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SERIES H: TRANSMISSION OF NON-TELEPHONE SIGNALS

Use of telephone-type circuits for voice-frequency telegraphy

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Transmission requirements of international voice-frequency telegraph links (at 50, 100 and 200 bauds)

ITU-T Recommendation H.22

Extract of **Red Book Fascicle III.4 (1984)**

NOTES

1 ITU-T Recommendation H.22 was published in Fascicle III.4 of the *Red Book*. This file is an extract from the *Red Book*. While the presentation and layout of the text might be slightly different from the *Red Book* version, the contents of the file are identical to the *Red 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.

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Recommendation H.22

TRANSMISSION REQUIREMENTS OF INTERNATIONAL VOICE-FREQUENCY TELEGRAPH LINKS (AT 50, 100 AND 200 BAUDS)

(Mar del Plata, 1968; amended at Geneva, 1972)

1 Links routed on carrier systems

Figure 1/H.21 shows the composition of an international circuit for voice-frequency (VF) telegraphy. The limits specified in the present Recommendation are based on the values between international terminal centres which are indicated in Recommendation G.151 [1] for an international telephone circuit and which are applied approximately to the international line in Figure 1/H.21. A slight increase has been made to certain characteristics to allow for unloaded national sections connecting the centres to the VF telegraph equipments since most telegraph installations belonging to public services are fairly close to the international maintenance centres.

1.1 *Nominal insertion loss at 800 Hz*

The nominal insertion loss of the link at 800 Hz depends on the nominal relative power levels at the extremities of the telegraph link. These levels will be those normally used in the national network of the countries concerned so that it is not possible to recommend a particular nominal value for the insertion loss.

The nominal relative power level at the input to the link and the absolute power level of the telegraph signals at this point must be such that the limits concerning the power level per telegraph channel at a zero relative point on carrier systems are respected.

1.2 *Variation of insertion loss with time*

In accordance with Recommendation M.160 [2]:

a) the difference between the mean value and the nominal value of the transmission loss should not exceed 0.5 dB;

b) the standard deviation from the mean value should not exceed 1 dB.

However, in the case of circuits set up wholly or partly on older equipment, where the international line consists of two or more circuit sections, a standard deviation not exceeding 1.5 dB may be accepted.

1.3 *Sudden variations of insertion loss and short interruptions*

Such defects of the transmission path impair the quality of the telegraph transmission and should be reduced to the minimum possible.

1.4 *Overall loss/frequency distortion*

The variation with frequency of the 600-ohm insertion loss of the link with respect to the loss at 800 Hz must not exceed the following limits:

1.4.1 *Links with 4-kHz sections throughout* (see Table 1/H.22)

TABLE 1/H.22

Frequency range (Hz)	Overall loss relative to that at 800 Hz
Below 300	Not less than –2.2 dB, otherwise unspecified
300- 400	–2.2 to +4.0 dB
400- 600	–2.2 to +3.0 dB
600-3000	–2.2 to +2.2 dB
3000-3200	–2.2 to +3.0 dB
3200-3400	–2.2 to +7.0 dB
Above 3400	Not less than –2.2 dB, otherwise unspecified

Overall loss limits are given in Table 1/H.22 and are shown hatched in Figure 1/H.22.

Note – The hatched limits in Figure 1/H.22 have been derived from the corresponding limits in Recommendation G.151 [1] by adding a margin to allow for the presence of unloaded national sections and also for the fact that the composition of the international line may be more complicated. This will permit the establishment of most international circuits for VF telegraphy without additional equalization.

In favourable cases it will be possible to respect the limits in the graph in Recommendation G.151 [1] which is shown as a broken line in Figure 1/H.22.

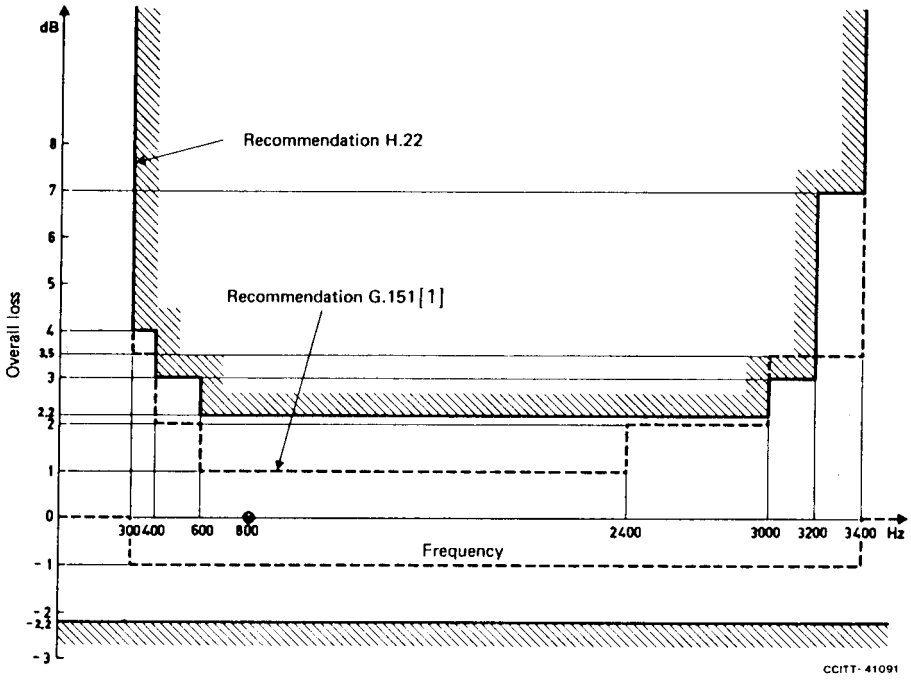

FIGURE 1/H.22

Variation with frequency of the overall loss relative to the value measured at 800 Hz with 4 kHz end-to-end sections

1.4.2 *Links with one or more 3-kHz sections* (see Table 2/H.22)

TABLE 2/H.22

Frequency range (Hz)	Overall loss relative to that at 800 Hz
Below 300	Not less than –2.2 dB, otherwise unspecified
300- 400	–2.2 to +4.0 dB
400- 600	–2.2 to +3.0 dB
600-2700	–2.2 to +2.2 dB
2700-2900	–2.2 to +3.0 dB
2900-3050	–2.2 to +6.5 dB
Above 3050	Not less than –2.2 dB, otherwise unspecified

1.5 *Noise*

1.5.1 *Uniform-spectrum random noise*

The mean psophometric noise power referred to a point of zero relative level should not exceed 80 000 pW0p (–41 dBm0p)[1)].

Note – It was not possible to recommend a limit for the unweighted noise level. The CCITT psophometer with the telephone weighting network should continue to be the instrument used for specifying and measuring random noise power levels on telegraph links.

1.5.2 *Impulsive noise*

Impulsive noise should be measured with an instrument complying with Recommendation H.13 and used in the "flat" condition.

As a provisional limit for maintenance purposes, the number of impulsive noise peaks exceeding –18 dBm0 should not be more than 18 in 15 minutes.

Note – Final values are still under study.

1.6 *Crosstalk*

a) The crosstalk ratio between the go and return channels of the link should be at least 43 dB.

b) The crosstalk ratio between the link and other carrier circuits is restricted by the Recommendation cited in [3] to be not worse than 58 dB.

Crosstalk in any audio cables forming part of the terminal national sections should not normally significantly worsen the crosstalk ratio.

1.7 *Mean one-way propagation time*

The one-way propagation time referred to is the group delay as defined in [4] calculated at a frequency of about 800 Hz.

It should be noted that VFT links routed over high-altitude satellite communication systems introduce mean one-way propagation times in excess of 260 ms.

1.8 *Group-delay distortion*

Practical experience obtained up to the present shows that it is not necessary to recommend limits for group-delay distortion for 50-baud VFT links even when they are composed of several sections each provided on telephone channels of carrier systems. There is little practical experience with higher speed telegraph systems.

It may happen that under adverse conditions some telephone channels of the link are of insufficient quality to provide 24 telegraph channels. In such a case, a better combination of telephone channels must be chosen for the telegraph service.

1.9 *Frequency drift*

The frequency drift introduced by the link must not be greater than 2 Hz. According to Recommendation G.225 [5], this condition is fully met in practice even when the international line for VF telegraphy has the same composition as the 2500-km hypothetical reference circuit for the transmission system used.

1.10 *Interference caused by power supply sources*

When a sinusoidal measuring signal is transmitted over the link at a level of 0 dBm0, the level of the strongest unwanted side component should not exceed –45 dBm0 (see also Recommendation G.151 [1].

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1) If recourse be had to synchronous operation, a higher noise level might be tolerated (such as –30 dBm0p for a particular telegraph system).

1.11 *Variation introduced by changeover to the reserve line or section*

1.11.1 *Change in insertion loss at 800 Hz*

Bearing in mind that the insertion loss of the normal line (or section) and the reserve line (or section) are both subject to variations with time, which in general will be uncorrelated, it is not possible to assign a limit to the change of insertion loss at 800 Hz introduced by the changeover procedure.

1.11.2 *Change in the insertion loss at other frequencies relative to that introduced at 800 Hz*

The insertion-loss distortion characteristic of the link when established over the normal route should be within 2 dB or less of that of the link when established over the reserve route. This limit applies over the frequency bands 300-3400 Hz or 200-3050 Hz as appropriate.

There should ordinarily be no difficulty in achieving the limit when only one portion of the link – for example, the international telegraph line or one section – has a reserve section. However, when two or more portions of the link are separately associated with reserve portions, it becomes difficult to ensure that all combinations of normal and reserve portions comply with the limit. In these circumstances, the best that can be done is to ensure that the insertion-loss characteristics of corresponding normal and reserve portions are as much alike as possible. Careful attention should be paid to the impedance of normal and reserve sections at the point where they are connected to the changeover apparatus so that errors due to changing mismatch losses are minimized. A suitable target would be for all impedances concerned to have a non-reactive return loss against 600 ohms exceeding 20 dB over the appropriate band of frequencies.

1.11.3 The nominal relative power level at 800 Hz of the normal and reserve lines or sections at the changeover points for a particular direction of transmission should be the same. This level will be that normally used in the national network of the country concerned.

2 Links via audio-frequency line plant

2.1 *Attenuation/frequency distortion*

Graph No. 6, Figure 2/H.22, shows the variations with frequency of the difference between the relative power levels at the origin and extremity of the link relative to the measured value at 800 Hz.

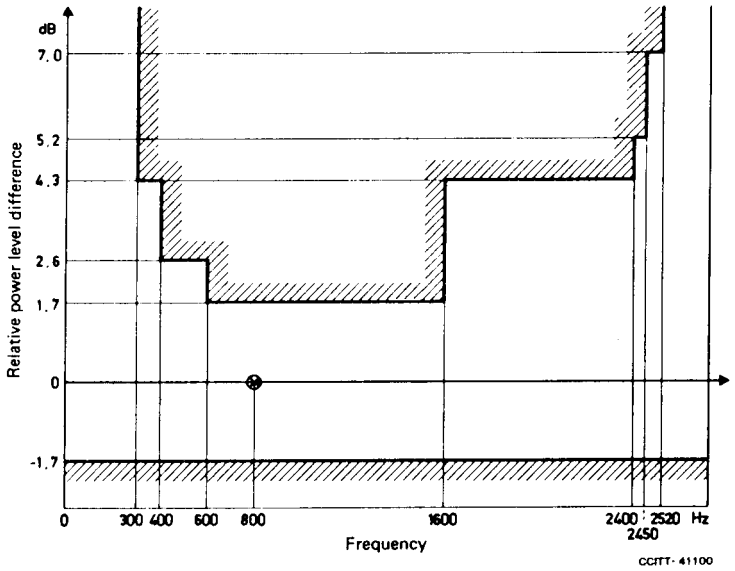

FIGURE 2/H.22.

Graph No. 6 – **Limits for the variation with frequency, relative to the value at 800 Hz, of the difference in relative power levels (in dB) between the input and output of a link used for VF telegraphy (set up on a telephone circuit using the band 300-2600 Hz)**

The permissible tolerances for the relative power level at the output of frontier repeaters are the same as those for 4-wire repeaters, if maintenance measurements are made by sending a power giving 1 mW at a zero relative level point (as found from the telephone circuit level diagram) to the input of the link for VF telegraphy. These tolerances are shown in Graph No. 7, Figure 3/H.22.

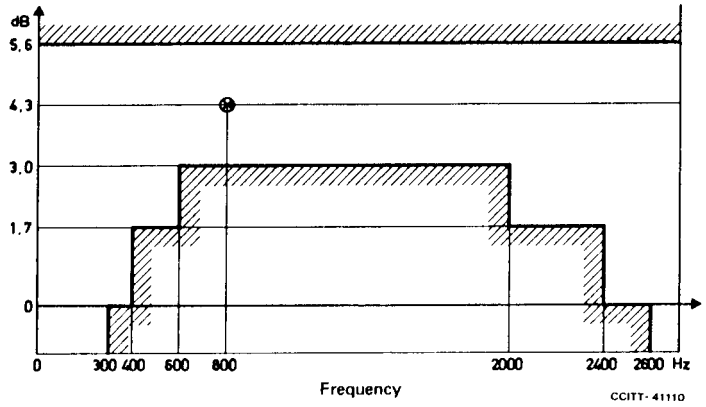

FIGURE 3/H.22.

Graph No. 7 – Maintenance limits for the absolute power level (in dB) at the output of a frontier repeater (frontier side) for an international circuit with a bandwidth of 300-2600 Hz and used for VF telegraphy (to be measured with a sent power at the origin of the VFT link such as to give 1 mW at a zero relative level point, deduced from the level diagram of the telephone circuit)

It does not appear necessary to fix particular limits for the variations with frequency of the level measured at the output of the frontier repeater since these may be calculated easily from the limits allowed for the relative power level.

2.2 *Level variations with time*

The relative power level at the point at the receiving end where the changeover between the VFT telegraph circuit and its reserve circuit takes place must be as constant as possible with time. Furthermore, any interruption in the circuit, even for a very short duration, spoils the quality of the telegraph transmission. Great care must therefore be taken when measurements are made on circuits and repeaters, when changing-over batteries, etc. To draw the attention of the staff to this matter, it is desirable for circuits used for VFT to be specially marked at the terminal stations and in the intermediate repeater stations.

2.3 *Freedom from modulation*

It is desirable to make special arrangements to avoid any modulation on the circuits and in the repeaters. Such modulation may in particular be caused by the variation in battery voltages or by the connection of equipment for sub-audio telegraphy to the cable pairs.

References

[1] CCITT Recommendation *General performance objectives applicable to all modern international circuits and national extension circuits*, Vol. III, Rec. G.151.

[2] CCITT Recommendation *Stability of transmission*, Vol. IV, Rec. M.160.

[3] CCITT Recommendation *General performance objectives applicable to all modern international circuits and national extension circuits*, Vol. III, Rec. G.151, § 4.

[4] CCITT Definition: *Group delay*, Terms and Definitions, Volume X.

[5] CCITT Recommendation *Recommendations relating to the accuracy of carrier frequencies*, Vol. III, Rec. G.225.