CIRCULATORS, WAVEGUIDE

2.5 - 40 GHz

BASED ON SERIES **CD****

ESCC Detail Specification No. 3202/021

ISSUE 1

October 2002

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ESA/SCC Detail Specification No. 3202/021

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 1	March 1994		
Revision 'A'	January 1995		

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	CHANGE Reference / Item	Approved DCR No.
'A'	Jan. '95	P1. Cover Page P2. DCN P6. Table 1(b) : Typographic errors changed for item 3.	None None 23676

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TABLES

FIGURES

APPENDICES (Applicable to specific Manufacturers only)
None.

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for a Circulator, Waveguide, 2.5 - 40 GHz, based on Series **CD****. It shall be read in conjunction with ESA/SCC Generic Specification No. 3202, the requirements of which are supplemented herein.

1.2 TYPE VARIANTS

A list of the type variants of the circulators specified herein, which are also covered by this specification, is given in "Table 1(a) - Type Variant Summary".

For each type variant, the full electrical and physical characteristics are given in individual Tables 1(a), "Type Variant Detailed Information", at the end of this specification.

The contents of the individual Tables 1(a) shall be as shown in Table 1(c) and the characteristics therein listed shall relate to the design parameters of the individual circulators, optimised for the intended application.

The specific characteristics shall be negotiated between the Manufacturer and the Orderer. The Manufacturer shall then apply to the ESA/SCC Secretariat for a type variant number for each individual circulator concerned, by sending a finalised Table 1(a) which shall also be copied to the Qualifying Space Agency (QSA).

1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the circulators specified herein, are as scheduled in Table 1(b).

1.4 PHYSICAL DIMENSIONS

The physical dimensions of the circulators specified herein, are shown in Figure 2.

1.5 FUNCTIONAL DIAGRAM

The functional diagram, showing port identification of the circulators specified herein, is shown in Figure 3.

2. APPLICABLE DOCUMENTS

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

(a) ESA/SCC Generic Specification No. 3202, Ferrite Microwave Components, Isolators and Circulators.

(b) IEC Publication No. 154, Flanges for Waveguides.

(c) MIL-F-3922, Flange, Waveguide, General Purpose, General Specification for.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

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

TABLE 1(a) - TYPE VARIANT SUMMARY

VARIANT	BASED ON TYPE	CENTRE FREQ. (f_c) (GHz)	MIN. BANDWIDTH (B) (GHz)	MINIMUM ISOLATION			MAXIMUM INSERTION LOSS			MINIMUM RETURN LOSS		
				ISO_{21} (dB)	ISO_{13} (dB)	ISO_{32} (dB)	IL_{12} (dB)	IL_{23} (dB)	IL_{31} (dB)	RL_1 (dB)	RL_2 (dB)	RL_3 (dB)
01	15CD340	7.5	0.5	20.0	20.0	20.0	0.5	0.5	0.5	19.1	19.1	19.1

NOTES

1. Full electrical and physical characteristics are given in the individual Tables 1(a) at the end of this specification.

TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT
1	Frequency Range	-	2.5 to 40	GHz
2	Peak RF Frequency Power Product Peak RF Power Duration Peak RF Power Duty Cycle	P_p - -	200 50 10	GHzW µs %
3	Peak RF Frequency Power Product (Reflected) Peak RF Power (Reflected) Duration Peak RF Power (Reflected) Duty Cycle	P_{pr} - -	200 50 10	GHzW µs %
4	Minimum RF Leakage	E	−70	dBc
5	Operating Temperature Range	T_{op}	Item 7 (1)	°C
6	Storage Temperature Range	T_{stg}	−60 to +125	°C

NOTES

1. See Individual Tables 1(a).

FIGURE 1 - PARAMETER DERATING INFORMATION

Not applicable.

TABLE 1(c) - FORMAT FOR INDIVIDUAL TABLES 1(a)

TABLE 1(a) - TYPE VARIANT DETAILED INFORMATION

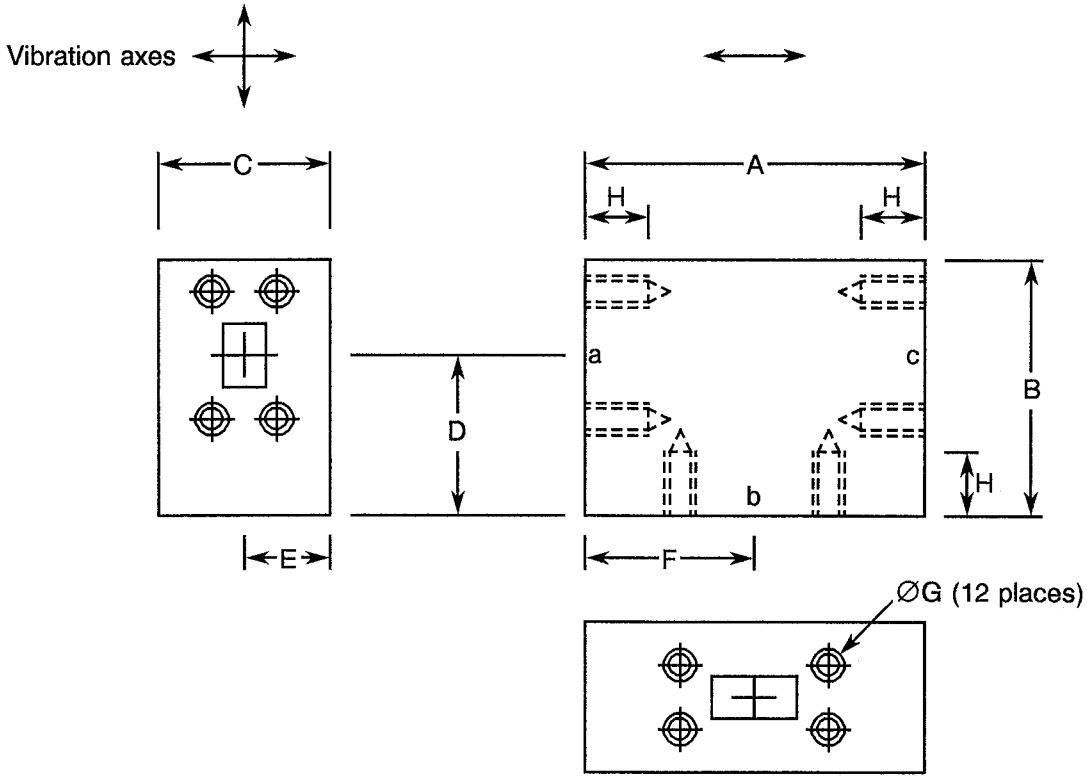
TYPE VARIANT No.

No.	CHARACTERISTICS		SYMBOL	VALUES		UNIT	REMARKS
				MIN.	MAX.		
1	Centre Frequency		f_c			GHz	
2	Bandwidth		B		-	GHz	
3	Isolation	Ports 2 to 1 Ports 1 to 3 Ports 3 to 2	ISO_{21} ISO_{13} ISO_{32}		- - -	dB dB dB	Note 1
4	Insertion Loss	Ports 1 to 2 Ports 2 to 3 Ports 3 to 1	IL_{12} IL_{23} IL_{31}	- - -		dB dB dB	Note 1
5	Return Loss	Port 1 Port 2 Port 3	RL_1 RL_2 RL_3		- -	dB dB dB	Note 1
6	Weight		-	-		g	
7	Interfaces	Port 1 Port 2 Port 3	- -	154 IEC- 154 IEC- 154 IEC-		- - -	Note 2
8	Operating Temperature Range		T_{op}			°C	T_{amb} (Note 3)
9	Physical Dimensions		A B C D E F G H	- - -	 -	mm mm mm mm mm mm mm mm	
10	Configuration and Functional Diagram		-	Figure 3( )		-	

NOTES

1. Over the frequency range specified in Items 1 and 2. Bandwidth is symmetrical around the centre frequency.
2. For components with flanges to MIL-F-3922, the applicable reference shall be inserted here. The interface description refers to the flange that the component is intended to mate with.
3. The Operating Temperature Range shall not exceed the Storage Temperature Range.

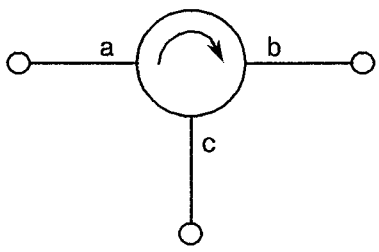
FIGURE 2 - PHYSICAL DIMENSIONS



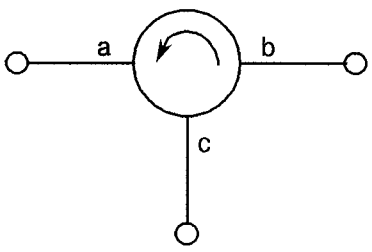
NOTES

1. Ports shall be marked as specified in Figure 3.
2. The perpendicularity and parallelism between the waveguide flanges shall be 0.2mm maximum.
3. For dimensions, see Individual Tables 1(a).

FIGURE 3 - FUNCTIONAL DIAGRAM



FIGURES 3(a) TO 3(c)



FIGURES 3(d) TO 3(f)

FIGURE	PORT		
	a	b	c
3(a)	1	2	3
3(b)	2	3	1
3(c)	3	1	2
3(d)	3	2	1
3(e)	2	1	3
3(f)	1	3	2

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the circulators specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3202. Deviations from the Generic Specification, applicable to this Detail Specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specifications and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

4.2.1 Deviations from Special In-process Controls

None.

4.2.2 Deviations from Final Production Tests (Chart II)

(a) Para. 9.7.1.6, Voltage Proof: Shall not be performed.

(b) Para. 9.6, Seal Test: Shall not be performed.

(c) Para. 9.8, Coupling Proof Torque: Shall not be performed.

(d) Para. 9.9, Mating and Unmating Forces: Shall not be performed.

(e) Para. 9.10, Centre Contact Retention: Shall not be performed.

(f) Para. 9.13, Contact Engagement and Separation Forces: Shall not be performed.

4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)

Not applicable.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.8, Coupling Proof Torque: Shall not be performed.

(b) Para. 9.20, Endurance: Shall not be performed.

(c) Para. 9.21, Solderability: Shall not be performed.

(d) Para. 9.22, Robustness of Terminations: Shall not be performed.

(e) Para. 9.6, Seal Test: Shall not be performed.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.8, Coupling Proof Torque: Shall not be performed.

(b) Para. 9.20, Endurance: Shall not be performed.

(c) Para. 9.6, Seal Test: Shall not be performed.

(d) Para. 9.9, Mating and Unmating Forces: Shall not be performed.

(e) Para. 9.13, Contact Engagement and Separation Forces: Shall not be performed.

(f) Para. 9.21, Solderability: Shall not be performed.

(g) Para. 9.22, Robustness of Terminations: Shall not be performed.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Contact Engagement and Separation Forces

Not applicable.

4.3.2 Voltage Proof

Not applicable.

4.3.3 Weight

The maximum weight of the components specified herein shall be as defined in the Individual Tables 1(a).

4.3.4 Coupling Proof Torque

Not applicable.

4.3.5 Mating and Unmating Forces

Not applicable.

4.3.6 Centre Contact Retention

Not applicable.

4.3.7 Dimension Check

The dimensions of the components specified herein shall be verified in accordance with the requirements set out in Para. 9 of ESA/SCC Generic Specification No. 3202 and shall conform to those shown in the Individual Tables 1(a).

4.3.8 Endurance

Not applicable.

4.4 MATERIALS AND FINISHES

4.4.1 General

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the components 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.

4.4.2 Body

Aluminium alloy (milled), chromate conversion finish.

4.4.3 Connector Receptacle

Not applicable.

4.4.4 Tab

Not applicable.

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700. Each component shall be marked in respect of:-

(a) Port Identification.

(b) The SCC Component Number.

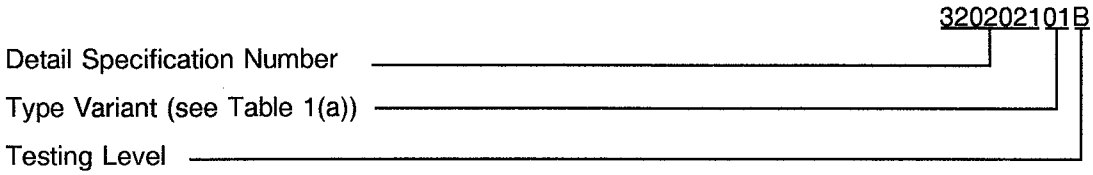
(c) Traceability Information.

4.5.2 Port Identification

Port identification shall be as shown in the Individual Tables 1(a) and Figure 3.

4.5.3 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:



4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. The measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3. Measurements shall be performed at the temperature extremes as defined in Item 8 of the Individual Tables 1(a).

4.6.3 Circuits for Electrical Measurements

Circuits for use in performing electrical measurements are given in ESA/SCC Generic Specification No. 3202.

4.7 BURN-IN TESTS

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3202 TEST METHOD AND CONDITION	LIMITS
1	Isolation	ISO	Para. 9.7.1.2	Item 3 (1)
2	Insertion Loss	IL	Para. 9.7.1.3	Item 4 (1)
3	Return Loss	RL	Para. 9.7.1.4	Item 5 (1)

NOTES
1. See Individual Tables 1(a).

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3202 TEST METHOD AND CONDITION	LIMITS
1	Isolation	ISO	Para. 9.7.1.2	Item 3 (1)
2	Insertion Loss	IL	Para. 9.7.1.3	Item 4 (1)
3	Return Loss	RL	Para. 9.7.1.4	Item 5 (1)

NOTES
1. See Individual Tables 1(a).

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

Not applicable.

TABLE 4 - PARAMETER DRIFT VALUES

Not applicable.

TABLE 5 - CONDITIONS FOR OPERATING LIFE TEST

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Ambient Temperature	T_{amb}	+125	°C

FIGURE 5 - ELECTRICAL CIRCUITS FOR OPERATING LIFE TEST

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 3202)

4.8.1 Measurements and Inspections on Completion of Environmental Tests

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

4.8.2 Measurements and Inspections at Intermediate Points and on Completion of Endurance Tests

The parameters to be measured and inspections to be performed at intermediate points and on completion of endurance tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +22 \pm 3°C$.

4.8.3 Conditions for Operating Life Tests (Part of Endurance Testing)

The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 3202. The conditions for operating life testing shall be as specified in Table 5 of this specification.

4.8.4 Electrical Circuits for Operating Life Tests

Not applicable.

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL TESTS AND AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTS

No.	ESA/SCC GENERIC SPECIFICATION NO. 3202		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS	UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS			
01	Rapid Change of Temperature	Para. 9.4	Electrical Measurements Visual Examination	Table 2 -		(2) -	
02	Vibration	Para. 9.5	Electrical Measurements Visual Examination	Table 2 -		(2) -	
03	Shock or Bump	Para. 9.16	Electrical Measurements Visual Examination	Table 2 -		(2) -	
04	Permanence of Marking	Para. 9.17	Visual Examination	-		-	
05	Climatic Sequence Dry Heat Cold Test Low Air Pressure Damp Heat	Para. 9.18 Para. 9.18.2 Para. 9.18.4 Para. 9.18.5 Para. 9.18.6	 Electrical Measurements Electrical Measurements 3202, Para. 9.18.5 Electrical Measurements	 Table 3 Table 3 - Table 2		 (2) (2) 3202, Para. 9.18.5 (2)	
06	Corrosion	Para. 9.19	Visual Examination	-		-	
07	Coupling Proof Torque	Para. 9.8	Not applicable	-		-	
08	Endurance	Para. 9.20	Not applicable	-		-	
09	Solderability	Para. 9.21	Not applicable	-		-	
10	Robustness of Terminations	Para. 9.22	Not applicable	-		-	
11	Seal Test	Para. 9.6	Not applicable	-		-	
12	Damp Heat	Para. 9.23	Electrical Measurements Visual Examination	Table 2 -		(2) -	
13	Operating Life	Para. 9.24.1 Para. 9.24.3 Para. 9.24.5	Init. Elec. Measurements Inter. Elec. Measurements Final Elec. Measurements	Table 2 Table 2 Table 2		(2) (2) (2)	
14	Mating and Unmating Forces	Para. 9.9	Not applicable	-		-	
15	Contact Engagement and Separation Forces	Para. 9.13	Not applicable	-		-	

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. See Individual Tables 1(a).

TABLE 1(a) - TYPE VARIANT DETAILED INFORMATION

TYPE VARIANT No. 01

No.	CHARACTERISTICS		SYMBOL	VALUES		UNIT	REMARKS
				MIN.	MAX.		
1	Centre Frequency		f_c	7.5		GHz	
2	Bandwidth		B	0.5	-	GHz	
3	Isolation	Ports 2 to 1	ISO_{21}	20.0	-	dB	Note 1
		Ports 1 to 3	ISO_{13}	20.0	-	dB	
		Ports 3 to 2	ISO_{32}	20.0	-	dB	
4	Insertion Loss	Ports 1 to 2	IL_{12}	-	0.5	dB	Note 1
		Ports 2 to 3	IL_{23}	-	0.5	dB	
		Ports 3 to 1	IL_{31}	-	0.5	dB	
5	Return Loss	Port 1	RL_1	19.1	-	dB	Note 1
		Port 2	RL_2	19.1	-	dB	
		Port 3	RL_3	19.1		dB	
6	Weight		-	-	320	g	
7	Interfaces	Port 1	-	154 IEC-UBR 84		-	Note 2
		Port 2	-	154 IEC-UBR 84		-	
		Port 3		154 IEC-UBR 84		-	
8	Operating Temperature Range		T_{op}	−30	+90	°C	T_{amb} (Note 3)
9	Physical Dimensions		A	-	70.3	mm	
			B	-	69.5	mm	
			C	-	48.2	mm	
			D	44.5	45.5	mm	
			E	23.5	24.5	mm	
			F	34.4	35.4	mm	
			G	M4		mm	
			H	5.0	-	mm	
10	Configuration and Functional Diagram		-	Figure 3(f)		-	

NOTES

1. Over the frequency range specified in Items 1 and 2. Bandwidth is symmetrical around the centre frequency.
2. For components with flanges to MIL-F-3922, the applicable reference shall be inserted here. The interface description refers to the flange that the component is intended to mate with.
3. The Operating Temperature Range shall not exceed the Storage Temperature Range.