INTERNATIONAL TELECOMMUNICATION UNION

ITU-T G.242

TELECOMMUNICATION
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INTERNATIONAL ANALOGUE CARRIER SYSTEMS

GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER - TRANSMISSION SYSTEMS

THROUGH - CONNECTION OF GROUPS, SUPERGROUPS, ETC.

ITU-T Recommendation G.242

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.242 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.242

THROUGH-CONNECTION OF GROUPS, SUPERGROUPS, ETC.

(amended at Geneva, 1964; further amended)

1 General considerations[1)]

It may be found desirable from both the technical and the economical points of view to provide facilities at the end of certain sections such that the channels routed over one section do not all have to be extended to the next section, this being done without demodulating all the channels to voice frequency, whole batches of channels being extended to different line sections.

At such points, which are at the ends of *the line links* concerned, the through-connection of batches of telephone channels should be possible from one line link to another. This can be achieved by means of the following two methods which, though basically different, can nevertheless be used in association at a given point for different batches of channels. In both cases arrangements are necessary to ensure that the through-connected frequency band is "clear", that is to say, as far as possible the channel vestiges on the two sides of the through-connected batch of channels should be suppressed by means of a through-connection filter**.**

1.1 *Through-group, supergroup, mastergroup, supermastergroup or 15-supergroup assembly*

It is assumed that the batch of through-connected channels occupies the frequency band of a group, supergroup, mastergroup, supermastergroup or 15-supergroup assembly, or that it can be split into several such bands. Each of the groups, supergroups, mastergroups, supermastergroups or 15-supergroup assemblies is then brought into the basic frequency band and is filtered in that band by means of a through-group filter, or through-supergroup, through-mastergroup, through-supermastergroup or through-15-supergroup assembly filter.

Note - The frequency band occupied by the 15-supergroup assembly No. 3 (8620 to 12 336 kHz) is within the frequency band occupied by the basic supermastergroup (8516 to 12 388 kHz). Hence, when 15-supergroup assemblies are used in the conditions specified in Recommendation G.211 (procedure 2), 15-supergroup assembly No. 3 can be through-connected by means of through-supermastergroup filters.

1.2 *Direct through-connection*

It is also possible to through-connect a group, supergroup, mastergroup, supermastergroup or 15-supergroup assembly or a batch of them by direct line filtration without demodulation and passage via the basic frequency band. It is then necessary to have direct through-connection filters connected to the line equipment to effect the necessary separation. An example of this possibility is given in Recommendation G.333 for the 60 MHz system.

In fixing the degree of suppression of unwanted components, it is convenient to use the following definitions:

intelligible crosstalk components

F: *composantes de diaphonie intelligible*

S: componentes de diafonía inteligible

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1) This Recommendation does not consider certain precautions necessary for the protection of various pilots and additional measuring frequencies. Such precautions are given in Recommendation G.243.

Transferred speech currents which can introduce intelligible crosstalk into certain channels at the point considered.

unintelligible crosstalk components

F: composantes de diaphonie inintelligible

S: componentes de diafonía ininteligible

Transferred speech currents which can introduce unintelligible crosstalk into certain channels at the point considered.

possible crosstalk components

F: composantes possibles de diaphonie

S: componentes posibles de diafonía

Transferred speech currents which, at the point considered, do not intrude into the channels of other systems but which may do so elsewhere.

harmful out-of-band components

F: composantes extra-bandes nuisibles

S: componentes fuera de banda perjudiciales

Transferred currents arising from speech, or pilots, or additional measuring frequencies, and of frequencies such that they will always lie outside the useful frequency band (corresponding to speech frequencies) of the carrier systems, but which may interfere with pilots or additional measuring frequencies.

harmless out-of-band components

F: composantes extra-bandes neutres

S: componentes fuera de banda neutras

Transferred currents arising from speech or pilots which, at all translation points, have frequencies outside the useful frequency band corresponding to audio frequencies or pilot frequencies.

The term "wanted component" is applied below in respect to speech band, to an 800-Hz signal with a power of 1 milliwatt sent to a zero relative level point, and in respect of pilots or additional measuring frequencies, to the signal of specified frequency and level at the point where it is normally injected.

2 Through-group connection

2.1 *Ratio between the wanted and unwanted components*

In the case of through-connection of a group, the ratio between the wanted components and the various unwanted components defined above should be:

1) intelligible crosstalk components: 70 dB;
2) unintelligible crosstalk components: 70 dB;
3) possible crosstalk components: 35 dB wherever possible components appear;
4) harmful out-of-band components: 40 dB;
5) harmless out-of-band components: 17 dB.

All these separations must be provided by the transfer filter itself. They relate to the nominal level, 84 kHz which is the reference frequency (close to the group pilots) at which the loss of the group transfer filter is set. At the other frequencies, account should be taken of the tolerance allowed for the distortion loss of this filter.

At any temperature between 10 ° C and 40 ° C, insertion loss for all the through-group connection equipment[2] at any frequency of the passband (60.6 to 107.7 kHz[3]) should not depart from the loss at 84 kHz[4] by more than ± 1 dB.

The loss between 10 ° C and 40 ° C at 84 kHz should not differ by more than ± 1 dB from the loss at 25 ° C.

Note 1 - It would be technically difficult for the CCITT to recommend a distribution of these overall limits among the equipments mentioned in footnote 2 on this page.

Note 2 - The value of 70 dB shown in 1) and 2) above for the intelligible or unintelligible crosstalk components is the minimum standard value for telephony. A value of 80 dB is recommended in the band which, in each group adjacent to the through-connected group, corresponds to the band 84 to 96 kHz in the basic group and which may therefore be used for programme transmissions by systems, whether or not equipped with compressors having the characteristics defined in Recommendation J.31, § 1.5 [1].

This condition should be fulfilled both when the adjacent group is direct and when it is inverted.

Note 3 - As a consequence of the condition in Note 2 above, in each through-connected group, the value recommended will also be achieved in the band corresponding to the band 72 to 84 kHz in the basic group.

Note 4 - The values recommended above for the intelligible or unintelligible crosstalk components are also compatible with the use of 15 kHz circuits (Recommendation J.21 [2]) and 7 kHz circuits (Recommendation J.23 [3]) for programme transmission. Consideration is given to the fact that the equipments used to set up these circuits (Recommendation J.31 [1] and Annexes, Recommendation J.34 [4]) are single sideband systems with compandors or double sideband systems. Account was also taken of the frequency band occupied by the programme channels of the equipments in the basic group and of the frequency response characteristics of the weighting network referred to in Recommendation J.16 [5].

2.2 *Group-delay distortion of the through-group filter*

In the case of through-connection of a group in the basic frequency band 60-108 kHz, it is recommended that the limits in Figure 1/G.242 for the group-delay distortion (relative to the value at 84 kHz) should not be exceeded by the through-group filter**.**

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

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2) This equipment comprises a group demodulation equipment, the through-group filter proper and a group modulation equipment.

3) If 16-channel groups be used, the passband must be extended from 60.1 to 107.9 kHz or, by agreement between the Administrations concerned, the band indicated in the present recommendation must be kept, in which event Note 1 to Recommendation G.235 will have to be carefully borne in mind.

4) Slightly different loss limits apply outside the band occupied by the telephone channels when out-of-band signalling is used; this point can be settled on the national level or by agreement between the Administrations concerned.

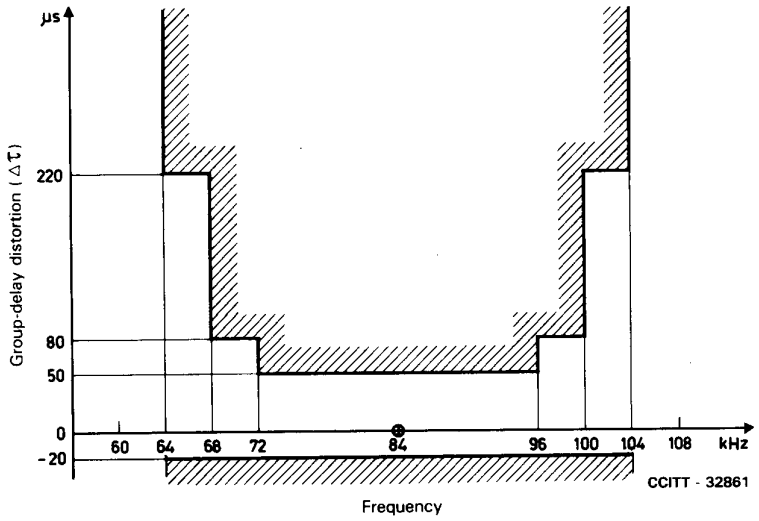

FIGURE 1/G.242

3 Through-supergroup connection

3.1 *Ratio between the wanted and unwanted components*

In the case of through-connection of a supergroup, the ratio between the wanted components and the various unwanted components defined above should be:

1) intelligible crosstalk components: 70 dB;
2) unintelligible crosstalk components: 70 dB;
3) possible crosstalk components: 35 dB wherever possible components appear;
4) harmful out-of-band components: 40 dB[5)];
5) harmless out-of-band components: 17 dB.

5) The specified attenuation should be met at the nominal frequencies of the pilots and additional measuring frequencies involved (at a point where these are 308 kHz or 556 kHz) in accordance with the definition of harmful out-of-band components.

All these separations must be provided by the through-supergroup filter itself. They relate to the nominal level 412 kHz, which is the reference frequency (close to the supergroup pilots), at which the loss of the supergroup transfer filter is set. At the other frequencies, account should be taken of the tolerance allowed for the distortion loss of this filter.

At any temperature between 10 ° C and 40 ° C, insertion loss for all the through-supergroup connection equipment[6] at any frequency of the passband (312.3 to 551.4 kHz should not depart from the loss at 412 kHz[7] by more than ± 1 dB.

The loss between 10 ° C and 40 ° C at 412 kHz should not differ by more than ± 1 dB from the loss at 25 ° C.

Note 1 - It would be technically difficult for the CCITT to recommend a distribution of these overall limits among the equipments mentioned in footnote 6 above.

Note 2 - The ratio of 70 dB shown in 1) and 2) above for the intelligible or unintelligible crosstalk components is a minimum standard value for telephony. A separation of 80 dB is advocated for the bands liable to be used for programme transmission in each supergroup adjacent to the transferred supergroup.

Note 3 - In the case of through-connection of supergroup 1 or 3, the range of insertion loss of the combined through-supergroup equipment can reach 3 dB in the passband of the filter around 312 kHz or 552 kHz.

3.2 *Group-delay distortion of the through-supergroup filter*

In the case of through-connection of a supergroup in the basic frequency band 312-552 kHz, it is recommended that the limits in Figure 2/G.242 for the group-delay distortion (relative to the value at 412 kHz) should not be exceeded by the through-supergroup filter.

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

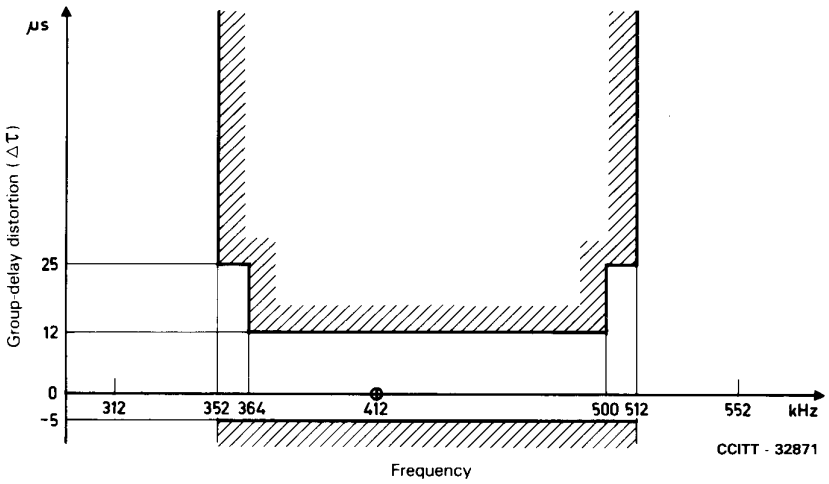

FIGURE 2/G.242

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6) This equipment comprises a supergroup demodulation equipment, the through-supergroup filter proper and a supergroup modulation equipment.

7) Slightly different loss limits apply outside the band occupied by the telephone channels when out-of-band signalling is used; this point can be settled on the national level or by agreement between the Administrations concerned.

4 Through-mastergroup connection

For the through-mastergroup connection, the ratio between wanted components and the various unwanted components defined above should be:

1) intelligible crosstalk components: 70 dB;

2) unintelligible crosstalk components: 70 dB;

3) possible crosstalk components: 35 dB wherever possible components appear;

4) harmful out-of-band components: 40 dB[8] ;

5) harmless out-of-band components: 17 dB.

All these ratios should be achieved by the through-mastergroup filter itself. They refer to the nominal level of the 1552-kHz reference frequency (mastergroup pilot) by which the loss of the through-mastergroup filter is fixed. At other frequencies, the attenuation/frequency distortion tolerance allowed for this filter should be taken into consideration.

At any temperature between 10 ° C and 40 ° C, the loss at any frequency within the passband (812 to 2044 kHz) of the combined through-mastergroup equipment[9] should not deviate by more than ± 1 dB from the loss at 1552 kHz.

The loss between 10 °C and 40 °C, at 1552 kHz, should not deviate by more than ± 1 dB from the loss at 25 ° C.

Within each supergroup the total variation of the insertion loss should not exceed ± 1 dB relative to the loss at the frequency of the supergroup reference pilot.

Note - The ratio of 70 dB shown in 1) and 2) above for intelligible or unintelligible crosstalk components is a minimum standard value for telephony. A separation of 80 dB is advocated for the bands liable to be used for programme transmission in each mastergroup adjacent to the transferred mastergroup.

5 Through-supermastergroup connection

For the through-supermastergroup connection, the ratio between wanted components and the various unwanted components defined above should be:

1) intelligible crosstalk components: 70 dB;

2) unintelligible crosstalk components: 70 dB;

3) possible crosstalk components: 35 dB; wherever possible components appear;

4) harmful out-of-band components: 40 dB[10] ;

5) harmless out-of-band components: 17 dB.

All these ratios should be achieved by the through-supermastergroup filter itself. They refer to the nominal level of the 11 096 kHz reference frequency (supermastergroup pilot) by which the loss of the combined supermastergroup equipment[11] is fixed. At other frequencies the attenuation/frequency distortion tolerance allowed for this filter should be taken into consideration.

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8) The specified attenuation should be met over a band corresponding to the recommended frequency stability of the original frequencies of the pilots or the additional measuring frequencies involved (where these are translated to 768 kHz or 2088 kHz) in accordance with the definition of harmful out-of-band components.

9) This equipment comprises a mastergroup demodulation equipment, the through-mastergroup filter proper, and a mastergroup translating equipment.

10) The specified attenuation should be met over a band corresponding to the recommended frequency stability of the original frequencies of the pilots or the additional measuring frequencies involved (after frequency translation of the supermastergroup into the basic 8516-12 388 kHz band) in accordance with the definition of harmful out-of-band components.

11) This equipment comprises the supermastergroup demodulation equipment, the through-supermastergroup filter proper and supermastergroup translating equipment.

At any temperature between 10 ° C and 40 ° C, the insertion loss at any frequency within the passband 8516 to 12 388 kHz of the combined through-supermastergroup equipment should not deviate by more than ± 1.5 dB from the loss at 11 096 kHz. Within each mastergroup the total variation in insertion loss should not exceed ± 1 dB relative to the loss at the frequency of the mastergroup pilot.

The loss between 10 ° C and 40 ° C, at 11 096 kHz, should not deviate by more than ± 1 dB from the loss at 25 ° C.

Note - The ratio of 70 dB shown in 1) and 2) above for intelligible or unintelligible crosstalk components is a minimum standard value for telephony. A separation of 80 dB is advocated for the bands liable to be used for programme transmission in each supermastergroup adjacent to the transferred supermastergroup.

6 Through-15-supergroup assembly connection

For through-15-supergroup assembly (No. 1) connection, the ratio between wanted components and the various unwanted components defined above should be:

1) intelligible crosstalk components: 70 dB;

2) unintelligible crosstalk components: 70 dB;

3) possible crosstalk components: 35 dB wherever possible components appear;

4) harmful out-of-band components: 40 dB[12] ;

5) harmless out-of-band components: 17 dB.

All these ratios should be achieved by the through-15-supergroup filter itself. They refer to the nominal level of the 1552-kHz reference frequency (frequency of the basic 15-supergroup assembly pilot) by which the loss of the through basic 15-supergroup assembly No. 1 filter is fixed. At other frequencies, the attenuation/frequency distortion tolerance allowed for the filter should be taken into consideration.

Alternatively, the above ratios may be provided by a through-connection equipment[13] that incorporates the necessary filtering within the 15-supergroup assembly demodulator and the 15-supergroup assembly modulator.

At any temperature between 10 ° C and 40 ° C, the loss at any frequency within the passband (312 to 4028 kHz) of the combined through-15-supergroup equipment[13] should not deviate by more than ± 1.5 dB from the loss at 1552 kHz.

The loss between 10 ° C and 40 ° C at 1552 kHz should not deviate by more than ± 1 dB from the loss at 25 ° C.

Within each supergroup, the total variation of the insertion loss should not exceed ± 1 dB relative to the loss at the frequency of the supergroup reference pilot.

Note - The ratio of 70 dB shown in 1) and 2) above for intelligible or unintelligible crosstalk components is a minimum standard value for telephony. A separation of 80 dB is advocated for the bands liable to be used for programme transmission in each 15-supergroup assembly adjacent to the transferred 15-supergroup assembly.

7 Direct through-connection

The values recommended for the attenuation of the various crosstalk components are the same as those given in §§ 2 to 6 above for through-connection of groups, supergroups, etc., in as far as they are not in contradiction with those recommended in Recommendation G.243, § 5.

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12) The specified attenuation should be met over a band corresponding to the recommended frequency stability of the original frequencies of the pilots or the additional frequencies involved (after frequency translation of the 15-supergroup assembly into the basic 312-4028 kHz band) in accordance with the definition of harmful out-of-band components.

13) This equipment comprises the 15-supergroup assembly demodulation equipment, the through-connection filter (if any) and the 15-supergroup assembly-translating equipment.

References

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

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

[3] CCITT Recommendation *Performance characteristics of narrow-bandwidth sound-programme circuits,* Vol. III, Rec. J.23.

[4] CCITT Recommendation *Characteristics of equipment used for setting up 7 kHz type sound-programme circuits,* Vol. III, Rec. J.34.

[5] CCITT Recommendation *Measurement of weighted noise in sound-programme circuits,* Vol. III, Rec. J.16.