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GENERAL ASPECTS OF DIGITAL TRANSMISSION SYSTEMS

PROTECTED MONITORING POINTS PROVIDED ON DIGITAL TRANSMISSION SYSTEMS

ITU-T Recommendation G.772

(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 G.772 was revised by the ITU-T Study Group XV (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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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PROTECTED MONITORING POINTS PROVIDED ON DIGITAL TRANSMISSION SYSTEMS

(Melbourne, 1988; amended at Helsinki, 1993)

1 General

Regular signal monitoring is an important measure to maintain performance of digital networks.

Existing transmission equipment does not have built-in devices providing extensive performance monitoring capabilities.

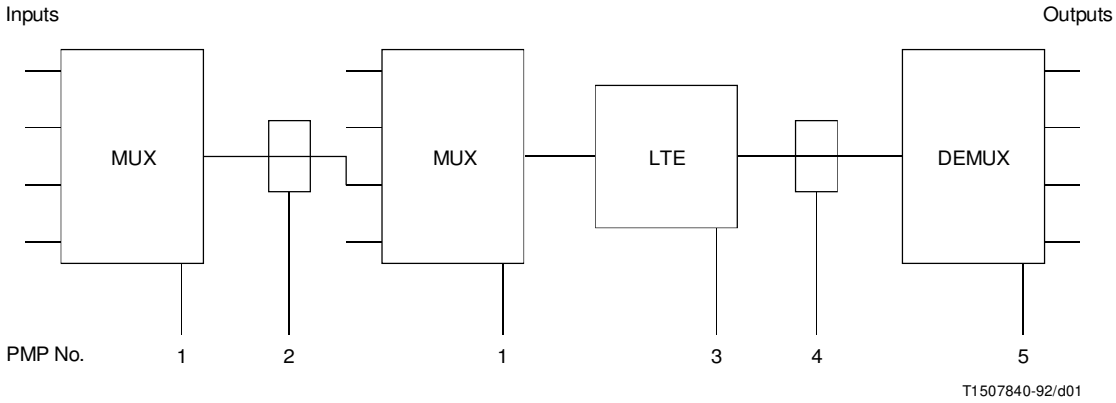
Monitoring points are an additional means to a telecommunication management network (TMN) for temporarily monitoring the transmitted signal for purposes of fault finding.

1.1 Definition

A **protected monitoring point (PMP)** provides a digital interface at which it is possible to monitor the transmitted digital signal without impairing it Protected monitoring points allow measurements to be made with suitable test equipment. [1]

1.2 Location of protected monitoring points

Protected monitoring points may be provided in conjunction with electrical output interfaces of equipment corresponding to Recommendation G.703 or at points between an output and an input interface, e.g. at distribution frames. Figure 1 shows some examples for the implementation of digital protected monitoring points.



PMP No. 1 Monitoring point at multiplexer output
2 Monitoring point at a distribution frame
3 Monitoring point at the output of line terminating equipment
4 Monitoring point at demultiplexer input/distribution frame
5 Monitoring point at demultiplexer output

FIGURE 1/G.772

Possible locations of monitoring points

1.3 Use of protected monitoring points

In the long term, protected monitoring points will be used primarily for measurements that are not scheduled (e.g. failure detection and fault localization) or made on an infrequent basis. Protected monitoring points offer an interface at which digital test equipment may be connected. Equipments specified in the O-Series Recommendations are preferred examples. (See Recommendations O.133, O.151, O.152, O.161, O.162 [2].)

External test equipment connected to protected monitoring points may permit performance monitoring on links/paths not provided with these functions built into terminal equipment, or might give the ability to monitor additional parameters.

Scanner devices may be used with protected monitoring points to provide nearly continuous monitoring of transmission systems and terminals. Special switching matrices may allow the connection of *m* external instruments to *n* protected monitoring points.

Concerning the maintenance of circuits at 64 kbit/s, an additional use of the protected monitoring points on the primary order digital path is to allow monitoring of individual time slots. This will permit, for example, measurement of analogue type parameters (signal level, quantizing distortion, etc.) using appropriate measuring equipment Other circuits to be monitored are signalling links of a common channel signalling system at a point on the exchange boundary, independent of the switching equipment itself.

It is necessary to distinguish between access points and protected monitoring points. The use of access points for testing, i.e. insertion and retrieval of signals, will disturb the transmission on the accessed link (the accessed link must be out of service). On the contrary, the use of protected monitoring points for retrieval of signals shoud not disturb the transmission (the monitored link will be in service).

The use of protected monitoring points is optional.

1.4 General electrical characteristics

Concerning the general characteristics of the protected monitoring points, namely

bit rate;
number of pairs;
code at the interface;
nominal pulse shape,

the relevant specifications of Recommendation G.703 shall apply [4].

NOTE – For transmission equipment with optical interfaces it not required to provide a digital signal which is encoded in accordance with Recommendation G. 703 only for the purpose of signal monitoring.

The monitoring point for this signal may provide an attenuated NRZ signal as available at the input/output of the electro-/optical converter.

2 Electrical characteristics of protected monitoring points provided on transmission equipments of the plesiochronous digital hierarchy

This clause applies to equipments operating in accordance wfth the plesiochronous digital hierarchy (PDH) as given in Recommendation G.702 [3].

NOTE – Subclauses 2.2.1 and 2.3.2 below specify a maximum signal attenuation of 20 dB at protected monitoring points. Monitoring points already available on existing transmission equipment may output lower levels.

Providers of measuring equipment shall take this into account.

2.1 Impedances at the protected monitoring points

The output and terminating impedances at the protected monitoring points shall be in accordance with Table 1.

The return loss shall be ≥ 14 dB over a frequency range corresponding to 5% to 150% of the relevant bit rate.

TABLE 1/G.772

Impedance, return loss and output signal balance of protected monitoring points

Bit rate (kbit/s)	Impedance symmetrical	Impedance coaxial
64	120 Ω	–
2 048	120 Ω	75 Ω
8 448	–	75 Ω
34 368	–	75 Ω
139 264	–	75 Ω
1 544	100 Ω	–
6 312	110 Ω	75 Ω
32 064	–	75 Ω
44 736	–	75 Ω

If applicable, the output siganal balance shall be ≥ 30 dB measured in accordance with Recommendation O.9 over a frequency range corresponding to 5% to 150% of the relevant bit rate.

NOTE – For bit rates up to 8448 kbit/s, a simple resistive protection network presenting an impedance not complying with this table is acceptable. The input impedance of the connected test equipment must always comply with the values specified in the table.

2.2 Characteristics of monitoring points incorporated in transmission equipment

2.2.1 Monitoring points at 64 kbit/s, 1544 kbit/s, 2048 kbit/s, 6312 kbit/s, 8448 kbit/s, 32 064 kbit/s, 34 368 kbit/s, 44 736 kbit/s and 139 264 kbit/s

The nominal voltage at the protected monitoring points when terminated in the nominal impedance as given in Table 1 shall be ≥ 1/10 of the voltage specified in Recommendation G.703. This means that the output signal at the protected monitoring point shall be attenuated not more than 20 dB referred to the output signal at a G.703 interface.

2.3 Characteristics of monitoring points located between transmission equipments

ln this case, protected monitoring points may be provided. for example, at digital distribution frames.

2.3.1 Monitoring points at 64 kbit/s, 2048 kbit/s, 8448 kbit/s, 34 368 kbit/s and 139 264 kbit/s

The digital signals presented at the protected monitoring points shall be as defined in 2.2.1 above but modified by the characteristics of the interconnecting cable. The attenuation of these cables shall be assumed to follow a $\sqrt{f}$ law. In accordance with Recommendation G.703, the attenuation at a frequency equivalent to half the nominal bit rate shall be as given below:

0 ≤ attenuation ≤ 3 dB for 64 kbit/s.

0 ≤ attenuation ≤ 6 dB for 2048 kbit/s and 8448 kbit/s.

0 ≤ attenuation ≤ 12 dB for 34 368 kbit/s and 139 264 kbit/s.

2.3.2 Monitoring points at 1 544 kbit/s, 6 312 kbit/s, 32 064 kbit/s and 44 736 kbit/s

The digital signals presented at protected monitoring points located at digital distribution frames shall be shaped as defined in 2, 3, 4 and 5/G.703. However, when terminated in the nominal impedance as given in Table 1, the nominal voltage shall be ≥ 1/10 of the voltage specified in Recommendation G.703. This means that the output signal at the monitoring point shall be attenuated not more than 20 dB referred to the output signal at a G.703 interface.

3 Electrical characteristics of protected monitoring points provided on transmission equipments of the synchronous digital hierarchy

This clause applies to equipments operating in accordance with the synchronous digital hierarchy (SDH) as given in Recommendations G.707 [5], G.708 [6] and G.709 [7]. The overhead bytes specified in Recommendations G.708 and G.709 provide extensive capabilities to monitor performance. These capabilities can be utilized by the telecommunications management network (TMN).

In addition, protected monitoring points may be provided for temporarily monitoring the transmitted signal with the aid of external measuring equipment.

3.1 Impedances at the protected monitoring points

The output and terminating impedances at the protected monitoring points shall be in accordance with Table 2.

The return loss shall be ≥ 14 dB over a frequency range corresponding to 5% to 150% of the relevant bit rate.

TABLE 2/G.772

Impedance and return loss of protected monitoring points

Bit rate (kbit/s)	Impedance coaxial
155 520	75 Ω

3.2 Characteristics of monitoring points at 155 520 kbit/s incorporated in transmission equipment

The nominal voltage at the protected monitoring point when terminated in a nominal impedance of 75 Ω shall be ≥ 1/10 of the voltage specified in Recommendation G.703. This means that the output at the protected monitoring point shall be attenuated not more than 20 dB referred to the output signal at a G.703 interface.

3.3 Characteristics of monitoring points at 155 520 kbit/s located between transmission equipments

The digital signals presented at the protected monitoring points shall be as defined in 3.1 above but modified by the characteristics of the interconnecting cable. The attenuation of these cables shall be assumed to follow a $\sqrt{f}$ law. In accordance with Recommendation G.703, the attenuation at a frequency of 77 760 kHz shall be between 0 and 12 dB.

Monitoring points at other bit rates are under study.

3.4 Other bit rates

Monitoring points at other bit rates are under study.

4 Protection of the transmitted signal

Installation of protected monitoring points shall not result in degradation of the transmitted signal exceeding the limits specified in Recommendation G.703.

When connecting any passive load to the protected monitoring point, including short and open circuit, the pulse shape of the signal on the monitored path shall still comply with Recommendation G.703. With any passive load, the voltage of the transmitted signal measured at a frequency equivalent to half the nominal bit rate shall not be different from the voltage without load by more than 0.7 dB.

5 Resilience of the protected monitoring point

With regard to overvoltage protection, the protected monitoring points shall comply with Annex B/G.703.

No damage shall result from the application of any load impedance, including short and open circuits, to the protected monitoring points.

Properly screened coaxial or balanced cables shall be used for the installation of the protected monitoring points to minimize electromagnetic susceptibility and generation of interfering signals.

The protection against the inadvertent application of external voltages to the protected monitoring points is under study.

References

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

[2] CCITT O-Series Recommendations.

[3] CCITT Recommendation G.702 *Digital hierarchy bit rates*.

[4] CCITT Recommendation G.703 *Physical/electrical characteristics of hierarchical digital interfaces*.

[5] CCITT Recommendation G.707 *Synchronous digital hierarchy bit rates*.

[6] CCITT Recommendation G.708 *Network node interface for the synchronous digital hierarchy*.

[7] CCITT Recommendation G.709 *Synchronous multiplexing structure*.