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SPECIFICATIONS OF SIGNALLING SYSTEM R2

TESTING AND MAINTENANCE

ITU-T Recommendation Q.490

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.490 was published in Fascicle VI.4 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 Q.490

TESTING AND MAINTENANCE

6.1 *General*

In international working the guiding principles and testing arrangements for maintenance as defined in Recommendations M.700 to M.728 and Q.134 also apply to Signalling System R2. The organization of routine maintenance, tests and measurements of signalling and switching should comply with Recommendations M.716, M.718, M.719, M.728 and M.732.

The analogue line signalling of System R2 differs from other CCITT signalling systems in two significant respects:

- line signals are sent over out-band signalling channels;
- an "interruption control" protects the line signalling from the consequences of interruptions of the transmission path.

These two features of System R2 require special attention from a maintenance point of view.

6.2 *Automatic procedures for transmission measurements and signalling tests*

Circuits operated with System R2 require elaborate transmission measurements and signalling tests and also rapid and simple testing of transmission and signalling. Both needs are preferably met by means of automatic devices.

The specification for ATME-2 as adopted by CCITT makes it applicable to the testing of international circuits using System R2. The necessary information for its use on such circuits is contained in Recommendation O.22.

A description of a simplified programme for rapid testing of signalling and checking the transmission quality of a circuit is given in § 6.3. Generally speaking, the arrangements for automatic testing consist of outgoing test equipment connected at the outgoing end of the circuit and incoming test equipment connected at the incoming end.

6.3 *Automatic test procedures for test equipments*

Automatic test procedures provides a means for rapid testing of signalling and also checking the transmission quality of circuits operated with Signalling System R2.

6.3.1 *Numbering of access to test equipment*

In international working, to set up a call to maintenance equipment via circuits operated with System R2, the following multifrequency signals must be sent:

- I-13 (replacing the language digit, in accordance with Recommendation Q.133),
- I-13,
- two digits "XY" which will be associated with the type of test equipment and the procedure for testing to be employed (see Recommendation Q.107, Table 7),
- I-15 (if requested by the incoming equipment).

Provision is made for repetition of signal I-13 to avoid complications in the incoming R2 register in the country of destination. The second signal I-13 is stored in the place where the first digit of the routing information is normally recorded. In this way, access to the test equipment requires no analysis, for routing purpose, of the signal which takes the place of the language digit.

When calls are set up to the test equipment, it is desirable to avoid repetition of the request for the access code or for any other digit. This is because the calls may come from equipment which is not normally designed to interpret signals A-2, A-7 or A-8.

The address complete signal to be sent on calls to test equipment must be one of the following:

- A-6 or A-3 followed by B-6 when incoming test equipment is free,
- A-4 or A-3 followed by B-3 or B-4 when incoming test equipment is busy.

Precautions should be taken that signal A-6 is only sent when it is sure that the incoming test equipment is available for that call. When receiving signal A-3, the outgoing test equipment sends signal II-7 in response.

Note - In national working, or in international working where the language digit is omitted by bilateral agreement, the following multifrequency signals must be sent:

- I-13.
- Two digits "XY".
- I-15 (if necessary).

6.3.2 *Test sequence for simplified test*

The test sequence is as follows:

- a) seizing of the automatic incoming test equipment;
- b) transition to answer state;
- c) sending backward of a composite identification signal 1020 + 1140 Hz; this signal will be acknowledged in a compelled manner by the signal mentioned under d);
- d) recognition of a composite acknowledgement signal 1380 + 1980 Hz, sent in the forward direction;
- e) on the disappearance of the acknowledgement signal the incoming test equipment passes to the clear-back state;
- f) on recognition of the clear-back signal, the outgoing equipment will send in a normal manner the clear-forward signal which will clear the connection and release incoming test equipment. After release of the incoming line circuit the release-guard signal will be sent in the normal way.

Detection of failure is made by timing out at the outgoing equipment.

The frequencies mentioned under c) and d) are those for System R2 interregister signalling; transmission and reception of these frequencies in the incoming test equipment must be in accordance with Section 4.

Attenuation pads may be inserted in the send and receive paths of the outgoing test equipment to shift the receive level at the input of the multifrequency receivers of the outgoing and incoming test equipment toward the lower operational limit. This makes it possible to diagnose abnormal loss on the circuit under test from defective multifrequency signal exchange between outgoing and incoming test equipment. For testing international System R2 circuits, the additional attenuation produced by the pads should be 10 ± 1 dB.

6.3.3 *Good/no good transmission test equipment*

In addition to the tests described in §§ 6.3.1 and 6.3.2 a good/no good transmission test may be provided as a simple means for fast error localization. Such a test is described in Recommendation Q.137 for System No. 4 (i.e. and the frequency of the test signal, the tolerances and the deviation from the nominal value, the test signal generators and receivers would all be the same) but the sending level being - 10 dBm.

It is to be noted that loop transmission measurements of the kind specified in Recommendation Q.136 cannot be made on System R2 circuits.

6.4 *Testing of analogue line signalling equipment under abnormal conditions*

The specification of the analogue line signalling equipment contains clauses concerning operation under abnormal conditions, including the action to be taken in case of interruption control alarm. The testing equipment described in § 6.2 is not applicable to such conditions and therefore the functioning of the analogue line signalling equipment under abnormal conditions should be tested internally at each end of a circuit either manually or automatically with special equipment.

The detailed programme for this testing will be specified by each Administration.

The design and construction of the line signalling equipment should be such as to permit both operational and limit testing in normal and abnormal conditions.

6.5 *Alarms for the technical staff*

Certain abnormal conditions in the signalling equipment should cause alarms to be set off for the technical staff (see also Recommendation Q.117). The relevant requirements are found in Section 2 (line signalling equipment) and in Section 5 (time-out in multifrequency registers).

As indicated in § 2.2.3, a fault occurring during release of a circuit may result in an abnormal blocking condition. In this case there is a "tone-on" condition in both signalling directions, yet the circuit is not in the idle condition since the release-guard signal has not been received. If no special action is taken, a temporary fault may therefore result in the circuit's being out of service until it is manually restored by the maintenance staff, after receipt of an alarm (see § 2.2.4).

It may accordingly be desirable to arrange for automatic restoration of abnormally blocked circuits. For Administrations wishing to introduce this function, the recommended arrangement is described below.

6.6 *Recommended method for automatic restoration of an abnormally blocked circuit*

When an outgoing link is abnormally blocked, periodic sending on the outgoing link of the seizing signal, followed shortly afterwards by the clear-forward signal, is initiated.

Clearance of the fault which caused the abnormal blocked condition will initiate a release-guard signal at the incoming end whereupon the outgoing end restores the link to the idle condition.

The intervals, at which the periodic sequence described above is repeated, should be between 30 seconds and 2 minutes.

The first operation of the automatic device should be performed as soon as possible, but not before 2-3 seconds have elapsed, after recognition of the abnormally blocked condition at T1 (see § 2.2).

After a period of three to six minutes a delayed alarm should be given in accordance with Recommendation Q.412, § 2.2.4.

In the event of a backward tone-off condition being detected, other than in response to a periodic clear-forward signal, the periodic sequence is suspended until the backward tone is again recognized whereupon the periodic sending sequence is restarted.

If interruption control at the outgoing end occurs during the abnormally blocked condition, the periodic sending sequence is suspended until the interruption control reverts to normal, whereupon the periodic sending sequence is restarted.

6.7 *Instructions for the maintenance of channels and circuits using System R2 line signalling system at 3825 Hz*

The analogue line signalling equipment specified in Section 2 is closely associated with the channel translating equipment and its operation may be a function of the group and supergroup translating and through-connection equipments. Maintenance of the circuits and groups which support them is governed by the principles and Recommendations of Volume IV. However, the introduction of out-band signalling calls for a few complements to these Recommendations, as described below.

6.7.1 *Bringing into service of group, supergroup, mastergroup or supermastergroup links*

a) §§ 2.1 and 7.6 of Recommendation M.460

It should be noted that group and supergroup pilots placed at 140 Hz from a virtual carrier frequency are incompatible with signalling at 3825 Hz. Hence, the pilot on 84.140 kHz should not be applied to groups in which channel 6 is to be operated with this out-band signalling. Similarly, the pilot on 411.860 kHz should not be applied to supergroups in which channel 1 of the group in the group 3 position is to be operated with signalling at 3825 Hz.

If the channels of a group are to be operated with System R2, each extremity of the group should be equipped, at the receiving end, with a device to give protection against faulty signalling conditions which may result from an interruption in the transmission channels (interruption control). This equipment, which is based on pilot level detection; must comply with the conditions specified in § 2.4.3 of Recommendation Q.416.

Note - If the channels of a supergroup which are operated with System R2 have the same extremities as the supergroup, a device based on monitoring of the supergroup pilot can be used instead of one based on monitoring of the group pilot. It will have to meet the same specifications.

b) § 7.2 of Recommendation M.460

The group-translating and through-connection equipments are specified with a passband extending from 60.600 kHz to 107.700 kHz. If it is wished to use channels 12 with signalling at 3825 Hz, it is necessary to ensure when the group is set up, that the corresponding frequency (60.175 kHz) is transmitted satisfactorily from end to end of the group link.

Provisionally, in view of the operating margin of the receiving part of the signalling equipment, it is desirable to check that attenuation at this frequency does not exceed the attenuation at the group pilot frequency by more than 3 dB.

A similar precaution should be taken on setting up group links when signalling is to be used at 3825 Hz on channel 12 of the group transmitted in position 5 on the supergroup.

6.7.2 *Setting-up and lining-up the channels of an international group*

6.7.2.1 *Setting up the out-band signalling channel for the System R2*

Testing of the sending equipment:

- The sending level of the signalling frequency corresponding to 3825 Hz if the carrier is taken as the frequency of origin must be lined up at -20 ± 1 dBm₀. When this frequency is not to be sent, its leak transmitted to line should not exceed -45 dBm₀.

Testing of the receiving equipment:

- The signalling receiver must operate in the conditions described in §§ 2.3.2.1 and 2.3.2.2. It must not function when a signal, of which the characteristics (level and frequency) are such that the representative point is below the graph in Figure 8/Q.415, is applied to the same point.

This test may be replaced by the following one to check the protection against unwanted signals (impulsive noise):

- The sending part of the group terminal equipment is connected to its receiving part by a closed-circuit loop at the group distribution frame, this loop introducing a slight gain (e.g. 3 dB) if possible. The standardized click generator (see Figure 7/Q.414) is applied to each speech channel successively at the point where this channel is connected to the switching equipment, and a check is made to ensure that no wrong signals are retransmitted at the receiving end to the switching equipment by the channel signalling equipment concerned or by those of the other channels in the group.

6.7.2.2 *Closed-circuit loop tests: response time*

When the transmission-reception loop of the terminal equipment is effected at the group distribution frame or at an equivalent point, a check is made to ensure that less than 30 ms elapse between the moment when the change of condition is applied to the transmitter associated with each channel and the moment when it appears at the output of the corresponding receiver.

6.7.2.3 *End-to-end tests*

When the terminal channel-translating equipments are normally connected to the extremities of the link, an end-to-end operating test is carried out. The level of the line-signalling frequencies transmitted and received for each channel are likewise measured, to provide a reference, at the group terminal distribution frames or at equivalent points.