

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



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**Radio frequency and coaxial cable assemblies –  
Part 3-3: Detail specification for semi-flexible cable assemblies (Jumper) –  
Frequency range up to 18 GHz, Type 50-141 semi-flexible coaxial cable**

**Cordons coaxiaux et cordons pour fréquences radioélectriques –  
Partie 3-3: Spécification particulière relative aux cordons semi-flexibles (câble  
de liaison), plage de fréquences jusqu'à 18 GHz, câble coaxial semi-flexible de  
type 50-141**



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RADIO FREQUENCY AND COAXIAL CABLE ASSEMBLIES –****Part 3-3: Detail specification for semi-flexible cable assemblies (Jumper) –  
Frequency range up to 18 GHz, Type 50-141 semi-flexible coaxial cable**

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IEC 60966-3-3 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.

It has the status of a horizontal standard in accordance with IEC Guide 108.

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

Draft	Report on voting
46/927/FDIS	46/931/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.

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.

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

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## RADIO FREQUENCY AND COAXIAL CABLE ASSEMBLIES –

### Part 3-3: Detail specification for semi-flexible cable assemblies (Jumper) – Frequency range up to 18 GHz, Type 50-141 semi-flexible coaxial cable

#### 1 Scope

This part of IEC 60966 is a detail specification that relates to semi-flexible cable assemblies composed of type 50-141 semi-flexible coaxial cables with polytetrafluoroethylene (PTFE) dielectric (IEC 61196-8-4) and connectors such as, type SMA (IEC 61169-15), type N (IEC 61169-16). It gives subfamily detail requirements and severities to be applied.

These cable assemblies are mainly used in the field of microwave and wireless equipment or other signal transmission equipment or units. The operating frequency is up to 18 000 MHz.

The qualification will be conducted in accordance with IEC 60966-3. Once one variant obtains the qualification approval, the other variant with the same cable and connection type can obtain the qualification approval by conducting tests whose results might depend on the variants.

Under capability approval, the qualification will be conducted on the relating CQCs (capability qualifying components) as defined in IEC 60966-3 and described in the CM (capability manual). Unless otherwise specified in the CM, only lot-by-lot tests from groups Ba and Eb will be conducted on delivered products, all other tests will be performed on CQCs as defined in IEC 60966-3 and described in the CM.

#### 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 60068-2-11, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

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

IEC 60966-3, *Radio frequency and coaxial cable assemblies – Part 3: Sectional specification for semi-flexible coaxial cable assemblies*

IEC 60966-3-1, *Radio frequency and coaxial cable assemblies – Part 3-1: Blank detail specification for semi-flexible coaxial cable assemblies*

IEC 61169-15, *Radio-frequency connectors – Part 15: Sectional specification – RF coaxial connectors with inner diameter of outer conductor 4,13 mm (0,163 in) with threaded coupling – Characteristic impedance 50 Ω (type SMA)*

IEC 61169-16, *Radio-frequency connectors – Part 16: Sectional specification – RF coaxial connectors with inner diameter of outer conductor 7 mm (0,276 in) with screw coupling – Characteristics impedance 50 ohms (75 ohms) (type N)*

IEC 61196-8-4, *Coaxial communication cables – Part 8-4: Detail specification for 50-141 type semi-flexible cables with solid polytetrafluoroethylene (PTFE) insulation*

IEC 61726, *Cable assemblies, cables, connectors and passive microwave components – Screening attenuation measurement by the reverberation chamber method*

### 3 Terms and definitions

No terms and definitions are listed in this document.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
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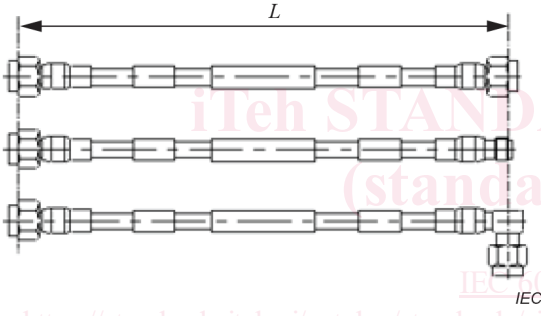
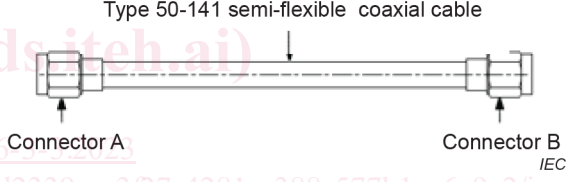
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## 4 Detail specification

<b>RADIO FREQUENCY AND COAXIAL CABLE ASSEMBLIES –</b>			
<b>Part 3-3: Detail specification for semi-flexible cable assemblies (Jumper), frequency range up to 18 GHz, Type 50-141 semi-flexible coaxial cable</b>			
[1]	Prepared by: IEC TC 46		[2] Document No.: IEC 60966-3-3 Issue: First issue Date:
[3]	Available from: IEC	[4]	Generic specification: IEC 60966-1 Sectional specification: IEC 60966-3 Blank detail specification: IEC 60966-3-1
[5]	Additional references:		
<b>Outline for semi-flexible coaxial cable assemblies</b>			
NOTE Example diagram, see Figure 1 and Figure 2, manufacturer to insert actual diagram			
			
<b>Figure 1 – Length definition of cable assemblies</b>		<b>Figure 2 – Semi-flexible cable assemblies with type 50-141 semi-flexible coaxial cable</b>	
[6]	Maximum diameter of type 50-141 semi-flexible coaxial cable < 4,7 mm		
[7]	Characteristic impedance: 50 Ω	[8]	Frequency: up to 18 000 MHz
[9]	Typical weight: Cable: 50 g/m Connector: Type SMA: 2,5 g Type N: 20 g	[10]	Minimum inside radius: For static bending: 10 mm For dynamic bending: 40 mm
[11]	Climatic category: 40/70/21	[12]	Applicable test group: Ba, Eh, Eb, Ez, Ep, Ee, Et, Mn, Vv, Vc, Vt, Vf
[13]	Connector reference number:	IEC 61169-15 (type SMA), IEC 61169-16 (type N)	
	Type (series), style, sex of the connector	Type SMA, straight or right angled, male or female Type N, straight or right angled, male or female	
	Reference no, type of the cable	IEC 61196-8-4, IEC-50-141 or equivalent (IEC 61196-8-4).	
	Marking method	Marking of the assembly shall be applied to the sheath of the cable.	
	Marking text	The marking shall consist at least of the IEC cable assembly type and IEC standard number. (See Clause A.2).	
[14]	Variants: See Clause A.1	[15]	Page 1 of 7 pages

[16] Inspection values, ratings or characteristics	[17] IEC 60966-1:2019 Subclause	[18] Value	[19] Remarks
<b>Electrical</b>			
Reflection properties (Return loss)	8.1	1) With straight connector $\geq 20,50$ dB (DC to 6 000 MHz) $\geq 18,97$ dB (> 6 000 MHz to 12 000 MHz) $\geq 16,51$ dB (> 120 00 MHz to 18 000 MHz) 2) With right angled connector $\geq 19,91$ dB (DC to 6 000 MHz) $\geq 17,65$ dB (> 6 000 MHz to 12 000 MHz) $\geq 16,33$ dB (> 12 000 MHz to 18 000 MHz)	
Uniformity of impedance	8.2	$50 \Omega \pm 2 \Omega$	Rise time of pulse <150 ps
Insertion loss	8.3	$\leq 0,01 \times a_f \times L + 2 \times 0,05 \sqrt{f}$ $a_f$ : see IEC 61196-8-4, in dB/100 m $L$ : see Figure 1, in m $f$ : in GHz	$a_f$ : see IEC 61196-8-4
Propagation time	8.5	$(3,91 \text{ ns} \pm 0,05 \text{ ns})/\text{m}$	
Stability of electrical length	8.6	$\leq 7^\circ$	DC to 18 GHz Mandrel radius: 40 mm Test method: 2iec-Bending test
Phase difference	8.7	$\leq 6^\circ$	18 GHz
Phase variation with temperature	8.8	$\leq 5^\circ/\text{GHz}$	Length of assemblies: 1 m Test temperature: $-40^\circ\text{C}$ to $70^\circ\text{C}$ $t$ : 30 min Cycles: 6
Screening effectiveness	8.9	$\leq -90$ dB	According to IEC 61726 1 000 MHz to 18 000 MHz
Voltage proof	8.10	1,5 kV	AC, 1 min
Insulation resistance	8.11	$\geq 5\,000$ M $\Omega$	Test voltage: 500 V, DC 60 s $\pm$ 5 s
Inner and outer conductor continuity	8.12	Inner conductor and outer conductor shall be continuous	Test voltage $\leq 36$ V DC
Power rating	8.13	$\geq 38$ W	Temperature: $40^\circ\text{C}$ DC to 18 000 MHz

<b>[16]</b> Inspection values, ratings or characteristics	<b>[17]</b> IEC 60966-1:2019 Subclause	<b>[18]</b> Value	<b>[19]</b> Remarks
Intermodulation level	8.14	$\leq -155$ dBc	Test power: $2 \times 20$ W Test frequency: 700 MHz, 900 MHz, 1 800 MHz, 2 100 MHz, 2 600 MHz
<b>Mechanical</b>			
Tensile	9.1	1) Inner conductor and insulator positions shall be in accordance with interface dimensions 2) No visual evidence of the movement of the cable relative to the connector 3) Return loss shall meet 8.1	Force: 100 N Duration: 60 s Test: IEC 60966-1:2019, 8.1
Cable assembly crushing	9.4	1) Inner conductor and insulator positions shall be in accordance with interface dimensions 2) No visual evidence of the movement of the cable relative to the connector 3) Return loss shall meet 8.1	Force: 200 N Duration: 60 s Test: IEC 60966-1:2019,8.1
Torque	9.5	1) Inner conductor and insulator positions shall be in accordance with interface dimensions 2) No visual damage in cable assembly 3) Return loss shall meet 8.1	$\geq 5$ Ncm Test: IEC 60966-1: 2019, 8.1
Multiple bending	9.6	1) Inner conductor and insulator positions shall be in accordance with interface dimensions 2) No visual damage in cable assembly 3) Return loss shall meet 8.1	Cycles: 20
<b>Environmental</b>			
Vibration	10.2	1) No visual damage in cable assembly 2) No electrical interruptions exceeding $1 \mu\text{s}$	$98 \text{ m/s}^2$ (10 g) 10 Hz to 2 000 Hz
Bumps	10.2	No visual damage in cable assembly	
Shock	10.2	1) No visual damage in cable assembly 2) No electrical interruptions exceeding $1 \mu\text{s}$	$147 \text{ m/s}^2$ (15 g) Half-sine wave, 11 ms
Climatic sequence	10.3	1) No visual damage in cable assembly 2) Insertion loss shall meet 8.3 3) Voltage proof shall meet 8.10 4) Insulation resistance shall meet 8.11	Cycles: 1 (connectors un- mated) Tests: IEC 60966-1: 2019, 7.2, 8.3, 8.10, 8.11
Damp heat, steady state	10.4	1) No visual damage in cable assembly 2) Insertion loss shall meet 8.3	Cycles: 1 Days: 21 (connectors un- mated) Tests: IEC 60966-1: 2019, 7.2, 8.3,

[16] Inspection values, ratings or characteristics	[17] IEC 60966-1:2019 Subclause	[18] Value	[19] Remarks
Rapid change of temperature	10.5	1) Inner conductor and insulator positions shall be in accordance with interface dimensions 2) No visual damage in cable assembly 3) Insertion loss shall meet 8.3 4) Voltage proof shall meet 8.10 5) Insulation resistance shall meet 8.11	Test temperature: $T_A = -55\text{ °C}$ , $T_B = 125\text{ °C}$ $t: 4\text{ h}$ Cycles: 5 Tests: IEC 60966-1: 2019, 7.2, 8.3, 8.10, 8.11
Solvents and contaminating fluids	10.6	1) No visual damage in cable assembly 2) Insertion loss shall meet 8.3 3) Insulation resistance shall meet 8.11	Cycles: 5 (connectors unmated) Tests: IEC 60966-1: 2019, 7.2, 8.3, 8.11
Water immersion	10.7	1) Insertion loss shall meet 8.3 2) Insulation resistance shall meet 8.11	(connectors mated) Tests: IEC 60966-1: 2019, 8.3, 8.11
Salt mist and sulphur dioxide	10.8	1) No visual damage in cable assembly 2) Insertion loss shall meet 8.3 3) Insulation resistance shall meet 8.11	According to IEC 60068-2-11 Duration of spraying: 96 h
Dust tests	10.9	1) No visual damage in cable assembly 2) Insertion loss shall meet 8.3	Cycles: 5 Tests: IEC 60966-1: 2019, 7.2, 8.3
Flammability	10.10	1) The cable shall not continue to burn for more than 15 s after removal from the flame 2) During the test, burning particles shall be not detached from the cable	