

TECHNICAL REPORT



**Transmitting and receiving equipment for radiocommunication – Short-range radar technologies and their performance standard –
Part 1: System applications of short-range radars**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.060.20

ISBN 978-2-8322-7752-2

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms, definitions and abbreviated terms	6
3.1 Terms and definitions.....	6
3.2 Abbreviated terms.....	6
4 Considerations on measurement principles of radars.....	7
4.1 General.....	7
4.2 Pulsed radar system	7
4.3 Frequency modulated (FM) radar system	9
4.4 Digital processing radar system using signal correlation	10
4.5 Secondary surveillance radar system.....	10
4.6 Passive radar system.....	12
5 Practical applications of short-range radars	12
5.1 General.....	12
5.2 Automotive radar applications	12
5.3 Radars in mobile phones	13
5.4 Radars for trapped-person detection	13
5.5 Weather radars	13
5.6 Short-range radars for civil aviation	13
5.6.1 Airborne weather radar	13
5.6.2 Radar altimeters	14
5.7 Airport object detection radars	14
5.8 Security inspection radars.....	15
5.9 THz short-range radars	16
Bibliography.....	17
Figure 1 – Schematic diagram of radar system	7
Figure 2 – Waveform and timing of transmission and reception for a pulsed radar system.....	7
Figure 3 – Frequency sweep pattern and beat frequency of transmission and reception for linear FMCW radar	9
Figure 4 – Time measurement using correlation calculation by digital codes	10
Figure 5 – Principle of secondary surveillance radar system	11
Figure 6 – Principle of passive radar system.....	12
Figure 7 – Airborne weather radar	14
Figure 8 – Foreign object and debris detection system.....	15
Figure 9 – Imaging application scene.....	16
Figure 10 – Results of radar images	16

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TRANSMITTING AND RECEIVING EQUIPMENT FOR
RADIOCOMMUNICATION – SHORT-RANGE RADAR
TECHNOLOGIES AND THEIR PERFORMANCE STANDARD –**

Part 1: System applications of short-range radars

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TR 63385-1 has been prepared by IEC technical committee 103: Transmitting and receiving equipment for radiocommunication. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
103/235/DTR	103/257/RVDTR

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 Technical Report 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/standardsdev/publications.

A list of all parts in the IEC 63385 series, published under the general title *Transmitting and receiving equipment for radiocommunication – Short-range radar technologies and their performance standard*, can be found on the IEC website.

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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Short-range radar systems are widely exploited in civil applications, such as automotive, weather forecast, mobile, aviation, or security inspections applications. The performance of each radar system is guaranteed in the field without any harmful interference but the frequency allocation using theoretical calculations does not consider the latest mitigation technologies. In order to increase the efficiency of the system usage without any degradation of the performance of the radars, this document describes the principles of the radar systems and their performance in applications.

This document summarizes the technological features of short-range radar systems. In addition, some practical applications are also investigated and reported.

TRANSMITTING AND RECEIVING EQUIPMENT FOR RADIOCOMMUNICATION – SHORT-RANGE RADAR TECHNOLOGIES AND THEIR PERFORMANCE STANDARD –

Part 1: System applications of short-range radars

1 Scope

This part of IEC 63385 provides a catalogue of the architecture and principles of measurement of short-range radars that are widely exploited in civil applications. The applications are related to the detection of the target for obstacle avoidance, motion sensing, or identification of devices. The mass civil use of radars sometimes creates compatibility issues among the services. This document provides clarification on the characteristics of the radar systems and additional information on applications in the field.

2 Normative references

There are no normative references in this document.