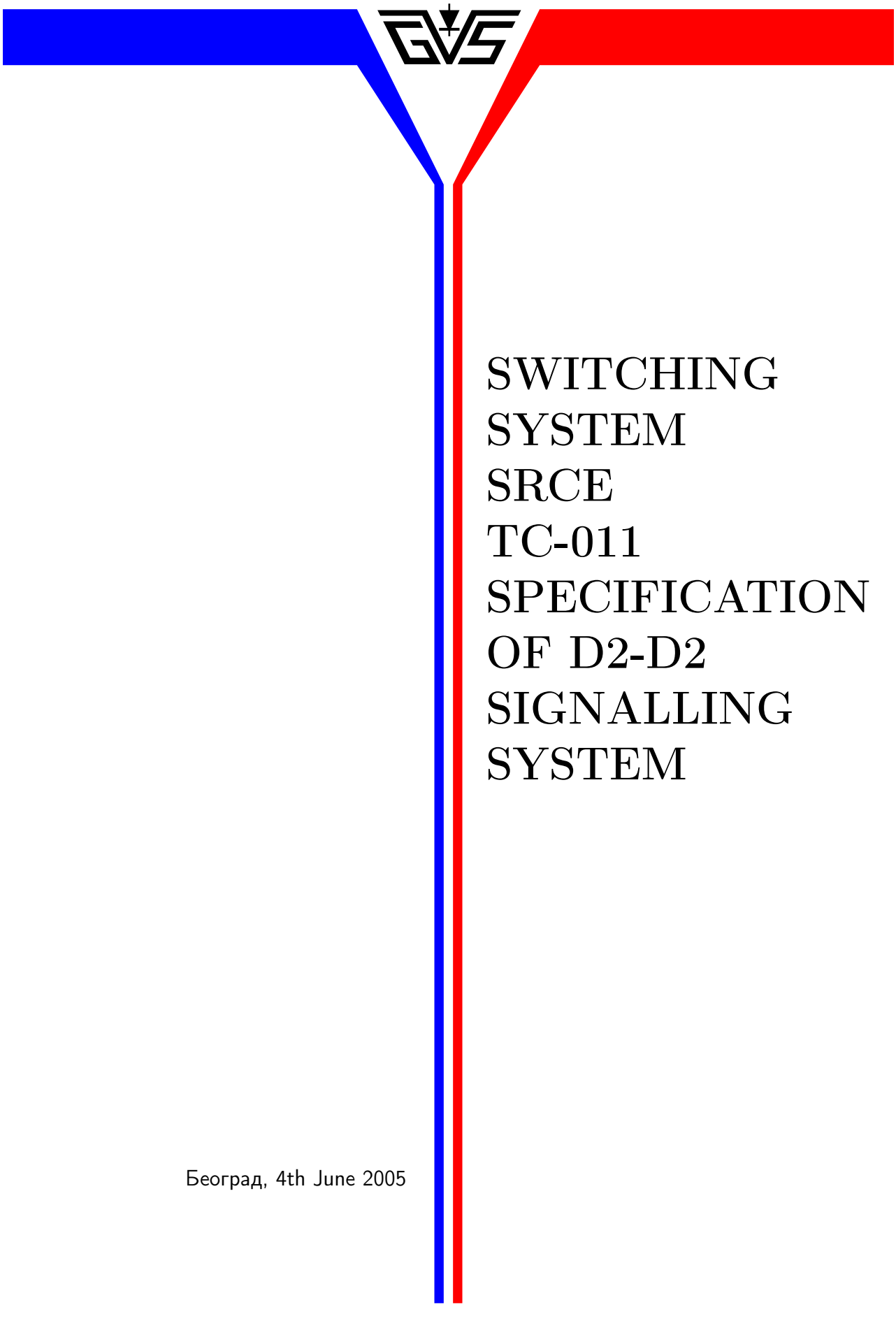

SWITCHING SYSTEM SRCE TC-011 SPECIFICATION OF D2-D2 SIGNALLING SYSTEM

Београд, 4th June 2005

Contents

1 INTRODUCTION

This document presents Signalling System D2-D2 specification on Switching system SRCE TC 011. The presentation style and structure of the document are similar to the original ITU-T Recommendations Q.4xx text.

It is important to mention that exchanges, working on D2-D2 Signalling System behave differently depending on signalling route, which could be:

1. Urban → interurban / urban → tandem
2. Interurban → urban
3. Urban → urban

In this document, it is supposed that the Switching System SRCE will never work in Signalling System D2-D2, as a low-level exchange.

2 DEFINITIONS AND FUNCTIONS OF SIGNALS

2.1 Forward line signals

2.1.1 Seizing signal

Seizing signal is sent at the beginning of the call to initiate the transition of the circuit at the incoming end from the idle state to the *seized state*. At the incoming exchange it causes the association of equipment capable of receiving register signals.

2.1.2 Clear-forward signal

The clear-forward signal is sent to terminate the call or call attempt and to release in the incoming exchange and beyond it all switching units held on the call. This signal is also sent by outgoing exchange in the case of forced release of the connection.

2.1.3 Trunk offering signal

Trunk offering signal is sent forward by the operator in order to enter connection due to the new call.

2.1.4 Trunk disconnect signal

Trunk disconnect signal is sent forward by the operator in order to leave connection.

2.1.5 Reringing signal

Reringing signal is sent to the called subscriber incoming end by the operator, after receipt of clear-back after offering signal, in order to establish the new connection.

2.1.6 Address signal

Address signals represents called party number's digits (0..9). These signals are transmitted forward during sending address signals.

2.2 Backward line signals

2.2.1 Seizing acknowledgement signal

Seizing acknowledgement signal is sent by the incoming exchange immediately after receipt of the seizing signal.

2.2.2 Proceed to send signal

Proceed to send signal is sent to the outgoing exchange indicating that the equipment at the incoming end is ready to receive the address signals.

2.2.3 End of dialling signal

End of dialling signal is sent to the outgoing exchange indicating that all needed digits have been recognised.

2.2.4 Signals indicating the condition of the called subscriber's line

Signals, sent to the outgoing exchange, are provided to give an information about the called subscriber's line at the end of sending address signals. These signals are:

a) **subscriber line free**, indicating that the subscriber's line is free

b) **subscriber line busy**, indicating that the line or lines, connecting the called subscriber to the exchange, are busy.

2.2.5 Answer signal

Answer signal is sent to the outgoing exchange to indicate that the called party has answered the call.

2.2.6 Clear-back signal

The clear-back signal is sent to the outgoing exchange to indicate that the called party has cleared.

2.2.7 Forced release signal

Forced release signal is sent by the charge controlling exchange to any preceding exchange, in order to release the connection, under the following conditions:

- when the answer signal is not received within a defined period of time
- when the called party clears back, but the calling party does not clear forward within a defined period of time.

2.2.8 Release guard signal

Release-guard signal is sent to the outgoing exchange in response to clear-forward signal to indicate that the latter has been fully effective in returning switching units at the incoming end of the circuit to idle condition. A circuit is protected against subsequent seizure as long as the release operations initiated by clear-forward signal have not been completed at the incoming end.

2.2.9 Malicious call signal

Malicious call signal is sent to the outgoing end during the conversation, requesting the connection to be held in order to trace the malicious call.

2.2.10 Blocking signal

Blocking signal is sent on an idle circuit to the outgoing exchange to cause engaged conditions (blocking) to be applied to this circuit, guarding it against subsequent seizure.

2.2.11 Unblocking signal

Unblocking signal is sent on a blocked circuit to restore it to the idle state.

2.2.12 Clear-back after offering signal

The clear-back after offering signal is sent to the calling operator in the case of trunk offering, after the primary connection has been cleared.

2.2.13 Meter signal

Meter signals are signals transmitted backwards during the conversation from the call charging point to the subscriber's call meter in the originating exchange.

2.3 Digital line signalling code

2.3.1 General

The digital version of System D2-D2 line signalling uses two signalling channels in each direction of transmission per speech circuit. These signalling channels are referred to as a_f and b_f for the forward direction (i.e. the direction of call set-up) and a_b and b_b for the backward direction. In the idle state of transmission circuit a_f=1, b_f=0, a_b=1, and b_b=0.

Signals are sent link by link.

This signalling scheme is used for one-way working.

2.3.2 Signalling code

All signals used in D2-D2 signalling could be classified as pulses (with defined duration) and continuous. Continuous signals should be recognised within a defined period of time.

2.3.2.1 Address signal

Address signal is made as sequence of dial pulses followed by an interdigit pause. Pause between two consequent dial pulses within a sequence should be as long as dial pulse (50 ms). The sequence, representing an address signal must not consist of more than ten dial pulses (digit 0). The interdigit pause should be longer than 300 ms[1)] to be recognised as the end of the address signal.

2.3.2.2 Tones

In the D2-D2 Signalling System there are no special line signals, indicating the state of the called subscriber. However, there is a need to inform the calling party exchange about these conditions. Therefore, the exchange, that has such information, transmits tones through the speech channel. These signals are busy tone, blocking tone and special information tone.

2.3.2.3 Signal implementation

Table 1 shows the signalling code on the PCM line under normal conditions.

Table 1

	Signalling code						
Signals	Forward		Backward			Direction	Remarks
	a_f	b_f	a_b		b_b		
Idle	1	0	1		0	$\leftrightarrow$	
Seizing	0	0	1		0	$\rightarrow$	
Seizing acknowledgement	0	0	1		1	$\leftarrow$	
Proceed to send	0	0	0		1	$\leftarrow$	
Address signal	1	0	0		1	$\rightarrow$	Pulsed, a_f=1 at least 50 ms
End of dialling	0	0	0		0	$\leftarrow$	Pulsed, b_b=0 at least 80 ms
Subscriber state: 1) free	0	0	1		1	$\leftarrow$	
2) busy	0	0	0		1	$\leftarrow$	
Answer	0	0	0		1	$\leftarrow$	
Clear-back [2]	0	0	1		1	$\leftarrow$	Recognition time 240-450 ms

[1]In some signalling scheme such as interurban-urban route, interdigit pause should be between 600 and 700 ms.

[2]The clear back signal can be sent only by the incoming end of the circuit beyond the charging point.

	Signalling code						
Signals	Forward		Backward			Direction	Remarks
Forced Release [3]	0	0	0		0	←	
Clear-forward	1	0	0 1	or	x 1	→	
Release guard	1	0	1		0	←	
Malicious call [4]	0	0	1		0	←	
Blocking	1	0	1		1	←	State b_b=1 at least 100 ms
Unblocking [5]	1	0	1		0	←	
Trunk offering [6] [7]	1	0	0		1	→	Pulsed, a_f=1 for 150 ± 30 ms
Trunk disconnect [6] [7]	1	0	0		1	→	Pulsed, a_f=1 for 150 ± 30 ms
Clear-back after offering	0	0	1		1	←	
Reringing	1	0	0		1	→	Pulsed, a_f=1 for 150 ± 30 ms
Meter	0	0	1		1	←	Pulsed, a_b=1 for 150 ± 30 ms

[3] The forced release signal can be sent only by the incoming end of the circuit prior to the charging point.

[4] Used only in the case of urban → urban route

[5] This signal can be recognised/sent only if the blocking signal has already been sent/recognised. It is implemented as restoration of signalling channels to idle state.

[6] Applicable only on the interurban-urban route

[7] Minimal period between trunk offering and trunk disconnect signals is 240 ms.

3 CLAUSES FOR EXCHANGES LINE SIGNALLING EQUIPMENT

3.1 Recognition of a change of signalling code

3.1.1 Recognition of a change of signalling code

3.1.1.1 Signalling channel transitions

The recognition time for a transition from 0 to 1 or vice versa on a signalling channel is 20±10 ms. This value presupposes the existence of protection against the effects of faulty transmission conditions on the PCM multiplex.

The recognition time is defined as the duration that the signals representing 0 or 1 must have at the output of the terminal equipment of a signalling channels a_f and a_b in order to be recognised by the exchange equipment.

3.1.1.2 Change of signalling code

Recognition of a change of signalling code is thus defined as either of the following:

a) Recognition of a transition detected on one signalling channel with no transition detected on the second signalling channel during the recognition period.

b) Recognition of a transition detected on the second signalling channel during the recognition period already being applied to the first signalling channel. In this case, a change of signalling code is recognised only when both recognition timing periods have elapsed.

3.1.2 Sent signal time tolerance

The time difference between application of transitions intended to be simultaneous on two signalling channels in the same direction of transmission does not exceed 2 ms.

3.2 States and procedures under normal conditions

In the forward direction $b_f = 0$ is established permanently.

3.2.1 Idle state

In the *idle* state the outgoing end sends idle signal. At the incoming end this results in sending idle signal in the backward direction, provided that the switching equipment at the incoming end of the circuit is idle. This state denotes the availability of the circuit for the seizure for the new call set-up.

3.2.2 Seizing procedure

a) *Seizure*

The seizing procedure should occur only if the transmission circuit is idle at the moment. The outgoing end sends seizing signal, and the *seized state* of the circuit is established. At that state, timer defined as vkPTS is started and the seizing acknowledgement or proceed to send signal should be recognised within this time-out period.

b) *Seizure acknowledgement*

After having recognised the seizing signal, the incoming end of the circuit sends the seizing acknowledgement immediately, without checking receiving digits readiness. The receipt of the seizing acknowledgement at the outgoing end change the state of the circuit to the *seizure acknowledged state.*

c) *Proceeding*

When the incoming exchange becomes ready for receiving digits, the proceed to send signal is sent to the outgoing end of the circuit, indicating that the sending address signals procedure can start. A timer defined as vkCFE is started at the incoming end.

3.2.3 Sending address signals procedure

Sending address signals procedure starts when the outgoing end begins to send decade digits as address signals to identify called subscriber. The proceed to send signal is being received at the outgoing end of the circuit allowing digit sending. If a lack of the proceed to send signal has been noticed at the outgoing end of the circuit, current digit is entirely sent and then, timer vkPTS2 is started. If the proceed to send signal is not recognised within a time-out period defined as vkPTS2, the sending address signals procedure is considered to be terminated. Otherwise, sending of the address signals is continued with the next digit. When a number of digits, needed to rich the called subscriber, is recognised, the incoming end returns the end of dialling signal and then sends also the signal indicating the condition of called subscriber's line (free or busy). If the signal, indicating the condition of the called subscriber's line has been received, the state of the circuit is changed to *waiting for answer.* If any of signals indicating the condition of the called subscriber's line has not been received within a time-out period defined as vkBFR, the subscriber's line is assumed to be busy. If the subscriber's line is busy, the clear forward procedure, described in §3.2.8 will be carried out but delayed for a 10 seconds, allowing the operator to enter the connection.

Possibly abnormal conditions are maintained by sending appropriate tone to the calling subscriber, through the speech channel. Therefore, if a digit greater then 10 is recognised, the incoming end of the circuit sends the blocking tone through the speech channel and waits for clear-forward procedure, described in §3.2.8, to be carried out. Also, receipt of some digits, which does not match any of known prefixes is indicated by sending the special information

tone through the speech channel during 20-30 s. The busy tone and the ringing tone are also sent to the calling subscriber.

3.2.4 Waiting for answer

In the *waiting for answer* state of the circuit, the answer signal should be recognised within a time-out period defined as vkANU, to change to the answered state of the circuit.

3.2.5 Answering

In the *waiting for answer* state of the circuit, the off-hook condition of the called subscriber's line provokes the incoming switching equipment to send the answer signal and the *answered* state of the circuit is established.

The answered state is established on the preceding link immediately after the answer signal is recognised, see also §3.2.13 below.

3.2.6 Clear-back procedure

The on-hook condition of the called subscriber's line provokes the incoming switching equipment to send clear-back signal and the *cleared-back* state of the circuit is established. The *cleared-back* state is established on the preceding link immediately after the clear-back signal is recognised, see also §3.2.13 below.

3.2.7 Reanswering

The off-hook condition of the called subscriber's line in the *cleared-back* state of the circuit provokes the incoming switching equipment to send the answer signal and the *answered* state of the circuit to be re-established. In such a condition, the answer signal could be noted as reanswer signal. If the forced release procedure described in §3.2.13 has been started, it is stopped and timer vkPJ is cancelled.

3.2.8 Clear-forward procedure

The clear condition of the calling subscriber's line or the release of the outgoing switching equipment will normally result in sending the clear-forward signal and establishing the *cleared-forward state* of the circuit. The outgoing switching equipment will not be restored to the *idle state* until the release guard signal is recognised, see also §3.2.9. On the incoming end receipt of the clear-forward signal will initiate the release procedure, described below.

3.2.9 Release procedure

Recognition of the clear-forward signal in the incoming switching equipment initiates the release of the succeeding link even though answering or clearing by the called party has occurred.

Upon complete release of the incoming switching equipment, the release guard signal is sent backward. This will cause circuit to be restored to the *idle state* and the outgoing switching equipment to become available for another call.

If the clear-forward signal is not acknowledged by the release-guard signal within a period defined as vkOSL, the circuit is marked as blocked.

3.2.10 Blocking and unblocking procedure

Blocking signal is sent on an idle circuit to the outgoing exchange to cause engaged conditions (blocking) to be applied to this circuit, guarding it against subsequent seizure.

Recognition of the blocking signal at the outgoing end indicates that transmission circuit is in the *blocked state*. In the *blocked state*, recognition of unblocking signal at the outgoing end, restores the circuit to the *idle state*.

3.2.11 Trunk offering procedure

In the case of called subscriber's busy state, whether he is calling or called party in the primary connection, new calling subscriber could ask the operator for trunk offering. The operator sends the trunk offering signal in order to enter the connection and offer new call to called subscriber. *Trunk offered state* of the circuit is established. After that, the operator sends trunk disconnect signal to leave the connection. *Trunk disconnected state* of the circuit is established This sequence could be repeated any number of times. After the primary connection has been cleared and used equipment has been released, the clear-back after offering signal is sent to the operator. *Cleared back after offering state* of the circuit is established The operator can then send the reringing signal. This will be manifested as ringing at the called subscriber's side. After called subscriber's answer, operator connects calling and called subscriber. In the case of called subscriber's busy state after the reringing signal sending, trunk offering procedure could be repeated.

3.2.12 Metering procedure

Metering signals are pulse type signals transmitted backward during the conversation from the call charging point to the subscriber's call meter in the originating exchange.

3.2.13 Forced release procedure

Prior to answer and after the time-out period defined as timer vkANU, the charge controlling exchange transmits the forced release signal to the preceding exchange and clears forward the succeeding part of the connection.

When the called subscriber clears at the end of the call, the exchange which controls call charging will receive the clear-back signal from the called subscriber's end. If the calling subscriber does not clear within a period defined as timer vkPJ, the charge controlling exchange

stops metering, transmits the forced-released signal to the preceding exchange and clears forward the succeeding part of the connection.

On recognition of forced release signal in a preceding exchange the connection is released, the forced release signal repeated to any other preceding exchanges and clear forward procedure §3.2.8 is initiated.

3.2.14 Malicious call procedure

Malicious call procedure is started when called party sends the appropriate signal in order to hold the connection during the malicious call trace. Two cases, depending on whether the Switching system SRCE is calling or called party exchange, are separately considered.

- If SRCE is calling part of the connection, the malicious call signal is received all the time the connection is being held. When the malicious call tracing has been completed, the connection should be cleared. Normally, the operater on the called party exchange switches off manually the equipment that sends the malicious call signal, so that SRCE will receive the clear back signal that enables a usual clear-forward procedure. However, there is also a solution, which is the implemented one, where the operator on SRCE can initiate clearing of the connection. SRCE then sends the clear forward signal without waiting for the release guard signal. In this solution, it is assumed that the called party exchange, no matter of sending the malicious signal, will react appropriately, by releasing its equipment.

- If SRCE is called part of the connection, which is held due to malicious call tracing, the malicious call signal is sent a 240 ms after the answer signal. The malicious call signal is also sent a 240 ms after the reanswer signal (see §3.2.7). When the malicious call tracing has been completed, the operater initiates clearing of the connection and SRCE sends the clear back signal, allowing the calling part to perform the normal clear-forward procedure.

3.2.15 Actions appropriate to various signalling conditions

In addition to normal conditions described in Table 1 other conditions due to faults may be encountered. Table 2 and Table 3 indicate the states appropriate to each signalling code recognised and the actions to be taken at the outgoing and incoming end respectively of a circuit operated with the digital version of D2-D2 line signalling.

3.2.16 Outgoing end

Table 2

Circuit state at the outgoing	Sent code	Received code			
		a_b=0, b_b=0	a_b=0, b_b=1	a_b=1, b_b=0	a_b=1, b_b=1
Idle/Released	a_f=1, b_f=0	Abnormal see Note 1	Abnormal see Note 1	Idle	Blocking
Seized	a_f=0, b_f=0	Ignored see Note 2	Proceed to send	see Note 2	Seizing ackn.
Seizure acknowledged	a_f=0, b_f=0	Ignored see Note 2	Proceed to send	Ignored see Note 2	-
Sending address signals	see §2.3.2.1	End of dialling	Proceed to send	see §3.2.3	see §3.2.3
Waiting for subscriber's state	a_f=0, b_f=0	see Note 3	Subscriber busy	Ignored see Note 3	Subscriber free
Waiting for answer	a_f=0, b_f=0	Ignored see §3.2.13	Answering	Ignored see §3.2.13	see §3.2.13
Answered	a_f=0, b_f=0	Ignored see Note 4	-	Malicious call	Clear-back [8]
Cleared-back [9]	a_f=0, b_f=0	Ignored	Reanswering see §3.2.7	Malicious call see Note 5	-
Cleared-forward	a_f=1, b_f=0	Ignored	Ignored	Release guard	Ignored
Blocked	a_f=1, b_f=0	Ignored	Ignored	Unblocking	-

In the case of the trunk offering procedure, line signalling taking place on the circuit between operator exchange and called subscriber's exchange, is described in the Table 3 below.

[8] Applicable only for the circuit beyond charging point.
[9] Applicable only for the circuit beyond charging point.

Table 3

Circuit state at the outgoing	Sent code	Received code			
		a_b=0, b_b=0	a_b=0, b_b=1	a_b=1, b_b=0	a_b=1, b_b=1
Trunk offered	a_f=1, b_f=0	Ignored	-	Ignored	Clear-back after offering
Trunk disconnected	a_f=1, b_f=0	Ignored	-	Ignored	Clear-back after offering
Cleared back after offering	a_f=1, b_f=0	Ignored	Ignored	Ignored	-

Note 1. In these abnormal conditions the outgoing end must prevent a new seizure of the circuit. The circuit is marked as blocked due to an equipment damage and also delayed alarm is given to the technical staff.

Note 2. Non-recognition of the seizing acknowledgement signal or the proceed to send signal during defined time-out period after sending the seizing signal results in an alarm and either congestion information being sent backward or a repeat attempt being made to set up the call. Time-out period is defined as timer vkPTS.

Note 3. In the *waiting for subscriber's state,* the signal indicating state of the subscriber should be recognised within a time-out period defined as vkBFR. Otherwise, it is assumed that subscriber is busy. See also §3.2.3.

Note 4. In the case of circuit prior to charging point, this received code should be recognised as the forced release signal. But, it is assumed that the Switching system SRCE will not work in Signalling System D2-D2 as a low-level exchange. Therefore, the outgoing end of the circuit can not receive the forced release signal in Signalling System D2-D2 and also the*forced release state* is not applicable.

Note 5. The malicious call signal is recognised and the *answered state* of the circuit is re-established.

3.2.17 Incoming end

Table 4

Circuit state at the outgoing	Sent code	Received code			
		a_f=0, b_f=0	a_f=0, b_f=1	a_f=1, b_f=0	a_f=1, b_f=1
Idle/Released	a_b=1, b_b=0	Seizure	Ignored	Idle	Ignored
Seized	a_b=1, b_b=0	-	Ignored	Ignored	Ignored
Seizure acknowledged	a_b=1, b_b=1	-	Ignored	Clear-forward	Ignored
Sending address signals	a_b=0, b_b=1	see §2.3.2.1	Ignored	Clear-forward see Note 2	Ignored
Answered	a_b=0, b_b=1	-	Ignored	Clear-forward	Ignored
Cleared-back [10]	a_b=1, b_b=1	-	Ignored	Clear-forward	Ignored
Forced release	a_b=0, b_b=1	-	Ignored	Clear-forward	Ignored
Cleared-forward	a_b=1, b_b=1 a_b=0, b_b=x	Ignored	Ignored	-	Ignored

In the case of the trunk offering procedure, line signalling taking place on the circuit between operator exchange and called subscriber's exchange, is described in the Table 5 below.

Table 5

Circuit state at the outgoing	Sent code	Received code			
		a_f=0, b_f=0	a_f=0, b_f=1	a_f=1, b_f=0	a_f=1, b_f=1
Trunk offered	a_b=0, b_b=1	see Note 1	Ignored	Clear-forward see Note 2	Ignored
Trunk disconnected	a_b=0, b_b=1	see Note 1	Ignored	Clear-forward see Note 2	Ignored
Cleared back after offering	a_b=1, b_b=1	Ignored	Ignored	Reringing see Note 1	Ignored

Note 1. These signals are implemented as pulsed signals a_f=1, with defined duration of 150±30ms.

Note 2. Recognition time of a continuous signal is between 240 and 450 ms.

[10] Applicable only for the circuit beyond charging point.

3.2.18 Safeguard against failures

The PCM equipment and the exchange line signalling equipment should be designed in such a way that at least those faults which are most likely to occur in this equipment or in the interconnecting cables, result in blocking of the circuit at the outgoing end and in the ultimate clearing of the connection beyond the incoming switching equipment. This can be achieved, as far as possible, by ensuring that the blocking signal is sent on line upon:

- removal of PCM or switching equipment by maintenance personnel;

- occurrences of abnormal conditions (e.g. open wire, low voltage) in switching equipment.

4 TIMER SPECIFICATION

Timers, defined in Switching system SRCE and mentioned in this document are the following:

1. vkPTS - a period of the outgoing end's waiting for seizure acknowledgement signal
2. vkOSL - a period, started from the moment of the clear-forward signal sending, within which the outgoing end should recognise the release-guard signal.
3. vkANU - a period of the outgoing end's waiting for the answer signal, after successful sending digits procedure.
4. vkPJ - a period of the outgoing end's waiting for the reanswering signal after the clear-back signal has been received.
5. vkPTS2 - a period of the outgoing end's waiting for the proceed to send signal, after one digit sending
6. vkBFR - a period of the outgoing end's waiting for the subscriber's state signal after receipt of the end-of-dialling signal.
7. vkCFE - a period of the incoming end's waiting for a first and every next digit

Minimum, maximum and default values for timers in ms are specified in the following table:

Table 6

Timer	Values [ms]		
	Minimum	Maximum	Default
vkOSL	4000	15000	8000
vkANU	120000	120000	120000
vkPJ	60000	120000	120000
vkPTS	15000	30000	18000
vkBFR	2000	4000	4000
vkCFE	15000	30000	20000
vkPTS2	500	500	500

5 REFERENCES

[1] ITU-T Recommendation Q.107, *General Recommendations on Telephone Switching and Signalling, Standard Sending Sequence of Forward Address Information*, Fascicle VI.1, *Blue book*

[2] ITU-T Recommendation Q.120, *Specifications of Signalling System No. 4, Definition and Function of Signals,* Fascicle VI.2 , Blue book; Geneva, 1980; Melbourne, 1988

[3] ITU-T Recommendation Q.400, *Specifications of Signalling System R2, Definitions and functions of signals,* Fascicle VI.4, *Blue Book*

[4] ITU-T Recommendation Q.421, *Specifications of Signalling System R2; Line Signalling, Digital version; Digital line signalling code,* Fascicle VI.4, *Blue Book*

[5] ITU-T Recommendation Q.422, *Specifications of Signalling System R2; Line Signalling, Digital version; Clauses for Exchange Line Signalling equipment,* Fascicle VI.4, *Blue Book*

[6] ITU-T Recommendation Q.117, *General Recommendations on Telephone Switching and Signalling; Clauses Applicable to ITU-T Standard Systems; Alarms for Technical Staff and Arrangements in Case of Faults,* Fascicle VI.1, *Blue Book*

[7] ITU-T Recommendation G.732, *General Aspects of Digital Transmission Systems; Terminal Equipment; Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s***,** Fascicle III.4, Blue Book

[8] ITU-T Recommendation G.734, *General Aspects of Digital Transmission Systems; Terminal Equipment; Characteristics of synchronous digital multiplex equipment operating at 1544 kbit/s,* Fascicle III.4, *Blue Book*

[9] ITU-T Supplement No. 6, *Line Signalling (Digital Version) with Metering,* Fascicle VI.4, *Blue Book*