INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.457

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

SPECIFICATIONS OF SIGNALLING SYSTEM R2

INTERREGISTER SIGNALLING

RANGE, SPEED AND RELIABILITY OF INTERREGISTER SIGNALLING

RANGE OF INTERREGISTER SIGNALLING

ITU-T Recommendation Q.457

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.457 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.457

4.5.1 RANGE OF INTERREGISTER SIGNALLING

4.5.1.1 *Number of international links*

The number of international links switched in tandem for establishing an international connection using System R2 must not exceed 4 (see Recommendation Q.440).

Assumptions for the transmission loss in 4-wire international links:

i) nominal transmission loss at 800 Hz: 0.5 dB (Recommendation G.101, § 5);

ii) standard deviation of transmission loss variations with time must not exceed 1 dB [Recommendation G.151, § 3, a)];

iii) the difference between the mean value and the nominal is assumed to be 0 [as in Recommendations G.122, § 1.2), and G.131, § 1].

4.5.1.2 *Number of national links*

a) *Outgoing international R2 register and number of national 4-wire extension links in the country of origin*

The outgoing international R2 register is always provided with 4-wire multifrequency signalling equipment and the 4-wire loop will be open during interregister signalling.

The outgoing international R2 register must be placed in an exchange from where the incoming international exchange in the country of destination is reached by not more than four 4-wire links switched in tandem (see Recommendation Q.440).

It is understood that the national 4-wire links in the country of origin shall have the same standard deviation of transmission loss variations with time (1 dB) as the international links and that, if these national links do not have the same nominal transmission loss as the international links (0.5 dB), appropriate compensation of the multifrequency combination levels will be made in both directions of transmission.

b) *Number (k) of national 4-wire extension links in the country of destination*

Not more than four national 4-wire extension links may be used.

Forward transmission loss in the country of destination:

i) The standard deviation of transmission loss variations with time in the national 4-wire extension links in the country of destination must not exceed 1 dB.

ii) The nominal transmission loss at 800 Hz in the forward direction (A_f) between the virtual switching point in the incoming international exchange and any incoming R2 register in the country of destination must not exceed:

11.4 dB for a country using 3 national 4-wire extension links at the most

or

11.0 dB for a country using 4 national 4-wire extension links at the most,

and must never be less than:

$$A_{f\,\text{min.}} = -2.5 - 0.5\,m + 2.3\,\sqrt{(m + k) + (m + k + 1)\,0.04}\ \text{dB.}$$

The values for the minimum forward transmission loss $A_{f\text{min.}}$ resulting from this formula are shown in Table 10/Q.457 (for the definitions of *m* and *k* see Recommendation Q.454). In practice the forward transmission loss must not fall below these values.

The formula has been determined as shown in Annex C to Section 4.

When System R2 end-to-end signalling is applied in a national network, the 4-wire links involved may not conform to the characteristics specified by the CCITT for international circuits. Also, national transmission plans may be based on principles different from those of the international transmission plan. Consequently, the range over which end-to-end signalling is possible must be established using calculations, e.g. as shown in Annex C to Section 4 (see also §§ 4.5.1.3 and 4.5.1.4 below).

TABLE 10/Q.457

Minimum forward transmission loss in the country of destination

k \ *m*	1	2	3	4
1	0.3	0.6	0.7	0.8
2	1.1	1.2	1.3	1.3
3	1.7	1.8	1.8	1.7
4	2.3	2.3	2.2	2.2

4.5.1.3 *Total attenuation distortion*

It has been assumed that at all frequencies within the 530-1990 Hz band the overall attenuation distortion relative to 800 Hz between the outgoing international R2 register and any incoming R2 register will not exceed ± 3 dB. Attention is drawn to the fact that on some national connections these assumptions might not be fulfilled.

As type B test signals (see Recommendation Q.455) allow for a 5 dB difference in level between two adjacent signalling frequencies, and a 7 dB difference between two non-adjacent signalling frequencies, a 4 dB attenuation distortion of the multi-link section can be allowed for two adjacent frequencies and a 6 dB distortion for two non-adjacent frequencies, provided that the level of the weakest signalling frequency is not lower than -35 dBm at the terminals of the receiving part of the multifrequency signalling equipment.

The values 4 dB and 6 dB were obtained by allowing for a 1 dB difference in sending level.

4.5.1.4 *Intermodulation*

A multifrequency signalling system in conformity with the above specifications will allow satisfactory working over a multi-link section introducing intermodulation products from two signalling frequencies and falling within the 520-1160 Hz and 1360-2000 Hz bands, the level of each of such products being at least 24 dB below the highest signal frequency level.

4.5.2 *Build-up and time specification of a complete forward compelled signalling cycle*

Figure 18/Q.457 shows in detail the build-up and time sequence of a compelled signalling cycle.

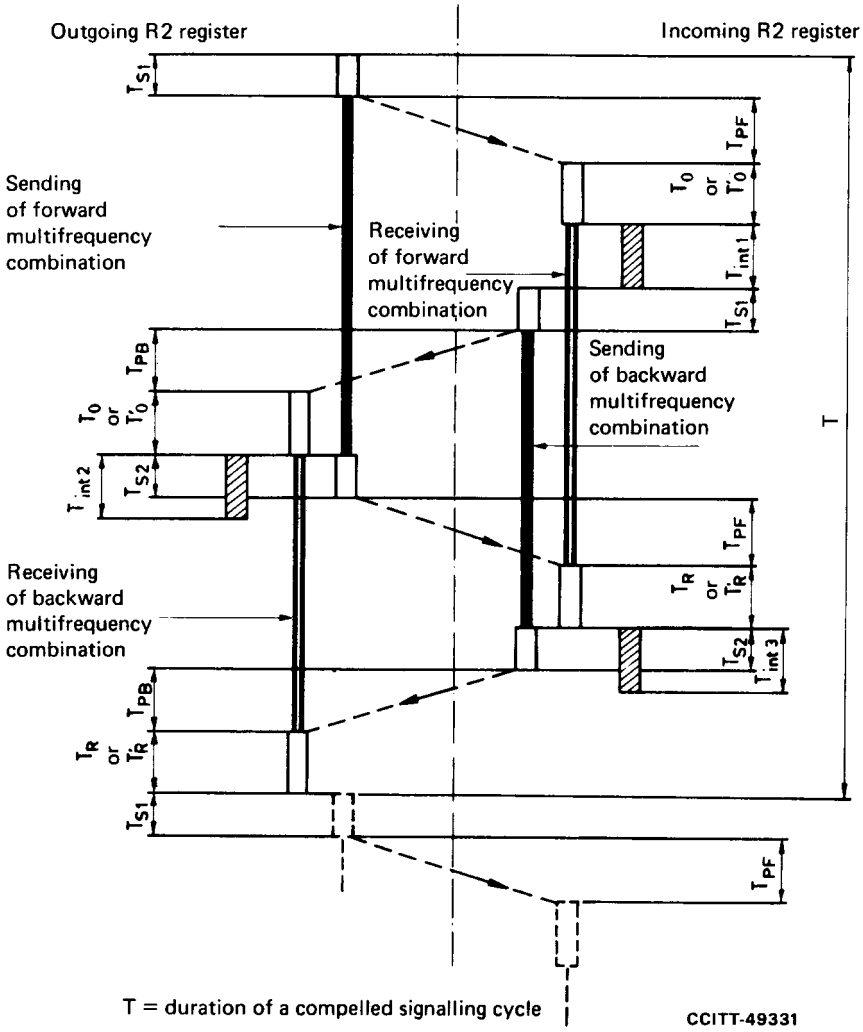

FIGURE 18/Q.457

Sequence of a complete compelled signalling cycle

In this figure:

T_{PF} denotes the transmission delay of the slower of the two frequencies of a forward multifrequency combination;

T_{PB} denotes the transmission delay of the slower of the two frequencies of a backward multifrequency combination;

T_0 and T'_0 denote the operating times as defined in Recommendation Q.451;

T_R and T'_R denote the release times as defined in Recommendation Q.451;

$T_{int\,1}$, $T_{int\,2}$ and $T_{int\,3}$ denote the internal operation times as defined in Recommendation Q.451.

If the values of $T_{int\,2}$ and $T_{int\,3}$ lie within certain limits, they do not contribute to the total duration of the compelled signalling cycle, as can be seen from Figure 18/Q.457.

T_{S1} and T_{S2} denote respectively the time required for starting and stopping the sending of a multifrequency combination (switching-on or switching-off times, exclusive of logic operations).

It thus appears that the total duration T of a complete compelled signalling cycle is given by the formula:

$$T = 2\,(T_{PF} + T_{PB}) + \left\{\begin{matrix}(T_0 + T_R)_D + (T_0 + T_R)_A \\ \text{or} \\ (T'_0 + T'_R)_D + (T'_0 + T'_R)_A\end{matrix}\right\} + T_{int\,1} + (T_{S1} + T_{S2})_D + (T_{S1} + T_{S2})_A$$

The subscripts D and A apply respectively to the outgoing and the incoming registers.

T_{PF} and T_{PB} depend on the propagation characteristics of the forward and backward speech paths respectively and therefore cannot be specified.

A value of 10 ms for T_{PF} and T_{PB} can be considered as typical, e.g. for average terrestrial regional connections and 320 ms for circuits including a satellite link.

The maximum value of $T_0 + T_R$ has been fixed at 70 ms. A value of 35 ms could be taken in a certain number of cases as representing the minimum duration of $T_0 + T_R$.

$T_{int\,1}$, $T_{int\,2}$ and $T_{int\,3}$ are dependent on the type of exchange and therefore cannot be specified; but their contribution to the total duration of the compelled signalling cycle must be kept as small as possible.

If the influence of $T_{int\,1}$,$T_{int\,2}$ and $T_{int\,3}$ is ignored, and if the extreme values of $T_0 + T_R$ and for $T_{S1} + T_{S2}$ are assumed to be identical for the outgoing and the incoming register, the extreme values of $T_{S1} + T_{S2}$ being taken as 5 ms $\leq T_{S1} + T_{S2} \leq$ 10 ms and if the value of 10 ms indicated above as typical is adopted for T_{PF} and T_{PB}, the probable extreme values of the compelled signalling cycle T would be:

for terrestrial connections: 120 ms $\leq T \leq$ 200 ms.

for circuits including a satellite link: 1080 ms $\leq T \leq$ 1440 ms.

The signalling rates would be between approximately 8 and 5 signalling cycles per second for terrestrial circuits. These values are not absolute limits; the signalling cycle could, for example, be longer on a complex connection or in the presence of noise or other conditions approaching those of type B test combinations (see Recommendation Q.455).