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LINE SIGNALLING (DIGITAL VERSION) WITH METERING

Reedition of CCITT Recommendation Q.400, Supplement No. 6, published in the Blue Book, Fascicle VI.4 (1988)

NOTES

1 CCITT Recommendation Q.400 Supplement No. 6 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. 6

LINE SIGNALLING (DIGITAL VERSION) WITH METERING

1 Introduction

Signalling System R2 line signalling, digital version, is a line signalling system for use over digital line transmission equipment conforming to Recommendation G.732.

For many national applications it is desirable that the digital version has additional line signals available to enable the charging of calls.

This supplement proposes possible solutions to provide for charging of calls, namely the provision of a meter signal and a forced release signal.

2 Signal codes

The signalling codes are given in the Table 1 below.

TABLE 1

State of the circuit	Signalling Code			
	Forward		Backward	
	a_f	b_f	a_b	b_b
Idle/released	1	0	1	0
Seized	0	0	1	0
Seizure acknowledged	0	0	1	1
Answered/meter	0	0	0	1
Meter/seizure acknowledged	0	0	1	1
Clear-forward	1	0	0	1
			or 1	1
			or 0	0
Forced release	0	0	0	0
Blocked	1	0	1	1

3 Choice of meter codes

Some line signalling systems indicate a meter pulse by a signal identical to a "pulsed clear-back", signal. In this circumstance for ease of signal conversion $a_b = 1$, $b_b = 1$, which normally indicates clear-back, may be used to represent a meter pulse. Other signalling schemes however use a "pulsed answer" signal to indicate a meter pulse. In this circumstance $a_b = 0$, $b_b = 1$ may be used to represent a meter pulse.

4 Clauses for exchange line signalling equipment

4.1 *Normal operating conditions*

The following operating conditions apply in addition to those described in Recommendation Q.422.

4.1.1 *Meter:* Metering signals are pulse type signals transmitted backwards during the conversation from the call charging point to the subscriber's call meter in the originating exchange.

In the case of "pulsed clear-back" meter pulses, a pulse is indicated by a change from the answer ($a_b = 0$, $b_b = 1$) signal to an $a_b = 1$, $b_b = 1$ signal and then a change back to $a_b = 0$, $b_b = 1$. To avoid confusion between meter pulses and clear-back the use of clear-back is not allowed.

In the case of “pulsed answer” meter pulses, a pulse is indicated by a change of $a_b = 1$, $b_b = 1$ to $a_b = 0$, $b_b = 1$ and back to $a_b = 1$, $b_b = 1$. The first pulse indicates answer, it may also indicate a meter pulse. A clear-back signal is not provided.

Meter pulses must be longer than 30 ms to ensure recognition at the outgoing end.

4.1.2 *Forced release:* Prior to answer and after a period defined by the Administration concerned for national traffic and according to Recommendation Q.118 for international traffic, 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 a 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 for national traffic by the Administration concerned and for international traffic according to Recommendation Q.118, the charge controlling exchange stops metering, transmits the forced release signal to the preceding exchange and clears forward the succeeding part of the connection. A forced release signal is indicated by a change to $a_b = 0$, $b_b = 0$.

On recognition of forced release in a preceding exchange the connection is released, the forced release signal repeated to any other preceding exchanges, and a clear forward signal sent on the link. The succeeding exchange, on receipt of the clear forward, returns an idle signal and returns the link to the idle state.

Figure 1 shows line signals for a sequence of meter pulses followed by forced release in the case of “pulsed clear-back” meter pulses.

4.2 *Actions appropriate to various signalling conditions*

Tables 2 and 3 indicate the states appropriate to each signalling code recognized and the actions to be taken at the outgoing and incoming ends respectively.

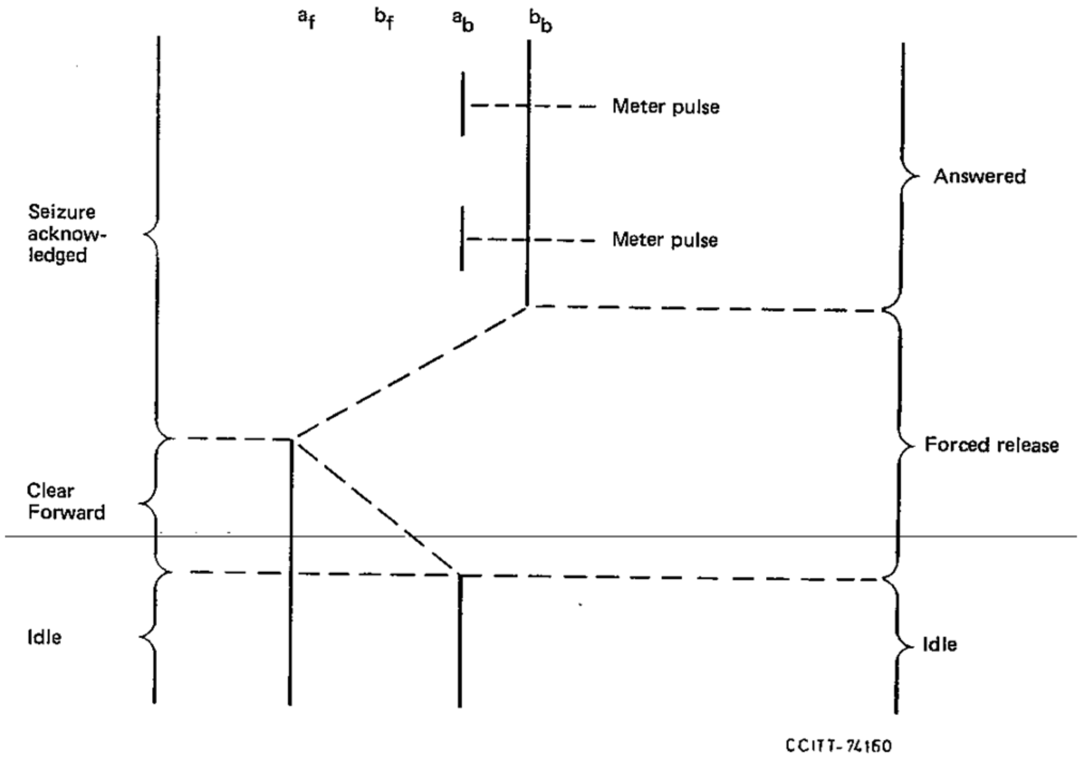

FIGURE 1

Release sequence when called party clears without clearing of the calling party

TABLE 2

Outgoing end

Normal state at the outgoing end	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	Blocked
Seized	$a_f = 0, b_f = 0$	Abnormal, see Note 2	Abnormal, see Note 2	Seized, see Note 2	Seizure acknowledged
Seizure acknowledged	$a_f = 0, b_f = 0$	Forced release	Answered/ meter	Abnormal, see Note 3	Seizure acknowledged
Answered [a]/meter [b]	$a_f = 0, b_f = 0$	Forced release	Answered/ meter	Abnormal, see Note 4	Meter/seizure acknowledged
Meter [a]/seizure acknowledged [b]	$a_f = 0, b_f = 0$	Forced release	Answered/ meter	Abnormal, see Note 4	Meter/seizure acknowledged
Forced release	$a_f = 0, b_f = 0$	Forced release, see Note 5	Abnormal, see Note 5	Abnormal, see Note 5	Abnormal, see Note 5
Clear-forward	$a_f = 1, b_f = 0$	Clear-forward	Clear-forward	Released = Idle	Clear-forward
Blocked	$a_f = 1, b_f = 0$	Abnormal, see Note 1	Abnormal, see Note 1	Idle	Blocked

[a] Used for “pulsed clear-back” meter pulses.

[b] Used for “pulsed answer” meter pulses.

Note 1 – In these conditions the outgoing end must prevent a new seizure of the circuit. A delayed alarm should also be given.

Note 2 – Non-recognition of the seizing acknowledgement signal 100-200 ms after sending the seizing signal on a terrestrial link or 1-2 seconds after sending the seizing signal on a satellite link results in an alarm and either congestion information being sent backward or a repeat attempt being made to set up the call. The outgoing end must prevent a new seizure of the circuit. When the seizure acknowledgement signal is recognized after the time-out period has elapsed, the clear-forward signal must be sent.

Note 3 – Receipt of $a_b = 1$, $b_b = 0$ by the outgoing switching equipment for 1-2 seconds after recognition of the seizing acknowledgement signal and prior to recognition of the answer signal, results in an alarm and either congestion information being sent backward or a repeat attempt being made to set up the call. The outgoing end must prevent new seizures of the circuit. When b_b reverts to 1 after the 1-2 seconds time-out period has elapsed, the clear-forward signal must be sent.

Note 4 – In the case of recognition of $a_b = 1$, $b_b = 0$ whilst in the answered state, immediate action is not necessary. On receipt of clearing from the preceding link, the clear-forward signal ($a_f = 1$, $b_f = 0$) must not be sent until b_b is restored to 1. A delayed alarm should also be given.

Note 5 – After forced release is recognized, the outgoing switching equipment must be released and then the idle signal ($a_f = 1$, $b_f = 0$) sent on the link. The outgoing end must prevent a new seizure on the circuit until the link returns to the idle state upon reception of $a_b = 1$, $b_b = 0$. The forced release signal must be sent on the preceding link (if any).

TABLE 3

Incoming end

Normal state at the incoming end	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	$a_b = 1, b_b = 0$	Seized	Fault, see Note 1	Idle	Fault, see Note 1
Seizure acknowledged	$a_b = 1, b_b = 1$	Seizure acknowledged	Fault, see Note 2	Clear-forward	Fault, see Note 2
Answered [a)]/meter [b)]	$a_b = 0, b_b = 1$	Answered/ meter	Fault, see Note 3	Clear-forward	Fault, see Note 3
Meter [a)]/seizure acknowledged [b)]	$a_b = 1, b_b = 1$	Meter/seizure acknowledged	Fault, see Note 3	Clear-forward	Fault, see Note 3
Forced release	$a_b = 0, b_b = 0$	Forced release	Fault, see Note 8	Clear-forward see Note 4	Fault, see Note 8
Clear-forward	$a_b = 0, b_b = 1$ or $a_b = 1, b_b = 1$	Abnormal seized see Note 7	Fault, see Note 7	Clear-forward see Note 7	Fault, see Note 7
Blocked	$a_b = 1, b_b = 1$	Abnormal seized see Note 5	Fault, see Note 6	Blocked	Fault, see Note 6

a) Used for “pulsed clear-back” meter pulses.

b) Used for “pulsed answer” meter pulses.

Note 1 – When in the idle/released state b_f changes to 1, b_b must be changed to 1.

Note 2 – In these cases a timeout device is started which after a certain interval clears the connection beyond the faulty circuit: this timing arrangement may be the one specified in Recommendation Q.118, § 4.3.3. If the answer signal is recognized during the timeout delay, the timer is stopped but the answer signal is not sent on the preceding link until recognition of $a_f = 0$, $b_f = 0$. If the clear-back signal is recognized while the fault persists, the connection beyond the faulty circuit must be released immediately. Additionally, when the incoming register has not started to send the last backward signal, the rapid release procedure described in Note 5 may be used.

Note 3 – In these cases no action is taken until the forced release signal or the clear-back signal (if the exchange is the call metering control point) is recognized, at which stage the connection beyond the faulty circuit is immediately released and the forced release signal sent to the preceding exchange.

Note 4 – After $a_f = 1$, $b_f = 0$ is recognized, the circuit is returned to the idle state by sending $a_b = 1$, $b_b = 0$.

Note 5 – In this case, immediate action is not necessary. However, rapid release of the circuit should occur if the incoming end simulates answer by sending $a_b = 0$, $b_b = 1$.

Note 6 – Under these conditions no action is taken.

Note 7 – After clear-forward signal is recognized and until the code $a_b = 1$, $b_b = 0$ is sent, all transitions in the forward direction shall be ignored.

Note 8 – The circuit is kept in the forced release state until $a_f = 1$, $b_f = 0$ is recognized.

5 Protection against the effects of faulty transmission

5.1 *Introduction*

When faulty transmission conditions in PCM systems are detected both PCM terminals apply the state corresponding to state 1 on the PCM line on each “receive” signalling channel at the interface with the switching equipment, as indicated in Table 4 of Recommendation G.732. In this way the incoming switching equipment receives the equivalent $a_f = 1$, $b_f = 1$ on the PCM line and the outgoing switching equipment receives the equivalent of $a_b = 1$, $b_b = 1$.

5.2 *Incoming switching equipment*

At the incoming end a PCM fault results in $a_f = 1$, $b_f = 1$: so this fault can be identified and appropriate actions according to Table 3 can be taken.

5.3 *Outgoing switching equipment*

At the outgoing end a PCM fault results in $a_b = 1$, $b_b = 1$.

Two cases are to be considered:

a) Meter pulses are indicated by $a_b = 0$, $b_b = 1$

A fault results, as it is stated in Table 2, in a blocked state or seizure acknowledged state. This means that all circuits in the idle state of a faulty PCM multiplex will be blocked and that seized circuits will go to or remain in the seizure acknowledged state.

b) Meter pulses are indicated by $a_b = 1$, $b_b = 1$

A PCM fault will result in the recognition of a meter pulse each time a failure appears. To avoid this recognition, the outgoing switching equipment must handle the service alarm information given by the PCM terminal equipment in a separate way.

When the outgoing switching equipment detects a service alarm information it must block the detection of signalling transitions to avoid recognition of erroneous signalling codes caused by the failure.

The reception of a clear-forward signal on the preceding link or the detection of the calling subscriber's release will cause, after the end of the PCM failure, the sending of a clear-forward signal on the succeeding part of the connection.

6 Bothway working

The additions described in this contribution do not affect the suitability of the digital version for bothway use.

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