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OF ITU

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SERIES O: SPECIFICATIONS OF MEASURING  
EQUIPMENT

General

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## **Scope and application of measurement equipment specifications covered in the O-series Recommendations**

ITU-T Recommendation O.1

(Formerly CCITT Recommendation)

ITU-T O-SERIES RECOMMENDATIONS  
SPECIFICATIONS OF MEASURING EQUIPMENT

|                                                                          |                |
|--------------------------------------------------------------------------|----------------|
| <b>General</b>                                                           | <b>0.1-0.9</b> |
| Maintenance access                                                       | 0.10-0.19      |
| Automatic and semi-automatic measuring systems                           | 0.20-0.39      |
| Equipment for the measurement of analogue parameters                     | 0.40-0.129     |
| Equipment for the measurement of digital and analogue/digital parameters | 0.130-0.199    |

*For further details, please refer to the list of ITU-T Recommendations.*

## **ITU-T Recommendation O.1**

### **Scope and application of measurement equipment specifications covered in the O-series Recommendations**

#### **Summary**

This ITU-T Recommendation gives a summary of the content of all O-series Recommendations. It lists the titles and contains information on scope and application of the Recommendations.

In addition, an alphabetical list of measurement terms covered by O-series Recommendations helps the reader to select the right Recommendation for his/her application.

Appendix I contains information about a crosstalk test device for carrier transmission systems.

#### **Source**

ITU-T Recommendation O.1 was revised by ITU-T Study Group 4 (1997-2000) and approved under the WTSC Resolution 1 procedure on 4 February 2000.

## FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. 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, 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 WTSC 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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# CONTENTS

|                                                                                                                                                                     | Page |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1 Scope .....                                                                                                                                                       | 1    |
| 2 References .....                                                                                                                                                  | 1    |
| 3 Abbreviations .....                                                                                                                                               | 2    |
| 4 How to use this Recommendation .....                                                                                                                              | 3    |
| 5 Content of the O-series Recommendations .....                                                                                                                     | 3    |
| 5.1 General Recommendations.....                                                                                                                                    | 4    |
| 5.1.1 Recommendation O.3 – Climatic conditions and relevant tests for<br>measuring equipment .....                                                                  | 4    |
| 5.1.2 Recommendation O.6 – 1020 Hz reference test frequency.....                                                                                                    | 4    |
| 5.1.3 Recommendation O.9 – Measuring arrangements to assess the<br>degree of unbalance about Earth .....                                                            | 4    |
| 5.2 Maintenance access .....                                                                                                                                        | 4    |
| 5.2.1 Recommendation O.11 – Maintenance access lines .....                                                                                                          | 4    |
| 5.3 Automatic and semi-automatic measuring systems .....                                                                                                            | 5    |
| 5.3.1 Recommendation O.22 – CCITT Automatic Transmission Measuring<br>and signalling testing Equipment ATME No. 2.....                                              | 5    |
| 5.3.2 Recommendation O.27 – In-Station Echo canceller Test equipment .....                                                                                          | 5    |
| 5.3.3 Recommendation O.33 – Automatic equipment for rapidly measuring<br>stereophonic pairs and monophonic sound-programme circuits, links<br>and connections ..... | 5    |
| 5.4 Equipment for the measurement of analogue parameters .....                                                                                                      | 5    |
| 5.4.1 Recommendation O.41 – Psophometer for use on telephone-type circuits ..                                                                                       | 5    |
| 5.4.2 Recommendation O.42 – Equipment to measure non-linear distortion<br>using the 4-tone intermodulation method.....                                              | 6    |
| 5.4.3 Recommendation O.61 – Simple equipment to measure interruptions<br>on telephone-type circuits .....                                                           | 6    |
| 5.4.4 Recommendation O.62 – Sophisticated equipment to measure<br>interruptions on telephone-type circuits .....                                                    | 6    |
| 5.4.5 Recommendation O.71 – Impulsive noise measuring equipment for<br>telephone-type circuits .....                                                                | 6    |
| 5.4.6 Recommendation O.72 – Characteristics of an impulsive noise<br>measuring instrument for wideband data transmissions .....                                     | 6    |
| 5.4.7 Recommendation O.81 – Group-delay measuring equipment for<br>telephone-type circuits .....                                                                    | 6    |
| 5.4.8 Recommendation O.82 – Group-delay measuring equipment for<br>the range 5 to 600 kHz .....                                                                     | 7    |
| 5.4.9 Recommendation O.91 – Phase jitter measuring equipment for<br>telephone-type circuits .....                                                                   | 7    |
| 5.4.10 Recommendation O.95 – Phase and amplitude hit counters for<br>telephone-type circuits .....                                                                  | 8    |



**Documents**

Document Sharing Hub

|                                                                                                                                                                    | Page |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 5.4.11 Recommendation O.111 – Frequency shift measuring equipment for use on carrier channels .....                                                                | 8    |
| 5.5 Equipment for the measurement of analogue/digital and digital parameters .....                                                                                 | 8    |
| 5.5.1 Recommendation O.131 – Quantizing distortion measuring equipment using a pseudo-random noise test signal .....                                               | 8    |
| 5.5.2 Recommendation O.132 – Quantizing distortion measuring equipment using a sinusoidal test signal .....                                                        | 9    |
| 5.5.3 Recommendation O.133 – Equipment for measuring the performance of PCM encoders and decoders .....                                                            | 9    |
| 5.5.4 Recommendation O.150 – General requirements for instrumentation for performance measurements on digital transmission equipment.....                          | 10   |
| 5.5.5 Recommendation O.151 – Error performance measuring equipment for digital systems at the primary bit rate and above .....                                     | 10   |
| 5.5.6 Recommendation O.152 – Error performance measuring equipment for bit rates of 64 kbit/s and $N \times 64$ kbit/s .....                                       | 10   |
| 5.5.7 Recommendation O.153 – Basic parameters for the measurement of error performance at bit rates below the primary rate .....                                   | 10   |
| 5.5.8 Recommendation O.161 – In-service code violation monitors for digital systems .....                                                                          | 10   |
| 5.5.9 Recommendation O.162 – Equipment to perform in-service monitoring on 2048, 8448, 34 368 and 139 264 kbit/s signals .....                                     | 10   |
| 5.5.10 Recommendation O.163 – Equipment to perform in-service monitoring on 1544 kbit/s signals .....                                                              | 11   |
| 5.5.11 Recommendation O.171 – Timing jitter and wander measuring equipment for digital systems which are based on the Plesiochronous Digital Hierarchy (PDH) ..... | 11   |
| 5.5.12 Recommendation O.172 – Jitter and wander measuring equipment for digital systems which are based on the Synchronous Digital Hierarchy (SDH) .....           | 11   |
| 5.5.13 Recommendation O.181 – Equipment to assess error performance on STM-N interfaces .....                                                                      | 12   |
| 5.5.14 Recommendation O.191 – Equipment to measure the cell transfer performance of ATM connections .....                                                          | 12   |
| Annex A – Alphabetical list of measurement terms covered by O-Series Recommendations .....                                                                         | 13   |
| Appendix I – Crosstalk test device for carrier transmission on coaxial systems .....                                                                               | 21   |
| I.1 Introduction .....                                                                                                                                             | 21   |
| I.2 Operation .....                                                                                                                                                | 21   |
| I.3 Basic technical parameters of a device designed for transmission systems at frequencies less than 18 MHz.....                                                  | 23   |
| I.3.1 Basic characteristics .....                                                                                                                                  | 23   |
| I.3.2 Several technical characteristics.....                                                                                                                       | 23   |

## Introduction

This Recommendation is intended to help maintenance personnel and other interested parties to select the test equipment specified by an O-series Recommendation which is applicable to a specific measurement task.

For this reason, this Recommendation lists the titles of all O-series Recommendations and informs about their scope and application. An alphabetical list of measurement terms covered by the O-series Recommendations is given in Annex A.

This Recommendation does not contain any test equipment specification.

## Background

Within the ITU Standardization Sector, Study Group 4 is responsible for Network Maintenance. One of its tasks is defining measuring equipment required to assess network quality. Different kinds of measuring equipment Recommendations have to be considered, namely those covering:

- a) conformance tests for telecommunications equipment; and
- b) operational matters, e.g. procedures for bringing circuits into service and routine performance checks.

The kinds of tests for checking compliance with these two categories of Recommendations are essentially different, and this often leads to a different choice of test equipment.

Category a) tests will normally be more comprehensive. Their purpose (often based upon measurements of sample or prototype equipment) is to certify compliance with design objectives and they may therefore be a prerequisite to equipment being accepted for installation in a network. Such tests are unlikely to be employed routinely.

Category b) tests, however, are used systematically and repetitively and their widespread application may necessitate additional considerations, in particular the need for:

- 1) conformity of results when tests may be performed using test equipment supplied by several manufacturers; and
- 2) a common measurement technique to ensure compatibility when a test requires measurement equipment at both ends of a device under test.

It is primarily for these circumstances that ITU-T issues the O-series Recommendations.

The above remarks apply equally to analogue and digital techniques.

## ITU-T Recommendation O.1

### Scope and application of measurement equipment specifications covered in the O-series Recommendations

#### 1 Scope

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For this reason, this Recommendation lists the titles of all O-series Recommendations and informs about their scope and application. An alphabetical list of measurement terms covered by the O-series Recommendations is given in Annex A.

This Recommendation does not contain any test equipment specification.

#### 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: all 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 G.117 (1996), *Transmission aspects of unbalance about Earth.*
- [2] ITU-T Recommendation G.165 (1993), *Echo cancellers.*
- [3] ITU-T Recommendation G.712 (1996), *Transmission performance characteristics of pulse code modulation.*
- [4] ITU-T Recommendations Q.550-series, *Transmission characteristics.*
- [5] ITU-T Recommendation G.821 (1996), *Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an integrated services digital network.*
- [6] ITU-T Recommendation G.826 (1999), *Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate.*
- [7] ITU-T Recommendation M.2100 (1995), *Performance limits for bringing-into-service and maintenance of international PDH paths, sections and transmission systems.*
- [8] ITU-T Recommendation G.707 (1996), *Network node interface for the synchronous digital hierarchy (SDH).*
- [9] ITU-T Recommendation G.783 (1997), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks.*
- [10] ITU-T Recommendation G.784 (1999), *Synchronous digital hierarchy (SDH) management.*
- [11] ITU-T Recommendation M.2101 (2000), *Performance limits and objectives for bringing-into-service and maintenance of international SDH paths and multiple sections.*
- [12] ITU-T Recommendation I.356 (2000), *B-ISDN ATM layer cell transfer performance.*
- [13] ITU-T Recommendation I.357 (1996), *B-ISDN semi-permanent connection availability.*

- [14] ITU-T Recommendation I.361 (1999), *B-ISDN ATM layer specification.*
- [15] ITU-T Recommendation I.610 (1999), *B-ISDN operation and maintenance principles and functions.*
- [16] ITU-T Recommendation G.823 (2000), *The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy.*
- [17] ITU-T Recommendation G.824 (2000), *The control of jitter and wander within digital networks which are based on the 1544 kbit/s hierarchy.*
- [18] ITU-T Recommendation G.825 (2000), *The control of jitter and wander within digital networks which are based on the synchronous digital hierarchy (SDH).*
- [19] CCITT Recommendation G.793 (1988), *Characteristics of 60-channel transmultiplexing equipments.*
- [20] CCITT Recommendation G.794 (1988), *Characteristics of 24-channel transmultiplexing equipments.*
- [21] ITU-T Recommendation G.704 (1998), *Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels.*
- [22] CCITT Recommendation G.751 (1988), *Digital multiplex equipments operating at the third order bit rate of 34 368 kbit/s and the fourth order bit rate of 139 264 kbit/s and using positive justification.*

### 3 Abbreviations

This Recommendation uses the following abbreviations:

|        |                                                                   |
|--------|-------------------------------------------------------------------|
| A-A    | Analogue to Analogue                                              |
| A-D    | Analogue to Digital                                               |
| AIS    | Alarm Indication Signal                                           |
| AMI    | Alternate Mark Inversion                                          |
| ATM    | Asynchronous Transfer Mode                                        |
| ATME   | Automatic Transmission Measuring and signalling testing Equipment |
| AU-AIS | Administrative Unit Alarm Indication Signal                       |
| AU-LOP | Administrative Unit Loss Of Pointer                               |
| CDV    | Cell Delay Variation                                              |
| CER    | Cell Error Ratio                                                  |
| CLR    | Cell Loss Ratio                                                   |
| CMR    | Cell Misinsertion Rate                                            |
| CMR    | Common Mode Rejection                                             |
| CRC    | Cyclic Redundancy Check                                           |
| CTD    | Cell Transfer Delay                                               |
| D-A    | Digital to Analogue                                               |
| D-D    | Digital to Digital                                                |
| HDB 3  | High Density Bipolar with 4-zero suppression                      |
| HP-RDI | Higher-order Path Remote Defect Indication                        |



|        |                                             |
|--------|---------------------------------------------|
| HP-REI | Higher-order Path Remote Error Indication   |
| HP-TIM | Higher-order Path Trace Identifier Mismatch |
| ILIL   | Input Longitudinal Interference Loss        |
| ISET   | In-Station Echo canceller Test equipment    |
| LCL    | Longitudinal Conversion Loss                |
| LCTL   | Longitudinal Conversion Transfer Loss       |
| LOF    | Loss Of Frame alignment                     |
| LOS    | Loss Of Signal                              |
| LP-RDI | Lower-order Path Remote Defect Indication   |
| LP-REI | Lower-order Path Remote Error Indication    |
| LP-TIM | Lower-order Path Trace Identifier Mismatch  |
| MS-AIS | Multiplex Section Alarm Indication Signal   |
| MS-RDI | Multiplex Section Remote Defect Indication  |
| OOF    | Out Of Frame alignment                      |
| OSB    | Output Signal Balance                       |
| PDH    | Plesiochronous Digital Hierarchy            |
| SDH    | Synchronous Digital Hierarchy               |
| TCL    | Transverse Conversion Loss                  |
| TCTL   | Transverse Conversion Transfer Loss         |
| TU-AIS | Tributary Unit Alarm Indication Signal      |
| TU-LOM | Tributary Unit Loss Of Multiframe alignment |
| TU-LOP | Tributary Unit Loss Of Pointer              |

#### 4 How to use this Recommendation

Clause 5 lists the titles of all O-series Recommendations including a brief summary of the relevant specification. Titles and summaries are in most cases sufficiently descriptive to select the O-series Recommendation applicable to the measurement task the reader is interested in.

In addition, Annex A provides a comprehensive index of measurement related terms and abbreviations covered in O-series Recommendations. Where useful, index entries are given twice: Firstly under a summary keyword (e.g. PCM encoder/decoder, quantizing distortion) and secondly under the specific task (e.g. quantizing distortion). Using the index is the easiest way to find the relevant O-Recommendation.

#### 5 Content of the O-series Recommendations

This clause is presented as an aid to selecting and applying measuring instrumentation specified in the O-series Recommendations. It gives an overview of the titles and the content of these Recommendations which can be categorized into five classes, namely:

- General Recommendations.
- Recommendations dealing with maintenance access lines.
- Automatic and semi-automatic measuring systems.

- Equipment for the measurement of analogue parameters.
- Equipment for the measurement of analogue/digital and digital parameters.

## 5.1 General Recommendations

### 5.1.1 Recommendation O.3 – Climatic conditions and relevant tests for measuring equipment

The Recommendations of the O-series specify measurement equipment for a wide range of applications. Reliable test equipment is an important prerequisite when maintaining telecommunication equipment and telecommunication networks. The reliability of measuring equipment can be affected by the environmental conditions to which the equipment is exposed to during its use.

Recommendation O.3 gives a range of climatic conditions for the indoor operation of measuring equipment specified in the O-series Recommendations. In addition, climatic conditions for transportation and storage of measuring equipment are defined.

In order to be able to prove that the requirements of Recommendation O.3 are fulfilled, test conditions simulating the various environmental parameters are specified.

### 5.1.2 Recommendation O.6 – 1020 Hz reference test frequency

The intent of Recommendation O.6 is to specify a single nominal reference frequency of 1020 Hz in order to provide guidance to manufacturers and network operators in the design and operation of equipment and systems. In addition to the nominal reference frequency, Recommendation O.6 defines a nominal reference level of  $-10$  dBm0.

Recommendation O.6 takes into account the specific difficulties of testing circuits routed over PCM systems.

### 5.1.3 Recommendation O.9 – Measuring arrangements to assess the degree of unbalance about Earth

Recommendation O.9 describes arrangements for measuring the following parameters:

- Longitudinal Conversion Loss (LCL);
- Transverse Conversion Loss (TCL);
- Longitudinal Conversion Transfer Loss (LCTL);
- Transverse Conversion Transfer Loss (TCTL);
- Input Longitudinal Interference Loss (ILIL);
- Common Mode Rejection (CMR);
- Output Signal Balance (OSB).

In practice, these are the seven most significant unbalance parameters. Limits, special considerations for test terminations and the measurement frequencies to be used are given.

Recommendation O.9 is based upon Recommendation G.117 [1] which contains additional information on unbalanced measurements.

## 5.2 Maintenance access

### 5.2.1 Recommendation O.11 – Maintenance access lines

In order to more effectively carry out manual and automatic maintenance of international circuits in an automatic telephone network, Recommendation O.11 gives the basic specifications for maintenance access lines.