



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**V.53**

**DATA COMMUNICATION OVER THE TELEPHONE  
NETWORK**

---

**LIMITS FOR THE MAINTENANCE OF  
TELEPHONE-TYPE CIRCUITS USED FOR  
DATA TRANSMISSION**

**ITU-T Recommendation V.53**

(Extract from the *Blue Book*)

---

## NOTES

1 ITU-T Recommendation V.53 was published in Fascicle VIII.1 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 V.53

### LIMITS FOR THE MAINTENANCE OF TELEPHONE-TYPE CIRCUITS USED FOR DATA TRANSMISSION

(Mar del Plata, 1968)

For data transmission maintenance purposes, the following limits are recommended for the essential parameters indicating the quality of a transmission channel.

#### 1 Telegraph distortion limits

Limits for the *degree of distortion on a transmission channel* between the interfaces (i.e. including the modems) vary with the data transmission system. The following values are recommended, these same limits applying to the backward channel:

System with Recommendation V.21 modem: 20-25%

Systems with Recommendation V.23 modem:

600 bauds - leased circuits: 20-30%

1200 bauds - leased circuits: 25-35%

600 bauds - switched circuit: 25-30%

1200 bauds - switched circuit: 30-35%

(when this mode of operation is possible).

These figures express provisionally maximum degrees of individual distortion. They will be converted into degrees of isochronous distortion once a method for determining the reference ideal instant has been studied, specifying a synchronization procedure for the distortion-measuring receiver.

#### 2 Limits for error rates

##### 2.1 Bit error rate

The limits in Table 1/V.53 are recommended; when they are exceeded the maintenance services should consider the transmission channel defective. The period of measurement is about 15 minutes (more precisely, the period corresponding to the transmission of the total number of sequences which is closest to 15 minutes).

TABLE 1/V.53

Modulation rate (bauds)	Connection	Maximum bit error rate
1200	switched (when possible)	$10^{-3}$
1200	leased	$5 \cdot 10^{-5}$
600	switched	$10^{-3}$
600	leased	$5 \cdot 10^{-5}$
200	switched	$10^{-4}$
200	leased	$5 \cdot 10^{-5}$

*Note* - These values are not intended for use in planning circuits, but for the information of maintenance services.

## 2.2 Block error rate

Information on the error rate for sequences of 511 bits would be given in a form similar to that for the bit error rate, the two measurements being made simultaneously. However, no limit for the sequence error rate can be recommended for the time being.

*Note* - To enable Administrations to appreciate the value of sequence error-rate measurement, Table 2/V.53 shows the *maximum and minimum theoretic values* of error rates for sequences of 511 bits corresponding to different values of bit error rate.

These theoretic values do not depend on the modulation rate. For the purposes of this table, a modulation rate of 1200 bauds has been taken as an example.

Modulation rate:	1200 bauds
Period of measurement:	15 minutes = 900 seconds
Number of bits transmitted:	1 080 000
Length of sequence:	511 bits
Number of sequences transmitted:	2113

## 3 Limit of uniform-spectrum random noise

See Recommendation G.153 [1].

TABLE 2/V.53

Bit error rate	Number of erroneous bits	Erroneous sequences			
		Maximum number <sup>a)</sup>	Maximum rate in %	Minimum number <sup>b)</sup>	Minimum rate in %
$2 \cdot 10^{-3}$	2160	2113	100	5	0.24
$10^{-3}$ <sup>c)</sup>	1080	1080	51.1	3	0.15
$5 \cdot 10^{-4}$	540	540	25.5	2	0.10
$10^{-4}$	108	108	5.1	1	0.05
$5 \cdot 10^{-5}$	54	54	2.5	1	0.05

- a) The *maximum* number of erroneous sequences corresponds to a *uniform* distribution of erroneous bits (one bit per sequence).
- b) The *minimum* number of erroneous sequences corresponds to a *grouped* distribution of erroneous bits (sets of 511 bits affecting the sequences).
- c) It will be seen that for a bit error rate of  $10^{-3}$ , the sequence error rate can vary between 0.15% and 51.1%. (This shows the value of sequence error-rate measurement, not only for users, but also for Administrations, which can thus obtain useful information on the causes of bit and sequence error).

## 4 Limits for impulsive noise

4.1 Bearing in mind the following two points:

- that Recommendation V.2 demands a maximum data signal level of -10 dBm0 for a simplex transmission and -13 dBm0 for duplex transmission,
- that there has been considerable experience of using the threshold -18 dBm0 and -22 dBm0,

the threshold settings should be -18 dBm0 for telephone-type circuits and -21 dBm0 for the special quality circuits mentioned in Recommendation M.1020 [2], the standard measuring instrument (see Recommendation 0.71, [3]) being adjustable to thresholds 3 dB apart (see Note 1).

4.2 For counting the number of impulses, the instrument shall be used in the "flat" bandwidth condition (see Note 2).

On a leased circuit, the admissible limit should be 70 impulse counts per hour; but in realizing that error rate measurements are conducted for periods of 15 minutes each, the recommended maintenance limit should be 18 counts in 15 minutes for leased circuits (see Note 3). The measurements should be made during peak hours.

At the time of measurement the line should be terminated at both ends by impedances of 600 ohms. The modem may be used for this purpose if it complies with this impedance.

4.3 For the general switched telephone network, there should be no recommended maintenance limits for impulse counts, but the instrument might be useful as a diagnostic aid at the discretion of the Administrations. This is because the impulse count results taken on any one connection vary considerably with time and even greater differences appear between various connections.

4.4 The correlation between the bit error rate and the number of impulse counts thus determined has not yet been established.

*Note 1* - Levels should be expressed in dBm0, because

- a) the difference between the various national transmission plans is taken into account, and
- b) the level value is related to the value of the data signal level to a close degree.

*Note 2* - Owing to lack of experience, no external filter should be used for present maintenance purposes. However, the study of the use of external filters should continue. By means of additional filters the instrument may provide other optional bandwidths (see the Recommendation cited in [4]).

*Note 3* - These values are given as an indication. The question of the duration of the measurement and permissible maximum standards for impulsive noise forms the subject of future studies.

#### **References**

- [1] CCITT Recommendation *Characteristics appropriate to international circuits more than 2500 km in length*, Vol. III, Rec. G.153.
- [2] CCITT Recommendation *Characteristics of special quality international leased circuits with special bandwidth conditioning*, Vol. IV, Rec. M.1020.
- [3] CCITT Recommendation *Specification for an impulsive noise measuring instrument for telephone-type circuits*, Vol. IV, Rec. O.71.
- [4] *Ibid.*, § 3.5.2.