SECTION 2

INTERNATIONAL TRANSMISSION SYSTEMS

2.1 Definitions

Recommendation M.300

DEFINITIONS CONCERNING INTERNATIONAL TRANSMISSION SYSTEMS

1 Definitions concerning international analogue transmission systems

Note 1 — This Recommendation is partly duplicated in Recommendation G.211 [1].

Note 2 — Figure 1/M.300 refers to definitions 1.2 to 1.13. Figures 2/M.300, 3/M.300 and 4/M.300 refer to definitions 1.1 to 1.18.

Those of the following definitions that concern *links* or *sections* apply, unless otherwise stated, to the combination of both directions of transmission. A distinction between the two directions of transmission may, however, be necessary in the case of unidirectional, multiple-destination *links* or *sections* set up over multiple-destination communication satellite systems.

1.1 **line link (using symmetric pairs, coaxial pairs, radio-relay link, etc.)**

A transmission path, however provided, together with all the associated equipment, such that the bandwidth available, while not having any specific limits, is effectively the same throughout the length of the link.

Within the link there are no direct filtration points nor any through-connection points for groups, supergroups, etc., and the ends of the link are the points at which the band of line frequencies is changed in some way or other.

1.2 **group section**

The whole of the means of transmission using a frequency band of specified width (48 kHz) connecting two consecutive group distribution frames (or equivalent points).

1.3 **group link**

The whole of the means of transmission using a frequency band of specified width (48 kHz) connecting two terminal equipments, for example, channel translating equipments, wideband sending and receiving equipments (modems, etc.). The ends of the link are the points on group distribution frames (or their equivalent) to which the terminal equipments are connected.

It can include one or more group sections.

1.4 group

A group consists of a group link connected at each end to terminal equipments. These terminal equipments provide for the setting-up of a number of telephony channels (generally 12), one or more data transmission or facsimile channels, etc.

It occupies a 48 kHz frequency band. Figures 1/M.320, 2/M.320 and 3/M.320 show various possible arrangements of telephony channels in a basic group B (60 to 108 kHz).

1.5 supergroup section

The whole of the means of transmission using a frequency band of specified width (240 kHz) connecting two consecutive supergroup distribution frames (or equivalent points).

1.6 supergroup link

The whole of the means of transmission using a frequency band of specified width (240 kHz) connecting two terminal equipments, for example, group translating equipments, wideband sending and receiving equipments (modem, etc.). The ends of the link are the points on supergroup distribution frames (or their equivalent) to which the terminal equipments are connected.

It can include one or more supergroup sections.

1.7 supergroup

A supergroup consists of a supergroup link connected at each end to terminal equipments. These terminal equipments provide for the setting-up of five group links or sections occupying adjacent frequency bands in a 240 kHz band or for one or more data transmission or facsimile channels, etc.

The basic supergroup occupies the band 312 to 552 kHz. Figure 1/M.330 shows the position of groups and channels within the supergroup.

1.8 mastergroup section

The whole of the means of transmission using a frequency band of specified width (1232 kHz) connecting two consecutive mastergroup distribution frames (or equivalent points).

1.9 mastergroup link

The whole of the means of transmission using a frequency band

of specified width (1232 kHz) connecting two terminal equipments, for example, supergroup translating equipments, wideband sending and receiving equipments (modems, etc.). The ends of the link are the points on mastergroup distribution frames (or their equivalent) to which the terminal equipments are connected.

It can include one or more mastergroup sections.

1.10 mastergroup

A mastergroup consists of a mastergroup link terminated at each end by terminal equipments. These terminal equipments provide for the setting-up of five supergroup links or sections occupying frequency bands separated by 8 kHz in a 1232 kHz band.

The basic mastergroup consists of supergroups 4, 5, 6, 7 and 8 within the band of frequencies 812 kHz to 2044 kHz. (See Figure 1/M.340.)

1.11 supermastergroup section

The whole of the means of transmission using a frequency band of specified width (3872 kHz) connecting two consecutive supermastergroup distribution frames (or equivalent points).

1.12 **supermastergroup link**

The whole of the means of transmission using a frequency band of specified width (3872 kHz) connecting two terminal equipments, for example, mastergroup translating equipments, wideband sending and receiving equipment (modems, etc.). The ends of the link are the points on supermastergroup distribution frames (or their equivalent) to which the terminal equipments are connected.

It can include one or more supermastergroup sections.

1.13 **supermastergroup**

A supermastergroup consists of a supermastergroup link connected at each end to terminal equipments. These terminal equipments provide for the setting-up of three mastergroup links or sections separated by two free spaces of 88 kHz and occupying a band whose total width is 3872 kHz. The basic supermastergroup is composed of mastergroups 7, 8 and 9 occupying the frequency band 8516-12 | 88 kHz. (See Figure 1/M.350.)

This definition is still under study by Study Group IV and is not identical to the one given in Recommendation | .211 [1].

1.14 **15 supergroup assembly section**

The whole of the means of transmission using a frequency band of specified width (3716 kHz) connecting two consecutive 15 supergroup assembly distribution frames (or equivalent points) and connected, at least at one end, to through-15 supergroup assembly connection equipment. It always forms part of a 15 supergroup assembly link.

1.15 **15 supergroup assembly link**

The whole of the means of transmission using a frequency band of specified width (3716 kHz) connecting two 15 supergroup assembly distribution frames (or equivalent points). It can be made up of a number of 15 supergroup assembly sections. When terminal equipments are connected to both ends, it becomes a constituent part of a 15 supergroup assembly for carrying telephony or telegraphy channels or data or facsimile, etc.

1.16 **15 supergroup assembly**

A 15 supergroup assembly consists of a 15 supergroup assembly link terminated at each end by terminal equipments. These terminal equipments provide for the setting-up of 15 supergroup links or sections separated by free spaces of 8 kHz and occupying a band whose total width is 3716 kHz. The basic 15 supergroup assembly is made up of supergroups 2 to 16 occupying the frequency band 312-4028 kHz.

1.17 **through-group connection point**

When a group link is made up of several group sections, they are connected in tandem by means of through-group filters at points called through-group connection points.

1.18 **through-supergroup connection point**

When a supergroup link is made up of several supergroup sections, they are connected in tandem by means of through-supergroup filters at points called through-supergroup connection points.

1.19 **through-mastergroup connection point**

When a mastergroup link is made up of several mastergroup sections, they are connected in tandem by means of through-mastergroup filters at points called through-mastergroup connection points.

1.20 **through-supermastergroup connection point**

When a supermastergroup link is made up of several supermastergroup sections, they are connected in tandem by means of through-supermastergroup filters at points called through-supermastergroup connection points.

1.21 **through-15 supergroup assembly connection point**

When a 15 supergroup assembly link is made up of several 15 supergroup assembly sections, these sections are interconnected in tandem by means of through-15 supergroup assembly filters at points called through-15 supergroup assembly connection points.

Note — In a country normally using mastergroup and supermastergroup arrangements, a 15 supergroup assembly can be through-connected without difficulty at the supermastergroup distribution frame by means of through-supermastergroup filters. In this case, the 15 supergroup assembly is through-connected to position 3 (8620-12 | 36 kHz) instead of position 1 (312-4028 kHz) as required by the definition of the through-connection point of such an assembly. The point where this through-connection is made is a through-supermastergroup connection point and not a through-15 supergroup assembly connection point.

1.22 **regulated line section (symmetric pairs, coaxial pairs or radio relay links)**

In a carrier transmission system, a line section on which the line-regulating pilot or pilots are transmitted from end to end without being subjected to any intermediate amplitude regulation associated with the pilot or pilots.

FIGURE 1/M.300, p.

2 Definitions concerning international digital transmission systems

Note 1 — This Recommendation is partly duplicated in Recommendation G.701 [2].

Note 2 — Figure 5/M.300 refers to definition 2.3 below. Figure 6/M.300 refers to definitions 2.10 to 2.19 below.

Those of the following definitions that concern digital paths or sections apply, unless otherwise stated, to the combination of both directions of transmission. A distinction between the two directions of transmission may, however, be necessary in the case of unidirectional, multiple-destination paths or sections set up over multiple-destination communication satellite systems.

2.1 **alarm indication signal (AIS)**

A signal that is used to replace the normal traffic signal when a maintenance alarm indication has been activated.

2.2 **upstream failure indication**

An indication provided by a digital multiplexer, line section or radio section, that a signal applied at its input port is outside its prescribed maintenance limit.

2.3 **primary block (American: digroup)**

A basic group of PCM channels assembled by time division multiplexing.

Note — The following conventions could be useful:

Primary block μ — a basic group of PCM channels derived from 1544 kbit/s PCM multiplex equipment.

Primary block A — a basic group of PCM channels derived from 2048 kbit/s PCM multiplex equipment.

Figure 2/M.300, p. 2

Figure 3/M.300, p. 3

Figure 4/M.300, p. 4

2.4 PCM multiplex equipment

Equipment for deriving a single digital signal at a defined digit rate from two or more analogue channels by a combination of pulse code

modulation and time division multiplexing (multiplexer) and also for carrying out the inverse function (demultiplexer).

The term should be preceded by the relevant equivalent binary digit rate, e.g., 2048-kbit/s PCM multiplex equipment.

2.5 digital multiplexer

Equipment for combining by time division multiplexing two or more tributary digital signals into a single composite digital signal.

2.6 muldex

A contraction of multiplexer-demultiplexer. The term may be used when the multiplexer and demultiplexer are associated in the same equipment.

Note — When used to describe an equipment, the function of the equipment should qualify the title, e.g., PCM muldex, data muldex, digital muldex.

2.7 digital multiplex equipment

The combination of a digital multiplexer and a digital demultiplexer at the same location.

2.8 **digital multiplex hierarchy**

A series of digital multiplexers graded according to capability so that multiplexing at one level combines a defined number of digital signals, each having the digit rate prescribed for a lower order, into a digital signal having a prescribed digit rate which is then available for further combination with other digital signals of the same rate in a digital multiplexer of the next higher order.

2.9 **transmultiplexer**

An equipment that transforms frequency division multiplexed signals (such as group or supergroup) into corresponding time division multiplexed signals that have the same structure as those derived from PCM multiplex equipment. The equipment also carries out the inverse function.

2.10 **digital distribution frame**

A frame at which interconnections are made between the digital outputs of equipments and the digital inputs of other equipments.

2.11 **digital section**

The whole of the means of transmitting and receiving between two consecutive digital distribution frames (or equivalent) a digital signal of specified rate.

Note 1 — A digital section forms either a part or the whole of a digital path.

Note 2 — Where appropriate, the bit rate should qualify the title.

2.12 **digital path**

The whole of the means of transmitting and receiving a digital signal of specified rate between those two digital distribution frames (or equivalent) at which terminal equipments or switches will be connected. Terminal equipments are those at which signals at the specified bit rate originate or terminate.

Note 1 — A digital path comprises one or more digital sections.

Note 2 — Where appropriate, the bit rate should qualify the title.

Note 3 — Digital paths interconnected by digital switches form a digital connection.

2.13 **digital line section**

Two consecutive line terminal equipments, their interconnecting transmission medium and the in-station cabling between them and their adjacent digital distribution frames (or equivalents), which together provide the whole of the means of transmitting and receiving between two consecutive digital distribution frames (or equivalents) a digital signal of specified rate.

Note 1 — Line terminal equipments may include the following:

— regenerators,

— code converters,

— scramblers,

— remote power feeding,

— fault location,

— supervision.

Note 2 — A digital line section is a particular case of a digital section.

2.14 **digital line system**

A specific means of providing a digital line section.

2.15 **digital block**

The combination of a digital path and associated digital multiplex equipments.

Note — The bit rate of the digital path should form part of the title.

2.16 **digital line path**

Two or more digital line sections interconnected in tandem in such a way that the specified rate of the digital signal transmitted and received is the same over the whole length of the line path between the two terminal digital distribution frames (or equivalent).

2.17 **digital radio section**

Two consecutive radio terminal equipments and their interconnecting transmission medium which together provide the whole of the means of transmitting and receiving between two consecutive digital distribution frames (or equivalents) a digital signal of specified rate.

Note — A digital radio section is a particular case of a digital section.

2.18 **digital radio system**

A specific means of providing a digital radio section.

2.19 **digital radio path**

Two or more digital radio sections interconnected in tandem in such a way that the specified rate of the digital signal transmitted and received is the same over the whole length of the radio path between the two terminal digital distribution frames (or equivalent).

FIGURE 5/M.300, p.

3 General definitions for international transmission systems

3.1 **national section**

The digital sections and group, supergroup, etc., sections between a station with control or subcontrol functions and a frontier station within the same country are termed comprehensively a national section. A national section will usually comprise several digital, group, supergroup, etc., sections. The digital, group, supergroup, etc., sections between the two stations with control functions within one country also constitute a national section.

3.2 **international section**

The digital, group, supergroup, etc., sections between two adjacent frontier stations in different countries constitute an international section. Some international sections may be a single digital, group, supergroup, etc., section routed over long submarine cable systems. If the international group, supergroup, etc., is routed via intermediate countries without the digital path being demultiplexed to its characteristic bit rate/basic frequency band, the frontier stations at the ends of the international digital, group, supergroup, etc., section are still considered to be adjacent.

3.3 **main section**

The sections into which a digital path or group, supergroup, etc., link is divided by the digital path, group, supergroup, etc., control and subcontrol stations are called main sections. A main section is the portion of the digital path or, group, supergroup, etc., link between two adjacent stations having control functions. In many cases, these two stations are in different countries. In the case of a country which has elected to have more than one station with control functions, a main section will lie wholly within that country. (See Figure 2/M.460.)

4 Definitions concerning international channels

Note 1 — Figure 7/M.300 refers to definition 4.2 below. Figures 8/M.300 and 9/M.300 refer to definition 4.3 below.

Figure 6/M.300, p. 6

A channel, as used in the Series M Recommendations with international transmission systems and international telephone circuits, is a one-way transmission capability for a voice-frequency or equivalent voice-frequency signal. The specific types of channels are:

4.1 **analogue channel**

An analogue channel is a one-way transmission capability which is provided on audio pairs or analogue transmission systems, and which appears at voice frequency at both ends. Where an analogue channel is provided by an analogue transmission system, it will not have voice frequency appearances other than at its ends.

4.2 **digital channel**

A digital channel provides one-way 64 kbit/s transmission capability, on a digital path. A digital channel appears at both ends on a digital distribution frame or equivalent either at 64 kbit/s or as a 64 kbit/s time slot in a digital path at a specified level of the digital hierarchy.

4.3 **mixed analogue/digital channel**

A mixed analogue/digital channel is a one-way transmission capability provided over an analogue transmission system with transmultiplexer equipment at one end and transmultiplexer or analogue translating equipment at the other end. Where the end of the channel is provided by transmultiplexer

equipment, the channel appears as a 64 kbit/s time slot on a digital distribution frame at the output of the transmultiplexing equipment in a digital path at a specified level of the digital hierarchy. Where the end of the channel is provided by analogue translating equipment, it appears at voice frequency.

Figure 7/M.300, p.

Figure 8/M.300, p.

Figure 9/M.300, p.

References

[1] CCITT Recommendation *Make-up of carrier links* , Vol. III, Rec. G.211.

[2] CCITT Recommendation *Vocabulary of pulse code modulation (PCM) and digital transmission terms* , Vol. III, Rec. G.701.

BLANC

2.2 Numbering of channels, groups, supergroups, etc. and digital blocks in transmission systems

Recommendation M.320

NUMBERING OF THE CHANNELS IN A GROUP

1 General

The position of a channel within a group is identified by a number starting from 1, the numbers of the different channels being taken in order of frequency in the basic group frequency band.

A channel is said to be *erect* | within a group when the frequencies in the group-frequency band corresponding to the audio-frequencies in the channels *ascend* | in the same relative order as those in the channels forming the group.

Similarly, a channel is said to be *inverted* | within a group when

the frequencies in the group-frequency band descend in the same relative order as the ascending order of the frequencies in the channels.

A group, supergroup, etc., is said to be *erect* | when all of its channels are *erect* | and is said to be *inverted* | when all of its channels are *inverted* .

1.1 *8 channel group*

Basic group B is *inverted* . The channels will be numbered from 1 to 8 in descending order of frequency within the group-frequency range. (See the recommended arrangement in Recommendation G.234 [1].)

The numbering is as shown in Figure 1/M.320.

1.2 *12 channel group*

Basic group B is *inverted* . The channels will be numbered from 1 to 12 in descending order of frequency within the group-frequency range.

The numbering is as shown in Figure 2/M.320.

1.3 *16 channel group*

Channels of a 16 channel group are normally assembled in the basic group B frequency range. The channels are numbered from 1 to 16 in descending

order of frequency within the basic group B frequency band, the odd-numbered channels being *erect* | and the even-numbered channels being *inverted*
| or *inverted* | group.

The numbering is as shown in Figure 3/M.320.

FIGURE 1/M.320 p.

FIGURE 2/M.320 p.

FIGURE 3/M.320 p.

Reference

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

Recommendation M.330

NUMBERING OF GROUPS WITHIN A SUPERGROUP

The position occupied by a group within a supergroup is identified by a number in the series from 1 to 5, the numbers being allocated in ascending order of frequency in the basic supergroup 312 kHz to 552 kHz and in descending order of frequency in the other supergroups. (See Figure 1/M.330.)

If all the groups comprising the supergroup are erect:

— the basic supergroup is said to be *erect* ;

— the other supergroups are said to be *inverted* .

Figure 1/M.330 p.13

Recommendation M.340

NUMBERING OF SUPERGROUPS WITHIN A MASTERGROUP

The position of a supergroup within a mastergroup is identified by a number in the series from 4 to 8 which refers to one of the numbers of the supergroups constituting the basic mastergroup in the supergroup arrangement of the standard 4-MHz coaxial system.

The numbering is shown in Figure 1/M.340.

FIGURE 1/M.340 p.

Recommendation M.350

NUMBERING OF MASTERGROUPS WITHIN A SUPERMASTERGROUP

The position of a mastergroup within a supermastergroup is identified by a number in the series from 7 to 9 which refers to one of the numbers of the mastergroups constituting the basic supermastergroup.

The numbering is shown in Figure 1/M.350.

Figure 1/M.350 p.15

Recommendation M.380

NUMBERING IN COAXIAL SYSTEMS

1 Numbering of groups, supergroups, etc., and of channels in coaxial systems

1.1 *Numbering of a supermastergroup or of a 15 supergroup assembly*

The supermastergroups and 15 supergroup assemblies of a coaxial system are identified by numbers giving their respective position in the frequency spectrum transmitted on the line. The numbering is shown in Figures 1/M.380, 2/M.380 and 3/M.380.

1.2 *Numbering of a mastergroup*

The mastergroups of a coaxial system are identified by numbers giving their respective position in the frequency spectrum transmitted on the line. The numbering is shown in Figures 1/M.380, 2/M.380, 4/M.380, 8/M.380 and 10/M.380.

Alternatively, when a mastergroup is regarded as being part of a supermastergroup, the position of the mastergroup can be indicated by the number of that supermastergroup followed by the number of mastergroup within the basic supermastergroup (for example, in Figure 1/M.380, the 5652-6884 kHz mastergroup in a 12 MHz system with supermastergroup frequency allocation is designated by the two numbers 2 and 8).

1.3 *Numbering of a supergroup*

The supergroups of a coaxial system are identified by numbers giving their respective position in the frequency spectrum transmitted on the line. The numbering is shown in Figures 2/M.380, 5/M.380, 6/M.380, 7/M.380 and 9/M.380.

The position of a supergroup that is part of a mastergroup is designated by the number of that mastergroup followed by the number of the supergroup within the basic mastergroup (examples: in Figure 1/M.380, the 5652-5892 kHz supergroup in a 12-MHz system with supermastergroup frequency allocation is designated by the three numbers 2, 8 and 4; in Figure 8/M.380, the 4332-4572 kHz supergroup in a 6-MHz system with mastergroup frequency allocation is designated by the two numbers 4 and 4).

The position of a supergroup that is part of a 15 supergroup assembly is designated by the number of that 15 supergroup assembly followed by the number of the supergroup within the basic 15 supergroup assembly (for example, in Figure 3/M.380, the 10 | 56-10 | 96 kHz supergroup in a 12-MHz system with frequency allocation by 15 supergroup assemblies is designated by the two numbers 3 and 9).

1.4 *Numbering of a group*

The position of a group is designated by the number of the supergroup in which it is placed followed by the number of the group within that supergroup (examples: in Figure 1/M.380 the 5844-5892 kHz group in a

12-MHz system with supermastergroup frequency allocation is designated by the four numbers 2, 8, 4 and 1; in Figure 8/M.380, the 4924-4972 kHz group in a 6-MHz system with mastergroup frequency allocation is designated by the three numbers 4, 6 and 3).

1.5 *Numbering of a channel*

The position occupied by a channel is designated by the number of the group to which it belongs followed by the number of the channel within that group (examples: in Figure 1/M.380, the 5884-5888 kHz channel in a 12-MHz system with supermastergroup frequency allocation is designated by the five numbers 2, 8, 4, 1 and 2; in Figure 8/M.380, the 4936-4940 kHz channel in a 6-MHz system with mastergroup frequency allocation is designated by the four numbers 4, 6, 3 and 9).

Note — In this system of numbering, the order of the numbers corresponds to a decreasing bandwidth, that is to say, number of supermastergroup (if any) followed by the numbers of the mastergroup, supergroup, group and channel.

2 Standard frequency allocations on 2.6/9.5 mm coaxial pairs

The CCITT has recommended various methods for allocating supermastergroups, mastergroups, supergroups and 15 supergroup assemblies

on 2.6/9.5-mm coaxial pairs. The method for each standard system is given below. The identification numbers are shown in each figure to facilitate application of the rules set forth above.

2.1 *12-MHz systems using valves or transistors*

The frequency allocation for 12-MHz systems is in conformity with scheme 1A, 1B or 2 shown in Figures 1/M.380, 2/M.380 and 3/M.380.

The CCITT has also recommended the frequency-allocation scheme in Figure 4/M.380 for the simultaneous transmission of telephony and television.

2.2 *4-MHz systems*

Scheme A of Figure 5/M.380 shows the frequency-allocation scheme used in this case. The 2604-kHz pilot is used only in the 2.6-MHz system described below in § 2.3.

The 4287-kHz pilot is recommended only for 4-MHz systems on 1.2/4.4-mm coaxial pairs.

2.3 *2.6-MHz systems*

The frequency-allocation scheme for a 2.6-MHz system uses the scheme in Figure 5/M.380 retaining only supergroups 1 to 10 inclusive.

The pilots are: 60 or 308 kHz and 2604 kHz.

3 Standard frequency allocations on 1.2/4.4-mm coaxial pairs

The CCITT has recommended various methods for allocating supermastergroups, mastergroups, supergroups and 15 supergroup assemblies on 1.2/4.4-mm coaxial pairs. The method for each standard system is given below. The identification numbers are shown in each figure to facilitate application of the rules set forth in § 1 above.

3.1 *12-MHz systems*

The frequency-allocation schemes are the same as for 2.6/9.5-mm pairs (see Figures 1/M.380, 2/M.380 and 3/M.380).

3.2 *6-MHz systems*

The frequency allocation for 6-MHz systems is in conformity with scheme 1, 2 or 3 shown in Figures 6/M.380, 7/M.380 and 8/M.380.

3.3 *4-MHz systems*

The line-frequency allocation scheme A shown in Figure 5/M.380 is the same as for 2.6/9.5-mm pairs. However, the 4287 kHz pilot must be transmitted continuously if one of the Administrations concerned so requests.

Scheme B of Figure 5/M.380 shows the line-frequency allocation scheme used for mastergroups.

3.4 *1.3-MHz systems*

The line-frequency allocation scheme is in conformity with one of the schemes shown in Figures 9/M.380 and 10/M.380.

Figure 1/M.380 p.16

Figure 2/M.380 p.17

Figure 3/M.380 p.18

Figure 4/M.380 p.19

Figure 5/M.380 p.20

Figure 6/M.380 p.21

Figure 7/M.380 p.22

Figure 8/M.380 p.23

Figure 9/M.380 p.24

Figure 10/M.380 p.25

Recommendation M.390

NUMBERING IN SYSTEMS ON SYMMETRIC PAIR CABLE

1 Systems providing 12 telephone carrier circuits on a symmetric pair in cable (12 + 12) systems

In systems of the 12 + 12 type, 12 go and 12 return channels constitute one 12 circuit group.

For the arrangement of the line frequencies transmitted for 12 + 12 cable systems using transistors, the Administrations concerned in setting up such an international system can make their choice from scheme 1 or scheme 2 of Figure 1/M.390. Systems using scheme 2 can use only pilot frequencies of 54 kHz or 60 kHz.

Figure 1/M.390 p.

Figure 1/M.390 also applies to (12 + 12) systems using valves, provided that in the case of scheme 2 the indicated line-regulating pilots of 54 kHz and 60 kHz, or 30 kHz and 84 kHz, can be chosen as pilot frequencies.

2 Systems providing five groups or less

2.1 *Numbering in systems comprising both erect and inverted groups*

2.1.1 *Designation of groups*

The following indications are used to define the position of the group on the line, as shown in Figure 2/M.390:

A: 12-60 kHz group; B: 60-108 kHz group; C: 108-156 kHz group;

A: 12-60 kHz group; D: 156-204 kHz group; E: 204-252 kHz group.

Figure 2/M.390 p.

2.1.2 *Designation of channels*

The position occupied by a telephone channel of a carrier system is designated by means of a letter giving the position of the group (transmitted on the line) containing the channel and by means of the number of the channel within this group.

The designation of a channel on such a carrier system is therefore of the form A-7, C-9, D-4, etc. (i.e. group A, channel 7, etc.).

2.2 *Numbering in systems with inverted groups*

In this case, all the groups are in the same sense. For systems with five groups on symmetric pair cable, this is the normal arrangement which is as shown in Scheme 2 of Figure 2/M.390 | fIc) .

2.2.1 *Numbering of the groups*

The five groups, all in the same sense, are numbered in the direction of ascending frequency, 5, 4, 3, 2, 1 and the assembly constitutes a supergroup having a displacement by 48 kHz towards the lower frequencies of supergroup 1 of 4-MHz coaxial system. For this reason the assembly of groups in the figure is designated by the number 1*, in order to integrate this supergroup with the general numbering for supergroups.

2.2.2 *Numbering of channels*

The place occupied by a telephone channel in such a carrier system is also designated by three numbers, e.g. 1*-4-11 (i.e. supergroup 1*, 12 channel group 4, channel 11).

2.3 *Systems with four groups*

By agreement between the Administrations concerned, one group of supergroup 1* may be omitted, but the above numbering of the groups and channels in the groups should be retained as if no group had been omitted [see scheme 1 | fIbis of Figure 2/M.390 | fIb)].

3 Systems providing two supergroups

3.1 *Alternative frequency arrangements*

The two recommended frequency arrangements are shown in scheme 3 and scheme 4 of Figure 3/M.390. In scheme 4, the line-frequency allocation is the same as that for coaxial cable systems, and permits satisfactory interconnection at basic supergroup frequencies (312-552 kHz) between supergroups in these coaxial systems and the two supergroups on symmetric pair cable systems.

Figure 3/M.390 p.

In scheme 3, the line-frequency allocation for supergroup 1* is the same as that recommended for a 5 group system on symmetric pair cables [scheme 2, Figure 2/M.390 | fIc)].

The frequency allocation shown for supergroup 1* in scheme 3 | fIbis may be used by agreement between Administrations where interconnection with existing systems having five groups or less is required.

3.2 *Numbering of supergroups, groups and channels*

3.2.1 The numbering of the groups and channels on a 2 supergroup system follows the principles given in Recommendations M.320 and M.330.

3.2.2 For supergroup 2 in each scheme and for supergroup 1 in scheme 4 the numbering used is that given in Recommendations M.320 and M.330 for coaxial systems.

3.2.3 For supergroup 1* and l*‘ the numbering used is the same as that shown for scheme 2 and scheme 2 | fIbis in Figure 2/M.390 | fIc)

Recommendation M.400

NUMBERING IN RADIO-RELAY LINKS OR OPEN-WIRE LINE SYSTEMS

For numbering in a radio-relay link using freqency division multiplex, the channels, groups, supergroups, etc., are considered in the position they occupy in the baseband to be transmitted by that link.

In the interests of direct interconnection the CCIR and CCITT have collaborated in drawing up Recommendation G.423 [1] from which it follows that the numbering of the telephony channels, groups and supergroups, etc., of the radio-relay link is as described in Recommendations M.320 to M.390.

The same rules are applied to carrier systems on open-wire lines providing at least one group having 12 telephone channels.

Reference

[1] CCITT Recommendation *Interconnection at the baseband frequencies of frequency-division multiplex radio-relay systems* , Vol. III, Rec. G.423.

Recommendation M.410

NUMBERING OF DIGITAL BLOCKS IN TRANSMISSION SYSTEMS

1 General

This Recommendation gives the numbering of tributaries in digital blocks and the numbering of blocks within higher order blocks and digital line system. The Series G Recommendations referred to below can be found in

Volume III (Digital networks, transmission systems and multiplexing equipments).

2 Primary multiplex equipment

2.1 *Primary PCM multiplex equipment operating at 2048 kbit/s (Recommendation G.732)*

Channel time slots 1 to 15 and 17 to 31 are assigned to 30 telephone channels numbered from 1 to 30 as indicated in Figure 1/M.410.

Figure [T1.410] p.

2.2 *Primary PCM multiplex equipment operating at 1544 kbit/s (Recommendation G.733)*

Channel time slots 1 to 24 are assigned to 24 telephone channels numbered from 1 to 24.

2.3 *Synchronous digital multiplex equipment operating at 2048 kbit/s (Recommendation G.736)*

Channel time slots 1 to 31 are assigned to 31 channels at 64 kbit/s numbered from 1 to 31.

2.4 *Synchronous digital multiplex equipment operating at 1544 kbit/s (Recommendation G.734)*

Channel time slots 1 to 23 are assigned to 23 channels at 64 kbit/s numbered from 1 to 23.

2.5 *Primary PCM multiplex equipment operating at 2048 kbit/s and offering synchronous 64 kbit/s digital access options (Recommendation G.737)*

It should be possible to assign channel time slots 1 to 15 and 17 to 31 to thirty telephone channels numbered from 1 to 30 as indicated in Figure 1/M.410.

Provision should also be made to provide 64 kbit/s digital access to at least two of these channel time slots, allocated in an order of priority given in Recommendation G.737.

If there are *n* telephone channels and (30 — *n*) 64 kbit/s digital accesses, the channels are numbered from 1 to 30, with the digital access channels having DA (digital access) appended to the channel number.

3 Second order PCM multiplex equipments

3.1 *Second order PCM multiplex equipment operating at 8448 kbit/s (Recommendation G.744)*

3.1.1 *Channel time slots assignment for the case of channel associated signalling*

Channel time slots 5 to 32, 34 to 65, 71 to 98 and 100 to 131 are assigned to 120 telephone channels numbered from 1 to 120 as indicated in Figure 2/M.410.

Figure [T2.410] p.

3.1.2 *Channel time slot assignment for the case of common channel signalling*

The telephone channels corresponding to channel time slots 2 to 32, 34 to 65, 67 to 98 and 100 to 131 are numbered from 1 to 127.

When there is a bilateral agreement between the Administrations involved for using channel time slot 1 for another telephone or service channel, this channel will be numbered 0.

3.2 *Second order digital multiplex equipment operating at 8448 kbit/s (Recommendations G.742 and G.745)*

The four tributaries operating at 2048 kbit/s are numbered from 1 to 4 in the order of interleaving.

3.3 *Second order digital multiplex equipment operating at 6312 kbit/s (Recommendation G.743)*

The four tributaries operating at 1544 kbit/s are numbered from 1 to 4 in the order of interleaving.

4 **Higher order multiplex equipment**

4.1 *Digital multiplex equipments operating at the third order bit rate of 34 | 68 kbit/s (Recommendations G.751 and G.753)*

The four tributaries operating at 8448 kbit/s are numbered from 1 to 4 in the order of interleaving.

4.2 *Digital multiplex equipments operating at the fourth order bit rate of 139 | 64 kbit/s (Recommendations G.751 and G.754)*

4.2.1 *Method using a 3rd order bit rate in the digital hierarchy*

The four tributaries operating at 34 | 68 kbit/s are numbered from 1 to 4 in the order of interleaving.

4.2.2 *Method by directly multiplexing 16 digital signals at 8448 kbit/s*

The 16 tributaries at 8448 kbit/s are numbered from 1 to 16: 1 to 4 in the order of interleaving for the first intermediate tributary at 34 | 68 kbit/s, 5 to 8 for the second, 9 to 12 for the third and 13 to 16 for the fourth as indicated in Figure 3/M.410.

Figure [T3.410] p.

4.3 *Digital multiplex equipment based on a second order bit rate of 6312 kbit/s (Recommendation G.752)*

4.3.1 *Third order digital multiplex equipment operating at 32 | 64 kbit/s*

The five tributaries operating at 6312 kbit/s are numbered from 1 to 5 in the order of interleaving.

4.3.2 *Third order digital multiplex equipment operating at 44 | 36 kbit/s*

The seven tributaries operating at 6312 kbit/s are numbered from 1 to 7 in the order of interleaving.

5 Digital line system at 564 | 92 kbit/s on coaxial pairs (Recommendation G.954)

The four tributaries operating at 139 | 64 kbit/s are numbered from 1 to 4 in the order of interleaving.

2.3 Bringing new international transmission systems into service.

Setting up and lining up. Reference measurements

Recommendation M.450

BRINGING A NEW INTERNATIONAL TRANSMISSION | SYSTEM INTO SERVICE

1 Preliminary exchange of information

As soon as Administrations have decided to bring a new international transmission system into service, the necessary contacts are made between their technical services for the exchange of information. Those services jointly select the control and sub-control stations for the new system (see Recommendations M.80 and M.90).

The technical service of each Administration is responsible for the setting-up and lining-up of the line sections on its territory and for arranging that the adjustments and tests required are made by the repeater station staff concerned.

To set up a line section which crosses a frontier, Administrations should arrive at bilateral arrangements on the basis of CCITT Recommendations and, for radio-relay sections, the Recommendations of the CCIR.

2 Setting up sections crossing a frontier

2.1 *Radio-relay section*

Details of the following points will have been settled by a bilateral agreement between the technical services of Administrations:

— geographical position of the radio-relay station nearest to the frontier;

— contour of the terrain of the radio section crossing the frontier, with details of the height of the antennae above normal level;

— directivity characteristic and gain of the antennae;

— radio-frequency channel arrangement (centre frequency, polarization, intermediate frequency);

— provision of supervisory system;

— radio equipment line-regulating pilots (if any);

— continuity pilots, used for supervising the radio-relay link, in accordance with the CCIR Recommendations on the frequency and frequency deviation of this signal, each country transmitting the pilot required by the system in the receiving country;

The *technical service* represents the appropriate authorities within the international maintenance organization of an Administration which have the responsibility for making international agreements on engineering provision and maintenance matters, specifying

provision and maintenance facilities, determining engineering and maintenance policy and overseeing its implementation.

— noise measurement channels outside the transmitted baseband;

— total noise for the radio-relay section;

— frequency deviation of the telephony channel the level of

which at the centre frequency is unaffected by pre-emphasis (either of the telephony channel itself or of the radio-frequency channel of the system);

— pre-emphasis characteristics of the radio-frequency channel;

— service, supervisory and remote channel circuits;

— level, frequency and coding of the signals transmitted over these lines;

— protective switching equipment;

— interconnection points T, R, T‘, R‘ (see Figure 1/M.450) defined in Recommendation G.213 [1] (see also [2] and especially the return loss at points R and R‘ if required (see CCIR Recommendation 380 [3] for values).

Figure 1/M.450 p.

2.2 *Coaxial-pair line section*

Details of the following points will have been settled by bilateral agreement between the technical services of the Administrations:

— the choice of the frequency arrangement to be adopted;

— the pilot signals to be used for regulating the line, in accordance with CCITT Recommendations on the frequency and level of such signals, each country transmitting the pilot signals required by the equipment of the other country (see the table in Recommendation M.540 indicating the pilot frequencies for various systems);

— service, supervisory and remote control circuits;

— repeater identification method and frequencies for fault location and monitoring on transistorized systems;

— provisions for remote power feeding, where a section of the supply line crosses the frontier;

— the regulation systems used by each country;

— the nominal level at various frequencies, at the output of the frontier repeater.

Concerning this last item, at the incoming point, each Administration should as far as possible accept the conditions usual for the system of the other country.

During the lining-up tests, the relative power level measured at the output of the repeater in the unburied repeater station nearest to the frontier should not differ, for any frequency, by more than ± | dB from the nominal value (as defined by a graph drawn up beforehand and based on the characteristics of the system in question).

The frequencies used in lining up the line are determined by agreement between the Administrations concerned. Experience shows that, provided the number of test frequencies required is not too large, it is useful to make these tests at frequencies lying very close to each other at the edges of the frequency band, or at points where irregularities have to be corrected, and at frequencies less close to each other elsewhere in the band.

If the necessary test equipment is available sweep measurements can substantially facilitate the line-up procedure. But in this case also, some test frequencies have to be agreed upon to obtain reference values for later in-service maintenance measurements.

2.3 *Symmetric-pair line section*

The following points will have been settled by bilateral agreement between the Administrations:

— frequency allocation;

— pilots (see the table in Recommendation M.540 indicating the pilot frequencies for various systems);

— service, supervisory or remote control lines, etc.;

— repeater identification method and frequencies for fault location and monitoring on transistorized systems;

— provisions for remote power feeding, where a section of the supply line crosses the frontier.

When a symmetric-pair line section crossing a frontier section is first set up, tests should be made at clearly defined frequencies to determine the insertion loss/frequency characteristics. For example, frequencies spaced at the following intervals could be used, except at the edges of the band, where more closely spaced measuring frequencies are desirable.

4 kHz between 12 kHz and 60 kHz,

8 kHz between 60 kHz and 108 kHz,

12 kHz between 108 kHz and 252 kHz,

24 kHz between 288 kHz and 552 kHz.

The conditions for making measurements at line-pilot frequencies should be agreed by the technical service concerned.

Level measurements at the frequencies chosen will be made at each line amplifier at the unburied repeater station nearest to the frontier. The relative power level measured at any of the frequencies chosen should not differ by more than ± | .0 dB from the nominal value.

3 Overall reference measurements for the line

The section across frontiers and national sections having been set up and connected, reference measurements are made between the high-frequency line terminals of the carrier system, excluding the terminal equipment.

3.1 *Level measurements*

These are made at several frequencies, even if the regulated line section or line link has been equalized by means of sweep frequency measurements.

3.1.1 *Radio-relay line section*

When a radio-relay section is put into service, measurements and adjustments in accordance with the CCIR Recommendations for the radio-relay system concerned are first made of:

— the frequency at which the level is unchanged by pre-emphasis and the deviation of that frequency;

— the level and frequency of the baseband reference frequency;

— the *central position of the intermediate frequency* (if necessary);

— check and adjustment of input and output levels baseband/baseband (see CCIR Recommendation 380 [3] for values);

— measure of overall loss/frequency characteristics using additional measurement frequencies

---

Reference measurements should be made at several frequencies in both directions of transmission between accessible measuring points corresponding as nearly as possible to points R and R' as defined in Recomendation G.213 [1]. These measurements should be made at the frequencies specified in § 3.1.2 for each transmitted bandwidth.

3.1.2 *Coaxial line section*

The frequencies for reference measurements should be selected from the following values. (These values comprise the line pilot frequencies which, of course, cannot be sent into a system with the pilots already being transmitted.)

3.1.2.1 *For a 1.3-MHz system:* 60, 308, 556, 808, 1056, 1304, 1364 kHz.

3.1.2.2 *For a 2.6-MHz system:* 60, 308, 556, 808, 1056, 1304, 1552, 1800, 2048, 2296, 2604 kHz.

3.1.2.3 *For a 4-MHz system:*

— frequency allocation with supergroups:

60, 308, 556, 808, 1056, 1304, 1552, 1800, 2048, 2296, 2544, 2792, 3040, 3288, 3536, 3784, 4092, 4287 kHz;

— frequency allocation with mastergroups (Figure 5/M.380, scheme 2):

308, 560, 808, 1304, 1592, 2912, 4287 kHz.

3.1.2.4 *For a 6-MHz system:*

This frequency may be 5640 kHz.

— frequency allocation with supergroups:

308, 556, 808, 1056, 1304, 1552, 1800, 2048, 2296, 2544, 2792, 3040, 3288, 3536, 3784, 4287, (5680) kHz;

— frequency allocation with mastergroups (Figure 8/M.380, scheme 3):

308, 560, 808, 1304, 1592, 2912, 4287, 5608 kHz.

3.1.2.5 *For a 12-MHz system:*

— at frequencies below 4 MHz:

if frequency allocation without mastergroups is used:

308 , *560* , *808* , 1056, *1304* , 1552, *1800* , 2048, *2296* , 2544, *2792* , 3040, 3288, *3536* and *3784* kHz

(the frequencies in italics are those at which the measurements must always be made);

if frequency allocation with mastergroups is used:

308, 560, 808, 1304, 1592 and 2912 kHz;

A frequency of 8248 kHz can be used as a radio-relay link line regulating pilot. In such a case, the precautions shown in Recommendation G.423 [5] should be applied.

— at frequencies above 4 MHz:

if frequency allocation with 15 supergroup assemblies is used:

5392, 7128, 8248, 8472, 8864, 9608 and 11 | 44 kHz;

if frequency allocation with mastergroups is used:

5608, 6928, 8248 , 8472, 9792 and 11 | 12 kHz.

3.1.2.6 *For an 18-MHz system:*

— if frequency allocation is according to Plan 1 of Recommendation G,334 [4]:

560, 808, 1304, 1592, 2912, 5608, 6928, 8248 , 8472, 9792, 11 | 12, 12 | 78 or 12 | 60, 14 | 08, 15 | 28 and 17 | 42 kHz;

— if frequency allocation is according to Plan 2 of Recommendation G.334 [4]:

560 , *808* , 1056, *1304* , 1552, *1800* , 2048, *2296* , 2544, *2792* , 3040, 3288, *3536* , 3784, *5392* , *7128* , *8248* , *8472* , *8864* , *9608* , *11* | *44* , *12* | *78* or *12* | *60* , *14* | *08* , *15* | *28* and *17* | *42* kHz (the frequencies in italics are those at which measurements must always be made);

— if frequency allocation is according to Plan 3 of Recommendation G.334 [4]:

552, 1872, 3192, 4758, 6272, 7592, 9158, 10 | 72, 11 | 92, 13 | 58, 15 | 72 and 16 | 92 kHz

---

These measuring frequencies are provisional and subject to further study by Study Group XV.

3.1.2.7 *For a 60-MHz system:*

It may be necessary to use this frequency if an adjacent auxiliary line pilot is used for regulation.

— frequencies which do not cause interference to a regulated line section and, therefore, can be sent at any time:

8472, 12 | 78 or 12 | 60 , 17 | 88, 26 | 22, 31 | 22, 35 | 22, 40 | 22 , 42 | 22, 46 | 22, 51 | 22, 55 | 22 kHz;

These frequencies may also be in use as frequency comparison pilots.

In accordance with Recommendation M.500, Administrations choosing to use these frequencies must ensure that interference is not caused to a following regulated line section which may be using these frequencies as line pilots.

— frequencies which should not be sent without the agreement of the Administration at the receiving end:

4200 or 4287 , 8316 , 12 | 35 , 22 | 02, 22 | 72 , 40 | 20 , 59 | 92 kHz.

3.1.3 *Symmetric-pair line section*

Frequency of the line pilot or pilots, and frequencies showing the insertion loss/frequency characteristic of the line, for example, frequencies spaced at:

4 kHz between 12 kHz and 60 kHz,

8 kHz between 60 kHz and 108 kHz,

12 kHz between 108 kHz and 252 kHz,

24 kHz between 288 kHz and 552 kHz.

3.2 *Loss/frequency distortion*

The loss/frequency distortion of the regulated line section (symmetric pair, coaxial or radio-relay link) shall be such that the relative level at any frequency does not differ by more than ± | dB from the nominal level for older type-systems and ± | dB in case of modern transistorized systems.

Reference measurements at the frequencies chosen will be made at all attended stations at the output of each amplifier and also at the unburied station nearest the frontier.

Reference tests at unattended stations other than frontier stations are left to the discretion of each Administration.

The setting of equalizers should be noted and recorded during the reference measurements as well as the temperature of the cable, or the resistance of one of the conductors, from which the temperature could be deduced.

3.3 *Measurement of noise power*

Measurements of noise power shall be made by sending a uniform continuous spectrum signal in the transmitted frequency band in accordance with Recommendations G.228 [6] and G.371 [7] and CCIR Recommendation 399 [8]

In the case of a radio-relay line section, measurements should also be taken outside the baseband on the noise measurement channels indicated in CCIR Recommendation 398 [9]. These noise values will serve as reference values for subsequent maintenance measurements.

3.4 *Complementary measurements*

If the Administrations find it necessary, the following measurements could also be made:

— check of near-end crosstalk with artificial loading of radio channels;

— check of the suppression of line pilots from other regulated sections;

— check of power supply modulation, etc. (including checking of the baseband for the presence of interfering signals from radio-frequency sources outside the system);

— check of stability using a level recorder.

3.5 *Line-up record*

The results of the reference measurements made at the line terminals and at the output of frontier repeaters will be entered in a line-up record, specimens of which are included as examples in Appendices I (coaxial or radio-relay regulated line section line-up record) and II (symmetric-pair regulated line section line-up record) below.

APPENDIX I

(to Recommendation M.450)

H.T. [T1.450]

Line-up record for a coaxial-pair regulated line section

|)

Control station: Designation of link: Direction of transmission | u4): }	Annemasse Annemasse-Courmayeur Courmayeur-Annemasse	Date of measurements: {	16 Novembre 1972	
Stations	Courmayeur	Chamonix	Cluses	Annemasse
Distance (km)	18.6	42.3	34.96	
{ Resistance of conductor used for temperature compensation (ohms) }	982	2222	1846	

Frequencies (kHz) Send | u1) Var. eq. | u2) Rec. | u3) Send | u1) Var. eq. | u2) Rec. | u3) Send | u1) Var. eq. | u2) Rec. | u3)

{
| 08
| 60
| 08
1 | 56
1 | 04
1 | 00
2 | 96
2 | 92
3 | 36
4 | 32
4 | 87
4 | 48
5 | 44
5 | 40
6 | 36
6 | 32
7 | 28
7 | 24
8 | 24
8 | 64
9 | 60
9 | 56
10 | 52
10 | 48
11 | 44
12 | 40
12 | 35
} {
—65.**2**
—65.**2**
—65.2
—65.3
—65.3
—65.4
—65.4
—65.4

—65.4	
—65.3	
—65.3	
—65.3	
—65.2	
—65.1	
—65**.1**	
—64.7	
—64.5	
—64.3	
—64**.4**	
—63.4	
—63**.4**	
—62.4	
—61.7	
—61**.1**	
—60.2	
—58.6	
—58.1	
}	{
—8	
—6	
—6	
—6	
—6	
—4	
—4	
—6	
—8	
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}	{
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—53.8	
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—53.9	
—53.9	
—53.8	
—53.8	
—53.8	
—53.9	

—53.9
} {
—65.**2**
—65.2
—65.2
—65.3
—65.4
—65.5
—65.5
—65.4
—65.4
—65.2
—65.3
—65.2
—65.3
—65.**3**
—65.**3**
—64.7
—64.5
—64.3
—64.**4**
—63.5
—63.**1**
—62.5
—61.8
—61.**5**
—60.2
—58.6
—58.5
} Not used {
—53.7
—53.7
—53.7
—53.7
—53.9
—53.8
—53.8
—53.8
—53.9
—53.7
—53.7
—54.**7**
—54.**7**
—53.8
—53.8
—53.9
—54.1
—54.**7**
—53.8
—54.1
—53.8
—53.8
—53.8
—53.9
—54.1
—54.**7**
—54.1
} {
—64.7
—64.8
—65.1
—65.1
—65.**8**

—65.4	
—65.4	
—65.4	
—65.4	
—64.8	
—65.1	
—65.2	
—65.7	
—64.9	
—64.9	
—64.8	
—65.1	
—63.9	
—63.6	
—62.8	
—62.3	
—61.6	
—60.9	
—60.4	
—58.6	
—58.4	
}	{
—4	
—2	
—4	
—4	
—4	
—2	
—2	
—2	
—2	
—2	
—4	
—6	
—6	
—4	
—6	
+4	
}	{
—53.8	
—53.7	
—53.8	
—53.8	
—53.9	
—53.9	
—53.9	
—53.9	
—53.9	
—53.8	
—53.9	
—54.1	
—53.8	
—54.7	
—53.8	
—53.8	
—53.8	
—53.7	
—53.7	
—53.7	
—53.6	
—53.6	
—53.6	
—53.8	

—53.7 —53.8									

*) Can also be used for a radio-relay regulated line section.

1) 600 ohm through-level (dB) at repeater output points.

2) Variable equalizer setting.

3) 600 ohm through-level (dB) at special measuring points.

4) There will be a corresponding form for the other direction of transmission.

} _

tableau (appendice I) [T1.450] p.33

APPENDIX II
(to Recommendation M.450)

H.T. [T2.450]
Line-up record for a symmetric-pair line

Control station:	Antwerpen	Date of measurements:	10 Octobre 1959
Designation of link:	Antwerpen-Rotterdam	Issue:	22 March 1960
	{		
Direction: Antwerpen-*Rotterdam*			
}	{		
Direction: Rotterdam-*Antwerpen*			
}			

Distance (km)	15.8	17.7	72.4	72.4	17.7	15.8		
Test frequencies kHz	Ant- werpen dB	Brasschaat dB	Zundert dB	Rotterdam dB	Rotterdam dB	Zundert dB	Brasschaat dB	Ant- werpen dB
{								
12								
16								
20								
24								
28								
32								
36								
40								
44								
48								
52								
56								
60								
68								
76								
84								
92								
100								
108								
120								
132								
144								
156								
168								
180								
192								
204								
216								
228								
240								
252								
256								
}	+1.75 Sending station	{						
+1.75								
1.75								
1.75								
1.80								
1.85								
1.85								
1.85								
1.80								
1.80								
1.75								
1.75								
1.75								
1.80								
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1.70								
1.70								
1.75								
1.80								
1.80								
1.85								
1.85								
1.85								
1.80								
1.80								
1.85								
1.90								

1.85
1.80
1.75
1.75
1.70
1.70
} {
+1.80
1.80
1.80
1.85
1.85
1.90
1.90
1.90
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1.85
1.85
1.80
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1.90
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1.80
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1.75
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1.70
1.65
} {
+1.85
1.90
1.90
1.95
1.90
1.90
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1.80
1.75
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1.75
1.80
1.80
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1.85
1.85
1.90
1.95
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1.95

1.90
1.90
1.85
1.80
1.75
1.70
1.65
1.65
1.60
} +1.75 Sending station {
+1.65
1.65
1.70
1.70
1.70
1.75
1.75
1.75
1.80
1.80
1.75
1.75
1.70
1.70
1.70
1.70
1.65
1.65
1.65
1.70
1.70
1.75
1.80
1.85
1.85
1.90
1.90
1.95
2.00
2.00
1.85
1.70
} {
+1.65
1.70
1.70
1.70
1.65
1.65
1.70
1.70
1.75
1.75
1.70
1.75
1.65
1.65
1.60
1.65
1.65
1.70
1.70
1.75

lw(66p) | cw(18p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) .

lw(66p) | cw(18p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) .

lw(66p) | cw(18p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) .

lw(66p) | cw(18p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) | cw(24p) | cw(18p) .

1.80 1.85 1.85 1.90 1.95 1.90 1.85 1.80 1.80 1.80 1.80 1.75 } +1.65 1.65 1.70 1.70 1.75 1.80 1.80 1.85 1.90 1.90 1.90 1.85 1.85 1.85 1.80 1.75 1.75 1.75 1.70 1.70 1.70 1.75 1.80 1.80 1.85 1.80 1.80 1.80 1.75 1.75 1.70 1.70 }	{							
60 kHz line pilot	—13.2	—13.1	—13.1	—13.2	—13.2	—13.2	—13.3	—13.1
{ Additional measuring frequencies | u1) }	—	—	—	—	—	—	—	—
Equalizers	—	0	+1	0	—	+1	+1	+1
Temperature or resistance	—	391 | (*W	221 | (*W	+4.7 | (deC	—	+4.5 | (deC	226 | (*W	392 | (*W

1) Indicate frequencies of these pilots.

tableau (appendice II) [T2.450] p.34

References

[1] CCITT Recommendation *Interconnection of systems in a main repeater station* , Vol. III, Rec. G.213.

[2] CCIR Recommendation *Interconnection at baseband frequencies of radio-relay systems for telephony using frequency-division multiplex* , Vol. IX, Rec. 380, Annex I, ITU, Geneva, 1986.

[3] CCIR Recommendation *Interconnection at baseband frequencies of radio-relay systems for telephony using frequency-division multiplex* , Vol. IX, Rec. 380, ITU, Geneva, 1986.

[4] CCITT Recommendation *18-MHz systems on standardized 2.6/9.5-mm coaxial cable pairs* , Vol. III, Rec. G.334.

[5] CCITT Recommendation *Interconnection at the baseband frequencies of frequency-division multiplex radio-relay systems* , Vol. III, Rec. G.423.

[6] CCITT Recommendation *Measurement of circuit noise in cable systems using a uniform-spectrum random noise loading* , Vol. III, Rec. G.228.

[7] CCITT Recommendation *FDM carrier systems for submarine cable* , Vol. III, Rec. G.371.

[8] CCIR Recommendation *Measurement of noise using a continuous uniform spectrum signal on frequency-division multiplex telephony radio-relay systems* , Vol. IX, Rec. 399, ITU, Geneva, 1986.

[9] CCIR Recommendation *Measurements of noise in actual traffic over radio-relay systems for telephony using frequency-division multiplex* , Vol. IX, Rec. 398, ITU, Geneva, 1986.

Recommendation M.460

BRINGING INTERNATIONAL GROUP, SUPERGROUP, ETC.,

LINKS INTO SERVICE

1 Preliminary exchange of information

The technical services concerned nominate the control and sub-control stations for the link to be brought into operation in accordance with Recommendations M.80 and M.90.

The technical services should indicate the routing to be followed and the method given in Recommendation M.570 may be applied. In the case of group or supergroup links, they will mutually agree on the pilot or pilots to be used.

Note — When group, supergroup, etc. links are used to provide the terrestrial links to a time division multiple access (TDMA) satellite system, the pilots are not transmitted over the satellite section. An alternative method of supervision for the individual circuits is described in Recommendation Q.33 [1].

In determining the routing of group links, in order to avoid interference between the pilots on two supergroup links, the technical services will try to arrange that position No. 3 is not occupied by the same group link on two supergroup links. (Where this is impossible, the supergroup pilot should be blocked at the through-group connection point.)

Information necessary for the control station, which will be entered on a *routing form* [see specimens in Appendix I (supergroup routing form) and Appendix III (A or B) (group routing form) of this Recommendation] is indicated below:

— routing of the link,

— names of control and sub-control stations,

— through-connection points,

— points where regulators are fitted.

The overall routing form for the entire link is drawn up by the control station on the basis of information furnished by its technical service and by each sub-control station for the sections for which the latter is responsible.

When the group link is assigned its designation (according to Recommendation M.140, §§ 5 and 6), the Administration with control station responsibility will assemble the necessary technical and operational information. This is entered into the list of *Related information* (as defined in Recommendation M.140, § 7) which consists of the items shown in Annex A.

2 Frequencies and levels of group, supergroup, etc., pilots

2.1 Details of the recommended frequency and level of pilots are given in Table 1/M.460.

The specifications of terminal equipments provide that for every group or supergroup two pilots can be simultaneously transmitted. However, the normal case is that only one is being transmitted.

Note — Special considerations apply to the use of group and supergroup pilots if circuits are to be provided using Signalling System R2. Group and supergroup pilots placed at 140 Hz from a virtual carrier frequency are incompatible with signalling at 3825 Hz. Hence, the pilot at 84.140 kHz should not be applied to groups in which channel 6 is to be operated with this out-of-band signalling. Similarly, the pilot on 411.860 kHz should not be applied to supergroups in which channel 1 of the group in the group 3 position is to be operated with signalling at 3825 Hz.

H.T. [T1.460]

TABLE 1/M.460

{	Frequency (kHz) 8 ch. and 12 ch.	Power level | ua) 16 ch.	dBm0
Basic group (60-108 kHz)	84.080 84.140 104.080	84 | ub)	—20 —25 —20
Basic supergroup	411.860 411.920 547.920	. 444 | uc)	—25 —20 —20
Basic mastergroup	1 | 52	—20	
Basic supermastergroup	11 | 96	—20	
Basic 15 supergroup assembly	1 | 52	—20	

a) To avoid errors in interpreting measurement results, the results of measurements on pilots will be stated in terms of the departure from the nominal pilot level in dBm at that particular point.

b) A pilot of 84 kHz is normally used. A different frequency can be used by agreement between Administrations.

c) A pilot of 444 kHz with a power level of —20 dBm0 is used.

TABLE 1/M.640 [T1/.460], p.

2.2 *Level tolerances for transmitted pilots*

2.2.1 At the point where a pilot is injected, its level should be so adjusted that its measured value is within ± | .1 dB of its nominal value. The measuring equipment used for making this measurement must give an accuracy of at least ± | .1 dB.

2.2.2 The change in output level of the pilot generator with time (which is a factor included in equipment specifications) must not exceed ± | .3 dB.

2.2.3 The total maximum variation resulting from §§ 2.2.1 and 2.2.2 above will be ± | .5 dB. It is advisable to have a device to give an alarm when the variation at the generator output exceeds these limits, the zero of the warning device being aligned as accurately as possible with the lining-up level of the transmitted pilot.

2.3 *Frequency tolerances for transmitted pilots*

The permissible frequency tolerances for transmitted pilots are as follows:

— 84 kHz and 444 kHz (if used as reference pilots for 16-channel systems) ± | Hz

— 84.080 kHz and 411.920 kHz pilots ± | 1 Hz

— 84.140 kHz and 411.860 kHz pilots ± | Hz

— 104.080 kHz and 547.920 kHz pilots ± | Hz

— 1552-kHz pilot ± | Hz

— 11 | 96-kHz pilot ± | 0 Hz

3 Frequencies and levels of test signals

Reference measurements for a link and its component sections are made at some or all of the following frequencies:

— supermastergroup link:

8516, 9008, 11 | 96, 11 | 48, 12 | 88 kHz;

— 15 supergroup assembly link:

312, 556, 808, 1056, 1304, 1552, 2048, 2544, 3040, 3536, 4028 kHz;

— mastergroup link:

814, 1056, 1304, 1550, 1800, 2042 kHz;

— supergroup link (4-kHz channels):

313, 317, 333, 381, 412, 429, 477, 525, 545, 549 kHz;

— supergroup link (3-kHz channels or 3+4-kHz channels):

312.1, 313, 317, 333, 381, 412, 429, 477, 525, 545, 549, 551.9 kHz;

— group link (4-kHz channels):

If the group-measuring frequencies are generated by applying 1020 Hz to the input of channel modulating equipment, special precautions will have to be taken at the receiving end to prevent carrier leak from affecting the readings of the measuring equipment. In these circumstances, the measuring device must be of the selective kind. For further information about the choice of the test signal frequency, refer to Recommendation O.6 [2].

61, 63, 71, 79, 84, 87, 95, 103, 107 kHz ;

— group link (3-kHz channels):

60.1, 60.6, 61, 63, 71, 79, 84, 87, 95, 103, 107, 107.3, 107.9 kHz

Administrations may also make measurements at other frequencies as considered necessary. In the case of group and supergroup links of simple constitution, three measuring frequencies (midband and at the two edges) may suffice.

The overall loss will be measured by means of a test frequency being equal or very close to the reference pilot frequency.

The level of the test signal to be used for the measurements will be —10 dBm0.

4 Reference measurements for a link

The measurements described in § 7.2 below for lining-up also constitute reference measurements. These data should be recorded at every group, supergroup, etc. sub-control station and in the through-connection stations adjacent to frontiers and, on request, forwarded to the control station which then can draw up a *line-up record* .

5 Some features of a multiple destination unidirectional transmission link as might be provided by a communication-satellite system

This section refers to Figure 1/M.460, which is drawn in terms of a supergroup. An analogous arrangement can occur for groups or, in principle, for higher-order assemblies. There is no loss of generality in describing the arrangement of a supergroup.

Figure 1/M.460, p.

5.1 In the example the supergroup is assembled in London and portions of it appear in three other places. Hence the designatory letter M standing for **MULTIPLE DESTINATION** .

5.2 In the return directions of transmission for any or all of the groups in this supergroup, the transmission path may be quite different and will not necessarily bear any relationship to the direction illustrated. Hence the designatory letter U standing for **UNI-DIRECTIONAL** .

5.3 The supergroup may be set up initially with only some of the destinations, for example, Montreal may be connected some time, say a year or so, after Bogota and Lusaka.

Furthermore, a destination may alter the amount of bandwidth it exploits, e.g. Bogota may initially derive Groups 1 and 2, Group 5 being derived some time later.

5.4 The portions of the supergroup defined by the stations 1-2-3, 4-5-6, and 8-9 are supergroup sections which are to be treated in the way described in the following paragraphs of this Recommendation.

5.5 The routings connecting stations 3, 4, 7 and 8 to their corresponding earth stations A, B, C and D can be markedly dissimilar. For example, the routing to control station 4 from earth station B need not resemble in any way the analogous routing from earth station D to control station 8. Control station 4 may be at the earth station, that is, the *distance* between B and 4 is zero whereas the *distance* between D and 8 may be several hundreds of miles perhaps and may be routed over a variety of coaxial line or radio-relay systems.

5.6 The portion 1-2-3 is referred to as a *common path* . Operations on the common path can affect all destinations whereas operations on the other paths (4-5-6 and 8-9) can affect only one destination.

5.7 Station 3 is likely to have a community of interest with each of stations 4, 7 and 8. This is not necessarily so likely among 4, 7 and 8 themselves.

5.8 The stations 4, 7 and 8 each receive the whole of the basic supergroup band from station 3 though none of them exploits the whole of it.

The above-mentioned distinctive features of a multiple destination unidirectional group, supergroup, etc. (such as might be provided by a communication-satellite system) make special procedures for lining-up and maintenance a necessity. This fact is taken into account below.

6 Organization of the control of an international group, supergroup, etc.

6.1 *Classes of station*

6.1.1 As far as international cooperation is concerned, only two classes of through-connection stations need be designated by any country:

a) stations which exercise control functions, i.e. group, supergroup, etc., control stations and group, supergroup, etc., sub-control stations;

b) attended stations nearest the frontier, which in this Recommendation are referred to as *frontier stations* .

6.1.2 In accordance with Recommendations M.80 and M.90 the station at each end of the group, supergroup, etc., is the *control station* for the receiving direction of transmission and the terminal *sub-control station* for the sending direction. Stations having control functions in intermediate countries are *group, supergroup, etc., intermediate sub-control stations* . Other stations involved in international maintenance are frontier stations.

6.1.3 In general, a transit country will have one station with control functions or one with sub-control functions and two frontier stations. A country in which the group, supergroup, etc., terminates has only one frontier station. In some countries, a station with control functions or sub-control functions and a frontier station will be the same.

6.2 *Classes of group, supergroup, etc. section*

For the purposes of setting-up, lining-up and subsequent maintenance, an international group, supergroup, etc., link is subdivided into national sections, international sections and main sections as defined in Recommendation M.300.

These terms are illustrated in Figure 2/M.460.

Figure 2/M.460, p.

6.3 *Organization of control functions*

The terminal stations of each national, international and main section will be appointed as a control or sub-control station for that class of section with which they are concerned. However, as a consequence of the definitions of national, international and main sections of a link some stations will be nominated for more than one control or sub-control function. For example, station S in Figure 2/M.460 is:

— control station for main section Q-S,

— sub-control station for main section S-T,

— control station for national section R-S.

6.4 *Control functions in case of multiple destination (MU) transmission links*

The multiple destination unidirectional section defined by the through-connection stations nearest to the earth stations is to be a main section. The full designation is: *multiple destination unidirectional main group, supergroup, etc., section.*

In the example (Figure 1/M.460), stations 3, 4, 7 and 8 serve to define this main section.

The through-connection stations defining the extent of the MU main section will be assigned the control functions normally called for in the case of group, supergroup, etc. sections.

It follows that if the group, supergroup, etc., appears in the earth station at the basic group, supergroup, etc., frequencies, the earth station must function as a main section control or sub-control station for the multiple destination unidirectional section.

A very clear distinction must be made between:

— satellite control stations that might be concerned with baseband-to-baseband response (for example),

— group, supergroup, etc., control stations concerned with the performance of the group, supergroup, etc. (These are places where the bands 60-108, 312-552 kHz, etc., are normally accessible.) Such control stations are not called *satellite* stations because group, supergroup, etc., control functions are independent of the means of transmission.

In addition:

— the sub-control station for the MU main group, supergroup, etc., section is designated the *send reference station* for the MU main group,

supergroup, etc., section (in the example, station 3 is so designated).

Again the distinction must be maintained between any coordination stations nominated for the satellite system (concerned with baseband, etc., matters) and MU main group, supergroup, etc., section reference stations. If stations 3, 4, 7 and 8 are physically in earth stations A, B, C and D respectively, then those earth stations will also have to function as the MU main section reference stations in addition to other responsibilities associated with coordination functions of the satellite system.

In addition to the responsibilities conferred on the send reference station by Recommendations M.80, M.90 and this Recommendation, the following responsibilities also apply:

a) coordinating the lining-up of the MU main section;

b) cooperating with MU main section control stations during the lining-up of the section;

c) keeping a record of the measurements made at MU section control stations during the lining-up of the section;

d) coordinating maintenance action for the MU main section when called upon to do so by one of the MU main section control stations.

7 Setting up and lining up an international group, supergroup, etc., link

7.1 *Setting up the link*

7.1.1 Once the route has been agreed, the supermastergroup, mastergroup, supergroup or group link control station will direct the operations needed to set up the link.

All the repeater stations concerned — i.e. the stations at the ends of each supermastergroup, mastergroup, supergroup, or group section that will make up the link — should make setting-up tests and check the equipment to be used, such as the through supermastergroup, mastergroup, supergroup, and group filters, etc. The check should include a general visual inspection and vibration tests, particularly if the equipment has remained unused for some time since acceptance tests were carried out after installation.

7.1.2 Each country sets up the national part within its territory, each international supermastergroup, mastergroup, supergroup or group section is set up by the stations at the ends of this section in the two countries concerned (which are the supermastergoup, mastergroup, supergroup or group through-connection stations closest to the frontier) and these national and international supermaster-group, mastergroup, supergroup or group sections are interconnected by through-supermastergroup, through-mastergroup, through-supergroup or through-group filters, as may be appropriate. The

sub-control stations inform the control station when each interconnection is completed.

7.2 *Lining up the link*

7.2.1 The lining-up procedure for an international group, supergroup, etc., link is based on the progressive line-up of its component sections as follows. The limits to apply are given in Table 2/M.460.

i) National and international sections, which are then interconnected to form main sections.

ii) Main sections. When there are three or more main sections, the line-up is made in two or more stages. The first two main sections are connected together and lined up to main section standards, the third main section is added and this part of the link lined up, and so on.

iii) Overall link

a) Comprising two main sections. The two main sections are connected together and the link lined up to the standards given in Table 2/M.460.

b) Comprising three and more main sections. Lining-up is in two or more stages. The first two main sections are connected together and lined up to main section standards. The third main section is added and the complete link

lined up. With more than three main sections the overall link is lined up accordingly in more than two stages.

The frequencies and levels of the pilots and testing signals are given in §§ 2.1 and 3 above.

Note — Where circuits using Signalling System R2 are to be provided, additional measurements on group and supergroup links may be necessary. The group-translating and through-connection equipments are specified with a passband extending from 60.600 kHz to 107.700 kHz. If it is wished to use channel 12 with signalling at 3825 Hz, it is necessary to ensure when the group is set up, that the corresponding frequency (60.175 kHz) is transmitted satisfactorily from end to end of the group link.

Provisionally, in view of the operating margin of the receiving part of the signalling equipment, it is desirable to check that the attenuation at this frequency does not exceed the attenuation at the group-pilot frequency by more than 3 dB.

A similar precaution should be taken on setting up group links when signalling is to be used at 3825 Hz on channel 12 of the group transmitted in position 5 of the supergroup.

7.2.2 In addition to the measurements specified in § 7.2.1 above, the levels of unwanted signals and random noise at the receive end of group and supergroup links may also be checked. Such additional measurements are optional, and need only be carried out at the discretion of Administrations. The following (provisional) limits should apply for group and supergroup links:

7.2.2.1 *Unwanted signals*

The levels of unwanted signals should not exceed the following values:

a) —40 dBm0 (provisional), where such signals originate from carrier or pilot generating equipment;

b) —60 dBm0 (provisional), where such signals originate from other sources.

The measured levels of any unwanted signals, and their location in the group or supergroup frequency band, should be recorded for subsequent maintenance purposes. (See Supplement 3.6 [3].)

7.2.2.2 *Random noise*

Random noise should be measured using an instrument with an effective noise bandwidth of 3.1 kHz taking into account the correction factor for weighting which is 2.5 dB or using an instrument with an effective bandwidth of 1.73 kHz. (See Recommendation G.223 [4].)

The limits in Table 3/M.460 apply.

H.T. [T2.460]
TABLE 2/M.460
Line-up limits

	{ { Remarks Groups (dB)	Supergroups (dB)	Groups (dB)	Supergroups (dB)	
{ 1. National and international sections }					
{ a) Sections which are not main sections }	±0.5	±0.5	**±1.5**	±1.5	
b) Main sections	±0.1	±0.1	**±1.5**	±1.5	
2. Main sections A main section equalizer, whether terminal or intermediate, is not considered to be part of a national or international section. }	±0.1	±0.1	**±1.5**	±1.5	{
3. Link A link equalizer is not considered to be part of a main section. }	±0.1	±0.1	±1.5	±2.0	{

TABLE 2/M.460 [T2.460], p.

H.T. [T3.460]
TABLE 3/M.460
Limits for random noise on group and supergroup links

Distance in kilometres	320	321 to 640	641 to 1600	1601 to 2500	2501 to 5000	5001 to 10 | 00	10 | 01 to 20 | 00
Noise (dBm0p)	—56	—54	—52	—50	—47	—44	—41

Note — For satellite routed group and supergroup links, the satellite section (between earth stations) will contribute approximately 10 | 00 pWp (—50 dBm0p) to the overall random noise. Therefore, for the purpose of determining the noise limits for satellite routed group and supergroup links, the section provided by the satellite may be considered to be equivalent to a length of 2500 km. The effective noise length of such a link will be 2500 km plus the length of the terminal routings.

TABLE 3/M.460 [T3.460], p.

It should be noted that the measured level of random noise will be influenced by unwanted signals in the group or supergroup frequency band. This must be taken into account when considering the results of random noise measurements.

7.2.3 *Frequency error*

The frequency error over the group link should not exceed 5 Hz. When this measurement is necessary, it should be made according to bilateral agreement between Administrations.

7.3 *Lining up an MU main section for the first time*

The MU main section will first be lined up between the send reference station and the initial MU main section control station using the procedure and limits given above. The whole of the band should be brought to within the appropriate limits even if the destination concerned is not exploiting the whole band. This is to ensure that the various pilots and other measuring signals that can be inserted (for example, intersupergroup measuring signals) are received at the correct levels, and can be measured at the receive station to provide valid reference measurement results for use in maintenance. There are other obvious advantages if this could be done. Unforeseen increases in exploitation or rearrangement of the allocated bandwidth (permanent or emergency) would be eased if the whole band were equalized. Such matters the Administration concerned must decide.

The sections to the other MU main section control stations (associated with the paths to the other destinations) should now be lined up in accordance with the procedures given above.

7.4 *Lining up (or other maintenance operations) on the common path of an MU group, supergroup, etc., when portions of its bandwidth are already in service*

Operations on the exclusive path to a particular destination, made by an intermediate station, need the consent of only one control station. However, operations on the common path would, in principle, require the consent of several remote control stations.

In consequence, the following recommendations are made:

7.4.1 Control and sub-control stations on the common path should be equipped with decoupled testing points. It is recommended that these decoupled testing points be test hybrids because there is no need to break the transmission path and make terminated-level measurements if test hybrids are used and, furthermore, test signals may be inserted via a test hybrid.

7.4.2 The only signals that may be inserted and measured are:

— pilot signals;

— additional measuring signals (e.g. intersupergroup measuring signals);

— test signals at frequencies lying within the portion of the band concerned (for example, referring to Figure 1/M.460 if Group 4 to Montreal is to be lined up (all others being in service) then stations 1 or 3 may be required to inject signals only at frequencies lying in the band 456-504 kHz).

7.4.3 On the MU main section the record of the response of the portion of bandwidth concerned held by the send reference station can be used to see if any significant difference exists between what was originally achieved on the portion between the send and receive stations.

7.5 *Records*

For each class of section, terminal receiving stations will make terminated-level measurements and sending and intermediate stations will make through-level measurements.

The measurements made at each station should be recorded for reference purposes and be made available to the appropriate control stations as required.

7.6 *Connecting the group, supergroup, etc., reference pilot*

Control stations, sub-control stations and frontier stations may

be equipped with reference pilot monitors fitted with limit alarms. In addition, there may be automatic devices at these stations in accordance with Recommendation M.160. Pilot monitors should be provided at the input to the automatic regulator.

The settings of such pilot monitors and automatic regulators at different stations are interdependent and the devices must be set up successively.

7.6.1 The sending terminal station should connect the reference pilot at a level that is within ± | .1 dB of the nominal value. (This sometimes requires an appropriate translating equipment to be connected at this stage.)

7.6.2 The frontier stations and the control station of the first main section should be successively asked to check the level of the reference pilot and, where appropriate, to adjust any pilot monitors, automatic regulators or other devices associated with the link.

a) The level at the frontier stations and at the main section control station should be checked to verify that there is nothing obviously wrong. (In general, small variations in level are to be expected and no limits can be given. Automatic regulation devices are installed to compensate for these small changes, which must therefore be accepted.)

b) The pilot monitors should be adjusted so that they subsequently indicate departures from the line-up value, that is to say, they should be adjusted to indicate 0 dB under line-up conditions. Stations not equipped with pilot monitors should measure and record the level of the group reference pilot.

c) At stations where automatic regulation devices are fitted they should be arranged to operate symmetrically about the line-up level. At main section control stations they should be adjusted, where appropriate, so that the output level of the reference pilot is within ± | .1 dB of the nominal value of the reference pilot level.

7.6.3 When the first main section has been dealt with, the first main section control station should inform the control station of the second main section, which should then follow the procedure of § 7.6.2 |)-c) above, the sending terminal station leaving the reference pilot connected.

7.6.4 When the second main section has been dealt with, the second main section control station should inform the control station of the third main section, which again follows the procedure of § 7.6.2 |)-c) above, and so on until the whole of the link has been lined up.

In the case of MU links the appropriate reference pilot should be connected by the MU terminal sub-control station after the sections in the common path have been successively adjusted in accordance with §§ 7.2 and 7.3 above. Then, the MU main section control stations should make any necessary adjustments to pilot receivers or automatic regulators. The reference pilot signals now appearing on the remaining section on each of the paths to the various destinations are adjusted as stated above.

8 Reliability tests on the link

When the initial overall lining-up measurements have been made on a link, and the automatic regulators (if any) have been installed, it is desirable to check the working of the link before putting it into service by testing it over a period of a few hours, if practicable. If the observed results are not satisfactory, taking into account the routing of the link and the services involved, the check should be continued to allow the trouble to be investigated and cleared. The checking is done using the pilot (or, if there is none, using a test frequency at about the same frequency), whose level is continuously recorded during the test, at the far end of the link. The

recording devices should be able to record short interruptions in addition to recording the level.

9 Setting up lower order sections after line-up of the higher order links

The different orders of sections have to be set up in sequence.

9.1 Thus, when a supermastergroup link, mastergroup link or supergroup link has been lined up, each end of it is connected to the appropriate translating equipment (supermastergroup link to mastergroup translating equipment, mastergroup link to supergroup translating equipment, and supergroup link to group translating equipment) and the corresponding lower-order sections are then set up.

9.2 The translating equipment, before it is connected to the ends of the link, must be checked and adjusted to ensure that it meets CCITT Recommendations and other relevant specifications.

9.3 When the lower-order sections have been set up in the above manner, they are interconnected as necessary to form links, as described in § 7.1 above, and the appropriate link line-up procedure as detailed in §§ 7.2 to 7.4 above, is then applied.

10 Setting up and lining up links for wide-spectrum transmission (data, facsimile, etc.)

When the whole bandwidth of a group, supergroup, etc., link is used for wide-spectrum transmission (data, facsimile, etc.) the transmission characteristics are those of the relevant Recommendations of Volume III and IV of the *CCITT Book* . In particular, Recommendations H.14 [5], M.900 [6] and M.910 [7] concern such group links.

ANNEX A

(to Recommendation M.460)

Designation information on international group links, etc.

A.1 *Designation*

The designation is according to Recommendation M.140, §§ 5 and 6.

A.2 *Related information (RI)*

The additional information on groups etc. is covered by the following items:

RI 1. Urgency for restoration;

RI 2. Terminal countries;

RI 3. Carriers' names;

RI 4. Control and sub-control station(s);

RI 5. Fault report points;

RI 6. Routing;

RI 7. Association;

RI 8. Equipment information;

RI 9. Use;

RI 10. Transmission medium;

RI 11. (Empty item, use ‘‘—;’’) only for the mixed analogue-digital network: End-to-end information;

RI 12. Bandwidth;

RI 13. Occupancy (for groups/supergroups, etc. and for line links).

The various items will be dealt with in § 7 of Recommendation M.140.

APPENDIX I
(to Recommendation M.460)

H.T. [T4.460]
Routing form
| u1) **for a supergroup**

1.	Date of issue	1 December 1978
2.	Technical service of	United Kingdom
3.	Supergroup designation	{ Bruxelles (1)—London (Stag Lane) 6011 }
4.	Length	446 km
5.a)	{ Control stations for supergroup }	{ London (Stag Lane), Bruxelles (1) }
5.b) |)	{ Sub-control stations in the direction London to Bruxelles }	{ London (Stag Lane), Broadstairs, Oostende }
5.b) | i)	{ Sub-control stations in the direction Bruxelles to London }	{ Bruxelles (1), Oostende, Broadstairs }
6.	{ Station where automatic regulators are fitted }	London (Stag Lane)
7.	{ Supergroup pilot frequency(ies) }	411.92 kHz

{		Section in cable	Section on radio link	Coaxial pair sections Number of coaxial system	{ Position of supergroup	Designation of radio link	Position of supergroup	Symmetrical pair sections Remarks | u3)		
A	B	C	D	E	F	G	H	J	K	L
London (Stag Lane)								—35	—30	
	193			1002	6					Coaxial pair
Broadstairs								—35	—30	
	119									Submarine cable
Oostende								—35	—30	
	134			30002	4					Coaxial pair
Bruxelles (1) —35 }								—30	{	

1) A diagram can be associated in complicated cases.

2) Underline through-supergroup points.

[3] Mention any special types of carrier system, e.g. submarine cable system. In such cases state the frequency band for the two directions of transmission. Show type of through-supergroup equipment and supplementary information if necessary.

TABLE [T4.640], p.

Blanc

APPENDIX II
(to Recommendation M.460)

H.T. [T5.460]
Line-up record for a supergroup link

Date of issue	1 December 1978
Technical service of	United Kingdom
Supergroup designation	{
Bruxelles (1)—London (Stag Lane) 6011	
}	
Length	446 km
Control station	Bruxelles (1)
Sub-control station	{
Broadstairs, Oostende, London (Stag Lane)	
}	
Date of measurements	November 1978
Direction	London-Bruxelles

Distance (km)	Stations	{																
		Pilot B | u1) 313	Measur- ing point 317	{ 333	381	429	477	Test frequencies kHz 525	545	549								
193	London (Stag Lane)	0	0	0	0	0	0	0	0	0	0	HF Test and fatch frame	NS	—35	75		
119	Broadstairs	—0.1	—0.1	—0.1	0	0	0	0	—0.1	—0.1	0	HF Test and fatch frame	NS	—35	75		
134	Oostende	—0.3	—0.1	—0.1	0	0	0	0	—0.2	—0.2	0	SDF	S	—35	75		
	Bruxelles (1)	—0.4	—0.2	—0.1	0	0	0	0	—0.2	—0.4	0	SDF	S	—30	75		

TABLE [T5.460], p.

Blanc

APPENDIX III (A)
(to Recommendation M.460)

EXAMPLE FOR A SIMPLE GROUP

H.T. [T6.460]
Routing form
| u1) **for a group**

1.	Date of issue	1 June 1979
2.	Technical service of	United Kingdom
3.	Group designation	{
London (Faraday)-Amsterdam (1) 1203		
}		
4.	Length	516.5 km
5.a)	Control stations for group	{
London (Faraday), Amsterdam (1)		
}		
5.b) |)	{	
Sub-control stations in the direction London to Amsterdam		
}	{	
London (Faraday), Aldeburgh, Goes		
}		
5.b) | i)	{	
Sub-control stations in the direction Amsterdam to London		
}	{	
Amsterdam (1), Goes, Aldeburgh		
}		
6.	{	
Stations where automatic regulators are fitted		
}	{	
London (Faraday), Amsterdam (1)		
}		
7.	Group pilot frequency(ies)	84.080 kHz

A	B	C	D	E	F	G	H	J
London (Faraday)						—37	—8	
	152.5			6001	14/3			Coaxial pair
Aldeburgh						—37	—8	
	153.5							Submarine cable
Domburg								
	39.5			6001	3/5			
Goes						—30	—30	
	164.5			6004	4/3			Microwave
Amsterdam (2)						—37	—30	
	8.5			6024	2/2			Coaxial pair
Amsterdam (1)						—30	—37	

1) A diagram can be associated in complicated cases.

2) Underline the through-group points.

3) Sections in cable, open-wire or radio link not providing a supergroup.

4) Sections in cable or radio links with at least one supergroup.

5) Mention the type of carrier system: 12, 24..., 12 + 12... channels and if not underground cable, state: open-wire, radio-link, submarine cable. In such cases give the frequency bands for the two directions of transmission. Show the type of through-group equipment.

Table [T6.460], p.

Blanc

APPENDIX III (B)
(to Recommendation M.460)

EXAMPLE FOR A COMPLICATED GROUP

H.T. [T7.460]
Routing form
|) for a group

1.	Date of issue	July 1979
2.	Technical service of	United Kingdom
3.	Group designation	{
London (Stag Lane)—Sydney (Broadway) 1214		
}		
4.	Length	12,606 km + satellite section
5.a)	Control stations for group	{
London (Stag Lane), Sydney (Broadway)		
}		
5.b) |)	{	
Sub-control stations in the direction		
London to Sydney		
}	{	
London (Stag Lane), Beaver Harbour, Montreal, Vancouver,		
Lake Cowichan, Moree		
}		
5.b) | i)	{	
Sub-control stations in the direction		
Sydney to London		
}	{	
Sydney (Broadway), Moree, Lake Cowichan, Vancouver, Montreal,		
Beaver Harbour		
}		
6.	{	
Stations where automatic regulators are fitted		
}	{	
London (Stag Lane), Sydney (Broadway)		
}		
7.	Group pilot frequency(ies)	104.08 kHz

A	B	C	D	E	F	G	H	J
{		{ {						
London (Stag Lane)						—37,5	—8 ,5	
	317				8/2			Coaxial pair
Widemouth Bay						—37,5	—8 ,5	
	5180			6008	20/2			Submarine cable (CANTAT 2)
Beaver Harbour						—37.5	—37.5	
	1931			6006	12/5			Microwave
Montreal						—37.5	—37.5	
	4431			6004	3/5			Microwave
Vancouver						—37.5	—37.5	
	97			6004	4/5			Microwave
Lake Cowichan						—37,5	—37,5	
	(satellite)			6001	4/4			Satellite (Pacific Ocean)
Moree						—30.5	—36.5	
	650			6010	10/4			Coaxial pair
Sydney (Broadway) —36.5 }						—30.5	{	

*) A diagram can be associated in complicated cases.

1) Underline the through-group points.

2) Sections in cable, open-wire or radio link not providing a supergroup.

3) Sections in cable or radio links with at least one supergroup.

4) Mention the type of carrier system: 12, 24..., 12 + 12... channels and if not underground cable, state: open-wire, radio link, submarine cable. In such cases give the frequency bands for the two directions of transmission. Show the type of through-group equipment.

Line-up record for a group link	
Date of issue	1 June 1979
Technical service of	United Kingdom
Group designation	Amsterdam (1)—London (Faraday) 1203
Length	516.5 km
Control station	Amsterdam (1)
Sub-control stations	Goes, Aldeburgh, London (Faraday)
Date of measurement	14 January 1979
Direction	London-Amsterdam

Distance (km)	Stations	63	71	79	84	87	95	103	107				
152.5	London (Faraday)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3			
192.5	Aldeburgh	+0.3	+0.7	+0.7	+0.3	+0.3	+0.5	+0.4	+0.7	+0.9			
	Goes	—0.8	—0.2	0.3	0.3	0.3	0.3	0.3	—0.1	+0.2			
172.5													
	Amsterdam (1)	—1.5	—0.3	—0.2	—0.2	0.3	—0.15	—0.05	—0.45	0.3			

Table [T7.460], p.

APPENDIX IV (A)
(to Recommendation M.460)

EXAMPLE FOR A SIMPLE GROUP LINK

H.T. [T8.460]
Line-up record for a group link

Date of issue	1 June 1979
Technical service of	United Kingdom
Group designation	{
Amsterdam (1)—London (Faraday) 1203	
}	
Length	516.5 km
Control station	Amsterdam (1)
Sub-control stations	{
Goes, Aldeburgh, London (Faraday)	
}	
Date of measurement	14 January 1979
Direction	London-Amsterdam

Distance (km)	Stations	{											
		{ 63	71	79	84	87	95	103	107				
152.5	London (Faraday)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3			
192.5	Aldeburgh	+0.3	+0.7	+0.7	+0.3	+0.3	+0.5	+0.4	+0.7	+0.9			
	Goes	—0.8	—0.2	0.3	0.3	0.3	0.3	0.3	—0.1	+0.2			
172.5													
	Amsterdam (1)	—1.5	—0.3	—0.2	—0.2	0.3	—0.15	—0.05	—0.45	0.3			

Table [T8.460], p.

APPENDIX IV (B)
(to Recommendation M.460)

EXAMPLE FOR A COMPLICATED GROUP LINK

H.T. [T9.460]
Line-up record for a group link

Date of issue	July 1979
Technical service of	United Kingdom
Group designation London (Stag Lane)—Sydney (Broadway) 1214	
Group length 12 | 06 km + satellite section	
Control station	Sydney (Broadway)
Sub-control stations London (Stag Lane), Beaver Harbour, Montreal, Vancouver, Lake Cowichan, Moree	
Date of measurement	18 July 1978
Direction	London-Sydney

Distance (km)	Stations	Test frequencies in kHz	61	63	71	79	84	87	95	103
7428	London (Stag Lane)	0.7	0.7	0.7	0.15	0.7	0.7	0.25	0.7	0.05
4431	Montreal	—0.4	—0.7	—0.3	—0.15	—0.1	0.7	0.25	0.7	+0.25
747+ satellite	Vancouver	—0.7	—0.5	—0.3	—0.1	—0.1	—0.1	—0.1	0.1	0.05
	Sydney (Broadway)	—1.0	—1.0	—0.8	—0.7	—0.2	—0.5	—0.25	—0.1	—0.05

Table [T9.460], p.

References

[1] CCITT Recommendation *Protection against the effects of faulty transmission on groups and circuits* , Vol. VI, Rec. Q.33.

[2] CCITT Recommendation *1020 Hz test reference frequency* , Vol. IV, Rec. O.6.

[3] CCITT Supplement *Crosstalk test device for carrier-transmission systems on coaxial systems* , Vol. IV, Supplement No. 3.6.

[4] CCITT Recommendation *Assumptions for the calculation of noise on hypothetical reference circuits for telephony* , Vol. III, Rec. G.223.

[5] CCITT Recommendation *Characteristics of group links for the transmission of wide-spectrum signals* , Vol. III, Rec. H.14.

[6] CCITT Recommendation *Use of leased group and supergroup links for wide-spectrum signal transmission (data, facsimile, etc.)* , Vol. IV, Rec. M.900.

[7] CCITT Recommendation *Setting up and lining up an international leased group link for wide-spectrum signal transmission* , Vol. IV, Rec. M.910.

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