INTERNATIONAL TELECOMMUNICATION UNION

ITU-T M.460

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MAINTENANCE :

INTERNATIONAL TRANSMISSION SYSTEMS (ANALOGUE)

BRINGING INTERNATIONAL GROUP, SUPERGROUP, ETC., LINKS INTO SERVICE

ITU-T Recommendation M.460

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation M.460 was published in Fascicle IV.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation 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.

TABLE 1/M.460

Group, supergroup and mastergroup pilots for	Frequency (kHz)		Power level[a]
	8 ch. and 12 ch.	16 ch.	dBm0
Basic group (60-108 kHz)	84.080 84.140 104.080	84[b]	–20 –25 –20
Basic supergroup	411.860 411.920 547.920	444[c]	–25 –20 –20
Basic mastergroup	1 552		–20
Basic supermastergroup	11 096		–20
Basic 15 supergroup assemble	1 552		–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.

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 ± 0.1 dB of its nominal value. The measuring equipment used for making this measurement must give an accuracy of at least ± 0.1 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 ± 0.3 dB.

2.2.3 The total maximum variation resulting from §§ 2.2.1 and 2.2.2 above will be ± 0.5 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) ..... ± 1 Hz

– 84.080 kHz and 411.920 kHz pilots ..... ± 1 Hz

– 84.140 kHz and 411.860 kHz pilots ..... ± 3 Hz

– 104.080 kHz and 547.920 kHz pilots ..... ± 1 Hz

– 1552-kHz pilot ..... ± 2 Hz

– 11 096-kHz pilot ..... ± 10 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, 11 096, 11 648, 12 388 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):
  61, 63, 71, 79, 84, 87, 95, 103, 107 kHz [1)];

– group link (3-kHz channels):
  60.1, 60.6, 61, 63, 71, 79, 84, 87, 95, 103, 107, 107.3, 107.9 kHz [1)].

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.

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1) 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].

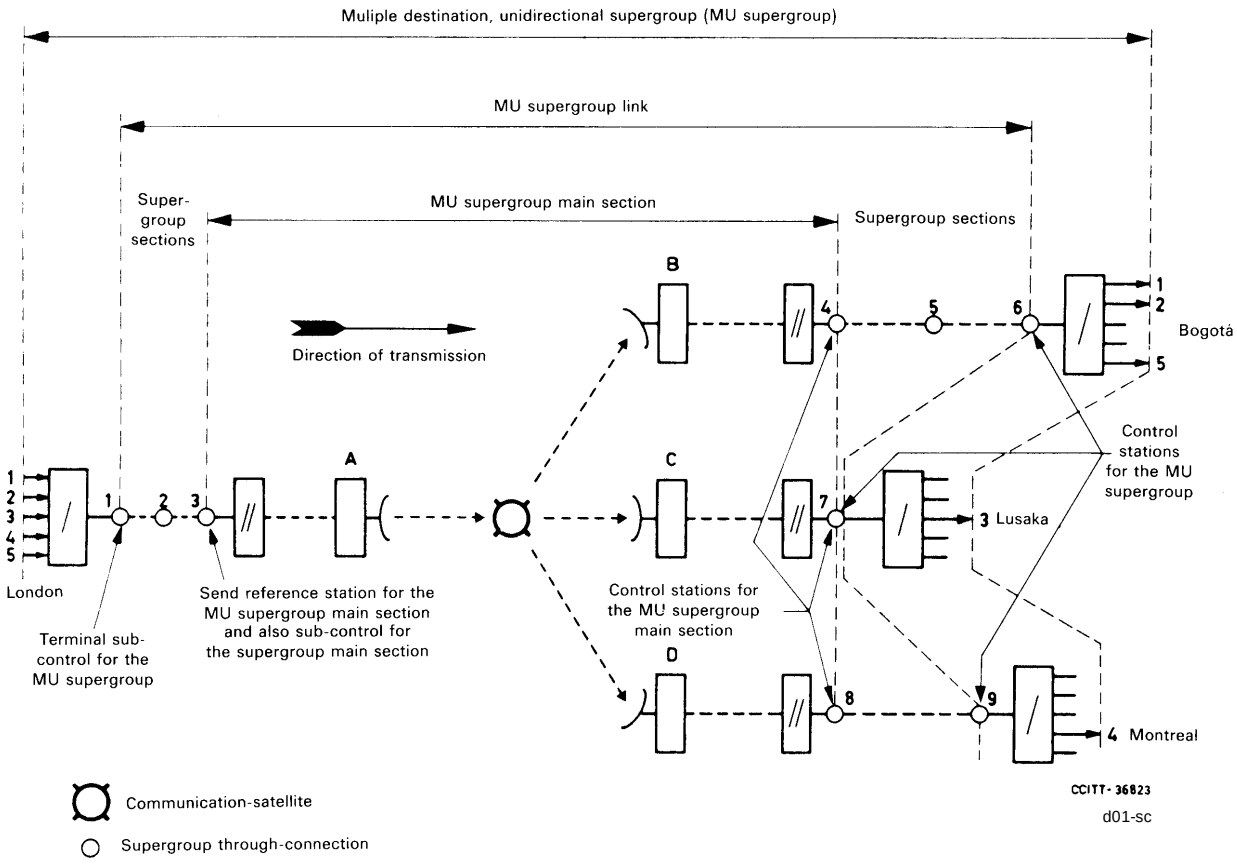

FIGURE 1/M.460

Arrangements for a multiple-destination, unidirectional supergroup (MU supergroup)

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 **UNIDIRECTIONAL**.

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.

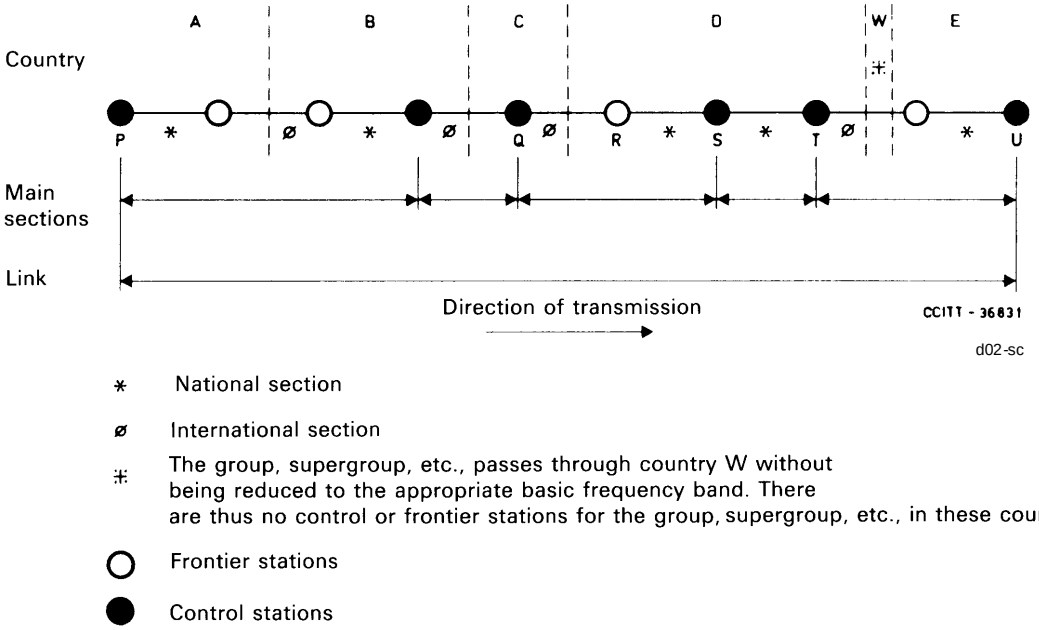

FIGURE 2/M.460

Example of an international link showing how it may be divided into sections of control for lining-up and maintenance

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 supermastergroup, 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.

TABLE 2/M.460

Line-up limits

	Loss of reference or pilot frequency as appropriate		Loss/frequency response relative to loss at reference or pilot frequency		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	± 1.5	
b) Main sections	± 0.1	± 0.1	± 1	± 1.5	
2. Main sections	± 0.1	± 0.1	± 1	± 1.5	A main section equalizer, whether terminal or intermediate, is not considered to be part of a national or international section
3. Link	± 0.1	± 0.1	± 1.5	± 2.0	A link equalizer is not considered to be part of a main section

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	5901 to 10 000	10 001 to 20 000
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 10 000 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..

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 ± 0.1 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 ± 0.1 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 a)-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 a)-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)

Routing form[1] 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) i)	Sub-control stations in the direction London-Bruxelles	London (Stag Lane), Broadstairs, Oostende
5.b) ii)	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

Stations and designation of cable[2]	Length of section (km)	Section in cable				Section on radio link		Nominal levels at supergroup measuring points dBr		Remarks[3]
		Symmetrical pair sections		Coaxial pair sections		Designation of radio link	Position of supergroup			
		Pair number	Position of supergroup	Number of coaxial system	Position of supergroup			↓	↑	
A	B	C	D	E	F	G	H	J	K	L
London (Stag Lane)								–35	–30	
	193			1002	6					Coaxial pair
Broadstairs								–35	–30	} Submarine cable
	119									
Oostende								–35	–30	
	134			30002	4					Coaxial pair
Bruxelles (1)								–30	–35	

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.

APPENDIX II

(to Recommendation M.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	Relative levels[1] dB									Pilot A[1]	Pilot B[1]	Measuring point	Measuring equipment-[2]	Nominal relative level at measuring point dBr	Impedance at measuring point (ohms)	Remarks[3]
		Test frequencies kHz															
		313	317	333	381	429	477	525	545	549							
	London (Stag Lane)	0	0	0	0	0	0	0	0	0	0		HF Test and fatch frame	NS	–35	75	
193																	
	Broadstairs	– 0,1	– 0,1	– 0,1	0	0	0	0	– 0,1	– 0,1	0		HF Test and fatch frame	NS	–35	75	
119																	
	Oostende	– 0,3	– 0,1	– 0,1	0	0	0	0	– 0,2	– 0,2	0		SDF	S	–35	75	
134																	
	Bruxelles (1)	– 0,4	– 0,2	– 0,1	0	0	0	0	– 0,2	– 0,4	0		SDF	S	–30	75	

Frequency (kHz) of supergroup reference pilot: 411.920 kHz.
Absolute power level dBm (referred to 1m W) of supergroup reference pilot at a zero relative level point: –20 dBm0.

1) Show in these columns the differences relative to the nominal values.

2) State if the equipment is selective (S) or not (NS).

3) Indicate the presence of supergroup automatic gain control (AGC).

SDF: Supergroup distribution frame.

APPENDIX III (A)

(to Recommendation M.460)

EXAMPLE FOR A SIMPLE GROUP

Routing form[1] 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) i)	Sub-control stations in the direction London to Amsterdam	London (Faraday), Aldeburgh, Goes
5.b) ii)	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

Stations and designation of cable [2]	Length of section (km)	Group sections [3]		Supergroup sections [4]		Nominal levels at through-group points dBr		Remarks [5]
		Pair numbers	Position (A B C D E) of group	Super-group number	Position of the super-group followed by the position of the group in the super-group	↓	↑	
A	B	C	D	E	F	G	H	J
London (Faraday)						–37	– 8	
	152			6001	14/3			Coaxial pair
Aldeburgh						–37	– 8	
	153							Submarine cable
Domburg								
	39			6001	3/5			
Goes						–30	–30	
	164.5			6004	4/3			Microwave
Amsterdam (2)						–37	–30	
	8			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.

APPENDIX III (B)

(to Recommendation M.460)

EXAMPLE FOR A COMPLICATED GROUP

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) i)	Sub-control stations in the direction London to Sydney	London (Stag Lane), Beaver Harbour, Montreal, Vancouver, Lake Cowichan, Moree
5.b) ii)	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

Stations and constitutions 1),4)	Length of section (km)	Group sections 2)		Supergroup sections 3)		Nominal levels at through-group points dBr		Remarks 4)
		Pair numbers	Position of group	Super-group number	Position of the super-group followed by the position of the group in the super-group	↓	↑	
A	B	C	D	E	F	G	H	J
London (Stag Lane)						–37	–8	
	317				8/2			Coaxial pair
Widemouth Bay						–37	–8	
	5180			6008	20/2			Submarine cable (CANTAT 2)
Beaver Harbour						–37	–37	
	1931			6006	12/5			Microwave
Montreal						–37	–37	
	4431			6004	3/5			Microwave
Vancouver						–37	–37	
	97			6004	4/5			Microwave
Lake Cowichan						–37	–37	
	(satellite)			6001	4/4			Satellite (Pacific Ocean)
Moree						–30.5	–36.5	
	650			6010	10/4			Coaxial pair
Sydney (Broadway)						–30.5	–36.5	

*) 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.

APPENDIX IV (A)

(to Recommendation M.460)

EXAMPLE FOR A SIMPLE GROUP LINK

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	Relative levels[1] dB											
		Test frequencies in kHz (4 kHz spacing)											
		61	63	71	79	84	87	95	103	107			
152 192 172.5	London (Faraday)	0	0	0	0	0	0	0	0	0			
	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	0	0	0	0	–0.1	+0.2			
	Amsterdam (1)	–1.5	–0.3	–0.2	–0.2	0	–0.15	–0.05	–0.45	0			

Distance (km)	Stations	Pilot A[1] dB	Measuring point	Measuring equipment[2]	Nominal relative level at measuring point dBr	Impedance at measuring point (ohms)	Remarks[3]
152 192 172.5	London (Faraday)	0	GDF	NS	–37	75	
	Aldeburgh	+0.1	GDF	NS	–37	75	
	Goes	0	GDF	S	–30	150	
	Amsterdam (1)	0	GDF	S	–30	150	AGC

Frequency of group reference pilot in kHz: 84.080 kHz.
Absolute power level dBm (referred 1 mW) of group reference pilot at a point of zero relative level: –20 dBm0.

1) Show in these columns the differences relative to the nominal values.

2) State if the equipment is selective (S) or not (NS).

3) Indicate the presence of group automatic gain control (AGC).

GDF: Group distribution frame.

APPENDIX IV (B)

(to Recommendation M.460)

EXAMPLE FOR A COMPLICATED GROUP LINK

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 ..... 12 606 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	Relative levels[1] dB								
		Test frequencies in kHz								
		61	63	71	79	84	87	95	103	107
7428 4431 747 + satellite	London (Stag Lane)	0	0	0	0	0	0	0	0	0
	Montreal	−0.4	−0.7	−0.3	−0.15	−0.1	0	0	0	+0.2
	Vancouver	−0.7	−0.5	−0.3	−0.1	−0.1	−0.1	−0.1	0	0
	Sydney (Broadway)	−1.0	−1.0	−0.8	−0.7	−0.2	−0.5	−0.25	−0.1	−0.05

Distance (km)	Stations	104.08 kHz pilot[1]	Measuring point	Measuring equipment[2]	Nominal relative level at measuring point dBr	Impedance at measuring point (ohms)	Remarks[3]
7428 4431 747 + satellite	London (Stag Lane)	0	HF test and Patch frame	NS	–37	75	
	Montreal	0	GDF	S	–37	75	
	Vancouver	0	GDF	S	–37	75	
	Sydney (Broadway)	0	Group control rack	S	–30.5	150	AGC

Absolute power level dBm (referred to 1 mW) of group reference pilot at a point of zero relative level: –20 dBm0.

1) Show in these columns the difference relative to the nominal values.

2) State if the equipment is selective (S) or not (NS).

3) Indicate the presence of group automatic gain control (AGC).

GDF: Group distribution frame.

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.