


Titre / Title

**RF COAXIAL PHASE SHIFTER
SMA – DC to 18 GHz**

DETAIL SPECIFICATION

Rédigé par / Written by	Responsabilité / Responsibility	Date	Signature
S. POIZAT	Space Project Manager	112/12/2019	
Vérifié par / Verified by			
V EUDELIN	Space B. U. Manager	12/12/2019	
Approuvée par / Approved by			
C. DUMORTIER	Space Quality Manager	12/12/2019	

DOCUMENTATION CHANGE NOTICE

REVISION or ISSUE	DATE	CHANGE
1/- 1/A	04/07/03 23/04/04	Creation – Replacement of R499100600 Issue 2/- specification Minor corrections: - added tests not applicable in Para 4.2.4 - 4.2.5 & 4.2.6 - minor correction in table 1 - changed figure 1B – Power Derating Versus Frequency
1/B	05/09/06	Add new types of phase shifter: Female-Female and Male-Female
2/-	27/11/06	Codification of Variant 02 (TBC by R499100610)
2/A	05/12/06	Added dimension E on figure 2c Added coupling torque for locking nuts and SMA connector in the table of each variant.
2/B	04/01/07	Correction of temperature range (+105°C instead of +125°C) Added a Final production Flow chart to clarify the tests performed on Flight Model (§4.2.2) Added some details for the marking of the label on the product (§4.5.1 b)
2/C	13/03/07	New codification for the phase shifter Male-Female (Variant 02) R499100620
2/D	25/05/07	Correction of the material and finish for variant 02 and 03.
2E	04/06/07	Correction of the material and finish for variant 02 and 03.
3/-	04/05/07	Added Variant 04
3/A	06/11/08	Codification of Variant 04
3/B	30/01/09	Modification of VSWR requirement for variants 01 to 03 and added instruction to use on each variant in figure 2c
4/-	13/06/14	Added new Radiall logo + Updated VSWR limits
4 / A	1/08/15	Updated to correct: - Dimension B min for figure 2c-1 and 2c-2: 48.5mm by 48mm
4 / B	04/12/15	Updated to correct VSWR requirement and dimension B on variant 04
5 / -	19/06/19	Updated to correct §4.2.5: LAT2 instead of LAT3 Add deviation about corrosion test: Not Applicable
5 / A	12/12/19	Updated §4.2.2 Deviation of Final production test. Sample level for test n°9: RF measurement change: 100% of sample instead of sampling level S3 AQL2.5

TABLE OF CONTENTS

1. INTRODUCTION..... 5

1.1. SCOPE 5

1.2. PART TYPE OPTION..... 5

1.3. MAXIMUM RATINGS 5

1.4. PARAMETER DERATING INFORMATION..... 5

1.5. PHYSICAL DIMENSION..... 5

1.6. FUNCTIONAL DIAGRAM..... 5

2. APPLICABLE DOCUMENTS 6

2.1. ESCC SPECIFICATIONS 6

2.2. MIL SPECIFICATIONS 6

2.3. ORDER OF PRECEDENCE..... 6

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS 6

4. REQUIREMENTS 6

4.1. GENERAL 6

4.2. DEVIATIONS FROM GENERIC SPECIFICATION 6

4.2.1. *Deviations from special in-process controls..... 6*

4.2.2. *Deviations from Final Production Tests (Chart II)..... 7*

4.2.3. *Deviations from Burn-in Tests (Chart III)..... 7*

4.2.4. *Deviations from Qualification, Environmental and Endurance Tests (Chart IV)..... 7*

4.2.5. *Deviations from Lot Acceptance Tests (Chart V) 7*

4.2.6. *Deviations from Test Methods and Procedures (Para 9) 7*

4.3. MECHANICAL REQUIREMENTS 8

4.3.1. *Dimension check..... 8*

4.3.2. *Weight..... 8*

4.3.3. *Coupling Proof Torque..... 8*

4.3.4. *Mating and Unmating Forces..... 8*

4.3.5. *Endurance..... 8*

4.3.6. *Residual Magnetism..... 8*

4.3.7. *Contact Engagement and Separation Forces 8*

4.3.8. *Centre Contact Retention..... 9*

4.3.9. *RF measurements..... 9*

4.4. MATERIALS AND FINISHES 9

4.4.1. *Female connector 9*

4.4.1.1. *Shell centre contact 9*

4.4.1.2. *Inserts..... 9*

4.4.1.3. *Gaskets 9*

4.4.1.4. *Accessories (ferrule, crimping sleeve and nut)..... 9*

4.4.2. *Male connector 10*

4.4.2.1. *Shell, coupling nut 10*

4.4.2.2. *Centre contact 10*

4.4.2.3. *Inserts..... 10*

4.4.2.4. *Gaskets 10*

4.4.2.5. *Accessories..... 10*

4.5. MARKING 10

4.5.1. *General 10*

4.5.2. *The RADIALL component number..... 10*

4.5.3. *Traceability Information..... 11*

4.5.4. *Marking of Small components 11*

4.5.5. *Marking of Qualification and Lot Acceptance Test subplot 11*

4.5.5.1. *Components 11*

4.5.5.2. *Primary Package..... 11*

4.6. ELECTRICAL CHARACTERISTICS..... 11

4.6.1. *Electrical Measurements at Room Temperature 11*

4.6.2. *Electrical Measurements at High and Low Temperature (Table 3) 11*



DETAIL SPECIFICATION

REF.: RAD-DET-PHSH-001

Date:
December 12th, 2019

ED/REV:
5 / A

PAGE:
4/ 35

4.6.3. Circuits for Electrical Measurements..... 11

4.7. BURN-IN TESTS (TABLE 4 AND 5) 11

4.8. ENVIRONMENTAL MEASUREMENTS ON COMPLETION OF ENVIRONMENTAL TESTS..... 11

4.8.1. Electrical Measurements on Completion of Environmental Tests..... 11

4.8.2. Electrical Measurements at Intermediate Points during Endurance Tests..... 11

4.8.3. Electrical Measurements on Completion of Endurance Tests 12

4.8.4. Condition for Operating life Test..... 12

4.8.5. Electrical Circuits for Operating Life Test..... 12

4.8.6. Condition for High Temperature Storage Test 12

Table 1 – Maximum Rating 13

Table 2 – Electrical Measurements at Room Temperature 13

Table 3, 4 and 5 13

Table 6 – Measurements and Inspections on Completion of Environmental and Endurance Tests 14

Table 6 – Measurements and Inspections on Completion of Environmental and Endurance Tests (continued) 15

Figure 1a – Power Derating Versus Temperature..... 16

Figure 1b – Power Derating Versus Frequency 16

Figure 1c – Working and Proof Voltage Derating at Low Air Pressure..... 17

Figure 2a – Female Connector Interface..... 18

Figure 2b – Male Connector Interface..... 19

Figure 2c_1 – Mechanical Outline and Electrical Characteristics Variant 01 (Female-Male)..... 20

Figure 2c_2 – Mechanical Outline and Electrical Characteristics Variant 02 (Male-Female)..... 23

Figure 2c_3 – Mechanical Outline and Electrical Characteristics Variant 03 (Female-Female)..... 26

Figure 2c_4 – Mechanical Outline and Electrical Characteristics Variant 04 (Female-Female)..... 29

Figure 3b – Standard Test Interface - Female..... 33

Figure 4 – Test Pin Configuration 34

Figure 5 – Test method for Contact Resistance 34

Table 7 – List of part numbers with applicable Power Handling Category 35

**DETAIL SPECIFICATION**

REF.: RAD-DET-PHSH-001

Date:
December 12th, 2019**ED/REV:**
5 / A**PAGE:**
5/ 35**1. INTRODUCTION****1.1. SCOPE**

This specification details the ratings, physical and electrical characteristics, and test and inspection data of RF Coaxial Phase Shifters Type SMA, suitable for use in a spacecraft application..

1.2. PART TYPE OPTION

Option No	RADIALL P/N	Connector material and finish	
01	R 499 100 600 DC - 18GHz	Female connector:	Beryllium-copper, nickel underplate, gold plated finish.
		Male connector:	Stainless steel passivated
02	R 499 100 620 DC - 18GHz	Male connector:	Beryllium-copper, nickel underplate, gold plated finish.
		Female connector:	Stainless steel passivated
03	R 499 104 601 DC - 18GHz	Female connector:	Beryllium-copper, nickel underplate, gold plated finish
		Female connector:	Stainless steel passivated
04	R 499 104 640 DC - 8 GHz	Female connector:	Brass, nickel underplate, gold plated finish
		Female connector:	Stainless steel passivated

1.3. MAXIMUM RATINGS

The maximum ratings which shall not be exceeded at any time during use or storage, applicable to the coaxial phase shifters specified herein, are scheduled in Table 1

Low air pressure derating shall not apply at pressures of 10^{-4} kPa or less.

1.4. PARAMETER DERATING INFORMATION


The parameter derating Information applicable to the coaxial phase shifters specified herein is shown in Figure 1.

1.5. PHYSICAL DIMENSION

The physical dimensions of the coaxial phase shifters specified herein are shown in Figure 2c.

1.6. FUNCTIONAL DIAGRAM

Not applicable

	DETAIL SPECIFICATION		
	REF.: RAD-DET-PHSH-001		
	Date: December 12 th , 2019	ED/REV: 5 / A	PAGE: 6/ 35

2. APPLICABLE DOCUMENTS

The following documents form part of, and shall be read in conjunction with this specification. The relevant issues shall be those in effect on the date of placing the purchase order.

When manufacturer's or other specifications are compatible with the requirements of the following specifications, they may replace them, subject to approval by the orderer for a procurement.

2.1. ESCC SPECIFICATIONS

ESCC N°3402 Generic Specification for RF Coaxial Connectors.
ESCC N°3403 Generic Specification for RF Coaxial Fixed Attenuators and Loads

2.2. MIL SPECIFICATIONS

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts

2.3. ORDER OF PRECEDENCE

The order of precedence for documents shall be as follows :

- (a) Purchase order or contract
- (b) This Detail specification
- (c) Other referenced documents

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purposes of this specification the terms, definitions, abbreviations, symbols and units as specified in ESCC Basic specification N°21300 shall apply.

4. REQUIREMENTS

4.1. GENERAL

The complete requirements for procurement of the Coaxial Phase Shifters specified herein are stated in this specification and ESCC Generic Specification N°3402 for RF Coaxial Connectors.

Deviations from the generic specification, applicable to this detail specification only, are detailed in Para 4.2.

Deviations from the applicable generic specification and this detail specification, formally agreed with specific manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirements and do not affect the components reliability, are listed in the appendices attached to this specification.

4.2. DEVIATIONS FROM GENERIC SPECIFICATION

The following deviations from ESCC Generic Specification N°3402 shall apply.

4.2.1. *Deviations from special in-process controls*

None

4.2.2. *Deviations from Final Production Tests (Chart II)*

The following Flow chart shall be applied for Final test production :

Test nb	Insepction level	Radiall specification	ESCC3402 specification	Designation
1	100%	§4.3.1 & 4.3.2	§4.4	Marking
2	S4-AQL1	-	§9.25	Dimension check and weight
3	100%	-	§9.26	Change of temperature
4	100%	-	§9.1	Insulation resistance
5	100%	-	§9.2	Voltage proof
6	S4-AQL1	§4.3.3	§9.4	Coupling proof torque
7	S4-AQL1	§4.3.4	§9.5	Mating and unmating forces
8	100%	§4.3.7	§9.6	Contact engagement and separation force
9	100%	§4.3.9	-	RF measurements (VSWR and Insertion Loss)
10	100%	-	§9.8	External visual inspection

4.2.3. *Deviations from Burn-in Tests (Chart III)*

Not applicable

4.2.4. *Deviations from Qualification, Environmental and Endurance Tests (Chart IV)*


- Para 9.7 : « Seal Test », Not applicable
- Para 9.14 : « Cable Retention Force », Not applicable
- Para 9.15 : « Cabling and crimping capability », Not applicable
- Para 9.17 : « Corona level », Not applicable
- Para 9.20: « Corrosion »: Not Applicable
- Para 9.22 : « Soldering proof », Not applicable

4.2.5. *Deviations from Lot Acceptance Tests (Chart V)*

- Para 9.20: « Corrosion »: Not Applicable
- Para 9.7 : « Seal Test », Not applicable
- Para 9.14 : « Cable Retention Force », Not applicable
- Para 9.15 : « Cabling and crimping capability », Not applicable
- Para 9.5 : « Mating/Unmating forces » added for LAT 2
- Para 9.8 : « External Visual Inspection » added for LAT 2

4.2.6. *Deviations from Test Methods and Procedures (Para 9)*

- Para 9.4 : Coupling Proof Torque
The required force is 170 N.cm for the locking nuts
In addition, for qualification and Lot acceptance, on one (1) sample the locking nuts are to be torqued up and then released, recording the maximum torque required to release them. This is to be repeated, increasing the torque on locking by 10 N.cm steps, from 170 N.cm to 250 N.cm or mechanical failure, whichever occurs first.
After the contact resistance test, in the Electrical and Endurance sub-group, add an RF leakage test in accordance with para 9.16 of ESCC N°3403, except that the attenuation shall be (85-f(GHz)).

	DETAIL SPECIFICATION		
	REF.: RAD-DET-PHSH-001		
	Date: December 12 th , 2019	ED/REV: 5 / A	PAGE: 8/ 35

Para 9.9 : Contact Resistance :
See figure 5 for contact resistance measurement method.

4.3. MECHANICAL REQUIREMENTS

4.3.1. Dimension check

The dimensions of the coaxial phase shifters specified herein shall be checked; they shall conform to those shown in Figure 2.

4.3.2. Weight

The maximum weight of the coaxial phase shifters specified herein shall be as specified in Figure 2.

4.3.3. Coupling Proof Torque

The requirements for testing of the coupling proof torque are specified in Section 9 of ESCC Generic Specification N°3402 as amended by Para 4.2.6 above.

4.3.4. Mating and Unmating Forces

The applicable measurement requirements are specified in Section 9 of ESCC Generic Specification N°3402. The maximum torque during engagement and separation shall not exceed 24 N.cm. Whenever a test is performed on mated pairs of connectors, the pairs shall be torqued at 80-120 N.cm.

4.3.5. Endurance

The applicable test requirements are specified in Section 9 of ESCC Generic Specification N°3402. The test conditions shall be as follows:

Number of cycles : 500 : For Qualification
100 : For Lot Acceptance Testing
Rate : 12 cycles maximum/minute.

4.3.6. Residual Magnetism

The applicable measurement requirements are specified in Section 9 of ESCC Generic Specification N°3402.

- Beryllium copper, copper underplate, gold-plated connectors.
The maximum allowable value shall not exceed 20 gammas
- Beryllium copper, nickel underplate, gold-plated connectors and stainless steel connectors.
There are no requirements in respect of residual magnetism. For information, residual magnetism is 2000 gammas maximum.

4.3.7. Contact Engagement and Separation Forces

The requirements for these measurements are specified in Section 9 of ESCC Generic Specification N°3402 and apply to socket contacts only.

- Oversize Pin :
Diameter : 0.952 ^{+0.0025} mm
Insertion Depth : 1.27 to 1.90 mm
Number of Insertions : 3
- Insertion Force Test :
Steel test pin diameter : 0.940 ^{+0.0025} mm
Insertion Force : 1400 grams max

c. Withdrawal Force Test :Steel test pin diameter : 0.902^{-0.0025} mmWithdrawal Force : 42 grams min (initially)
28 grams min (after connector durability)**4.3.8. Centre Contact Retention**

The requirements for this test are specified in Section 9 of ESCC Generic specification N°3402. The test conditions are given in Figure 2c. After testing, the connector interface dimensions shall be within the limits of Figures 2a and 2b.

4.3.9. RF measurements

The insertion Loss and VSWR measurements shall be performed at following point and phase values :

Frequency : 2 / 5.8 / 7.5 / 12.5 / 15.5 & 18 GHz for 18 GHz variants

2 / 4 / 6 / 8 GHz for 8 GHz variants

Phase value : 0° / 90° / 180° at 18GHz for variants 01 to 03

0° / 280° / 560° at 8GHz for variant 04

See figures 2c for sanction of measurements

4.4. MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the coaxial phase shifters specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

4.4.1. Female connector*4.4.1.1. Shell centre contact*

- Beryllium copper
- Nickel underplate 2 microns minimum
- Gold-plating 2.5 microns minimum, class2, type 2 of MIL-G-45204
- Baking conditions : +250°C, 30 minutes, method 108 of MIL-STD-202.

4.4.1.2. Inserts

- PTFE
- Baking conditions : 10 cycles (-10/+55°C) according to MIL-STD-202, method 107

4.4.1.3. Gaskets

- Silicone

4.4.1.4. Accessories (ferrule, crimping sleeve and nut)

- Brass
- Nickel underplate, 2 microns minimum
- Gold-plating 2.5 microns minimum, class2, type 2 of MIL-G-45204
- Baking conditions : +250°C, 30 minutes, method 108 of MIL-STD-202.

4.4.2. Male connector

4.4.2.1. Shell, coupling nut

- A magnetic stainless steel, electro-passivated. For soldertype connectors: rear part of shell shall be protected by an adequate coating for solderability.

4.4.2.2. Centre contact

- Beryllium copper
- Nickel underplate 2 microns minimum
- Gold-plating 2.5 microns minimum, class2, type 2 of MIL-G-45204
- Baking conditions : +250°C, 30 minutes, method 108 of MIL-STD-202.

4.4.2.3. Inserts

- PTFE
- Baking conditions : 10 cycles (-10/+55°C) according to MIL-STD-202, method 107

4.4.2.4. Gaskets

- Silicone

4.4.2.5. Accessories

- a. Crimping elements :
 - Brass
 - Nickel underplate, 2 microns minimum
 - Adequate coating for solderability.
- b. Nut :
 - Amagnetic stainless steel, electro-passivated
- c. Washers :
 - Beryllium copper
 - Nickel underplate 2 microns minimum
- d. Insulator
 - Rexolite 1422

4.5. MARKING


4.5.1. General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification N°21700 and the following subparagraphs. Each component shall be marked in respect of:

- a) The RADIALL component number,
- b) Traceability information : Date Code and Serial Number

4.5.2. The RADIALL component number

See Para 1.2

	DETAIL SPECIFICATION		
	REF.: RAD-DET-PHSH-001		
	Date: December 12 th , 2019	ED/REV: 5 / A	PAGE: 11 / 35

4.5.3. Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification N°21700

4.5.4. Marking of Small components

When it is considered that the component is too small to accommodate the marking as specified above, as much as space permits shall be marked. The order of precedence shall be as specified in Subpara 4.5.1. The marking information in full shall accompany each component in its primary package.

4.5.5. Marking of Qualification and Lot Acceptance Test subplot

4.5.5.1. Components

Each phase shifter in the test sub-lots for qualification and lot acceptance shall be marked with a red dot, with the exception of phase shifters used for LAT LEVEL 3

Phase shifters for LAT level 3 shall be delivered as Flight components.

4.5.5.2. Primary Package

In addition to the requirements of Para 4.5.1, the primary package shall be marked with the following :

- a. 'Test Sample'
- and
- b. 'Failure' (when applicable)

4.6. ELECTRICAL CHARACTERISTICS

4.6.1. Electrical Measurements at Room Temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22^{\circ}C^{\pm 3}$.

4.6.2. Electrical Measurements at High and Low Temperature (Table 3)

Not applicable

4.6.3. Circuits for Electrical Measurements

Not applicable

4.7. BURN-IN TESTS (TABLE 4 AND 5)

Not applicable


4.8. ENVIRONMENTAL MEASUREMENTS ON COMPLETION OF ENVIRONMENTAL TESTS

4.8.1. Electrical Measurements on Completion of Environmental Tests

The parameters to be measured on completion of environmental tests are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22^{\circ}C^{\pm 3}$.

4.8.2. Electrical Measurements at Intermediate Points during Endurance Tests

Not applicable

	DETAIL SPECIFICATION		
	REF.: RAD-DET-PHSH-001		
	Date: December 12 th , 2019	ED/REV: 5 / A	PAGE: 12 / 35

4.8.3. Electrical Measurements on Completion of Endurance Tests

The parameters to be measured on completion of endurance testing are scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22^{\circ}C^{\pm 3}$.

4.8.4. Condition for Operating life Test

Not applicable

4.8.5. Electrical Circuits for Operating Life Test

Not applicable

4.8.6. Condition for High Temperature Storage Test

The requirements for the high temperature storage test are specified in Section 9 of ESCC Generic specification N°3402. The conditions for high temperature storage shall be $T_{amb} = +125(+0,-3)^{\circ}C$.


	DETAIL SPECIFICATION		
	REF.: RAD-DET-PHSH-001		
	Date: December 12 th , 2019	ED/REV: 5 / A	PAGE: 13 / 35

Table 1 – Maximum Rating

No.	Characteristics	Symbol	Maximum Rating	Unit	Remarks
1	Average power	P	See Figure 1b		
2	Nominal impedance	Z	50	Ohms	
3	Rated Operating Voltage rating	U _R	335	Vrms	DC or AC Peak at sea level
4	Storage temperature	T _{amb}	-55 to +105	°C	

Table 2 – Electrical Measurements at Room Temperature

No.	Characteristics	Symbol	Spec. and Test Method	Conditions	Limits.		Unit
					Min.	Max.	
1 -	Insulation resistance	I _R	MIL-STD-202 Method 302	B	1000	-	Mohms
2	VSWR (see Note)	-	ESCC 3402 Section	Para 9.16	See Fig. 2		-
3	Voltage proof	V _p	MIL-STD-202 Method 301	-	See Fig. 2		V at sea level

Note : This measurement shall be performed on a sample only
Single sampling level S3 ; AQL 2.5%

Table 3, 4 and 5

Not applicable



DETAIL SPECIFICATION

REF.: RAD-DET-PHSH-001

Date:
December 12th, 2019

ED/REV:
5 / A

PAGE:
14/ 35

Table 6 – Measurements and Inspections on Completion of Environmental and Endurance Tests

N°	ESCC GENERIC SPEC N°3402		MEASUREMENTS AND		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS(1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN	MAX	
01	CONTACT RESISTANCE	PARA 9.9 6V 10 mA	CONTACT RESISTANCE	CENTRE CONTACT SHELL HERMETIC CENTRE CONTACT		-	12 10 10	mohms mohms mOhms
02	VIBRATION	PARA 9.10	FULL ENGAGEMENT CONTACT RESISTANCE VISUAL EXAMINATION	- CENTRE CONTACT 6V 10 mA -		-	12	mOhms
03	SHOCK OR BUMP	PARA 9.11	FULL ENGAGEMENT CONTACT RESISTANCE VISUAL EXAMINATION	- CENTRE CONTACT 6V 10 mA -		-	12	mOhms
04	RAPID CHANGE OF TEMPERATURE	PARA 9.12	CONTACT RESISTANCE VOLTAGE PROOF VISUAL EXAMINATION	CENTRE CONTACT 6V 10 mA TABLE 2 ITEM 3 -	Vp	-	12 FIGURE 2(c)	mOhms
05	CLIMATIC SEQUENCE	PARA 9.13	AFTER DAMP HEAT (WITHIN 1 TO 24 HRS) INSULATION RESISTANCE (AFTER 24 HRS) VOLTAGE PROOF EXTERNAL VISUAL INSPECTION	- TABLE 2 ITEM 1 TABLE 2 ITEM 3 GEN 3402 PARA 9.8	Ri Vp	200	- FIGURE 2(c)	MOhms
06	CABLE RETENTION FORCE	PARA's 9.14 & THIS SPEC 4.3.4	NOT APPLICABLE					
07	COUPLING PROOF TORQUE	PARA 9.4	INTERFACE DIMENSIONS VISUAL EXAMINATION	-			FIGURE 2(a) and 2(b)	
08	MATING/UNMATING FORCES	PARA 9.5	TORQUE	PARA 4.3.4		-	24	N/cm



DETAIL SPECIFICATION		
REF.: RAD-DET-PHSH-001		
Date: December 12 th , 2019	ED/REV: 5 / A	PAGE: 15/ 35

Table 6 – Measurements and Inspections on Completion of Environmental and Endurance Tests (continued)

N°	ESCC GENERIC SPEC N°3402		MEASUREMENTS AND		SYMBOL	LIMITS		UNIT	
	ENVIRONMENTAL AND ENDURANCE TESTS(1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN	MAX		
09	SEAL TEST	PARA 9.7	NOT APPLICABLE						
10	CABLING AND CRIMPING CAPABILITY	PARA 9.15	NOT APPLICABLE						
11	VSWR OR REFLEXION COEFFICIENT	PARA 9.16	VSWR	TABLE2 ITEM 2		FIGURE 2(c)			
12	CORONA LEVEL	PARA 9.17	NOT APPLICABLE						
13	ENDURANCE	PARA's 9.18 & THIS SPEC 4.3.5	MATING/UNMATING FORCES	PARA 4.3.4		-	24	N/cm	
			CONTACT RESISTANCE	CENTRE CONTACT SHELL		-	15	mOhms	
			6V 10 mA	HERMETIC CENTRE CONTACT		-	13	mOhms	
			VISUAL EXAMINATION	GEN 3402 PARA 9.18		-	12	mOhms	
14	RF INSERTION LOSS	PARA 9.19	INSERTION LOSS	GEN 3402 PARA 9.19		FIGURE 2(c)			
15	CORROSION	PARA 9.20	VISUAL EXAMINATION	-	NO EXPOSURE OF BASE METAL				
16	RESIDUAL MAGNETISM	PARA 9.21	MAGNETISM	-	PARA 4.3.6				
17	SOLDERING PROOF	PARA 9.22	NOT APPLICABLE						
18	RF LEAKAGE	ESCC 3403 PARA 9.16	LEAKAGE	-		FIGURE 2(c)			
19	HIGH TEMPERATURE	PARA's 9.24 & THIS SPEC 4.8.6	MATING/UMATING FORCES	PARA 4.3.4		-	24	N/cm	
			INSULATION RESISTANCE	TABLE 2 ITEM 1	Ri	500	-	MOhm	
			VOLTAGE PROOF	TABLE 2 ITEM 3	Vp	FIGURE 2(c)			
			CONTACT RETENTION	PARA 4.3.8		PARA 4.3.8			
			VISUAL EXAMINATION	-					
			CONTACT RESISTANCE	CENTRE CONTACT SHELL		-	15	mOhms	
		HERMETIC CENTRE CONTACT		-	13	mOhms			
		EXTERNAL VISUAL INSPECTION	GEN 3402 PARA 9.8		-	15	mOhms		

Figure 1a – Power Derating Versus Temperature

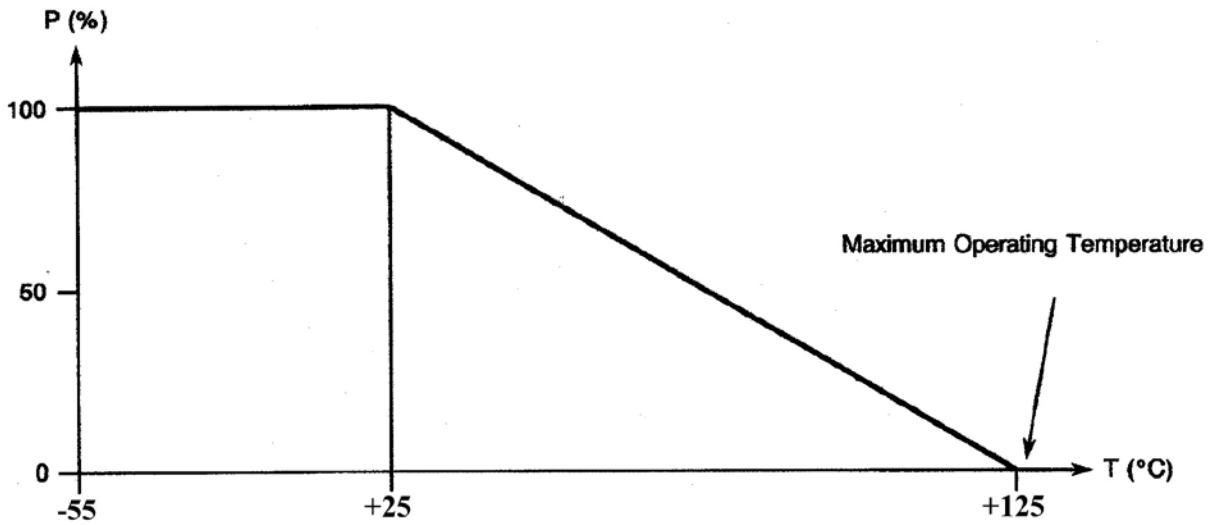
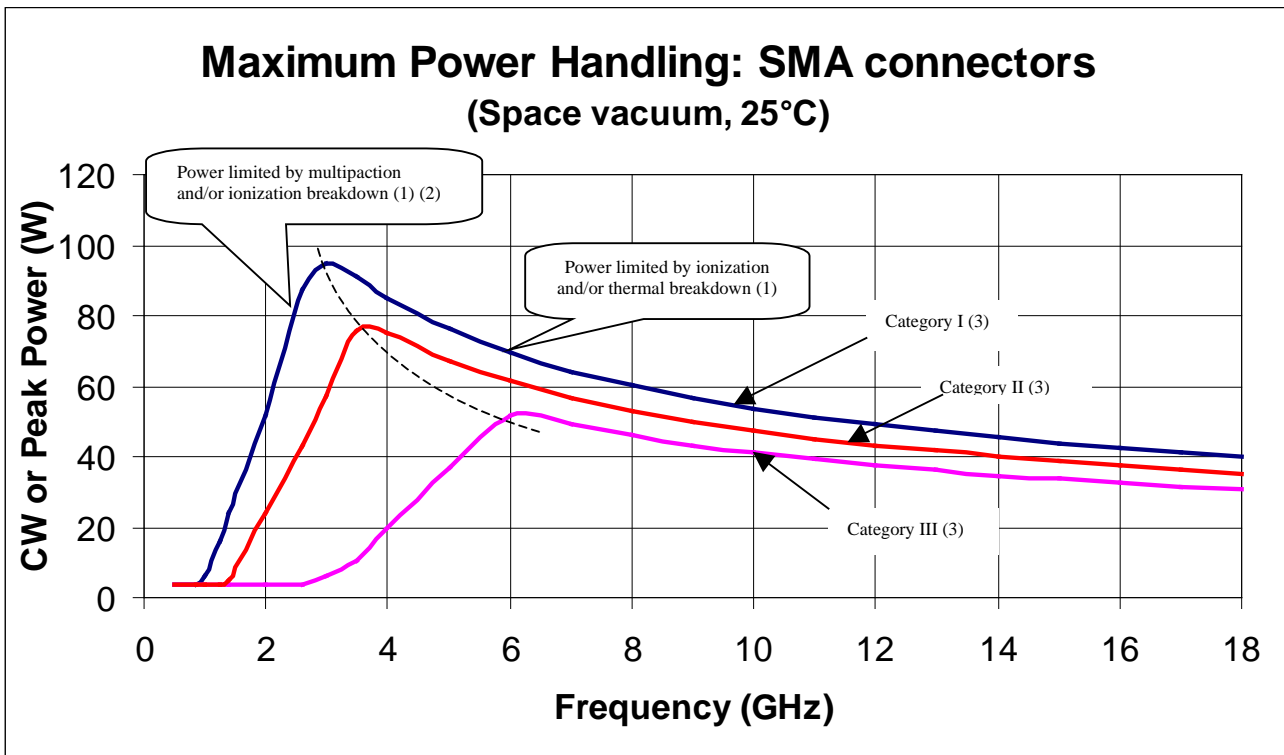


Figure 1b – Power Derating Versus Frequency



Notes:

- 1: Load VSWR is better than 1,30:1
- 2: The part of the curve limited by multipaction takes into account a 6 dB margin as recommended by ESA
- 3: See Table 7 to know applicability of power handling categories to the different part numbers

Figure 1c – Working and Proof Voltage Derating at Low Air Pressure

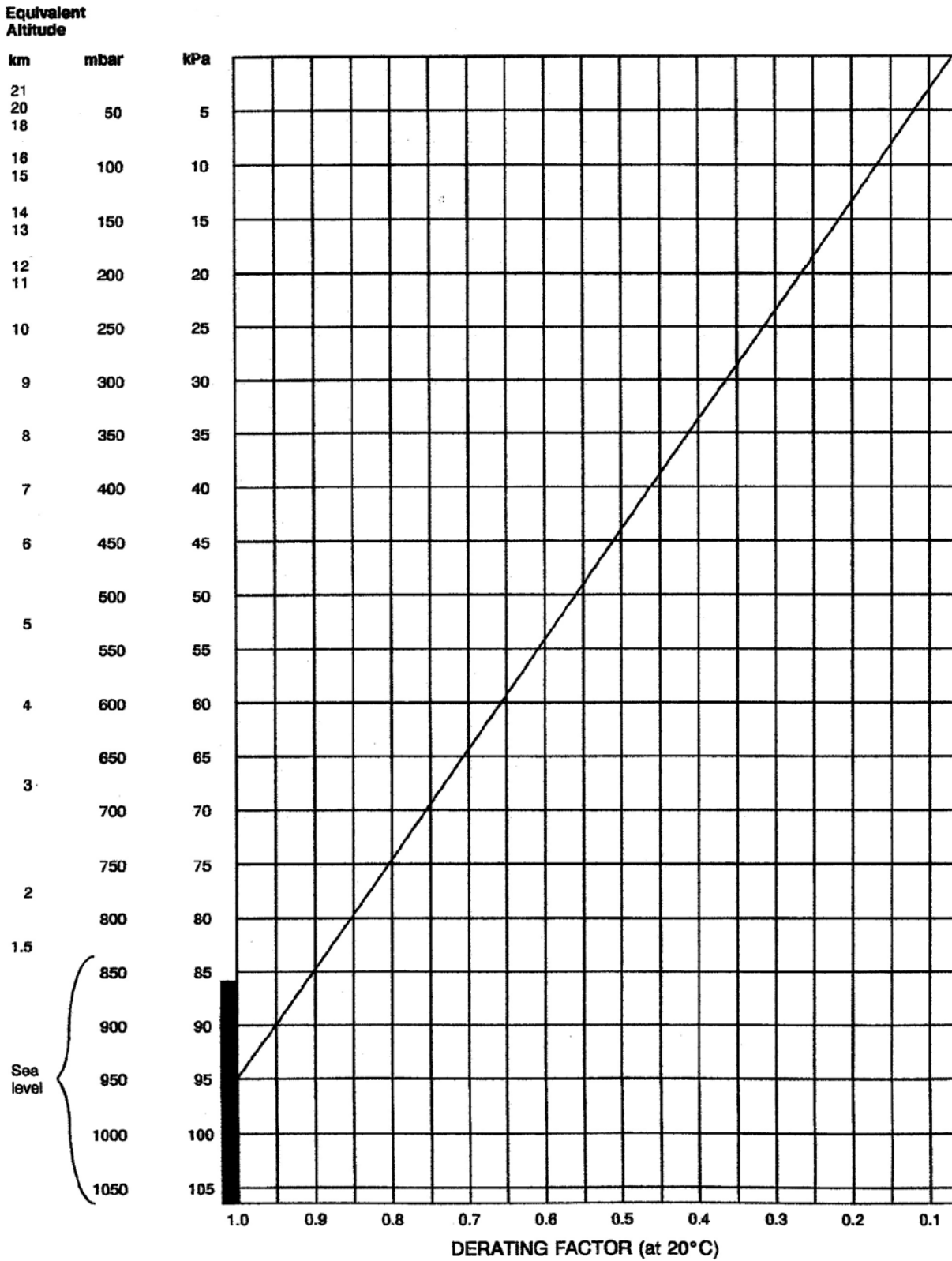
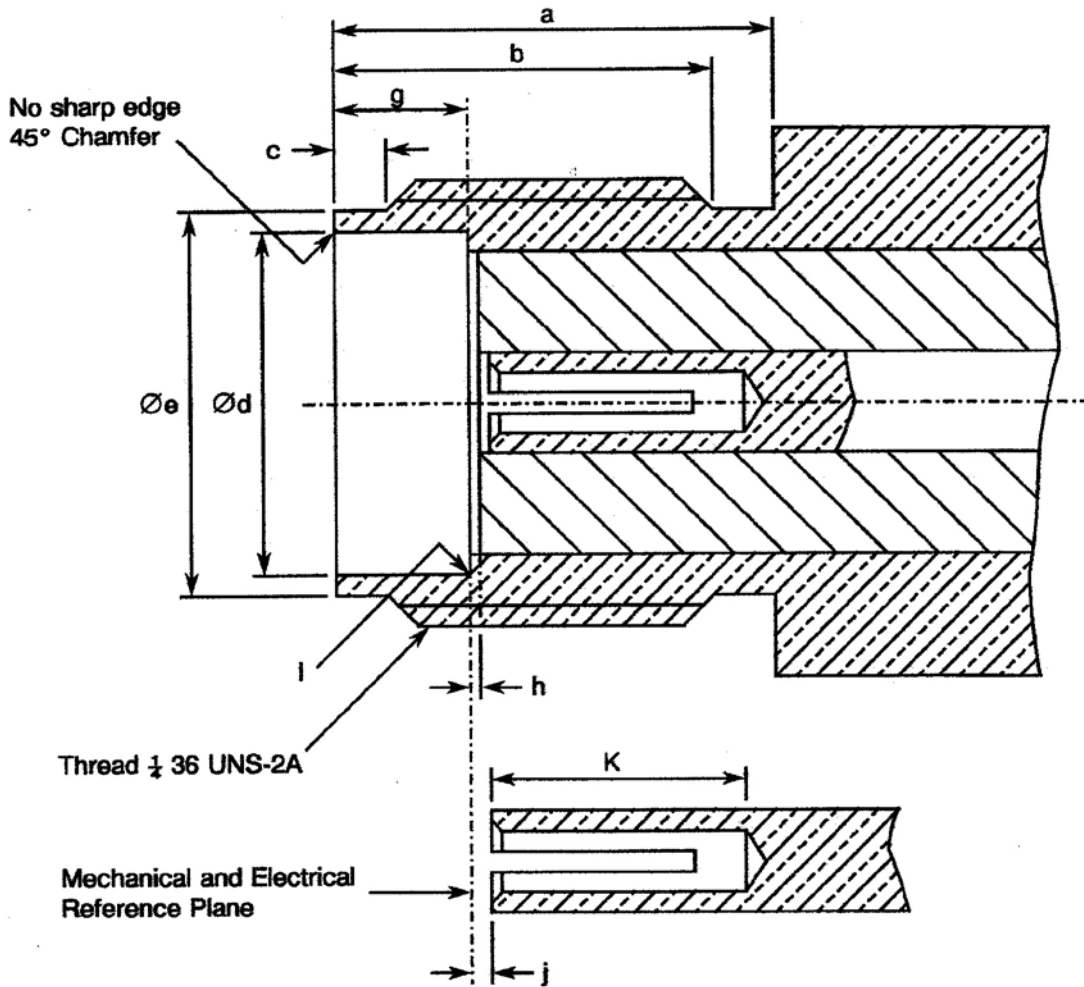
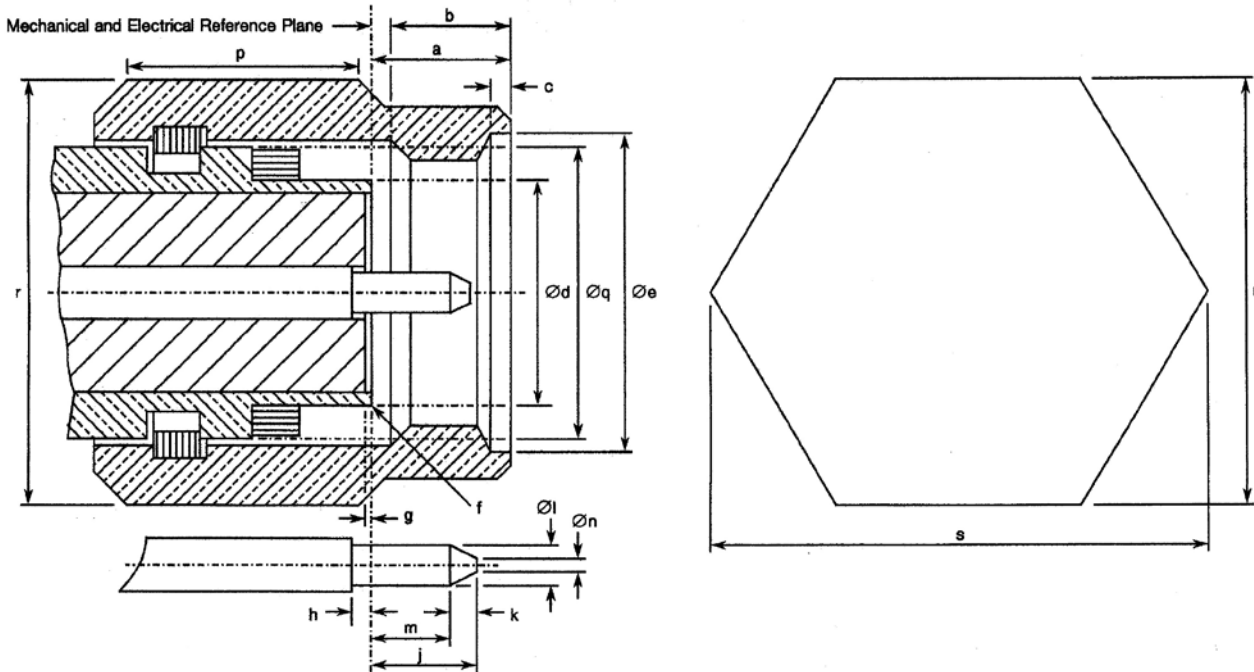


Figure 2a – Female Connector Interface



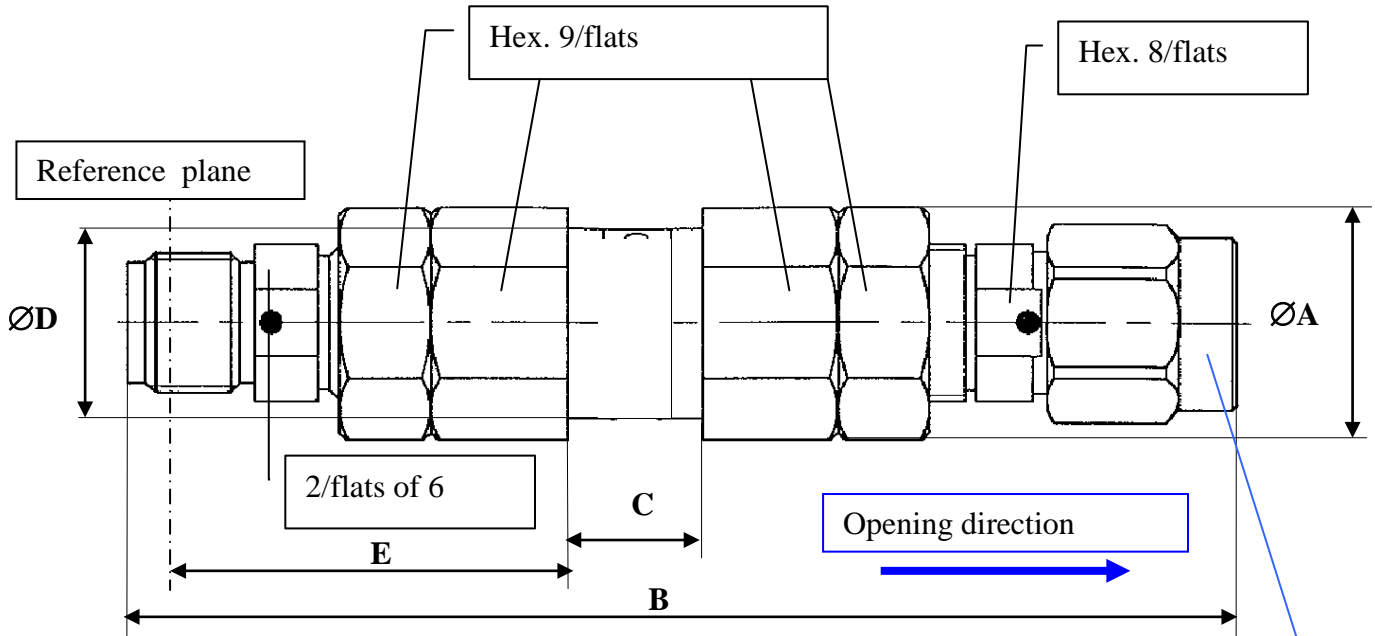
SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
a	5.54	-	
b	4.32	-	
c	0.38	1.14	
Ød	4.597	4.67	
Øe	5.28	5.49	
g	1.88	1.98	
h	0.00	0.20	
j	0.00	0.25	
K	2.92	-	
l	-	0.04	Radius

Figure 2b – Male Connector Interface



SYMBOL	MILLIMETRES		NOTES
	MIN.	MAX.	
a	-	3.43	
b	2.54	-	
c	0.38	1.14	
Ød	-	4.592	
Øe	6.35	-	
f	-	0.08	Radius or 45° chamfer
g	0.00	0.20	
h	0.00	0.25	
j	-	2.54	
k	0.38	-	
Øl	0.90	0.94	
m	1.27	-	
Øn	-	0.38	
p	3.17	-	
Øq	-	-	
r	7.84	8.00	Hexagonal on flat
s	-	9.20	

Figure 2c_1 – Mechanical Outline and Electrical Characteristics Variant 01 (Female-Male)



Marking : **R499100600 – XXXX*-YYY****
 * XXXX = Date Code
 **YYY = Serial Number

SYMBOL / CHARACTERISTICS	PHYSICAL DIMENSION (mm)	
	Min	Max
$\varnothing A$	9.5	10.5
B	48	56.5
C	5.7	6.3
$\varnothing D$	8.5	8.7
E	16.97	17.97
Interface Male Connector		
Insulator / Ref. plane	0.00	-0.20
Contact / Ref. plane	0.00	-0.25
Interface Female Connector		
Insulator / Ref. plane	0.00	-0.20
Contact / Ref. plane	0.00	-0.25

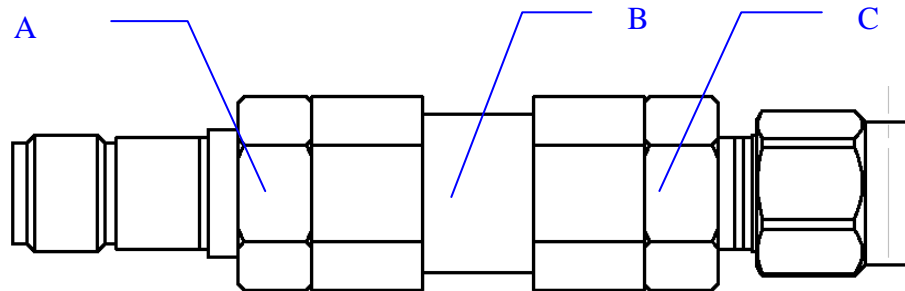
VARIANT 01 – STRAIGHT FEMALE-MALE

Electrical characteristics	Values	Unit
Frequency range	0 - 18	GHz
Maximum Voltage Standing Ratio (VSWR): From DC to 12.5GHz	1.11 + 0.012 x F(GHz)	-
From 12.5 to 18GHz	1.37	-
Maximum Insertion Loss	0.1 \sqrt{F} (GHz)	dB
RF leakage	- [85-F (GHz)]	dB
Voltage Proof	500	V
Corona Level	Not Applicable	V
Maximum Phase Variation	10 x F(GHz)	° (deg)
Phase Variation per turn	0.6 x F(GHz)	° (deg)
Phase Stability over life	0.1 x F (GHz)	° (deg)

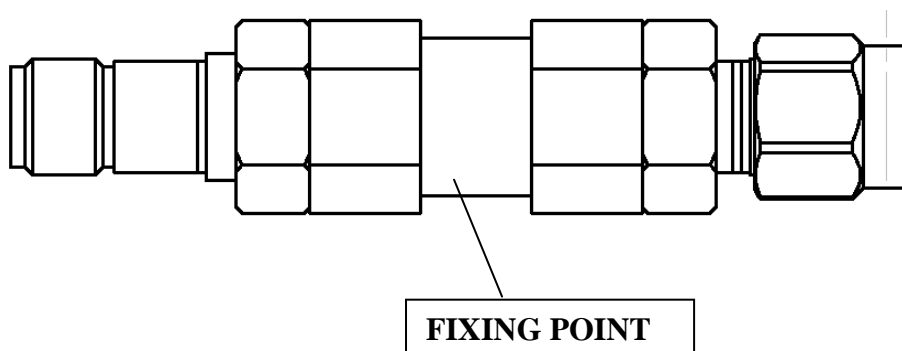
Mechanical characteristics	Values	Unit
Mini centre contact retention force (axial)	27*	N
Mini centre contact retention torque	0.5*	N.cm
Maximum weight	20	g
Torque for locking nuts	170	N.cm
Torque for SMA connector	80 - 120	N.cm

* This test can't be performed on Flight Model

Other characteristics	Values	Unit
Temperature cycling – Peak value	+115	°C
Operating temperature range	-40 to +105	°C

VARIANT 01 – STRAIGHT FEMALE-MALE**INSTRUCTION FOR USE**

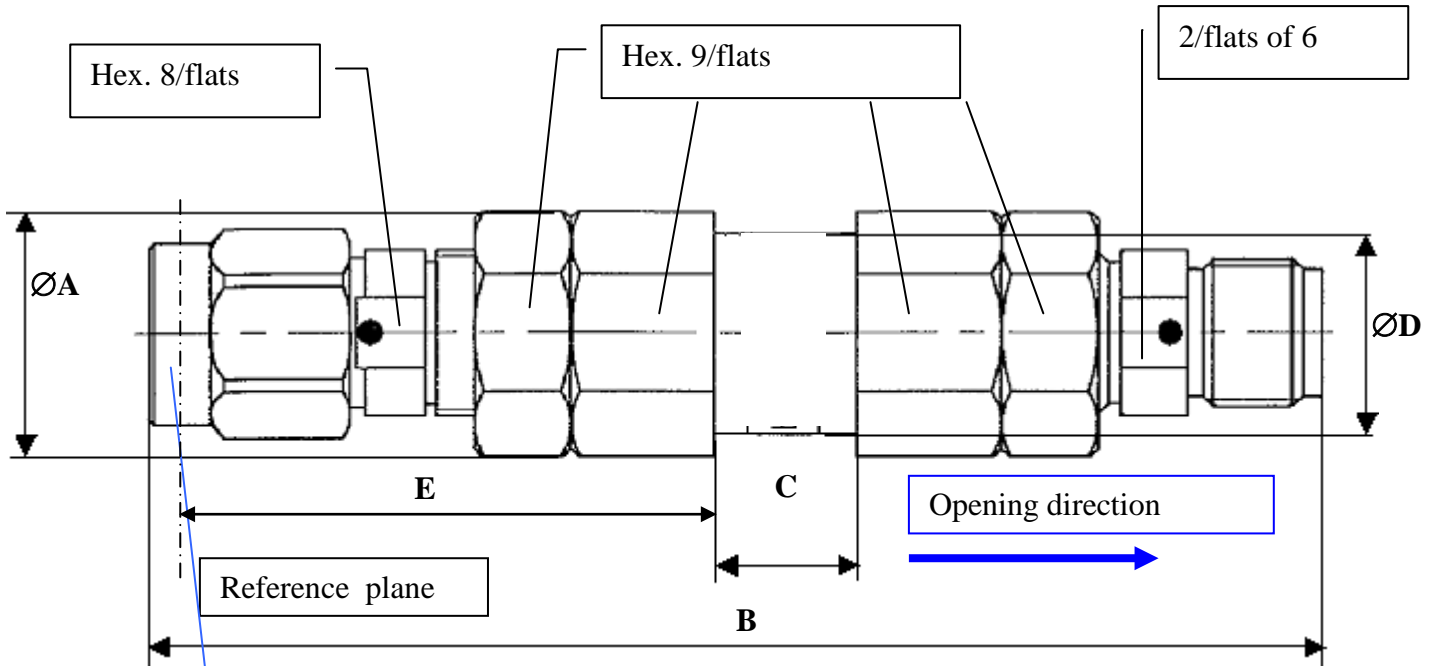
- Free A from B
- Free C from B
- Adjustment phase by rotating of B (Warning, not exceeded 180° at 18GHz if not there is a risk of the dismounting the phase shifter)
- Lock A to B without rotating B
- Lock C to B

Fixing points recommended by RADIALL for integration :

This phase shifter shall be immobilised by on fixing point minimum as it's shown on the figure above.

RADIALL don't guaranteed the integrity of the mechanical performances if these fixing point is not respected.

Figure 2c_2 – Mechanical Outline and Electrical Characteristics Variant 02 (Male-Female)



Marking : **R499100620** – **XXXX*-YYY****
 * XXXX = Date Code
 **YYY = Serial Number

SYMBOL / CHARACTERISTICS	PHYSICAL DIMENSION (mm)	
	Min	Max
$\varnothing A$	9.5	10.5
B	48	56.5
C	5.7	6.3
$\varnothing D$	8.5	8.7
E	17.12	18.12
Interface Male Connector		
Insulator / Ref. plane	0.00	-0.20
Contact / Ref. plane	0.00	-0.25
Interface Female Connector		
Insulator / Ref. plane	0.00	-0.20
Contact / Ref. plane	0.00	-0.25

**DETAIL SPECIFICATION**

REF.: RAD-DET-PHSH-001

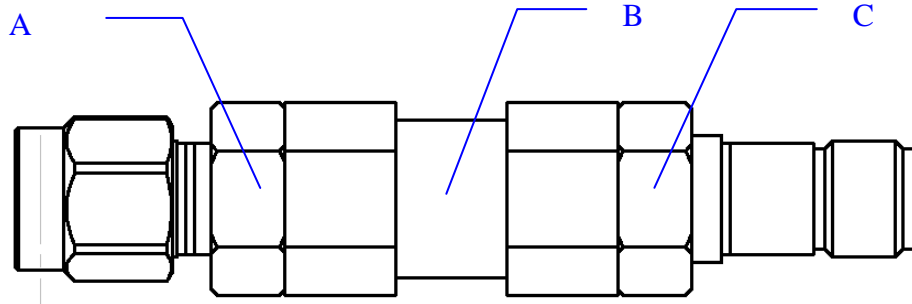
Date:
December 12th, 2019**ED/REV:**
5 / A**PAGE:**
24/ 35**VARIANT 02 – STRAIGHT MALE-FEMALE**

Electrical characteristics	Values	Unit
Frequency range	0 - 18	GHz
Maximum Voltage Standing Ratio (VSWR): From DC to 12.5GHz	1.11 + 0.012 x F(GHz)	-
From 12.5 to 18GHz	1.37	-
Maximum Insertion Loss	0.1 \sqrt{F} (GHz)	dB
RF leakage	- [85-F (GHz)]	dB
Voltage Proof	500	V
Corona Level	Not Applicable	V
Maximum Phase Variation	10 x F(GHz)	° (deg)
Phase Variation per turn	0.6 x F(GHz)	° (deg)
Phase Stability over life	0.1 x F (GHz)	° (deg)

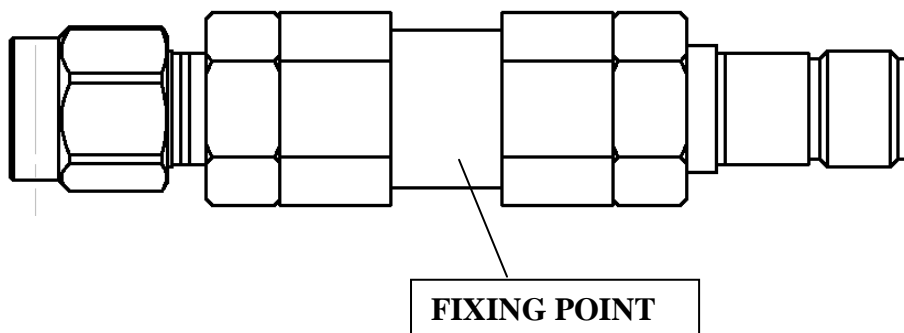
Mechanical characteristics	Values	Unit
Mini centre contact retention force (axial)	27*	N
Mini centre contact retention torque	0.5*	N.cm
Maximum weight	20	g
Torque for locking nuts	170	N.cm
Torque for SMA connector	80 - 120	N.cm

* This test can't be performed on Flight Model

Other characteristics	Values	Unit
Temperature cycling – Peak value	+115	°C
Operating temperature range	-40 to +105	°C

VARIANT 02 – STRAIGHT MALE-FEMALE**INSTRUCTION FOR USE**

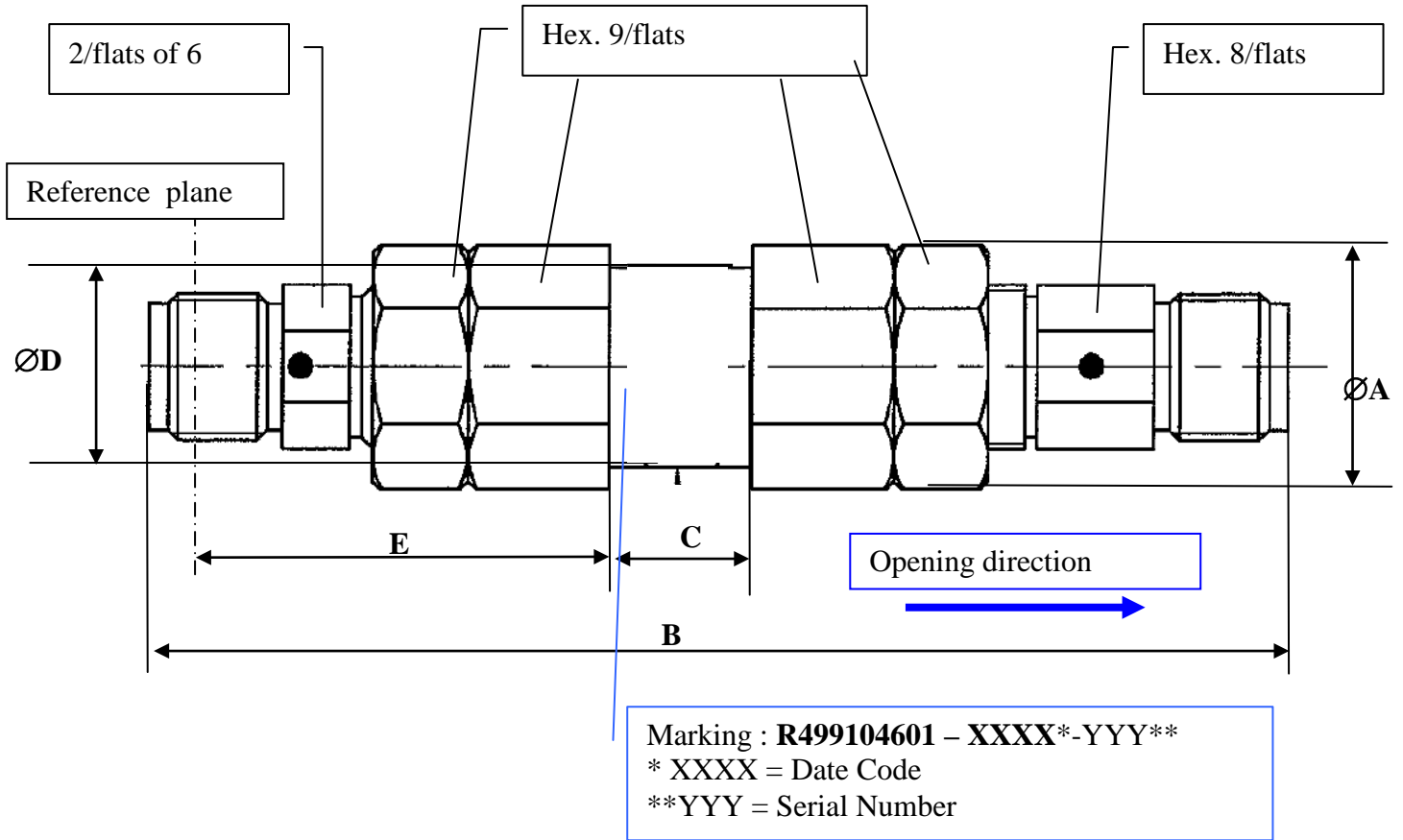
- Free A from B
- Free C from B
- Adjustment phase by rotating of B (Warning, not exceeded 180° at 18GHz if not there is a risk of the dismounting the phase shifter)
- Lock A to B without rotating B
- Lock C to B

Fixing points recommended by RADIALL for integration :

This phase shifter shall be immobilised by on fixing point minimum as it's shown on the figure above.

RADIALL don't guaranteed the integrity of the mechanical performances if these fixing point is not respected.

Figure 2c_3 – Mechanical Outline and Electrical Characteristics Variant 03 (Female-Female)



SYMBOL / CHARACTERISTICS	PHYSICAL DIMENSION (mm)	
	Min	Max
Ø A	9.5	10.5
B	47.5	55.5
C	5.7	6.3
Ø D	8.5	8.7
E	16.97	17.97
Interface Female Connector		
Insulator / Ref. plane	0.00	-0.20
Contact / Ref. plane	0.00	-0.25

VARIANT 03 – STRAIGHT FEMALE-FEMALE

Electrical characteristics	Values	Unit
Frequency range	0 - 18	GHz
Maximum Voltage Standing Ratio (VSWR): From DC to 12.5GHz	1.11 + 0.012 x F(GHz)	-
From 12.5 to 18GHz	1.37	-
Maximum Insertion Loss	0.1 \sqrt{F} (GHz)	dB
RF leakage	- [85-F (GHz)]	dB
Voltage Proof	500	V
Corona Level	Not Applicable	V
Maximum Phase Variation	10 x F(GHz)	° (deg)
Phase Variation per turn	0.6 x F(GHz)	° (deg)
Phase Stability over life	0.1 x F (GHz)	° (deg)

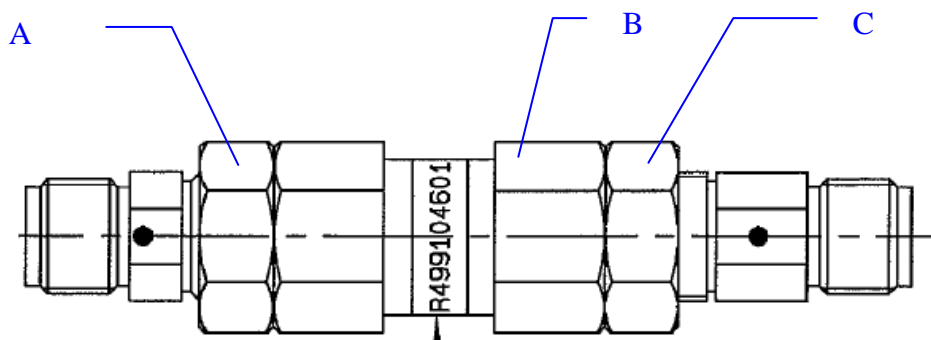
Mechanical characteristics	Values	Unit
Mini centre contact retention force (axial)	27*	N
Mini centre contact retention torque	0.5*	N.cm
Maximum weight	20	g
Torque for locking nuts	170	N.cm
Torque for SMA connector	80 - 120	N.cm

* This test can't be performed on Flight Model

Other characteristics	Values	Unit
Temperature cycling – Peak value	+115	°C
Operating temperature range	-40 to +105	°C

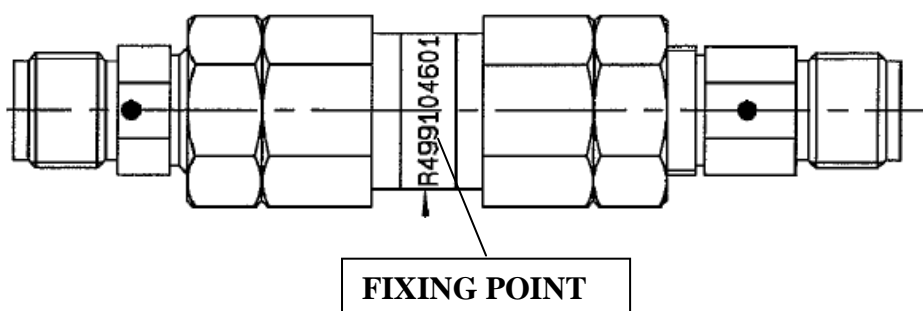
VARIANT 03 – STRAIGHT FEMALE-FEMALE

INSTRUCTION FOR USE



- Free A from B
- Free C from B
- Adjustment phase by rotating of B (Warning, not exceeded 180° at 18GHz if not there is a risk of the dismounting the phase shifter)
- Lock A to B without rotating B
- Lock C to B

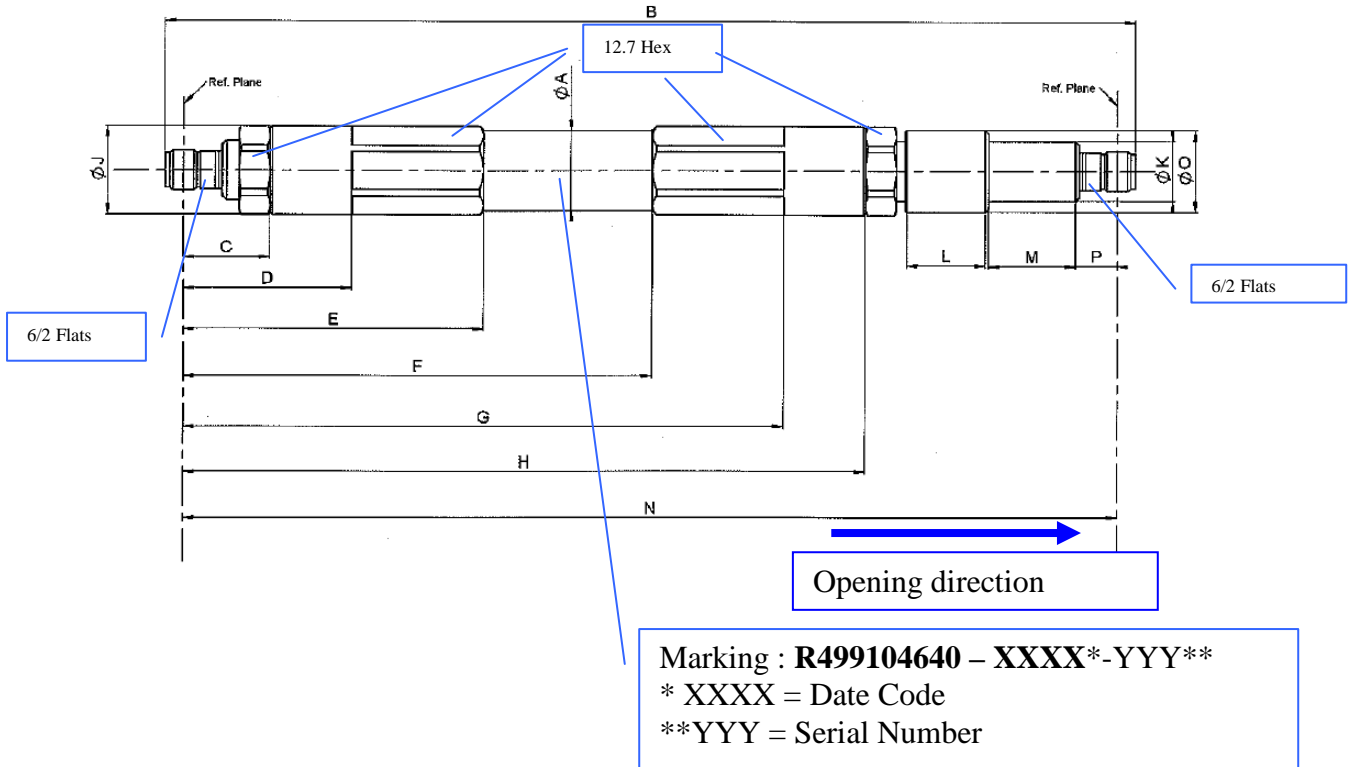
Fixing points recommended by RADIALL for integration :



This phase shifter shall be immobilised by on fixing point minimum as it's shown on the figure above.

RADIALL don't guaranteed the integrity of the mechanical performances if these fixing point is not respected.

Figure 2c_4 – Mechanical Outline and Electrical Characteristics Variant 04 (Female-Female)



SYMBOL / CHARACTERISTICS	PHYSICAL DIMENSION (mm)	
	Min	Max
Ø A	12.55	12.6
B	154	214
C	13.71	13.91
D	26.71	26.91
E	47.71	47.91
F	74.39	74.79
G	95.39	95.79
H	108.39	108.79
Ø J	13.9	14.1
Ø K	9.45	9.55
L	12.4	12.6
M	13.49	14.07
N	148.59	206.09
Ø O	12.95	13.05
P	6.65	6.75

VARIANT 04 – STRAIGHT FEMALE-FEMALE

Interface Female Connector		
Insulator / Ref. plane	0.00	-0.20
Contact / Ref. plane	0.00	-0.25

Electrical characteristics	Values	Unit
Frequency range	0 - 8	GHz
Maximum Voltage Standing Ratio (VSWR): From DC to 8GHz	1.10 + 0.014 x F(GHz)	--
Maximum Insertion Loss: From DC to 3.5GHz	0.20 \sqrt{F} (GHz)	dB
From 3.5 to 8GHz	0.23 \sqrt{F} (GHz)	dB
RF leakage	- [85-F (GHz)]	dB
Voltage Proof	500	V
Corona Level	Not Applicable	V
Maximum Phase Variation	70 x F(GHz)	° (deg)
Phase Variation per turn	1.3x F(GHz)	° (deg)
Phase Stability over life	0.1 x F (GHz)	° (deg)

Mechanical characteristics	Values	Unit
Mini centre contact retention force (axial)	27*	N
Mini centre contact retention torque	0.5**	N.cm
Maximum weight	115	g
Torque for locking nuts	170	N.cm
Torque for SMA connector	80 - 120	N.cm

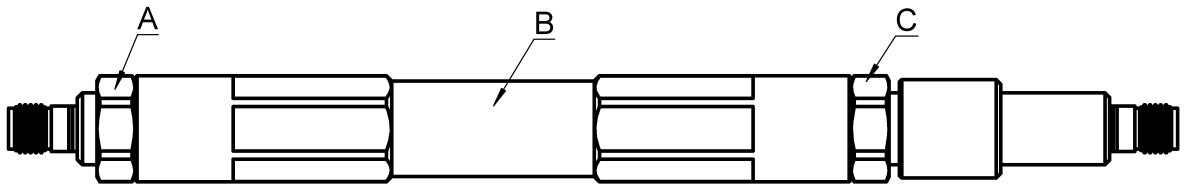
* This test can't be performed on Flight Model

** Not measurable

Other characteristics	Values	Unit
Temperature cycling – Peak value	+105	°C
Operating temperature range	-40 to +105	°C

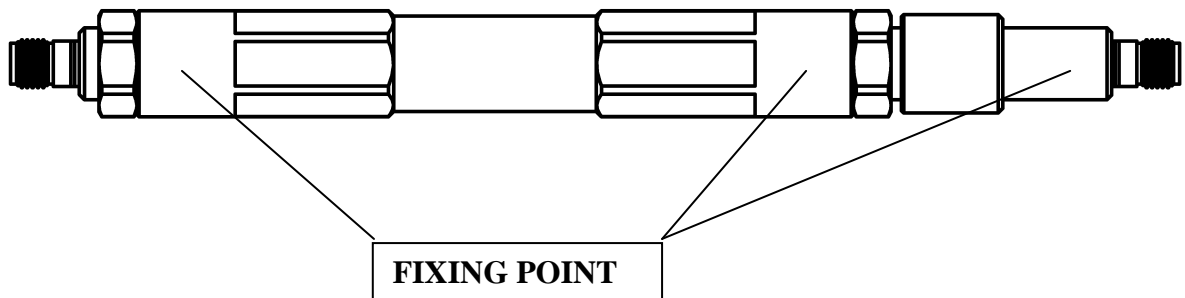
VARIANT 04 – STRAIGHT FEMALE-FEMALE

INSTRUCTION FOR USE



- Free A from B
- Free C from B
- Adjustment phase by rotating of B
- Lock A to B without rotating B
- Lock C to B

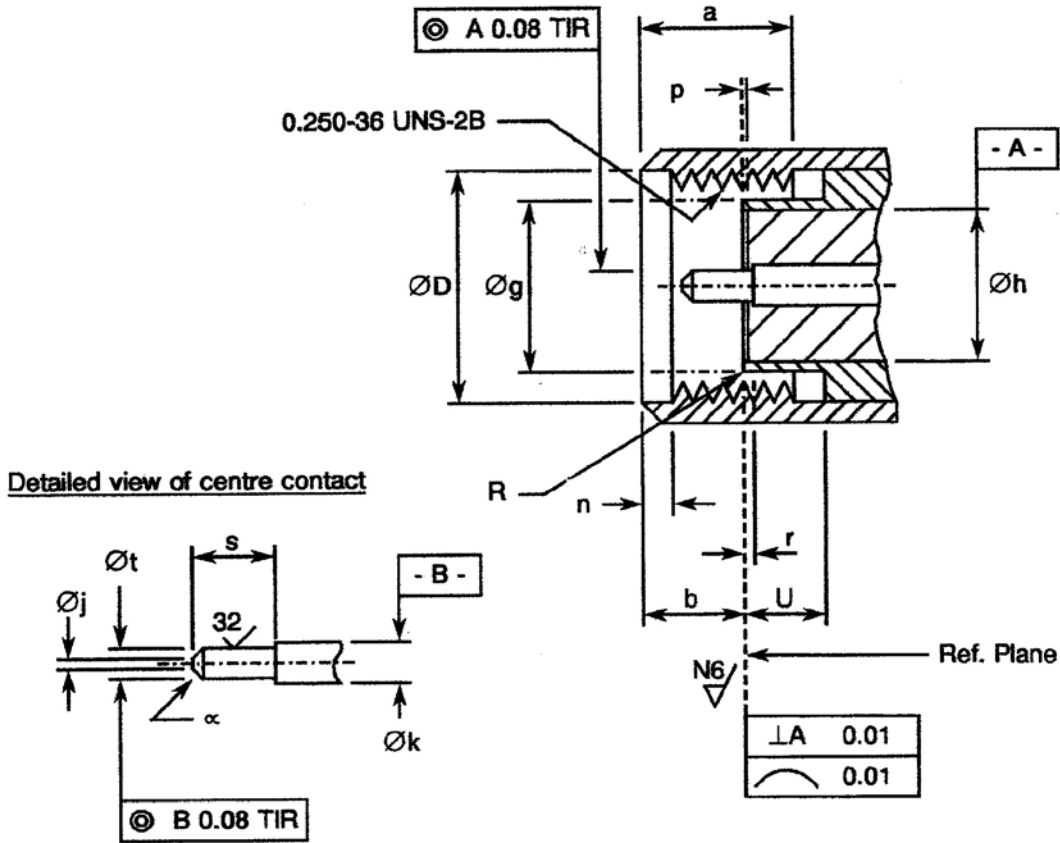
Fixing points recommended by RADIALL for integration :



This phase shifter shall be immobilised by three fixing points as it's shown on the figure above.

RADIALL don't guaranteed the integrity of the mechanical performances if these fixing points aren't respected.

Figure 3a – Standard Test Connector Interface - Male



SYMBOL	MILLIMETRES		NOTES	
	MIN.	MAX.		
a	3.71	4.32	Flat	
b	2.59	3.35		
ØD	6.48	6.73		
Øg	4.34	4.59		
Øh	4.10	4.13		
Øj	-	0.38		
Øk	1.27	1.29		
n	0.64	1.14		
p	0.00	0.05		Insert recess
r	0.00	0.08		Contact recessed
R	-	0.08		Radius
s	2.03	2.29		
Øt	0.90	0.93		
U	2.03	-		
α	-	-	45 ± 3° Chamfer	

Figure 4 – Test Pin Configuration

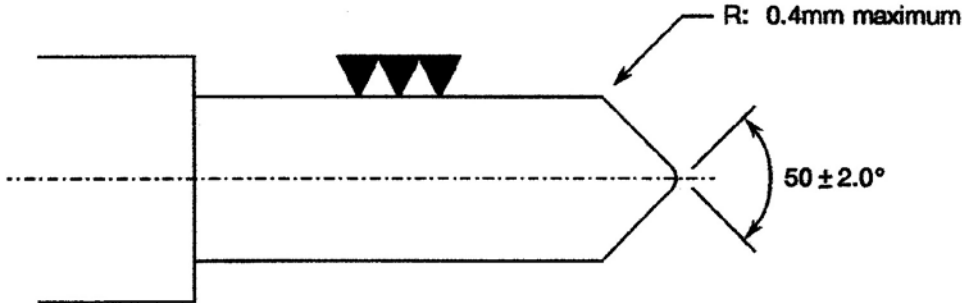
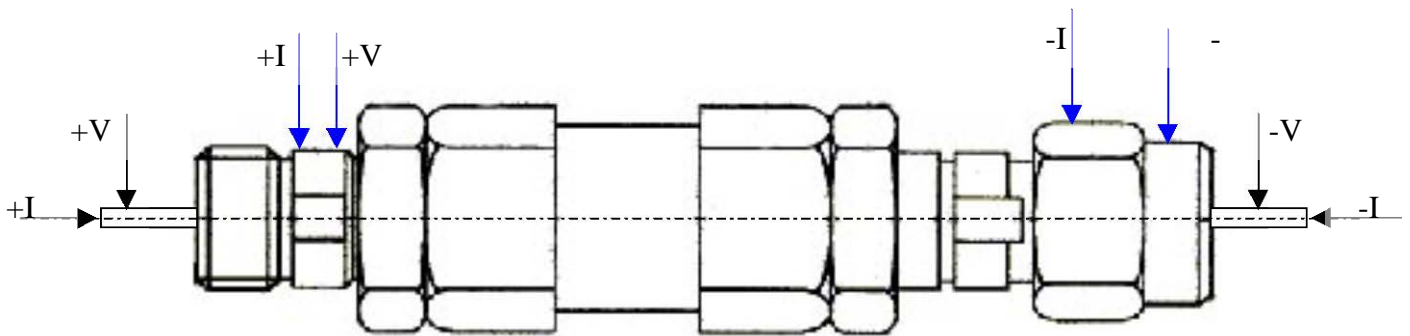


Figure 5 – Test method for Contact Resistance



Notes :

- Points of measurement on a phase shifter connectors :
- The black arrows show probe positions for measuring contact resistance of the centre contact
- The blue arrows show probe positions for measuring contact resistance of the outer contact


	DETAIL SPECIFICATION		
	REF.: RAD-DET-PHSH-001		
	Date: December 12 th , 2019	ED/REV: 5 / A	PAGE: 35/ 35

Table 7 – List of part numbers with applicable Power Handling Category

PART NUMBERS	DESIGNATION	POWER HANDLING CATEGORY
R499.100.600	Phase Shifter SMA 18GHz Female - Male	Category II
R499.100.620	Phase Shifter SMA 18GHz Male - Female	Category II
R499.104.601	Phase Shifter SMA 18GHz Female – Female	Category II
R499.104.640	Phase Shifter SMA 8GHz Female – Female	Category II