IEC 62803-3

Edition 1.0 2024-08

INTERNATIONAL STANDARD

colour inside

Transmitting and receiving equipment for radiocommunication – Frequency response of optical-to-electric conversion device in high-frequency radio-over-fibre systems –
Part 3: Measurement method of non-linear response of optical-to-electric converter

IEC 62803-3:2024-08(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.060.20

ISBN 978-2-8322-9570-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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TRANSMITTING AND RECEIVING EQUIPMENT FOR RADIOCOMMUNICATION – FREQUENCY RESPONSE OF OPTICAL-TO-ELECTRIC CONVERSION DEVICE IN HIGH-FREQUENCY RADIO-OVER-FIBRE SYSTEMS –

Part 3: Measurement method of non-linear response of optical-to-electric converter

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IEC 62803-3 has been prepared by IEC technical committee 103: Transmitting and receiving equipment for radiocommunication. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
103/270/FDIS	103/273/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62803 series, published under the general title *Transmitting and receiving equipment for radiocommunication – Frequency response of optical-to-electric conversion device in high-frequency radio-over-fibre systems*, can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

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

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

A variety of photonic devices operated in microwave, millimetre-wave, and terahertz-wave bands are useful for an optical fibre transport system as well as for wireless communication and broadcasting systems. An optical-to-electric conversion device plays as an interface, which converts an optical signal into an electrical signal directly.

Microwave, millimetre-wave and terahertz-wave radio-over-fibre (RoF) systems are comprised of two parts: an electric-to-optical converter (E/O), and an optical-to-electric converter (O/E). Radio waves are converted into an optical signal at the E/O, and the signal is transferred through the optical fibre, and then the radio waves are regenerated at the O/E.

A variety of photonic devices which carry microwave, millimetre-wave, and terahertz-wave signals at subcarrier frequencies are used for high-frequency RoF systems. In advanced radio wireless communication systems, orthogonal frequency domain multiplexing and multi-level modulation techniques have been implemented for the enhancement of spectral efficiency. Even in high-frequency wireless systems in the millimetre-wave and terahertz-wave bands, high spectral efficiency modulation and demodulation formats are indispensable. These advanced modulation formats require a high linearity in devices and transmission lines, and therefore, the high-frequency RoF system should also have high linearity to transfer these radio signals. Particularly in optical-to-electric converters, non-linear distortions directly affect the quality of regenerated radio signals, to be compliant with radio regulations. Therefore, the non-linear response of the optical-to-electric converter is a key characteristic to specify result signal quality. This document defines the measurement method of a non-linear response, which has a significant impact on the performance of RoF systems.

TRANSMITTING AND RECEIVING EQUIPMENT FOR RADIOCOMMUNICATION – FREQUENCY RESPONSE OF OPTICAL-TO-ELECTRIC CONVERSION DEVICE IN HIGH-FREQUENCY RADIO-OVER-FIBRE SYSTEMS –

Part 3: Measurement method of non-linear response of optical-to-electric converter

1 Scope

This part of IEC 62803 specifies the measurement method of the non-linear response of optical-to-electric converters in both optical signal transport systems and RoF systems. The method applies for the following:

– frequency range: up to 170 GHz;
– wavelength band: 0,8 μm to 2,0 μm.

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 terminology databases for use in standardization at the following addresses:

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

3.1.1
3rd order intercept point
IP3
crossing point of output powers, which depend on the input optical signal power, at a frequency which is the same as the input frequency and at a frequency which is triple the input frequency

3.2 Abbreviated terms

DFG	difference frequency generation
DSB	double side-band
DSB-SC	double side-band suppressed-carrier
DUT	device under test
E/O	electric-to-optical converter
LD	laser diode
IMD3	3rd order inter-modulation distortion
IP3	3rd order intercept point
IIP3	input 3rd order intercept point
MZM	Mach–Zehnder interferometer-type intensity modulator
O/E	optical-to-electric converter
OIP3	output 3rd order intercept point
PD	photodiode
PN	positive-negative
RF	radio frequency

4 Optical-to-electric converters

4.1 Photodiode (PD)

4.1.1 General

A PD has a positive-negative (PN) junction which can be illuminated by an optical signal. When a photon is incident to the PN junction, an electron is excited, and an electron-hole pair is generated. The electron and hole drift to the opposite direction because of the built-in and reverse-biased voltage at the PN junction and can be used as an output electric current.

4.1.2 Component parts

The O/E converters consist of basic parts as follows:

– PD;
– input fibre pigtail (where appropriate);
– input receptacle (where appropriate);
– output RF port (where appropriate);
– bias electrode (where appropriate);
– transimpedance amplifier (where appropriate);
– impedance matching

4.1.3 Structure

The structure consists of the following (see Figure 1):

– optical input: fibre pigtail or receptacle;
– RF output: coaxial connector, microstrip line, coplanar waveguide, antenna, etc.;
– options: bias electrode, transimpedance amplifier, impedance-matching resistor.