

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Radio frequency and coaxial cable assemblies –
Part 3: Sectional specification for semi-flexible coaxial cable assemblies**

**Cordons coaxiaux et cordons pour fréquences radioélectriques –
Partie 3: Spécification intermédiaire pour cordons coaxiaux semi-flexibles**

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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	5
3 Terms and definitions	6
4 Design and construction	6
4.1 Cable design and construction	6
4.2 Connector design and construction	6
4.3 The relative position dimensions of the interface.....	6
4.4 Outline of the cable assembly	6
5 Workmanship, marking and packaging.....	7
6 IEC type designation	8
7 Rating and characteristics	9
7.1 Nominal characteristic impedance.....	9
7.2 Temperature range	9
8 Requirements of finished cable assemblies	9
8.1 General.....	9
8.2 Electrical requirements	9
8.3 Mechanical requirements	11
8.4 Environmental requirements	13
9 Quality management.....	15
10 Test schedules	16
10.1 Qualification test.....	16
10.2 Acceptance tests	17
10.3 Periodic tests	18
Annex A (normative) The relative position dimensions of the interface of some typical connectors.....	19
Annex B (normative) Preferred arrangement for vibrations, shocks test	22
Figure 1 – Length definition of cable assemblies with two connectors	7
Figure 2 – Length definition of cable assemblies with one connector.....	7
Figure 3 – The marking example of a cable assembly	8
Figure A.1 – The relative position dimensions of the interface of some typical connectors.....	20
Figure B.1 – Preferred arrangement for vibrations, shocks test	22
Table 1 – Rated temperature of cable assemblies with semi-flexible cables with polytetrafluoroethylene dielectric (IEC 61196-8).....	9
Table 2 – Electrical requirements.....	10
Table 3 – Mechanical requirements.....	12
Table 4 – Environmental requirements	14
Table 5 – Qualification test	16
Table 6 – Acceptance test.....	17
Table 7 – Sampling plan	17
Table 8 – Periodic test	18
Table A.1 – The dimensions of A and B in Figure A.1	21

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RADIO FREQUENCY AND COAXIAL CABLE ASSEMBLIES –**Part 3: Sectional specification for semi-flexible coaxial cable assemblies**

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IEC 60966-3 has been prepared by IEC technical committee 46: Cables, wires, waveguides, RF connectors, RF and microwave passive components and accessories. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2008. This edition constitutes a technical revision.

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

- a) Added “4.3 The relative position dimensions of the interface”;
- b) Added “Figure 2”;
- c) Added “6 IEC type designation”;
- d) Modified “Figure 3”;

- e) Added “7 Rating and characteristics”;
- f) Added “Requirements/Remarks” to all the tests in Clause 8;
- g) Added some characteristics, such as insertion loss stability, intermodulation level measurement, corona extinction voltage, single bending, abrasion test of cable assembly, mechanical endurance, etc.;
- h) Rewrote test schedules;
- i) Added Annex A and Annex B.

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

Draft	Report on voting
46/945/FDIS	46/957/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_exparts/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 60966 series, published under the general title *Radio frequency and coaxial cable assemblies*, 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.

RADIO FREQUENCY AND COAXIAL CABLE ASSEMBLIES –

Part 3: Sectional specification for semi-flexible coaxial cable assemblies

1 Scope

This part of IEC 60966 is a sectional specification that relates to semi-flexible coaxial cable assemblies operating in the transverse electromagnetic mode (TEM). It specifies the design and construction, IEC type designation, workmanship, marking and packaging, standard rating and characteristics, electrical, mechanical and environmental requirements of finished semi-flexible cable assemblies, quality assessment, delivery and storage, etc.

This part of IEC 60966 applies to semi-flexible cable assemblies composed of semi-flexible coaxial cables and coaxial connectors. Semi-flexible cable assemblies are widely used in mobile communication systems, microwave test equipment, radar, aerospace and other fields.

NOTE 1 For the purpose of this sectional specification, a cable assembly is always regarded as an integral unit. All specifications apply to the finished assembly and not to individual and non-assembled parts thereof.

NOTE 2 This sectional specification can be supplemented with detail specifications giving additional details as required by the particular application. This application will not necessarily require all tests.

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.

<https://standards.iteh.ai/>
<https://standards.iteh.ai/document/iec-60966-3-2023>

<https://standards.iteh.ai/document/iec-60068-1-2013>, *Environmental testing – Part 1: General and guidance*

IEC 60966-1:2019, *Radio frequency and coaxial cable assemblies – Part 1: Generic specification – General requirements and test methods*

IEC 61169 (all parts), *Radio frequency connectors*

IEC 61196-1-126, *Coaxial communication cables – Part 1-126: Electrical test methods – Corona extinction voltage*

IEC 61196-1-314:2015, *Coaxial communication cables – Part 1-314: Mechanical test methods – Test for bending*

IEC 61196-8, *Coaxial communication cables – Part 8: Sectional specification for semi-flexible cables with fluoropolymer dielectric*

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 60966-1:2019 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>

4 Design and construction

4.1 Cable design and construction

Cables should conform to IEC 61196-8 and its related detail specifications. Where cable designs deviating from these publications are required, they shall comply with the requirements of the detail specification of the cable.

If required, the manufacturer can use additional protective tubing or cable deviating from IEC 61196-8, in order to comply with the requirements of the detail specification.

The materials used in the cable shall be given as engineering information in the relevant detail specification.

4.2 Connector design and construction

Connectors should conform to the IEC 61169 series. Where connector designs deviating from the IEC 61169 series are required, the interface should conform to the relevant part of IEC 61169 where available and shall comply with the requirements of the relevant detail specification.

The materials used in the connector shall be given as engineering information in the relevant detail specification.

4.3 The relative position dimensions of the interface

The relative position dimensions of the interface of end connector(s) of the cable assemblies shall comply with the interface of the relevant part of IEC 61169 or the relevant detail specification. The relative position dimensions of the interface of end connector(s) include the dimension of inner conductor relative to dielectric and inner conductor relative to outer conductor.

The relative position dimensions of the interface of some typical connectors are shown in Annex A.

4.4 Outline of the cable assembly

The outline shall be in accordance with the relevant detail specification of the cable assembly.

The length, unless otherwise specified in the relevant detail specification, is defined as between the end planes of the connectors. In the case of right-angle connectors, the length applies to the axis of the connectors (see Figure 1 and Figure 2).

Unless specified in the relevant detail specification, the length tolerance shall be $\pm 1\%$ for cables equal to or longer than 300 mm, and ± 3 mm for cables shorter than 300 mm.

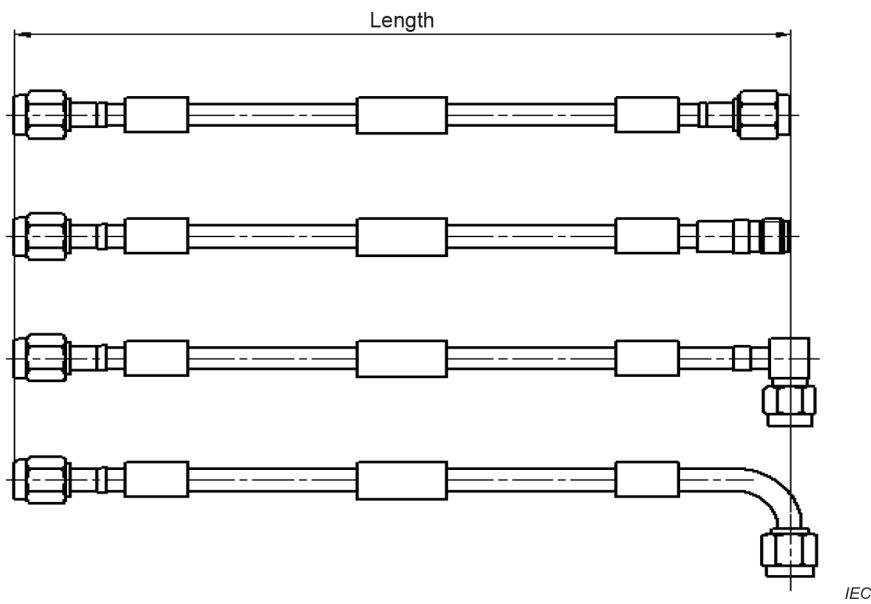


Figure 1 – Length definition of cable assemblies with two connectors

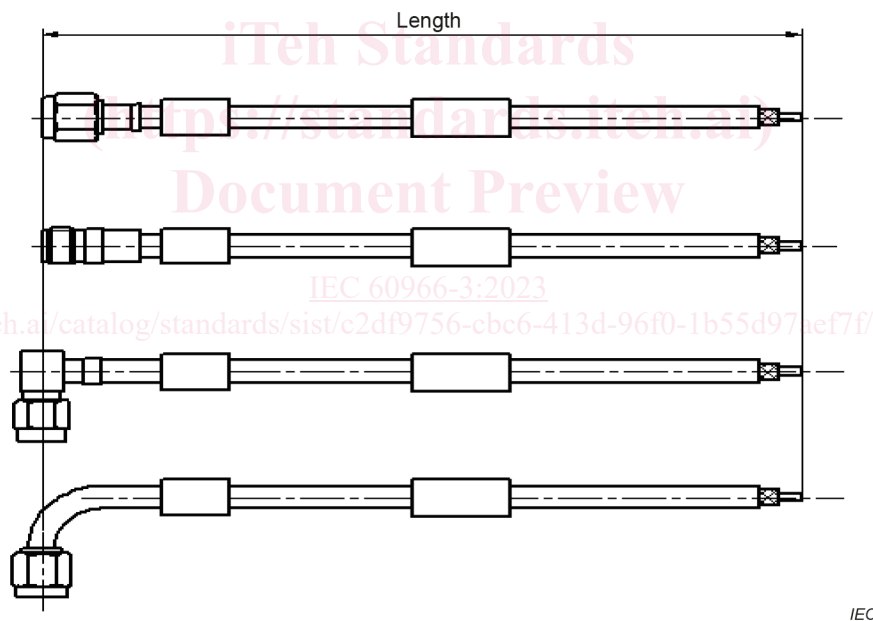
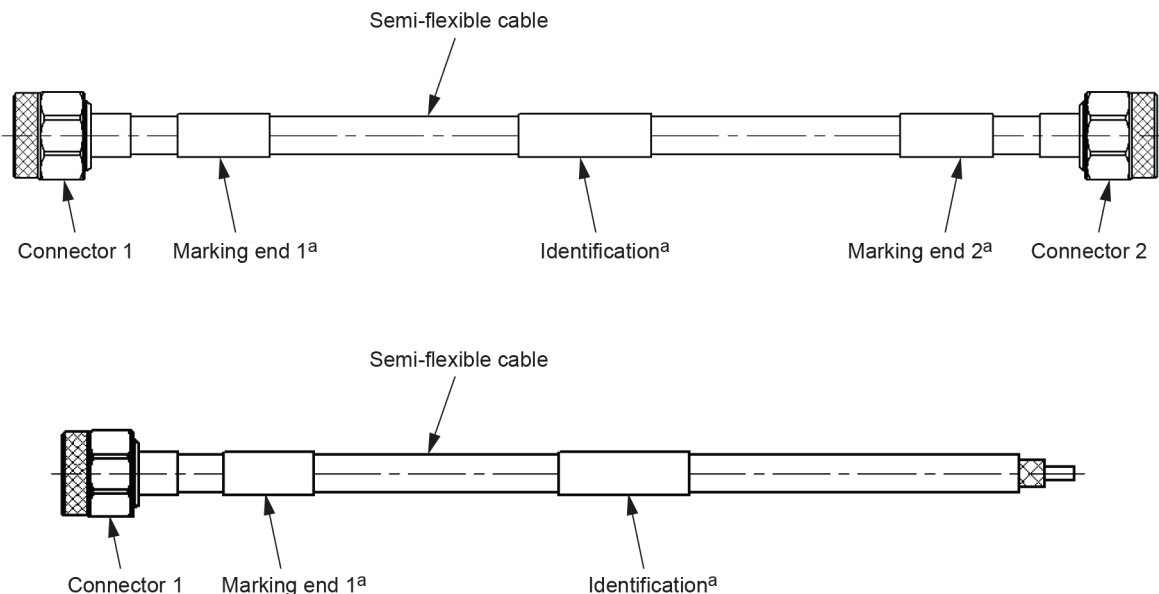


Figure 2 – Length definition of cable assemblies with one connector

5 Workmanship, marking and packaging

IEC 60966-1:2019, Clause 5 and the following paragraph applies:

Cable assemblies made in accordance with this sectional specification comprise a section of cable and two connectors (see Figure 1). Occasionally, the cable assembly will comprise only a cable and one connector (see Figure 2). When specified in the relevant detail specification, the assembly may additionally include markers for identification of the assembly and interconnecting ends. End caps and other accessories may also be specified (see Figure 3).



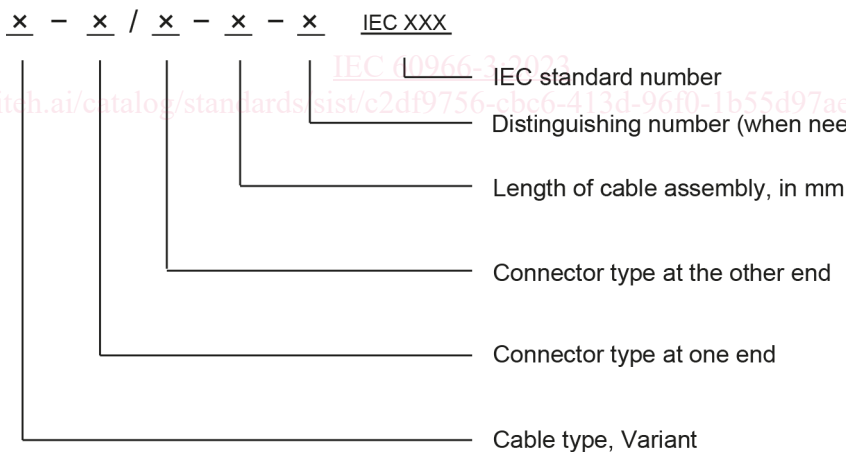
IEC

^a When specified.

Figure 3 – The marking example of a cable assembly

6 IEC type designation

IEC type designation of cable assembly consists of the type of cable and connectors, the length of the cable assembly and the IEC standard number, as shown below:



IEC

Example 1: 50-141-13-SMA/SMA-100-A IEC 60966-3 cable assembly is composed of 50-141-13 semi-flexible cable, one end is SMA pin connector and the other end is SMA pin connector, the length of the cable assembly is 100 mm, its distinguishing number is A. This cable assembly complies with IEC 60966-3.

Example 2: 50-141-13-SMA-100-A IEC 60966-3 cable assembly is composed of 50-141-13 semi-flexible cable, one end is SMA pin connector and the other end empty, the length of the cable assembly is 100 mm, its distinguishing number is A. This cable assembly complies with IEC 60966-3.

7 Rating and characteristics

7.1 Nominal characteristic impedance

The nominal characteristic impedance shall be 50 Ω , 75 Ω or as specified in the relevant detail specification.

7.2 Temperature range

The rated temperature range of the cable assemblies with different cables shall be in accordance with Table 1 or as specified in its detail specification.

Table 1 – Rated temperature of cable assemblies with semi-flexible cables with polytetrafluoroethylene dielectric (IEC 61196-8)

Parameter	No sheath °C	PVC sheath °C	FEP sheath °C	LSZH sheath °C
Operational temperature range	-55 to 125	-40 to 85	-55 to 125	-15 to 70
Storage temperature range	-55 to 125	-40 to 85	-55 to 125	-15 to 70
Installation temperature range	-10 to 40	-30 to 60	-40 to 60	-10 to 60

8 Requirements of finished cable assemblies

8.1 General

For finished cable assemblies, the requirements given below shall apply when they are tested in accordance with IEC 60966-1:2019 and the test methods specified herein.

When needed, cable assemblies with one connector shall be terminated with a suitable connector at the cable end to do the test and cut off after the test.

Unless otherwise specified, all measurements shall be carried out under standard atmospheric conditions for testing in accordance with IEC 60068-1:2013, Clause 4.

8.2 Electrical requirements

Electrical requirements are given in Table 2.

Table 2 – Electrical requirements

No.	Parameter	Test method	Requirements/Remarks
		IEC 60966-1:2019	
1	Reflection properties (Return loss)	8.1	Value in accordance with the relevant detail specification. While the parameter return loss (A_r) is preferred, the reflection factor (r) or the VSWR (voltage standing wave ratio) may be specified where $A_r = -20 \log_{10} r $ and $VSWR = \frac{1 + r }{1 - r }$
2	Uniformity of impedance	8.2	Rise time of the TDR system in accordance with the detail specification. The characteristic impedance variation shall not exceed $\pm 5\%$ of the nominal value or shall be in accordance with the relevant detail specifications.
3	Insertion loss	8.3	Value in accordance with the relevant detail specification
4	Insertion loss stability	8.4	When required, unless otherwise specified in the relevant detail specification, test conditions and requirements are as follows: a) test mandrel radius: dynamic state bending radius in the relevant detail specification of cable; b) number of turns: 1; c) portion of the cable assembly on the mandrel is its central portion. After bending, the insertion loss shall be in accordance with the detail specification.
5	Propagation time	8.5	When required, value in accordance with the detail specification. Typical values are for solid PTFE dielectric of cable: 4,76 ns/m.
6	Stability of electrical length	8.6	When required, method 1 or method 2 in IEC 60966-1:2019, 8.6.2.1 shall be used in accordance with the detail specification. Test conditions and requirements in accordance with the detail specification.
7	Phase difference	8.7	When required, the phase difference shall not exceed the limits specified in the relevant detail specification. When more than two cable assemblies are measured, the reference cable shall be clearly marked.
8	Phase variation with temperature	8.8	When required, value in accordance with the detail specification.
9	Screening effectiveness	8.9	Value of transfer impedance or shield attenuation in accordance with the detail specification. Typical values are as follows: a) transfer impedance: when test frequency is less than 30 MHz, the maximum value is 300 $\mu\Omega/m$; b) shield attenuation: better than $(90 - f)$ dB, f : GHz.

No.	Parameter	Test method	Requirements/Remarks
		IEC 60966-1:2019	
10	Voltage proof	8.10	Value in accordance with the relevant detail specification There shall be no breakdown, arcing or flashover throughout. Typical values are as follows: – sea-level: 86 kPa to 106 kPa; – 10 km: 25 kPa; – 20 km: 4,4 kPa.
11	Insulation resistance	8.11	≥ 1 000 MΩ, or in accordance with the relevant detail specification.
12	Inner and outer conductor continuity	8.12	Test voltage: ≤ 36 V DC. Inner conductor and outer conductor shall be continuous
13	Power rating	8.13	When required, test conditions and value in accordance with the relevant detail specification.
14	Intermodulation level measurement	8.14	When required, if applicable to 50 Ω assemblies, the test frequencies (f_1 and f_2), input power, Intermodulation level measurement values in accordance with the relevant detail specification. Typical assemblies with the following connectors, when tested at frequency 700 MHz\ 800 MHz\ 900 MHz\ 1 800 MHz\ 2 100 MHz\ 2 600 MHz, input power:2×20 W, the PIM shall be as follows: – ≤-150 dBc (with N type connectors); – ≤-155 dBc (with 4.3/10 type connectors); – ≤-155 dBc (with 7/16 type connectors).
15	Corona extinction voltage	IEC 61196-1-126	When required, sample preparation is not needed, and the test is carried out in air without immersion in insulating oil, value in accordance with the relevant detail specification. It is recommended to use a relatively non corona adapter to connect the cable assembly for testing.

8.3 Mechanical requirements

Mechanical requirements are given in Table 3.

Table 3 – Mechanical requirements

No.	Parameter	Test method	Requirements/Remarks
		IEC 60966-1:2019	
1	Visual inspection	7.2	Meets the requirements of IEC 60966-1:2019, Clause 5 and 7.2.
2	The relative position dimensions of the interface	7.3.1	Value in accordance with the relevant detail specification. The relative position dimensions of the interface of some typical connectors are shown in Annex A.
3	Outline of the cable assembly	7.3.2	Value in accordance with the relevant detail specification.
4	Tensile	9.1	Value of the force and duration in accordance with the relevant detail specification. Normally, the duration is 60 s. Requirements after the test: a) no obvious damage or loosening of the assembly by visual inspection; b) the relative position dimensions of the interface shall meet the requirement of No.2 of Table 3; c) reflection properties shall meet the requirement of No.1 of Table 2.
5	Torque	9.5	Value of the torque in accordance with the relevant detail specification. The torque shall be applied at least 60 s in both clockwise and counter clockwise directions. Requirements after test: a) no visual damage or loosening of the assembly; b) the relative position dimensions of the interface shall meet the requirement of No.2 of Table 3; c) reflection properties shall meet the requirement of No.1 of Table 2.
6	Single bending	IEC 61196-1-314: 2015, 4.3.2	Unless otherwise specified in the relevant detail specification, test conditions are as follows: a) radius of test mandrel: static state bending radius; b) number of cycles: 2; c) number of turns: 1; d) test temperature: 20 °C ± 5 °C. Requirements after test: a) no visual damage or loosening of the assembly; b) the relative position dimensions of the interface shall meet the requirement of No.2 of Table 3; c) the reflection properties shall meet the requirement of No.1 of Table 2.
7	Multiple bending	9.6	Number of cycles (normally 20) in accordance with the relevant detail specification. Requirements after test: a) no visual damage or loosening of the assembly; b) the relative position dimensions of the interface shall meet the requirement of No.2 of Table 3; c) the reflection properties shall meet the requirement of No.1 of Table 2.