

PUBLICLY
AVAILABLE
SPECIFICATION

IEC
PAS 61169-4

Pre-Standard

First edition
2006-05

Radio-frequency connectors–

Part 4:

Sectional specification –

**Radio-frequency coaxial connectors
with inner diameter of outer conductor**

16 mm (0,63 in) with screw lock –

Characteristic impedance 50 Ω (type 7-16)



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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



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 IEC PAS 61169-4:2006

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIO-FREQUENCY CONNECTORS –

**Part 4: Sectional specification –
Radio-frequency coaxial connectors with inner diameter
of outer conductor 16 mm (0,63 in) with screw lock –
Characteristic impedance 50 Ω (type 7-16)**

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IEC-PAS 61169-4 has been processed by subcommittee 46F: RF and microwave passive components, of IEC technical committee 46: Cables, wires, waveguides, r.f. connectors, r.f. and microwave passive components and accessories.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:

Draft PAS	Report on voting
46F/40/NP	46F/45/RVN

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned will transform it into an International Standard.

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RADIO-FREQUENCY CONNECTORS –

Part 4: Sectional specification – Radio-frequency coaxial connectors with inner diameter of outer conductor 16 mm (0,63 in) with screw lock – Characteristic impedance 50 Ω (type 7-16)

1 Scope

This part of IEC 61169, which is a sectional specification (SS), provides information and rules for the preparation of detail specifications (DS) for type 7-16 r.f. coaxial connectors with screw lock.

The connectors are normally used with 50 Ω flexible and semi-rigid r.f. cables for middle power applications in an operating frequency range up to 7,5 GHz.

It describes the interface dimensions for general-purpose grade 2 connectors, dimensional details for standard test connectors, grade 0, together with gauging information and the mandatory tests selected from IEC 61169-1 applicable to all DS relating to type 7-16 connectors.

This specification indicates the recommended performance characteristics to be considered when writing a DS and covers test schedules and inspection requirements.

2 Normative references

The following referenced documents are indispensable for the application 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 61169-1:1992, *Radio-frequency connectors – Part 1: Generic specification – General requirements and measuring methods*

IEC 62037:1999, *RF connectors, connector cable assemblies and cables – Intermodulation level measurement*

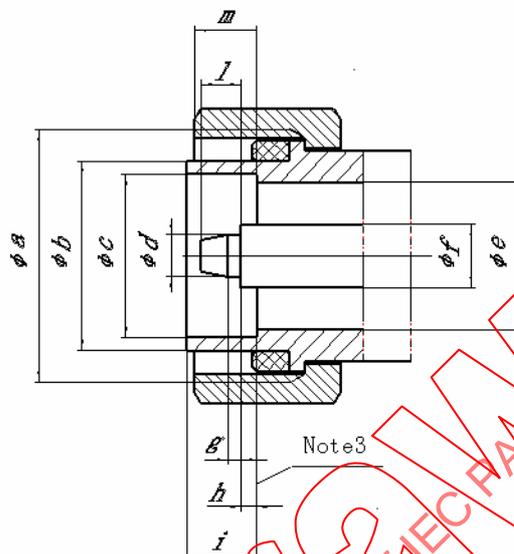
3 Mating face and gauge information

Metric dimensions are original dimensions.

All un-dimensioned pictorial configurations are for reference purposes only.

3.1 Dimensions – General connectors – Grade 2

3.1.1 Connector with pin-centre contact



Ref.	mm		in		Notes
	Min.	Max.	Min.	Max.	
<i>a</i>	M29×1,5				2
<i>b</i>	20,6	21,4	0,811	0,843	
<i>c</i>	18,03	18,21	0,7098	0,7169	
<i>d</i>	4,96	5,04	0,1953	0,1984	
<i>e</i>	15,85	16,25	0,6240	0,6398	
<i>f</i>	7 (nominal)		0,276 (nominal)		1
<i>g</i>	1,4	1,6	0,0551	0,0630	
<i>h</i>	1,47	1,77	0,0579	0,0697	
<i>i</i>	7,00	8,00	0,276	0,315	
<i>l</i>	–	4,5	–	0,177	
<i>m</i>	7,00	9,00	0,276	0,354	

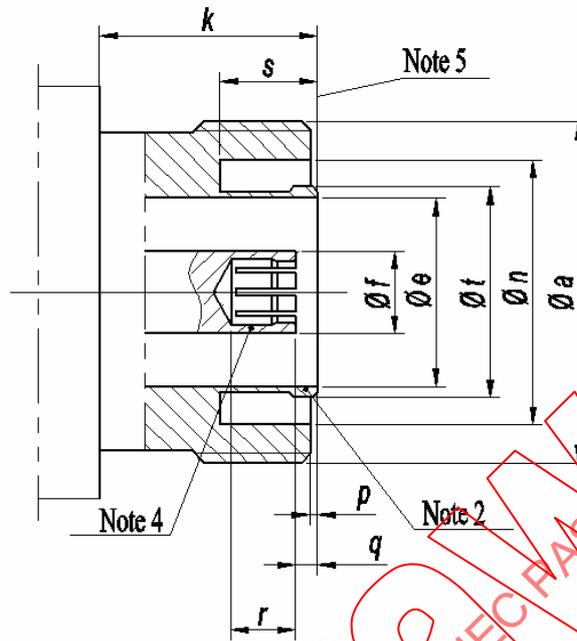
NOTE 1 The tolerances on this dimension are determined by the tolerance of characteristic impedance.

NOTE 2 M29 × 1,5 indicates metric screw thread with a nominal diameter of 29 mm (1,141 in) and a pitch of 1,5 mm (0,059 in).

NOTE 3 Mechanical and electrical reference plane.

Figure 1 – Connector with pin-centre contact

3.1.2 Connector with socket-centre contact



Ref.	mm		in		Note
	Min.	Max.	Min.	Max.	
a	M29 × 1,5				3
e	15,85	16,25	0,6240	0,6398	
f	7 (nominal)		0,276 (nominal)		1
k	10	-	0,394	-	
n	22,1	22,9	0,870	0,902	
p	0,5	0,7	0,0197	0,0276	
q	1,77	2,07	0,0697	0,0815	
r	5	-	0,197	-	
s	8,1	-	0,319	-	
	17,84	18,02	0,7024	0,7094	2

NOTE 1 The tolerances on this dimensions are determined by the tolerance of characteristic impedance.

NOTE 2 May be slotted as required. After slotting, to be bent outwards to 18,5 mm (0,728 in) max. The slotted sleeve should to meet the requirement of the gauge retention force.

NOTE 3 M29 × 1,5 indicates metric screw thread with a nominal diameter of 29 mm (1,141 in) and a pitch of 1,5 mm (0,059 in).

NOTE 4 Slot design optional. Contact to be closed to meet performance requirements.

NOTE 5 Mechanical and electrical reference plane.

Figure 2 – Connector with socket-centre contact

3.2 Gauges for general purpose connectors – Grade 2

3.2.1 Gauges for socket-centre contact connector

3.2.1.1 Centre contact

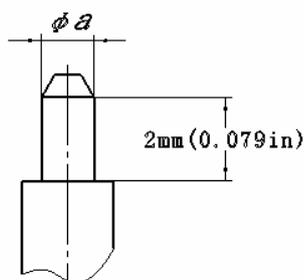


Figure 3 – Gauge pins for centre contact of socket connector

Test procedure

- A steel test pin (Figure 3) with a diameter a of $5,10 \pm 0,001$ mm ($0,2008 \pm 0,0004$ in) and a $0,4 \mu\text{m}$ ($16 \mu\text{in}$) max. finish shall be inserted once into the centre contact a minimum distance of 2 mm ($0,079$ in).
- A second steel test pin (Figure 3) with a diameter a of $4,96 \pm 0,01$ mm ($0,1953 \pm 0,0004$ in) and a $0,4 \mu\text{m}$ ($16 \mu\text{in}$) max. finish shall have a minimum withdrawal force of 6 N after insertion into the centre contact.

It is recommended that this gauge should have a mass of 600 g.

3.2.1.2 Outer contact

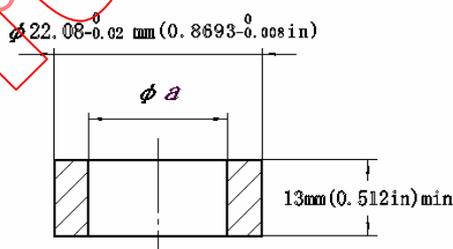


Figure 4 – Gauge ring for outer contact of socket connector

- For non-slotted outer contacts, a steel test ring (Figure 4) with inner diameter a of $18,03 \pm 0,001$ mm ($0,7098 \pm 0,0004$ in) and a $0,4 \mu\text{m}$ ($16 \mu\text{in}$) max. finish shall be pushed over the outer electrical contact of the connector. The force required to push this test ring on to the connector a minimum distance of 8 mm ($0,315$ in) shall not exceed 40 N.
- For slotted outer contacts, a steel test ring (Figure 4) with inner diameter a of $18,23 + 02/0$ mm ($0,7177 + 0,0008/0$ in) and a $0,4 \mu\text{m}$ ($16 \mu\text{in}$) max. finish shall be placed over the outer electrical contact of the connector. The test ring shall uniformly meet the outer electrical contact when pushed no more than 3 mm ($0,12$ in) over this contact.

The retention force for the gauge ring shall be 15 N min.

3.3 Dimensions – Standard test connectors – Grade 0

In order to carry out the reflection coefficient measurement according to 9.2.1 of IEC 61169-1, the measuring equipment should be provided with the standard test connector. The standard test connector, with the tolerances specified in 3.3.1 and 3.3.2, guarantees an accuracy of characteristic impedance of $\pm 0,075 \Omega$.

3.3.1 Standard test connector with pin-centre contact

The dimensions of the standard test connector with pin-centre contact shall be as specified in 3.1.1 but with the following tolerance in Table 1.

Table 1 – Pin-centre tolerances

Dimension	mm		in	
	Min.	Max.	Min.	Max.
<i>d</i>	4,99	5,00	0,19646	0,19685
<i>e</i>	16,05	16,07	0,63189	0,63268
<i>f</i>	6,971	6,981	0,27445	0,27484
<i>h</i>	1,73	1,75	0,06811	0,06890

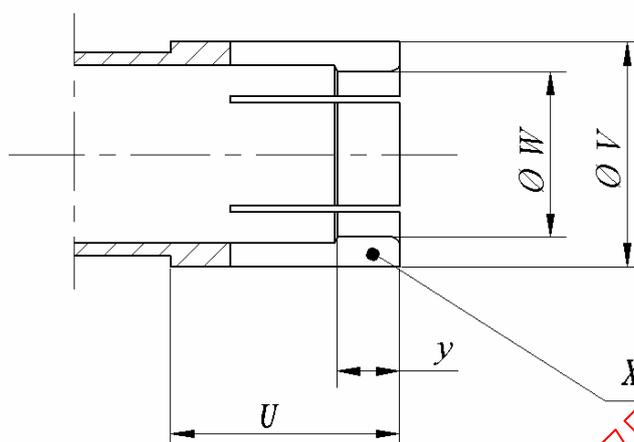
3.3.2 Standard test connector with socket-centre contact

The dimensions of the standard test connector with socket centre contact shall be as specified in 3.1.2 but with the following tolerance in Table 2.

Table 2 – Socket-centre tolerances

Dimension	mm		in	
	Min.	Max.	Min.	Max.
<i>e</i>	16,05	16,07	0,63189	0,63268
<i>f</i>	6,971	6,981	0,27445	0,27484
<i>q</i>	1,79	1,81	0,07047	0,07126

Additionally, dimensions of the slotted centre contact (Figure 5) shall be as follows.



U = 7,2 mm (0,2835 in) min., 7,4 mm (0,2913 in) max.

V = 6,997 mm (0,275473 in) min. when pin gauge has a diameter of 4,99 mm (0,19646 in) min.
 7,003 mm (0,275709 in) max. 5,00 mm (0,19685 in) max.
 inserted 2 mm (0,079 in) deep min.

W to fulfil the requirements of dimension V .

X six slots spaced 60° apart, 0,3 mm (0,0118 in) wide 6,9 mm (0,2717 in) min. deep.
 7,1 mm (0,2795 in) max.

y = 1,2 mm (0,0472 in) min.

Figure 5 – Slotted centre contact

4 Quality assessment procedures

4.1 General

The following subclauses provide recommended rating, performance and test conditions to be considered when writing a detail specification (DS). They also provide an appropriate schedule of tests with the proforma blank detail specification and instructions for the preparation of a detail specification.

4.2 Rating and characteristics (see Clause 6 of IEC 61169-1)

The values indicated below are recommended for type 7-16 connectors and are given for the writer of the detail specification. They are applicable for the condition where the connectors are fully mated .

Certain tests will usually not be required. When these tests are required, appropriate values shall be entered in the detail specification at the discretion of the specification writer.

Table 3 – Ratings and characteristics

Ratings and characteristics	IEC61169-1 Subclause	Value	Remarks including any deviations from standard test method
Electrical			
Nominal impedance		50 Ω	
Frequency range ^a		Up to 7,5 GHz	See DS
Reflection factor ^a – straight styles – right angle styles – solder bucket and PCB mounting styles	9.2.1	0,1	See DS Under consideration
Centre contact resistance – initial – after conditioning	9.2.3	$\leq 0,4$ m Ω $\leq 0,4$ m Ω	
Outer conductor continuity – initial – after conditioning		$\leq 1,5$ m Ω $\leq 1,5$ m Ω	See DS See DS
Insulation resistance – initial – after conditioning	9.2.5	> 10 G Ω $> 0,1$ G Ω	
Proof voltage at sea-level ^{b, c}	9.2.6	4 000 V	(86 ~ 106) kPa
Proof voltage at 4,4 kPa ^{b, c}	9.4.2	350 V	4,4 kPa approximately equivalent to 20 km altitudes
Environmental test voltage at sea-level ^{b, c}	9.4.3	3 000 V	(86 ~ 106) kPa
Screening effectiveness	9.2.8	$a_s \geq 110$ dB ($Z_t \leq 0,02$ m Ω)	Frequency: 1 GHz, fully mated applied torque: 25 N·m
Discharge test (corona effect) ^c	9.2.9	2,8kV	See DS
Intermodulation level ^d	IEC 62037	over -155 dBc	Test power: 20 W
Mechanical			
Gauge retention force (resilient contacts) Centre contact Outer contact	9.3.4	(6 ~ 18) N (15 ~ 45) N	(Only for slotted connectors)
Centre contact captivation – axial force	9.3.5	200 N, 1 min Maximum permanent axial displacement of 0,25 mm in each direction	Only for fixed connector
– torque			See DS
Engagement and separation coupling torque – normal value – enduring torque	9.3.6	(20 ~ 28) N·m (25 ~ 30) N·m	To overcome the force of connect nut

Ratings and characteristics	IEC61169-1 Subclause	Value	Remarks including any deviations from standard test method
Mechanical tests on cable fixing ^a			
- cable rotation (rotation)	9.3.7.2	Number of revolutions: 2 × 25	Minimum bending radius: as specified for the cable
- cable pulling	9.3.8	Climatic category A: 500 N Climatic category B: 250 N	Time: 1 min
- cable bending	9.3.9	Climatic category A: 300 N Climatic category B: 150 N	Bending number: 10 Bending angle: 90°
- cable torsion	9.3.10	Climatic category A: 5 N·m Climatic category B: 2,5 N·m	
Tensile strength of coupling mechanism	9.3.11	445 N	
Bending moment (and shearing force)	9.3.12		See DS
Environmental			
Vibration	9.3.3	98 m/s ² (10 ~ 500) Hz	Acceleration : 10 g
Climatic sequence	9.4.2	Climatic category A: 40/85/21 Climatic category B: 55/155/56	
Non-hermetically sealed	9.4.5.1	100 kPa·cm ³ /h, max.	(100 ~ 110)kPa
Salt mist	9.4.6	48 h	
Endurance			
Mechanical	9.5	500 operations	
High temperature	9.6	1 000 h	
^a These values apply to the basic connector (straight screw-type). In practice, these may be influenced by the cable used, and relevant values are given in the DS. ^b Voltage values are r.m.s. values at 50-60 Hz, unless otherwise specified. ^c Cables used with these connectors may have values of lower performance than those given in this table. ^d As applicable.			

4.3 Test schedule and inspection requirements

4.3.1 Acceptance tests

For acceptance tests, see Table 4

Table 4 – Acceptance tests

	IEC 61169-1 Subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	IL	AQL %	Period	Test required	IL	AQL %	Period
<i>Group A1</i>									
Visual examination	9.1.2	a	II	1,0		a	S3	1,5	
<i>Group B1</i>									
Outline dimensions	9.1.3.1	a	S4	0,40		a	S3	4,0	
Mechanical compatibility	9.1.3.3	a	II	1,0		a	S3	1,5	
Engagement and separation forces and torques	9.3.6	a	S4	0,40	Lot	a	S3	1,5	Lot
Gauge retention (resilient contact)	9.3.4	ia	II	1,0	by lot	ia	S3	1,5	by lot
Sealing, non-hermetic	9.4.5.1	ia	II	0,65		ia	S3	1,0	
Voltage proof	9.2.6	a	S4	0,40		a	II	4,0	
Solderability piece parts	9.3.2.1.1	ia	S4	0,40		ia	S3	4,0	
Insulation resistance	9.2.5	a	S4	0,40		a	S3	4,0	

NOTE For details of symbols, abbreviations and procedures, see Table 5.

4.3.2 Periodic tests

There are no group C tests for levels H and M.

Table 5 – Periodic tests

	IEC 61169-1 Subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of speci- mens	Permit- ted failures per group ^a	Period	Test required	Number of speci- men	Permit- ted failures per group ^a	Period
<i>Group D1 (d)</i>			6	1	3y		3	1	3y
Solderability connector assemblies	9.3.2.1.1	ia				ia			
Resistance to soldering heat	9.3.2.1.2	ia				ia			
Mechanical tests on cable fixing									
– cable rotation (nutation)	9.3.7.2	ia				ia			
– cable pulling	9.3.8	ia				ia			
– cable bending	9.3.9	ia				ia			
– cable torsion	9.3.10	ia				ia			
Bending moment (and shearing force)	9.3.12	a				a			
Strength of coupling mechanism	9.3.11	ia				ia			
<i>Group D2 (d)</i>			6	1	3y		3	1	3y
Contact resistance, outer conductor and screen continuity, also centre conductor continuity	9.2.3	a				a			
Bump	9.3.13	a							
Vibration	9.3.3	a							
Shock	9.3.14	a							
Damp heat, steady state	9.4.3	a				a			
Salt mist	9.4.6	a							
<i>Group D3</i>									
Dimensions piece-parts and materials	9.1.3.2	a	1 ^b	1	3y	a	1 ^b	1	3y
<i>Group D4 (d)</i>			6	1	3y		3	1	3y
Mechanical endurance	9.5	a				a			
High-temperature endurance	9.6	a				a			
Sulphur dioxide	9.4.8	na				na			
<i>Group D5 (d)</i>			6	1	3y		3	1	3y
Reflection factor	9.2.1	a				a			
Screening effectiveness	9.2.8	a				a			
Intermodulation level	IEC 62037	ia				ia			
Water immersion	9.2.7	ia				ia			
<i>Group D6 (d)</i>			6	1	3y		3	1	3y
Centre contact captivation	9.3.5	a				a			
Discharge test (corona)	9.2.9	a				a			
Rapid change of temperature	9.4.4	a				a			
Climatic sequence	9.4.2	a				a			
<i>Group D7 (d)</i>									
Resistance to solvents and contaminating fluid	9.7	ia	1 ^c		3y	ia	1 ^c	1	3y

^a For Qualification Approval (QA), a total of two failures only is permitted for level H and one failure only for level M from groups D1 to D7

^b One set of piece-parts for each style and variant, unless using common piece-parts.

^c Group D7: number of pairs for each solvent

NOTE Symbols, abbreviations and procedures:

a: suggested as applicable

ia: test suggested (if technically applicable)

na: not applicable

IL: Inspection Level

AQL: Acceptable Quality Level

(d): destructive tests; specimens should not be returned to stock.

4.4 Procedures

4.4.1 Quality conformance inspection

This shall consist of test groups A1 and B1 on a lot-by-lot basis.

4.4.2 Qualification approval and its maintenance

This shall consist of three consecutive lots passing test groups A1 and B1 followed by selection of specimens from the lots as appropriate. These specimens shall successfully pass the specified periodic D tests.

5 Instructions for the preparation of detail specifications

5.1 General

Detail specifications (DS) writers shall use the appropriate BDS pro forma. The following pages comprise the pro forma BDS specified for use with type 7-16 connectors. As such, it will already have entered on it information relating to

- a) the basic specification number applicable to all the detail specifications covering connector styles of the type covered by the sectional specification;
- b) the connector series designation.

The specification writer should enter the details relating to the connector style/variant (s) to be covered as indicated. The numbers in brackets on the BDS pro forma correspond to the following indications which shall be given.

5.2 Identification of the detail specification

- 1) The name of the National Standards Organization (NSO) under whose authority the DS is published and, if applicable, the organization from whom the DS is available.
- 2) The relevant mark of conformity and the number allotted to the DS by the relevant national or international organization authorizing the DS.
- 3) The number and issue number of the IEC/IECQ generic or sectional specification as relevant; also national reference if different.
- 4) If different from the IEC/IECQ number, any national number of the DS, date of issue and any further information required by the national system, together with any amendment numbers.

5.3 Identification of the component

- 5) Enter the following details
 - Style: The style designation of the connector including type of fixing and sealing, if applicable
 - Attachment: By deletion of the inapplicable options of cable/wire: given for centre and outer conductors
 - Special features and markings : As applicable
 - Series designation: in bold characters/digits approximately 15 mm high
- 6) Enter details of assessment level and the climatic category.
- 7) A reproduction of the outline drawing and details of the panel piercing, if applicable. It shall provide the maximum envelope dimensions, also the position of the reference plane and, in the case of a fixed connector, the position of the mounting plane (s) relative to the front face of the connector.

Any maximum panel thickness limitations for fixed connectors shall be stated.

- 8) Particulars of all variants covered by the DS. As appropriate, the information shall include
- cable types (or sizes) applicable to each variant;
 - alternative plated or protective finishes;
 - details of alternative mounting flanges having either tapped or plain mounting holes;
 - details of alternative solder spills or solder buckets including, when applicable, those for use with microwave integrated circuit (MIC) components.

5.4 Performance

- 9) Performance data listing the most important characteristics of the connector taking into account the recommended values in 4.2 of this specification. Deviations from the minimum requirements shall be clearly indicated. Non-applicable parameters shall be marked "na".

5.5 Marking, ordering information and related matters

- 10) Insert marking and ordering information as appropriate, together with details of related documents and any invoked structural similarity.

5.6 Selection of tests, test conditions and severities

- 11) "na" shall be used to indicate non-applicable tests. All tests marked "a" by the detail specification writer shall be mandatory.

When using the normal procedure with a dedicated BDS, the letter "a" – for applicable – shall be entered in the "Test required" column against each of the tests indicated as being mandatory in the test schedule as in 4.3 of this specification. Any additional tests required at the discretion of the specification writer shall also be indicated by an "a".

The specification writer shall also indicate, when necessary, details of deviations from the standard test methods and test conditions, including any relevant deviations given in the test schedule of the sectional specification.

The qualification approval and conformance inspection shall be such that the National Supervising Inspectorate (NSI) shall be satisfied that they are appropriate and in line with those for other connectors within the system providing a reasonably comparable service.

5.7 Blank detail specification pro forma for type 7-16 connector

The following pages contain the complete BDS pro forma.

(1)		(2) ^a	
			
(3) ELECTRONIC COMPONENT OF ASSESSED QUALITY IN ACCORDANCE WITH GENERIC SPECIFICATION IEC 61169-1 SECTIONAL SPECIFICATION IEC 61169-4		(4) ISSUE	
		
		
(5) Detail specification for radio-frequency coaxial connector assessed quality		Type: 7-16	
Style:		Special features and markings :	
Method of cable/wire+ attachment: Centre conductor – solder\crimp ^b Outer conductor –solder\clamp\crimp ^b			
(6) Assessment level.....	Characteristic impedance 50 Ω	Climatic category	
(7) Outline and maximum dimension		Panel piercing and mounting details	
(8) Variants			
Variant No.	Description of variant		
-01.....
.....
.....
.....
.....
.....
.....
Information about manufacturers who have components qualified to this detail specification is available in the current QC 001005 Qualified Product List.			
^a Insert ISO national identity code or “XX” if completed by the IEC committee.			
^b Delete as appropriate			