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CCITT

THE INTERNATIONAL
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CONSULTATIVE COMMITTEE

M.2110

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**MAINTENANCE: INTERNATIONAL TRANSPORT
NETWORK**

**BRINGING INTO SERVICE INTERNATIONAL
DIGITAL PATHS, SECTIONS AND
TRANSMISSION SYSTEMS**



Recommendation M.2110

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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Recommendation M.2110 was revised by Study Group IV and was approved under the Resolution No. 2 procedure on the 5th of October 1992.

CCITT NOTE

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

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Recommendation M.2110

BRINGING INTO SERVICE INTERNATIONAL DIGITAL PATHS, SECTIONS AND TRANSMISSION SYSTEMS¹⁾

(Melbourne 1988 as Rec. M.555; revised and renumbered in 1992)

Abstract

This Recommendation provides for bringing-into-service international digital sections, path and transmission systems with and without in-service monitoring.

Keywords

- bringing-into-service procedures;
- in-service monitoring;
- exchange of information for BIS;
- initial measurements;
- digital section;
- digital path;
- digital transmission system.

Abbreviations

BIS	bringing-into-service
CRC	cyclic redundancy check
ES	errored second
ISM	in-service monitoring
SES	severely errored second

1 General

This Recommendation covers bringing international digital paths, sections and transmission systems into service. This involves control and sub-control stations whose roles are specified in Recommendations M.80 [2] and M.90 [3]. Various administrative and technical measures are applicable to these operations. Such measures are distinct from equipment acceptance procedures (commissioning) resulting from a contract with a supplier (internal or external to the Administration).

In this Recommendation the distinction is made between BIS procedures with and without in-service monitoring. If there are no in-service monitoring capabilities, initial measurements will be the only way of checking operations without disturbing traffic. Before loading the entities concerned with traffic, there must be no doubt concerning performance.

If it is possible to perform in-service measurements, e.g. if there is a CRC or other such mechanism, BIS measurements without traffic can be reduced provided particular attention is paid to the entity when it is first put into operation.

2 Preliminary exchange of information and coordination

The technical services (see Recommendation M.75 [4]) concerned designate the control and sub-control stations for the digital path or section to be brought into operation, in accordance with Recommendations M.80 [2] and M.90 [3].

¹⁾ Throughout this Recommendation the terms “path”, “section” and “transmission system” should be understood as digital.

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

- a) stations which exercise control functions, i.e. digital path control stations and digital path sub-control stations;
- b) stations nearest the frontier, which in this Recommendation are referred to as frontier stations.

The technical service should indicate the routing to be followed and the method given in Recommendation M.570 [5] can be applied.

Designation information required for the control station is specified in Recommendation M.1400 [6].

The overall routing form, for an entire block or path, is drawn up by the control station on the basis of information provided by its technical service and by each sub-control station for the sections for which the sub-control station is responsible.

The control stations for each end of an international path, etc. must coordinate their activities in the two directions.

These consist of

- checking that the designation information is consistent in both Administrations;
- ensuring work orders are received by the participating control and sub-control stations;
- ensuring work is executed;
- recording difficulties and transmitting them to the relevant departments for attention;
- setting initial measurement dates;
- determining BIS limits in accordance with Recommendation M.2100 [7];
- coordinating measurements;
- collecting measurement results and declaring whether requirements are met or not met in agreement with the other control stations;
- making the necessary fault localization arrangements if initial measurements do not meet requirements;
- ensuring that the means for ISM, if provided, are operational;
- distributing the completed BIS forms;
- validating data bases (network configuration, description and maintenance data bases);
- declaring the entity, “In-service”.

3 Initial measurements of a digital transmission system

3.1 General

In the rest of this Recommendation, it is assumed that the transmission system has already undergone the checks stipulated in the contract between the Administration and the equipment supplier (margins, monitoring equipment operation, etc.).

The aim of these measurements is to ensure correct operation of the transmission system in terms of service and to serve as reference for maintenance operations.

3.2 Measurements

3.2.1 Initial transmission system measurements will be made terminal-to-terminal using instruments with a pseudo-random or framed pseudo-random bit sequence in conformity with Recommendation O.151 [1]. A framed pseudo-random bit sequence is recommended for this type of measurement.

The measurement configuration must conform to one of the arrangements shown in Figure 1/M.2110.

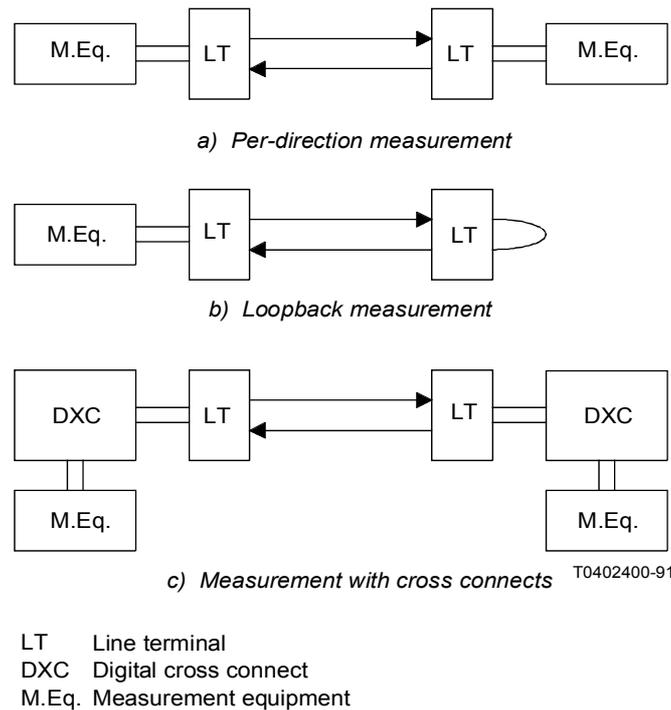


FIGURE 1/M.2110
Digital line section measurement configuration

3.2.2 The measurements must be made during the initial minimum measurement period specified in Recommendation M.2100 [7]. This time must include work periods to ensure detection of any disturbance problems linked with industrial activity²⁾.

3.2.3 When the initial measurement period is over, the measurement will be compared to the S1 and S2 thresholds of the line section allocation in Recommendation M.2100 [7]; this must be done for each of the parameters.

- If all of the measurements corresponding to the parameters are below their respective S1 thresholds, BIS may be declared without reservation.
- If the measured value of any parameter is greater than the parameter's S2 threshold, BIS cannot be declared and fault localization must be undertaken as indicated in Recommendation M.2120 [8].
- If some of the measurements corresponding to the parameters fall between the S1 and S2 thresholds whereas others are below their S1 threshold, measurement must be extended by a second period. If each of the measurements corresponding to the parameters are then below their respective S1 thresholds, BIS may be declared. Otherwise, fault localization must be performed.

²⁾ Industrial activity is an informal term covering everything which may impact on the transmission system, from maintenance actions on other equipment to vibration caused by vehicles passing by.

3.2.4 If loopback measurements are made, the S1 and S2 values for one direction only are to be considered. In these conditions, it is impossible to assess the distribution of degradation between directions. If the measurement fails, it will be necessary to start over again in the per-direction mode.

3.2.5 The control station may decide to stop a measurement as soon as it becomes clear that a limit threshold has been crossed.

4 Setting-up and initial testing of an international digital path

4.1 Setting up the path

4.1.1 Once the route has been agreed, the (*n*th order) path control station will direct the operations needed to set up the path.

All the repeater stations concerned (i.e. the stations at the ends of each section that will make up the digital path) should make setting-up tests and check the equipment to be used.

4.1.2 Each country sets up the national part within its territory, each international section is set up by the stations at the ends of the section in the two countries concerned (generally the frontier stations) and the national and international sections are interconnected as may be appropriate. The sub-control stations inform the control station when each interconnection is completed.

4.1.3 The procedure for an international *n*th order path is based on the progressive testing of its component sections as follows:

- national and international sections;
- combined sections (the connection of national and international sections);
- overall path (the connection of combined sections).

4.2 Initial testing of the digital path

4.2.1 Determining the BIS limits

The work order for setting up the path indicates the path composition. From this information, it is possible to calculate the path allocation by applying the principles of Recommendation M.2100 [7].

4.2.1.1 International primary rate

The duration of the measurement will be determined from the path operating conditions explained below. This duration, along with the value of the path allocation, will yield two limits, S1 and S2, which are given in Table 10/M.2100 [7]. These limits are derived as described in section 2.6/M.2100 [7].

4.2.2 General considerations on BIS testing procedure

The BIS testing procedure can be split as follows:

4.2.2.1 Step 1

Initial measurements must be performed over a 15-minute period of time, using a measuring instrument with a pseudo-random bit sequence (preferably framed) in accordance with Recommendation O.151 [1].

During this 15-minute period of time, there should be no error or unavailability event. If any event is observed, this step must be repeated up to two times. If, during the third (and last) test, there is any event, fault localization and correction must be done (see Recommendation M.2120 [8]).

4.2.2.2 Step 2

After successfully passing the first step, a test over a 24-hour period of time is applied. Real traffic could be carried on the path if ISM is available. However, if ISM is not available, the test is applied in the same conditions as for step 1 (i.e. using a measuring instrument).

At the end of the 24-hour period of time, the results of the measurement are compared to the BIS limits S1 and S2.

Should an unavailability event occur at any time during the BIS testing, the cause should be investigated and a new BIS test re-scheduled. Should a further unavailability event occur in the second BIS test, then BIS testing should be suspended until the cause of the unavailability event has been cleared.

Note – It is recognized that, in the near term at least, some paths might not meet the unavailability requirement.

The outcome of all BIS tests should be recorded for future reference.

4.2.3 Bringing-into-service paths that are not monitored during operation

The two steps of the BIS testing procedure, described above, must be performed using a measuring instrument. At the end of step 2, the following scenarios are possible:

- if ES and SES are both smaller than or equal to their respective S1 values, the path is accepted and enters the normal non-ISM maintenance mode;
- if either ES or SES (or both) are greater than or equal to their respective S2 values, the path is rejected and enters the non-ISM fault location maintenance mode, according to the procedures given in Recommendation M.2120 [8];
- if either ES or SES (or both) are greater than their respective S1 values but both smaller than their respective S2 values, the path can be either provisionally accepted or re-tested subject to bilateral or multilateral agreement.

This is illustrated in Figure 2/M.2110.

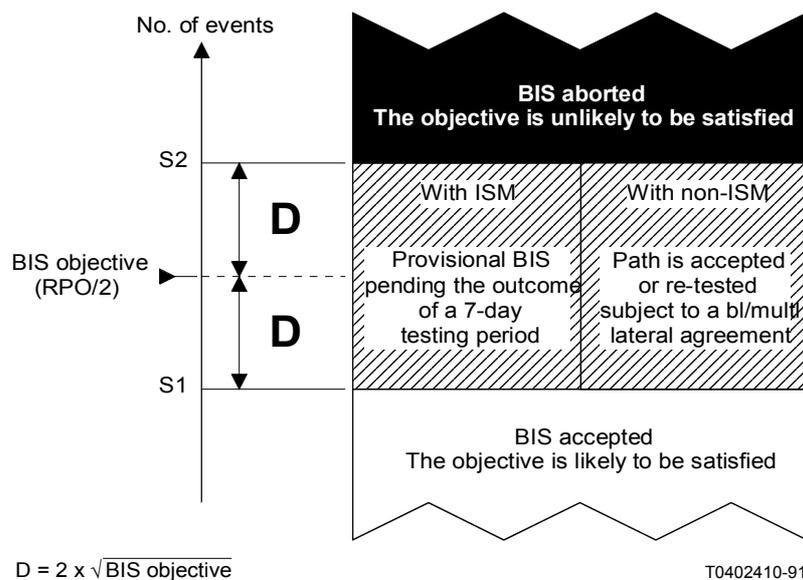


FIGURE 2/M.2110

4.2.4 *Bringing-into-service paths that are continuously monitored during operation*

The two steps of the BIS testing procedure, described in §§ 4.2.2.1 and 4.2.2.2 must be performed. At the end of step 2, the following scenarios are possible:

- if ES and SES are both smaller than or equal to their respective S1 values, the path is accepted and enters the normal ISM maintenance mode;
- if either ES or SES (or both) are greater than or equal to their respective S2 values, the path is rejected and enters the fault locating ISM maintenance mode, according to the procedures given in Recommendation M.2120 [8];
- if either ES or SES (or both) are greater than their respective S1 values but both smaller than their respective S2 values, the path is provisionally accepted pending the outcome of an extended seven-day BIS testing period.

4.2.5 *Description of the extended seven-day BIS test*

This test is only applicable to paths with ISM which have exhibited marginal performance of the 24-hour test of step 2. The first 24-hour period of time is included in the seven days.

At the end of this period, the measurement should not exceed the seven-day BIS objectives given in Table 10/M.2100 [7]. Two outcomes are possible:

- if the test is passed, the path is accepted and enters the normal ISM maintenance mode;
- if the seven-day ES or SES BIS objectives (or both) are exceeded, the path is rejected and enters the fault locating ISM maintenance mode, according to the procedures given in Recommendation M.2120 [8].

This is illustrated in Figure 2/M.2110.

4.3 *Bringing-into-service more than one path at the same time on the same higher order digital path*

When bringing into service more than one path³⁾ at a time, the procedure to be used depends on whether the higher order path has been in service for some time or whether it is also new. The procedures for primary rate paths also depend on whether or not ISM is available.

4.3.1 *Procedures for new international path and transmission systems*

On each higher order path or section above the primary rate:

- The first higher order path or section tributary would be tested for 24 hours.
- The remaining higher order tributaries would be tested for one or two hours depending on the interconnection with other digital line sections. If the digital path is not being extended it would be tested for two hours. If the tributary is to be connected to another transmission system it should be tested for one hour and then tested for 24 hours between the path terminals.
- The first primary rate path of each higher order path should be tested for 24 hours whether or not ISM is available.
- The remaining paths should be tested for 15 minutes each. These tributaries may be connected in a tandem-loop arrangement and tested simultaneously for 15 minutes. If this procedure is used, the 15-minute performance limits for one direction of transmission for one tributary apply.

³⁾ In §§ 4.3.1 and 4.3.2 the term tributary is used to indicate one of several sections or paths carried on a higher order section, path or transmission system.

- 4.3.2 *Procedure for bringing-into-service multiple primary rate paths on an existing higher order path with co-located path end points*
- If ISM is available, all tributaries would be tested for 15 minutes each or they may be connected in a tandem-loop arrangement and tested simultaneously for 15 minutes. If this procedure is used, the 15-minute performance limits for one direction of transmission for one tributary apply.
 - If ISM is not available, the first tributary would be tested for 24 hours. The remaining tributaries would be tested for 15 minutes each or they may be connected in a tandem-loop arrangement and tested simultaneously for 15 minutes. If this procedure is used, the 15-minute performance limits for one direction of transmission for one tributary apply.

4.4 *Contingency planning*

When testing, it is not unusual for problems to occur. By placing contingency periods in the test schedule, many problems can be resolved without the need for revising the entire schedule.

References

- [1] CCITT Recommendation O.151 *Error performance measuring equipment for digital systems operating at the primary rate and above.*
- [2] CCITT Recommendation M.80 *Control stations.*
- [3] CCITT Recommendation M.90 *Sub-control stations.*
- [4] CCITT Recommendation M.75 *Technical service.*
- [5] CCITT Recommendation M.570 *Constitution of the circuit; preliminary exchange of information.*
- [6] CCITT Recommendation M.1400 *Designation for international network.*
- [7] CCITT Recommendation M.2100 *Performance limits for bringing-into-service and maintenance of international digital paths, sections and transmission systems.*
- [8] CCITT Recommendation M.2120 *Digital path, section and transmission system fault detection and localization procedures.*

