ISOLATORS AND CIRCULATORS, LOW POWER, Ka-BAND (22GHz - 32GHz), WITH NON-INTEGRAL SMA 2.9 COAXIAL CONNECTORS

BASED ON TYPES BK1XXX AND BK3XXX

ESCC Detail Specification No. 3202/026

Issue 4	November 2023

Document Custodian: European Space Agency – see https://escies.org

LEGAL DISCLAIMER AND COPYRIGHT

DOCUMENTATION CHANGE NOTICE

(Refer to https://escies.org for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
1571	Specification upissued to incorporate changes per DCR.

TABLE OF CONTENTS

1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or 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. 3202.

(b) ESCC Detail Specification No. 3402/021, RF Coaxial Connectors Type SMA 2.9 (Male Contact).

(c) ESCC Detail Specification No. 3402/022, RF Coaxial Connectors Type SMA 2.9 (Female Contact).

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: 320202601A1234

- Detail Specification Reference: 3202026
- Component Type Variant Number: 01 (as required)
- Manufacturer Specific Component Identification: A1234 (as applicable), where:
  - A: the first letter of the applicable Manufacturer's name.
  - 1234: a unique 4-digit number, sequentially allocated by the applicable Manufacturer, for each individual Component Design Drawing.

1.4.2 Component Type Variants

The component type variants applicable to this specification are as follows:

Variant Number	Based on Type	Description	Maximum Weight (g)
01	BK1xxx	Isolator with Non-integral Male or Female Coaxial Connectors in accordance with ESCC No. 3402/021 or ESCC No. 3402/022	21
02	BK3xxx	Circulator with Non-integral Male or Female Coaxial Connectors in accordance with ESCC No. 3402/021 or ESCC No. 3402/022	23

1.4.3 Manufacturer Specific Component Identification

A Component Design Drawing shall be produced by the Manufacturer after negotiation with the Orderer and shall be held under configuration control by the Manufacturer who will allocate a unique Manufacturer Specific Component Identification sequentially when a request for an isolator or circulator is received.

Each Component Design Drawing shall include the following information:

- The ESCC Component Number including the Manufacturer Specific Component Identification.
- Physical and mechanical details as follows:
  - Component Type (isolator or circulator)
  - The non-integral coaxial connectors (and contacts) including the applicable ESCC Component Number(s) and ESCC Detail Specification(s)
  - Component physical configuration, i.e. the locations of the connectors (and load for isolators)
  - Port identification number marking which gives the specified signal direction.
- The required centre frequency and operating frequency range (f_{min} – f_{max}) (see Para. 1.5 Maximum Ratings).

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
Centre Frequency Range	f_C	22 – 32	GHz	Note 1
Rated RF Power (Forward)	P_F	1	W	
Rated RF Power (Reverse)	P_R	0.5	W	
Functional Temperature Range	T_{func}	-30 to +115	°C	T_{amb} Note 2
Operating Temperature Range	T_{op}	-30 to +85	°C	T_{amb}
Storage Temperature Range	T_{stg}	-40 to +115	°C	

NOTES:

1. The centre frequency of the component shall be defined in the Component Design Drawing (see Para. 1.4.3) and shall be within the centre frequency range. The best available centre frequency resolution is 0.1GHz.

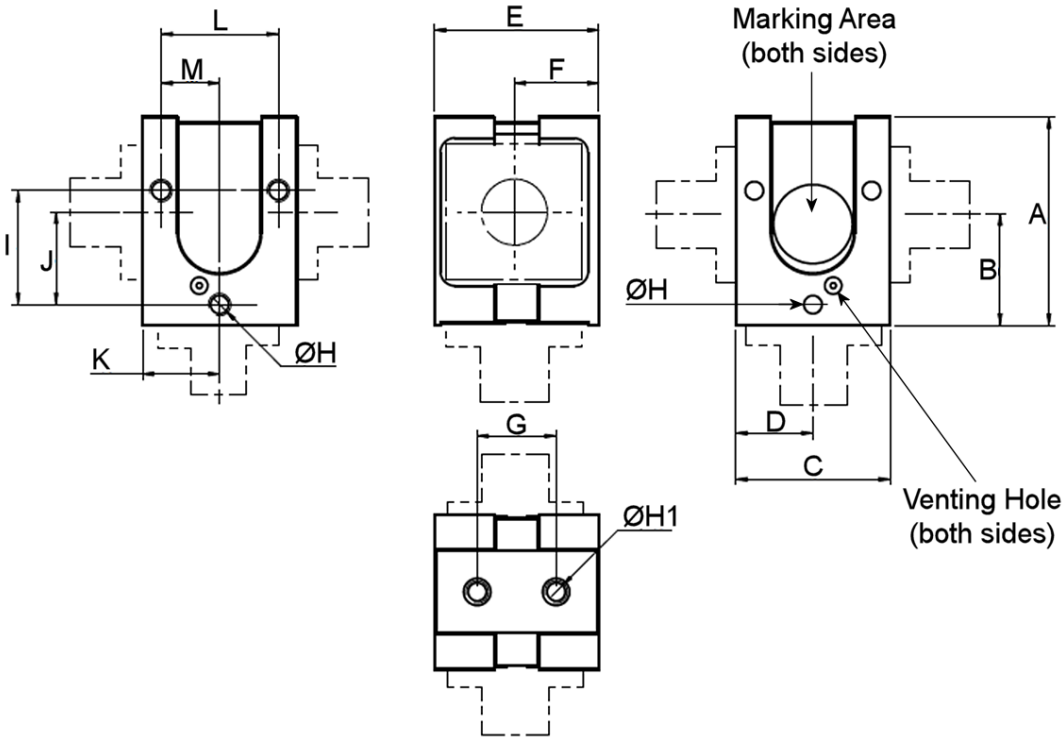
   The maximum bandwidth (f_{min} – f_{max}), i.e. the Operating Frequency Range over which device performance per Para. 2.3.1 Room Temperature Electrical Measurements and Para. 2.3.2 High and Low Temperatures Electrical Measurements is guaranteed, is ±7% of the centre frequency.
2. The electrical performance of the components at T_{amb} > +85°C is neither guaranteed nor measured.

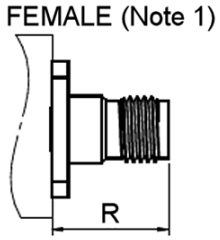
1.6 HANDLING PRECAUTIONS

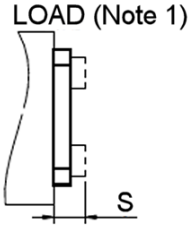
These devices are susceptible to damage by strong magnetic fields. Therefore suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

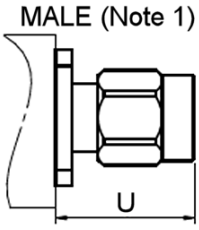
1.7 PHYSICAL DIMENSIONS

All dimensions shown below are critical dimensions.









SYMBOL	MILLIMETRES		NOTES
	MIN	MAX	
A	18.35	18.55	
B	9.52	10.52	
C	13.6	13.8	
D	6.35	7.35	
E	14.1	15.1	
F	7.2	7.8	
G	6.7	7.3	
ØH	M2		2
ØH1	M2		3
I	10	10.2	
J	7.9	8.5	
K	6.75	6.95	
L	10.2	10.6	
M	5.1	5.3	
R	10.57	10.74	4
S	-	2.8	
U	12.83	12.89	5

NOTES:

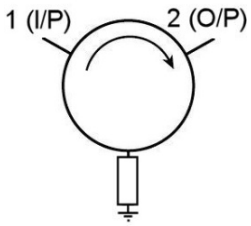
1. For each component, the physical characteristics of the 3 ports shall be defined in the Component Design Drawing (see Para. 1.4.3).

   For Variant 01 (isolators), one port shall be a load and the two remaining ports may be any combination of Male and Female SMA 2.9 coaxial connectors per ESCC Nos. 3402/021 and 3402/022.

   For Variant 02 (circulators), each port may be either a Male or Female SMA 2.9 coaxial connector per ESCC No. 3402/021 or ESCC No. 3402/022.
2. 6 places. Hole depth ≥ 3mm.
3. 2 places. Hole depth ≥ 5mm.
4. Full dimensions of the Female SMA 2.9 interface are specified in ESCC No. 3402/022.
5. Full dimensions of the Male SMA 2.9 interface are specified in ESCC No. 3402/021.

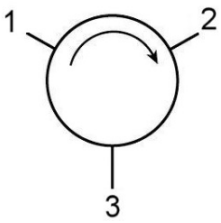
1.8 FUNCTIONAL DIAGRAM

1.8.1 Variant 01 – Isolators



The 3 ports may be configured as either the Input, Output or Load. The signal direction is given by the port identification numbers. The port identification number marking shall be as specified in the Component Design Drawing (see Para. 1.4.3).

1.8.2 Variant 02 – Circulators



Port number 1 may be assigned to any of the 3 ports and shall be as specified in the Component Design Drawing (see Para. 1.4.3). The signal direction (e.g. 1→2, 2→3, 3→1) is given by the port identification numbers.

1.9 MATERIALS AND FINISHES

(a) Main Body: Aluminium, silver plated, plating thickness 13µm minimum.

(b) Yoke: Steel, nickel plated, plating thickness 5µm minimum.

(c) Coaxial Connectors: In accordance with ESCC No. 3402/021 or ESCC No. 3402/022, as applicable.

(d) Load (applicable to Variant 01 (isolators) only): The load shall be made of a suitable absorptive material.

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

None.

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 shall be:

(a) Port identification numbers (see Para. 1.8).
(b) The ESCC qualified components symbol (for ESCC qualified components only).
(c) The ESCC Component Number (see Para. 1.4.1).
(d) Traceability information.

2.3 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

The measurements shall be performed at room, high and low temperatures.

2.3.1 Room Temperature Electrical Measurements

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

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Voltage Standing Wave Ratio	VSWR	ESCC No. 3202	-	1.15	-
Isolation	ISO	ESCC No. 3202	23	-	dB
Insertion Loss	I_L	ESCC No. 3202	-	0.6	dB
Insertion Loss Variation	I_{LR}	Note 2	-	0.1	dBp-p

NOTES:

1. Tested over the full operating frequency range specified in the applicable Component Design Drawing (see Para. 1.4.3).
2. Calculated from the minimum and maximum values of Insertion Loss measured over the full operating frequency range.

2.3.2 High and Low Temperatures Electrical Measurements

The measurements shall be performed at T_{amb} = +85 (+0 -3)°C and T_{amb} = -30 (+3 -0)°C.

Characteristics	Symbols	Test Method and Conditions (Note 1)	Limits		Units
			Min	Max	
Voltage Standing Wave Ratio	VSWR	ESCC No. 3202	-	1.22	-
Isolation	ISO	ESCC No. 3202	20	-	dB
Insertion Loss	I_L	ESCC No. 3202	-	0.6	dB

NOTES:

1. Tested over the full operating frequency range specified in the applicable Component Design Drawing (see Para. 1.4.3).

2.4 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. 2.3.1 Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic where specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Test Reference per ESCC No. 3202	Characteristics	Symbols	Limits		Units
			Min	Max	
Random Vibration					
Final Measurements	Voltage Standing Wave Ratio	VSWR	-	1.15	-
	Isolation	ISO	23	-	dB
	Insertion Loss	I_L	-	0.6	dB
Shock					
Final Measurements	Voltage Standing Wave Ratio	VSWR	-	1.15	-
	Isolation	ISO	23	-	dB
	Insertion Loss	I_L	-	0.6	dB
Thermal Shock					
Final Measurements	Voltage Standing Wave Ratio	VSWR	-	1.15	-
	Isolation	ISO	23	-	dB
	Insertion Loss	I_L	-	0.6	dB
Thermal Stability of Insertion Loss	Continuous monitoring of Insertion Loss	IL	As per ESCC No. 3202		-
Radiated Emission Sniff Test	Shielding Effectiveness	SE	70	-	dBi

APPENDIX A

AGREED DEVIATIONS FOR EXENS SOLUTIONS (F)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Para. 2.1.1 Deviations from the Generic Specification: Deviations from Qualification and Periodic Tests - Chart F4	The annual Endurance Subgroup testing on 3 components shall not be performed.