

---

---

**Optics and photonics —  
Measurement method of  
semiconductor lasers for sensing**

*Optique et photonique — Méthode de mesure des lasers semi-  
conducteurs pour la sensibilité*

**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

[ISO 17915:2018](https://standards.iteh.ai/catalog/standards/iso/ac0c59a0-49a6-48a1-bf06-fec8b3c1e5a5/iso-17915-2018)

<https://standards.iteh.ai/catalog/standards/iso/ac0c59a0-49a6-48a1-bf06-fec8b3c1e5a5/iso-17915-2018>



**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

[ISO 17915:2018](https://standards.iteh.ai/catalog/standards/iso/ac0c59a0-49a6-48a1-bf06-fec8b3c1e5a5/iso-17915-2018)

<https://standards.iteh.ai/catalog/standards/iso/ac0c59a0-49a6-48a1-bf06-fec8b3c1e5a5/iso-17915-2018>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Fax: +41 22 749 09 47  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Optical sensing using semiconductor lasers</b> .....	<b>1</b>
4.1 General.....	1
4.2 Semiconductor laser.....	1
4.2.1 General.....	1
4.2.2 Basic structure.....	2
4.2.3 Transverse mode stabilizing structure.....	2
4.2.4 Mode (wavelength) selection structure.....	2
4.2.5 Active layer structure.....	2
4.3 Common sensing technique and equipment using semiconductor lasers.....	3
4.3.1 General.....	3
4.3.2 Tunable laser absorption spectroscopy (TLAS).....	3
4.3.3 Cavity ring down spectroscopy (CRDS).....	4
4.3.4 Photoacoustic spectroscopy (PAS).....	5
4.4 Temperature and current dependence of wavelength.....	6
4.5 Effect of current injection on lasing wavelength.....	8
4.6 Effect of ambient temperature on lasing wavelength.....	9
<b>5 Measurement method for temperature dependence of wavelength</b> .....	<b>10</b>
5.1 General.....	10
5.2 Description of measurement setup and requirements.....	10
5.3 Precautions to be observed.....	11
5.4 Measurement procedures.....	12
<b>6 Measurement method for current dependence of wavelength</b> .....	<b>12</b>
6.1 General.....	12
6.2 Description of measurement setup and requirements.....	12
6.3 Precautions to be observed.....	13
6.4 Measurement procedures.....	14
6.4.1 Static current dependence.....	14
6.4.2 Dynamic current coefficient.....	14
<b>7 Measurement method of spectral line width</b> .....	<b>14</b>
7.1 General.....	14
7.2 Description of measurement setup and requirements.....	15
7.3 Precautions to be observed.....	18
7.4 Measurement procedures.....	18
7.4.1 System employing two semiconductor lasers [shown in <a href="#">Figures 11</a> and <a href="#">12</a> ].....	18
7.4.2 Self-delayed heterodyne [shown in <a href="#">Figure 13</a> ].....	18
<b>Annex A (informative) Essential ratings and characteristics</b> .....	<b>20</b>
<b>Bibliography</b> .....	<b>29</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Laser and electro-optical systems*.

This first edition cancels and replaces the Technical Specification ISO/TS 17915:2013, which has been technically revised.

The main changes compared to ISO/TS 17915:2013 are as follows:

- interband cascade semiconductor lasers have been included in [4.2.5](#).
- in [A.3](#): Regarding the monitor photodiode, “option” has been inserted.
- Tables in [Annex A](#) have been separated for clarity.

## Introduction

Sensing technologies for materials related to the environment or wellness, etc., by using lasers have been researched and developed in academic and industrial fields. Semiconductor lasers including quantum cascade semiconductor lasers have been widely used in sensing applications because of their advantages of compactness and wide selectivity of lasing wavelengths. The tunable laser absorption spectroscopy, the cavity ring down spectroscopy and the photoacoustic spectroscopy are commonly used sensing techniques. In those sensing techniques, wavelength and/or spectrum analysis by changing temperature or injected current is the key for determining the composition or element of the material or the mixture to be examined. Therefore measuring methods of semiconductor lasers for sensing applications are described with an informative annex for an example of essential ratings and characteristics.

# iTeh Standards (<https://standards.iteh.ai>) Document Preview

[ISO 17915:2018](https://standards.iteh.ai/catalog/standards/iso/ac0c59a0-49a6-48a1-bf06-fec8b3c1e5a5/iso-17915-2018)

<https://standards.iteh.ai/catalog/standards/iso/ac0c59a0-49a6-48a1-bf06-fec8b3c1e5a5/iso-17915-2018>