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INTERNATIONAL STANDARD

colour inside

Coaxial communication cables –
Part 1-127: Electrical test methods – Link loss of radiating cable

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CONTENTS

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COAXIAL COMMUNICATION CABLES –

Part 1-127: Electrical test methods – Link loss of radiating cable

FOREWORD

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IEC 61196-1-127 has been prepared by subcommittee 46A: Coaxial cables, of IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

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

Draft	Report on voting
46A/1661/FDIS	46A/1670/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 61196 series, published under the general title *Coaxial communication cables*, 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- withdrawn, or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.

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COAXIAL COMMUNICATION CABLES –

Part 1-127: Electrical test methods – Link loss of radiating cable

1 Scope

This part of IEC 61196 applies to radiating cables. It specifies a test method for determining the link loss of radiating cables for use in communication systems.

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 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 61196-1, *Coaxial communication cables – Part 1: Generic specification − General, definitions and requirements*

IEC 61196-1-123, *Coaxial communication cables – Part 1-123: Electrical test methods – Test for attenuation constant of radiating cable*

IEC 61196-1-124, *Coaxial communication cables – Part 1-124: Electrical test methods – Test for coupling loss of radiating cable*

IEC 61196-4, *Coaxial communication cables – Part 4: Sectional specification for radiating cables*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61196-1, IEC 61196-4 and the following 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
link loss
ratio of the input power P_{in} transmitted into the transceiver end of the radiating cable from signal source to the power P_r received by a half-wavelength dipole antenna located at a distance from the radiating cable, expressed by Formula (1):

$$L_L(X) = 10log_{10}\frac{P_{in}}{P_r(X)} \qquad (1)$$

where

$L_L(X)$ is the link loss at the axial antenna position X, in dB;

P_{in} is the input power transmitted into the transceiver end of the radiating cable from the signal source, in W;

$P_r(X)$ is the receiving power of the half-wavelength dipole antenna at the axial antenna position X and at a radial distance from the radiating cable, in W;

X is the axial distance of the dipole from the transceiver end of the cable, in m.

4 Test equipment

4.1 Signal generator

A signal generator or other suitable signal source shall be used. Its output power, frequency range and bandwidth shall meet the measurement requirements. In order to ensure the repeatability of measurement, the frequency stability of signal generator or other signal source should be better than 10^{-6}.

4.2 Receiver

The frequency range, bandwidth, sampling rate, sensitivity and port type of the receiver shall meet the test requirements. If equivalent equipment can achieve the same function, it can also be used. In order to ensure the repeatability of measurement, the measurement uncertainty of the receiver or equivalent equipment (such as the vector network analyser) should be better than 0,5 dB.

4.3 Trolley

The trolley can move freely along the track on one side of the cable to be tested.

4.4 Antenna

Generally, a half-wave dipole antenna shall be used; if other antenna types are used, the frequency range and the port type of antenna shall meet the test requirements. The accuracy of the antenna gain shall comply with the relevant specifications.

NOTE Not only the gain of an antenna has an impact on the test result but also its directivity. Highly directive antennas for instance enable different orientations to the cable compared with dipoles as described in Figure 4 and Figure 6. If other antenna types than dipoles are used, the antenna orientation relative to the cable needs to be clearly described in the test report.

4.5 Load

The frequency range, return loss, absorbed power and port type of the load shall comply with the test requirements.

4.6 Connecting cables and connectors

Connecting cables can be used to connect the signal generator to the tested cable, and the receiver to the antenna. The return losses of test leads, test connectors, adapters and other devices for connection shall at least be 2 dB better than the required value of the test sample.

4.7 Data collection system and calculations

The data collection system consists of a position sensor, a connecting cable, a receiver and a computer.

There shall be sufficient local resolution for the measurement to be valid. Therefore, more than 10 measurements per half-wavelength shall be made to calculate the link loss for reception probabilities up to 95 %. To calculate higher reception probabilities, more than 20 measurements per half-wavelength shall be made. The total number of measurements shall not be less than 1 000 per 50 m. In order to avoid the influence of end effects of the test sample, the measured data within 5 m at both ends of the test sample shall not be included.

NOTE 1 The impact of end effects depends on the cable type and frequency. If the cable operates in radiating mode and the test frequency is either slightly above or > 10 times the resonant frequency, end effects could be present at sections longer than 5 m. If the test frequency is close to the resonant frequency, the end effect occurs typically at the load end of the cable, while it can be observed at the transceiver end at very high frequencies. In that case a larger section of the concerned cable end can be excluded from the statistical evaluation of reception probability.

The system can calculate the link loss automatically by using Formula (2):

$$L_{\mathrm{L}}\left(X\right)=N_{\mathrm{in}}-N_{\mathrm{r}}\left(X\right)+G \qquad (2)$$

where

$L_{\mathrm{L}}(X)$ is the link loss at the axial antenna position X, in dB; if needed, the value of link loss can be calculated by 95 %/50 % probability values;

N_{in} is the input power level transmitted into the transceiver end of the radiating cable from the signal source, in dBm;

$N_{\mathrm{r}}(X)$ is the receiving power level of the antenna at the axial antenna position X and at a radial distance from the radiating cable, in dBm;

G is the gain of the antenna with reference to a dipole of 2,1 dBi gain, in dBd.

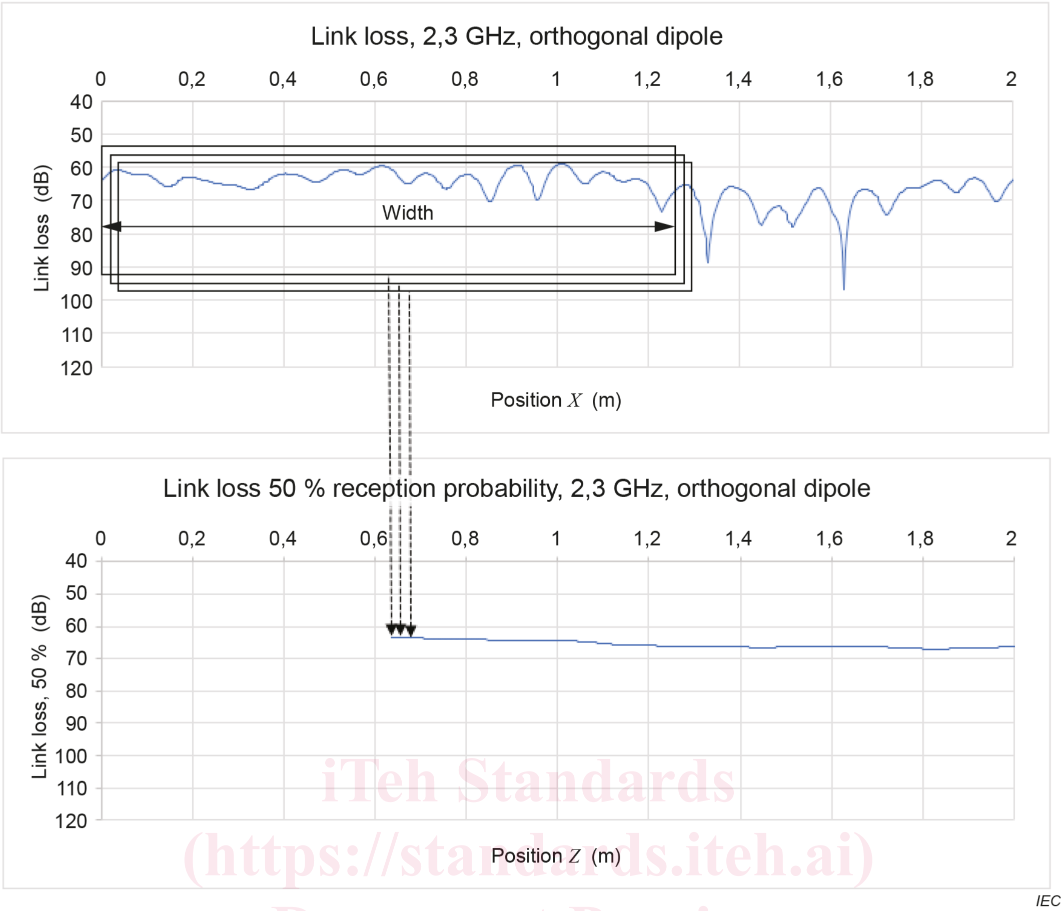

Figure 1 – Illustration of section-wise link loss calculation of 50 % reception probability

The link loss values of the required reception probabilities shall be calculated within segments of defined width. If not specified otherwise, the segment width shall correspond to 10 times the wavelength of the tested frequency. The segment is moved along the entire tested length with an increment that is equivalent to the distance between 2 test points. The maximum value of reception probability of all segments is the final test result of the TS. Figure 1 and Figure 2 illustrate the calculation of a 50 % reception probability link loss curve from a local link loss measurement. The statistical evaluation shall be performed for each antenna orientation and frequency.