INTERNATIONAL TELECOMMUNICATION UNION

ITU-T G.233

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

INTERNATIONAL ANALOGUE CARRIER SYSTEMS

GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER - TRANSMISSION SYSTEMS

RECOMMENDATIONS CONCERNING TRANSLATING EQUIPMENTS

ITU-T Recommendation G.233

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.233 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.

Recommendation G.233

RECOMMENDATIONS CONCERNING TRANSLATING EQUIPMENTS

(amended at Geneva, 1964; further amended)

This Recommendation concerns translating equipments with the exception of:

- channel-translating equipment, in respect of which Recommendations G.232, G.234 [1] and G.235 should be consulted;

- equipment for translation into the line-frequency band; the Recommendations relating to the various line systems should be consulted.

1 Translating procedure

The procedures whereby the translating equipments defined in Recommendation G.211 translate basic groups, supergroups and mastergroups or a basic 15-supermastergroup assembly (No. 1) are represented by the following figures:

1) Figure 1/G.233 for group-translating equipments (procedures 1 and 2);

2) Figure 2/G.233 for supergroup-translating equipments (procedure 1);

3) Figure 3/G.233 for mastergroup-translating equipments (procedure 1);

4) Figure 4/G.233 for supergroup-translating equipments (procedure 2);

5) Figure 5/G.233 for translating equipments for basic 15-supergroup assembly (No. 1) (procedure 2).

Note - Equipments 4 and 5 above are peculiar to procedure 2 described in Recommendation G.211. The conditions in which this procedure is used are described in that Recommendation.

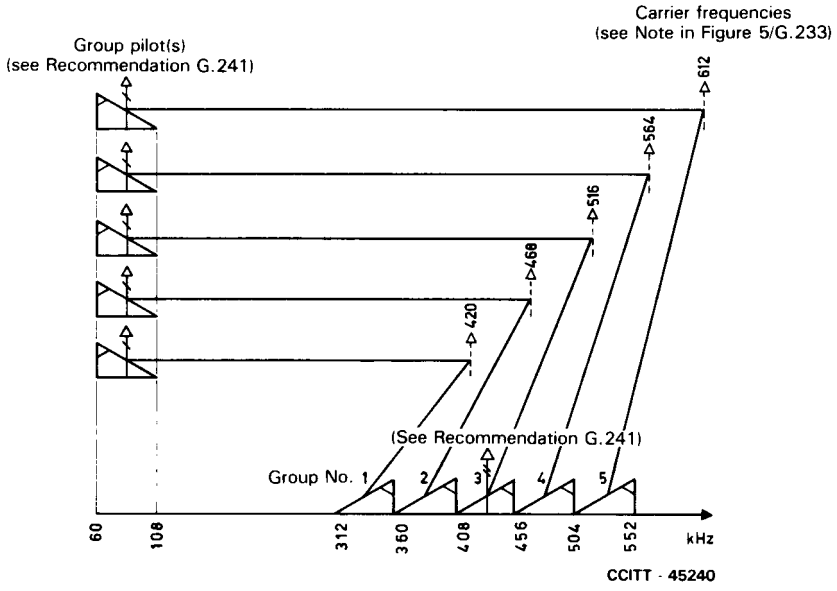

FIGURE 1/G.233

Constitution of the basic supergroup

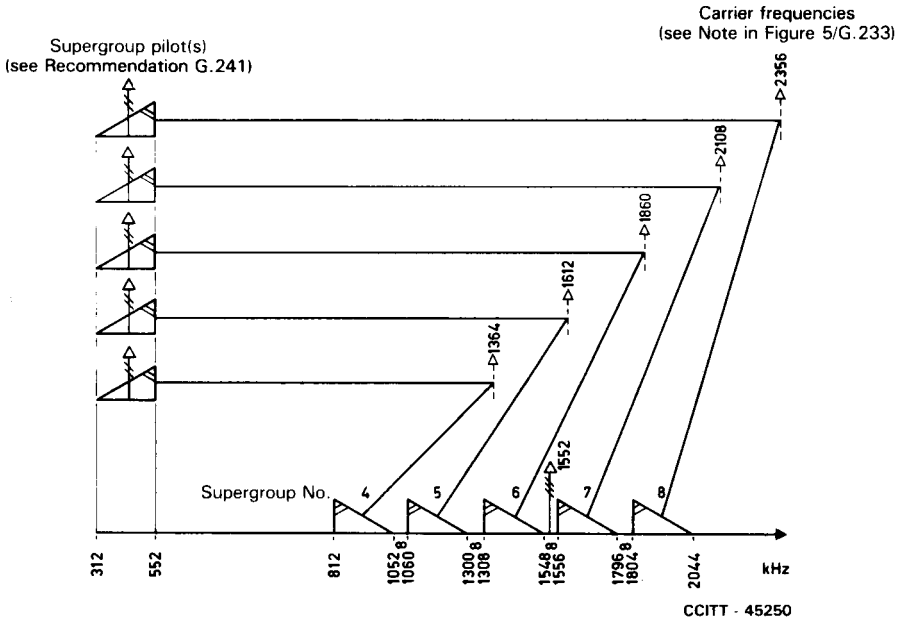

FIGURE 2/G.233

Constitution of the basic mastergroup

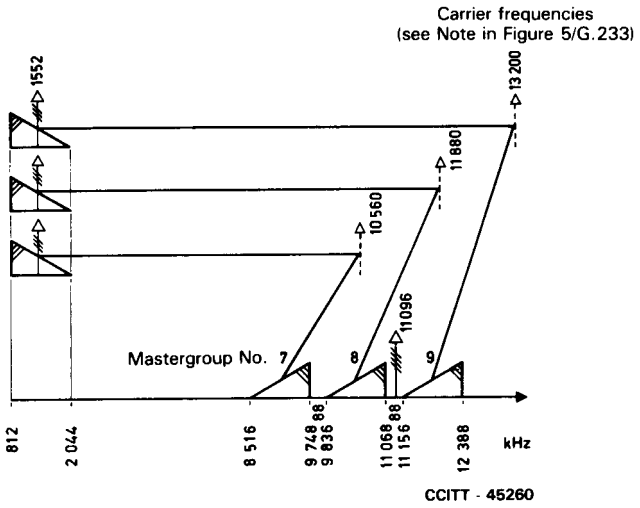

FIGURE 3/G.233

Constitution of the basic supermastergroup

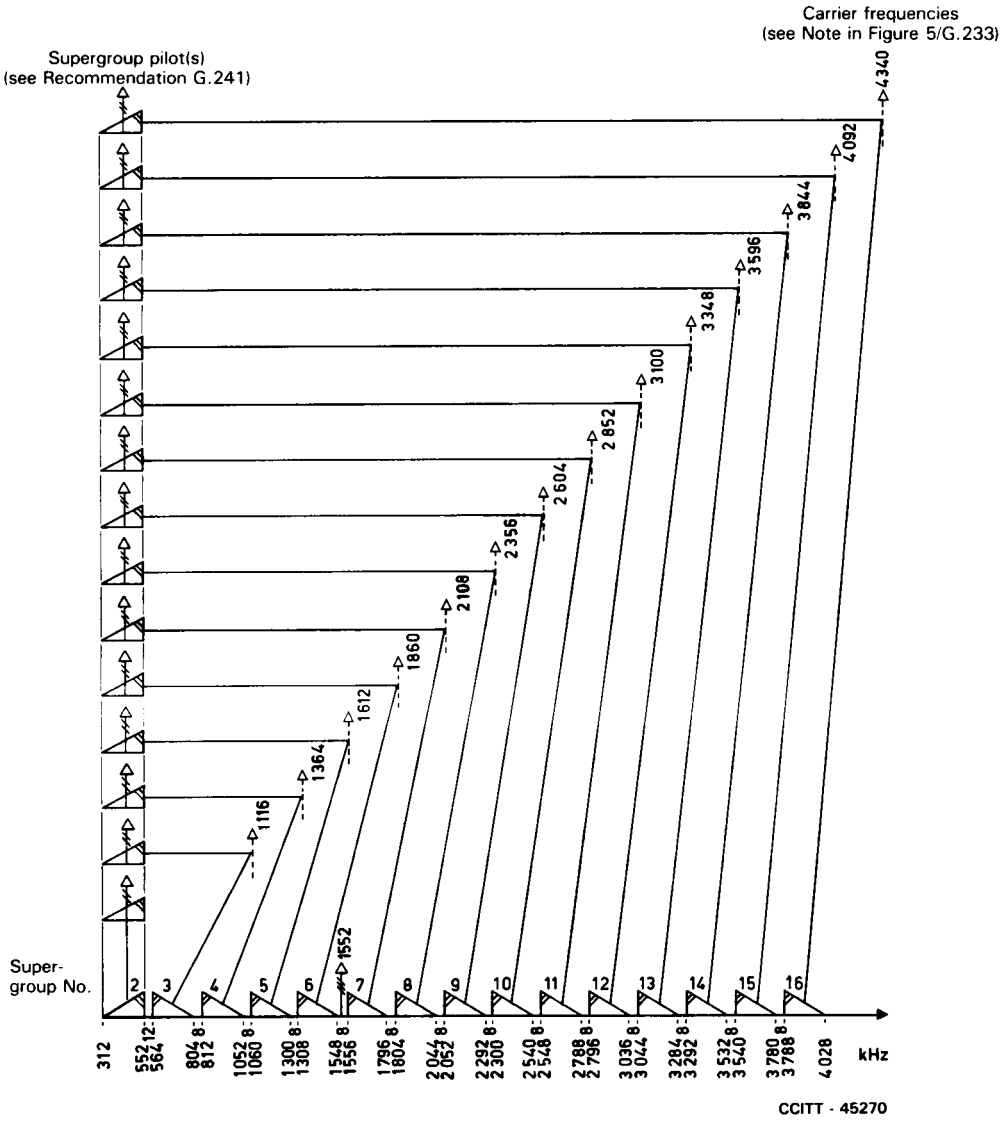

FIGURE 4/G.233

Constitution of the basic 15-supergroup assembly

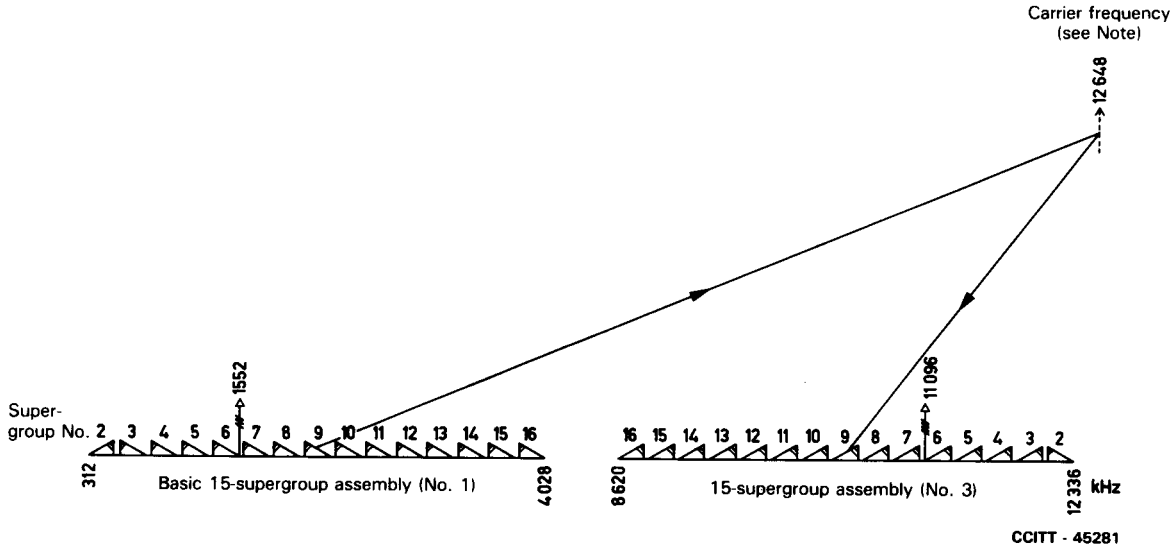

FIGURE 5/G.233

Constitution of 15-supergroup assembly No. 3

Note to Figures 1/G.233 to 5/G.233 - The virtual carrier frequencies shown in Figures 1/G.233 to 5/G.233 will normally be the frequencies actually used. However, they are all shown as virtual frequencies to allow for the possibility of using cheaper ways of constituting basic groups, supergroups, etc., in the future.

2 Adjustment of level at basic group-frequency points

When a group passes through different carrier systems, it is necessary to provide for an adjustment of level: for example, between the limits of about ± 4 dB, wherever the group passes through the basic frequency range.

3 Relative power levels at group distribution frames and supergroup distribution frames

Although the standardization of the relative power levels at group distribution frames and supergroup distribution frames would be desirable to facilitate the setting-up and maintenance of international carrier systems and routing changes of groups or supergroups from one system to another, it was not possible before the Plenary Assembly of 1972 to recommend such a standardization internationally, because of the diversity of carrier systems already in service. Table 1/G.233 shows, for information, the level used by different Administrations.

The CCITT concerned itself solely with recommending preferred values for countries which have not yet fixed these values for their national networks. Accordingly:

- a relative sending level of -36 dBr is recommended at group and supergroup distribution frames;
- for reception, it is recommended that a choice be made between -23 dBr and -30 dBr;
- the following values are recommended for the impedance**:**

  150 ohms balanced for group distribution frames,

  75 ohms unbalanced for supergroup distribution frames.

TABLE 1/G.233

Relative power levels at the basic group and supergroup distribution frames in the carrier systems of various Administrations

Country		Relative power level at group distribution frame		Impedance at group distribution frame	Relative power level at supergroup distribution frame		Impedance at supergroup distribution frame
		Transmit (dBr)	Receive (dBr)		Transmit (dBr)	Receive (dBr)	
Federal Republic of Germany		-36	-30	150 ohms, balanced	-35	-30	75 ohms, unbalanced
Australia Denmark [a]	System 1	-36.5	-30.5	150 ohms, symetrique	-35	-30.5	id.
	System 2	-42	-5	135 ohms, balanced	-35	-30	id.
Austria		-37 -36	-8 -30	75 ohms, unbalanced 150 ohms balanced	-35	-30	id.
Belgium		-37	-8	150 ohms, balanced	-35	-30	id.
People's Republic of Bulgaria		-36	-23	150 ohms, balanced	-36	-23	id.
Spain, Ireland, New Zealand, Norway, United Kingdom		-37	-8	150 ohms, unbalanced	-35	-30	id.
USA (American Telephone and Telegraph Company)		-42	-5	135 ohms, balanced	-25	-28	id.
France		-33	-15	150 ohms, balanced	-45	-35	id.
Hungary, Italy, Netherlands		-37	-30	150 ohms, balanced	-35	-30	id.
India		-36.5	-30.4	150 ohms, balanced	-34.8	-30.4	id.
Japan (Nippon Telegraph and Telephone Public Corporation)		-36	-18	75 ohms, balanced	-29	-29	id.
Mexico (Teléfonos de México)		-47	-10	150 ohms, balanced	-47	-24	id.

TABLE 1/G.233 *(continued)*

People's Republic of Poland	-36	-23	150 ohms, balanced	-36	-23	id.
German Democratic Republic	-36	-23	150 ohms, balanced	-36	-23	id.
Sweden				-35	-30	id.
Switzerland	-36.5	-30.5	75 ohms, unbalanced	-35	-26	id.
USSR	-36	-23	150 ohms, balanced	-36	-23	id.

a) System 1 only.

4 Relative power levels at mastergroup distribution frames

The relative power levels at mastergroup distribution frames (see Figure 6/G.233) should be adjusted to the following values:

- transmit: -36 dBr,
- receive: -23 dBr,

across a 75-ohm impedance, unbalanced to earth.

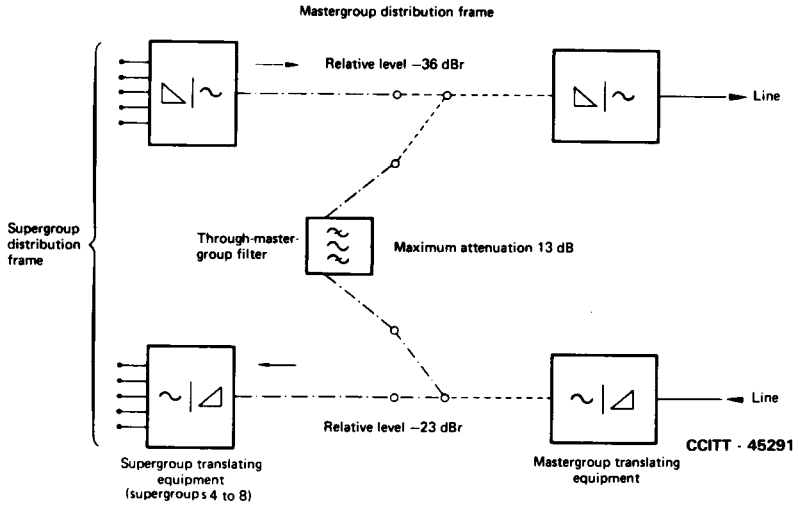

FIGURE 6/G.233

Relative levels at mastergroup distribution frame

5 Relative levels at supermastergroup distribution frames

Relative power levels at supermastergroup distribution frames should be adjusted to the following values:

- transmit: -33 dBr,
- receive: -25 dBr,

across a 75-ohm impedance, unbalanced to earth.

6 Relative levels at the distribution frame of 15-supergroup assembly (No. 1)

The relative power levels at the 15-supergroup assembly distribution frame should be adjusted to the following values:

- send: -33 dBr,
- receive: -25 or -33 dBr,

across a 75-ohm impedance, unbalanced to earth.

7 Return loss

In relation to the nominal impedance, the return loss at the input and output of the translating equipment of supergroups, mastergroups, supermastergroups and 15-supergroup assemblies should not be lower than 20 dB in the wanted frequency band for both directions (send and receive) of transmission.

With respect to the group translating equipment, the same limit applies at the high-frequency side; at the low-frequency side, it is also valid except in those areas in the vicinity of the group and supergroup pilots such as:

- the band 103.7-104.6 kHz of group 3 when there is a stop filter for the 411.920 kHz pilot;
- the band 63.7-64.6 kHz of group 5 when there is a stop filter for the 547.920 kHz pilot.

The above limits relate to the intrinsic return loss, i.e., that obtained when the cords connecting the measuring apparatus to the equipment are as short as possible. In view of the station cabling encountered in practice, the return loss recorded at the distribution frame of groups, supergroups, etc., may differ from the intrinsic return loss. This factor should be taken into account in designing and establishing the links.

8 Noise

Recommendation G.222, § 4 gives information on the noise produced by group, supergroup, mastergroup and 15-supergroup assembly translating equipment.

9 Interference related to supergroup reference pilot

Interference from, or with, supergroup reference pilots may be avoided by taking suitable precautions in channel terminal equipments or group-translating equipment (see Recommendation G.232, § 13.2 and the Recommendation cited in [2]).

9.1 *Pilots at 411.860 and 411.920 kHz*

9.1.1 For the protection of pilots at a through-connection point (see Recommendation G.243), group 3 should at the receive end of a supergroup link be through-connected without demodulation, for example to another supergroup link; the modulating equipment for group 3 should present an attenuation of at least 20 dB at the frequency of the supergroup pilot.

9.1.2 Moreover, when an Administration wishes to route 8- or 12-channel groups free between one supergroup link and another with no restrictions on routing of group 3, then the group 3 modulating and group 3 demodulating equipment should each provide in all cases at least 20 dB suppression at the frequency of the supergroup reference pilot.

9.2 *Pilot at 547.920 kHz*

If this pilot is used in a supergroup transmitting five groups (regardless of the use made of these groups) and not a wideband signal (for data, etc.) occupying most of the frequency band, the arrangements mentioned in § 9.1 above for the group 3 equipment should be adopted in the modulating and demodulating equipment of group 5.

10 Accuracy of carrier frequencies

See Recommendation G.225, § 1).

11 Carrier leaks

11.1 The carrier leak at the transmit side of a modulation stage should not exceed:

-47 dBm0 for group modulation,

-50 dBm0 for supergroup modulation,

-45 dBm0 for mastergroup modulation,

-50 dBm0 for supermastergroup modulation and 15-supergroup assembly modulation,

-30 dBm0 for 15-supergroup assemblies Nos. 2 and 3 on 12-MHz and 60-MHz systems, and for the first modulation stage of 15-supergroup modulation on 60-MHz systems, since in this case the carrier leaks fall into bands of frequencies not used for traffic.

11.2 Higher levels of carrier leaks can be tolerated at the output of a modulation stage at the receive side, provided no interference with adjacent groups, etc. occurs (e.g. by way of backward carrier leak, etc.)

11.3 In the case of sound-programme transmission according to the Recommendation cited in [3] certain channel carrier leaks, pregroup carrier leaks etc. falling in adjacent groups may cause excessive interference. In order to meet Recommendation cited in [4] the level of such leaks, measured at the supergroup distribution frame or an equivalent point, should not be higher than the values indicated below:

-75 dBm0 in the frequency ranges 73-82 kHz and 86-95 kHz,

-55 dBm0 at 67 kHz and 101 kHz.

In the frequency bands 67-73 kHz and 95-101 kHz the requirements are based on straight lines (linear frequency and dB scales) connecting the limits indicated above.

Note 1 - It is recognized that there are several possibilities of meeting this recommended limit, such as allocating the necessary attenuation wholly or partly to the channel or group translating equipment respectively, to insert special filters at the group distribution frame, or by selection of groups.

Note 2 - The above limit is applicable to the transmit side only.

Note 3 - The 7 dB margin between the Recommendation cited in [4] and § 11.3 above allows for cumulation on the group links involved.

11.4 In the case of 3-kHz spaced channels, the following recommendations apply:

When a baseband carries 3-kHz or a mixture of 3- and 4-kHz channels, the level of each carrier leak should not exceed the value given in Table 2/G.233 (limits apply to transmit path only).

TABLE 2/G.233

Carrier leak of:	Group and supergroup carrying 3 kHz channels	Recommended limit, dBm0
Groups 1, 2, and 3 of any supergroup	Same supergroup	—60[a)]
Groups 4 and 5 of supergroups 4 to 16	Groups 1 and 2 respectively of the adjacent lower supergroup (i.e. supergroup 3 to 15)	—73[a),b)]
Supergroup 1	Supergroup 3	—60[a),b)]
Supergroups 3 to 14	Group 4 of supergroups 5 to 16 respectively	—73[a)]

a) Based on Recommendation G.235 relating to subgroup carrier leaks.

b) Based on the assumption that the interference limit per single frequency is -73 dBm0p.

The filters of the supergroup translating equipment may contribute to the suppression of the group 4 and 5 carrier leaks.

Special attention is also necessary to avoid backward carrier leaks in the demodulation stage that may result in a product falling into a 3-kHz channel in either the group or supergroup demodulation stage.

Note - No allowance has been given for cumulation. The effects of cumulation are offset at least in part by the noise masking effect of long interconnected sections that commonly accompany the use of 3-kHz channel equipments.

12 Go-to-return crosstalk

The following limits are recommended for crosstalk ratios (single frequency measurements) for group and higher order translating equipments; they will apply to both the low and high frequency sides:

- group translation: 80 dB;
- higher order translation stages: 85 dB.

Note - On the basis of telephony considerations alone, a limit of 80 dB would have been proposed for all translation stages; this would also have sufficed to meet the recommended limit for intelligible crosstalk between programme circuits (74 dB in Recommendation J.21 [5]) in networks where programme circuits are systematically equipped with compandors. However, importance was attached to adopting a single requirement for each translation stage which would suffice for the most demanding network conditions to be encountered.

13 Group-delay distortion

13.1 *Group translating equipment*

It is recommended that the limits in Figure 7/G.233 for the group-delay distortion (relative to the value at 84 kHz) should not be exceeded by a group translating equipment consisting of a pair of group transmitting and receiving equipments. The given values are applicable to groups 2, 3 and 4 (without additional pilot stop filters). Groups 1 and 5 are excluded due to additional distortions caused by various sources (pilot stop filters, position at the end of the supergroup band, etc.); group 3 may be excluded, when the supergroup pilot 411.92 kHz or 411.86 kHz is used.

Note - The range of measured values on modern equipments is indicated in Supplement 17 at the end of this fascicle.

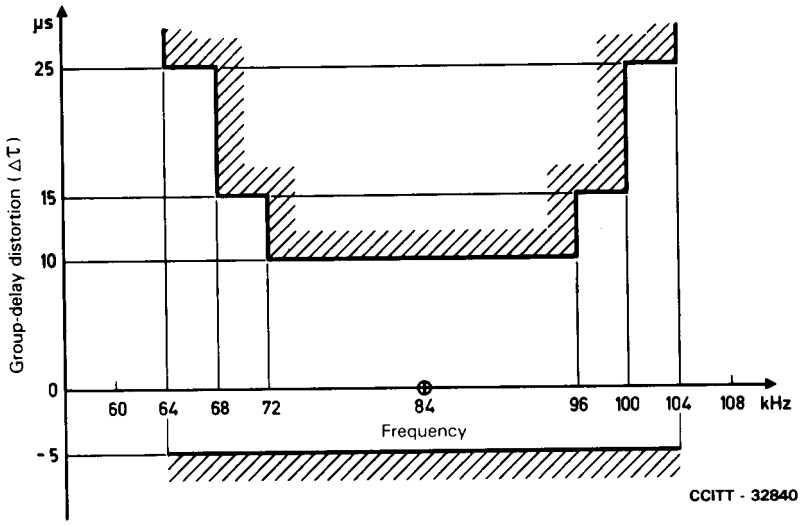

FIGURE 7/G.233

13.2 *Supergroup translating equipment*

It is recommended that the limits in Figure 8/G.233 for the group-delay distortion (relative to the value at 412 kHz) should not be exceeded by a supergroup translating equipment consisting of a pair of supergroup transmitting and receiving equipments. The given values are not applicable to supergroups 1 and 3. Depending on the design of supergroup translating equipment this restriction may also apply to supergroups 6 and 7 (due to pilot protection filter).

Note - The range of measured values on modern equipments is indicated in Supplement 17 at the end of this fascicle.

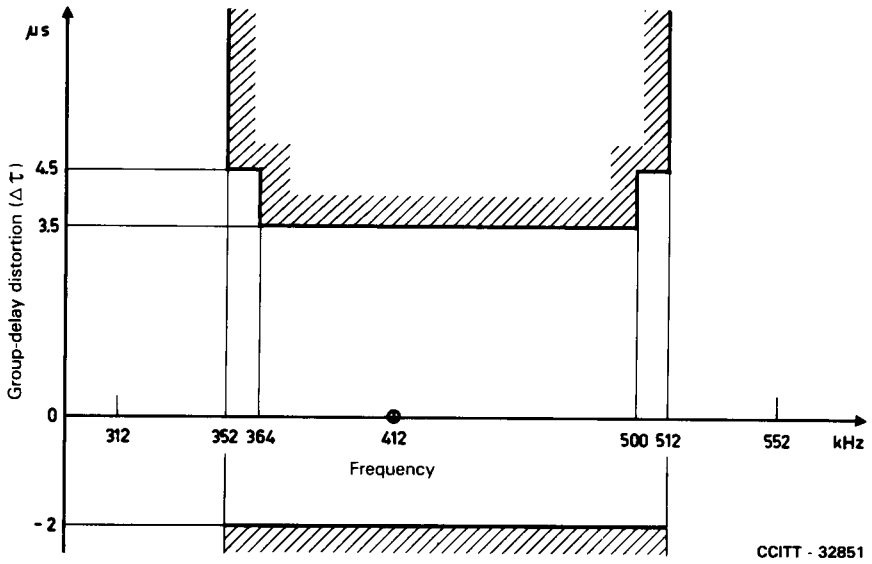

FIGURE 8/G.233

References

[1] CCITT Recommendation *8-channel terminal equipments*, Orange Book, Vol. III-l, Rec. G.234, ITU, Geneva, 1977.

[2] *Ibid.*, § f) 2.

[3] CCITT Recommendation *Characteristics of equipment lines used for setting up 15-kHz type sound-programme circuits*, Vol. III, Rec. J.31, § 1.

[4] *Ibid.*, § 2.

[5] CCITT Recommendation *Performance characteristics of 15-kHz type sound-programme circuits*, Vol. III, Rec. J.21.