



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

R.79

TELEGRAPHY

TELEGRAPH TRANSMISSION

**AUTOMATIC TESTS OF TRANSMISSION
QUALITY ON TELEGRAPH CIRCUITS
BETWEEN SWITCHING CENTRES**

ITU-T Recommendation R.79

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation R.79 was published in Fascicle VII.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation R.79

AUTOMATIC TESTS OF TRANSMISSION QUALITY ON TELEGRAPH CIRCUITS BETWEEN SWITCHING CENTRES

(Previous Recommendation R.79 – Mar del Plata, 1968: amended at Geneva, 1972, 1976, 1980 and Malaga-Torremolinos, 1984 and R..79 bis, Geneva, 1976; amended at Geneva, 1980 and Melbourne, 1988)

The CCITT,

considering

(a) that maintenance measurement on a telegraph circuit made in the course of routine maintenance measurements takes a relatively long time to carry out and occupies staff at both ends of the circuit. This applies as much to circuits in a satisfactory condition (the majority of cases) as to faulty circuit;

(b) that automatic tests of the transmission quality on telegraph circuits between switching centres can be organized without intervention of personal;

(c) that transmission characteristics for international links are contained in Recommendation R.58;

(d) that the specification of muldexes is given for MCVFT equipment in the R.30-Series of Recommendations and for TDM equipment in the R.100-Series of Recommendations;

(e) that tests of TDM telegraph channels are possible using maintenance loops according to Recommendation R.115;

(f) that standardized texts for distortion testing are given in Recommendations R.51 and R.51 *bis*; and

(g) that the signalling aspects are contained in the U-Series of Recommendations,

unanimously declares the view

(1) that Administrations (or recognized private operating agencies) may organize between international switching and testing centres (ISTCs) an automatic maintenance test service for testing the international trunk circuits of telex and Gentex networks with automatic switching consisting of one or two multi-channel code independent transmission links connected in tandem;

(2) that automatic maintenance tests of telegraph circuits should be based on the following principles:

1 Purpose of automatic tests

1.1 The purpose of automatic testing is to make it possible to perform rapid tests; circuits found to be “satisfactory” in the course of these will not be subjected to full maintenance tests and the maintenance staff can thus concentrate on making full tests of circuits identified as “doubtful” during the rapid tests.

1.2 Automatic tests should be organized in such a way that at least at one end of the group of circuits under test, no staff is required. This end of the circuit will then be said to be “in the passive position”, while the end initiating the tests will be said to be “in the active position”.

For these tests it is necessary to distinguish between trunks including regenerative equipment and those without. Tests on trunks where no regeneration is involved are dealt with in § 2. Tests on trunks where regeneration is involved are dealt with in § 3.

Note 1 – Unless stated otherwise, the end of the circuit in the active position will be denoted by the letter A and the end of the circuit in the passive position by the letter B throughout this Recommendation.

Note 2 – Where regenerative and non-regenerative sections of the telegraph circuits are connected in tandem (e.g. national extension DT in Figure 3/R.79) the tests to be conducted shall be defined in the framework of bilateral agreements.

2 Test of transmission quality of non-regenerative telegraph circuits

2.1 Introduction

2.1.1 This test method is intended for trunks set up with code-independent transmission systems. Figure 1/R.79 presents a typical block diagram for this case. Station A is in active position and station B in passive.

2.1.2 The tests shall consist of measurements of the degree of gross start-stop distortion made independently in each direction of transmission of the trunk circuit with the test text chosen.

2.1.3 The tests shall check that, on each transmission direction of the circuit, the degree of gross start-stop distortion measured does not exceed a level called the "decision level", which is established at 10% if the circuit consists of a single code independent transmission link or at 14% if the channel consists of two code independent transmission links in tandem. The degree of gross start-stop distortion at the transmission end shall not exceed 0.5% and the tolerance for the decision level at the receiving end shall not exceed 0.5%.

2.2 Circuits tested

2.2.1 It must be possible for the end of the circuit in the active position to be connected up automatically with the automatic testing equipment at the passive end. Rapid automatic tests should therefore only be envisaged over circuits connected at the incoming end to an automatic circuit switching centre, i.e. on circuits of the telex and Gentex networks.

2.2.2 For practical reasons, which will be explained later, tests are limited to circuits connecting two international switching centres. No tests are envisaged for the time being on chains of circuits set up through a transit switching centre.

2.2.3 If a trunk circuit system between two centres A and B is divided into groups of circuits made up, say, of a group of circuits confined to traffic from A to B, a group of circuits confined to traffic from B to A and a group of both-way circuits, station A can be in the active position only for the both-way circuits and the circuits confined to traffic from A to B; and, vice versa, station B will be active for tests concerned with traffic from B to A and may also be active on both-way circuits.

2.2.4 Separate tests must be made in each direction of transmission of the circuit being tested since, if tests are made in the two directions in tandem, an inadmissible bias distortion on the forward path can be masked by a bias distortion of opposite sense on the backward path.

2.2.5 The test is carried out over only one circuit of a trunk group. The test of the next circuit begins when the last circuit tested can be used for traffic.

2.2.6 The automatic tests should take place in a slack period. To prevent collision between two international centres A trying to seize the same passible station B at the same time, a timetable for the automatic tests should be established by the Administration concerned to enable Administrations to have access to a particular passive station one after the other.

2.2.7 To make sure that circuits that are busy when due to be tested, or on which busy conditions from the distant network are encountered when testing, are not overlooked during automatic testing, the Administrations concerned shall agree on when new attempts should be carried out on these circuits.

2.3 Test station equipment

An automatic measurement station will consist of two main groups of equipment (see Figure 1/R.79):

2.3.1 A transmission unit consisting of a test transmitter TT and a test analyser TA. The test analyser will be adjusted to a particular degree of distortion, called the decision level, in such a way that if the latter value is exceeded in the signals received during the measurement, the transmission channel being tested will be classified as "doubtful"; otherwise it will be classified as "satisfactory". (To allow for very occasional distortion of a fortuitous nature, it would be useful to classify a channel as "doubtful" only if the decision level is exceeded twice during the measurement.)

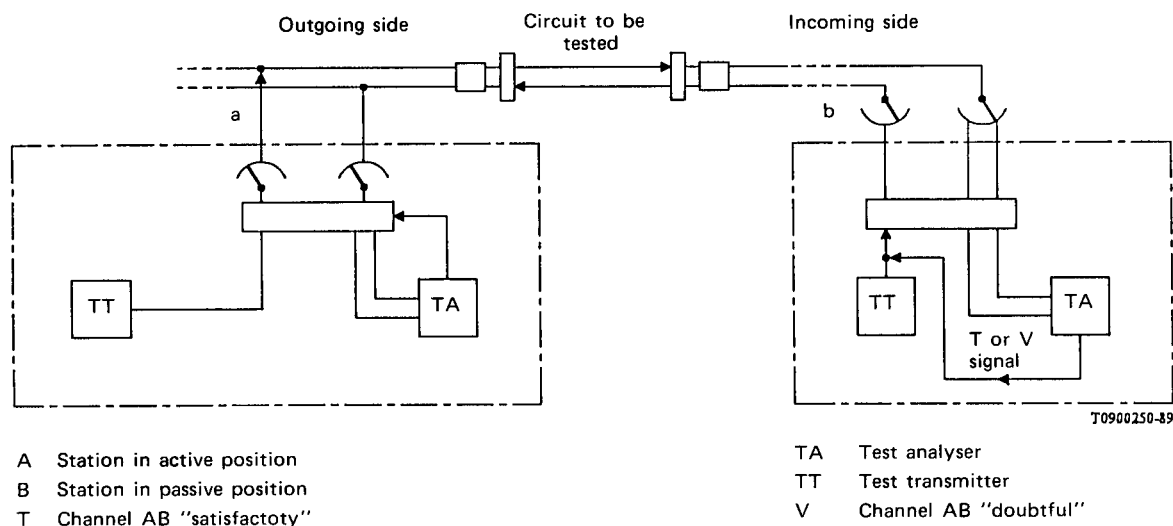


FIGURE 1/R.79
Typical equipment block diagram for automatic testing of transmission quality on telegraph circuits

2.3.2 A switching unit for access operations; selection and signalling on the A-to-B circuit to be operated in accordance with the characteristics of switching centre B, checking at station A the call-connected signal originating at station B; receiving the call, transmitting the call-connected signal and the identification signals when the station is in the passive position.

2.3.3 In an ISTC, a station is normally in the passive condition. In this condition it can be seized by an incoming call for automatic tests and can participate in these tests without the intervention of an operator.

2.4 Test text: decision levels and decision signals

2.4.1 The texts chosen for the tests by bilateral agreement between Administrations are given in Recommendations R.51 (Q9S) and R.51 bis (QKS).

Note 1 – For tests over circuits with regeneration of telegraph signals, the use of the test pattern of Recommendation R.51 (Q9S) is only possible when the pattern is modified such that an average character length of at least 150 ms is maintained.

Note 2 – It should be noted that there is equipment in use that applies the test text specified in Recommendation R.51 (the Q9S text) but with 1.5 units stop element length.

Note 3 – In some cases predistorted test signals may be used by Administrations for testing code independent transmission systems.

2.4.2 The choice of the decision level is complicated by the fact that, while most international telex or Gentex circuits are made up of a single voice-frequency telegraph (VFT) channel, these are also links in which these circuits consist of two VFT channels in tandem. International circuits consisting of three interconnected VFT channels in tandem are very rare and can be ignored as far as the organization of automatic maintenance tests is concerned (which means that these circuits can only with difficulty be subjected to automatic maintenance tests).

2.4.3 Recommendations R.57 and R.58 specify the following values for the limit of inherent start-stop distortion on standardized texts:

- a) 8% for a switched network circuit consisting of a single VFT channel;
- b) 13% for a switched network circuit consisting of two VFT channels.

2.4.4 The following decision levels are recommended:

- a) 10% for a circuit consisting of a single VFT channel or equivalent;
- b) 14% for a circuit consisting of 2 VFT channels or equivalent.

These decision levels for automatic tests are slightly in excess of the limits given in § 2.4.3 in order to give a greater assurance that the circuits identified are genuinely “doubtful” and also because automatic tests can be more stringent than manual tests which can give rise to optimistic results due to missed peaks.

2.4.5 Distortion tests on the backward signalling path will commence as soon as possible after the start of the test signals on the forward signalling path.

2.4.6 The test check results made at the passive station will be sent to the active station by means of the following decision signals:

- a) combination No. 20 (letter T) of International Telegraph Alphabet No. 2 (ITA2) for an affirmative reply (satisfactory channel AB of the circuit);
- b) combination No. 22 (letter V) for a negative reply (doubtful channel AB of the circuit).

2.5 *Method of access and identification signals*

2.5.1 The circuits to be tested will be seized at the output of the switching equipment of A. A seized circuit will be marked “busy” for outgoing calls from switching unit A (and at switching equipment B in the case of a both-way circuit). Station A will call test station B on the circuit seized for the test in accordance with the selection and signalling system applicable to calls from A to B.

2.5.2 In choosing between measurements with a decision level of 10% or of 14%, one of the following principles can be selected by bilateral agreement.

- a) For automatic maintenance tests between SPC type switching systems the decision level is contained in the trunk group description table of both stations; one access number to station B is sufficient.
- b) If station B is not of SPC-type the receive decision level can be determined from the identification sequence of station A, as explained in § 2.5.8. There is only one access number to station B in this case.
- c) For other switching systems station B may be given two access numbers, one for access to the 10% decision level and another one to access the 14% decision level.

These call numbers must be as short as possible and they should if possible be chosen from among the service position numbers. The call numbers for access to the test analyser should if possible be the same for both telex and Gentex circuit tests.

2.5.3 Safeguards against seizure of test stations by telex subscribers are strongly recommended. It is also recommended that calls made in connection with automatic tests should not be included in traffic accounting on the international circuits.

2.5.4 It would be useful if the outgoing access could be so arranged as to include the supervisory and other elements normally associated with the trunk circuits used for calls to make sure that these elements are not subject to faults liable to have an adverse effect on transmission. It is considered that normal switching equipment should be used to permit access to the testing equipment at the incoming end of the circuits. This will obviate the need for special access equipment and enable normal signalling functions to be tested in addition to transmission performance.

2.5.5 If station A wishes to initiate automatic tests on an AB circuit (i.e. one permitting a call from centre A to centre B), station A:

- i) Goes into the active position.
- ii) Checks that the AB circuit to be tested is not being used by switching unit A for a call and, if it is free, seizes this circuit on the outgoing side of switching equipment A. This seizure of the AB circuit marks the latter as busy for outgoing calls from switching unit A.
- iii) Calls the automatic testing station B in accordance with the selection and signalling system to be used on circuit AB.

2.5.6 As soon as station B, in the passive position, is seized by the call, it sends the call-connected signal. This will be followed by the identification sequence (either automatically returned or returned in response to the WRU sent by station A) and then by the RFT signal [consisting of 4 x combination No. 11 (K) of ITA2] with a delay not exceeding 500 ms after the end of the preceding block.

- 2.5.7 The identification of the station obtained should be indicated by the return of an answerback consisting of:
- letter-shift, carriage-return, line-feed, one or two letters representing the telex network identification code of the country of the station and space;
 - the letters MAT;
 - the figures 00 if station B is reached by one access number as outlined under item b) of § 2.5.2 or the figures 10 or 14 in the other cases depending whether equipment with 10% or a 14% decision level adjustment is involved.

For networks that have to send an answer-back in accordance with Recommendation S.6 [1], the requisite additional letter shifts will be added.

2.5.8 If two access numbers are used to access the measuring equipment of station B, the characters indicating the decision level in the answerback return by station A may be replaced by figure shifts.

When only one access number is provided at station B and when the decision level can not be obtained from tables related to the trunk circuits that are to be tested, then station B has to solicit the identification of station A, containing either figure 10 or 14 corresponding to the decision levels involved, after sending its own identification containing the figures 00.

The passive station, on receipt of identification, shall adapt itself to the required received decision level.

2.5.9 Station A will receive the call-connected signal, the identification code and the RFT signal. It may be necessary either as part of the normal signalling requirements of network B or because station B uses station A's identification to adapt itself to the required decision level for network B to send the WRU signal to network A. Station A will always return its identification in response to the WRU signal. Station B will delay transmission of the RFT signal until the identification code has been received in response to the WRU signal. The RFT signal will be sent with a delay not exceeding 500 ms after the last character of this block has been received.

2.5.10 The identification codes returned by station A will correspond to those described under § 2.5.7 above. If two access numbers are used to access the measuring equipment of station B, the characters indicating the decision level in the identification code returned by station A may be replaced by figure shifts. For networks that have to send an answer-back in accordance with Recommendation S.6, the requisite additional letter-shifts will be added.

2.6 *Test procedure*

2.6.1 The transmission tests will be carried out with 6 cycles of test signals (see Figure 2/R.79).

2.6.2 Having verified that the RFT signal is correct, station A will then send six cycles of test signals with a delay not exceeding 500 ms from the end of the reception of the RFT signal. In the event that the block of signals representing the RFT signal proves to be erroneous or the signal was not received in the time permitted the circuit under test will be indicated as doubtful.

2.6.3 Station B shall begin to transmit six cycles of test signals on the BA channel, as soon as the first test signal is received.

2.6.4 The test analyser of station B will check whether or not the degree of distortion on the test signals received at B has exceeded the decision level, If it has not, station B will send the signal T of ITA2 over channel BA. If it has, station B will send signal V of ITA2 over the BA channel 500 ms ($\pm 20\%$) shall elapse between the end of the transmission at B of the last test cycle and the beginning of decision signal V or T.

2.6.5 The test analyser of station A will check whether the degree of distortion of the test signals received at A exceeds the decision-level. The decision will be indicated locally at A.

2.7 *Clearing procedure*

2.7.1 After receiving signal V or signal T, station A will send the clearing signal to B within 500 ms. Any call set up for the automatic testing of a circuit shall be automatically cleared if it lasts longer than 30 s. The circuit on which a call has been released in this manner will be marked doubtful for further examination.

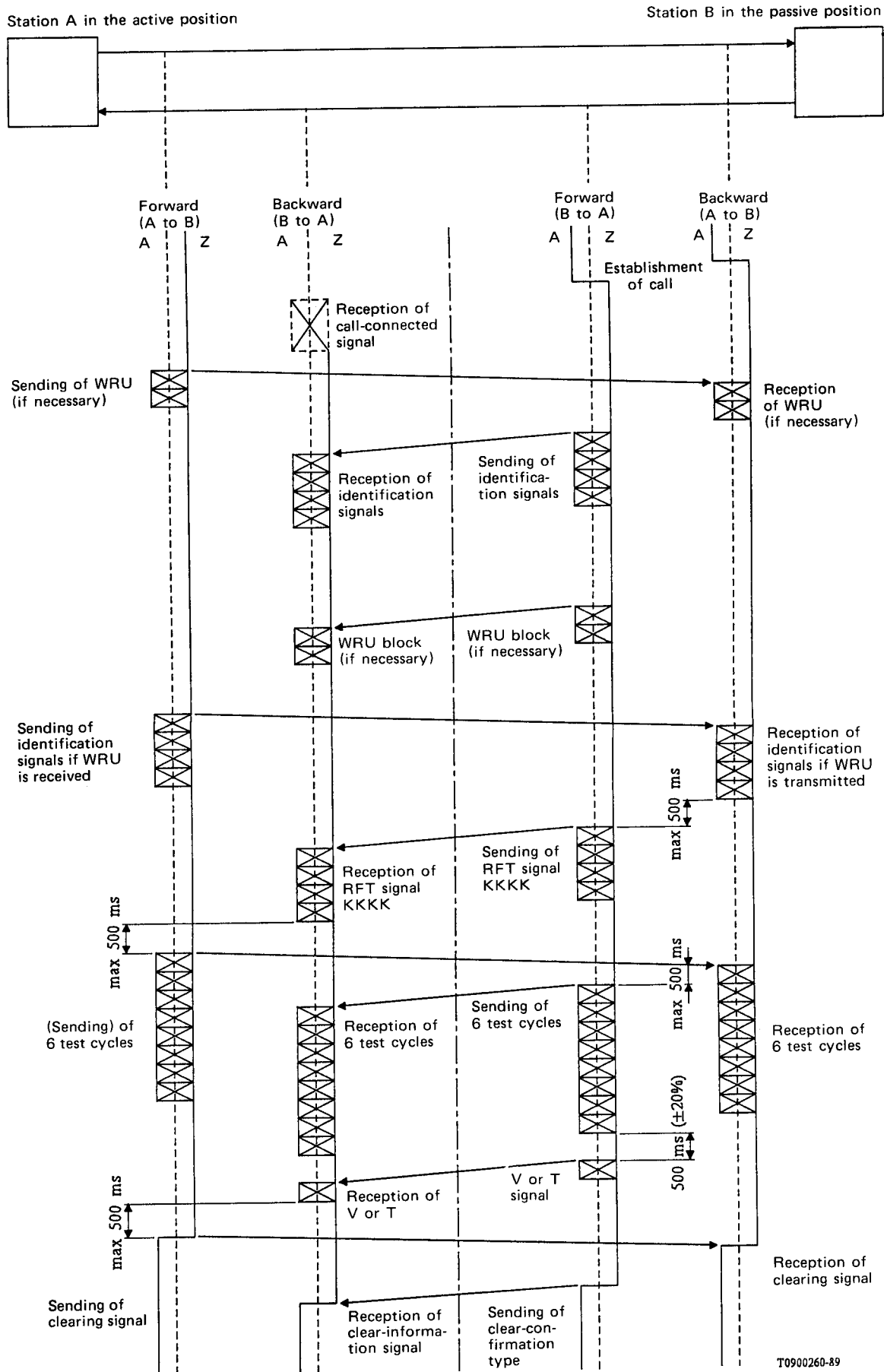


FIGURE 2/R.79
Timing diagram for automatic maintenance test

3 Test of transmission quality of telegraph circuits when regeneration of the telegraph signals is involved

3.1 Introduction

There are various possible combinations of regenerative and non-regenerative sections on a telegraph circuit, including exchanges. Only if the last section in one direction is non-regenerative the test according to § 2 can give information about faulty circuits.

In these cases the use of the tests in §§ 2 and 3 (either one or both of them) in either direction of the telegraph circuit can be used by bilateral agreement.

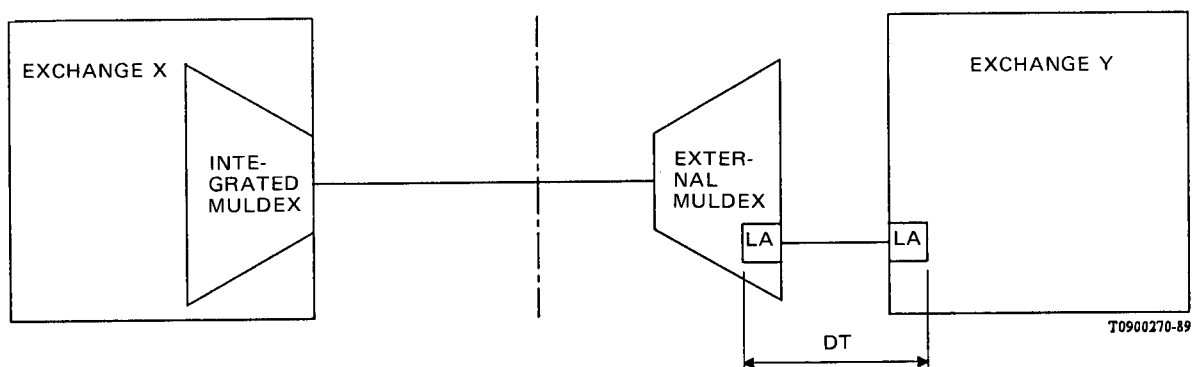
3.2 Integrated muldexes

The introduction of new equipment in the telex network makes it possible to regenerate the telegraph signal in the muldex equipment (e.g. R.101 equipment).

The muldex equipment can be located either (Figure 3/R.79):

- externally to the switching equipment (access then being on a channel-by-channel basis)
- or form an integral part of the switching equipment (access then being a multiplexing frame and switching consisting of a transfer of time slots from one frame to another).

Note – If the external muldex or exchange is without distortion supervision facility it may be needed to carry out distortion measurements according to § 2 on some part of the circuit which can be exposed to transmission errors caused by distortion (e.g. DT in Figure 3/R.79).



EXCHANGE X	The muldex equipment is integrated with the switching equipment
EXCHANGE Y	The muldex equipment is separate to the switching equipment
LA	Line adapter circuit
DT	A part of the transmission circuit which may be distortion tested

FIGURE 3/R.79

Telegraph circuit with regeneration of the telegraph signals involved

3.3 Test method

Regeneration of the telegraph signal makes it pointless to carry out distortion measurements. Instead:

- to verify the quality of the circuits the bit error rate shall be monitored.
- and to verify the traffic switching capabilities a test call shall be made.

To ensure a proper end-to-end function of circuits with regeneration, two complementary methods may be used (to be defined in the framework of bilateral agreements):

3.3.1 To provide permanent supervision of the link either by:

- a) supervision of the synchronisation bits as described in Recommendation R.101 or by
- b) supervision of the bits which are sent on a test and maintenance channel in the muldex conveying the telegraph circuits.

3.3.2 To set up automatic tests on a complete link outside busy periods two methods are possible:

- a) by automatic calls on every circuit to a designated terminal on the remote exchange, and by verifying the terminal's answerback;
- b) in line with the general rules of § 2 but limiting the tests to text monitoring only.

The text consists of QKS signals (or Q9S – with 150 ms average character length) and shall be sent for a duration of one minute.

If the test shows one or more errors the test will be repeated. If the second test also detects errors, the circuit is declared doubtful.