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SERIES Q: SWITCHING AND SIGNALLING

Specifications of Signalling System R1

ITU-T Recommendation Q.310-Q.332

(Formerly CCITT Recommendation)

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ITU-T Recommendations Q.310-Q.332

Specifications of Signalling System R1

Summary

System R1 may be applied for automatic and semi-automatic operation of one-way and both-way circuits, within an international region (world numbering zone). When utilized in an integrated world numbering zone (e.g. Zone 1) the numbering and routing plans and operating facilities of that zone should apply.

The system is applicable to all types of circuits (except TASI derived circuits) meeting CCITT transmission standards, including satellite circuits.

Source

ITU-T Recommendations Q.310-Q.332 was prepared by CCITT Study Group XI (1985-1988) and approved by WTSC on 18 November 1988. Those texts were originally published in Blue Book, Fascicle VI.4.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSC Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

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PART I – SPECIFICATIONS OF SIGNALLING SYSTEM R1

INTRODUCTION

PRINCIPLES OF SIGNALLING SYSTEM R1

General

The development of new exchanges, especially those utilizing stored programme control, has introduced new concepts in the division of functions between various components of signalling and switching systems. To allow the maximum freedom in incorporating new concepts which can contribute to the overall economy and efficiency of the system, the requirements as covered in this specification are for the combination of equipments necessary to provide a function. For example, the requirements for line signal receiving equipment as given here may be met by various subdivisions of functions between signal receiver, trunk relay sets and stored programme control.

System R1 may be applied for automatic and semi-automatic operation of one-way and both-way circuits, within an international region (world numbering zone). When utilized in an integrated world numbering zone (e.g. Zone 1) the numbering and routing plans and operating facilities of that zone should apply.

The system is applicable to all types of circuits (except TASI derived circuits)¹⁾ meeting CCITT transmission standards, including satellite circuits.

The signalling equipment used in System R1 consists of two parts:

- a) line signalling for line or supervisory signals; and
- b) register signalling for address signals.

a) *Line signalling*

1) *2600 Hz signalling*

Continuous tone type in-band line-signalling is used for the link-by-link transmission of all supervisory signals except the ring-forward (forward-transfer) signal which is a spurt signal. A single frequency, 2600 Hz, is used in each direction of the 4-wire transmission path, the presence or absence of this frequency indicates a specific signal dependent upon when it occurs in the signalling sequence and in certain cases upon its duration. When the circuit is idle, a low level signalling tone is continuously present in both directions.

2) *PCM signalling*

The 2600 Hz line signalling described in 1) is not normally applied to the speech paths of circuits working on PCM systems unless the PCM channels are connected in cascade with analogue channels to form a circuit. The signalling on PCM systems in the North American region is channel associated, in-slot, providing two signalling channels per speech channel, and utilizing bit stealing of the eighth bit of each channel every sixth frame.

¹⁾ Register signalling can be made compatible with TASI by providing a TASI locking tone.

b) *Register signalling*

Link-by-link multifrequency (MF) in-band pulse signalling is used for the transmission of address information. The signalling frequencies are 700 Hz to 1700 Hz, in 200 Hz steps, and combinations of two, and two only, determine the signal. The address information is preceded by a KP signal (start-of-pulsing) and terminated by an ST signal (end-of-pulsing). Either *en bloc*²⁾, or *en bloc* overlap²⁾, or overlap sending may apply. This register signalling arrangement is used extensively with other in-band and out-band line signalling systems.

Companders may affect signalling, particularly short pulse compound register signals, due to pulse length distortion and the production of intermodulation frequencies. By virtue of the link-by-link signalling and the adopted duration of register and line signal pulses, System R1 functions correctly in the presence of companders designed in accordance with CCITT recommendations.

²⁾ See Recommendation Q.151, Note to § 3.1.1 for an explanation of these terms.

SECTION 1

DEFINITION AND FUNCTION OF SIGNALS

Recommendation Q.310

Specifications of Signalling System R1

1. DEFINITION AND FUNCTION OF SIGNALS¹⁾

1.1 **connect (seizing) signal** (sent in the forward direction)

This line signal is transmitted at the beginning of a call to initiate circuit operation at the incoming end of the circuit to busy the circuit and to seize equipment for switching the call.

1.2 **delay-dialling signal** (sent in the backward direction)

This line signal is transmitted by the incoming exchange following the recognition of the connect (seizing) signal to verify receipt of the connect (seizing) signal and to indicate that the incoming register equipment is not yet attached or ready to receive address signals.

1.3 **start-dialling (proceed-to-send) signal** (sent in the backward direction)

This line signal is sent from the incoming exchange subsequent to the sending of a delay-dialling signal to indicate that the incoming register equipment has been connected and is ready to receive address signals.

1.4 **KP (start-of-pulsing) signal** (sent in the forward direction)

This register signal is sent subsequent to the recognition of a start-dialling signal and is used to prepare the incoming multifrequency register for the receipt of subsequent interregister signals.

1.5 **address signal** (sent in the forward direction)

This register signal is sent to indicate one decimal element of information (digit 1, 2, ..., 9 or 0) about the called party's number. For each call a succession of address signals is sent.

1.6 **ST (end-of-pulsing) signal** (sent in the forward direction)

This register signal is sent to indicate that there are no more address signals to follow. The signal is always sent in semi-automatic as well as automatic working.

¹⁾ In this part the North American designation for line signals is used. The designation of the signal in System No. 5 which most nearly corresponds to a particular North American signal is shown in parentheses. There is not always exact correspondence in function, e.g. the ring-forward signal can only be effective when a connection has been established through an incoming operator.

1.7 **answer signal** (sent in the backward direction)^{2), 3)}

This line signal is sent to the outgoing exchange to indicate that the called party has answered.

In semi-automatic working, the signal has a supervisory function.

In automatic working, it is used:

- to start metering the charge to the calling subscriber;
- to start the measurement of call duration for international accounting purposes, if this is desired.

1.8 **hang-up (clear-back) signal** (sent in the backward direction)²⁾

This line signal is sent to the outgoing exchange to indicate that the called party has cleared. In the semi-automatic service it performs a supervisory function.

In automatic working, arrangements are made to clear the connection, stop the charging, and stop the measurement of call duration if within 10 to 120 seconds⁴⁾ after recognition of the hang-up signal, the calling subscriber has not cleared. Clearing of the connection should preferably be controlled from the point where the charging is carried out.

1.9 **ring-forward (forward-transfer) signal** (sent in the forward direction)

This line signal is initiated by an operator to recall an operator at a point further ahead in the connection.

1.10 **disconnect (clear-forward) signal** (sent in the forward direction)

This line signal is sent in the forward direction at the end of a call when:

- a) in semi-automatic working, the operator at the outgoing exchange withdraws the plug from the jack, or when an equivalent operation is performed;
- b) in automatic working, the calling party hangs up, or when the time-out period of 10 to 120 seconds as discussed in § 1.8 above occurs.

1.11 *Diagrams showing signal sequence*

Typical sequences of signals in semi-automatic and automatic working are shown in Annex A to these Specifications of Signalling System R1.

2) Notes on the answer and hang-up (clear-back) signals. – See corresponding notes in Recommendation Q.120, § 1.8, Volume VI-2 of the *Green Book*.

3) See Recommendation Q.27 for the actions to be taken to assure that answer signals, both national and international, are transmitted as quickly as possible.

4) In word numbering Zone 1, 13 to 32 seconds is used.

SECTION 2

LINE SIGNALLING

Recommendation Q.311

2.1 2600 HZ LINE SIGNALLING

The line-signal coding arrangement is based on the application and removal of a single frequency tone (2600 Hz) as shown in Table 1/Q.311.

TABLE 1/Q.311
Line signal code

Signal	Signal direction ^{1), 2)}	Transmitted (sending) duration	Transmitted state ^{5), 6)}	
			Originating end	Terminating end
Idle		continuous	0	0
Connect (seizing)		continuous	1	0
Delay-dialling		continuous ³⁾	1	1
Start-dialling (proceed-to-send)		continuous ³⁾	1	0
Answer		continuous	1	1
Hang-up (clear-back)		continuous	1	0
Disconnect (clear-forward)		continuous	0	0 or 1
Ring-forward (forward-transfer)		65-135 ms	0	0 or 1
Busy, re-order (congestion) ⁴⁾		—	off	on

¹⁾  ,  indicates forward signalling state 0 or 1, respectively.

²⁾  ,  indicates backward signalling state 0 or 1, respectively.

³⁾ The durations of these signals are variable and depend upon when the succeeding signal occurs. To ensure proper registration of these signals, the transmitted signal durations should not be less than 140 ms.

⁴⁾ Busy and re-order (congestion) conditions are indicated by audible tones.

⁵⁾ 0: Tone on, or signalling bit state 0 in PCM systems.

⁶⁾ 1: Tone off, or signalling bit state 1 in PCM systems.

By taking advantage of the fixed order of occurrence of specific signals, both tone-on and tone-off signals are used to indicate more than one signal condition. For example, in the backward direction tone-on is used to indicate start-dialling (proceed-to-send), and terminating end hang-up (clear-back) signals without conflict. The equipment must retain memory of the preceding signal states and the direction of signals in order to differentiate between tone-on and tone-off signals.