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International leased circuits

Lining up an international point-to-point leased circuit with analogue presentation to the user

ITU-T Recommendation M.1050

(Previously CCITT Recommendation)

ITU-T M-SERIES RECOMMENDATIONS

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Introduction and general principles of maintenance and maintenance organization	M.10–M.299
International transmission systems	M.300–M.559
International telephone circuits	M.560–M.759
Common channel signalling systems	M.760–M.799
International telegraph systems and phototelegraph transmission	M.800–M.899
International leased group and supergroup links	M.900–M.999
International leased circuits	**M.1000–M.1099**
Mobile telecommunication systems and services	M.1100–M.1199
International public telephone network	M.1200–M.1299
International data transmission systems	M.1300–M.1399
Designations and information exchange	M.1400–M.1999
International transport network	M.2000–M.2999
Telecommunications management network	M.3000–M.3599
Integrated services digital networks	M.3600–M.3999
Common channel signalling systems	M.4000–M.4999

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ITU-T RECOMMENDATION M.1050

LINING UP AN INTERNATIONAL POINT-TO-POINT LEASED CIRCUIT WITH ANALOGUE PRESENTATION TO THE USER

Summary

This Recommendation provides two methodologies to ensure effective lining up of an international leased circuit with analogue presentation to the user.

Source

ITU-T Recommendation M.1050 was revised by ITU-T Study Group 4 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 26th of June 1998.

Keywords

Analogue presentation, end-to-end line up, international leased circuit, section-by-section line up.

FOREWORD

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NOTE

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CONTENTS

Page

1 Scope 1

2 References 1

3 Terminology and definitions 2

4 Abbreviations 2

5 General 3

6 Lining up the constituent parts of the circuit 3

6.1 National sections 3

6.1.1 Overall loss at reference frequency 3

6.1.2 Loss/frequency distortion (special quality circuits only) 4

6.1.3 Group-delay distortion (special quality circuits only) 4

6.2 International section 4

6.2.1 Overall loss at reference frequency 4

6.2.2 Loss/frequency distortion 4

6.2.3 Group-delay distortion (special quality circuits only) 4

6.3 International link 4

7 Lining up the overall circuit 4

7.1 Overall loss 5

7.2 Loss/frequency distortion 5

7.2.1 Ordinary quality circuits 5

7.2.2 Special quality circuits 5

7.3 Group-delay distortion (special quality circuits only) 5

7.4 Variation with time of the overall loss at 1020 Hz 6

7.4.1 Amplitude hits (special quality circuits only) 6

7.4.2 Other variations 6

7.5 Random circuit noise 6

7.6 Impulsive noise (special quality circuits only) 6

7.7 Phase jitter (special quality circuits only) 6

7.8 Total distortion (special quality circuits only) 6

7.9 Single tone interference (special quality circuits only) 7

7.10 Frequency error (special quality circuits only) 7

7.11 Harmonic and intermodulation distortion (special quality circuits only) 7

7.12 Crosstalk (special quality circuits only) 7

7.13 Power source interferences (special quality circuits only) 7

8 Section-by-section line-up 7

8.1 Lining up the analogue-type section 8

8.1.1 National sections 8

8.1.2 International section 10

8.2 Lining up the digital-type section 10

8.2.1 National sections 10

8.2.2 International section 11

Page

8.3 Overall circuit 11

8.3.1 Configuration and testing of digital-type sections bounded by A/D converters 11

8.3.2 Overall lineup 11

9 Additional reference measurements 11

10 Functional checks 11

11 Transmission level checks 12

12 Level limiters 12

13 Marking of equipment associated with special quality circuits 12

14 Short-time rerouting of special quality leased circuits 12

Recommendation M.1050

LINING UP AN INTERNATIONAL POINT-TO-POINT LEASED CIRCUIT WITH ANALOGUE PRESENTATION TO THE USER

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M.111 (part) and M.113 and revised in 1976; renumbered M.1050 in 1980;
revised in 1984, 1988, 1993 and 1998]*

1 Scope

This Recommendation deals with the lining-up of both ordinary quality point-to-point leased circuits (the characteristics of which are specified in Recommendation M.1040 [15]), and special quality point-to-point leased circuits (the characteristics of which are specified in Recommendations M.1020 [12] and M.1025 [13]), which are provided by analogue transmission systems or by a mixture of analogue and digital systems.

2 References

The following ITU-T Recommendations contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendation listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation G.101 (1996), *The transmission plan*.

[2] ITU-T Recommendation G.122 (1993), *Influence of national systems on stability and talker echo in international connections*.

[3] ITU-T Recommendation G.131 (1996), *Control of talker echo*.

[4] CCITT Recommendation G.134 (1988), *Linear crosstalk.*

[5] CCITT Recommendation G.151 (1980), *General performance objectives applicable to all modern international circuits and national extension circuits.*

[6] CCITT Recommendation G.224 (1984), *Maximum permissible value for the absolute power level (power referred to one milliwatt) of a signalling pulse*.

[7] CCITT Recommendation G.232 (1984), *12-channel terminal equipments.*

[8] CCITT Recommendation H.13 (1988), *Impulsive-noise measuring instrument for telephone-type circuits*.

[9] ITU-T Recommendation M.60 (1993), *Maintenance terminology and definitions*.

[10] CCITT Recommendation M.580 (1988), *Setting up and lining up an international circuit for public telephony*.

[11] CCITT Recommendation M.1010 (1988), *Constitution and nomenclature of international leased circuits.*

[12] ITU-T Recommendation M.1020 (1993), *Characteristics of special quality international leased circuits with special bandwidth conditioning.*

[13] ITU-T Recommendation M.1025 (1993), *Characteristics of special quality international leased circuits with basic bandwidth conditioning.*

[14] CCITT Recommendation M.1030 (1988), *Characteristics of ordinary quality international leased circuits forming part of private switched telephone networks.*

[15] CCITT Recommendation M.1040 (1988), *Characteristics of ordinary quality international leased circuits.*

[16] CCITT Recommendation M.1060 (1988), *Maintenance of international leased circuits.*

[17] ITU-T Recommendation M.1340 (1996), *Performance allocations and limits for international data transmission links and systems*.

[18] ITU-T Recommendation M.1370 (1993), *Bringing-into-service of international data transmission systems*.

[19] ITU-T Recommendation M.2100 (1995), *Performance limits for bringing-into-service and maintenance of international PDH path, sections and transmission systems*.

[20] ITU-T Recommendation O.41 (1994), *Psophometer for use on telephone-type circuits*.

[21] CCITT Recommendation O.71 (1988), *Impulsive noise measuring equipment for telephone-type circuits*.

[22] CCITT Recommendation O.81 (1972), *Group-delay measuring equipment for telephone-type circuits*.

[23] CCITT Recommendation O.91 (1988), *Phase jitter measurement equipment for telephone-type circuits*.

[24] CCITT Recommendation O.95 (1980), *Phase and amplitude hits counters for telephone-type circuits*.

[25] CCITT Recommendation O.111 (1988), *Frequency shift measuring equipment for use on carrier channels.*

[26] CCITT Recommendation O.132 (1988), *Quantizing distortion measuring equipment using a sinusoidal test signal.*

[27] CCITT Recommendation M.810 (1988), *Setting up and lining up of an international voice-frequency telegraph link for public telegraph circuits (for 50, 100 and 200 baud modulation rates).*

[28] CCITT Recommendation V.2 (1988), *Power levels for data transmission over telephone lines*.

[29] CCITT Recommendation V.55 (1988), *Impulsive noise measuring instrument for telephone-type circuits*.

[30] CCITT Recommendation O.42 (1984), *Equipment to measure non-linear distortion using the 4-tone intermodulation method*.

3 Terminology and definitions

Terminologies and definitions relating to this Recommendation are provided in Recommendation M.60 [9].

4 Abbreviations

This Recommendation uses the following abbreviations.

A/D Analogue/Digital

ES Errored Second

FDM Frequency Division Multiplexing

PCM Pulse Code Modulation

RP Renter's Premises

SES Severely Errored Second

TIC Terminal International Centre

TNC Terminal National Centre

5 General

Figure 1 shows the constituent parts of an international point-to-point leased circuit.

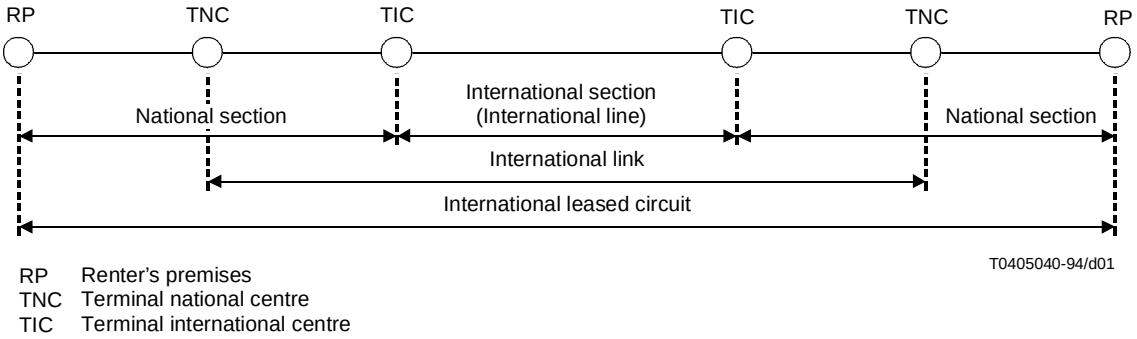

Figure 1/M.1050 – The constituent parts of an international point-to-point leased circuit

Test signals transmitted over the international section and link should be applied at a level of –10 dBm0.

The method of line-up described in clauses 6 and 7 below requires that appropriate personnel be present at the renter's premises in the two terminal countries to carry out overall, end-to-end tests of the characteristics of international leased circuits. The cooperation of staff at the terminal international centres may also be required to overcome language or technical difficulties.

Recognizing that differing national practices may mean that the required degree of international coordination is difficult to achieve, and acknowledging that it may not be possible to arrange simultaneous attendance at the two renter's premises because of time zone differences or restricted access to those premises, clause 8 below describes a method of circuit line-up using a section-by-section approach.

It should be noted that the end-to-end line-up approach (see clauses 6 and 7) and the section-by-section approach (see clause 8) are not compatible. Thus, Network Operators/Service Providers must agree, on a bilateral basis, which approach they will adopt.

When a section is entirely routed over a digital transmission system, the section-by-section approach is preferred.

6 Lining up the constituent parts of the circuit

After the circuit has been set up, the following lining-up procedure should be followed in each direction of transmission.

6.1 National sections

When analogue access to the circuit is available at the terminal international centre, the following tests should be performed regardless of whether the national section is provided by analogue circuit sections or a combination of analogue, mixed and digital circuit sections.

6.1.1 Overall loss at reference frequency

Each national section should be lined up at the reference frequency according to national practices between the terminal national centre and international centre. Note should be taken of the requirement concerning the receiving relative level in 2.1/M.1020 [12], 2.1/M.1025 [13] and 2.1/M.1040 [15]. For international leased circuits forming part of a private switched network, the loss of the national section must be consistent with meeting the required overall loss of the circuit as agreed between Network Operators/Service Providers (refer to 2.1/M.1030 and to clause 3/M.1030 [14]). A record should be kept of the levels received (including any measurements made at intermediate national test points). National sections beyond the terminal national centre must also be lined up.

6.1.2 Loss/frequency distortion (special quality circuits only)

The loss/frequency distortion should be measured at several frequencies. The limits of Table 1/M.580 [10] (column headed "between circuit access points") have to be met, if necessary, by means of an equalizer.

6.1.3 Group-delay distortion (special quality circuits only)

For circuits in conformity with Recommendation M.1020 [12], the limits to be applied are those given in Figure 2/M.1020 [12]. In the case of circuits in conformity with Recommendation M.1025 [13], the group-delay distortion should be measured and recorded for subsequent maintenance purposes. Any obvious abnormal condition shall be cleared.

6.2 International section

When analogue access to the circuit is available at the terminal international centres, the following tests should be performed regardless of whether the international section is provided by analogue circuit sections or a combination of analogue, mixed and digital circuit sections.

6.2.1 Overall loss at reference frequency

The sections comprising the international line (see Figure 2/M.1010 [11]) should be lined up so that when, at the sending terminal international centre, a test signal at a level of –10 dBm0 is connected to the input of the international line, the level received at the other terminal international centre is as close as possible to –10 dBm0. The level at intermediate test points should also be as close as possible to –10 dBm0.

6.2.2 Loss/frequency distortion

The loss/frequency distortion should be measured at several frequencies. The appropriate limits of Tables 1/M.580, 2/M.580 and 3/M.580 [10] (column headed "between circuit access points") have to be met, if necessary, by means of an equalizer.

6.2.3 Group-delay distortion (special quality circuits only)

For circuits in conformity with Recommendation M.1020 [12], the limits to be applied are those given in Figure 2/M.1020 [12]. In the case of circuits in conformity with Recommendation M.1025 [13], the group-delay distortion should be measured and recorded for subsequent maintenance purposes. Any obvious abnormal condition shall be cleared.

6.3 International link

If it is possible, after the national and international sections have been lined up and connected together at the terminal international centres, measurements should be made of the international link between terminal national centres. These measurements should be of overall loss at reference frequency and loss/frequency distortion and should be recorded for subsequent maintenance purposes.

7 Lining up the overall circuit

The constituent parts of the circuit having been satisfactorily lined up, the line-up of the overall circuit between renter’s premises should now be made.

Where loop facilities exist, these may be used to obtain reference measurements, for subsequent maintenance. Care must be taken to avoid simultaneous operation of loop facilities should they exist at both terminals.

7.1 Overall loss

The loss at 1020 Hz should be measured and recorded. Note should be taken of 2.1/M.1020 [12], 2.1/M.1025 [13] and 2.1/M.1040 [15]. For international leased circuits forming part of a private switched network, the overall loss of the circuit should be adjusted to the value agreed between Network Operators/Service Providers (see 2.1/M.1030 [14] and clause 3/M.1030 [14]).

If 2-wire operation is intended, the curve in Recommendation G.131 [3] may be used to determine if an echo suppressor/canceller is necessary. Where appropriate, the stability of the circuit should be checked against the requirements of Recommendation G.122 [2]. Inasmuch as the same sort of plant is used for leased circuits as is used to provide the "national system" of Recommendation G.101 [1], this should ordinarily present no problem. References to virtual switching points (*extrémités virtuelles* in French) in the G series Recommendations should be interpreted as "points in the two directions of transmission on the international line at equal relative level".

7.2 Loss/frequency distortion

7.2.1 Ordinary quality circuits

The loss/frequency distortion should meet the limits of 2.2/M.1030 [14] or of 2.2/M.1040 [15] as appropriate. Equalization should not normally be required to meet these limits.

7.2.2 Special quality circuits

The loss/frequency distortion should be measured at several frequencies and recorded. To meet the limits given in Figure 1/M.1020 [12] or in clause 1/M.1025 [13], as appropriate, *mop-up* equalization may be necessary (see Notes 1 and 2).

7.3 Group-delay distortion (special quality circuits only)

The group-delay distortion should be measured using a measuring set in accordance with Recommendation O.81 [22].

7.3.1 In the case of circuits to Recommendation M.1020 [12], the limits to be met are given in Figure 2/M.1020 [12]. The maximum unequalized group-delay distortion to be expected at the receiving end is three times that of Figure 2/M.1020 [12] (see Notes 1 and 2).

7.3.2 In the case of circuits to Recommendation M.1025 [13], the limits to be met are given in Figure 2/M.1025 [13] (see Notes 1 and 3).

Notes concerning 7.2.2 and 7.3 (Equalization of loss/frequency distortion and group-delay distortion on special quality leased circuits):

NOTE 1 – The precise location of any necessary equalizers is left to Network Operators/Service Providers to decide according to national practices. Equalizers built into the modems are not part of the international leased circuit as it is defined in Recommendation M.1010 [11].

The Network Operator/Service Provider at the receiving end of the circuit is responsible for seeing that the circuit meets the overall distortion limits in the receiving transmission direction.

Routing restrictions may be necessary to achieve the loss/frequency and group-delay distortion limits specified. Factors that may contribute to difficulties in meeting these limits are the number of through-group filters in group links, the number of channel translating equipments, the use of edge channels, heavily loaded cable, etc.

NOTE 2 – Equal distortion limits have been allocated to the national circuit section at the transmitting end, the international line and the national circuit section at the receiving end.

Individual cases of section limits being slightly exceeded can be accepted if the other sections do not attain their limits, so that the admissible overall unequalized distortion of three times the section limits at the receiving end is met.

NOTE 3 – Any necessary equalization to bring the overall group-delay distortion within the specified limits should be carried out at one location only for each direction of transmission.

7.4 Variation with time of the overall loss at 1020 Hz

7.4.1 Amplitude hits (special quality circuits only)

Amplitude hits should be measured with an instrument complying to Recommendation O.95 [24] and recorded. The limits specified in Recommendations M.1020 [12] and M.1025 [13], as appropriate, should not be exceeded.

7.4.2 Other variations

The variation of overall loss at 1020 Hz should be measured over a period of a few hours to check that the limits specified in Recommendations M.1020 [12], M.1025 [13] and M.1030 [14] are not exceeded. If the results are not satisfactory, the check should be continued to allow the trouble to be investigated and cleared.

7.5 Random circuit noise

Random circuit noise may be measured with a psophometer complying with Recommendation O.41 [20].

With the circuit correctly terminated, the psophometric noise power at the end of the circuit should be measured and recorded. The measured noise power should meet the requirements of Recommendations M.1020 [12], M.1025 [13], M.1030 [14] or M.1040 [15], as appropriate[1]. Where the measured noise is higher by 5 dB or more than the appropriate value in these Recommendations or is higher than –38 dBm0p, whichever is the more stringent requirement, a fault should be suspected and action taken to locate and remedy it where possible. It may be useful to compare noise measurements on circuits of identical or similar constitution to help locate a possible fault.

7.6 Impulsive noise (special quality circuits only)

Impulsive noise should be measured with an instrument complying with Recommendation O.71 [21] and recorded. It should meet the limits given in Recommendation M.1020 [12] or in Recommendation M.1025 [13] as appropriate.

A method of measurement is described in Recommendations H.13 [8] and V.55 [29].

It should be noted that satisfactory impulsive noise performance on a circuit is likely to be achieved if the circuit is routed via a 64 kbit/s digital path complying with Recommendation M.2100 [19].

7.7 Phase jitter (special quality circuits only)

Phase jitter should be measured using an instrument complying with Recommendation O.91 [23] and recorded.

The limits given in Recommendation M.1020 [12] or in Recommendation M.1025 [13], as appropriate, should not be exceeded, and routing restrictions (for example, minimizing the number of modulating equipments) may be necessary to achieve the objective limit.

7.8 Total distortion (special quality circuits only)

When the circuit includes any digital circuit sections, a measurement of total distortion should be made using an instrument complying with Recommendation O.132 [26]. Such a measurement will include contributions from quantizing distortion, random noise, harmonic distortion and single tone interference. The minimum signal-to-total distortion ratio is given in Recommendations M.1020 [12] and M.1025 [13]. However, if this minimum ratio is satisfied, it should not be assumed that all the parameters which contribute to the measurement are satisfactory. The total distortion measurement is not a substitute for the individual measurements specified in this Recommendation.

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[1] Recommendation O.41 [20] specifies a flat filter of 3.1 kHz bandwidth for unweighted noise measurements on data circuits. If this filter is used, the noise values given in Recommendations M.1020 [12] to M.1060 [16] do not apply because they are based on the use of psophometric weighting. Therefore, further study is required to determine the appropriate values for unweighted circumstances.

7.9 Single tone interference (special quality circuits only)

The method of measurement is under study.

7.10 Frequency error (special quality circuits only)

The frequency error introduced by the circuit should be measured and recorded. A method of measurement is given in Recommendation O.111 [25].

The limits specified in Recommendation M.1020 [12] or in Recommendation M.1025 [13], as appropriate, should be met.

7.11 Harmonic and intermodulation distortion (special quality circuits only)

Harmonic distortion should be measured by injecting a 700 Hz test frequency of –13 dBm0 at the transmit end of the circuit. The level of any individual harmonic at the receiving end should not exceed the limit given in Recommendation M.1020 [12] or in Recommendation M.1025 [13] as appropriate.

Alternatively, by bilateral agreement between Network Operators/Service Providers, a measurement of second and third order intermodulation products using an instrument complying with Recommendation O.42 [30] should be performed. The limits are for further study.

The results should be recorded.

7.12 Crosstalk (special quality circuits only)

Crosstalk attenuation between different circuits and between the forward and reverse direction of the same circuit should meet the characteristics given in Recommendations M.1020 [12] and M.1025 [13]. Measuring techniques for the measurement of this parameter are described in Recommendations G.134 [4] and G.232 [7]. The bandwidth of the measuring equipment should not exceed 10 Hz.

7.13 Power source interferences (special quality circuits only)

Admissible values of power source interferences are given in Recommendations M.1020 [12] and M.1025 [13].

A test reference frequency of 1020 Hz at a level of 0 dBm0 has to be used for the measurement of this parameter. Levels of unwanted side components should be measured at frequencies up to ± 400 Hz (see Recommendation G.151 [5]) from the test reference frequency.

8 Section-by-section line-up

The section-by-section approach to the line-up of international leased circuits has been devised to minimize the need for international coordination and to overcome those situations where end-to-end line-up is not practical or possible.

Sections are defined in Figure 1.

Two section types will be considered depending on the transmission bearer:

– analogue-type section where the section is routed over an analogue transmission system or a mixture of analogue and digital systems but, in any case, an analogue access to the circuit is available at the TIC;

– digital-type section where the section is entirely routed over a digital transmission system. It is assumed that a digital access to the circuit at the nominal bit rate is available at both ends of the section.

A national section where the terminal section is routed over an analogue transmission system and the sub-section bounded by TNC and TIC (national line, see Figure 2/M.1010 [11]) is fully digitized should be categorized as an analogue-type section referring to the definition above. However, this classification may cause some difficulties in lining-up operations. In this case, the national section should be split into two sub-sections lined up independently. The terminal section shall be lined up according to analogue-type section specifications and the national line shall be lined up according to digital-type section specifications. Allocating national section loss/frequency and group-delay distortion limits to the terminal section should not cause any problem as digital systems do not normally impair these parameters.

8.1 Lining up the analogue-type section

Loss/frequency and group-delay distortion limits are apportioned to the international and national sections as follows (see Figure 2):

– International section: one third;

– National sections: one third.

The resulting limits for the international and national sections are given in Tables 1 and 2 for loss/frequency and group-delay, respectively.

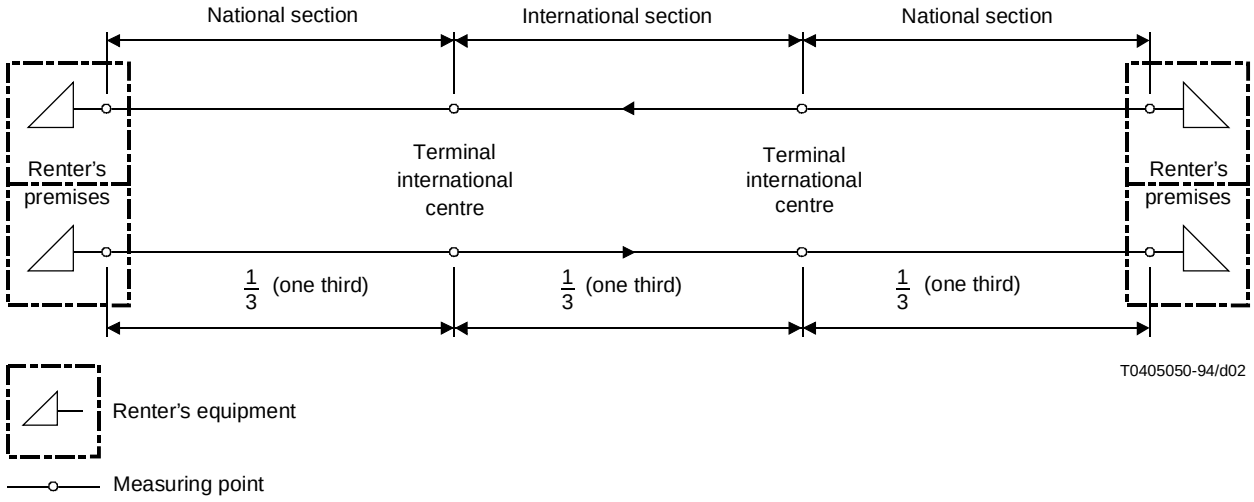

Figure 2/M.1050 – Apportionment of overall distortion limits to national and international sections of international leased circuits

8.1.1 National sections

The following tests should be performed regardless of whether the national section is provided by analogue circuit sections or by a combination of analogue, mixed and digital circuit sections.

8.1.1.1 Overall loss

Each national section should be lined up at the reference frequency according to national practices between the terminal national centre and international centre. Note should be taken of the requirement concerning the receiving relative level in 2.1/M.1020 [12], 2.1/M.1025 [13] and 2.1/M.1040 [15]. For circuits forming part of a private switched network, the loss of the national section must be consistent with meeting the required overall loss as agreed between Network Operators/Service Providers (see 2.1/M.1030 [14] and clause 3/M.1030 [14]). A record should be kept of the levels received (including any measurements made at intermediate national test points). National sections beyond the terminal national centre must also be lined up.

Table 1/M.1050 – Apportionment of loss/frequency distortion limits

Frequency range	Overall loss relative to that at 1020 Hz (dB)					
	National sections (as per Recommendations)			International section (as per Recommendations)		
	M.1020	M.1025	M.1040	M.1020	M.1025	M.1040
Below 300 Hz	Loss shall not be less than 0 dB, otherwise unspecified					
300-400 Hz	–	–	∅ to –1.0	–	–	∅ to –1.0
300-500 Hz	+2.0 to –0.7	+4.0 to –0.7	–	+2.0 to –0.7	+4.0 to –0.7	–
400-2000 Hz	–	–	+3.0 to –1.0	–	–	+3.0 to –1.0
500-2500 Hz	–	+2.7 to –0.7	–	–	+2.7 to –0.7	–
500-2800 Hz	+1.0 to –0.3	–	–	+1.0 to –0.3	–	–
2000-2800 Hz	–	–	+5.3 to –1.0	–	–	+5.3 to –1.0
2500-3000 Hz	–	+4.0 to –0.7	–	–	+4.0 to –0.7	–
2800-3000 Hz	+2.0 to –0.7	–	∅ to –1.0	+2.0 to –0.7	–	∅ to –1.0
Above 3000 Hz	Loss shall not be less than 0 dB, otherwise unspecified					
∅ Unspecified						

Tableau 2/M.1050 – Apportionment of group-delay distortion limits

Frequency range	Limits for group delay relative to the minimum measured group delay in the 500-2800 Hz (ms)			
	National sections (as per Recommendations)		International section (as per Recommendations)	
	M.1020	M.1025	M.1020	M.1025
Below 500 Hz	Unspecified	–	Unspecified	–
Below 600 Hz	–	Unspecified	–	Unspecified
500-600 Hz	1.0	–	1.0	–
600-1000 Hz	0.5	1.0	0.5	1.0
1000-2600 Hz	0.17	0.5	0.17	0.5
2600-2800 Hz	1.0	1.0	1.0	1.0
Above 2800 Hz	Unspecified			

8.1.1.2 Loss/frequency distortion

The loss/frequency distortion should be measured at several frequencies. The limits in Table 1 (column headed "National sections") have to be met, if necessary, by means of an equalizer (see Note 1).

8.1.1.3 Group-delay distortion (special quality circuits only)

The limits in Table 2 (column headed "National sections") have to be met, if necessary, by means of an equalizer (see Note 1).

8.1.1.4 Other characteristics (special quality circuits only)

The remaining characteristics of special quality international leased circuits (see 2.4-2.11/M.1020 [12] and 2.4-2.11/M.1025 [13]) should be treated in accordance with the national practices of the Network Operators/Service Providers concerned, bearing in mind the constitution of the national sections involved. Note that it may not be necessary to measure all such characteristics. For example, quantizing distortion need only be checked when a PCM system is involved, while phase jitter and frequency error might be omitted where the national section is provided solely by audio line plant.

It should be noted that satisfactory impulsive noise performance on a circuit is likely to be achieved if the circuit is routed via a 64 kbit/s digital path complying with Recommendation M.2100 [19].

The limits given in 2.4-2.11/M.1020 [12] and in 2.4-2.11/M.1025 [13], as appropriate, apply to the overall circuit, and cannot therefore be exceeded by either national section.

8.1.2 International section

The following tests should be performed regardless of whether the international section is provided by analogue circuit sections or a combination of analogue, mixed and digital circuit sections.

8.1.2.1 Overall loss

The sections comprising the international line (see Figure 2/M.1010 [11]) should be lined up so that when, at the sending terminal international centre, a test signal at a level of –10 dBm0 is connected to the input of the international line, the level received at the other terminal international centre is as close as possible to –10 dBm0. The level at intermediate test points should also be as close as possible to –10 dBm0.

8.1.2.2 Loss/frequency distortion

The loss/frequency distortion should be measured at several frequencies. The limits in Table 1 (column headed "International section") have to be met, if necessary, by means of an equalizer (see Notes 1 and 2).

8.1.2.3 Group-delay distortion (special quality circuits only)

The limits in Table 2 (column headed "International section") have to be met, if necessary, by means of an equalizer (see Notes 1 and 2).

8.1.2.4 Other characteristics (special quality circuits only)

Bearing in mind the constitution of the international section, the remaining characteristics of special quality circuits (as specified in 2.4-2.11/M.1020 [12] and 2.4-2.11/M.1025 [13]) should be checked using the measuring instruments and methods of measurement mentioned in clause 7 above.

The limits given in 2.4-2.11/M.1020 [12] and 2.4-2.11/M.1025 [13] apply to the overall circuit, and cannot therefore be exceeded by the international section. Staff responsible for the line-up of international leased circuits at the terminal international centres should assess, based on the measured values for the international and national sections, whether or not the overall limits will be met.

It should be noted that satisfactory impulsive noise performance on a circuit is likely to be achieved if the circuit is routed via a 64 kbit/s digital path complying with Recommendation M.2100 [19].

8.2 Lining up the digital-type section

8.2.1 National sections

The national section is provided by a digital link. Tests should be performed according to national practices to ensure that the link shows satisfactory error performance.

A performance allocation methodology derived from those described in Recommendation M.1340 [17] may be used to calculate ES and SES performance limits applicable to this link. Percentage performance allocation attributable to this link is the responsibility of the Network Operator/Service Provider concerned. However, it is suggested that national section allocation should not exceed 30% of the overall allocation. This figure would become 15% for the TIC-TNC section.

In the above cases, it is assumed that limits specified for analogue parameters will be met.

8.2.2 International section

The international section is provided by a digital link. It is assumed that limits specified for analogue parameters will be met if this link complies with Recommendation M.1370 [18].

The ES and SES performance limits of this digital link should be calculated by using the error performance allocation methodology described in clause 3/M.1340 [17].

8.3 Overall circuit

8.3.1 Configuration and testing of digital-type sections bounded by A/D converters

Digital-type sections are directly connected together. Where an analogue-type section is to be connected to a digital-type one, an A/D converter is installed at the end of this digital-type section. Where a national section is a digital-type one, an A/D converter is installed at customer premises.

A test should be performed to check overall loss on any portion of the circuit bounded by A/D converters. A 1020 Hz test signal at a level of –10 dBm0 is sent to the input of the circuit section; the level received at the other end is as close as possible to –10 dBm0.

8.3.2 Overall lineup

The constituent analogue and digital link sections of the circuit having been satisfactorily lined up, they should be connected together.

Where appropriate and possible, the overall circuit should be checked for satisfactory operation (see clause 10 below).

Notes concerning 8.1.1.2, 8.1.1.3, 8.1.2.2 and 8.1.2.3 (Equalization of loss/frequency distortion and group-delay distortion on special quality leased circuits):

NOTE 1 – The precise location of any necessary equalizers is left to Network Operators/Service Providers to decide according to national practices. Equalizers built into the modems are not part of the international leased circuit as it is defined in Recommendation M.1010 [11].

Routing restrictions may be necessary to achieve the loss/frequency and group-delay distortion limits specified. Factors that may contribute to difficulties in meeting these limits are the number of through-group filters in group links, the number of channel translating equipments, the use of edge channels, heavily loaded cable, etc.

NOTE 2 – The Network Operator/Service Provider at the receiving end of the circuit is responsible for seeing that the international section meets the distortion limits in the receive direction of transmission.

9 Additional reference measurements

As part of the lining-up procedure, it may be considered useful to make reference measurements at intermediate points by high-impedance bridging methods, and/or by measurements made on a loop-basis. Such measurements should be carried out under the direction of the circuit control station.

10 Functional checks

Where appropriate and possible, the complete circuit should be checked for satisfactory operation as follows:

a) Circuit signalling should be checked for satisfactory operation. When the signalling current is transmitted at the level permitted by national regulations, the limits given in the relevant Q-series Recommendations should not be exceeded at the input to the international line.

b) Tests should be made to determine if excessive echo, instability or other impediments to satisfactory operation, are present. For example, by means of a bilateral agreement, the additional characteristics mentioned in clause 6/M.1060 [16] may be checked.

11 Transmission level checks

It should be verified by direct measurement if possible (otherwise by calculation) that when the renter's apparatus is transmitting signals at the level permitted by national regulations, the following limits (see Note 3) are not exceeded at the input to the international line:

– Data transmission (Recommendation V.2 [28]) –13 dBm0

– Voice-frequency telegraphy

Amplitude - modulated
Frequency - modulated } see 4.1/M.810 [27]

– Phototelegraph or facsimile

Amplitude modulation (white level) –3 dBm0

Frequency modulation –13 dBm0

– Simultaneous transmission of various signals

Total power –13 dBm0

NOTE 1 – The above limits apply when the whole of the bandwidth is devoted to one particular transmission at any one time. When the band is divided among two or more types of transmission, the power levels permitted by the various Recommendations mentioned above should be reduced by the quantity 10 log (3100/*x*) dB, where *x* is the nominal bandwidth in hertz occupied by the transmission concerned.

NOTE 2 – In addition to the above specification, discrete frequency signals must comply with the requirements of Recommendation G.224 [6].

NOTE 3 – These are considered too high by some Network Operators/Service Providers, and additional study of these limits is anticipated in the future.

12 Level limiters

Where level-limiting devices are fitted on the circuit, they should not introduce distortion when the levels transmitted are within the permitted limits.

13 Marking of equipment associated with special quality circuits

In order to reduce to a minimum interruptions on the circuits, it is necessary that all equipment associated with such circuits (e.g. amplifiers, channel translating equipment, distribution frames, etc.) be positively marked so that the maintenance staff can readily identify it and can therefore avoid causing interruptions to the circuit inadvertently when they carry out maintenance work in repeater stations and exchanges.

14 Short-time rerouting of special quality leased circuits

The *make good* of a special quality circuit in case of a breakdown or planned outage needs special attention in order to keep the circuit characteristics within the required limits.

If there is a breakdown or planned interruption of a transmission system, rerouting should be carried out as far as possible at group, supergroup, etc., or digital path level. This would normally not seriously affect the attenuation and group-delay distortion. When such a rerouting of transmission links cannot be effected or when only the circuit concerned is faulty, a reroute circuit or circuit section of similar constitution as that in service should be chosen, in particular with regard to the number of FDM carrier sections and the relative number of analogue and digital circuit sections. The procedure of short-time rerouting at audio level can be facilitated if nominated reroute circuit sections having the same characteristics as the circuit sections of the regular route are available. This consideration also applies to the local line sections.

The circuit control station, if not directly involved, should be apprised of short-time rerouting which might affect the operation of the circuit. If a complete line-up is not practical, e.g. due to the expected short duration of the rearrangement, it is a minimum requirement that at least a check of the circuit overall loss at reference frequency and a measurement of the random circuit noise should be made.

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