



BSI Standards Publication

**Identification cards —
Contactless integrated circuit
cards — Proximity cards —
Multiple PICCs in a single PCD
field**

National foreword

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TECHNICAL
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**Identification cards — Contactless
integrated circuit cards — Proximity
cards — Multiple PICCs in a single PCD
field**

*Cartes d'identification — Cartes à circuit(s) intégré(s) sans contact —
Cartes de proximité — Plusieurs PICCs dans le champ d'un seul PCD*

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Symbols and abbreviated terms	1
3 General	1
4 Physical effects of multiple PICCs	2
4.1 Resonant frequency.....	2
4.2 Lowest operating field strength H_{low}	5
4.3 Loading effect.....	6
4.4 PCD to PICC communication.....	7
4.5 PICC to PCD communication.....	7
5 Addressing multiple PICCs	8
5.1 CID support.....	8
5.2 Altering random UID or PUPI.....	8
5.3 Receiving blocks of other type.....	8
5.4 AFI management.....	8
6 Scenarios	9
6.1 Passport - multiple visas.....	9
6.2 Wallet - multi-industry.....	9
6.3 Possible scenarios.....	10
6.4 Collision avoidance.....	10
Bibliography	11

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

In exceptional circumstances, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide to publish a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC TR 18268 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.

Introduction

Experience from the field has shown that the presence of multiple PICCs in a field can have unexpected results in terms of all PICCs being seen by the PCD and the quality of the communications. This Technical Report seeks to assemble the collective knowledge of the engineering principles involved.

This Technical Report is relevant to the standards listed in the Bibliography and an understanding of these is useful in placing this Technical Report in context.

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Identification cards — Contactless integrated circuit cards — Proximity cards — Multiple PICCs in a single PCD field

1 Scope

This Technical Report presents a collation of industry experience of technical issues resulting from the presence of multiple PICCs in the field of a PCD. It describes how resonance frequencies may shift, how individual PICCs may see a reduced field strength, how multiple PICCs load the PCD, how they may change the local modulation signal and how PICCs should manage their identities to aid support of simultaneous usage. Scenarios for electronic passports with multiple visas and wallets containing multi-industry cards are explored.

2 Symbols and abbreviated terms

f_r	resonant frequency
H_{low}	lowest magnetic field strength
Q	quality factor
PCD	proximity coupling device
PICC	proximity card or object

3 General

In order that multiple PICCs can be reliably presented to a PCD, the following should generally be achieved:

- PICCs presented (within the PCD operating field) need to receive sufficient power to operate.
- The communications interface between each PICC and the PCD needs to operate reliably (for all PICCs within the PCD operating field).
- The PCD should perform its intended functionality in a manner such that the cardholder experience is reliable and consistent.

In an operational contactless interface, there are a number of components that have a mutual interaction. The most dominant of these is the inductive coupling between the coil of the PCD antenna and that of the PICC, plus further interaction between all the PICC antennas if there are multiple PICCs within the field. The interaction is multi-faceted and depends on the coupling factor k between each inductance, the resonance frequency f_r of the individual PICCs and the quality factor Q of all of the inductive components. Other factors which also have an impact are the size of antenna, separation distance, spatial overlap, PICC loading and the dynamic movement of PICCs through the PCD field.

With so many degrees of freedom, it is not possible to describe the definitive outcome for any particular combination of PICCs presented to an individual PCD. However, it is possible to quantify certain aspects with the objective of gaining an improved understanding of the mechanisms involved. This is expected to lead to recommendations and potential revisions to the standards that will ultimately improve the acceptance of multiple PICCs presented to a single PCD. The main items that can be addressed are:

- the PICC interaction such that the resulting resonant frequency of the set of PICCs is lower compared to the resonant frequency of an individual PICC;