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BOTH-WAY WORKING OF THE ANALOGUE LINE SIGNALLING VERSION OF SIGNALLING SYSTEM R2

Reedition of CCITT Recommendation Q.400, Supplement No. 2, published in the Blue Book, Fascicle VI.4 (1988)

NOTES

1 CCITT Recommendation Q.400 Supplement No. 2 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.400 Supplement No. 2

BOTH-WAY WORKING OF THE ANALOGUE LINE SIGNALLING VERSION OF SIGNALLING SYSTEM R2

1 Both-way working

In principle the Signalling System R2 is specified for one-way working. The following additional clauses therefore apply only to cases where Administrations have undertaken by bilateral agreement to use both-way working.

Equipment which must be equally usable in both-way and in one-way operation should be so designed that it can be easily adapted to the requirements of either mode of operation.

A peculiarity of both-way working with the system under consideration is that a blocking signal cannot be distinguished from a seizing signal at either end of a circuit, since the transition of the signalling condition corresponding to these signals is the same, namely from *tone-on* to *tone-off*.

When a both-way circuit is seized simultaneously at both ends, the signalling tone is disconnected in both directions of transmission; this is the criterion for detecting the double-seizure situation.

The special arrangements required for both-way working relate to the two cases mentioned above. For all other signalling phases the specifications for one-way working remain valid without modification.

1.1 *Normal conditions*

1.1.1 *Double-seizure*

When the signalling equipment at one end of a both-way circuit seizes that circuit by disconnecting the signalling tone, it must verify that cessation of the signalling tone in the opposite direction does not occur within 250 ± 50 ms of the disconnection of the signalling tone in the forward direction. If the signalling equipment detects the removal of the signalling tone within that interval then a double-seizure situation is recognized. Each end must return to the idle state after sending the clear-forward signal and recognizing *tone-on* condition on the signalling channel.

However, each end must, even if immediately seized for an outgoing call, maintain *tone-on* condition for at least 100 ms on the outgoing signalling channel to ensure that the end of the double seizure situation is recognized at the other end.

Although a double seizure has been recognized, the *tone-off* condition in the backward direction is passed on backwards. This will be regarded as an erroneous answer signal and lead to the release of the connection in accordance with § 2.2.3 in the Specifications. However, as specified in § 1.2.1 below the clear-forward signal (*tone-on* condition) must not be sent until the *tone-off* condition has been maintained for at least 1250 ± 250 ms. Each end after sending of the clear-forward signal returns to the idle condition when the time interval 250 ± 50 ms (see § 2.2.2.6 in the Specifications) has elapsed, and the sending of the *tone-on* condition from the other end has been recognized.

In the sense of preventive action it is recommended that an opposite order of circuit selection is used by each exchange of a both-way circuit group to minimize double seizure.

1.1.2 *Minimum duration of idle state after release-guard*

When a both-way circuit is released, the end which acted as the incoming end must, even if immediately seized for a call in the opposite traffic direction, maintain the *tone-on* condition for at least 100 ms to ensure that the release-guard sequence is recognized at the other end.

1.1.3 *Blocking*

When a both-way circuit is blocked manually in its idle state at one end (A), the blocking signal, must be transmitted to the other end (B), where it will nevertheless be interpreted as a seizing signal. This will mean that an incoming R2 register is seized, but is not receiving any interregister signal. After the lapse of this register's time-out delay the circuit must be kept blocked locally (at end B) against all calls in the B-A direction so long as the *tone-off* condition persists in A-B direction.

To avoid certain difficulties (see §§ 1.2.1 and 1.2.2 below) and in contrast to § 2.2.3.5 in the Specifications the *tone-off* condition is not applied in the opposite direction (B-A) to the blocking direction (A-B).

When the blocking is removed at end A the signalling tone is again transmitted in direction A-B and the B-end interprets the onset of the signalling tone as a clear-forward signal, thereby initiating the release-guard sequence in the B-A direction.

1.2 *Abnormal conditions*

The cases described below relate to interruption of the individual signalling channels or to faults in the individual line-signalling equipment. Interruption control does not function in these cases.

In any circuit the interruption of one or both signalling channels can bring about signalling sequences different from those described in § 2.2.3 in the Specifications for one-way working.

1.2.1 When an interruption of the signalling channel in one of the two directions brings about a signalling state corresponding to blocking, the release-guard sequence will be initiated the moment the interruption ends (see § 1.1.3).

The release-guard sequence implies that the signalling tone in the backward direction be disconnected for an interval 450 ± 90 ms. In both-way working this *tone-off* condition must not be interpreted as seizing. To avoid a repetition of the exchange of release-guard sequences certain precautions must be taken.

The following additional requirements should then be met:

– when the *tone-off* condition has lasted for an interval of less than 750 ± 150 ms the return to *tone-on* condition must not initiate a release-guard sequence;

– once the signalling condition corresponding to seizing has been established, it must be maintained for at least 1250 ± 250 ms (this is a deviation to the requirement in § 2.2.2.1 in the Specifications).

When the interruption of one of the signalling channels has brought about blocking of the circuit at one end (B), as described above, that circuit can be seized at the other end (A). The end A will not have received the blocking signal from end B (see § 1.1.3) because that would cause permanent blocking of the circuit, which would then no longer be able to restore itself to normal functioning. Should a seizing now occur, this will lead to loss of a call; but subsequently, since the clear-forward signal cannot be transmitted, the circuit will remain blocked at end A. The whole further signalling sequence for reverting the circuit under consideration to idle follows the specification for one-way circuits.

1.2.2 An interruption of both signalling channels on any circuit will be interpreted by the equipment at each end of the line as seizing and the equipments will be blocked after the lapse of the time-out delay of the incoming R2 registers.

If, after an interruption, only one signalling channel is restored, the equipment at the incoming end in relation to that signalling channel will interpret the *tone-on* condition as a clear-forward signal and therefore bring into operation the release-guard sequence. The terminal equipment at that end will revert to the idle state, while the terminal equipment at the other end remains blocked. This is the situation envisaged in § 1.2.1 above.

When both signalling channels are simultaneously restored, the terminal equipment at both ends will interpret the onset of the signalling tone as a clear-forward signal and this will bring the release-guard sequence into operation. The result will be that the terminal equipment at both ends will again recognize the *tone-off* condition for a brief interval.

The following additional clause must be observed, to avoid permanent blocking of the circuit in this condition:

– When, after blocking, the line-signalling equipment at one end (A) of a both-way circuit has recognized the clear-forward signal, it must complete the release-guard sequence and restore the signalling tone after 450 ± 90 ms in the direction A-B, even if the tone in direction B-A is interrupted. If such interruption (in direction B-A) lasts for less than 750 ± 150 ms, the circuit returns to the idle state when the signalling tone is restored in both directions. If the interruption is longer than 750 ± 150 ms, restoration of the signalling tone in direction B-A will initiate a new release-guard sequence in direction A-B (see § 1.2.1 above).

1.2.3 If an abnormal condition according to § 2.2.3.3 in the Specifications occurs at one end of a both-way circuit, this end is blocked for outgoing traffic. Such blocking should, however, not prevent the circuit being used in the other traffic direction.

2 Special conditions regarding the interruption control for both-way working

2.1 As soon as an operating condition has been established on a both-way circuit and the outgoing and incoming ends of the circuit have been determined with certainty, the interruption control specifications for one-way working become equally applicable to both-way circuits.

2.2 When a both-way circuit is in the idle state, transition to alarm of the interruption control of one direction of transmission must bring about operations to ensure that the signalling condition existing at that moment on the signalling channel of the opposite direction is maintained - in contrast to specification 2.4.2.1 a) i) in the Specifications for one-way working. This precaution obviates a permanent blocking of a both-way circuit when interruption of the signalling channels occurs simultaneously in both directions. It does not ensure immediate blocking of the circuit; this will not occur until the circuit has been seized by the next call.

2.3 In all operating conditions intermediate between the *idle* state and the condition at the moment when the direction of seizure of the both-way circuit is determined (see above), the line-signalling equipment at both ends will be locked by interruption control in the condition in which it was before interruption control passed to alarm.

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