PROCEDURE FOR ESTABLISHING AND MAINTAINING CIRCUITS LOCAL CHANNEL

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1. GENERAL

1.01 This section describes the latest standards and equipment and conforms with the objectives stated in design practices.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

1.03 The title "Local Channel Circuits" identifies the correct tariff element and conforms with usage and design practices. The circuits included in this classification are:

(a) Program pickup loops, ie, circuits from remote program pickup points to:

(1) The broadcast company's studios or other control points

(2) The nearest toll office on a network.

(b) Network loops, ie, circuits between the broadcast company's studios or other control points and the toll office at the point of connection to a network.

(c) Studio-to-transmitter circuits, ie, those between the broadcast company's studios or other control points and their associated radio transmitters, including stereo channels.

(d) Tie circuits between two studios or other control points within the same local area. Additional special requirements for stereo channels are covered in Section 320-110-121.

1.04 Local program circuits will most frequently be routed in nonloaded exchange cables, although situations involving loaded cable facilities, open wire, and intermediate amplifiers also will occasionally be encountered. Furthermore, the circuits may be furnished equalized or nonequalized. The type and quantity of equipment to be associated with the circuit will ordinarily be specified in the service order or circuit order. This section is, therefore, concerned primarily with the tests and adjustments required to make the circuits ready for service and to maintain them in a satisfactory operating condition.

2. GENERAL TESTING CONSIDERATIONS

2.01 The tests discussed in this section will be made in connection with:

(a) Service orders

(b) Reassignment to program service of facilities previously used for program transmission service, except those which have not been disconnected and have been in use in their entirety within a period of 1 month

(c) Investigations of quality complaints where trouble has been localized to the local program facilities

(d) Periodic tests as scheduled in Part 7.

When changes of equipment or outside plant assignments are made, subsequent to the initial service date, only those tests affected by the changes need be repeated.

2.02 These tests apply to all facilities which are permanently assigned to program transmission service, including those held in reserve for emergency patches and those set up in anticipation of new services. They should also be applied to occasional and temporary services.

2.03 In all testing requiring the use of oscillators, the testing power impressed on the line should not exceed 0 dBm in order to guard against cross-induction into other facilities. Where amplifiers are employed on the circuit under test, care should be taken that the testing power does not overload the amplifier.

Note: An exception to these limits is the case of volume checks made at low frequencies as described in paragraphs 5.07 and 5.08. For these tests, levels of +8 dBm may be employed.

2.04 In connection with any testing work it is important that care be exercised to avoid disturbances to services on other facilities. In order to avoid the possibility of accidental disturbances to service, no tests other than monitoring or volume indicator readings should be made on working circuits during the service period, except as may be required for reestablishing service in cases of trouble. Similarly, work on equipment used on working program circuits should be limited only to that necessary to restore or maintain service in cases of trouble. Where such precautions would entail undue expense because of rearrangements of office coverage schedules, consideration may be given to assigning program service temporarily to other suitable facilities while making the required tests on the regularly assigned facilities.

3. PRELIMINARY TESTS

A. Line Facilities

3.01 Because of the nature of the service, the facilities assigned to program transmission should be selected from the pairs available which are most desirable from an overall standpoint, in order to provide as great a margin as possible against failure or interruption. To this end, pairs preferably with no bridged taps or with a minimum number of taps should be selected. Certain preliminary tests should be made on the pairs selected to determine that they are in good condition before proceeding with the equalization work and final lineup. These preliminary tests are discussed in the following paragraphs. If a pair is rejected on any one of these tests necessitating the selection of another pair, all tests should be repeated on the new pair. In order to expedite this work it appears desirable to make these preliminary tests on several pairs, selecting the most satisfactory pairs for the program service.

3.02 ***Listening Tests:*** A preliminary check for noise and crosstalk can be made by monitoring the pair using a 3C-type Noise Measuring Set (NMS); the far-end should be terminated in 600 ohms. The NMS should have the proper weighting network as specified in Table C, and its gain should be set for a "0" indication at the maximum noise level

allowed at the point of measurement. Only the monitor receiver associated with the NMS should be used. The repair will be unsatisfactory if the noise indication exceeds the maximum level or if noise or crosstalk (words or syllables) are heard in the monitor receiver. Tests should be made for at least 10 minutes during the busy hour.

3.03 ***Metallic Varley:*** The resistance unbalance of the pair may be checked by a metallic Varley measurement. To prevent burning out bad joints by the application of the test battery, a voltage less than 6 volts should be used in determining resistance unbalances. If an unbalance of greater than 4 ohms is indicated, another pair should be selected. In this connection it would be desirable to inspect the protector springs, clean them if necessary, and use only new heat coils.

3.04 ***Loop Resistance:*** The dc resistance may be measured and noted on the card record for purposes of later comparison in connection with tests made to locate troubles.

3.05 ***Insulation Resistance:*** Pairs selected for program transmission service should be chosen from the available spare pairs showing the highest insulation resistance and appearing in as few terminals as practicable. On this basis it should be possible to find cable pairs having an insulation resistance in the order of 200 to 500 megohms per mile as measured from main frame to main frame or to cable terminal. Lower values may be encountered during humid or rainy weather, in which case it would be advisable to choose pairs that are at least as good as the average of the spare pairs in the cable and that have approximately the same resistance from each side of the pair to ground. Where the pair appears at several terminals, the insulation resistance may fall considerably below 200 megohms, but if the above procedure of selection is followed, it should readily be possible to meet an overall value of insulation resistance in excess of the maintenance requirements for exchange lines, eg, 300,000 ohms in dry weather and 50,000 ohms in wet weather. Pairs having lower values than these should not be used.

3.06 ***Service Protection:*** In order to prevent plant forces from accidentally monitoring or otherwise disturbing working program circuits, it will be desirable to provide full Special Service Protection (SSP) in accordance with Section 460-110-101. This precaution is particularly important in the case of full-time facilities such as studio-to-transmission circuits and network loops.

B. Equipment

3.07 It will not be necessary to perform any preliminary tests on equalizers or repeating coils, except to check for proper strapping, before proceeding with the equalization work. In the case of intermediate amplifiers, certain initial adjustments and tests as outlined in Part 7 are required.

4. EQUALIZATION

4.01 The methods of adjusting the various types of equalizers which may be used on local program circuits are covered in other sections of this series of sections which describe the equipment.

4.02 Since equalization work involves primarily single-frequency transmission tests over the frequency range, only high-quality transmission testing equipment having an adequate range may be used. Suitable equipment is discussed in Section 320-300-100.

4.03 When the customer's equipment to be used with the program circuit is of other than 600-ohm impedance, the customer should be expected to provide impedance matching equipment. Standard 600-ohm testing equipment should be used for line measurements in all cases.

4.04 The precision of equalization obtainable is dependent on the outside plant facilities and the type of equalizer employed. The equalizers discussed in paragraphs 6.03 and 6.04 will provide equalization within their operating ranges to within ±10 dB of the 1000-Hz value, provided the outside plant is satisfactory.

4.05 Table A shows the length of single-gauge, nonloaded cable that can readily be equalized to the various bandwidths. When the pair is predominantly two gauges, the lengths should be reduced about 10 percent when the pair is made up equally of three or more gauges; the maximum length should be reduced about 20 percent.

4.06 In equalizing circuits consisting of more than 1-line sections (ie, those requiring intermediate amplifiers), each section requires equalization. This may be done by equalizing first the section adja-

TABLE A

TYPE OF CABLE	MAXIMUM MILES OF CABLE TO BE EQUALIZED TO		
	5 kHz	8 kHz	15 kHz
26 AST	4.5	4.4	3.4
26 BST	4.2	4.1	3.1
24 ASM	5.6	5.6	4.4
24 DSM	5.1	5.1	4.0
22 ASA	6.6	6.6	5.5
19 CNB	9.5	9.5	8.9
19 DNB	10.0	10.0	10.0

cent to the transmitting point, then going to the next point, equalizing the two sections in tandem through the first amplifier and continuing to the end of the circuit. In this way it should be possible to obtain a better overall result and affect economies in testing labor, as compared to equalizing each section as a unit and connecting them together and then making an overall test. In these tests the gain of the intermediate amplifiers will be adjusted to deliver proper volume levels to the succeeding line section.

4.07 When loaded facilities or open-wire facilities are used in local program circuits, either singly or in combination with nonloaded cable, special equalizing arrangements will be required. These will usually be specified by the engineers or in local instructions. In view of the special nature of such applications, it is not possible to establish accurate limits for the precision of equalization. In these cases, however, sufficient time should be put into the equalization work to be sure that the optimum adjustment has been obtained. If this results in a characteristic having a maximum spread of more than 2 dB, engineering approval should be obtained before turning over the circuit permanently to the customer.

4.08 When the direction of transmission over local program circuits is to be reversible, equalizers, when required, are provided at each end, so arranged that either end can readily be connected to the circuit, depending on direction of transmission. Although the settings should theoretically be the same for both equalizers, it will be desirable to make a check-frequency run with the second equalizer after it has been adjusted, in accordance with the setting determined for the first equalizer and any further changes made as indicated by the test.

5. FINAL TEST

A. General

5.01 As a final check on the circuit before turning it over to the customer, the tests outlined here may be made as governed by local conditions. If results which are not consistent with the expected performance are obtained, the equipment may be checked as discussed in Parts 6 and 7.

B. Frequency Characteristics

5.02 As a final check on the equalization work, a complete frequency run should be made. Tests should be made at many frequencies to ensure that the requirements have been met. The minimum requirements are shown in Table B. If any pronounced irregularities are indicated, the region where they occur should be explored with measurements at several intermediate frequencies. The requirements are: The attenuation in the range to be equalized shall not vary from the attenuation at 1000 Hz by more than ±1.0 dB.

C. Noise

5.03 Noise measurements usually are made at the receiving-end of the circuit with the far-end terminated in 600 ohms. The measurements should be made with all coils and equalizers in place and should be made during heavy traffic periods. A 3C-type NMS may be used which will provide measurements in dBrn if the proper networks are provided.

5.04 The requirements to be met are shown in Table C. They are all referred to the +8 VU point in the circuit, which is usually the sending-end. When measurements are made at the receiving-end or at intermediate points, the requirement is reduced by the amount of 1000-Hz loss between the +8 VU point and the point of measurement.

5.05 Noise readings are obtained by taking the average of maximum indications, disregarding very infrequent high peaks. Impulse noise measurements using impulse counters are not required.

TABLE B

TEST AT FREQUENCIES (CPS)	WHEN EQUALIZATION RANGE IS		
	100-5,000 Hz	35-8,000 Hz	50-15,000 Hz
35	—	X	—
50	—	X	X
70	—	X	X
100	X	X	X
300	X	X	X
500	X	X	X
1,000	X	X	X
2,000	X	X	X
3,000	X	X	X
4,000	X	X	X
4,500	X	—	—
5,000	X	X	X
6,000	—	X	X
7,000	—	X	X
8,000	—	X	X
10,000	—	—	X
12,000	—	—	X
15,000	—	—	X

TABLE C

TYPE OF CIRCUIT	WEIGHTING	REQUIREMENT— dBrn REFERRED TO +8 VU POINT
AM STL (5 kHz or 8 kHz)	Program	36
	15 kHz Flat	46
FM STL	15 kHz Flat	33
TV Aural STL	15 kHz Flat	38
Other:		
5 kHz or 8 kHz	Program	36
	15 kHz Flat	46
15 kHz	15 kHz Flat	33
Nonequalized	"C" Msg	36

D. Crosstalk Observations

5.06 Before turning the circuit over to the customer, a final check on crosstalk should be made. This can be done in conjunction with the noise tests, using only the monitor receiver associated with the NMS. Listening tests should be made as discussed in paragraph 3.02. If audible crosstalk is heard, the circuit should be referred for further investigation.

E. Volume Checks

5.07 After the circuit has been turned over to the customer, he/she may desire to check the lineup of his/her entire system, including telephone lines at program operating volume. This involves transmission into the local program circuits at volume levels as high as +8 dBm. These tests are usually made at a frequency of 400 Hz. The telephone company should encourage the broadcaster to make these tests during periods of minimum interference.

5.08 In the event that tests show the requirements have not been met, further tests may be made as discussed in Part 6. If the further equipment and facility tests do not reveal the trouble or if there appears to be a design problem, the matter should be reported through lines of organization.

6. EQUIPMENT TESTS

A. General

6.01 It will not be necessary to check the characteristics of equalizers, coils, amplifiers, etc. However, if the test results are not satisfactory, trouble-locating tests will be necessary. In order to determine whether the trouble is in the cable pair of the associated equipment, some requirements for the associated equipment are established.

B. Repeating Coils

6.02 The loss of the repeating coils at any frequency from 40 to 8000 Hz measured between impedances of 600-ohm resistance should be:

111C or 119E coil	Line Wdgs in parallel	2.2 ± 0.5 dB
	Line Wdgs in series	0.6 ± 0.2 dB
119C coil	Line Wdgs in parallel	2.7 ± 0.5 dB
	Line Wdgs in series	0.7 ± 0.2 dB

C. Equalizers

6.03 Some equalizers have fixed inductor-capacitor arrangements. They can be checked by measuring their insertion losses between 600-ohm impedances with the resistance element shorted. The requirements are shown in Table D.

TABLE D

TYPE OF EQUALIZER	LOSS (dB) AT		
	1,000 Hz	5,000 Hz	8,000 Hz
4A (1A and 2A)	17.5 ± 1.0	2.2 ± 1.0	—
Mod 4A	25.5 ± 1.5	—	2.1 ± 0.9
23A	25.5 ± 1.0	—	1.7 ± 0.5

6.04 The equalizers per SD-55503-01 and the KS-16816 equalizers have variable LC ratios. Their insertion losses will depend on the ratios used. For tests on all these equalizers, refer to the following sections.

SECTION	EQUALIZERS
320-230-100	KS-16816, L1 and L2
320-110-116	Equalizer per SD-55503-01
320-230-101	4A (1A and 2A)
320-230-102	Mod 4A and 23A

D. Amplifiers

6.05 When intermediate amplifiers are used on local program circuits, they should be routined completely in accordance with their appropriate practices before being put in service. These tests may consist of voltage measurements on the power supply, noise, gain-frequency tests, distortion tests, etc. Practices on amplifiers are listed in Table E.

6.06 After checking the power supply, measurements and adjustments of operating currents and voltages should be made as covered in standard information for the particular type of amplifier involved. After these measurements and adjustments have been made, no further tests should be necessary before proceeding with the overall circuit lineup.

6.07 The amplifier gain is adjusted to be equal to the equalized net loss of the preceding line section, including equipment and wiring. In this connection, if the amplifier is located at the junction of a cable and an open-wire section, the gain adjustment should include an allowance for the difference in permissible output levels for the two types of facilities (+8 VU for cable and up to +14 VU for open wire).

6.08 Before patching an amplifier into a circuit, a noise test should be made with a 3C-type NMS. Measurements should be made with program weighting and 15-kHz flat weighting. The noise should not exceed 25 dBrn with program weighting and 40 dBrn with 15-kHz flat weighting, when measured at the full gain of the amplifier—the measurement to include the loss of any output pads or equipment which may be used for the operating condition.

7. ROUTINE MAINTENANCE

A. General

7.01 This part suggests a schedule for routine maintenance tests on overall circuits and

TABLE E

TYPE	DESCRIPTION AND OPERATING METHODS	SERVICE MAINTENANCE AND PLANT OPERATING ROUTINES	OPERATING AND TESTING METHODS
KS-16575	024-120-100	024-120-300	024-120-500
KS-16622	024-125-100	024-125-300	024-125-500
KS-16740	024-130-100	024-130-300	024-130-500
KS-16831	024-175-100	—	024-175-500
KS-20159	024-175-110	024-175-210	024-175-510

amplifiers which may be followed in the absence of other testing intervals authorized by local instructions.

7.02 In the following paragraphs the term "permanent services" applies to facilities continuously in use, such as studio-to-transmitter circuits or network loops, or continuously available for use, such as pickup loops to points from which repeated broadcasts are made. The term "occasional services" applies to facilities established, wholly or in part, for single occasions or short periods of the order of 1 month or less.

B. Overall Circuit

7.03 ***Permanent Services:***

(a) ***Line Conductors:*** Upon notification of the customer's intent to use a pickup circuit, which though set up has been idle for some time, dc continuity, resistance unbalance, and insulation tests may be made as governed by local conditions.

(b) ***Check Equalization:*** Annually, unless the circuit has been reequalized during the year because of cable transfer or other changes, or as local conditions require.

(c) ***Noise and Crosstalk Observations:*** Annually, unless local conditions indicate other intervals to be desirable.

7.04 ***Occasional Services:*** None except as required for establishing service.

7.05 In connection with any cable transfers—replacement due to storm breaks or similar situations—all program facilities in service along such routes should be checked as soon as practicable.

C. Amplifiers

7.06 ***Permanent Services:*** All tests should be made on circuit order. Routine intervals should be as specified in the section for the amplifier.

7.07 ***Occasional Services:*** None except as required for establishing service.