

# **BT NETWORK REQUIREMENT**



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**SIGNALLING SYSTEM AC15**  
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SIGNALLING SYSTEM AC15-B

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Issue 3 March 1987

BTNR181

## 1 GENERAL

1.1 The Signalling requirements of the British Telecom Signalling System AC15-B are detailed in this section of the BTNR.

1.2 SSAC15-B is the BT Code for that part of the CEPT Signalling System L1, used to provide line signalling in support of CEPT Signalling System L1/MFC between PBX's within a private network (Note: L1/MFC is the BT Signalling System MF5 detailed in BTR 184).

1.3 The requirements for SSAC15-B shall be in accordance with CEPT recommendation T/CS49-01 utilising those line signals required in CEPT recommendation T/CS49-08 (System L1/MFC).

1.4 BT require that in addition to the CEPT recommendations for SSAC15-B within the UK the following requirements of Section 1 BTNR 181 shall apply:-

## 1.4.1 Paragraph 2.1.2

Paragraph 2.1.4

Paragraph 2.1.5

1.5 The signal sending and receiving requirements of CEPT L1 align with those of SSAC15 and equipment conforming to the requirements of Section 1 of this BTR shall be acceptable for international use. Also equipment conforming to the sending and receiving requirements of CEPT L1 shall be acceptable for inland use of SSAC15-B with the exceptions detailed in paragraph 1.4 above.

## 2 REFERENCES

CEPT Signalling signal L1-CEPT Recommendations T/CS49-01 and T/CS49-08.

BTR 184.

## 3 HISTORY

Issue 1 - November 1980

Issue 2 - May 1983

Section completely revised with reference to CEPT Recommendations T/CS49-01 and T/CS49-08.

Issue 3 - March 1987

Editorial amendments

END OF SECTION 3

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SIGNALLING SYSTEM AC15-C

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Issue 3 - March 1987

BTNR181

## 1 GENERAL

1.1 The signalling requirements of the British Telecom Signalling System AC15-C are detailed in this section of the BTNR.

1.2 SSAC15-C is the BT Code for the CEPT Signalling System L2.

1.3 The requirements for SSAC15-C shall be in accordance with CEPT recommendation T/CS49-12 with the following options invoked.

1.3.1 Four-wire working.

1.3.2 2280 Hz in both directions.

1.3.3 Both Timed Break and Earth Loop Recall to be provided.

1.3.4 Answer Signal ESU to ISU not to be provided.

1.3.5 Metering not to be provided.

1.4 The system is intended to provide line supervisory signals for extra long PBX or Telephone Plan No extensions both Inland and via International leased lines.

1.5 The signal sending and receiving requirements of CEPT Signalling System L2 align with those of SSAC15 and equipment conforming to the requirements of Section 1 and 4 of this BTNR shall be acceptable for international use. Also equipment conforming to the sending and receiving requirements of CEPT Signalling System L2 shall be acceptable for Inland use of SSAC15-C subject to the equipment conforming, additionally, to the requirements of paragraphs 2.1.2, 2.1.4 and 2.1.5 of Section 1 of this BTNR.

1.6 When used Inland, any associated SSMF4 signalling shall be in accordance with BTR 1151, Section 2.

## 2 REFERENCES

CEPT Signalling System L2-CEPT Recommendation T/CS49-12.

BTR 1151, Section 2.

3 HISTORY

Issue 1 October 1981.

Partial distribution. CEPT Draft Recommendation T/CS(81) 99E incorporated as Appendix.

Issue 2 May 1983.

Section revised with appendix related to T/CS(81) 99E removed and reference to CEPT Recommendation T/CS49-12 inserted.

Issue 3 - March 1987

Editorial amendments

END OF SECTION 4

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SIGNALLING SYSTEM AC15-D

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- 2 REFERENCES
- 3 HISTORY

Issue 3 - March 1987

BTNR181

## 1 GENERAL

1.1 The Signalling requirements of the British Telecom Signalling System AC15-D are detailed in this section of the BTNR.

1.2 SSAC15-D is the BT Code for the CEPT Signalling System L1.

1.3 The requirements for SSAC15-D shall be in accordance with CEPT recommendations T/CS49-01, 49-02 and 49-03 with the exception of the optional signals listed in paragraph 1.6.

1.4 The system is primarily intended for use between PBX's in different countries, via international leased lines, but may be used inland.

1.5 The signal sending and receiving requirements of CEPT L1 align with those of SSAC15 and equipment conforming to the requirements of Section 1 of this BTNR shall be acceptable for international use. Also equipment conforming to the sending and receiving requirements of CEPT L1 shall be acceptable for inland use of SSAC15-D with the exceptions detailed in paragraph 1.4 Section 3 of this BTNR.

1.6 The following signals are optional within the CEPT Signalling System L1, and are not required for SSAC15-D by British Telecom.

- 1.6.1 Address Complete
- 1.6.2 Address Complete extension free
- 1.6.3 Address Complete extension busy
- 1.6.4 Busy Extension changed to Free
- 1.6.5 Intrusion
- 1.6.6 End of Intrusion
- 1.6.7 Service Request Recall
- 1.6.8 Link Recall

1.7 Where any of the options listed in paragraph 1.6 Section 5 of this BTNR are required, they may be provided where agreement between all parties is reached.

## 2 REFERENCES

CEPT Signalling System L1-CEPT Recommendations T/CS49-01, T/CS49-02 and T/CS49-03.

3 HISTORY

Issue 1 - November 1980

Issue 2 - May 1983

Section revised with reference to CEPT Recommendation T/CS49-01,  
49-02 and 49-03.

Issue 3 - March 1987

Editorial amendments

END OF SECTION 5

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ISSUE 1

HISTORY

Issue 1 - November 1980

Sections 1, 2, 3 and 5 issued

Issue 2 - October 1981

Section 4 issued referencing CEPT document T/CS(81)99E  
as the Section Appendix.

Issue 3 - May 1983

Section 1 has been left as Issue 1 with no changes.

Section 2 has been left as Issue 1 with no changes.

Section 3 has been updated and raised to Issue 2 with  
reference to CEPT recommendations T/CS49-01 and 49-08.  
Section 4 has been updated and raised to Issue 2 with  
reference to CEPT recommendation T/CS49-12. Section 5  
has been updated and raised to Issue 2, with reference  
to CEPT recommendations T/CS49-01, 49-02 and 49-03.

Issue 4 - April 1984 : Section 6 issued, Editorial Amendments

Issue 5 - Divided into two volumes.

Issue 6 - Reference to SSMF4 added to Section 2

SIGNALLING SYSTEM AC15-E

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- 3 SIGNALLING CODE
- 4 SIGNAL SENDING AND DETECTING REQUIREMENTS
- 5 LINE SIGNALLING TRANSMISSION REQUIREMENTS
- 6 HISTORY

Issue 1 - March 1987

## 1 GENERAL

1.1 The signalling requirements of the British Telecom Signalling System AC15-E are detailed in this section of the BTNR.

1.2 The system is intended to provide line supervisory for extra-long lines between a telephone instrument, PBX, Automatic Call Distribution Equipment, etc and a public exchange, or between a telephone instrument, satellite PBX etc and a PBX. Provision shall be made to transfer address information in the direction telephone instrument (or its equivalent) to the exchange; transfer of address information in the reverse direction is not required. The address information may be applied to the signalling path either as 10pps pulses of signalling tone or as multi-frequency signals of SSMF4 code (BTR 1151 refers).

Pulse correction shall be employed to compensate for pulse distortion in preceding links in a network.

1.3 The general signalling requirements common to all SSAC15 variants, eg sending and receiving conditions, are given in Section 1 of the BTNR.

1.4 For the purpose of this description, this Section of the BTNR refers to a Subscribers Unit (SSU) and an Exchange Signalling Unit (ESU), but it does not imply that the signalling equipment cannot form an integral part of either the customers' equipment or of the exchange.

## 2 OUTLINE OF OPERATION

In this paragraph, signal names shown in upper case refer to specific signals in the signalling paths between SSU and ESU (and vice versa); the code for these is defined in paragraph 3 of this Section.

## 2.1 SIGNALS SENT FROM SSU TO ESU

2.1.1 IDLE. The SSU applies the IDLE-A signal to the signalling path to indicate that the customer's equipment is free to accept calls.

2.1.2 SEIZING. The customer's equipment applies a seizing condition to the SSU, which in turn applies the SEIZING signal to the signalling path. On recognition of the SEIZING signal, the ESU informs the exchange that the customer's equipment is originating a call. The exchange busies the circuit against incoming calls and prepares to receive call routing information.

### 2.1.3 CALL ROUTING INFORMATION

Call Routing Information is sent either in 10pps form as pulses of signalling tone (decadic pulses) or as multi-frequency signals of SSMP4 basic code. (If SSMP4 signals are being sent or received, SSAC15E remains quiescent).

### 2.1.4 ANSWER (CALL INCOMING TO CUSTOMER'S EQUIPMENT)

When the called customer's equipment applies an answer condition to the SSU, the SSU removes the IDLE-A signal from the signalling path. On recognising that the IDLE-A signal has been removed, the ESU informs the exchange that the customer's equipment has answered and that ringing must be stopped.

### 2.1.5 CLEARDOWN

When the customer's equipment applies a clearing condition to the SSU, the SSU applies the CLEAR-A signal to the signalling path. On recognising the CLEAR-A signal, the ESU informs the exchange that the customer's equipment has cleared.

### 2.1.6 RECALL

On receipt of a recall condition from the customer's equipment, the SSU applies a RECALL signal in the form of a tone-on pulse to the signalling path. The length of the tone-on pulse applied by the SSU depends upon whether the recall condition employed by customer's equipment is timed break (OPTION A) or earthed-loop (OPTION B).

## 2.2 SIGNALS SENT FROM ESU TO SSU

**2.2.1 IDLE.** The ESU applies the IDLE-B signal to the signalling path to indicate that the exchange is free to accept calls.

### 2.2.2 CALLING

The CALLING signal is applied to the signalling path to indicate that ringing current is being sent by the exchange. The signal is sent by the ESU as a series of tone-on pulses in step with the periods of ringing current sent by the exchange. On recognising that CALLING tone-on pulses are being received from the ESU, the SSU applies ringing current (BTNR 1080 refers) to the customer's equipment. This application is maintained until the SSU recognises that the CALLING tone-on pulses are no longer being received from the ESU, when it is ceased. The cadence of the ringing current connected to the customer's apparatus need not

be in step with the tone-on pulses received from the ESU.

### 2.2.3 ANSWER (CALL OUTGOING FROM CUSTOMER'S EQUIPMENT)

When the exchange indicates to the ESU that the called party has answered, the ESU applies the ANSWER signal to the signalling path. On recognition of the signal, the SSU informs the customer's equipment that the called party has answered.

(Note: BT does not guarantee that an indication that a called-party has answered will be given by means of electrical conditions at the calling-party's exchange connexion by all types of exchange and on all types of call. The signalling system shall function correctly regardless of the presence or absence of an answer indication from the exchange on any call).

### 2.2.4 CLEARDOWN

2.2.4.1 When the exchange indicates to the ESU that it is releasing from a call, the ESU commences to apply the DISCONNECT CLEAR signal to the signalling path. The signal is sent by the ESU as a tone-on pulse. On recognition of the signal, the SSU informs the customer's equipment that the exchange equipment is releasing.

2.2.4.2 The duration of the tone-on pulse applied by the ESU to the signalling path is extended if required until the exchange applies the idle condition to the ESU. Such extension is the BACKWARD GUARD signal. Whilst it recognises this signal, the SSU continues to inform the customer's equipment that the exchange equipment is releasing. On recognising that the exchange has applied the idle condition, the ESU replaces the BACKWARD GUARD signal with the IDLE-B signal. On recognising this change the SSU informs the customer's equipment that the exchange is free to receive calls.

### 2.2.5 BACK BUSY

On recognising that the exchange has replaced the idle condition with any condition that indicates the exchange is unable to accept calls, the ESU applies to the signalling path the BACK BUSY signal. On recognising this signal, the SSU informs the customer's equipment that the exchange is not free to accept calls.

## Part 2 - Signals from exchange-end signalling unit (Backward Signals)

SIGNAL	DESCRIPTION	TONE LEVEL (SEE NOTE BELOW)	COMMENTS
IDLE-B	Cont tone-off	-	No tone signal.
CALLING	Tone-on pulses	High	Tone pulses at the cadence of exchange ringing current.
ANSWER	Tone-on pulse	High	Tone pulse when called party answers on O/G calls.
DISCONNECT CLEAR	Tone-on pulse	High/Low	Tone pulse differentiated from above by greater length.
BACKWARD GUARD	Tone-on	High/Low	Tone signal of length determined by conditions applied from public exchange. May be prolongation of DISCONNECT CLEAR signal.
BACK BUSY	Tone-on	High/Low	Tone signal of length determined by conditions applied from public exchange, commenced from idle state.

NOTE: The distinction between high and low level tone sending is a transmission requirement and does not form part of the signalling code. To ensure positive recognition, tone signals commence at high level. To avoid overloading transmission equipment, any tone signal must be reduced to the low level after 550ms of continuous sending, and it may be so reduced after 300ms.

## 3 SIGNALLING CODE

The signalling code is as given in Table 1 below.

TABLE 1

Part 1 - Signals from subscribers-end signalling unit (Forward Signals)

SIGNAL	DESCRIPTION	STONE LEVEL (SEE NOTE BELOW)	COMMENTS
IDLE - A	Cont tone-on	Low	Prolongation of CLEAR-A.
SEIZING	Cont tone-off	-	No tone signal.
CALL ROUTING INFORMATION	Tone-on pulses	High	Tone pulses indicating each break pulse of decadic pulsing. Sending level remains high for each pulse in a train.
	OR MFA	-	AC15E signalling system remains quiescent.
RECALL OPTION A OR B	Tone-on pulse	High	Defined lengths of tone-on pulse.
CLEAR A	Cont tone-on	High/Low	Prolongation of CLEAR-A is also known as IDLE-A.

## 4 SIGNAL SENDING AND DETECTING REQUIREMENTS

## 4.1 SENDING OF SIGNALS

## 4.1.1 CONTINUOUS AND PULSED SIGNALS

Signals are sent by applying either a tone-on or tone-off condition to the transmit signalling path in continuous or pulsed form.

4.1.1.1 A continuous tone-on signal is the application of a tone-on condition to the transmit signalling path for a period exceeding 350ms.

4.1.1.2 A continuous tone-off signal is the application of a tone-off condition to the transmit signalling path for a period exceeding 80 ms.

4.1.1.3 A tone-on pulse signal is the application of a tone-on condition to the transmit signalling path for a period determined by the signal to be sent.

## 4.1.2 SENDING OF SIGNALS FROM SUBSCRIBER'S END

4.1.2.1 IDLE-A Signal. The IDLE-A signal is the application of the continuous tone-on condition to the transmit signalling path.

4.1.2.2 SEIZING Signal. The SEIZING signal is the application of the continuous tone-off condition to the transmit signalling path.

## 4.1.2.3 Call Routing Information. (Digit Signalling)

Call routing information (digit signalling) is conveyed in decadic or multi-frequency push-button (MFPB) form.

4.1.2.3.1 Decadic Pulsing. Tone-on pulse signals are applied to the transmit signalling path such that their duration corresponds to the disconnect periods of the digit signals received at the SSU from the customer's equipment. Each tone-on pulse is separated from the next by a period of the tone-off condition corresponding to the make periods of the received digit signals. A make or a break condition shall persist for a minimum period of 15ms before being accepted as a valid condition.

4.1.2.3.2 Multi-frequency Push-Button  
Signals

SSAC15E shall neither affect nor be affected by the transfer of call-routing information by means of SMF4 (BTR 1151 refers).

4.1.2.4 RECALL. The RECALL signal is the application of the pulsed tone-on condition to the transmit signalling path. The length of the tone-on condition is dependent on the type of recall applied by the associated customer's equipment. A RECALL signal as a consequence of a timed-break recall signal from the customer's equipment is the application of the tone-on condition for a period equivalent to that of a single digit-pulse. A RECALL signal as a consequence of an earthed-loop recall signal from the customer's equipment is the application of the tone-on condition for a period of 210 to 240ms.

4.1.2.5 CLEAR Signal. The CLEAR signal is the tone-on condition applied to the transmit signalling path for longer than 350ms.

## 4.1.3 SENDING OF SIGNALS FROM THE EXCHANGE END

4.1.3.1 IDLE-B Signal. The IDLE-B signal is the application of the continuous tone-off condition to the transmit signalling path for a period exceeding 80ms.

4.1.3.2 CALLING Signal. The CALLING signal is the application of the pulsed tone-on condition to the transmit signalling path in step with the ringing period of the exchange ringing cadence. The duration of each pulsed tone-on condition is 100-250 ms.

4.1.3.3 ANSWER Signal. The ANSWER signal is the application of the pulsed tone-on condition to the transmit signalling path for a period of 45-135 ms.

4.1.3.4 DISCONNECT CLEAR Signal. The DISCONNECT CLEAR signal is the application of the tone-on condition applied to the transmit signalling path for a period exceeding 350 ms.

4.1.3.5 BACKWARD GUARD Signal. The BACKWARD GUARD signal is the tone-on condition applied to the transmit signalling path immediately following the completion of a DISCONNECT CLEAR signal, the duration of application being

controlled by the source of the BACKWARD GUARD signal.

4.1.3.6 BACK BUSY signal. The BACK BUSY signal is the continuous tone-on condition applied to the transmit signalling path from the idle state, the duration of application being controlled by the source of the BACK BUSY signal.

#### 4.2 DETECTION OF SIGNALS

##### 4.2.1 SIGNAL VALIDATION

Electrical conditions conforming to the requirements of paragraph 5 of this section of this BTNR and applied to the line termination shall be regarded as potential signals. Signals are received as either a tone-on or a tone-off condition on the receive signalling path in either continuous or pulsed form.

To discriminate between signals having similar characteristics and between signals and spurious electrical conditions, it is necessary to state the minimum time for a potential signal.

A signal is not valid until the electrical condition proper to the signal (ie tone-on or tone-off) has persisted for a stated period. Until that period expires, only an electrical condition exists.

Paragraphs 4.2.3 to 4.2.4 detail the minimum persistence of a defined electrical condition before it becomes a signal (ie a valid electrical condition persisting for less than the stated period shall not be recognised as a signal). The period after which a validated electrical condition must be recognised as a signal is a function of the Signalling Unit logic and is not given in these specifications. However recognition should occur as soon as possible following expiry of the stated persistence check period.

#### 4.2.2 CONTINUOUS AND PULSED SIGNALS

##### 4.2.2.1 CONTINUOUS TONE-ON SIGNAL

A tone-on condition applied to the receive signalling path line termination is a continuous tone-on signal when it has persisted for 250 ms.

##### 4.2.2.2 CONTINUOUS TONE-OFF SIGNAL

A tone-off condition applied to the receive signalling path line termination is a continuous tone-off signal when it has persisted for 40 ms.

## 4.2.3 DETECTION OF SIGNALS AT THE EXCHANGE END

4.2.3.1 IDLE-A Signal. A tone-on condition applied to the receive path line termination for a period exceeding 250 ms is an IDLE-A signal.

4.2.3.2 SEIZING Signal. A tone-off condition applied to the receive signalling path line termination for a period exceeding 40 ms is a SEIZING signal.

4.2.3.3 CALL ROUTING Signals. Each digit signal is received as an equivalent number of tone-on pulses (Break pulses), each tone-on pulse being separated from the next by a period of tone-off (Make pulse). The end of each digit signal is indicated by a period of tone-off condition in excess of a make pulse.

4.2.3.3.1 Trains of break pulses (tone-on) consistent with the speed and duration limits of Table 2, followed by the tone-off condition for longer than 95 ms, are digit signals.

4.2.3.3.2 Within a digit signal, adjacent pulses may differ in speed and duration and any combination of break pulses within the limits of Table 2 shall be accepted.

4.2.3.3.3 Break pulses persisting for less than 25 ms applied to the receive line termination shall not be accepted as digit pulses.

TABLE 2

SPEED (pps)	7		9		11		12	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Break Pulse duration (ms)	35	122	35	91	35	71	35	62

## 4.2.3.4 RECALL Signal

4.2.3.4.1 A tone-on condition applied to the receive signalling path line termination for a period consistent with a single digit-pulse is a RECALL (OPTION A) signal.

4.2.3.4.2 A tone-on condition applied to the receive signalling path line termination for 190 ms to 250 ms is a RECALL (OPTION B) signal.

4.2.3.4.3 A tone-on condition persisting for less than 25 ms shall not be accepted as a RECALL signal of either option.

4.2.3.5 CLEAR-A Signal. A tone-on condition applied to the receive signalling path line termination for a period exceeding 260 ms is a CLEAR-A signal.

#### 4.2.4 DETECTION OF SIGNALS AT THE SUBSCRIBER'S END

4.2.4.1 IDLE-B Signal. A tone-off condition applied to the receive signalling path line termination for a period exceeding 40 ms is an IDLE-B signal.

4.2.4.2 CALLING Signal. A tone-on pulse applied to the receive signalling path line termination for 70 ms - 290 ms is a CALLING signal, received for each burst of ringing current sent from the exchange. A tone-on condition persisting for less than 25 ms shall not be accepted as a CALLING signal.

4.2.4.3 ANSWER Signal. A tone-on pulse applied to the receive signalling path line termination for 25 ms - 290 ms is an ANSWER signal. A tone-on condition persisting for less than 25 ms shall not be accepted as an ANSWER signal.

4.2.4.4 DISCONNECT CLEAR Signal. A tone-on pulse applied to the receive signalling path line termination for 290 ms - 300 ms is a DISCONNECT-CLEAR signal.

4.2.4.5 BACKWARD GUARD Signal. A tone-on condition applied to the receive signalling path line termination immediately following the completion of a DISCONNECT CLEAR signal is a BACKWARD GUARD signal.

4.2.4.6 BACK BUSY Signal. A continuous tone-on condition applied to the receive signalling path line termination immediately following an IDLE-B signal is a BACK BUSY signal.

5 LINE SIGNALLING TRANSMISSION REQUIREMENTS

The line signalling transmission performance shall be in accordance with CEPT recommendation T/CS 49-12 for 4-wire working.

6 HISTORY

Issue 1 - March 1987

END OF SECTION 6