

PUBLICLY AVAILABLE SPECIFICATION PRE-STANDARD

Radio-frequency connectors –
Part 40: Sectional specification for 2.4 series R.F connectors



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**Radio-frequency connectors –
Part 40: Sectional specification for 2.4 series R.F connectors**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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RADIO-FREQUENCY CONNECTORS –

Part 40: Sectional specification for 2.4 series R.F connectors

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IEC-PAS 61169-40 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/83/NP	46F/86/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.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

RADIO-FREQUENCY CONNECTORS –

Part 40: Sectional specification for 2.4 series R.F connectors

1 Scope

This PAS is a sectional specification providing information and rules for preparation of detail specification of 2.4 series R.F connectors together with the pro-forma blank detail specification.

2.4 series connectors with characteristic impedance $50\ \Omega$ are used for millimeter wave applications, connecting with RF cables or microstrips. The operating frequency limit is up to 50 GHz.

It also prescribes mating face dimensions for high performance connectors grade 1, dimensional detail of standard test connectors grade 0, gauging information and tests selected from QC 22000 (IEC 61169-1) applicable to all detail specifications relating to 2.4 series RF connectors.

This specification indicates recommended performance characteristics to be considered when writing a detail specification and it covers test schedules and inspection requirements for assessment levels M and H.

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*¹⁾

Amendment 1 (1996)

Amendment 2 (1997)

3 Mating face and gauge information

Metric dimension are original dimensions.

All undimensioned pictorial configurations are for reference purpose only.

¹⁾ A consolidated edition 1.2 (1998) exists, that comprises IEC 61169-1 (1992), Amendment 1 and Amendment 2.

3.1 Dimensions-High performance connectors – Grade1

3.1.1 Connector with pin-centre contact

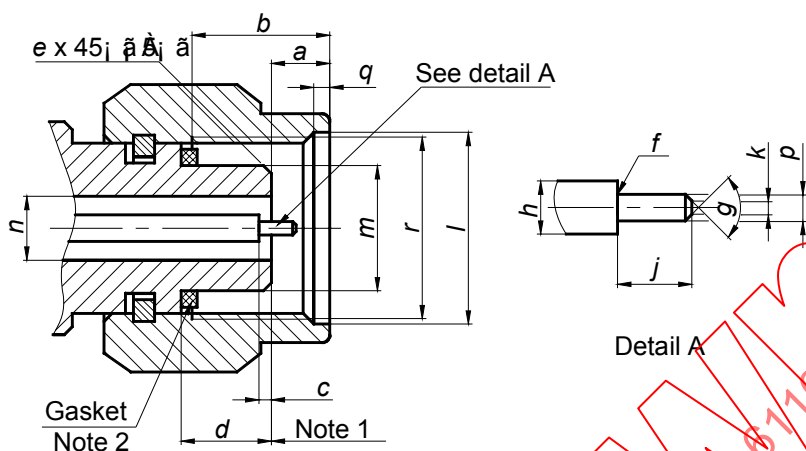


Figure 1 – Connector with pin- centre contact (for dimensions, see Table 1)

Table 1 – Dimensions of connector with pin-centre contact

Ref.	mm		Note
	Min.	Max.	
<i>a</i>	1,850	2,450	
<i>b</i>	4,340	4,660	
<i>c</i>	0,000	0,076	
<i>d</i>	3,380	3,480	
<i>e</i>	0,200	0,400	
<i>f</i>	—	0,050	Radius
<i>g</i>	56°	64°	Angle
<i>h</i>	1,029	1,054	Diameter
<i>j</i>	1,270	1,524	
<i>k</i>	0,000	0,250	Diameter
<i>l</i>	7,010	7,110	Diameter
<i>m</i>	4,725	4,750	Diameter
<i>n</i>	2,3875	2,4125	Diameter
<i>p</i>	0,498	0,523	Diameter
<i>q</i>	0,508	0,762	
<i>r</i>	M7×0,75-6H		
NOTE 1 Mechanical and electrical reference plane.			
NOTE 2 Gasket required on Grade 1 connectors.			

3.1.2 Connector with socket-centre contact

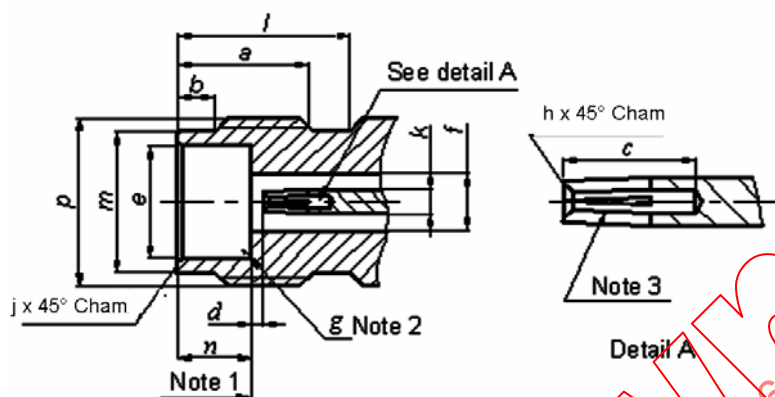


Figure 2 – Connector with socket-centre contact (for dimensions see Table 2)

Table 2 – Dimensions of connector with socket-centre contact

Ref.	mm		Note
	Min.	Max.	
a	4,800	5,060	
b	1,370	1,630	
c	2,650	—	
d	0,000	0,076	
e	4,779	4,795	Diameter
f	2,387 5	2,412 5	Diameter
g	—	0,127	Radius
h	0,100	0,127	
j	0,100	0,200	
k	1,029	1,054	Diameter
l	5,800	—	
m	5,790	5,890	Diameter
n	3,000	3,100	
p	M7×0,75-6g		
NOTE 1 Mechanical and electrical reference plane.			
NOTE 2 Design for root cut to be allowed.			
NOTE 3 Design for slotting optional, and should meet electrical and mechanical requirements, when mating with Ø 0,498 mm ~ Ø 0,523 mm gauge pin			

3.2 Gauges

3.2.1 Gauge pins for socket-centre contact

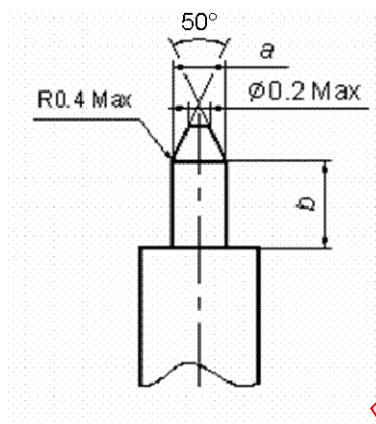


Figure 3 – Gauge pins for socket-centre contact (for dimensions see Table 3)

Table 3 – Dimensions of gauge pins for socket-centre contact

Ref.	Gauge A Maximum material for sizing purposes		Gauge B Minimum material for measurement of retention force Mass of gauge: 25 g ± 1 g	
	mm		mm	
	Min.	Max.	Min.	Max.
a	0,521 8	0,524 8	0,483 0	0,486 0
b	0,68	1,02	1,09	1,65
Material: steel, polished, surface roughness: Ra=0,4 µm (16 µin) maximum.				

3.2.2 Test procedure

The gauge A shall be inserted into the socket-centre contact three times with a minimum depth of 0,68 mm. This is a sizing operation and should only be carried out when the socket-centre contact is removed from the connector.

After this, the gauge B shall be inserted into socket-centre contact. The contact shall retain the mass of the gauge in a vertical downward position. This test also is carried out on connector when the socket-centre contact is not removed.

3.3 Dimensions- standard test connectors – Grade 0

3.3.1 Connector with pin-centre contact

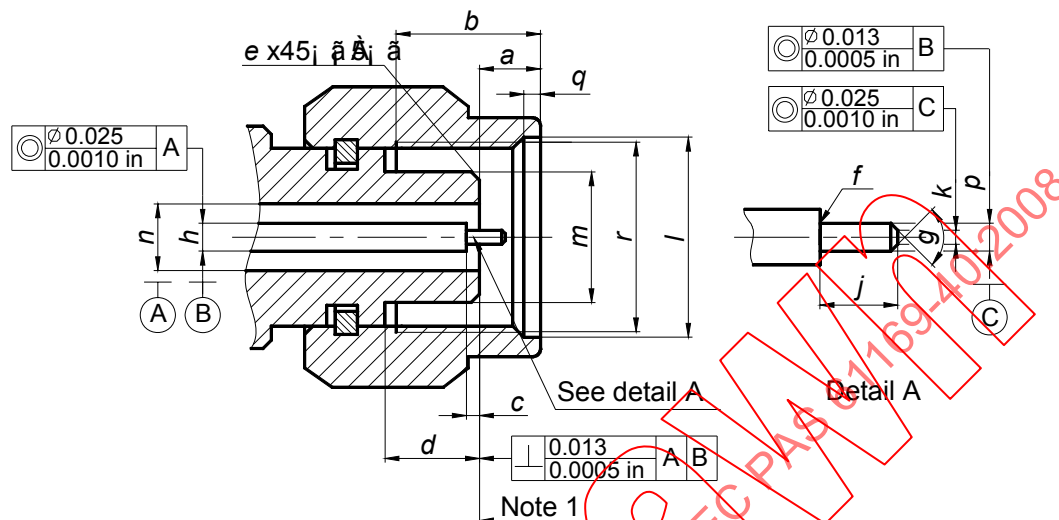


Figure 4 – Connector with pin-centre contact (for dimensions, see Table 4)

Table 4 – Dimensions of connector with pin-centre contact

Ref.	mm		Note
	Min.	Max.	
a	1,850	2,450	
b	4,370	4,630	
c	0,005	0,050	
d	3,380	3,480	
e	0,254	0,356	
f	—	0,050	Radius
g	58°	62°	Angle
h	1,037 6	1,045 2	Diameter
j	1,335	1,445	
k	0,250	0,300	Diameter
l	7,010	7,110	Diameter
m	4,725	4,750	Diameter
n	2,395	2,405	Diameter
p	0,506	0,516	Diameter
q	0,508	0,762	
r	M7×0,75-6H		
NOTE 1 Mechanical and electrical reference plane.			
NOTE 2 Surface roughness: Ra = 0,4 μm maximum.			

3.3.2 Connector with socket-centre contact

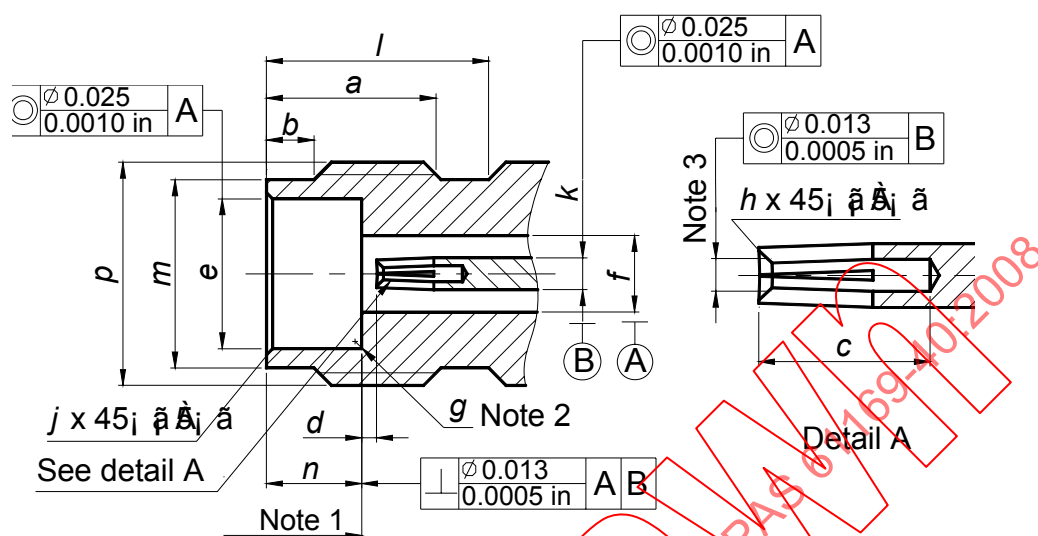


Figure 5 – Connector with socket-centre contact (for dimensions see Table 5)

Table 5 – Dimensions of connector with socket-centre contact

Ref.	mm		Note
	Min.	Max.	
a	4,800	5,060	
b	1,370	1,630	Diameter
c	2,650	—	
d	0,005	0,050	
e	4,770	4,795	Diameter
f	2,395	2,405	Diameter
g	—	0,127	Radius
h	0,100	0,127	
j	0,100	0,200	
k	1,037 6	1,045 2	Diameter
l	6,000	—	
m	5,790	5,890	Diameter
n	3,000	3,100	
p	M7×0,75-6g		
NOTE 1 Mechanical and electrical reference plane.			
NOTE 2 Design for root cut to be allowed.			
NOTE 3 Surface roughness: Ra=0,4 μ m maximum.			
NOTE 4 Design for slotting optional, and should meet electrical and mechanical requirements, when mating with Ø 0,498 mm ~ Ø 0,523 mm gauge pin.			

4 Quality assessment procedure

4.1 General

The following subclauses provide recommended rating, performance and test conditions to be considered when writing a detail specification. They also provide an appropriate schedule of tests with minimum levels of conformance inspection sampling. Together with the pro forma blank detail specification (BDS) and instructions for the preparation of a detail specification.

4.2 Rating and characteristics (see Clause 6 of IEC 61169-1/QC 220000)

The values indicated below are recommended for 2.4 series RF connectors and are given for the writer of the detail specification. They are applicable for the condition when the connectors are fully mated.

Certain tests are listed without any recommended values being given. These 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 6 – Ratings and characteristics

Ratings and characteristics	IEC 61169-1 Subclause	Value	Remarks including any deviations from standard test methods
<i>Electrical</i>			
Nominal impedance		50 Ω	
Frequency range		Up to 50 GHz	Or upper frequency limit of the cable
– Grade1 connectors			
– flexible cable, straight styles			
– semi-rigid cable, straight styles			
– right-angle styles ^b			
Reflection factor ^a	9.2.1		
– straight styles		DC~18 GHz: 0,050 1 max 18 GHz ~26,5 GHz 0,063 1 max 26,5 GHz ~ 50 GHz 0,125 9 max	
– right angle styles		As specified in the DS	
– component mounting styles		As specified in the DS	
– solder bucket and PCB mounting styles		As specified in the DS	
Centre contact resistance	9.2.3 ^b		
– initial		$\leq 4,0 \text{ m}\Omega$	
– after conditioning		$\leq 10,0 \text{ m}\Omega$	
Outer conductor continuity ^a	9.2.3 ^b		
– initial		$\leq 2,5 \text{ m}\Omega$	
– after conditioning		$\leq 7,5 \text{ m}\Omega$	
Insulation resistance ^a	9.2.5		
– initial		$\geq 1\,000 \text{ G}\Omega$	
– after conditioning		$\geq 200 \text{ M}\Omega$	

Ratings and characteristics	IEC 61169-1 Subclause	Value	Remarks including any deviations from standard test methods
Proof voltage at sea level ^{c, d} – uncabled styles – semi-rigid 0,090 in diameter – semi-rigid 0,085 in diameter – semi-rigid 0,047 in diameter	9.2.6 ^b	500 V 500 V 500 V 335 V 125 V	(86 kPa ~106 kPa)
Proof voltage at 4,4 kPa ^{c, d} – uncabled styles – semi-rigid 0,090 in diameter – semi-rigid 0,085 in diameter – semi-rigid 0,047 in diameter	9.2.6 ^b	85 V 85 V 65 V 45 V	4,4 kPa approximately equivalent to 20 km
Environmental test voltage at sea level ^{c, d} – uncabled styles – semi-rigid 0,090 in diameter – semi-rigid 0,085 in diameter – semi-rigid 0 047 in diameter	9.4.3	2 000 V 85 V 85 V 45 V 45 V	(86~106 kPa)
Screening effectiveness ^g	9.2.8	> 100 dB to 1 GHz	$Z_t \leq 1 \text{ m}\Omega$
Discharge test (Corona) – at sea level (cable 60096 IEC 50-3)	9.2.9	See DS	Extinction voltage
<i>Mechanical</i>			
Centre contact captivation axial force – torque	9.3.5	20 N, 1 min 0,01 Nm max	Maximum displacement 0,25 mm each direction
Engagement and separation force – engagement force – separation force			Can be carried out by hand
Coupling moment – normally moment – moment resistance	9.3.6	0,8 ~ 1,1 N•m 1,65 N•m	
Gauge retention force (resilient contacts) – centre – outer	9.3.4	>0,25 N N/A	
Mechanical tests on cable fixing	9.3.7		
Cable pulling		See DS	
cable rotation (rotation)		See DS	
Cable bending	9.3.9	See DS	
Cable torsion	9.3.10	See DS	
Tensile strength of coupling mechanism	9.3.11	450 N	
Bending moment (and sharing force)	9.3.12	N/A ^f	
Vibration	9.3.3	100 m/s ² 10 Hz – 2 000 Hz	10 g _n acceleration
Bump	9.3.13	–	
Shock	9.3.14	500 m/s ² $\frac{1}{2} \sin 11 \text{ ms}$	50 g _n acceleration

Ratings and characteristics	IEC 61169-1 Subclause	Value	Remarks including any deviations from standard test methods
<i>Environmental</i>			
Climatic category ^e		55/155/21	
Sealing – non-hermetic	9.4.5.1	1 cm ³ /h max. 100 kPa – 110 kPa differential	
Salt mist	9.4.6	Duration of spraying: 48 h	
<i>Endurance</i>			
Mechanical	9.5	500 operations	
High temperature ^e	9.6	1 000 h at 125 °C	
^a These values apply to basic connectors. They depend on the cable used. Relevant values are given in the DS. ^b Value for a single pair of mated connector ^c Voltage values are r.m.s. values at 40 Hz-60 Hz, unless otherwise specified. ^d Some cables usable with these connectors have ratings lower than the values given here. ^e For certain connectors, the upper temperature limit is restricted by the cable characteristics. Reference should be made to the relevant cable specification. ^f N/A= Not applicable. ^g When interfaces are fully mated ^h The test item of this type of connectors is not recommendable			

4.3 Test schedule and inspection requirements

4.3.1 Acceptance tests

Table 7 – Acceptance tests

	Test method 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	0,4		a	S3	4,0	
Mechanical compatibility	9.1.3.3	a	II	1,0		a	S3	1,5	
Engagement and separation	9.3.6	a	S4	0,40	Lot	a	S3	1,5	Lot
Gauge retention (resilient contact)	9.3.4	ia	II	1,0		ia	S3	1,5	
Sealing, non-hermetic	9.4.5.1	ia	II	0,65	by	ia	S3	1,0	by
Sealing, hermetic	9.4.5.2	ia	II	0,015		ia	S3	0,025	
Voltage proof	9.2.6	a	S4	0,40	lot	a	II	4,0	lot
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	

4.3.2 Periodic tests

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

Table 8 – Periodic tests

	Test method IEC 61169-1 subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of specimens	Permitted failures per group#	Period	Test required	Number of specimens	Permitted failures per group#	Period
Group D1 (d)			6	1	3 years		3	1	3 years
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							
– cable bending	9.3.9	ia							
– cable torsion	9.3.10	ia							
– Bending moment	9.3.12	ia				ia			
– Strength of coupling mechanism	9.3.11	a				a			
Group D2 (d)			6	1	3 years		3	1	3 years
Contact resistance, outer conductor and screen continuity centre conductor continuity	9.2.3	a				a			
Vibration	9.3.3	a							
Shock	9.3.14	a				a			
Damp heat, steady state	9.4.3	a				a			
Salt mist	9.4.6	a				a			
Group D3 (d)			1*	1	3 years		1*	1	3 years
Dimensions piece-parts and materials	9.1.3.2	a				a			
Group D4 (d)			6	1	3 years		3	1	3 years
Mechanical endurance	9.5	a				a			
High temperature endurance	9.6	a				a			
Sulphur dioxide	9.4.8	a				a			
Group D5 (d)			6	1	3 years		3	1	3 years
Reflection factor	9.2.1	a				a			
Screening effectiveness	9.2.8	a				a			
Water immersion	9.2.7	ia				ia			

	Test method IEC 61169-1 subclause	Assessment level M (higher)				Assessment level H (lower)			
		Test required	Number of specimens	Permitted failures per group#	Period	Test required	Number of specimens	Permitted failures per group#	Period
<i>Group D6 (d)</i>			6	1	3 years		3	1	3 years
Contact captivation	9.3.5	a				a			
Discharge test (corona effect)	9.2.9	a							
Rapid change of temperature	9.4.4	na				na			
Climatic sequence	9.4.2	a				a			
<i>Group D7 (d)</i>			1§		3 years		1§		3 years
Resistance to solvents and contaminating fluids	9.7	ia				ia			
Details of symbols, abbreviations and procedures: a = suggested as applicable ia = test suggested (if technically applicable) na = not applicable IL = Inspection Level AQL = Acceptable Quality Level * = one set of piece-parts each style and variant, unless using common piece parts # = for Qualification Approval (QA) a total of two failures only permitted for level H and 1 failure only for level M from groups D1 to D7 § = Group D7 – number of pairs for each solvent (d) = destructive tests – specimens shall 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 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 dedicated for use with type 2.4 connectors. As such, it will already have entered on it information relating to

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

- (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 of 7.2 in 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 7.3 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.

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Withdrawn

6 Blank detail specification pro-forma for type 2.4 connector

The following pages contain the complete BDS pro-forma.

(1)	Page 1 of		
ELECTRONIC COMPONENT OF ASSESSED QUALITY IN ACCORDANCE WITH GENERIC SPECIFICATION QC 220000 SECTIONAL SPECIFICATION QC 222XXX NATIONAL REFERENCE		 QC 222XXX	
		(4) ISSUE	
(5) Detail specification for Radio frequency coaxial connector of assessed quality			type 2.4
Style:.....		Special features and markings	
Method of cable/wire+ attachment		centre conductor – solder/crimp+ outer conductor – solder/clamp/crimp + + delete as appropriate	
(6) Assessment level.....	Characteristic impedance 50 Ω	Climatic category...../.../.../	
(7) Outline and maximum dimensions		Panel piercing and mounting details	
(8) Variants			
Variant No.	Description of variant	60096 IEC	
01.....			
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Information about manufacturers who have components qualified to this detail specification is available in the current QC 001005 Qualified Product List.			