GAIN MEASURING SYSTEM FOR REPEATERS AND AMPLIFIERS IN LOCAL AND SMALL TOLL OFFICES

1. GENERAL

1.01 This section describes a measuring system for making gain measurements on telephone repeaters and amplifiers in local and small toll offices. This system is composed of a source of 1 MW testing power, a sending pad circuit, and a portable receiving set.

1.02 Issue 2 replaces Issue 1 of this section. The principal changes consist of the addition of information covering the present standard form of the circuit, which supersedes the former jack arrangement, and information on additional types of receiving sets.

1.03 This section applies to small installations of either V-1 repeaters or of former types of repeaters. In the case of V-1 repeaters, however, the attenuator arrangements normally associated with these repeaters for testing purposes, usually will prove to be more desirable than the sending pad arrangements described in this section. The information given in this section, however, regarding transmission receiving sets and sources of testing power is applicable to V-1 repeaters as well as to the former types.

2. SOURCE OF TESTING POWER

2.01 Any source of 1 MW testing power at 1000 cycles is suitable for use with this system. In offices where sending panels and milliwatt distributing circuits are available, the pad arrangement should be connected permanently to the milliwatt distributing system, as indicated by the dashed lines in Figs. 1 and 2. In offices where milliwatt distributing circuits are not available, the measuring system can be used with a portable source of 1 MW testing power. In this case the sending power is patched to the PAD IN jacks shown in Fig. 1 and Fig. 2.

2.02 Where multi-frequency measurements are necessary to determine a gain-frequency characteristic, a multi-frequency source of testing power may be substituted for the 1000-cycle testing power used for normal gain tests and adjustments, by patching it to the PAD IN jacks.

3. SENDING PAD CIRCUIT

3.01 The sending pad circuit is covered on Drawing SD-95017-01. The present standard, 5 db step arrangement is shown in schematic form in Fig. 1 of this section. The 20 db pad and key, shown by dashed lines, are provided in addition to the other pads and keys only where required in order to cover the larger range of gains in the particular office. Fig. 2 of this section shows the former arrangement using pads, consisting of 19-type resistances, connected to jacks.

3.02 Either circuit is arranged as a permanent installation, and in conjunction with a source of 1 MW testing power, makes available at the repeater position, sending power of 1 MW and sending powers below 1 MW in steps of 5 db up to the capacity of the network.

3.03 Where only the 12A transmission measuring set is to be used with the sending pad circuit and where, also, the gains to be measured are not greater than 20 db, a

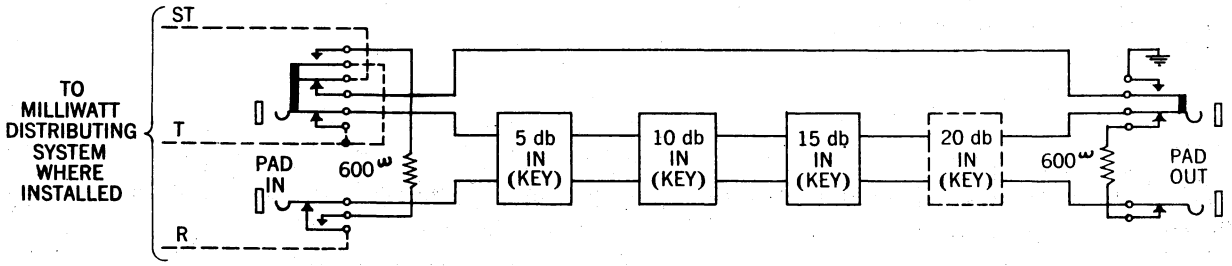

Fig. 1

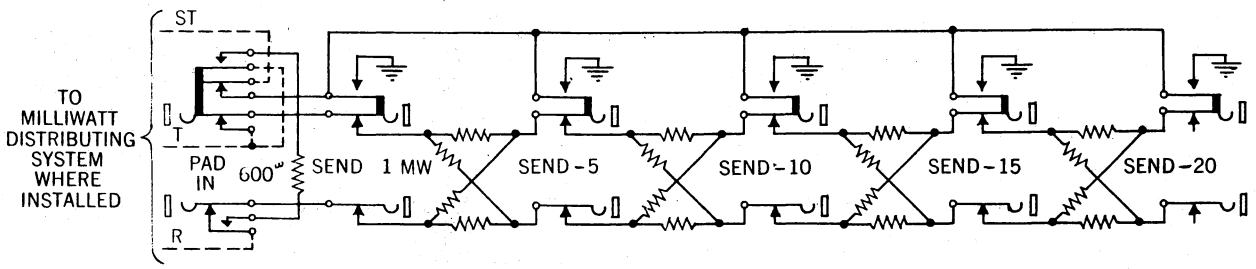

Fig. 2

simplification of the arrangements shown in Fig. 1 is practicable and somewhat cheaper. This arrangement is the same as that shown in Fig. 1, except that the 20 db pad and key are used and the 5 db, 10 db and 15 db pads and keys are omitted. This arrangement then consists of Figs. 3, 5 and 6 on Drawing SD-95017-01. The details of how to use the 12A set to obtain gain measurements in the various gain ranges up to 20 db are covered in Paragraph 5.05.

3.04 When connected to an office milliwatt distributing system, the circuit is arranged to provide remote control of the testing power supply and a 600-ohm resistance provides the necessary idle condition termination for the milliwatt distributing system.

3.05 When using the arrangement shown in Fig. 1, the PAD OUT jacks are patched to the input of the repeater, as shown in Fig. 3, and the pads are cut in or out of the circuit by the associated keys. These pads are made up of resistances arranged as "O-type" networks.

3.06 When using the arrangement shown in Fig. 2, the jacks representing the desired value of sending power (as indicated by their designation) are patched to the input of the repeater, as shown in Fig. 3. The four 5 db pads of the arrangement are of identical make-up, each being of the "lattice-type," constructed from two 19-type resistances.

4. TRANSMISSION RECEIVING SET

4.01 Any transmission measuring set calibrated in db with respect to a reference power of 1 MW is suitable for use with this system. The copper-oxide rectifier type of transmission measuring set, such as the 9A, 12A or the 13A, described in other sections of these practices is satisfactory for this purpose. Of these sets the 12A and 13A are preferable because the gain scales on these sets make measurement easier.

5. OPERATION

5.01 Fig. 3 shows a simple diagram of the application of this system to the gain measurement of the E-W side of a 22-type repeater. To measure the other direction of transmission, the sending and receiving patches to the repeater are interchanged.

5.02 Where a multi-frequency source of testing power is available, gain measurements can be made at any frequency within the effective frequency range of the receiving set, as discussed also in Paragraph 2.02.

5.03 When using a transmission measuring set, such as the 12A or 13A, which has a gain scale, this scale should be used. In the 12A set, this is the red (lower) scale, in the 13A set this is the red (upper) scale.

5.04 When using the 12A set the 5 DB-10 DB key usually should be in the normal position where the sending pad circuit has 5 db steps, and it is desirable to set the external pad value to obtain a reading in the 5 to 10 portion of the red (lower) scale since the accuracy of readings is greater in this part of the scale than in the 0 to 5 portion. For the normal position of the pad key on the 12A set the following formula applies:

Gain = external pad - 10 db + red scale reading (1)

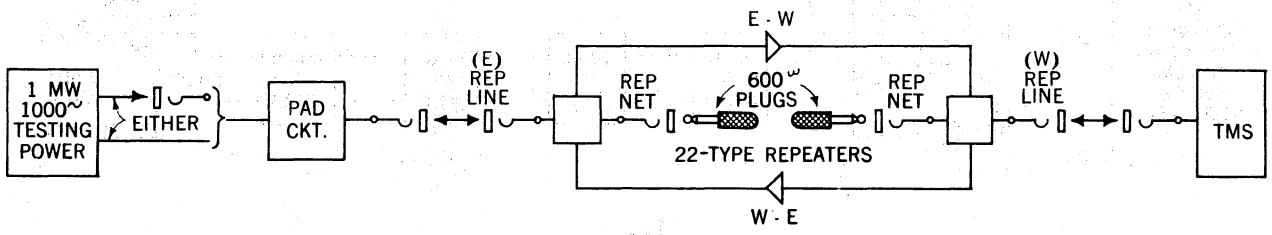

Fig. 3

For example, if the red scale reading is 8.2 db with a normal key setting, and the 15 db IN key in the external pad circuit is operated (i.e., the external pad value is 15 db, representing a sending power into the repeater of 15 db below 1 MW), the gain by formula (1) is (15 - 10 + 8.2) db or 13.2 db.

5.05 Where the 12A set and a single 20 db external pad are used as discussed in Paragraph 3.03 the position of the 5 DB-10 DB key position will depend on the gain to be measured. For this condition the following formula applies:

Gain = red scale reading + 10 db - key position (2)

In this form the numerical value of "key position" should be taken as 0 for normal key position, 5 db for the 5 DB position or 10 db for the 10 DB position. For example, if the red scale reading is 8.2 db and the 5 DB key is operated the gain by formula (2) is (8.2 + 10 - 5) db or 13.2 db.

5.06 The following table shows the position for the pad key in the 12A set for the condition that a single external pad of 20 db is used (i.e., the sending power into the repeater is 20 db below 1 MW:)

Gain Range	Key Setting	Red Scale Reading	Gain = Scale Reading Plus
0-10	10 DB	0-10	0
10-15	5 DB	5-10	5
15-20	Normal	5-10	10

5.07 When using the 13A set, where the sending pad circuit has 5 db steps, the usual position of the dial switch is on the red 0 to avoid overloading the repeater. The meter reading is obtained from the red (upper) scale. In this case the following formula applies:

Gain = external pad + red scale reading (3)

For example, if the meter reads 3.2 db on the red scale with the dial switch at the red 0, and the 10 db IN key in the external pad circuit is operated (i.e., the external pad value is 10 db, representing a sending power into the repeater of 10 db below 1 MW), the gain by formula (3) is (10 + 3.2) db or 13.2 db.

5.08 It should be noted that, with a single value of external sending pad, the dial switch may be employed to extend the range of the 13A set in a similar manner to that covered in Paragraphs 5.05 and 5.06 for the 12A set. In this case care must be taken to avoid overloading the repeater, as an output level of 10 db above 1 MW is possible with the dial switch in the red 5 position and an output level of 5 db above 1 MW is possible with the dial switch in the red 0 position. On the other hand care must be taken to avoid measurements under conditions where the resulting output level of the repeater is so far below 1 MW that the internal repeater noise may interfere with the accuracy of the reading. The following are the general formulae applying to the use of the 13A set in this way:

For red position of the dial switch:

Gain = external pad + red dial switch position + red scale reading (4)

For black position of the dial switch:

Gain = external pad - 5 db + red scale reading - black dial switch position (5)

For example, if the meter reads 3.2 db on the red scale with the dial switch on the red 5 and the external pad value is 5 db (i.e., the sending power into the repeater is 5 db below 1 MW) the gain by formula (4) is (5+5+3.2) db or 13.2 db.

Or, for example, if the meter reads 3.2 db with the dial switch on the black 5 and the external pad value is 20 db (i.e., the sending power into the repeater is 20 db below 1 MW) the gain by formula (5) is (20-5+3.2-5) db or 13.2 db.

5.09 When using the 9A set, the external pad should be set to obtain a reading in the 0 to 5 portion of the scale. The following formula applies:

Gain = external pad - meter reading (6)

For example, if the meter reads 1.8 db and the 15 db IN key in the external pad circuit is operated (i.e., the external pad value is 15 db, representing a sending power into the repeater of 15 db below 1 MW), the gain by formula (6) is (15 - 1.8) db or 13.2 db.