INTERNATIONAL TELECOMMUNICATION UNION

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TELEGRAPH SWITCHING

SIGNALLING OVER RADIO AND MULTIPLEXED CHANNELS

REQUIREMENTS FOR TELEX AND GENTEX OPERATION TO BE MET BY SYNCHRONOUS MULTIPLEX EQUIPMENT DESCRIBED IN RECOMMENDATION R.44

ITU-T Recommendation U.24

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation U.24 was published in Fascicle VII.2 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 U.24

REQUIREMENTS FOR TELEX AND GENTEX OPERATION TO BE MET BY SYNCHRONOUS MULTIPLEX EQUIPMENT DESCRIBED IN RECOMMENDATION R.44

(Mar del Plata, 1968)

The CCITT,

considering

(a) that it may be desirable to use synchronous systems described in Recommendation R.44 in the teleprinter switching networks;

(b) that it is essential to transmit the full range of telex signals for types A, B and C signalling;

unanimously declares the view

(1) that where it is necessary to receive signals with a nominal cycle of 7 units (see the Recommendation cited in [1]), it will be necessary to insert suitable storage to reconcile the two character rates (400 and 411 per minute);

(2) that type A and B signals in accordance with Recommendation U.1 and U.2 and type C signals in accordance with Recommendation U.11 should be accepted for transmission through the synchronous system. However, in the case of type A signalling, the delay between the start of the call-confirmation signal and the proceed-to-select signal should be increased to, at least, 150 ms;

(3) that the call signal should be transmitted through the synchronous system with the minimum delay obtainable with the particular method of multiplexing in use, e.g., element interleaving, in order to reduce the incidence of head–on collisions with both–way operation. The maximum delay due to the multiplex equipment should be limited to 60 ms;

(4) that the maximum delay on the call–confirmation signal due to the multiplex equipment should be 60 ms in the case of type A signalling, and 120 ms in the case of type B signalling;

(5) that the maximum delay on the start of the reception–confirmation signal due to the multiplex equipment should be 60 ms in the case of type C signalling;

(6) that the maximum delay on the proceed-to-select signal due to the multiplex equipment should be 450 ms in the case of type A signalling, and 120 ms in the case of type B signalling;

(7) that the maximum delay on the call-connected signal due to the multiplex equipment should be 450 ms (type A and type B signalling);

(8) that the maximum delay on a teleprinter character due to the multiplex equipment should be 450 ms;

(9) that the maximum delay on the clear and clear–confirmation signals due to the multiplex equipment should be 450 ms;

(10) that the tolerance of the type A and B pulse signals after retransmission through the synchronous multiplex system will be stated below:

a) *Call-confirmation and proceed-to-select signal – type B signalling*

The duration of the pulse after transmission through the synchronous system will not be less than 17.5 ms nor more than 50 ms.

b) *Dial pulses – type B signalling*

Speed – ± 3% of the mean speed of input measured for digit 0 (normally 9 to 11 pulses per second).

Ratio – The duration of stop polarity pulses will not be less than 32 ms; the duration of start polarity pulses will not be less than 44 ms.

Under certain circumstances the retransmitted dial signals may include pulses of stop polarity having durations of up to 73 ms and pulses of start polarity having durations of up to 98 ms. Where this is so and the incoming switching equipment cannot accept pulses with these characteristics a dial pulse regenerator should be inserted between the output of the multiplex circuit and the input of the switching equipment.

c) *Service signals for ineffective calls – type B signalling*

The duration of the period of stop polarity, whether followed by teleprinter signals or not, will, after transmissions through a synchronous system, be not less than 145 ms and not more than 292 ms.

If several synchronous systems are placed in tandem, the duration of the period of stop polarity of the service signal at the output of this group of systems should not exceed 440 ms.

At the input of a synchronous system, a type B service signal will cause the return of a clear–confirmation signal from the synchronous equipment without waiting for the return of the clear–confirmation signal from the distant end of the connection. Following the recognition of the clearing signal in the service signal, permanent start polarity will be transmitted over the synchronous system.

d) *Call–connect – type A signalling*

The duration of the pulse of start polarity after transmission through several synchronous systems will be within the limits 140 ms to 160 ms.

ANNEX A

(to Recommendation U.24)

TABLE A–1/U.24

Telex signalling through the multiplex equipment – Type A signalling

Signalling condition	Signal received from telex (Recommendation U.1)	Signal on channel aggregate path	Signal transmitted to telex
Free line	Continuous A polarity on both signaling paths	Continuous A polarity	Continuous A polarity
Call	Inversion to Z polarity on forward signalling path	Inversion to Z polarity (within 9-35 ms from inversion in column 2) (see Notes 1 and 2)	Inversion to Z polarity (maximum delay of 60 ms from inversion in column 2)
Call-confirmation	Inversion to Z polarity on backward path within 150 ms of receipt of calling signal	As for call	As for call
Proceed-to-select	Teleprinter signals or 40 ms pulse of A polarity (± 8 ms) on backward path. Not to be returned within 150 ms of call-confirmation	Teleprinter signals or combination No. 22 (**V**)	Teleprinter signals or combination No. 22 (**V**) (see Note 3)
Selection	Teleprinter signals on the forward path	Teleprinter signals	Teleprinter signals (see Note 3)
Call-connect	Teleprinter signals or 150 ms (± 11 ms) pulse of A polarity followed by continuous Z polarity for 2 seconds minimum on the backward path	Teleprinter signals or one α combination followed by continuous Z polarity for 2 seconds minimum	Teleprinter signals or 145 5/6 ms pulse of A polarity followed by continuous Z polarity for 2 seconds minimum (see Note 3)
Service signals	Teleprinter signals on the backward path followed by clearing signal (see Note 4)	Teleprinter signals followed by one or two α combinations and then continuous A polarity (see Note 5)	Teleprinter signals followed by continuous A polarity (see Note 3)
Clear	Inversion to continuous A polarity on either signalling path (see Note 4)	One or two α combinations followed by continuous A polarity (see Note 5)	Inversion to A polarity (see Note 3)
Clear-confirmation	Inversion to continuous A polarity in opposite direction to clearing after a delay of 350-1500 ms following receipt of clearing signal	As for clear	As for clear

For notes, see Table A-3/U.24.

TABLE A-2/U.24

Telex signalling through the multiplex equipment – Type B signalling

Signalling condition	Signal received from telex (Recommendations U.1 and U.2)	Signal on channel aggregate path	Signal transmitted to telex
Free line	As for type A	As for type A	As for type A
Call	As for type A	As for type A	As for type A
Call-confirmation	A 17.5-35 ms pulse of Z polarity on the backward signalling path, returned within 150 ms of receipt of calling signal	1 or 2 consecutive elements of Z polarity	32-50 ms pulse of Z polarity (see Note 7)
Proceed-to-select	As call-confirmation signal. The interval of A polarity separating the signals to be 100 ms minimum	As for call-confirmation	As for call-confirmation. The interval separating the pulses may be reduced to 60 ms minimum (see Note 7)
Selection signals	Teleprinter signals or dial pulses having the following limits: Speed: 9-11 p.p.s. Ration: 1Z: 1.9A	Teleprinter signals (see Note 2) or dial pulses, when each start polarity interval is transmitted as 1-4 elements of A polarity and each stop polarity interval is transmitted as 1-3 elements of Z polarity. The mean speed of pulsing will be the same (± 3%) as the input signals (see Note 6)	Teleprinter signals (see Note 3) or dial pulses at the same mean speed of the input (± 3%) and having the following ratio limits: A polarity intervals: 44-98 ms Z polarity intervals: 32-73 ms
Call-connect	Continuous Z polarity for 2 seconds minimum on the backward signalling path	One β combination followed by continuous Z polarity for 2 seconds minimum (see Note 6)	Continuous Z polarity for 2 seconds minimum (see Note 7)
Service signals (busy pulse)	165-260 ms of Z polarity on the backward path followed by A polarity for 1500 ms (± 30%) continuously repeated. The Z polarity period may be followed by teleprinter signals when the tolerance of the A polarity period is reduced to ± 20%	One ot two β signals followed (possibly) by teleprinter signals, then by one α combination and A polarity as in the input signal (see Note 6)	145-292 ms Z polarity, followed (possibly) by teleprinter signals and then by A polarity of minimum duration 950 ms (see Note 7)
Clear and clear-confirmation	As for type A	As for type A	As for type A

For notes, see Table A-3/U.24.

TABLE A-3/U.24

Type C signalling effected by multiplex equipment

Signalling conditions	Signal received from telex (Recommendation U.11)	Signal on channel aggregate path	Signal transmitted to telex
Free line	Continuous A polarity on both signalling paths	Continuous A polarity	Continuous A polarity
Call signal (or automatic retest signal)	Inversion to Z polarity on the forward path for 150-300 ms followed by teleprinter signals	Inversion to Z polarity (within 9-35 ms from inversion in column 2) (see Note 1 and 2)	Inversion to Z polarity (maximum delay of 60 ms from inversion in column 2). The period of Z polarity may be lengthened by 450 ms maximum
Reception-confirmation (or receiving equipment congestion signal)	Inversion to Z polarity on the backward path for 450 ms (± 10 %) followed by teleprinter signals (or clearing signal)	As for call	As for call
Clear and clear-confirmation	As for type A	As for type A	As for type A

Notes concerning Tables A–1 /U.24 to A –3/U.24

Note 1 – Pulses of Z or A polarity from 0–9 ms (± 1 ms) should be rejected by the multiplex equipment.

Note 2 – The start–stop stores of either signalling path should be switched into circuit after a maximum delay of one β combination for all types of signalling except type B with dial selection.

Note 3 – Recognition time of the clearing signal is 300-1000 ms.

Note 4 – The start–stop stores of either signalling path should be switched out of circuit after a maximum delay of two α combinations.

Note 5 – For type B signalling with dial selection the start-stop stores of both signalling paths will be switched into circuit after recognition of a maximum delay of one β combination on the backward path with Z polarity on the forward path.

Note 6 – In order to meet the timing requirements of the type B service signals it may be necessary to delay the initial inversion to Z polarity by an amount (450 ms maximum) corresponding to the delay with teleprinter signals. The call–connect signal may also be similarly delayed. However, reversion to A polarity within 50 ms indicating a type B call–confirmation or proceed–to–select signal should cancel any further delay on the transmission of these signals.

Note 7 – Delays given in these tables do not include the propagation time of voice–frequency telegraph channels.

Reference

[1] CCITT Recommendation *Transmission characteristics of the load end with its termination (ITA No. 2)*, Rec. S.3, § 1.6.