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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic active components and devices – Test and measurement procedures – Part 5: Wavelength channel tuning time of tuneable transmitters

Composants et dispositifs actifs à fibres optiques – Procédures d'essais et de mesures – Partie 5: Durée d'accordement des émetteurs accordables en longueur d'onde

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FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – TEST AND MEASUREMENT PROCEDURES –

Part 5: Wavelength channel tuning time of tuneable transmitters

FOREWORD

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The text of this standard is based on the following documents:

FDIS	Report on voting
86C/1440/FDIS	86C/1445/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62150 series, published under the general title *Fibre optic active components and devices – Test and measurement procedures*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This part of IEC 62150 specifies testing and measurement procedures for the wavelength channel tuning time of a tuneable transmitter. In a multiple-wavelength network, such as described in the ITU-T G.989 series, the tuneable transmitter is controlled to change its output wavelength during its operation. In order to provide different use cases, the tuneable transmitters are categorized into several wavelength channel tuning time classes. The test and measurement procedures of the wavelength channel tuning time are established to guarantee interoperability.

FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – TEST AND MEASUREMENT PROCEDURES –

Part 5: Wavelength channel tuning time of tuneable transmitters

1 Scope

This part of IEC 62150 specifies test and measurement procedures for the wavelength channel tuning time of tuneable transmitters. It applies to laser transmitters, and to the transmitter portion of transceivers. This procedure examines whether the device or module satisfies the appropriate performance specification.

The method described in this document uses optical filters to transfer the transition of the output wavelength to the transition of the optical power. This is because the transient response of the output wavelength before stabilization at steady-state of the target wavelength channel is too fast to measure using a wavelength meter or an optical spectrum analyser. Reference optical filter sets are described in Annex A.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
tuneable transmitter
transmitter which can select a specific output wavelength and can be tuned across a specified wavelength range

3.1.2
wavelength channel
unidirectional optical communication channel characterized by a single unique centre frequency or a set of unique centre frequencies mapped to one wavelength multiplexer/demultiplexer tributary port

3.1.3
wavelength channel tuning time
T_{tu}
maximum time taken for the optical power from the tuneable transmitter to begin to decrease in the original wavelength channel (after a wavelength-change control signal) to the time when the optical power from the tuneable transmitter appears and remains stable within the desired wavelength channel

$$T_{tu} = T_p + T_{tr} + T_c$$

Note 1 to entry: See Figure 1.

3.1.4
processing time
T_p
time interval between the instant the electrical control signal reaches a specified level (Z %) and the instant the optical output power of the transmitter output port reaches a specified level (Y %)

3.1.5
transition time
T_{tr}
time interval between the instant the optical output power of the transmitter output port falls below a specified level (Y %) and the subsequent first instant the optical output power of the transmitter output port returns above the same specified level (Y %)

3.1.6
convergence time
T_c
time interval between the instant the optical output power of the transmitter output port first returns above a specified level (Y %) and the instant the optical output power of the transmitter output port last crosses a specified level (Y %)

3.2 Abbreviated terms

O/E optical-to-electrical

LPF low-pass filter

4 Apparatus

4.1 Tuneable transmitter under test

The tuneable transmitter under test can be a laser, a laser transmitter, or a transmitter portion of the transceiver, which can select a specific output wavelength within a specified wavelength range. The tuneable transmitter under test is required to be maintained at a specified temperature and/or humidity for the measurement period. In order to minimize the uncertainty caused by the device under test, the output wavelength and the optical power shall be stable at a steady state during the measurement. The stability of the output power during the measurement shall be smaller than one-hundredth of the output power. Also, the tuneable transmitter under test shall have repeatability in output power and wavelength.

4.2 Optical filter set

The optical filter set is a combination of reconfigurable optical filters. It has two or more transmission pass bands within the tuning range of the tuneable transmitter. The transmission loss of each of the optical filters shall be normalized over the wavelength range of interest. The optical filter set shall reflect the channel spacing and the spectral excursion of a specific network.

Details regarding the optical filter set are given in Annex A.

4.3 Optical-to-electrical (O/E) converter with low-pass filter (LPF)

The O/E converter with LPF is used to convert the optical output power of the target wavelength channel port of the optical filter to be measured to the electrical power to be observed by an oscilloscope. The bandwidth of the O/E converter with LPF shall be wide enough to measure the transition time.

The input power to the O/E converter shall be large enough to ensure measurement accuracy and to minimize the non-linearity O/E response effect caused by optical overload. Adjust the optical input power using a variable optical attenuator or an optical amplifier, to be positioned after the tuneable laser, if needed.

4.4 Oscilloscope

The oscilloscope shall have a storage function and shall have at least two traces.

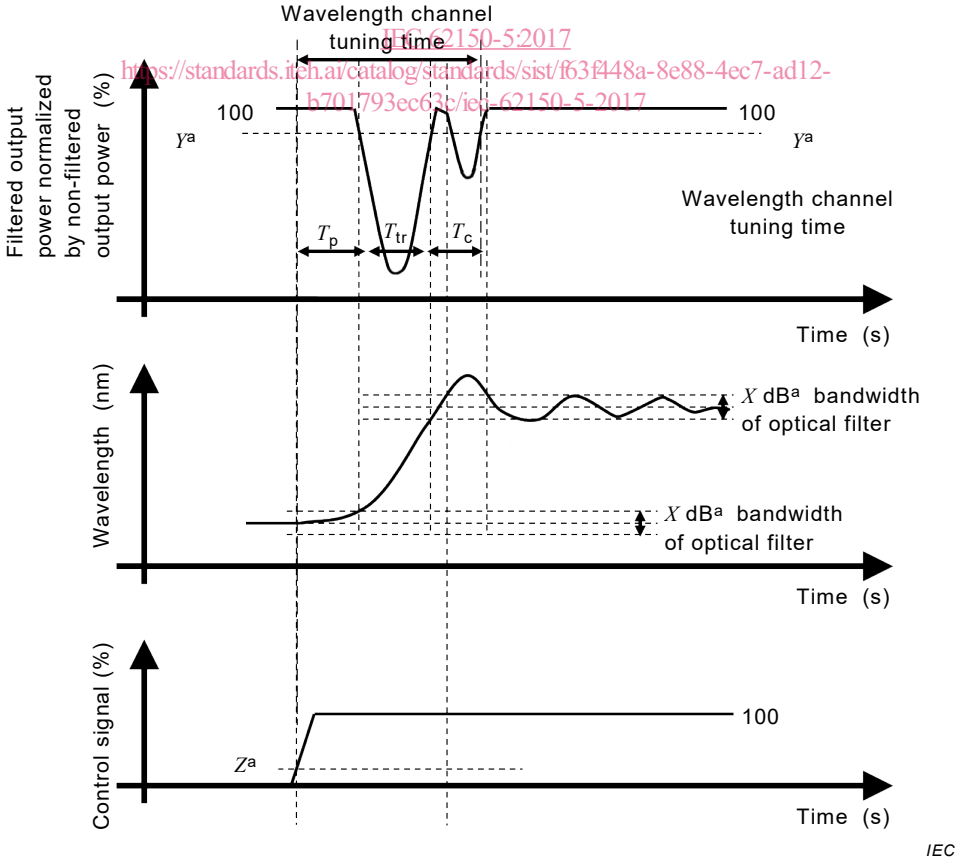
4.5 Control unit

The control unit is used to tune the tuneable transmitter under test. The control unit generates a control signal either in the form of a control message, or a voltage or current signal directly. The output control signal shall also be monitored and recorded. The wavelength channel tuning time can be calculated using the control unit.

5 Testing and measuring procedures

5.1 General

Since a change of the output wavelength of a tuneable transmitter occurs when the control signal is applied, the time-dependent behaviour of the tuneable transmitter is illustrated with the control signal in Figure 1. This control signal is applied either in the form of a control message, or directly by voltage or current. The wavelength channel tuning time, which includes the processing time or latency time, is defined in Figure 1 with the parameters generally used to characterize transient behaviour.



[a] values which can be found in relevant specifications

Figure 1 – Illustration of wavelength channel tuning time

5.2 Measurement procedures

A diagram of the measurement setup is given in Figure 2.

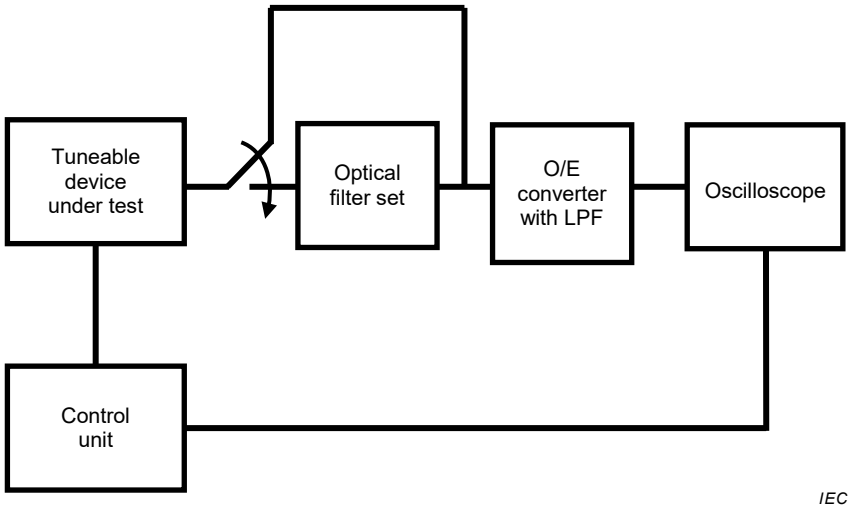


Figure 2 – Measurement setup for wavelength channel tuning time

This procedure shall be carried out as follows.

a) Configure the measurement setup as shown in Figure 2. Connect the tuneable transmitter under test directly to the O/E converter without the optical filter set.

b) Tune the output wavelength of the tuneable transmitter and record the output power over the wavelength of interest. Normalize the output power over the tuning range using the variable optical attenuator or optical amplifier.

c) Configure the measurement setup as shown in Figure 2 to include the optical filter set. Test the uniformity of the insertion loss of the optical filter over the wavelength of interest and normalize the insertion loss over the wavelength range of interest.

d) Tune the output wavelength of the tuneable transmitter repeatedly and record the output power. Tune the output wavelength of the tuneable transmitter from the initial value to the target value repeatedly, and record the output power throughout the tuning process.

e) Calculate the wavelength channel tuning time as shown in Figure 1.

6 Test results

6.1 Required information

The required information shall include the following:

a) date, title of test, and procedures used;

b) identification of the tuneable transmitter;

c) details of the utilized optical filter set;

d) test condition:

- operating temperature;
- initial wavelength;
- target wavelength;
- specified level which was used for the calculation;

e) results of the examination.

6.2 Information to be available on request

The information to be available on request is as follows:

a) details of the test equipment used and the latest date of test;
b) names of the test personnel.