HIGH DATA RATE CABLE ASSEMBLY WITH MICROMINIATURE, RECTANGULAR, COAXIAL CONNECTORS

BASED ON TYPES AXOMACH AND SPACEFIBRE

ESCC Detail Specification No. 3409/001

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1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2 APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

(a) ESCC Generic Specification No. 3409, High Data Rate Cable Assemblies.
(b) ESCC Detail Specification No. 3402/001, RF Coaxial Connectors, Type SMA, 50ohms (Male Contact).
(c) ESCC Detail Specification No. 3402/002, RF Coaxial Connectors, Type SMA, 50ohms (Female Contact).
(d) ECSS-E-ST-50-11, Space Engineering Standard for SpaceFibre – Very High-Speed Serial Link.

1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply.

1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

Example: 34090010103D042000

- Detail Specification Reference: 3409001
- Component Type Variant Number: 01 (see Note 1)
- Characteristic Code: Connector Type Side A (AxoMach 4 Way, Male, In-line Plug): 03 (as required)
- Characteristic Code: Wiring Type (Direct): D (as required)
- Characteristic Code: Connector Type Side B (AxoMach 1 Way, Female, In-line Plug): 04 (as required)
- Characteristic Code: Total Length (L = 2000mm): 2000 (as required)

NOTES:

1. Marking of the type variant number is mandatory. No further reference to type variant number is made in this specification.

1.4.1.1 Characteristics Codes

Characteristics to be codified as part of the ESCC Component Number shall be as follows:

(a) Connector Types

The connector type(s) at side A and side B of the HDR cable assembly (see Para. 1.6.2) shall be expressed by means of the following codes. Multiple connectors may be required for one side of of the cable assembly depending on the required combination.

Connector Type	Connector Code	Remarks
AxoMach HDR, 1 Way, Male, In-line Plug	01	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 2 Way, Male, In-line Plug	02	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 4 Way, Male, In-line Plug	03	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 1 Way, Female, In-line Jack	04	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 2 Way, Female, In-line Jack	05	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 4 Way, Female, In-line Jack	06	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 1 Way, Female, Panel Mount Jack	07	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 2 Way, Female, Panel Mount Jack	08	Used for side A and/or B. See Note 1 for available combinations.
AxoMach HDR, 4 Way, Female, Panel Mount Jack	09	Used for side A and/or B. See Note 1 for available combinations.
SpaceFibre HDR, Male, In-line Plug	10	Used for side A and/or B. See Note 1 for available combinations.
SpaceFibre HDR, Female, In-line Jack	11	Used for side A and/or B. See Note 1 for available combinations.
SMA Connector, Male, Straight Plug: ESCC 340200101B	12	Used in pairs. Used for side A and/or B. See Note 1 for available combinations.
SMA Connector, Male, Right Angle Plug: ESCC 340200109B	13	Used in pairs Used for side A and/or B. See Note 1 for available combinations.
SMA Connector, Female, Straight Jack: ESCC 340200201B	14	Used in pairs Used for side A and/or B. See Note 1 for available combinations.
SMA Connector, Female, Straight Jack, Back Mounting, 2-Hole Flange-Mounted: ESCC 340200209B	15	Used in pairs Used for side A and/or B. See Note 1 for available combinations.
SMA Connector, Female, Straight Jack, Back Mounting, 4-Hole Flange-Mounted: ESCC 340200268B	16	Used in pairs Used for side A and/or B. See Note 1 for available combinations.
SMA Connector, Male, Straight Plug (Axon Type P567525)	17	Used in pairs. Used for side A and/or B. See Note 1 for available combinations.
No Connector	00	Pigtails; Used in pairs Used only for side B. See Note 1 for available combinations.

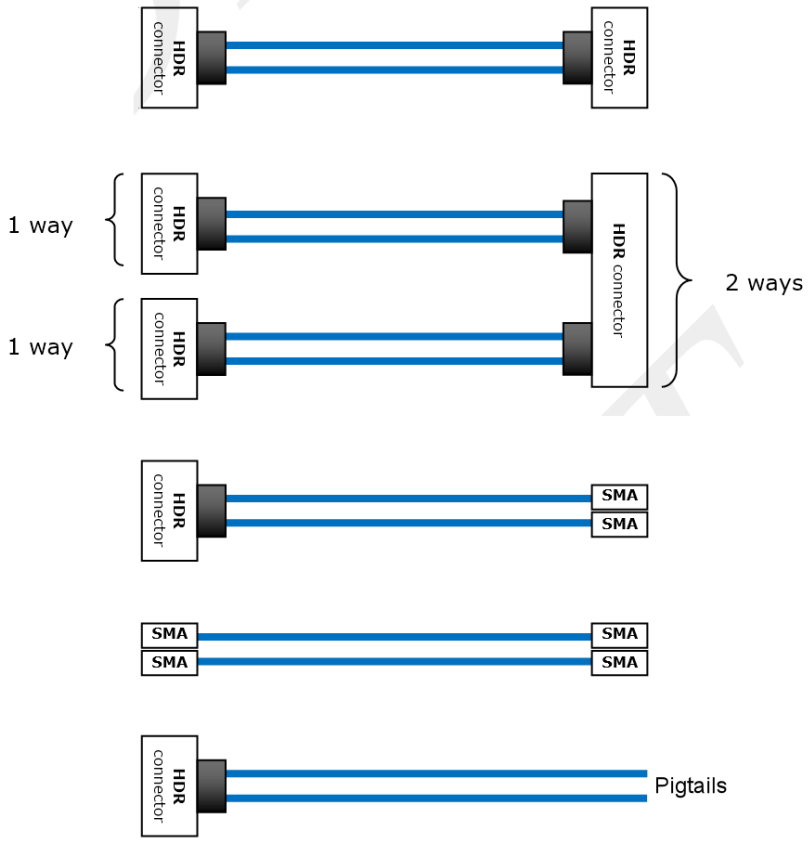
NOTES:

1. Available combinations of the above listed connector types within a single cable assembly are indicated by 'X' in the table below:

		Connector Code Side B																	
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	00
Connector Code Side A	01	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	02	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	03	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	04	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	05	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	06	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	07	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	08	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	09	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	10										X	X	X	X	X	X	X	X	X
	11										X	X	X	X	X	X	X	X	X
	12	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*	X*	X*	X*	
	13	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*	X*	X*	X*	
	14	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*	X*	X*	X*	
	15	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*	X*	X*	X*	
	16	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*	X*	X*	X*	
	17	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*	X*	X*	X*	

* A cable assembly that has Connector Codes 12 to 17 (SMA connectors) on both sides A and B shall consist of 2 pairs of connectors and a pair of cables.

2. Examples of the various cable assembly configurations are given below:



(b) Wiring Type
The type of wiring employed between the contacts of the two sides of the cable assembly shall be expressed by means of the following codes.

Wiring Type (Note 1)	Code	Remarks
Direct	D	Note 2
Indirect	I	

NOTES:

1. For Direct wiring of the cable assembly, each contact number in the connector(s) on side A shall be connected to its matching contact number in the connector(s) on side B.
   e.g. Contacts 1, 2, 3, 4 of the connector on side A are connected to contacts 1, 2, 3, 4 respectively, of the connector on side B.

   For Indirect wiring of the cable assembly, each contact number in the connector(s) on side A shall be connected to the contact number of the connector on side B read in reverse order.
   e.g. Contact 1, 2, 3, 4 of the connector on side A are connected to contacts 4, 3, 2, 1 respectively, of the connector on side B.

   Note: If one side of the cable assembly employs more than a single connector, the effective contact numbers shall be based on a sequential grouping of these connectors in the same order as their individual contact numbers.

2. For cable assemblies with Connector Code 00 (pigtails) or 12 to 17 (SMA connector), the wiring type code shall be D by default.

(c) Cable Assembly Length
The total nominal length of the cable assembly, L, expressed by means of the following codes. The unit quantity shall be millimetre (mm).

Nominal Length L (mm) (Note 1)	Code
100 to 999	0XXX
1000 to 9999	XXXX

NOTES:

1. See Para. 1.6.1 for details and limitations.

1.4.2 Range of Components
The range of components applicable to this specification are as follows:

Description	Physical Dimensions	Weight Max (g)
HDR Cable Assembly (All configurations - see Note 1)	See Para. 1.6	See Note 2

NOTES:

1. The available configurations for cable assemblies including details of the connector types, wiring types and the cable assembly length shall be as indicated in Para. 1.4.1.1.
2. The cable assembly total maximum weight is calculated from the individual maximum weights of the various piece parts, as applicable, as follows:

- Each connector:

Connector Code	Description	Weight Max (g)
01	AxoMach HDR, 1 Way, Male, In-line Plug	6
02	AxoMach HDR, 2 Way, Male, In-line Plug	9
03	AxoMach HDR, 4 Way, Male, In-line Plug	15
04	AxoMach HDR, 1 Way, Female, In-line Jack	6
05	AxoMach HDR, 2 Way, Female, In-line Jack	8
06	AxoMach HDR, 4 Way, Female, In-line Jack	12
07	AxoMach HDR, 1 Way, Female, Panel Mount Jack	8
08	AxoMach HDR, 2 Way, Female, Panel Mount Jack	10
09	AxoMach HDR, 4 Way, Female, Panel Mount Jack	15
10	SpaceFibre HDR, Male, In-line Plug	7
11	SpaceFibre HDR, Female, In-line Jack	8
12, 13	SMA Connector, Male (ESCC Types)	See ESCC No. 3402/001
14, 15, 16	SMA Connector, Female (ESCC Types)	See ESCC No. 3402/002
17	SMA Connector, Male, Straight Plug (Axon Type)	3

- Each cable (all configurations): 15g/m maximum for each individual cable (see Paras. 1.6.1 and 1.6.2)

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

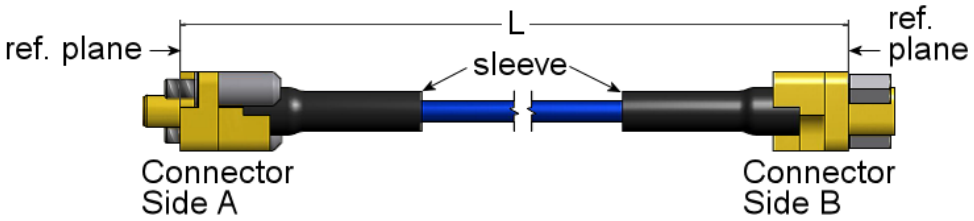
Characteristics	Symbols	Maximum Ratings	Units	Remarks
Maximum Operating Data Rate	DR_{max}	10	Gb/s	
Operating Frequency Range	f_R	≤ 10	GHz	
Working Voltage	U_R	150	Vrms	At sea level. Note 1
Rated Current	I_R	1	A	Each contact
Minimum Dynamic Bending Radius	R_{min}	25	mm	
Operating Temperature Range	T_{op}	-55 to +125	°C	T_{amb}
Storage Temperature Range	T_{stg}	-55 to +125	°C	
Coupling Nut Torque	Tq	170	N.cm	Coupling Proof Torque Note 2

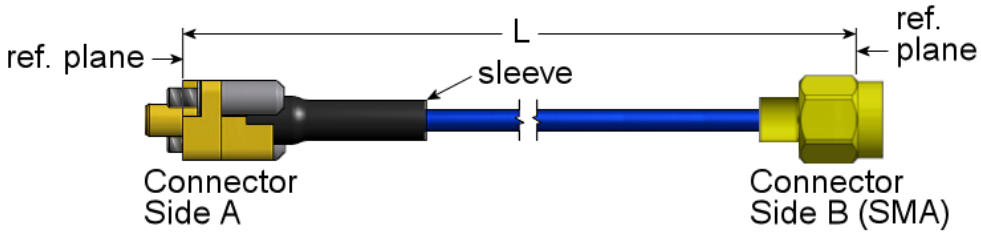
NOTES:

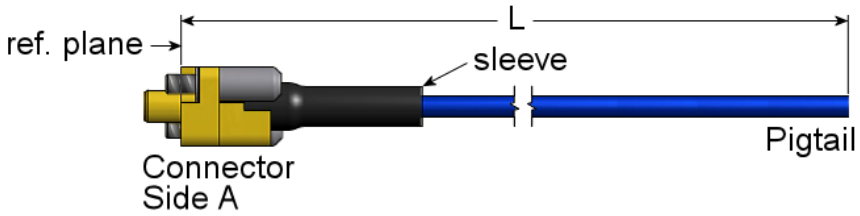
1. Between contacts, and contacts and shell.
2. Only applicable for Connector Codes 12 to 17. Whenever a test is performed on mated pairs of connectors, the pairs shall be torqued at 80 to 120N.cm.

1.6 PHYSICAL DIMENSIONS

1.6.1 Cable Assembly Dimensions
Examples:





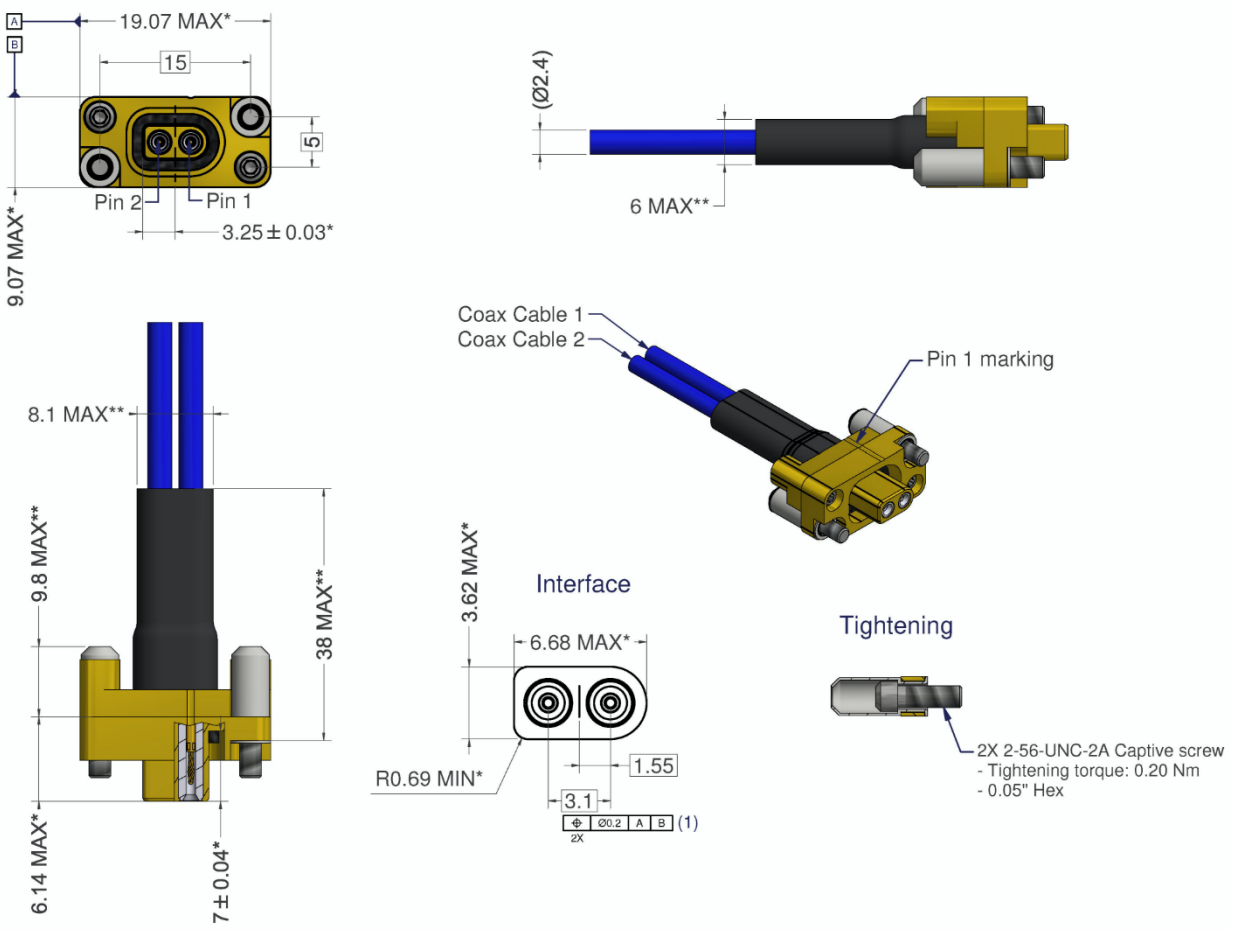


Symbols	Dimensions (mm)		Tolerance (mm)
	Min	Max	
L (Note 2)	100 (Note 3)	9999	(+30 -0) for L < 1000 (+50 -0) for L ≥ 1000

NOTES:
1. For connector dimensions, see Para. 1.6.2 (as applicable) and Para. 1.6.3.
2. L = nominal length.
3. For any cable assembly that is to be used in an application that requires the cables to be angled or twisted, the minimum length shall be as follows:
   - 100mm for any cable assembly that has no more than 2 individual HDR cables on any one of its connectors.
   - 200mm for any cable assembly that has no more than 4 individual HDR cables on any one of its connectors.
   - 500mm for any cable assembly that has 8 individual HDR cables on any one of its connectors.

1.6.2 Connectors

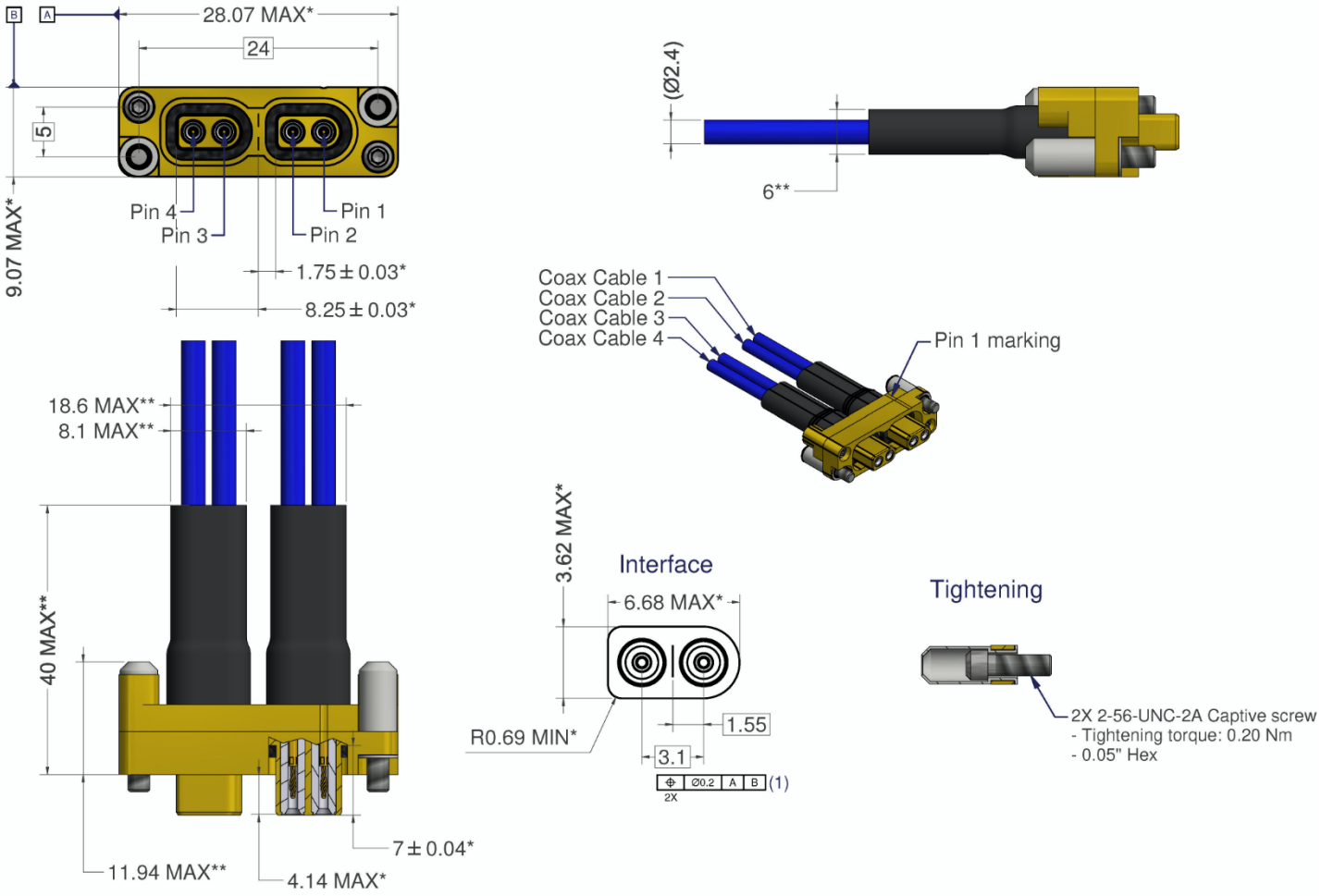
1.6.2.1 Connector Code 01 – AxoMach HDR, 1 Way, Male, In-line Plug (with 2 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Mating torque: 0.2N.m ±5%.
5. Contact and cable identification: Contact and cable Nos. 1 and 2 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above pin 1 (as shown above).
6. Cable diameter: 2.4 ±0.1mm for all cables.

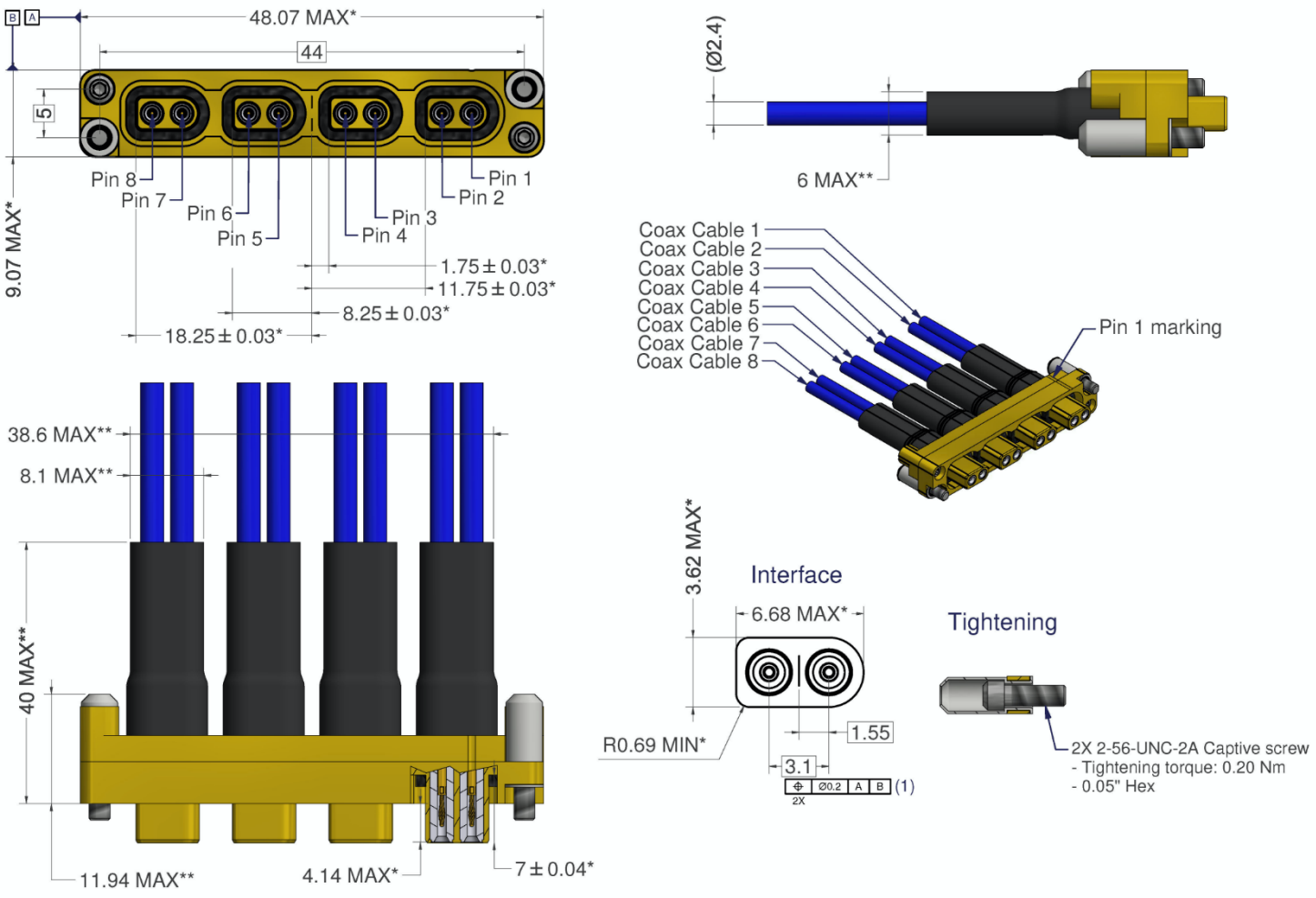
1.6.2.2 Connector Code 02 - AxoMach HDR, 2 Way, Male, In-line Plug (with 4 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Mating torque: 0.2N.m ±5%.
5. Contact and cable identification: Contact and cable Nos. 1 to 4 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above pin 1 (as shown above).
6. Cable diameter: 2.4 ±0.1mm for all cables.

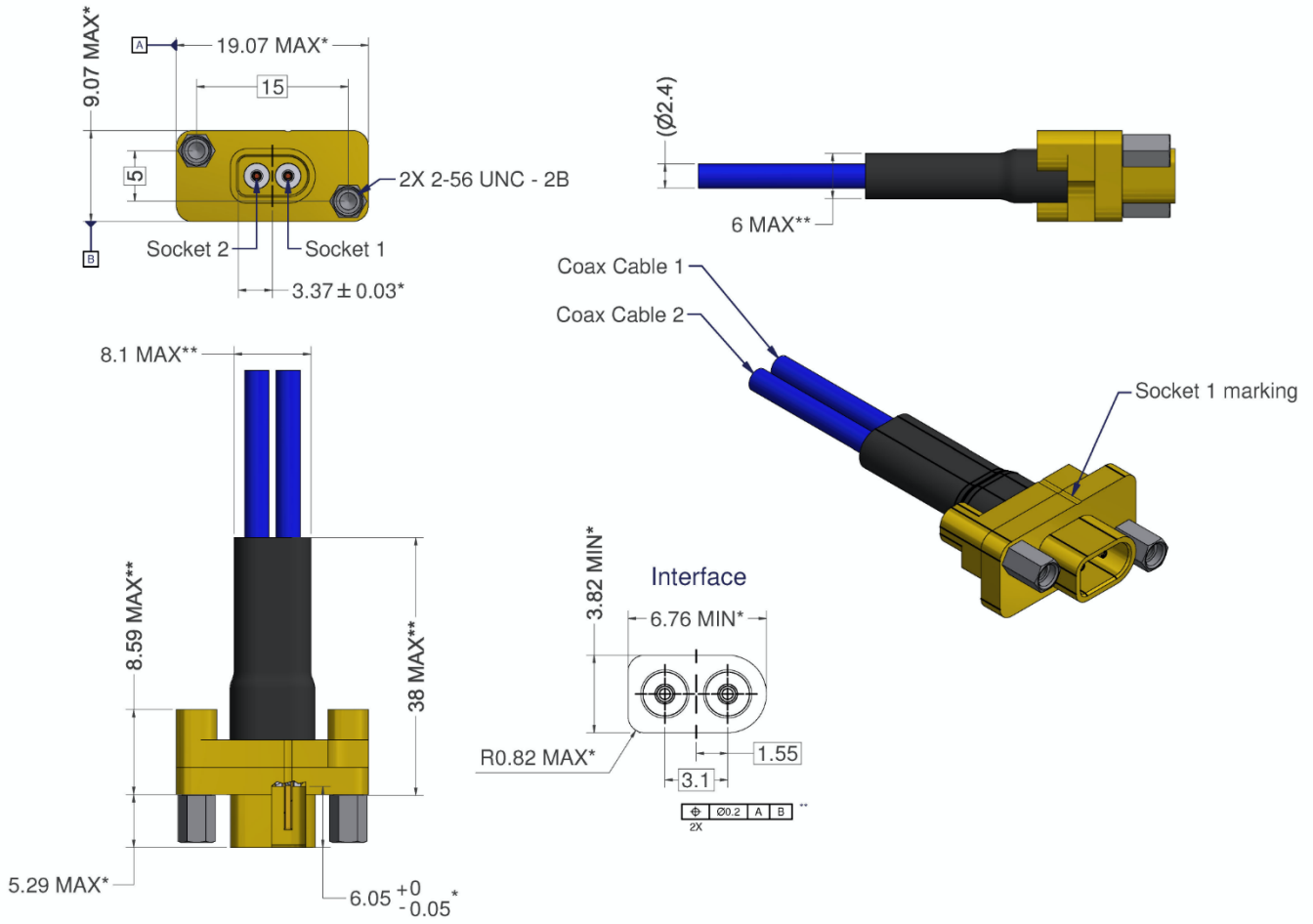
1.6.2.3 Connector Code 03 - AxoMach HDR, 4 Way, Male, In-line Plug (with 8 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Mating torque: 0.2N.m ±5%.
5. Contact and cable identification: Contact and cable Nos. 1 to 8 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above pin 1 (as shown above).
6. Cable diameter: 2.4 ±0.1mm for all cables.

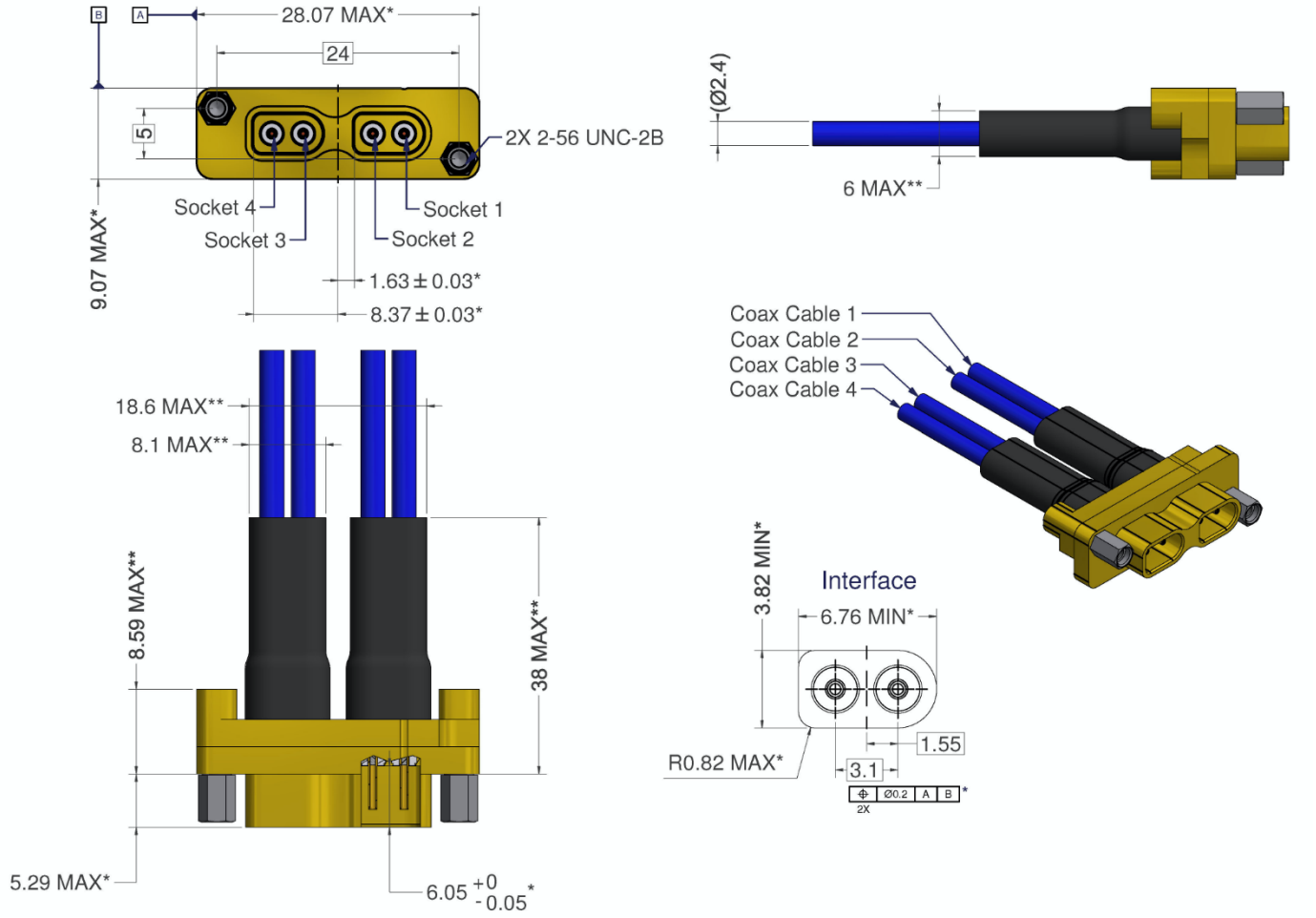
1.6.2.4 Connector Code 04 - AxoMach HDR, 1 Way, Female, In-line Jack (with 2 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Contact and cable identification: Contact and cable Nos. 1 and 2 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above socket 1 (as shown above).
5. Cable diameter: 2.4 ±0.1mm for all cables.

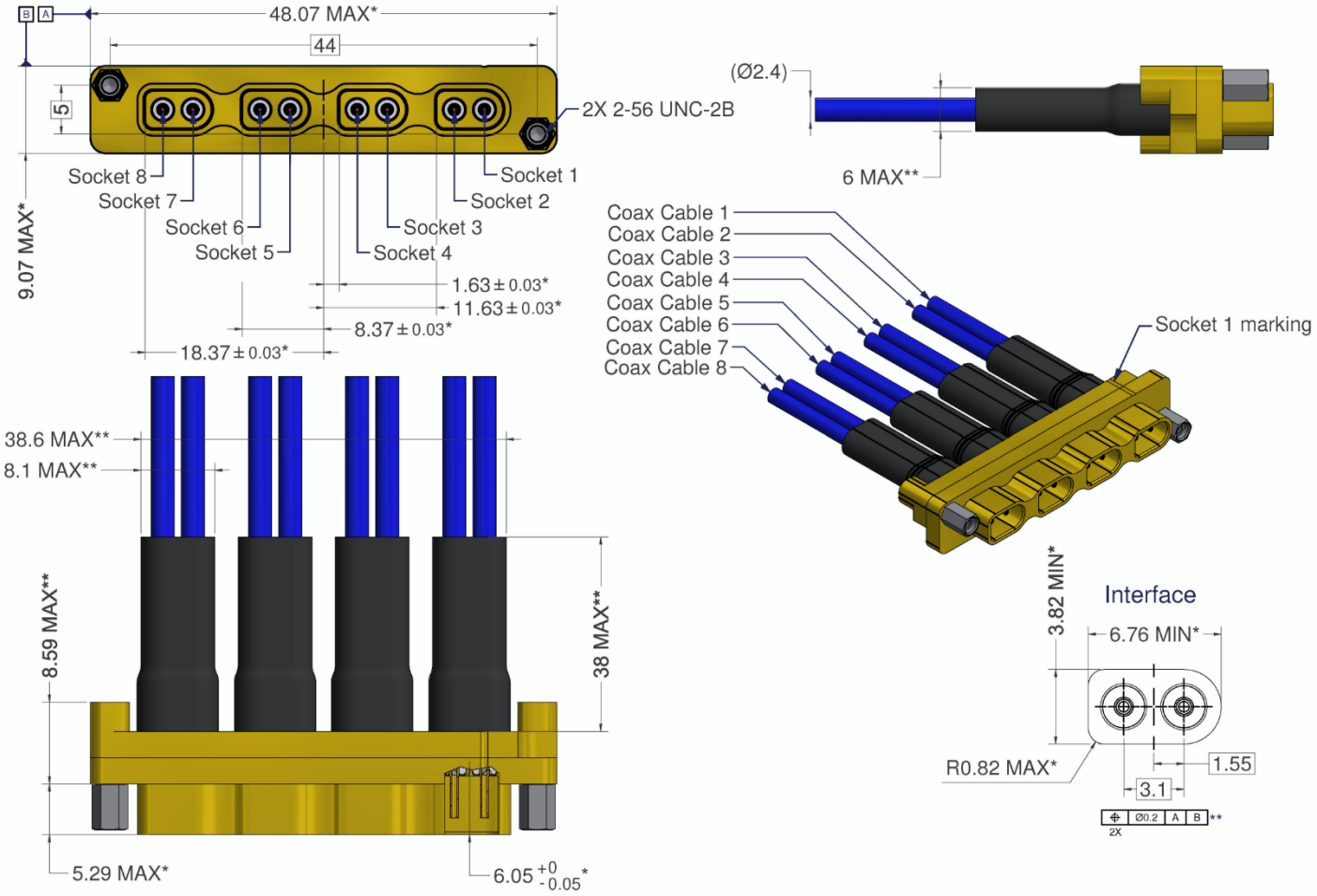
1.6.2.5 Connector Code 05 - AxoMach HDR, 2 Way, Female, In-line Jack (with 4 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Contact and cable identification: Contact and cable Nos. 1 to 4 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above socket 1! (as shown above).
5. Cable diameter: 2.4 ±0.1mm for all cables.

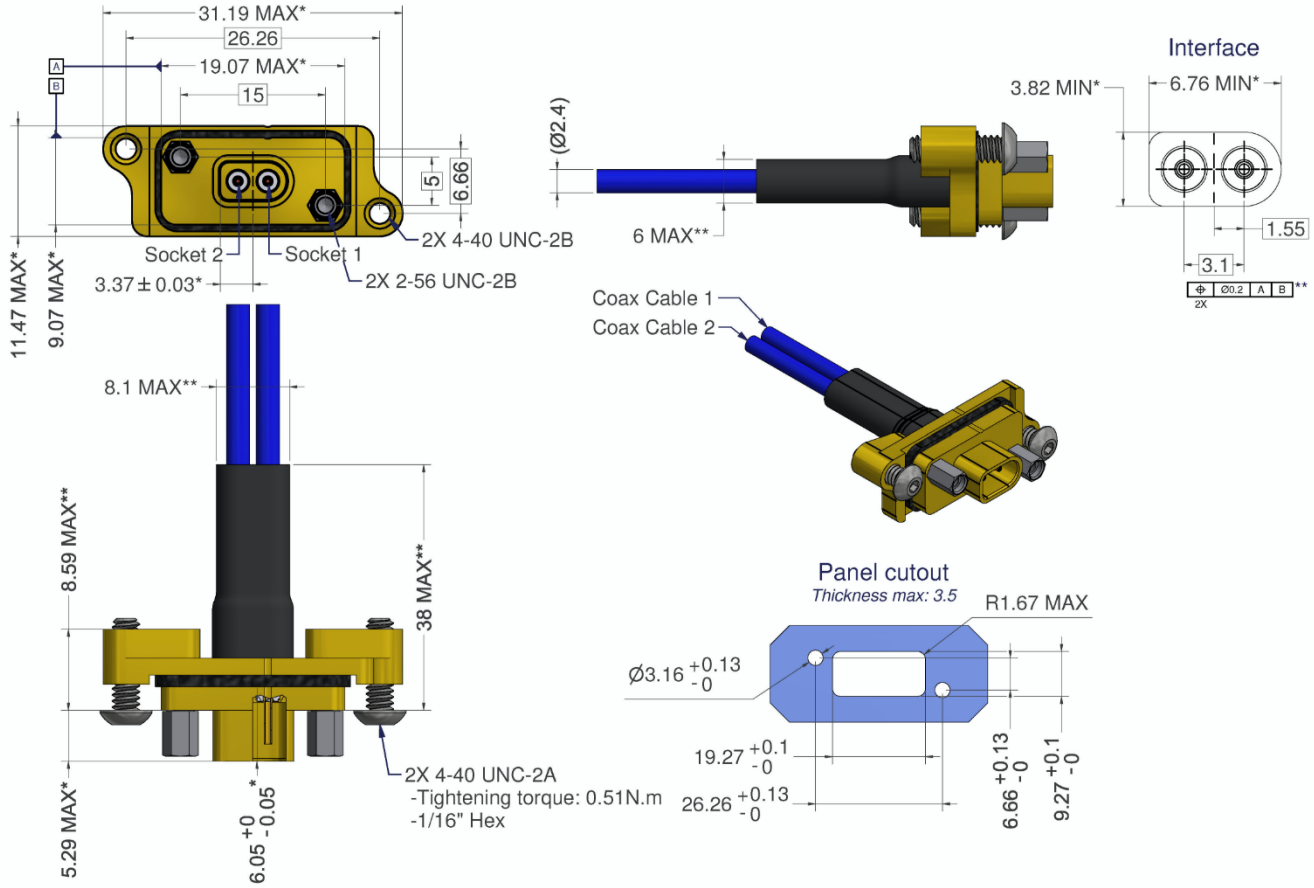
1.6.2.6 Connector Code 06 - AxoMach HDR, 4 Way, Female, In-line Jack (with 8 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Contact and cable identification: Contact and cable Nos. 1 to 8 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above socket 1 (as shown above).
5. Cable diameter: 2.4 ±0.1mm for all cables.

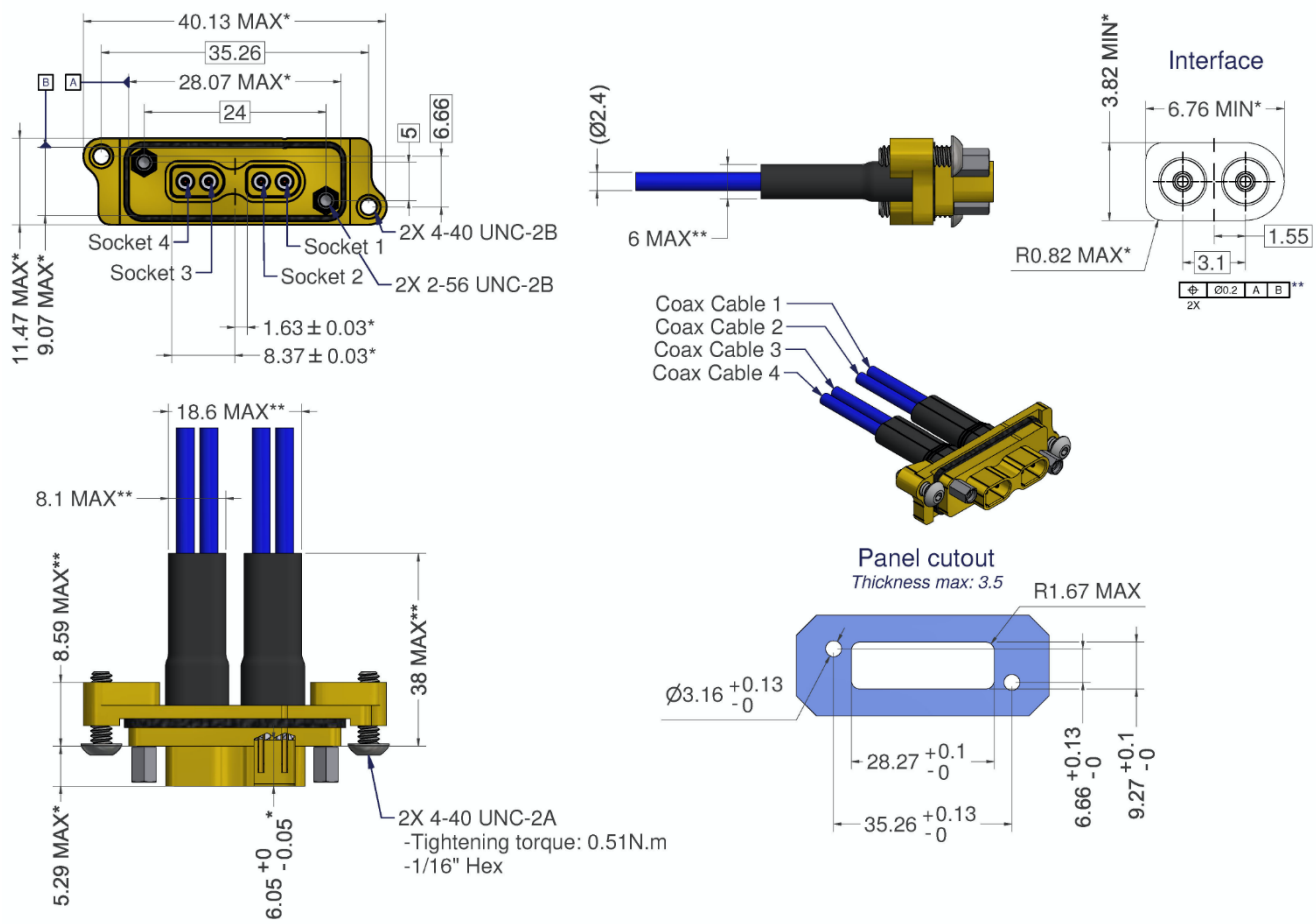
1.6.2.7 Connector Code 07 - AxoMach HDR, 1 Way, Female, Panel Mount Jack (with 2 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Mounting torque: 0.51N.m ±5%.
5. Contact and cable identification: Contact and cable Nos. 1 and 2 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above socket 1 (as shown above).
6. Maximum panel thickness: 3.5mm.
7. Cable diameter: 2.4 ±0.1mm for all cables.
8. Maximum panel thickness: 3.5mm.
9. Panel cut-out details are shown for information purposes only.

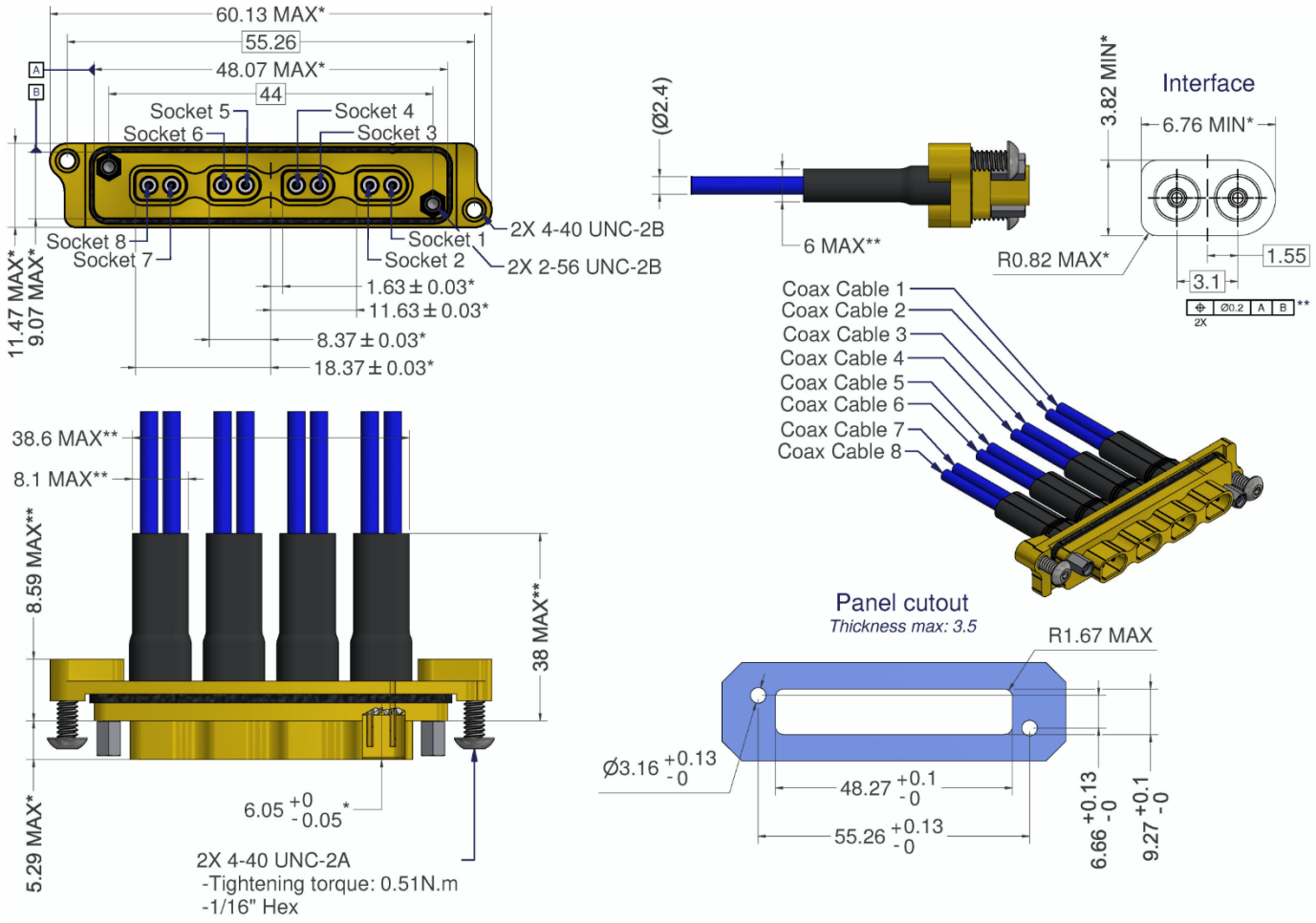
1.6.2.8 Connector Code 08 - AxoMach HDR, 2 Way, Female, Panel Mount Jack (with 4 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Mounting torque: 0.51N.m ±5%.
5. Contact and cable identification: Contact and cable Nos. 1 to 4 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above socket 1 (as shown above).
6. Maximum panel thickness: 3.5mm.
7. Cable diameter: 2.4 ±0.1mm for all cables.
8. Maximum panel thickness: 3.5mm.
9. Panel cut-out details are shown for information purposes only.

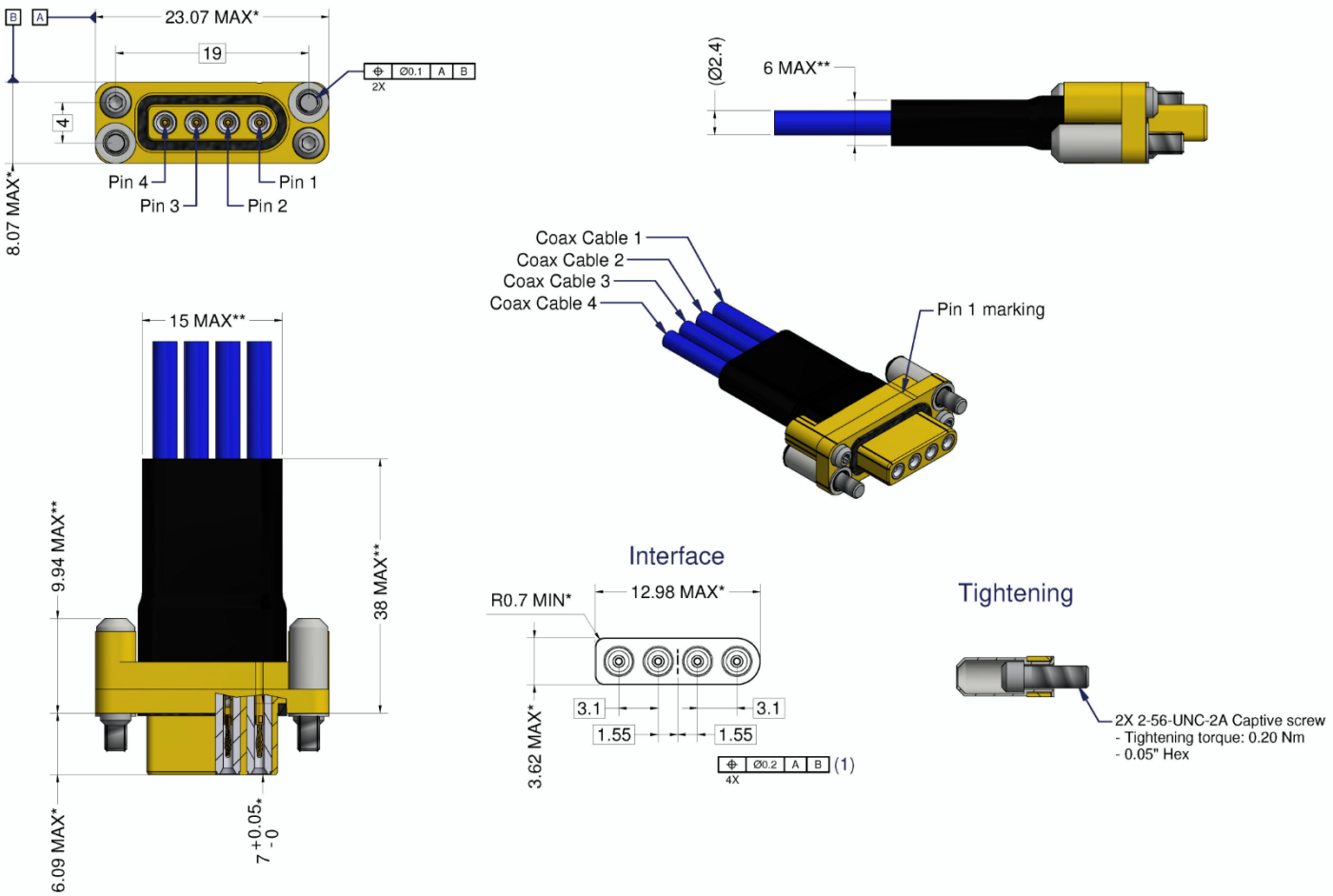
1.6.2.9 Connector Code 09 - AxoMach HDR, 4 Way, Female, Panel Mount Jack (with 8 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Mounting torque: 0.51N.m ±5%.
5. Contact and cable identification: Contact and cable Nos. 1 to 8 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above socket 1 (as shown above).
6. Maximum panel thickness: 3.5mm.
7. Cable diameter: 2.4 ±0.1mm for all cables.
8. Maximum panel thickness: 3.5mm.
9. Panel cut-out details are shown for information purposes only.

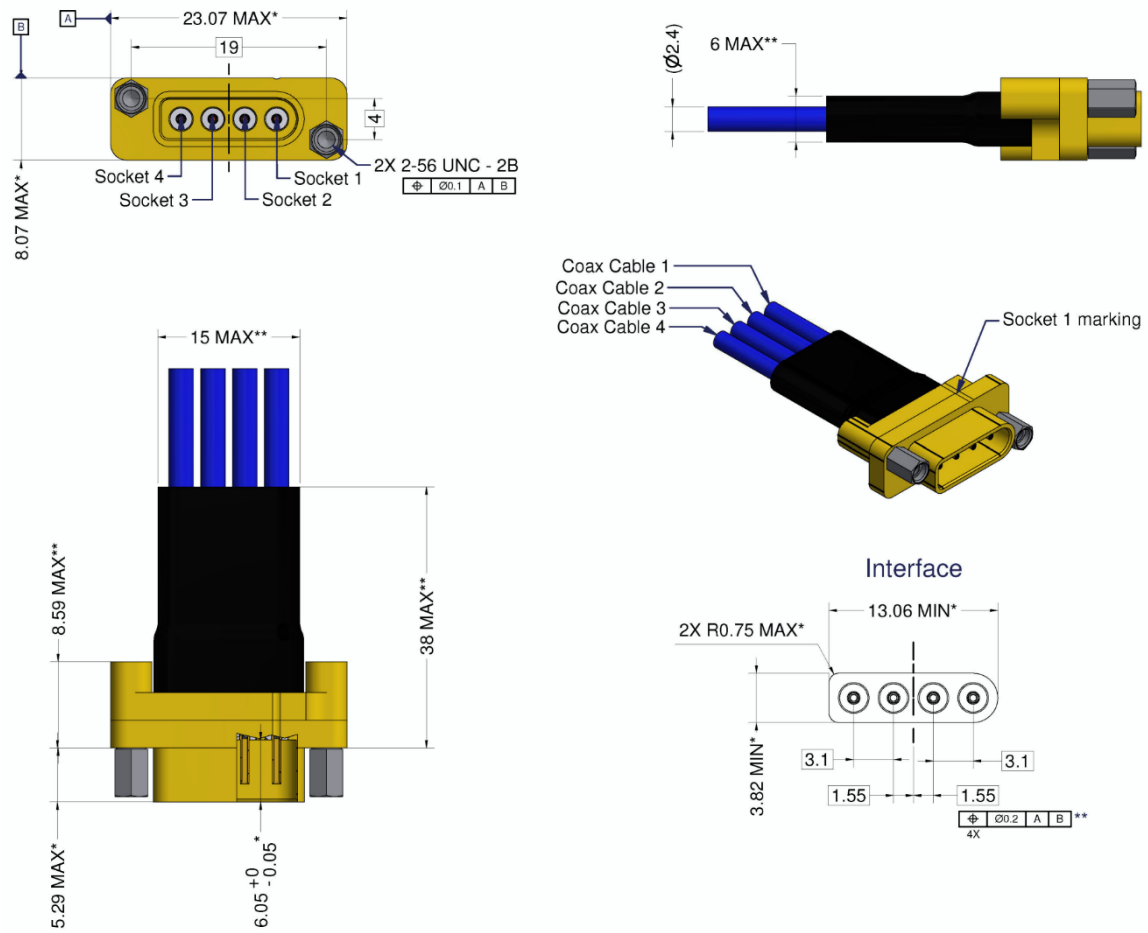
1.6.2.10 Connector Code 10 - SpaceFibre HDR, Male, In-line Plug (with 4 HDR cables)



NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Mating torque: 0.2N.m ±5%.
5. Contact and cable identification: Contact and cable Nos. 1 to 4 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above pin 1 (as shown above).
6. Cable diameter: 2.4 ±0.1mm for all cables.

1.6.2.11 Connector Code 11 - SpaceFibre HDR, Female, In-line Jack (with 4 HDR cables)

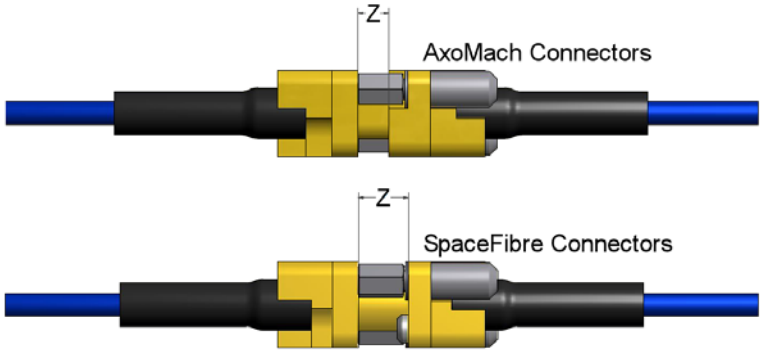


NOTES:

1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see also Para. 1.6.3.
4. Contact and cable identification: Contact and cable Nos. 1 to 4 are indicated by the physical configuration. In addition, contact No. 1 and cable 1 No. 1 are indicated by an index mark on the shell above socket 1 (as shown above).
5. Cable diameter: 2.4 ±0.1mm for all cables.

1.6.2.12 Mated Connector Dimensions

Examples:



Symbols	Dimensions mm		Remarks
	Min	Max	
Z	-	3.4	When mating Connector Codes: 01 to 09 (AxoMach)
	-	5.4	When mating Connector Codes: 10 and 11 (SpaceFibre)

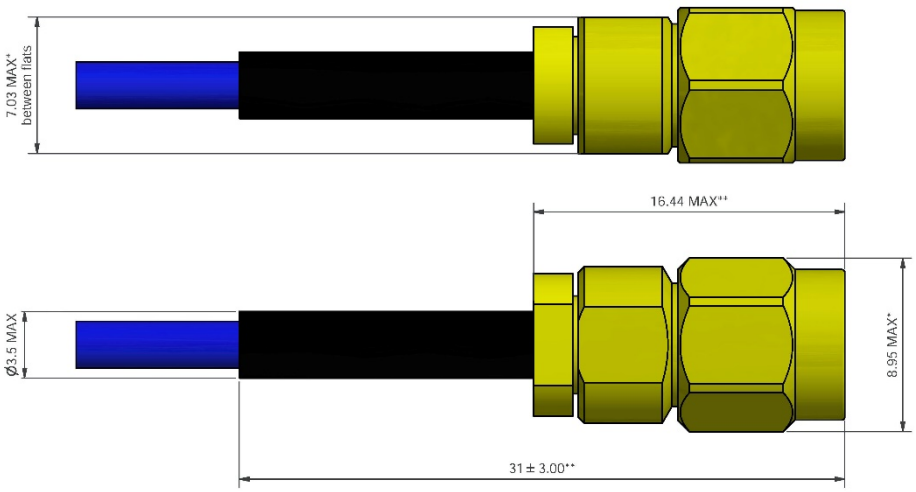
1.6.2.13 Connector Codes 12, 13, 14, 15, 16 – SMA Male and Female Connectors (ESCC Types)

For dimensions including interface dimensions, see ESCC Detail Specification Nos. 3402/001 and 3402/002, as applicable.

NOTES:

1. Mating torque: 80 to 120N.cm.

1.6.2.14 Connector Code 17 - SMA Connector, Male, Straight Plug (Axon Type P567525)

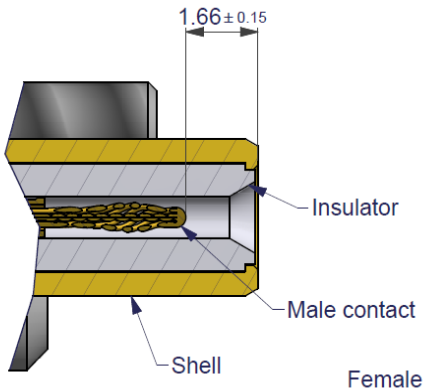


NOTES:

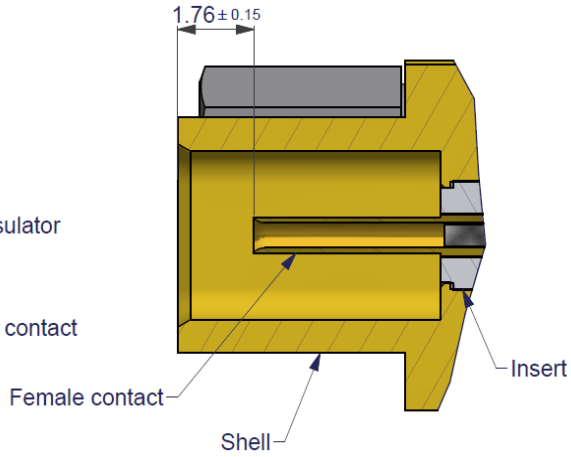
1. All dimensions are in mm.
2. Dimensions with a single asterisk (*) may be checked during the Manufacturer's internal processing. Dimensions with a double asterisk (**) shall be checked after assembly of the cable assembly.
3. For connector interface dimensions, see ESCC Detail Specification Nos. 3402/001.
4. Cable diameter: 2.4 ±0.1mm.
5. Mating torque: 80 to 120N.cm.

1.6.3 Connector Interface Dimensions (Contact Height) (for Connector Codes 01 to 11)

Plug, Male Contact



Jack, Female Contact



NOTES:

1. All dimensions are in mm.

1.7 ADD-ON COMPONENTS

1.7.1 Connectors

The connectors to be used in the components specified herein shall be as follows. They shall meet the requirements of this specification and the ESCC Generic Specification.

- Connector Codes 01 to 11: HDR connectors types: AxoMach and SpaceFibre (as applicable).
- Connector Codes 12 to 16: SMA male and female connectors in accordance with ESCC Detail Specification Nos. 3402/001 and 3402/002, as applicable.
- Connector Code 17: SMA male connector, Axon type P567525, that complies with the requirements specified in ESCC Generic Specification No. 3402.

1.7.2 Cable

The cable to be used in the components specified herein shall be 2.4mm outer diameter, RF ePTFE, flexible, 50Ω, coaxial cable type AXOWAVE 2.4S that meets the requirements of this specification and the ESCC Generic Specification.

1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows.

1.8.1 Connectors

The materials and finishes applicable to the various connectors shall be as follows:

(a) Connector Code 01 to 11: HDR AxoMach and SpaceFibre Connectors:

- Body Shell: Aluminium alloy, gold plated 2.54µm minimum over nickel underplate 25µm minimum.
- Centre Contact: Copper alloy, gold plated 1.27µm minimum over nickel underplate 1.27µm minimum.
- Note: measurements of plating thickness shall be made at 1.5mm from the engagement end.
- Male plug connector front face, and connector to backshell interface EMI seals: Conductive silicone-base rubber.
- Insert (insulator): PTFE.
- Locking devices: Passivated stainless steel
- Sleeve: Fluoropolymer; colour: black.

(b) Connector Code 12 to 16: SMA Male and Female Connectors (ESCC Types):

As specified in ESCC Detail Specification Nos. 3402/001 and 3402/002, as applicable.

(c) Connector Code 17: SMA Male Connector (Axon Type):

- Shell, Coupling Nut, Centre Contact: Beryllium copper, gold plated 2.54µm minimum over copper underplate 2.54µm minimum.
- Insert (insulator): PTFE.
- Gasket: Silicone rubber.
- Ferrule: Brass, gold plated 2.54µm minimum over copper underplate 2.54µm minimum
- Sleeve: Fluoropolymer; colour: black.

1.8.2 Cable

The materials and finishes applicable to the cable shall be as follows:

- Centre Conductor: Copper, silver plated 2µm minimum.
- Dielectric Core: Expanded PTFE.
- Shield 1: Copper tape, silver plated 1µm minimum.
- Separating Tape: Polyimide.
- Shield 2: Copper braid, silver plated 2.5µm minimum.
- Outer Jacket: Perfluoroalkoxy (PFA); colour: blue.

2 REQUIREMENTS

2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

2.1.1.1 Deviations from Qualification Testing – Chart F4A

(a) Para 8.28, Mating Endurance: For Connector Codes 12 to 17, Mating Endurance shall be performed in accordance with Endurance as specified in ESCC Generic Specification No. 3402.

(b) Para. 8.33, Destructive Physical Analysis: For Connector Code 00 (pigtails), a solderability test shall be added to DPA in accordance with ESCC Generic Specification No. 3902, performed on the centre conductor and shields of the cables.

2.1.1.2 Deviations from Periodic Testing – Chart F4B

(a) Para. 8.33, Destructive Physical Analysis: For Connector Code 00 (pigtails), a solderability test shall be added to DPA in accordance with ESCC Generic Specification No. 3902, performed on the centre conductor and shields of the cables.

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component or its primary package shall be:

(a) The ESCC qualified components symbol (for ESCC qualified components only).
(b) The ESCC Component Number (see Para. 1.4.1).
(c) Traceability information.

2.3 ENVIRONMENTAL AND MECHANICAL TESTS

The following requirements apply to tests performed on the connector (and contact) lot, the cable lot and the cable assembly lot, as specified in the ESCC Generic Specification:

(a) Para. 8.2, Contact Capability: The following test requirements shall apply, for Connector Codes 01, 02, 03, 10 only:

	Pick-up Test	Drop Test
Weight (g)	14 ±10%	170 ±10%
Test Sleeve Inner Diameter (mm)	0.582 to 0.587	0.559 to 0.564
Insertion Depth (mm)	1.5 ±0.05	1.5 ±0.05

(b) Para. 8.3, Engagement and Separation Forces: The following test requirements shall apply, for Connector Codes 01, 02, 03, 10 only:

	Minimum Diameter Test Sleeve Test	Maximum Diameter Test Sleeve Test
Engagement Force (N)	1.667 maximum	-
Separation Force (N)	-	0.14 minimum
Test Sleeve Inner Diameter (mm)	0.559 to 0.564	0.582 to 0.587
Insertion Depth (mm)	1.4 ±0.05	1.4 ±0.05

(c) Para. 8.5, Plating Thickness: See Para. 1.8.1.

(d) Para. 8.6, Magnetism Level: Not applicable.

(e) Para. 8.8, Insulation Flaws (Spark Test):
- Applied voltage: 600Vrms
- Frequency: 50 or 60Hz

(f) Para. 8.12, Adhesion of Inner Conductor: 1N minimum.

(g) Para. 8.13, Dielectric Strength of Jacket: Applicable to all cable assemblies.
- Test voltage: 1.5kVac
- Frequency: 50 or 60Hz

(h) Para. 8.14, Conductor Resistance: 100Ω/km maximum at T_{amb} = +20°C.

(i) Para. 8.15, Capacitance: 90pf/m maximum.

(j) Para. 8.16, Characteristic Impedance (each individual cable): 50 ±2Ω.

(k) Para. 8.19, Coupling Proof Torque: See Para. 1.5, for Connector Codes 12 to 17 only.

(l) Para. 8.23, Contact Height: See Para. 1.6.3, for Connector Codes 01 to 11 only.

(m) Para. 8.26, Cable Retention Force: 25N per cable.

(n) Para. 8.29.1, Contact Retention (in Insert): 14.8N, for Connector Codes 4 to 9 and 11 to 17 only.

(o) Para. 8.29.2, Insert Retention (in Shell): 4N, for Connector Codes 01 to 11 only.

(p) Para. 8.34, Radiation: Applicable to all cable assemblies. Radiation dosage: 30Mrad.

(q) Para. 8.35, Permanence of Marking: Applicable to all components with marking.

(r) Para. 8.36, Mating and Unmating Forces:

Connector Code	Mating Force	Unmating Force	
	Max	Min	Max
01, 04, 07	5.6N	0.4N	5.6N
02, 05, 08, 10, 11	11.2N	0.8N	11.2N
03, 06, 09	22.4N	1.6N	22.4N
12, 13, 14, 15, 16, 17	-	-	120N.cm

(s) Para. 8.37, Crimp Contact Tensile Strength: Applicable to Connector Codes: 01 to 11 only.

2.4 ROOM TEMPERATURE ELECTRICAL MEASUREMENTS

The measurements shall be performed at T_{amb} = +22 ±3°C.

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Dielectric Withstanding Voltage	DWV	ESCC No. 3409, Note 1	600	-	Vrms
Voltage Proof Leakage Current	I_{VPL}	Note 2	-	2	mA
Insulation Resistance	R_I	ESCC No. 3409, V = 500Vdc	5	-	GΩ
Conductor Resistance	R_C	ESCC No. 3409	-	110	mΩ/m
Shield Resistance	R_S	ESCC No. 3409	-	45 per cable	mΩ/m
Mated Shell Conductivity	R_M	ESCC No. 3409	-	5	mΩ
Uniformity of Characteristic	Z_C	ESCC No. 3409	90	110	Ω

Characteristics	Symbols	Test Method and Conditions	Limits		Units
			Min	Max	
Impedance		Each pair of cables. tr ≤ 50ps Note 3			
Intra-pair Skew	SK_1	ESCC No. 3409, Data rate ≤ 10Gb/s Test each pair of cables Note 4			ps
		For HDR-HDR CA's; Note 5:	-	20	
		For other CA's; Note 6:	-	10	
Inter-pair Skew	SK_2	ESCC No. 3409, Data rate ≤ 10Gb/s Notes 4, 7			ps
		For HDR-HDR CA's; Note 5:	-	20	
		For other CA's; Note 6:	-	10	
Mask Test	MT	ESCC No. 3409 Only for CA's with all HDR connectors with codes 10, 11	See Note 8		
Jitter pp	Jpp	ESCC No. 3409, Notes 4, 9			ps
		For L ≤ 2.5m; Data rate ≤ 10Gb/s:	-	20	
		For L ≤ 4m; Data rate ≤ 5Gb/s:	-	30	
		For L ≤ 10m; Data rate ≤ 5Gb/s:	-	170	
Jitter rms	Jrms	ESCC No. 3409, Notes 4, 9			ps
		For L ≤ 2.5m; Data rate ≤ 10Gb/s:	-	5	
		For L ≤ 4m; Data rate ≤ 5Gb/s:	-	5	
		For L ≤ 10m; Data rate ≤ 5Gb/s:	-	30	
Near-end Crosstalk	N_{ext}	ESCC No. 3409, Note 7			dB
		f ≤ 10GHz:	-	-45	
		f ≤ 5GHz:	-	-35	
Far-end Crosstalk	F_{ext}	ESCC No. 3409, Note 7			dB
		f ≤ 10GHz:	-	-45	
		f ≤ 5GHz:	-	-35	
Insertion Loss	IL_{CA}	ESCC No. 3409, f ≤ 10GHz	-	Note 10	dB

NOTES:

1. Test voltage shall be applied between centre contacts, and between each centre contact and both respective connector bodies in the cable assembly.
2. Measured during Dielectric Withstanding Voltage.
3. Read and record measurements shall be performed on a sample of 3 components from each lot with 0 failures allowed. Alternatively a 100% inspection may be performed.
4. Tested using a PRBS-7 pattern with 1Vpp differential amplitude.
5. For any cable assembly that has only two or more HDR connectors (i.e. at both ends of the cable assembly).
6. For any cable assembly that either has one HDR connector and two or more SMA connectors, has all SMA connectors, or has only one HDR connector (i.e. with pigtails).
7. Applicable to any cable assembly with one or more HDR connector with Connector Code: 02, 03, 05, 06, 08, 09, 10, 11.
8. For cable assemblies with Connector Codes 10, 11, the Eye-Pattern requirements of ECSS-E-ST-50-11 shall apply.

9. Not applicable to cable assemblies with Connector Code 00 (pigtail).
10. Insertion Loss limit shall be calculated as follows:

$$IL_{CA} = IL_{CONNECTOR-A} + IL_{CONNECTOR-B} + (IL_{CABLE} \times L)$$

where:

- IL_{CA} = total cable assembly insertion loss
- $IL_{CONNECTOR-A}$, $IL_{CONNECTOR-B}$ = insertion loss for the connector types on side A and B
- IL_{CABLE} = cable insertion loss
- L = cable assembly length (in m)

$IL_{CONNECTOR}$ and IL_{CABLE} shall be calculated as follows, where f = frequency (in GHz):

- For each Connector Code 01 to 11: $IL_{CONNECTOR} = 0.2\ x\ f$
- For each Connector Code 12 to 16: $IL_{CONNECTOR} = 0.03\ x\ \sqrt{f}$
- $IL_{CABLE} = \left(0.63\ x\ \sqrt{f}\right) + (0.017\ x\ f)$

2.5 INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at T_{amb} = +22 ±3°C

Unless otherwise specified, test methods and test conditions shall be as per the corresponding test defined in Para. 2.4 Room Temperature Electrical Measurements.

Test Reference per ESCC No. 3409	Characteristics	Symbols	Limits		Units
			Min	Max	
Shielding Effectiveness	Shielding Effectiveness	SE	60	-	dB
Cable Retention Force	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		

Test Reference per ESCC No. 3409	Characteristics	Symbols	Limits		Units
			Min	Max	
Ageing	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		
	Uniformity of Characteristic Impedance	Z_C	See Para. 2.4		
	Intra-pair Skew	SK_1	See Para. 2.4		
	Inter-pair Skew	SK_2	See Para. 2.4		
	Mask Test	MT	See Para. 2.4		
	Jitter rms	Jrms	See Para. 2.4		
	Jitter pp	Jpp	See Para. 2.4		
	Near-end Crosstalk	N_{ext}	See Para. 2.4		
	Far-end Crosstalk	F_{ext}	See Para. 2.4		
	Insertion Loss	IL_{CA}	See Para. 2.4		
Mating Endurance					
Initial Measurement	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		
Final Measurement	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		
	Uniformity of Characteristic Impedance	Z_C	See Para. 2.4		
	Intra-pair Skew	SK_1	See Para. 2.4		
	Inter-pair Skew	SK_2	See Para. 2.4		
	Mask Test	MT	See Para. 2.4		
	Jitter rms	Jrms	See Para. 2.4		
	Jitter pp	Jpp	See Para. 2.4		
	Near-end Crosstalk	N_{ext}	See Para. 2.4		
	Far-end Crosstalk	F_{ext}	See Para. 2.4		
	Insertion Loss	IL_{CA}	See Para. 2.4		

Test Reference per ESCC No. 3409	Characteristics	Symbols	Limits		Units
			Min	Max	
Bending	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		
	Uniformity of Characteristic Impedance	Z_C	See Para. 2.4		
	Intra-pair Skew	SK_1	See Para. 2.4		
	Inter-pair Skew	SK_2	See Para. 2.4		
	Mask Test	MT	See Para. 2.4		
	Jitter rms	Jrms	See Para. 2.4		
	Jitter pp	Jpp	See Para. 2.4		
	Insertion Loss	IL_{CA}	See Para. 2.4		
	Shielding Effectiveness (ref. Para. 2.5)	SE	60	-	dB
Random Vibration During Testing	Electrical Continuity	-	No discontinuities > 1µs		
Final Measurement	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		
Sine Vibration	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		

Test Reference per ESCC No. 3409	Characteristics	Symbols	Limits		Units
			Min	Max	
Temperature Cycling	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Conductor Resistance	R_C	See Para. 2.4		
	Shield Resistance	R_S	See Para. 2.4		
	Mated Shell Conductivity	R_M	See Para. 2.4		
	Uniformity of Characteristic Impedance	Z_C	See Para. 2.4		
	Intra-pair Skew	SK_1	See Para. 2.4		
	Inter-pair Skew	SK_2	See Para. 2.4		
	Mask Test	MT	See Para. 2.4		
	Jitter rms	Jrms	See Para. 2.4		
	Jitter pp	Jpp	See Para. 2.4		
	Near-end Crosstalk	N_{ext}	See Para. 2.4		
	Far-end Crosstalk	F_{ext}	See Para. 2.4		
	Insertion Loss	IL_{CA}	See Para. 2.4		
Thermal Stability and Skew					
During Testing (at each temperature step)	Intra-pair Skew	SK_1	-	Note 1	
	Inter-pair Skew	SK_2	-	Note 1	

Test Reference per ESCC No. 3409	Characteristics	Symbols	Limits		Units
			Min	Max	
Electrical Measurements at Room, High and Low Temperatures	At room temperature: T_{amb} = +22 ±3°C				
	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Mask Test	MT	See Para. 2.4		
	Jitter rms	Jrms	See Para. 2.4		
	Jitter pp	Jpp	See Para. 2.4		
	Insertion Loss	IL_{CA}	See Para. 2.4		
	At high temperature: T_{amb} = +125 (+0 -5)°C				
	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Mask Test	MT	See Para. 2.4		
	Jitter rms	Jrms	-	Note 2	
	Jitter pp	Jpp	-	Note 2	
	Insertion Loss	IL_{CA}	-	Note 3	
	At low temperature: T_{amb} = -55 (+5 -0)°C				
	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Mask Test	MT	See Para. 2.4		
	Jitter rms	Jrms	See Para. 2.4		
	Jitter pp	Jpp	See Para. 2.4		
	Insertion Loss	IL_{CA}	-	Note 3	

Test Reference per ESCC No. 3409	Characteristics	Symbols	Limits		Units
			Min	Max	
Radiation					
Initial Measurement	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Uniformity of Characteristic Impedance	Z_C	See Para. 2.4		
	Insertion Loss	IL_{CA}	See Para. 2.4		
Final Measurement	Dielectric Withstanding Voltage	DWV	See Para. 2.4		
	Voltage Proof Leakage Current	I_{VPL}	See Para. 2.4		
	Insulation Resistance	R_I	See Para. 2.4		
	Uniformity of Characteristic Impedance	Z_C	See Para. 2.4		
	Insertion Loss	IL_{CA}	See Para. 2.4		

NOTES:

1. 125% of the limit given in Para. 2.4, at all test temperatures.
2. 133% of the limit given in Para. 2.4.
3. Insertion Loss limits at high and low temperatures shall be calculated using the Insertion Loss measurement at room temperature and the applicable test temperature (T) as follows:
   $IL(at\ T) = 1.2 \times IL(at\ 22°C) \times (1 + (T - 22) \times 0.002)$

APPENDIX A

AGREED DEVIATIONS FOR AXON CABLE (F)

Items Affected	Description of Deviations
Para. 2.1.1.1 Deviations from Qualification Testing – Chart F4A	Para. 8.37, Crimp Contact Tensile Strength: is not required to be repeated if it has already been performed as part of the Manufacturer's internal processing of the same lot, with equivalent sampling.