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MAINTENANCE: INTERNATIONAL DATA TRANSMISSION SYSTEMS

PERFORMANCE ALLOCATIONS AND LIMITS FOR INTERNATIONAL DATA TRANSMISSION LINKS AND SYSTEMS

ITU-T Recommendation M.1340

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation M.1340 was prepared by the ITU-T Study Group IV (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

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NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

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

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ABSTRACT

Provides digital transmission performance limits for out-of-service testing of international data transmission links and systems.

Keywords

Digital transmission performance, international data transmission links, international data transmission systems

Recommendation M.1340

PERFORMANCE ALLOCATIONS AND LIMITS FOR INTERNATIONAL DATA TRANSMISSION LINKS AND SYSTEMS

(Helsinki, 1993)

1 General

1.1 Introduction

The performance limits described in this Recommendation should form the basis for all digital test measurements associated with international data transmission links and systems[1)]. The limits are also applicable to the international section of international leased circuits that are supported by an international data transmission system and that have a digital interface at the renters' premises.

The limits described represent a typical minimum level of performance and Administrations should apply practical experience and negotiation for the agreement of superior limits whenever this is considered feasible. It should, however, be recognized that the performance limits described may not be achieved by certain existing transmission equipment technologies.

All performance limits described in this Recommendation are applicable to out-of-service measurements. Limits applicable to in-service performance measurement are for further study.

1.2 Terminology

Recommendation M.1300 [2] provides general descriptions of international data transmission links and international data transmission systems.

Terminologies and definitions relating to this Recommendation are provided in Recommendation M.60 [1].

1.3 Operational procedures

Recommendation M.1370 [3] covers the setting-up and bringing-into-service of international data transmission systems. Maintenance issues are covered by Recommendation M.1375 [4].

The bringing-into-service and maintenance issues relating to international leased circuits with a digital presentation at renters' premises that are supported by international data transmission systems are covered by Recommendations M.1380 [5] and M.1385 [6] respectively.

2 Basic principles

2.1 Measurement parameters

Performance limits are provided for errored seconds (ES) and severely errored seconds (SES) as defined in Recommendation M.60 [1].

2.2 Variation of performance limits with transmission data rate

In accordance with 2.4.2/M.2100 [7] the same performance limits will be applicable for all data rates up to and including 2048 kbit/s (for the purposes of this Recommendation this will include data rates from 600 bit/s). This Recommendation is not applicable to data rates above 2048 kbit/s.

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1) The performance limits described in this Recommendation do not represent design objectives.

2.3 Derivation of performance limits

The ES performance limits used in this Recommendation have a mathematical basis and are derived from a 40% allowance of an end-to-end ES objective as described in Recommendation G.821 [8]. However, taking account of practical experience, the 8% ES objective proposed in Recommendation G.821 [8] is reduced to 4%.

The SES performance limits used in this Recommendation are not directly related to the SES objectives described in Recommendation G.821 [8]. The limits have a mathematical basis but have been significantly modified to reflect practical experience.

The performance limit allocation principles described in this Recommendation are compatible with those presented in Recommendation M.2100 [7]. Table 2/M.2100 is used as the basis for deriving overall performance allocations for this Recommendation.

For greatly simplified operational performance measurements, this Recommendation uses the same ES and SES limits to cover all 24 hour out-of-service test requirements [e.g. bringing-into-service, maintenance intervention and returning to service (after repair)]. In addition, dual limits associated with a confidence window, as described in 2.6/M.2100 [7] are not used. While this overall approach is not directly compatible with Recommendation M.2100 [7], an international digital path set-up in accordance with the performance requirements of Recommendation M.2100 [7] should be able to support an international data transmission link set-up in accordance with the performance requirements of this Recommendation.

2.4 Test duration

To reflect operational requirements for out-of-service testing, test durations of 24 hours, 1 hour and 15 minutes are used in this Recommendation. Whilst the 1 month test duration suggested in Recommendation G.821 [8] is not realistic for most test requirements, it must be recognized that 24 hour test results are inherently less reliable.

The 1 hour and 15 minute test objectives specified in this Recommendation (see Table 3) are used to provide a basic check of operability and are not intended to give a reliable indication of transmission performance.

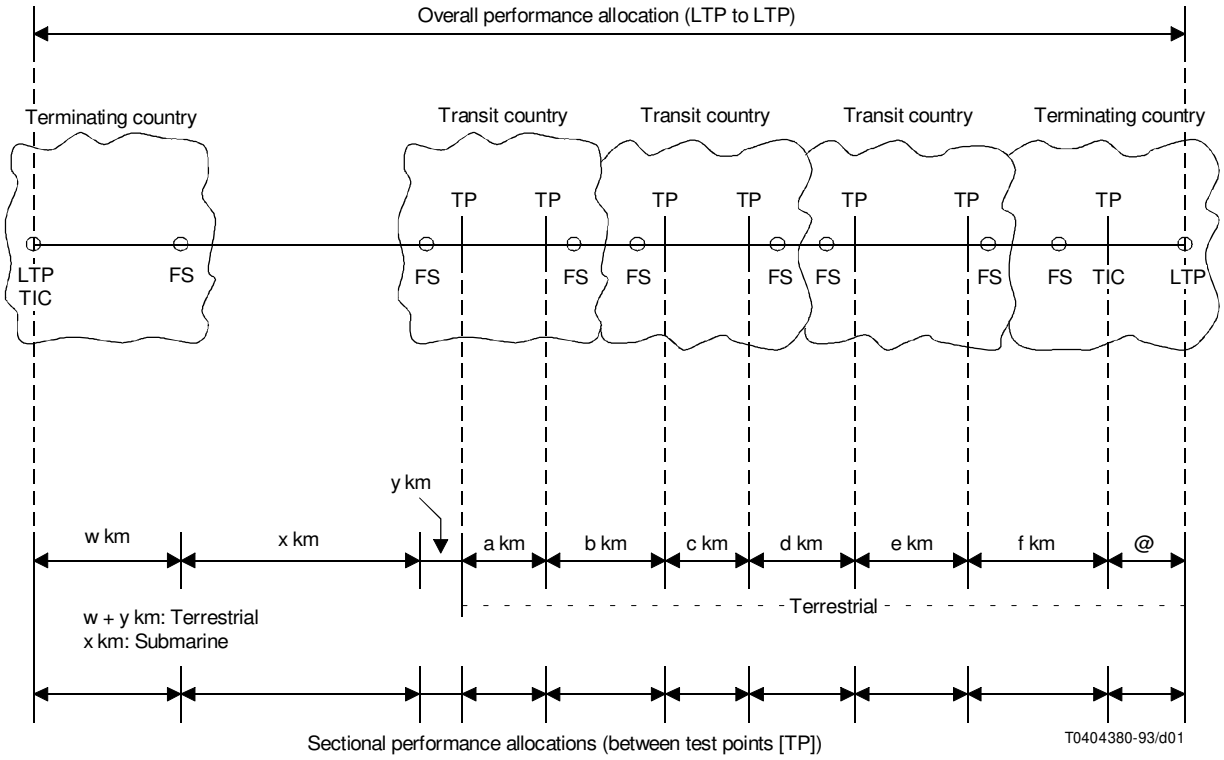
2.5 Action on test failure

A 24 hour test duration cannot be expected to give a particularly reliable indication of transmission performance (a test duration of 1 month is suggested in Recommendation G.821 [8]). When a performance limit is not met, Administrations should use practical judgment to determine an agreed course of action. Except where performance is catastrophically bad and a fault is obviously present, it will often be advantageous to continue testing to give an increased level of confidence. However, to avoid unnecessary testing where a limit is exceeded by a very small margin, following agreement between Administrations involved, it may be appropriate to deem the result acceptable. See Recommendations M.1370 [3] and M.1375 [4] for further guidance.

3 Error performance allocation principles

3.1 Overall performance allocation (link terminating point-to-link terminating point)

Prior to attempting to determine an overall performance allocation, Administrations should construct an agreed schematic routing diagram for the international data transmission link or system under consideration. The diagram should locate link terminating points (LTP), earth stations, terrestrial frontier stations (FS) and terminal international centres showing distances in kilometres (except for any satellite sections or national link sections). Figure 1 is a typical schematic diagram (see also Figure 3/M.2100). A suitable diagram may have been agreed at the initial planning stage prior to bringing-into-service. (The inclusion of intermediate test points (TP), as shown in Figure 1 is not necessary for the derivation of overall performance limits.)



LTP Link terminating point
TP Test point
FS Frontier station
TIC Terminal international centre

NOTES

1 An overall performance allocation is derived using Table 2/M.2100, Table 1 and taking account of allocations for national link sections (eg. @).

2 Individual international link section performance allocations are derived using Table 2 and Table 1.

3 Where an LTP is located at a TIC there will be no national link section.

FIGURE 1/M.1340

Performance allocation for international data transmission links and systems

Within international link sections percentage performance allocations attributable to terminating countries, transit countries, submarine cable systems, terrestrial border crossings and satellite systems are determined by reference to Table 2/M.2100 [the percentage allocations are described as "% of end-to-end RPO" (reference performance objectives) in this table]. Percentage performance allocations attributable to national link section components are the responsibility of the Administration concerned. Where a national link section is provided over a high grade transmission path, an allocation consistent with the terrestrial components given in Table 2 is recommended.

The calculation of overall performance limits from a single overall percentage allocation is preferred. An overall allocation is derived by simple addition of the individual sectional allocations. The overall percentage allocation should then be applied to Table 1 to determine single 24 hour test limits for ES and SES. Where an overall percentage performance allocation of greater than 40% is derived, Administrations should determine suitable limits for ES and SES by bilateral agreement taking account of the limits in Table 3. The linear addition of sectional performance limits to derive overall performance limits is not recommended.

The 24 hour performance limits derived are applicable to all out-of-service tests [e.g. bringing-into-service, maintenance intervention and returning to service (after repair)] of the overall international data transmission link (LTP to LTP) or system.

3.2 Sectional performance allocation (between test points)

For certain operational test requirements (e.g. during maintenance investigation and route rearrangements) it will be necessary to perform 24 hour tests of sectional components of an international data transmission link.

Prior to attempting to determine performance allocations, Administrations should construct an agreed schematic routing diagram for the international data transmission link or system under consideration (see Figure 1). The diagram should be as described in 3.1 above, but also include details of approximate distances (in kilometres) between agreed intermediate test points on all terrestrial link section components. A suitable diagram may have been agreed at the planning stage prior to bringing-into-service.

The sectional components from the schematic routing diagram should be applied to Table 2 (this is a simplified version of Table 2/M.2100) for the calculation of percentage allocations between points of interest.

Administrations must ensure that the sum total of allocations for individual sectional components is consistent with the overall allocation as described in section 3.1 above. Where the overall allocation is exceeded, Administrations should agree proportional reductions to sectional allocations by negotiation.

Agreed sectional allocations should be applied to Table 1 for the determination of single 24 hour test limits for ES and SES. These test limits may be used for all out-of-service test requirements between agreed test access points.

4 Short duration test objectives

It is recognized that 24 hour test limits are not appropriate for all out-of-service test requirements, especially those associated with maintenance operations. Proposed 15 minute and 1 hour test objectives for international data transmission links and systems are given in Table 3. These performance objectives are independent of the routing configuration that is used. The application of short duration test limits to bringing-into-service and maintenance operations is described in Recommendations M.1370 [3] (see 3.3, 4.3 and 4.4) and M.1375 [4] (see 4.2 and 4.3) respectively.

It must be recognized that short duration tests do not give a reliable indication of overall transmission performance. Failure to meet a short duration test objective by a small margin (see Note 3 of Table 3) may not necessarily be indicative of a performance problem and Administrations should use practical judgment to determine an agreed course of action taking account of operational requirements. Where a short duration test objective is exceeded by a significant margin, corrective action should be taken in accordance with Recommendation M.1370 [3] or Recommendation M.1375 [4] as appropriate. If there is any doubt about the validity of a 15 minute or 1 hour test result, a longer duration test may be appropriate.

TABLE 1/M.1340

24 hour out-of-service test limits

Allocation	Limits		Allocation	Limits	
%	ES	SES	%	ES	SES
1	10	1	21	318	12
1.5	18	1	21.5	326	13
2	26	1	22	334	13
2.5	34	1	22.5	342	13
3	41	2	23	349	13
3.5	49	2	23.5	357	14
4	57	2	24	365	14
4.5	64	2	24.5	372	14
5	72	3	25	380	15
5.5	80	3	25.5	388	15
6	87	3	26	395	15
6.5	95	4	26.5	403	16
7	103	4	27	411	16
7.5	111	4	27.5	419	16
8	118	5	28	426	16
8.5	126	5	28.5	434	17
9	134	5	29	442	17
9.5	141	5	29.5	449	17
10	149	6	30	457	18
10.5	157	6	30.5	465	18
11	164	6	31	472	18
11.5	172	7	31.5	480	18
12	180	7	32	488	19
12.5	188	7	32.5	496	19
13	195	8	33	503	19
13.5	203	8	33.5	511	20
14	211	8	34	519	20
14.5	218	8	34.5	526	20
15	226	9	35	534	21
15.5	234	9	35.5	542	21
16	241	9	36	549	21
16.5	249	10	36.5	557	21
17	257	10	37	565	22
17.5	265	10	37.5	573	22
18	272	10	38	580	22
18.5	280	11	38.5	588	23
19	288	11	39	596	23
19.5	295	11	39.5	603	23
20	303	12	40	611	24
20.5	311	12			

TABLE 1/M.1340 *(concluded)*

24 hour out-of-service test limits

ES Errored seconds

SES Severely errored seconds

NOTES

1 The % allocation relates to the proportion of the overall reference performance objective that is attributable to a particular routing configuration.

2 The limits are applicable to discrete periods of 24 hours. Where a test has a duration of more than 24 hours it is recommended that the limits be applied to each discrete period of 24 hours without averaging.

3 The maximum % allocation of 40% is consistent with the allowance for the high grade quality classification given in Recommendation G.821 [8].

4 The ES and SES limits relate to the maximum number of errored or severely errored seconds that would be acceptable in a given 24 hour period.

5 Limits for unavailable time are left for negotiation between Administrations. However, it should be appreciated that an availability of 100% would normally be achieved during a typical 24 hour period and that a transition to unavailable time would in any case not be consistent with SES limits for allocations below 16.5%.

TABLE 2/M.1340

Performance allocations for the derivation of sectional performance limits

International link section component	Distance (km)	Allocation (%)
Terrestrial (including transit and non-optical undersea cable)	< 500 > 500 - ≤ 1000 > 1000 - ≤ 2500 > 2500 - ≤ 5000 > 5000	2 3 4 6 8
Optical undersea cable	≤ 500 > 500	1 2.5
Satellite	–	20

NOTES

1 By negotiation, where sectional testing incorporates a terrestrial border crossing, it may be acceptable to incorporate an additional performance allocation. See Table 2/M.2100 (Notes 4 and 5); an allocation of 0.5% is suggested.

2 The allocations given in this table are maximum values and may be reduced by agreement between Administrations.

TABLE 3/M.1340

Short duration out-of-service test limits

Test duration	Objectives	
	ES	SES
15 minutes	0	0
1 hour	5	0

NOTES

1 The ES and SES objectives relate to the maximum number of errored or severely errored seconds that would be acceptable in the test duration specified.

2 Where a 15 minute objective is exceeded, it may be useful to reference 2.7.1.1/M.2100 [7] and Table 11/M.2100 for guidance.

3 The acceptable tolerance applicable to the limits of this Table is dependent upon the overall allocation as defined in 3.1 above

References

[1] Recommendation M.60 *Maintenance terminology and definitions*.

[2] Recommendation M.1300 *International data transmission systems operating in the range 2.4 kbit/s to 2048 kbit/s.*

[3] Recommendation M.1370 *Bringing-into-service of international data transmission systems*.

[4] Recommendation M.1375 *Maintenance of international data transmission systems*.

[5] Recommendation M.1380 *Bringing-into-service of international leased circuits that are supported by international data transmission systems*.

[6] Recommendation M.1385 *Maintenance of international leased circuits that are supported by international data transmission systems*.

[7] Recommendation M.2100 *Performance limits for bringing-into-service and maintenance of international digital paths, sections and transmission systems*.

[8] Recommendation G.821 *Error performance of an international digital connection forming part of an integrated services digital network*.