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Maintenance of international transmission systems and telephone circuits – International transmission systems

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BRINGING INTERNATIONAL DIGITAL BLOCKS, PATHS AND SECTIONS INTO SERVICE

Reedition of CCITT Recommendation M.555 published in the Blue Book, Fascicle IV.1 (1988)

NOTES

1 CCITT Recommendation M.555 was published in Fascicle IV.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

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

Recommendation M.555

BRINGING INTERNATIONAL DIGITAL BLOCKS, PATHS AND SECTIONS INTO SERVICE[1]

1 Preliminary exchange of information

The technical services concerned nominate the control and sub-control stations for the digital block, path or section to be brought into operation in accordance with Recommendations M.80 and M.90.

The technical services should indicate the routing to be followed and the method given in Recommendation M.570 may be applied.

Information necessary for the control station, which will be entered on a routing form is indicated below:

– routing of the block, path or section,

– names of control and sub-control stations,

– names of stations where the block or path appears at its characteristic bit rate.

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

Note – When digital paths are used to provide the terrestrial links to a time division multiple access (TDMA) satellite system, the usual digital system supervisory signals (AIS, remote alarm, etc.) are not transmitted over the satellite section. An alternative method of supervision for the individual circuits is described in Recommendation Q.33. [1].

When the block or path is assigned its designation (according to Recommendation M.140 §§ 9 and 10), the Administration with control station responsibility will assemble the necessary technical and operational information. This should be entered into the list of related information (as defined in Recommendation M.140, § 12) which consists of the items shown in the Annex A.

2 Digital system arrangements

2.1 *Digital hierarchy*

The layout of the presently identified hierarchical digital bit rates is given in Table 1/M.555, both for hierarchies based on 1544 kbit/s systems and for hierarchies based on 2048 kbit/s systems.

TABLE 1/M.555

Hierarchical bit rates

<table>
<tr><th>Level</th><th colspan="2">1544 kbit/s structure</th><th>2048 kbit/s structure</th></tr>
<tr><td>1</td><td colspan="2">1544</td><td>2 048</td></tr>
<tr><td>2</td><td colspan="2">6312</td><td>8 448</td></tr>
<tr><td>3</td><td>32 064</td><td>44 736</td><td>34 368</td></tr>
<tr><td>4</td><td>97 728</td><td>Note</td><td>139 264</td></tr>
</table>

Note – Level 4 bit rates presently under study.

2.2 *Digital interworking arrangements*

(The standard digital interworking arrangements presently under study by Study Group XVIII will be shown when they are available).

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[1] The procedures for introducing services using digital satellite systems are not covered in this Recommendation. This matter is for further study for Study Group IV.

3 Reference measurements for a path

The measurements described in § 5.2 below for ensuring that the digital path is within limits also constitute reference measurements. These data should be recorded at every sub-control station and at stations adjacent to frontiers where the block or path appears at its characteristic bit rate. On request, this data should be forwarded to the control station which then can draw up a record of reference measurements.

4 Organization of the control of international digital blocks, digital paths, etc.

4.1 *Classes of station*

4.1.1 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 block/digital path control stations and digital block/digital path sub-control stations;

b) attended stations nearest the frontier, which in this Recommendation are referred to as *frontier stations*.

4.1.2 In accordance with Recommendations M.80 and M.90, the station at each end of the digital block or digital path is the *control station* for the receiving direction of transmission and the terminal *sub-control station* for the sending direction. Stations having control functions in intermediate countries are digital block, digital path intermediate sub-control stations. Other stations involved in international maintenance are frontier stations.

4.1.3 In general, a transit country will have one station with control functions or one with sub-control functions and two frontier stations. A country in which the digital block or path terminates has only one frontier station. In some countries, a station with control functions or sub-control functions and a frontier station will be the same.

4.2 *Classes of digital sections*

For the purposes of setting-up, making initial tests and subsequent maintenance, an international digital path is subdivided into national sections, international sections and main sections as defined in Recommendation M.300. These terms are illustrated in Figure 1/M.555.

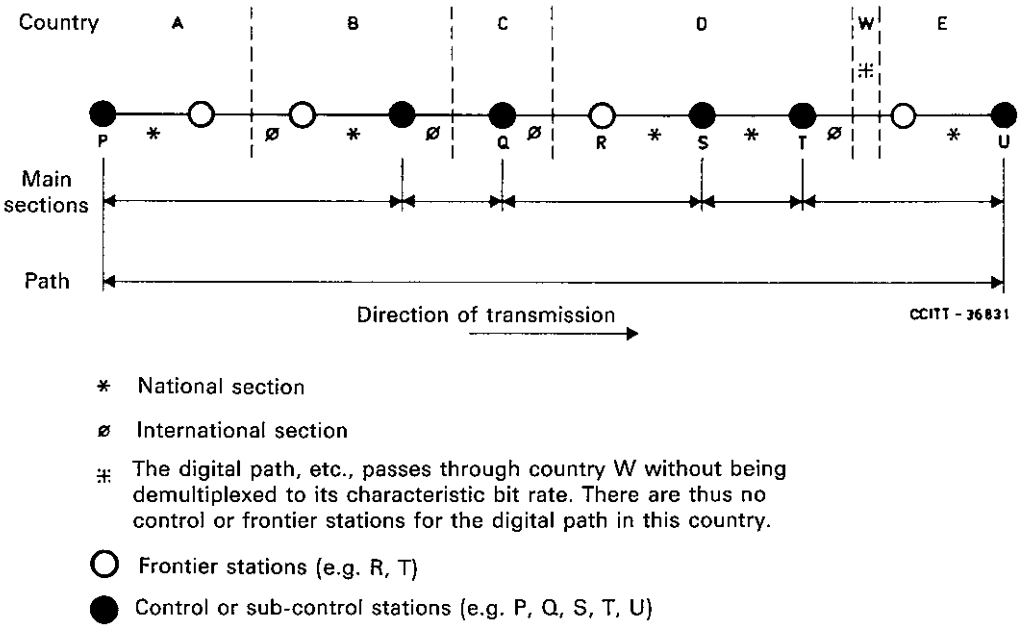

FIGURE 1/M.555

Example of an international digital path showing how it may be divided into sections of control for initial testing and maintenance

4.3 *Organization of control functions*

The terminal stations of each national, international and main section will be appointed as a control or sub-control station for that class of section with which they are concerned. However, as a consequence of the definitions of national, international and main sections of a digital path, some stations will be nominated for more than one control or sub-control function. For example, station S in Figure 1/M.555 is:

– control station for main section Q-S,

– sub-control station for main section S-T,

– control station for national section R-S.

5 Setting up and initial testing of an international digital path

5.1 *Setting up the path*

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

All the repeater stations concerned – i.e., the stations at the ends of each digital section that will make up the digital path – should make setting-up tests and check the equipment to be used. The check should include a general visual inspection and vibration tests, particularly if the equipment has remained unused for some time since acceptance tests were carried out after installation.

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

5.2 *Initial testing of the digital path*

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

i) national and international sections which are then interconnected to form main sections,

ii) main sections which are then interconnected to form the overall path,

iii) overall path.

The setting-up tests should include a quick test of the digital error performance. The function of such a check is not to guarantee compliance with performance objectives nor is it the testing of the system as part of a commissioning process (which might require measurement of margins), but rather to detect any immediate problems instead of having the user do so. Thus, it is analogous to a continuity check of a circuit, not to a measurement of the loss and noise of the circuit. The limits to apply are given in Table 2/M.555.

For these tests, satellite paths should be considered to have an equivalent length of 12 500 km.

5.2.2 The following procedures should be used when making the tests recommended in Table 2/M.555:

1) All tests should be performed at a first order digital connection point. Thus, tests of second order and other higher bit rate digital systems must have the appropriate multiplexers and demultiplexers in the test path. This ensures a complete test of the path regardless of its bit rate.

2) A test of digital path between two stations is set up by connecting a QRSS (quasi-random signal source) to the input for the digital path at the transmitting station distribution frame and connecting the output at the receiving station distribution frame to a receive input of a test set such as that described in Recommendation O.151 [2].

3) Tests may be one way in each direction or “looped” (combined 2-way). If looped, then test equipment is required at only one location, and the other end is arranged to be looped back (output connected to the input at the distribution frame).

4) Test equipment should have the features described in Recommendation O.151 [2]. Back-to-back tests of test equipment should occasionally be performed (connect output to input on the same test instrument) to test for locally generated errors due to unfiltered a.c. power or station equipment interference. In general, whenever possible, use protected d.c. power for all test equipment.

5) The results of error tests may be contaminated by events which cause the test instrument to lose synchronization. In general, all such "lost sync" tests should be repeated.

6) If the tests fail:

   a) Determine if some special circumstance was responsible for a circuit interruption or high error rate. If it was, repeat the test to verify that the circuit is working correctly.

   b) If no special circumstance is found, an attempt should be made to isolate the problem section for repair or replacement. If the digital path starts to function correctly during trouble isolation, repeat the original test.

   c) For marginal failures (i.e. just a few counts over the limit), the test should be repeated, but with the time limit and the maximum allowable count doubled.

TABLE 2/M.555

Quick check test of digital error performance for digital section and paths at the primary rate (Provisional)

Effective distance (kilometres)	**Minimum test duration (in minutes)**	**Maximum allowed counts**[a] **in errored seconds**[b]
500	15	5
1 000	15	10
2 000	15	20
4 000	15	40
8 000	15	80
12 500	15	125
18 000	15	180
25 000	15	250

a) Values relate to 1.5 or 2.0 Mbit/s and may be linearly interpolated for other distances.

b) For the meaning of the term "errored seconds", see Recommendation G.821 [3].

6 Setting up lower-order sections after the initial testing of the higher-order paths

The different hierarchical orders of sections have to be set up in sequence.

6.1 Thus, when the digital path has been initially tested, each end of it is connected to the appropriate digital multiplexing equipment and the corresponding lower-order sections are then set up.

6.2 In each case, the digital multiplexing equipment, before it is connected to the ends of its associated path, must be checked and adjusted to ensure that it meets CCITT Recommendations and other relevant specifications.

6.3 When the lower-order sections have been set up in the above manner, they are interconnected as necessary to form paths, as described in § 5.1 above, and the appropriate path testing procedure as detailed in § 5.2 above, is then applied.

ANNEX A

(to Recommendation M.555)

Designation information of international digital blocks and paths

A.1 *Designation*

The designation is according to Recommendation M.140, §§ 9 and 10.

A.2 *Related information*

The additional information on digital blocks, etc. is covered by the following items:

RI 1. urgency for restoration;

RI 2. terminal countries;

RI 3. carriers' names;

RI 4. control and subcontrol station(s);

RI 5. fault report points;

RI 6. routing;

RI 7. association;

RI 8. equipment information;

RI 9. use;

RI 10. transmission medium;

RI 11. (empty item, use "–"); only for the mixed analogue/digital network: end-to-end information;

RI 12. bit rate;

RI 13. occupancy (for blocks);

RI 14. actual number of channels (for primary blocks);

RI 15. clocking information (for blocks);

RI 16. direction of transmission (for unidirectional blocks).

The various items will be dealt with in § 12 of Recommendation M.140.

References

[1] CCITT Recommendation *Protection against the effects of faulty transmission on groups and circuits*, Vol. VI, Rec. Q.33.

[2] CCITT Recommendation *Error performance measuring equipment for digital systems*, Vol. IV, Rec. O.151.

[3] CCITT Recommendation *Error performance of an international digital connection forming part of an integrated services digital network*, Vol. III, Rec. G.821.

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