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Coaxial communication cables –
Part 1-119: Electrical test methods – RF average power rating
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COAXIAL COMMUNICATION CABLES –

Part 1-119: Electrical test methods – RF average power rating

FOREWORD

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International Standard IEC 61196-1-119 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.

This second edition cancels and replaces the first edition, published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) title was changed from: RF power rating to: RF average power rating;
- b) a test method to determine sufficient duration is included as Annex A;
- c) the equations used for calculating cable coefficients and RF average power rating are corrected;
- d) the clauses and subclauses are rearranged.

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

FDIS	Report on voting
46A/1401/FDIS	46A/1408/RVD

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

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

A list of all the 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

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COAXIAL COMMUNICATION CABLES –

Part 1-119: Electrical test methods – RF average power rating

1 Scope

This part of IEC 61196 defines the requirements to determine the average power handling capability of a coaxial cable at specified frequencies at ambient temperatures.

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

IEC 61196-1-113, *Coaxial communication cables – Part 1-113: Electrical test methods – Test for attenuation constant*

3 Terms and definitions

IEC 61196-1-119:2020

For the purposes of this document, the terms and definitions given in IEC 61196-1 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

RF average power rating

maximum average input power that a cable can continuously handle when terminated in its characteristic impedance at a reference ambient temperature (usually 40 °C) and RF frequency

Note 1 to entry: RF average power rating is determined by the power level at which the temperature at any location in the cable does not exceed the allowable maximum temperature rating of the materials used in the cable's construction.

Note 2 to entry: Typically, the inner conductor temperature determines the maximum operating temperature.

Note 3 to entry: The test RF signal is a pure sinusoidal, without any modulation.

4 Symbols

For the purposes of this document, the following symbols apply.

K_i thermal constant of the insulation (W/(°C·m))

K_o thermal constant of outer sheath (W/(°C·m))

A	attenuation constant associated with the conductors $\left(\frac{\text{dB}}{\text{m} \cdot \sqrt{\text{MHz}}} \right)$
A_i	attenuation constant of inner conductor $\left(\frac{\text{dB}}{\text{m} \cdot \sqrt{\text{MHz}}} \right)$
A_o	attenuation constant of outer conductor $\left(\frac{\text{dB}}{\text{m} \cdot \sqrt{\text{MHz}}} \right)$
B	attenuation constant for the dielectric material $\left(\frac{\text{dB}}{\text{m} \cdot \text{MHz}} \right)$
a	mean outer diameter of inner conductor (mm) Sine shape corrugated: Mean = (peak + root)/2 Other shape corrugated: Mean shall be specified by the manufacturer. Smooth wall = outer diameter Wire = outer diameter
b	mean inner diameter of outer conductor (mm) Sine shape corrugated: Mean = (peak + root)/2 Other shape corrugated: Mean shall be specified by the manufacturer. Smooth wall = inner diameter
C_i	corrugation factor of inner conductor: Ratio of the distance that compares the non-corrugated (conversion of corrugated length to an equivalent smooth wall length) to the cable corrugated length. $C_i > 1$ for corrugated cable $C_i = 1$ for smooth wall or wire <small>IEC 61196-1-119:2020 https://standards.itec.org/standards/sist/538a667b-3384-4d19-95bc-2311031aad0b/iec-61196-1-119-2020</small>
C_o	corrugation factor of outer conductor: Ratio of the distance that compares the non-corrugated (conversion of corrugated length to an equivalent smooth wall length) to the cable corrugated length. $C_o > 1$ for corrugated cable $C_o = 1$ for smooth wall
P_{in}	RF input power (W)
P_r	rated RF average power (W) at frequency f
$P_{r/1}$	rated RF average power (W) at frequency f_1
$P_{r/2}$	rated RF average power (W) at frequency f_2
P_i	power dissipated in inner conductor (W/m)
P_o	power dissipated in outer conductor (W/m)
σ_i	conductivity of inner conductor (relative to copper)
σ_o	conductivity of outer conductor (relative to copper)
γ_i	temperature coefficient of resistance for inner conductor
γ_o	temperature coefficient of resistance for outer conductor
α_c	attenuation of cable, at frequency f (dB/100 m)
α_{f1}	attenuation of cable, at frequency f_1 (dB/100 m)
α_{f2}	attenuation of cable, at frequency f_2 (dB/100 m)
α_i	attenuation of inner conductor, at frequency f (dB/100 m)
α_o	attenuation of outer conductor, at frequency f (dB/100 m)
T_i	inner conductor temperature (°C)

T_o	outer conductor temperature (°C)
T_a	test ambient temperature (°C)
T_{ri}	inner conductor temperature rise (°C)
T_{ro}	outer conductor temperature rise (°C)
R_T	maximum rated ambient temperature (°C)

5 Methodology

5.1 Method A

If a suitable RF power source is available, it is possible to determine the input power required for a conductor temperature to reach its limiting value (i.e. the RF average power rating), per 7.1. This provides measurements at one frequency and generally needs to be adjusted to other frequencies by knowing the RF cable attenuation.

5.2 Method B

Cables of large diameter, however, have high RF average power ratings, and a suitable RF source may not be available for such direct test. The following methodology allows the RF average power rating to be determined by using low frequency (50 Hz or 60 Hz) AC power to determine the cable thermal characteristics first (i.e. the thermal constants K_i and K_o). As these parameters are independent with frequency, it can be combined with RF data for RF average power rating calculation. This is because the relative conductor power dissipations are different. Also, there is no dissipation in the dielectric in the low frequency case, but at RF frequencies it becomes significant.

6 Test general considerations

6.1 Sample preparation

A cable of sufficient length shall be used so that the temperatures measured at the centre of the cable are not influenced by heat sinking effects at the ends of the cable.

6.2 Surrounding condition

There shall be sufficient air space around the cable under test to allow natural air circulation.

6.3 Temperature test

Temperature measurements on the inner and outer conductors shall be made at the centre of the cable length and 0,5 m away from both sides of the centre point. For RF test – method A, the temperature should be measured at the cable's current antinode.

The thermocouples should be chosen and sized to eliminate the possibility of heat sinking effects, particularly with thin walled cables.

The test is conducted for sufficient duration for the conductors to reach constant temperatures. A test method to determine sufficient duration is included as Annex A.

6.4 Test equipment

For method A, the RF power source, power meter, temperature tester, coupler and absorbing load are needed.

For method B, the AC power source, multimeter and temperature tester are needed.