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STANDARDIZATION SECTOR
OF ITU

SPECIFICATIONS OF SIGNALLING SYSTEM No. 6

TESTING AND MAINTENANCE

OVERALL TESTS OF SIGNALLING SYSTEM No. 6

ITU-T Recommendation Q.295

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.295 was published in Fascicle VI.3 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.

9.1 OVERALL TESTS OF SIGNALLING SYSTEM No. 6

9.1.1 *Automatic operational tests of circuits served*

Information can be gained on faulty operation of System No. 6 from overall operational tests of international circuits served by the system. Such tests can be performed by the use of the automatic transmission measuring and signalling testing equipment (ATME 2 - Recommendation O.22). In accordance with Recommendation Q.258, the information to be transmitted in the IAM is the following:

Country-code indicator..... No country code included

Nature-of-circuit indicator ..... As appropriate

Echo suppressor indicator .....Outgoing half-echo suppressor not included

Calling-party's category indicator..... Test call

Address signals .....**X** + **ST**

This format allows 16 types of tests, both for transmission and signalling. If more are required, an additional address signal can be used.

The following **X** address signal codes are assigned:

0 0 0 0 System No. 6 continuity check, see Recommendation Q.261, § 4.1.4

0 0 0 1 ATME 2, Signalling check and transmission test

0 0 1 0 ATME 2, Signalling check only

0 0 1 1 Quiet termination test line

0 1 0 0 Echo suppressor test system

0 1 0 1 Loop around test line

0 1 1 0 Transmission access test line

0 1 1 1 Transmission access test line

1 0 0 0 Transmission access test line

1 0 0 1 Echo Canceller test line

All test calls are completed with the clear-forward and release-guard sequence regardless of the outcome of the test.

All test calls must be allowed to be completed (for example to the responding equipment of ATME 2), even if there is a failure of the continuity check. On test calls, therefore, the continuity signal will be sent irrespective of the result of the continuity check of the speech path.

9.1.2 *Signal unit error rate monitor*

The signal unit error rate monitor, which is described in Recommendation Q.291, § 8.3.2, also provides a means of detecting deterioration of the data link. When the error rate exceeds 0.2% for a period of 6 to 10 minutes, an alarm should be given to alert maintenance personnel.

9.2 SIGNALLING DATA LINK

The data link is composed of two one-way data channels. In general, the maintenance functions are performed independently for each direction of transmission.

For maintenance purposes each data channel may be considered to be composed of the following elements:

- Analogue version
  a) a voice frequency channel;
  b) the modulator and demodulator;
  c) a data carrier failure detector.
- Digital version
  a) a digital channel,
  b) the digital interface adaptor at each end;
  c) a loss of frame alignment detector.

The data channel and its constituent parts must be tested to ensure that they meet the requirements of Recommendation Q.272.

9.2.1 *Maintenance safeguard*

Since interruptions of the data link will affect many speech circuits, the data channels must be treated with the utmost care. Appropriate special measures should be taken to prevent unauthorized maintenance access which could result in interruptions to service. These special measures may include marking or flagging the equipment and appearances on distribution frames or test bays where access is possible (see Recommendation M.1050).

9.2.2 *Voice-frequency channel line-up and maintenance*

The recommendations for the line-up and maintenance of the voice-frequency channel are taken from Recommendation M.1050, taking also into account Recommendation Q.272, § 6.1.3.

9.2.2.1 *Line-up*

The voice-frequency channel line-up must be done in such a way as to ensure that the attenuation/ frequency and delay/frequency distortions meet the requirements of Recommendation Q.272, § 6.1.3, within the frequency band 1000 to 2600 Hz. In addition, the uniform spectrum random noise and impulsive noise requirements of Recommendation Q.272 must be met at the receiving end.

9.2.2.2 *Maintenance*

To ensure proper operation of the common channel signalling system, it will be necessary to schedule preventive maintenance for the voice-frequency channel. The tests to be made as a routine measure are:

	Test	*Periodicity*
a)	Overall loss at 800 Hz	See Table 1/M.610, column 3
b)	Attenuation frequency distortion	Annually
c)	Delay/frequency distortion	Annually
d)	Noise	See Table 1/M.610, column 3

9.2.3 *Digital channel line-up and maintenance*

Tests should be applied to ensure that the digital channel meets the requirements given in Recommendation Q.46 or Q.47.

9.2.4 *Data carrier failure and loss of frame alignment detector tests*

Local tests should be applied to ensure that the data carrier failure detector and the loss of frame alignment detector meet the requirements given in Recommendation Q.275.

9.2.5 *Modem tests*

Modems should be tested locally to ensure that the requirements of Recommendation Q.274 are met. Appropriate arrangements should be provided so that tests may be made independently of the voice-frequency channel and other equipment.

9.2.6 *Interface adaptor tests*

The interface adaptors used in the digital version of System No. 6 should be tested locally to ensure that the requirements of Recommendation Q.274 are met.

9.2.7 *Data channel line-up and maintenance*

9.2.7.1 *Line-up*

After verifying that the transmission path meets the requirements (§§ 9.2.2.1, 9.2.3 above), the data channel error rate should be checked for a period of 15 minutes (without interruption) using the equipment described in § 9.2.8 below. The error rate requirements are given in Recommendation Q.272, § 6.1.2.

9.2.7.2 *Routine maintenance*

The checks described in § 9.2.7.1 above should be made each time routine noise tests of the voice frequency channel (see § 9.2.2.2 above) or tests (see § 9.2.3 above) of the digital channel are required.

9.2.8 *Data test equipment*

The equipment for testing the data channel error rate consists of a pseudo-random bit stream generator to be connected to the input of the transmitting end of the data channel and a monitor to be connected to the output of the corresponding receiving end.

The bit stream to be generated, as specified in Recommendation V.52, is reproduced in Annex A to this Recommendation.

9.3 (Reserved)

9.4 (Reserved)

9.5 NETWORK MAINTENANCE

Network maintenance signals relate to the maintenance of the telephone network. They refer normally to groups of circuits, exchanges, etc., rather than to individual circuits and relate to maintenance activity rather than the rerouting of traffic to provide continuing service.

9.5.1 *Reset-band signal*

In systems which maintain circuit status in software, there may be very rare occasions when large blocks of memory are erased during an emergency action or are accidentally mutilated. In these cases, the sending of the reset-circuit signal would be too laborious during recovery procedures, and two reset-band signals will be sent for each affected group or subgroup of circuits (label band number). The memory should be reconstructed according to the

response received in the reset-band-acknowledgement message. Any interconnected circuits may be cleared by the use of an appropriate signal.

The unaffected exchange receiving a reset-band signal twice within a period of 5 seconds will:

1) make the circuits idle in the designated band, except those circuits at the receiving end that have imposed a blocked condition on the sending end,

2) send the appropriate clearing signal (clear-forward, clear-back) on any tandem-connected circuits, and

3) respond with a reset-band-acknowledgement message for the designated band coded as follows:

   - *band number:* same band number as received reset-band signal

   - *circuit status indicators:* i) for all circuits idle, coded as described in § 3.4.2.3 d) in an LSU; ii) for any other status condition, coded as described in the last (1 1 1 1) entry of § 3.4.2.4 e), with 0 to indicate available for service, 1 to indicate unavailable for service due to blocked condition. In this case a two unit message results.

Should a reset-band signal be received after sending a reset-band signal, but before receiving a reset-band acknowledgement message indicating that both exchanges have lost memory, the response should be a reset-band-acknowledgement, all circuits idle LSU. If the exchange has not been arranged to avoid all-zero signal units by recourse to the LSU established to supersede the prior RBA coding, the original two-unit message remains applicable. Although the new LSU is recommended, no time has been set to remove the validity of the reset-band-acknowledgement as originally coded.

Maintenance status should then be established manually by maintenance personnel especially for those circuits in the installation and testing process. Faulty circuits will be detected during the continuity check on the first call attempt.

When both exchanges are arranged to handle reset-circuit and band signals, if no reset-band acknowledgement is received before 4-15 seconds after sending the second reset-band signal, the reset-circuit signal should be sent for each affected circuit. If an acknowledgement signal for the reset-circuit signal is not received within a period of one minute after the sending of the initial reset signal, maintenance personnel should be notified to facilitate manual restoration procedures. The sending of the reset-circuit signal should continue at one minute intervals until maintenance intervention occurs.

The use of reset-circuit and reset-band signals is optional. Therefore, in the situation where only one exchange is arranged to handle these signals, if no acknowledgement is received for either signal, the signalling procedure should be ceased and maintenance personnel notified to facilitate manual restoration of affected circuits. Although the indicated signals are optional, the ability to cooperate with exchanges transmitting them should be regarded as the preferred status.

To the extent that selective use of the reset-band signal improves recovery from other fault situations, its use for this purpose is permitted.

In the event that reset signals are received at an STP, the following procedures apply:

1) An STP receiving a reset-band, reset-band-acknowledgement or reset-circuit signal will forward the signal on the opposite signalling route in the normal manner, after band number translation (if required);

2) If an STP transmits a Transfer Prohibited Signal (TFP) and subsequently receives:

   a) a reset-circuit signal: a message-refusal signal shall be returned;

   b) a reset-band signal: the TFP signal shall be repeated;

   c) a reset-band-acknowledgement: the TFP signal shall be repeated.

Actions b) and c) allow the failed exchange to reconstruct its transfer status information. It is assumed that any re-initialization should cause all connected STPs to appear to have transfer status "Allowed".

ANNEX A

(to Recommendation Q.295)

Pseudo-random test pattern

In order to test circuits for data transmission on an international basis, it is necessary to standardize the test patterns to be used. Such a pattern should be a pseudo-random one having the following characteristics:

1) it should contain all or at least the majority of eight-bit sequences likely to be met in the transmission of actual data;

2) it should contain sequences of **0**s and **1**s as long as possible compatible with ease of generation;

3) the pattern should be of sufficient length such that at data transmission rates higher than 1200 bits per second its duration is significant compared with line noise disturbances.

Accordingly, a 511-bit test pattern is chosen. The pattern is generated in a nine-stage shift register whose fifth and ninth stage outputs are added together in a modulo-two addition stage, and the result is fed back to the input of the first stage. The modulo-two adder is such that the output produces an output **0** when the two inputs are similar and an output **1** when the two inputs are dissimilar.

Table 11/Q.295 shows the state of each stage of the shift register during the transmission of the first 15 bits. The pattern over a longer period is

1 1 1 1 1 1 1 1 1 0 0 0 0 0 1 1 1 1 0 1 1 1 1 1 0 0 0 1 0 1 1 1 0 0 1 1 0 0 ...

It is clear from the table that this pattern is the sequence of bits in stage 9 of the shift register but it also represents the sequence in any other stage shifted in time. The choice of stage to be connected to the output is therefore a matter of circuit convenience.

TABLE 11/Q.295

Shift-register stages during pseudo-random test pattern generation

Output

1	2	3	4	5	6	7	8	9
1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1
0	0	1	1	1	1	1	1	1
0	0	0	1	1	1	1	1	1
0	0	0	0	1	1	1	1	1
0	0	0	0	0	1	1	1	1
1	0	0	0	0	0	1	1	1
1	1	0	0	0	0	0	1	1
1	1	1	0	0	0	0	0	1
1	1	1	1	0	0	0	0	0
0	1	1	1	1	0	0	0	0
1	0	1	1	1	1	0	0	0
1	1	0	1	1	1	1	0	0
1	1	1	0	1	1	1	1	0
1	1	1	1	0	1	1	1	1