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TECHNICAL SPECIFICATION

colour inside

Radio frequency connectors – Part 1-51: Technical specification of electrical tests – Uncertainty specification of frequency domain test for return loss

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FOREWORD

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 61169-1-51, which is a Technical Specification, has been prepared by subcommittee 46F: RF and microwave passive components, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories.

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

Draft TS	Report on voting
46F/488/DTS	46F/495/RVDTS

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61169 series, published under the general title *Radio frequency connectors*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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

This document relates to technical requirements for electrical tests for radio frequency connectors. In IEC 61169-1:2013, a frequency domain test method has been described. However, the document does not contain the quantitative uncertainty specification for measurement instruments, i.e. vector network analysers and terminations, for return loss. This document shows quantitative uncertainty specifications of electrical tests for return loss of radio frequency connectors. In addition, the document includes a brief analysis of vector network analyser measurement uncertainty for return loss measurements of radio frequency connectors.

RADIO FREQUENCY CONNECTORS –

Part 1-51: Technical specification of electrical tests – Uncertainty specification of frequency domain test for return loss

1 Scope

This part of IEC 61169, which is a Technical Specification, relates to radio frequency connectors for RF transmission lines for use in telecommunications, electronics and similar equipment.

It provides the technical report for the uncertainty specifications for return loss measurements, which apply to individual connector types, by vector network analysers (VNAs). It is intended to establish concepts and procedures considering:

– testing and measuring procedures concerning frequency domain electrical properties;
– uncertainty specifications of VNAs measurements for return loss of RF connectors.

The test methods and procedures of this document are intended for acceptance and type approval testing.

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 60027, *Letter symbols to be used in electrical technology*

IEC 60050, *International Electrotechnical Vocabulary* (available from: http://www.electropedia.org)

IEC 60617, *Graphical symbols for diagrams*

IEC 61169-1:2013, *Radio frequency connectors – Part 1: Generic specification – General requirements and measuring methods*

ISO/IEC 17025:2017, *General requirements for the competence of testing and calibration laboratories*

ISO/IEC Guide 98-1, *Uncertainty of measurement – Part 1: Introduction to the expression of uncertainty in measurement*

ISO 1000:1992[1], *SI units and recommendations for the use of their multiples and of certain other units*

[1] Withdrawn in 2009, revised by ISO 80000-1:2009.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61169-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

4 Units, symbols and dimensions

4.1 Units and symbols

Units, graphical symbols, letter symbols and terminology shall, whenever possible, be taken from the following IEC publications:

a) IEC 60027: Letter symbols to be used in electrical technology,

b) IEC 60050: International Electrotechnical Vocabulary (IEV),

c) IEC 60617: Graphical symbols for diagrams.

Other publication:

ISO 1000:1992[2]: SI units and recommendations for the use of their multiples and of certain other units.

5 Report characteristics

The report characteristics applicable to each connector type and style are recommended to the relevant specifications of return loss measurements. They normally cover the return loss as a function of operation frequency for the different grades (if applicable) together with the conditions for which it is valid.

6 Return loss in frequency domain tests

6.1 Parameters

Return loss is a useful parameter for specifying the characteristics of RF connectors. However, the following three representations are also widely used:

1) reflection coefficient: $\Gamma = a + jb$

   where a is real part, b is imaginary part),

2) return loss: Return loss = –20 log(|Γ|) (dB),

3) voltage standing wave ratio ($VSWR$): $VSWR = (1+|\Gamma|)/(1-|\Gamma|)$.

6.2 General considerations

Measurement/testing results, or specification, of return loss should not only include exact measurement values but also error/uncertainty in VNA measurement (Figure 1 and Figure 2). Classification of return loss of connector(s) is decided from the combination of the exact measurement value and its uncertainty for test specimen.

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2 Withdrawn in 2009, revised by ISO 80000-1:2009.