

**Recommendation T/CS 49-04 (Vienna 1982, revised in Montpellier 1984)**

**SYSTEM L1 MULTIFREQUENCY PUSH-BUTTON INTERREGISTER SIGNALLING**

Recommendation proposed by Working Group T/WG 11 "Switching and Signalling" (CS)

*Revised text of the Recommendation adopted by the "Telecommunications" Commission:*

"The European Conference of Postal and Telecommunications Administrations,

*considering*

- that multifrequency push-button (MFPB) subscriber's line signalling may enable faster call setup than decadic pulse signalling;
- that MFPB signalling provides more codes than decadic pulse signalling;
- that MFPB signalling employs in-band signals making possible end-to-end interregister signalling between private automatic branch exchanges (PABXs);
- that, as a system that is also used for simple data communication, MFPB signalling is suitable for a dialogue-like interchange of signalling information;
- that MFPB telephones are being used more and more on extension lines;
- that equipment located on the subscriber's premises and used for private networks may be based on MFPB signalling techniques,

*recommends*

that members, in conditions favouring MFPB signalling over links between analogue transmission interfaces of PABXs located in different countries, use System L1 multifrequency push-button interregister signalling as specified below."

**1. GENERAL**

**1.1. Line signalling**

System L1 MFPB interregister signalling is used in conjunction with system L1 line signalling according to Recommendation T/CS 49-01 [1]. The individual line signals to be provided and their uses are specified in Recommendations T/CS 49-05 [2] and T/CS 49-06 [3] on System L1 MFPB call control signalling procedures.

**1.2. Principles and field of application**

1.2.1. MFPB interregister signalling is suitable for automatic and semi-automatic working between PABXs via terrestrial circuits.

1.2.2. System L1 MFPB interregister signalling may be used to setup multi-link-tandem connections. Depending on the signalling procedures concerned, link-by-link or end-to-end signalling applies. In the case of link-by-link working, the signals, in accordance with CCITT Recommendation Q.25 [4], are contained within the appropriate link and are not allowed to spillover into subsequent or preceding links.

1.2.3. The maximum number of tandem connections over which a call may be setup is determined by the type of interconnecting circuits and is subject to mutual agreement between the parties concerned. All circuits used in a tandem connection should be according to the standard of CCITT Recommendations G.171 [5] and M.1010 to M.1060 [6].

1.2.4. On international leased lines, System L1 MFPB is used on four-wire circuits and the PABX termination arrangements set out in Recommendation T/CS 49-01 [1] apply. Special arrangements enable System L1 to be used on (national) two-wire circuits, if necessary.

**1.3. Structure**

1.3.1. The System L1 MFPB signalling provides the signalling capability for the interchange of additional information during a dialogue phase following the selection phase. During the dialogue phase, the full range of MFPB codes in the forward as well as in the backward direction is used. In this case, the System is called *System L1 MFPB bidirectional*. It is suitable for the implementation of an increased range of services. The signalling procedures are specified in Recommendation T/CS 49-06 [3].

- 1.3.2. System L1 MFPB signalling is designed, however, to allow the use of a simplified subsystem, called *System L1 MFPB unidirectional*. It provides the signalling capability for call establishment (selection phase) using the character set of the 12-button array according to Recommendation T/CS 46-02 [7] in the forward direction only. The signalling procedures are specified in Recommendation T/CS 49-05 [2].
- 1.3.3. A signalling compatibility check is included in the System L1 MFPB bidirectional signalling to enable interworking with System L1 MFPB unidirectional.

## 2. INTERREGISTER SIGNALS

### 2.1. Use of line signalling frequency signals

In System L1 MFPB, five line-signalling-frequency-backward signals are used for interregister type signalling, the proceed-to-send signal, the proceed-to-send-on-recall signal, the address-complete signal, the clear-request signal and the reconnect signal. The five signals are introduced in the system as specified in Recommendation T/CS 49-02 [8].

### 2.2. Signal codes

Table 1 (T/CS 49-04) shows the MFPB forward signals used in System L1 signalling. Table 2 (T/CS 49-04) shows the MFPB backward signals, which occur only in the dialogue phase, e.g. in bidirectional MFPB signalling.

The multifrequency codes used are in accordance with Recommendation T/CS 46-02 [7]; they are designated by the characters 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, ★, #, A, B, C, and D allocated as specified therein.

All signal names are in accordance with Recommendation T/CS 41-01 [9]. Signals having the same coding shall be distinguished by their position in the sequence of the signalling procedure.

The range of transmitted signalling information may in certain cases be extended by the use of the *escape signal* indicating the change-over to another set of meanings valid only for the following signal, or be reduced by the *end-of-block signal* indicating that no more signals will be transmitted.

### 2.3. Signalling sequence

System L1 MFPB signalling begins with the transmission of address signals (routing digits and extension number) which are sent character-by-character in a non-compelled mode in the sequence required by the numbering arrangements. This phase, called *selection phase*, may be followed by an additional information interchange, making up the *dialogue phase*. By means of the register-recall procedure, further MFPB signalling is possible after completion of the call set-up (see Section 3.).

#### 2.3.1. Selection phase

The address signals are coded in accordance with Recommendation T/CS 46-02 [7] and comprise the characters 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, ★ and #. In transit working, the signals are transmitted link-by-link. Under normal conditions, the selection phase is terminated with the transmission of an address-complete signal. In the simplified subsystem (MFPB unidirectional), this signal also concludes the multifrequency set-up signalling. However, register-recall signalling may follow (see Section 3.).

#### 2.3.2. Dialogue phase

In the System L1 MFPB bidirectional signalling, multifrequency signalling continues after the selection phase with forward and backward signals as described in Sections 2.4. and 2.5. The dialogue phase signals are transmitted en-bloc in a non-compelled mode, exception being made for the first forward signal, see §2.3.3.

Under normal conditions, the dialogue phase is terminated non-compelled by the transmission of the dialogue phase end-of-block signals in both directions.

In transit working, the dialogue phase signals are transmitted end-to-end.

Character indicating the MFPB code used	Addr. signal in the selection phase	Dialogue phase forward signals <i>Note 1</i>		
		<i>Note 2</i>	Type of call (TC) <i>Note 3</i>	Class of service of calling party (CSA) <i>Note 4</i>
1	Digit 1	Prohibited as a first dialogue phase forward signal	Extension originated	PSTN access, not data protected, group a
2	Digit 2		Enquiry call, PSTN call held	PSTN access, not data protected, group b
3	Digit 3		Transfer from night extension	PSTN access, not data protected, group a; intrusion privileged
4	Digit 4		Data	PSTN access, data protected, group b; intrusion privileged
5	Digit 5		Enquiry call, call held via restr. signalling link	PSTN access, data protected, group a
6	Digit 6		PSTN call	PSTN access, data protected, group b
7	Digit 7		Operator assisting extension	PSTN restr., not data protected, group a
8	Digit 8		Operator assisting PSTN call	PSTN restr., not data protected, group b
9	Digit 9		Extension via restricted signalling link	PSTN restr., data protected, group a
0	Digit 0		Enquiry call, extension call held	PSTN restr., data protected, group b
★	★		Reserved for end-of-block	Reserved for end-of-block
#	#		Operator assisting restr. signalling link	Incoming calls barred
A	Spares		Not diverted	Spares
B		Diverted	Fully restricted	
C		Network orig.	Operator, not assisting a call	
D		Op. & M.	Reserved for escape <i>Note 5</i>	

Table 1 (T/CS 49-04). MFPB forward signals.

**Notes to Table 1 (T/CS 49-04)**

*Note 1:* Calling-line-identification is part of the dialogue phase. The characters 1 to 0 directly represent the address signals, digits 1 to 0, in the calling-line-identification procedure (see paragraph 2.4.3.).

*Note 2:* First signal to be transmitted forward following the selection phase, used for checking the bidirectional signalling capability and start of the dialogue phase.

*Note 3:* Second signal to be transmitted forward in the dialogue phase.

*Note 4:* The class-of-service signal follows the type-of-call signals.

*Note 5:* An escape set is at present being considered for class-of-service signals only (see paragraph 2.4.2.).

**Legend to Tables 1 and 2 (T/CS 49-04)**

restr.: restricted  
 Network orig.: Network originated call  
 Op. & M. Operation and Maintenance  
 i/c: incoming

CSA  
 CSB  
 DDI  
 SOD  
 TC

For abbreviations see Table 4 (T/CS 49-04)

Character indicating the MFPB code used <i>Note 1</i>	Class of service of called party (CSB)  <i>Note 2</i>	Signals		
		Reason for call refusal  <i>Note 3</i>	State of destination (SOD)  <i>Note 4</i>	
1	PSTN access, not data protected, group a	Call diversion to outside of i/c PABX	Free	
2	PSTN access, not data protected, group b	Divert call to intercept service	Engaged on internal call	
3	PSTN access, not data protected, group a intrusion privileged	Divert call to operator	Engaged on PSTN call	
4	PSTN access, data protected, group b intrusion privileged	Unallocated number	Engaged on conference call	
5	PSTN access, data protected, group a	Congestion encountered	Engaged on data call	
6	PSTN access, data protected, group b	Call failure	Line out of service	
7	PSTN restr., not data protected, group a	Spares	No meaning	
8	PSTN restr., not data protected, group b		PSTN encountered	
9	PSTN restr., data protected, group a		Engaged, call waiting	
0	PSTN restr., data protected, group b		Spares	
A	No restriction			
B	Fully restricted			
C	DDI calls barred			
#	Incoming calls barred			
D	Escape <i>Note 5</i>		Reserved for escape <i>Note 5</i>	Reserved for escape
★	Call refusal		End-of-block	End-of-block

Table 2 (T/CS 49-04). Dialogue phase backward signals.

**Notes to Table 2 (T/CS 49-04)**

*Note 1:* The characters shown directly represent the address signal, digit 1 to 0, in the called-line-identification procedure (see paragraph 2.5.3.).

*Note 2:* A signal from this column shall be the first dialogue phase signal to be transmitted backwards.

*Note 3:* The reason for call-refusal may be transmitted after the call-refusal signal.

*Note 4:* A state-of-destination signal may follow the class-of-service or the called-party-line-identification.

*Note 5:* An escape set is at present being considered for class-of-service signals only (see paragraph 2.5.1.).

2.3.3. *Signalling compatibility check*

The first MFPB dialogue phase forward signal, see Table 1 (T/CS 49-04), requires as a response a first MFPB dialogue phase backward signal, see Table 2 (T/CS 49-04), before forward signalling continues. If that MFPB backward signal has not been recognised within 200 ms, the outgoing PABX shall assume that the dialogue phase is not possible.

2.4. **Dialogue phase forward signals**

The descriptions for the dialogue phase forward signals listed below are set-out in the sequence in which the signals will be transmitted to the destination PABX. See also paragraph 2.4.4.

2.4.1. *Type-of-call signals*

Two type-of-call signals are used and transmitted one after the other. In principle, both signals can be freely combined. However, not all combinations are reasonable, e.g. an operator-assisted call will not be network originated.

2.4.2. *Class-of-service signals*

A set of fourteen calling party class-of-service signals is given in Table 1 (T/CS 49-04).

Other class-of-service indications are possible by the transmission of the escape signal followed by a signal from Table 3 (T/CS 49-04).

MFPB	Signal
1	These signals are not yet allocated
2	
3	
4	
5	
6	
7	
8	
9	
0	
A	
B	
C	
#	

Table 3 (49-04). Allocation of class-of-service of the calling party signals to MFPB codes.

If a transit switch indicates with a restricted-signalling-capability signal that the originating PABX is connected over a link with restricted signalling capability, the class-of-service signal will not be transmitted.

2.4.3. *Calling-line-identity signals*

The calling-line-identity is transferred from the outgoing PABX to the incoming PABX after the class-of-service information. If a transit switch indicates with a restricted-signalling-capability signal that the originating PABX is connected over a link with restricted signalling capability, the calling-line-identification procedure is omitted.

The calling-line-identity signals are the numerical characters of the MFPB code (see Table 1 (T/CS 49-04), Note 1).

2.4.4. *End-of-block signal*

The end-of-block signal terminates the dialogue phase forward en-bloc signal sequence.

2.4.5. *Forward escape signal*

The escape signal is at present envisaged for extension of the range of class-of-service signals only.

2.5. **Dialogue phase backward signals**

The sequence of dialogue phase backward signals depends on whether or not the call offered to the incoming PABX can be accepted. If the call is accepted, the first backward signal, a called party class-of-service signal, will indicate this. Called-line-identification and state-of-destination information may follow. If the call is not accepted, the first MFPB backward signal will be the call-refusal signal and further signals may follow, indicating the reason for the refusal.

2.5.1. *Class-of-service signals*

A set of fourteen called party class-of-service signals is given in Table 2 (T/CS 49-04). The number of class-of-service indications can be extended by the transmission of the escape signal followed by a signal from Table 3 (T/CS 49-04).

For a PABX each extension is characterised by a class-of-service indication. The same class-of-service applies irrespective of whether the call is outgoing or incoming to the extension. Consequently, the class-of-service signals given in Tables 1 (T/CS 49-04) and 2 (T/CS 49-04) are identical. Table 3 (T/CS 49-04), including the note, applies also for backward signalling.

If a transit switch indicates with a restricted-signalling-capability signal that the destination PABX is connected over a link with restricted signalling capability, the class-of-service signal will not be transmitted.

2.5.2. *Reason for refusal*

After transmission of the call-refusal signal, detailed reasons or advice to be taken by the outgoing PABX may be transferred by the next backward signal.

### 2.5.3. *Called-party's-line-identification*

The called-party's-line-identity will only be indicated by the incoming PABX if it differs from the address as it has been transmitted during the selection phase, e.g. under all conditions where call diversion has taken place at the destination PABX. This information can, however, not be provided if the destination PABX is reached via a link of restricted signalling capability.

Called-party's-line-identification may be transmitted in both cases, either when the call is accepted or when the call is refused by the incoming PABX.

The called-party's-line-identity signals are the numerical characters of the MFPB code (see Table 2 (T/CS 49-04), *Note 1*).

### 2.5.4. *State-of-destination signals*

The state-of-destination signal indicates the current state of the destination actually reached. If this state changes, a different state-of-destination signal may then be transmitted.

### 2.5.5. *End-of-block signal*

The end-of-block signal terminates the dialogue phase backward signalling sequence.

### 2.5.6. *Backward escape signal*

The escape signal is at present envisaged for extension of the range of class-of-service signals only.

## 3. REGISTER-RECALL SIGNALLING

Register-recall provides the means for control information transfer after dismissal of common-control equipment. Register-recall can, as forward or backward recall, be initiated in either direction, regardless of the direction of the original call set-up.

When the common-control equipment at the destination or originating PABX is required to be recalled, the forward or backward service-request-recall signal shall be sent. The service-request-recall signal shall not recall the common-control equipment of transit switches. However, certain call states may require response by a transit switch on recognition of a service-request-recall signal, e.g. in a three-party call where branching occurs at a transit switch. In the case of MFPB unidirectional, the proceed-to-send-on-recall signal using the line signalling frequency and specified in Recommendation T/CS 49-02 [7] shall be used. In the case of MFPB bidirectional, the proceed-to-send-on-recall signal is coded as the character ★. The initiating PABX will continue with the signalling capability check. Register-recall signalling depends on the supplementary services it is used for.

When the common-control equipment of a transit switch is required to be recalled, the forward- or backward-link-recall signal shall be sent to the adjacent transit switch. In this case, the proceed-to-send-on-recall signal using the line signalling frequency and specified in Recommendation T/CS 49-02 [7] shall be used.

MFPB signalling after a link-recall signal starts with the selection phase as described in paragraph 2.2.1.

In case of unidirectional MFPB:

Upon recognition of a register-recall signal, the reconnect signal is sent to indicate that the responding PABX

- does not allow a register-recall to be executed, or
- wishes the initiating PABX to switch-through the connection.

## 4. SYSTEM L1 MFPB SIGNALLING SENDING AND DETECTING REQUIREMENTS

### 4.1. **Sending of MFPB interregister codes**

The sending requirements for System L1 MFPB signalling shall be in accordance with Recommendation T/CS 34-08 [9].

For cooperation of low level senders (option 1) with receivers expecting high level signals (option 2) the level range of the receivers must be changed to a 3 dB higher sensitivity to guarantee the full signalling range.

### 4.2. **Detecting of MFPB interregister codes**

The detecting requirements for System L1 MFPB signalling shall be in accordance with Recommendation T/CS 46-02 [6].

CLI	CALLING-LINE-IDENTITY
CSA	CLASS-OF-SERVICE (A-PARTY)
CSB	CLASS-OF-SERVICE (B-PARTY)
DDI	DIRECT DIALLING-IN
DGT	DIGIT
DPS	DIALOGUE-PHASE SIGNAL
EOB	END-OF-BLOCK
IDP	INTERDIGIT-PAUSE
ISDN	INTEGRATED SERVICES DIGITAL NETWORK
MFC	MULTIFREQUENCY CODE
MFPB	MULTIFREQUENCY PUSH-BUTTON
PABX	PRIVATE AUTOMATIC BRANCH EXCHANGE
PSTN	PUBLIC SWITCHED TELEPHONE NETWORK
RCL	RECALL
SOD	STATE-OF-DESTINATION
TC	TYPE-OF-CALL
TOS	TEMPORARILY OUT-OF-SERVICE

Table 4 (T/CS 49-04). Abbreviations frequently used in System L1 multifrequency signalling procedures.

#### References

- [1] Recommendation T/CS 49-01. *System L1 MFC signalling call control signalling procedures.*
- [2] Recommendation T/CS 49-05. *System L1 multifrequency push-button unidirectional call control signalling procedures.*
- [3] Recommendation T/CS 49-06. *System L1 multifrequency push-button bidirectional call control and service control signalling procedures.*
- [4] CCITT Recommendation Q.25. *Splitting arrangements and signal recognition times in "in-band" signalling systems.*
- [5] CCITT Recommendation G.171. *Transmission characteristics of leased circuits forming part of a private telephone network.*
- [6] CCITT Recommendation M.1010 to M.1060. *International leased circuits.*
- [7] Recommendation T/CS 46-02. *Multifrequency signalling system to be used for push-button telephones.*
- [8] Recommendation T/CS 49-02. *System L1 decadic pulsing interregister signalling.*
- [9] Recommendation T/CS 41-01. *Signal and signalling message names and meanings.*
- [10] Recommendation T/CS 34-08. *Automatic sender for push-button multifrequency signalling.*