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SERIES M: TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

International transport network

Bringing into service international multi-operator paths, sections and transmission systems

ITU-T Recommendation M.2110

ITU-T M-SERIES RECOMMENDATIONS

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ITU-T Recommendation M.2110

Bringing into service international multi-operator paths, sections and transmission systems

Summary

This Recommendation provides procedures for bringing into service international multi-operator paths, sections and transmission systems with and without in-service monitoring. These tests and procedures are applicable whatever the technology used.

Source

ITU-T Recommendation M.2110 was revised by ITU-T Study Group 4 (2001-2004) and approved under the WTSA Resolution 1 procedure on 14 July 2002.

Keywords

Bringing into service tests, exchange of information for BIS, initial measurements, in-service monitoring, international multi-operator transmission entities, path, procedures, section, transmission system.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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ITU-T Recommendation M.2110

Bringing into service international multi-operator paths, sections and transmission systems

1 Scope

This Recommendation covers bringing international multi-operator transmission entities into service. These transmission entities include paths, sections, and transmission systems that cross international and operator boundaries. This involves control and sub-control stations whose roles are specified in ITU-T Recs M.80 [3] and M.90 [4]. 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 bringing into service (BIS) procedures with and without in-service monitoring (ISM). If there are no ISM capabilities, initial out-of-service (OOS) 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.

This Recommendation only describes tests and procedures, dealing with the counting of the number of occurrences of error performance events. First of all, tests are described (see clause 7). Subsequently, procedures that show the progression of tests are explained according to the tested transmission entity.

No performance event is defined in this Recommendation. For the definition of the error performance events, and the set of them that applies to BIS and their limits, refer to the specific technology Recommendations.

2 References

The following ITU-T Recommendations and other references 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 and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

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

[2] ITU-T Recommendation M.75 (1992), *Technical service*.

[3] ITU-T Recommendation M.80 (1988), *Control stations*.

[4] ITU-T Recommendation M.90 (1988), *Sub-control stations*.

[5] ITU-T Recommendation M.570 (1988), *Constitution of the circuit; preliminary exchange of information*.

[6] ITU-T Recommendation M.1400 (2001), *Designations for interconnections among operators' networks*.

[7] ITU-T Recommendation M.2120 (2002), *International multi-operator paths, sections and transmission systems fault detection and localization procedures*.

[8] ITU-T Recommendation O.150 (1996), *General requirements for instrumentation for performance measurements on digital transmission equipment*.

[9] ITU-T Recommendation O.151 (1992), *Error performance measuring equipment operating at the primary rate and above*.

[10] ITU-T Recommendation O.181 (2002), *Equipment to assess error performance on STM-N interfaces*.

3 Terms and definitions

General terms and definitions relating to this Recommendation are provided in ITU-T Rec. M.60 [1].

4 Abbreviations

This Recommendation uses the following abbreviations:

BIS Bringing Into Service

CRC Cyclic Redundancy Check

FL Fault Localization

ISM In-Service Monitoring

OOS Out-of-Service

RFS Ready For Service

SDH Synchronous Digital Hierarchy

5 Exchange of information and coordination

The technical services (see ITU-T Rec. M.75 [2]) concerned designate the control and sub-control stations for the transmission entity to be brought into operation, in accordance with ITU-T Recs M.80 [3] and M.90 [4]. As far as cooperation between operators is concerned, only two classes of through-connection station need to be designated by any country:

a) stations, which exercise control functions for international transmission entities;

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 ITU-T Rec. M.570 [5] can be applied.

Designation information required for the control station is specified in ITU-T Rec. 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.

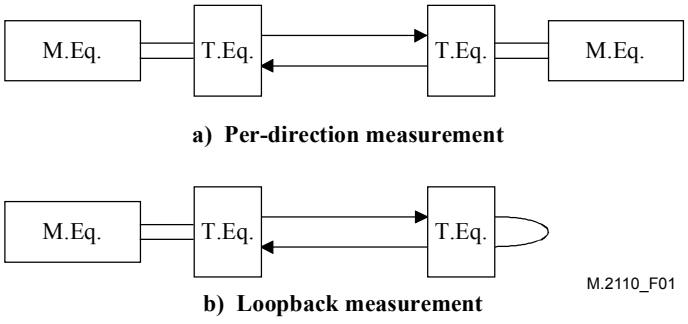
The control stations for each end of an international path, etc. must coordinate their activities in the two directions of transmission. These consist of:

- checking that the designation information (including path trace identifier information, if applicable) is consistent in both locations;
- checking that the technical configuration information is consistent in both locations (e.g. CRC-4 interworking, framing format, SDH adaptation function);
- 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 the specific technology Recommendations;
– coordinating measurements;
– collecting measurement results and declaring whether requirements are met or not met in agreement with the other control stations;
– exchanging test results as appropriate;
– making the necessary fault localization arrangements, as indicated in ITU-T Rec. M.2120 [7], if initial measurements do not meet requirements;
– ensuring that the means for ISM, if provided, are operational;
– validating data bases (network configuration, description and maintenance data bases);
– declaring the entity Ready For Service (RFS).

6 Measurements

Initial measurements will be made using instruments with a pseudo-random or framed pseudo-random bit sequence in conformity with ITU-T Recs O.150 [8] and O.151 [9] or a measurement mode in accordance with ITU-T Rec. O.181 [10] or in accordance with new requirements for optical measurements. In the case of bidirectional transmission, the measurement configuration must conform to one of the arrangements shown in Figure 1, i.e. either per-direction or loopback.



M.Eq. Measurement equipment
T.Eq. Transmission system or multiplex section termination equipment

Figure 1/M.2110 – Measurement configurations

Tandem connection measurements

For further study.

7 Bringing into service tests

For bringing transmission entities into service, several tests are necessary according to the concerned transmission entity. These tests consist of recording the number of occurrences of performance events over a certain duration and comparing the result with a limit value. Limit values are different according to the type of tests and the tested transmission entity. These limits are defined for each performance event and for each test in the specific technology Recommendations. Tests 15 m, 2 h and 24 h should be applied to each direction of transmission. Wherever possible, the per-direction measurement configuration should be used. For a bidirectional path or section, the test is considered passed if both directions meet the limits, or failed if either direction fails the limit.

7.1 Continuity test

This test consists of verifying the continuity of the link, during a short period of time (15 minutes maximum).

– For a per-direction measurement, the continuity test consists of sending bit errors with a test set at both termination points. The test is considered **passed** if each path termination point receives the sent errors.

– For a loopback measurement, the continuity test consists in opening and closing the loop. The test is considered **passed** if the test set (see Figure 1) receives AIS when the loop is opened.

– In either configuration, if the continuity test **failed**, fault localization and correction must be carried out.

7.2 Test15m

This test consists of recording the number of occurrences of each performance event for a time period of 15 minutes and comparing the result with a single limit value, named S_{15}.

– The test is considered **passed** if the number of occurrences for all performance events is less than or equal to S_{15}.

– The test is considered **failed** if unavailability occurs or the number of occurrences for at least one performance event is greater than S_{15}; in this case, fault localization and correction must be carried out.

7.3 Test2h

This test consists of recording the number of occurrences of each performance event for a time period of 2 hours and comparing the result with a single limit value, named S_2.

– The test is considered **passed** if the number of occurrences for all performance events is less than or equal to S_2.

– The test is considered **failed** if unavailability occurs or the number of occurrences for at least one performance event is greater than S_2; in this case, fault localization and correction must be carried out.

7.4 Test24h

This test consists of recording the number of occurrences for each performance event for a time period of 24 hours and comparing the result with a single limit value, named S_{24}.

– The test is considered **passed** if the number of occurrences for all performance events is less than or equal to S_{24}.

– The test is considered **failed** if unavailability occurs or the number of occurrences for at least one performance event is greater than S_{24}; in this case, fault localization and correction must be carried out.

8 Bringing into service procedures

The BIS test procedures, including how to deal with any period of unavailability during the test, are defined in this clause. These procedures refer to various tests, which are described in clause 7. They show the tests succession and how to deal with tests according to the test result. Procedures are specific to the tested transmission entity (section, path).

8.1 Initial measurements of a section

8.1.1 General

In this Recommendation, it is assumed that the section has already undergone the checks stipulated in the contract between the Network Operator and the equipment supplier (margins, monitoring equipment operation, etc.). The aim of these initial measurements is to ensure correct operation of the transmission system or multiplex section in terms of service and to serve as a reference for maintenance operations.

8.1.2 BIS testing procedure

The measurements must be made during an initial minimum measurement period of 24 hours. A Test24h is carried out for each error performance event:

– If Test24h has **passed** for all performance events, Ready For Service (RFS) may be declared without reservation.

– If Test24h has **failed** for at least one performance event, RFS cannot be declared and fault localization and correction must be carried out and a new Test24h repeated.

If loopback measurements are made, the limit values for one direction only are to be used. In these conditions, it is impossible to assess the distribution of degradation between directions. If the BIS test fails, it will be necessary to make new measurements in the per-direction mode in order to localize the source of the degradation. Measurements may be stopped if it becomes clear that a limit threshold has been crossed.

This BIS procedure for a section is illustrated in Figure 2.

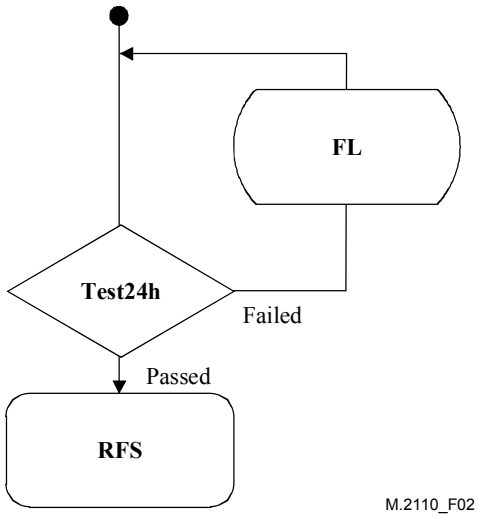


Figure 2/M.2110 – BIS procedure for a section

8.2 Initial measurements of a path

8.2.1 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 the specific technology Recommendations. 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 one limit, S_n as defined in this Recommendation.

8.2.2 General considerations on BIS testing procedure

The BIS testing procedure is illustrated in Figure 3 and can be split into two steps as follows.

Step 1: A continuity test is carried out on the new path.

– If the continuity test has **passed**, step 2) can be carried out.

– If the continuity test has **failed**, the procedure should be repeated after fault localization and correction until the test is successful.

Step 2: A Test24h is carried out of each error performance event; values for S_{24} are given in the specific technology Recommendation.

– If Test24h has **passed** for all the performance events, BIS ends and the path is RFS.

– If Test24h has **failed** for at least one performance event, fault localization and correction are carried out; then a new Test24h is performed.

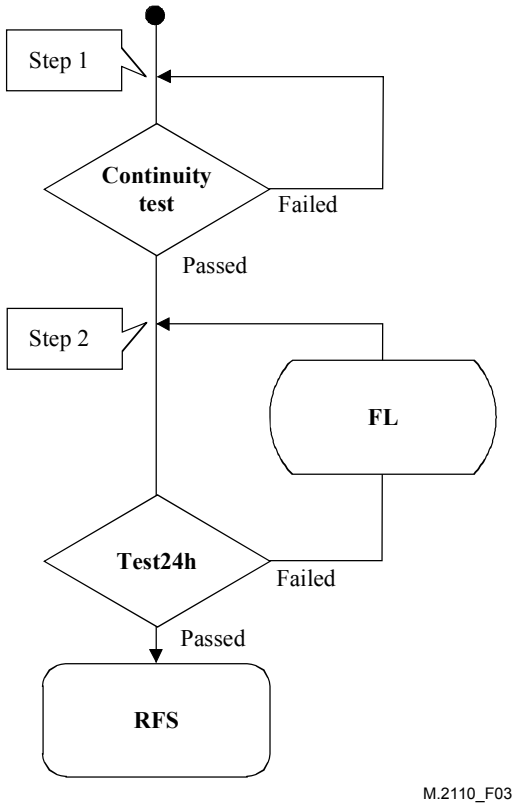


Figure 3/M.2110 – BIS procedure for a path

If an unavailability event occurs at any time during the BIS testing, the cause should be investigated and a new BIS test rescheduled. If a further unavailability event occurs in the second BIS test, then BIS testing should be suspended until the cause of the unavailability event has been resolved.

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.

8.3 Bringing into service more than one path at the same time and with identical routing

When bringing into service more than one path 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 also depend on whether or not ISM is available.

8.3.1 Procedure for bringing into service multiple tributaries on an existing higher order path with identical routing

The BIS procedure for multiple tributaries on an existing higher order path with identical routing is illustrated in Figure 4 and depends on whether ISM is available.

If ISM is available, all tributaries should be submitted to a Test15m of each performance event. Each of the tributaries may be connected in a tandem-loop arrangement and tested by Test15m simultaneously. If this procedure is used, the S_{15} value for the test should be fixed as the 15-minute performance limits for one direction of transmission for one tributary.

- If Test15m has **passed** for all performance events, the tributary is RFS.
- If Test15m has **failed** for at least one performance event, fault localization and correction are carried out; then the procedure has to be repeated for the tributary that has failed.

If ISM is not available, a two-step procedure is used:

Step 1: One tributary should be submitted to a Test24h of each performance event; values for S_{24} are given in the specific technology Recommendations.

- If Test24h has **passed** for all performance events, step 2) can be carried out;
- If Test24h has **failed** for at least one performance event, fault localization and correction are carried out; then the Test24h has to be repeated.

Step 2: The remaining tributaries should each be tested according to Test2h, for each performance event, or they may be connected in a tandem-loop arrangement and tested simultaneously according to the same test. If this procedure is used, the S_2 value should be fixed as the 2-hour performance limits for one direction of transmission for one tributary.

- If Test2h has **passed** for all performance events, the tributary is RFS.
- If Test2h has **failed** for at least one performance event, fault localization and correction are carried out; then Test2h has to be repeated for the failed tributary.

NOTE – In the case of a tandem loop arrangement, if it is not possible to identify the failed tributary, all tributaries must be tested separately.

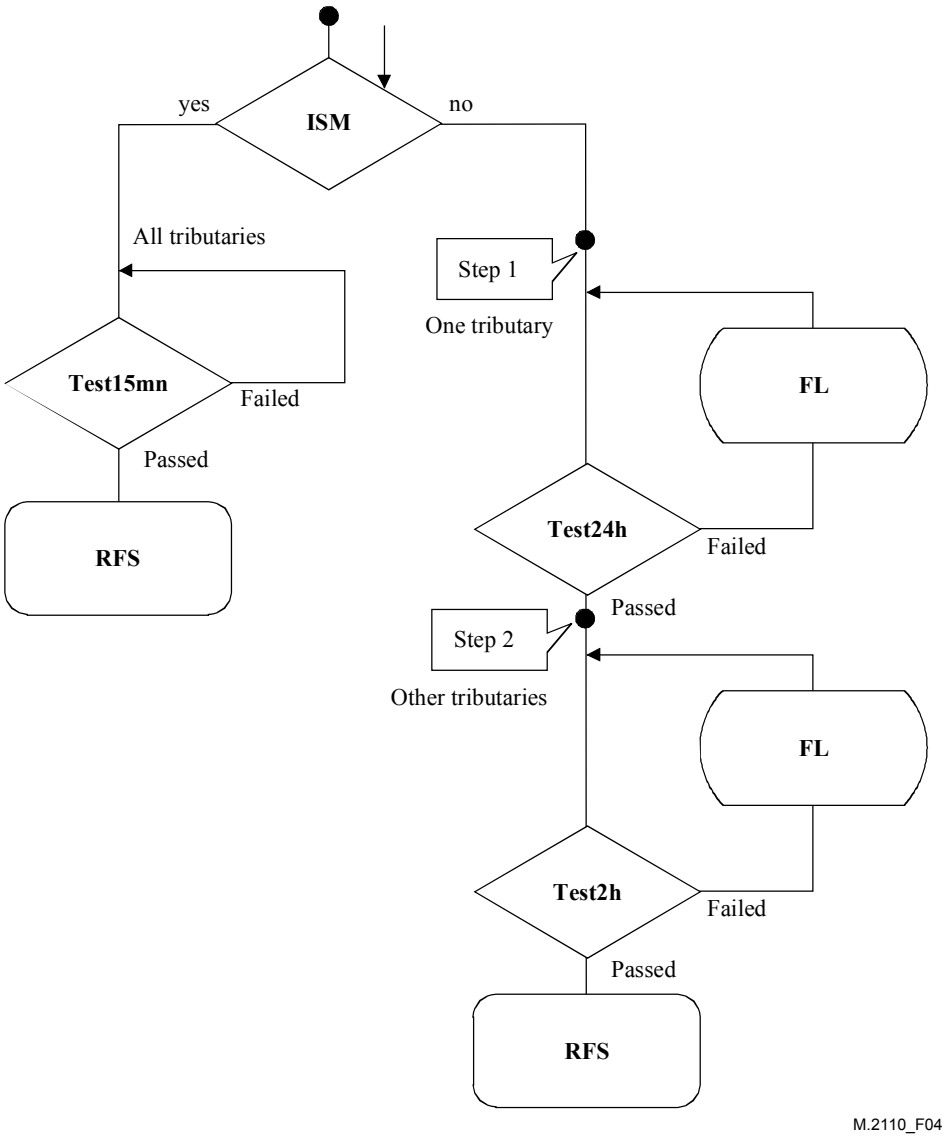


Figure 4/M.2110 – BIS test procedure for multiple tributaries on an existing higher order path with identical routing

8.3.2 Procedure for bringing into service multiple tributaries on a new higher order path with identical routing

The BIS procedure for multiple tributaries on a new higher order path with identical routing is illustrated in Figure 5 and has two steps.

Step 1: On the higher order path, the following tests have to be made:

– A continuity test is carried out on the new path.

– A Test24h is carried out of each performance event; values for S_{24} are given in the specific technology Recommendation.

– If Test24h has **passed** for all performance events, step 2) can be carried out;

– If Test24h has **failed** for at least one performance event, fault localization and correction are carried out; then Test24h must be repeated.

Step 2: The tributaries should be tested as in 8.3.1, depending on the availability of ISM.

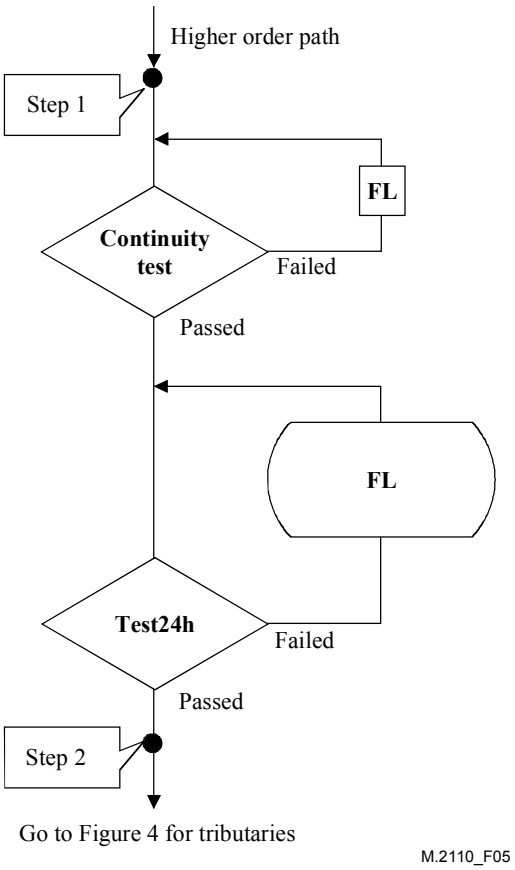


Figure 5/M.2110 – BIS test procedure for multiple tributaries on a new higher order path with identical routing

8.4 BIS of more than one path with not identical routing

In this case, BIS is carried out for each path individually as described in 8.2.2.

8.5 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.

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