ATTENUATORS AND LOADS,

RF, COAXIAL, FIXED

ESCC Generic Specification No. 3403

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Pages 1 to 31

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ESA/SCC Generic Specification No. 3403

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 3	May 1995		
Revision 'A'	August 1997		
Revision 'B'	April 1999		
Revision 'C'	February 2002		

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 2 and incorporates all modifications defined in Revisions 'A', 'B', 'C' and 'D' to Issue 2 and the following DCR's:-		
		Cover Page		None
		DCN		None
		Para. 2.1	: No. 21500 deleted and No. 24600 added	21078
			: No. 24800 added	23575
			: First sentence amended	23575/ 21078
		Para. 2.2	: ESA PSS-01-702 added	221007
		Para. 4.1	: "or 'C'" added to second sentence	221202
		Para. 4.3	: Last sentence added	221202
		Para. 4.3.2	: Changed to include Testing Level 'C'	221202
		Para. 4.5	: New paragraph added	221007/ 23605
		Chart I	: Changed to include Testing Level 'C'	221202
		Para. 6.2	: "applicable" added	221202
		Para. 7.1.1	: Changed to include Testing Level 'C'	221202
		Para. 7.1.2	: Changed to include Testing Level 'C'	221202
		Para. 7.4	: Editorial improvement	221202
		Para. 8.1.1	: "of tests " added to first line of second alinea	221202
		Para. 8.2.4	: Changed to include Testing Level 'C'	221202
		Para. 8.2.5	: Changed to include Testing Level 'C'	221202
		Para. 8.4	: Last sentence improved	221202
		Chart III	: Changed to include Testing Level 'C'	221202
		Chart IV	: Changes to Para. 9.9 and Para. 9.12 included	221202
		Chart V	: Changes to Para. 9.9 and Para. 9.12 included	221202
		Para. 9.4	: Changed to "Contact and Separation Forces"	221202
		Para. 9.6.3	: Changed to include Testing Level 'C'	221202
		Para. 9.6.5	: "Specified" changed to "Required"	221202
		Para. 9.9	: Changed to "Rapid Change of Temperature"	221202
		Para. 9.12	: Changed to "Mating and Unmating Forces"	221202
		Para. 9.21	: 21700 amended to "24800"	23575
		Para. 10.1.3	: Changed to include Testing Level 'C'	221202
		Para. 10.7.2	: Changed to include Testing Level 'C'	221202
		Para. 10.9.2	: Changed to include Testing Level 'C'	221202
'A'	Aug. '97	Implementation of Policy DCR 21107 is completed by the changes introduced by the following DCR:-		
		P1. Cover page		None
		P2. DCN		None
		P2A. DCN	: Page added	None
		P5. T of C	: Second 10.1.2 corrected to "10.1.3" and renumbered to "28A"	23876
			: Para. 10.1.4 entry added	23876
		P7. Para. 4.1	: Second paragraph amended	23876
			: New paragraph added	23876
		Para. 4.1.3	: Second sentence amended	23876
		Para. 4.1.4	: Text amended	23876
		P10. Chart I	: "(1)" added to Lot Acceptance Boxes and Note added	23876
		P14. Para. 8.2.1	: In the last paragraph, both sentences amended	23876

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		P15. Para. 8.4	: In the last paragraph, "either" and all after "months" deleted	23876
		P20. Para. 9	: Text added	23876
		Para. 9.6.1.4	: Moved to Page 21	None
		P21. Para. 9.6.1.4	: Added from Page 20	None
		P28. Para. 10.1	: "(when applicable)" added to (g)	23876
		1st Para. 10.1.2:	Existing text deleted and new text added	23876
		2nd Para. 10.1.2:	Corrected to "10.1.3" and moved to Page 28A	23876
		P28A.	: Page added	None
		Para. 10.1.3	: Title added from Page 28	None
			: Text deleted and new text added	23876
		Para. 10.1.4	: New paragraph added	23876
		P29. Para. 10.2	: (e) amended	23876
		Para. 10.3	: First sentence amended	23876
		Para. 10.6	: In the second paragraph, second sentence amended	23876
			: Last paragraph deleted	23876
		P30. Para. 10.7.1	: In the second sentence, "provided" replaced by "recorded"	23876
		Para. 10.7.2	: In the text, "provided" replaced by "prepared"	23876
		P31. Para. 11	: In (b), "(when applicable)," added after "testing"	23876
			: In the last sentence, ", when requested," added after "copied"	23876
'B'	Apr. '99	P1. Cover page		None
		P2A. DCN		None
		P14. Para. 8.2.1	: New second sentence added to last paragraph	21111
		P28. Para. 10.1.2.1	: Item (b), "PDA figure and" deleted from text	21119
			: Item (c) rewritten	21119
		P28A. Para. 10.1.3.1	: Item (a), "(including PDA figure)" deleted	21119
'C'	Feb. '02	P1. Cover page		None
		P2A. DCN		None
		P23. Para. 9.19.3	: In the first sentence, "68-2-4" deleted, "68-2-30" inserted.	221656

TABLE OF CONTENTS

1. INTRODUCTION

1.1 SCOPE

This specification defines the general requirements for the qualification approval, procurement, including lot acceptance testing, and delivery of Fixed, RF Coaxial Attenuators and Loads, for space application.

This specification contains the appropriate inspection and test schedules and also specifies the data documentation requirements.

1.2 APPLICABILITY

This specification is primarily applicable to the granting of qualification approval to a component in accordance with ESA/SCC Basic Specification No. 20100 and the procurement of such components from qualified Manufacturers.

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.

2.1 ESA/SCC SPECIFICATIONS

No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.

No. 20500, External Visual Inspection.

No. 20600, Preservation, Packaging and Despatch of SCC Electronic Components.

No. 21300, Terms, Definitions, Abbreviations, Symbols and Units.

No. 21700, General Requirements for the Marking of SCC Components.

No. 22800, ESA/SCC Non-conformance Control System.

No. 24600, Minimum Quality System Requirements.

No. 24800, Resistance to Solvents of Marking, Materials and Finishes.

No. 3402, Connectors, R.F. Coaxial.

With the exception of ESA/SCC Basic Specifications Nos. 20100, 21700, 22800 and 24600, where Manufacturers' specifications are equivalent to, or more stringent than, the ESA/SCC Basic Specifications listed above, they may be used in place of the latter, subject to the approval of the appropriate Qualifying Space Agency.

Such replacements shall be clearly identified in the applicable Process Identification Document (P.I.D.) and listed in an Appendix to the appropriate Detail Specification.

Unless otherwise stated herein, references within the text of this specification to "the Detail Specification" shall mean the relevant ESA/SCC Detail Specification.

2.2 OTHER (REFERENCE) DOCUMENTS

IEC Publication No. 68, Basic Environmental Testing Procedures.

IEC Publication No. 410, Sampling Plans and Procedures for Inspection by Attributes.

ESA PSS-01-702, A Thermal Vacuum Test for the Screening of Space Materials.

2.3 ORDER OF PRECEDENCE

For the purpose of interpretation and in case of conflict with regard to documentation, the following order of precedence shall apply:-

(a) ESA/SCC Detail Specification.

(b) ESA/SCC Generic Specification.

(c) ESA/SCC Basic Specification.

(d) Other documents, if referenced herein.

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

The terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply.

4. REQUIREMENTS

4.1 GENERAL

The test requirements for qualification approval of a component shall comprise final production tests (see Chart II), burn-in and electrical measurements to testing level 'B' (see Chart III) and qualification testing (see Chart IV).

The test requirements for procurement of components shall comprise final production tests (Chart II), burn-in and electrical measurements to testing level 'B' or 'C' as required (Chart III) together with, when applicable, a level of lot acceptance testing (see Chart V) to be specified by the Orderer.

If a Manufacturer elects to eliminate a final production test by substituting an in-process control or statistical process control procedure, the Manufacturer is still responsible for delivering components that meet all of the performance, quality and reliability requirements defined in this specification and the Detail Specification.

4.1.1 Specifications

For qualification approval, procurement (including lot acceptance testing) and delivery of components in conformity with this specification, the specifications listed in Section 2 of this document shall apply in total unless otherwise specified herein or in the Detail Specification.

4.1.2 Conditions and Methods of Test

The conditions and methods of test shall be in accordance with this specification, the ESA/SCC Basic Specifications referenced herein and the Detail Specification.

4.1.3 Manufacturer's Responsibility for Performance of Tests and Inspections

The Manufacturer shall be responsible for the performance of tests and inspections required by the applicable specifications. These tests and inspections shall be performed at the plant of the Manufacturer of the components unless it is agreed by the Qualifying Space Agency prior to commencing qualification testing, or procurement, to use an approved external facility.

4.1.4 Inspection Rights

The Qualifying Space Agency (for qualification approval or for a procurement) reserves the right to monitor any of the tests and inspections scheduled in the applicable specifications.

4.1.5 Pre-encapsulation Inspection

The Manufacturer shall notify the Orderer at least 2 working weeks before the commencement of pre-encapsulation inspection. The Orderer shall indicate immediately whether or not he intends to witness the inspection.

4.2 QUALIFICATION APPROVAL REQUIREMENTS ON A MANUFACTURER

To obtain and maintain the qualification approval of a component, or family of components, a Manufacturer shall satisfy the requirements of ESA/SCC Basic Specification No. 20100.

4.3 DELIVERABLE COMPONENTS

Components delivered to this specification shall be processed and inspected in accordance with the relevant Process Identification Document (P.I.D.). Each delivered component shall be traceable to its production lot. Components delivered to this specification shall have completed satisfactorily all tests to the testing level and lot acceptance level specified in the purchase order (see Para. 4.3.2).

ESA/SCC qualified components delivered to this specification shall be produced from lots that are capable of passing all tests, and sequences of tests, that are defined in Charts IV and V. The Manufacturer shall not knowingly supply components that cannot meet this requirement. In the event that, subsequent to delivery and prior to operational use, a component is found to be in a condition such that it could not have passed these tests at the time of manufacture, this shall be grounds for rejection of the delivered lot.

Components failing inspections and tests of the higher testing level (i.e level 'B') shall not be supplied against any order for components of the lower testing level.

4.3.1 Lot Failure

Lot failure may occur during burn-in and electrical measurements (Chart III), qualification testing (Chart IV) or lot acceptance testing (Chart V).

Should such failure occur, the non-conformance procedure shall be initiated in accordance with ESA/SCC Basic Specification No. 22800.

Should such failure occur during procurement, the Manufacturer shall notify the Orderer by telex within 2 working days, giving details of the number and mode of failure and the suspected cause.

In the case where qualification approval has been granted to the component, he shall, at the same time by the same means, inform the Qualifying Space Agency in order that the latter may consider its implications.

No further testing shall be performed on the failed components except on instruction from the Orderer. The Orderer shall inform the Manufacturer and the Qualifying Space Agency within 2 working days of receipt of the telex, by the same means, what action shall be taken.

In the case when lot failure occurs during qualification testing, the Manufacturer shall immediately notify the appropriate Qualifying Space Agency who will define a course of action to be followed. No further testing shall be performed on the failed components.

4.3.2 Testing and Lot Acceptance Levels

This specification defines 2 levels of testing severity which are designated by the letters 'B' and 'C' (see Chart I) and 3 levels of lot acceptance testing (see Chart V).

The lot acceptance levels are designated 1, 2 and 3 and are comprised of tests as follows:-

Level 3 (LA3) - -

Level 2 (LA2) - Endurance Subgroup.

Level 1 (LA1) - Environmental and Mechanical Subgroup
plus Endurance Subgroup.

The required testing level and lot acceptance level shall both be specified in a purchase order.

4.4 MARKING

All components procured and delivered to this specification from a source qualified according to ESA/SCC Basic Specification No. 20100 shall be marked in accordance with ESA/SCC Basic Specification No. 21700. Thus, they shall bear the ESA symbol to signify their conformance to the ESA/SCC qualification approval requirements and full compliance with the requirements of this specification and the Detail Specification.

Components procured from sources which are not ESA/SCC qualified, provided that they fully comply with the procurement requirements of this specification and the Detail Specification, may bear the SCC marking **with the exception of the ESA symbol**.

4.5 MATERIALS AND FINISHES

All non-metallic materials and finishes, that are not within a hermetically sealed enclosure, of the components specified herein shall meet the outgassing requirements as outlined in ESA PSS-01-702.

Specific requirements for materials and finishes are specified in the Detail Specification.

5. PRODUCTION CONTROL

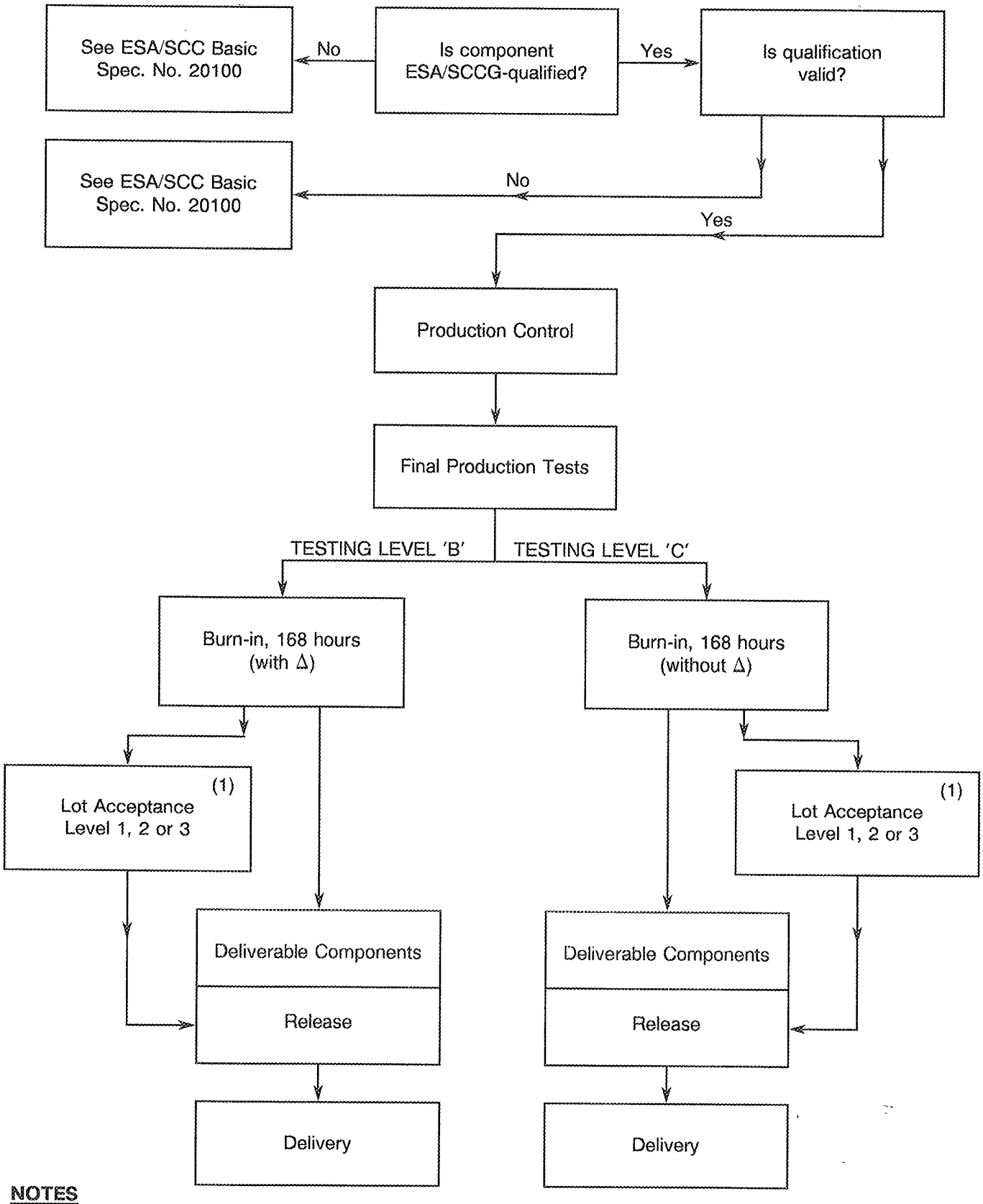
5.1 GENERAL

The minimum requirements for production control, which are equally applicable to procurement, are defined in ESA/SCC Basic Specification No. 20100, Para's 5.1 and 5.2.

5.2 SPECIAL IN-PROCESS CONTROLS

Where applicable, special in-process controls shall apply as specified in the Detail Specification.

CHART I - TESTING LEVELS



NOTES

1. When applicable.

6. FINAL PRODUCTION TESTS

6.1 GENERAL

Unless otherwise specified in the Detail Specification, all components used for qualification testing and all components for delivery, including those submitted to lot acceptance tests, shall be subjected to tests and inspections in accordance with Chart II.

Unless otherwise specified in the Detail Specification, the tests shall be performed in the order shown.

Any components that do not meet these requirements shall be removed from the lot and at no future time be re-submitted to the requirements of this specification.

6.2 TEST METHODS AND CONDITIONS

The applicable test methods and conditions are specified in the paragraphs referenced in Chart II of this specification.

6.3 DOCUMENTATION

Documentation of final production test data shall be in accordance with the requirements of Para. 10.6 of this specification.

7. BURN-IN AND ELECTRICAL MEASUREMENTS

7.1 GENERAL

Unless otherwise specified in the Detail Specification, all components used for qualification testing and all components for delivery, including those submitted to lot acceptance tests, shall be subjected to tests and inspections in accordance with Chart III.

Unless otherwise specified in the Detail Specification, the tests shall be performed in the order shown.

The applicable test methods and conditions are specified in the paragraphs referenced in Chart III.

Components of testing level 'B' shall be serialised prior to the tests and inspections.

7.1.1 Conditions of Test

The conditions for burn-in shall be as shown in Table 5 of the Detail Specification.

Unless otherwise specified in the Detail Specification, components of both levels 'B' and 'C'shall be subjected to a total burn-in period of 168 hours.

7.1.2 Data Points

For components of testing level 'B', undergoing a total burn-in period of 168 hours, the data points for parameter drift measurement shall be 0 hours (initial) and 168 (+24 – 0) hours (final).

For components of testing level 'C', undergoing a total burn-in period of 168 hours, the data points for post burn-in electrical measurements shall be 168 (+24 – 0) hours.

7.2 FAILURE CRITERIA

7.2.1 Parameter Drift Failure

The acceptable delta limits are shown in Table 4 of the Detail Specification. A component of testing level 'B' shall be counted as a parameter drift failure if the changes during burn-in are larger than the delta (Δ) values specified.

7.2.2 Parameter Limit Failure

A component shall be counted as a limit failure if one or more parameters exceed the limits shown in Tables 2 or 3 of the Detail Specification.

Any component which exhibits a limit failure prior to the burn-in sequence shall be rejected and not counted when determining lot rejection.

7.2.3 Other Failures

A component shall be counted as a failure in any of the following cases:

- Mechanical failure.
- Handling failure.
- Lost component.

7.3 FAILED COMPONENTS

A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 7.2 of this specification.

7.4 LOT FAILURE

In the case of lot failure, the Manufacturer shall act in accordance with the requirements of Para. 4.3.1 of this specification.

7.4.1 Lot Failure during 100% Testing

If the number of components failed on the basis of the failure criteria described in Para. 7.2 is:

- 6% of a lot larger than 50 components
- 3 devices of a lot of between 20 and 50 components
- 2 devices of a lot smaller than 20 components

the lot shall be considered as failed.

If a lot is composed of groups of components of one family defined in one Detail Specification, but separately identifiable for any reason, then the lot failure criteria shall apply separately to each identifiable group.

7.4.2 Lot Failure during Sample Testing

A lot shall be considered as failed if the number of allowable failures during sample testing, in accordance with General Inspection Level II of IEC Publication No. 410 and the applicable AQL, as specified in the Detail Specification, is exceeded.

If a lot failure occurs in either case, a 100% testing may be performed with the lot failure criteria given in Para. 7.4.1.

7.5 DOCUMENTATION

Data documentation of burn-in and electrical measurements shall be in accordance with Para. 10.7 of this specification.

8. QUALIFICATION APPROVAL AND LOT ACCEPTANCE TESTS

8.1 QUALIFICATION TESTING

8.1.1 General

Qualification testing shall be in accordance with the requirements of Chart IV of this specification. The tests to Chart IV shall be performed on the specified sample, chosen at random from components which have successfully passed the tests in Charts II and III for testing level 'B'. This sample constitutes the qualification test lot.

The qualification test lot is divided into subgroups of tests and all components assigned to a subgroup shall be subjected to all of the tests in that subgroup, in the sequence shown.

The applicable test requirements are detailed in the paragraphs referenced in Chart IV.

The conditions governing qualification testing are given in ESA/SCC Basic Specification No. 20100, Para. 5.3 and, for the extension or renewal of qualification approval, in Para's 6.3 and 6.4.

8.1.2 Distribution within the Qualification Test Lot

A sample of 10 components shall be submitted to qualification testing (Chart IV). The distribution within the sample shall be as follows:-

Attenuators	Loads coupled with Attenuator Qualification	Loads Alone
Subgroup I - 1 attenuator, 0.5dB (absorbent) - 1 attenuator, minimum value (strip) - 2 attenuators, maximum value (strip)	2	4
Subgroup II - 1 attenuator, 0.5dB (absorbent) - 1 attenuator, minimum value (strip) - 2 attenuators, maximum value (strip)	1	3
Subgroup III - 1 attenuator, 0.5dB (absorbent) - 1 attenuator, minimum value (strip) - 2 attenuators, maximum value (strip)	1	3

The selected distribution shall be agreed with the Qualifying Space Agency.

8.2 LOT ACCEPTANCE TESTING

8.2.1 General

The sample sizes of the 3 lot acceptance levels are specified in Chart V. All components assigned to a subgroup shall be subjected to all of the tests of that subgroup in the sequence shown.

The tests to Chart V shall be performed on the specified sample which shall have been chosen, whenever possible, at random from the proposed delivery lot.

The applicable test requirements are detailed in the paragraphs referenced in Chart V.

As a minimum for procurement of non-qualified components, lot acceptance level 3 tests shall apply. For procurement of qualified components, lot acceptance testing shall be performed if specified in a purchase order. Procurement lots ordered with a lot acceptance test level shall be delivered only after successful completion of lot acceptance testing.

8.2.2 Distribution within the Sample for Lot Acceptance Testing

Where a Detail Specification covers a range or series of components that are considered similar, then it may be necessary that the sample for lot acceptance testing be comprised of component types so selected that they adequately represent all of the various mechanical, structural and electrical peculiarities of the procured range or series.

The distribution of the component types will normally vary from procurement to procurement and shall be as specified by the Orderer, following as closely as possible the requirements prescribed in Para. 8.1.2. of this specification.

8.2.3 Lot Acceptance Level 3 Testing (LA3)

No tests or inspections are required for this level.

8.2.4 Lot Acceptance Level 2 Testing (LA2)

Lot acceptance level 2 testing shall comprise the tests on an endurance subgroup.

For the endurance subgroup, the following shall apply:-

(a) Components of testing level 'C', selected for the endurance subgroup, shall be serialised prior to the test.

(b) The tests in this subgroup are considered to be destructive and therefore components (of testing level 'B' or 'C') so tested shall not form part of the delivery lot.

8.2.5 Lot Acceptance Level 1 Testing (LA1)

Lot acceptance level 1 testing shall comprise the tests for LA2 (endurance subgroup) plus tests on an environmental and mechanical subgroup. For the endurance subgroup, the requirements and conditions for LA2 (see Para. 8.2.4) respectively shall apply.

For the environmental subgroup, the following shall apply:-

(a) Components of testing level 'C', selected for the environmental subgroup, shall be serialised prior to the test.

(b) The tests in this subgroup are considered to be destructive and therefore components (of testing level 'B' or 'C') so tested shall not form part of the delivery lot.

8.3 FAILURE CRITERIA

The following criteria shall apply to qualification testing and to lot acceptance testing.

8.3.1 Environmental and Mechanical Test Failures

The following shall be counted as component failures:

- Components which fail during tests for which the pass/fail criteria are inherent in the test method, e.g. vibration, etc.

8.3.2 Electrical Failures

The following shall be counted as component failures:-

(a) Components which, when subjected to electrical measurements on completion of environmental tests, in accordance with either Table 2 or Table 6, as specified in the Detail Specification, fail one or more of the applicable limits.

(b) Components which, when subjected to electrical measurements on completion of endurance testing, in accordance with Table 6 of the Detail Specification, fail one or more of the applicable limits.

(c) Components which, when subjected to measurement of electrical characteristics, in accordance with Tables 2 and 3 of the Detail Specification, fail one or more of the applicable limits.

8.3.3 Other Failures

The following additional failures may also occur during qualification testing or lot acceptance testing:-

(a) Components failing to comply with the requirements of ESA/SCC Basic Specification No. 20500.

(b) Lost components.

8.4 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para. 8.3 of this specification.

The allowable number of failed components per subgroup, the aggregate failure constraints and the permitted distribution of such failures are shown at the foot of Charts IV and V of this specification.

When requested by the Qualifying Space Agency or the Orderer, failure analysis of failed components shall be performed by the Manufacturer and the results provided.

Failed components from successful lots shall be marked as such and be stored at the Manufacturer's plant for 24 months.

8.5 LOT FAILURE

A lot shall be considered as failed if the allowable number of failures according to Chart IV or V of this specification, as relevant, has been exceeded.

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.1 of this specification.

8.6 DOCUMENTATION

For qualification testing, the qualification test data shall be documented in accordance with the requirements of Para. 10.8 of this specification.

In the case of lot acceptance testing, the data shall be documented in accordance with the requirements of Para. 10.9 of this specification.

CHART II - FINAL PRODUCTION TESTS

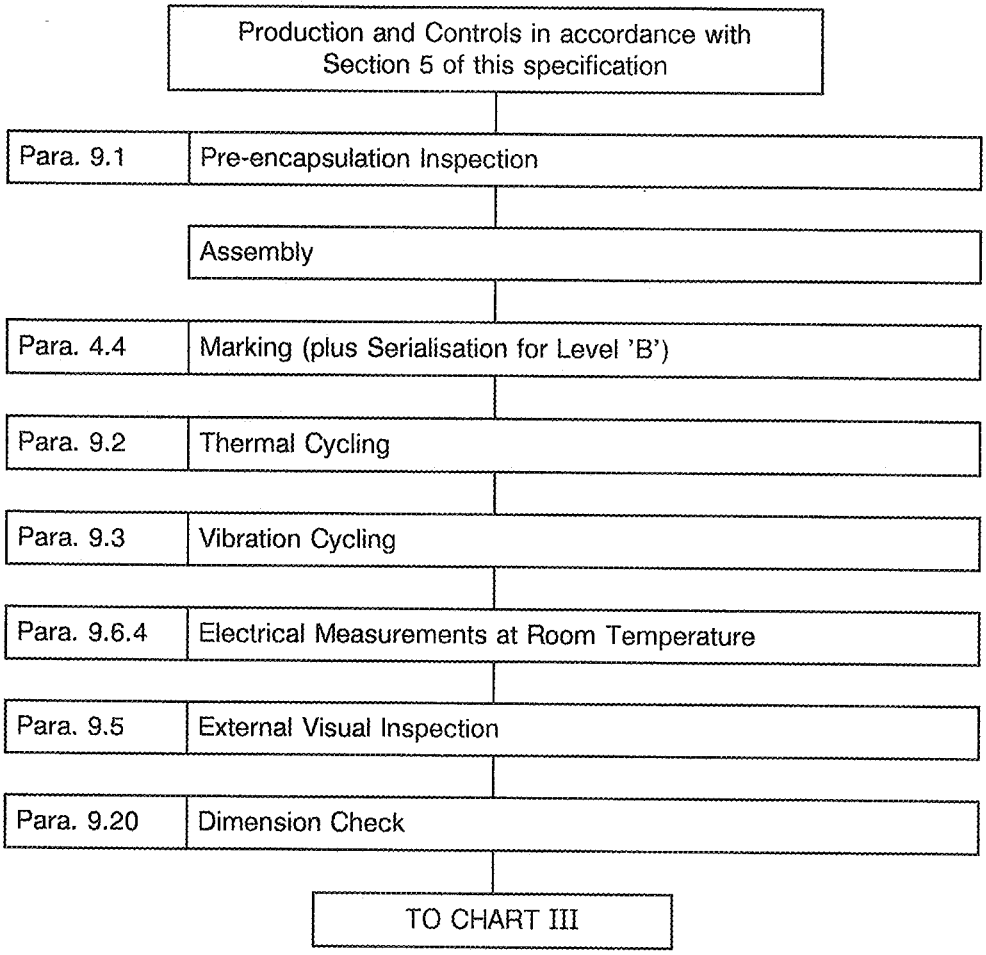


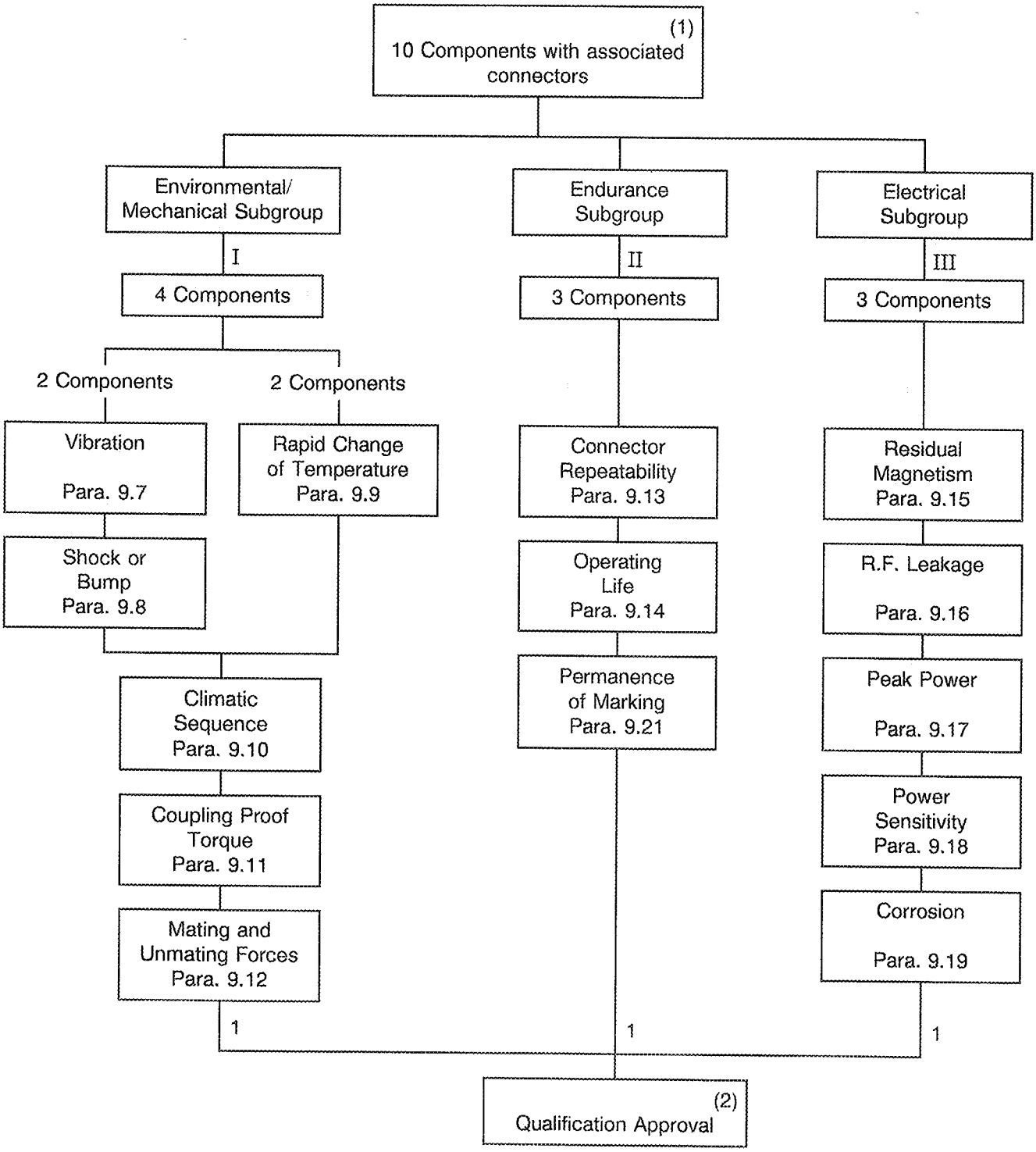
CHART III - BURN-IN AND ELECTRICAL MEASUREMENTS

	Components from Final Production Tests	Testing Levels	
		B	C
Para. 9.6.2	Parameter Drift Value, Initial Measurements	X	-
Para. 7.1	Burn-in, 168 hours	X	X
Para. 9.6.2	Parameter Drift Value, Final Measurements	X	-
Para. 9.6.3	Electrical Measurements at High and Low Temperatures	X	X
Para. 9.6.4	Electrical Measurements at Room Temperature (1)	X	X
Para. 9.4	Contact Engagement and Separation Forces	X	X
Para. 9.5	External Visual Inspection	X	X
Para. 7.4	Check for Lot Failure	X	X
	TO CHART IV OR V		

NOTES

1. The measurements of parameters for the purpose of drift value measurements need not be repeated for electrical measurements at room temperature.

CHART IV - QUALIFICATION TESTS

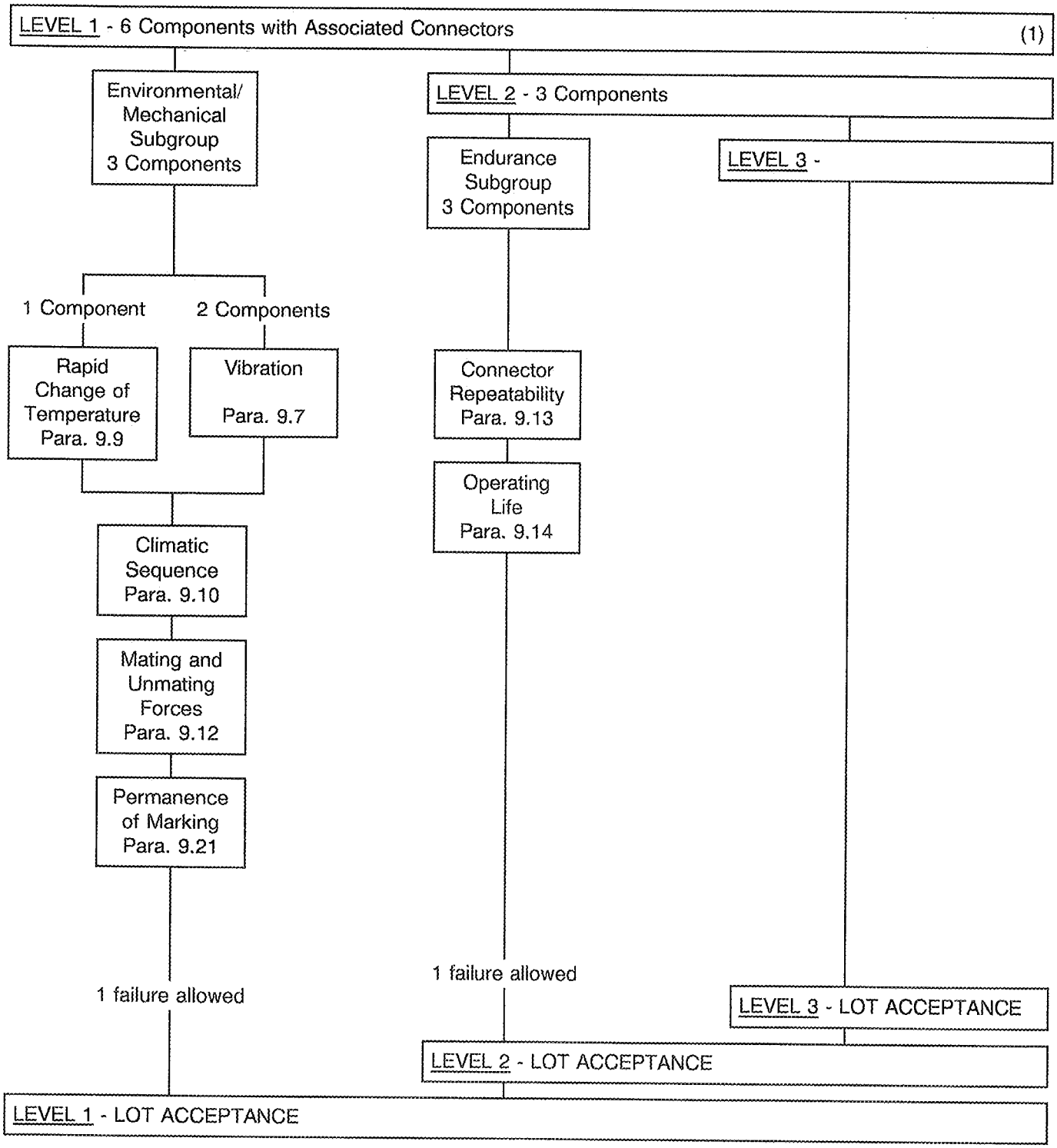


Total allowable number of failed components: 1.

NOTES

1. Associated connectors shall be procured from an ESA/SCC-qualified source.
2. The tests shown in this Chart are considered to be destructive and therefore components so tested shall not form part of the delivery lot.

CHART V - LOT ACCEPTANCE TESTS



Total allowable number of failed components: 1.

NOTES

1. Associated connectors shall be procured from an ESA/SCC-qualified source.
2. The tests shown in this Chart are considered to be destructive and therefore components so tested shall not form part of the delivery lot.

9. TEST METHODS AND PROCEDURES

If a Manufacturer elects to eliminate or modify a test method or procedure, the Manufacturer is still responsible for delivering components that meet all of the performance, quality and reliability requirements defined in this specification and the Detail Specification.

Documentation supporting the change shall be approved by the Qualifying Space Agency and retained by the Manufacturer. It shall be copied, when requested, to the Qualifying Space Agency.

The change shall be specified in the Detail Specification and in the P.I.D.

9.1 PRE-ENCAPSULATION INSPECTION

This inspection shall be performed in accordance with the requirements of ESA/SCC Basic Specification No. 20500.

9.2 THERMAL CYCLING

The components shall be subjected to Test 'Na' of IEC Publication No. 68-2-14. The number of cycles shall be 5 with 30 minutes at each temperature extreme, except that the lower and upper temperatures shall be −30 and +100 °C respectively.

9.3 VIBRATION CYCLING

The components shall be subjected to vibration in accordance with Para. 9.7 of this specification except for the following:

- The number of cycles shall be 3.
- The vibration level shall be 20g.
- The electrical continuity during testing shall not be monitored.

9.4 CONTACT ENGAGEMENT AND SEPARATION FORCES

These measurements shall be performed in accordance with Para. 9.3.2 of ESA/SCC Generic Specification No. 3402

9.5 EXTERNAL VISUAL INSPECTION

See ESA/SCC Basic Specification No. 20500.

9.6 ELECTRICAL MEASUREMENTS

9.6.1 General

Unless otherwise specified in the Detail Specification, the following measurements shall be made under the standard conditions.

9.6.1.1 Voltage Standing Wave Ration (VSWR) (Attenuators and Loads)

This measurement shall be made, on both ends for attenuators, in accordance with Para. 9.16 of ESA/SCC Generic Specification No. 3402.

9.6.1.2 Attenuation (Attenuators only)

This measurement shall be made in accordance with Para. 9.19 of ESA/SCC Generic Specification No. 3402.

9.6.1.3 Attenuation versus Frequency (Attenuators only)

This measurement shall be made identically to the measurement specified in Para. 9.6.1.2 above except that the frequencies shall be one from each third of the rated frequency range.

9.6.1.4 Resistance (Loads only)

This measurement shall be made in accordance with the details set out in the Detail Specification.

9.6.2 Parameter Drift Value Measurements

At each of the relevant data points, measurements shall be made of all parameters listed in Table 4 of the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated.

9.6.3 Electrical Measurements at High and Low Temperatures

For components of testing levels 'B' and 'C', the electrical measurements at high and low temperatures shall be made in accordance with Table 3 of the Detail Specification on a sample of 2 attenuators with the highest attenuation value or 2 loads. The lower and upper temperatures shall be −55 and +125 °C respectively. For testing level 'B', all values obtained shall be recorded against serial numbers.

9.6.4 Electrical Measurements at Room Temperature

The measurements of electrical characteristics shall be made in accordance with Table 2 of the Detail Specification. All values obtained shall be recorded against serial numbers.

9.6.5 Electrical Measurements during Endurance Testing

At each of the relevant data points required for endurance testing, measurements shall be made of all parameters listed in Table 6 of the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated, if required.

9.7 VIBRATION

9.7.1 Mounting

The specimens shall be mechanically connected to the vibration generator either directly or by means of a fixture as specified below. Mounting fixtures shall be such that they enable the specimen to be vibrated in 3 mutually perpendicular axes in turn, which should be so chosen that faults are most likely to be revealed. If the component is provided with specific means of mounting, they shall be used as specified in the Detail Specification and any additional restraining straps should be avoided.

Unless otherwise specified, components not provided with specific mounting means shall be clamped by the body. If external connections, necessary for measuring and supply purposes, are specified in the Detail Specification, they should add the minimum restraint and mass.

9.7.2 Procedure

The components shall be subjected to Test 'Fc' of IEC Publication No. 68-2-6, Procedure B4. Sweep frequency: 10-2000-10 Hz. The entire frequency range of 10 to 2000Hz and return to 10Hz shall be traversed in 10 minutes. This cycle shall be performed 12 times in each of the 3 directions (i.e. 36 times in total), so that the motion is applied for a total period of approximately 6 hours. The vibration amplitude shall be 1.5mm (total display).

9.7.3 Measurement During Vibration

During the last cycle in each direction, an electrical measurement shall be made to determine intermittent contact of 0.5ms or longer duration, or open or short circuiting.

9.7.4 Final Measurements

After vibration, the components shall be visually inspected and there shall be no evidence of damage.

Electrical measurements as specified in Table 6 of the Detail Specification shall be performed and shall not exceed the specified limits.

9.8 SHOCK OR BUMP

9.8.1 Shock

9.8.1.1 Mounting

The specimens shall be fixed to the shock machine, either directly or by means of a fixture as specified below. Mounting fixtures shall enable the specimens to be subjected to shocks in 3 mutually perpendicular axes in turn. When the component is provided with specific mounting means, these shall be used as specified in the Detail Specification and any additional restraining straps should be avoided. Unless otherwise specified, components not provided with specific mounting means shall be clamped by the body. When external connections, necessary for measuring and supply purposes, are specified in the Detail Specification, they should add the minimum restraint and mass.

9.8.1.2 Procedure

The components shall be subjected to Test 'Ea' of IEC Publication No. 68-2-27. Unless otherwise specified in the Detail Specification, the following conditions shall apply:

- Shape of shock pulse : Half-sine.
- Peak acceleration : 100g.
- Duration of pulse : 6.0ms.
- Number of shocks : 18 (3 shocks in each direction along the 3 perpendicular axes of the test specimen).

9.8.1.3 Visual Inspection

After shock, the components shall be visually examined and there shall be no evidence of damage. Electrical measurements as specified in Table 6 of the Detail Specification shall be performed and shall not exceed the specified limits.

9.8.2 Bump

9.8.2.1 Mounting

As specified in Para. 9.8.1.1, the word "shock" to be replaced by "bump".

9.8.2.2 Procedure

The components shall be subjected to Test 'Eb' of IEC Publication No. 68-2-29. Unless otherwise specified in the Detail Specification, the following conditions shall apply:

- Peak acceleration : $390 m/s^2$.
- Number of bumps : 4000 ± 10.

9.8.2.3 Visual Inspection

After bump, the components shall be visually examined and there shall be no evidence of damage. Electrical measurements as specified in Table 6 of the Detail Specification shall be performed and shall not exceed the specified limits.

9.9 RAPID CHANGE OF TEMPERATURE

9.9.1 Initial Measurements

None.

9.9.2 Procedure

The components shall be subjected to Test 'Na' of IEC Publication No. 68-2-14. The number of cycles shall be 10 with 30 minutes at each temperature extreme unless otherwise specified in Table 1(b) of the Detail Specification.

9.9.3 Recovery and Final Measurements

The duration of recovery shall be 24 ± 2 hours at room temperature conditions. After recovery, the components shall be visually examined and there shall be no evidence of damage. Electrical measurements as specified in Table 6 of the Detail Specification shall be performed and shall not exceed the specified limits.

9.10 CLIMATIC SEQUENCE

9.10.1 Initial Measurements

No initial measurements are required.

9.10.2 Dry Heat

The components shall be subjected to Test 'Ba' of IEC Publication No. 68-2-2. Duration: 2 hours. Maximum operating temperature as prescribed in Table 1(b) of the Detail Specification. While still at the specified high temperature and at the end of the period of high temperature, electrical measurements as specified in Table 3 of the Detail Specification shall be performed and shall not exceed the specified limits.

9.10.3 Damp Heat, Accelerated, First Cycle

Unless otherwise specified in the Detail Specification, the components shall be subjected to Test 'D' of IEC Publication No. 68-2-30 for one cycle of 24 hours. After recovery, the components shall be subjected immediately to the cold test.

9.10.4 Cold Test

The components shall be subjected to Test 'Aa' of IEC Publication No. 68-2-1. Duration: 2 hours. Minimum operating temperature as prescribed in Table 1(b) of the Detail Specification. While still at the specified low temperature and at the end of the period of low temperature, electrical measurements as specified in Table 3 of the Detail Specification shall be performed and shall not exceed the specified limits.

9.10.5 Low Air Pressure

The components shall be subjected to Test 'M' of IEC Publication No. 68-2-13 under the following conditions:

- 1 to 2 minutes at 85mbar.
- Temperature: +15 to +25 °C.

Rated d.c. power shall be applied to one end of the attenuator under test while the other end shall be connected to a matched fixed coaxial load, for 1 to 2 minutes immediately after the pressure of 85mbar has been attained.

When loads are tested alone, rated d.c. power shall be applied directly.

9.10.6 Damp Heat, Accelerated, Remaining Cycles

The components shall be subjected to Test 'D' of IEC Publication No. 68-2-4 for 5 cycles of 24 hours.

9.10.7 Final Measurements

After a recovery period of 1 to 24 hours, the components shall be visually inspected in accordance with ESA/SCC Basic Specification No. 20500 and there shall be no evidence of mechanical damage. Electrical measurements as specified in Table 6 of the Detail Specification shall be performed and shall not exceed the specified limits.

9.11 COUPLING PROOF TORQUE

This test shall be performed in accordance with Para. 9.4 of ESA/SCC Generic Specification No. 3402. The requirements are given in the applicable Detail Specification.

9.12 MATING AND UNMATING FORCES

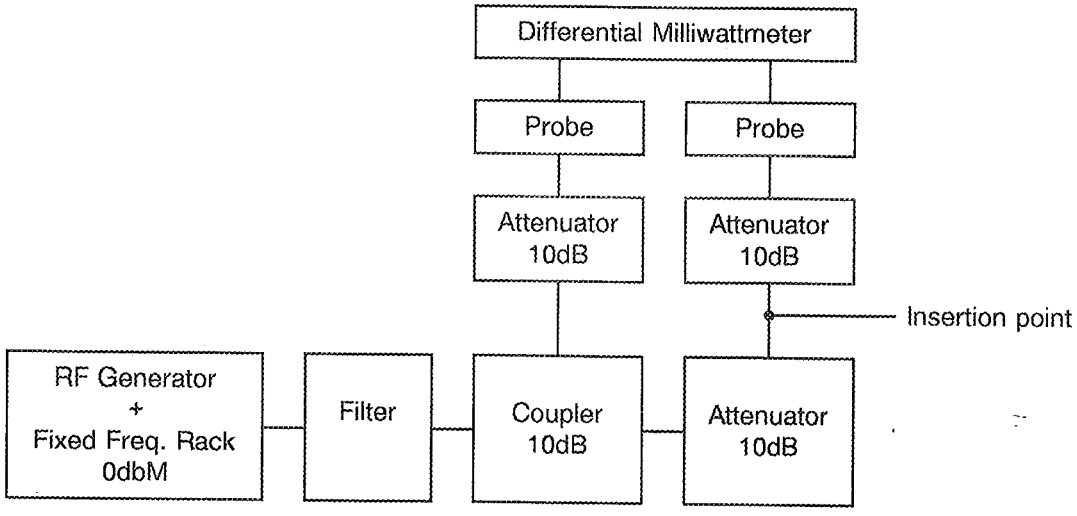
These measurements shall be performed in accordance with the requirements set out in Para. 9.5 of ESA/SCC Generic Specification No. 3402.

9.13 CONNECTOR REPEATABILITY (NOT APPLICABLE TO LOADS)

The components shall be tested for connector repeatability, using the system shown in Figure I or an equivalent method. The following details shall apply:

- Test at specified frequencies or at 3 frequencies, 1 from each third of the rated frequency range.
- Perform 10 complete engagements and separations, both ends separately.
- Rotate attenuator through the full 360° with an increment of approximately 36° for each engagement.
- Cleaning of connectors or reshaping of contacts is not permitted during the test sequence.
- Side-thrust shall not be permitted during the test.

FIGURE I - TEST SET-UP FOR CONNECTOR REPEATABILITY



9.14 OPERATING LIFE

9.14.1 Initial Measurements

The attenuation or resistance shall be measured at room temperature in accordance with Para. 9.6.1.2 or 9.6.1.4.

9.14.2 Mounting

The components shall be placed on a rack of insulating material or suspended in the oven. There shall be no undue draught over the components, only natural convection resulting from the hot components may occur.

9.14.3 Testing

The components shall be subjected to an operating life test of 1000 hours at the ambient temperature defined in the Detail Specification.

They shall be tested at rated input power applied in cycles of 1.5 hours "on" and 0.5 hours "off" throughout the test. The half-hour "off" periods are included in the total test duration. The test frequency shall be 10GHz.

After not less than 1000 hours, the components shall be removed from the chamber and allowed to cool under standard atmospheric conditions for testing for not less than 1 hour and not more than 2 hours.

The removal from the chamber shall take place at the end of the half-hour "off" period.

9.14.4 Final Measurements

The components shall be visually examined. There shall be no evidence of damage. Attenuation or resistance shall be measured in accordance with Para. 9.6.1.2 or 9.6.1.4 of this specification and meet the Delta (Δ) requirements of Table 6 of the Detail Specification.

9.15 RESIDUAL MAGNETISM (GOLD-PLATED WITH COPPER UNDERPLATE VERSION ONLY)

After submission to a magnetic field of 200 Gauss, the components, without connectors, shall exhibit a residual magnetism of less than 20γ ($1\gamma = 10^5$ Gauss), measured at 3.0mm from the component.

9.16 RF LEAKAGE (WHEN SPECIFIED IN THE DETAIL SPECIFICATION)

The swept frequency measurement shall cover the whole frequency range in steps not exceeding an octave band.

The test circuit shall be as shown in Figure II.

(a) Apply a fixed amount of RF power to a transmission line 'a' in a series with a variable attenuator and a network analyser.

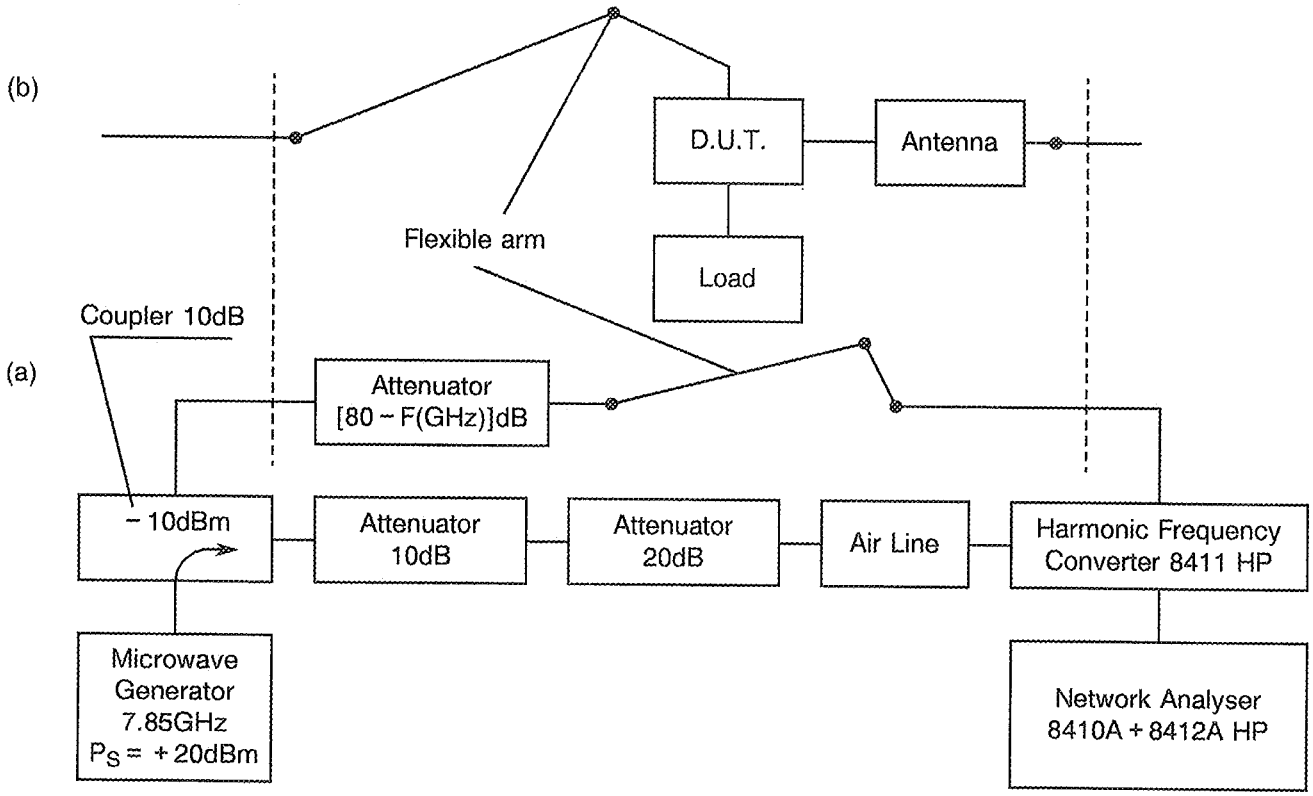
(b) Apply an attenuation of [80 − F(GHz)]db to line 'b' through a variable attenuator and note the difference between readings on the network analyser.

(c) Remove the attenuator, insert a flexible arm in series with the component under test terminated on an adapted load without leakage.

(d) Use an adaptor terminated by an antenna and "sniff" the component under test, keeping a distance of 1.0cm between antenna and component.

(e) Any attenuation less than the value specified in (b) above shall be cause for rejection of the part.

FIGURE II - TEST SET-UP FOR RF LEAKAGE



9.17 PEAK POWER

The component shall be placed in still air and free space at the standard atmospheric conditions. The specified peak power shall be applied 10 times to each end of the attenuators or to the load for the time specified in the Detail Specification. The other end of the attenuator shall be connected to a matched fixed coaxial load. After the component has cooled down to standard inspection conditions, the attenuation or resistance shall be measured as specified in Para. 9.6.1.2 or 9.6.1.4 of this specification.

9.18 POWER SENSITIVITY (ATTENUATORS ONLY)

The sensitivity of attenuation of the attenuators shall be determined by measuring the attenuation as specified in Para. 9.6.1.2 at full input power and any reference power.

Sensitivity of attenuation shall be computed in accordance with the following formula:-

$$\text{Power sensitivity} = \frac{\Delta dB}{dB} \quad \frac{1}{\Delta P} \text{ , where}$$

ΔdB = Change in attenuation at either extreme of the operating frequency at full input power or at either extreme of the operating temperature.

dB = Attenuation at reference frequency, reference power or reference temperature.

ΔP = Change in Watts from reference power to full input power.

9.19 CORROSION

The components with protective connectors shall be submitted to this test in accordance with IEC Publication No. 68-2-11 for a duration of 48 hours. After exposure, they shall be washed, shaken and lightly brushed and then allowed to dry at +40°C for 24 hours. The components shall then be inspected. No base metal shall be exposed.

9.20 DIMENSION CHECK

In accordance with ESA/SCC Basic Specification No. 20500 and the Detail Specification. To be performed on 5 samples only.

If 1 failure occurs, the complete lot shall be checked.

9.21 PERMANENCE OF MARKING

In accordance with ESA/SCC Basic Specification No. 24800.

10. DATA DOCUMENTATION

10.1 GENERAL

For the qualification approval records and with each component delivery, a data documentation package is required. Depending on the testing level and lot acceptance level specified for the component, this package shall be compiled from:-

(a) Cover sheet (or sheets).

(b) List of equipment (testing and measuring).

(c) List of test references.

(d) Final production test data (Chart II) (but see Para. 10.6).

(e) Burn-in and electrical measurement data (Chart III).

(f) Qualification test data (Chart IV).

(g) Lot acceptance test data (Chart V) (when applicable).

(h) Failed component list (see Paras. 7.3 and 8.4) and failure analysis report (see Para. 8.4).

(i) Certificate of Conformity.

Items (a) to (i) inclusive shall be grouped, preferably as subpackages and, for identification purposes, each page shall include the following information:

- ESA/SCC Component Number.
- Manufacturer's name.
- Lot identification.
- Date of establishment of the document.
- Page number.

10.1.1 Qualification Approval

In the case of qualification approval, the items listed in Para. 10.1 (a) to (i) less item (g) are required.

10.1.2 Testing Level 'B'

10.1.2.1 Qualified Components

For deliveries of qualified components, the following documentation shall be supplied:-

(a) Cover sheet (if all of the information is not included on the Certificate of Conformity).

(b) Certificate of Conformity (including range of delivered serial numbers).

(c) Attributes record of measurements, tests and inspections performed in Chart II, Chart III (including PDA figure) and Chart V (where applicable).

(d) Failed components list.

10.1.2.2 Unqualified Components

For deliveries of unqualified components, the documentation to be supplied shall be in accordance with Para. 10.1.2.1 plus the following:-

(a) Read and record data from Chart III.

(b) Special in-process control data (where applicable).

(c) Failure analysis report on failed components.

10.1.3 Testing Level 'C'

10.1.3.1 Qualified Components

For deliveries of qualified components, the following documentation shall be supplied:-

(a) Certificate of Conformity.

10.1.3.2 Unqualified Components

For deliveries of unqualified components, the documentation to be supplied shall be in accordance with Para. 10.1.3.1 plus the following:-

(a) Cover sheet (if all of the information is not included on the Certificate of Conformity).

(b) Attributes record of all measurements, tests and inspections performed in Charts II, III and V (when applicable).

(c) Failed components list (including Failure Analysis Report).

(d) Special in-process control data (when applicable).

10.1.4 Data Retention/Data Access

If not delivered, all data shall be retained by the Manufacturer for a minimum of 5 years during which time it shall be available to the Qualifying Space Agency and the Orderer, if requested, for review. The Manufacturer shall deliver variables Data/Reports to the Orderer if required by the Purchase Order.

10.2 COVER SHEET(S)

The cover sheet(s) of the data documentation package shall include as a minimum:-

(a) Reference to the Detail Specification, including issue and date.

(b) Reference to the applicable ESA/SCC Generic Specification, including issue and date.

(c) Component type and number.

(d) Lot identification.

(e) Range of delivered serial numbers (for components of testing level 'B').

(f) Number of purchase order.

(g) Information relative to any additions to this specification and/or the Detail Specification.

(h) Manufacturer's name and address.

(j) Location of the manufacturing plant.

(k) Signature on behalf of Manufacturer.

(l) Total number of pages of the data package.

10.3 LIST OF EQUIPMENT USED

A list of equipment used for tests and measurements shall be prepared, if not in accordance with the data given in the Process Identification Document (P.I.D.). Where applicable, this list shall contain inventory number, Manufacturer's type number, serial number, etc. This list shall indicate for which tests such equipment was used.

10.4 LIST OF TEST REFERENCES

This list shall include all Manufacturer's references or codes which are necessary to correlate the test data provided with the applicable tests specified in the tables of the Detail Specification.

10.5 SPECIAL IN-PROCESS CONTROL DATA

Not applicable.

10.6 FINAL PRODUCTION TEST DATA (CHART II)

A test result summary shall be compiled showing the total number of components submitted to, and the total number rejected after, each of the following tests:

- Electrical measurements (Para. 9.6.4).
- External visual inspection (Para. 9.5).
- Dimension check (Para. 9.20).

The final production test data shall form an integral part of the data documentation package, but it is not a mandatory requirement that it be delivered with the qualification lot or delivery lot. However, the data package to be delivered shall contain the information as detailed in Paras. 10.1.2 and 10.1.3 or at least shall contain a list of final production tests actually performed and a certification that the data is available for review.

10.7 BURN-IN AND ELECTRICAL MEASUREMENT DATA (CHART III)

10.7.1 Testing Level 'B'

For components of testing level 'B', all data shall refer to the relevant serial numbers. Against these serial numbers, data shall be recorded for the following:-

(a) 0-hour measurement for burn-in.

(b) 168-hour measurement for burn-in.

(c) Delta values after burn-in.

(d) Values obtained during measurements at high and low temperatures (Table 3 of the Detail Specification).

(e) Values obtained during measurements of electrical characteristics (Table 2 of the Detail Specification).

(f) Failures during external visual inspection.

10.7.2 Testing Level 'C'

For components of testing level 'C', a test result summary (i.e. the total number of components submitted to, and the total number rejected from, each of the tests and inspections) shall be prepared.

10.8 QUALIFICATION TEST DATA (CHART IV)

All data shall be referenced to the relevant serial numbers. Detailed records shall be provided of the components submitted to each test in each of the subgroups and of those rejected. Detailed data shall be provided of all electrical measurements made in accordance with Table 6 of the Detail Specification, as and where applicable.

10.9 LOT ACCEPTANCE TEST DATA (CHART V)

10.9.1 Testing Level 'B'

All data shall be referenced to the relevant serial numbers. Detailed records shall be provided of the components submitted to each test in each of the subgroups (as relevant to the lot acceptance level) and of those rejected.

Detailed data shall be provided of all electrical measurements made in accordance with Table 6 of the Detail Specification, as and where applicable.

10.9.2 Testing Level 'C'

A test result summary (i.e. the total number of components submitted to, and the total number rejected from, each of the tests and inspections) as relevant to the lot acceptance level shall be provided.

In the case of lot acceptance 2 testing, all data in respect of electrical measurements made in accordance with Table 6 of the Detail Specification shall be referenced to the relevant serial numbers (see Para. 8.2.4(a)).

In the case of lot acceptance 1 testing, all data in respect of electrical measurements made in accordance with Tables 2 and 6 of the Detail Specification shall be referenced to the relevant serial numbers (see Para. 8.2.5(a)).

10.10 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

The failed component list and failure analysis report shall provide full details of:-

(a) The reference number and description of the test or measurement performed as defined in this specification and/or the Detail Specification.

(b) The serial number (if applicable) of the failed component.

(c) The failed parameter and the failure mode of the component.

(d) Detailed failure analysis, if requested.

10.11 CERTIFICATE OF CONFORMITY

A Certificate of Conformity shall be established as defined in ESA/SCC Basic Specification No. 20100.

11. DELIVERY

For qualification approval, the disposition of the qualification test lot and its related documentation shall be as specified in ESA/SCC Basic Specification No. 20100 and the relevant paragraphs of Section 10 of this specification.

For procurement, for each order, the items forming the delivery are:-

(a) The delivery lot.

(b) The components used for lot acceptance testing, (when applicable), but not forming part of the delivery lot (see Para's 8.2.4(b) and 8.2.5(b)).

(c) The relevant documentation in accordance with the requirements of Section 10 of this specification.

In the case of a component for which a valid qualification approval is in force, all data of all components submitted to LA1 and LA2 testing shall also be copied, when applicable, to the relevant Qualifying Space Agency.

12. PACKAGING AND DESPATCH

The packaging and despatch of components to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 20600.