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INTERNATIONAL STANDARD

colour inside

Transmitting and receiving equipment for radiocommunication – Radio-over-fibre technologies and their performance standard – Part 2: Radio-over-fibre-based fronthaul network for railway communication systems



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TRANSMITTING AND RECEIVING EQUIPMENT FOR RADIOCOMMUNICATION – RADIO-OVER-FIBRE TECHNOLOGIES AND THEIR PERFORMANCE STANDARD –

Part 2: Radio-over-fibre-based fronthaul network for railway communication systems

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

Draft	Report on voting
103/244/FDIS	103/249/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 63098 series, published under the general title *Transmitting and receiving equipment for radiocommunication – Radio-over-fibre technologies and their performance standard*, 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.

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- withdrawn,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

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INTRODUCTION

A high-speed train communication network comprises two parts: a back-end network and wireless access system to deliver data to train cars. In this back-end network, optical fiber communication-based networks are generally utilized to reduce the complexity of the radio access units set along the railway track, which delivers the signal wirelessly to the train car, wireless signals are generated and processed at a central office, and then are transported via an optical fiber network into the radio access units. A radio-over-fiber fronthaul network is configured to transport the wireless signal, which is applicable between a node base station and radio access units set at a trackside. The radio-over-fiber-based fronthaul link connects the node base station to the trackside radio access units and carries millimeter-wave subcarrier or intermediate frequency components to transmit high-capacity signals. This document provides the required performance with reliability and quality assurance of radio-over-fiber-based fronthaul networks for railway communication networks between trains and tracksides, as well as a design guide for network configuration.

TRANSMITTING AND RECEIVING EQUIPMENT FOR RADIOCOMMUNICATION – RADIO-OVER-FIBRE TECHNOLOGIES AND THEIR PERFORMANCE STANDARD –

Part 2: Radio-over-fibre-based fronthaul network for railway communication systems

1 Scope

This part of IEC 60598 specifies a radio-over-fiber-based fronthaul network for railway communication systems between trains and tracksides and their transmitters and receivers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

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
radio over fiber
RoF
radio signal transmission method using an optical fiber whose signal is modulated by the radio signal

3.1.2
double-sideband modulation
modulation pertaining to a transmission or emission where both sidebands resulting from amplitude modulation are preserved equally

3.1.3
single-sideband modulation
modulation pertaining to a transmission or emission where only either the lower sideband or the upper sideband resulting from amplitude modulation is preserved

3.1.4
wavelength division multiplexing
WDM
multiplexing in which several independent signals are allotted separate wavelengths for transmission over a common optical transmission medium

[SOURCE: IEC 60050-704:2019, 704-08-06, modified – The Note 1 to entry has been deleted.]

3.2 Abbreviated terms

The abbreviated terms used in this document are listed in Table 1.

Table 1 – Abbreviated terms

CO	central office
DeMUX	demultiplexer
DSB	double sideband
DUT	device under test
E/O	electrical-to-optical converter
LD	laser diode
MUX	multiplexer
MZM	Mach-Zehnder interferometer-type optical modulator
O/E	optical-to-electrical converter
RF	radio frequency
RoF	radio over fiber
Rx	receiver
SSB	single sideband
TDC	train direction centre
TLD	wavelength tunable laser diode
TLI	train location information
TRx	transceiver
TS-RAU	trackside radio access unit
Tx	transmitter
WDM	wavelength division multiplexing

4 Functional specification

4.1 RoF fronthaul network

A general block diagram of the fronthaul network is shown in Figure 1. Typically, a central office (CO) is located in a train direction centre (TDC) or a train station, a radio-over-fiber transceiver (RoF TRx), which comprises an RoF transmitter (RoF Tx) and RoF receiver (RoF Rx) irradiates the RoF signal into an optical fiber. At a demultiplexer (DeMUX), the RoF signal is delivered via an optical fiber to a trackside radio access unit (TS-RAU). On the opposite side, the RoF signals from the RoF TRxs in the TS-RAU are multiplexed at a multiplexer (MUX), and then the multiplexed signal is transmitted over the fiber into the RoF TRx in the CO.

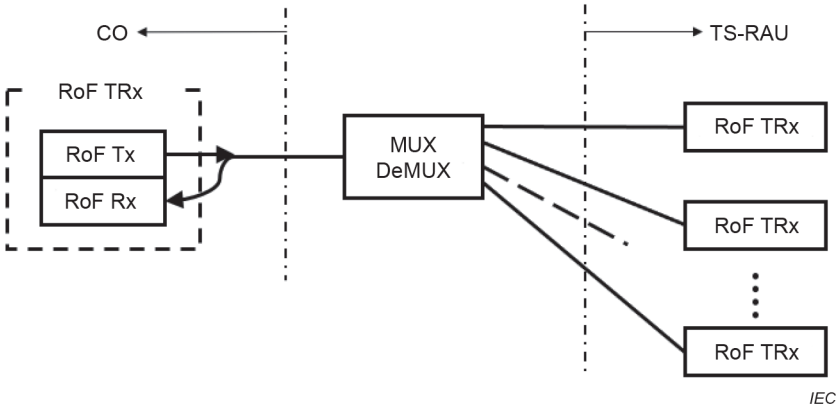


Figure 1 – Block diagram of RoF fronthaul network for a railway communication system

Functional specifications are listed in Annex A.

4.2 RoF transmitter and receiver

Functional specifications are listed in Annex B and Annex C.

4.3 Operating environment

The operating environment of the network, transmitter and receiver is specified in Table 2.

Table 2 – Operating environment

Parameter	Symbol	Value		Unit
		Minimum	Maximum	
Operating temperature (case)	T_{op}	−20	+60	°C

5 Testing

5.1 General

Initial characterizations and qualifications should be undertaken when a build standard is completed and frozen. Qualification maintenance is carried out using periodic testing programmes.

The test conditions for all tests, unless otherwise stated, are 0 °C, 25 °C, and 60 °C.

5.2 Performance testing

Performance testing is performed upon completion of the characterization testing. The performance test plan and recommended performance test failure criteria are specified in Annex A.

6 Environmental specifications

6.1 General safety

All products specified in this document shall conform to IEC 60950-1.