INTERNATIONAL TELECOMMUNICATION UNION

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OF ITU

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SPECIFICATIONS OF SIGNALLING SYSTEM No. 5 LINE SIGNALLING

LINE SIGNAL RECEIVER

ITU-T Recommendation Q.144

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation Q.144 was revised by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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CLAUSE 2 – LINE SIGNALLING
2.4 LINE SIGNAL RECEIVER[1)]

(Geneva, 1964; modified at Helsinki, 1993)

2.4.1 Operating limits

The line signal receiver shall operate in the conditions specified under 2.4.5 for the distortion of received signals that meet the following conditions:

a) $f1$: 2400 ± 15 Hz; $f2$: 2600 ± 15 Hz.

b) The absolute power level N of each unmodulated signal received shall be within the limits:

$$(-16 + n) \leq N \leq (-2 + n) \text{ dBm}$$

where n is the relative power level at the signal received input.

These limits give a margin of ±7 dB on the nominal absolute level of each received signal at the input to the signal receiver.

c) The absolute level of the two unmodulated signal frequencies in a compound signal may differ from each other by not more than 5 dB.

The tolerances given in a), b) and c) are to allow for variations at the sending end and for variations in line transmission.

2.4.2 Non-operate conditions of line signal receiver

a) *Selectivity*

The signal receiver shall not operate on a signal having an absolute power level at the receiving end within the limits specified in 2.4.1 when the frequency is outside:

$$2400 \begin{matrix} +100 \\ -150 \end{matrix} \text{ Hz for the } f1 \text{ signal circuit or}$$

$$2600 \begin{matrix} +100 \\ -100 \end{matrix} \text{ Hz for the } f2 \text{ signal circuit}$$

b) *Maximum sensitivity of line signal receiver*

The signal receiver shall not operate on a signal of 2400 ± 15 Hz or 2600 ± 15 Hz whose absolute power level at the point of connection of the receiver is (–17 –9 +n) dBm, n being the relative power level at this point. This limit is 17 dB below the nominal absolute level of the signal current at the input to the signal receiver.

2.4.3 Efficiency of the guard circuit

The signal receiver must be protected by a guard circuit against false operation due to speech currents, circuit noise, or other currents of miscellaneous origin circulating in the line.

The purpose of the guard circuit is to prevent:

a) signal imitation. (Signals are imitated if the duration of the resulting direct-current pulses at the output of the signal receiver is long enough to be recognized as signals by the switching equipment);

b) operation of the splitting device from interfering with speech.

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1) See also Recommendation Q.112.

To minimize signal imitation by speech currents it is advisable that the guard circuit be tuned.

To minimize signal interference by low-frequency noise it is advisable that the response of the guard circuit falls off towards the lower frequencies and that the sensitivity of the guard circuit at 200 Hz be at least 10 dB less than that at 1000 Hz.

An indication of the efficiency of the guard circuit is given by the following:

a) during 10 hours of speech, normal speech currents should not, on the average, cause more than one false operation of the $f1$ or the $f2$ signal circuit lasting more than 90 ms (the minimum recognition time of a signal liable to imitation is 100 ms);

b) the number of false splits of the speech path caused by speech currents should not cause an appreciable reduction in the transmission quality of the circuit.

Since Signalling System No. 5 and V.22 modem are using the same frequency, the following conditions should be verified when testing new receivers, so that the connection is not released during data transmission:

When the 2400 Hz or 2600 Hz frequencies are present at level from –2 dBm0 to –26 dBm0, the addition of one of the following should guard the receiver from recognizing them as line signalling frequencies:

a) a tone of 1800 Hz at 10 dB below the line frequency signal level;

b) any tone in the area of 1000 Hz to 1900 Hz at 7 dB below the line frequency signal level.

2.4.4 Guard circuit limits

A Steady noise

Considering:

(a) that when there is noise on a telephone circuit an over-sensitive guard circuit might give rise to signalling difficulties and, in particular, inhibit the response of the signal receiver;

(b) that unweighted noise of a level –40 dBm0 (100 000 pW) and uniform spectrum energy may arise on the longest international, i.e. intercontinental, circuit,

it is recommended that, for either one or two signalling currents (each being within the limits specified in 2.4.1), the signal receiver should satisfy the conditions indicated in 2.4.5 for the distortion of signals in the presence of noise of a level of –40 dBm0 and uniform spectrum energy over the frequency range 300 to 3400 Hz.

B Surges

A guard circuit with an excessive hand-over time may cause difficulties in receiving a signal, for example, when it has been immediately preceded by surges, and it is therefore recommended that the following condition should be fulfilled:

If a disturbing current of a frequency corresponding to the maximum sensitivity of the guard circuit and having an absolute power level of $(-10 + n)$ dBm at the relative level point n where the receiver is connected ceases 30 ms before the application of a signal satisfying the limits defined in 2.4.1, the lengths of the received signals must remain within the limits specified in 2.4.5.

2.4.5 Distortion of received signals

When the signal frequencies and levels are within the limits specified in 2.4.1, the change in signal length in the presence of noise as defined in 2.4.4, A should not exceed:

a) 15 ms when the signal receiver receives a pulse of one frequency $f1$ or $f2$ with a minimum duration of 150 ms;

b) 25 ms when the signal receiver receives a compound pulse of the two frequencies $f1$ and $f2$ with a minimum duration of 150 ms, the change being defined as the difference between the simultaneous reception of the two frequencies at the input to the receiver and the simultaneous production of the two components as a direct-current signal at the output of the signal receiver.

In general, the response time of the signal receiver should be as short as practicable to minimize the time required for signalling purposes.

Except for the forward transfer pulse signal the above pulse distortion requirements are of minor importance for the remaining line signals, which are all of the continuous compelled type[2]. Nevertheless the limits are specified for receiver design and test purposes.

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2) See 2.1.6/Q.141 explaining the term "continuous compelled".