INTERNATIONAL TELECOMMUNICATION UNION

ITU-T G.325

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

INTERNATIONAL ANALOGUE CARRIER SYSTEMS

INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES

GENERAL CHARACTERISTICS RECOMMENDED FOR SYSTEMS PROVIDING 12 TELEPHONE CARRIER CIRCUITS ON A SYMMETRIC CABLE PAIR [12 + 12) SYSTEMS]

ITU-T Recommendation G.325

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.325 was published in Fascicle III.2 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.

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Recommendation G.325

GENERAL CHARACTERISTICS RECOMMENDED FOR SYSTEMS PROVIDING 12 TELEPHONE CARRIER CIRCUITS ON A SYMMETRIC CABLE PAIR [(12 + 12) SYSTEMS]

Systems of the (12 + 12) type on symmetric pair in cable are used for carrier working either on old deloaded cables or on cables specially constructed for the purpose (without a second cable being required). These systems may be used in regional or local relations, or in long-distance relations, trunk or international.

This Recommendation applies to systems for long-distance relations making use of the kinds of cable at present recommended by the CCITT (see Recommendation G.611) and to multiple-twin quad cables with conductors of 0.9 mm diameter, with an effective capacitance of 35 to 40 nF/km or other kinds of deloaded cables of equivalent quality. For systems used for local or regional relations, some clauses of the present Recommendation may be made less stringent.

1 Frequency spectrum transmitted to line

The CCITT recommends that the line-frequency spectrum should be in accordance with Scheme 1 or 2 of Figure 1/G.325.

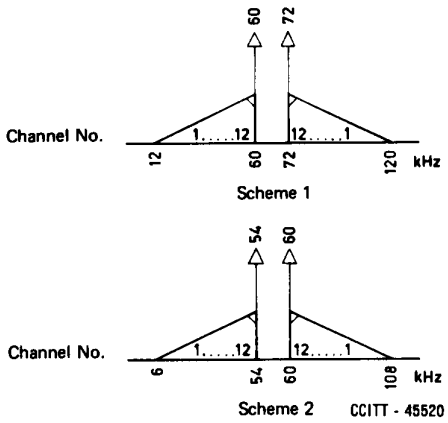

FIGURE 1/G.325

Arrangement of line-transmitted frequencies for international (12 + 12) cable systems

Administrations concerned in setting up such an international system should agree to use either one or the other of the two schemes.

2 Line-regulating pilots

The following frequencies are recommended:

– with Scheme 1: 60 kHz and 72 kHz;

– with Scheme 2: 54 kHz and 60 kHz.

The recommended accuracy is ± 1 Hz for the 60-kHz pilot. The frequency tolerance for other pilots will be decided by agreement between the Administrations concerned.

All these pilots should be transmitted at power level of -15 dBm0.

3 Hypothetical reference circuit for (12 + 12) symmetric-pair system

This is 2500 kilometres long, and for each direction of transmission comprises a total of:

– three channel translation pairs;

– nine special translation pairs translating a basic group into the band transmitted to line, and vice versa.

This circuit is carried on a (12 + 12) symmetric-pair system in cable, with pairs assumed to be of conductors of 0.9-mm diameter, with an effective capacitance of 35 to 40 nF/km.

Figure 2/G.325 shows one of the three identical parts of which this hypothetical reference circuit is made up. All in all, it has 18 homogeneous sections, each 140 kilometres long.

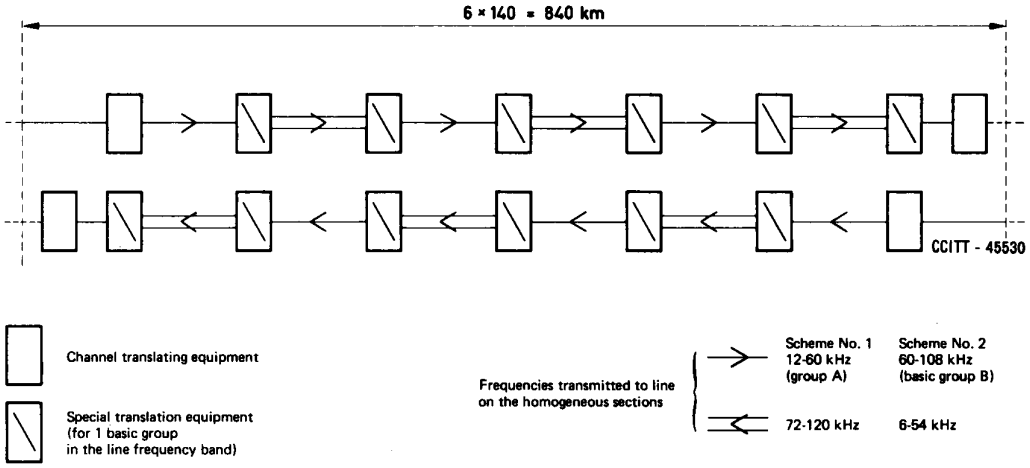

FIGURE 2/G.325

Basic diagram of one-third of the hypothetical reference circuit for symmetric pair (12 + 12) systems

Note 1 - There are only half as many translation pairs as there are homogeneous sections, because one of the two bands transmitted to line corresponds to a basic group (see Figure 2/G.325).

Note 2 - With systems using frequency-frogging in the repeaters, the appropriate modulators form part of the high-frequency line.

4 Design objectives for circuit noise

The objectives set forth in Recommendation G.222 apply to the hypothetical reference circuit for symmetric-pair (12 + 12) systems, in the circumstances described in Recommendation G.223.

In practice, it will suffice to check by calculation that the mean psophometric power at the end of every telephone channel as defined by the hypothetical reference circuit, at zero relative level, does not exceed 10 000 pW0p during any hour.

Provisionally, it is recommended that this overall limit be apportioned between the total noise components as follows:

– line noise (including noise due to special translation equipment) 9000 pW0p

– noise due to channel translating equipment..... 1000 pW0p

Apportionment of total noise inherent in the system among:

– basic noise,

– intermodulation noise,

– noise due to crosstalk,

is left entirely to the discretion of the carrier system designer, up to 1000 pW0p for channel translating equipment and 9000 pW0p for the line.

Note - In accordance with all recommendations on cable systems in the Series G Recommendations, the design objective as regards noise power does not take into consideration noise from external sources; it is assumed that this is negligible compared with the figure of 10 000 pW0p.

With regard to real circuits, Administrations must take whatever steps are required in each individual case to ensure that clicks arising on audio-frequency pairs in the same cable as a (12 + 12) system and transmitted by crosstalk do not create excessive noise on the circuits of that system which may be used for international communications.

5 Error on the reconstituted frequency

The difference between a frequency sent at the origin of a homogeneous section 140 km long (see § 3 above and Figure 2/G.325) and the frequency received at the end of that section, should not exceed a figure provisionally fixed at 0.3 Hz; this figure is the same whether there is frequency-frogging in the intermediate repeaters or not.

6 Direct line interconnection

When Administrations desire the direct line interconnection of two systems (with, of course, the same allocation of line-transmitted frequencies) it is recommended that each of these systems should meet the following requirements on the interconnection section (except where agreed otherwise between the Administrations concerned):

1) Relative level per channel, at all frequencies, at the output of the frontier repeaters: -15 dBr[1].

2) Attenuation of the frontier elementary cable section at the highest frequency transmitted to line: 25 dB[1] .

   Note - For composite cables, agreement should be reached between the two Administrations concerned to fix the attenuation of the frontier section in such a way that the repeaters of the symmetric pairs and those of the coaxial cables can be housed in the same frontier stations.

3) Matching of the impedances of the frontier repeaters and the line. The modulus of the return-current coefficient between the input (or output) impedance of a repeater and the characteristic impedance of the line should not exceed the lower of the two values:

$$0.15 \sqrt{\frac{f_{max.}}{f}} \text{ or } 0.25$$

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1) These values apply to low-gain systems. They are not valid for high-gain systems, i.e. for systems whose gain is substantially above 30 dB.

7 Interconnection in a main station

If such interconnection is necessary, either for operating reasons or because the two systems to be interconnected use different allocations of frequencies transmitted to line, one of the following procedures may be followed:

1) interconnection at a group distribution frame, with use of the basic group, levels and impedance applied normally by the Administration to which the frame belongs;

2) direct interconnection between the two systems. If they use different allocations of frequencies transmitted to line, the two Administrations concerned shall reach agreement on which of them shall install the necessary demodulators (the line of separation between the two types of equipment will then be CC' or DD' on Figure 3/G.325).

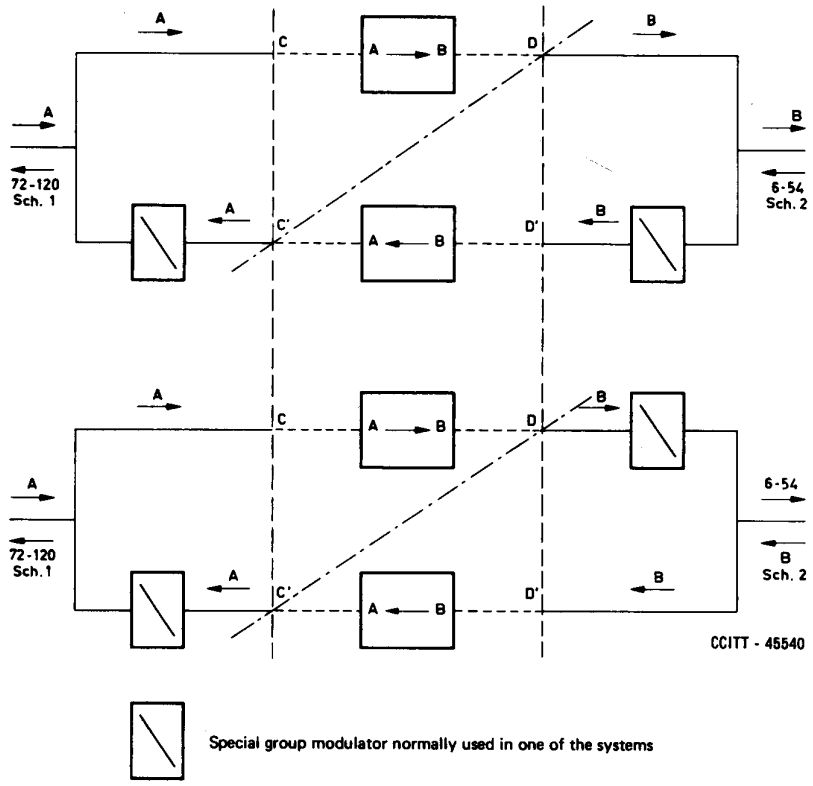

FIGURE 3/G.325

Direct interconnection of two (12 + 12) systems using different allocations of frequencies transmitted to line

In the absence of such an agreement, each incoming system must comprise equipment required for the outgoing system, in each direction of transmission (the separating line in Figure 3/G.325 would then be the oblique DC').

Unless there is a specific agreement, the relative power level will be -36 dBr at sending (input of each system - points C' and D in the case of Figure 3/G.325). The points considered do not correspond to points *T* and *T'* defined in Recommendation G.213. In particular, a translating equipment of any type cannot be connected to it without precautionary measures (see the levels indicated in the Table 1/G.233).

By agreement between Administrations, interconnection can be effected as indicated in Figure 4/G.325, a method whereby it is possible to replace three modulators by one.

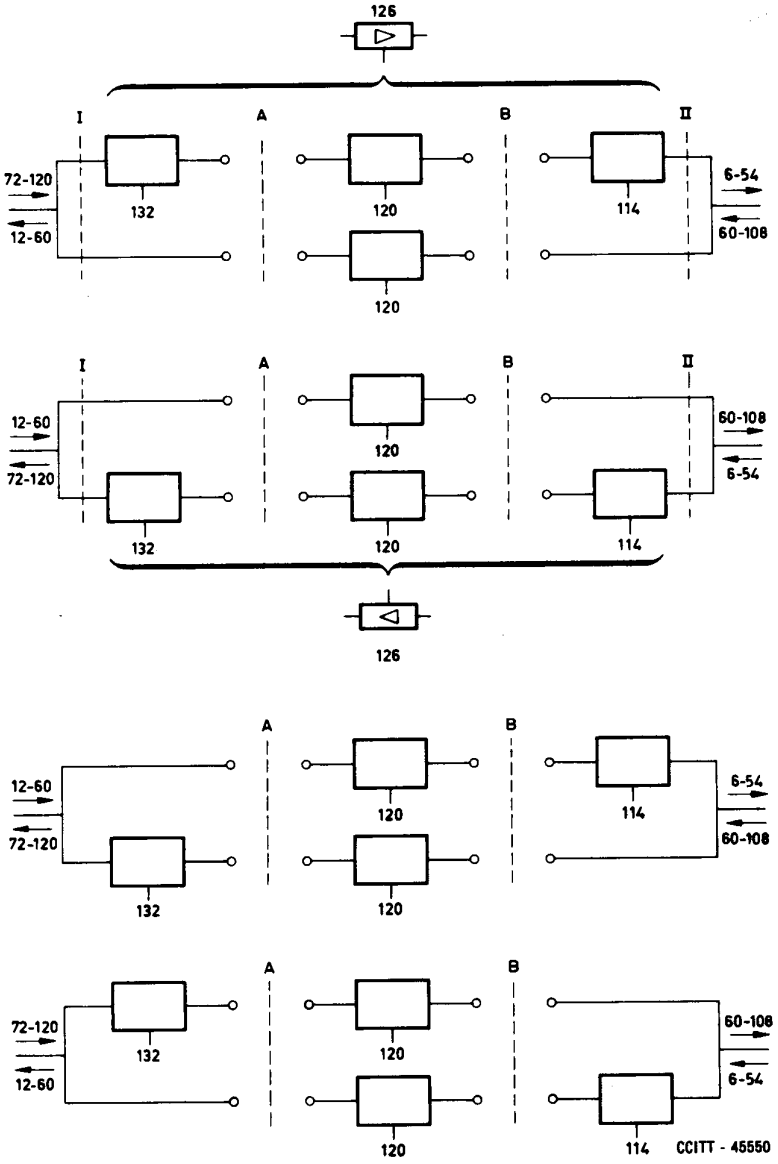

FIGURE 4/G.325

Method of interconnection that can be used by agreement between Administrations (the numbers on this diagram show frequencies in kHz; A and B indicate the basic group concerned)

8 Essential clauses for a model specification

See Recommendation G.326.