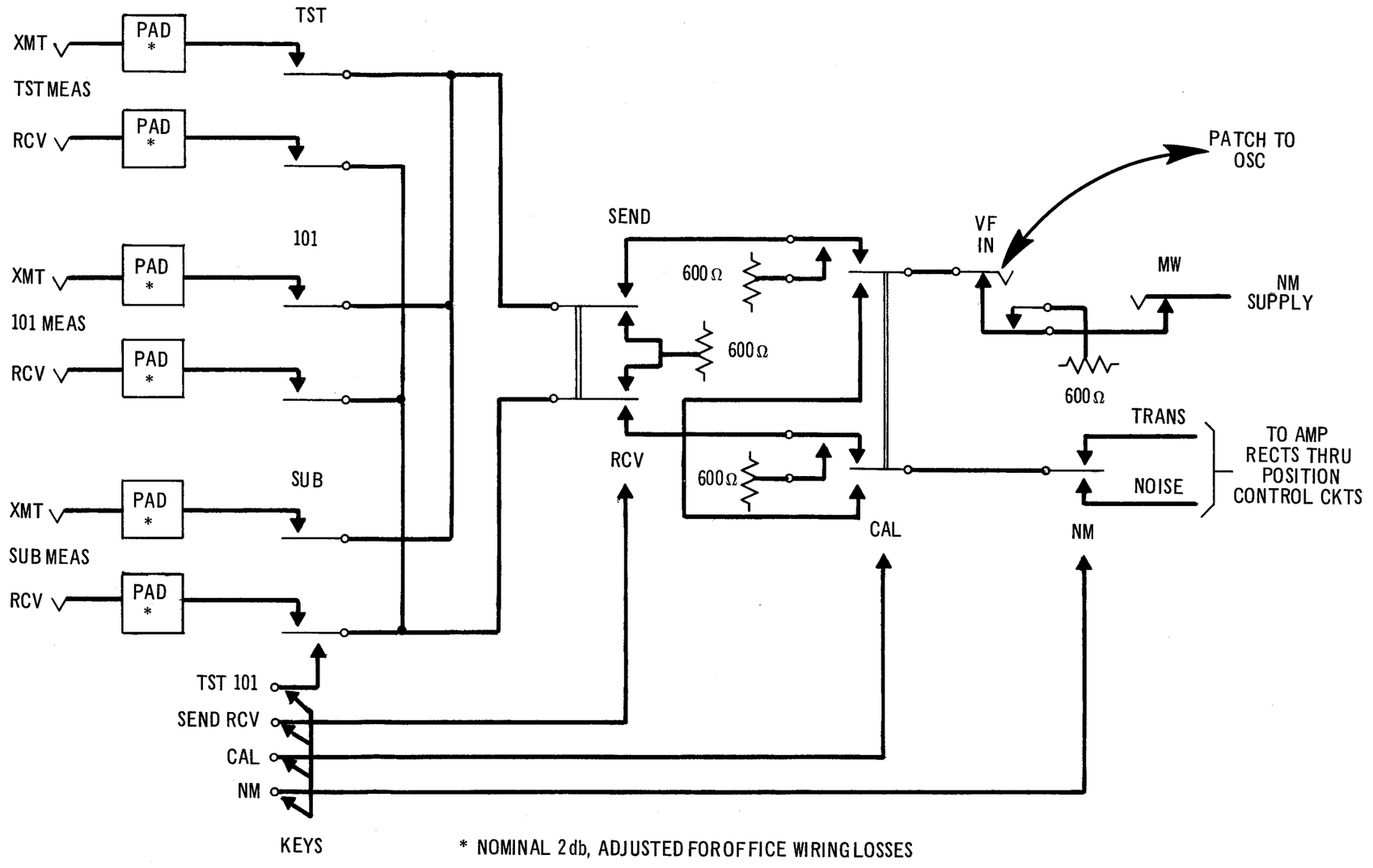


Fig. 1 – Simplified Diagram of Transmission and Noise Measuring Circuits per SD-95900-01 — 19A Testboard (single line per pair)

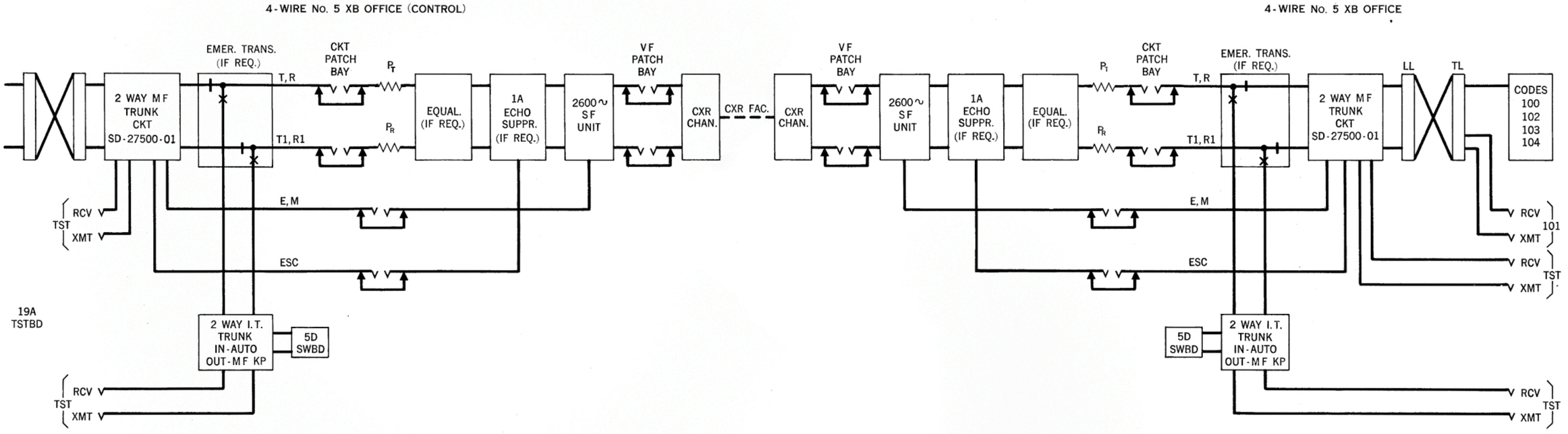


Fig. 2 – Typical Arrangement of a Network Trunk Between Two 4-Wire No. 5 Offices

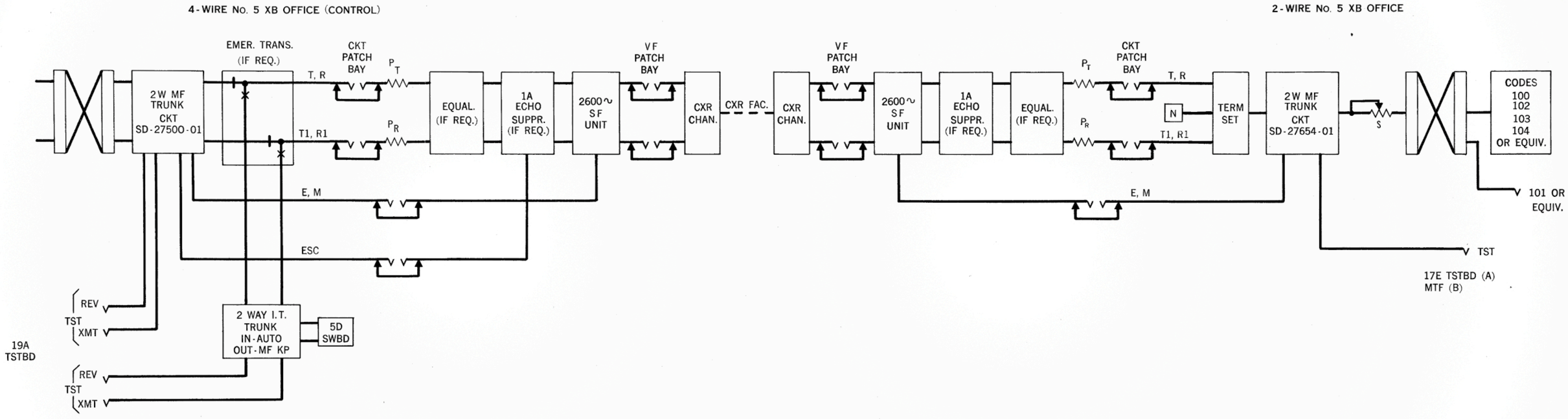


Fig. 3 – Typical Arrangement of

(A) Network Trunk Between a 4-Wire No. 5 Office and a 2-Wire No. 5 Office

(B) Access Line to No. 5 Centrex

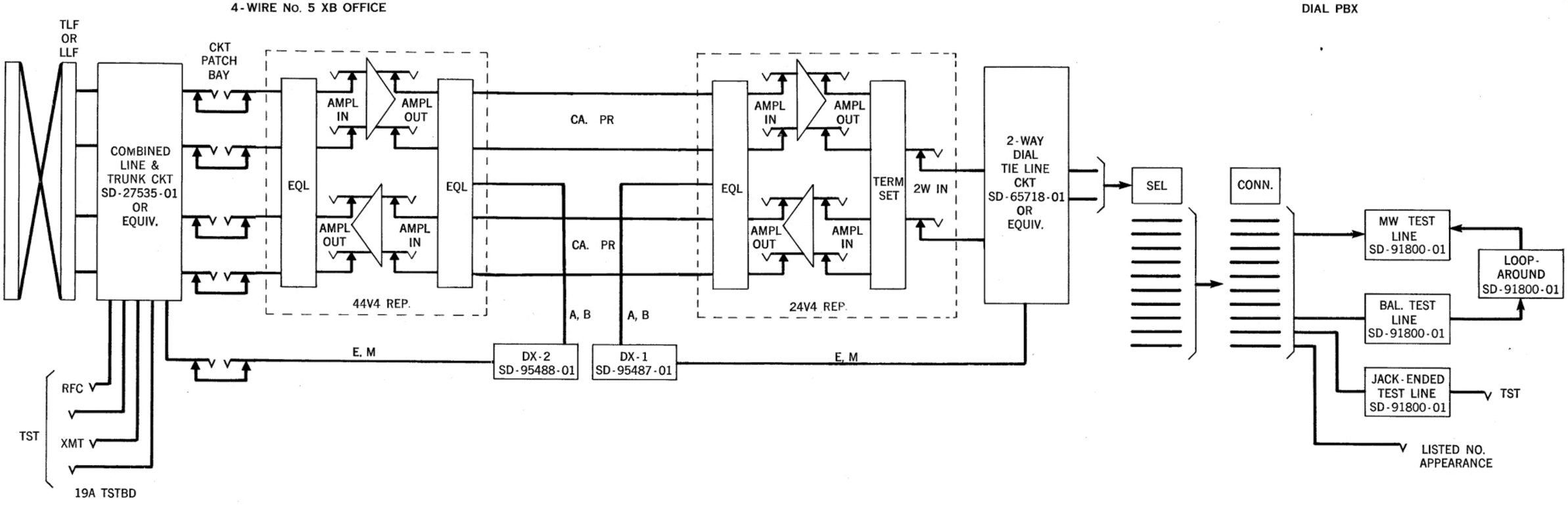


Fig. 4 – Typical Arrangement of Access Line from 4-Wire No. 5 Office to a Dial PBX on Cable Pairs

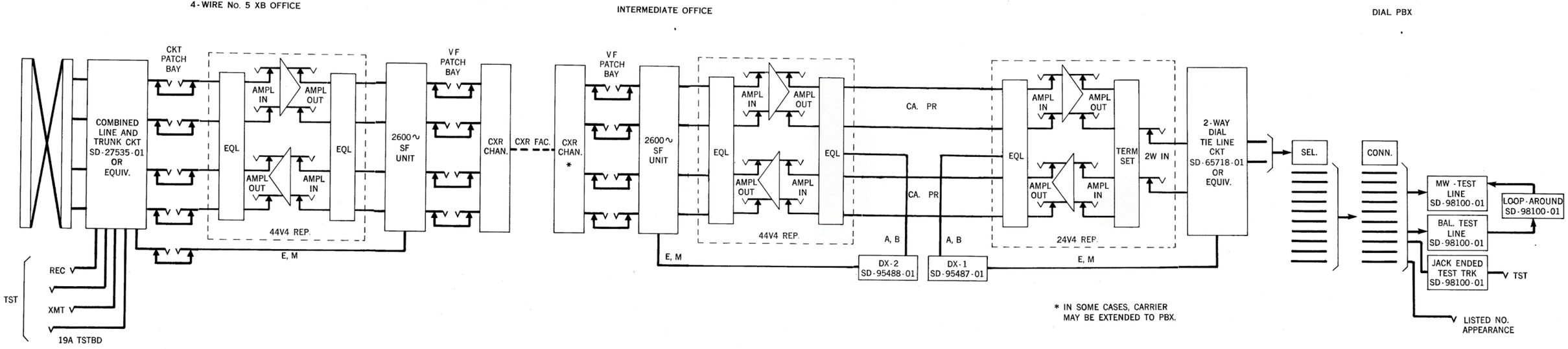
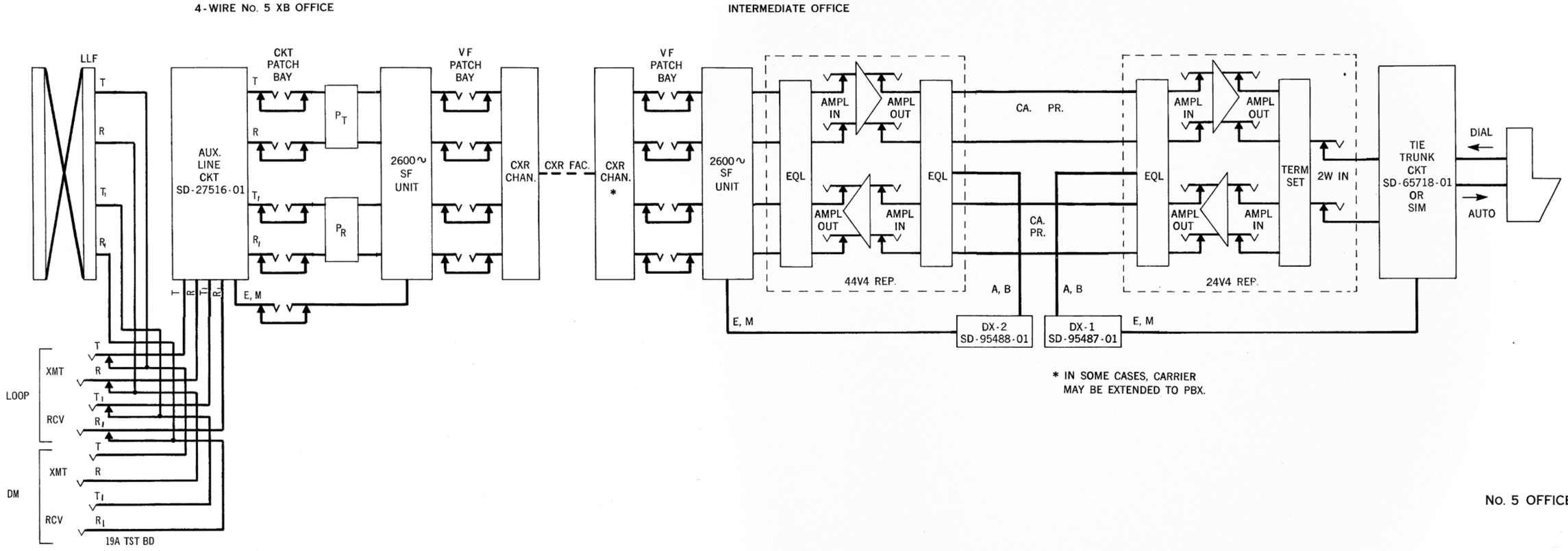


Fig. 5 – Typical Arrangement of Access Line from 4-Wire No. 5 Office to Dial PBX on Carrier and Cable



No. 5 OFFICE

Fig. 6 – Typical Arrangement of Access Line from 4-Wire to Manual PBX on Carrier and Cable

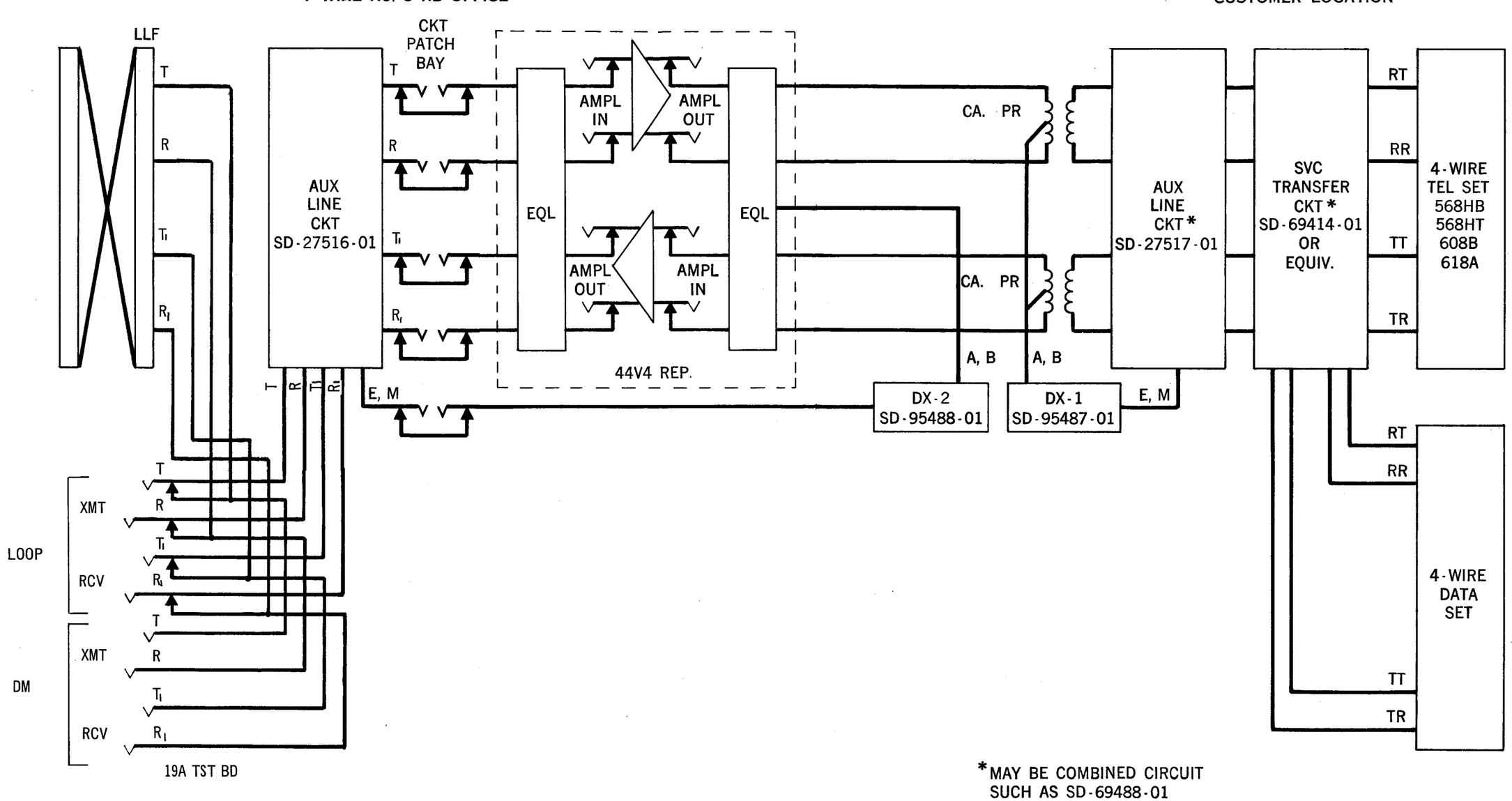


Fig. 7 – Typical Arrangement of a 4-Wire Subscriber Line on Cable Pairs

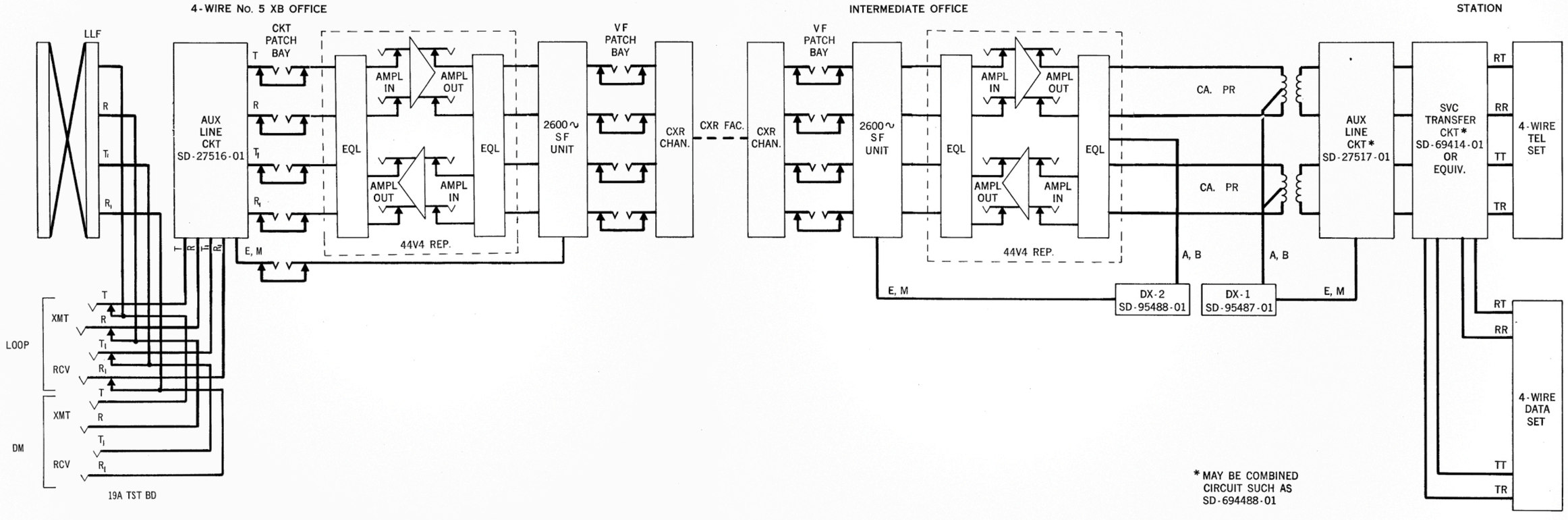


Fig. 8 – Typical Arrangement of a 4-Wire Subscriber Line on Carrier and Cable Facilities

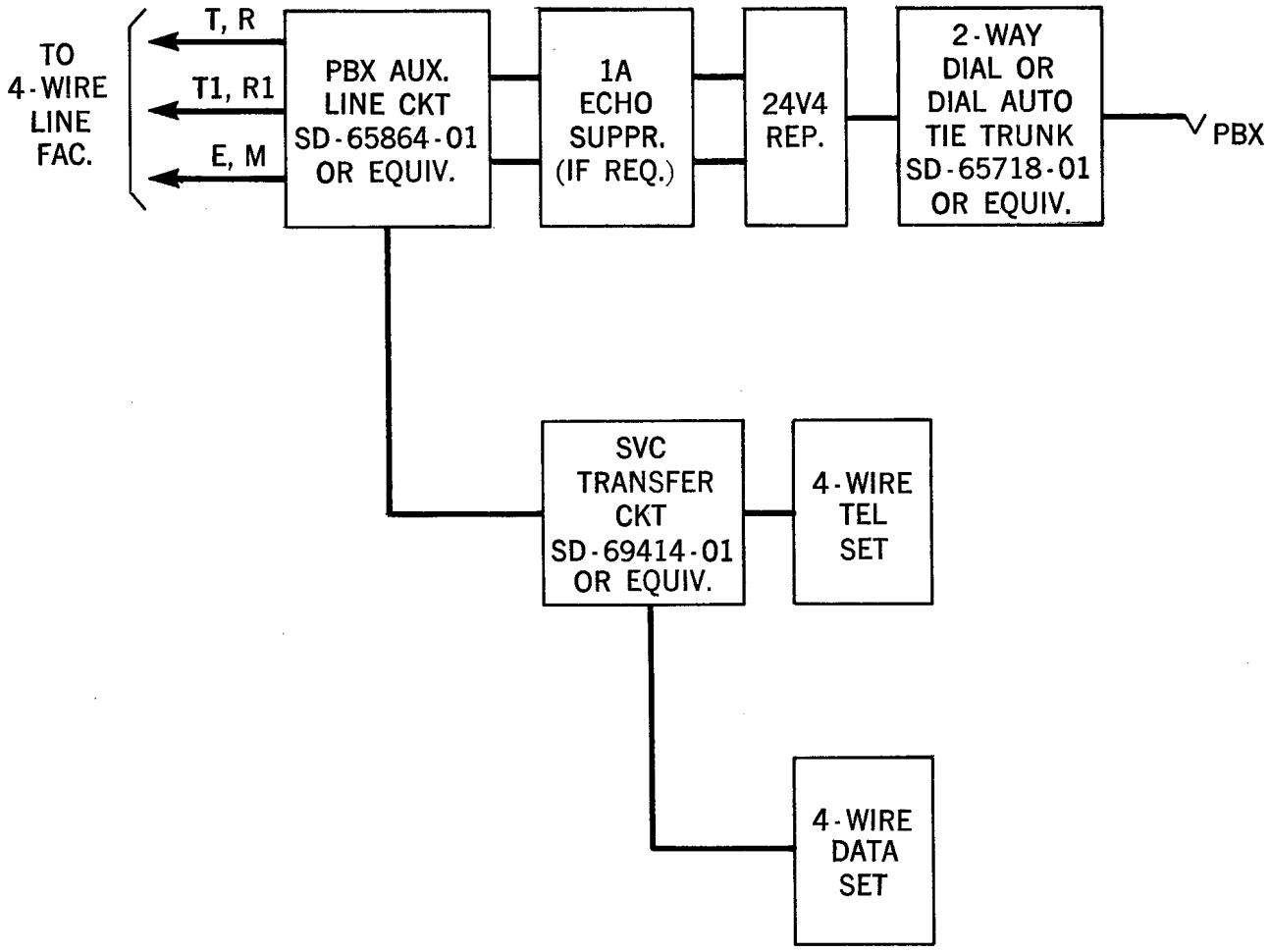


Fig. 9 – Typical Arrangement of 4-Wire Dual use Subscriber Line with Auxiliary Termination for Data Set