WAVEGUIDE DIPLEXERS,

WITH WAVEGUIDE AND COAXIAL INTERFACES,

4 - 18 GHz,

BASED ON SERIES WM***

ESCC Detail Specification No. 3102/001

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space components
coordination group

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Issue 1	November 1993		
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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
'A'	Oct. '94	P1. Cover page		None
		P2. DCN		None
		P16. Table 3	: No. 7 deleted in toto	221111
			: Note 2 deleted in toto	221111
'B'	June '95	P1. Cover page		None
		P2. DCN		None
		P14. Para. 4.4.2	: "electrolytic" changed to "electroless"	221243
		P15. Para. 4.6.2	: Second sentence amended	221243

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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 Waveguide Diplexer, with waveguide and coaxial interfaces, 4 - 18 GHz, based on Series WM***. It shall be read in conjunction with ESA/SCC Generic Specification No. 3102, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS

A list of the type variants of the Diplexers 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 Diplexers, 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 Diplexer 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 Diplexers specified herein, are as scheduled in Table 1(b).

1.4 PHYSICAL DIMENSIONS

The physical dimensions of the Diplexers specified herein are referenced to Figure 2 and shown in the individual Tables 1(a).

1.5 FUNCTIONAL DIAGRAM

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

1.6 STORAGE PRECAUTIONS

These components, being unsealed, require protection against humidity as specified in Para. 4.2 of ESA/SCC Basic Specification No. 20600.

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. 3102, Waveguide Filters and Multiplexers with Waveguide and Coaxial Interfaces.

(b) ESA/SCC Detail Specification No. 3402/xxx, Detail Specification for Connectors, RF, Coaxial.

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	CENTRE FREQUENCIES		MAX PEAK POWER	OPERATING BANDWIDTH		MIN OUT-OF-BAND REJECTION		MAX. INSERT LOSS	
	Channel 1 fc1 (MHz)	Channel 2 fc2 (MHz)	P_P (W)	Channel 1 BWo1 (MHz)	Channel 2 BWo2 (MHz)	Channel 1 BR1 (dB)	Channel 2 BR2 (dB)	Channel 1 IL1 (dB)	Channel 2 IL2 (dB)
01	11765.84	11842.56	20	27	27	30	30	5.0	5.0

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 RATING	UNIT	REMARKS
1	Frequency Range	-	4.0 to 18	GHz	
2	Rated RF Power (Continous)	P	Note 1	W	
3	Peak RF Power	P_P	Note 1	W	
4	Operating Temperature Range	T_{op}	Note 1	°C	T_{amb}
5	Storage Temperature Range	T_{stg}	−40 to +80	°C	

NOTES

1. 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

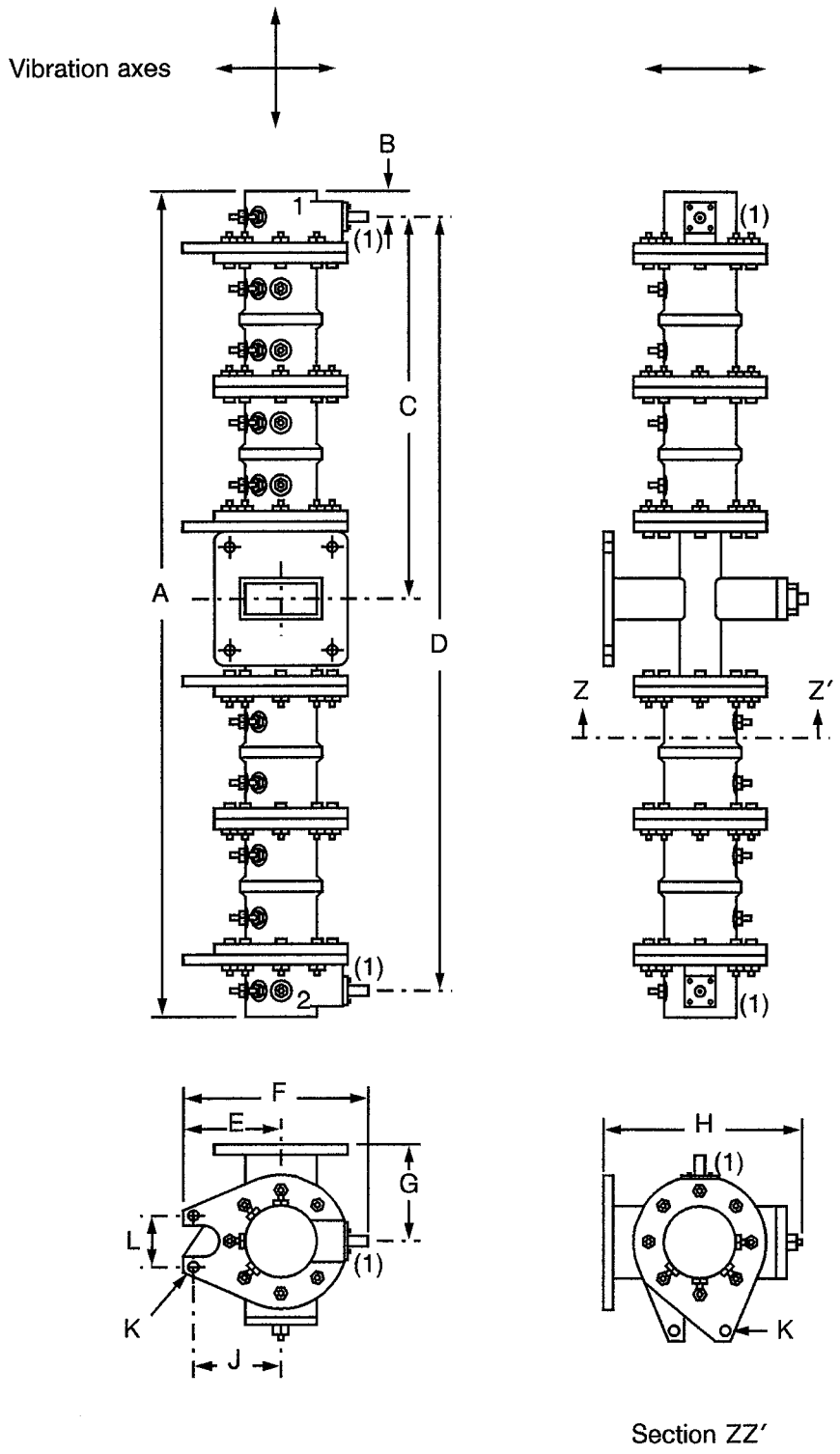
TYPE VARIANT No.

No.	CHARACTERISTIC		SYMBOL	LIMITS		UNIT	REMARKS
				MIN.	MAX		
1	Centre Frequencies	Channel 1 Channel 2	fc1 fc2			MHz	-
2	Operating Bandwidth	Channel 1 Channel 2	BW1 BW2			MHz	Note 1
3	Rated RF Power (Continuous)		P	-		W	Note 2
4	Peak RF Power Peak RF Power Duration		P_P t	- -		W Mins	Note 2 Note 3
5	Midband Insertion Loss	Channel 1 Channel 2	IL1 IL2		-	dB	-
6	Amplitude Variations	fc1 ± f1 fc1 ± f2 fc1 ± f3 fc1 ± f4 fc1 ± f5 fc2 ± f1 fc2 ± f2 fc2 ± f3 fc2 ± f4 fc2 ± f5	AV1 - 1 AV1 - 2 AV1 - 3 AV1 - 4 AV1 - 5 AV2 - 1 AV2 - 2 AV2 - 3 AV2 - 4 AV2 - 5	- - - - - - - - - -		dB	Notes 4, 5
7	Isolation	fc1 ± f6 fc2 ± f7	ISO12 ISO21		- -	dB	-
8	Out-Of-Band Rejection	fc1 ± f8 fc1 ± f9 fc1 + f9 to f10 < fc1 − f9 fc2 ± f8 fc2 ± f9 fc2 + f9 to f10 < fc2 − f9	BR1 - 8 BR1 - 9 BR1 - 9/10 BR1 - <9 BR2 - 8 BR2 - 9 BR2 - 9/10 BR2 - <9		- - - - - - - -	dB	Notes 4, 6
9	Group Delay Variations	fc1 ± f11 fc1 ± f12 fc1 ± f13 fc2 ± f11 fc2 ± f12 fc2 ± f13	GD1 - 11 GD1 - 12 GD1 - 13 GD2 - 11 GD2 - 12 GD2 - 13	- - - - - -		ns	Notes 4, 7
10	Common Port Return Loss		RL_P		-	dB	Note 8
11	Insulation Resistance		Ri		-	GΩ	Note 9
12	RF Leakage		E		-	dB	-
13	Operating Temperature Range		Top			°C	Tamb, Note 10
14	Weight		-	-		g	-
15	Interfaces	Common Channel 1 Channel 2	- - -	154 IEC-		- - -	Notes 11, 12
16	Outline Drawing		-	Figure 2( )		-	-
17	Physical Dimensions		A B C D E F G H J K L	- - - 		mm	Note 13

NOTES TO TABLE 1(c)

1. Operating bandwidth is symmetrical about each centre frequency.
2. These figures apply to the forward and reverse directions of device operation and apply to each channel when operating simultaneously.
3. This figure assumes that no additional heatsinking is provided and refers to the maximum duration for 1.0μs pulses with a 1.0s cycling rate.
4. More, or less, frequencies than shown may be specified.
5. $f1 < f2 < f3 < f4 < f5$.
6. $f8 < f9 < f10$.
7. $f11 < f12 < f13$.
8. Measured over $fc1 \pm \frac{1}{2}$ BWo1 and $fc2 \pm \frac{1}{2}$ BWo2.
9. For integral connectors only.
10. Shall not exceed the Storage Temperature Range specified in Table 1(b) of this specification.
11. Integral connectors shall be defined by identification of the connector type and the sex of the connector, e.g. SMA female. Non-integral connectors shall be identified by the ESA/SCC Part Number that identifies the connector, e.g. 340200219B.
12. For components with flanges to MIL-F-3922, the applicable reference shall be inserted here.
13. See Figure 2. For dimensions to/from connectors, these shall be measured to/from the reference plane of the connector.

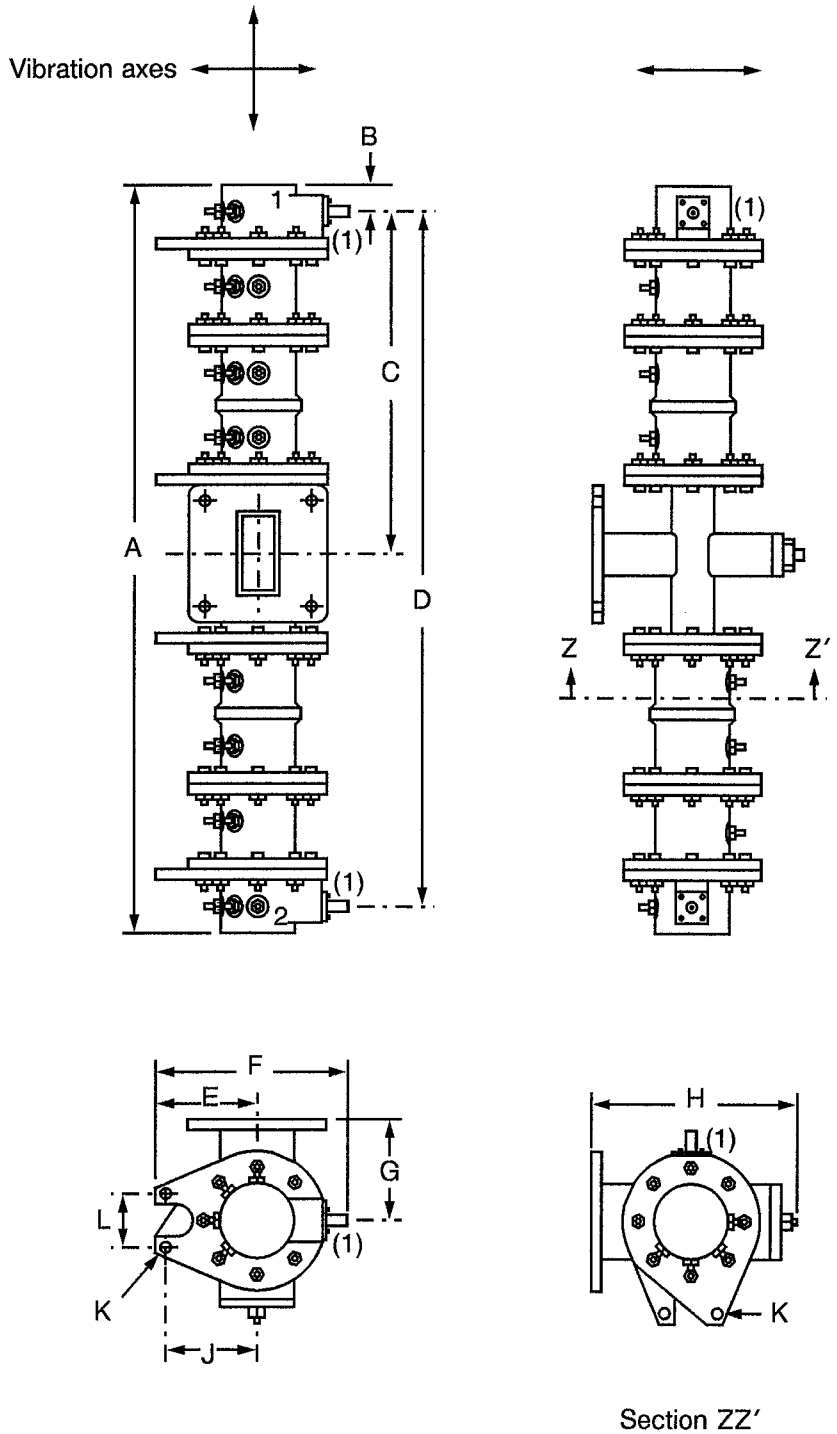
FIGURE 2(a) - PHYSICAL DIMENSIONS



NOTES

1. Connector basic outline. Full connector details are contained in the relevant ESA/SCC No. 3402/xxx Detail Specification.

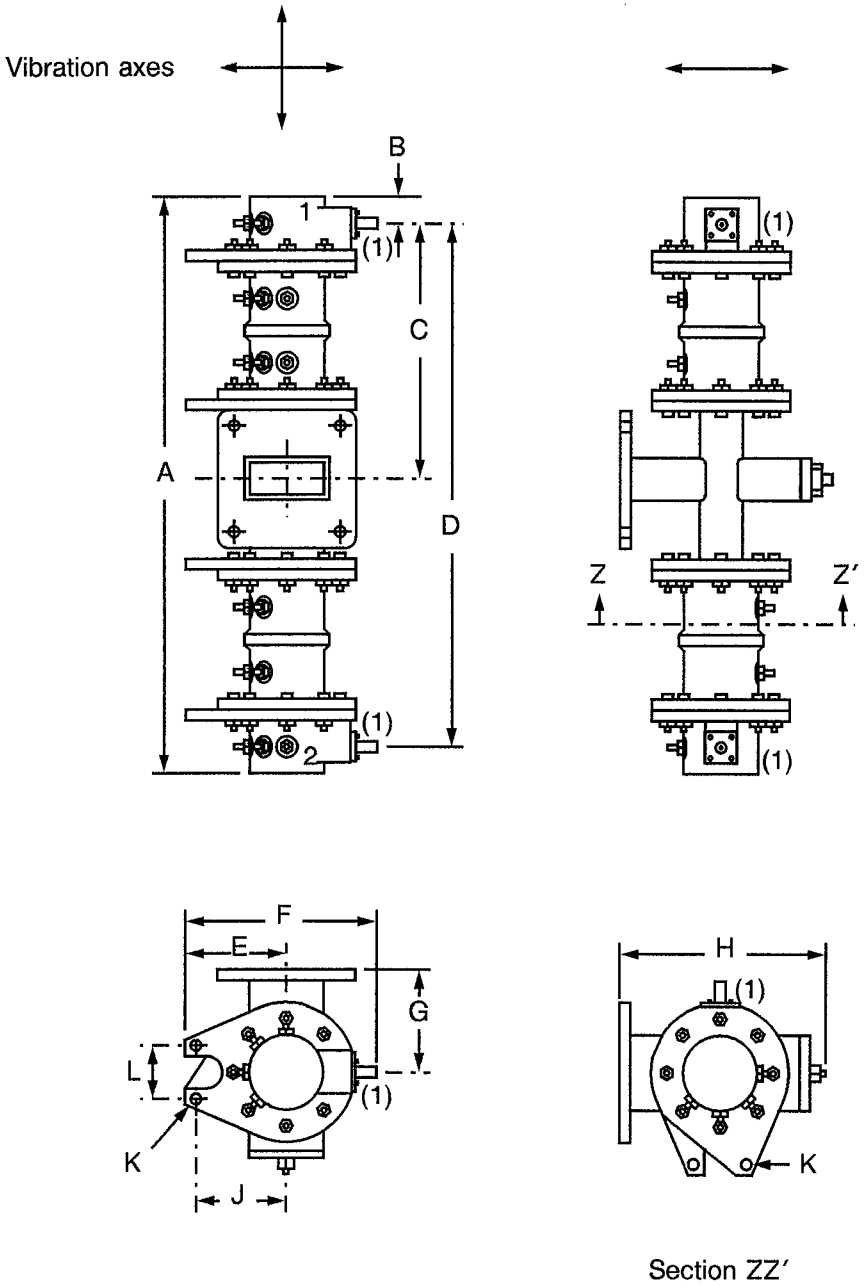
FIGURE 2(b) - PHYSICAL DIMENSIONS



NOTES

1. Connector basic outline. Full connector details are contained in the relevant ESA/SCC No. 3402/xxx Detail Specification.

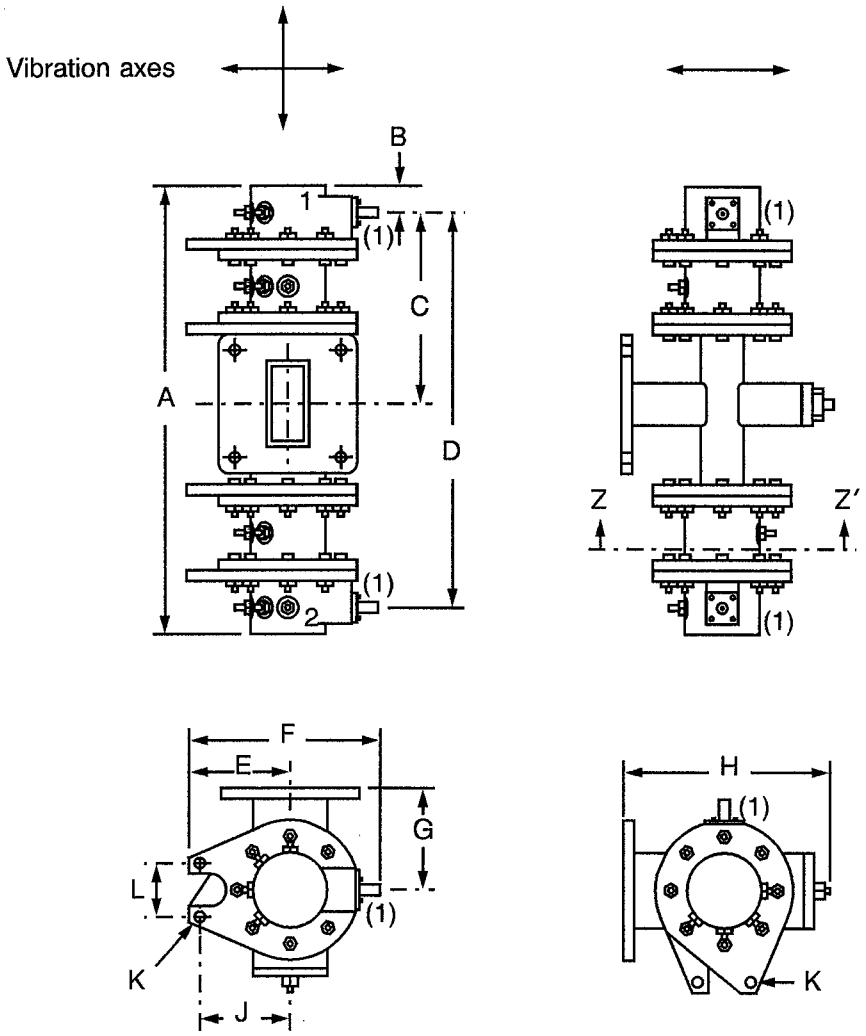
FIGURE 2(c) - PHYSICAL DIMENSIONS



NOTES

1. Connector basic outline. Full connector details are contained in the relevant ESA/SCC No. 3402/xxx Detail Specification.

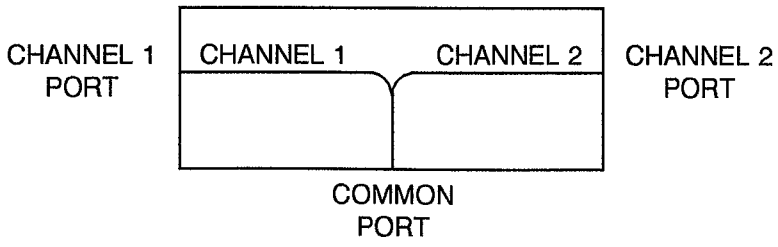
FIGURE 2(d) - PHYSICAL DIMENSIONS



NOTES

1. Connector basic outline. Full connector details are contained in the relevant ESA/SCC No. 3402/xxx Detail Specification.

FIGURE 3 - FUNCTIONAL DIAGRAM



NOTES

1. Channel 1 and Channel 2 can be used as inputs or outputs.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the components specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3102 for Waveguide Filters and Multiplexers. 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. 9.6, Seal Test: 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. 9.6, Seal Test: Shall not be performed.
(b) Para. 9.20, Operating Life: The power shall be applied to the common port.
(c) Para. 9.22, Peak Power: The power shall be applied to the common port.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.6, Seal Test: Shall not be performed.
(b) Para. 9.20, Operating Life: The power shall be applied to the common port.
(c) Para. 9.22, Peak Power: The power shall be applied to the common port.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the components specified herein shall be verified in accordance with the requirements set out in Para. 9.15 of ESA/SCC Generic Specification No. 3102 and shall conform to those shown in the Individual Tables 1(a).

4.3.2 Weight

The maximum weight of the components specified herein shall be as defined in Item 14 of the individual Tables 1(a).

4.3.3 Contact Engagement and Separation Forces

Where applicable, the test conditions shall be as specified in the relevant ESA/SCC 3402/xxx Detail Specification.

4.3.4 Voltage Proof

Where applicable, the test conditions shall be as specified in the relevant ESA/SCC 3402/xxx Detail Specification.

4.3.5 Coupling Proof Torque

Where applicable, the applied torque shall be as specified in the relevant ESA/SCC 3402/xxx Detail Specification.

4.3.6 Mating and Unmating Forces

Where applicable, the maximum torque shall be as specified in the relevant ESA/SCC 3402/xxx Detail Specification.

4.3.7 Centre Contact Retention

Where applicable, the test conditions shall be as specified in the relevant ESA/SCC 3402/xxx Detail Specification.

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 Diplexers 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

Invar 36, silver plated 8.0µm over electroless nickel 8.0µm.

4.4.3 Tuning Screws and Nuts

Stainless steel, silver plated 8.0µm over electrolytic nickel 8.0µm.

4.4.4 Connector Receptacles

As per the relevant ESA/SCC 3402/xxx Detail Specification.

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 Figure 2.

4.5.3 The SCC Component Number

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

310200101B

Detail Specification Number
Type Variant (see Table 1(a))
Testing Level

4.5.4 Traceability Information

Each component shall be marked in respect of traceability information as defined in ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL MEASUREMENTS

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 $T_{amb} = +22 \pm 3$ °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. Unless otherwise specified the measurements shall be performed at the operating temperature extremes specified in Item 13 of the Individual Tables 1(a).

4.6.3 Circuits for Electrical Measurements

Circuits for electrical measurements are given in ESA/SCC Generic Specification No. 3102.

4.7 BURN-IN TESTS

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3102 TEST METHOD	REQUIREMENT
1	Midband Insertion Loss	IL	Para. 9.7.1.2	Item 5, (1)
2	Amplitude Variations	AV	Para. 9.7.1.2	Item 6, (1)
3	Isolation	ISO	Para. 9.7.1.3	Item 7, (1)
4	Out-Of-Band Rejection	BR	Para. 9.7.1.4	Item 8, (1)
5	Group Delay Variations	GD	Para. 9.7.1.5	Item 9, (1)
6	Common Port Return Loss	RL_P	Para. 9.7.1.6	Item 10, (1)
7	Insulation Resistance	Ri	Para. 9.7.1.7	Item 11, (1) (2)

NOTES
1. Individual Tables 1(a).
2. For integral connectors only.

TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	CHARACTERISTICS	SYMBOL	ESA/SCC 3102 TEST METHOD	REQUIREMENT
1	Midband Insertion Loss	IL	Para. 9.7.1.2	Item 5, (1)
2	Amplitude Variations	AV	Para. 9.7.1.2	Item 6, (1)
3	Isolation	ISO	Para. 9.7.1.3	Item 7, (1)
4	Out-Of-Band Rejection	BR	Para. 9.7.1.4	Item 8, (1)
5	Group Delay Variations	GD	Para. 9.7.1.5	Item 9, (1)
6	Common Port Return Loss	RL_P	Para. 9.7.1.6	Item 10, (1)

NOTES
1. 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 TESTS

No.	CHARACTERISTICS	SYMBOL	CONDITION	UNIT
1	Case Temperature	T_{case}	+50	°C
2	Input Power	P	Item 3 (1)	W
3	Centre Frequency	fc	Item 1 (1)	MHz

NOTES
1. Individual Tables 1(a).

FIGURE 5 - ELECTRICAL CIRCUIT FOR OPERATING LIFE TESTS

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 3102)

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 specified, 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 specified, 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. 3102. The conditions for operating life testing shall be the same as specified in Table 5 of this specification.

4.8.4 Electrical Circuit 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 TESTING

NO.	ESA/SCC GENERIC SPEC. NO. 3102		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
1	Rapid Change of Temperature	Para. 9.4	Electrical Measurements Visual Examination	Table 2 -			(2) -	
2	Vibration	Para. 9.5	Electrical Measurements Visual Examination	Table 2 -			(2) -	
3	Seal Test	Para. 9.6	Not applicable	-			-	
4	Coupling Proof Torque	Para. 9.8 and Para. 4.3.5 of this spec.	Interface Dimensions Visual Examination	- -			3402/xxx Fig. 2 -	
5	Mating and Unmating Forces	Para. 9.9 and Para. 4.3.6 of this spec.	3402/xxx Table 6	-			3402/xxx Table 6	
6	Centre Contact Retention	Para. 9.10 and Para. 4.3.7 of this spec.	3402/xxx Table 6	-			3402/xxx Fig. 2	
7	Contact Engagement and Separation Forces	Para. 9.13 and Para. 4.3.3 of this spec.	3402/xxx Table 6	-			3402/xxx Table 6	
8	Shock or Bump	Para. 9.16	Electrical Measurements Visual Examination	Table 2 -			(2) -	
9	Permanence of Marking	Para. 9.17	-	-			-	
10	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 - Electrical Measurements Visual Examination	 Table 3 Table 3 - Table 2 -			 (2) (2) No discharge (2) -	
11	Corrosion	Para. 9.19	Visual Examination	-			-	
12	Operating Life	Para. 9.20.1 Para. 9.20.3 Para. 9.20.4	Initial Electr. Measurements Intermediate Electr. Meas. Final Electr. Measurements	Table 2 Table 2 Table 2			(2) (2) (2)	
13	Peak Power	Para. 9.21 Peak Power: (2) Pulse duration: 1.0μs Cycle rate: 1.0 sec.	Electrical Measurements Visual Examination	Table 2 -			(2) -	
14	Power Level	Para. 9.22 Power: 1.5P (2)	Electrical Measurements Visual Examination	Table 2 -			(2) -	
15	High Temperature Storage	Para. 9.23	Initial Electr. Measurements Intermediate Electr. Meas. Final Electr. Measurements	Table 2 Table 2 Table 2			(2) (2) (2)	
16	Endurance	Para. 9.24	Mating and Unmating Forces Contact Resistance Visual Examination	Gen. 3402 Para. 9.18 - -	 Rc		3402/xxx Table 6 -	 MΩ
17	External Visual Inspection	Para. 9.14	-	-			-	

NOTES

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

TABLE 1(a) - TYPE VARIANT DETAILED INFORMATION

TYPE VARIANT No. 01

No.	CHARACTERISTIC		SYMBOL	LIMITS MIN.	LIMITS MAX	UNIT	REMARKS
1	Centre Frequencies	Channel 1 Channel 2	fc1 fc2	11765.84 11842.56		MHz	-
2	Operating Bandwidth	Channel 1 Channel 2	BW1 BW2	27 27		MHz	Note 1
3	Rated RF Power (Continuous)		P	-	10	W	Note 2
4	Peak RF Power Peak RF Power Duration		P_P t	- -	20 20	W Mins	Note 2 Note 3
5	Midband Insertion Loss	Channel 1 Channel 2	IL1 IL2	- -	5.0 5.0	dB	-
6	Amplitude Variations	fc1 ± 5.0MHz fc1 ± 8.0MHz fc1 ± 10MHz fc1 ± 12MHz fc1 ± 13.5MHz fc2 ± 5.0MHz fc2 ± 8.0MHz fc2 ± 10MHz fc2 ± 12MHz fc2 ± 13.5MHz	AV1 - 5 AV1 - 8 AV1 - 10 AV1 - 12 AV1 - 13.5 AV2 - 5 AV2 - 8 AV2 - 10 AV2 - 12 AV2 - 13.5	- - - - - - - - - -	0.2 0.4 0.6 0.8 1.0 0.2 0.4 0.6 0.8 1.0	dB	Notes 4, 5
7	Isolation	fc1 ± 13.5MHz fc2 ± 13.5MHz	ISO12 ISO21	50 50	- -	dB	-
8	Out-Of-Band Rejection	fc1 ± 25MHz fc1 ± 39MHz fc1 + 39MHz to 15GHz < fc1 − 39MHz fc2 ± 25MHz fc2 ± 39MHz fc2 + 39MHz to 15GHz < fc2 − 39MHz	BR1 - 25 BR1 - 39 BR1 - 39/15 BR1 - <39 BR2 - 25 BR2 - 39 BR2 - 39/15 BR2 - <39	30 40 40 40 30 40 40 40	- - - - - - - -	dB	Notes 4, 6
9	Group Delay Variations	fc1 ± 10MHz fc1 ± 12MHz fc1 ± 13.5MHz fc2 ± 10MHz fc2 ± 12MHz fc2 ± 13.5MHz	GD1 - 10 GD1 - 12 GD1 - 13.5 GD2 - 10 GD2 - 12 GD2 - 13.5	- - - - - -	5.0 7.5 10 5.0 7.5 10	ns	Notes 4, 7
10	Common Port Return Loss		RL_P	15	-	dB	Note 8
11	Insulation Resistance		Ri	Not applicable		GΩ	Note 9
12	RF Leakage		E	55	-	dB	-
13	Operating Temperature Range		Top	0	+50	°C	Tamb, Note 10
14	Weight		-	-	700	g	-
15	Interfaces	Common Channel 1 Channel 2	- - -	154 IEC-PBR 120 340200229B 340200229B		- - -	Notes 11, 12
16	Outline Drawing		-	Figure 2(a)		-	-
17	Physical Dimensions		A B C D E F G H J K L	- 11.74 113.52 203.08 27.72 - 30.25 - 22.72 5.10 16.97	253.80 11.76 113.58 233.14 27.78 60.00 31.25 55.00 22.78 5.15 17.03	mm	Note 13

NOTES: See Page 8.