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R.F. ATTENUATORS, FIXED, COAXIAL,

0 - 20 dB, 0 - 22 GHz

ESA/SCC Detail Specification No. 3403/005

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 2	October 1999		
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DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 1 and incorporates all modifications defined in Revisions 'A' and 'B' to Issue 1 and the changes agreed in the following DCRs:-		
		Cover page		None
		DCN		None
		Para. 1.2	: Text completed	23916
		Para. 2	: Item (c) deleted and (d) renumbered as "(c)"	23916
		Table 1(a)	: Variants 32 and 33 added	221457
		Figure 3	: New Figure 3 entry added	23916
		Para. 3	: Symbol and definition for RL deleted	23916
		Para. 4.4.2	: Finish amended	221457
		Para. 4.5.1	: Existing text deleted and new text added	23916
		Para. 4.5.2	: Testing Level text completed	23916
		Para. 4.7.2	: In the second sentence, "5" amended to "5(a)"	23916
		Table 2	: No. 1, Characteristics and Symbol standardised	23916
		Figure 4	: New entry added and existing Figure 3 included	23916
		Table 4	: No. 1, corrected to "2"	23916
		Table 5	: Renumbered as "5(a)"	23916
			: Duration deleted	23916
		Table 5(b)	: Added from existing Table 7 and Duration deleted	23916
		Figure 5(a)	: New entry added	23916
		Figure 5(b)	: Added from existing Figure 4	23916
		Para. 4.8.4	: In the second sentence, "7" amended to "5(b)"	23916
		Para. 4.8.5	: In the text, "4" amended to "5(b)"	23916
		Para. 4.8.6	: Paragraph deleted in toto	23916
		Table 6	: Nos. 1 and 2, under Test Methods and Conditions, "3" amended to "4"	23916
			: No. 8, under Test Methods and Conditions, "7" and "4" amended to 5(b)	23916
		Table 7	: Table deleted in toto	23916
'A'	Feb. '02	P1. Cover page		None
		P2. DCN		None
		P6. Table 1(a)	: New Table 1(a) inserted.	221622
		P9. Para. 4.2.3	: Item (a) added.	221668

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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 R.F. Attenuators, Fixed, Coaxial, 0 to 20 dB, 0 - 22 GHz. It shall be read in conjunction with ESA/SCC Generic Specification No. 3403, the requirements of which are supplemented herein.

1.2 COMPONENT TYPE VARIANTS

Variants of the basic type attenuators specified herein, which are also covered by this specification, are given in Table 1(a).

1.3 MAXIMUM RATINGS

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

1.4 PARAMETER DERATING INFORMATION

The parameter derating information for the attenuators specified herein, is shown in Figure 1.

1.5 PHYSICAL DIMENSIONS

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

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. 3403, Attenuators and Loads, RF, Coaxial, Fixed.

(b) ESA/SCC Detail Specification No. 3402/003, RF Coaxial Connectors, Type SMA, 50 Ohms, Adaptors and Connecting Pieces.

(c) MIL-G-45204, Gold-plating, Electro-deposited.

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. In addition, the following symbols are used:-

E = RF Leakage.

TABLE 1(a) - TYPE VARIANTS

Variant No.	Attenuation (dB)	Attenuation Tolerance vs Frequency			Flatness (dB)	VSWR
		d.c. (±dB)	0<f≤18GHz (±dB)	18<f≤22GHz (±dB)		
01	0	0.2	0.3	0.4		
02	0.5	0.2	0.3	0.4		0<f≤4.0 GHz
03	1.0	0.2	0.3	0.4		<1.15
04	1.5	0.2	0.3	0.4		
05	2.0	0.2	0.3	0.4		
06	2.5	0.2	0.3	0.4		
07	3.0	0.2	0.3	0.4	f≤13 GHz	
08	3.5	0.2	0.3	0.4	0.05dB / 0.5GHz	
09	4.0	0.2	0.3	0.4		
10	4.5	0.2	0.3	0.4		
11	5.0	0.2	0.3	0.4		4<f≤8.0 GHz
12	5.5	0.2	0.3	0.4		<1.2
13	6.0	0.2	0.3	0.4		
14	6.5	0.2	0.3	0.4		
15	7.0	0.3	0.4	0.5	f>13 GHz	
16	7.5	0.3	0.4	0.5	0.07dB / 0.5GHz	8<f≤12.4 GHz
17	8.0	0.3	0.4	0.5		<1.25
18	8.5	0.3	0.4	0.5		
19	9.0	0.3	0.4	0.5		
20	9.5	0.3	0.4	0.5		
21	10	0.3	0.4	0.5		12.4<f≤18 GHz
22	11	0.3	0.5	0.6		<1.35
23	12	0.3	0.5	0.6	f≤13 GHz	
24	13	0.3	0.5	0.6	0.07dB / 0.5GHz	
25	14	0.3	0.5	0.6		
26	15	0.4	0.5	0.6		
27	16	0.4	0.5	0.6		18<f≤22 GHz
28	17	0.4	0.5	0.6	f>13 GHz	<1.5
29	18	0.4	0.5	0.6	0.1dB / 0.5GHz	
30	19	0.4	0.5	0.6		
31	20	0.4	0.5	0.6		

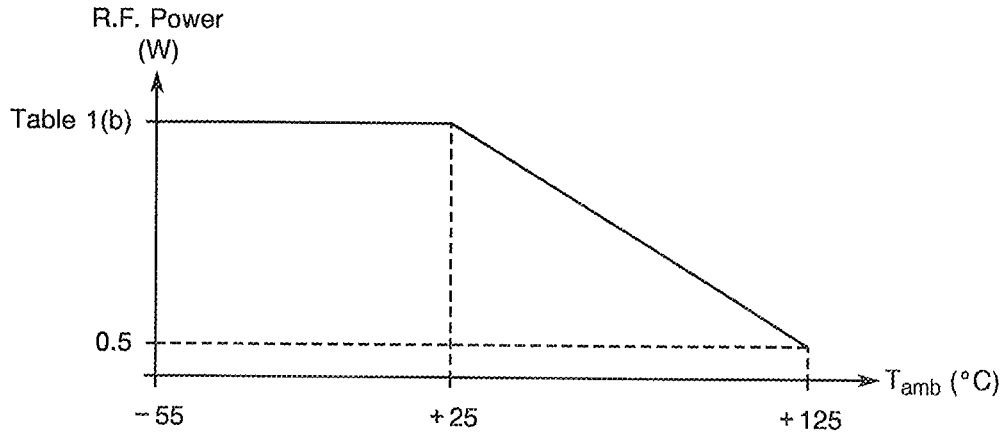
TABLE 1(b) - MAXIMUM RATINGS

No.	Characteristics	Symbol	Maximum Ratings		Unit	Remarks
			Min.	Max.		
1	R.F. Power	P	-	2.0	W	Notes 1 and 3
2	Peak Power	P_p	-	200	W	Note 2
3	Operating Temperature Range	T_{op}	−55	+125	°C	T_{amb}
4	Storage Temperature Range	T_{stg}	−55	+125	°C	
5	Frequency Range	f	0	22	GHz	
6	Impedance	Z	48	52	Ω	
7	RF Leakage	E	−85	-	dB	
8	Coupling Nut Torque	Tq	-	120	N.cm	

NOTES

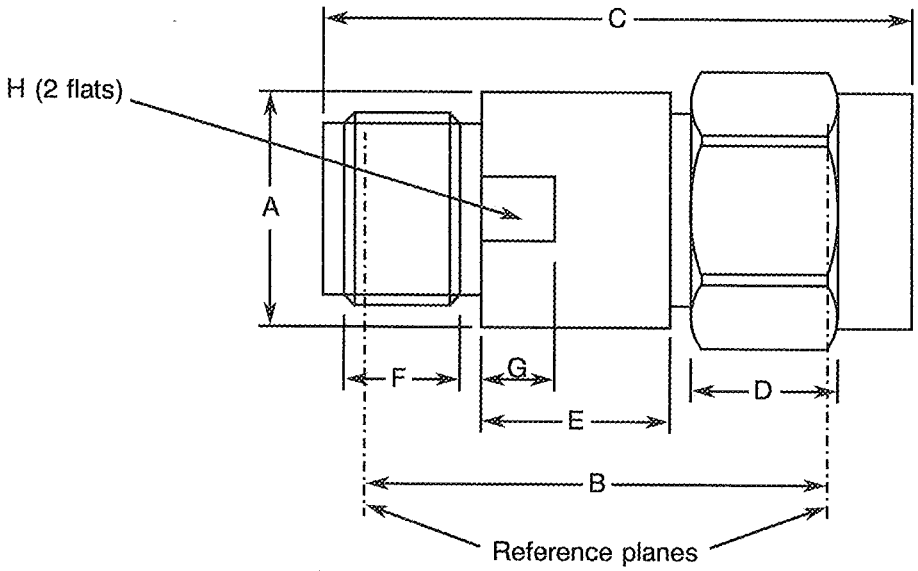
1. See Figure 1.
2. Duration 1.0µs, cyclic rate 1 second.
3. Attenuation greater than 10dB, 1.0W only.

FIGURE 1 - PARAMETER DERATING INFORMATION



RF Power versus Temperature

FIGURE 2 - PHYSICAL DIMENSIONS



(See ESA/SCC Detail Specification No. 3402/003)

SYMBOL	MILLIMETRES	
	MIN.	MAX.
A	-	7.7
B	16.7	17.1
C	20.9	-
D	5.7	6.1
E	6.5	7.1
F	3.9	-
G	1.9	2.3
H	6.9	7.0

FIGURE 3 - FUNCTIONAL DIAGRAM

Not applicable.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the attenuators specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 3403. Deviations from the Generic Specification, applicable to this specification only, are listed 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 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)

None.

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

(a) Para. 9.6.3, Electrical Measurement at High and Low Temperatures: Shall not be performed.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.14, Operating Life: Test frequency shall be 18GHz.

(b) Para. 9.16, R.F. Leakage Test: Shall be performed.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the attenuators specified herein shall be verified in accordance with the requirements set out in Para. 9.20 of ESA/SCC Generic Specification No. 3403. They shall conform to those shown in Figure 2 of this specification.

4.3.2 Weight

The maximum weight of the attenuators specified herein shall be 5.0 grammes.

4.3.3 Coupling Proof Torque

The requirements for testing of the coupling proof torque are specified in Section 9 of ESA/SCC Generic Specification No. 3403. The applied torque shall be 170N.cm.

4.3.4 Mating and Unmating Forces

The applicable measurement requirements are specified in Section 9 of ESA/SCC Generic Specification No. 3403. The maximum torque during mating and unmating shall not exceed 24N.cm. Whenever a test is performed with mated connectors, the connector/attenuator shall be torqued at 80 - 120 N.cm.

4.3.5 Contact Engagement and Separation Forces

The requirements for this test are specified in Section 9 of ESA/SCC Generic Specification No. 3402 and apply to female contacts only.

Female contacts shall be capable of meeting the requirements of Para. 4.3.8(c) of ESA/SCC Detail Specification No. 3402/003.

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 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.

4.4.1 Body and Coupling Nut

Electro-passivated amagnetic stainless steel.

4.4.2 Centre Contact

Material:	Beryllium copper.
Underplate:	Nickel, 2.0µm minimum.
Plating:	Gold, 1.27µm minimum, Type 2 Grade C of MIL-G-45204.

4.4.3 Inserts

PTFE.

4.5 MARKING

4.5.1 General

The marking of all components delivered to this specification shall be in accordance with with the requirements of ESA/SCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

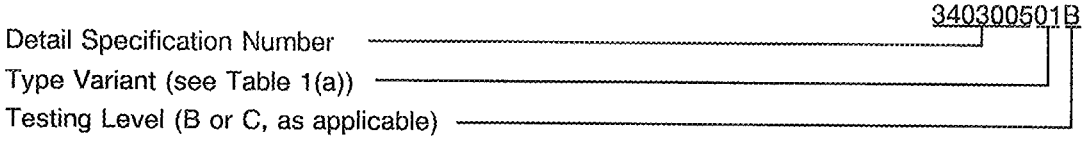
The information to be marked and the order of precedence, shall be as follows:-

(a) The SCC Component Number.

(b) Traceability Information.

4.5.2 The SCC Component Number

The SCC Component Number shall be constituted and marked as follows.



4.5.3 Traceability Information

Traceability information shall be marked 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. 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.

4.6.3 Circuits for Electrical Measurements

Circuits for electrical measurements are given in ESA/SCC Generic Specification No. 3403.

4.7 BURN-IN AND ELECTRICAL MEASUREMENTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at $T_{amb} = +22 \pm 3$ °C. The parameter drift values (Δ) applicable to the parameters scheduled, shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 3403. The conditions for burn-in shall be as specified in Table 5(a) of this specification.

On completion of burn-in, a recovery period of 24 ± 2 hours is necessary before performance of the end measurements.

4.7.3 Electrical Circuits for Burn-in (Figure 5(a))

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Symbol	Spec. and Test Method	Test Conditions	Limits		Unit
					Min.	Max.	
1	Voltage Standing Wave Ratio	VSWR	ESA/SCC Gen. Spec. No. 3403 Para. 9.6.1.1	Para. 9.6.1.1	See Table 1(a)		-
2	Attenuation	Att	ESA/SCC Gen. Spec. No. 3403 Para. 9.6.1.2	Para. 9.6.1.2 (Note 1)	See Table 1(a)		-
3	Attenuation Swept Frequency	Att	ESA/SCC Gen. Spec. No. 3403 Para. 9.6.1.2	Para. 9.6.1.2 (Note 2)	See Table 1(a)		-

NOTES

1. This measurement shall be made at 2.0, 12.4 and 22 GHz.
2. This measurement shall only be made at the end of Burn-in.

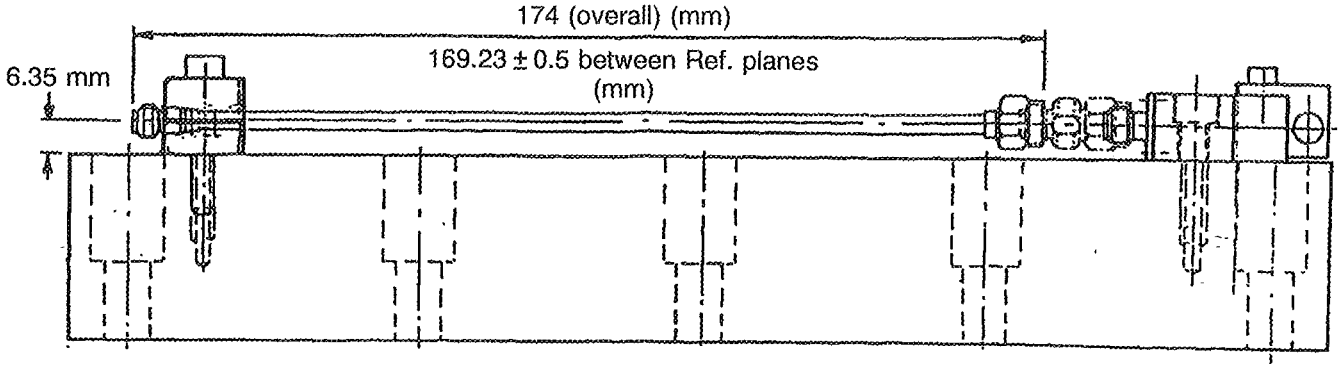
TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

No.	Characteristics	Symbol	Spec. and Test Method	Test Conditions	Limits		Unit
					Min.	Max.	
2	Attenuation Drift	ΔAtt	ESA/SCC Gen. Spec. No. 3403 Para. 9.6.1.2	Para. 9.6.1.3 (Notes 1 and 2)	-	7.10^{-4}	dB/dB/°C

NOTES

1. Measurement to be made on 2 samples only. If 1 failure occurs, the complete lot shall be measured.
2. This measurement shall be made at 2.0, 12.4 and 22 GHz, at both temperatures, −55 and +125°C

FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS



Schematic for Vibration and Shock or Bump

TABLE 4 - PARAMETER DRIFT VALUES

No.	Characteristics	Symbol	Spec. and/or Test Method	Test Conditions	Limits	Unit
2	Attenuation Drift	ΔAtt	As per Table 2	As per Table 2	0.05 or (1) ±0.5	dB %

NOTES

1. Whichever is greater.

TABLE 5(a) - CONDITIONS FOR BURN-IN

No.	Characteristics	Symbol	Condition	Unit
1	Input Power	P	0	W
2	High Temperature	T	+125(+0−3)	°C

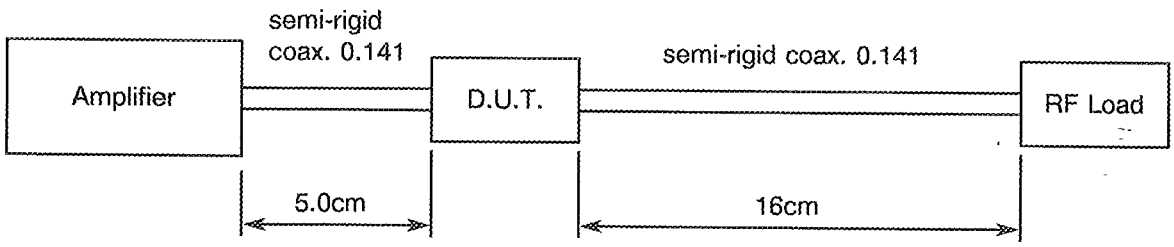
TABLE 5(b) - CONDITIONS FOR OPERATING LIFE TESTING

No.	Characteristics	Symbol	Limits	Unit
1	RF Power	P_{in}	Table 1(b) Item 1	-
2	Frequency	f	18	GHz
3	Ambient Temperature	T_{amb}	+25	°C

FIGURE 5(a) - SCHEMATIC FOR BURN-IN

Not applicable.

FIGURE 5(b) - SCHEMATIC FOR OPERATING LIFE TESTING



4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION No. 3403)

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 during Endurance Tests

Not applicable.

4.8.3 Measurements and Inspections on Completion of Endurance Tests

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

4.8.4 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. 3403. The conditions for operating life testing shall be as specified in Table 5(b) of this specification.

4.8.5 Electrical Circuits for Operating Life Tests

The electrical circuit for operating life testing is given in Figure 5(b).

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL AND ENDURANCE TESTING

No.	ESA/SCC GENERIC SPEC. NO. 3403		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
01	Vibration	Para. 9.7 and Figure 4 of this spec.	**Initial Measurements** Attenuation **During Last Cycle** Intermittent Contact **Final Measurements** Visual Examination Attenuation Drift	 Table 2 Item 2 >0.5ms. No open or short circuits No damage Table 2 Item 2	 Att - - ΔAtt	 Record Values - - -0.05 -0.5	 - - +0.05 +0.5	 - - dB or % (2)
02	Shock or Bump	Para. 9.8 and Figure 4 of this spec.	**Initial Measurements** Attenuation **Final Measurements** Visual Examination Attenuation Drift	 Table 2 Item 2 No damage Table 2 Item 2	 Att - ΔAtt	 Item 01 Value - -0.05 -0.5	 - +0.05 +0.5	 - dB or % (2)
03	Rapid Change of Temperature	Para. 9.9	**Initial Measurements** Attenuation **Final Measurements** Visual Examination Attenuation Drift	 Table 2 Item 2 After recovery time of 24 ± 2 hrs No damage Table 2 Item 2	 Att - ΔAtt	 Record Values - -0.05 -0.5	 - +0.05 +0.5	 - dB or % (2)
04	Climatic Sequence	Para. 9.10 Dry Heat Cold Test	Attenuation Drift Attenuation Drift **Final Measurements** Visual Inspection Attenuation Drift	Table 3 Item 2 at +125°C Table 3 Item 2 at -55°C After recovery time between 1 hr and 24 hrs ESA/SCC Basic Spec No. 20500 Table 2 Item 2	ΔAtt ΔAtt - ΔAtt	Table 3 Item 2 Table 3 Item 2 - -0.1 -1.0	 - +0.1 +1.0	 - dB or % (2)
05	Coupling Proof Torque	Para. 9.11 and Para. 4.3.3 of this spec.	Interface Dimensions	ESA/SCC No. 3402 Para. 9.4	-	Figure 2 of 3402/003		-
06	Mating and Unmating Forces	Para. 9.12 and Para. 4.3.4 of this spec.	Torque	ESA/SCC No. 3402 Para. 9.5	-	Para. 4.3.4		N.cm
07	Connector Repeatability (Not applicable to Loads)	Para 9.13	Attenuation Drift	Table 2 Item 2	ΔAtt	-0.05 -0.5	+0.05 +0.5	dB or % (2)
08	Operating Life	Para 9.14 and Para. 4.2.4, Table 5(b) and Figure 5(b) of this spec.	**Initial Measurements** Attenuation **Final Measurements** Visual Examination Attenuation Drift	 Table 2 Item 2 No damage Table 2 Item 2	 Att - ΔAtt	 Record Values - -0.1 -1.0	 - +0.1 +1.0	 - dB or % (2)
09	Residual Magnetism (Copper Underplate only)	Para. 9.15	Not applicable					
10	RF Leakage	Para. 9.16 and Para. 4.2.4 of this spec.	RF Leakage	Para. 9.16	E	-	-85	dB

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. Whichever is greater.

TABLE 6 - MEASUREMENTS AND INSPECTIONS ON COMPLETION OF ENVIRONMENTAL AND ENDURANCE TESTING (CONT'D)

No.	ESA/SCC GENERIC SPEC. NO. 3403		MEASUREMENTS AND INSPECTIONS		SYMBOL	LIMITS		UNIT
	ENVIRONMENTAL AND ENDURANCE TESTS (1)	TEST METHOD AND CONDITIONS	IDENTIFICATION	CONDITIONS		MIN.	MAX.	
11	Peak Power	Para. 9.17 and Table 1(b) of this spec.	**Final Measurements** Attenuation	Table 2 Item 2	Att	Table 2 Item 2		
12	Power Sensitivity (Attenuators only)	Para. 9.18 at Power of Table 1(b) and P_{ref} = 1.0mW	**Initial Measurements** Attenuation **Final Measurements** Attenuation Drift	Table 2 Item 2 Table 2 Item 2	Att ΔAtt	Record values −0.05 −0.5	 +0.05 +0.5	 dB or % (2)
13	Corrosion	Para. 9.19	**Final Measurements** Visual Examination	After drying at +40°C for 24 hours No base metal	-	-	-	-
14	Permanence of Marking	Para. 9.21	**Final Measurements** Visual Examination	No corrosion or obliteration of marking	-	-	-	-

NOTES

1. The tests in this table refer to either Chart IV or V and shall be used as applicable.
2. Whichever is greater.