

INTERNATIONAL STANDARD



**Transmitting and receiving equipment for radiocommunication –
Radio-over-fibre technologies and their performance standard –
Part 4: Radio-over-fibre-based indoor distributed antenna system (DAS) for 5G**

IEC 63098-4:2023

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 4: Radio-over-fibre-based indoor
distributed antenna system (DAS) for 5G**

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

Draft	Report on voting
103/253/FDIS	103/254/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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INTRODUCTION

This document provides the performance standards of the RoF-based 5G indoor distributed antenna system (DAS) network for cost-effectively offering quality of service (QoS) guaranteed 5G mobile communication services with high bandwidth and low-latency characteristics without radio shadowing in an indoor environment. First of all, the system overview, system configurations, and the elements of the system are presented and then the electrical and optical interfaces for each system element are defined. Finally, the detail system performance specifications of each element are described for downlink and uplink configurations.

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Part 4: Radio-over-fibre-based indoor distributed antenna system (DAS) for 5G

1 Scope

This part of IEC 63098 specifies a radio-over-fibre-based indoor distributed antenna system (DAS) for fifth generation wireless technology 5G.

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 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

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

3GPP TS 38.104 V15.3.0 (2018-10), *5G; NR; Base Station (BS) radio transmission and reception*

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 fibre

RoF

communication technology in which radio-frequency signals are modulated on light and transmitted over fibre optics

3.1.2

distributed antenna system

DAS

network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure

3.1.3

5G

fifth generation wireless technology for digital cellular networks

3.1.4

main hub unit

MHU

element that links a base station for 5G and a remote antenna unit spatially distributed

3.1.5

remote antenna unit

RAU

element that connects a main hub unit and a subscriber's mobile terminal

3.1.6

distribution point

split downstream signal from a main hub unit to a remote antenna unit or a combined upstream signal from a remote antenna unit to a main hub unit in a distributed antenna system, which is comprised of an optical splitter or wavelength division multiplexer/demultiplexer

3.2 Abbreviated terms

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

Table 1 – Abbreviated terms

5G	fifth generation technology standard
ACLR	adjacent channel leakage ratio
CM	control and management
CWDM	coarse wavelength division multiplexing
DAS	distributed antenna system
DUT	device under test
FA	frequency allocation
FS	frequency synchronization
IF	intermediate frequency
Me-CM	MHU electrical interface for system control and management signal
Me-FS	MHU electrical interface for frequency synchronization signal
Me-IF	MHU electrical interface for 5G signal at IF-band signal
Me-TD	MHU electrical interface for TDD synchronization signal
MHU	main hub unit
MIMO	multi input multi output
Mo-IF	MHU optical interface for IF-based data signals and digital-based auxiliary signals
mmWave	millimeter wave
O2I	outdoor-to-indoor
QoS	quality of service
RAU	remote antenna unit
Re-RF	RAU electrical interface for 5G signal at RF-band
Re-CM	RAU electrical interface for system control and management
RF	radio frequency
RoF	radio over fibre
Ro-IF	RAU optical interface for IF-based data signals and digital-based auxiliary signals
TDD	time-division duplexing
VSWR	voltage standing wave ratio

4 RoF based DAS

4.1 System overview

As a follow-on from the 2G network, the DAS has been actively utilized, removing the shaded area of a radio signal in a room or in a specific environment where radio wave arrival is restricted. This is particularly the case for the millimeter wave-based 5G mobile communication system that features broad bandwidth and low latency which requires the use of DASs in order to seamlessly bring the 5G services indoors, due to the property of high frequency electromagnetic waves such as high O2I penetration loss and strong straightness. The bandwidth of the baseband signal accommodated by the 5G system shall be as indicated in 3GPP TS 38.104 V15.3.0. It is up to 100 MHz/FA, where simultaneous transmission of up to 4 FA is normally required. Moreover, the use of MIMO configuration will lead the DAS to handle multi-GHz bandwidth mobile signals, demanding a bandwidth efficient transmission technology. From the perspective of bandwidth usage, RoF transmission is the most prospective candidate. Most of all, there is no redundancy traffic caused by digital to analogue (D/A) conversion and analogue to digital (A/D) conversion. There is no redundancy traffic caused by the specific digital framing procedure that conventional digital transmission always requires. Thus the RoF-based DAS is considered to be a notable solution for realization of mmWave-based 5G indoor network. Figure 1 shows the basic structure of the DAS for the 5G network. The MHU relays the mobile signals from the 5G base station to the RAU. The RAU delivers the 5G wireless signals to a plurality of subscriber equipment, and captures the 5G signals of the user equipment and delivers the signal towards the MHU. In Figure 1, the RoF link builds the connection between the MHU and RAU.

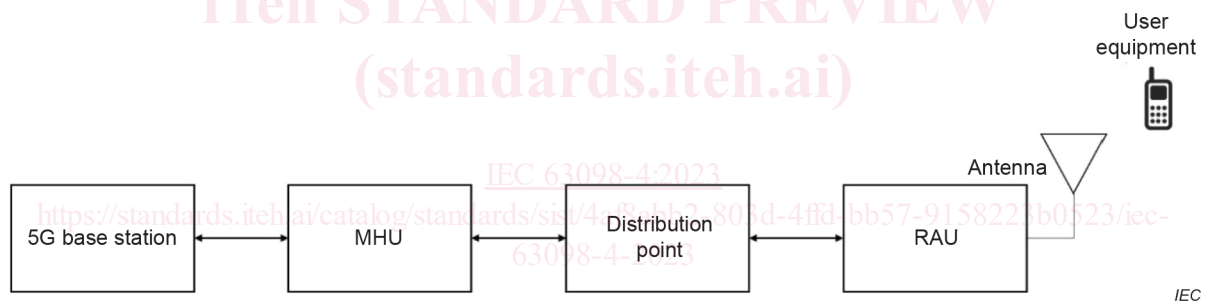


Figure 1 – Basic structure of a distributed antenna system (DAS) for 5G

4.2 System configurations

4.2.1 General

The DAS for 5G consists of various elements in a point-to-point or point-to-multipoint configuration. The system configurations presented in 4.2 can be a standard from the general point of view of cost-effective network deployment and operation as well as efficient 5G service provision.

4.2.2 Point-to-point configuration

The point-to-point configuration considers the case where a single RAU is directly connected to a single MHU without any distribution point, as shown in Figure 2. When the service is provided to a limited or small area, this configuration may be preferred, as the initial stage of 5G service provision.