IEC 61169-1-5

Edition 1.0 2022-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Radio frequency connectors –
Part 1-5: Electrical test methods – Rise time degradation

Connecteurs pour fréquences radioélectriques –
Partie 1-5: Méthodes d'essai électrique – Dégradation du temps de montée

IEC 61169-1-5:2022-02(en-fr)

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FOREWORD

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

Draft	Report on voting
46F/592/FDIS	46F/608/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/standardsdev/publications.

A list of all parts of the IEC 61169 series, under the general title *Radio frequency connectors* 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

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RADIO FREQUENCY CONNECTORS –

Part 1-5: Electrical test methods – Rise time degradation

1 Scope

This part of IEC 61169 provides test methods for the rise time degradation of radio frequency (RF) connector.

This document is applicable to triaxial and other radio frequency connectors.

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

3 Terms and definitions

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

3.1
rise time degradation
increase in rise time to a theoretically perfect (zero rise time) voltage step when the sample is inserted in the transmission path

Note 1 to entry: In general, the formula used to calculate rise time degradation from 20 % to 80 % levels is as follows:

$$t_3 = \sqrt{(t_2^{\,2} - t_1^{\,2})} \tag{1}$$

where

t_3 is the rise time degradation;

t_2 is the measured rise time when the sample is inserted in the transmission path;

t_1 is the measurement system rise time.

3.2
single-ended measurement
measurement method in which the rise time degradation is measured in a single channel formed by a signal line and the ground line

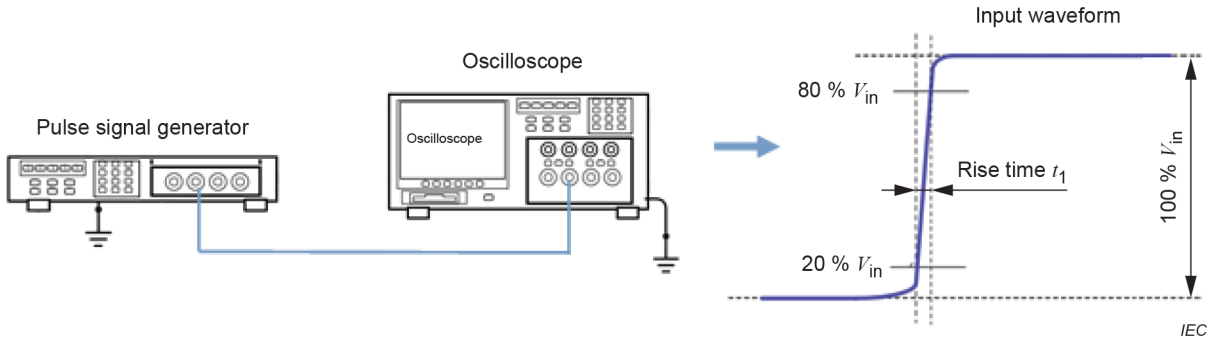
3.3
differential measurement
measurement method in which the rise time degradation is measured in two channels formed by two signal lines and the ground line(s) and the signals transmitted to the two signal lines are differential signals

4 Test principle

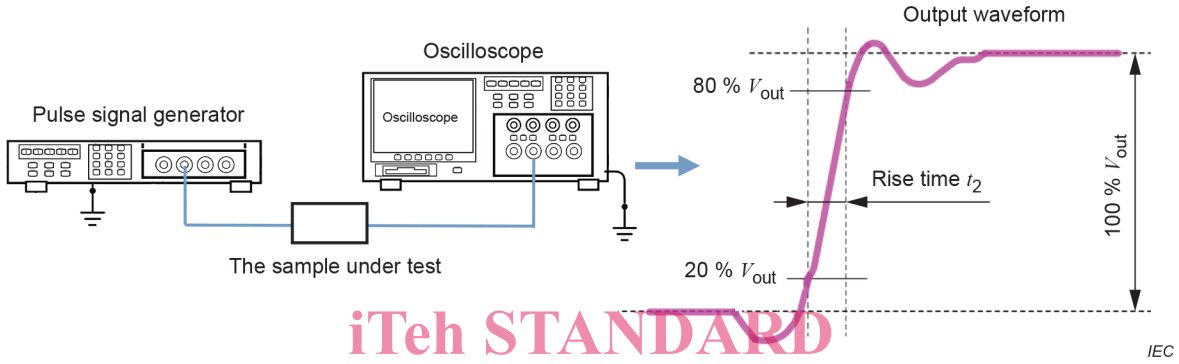
When a pulse signal with a transient rise time is connected to the input end of the sample under test and is transmitted to the output end, due to the nonlinear characteristic of the measured sample, the rise time of the pulse signal measured at the output end is increased compared with the rise time of the pulse signal at the input end. The cause of this phenomenon is the delay caused by the distributed inductance and distributed capacitance of the sample under test. See Figure 1.

Figure 1 – The equivalent distribution parameter of the sample under test

The test theory of rising time degradation generated by the pulse signal passing through the sample under test is shown in Figure 2. Unless otherwise specified in the relevant specification, rise time is measured from 20 % to 80 % levels. The rise time degradation is calculated according to Formula (1).



a) The input end rise time (measurement system rise time)



b) The output end rise time (measured rise time with sample)

Figure 2 – Test principle

5 Measurement system

5.1 General

Unless otherwise specified, the entire measurement system (including test equipment, test fixture, etc.) shall meet the following requirements:

a) The rise time shall be as short as possible and shall be less than or equal to 70 % of the rise time measured with the sample.

b) The rise time shall conform to the requirements of Table 1.

Table 1 – Measurement system rise time

Expected rise time degradation of the connector pair under test	Measurement system rise time
ps	ps
100～250	≤100
250～500	≤250
500～1 000	≤500
>1 000	≤1 000

c) The specimen environment impedance (this impedance is a result of transmission lines, termination resistors, attached receivers and signal sources, and fixture parasitic) shall match the impedance of the test equipment. When the specimen environment impedance does not match the impedance of the test equipment, an impedance converter should be used.

5.2 Equipment

Time domain reflectometer (TDR), signal generator and oscilloscope, or other suitable equipment, with the rise time shall meet the requirements of Subclause 5.1.

6 Preparation of test sample

6.1 Insertion method

Test samples are prepared as follows:

a) First, select one cable with a length of L and a uniform characteristic impedance that can be matched with the sample. Depending on the connector, the cable can be coaxial or symmetrical, with suitable connector or fixture at both ends, and directly connect the test equipment.

b) Then cut the cable assembly in the middle and connect to the tested connector pair respectively; the connector pair under test shall be mated together to test, as shown in Figure 3. When connecting to the test connector, the total length of the two pieces of the cut cable shall not be shorter than length of the original cable.

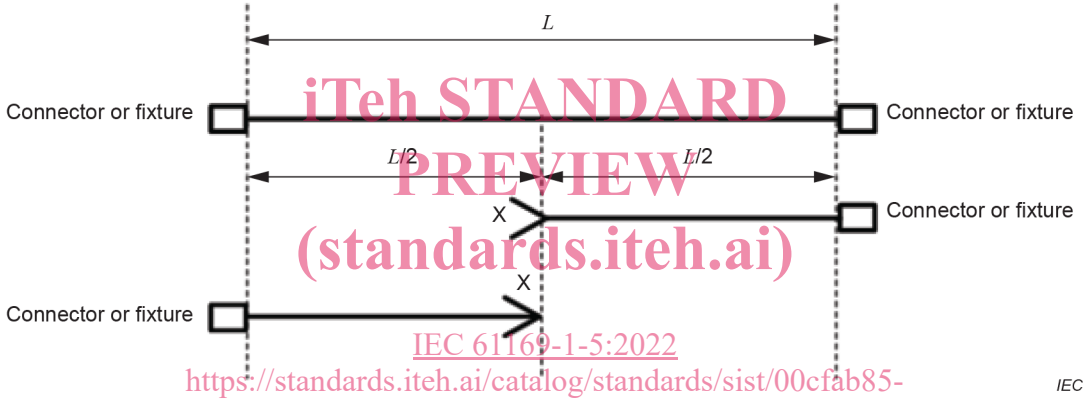


Figure 3 – Preparation of cable RF connector test sample (insertion method)

6.2 Reference method

Test samples are prepared as follows:

Select one cable with a uniform characteristic impedance that can be matched with the sample, cut into two cables with equal length L, and separately connect the two ends of the cable with suitable connectors or fixtures that can be connected with the test equipment. Use one of them as a reference cable assembly. Cut the other cable assembly out in the middle and attach the tested connector pair, and make sure that the cable is not shorter (excluding the tested connector pair), as shown in Figure 4.

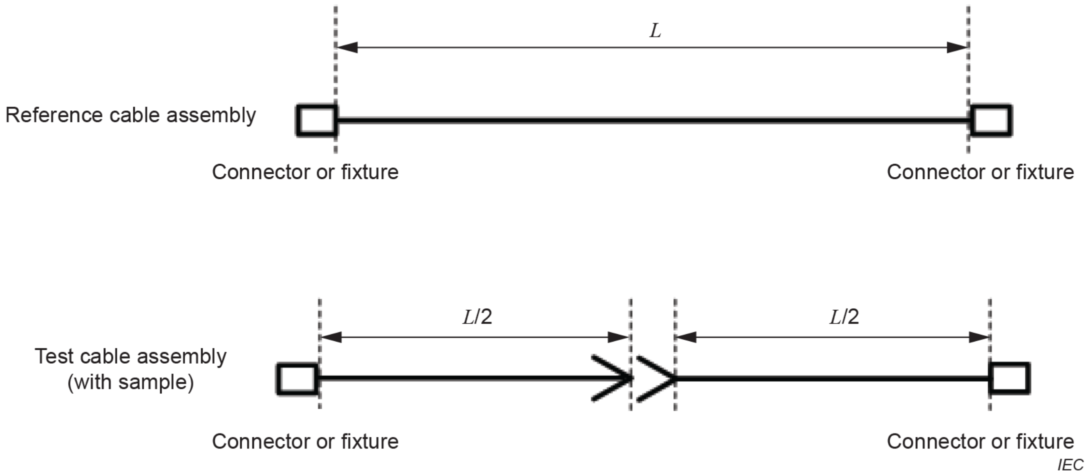


Figure 4 – Preparation of cable RF connector test sample (reference method)

7 Test procedure

7.1 General

The following two methods apply to both single-ended and differential measurements. It is recommended to use the fastest output signal the equipment is capable of. Place the sample at least 5 cm away from any object that could affect the measurement results.

7.2 Insertion method

Test procedure is as follows:

a) After the test equipment is fully preheated, the test ports shall be calibrated. For differential measurements, any phase and/or amplitude errors between the channels shall be determined and the necessary compensation for those errors shall be provided.

b) Set the test mode to measure the rise time and set the measurement range of rise time levels.

c) Measure the measurement system rise time: Connect the cable assembly to the equipment as shown in Figure 5a) and record the rise time t_1.

d) Maintain the test equipment with no change and take the cable assembly off. Then cut the cable assembly in the middle and connect respectively to the connector pair under test. Mate connectors under test and reconnect them to the test equipment as shown in Figure 5b) and record the rise time t_2.