REQUIREMENTS FOR THE EVALUATION OF STANDARD ELECTRONIC COMPONENTS FOR SPACE APPLICATION

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space components
coordination group

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1. PURPOSE

This specification describes the basic aspects of, and defines the minimum requirements for, a component evaluation procedure which normally forms the second phase of an ESA/SCC qualification activity for a standard electronic component.

A standard electronic component is one that is fabricated from well understood and stable technologies, usually confirmed by a history of continuous or frequent production runs, and for which widespread application data is available.

For any standard electronic component which is not the subject of such activity, this specification is available to, and recommended for use, either in whole or in part, by any User organisation procuring for space applications.

Application of this specification in such circumstances will be in the interest of standardisation of the approach to qualification and procurement of components for space application, contribute to a cost-effective and timely project qualification and provide, in an economical manner, data which can be assimilated for use in subsequent ESA/SCC qualifications.

2. APPLICABLE DOCUMENTS

The requirements of the following ESA/SCC specifications form part of this specification. The applicable issue shall be that current at the date of commencement of the evaluation:-

(a) No. 20200, Requirements for the Evaluation of a Manufacturer for the Manufacture and Supply of Standard Electronic Components for Space Application.

3. INTRODUCTION

The purpose of the evaluation detailed herein is to arrive, in the most cost-effective manner, at a decision to proceed with the qualification of a component for use in space applications, with a high level of confidence in the result.

The procedures are based on the maximum use of substantiated current data which exist for the component and the minimising or elimination of the need to introduce new and/or additional testing or test procedures.

Reference is made herein to an Evaluating Authority (E.A.).

For an ESA/SCC activity, this authority will be ESA/ESTEC or another Qualifying Space Agency. When this specification is used in other circumstances, the E.A. shall be as nominated by the appropriate User organisation.

4. GENERAL

The flow of activities is set out in Chart I of this specification and comprises essentially 2 stages:-

(a) The Component Selection Stage.

(b) The Detailed Evaluation Stage.

The evaluation will be carried out by an Evaluating Authority (E.A.) and the precise responsibilities of all parties shall be specified before the commencement of each stage.

Stage (a) (Chart I, Activities 1 to 5) should normally be completed within 1 month.

Stage (b) (Chart I, Activities 6 to 13) will depend on the particular Evaluation Test Programme defined, but should not normally exceed 3 months.

5. THE COMPONENT SELECTION STAGE

Prior to embarking on the Detailed Evaluation Stage, the E.A. will seek to rationalise all proposals by means of a Component Selection procedure. This procedure is aimed at reaching agreements on the space requirements and identifying likely sources of supply. In consultation with the Users, the E.A. shall consider the published data on the candidate component and examine the production record of the Manufacturer(s) against the envisaged space requirements. This will establish the scale of the task ahead by considering the amount and type of additional work required to satisfy the space application.

If the results are promising, random samples, taken from current production shall be subjected to a Constructional Analysis (C.A.) by the appropriate E.A. This C.A. shall comprise both destructive and non-destructive testing for the purpose of identifying:-

(a) Construction technology and materials used.

(b) Inherent reliability problems.

(c) Suitable screening procedures apposite to the particular construction and technology.

After completing the C.A., the E.A. shall review the C.A. results, together with all other data to hand, against the foreseen requirements and decide whether to proceed to the Detailed Evaluation Stage. If the decision is to proceed, a Detail Specification will be required at this stage.

An ESA/SCC Detail Specification for the component may or may not be available at the time of evaluation. In the case where it is not available, it should be drafted in accordance with the standard ESA/SCC format.

6. THE DETAILED EVALUATION STAGE

6.1 E.A. / MANUFACTURER LIAISON

At the commencement of the Detailed Evaluation Stage, the E.A. shall acquaint the Manufacturer of its findings following the review of his data and the outcome of the C.A.

The E.A. shall discuss criticisms and proposed corrective actions with the Manufacturer and establish agreements to their mutual satisfaction. The Detail Specification for the component shall be discussed and agreement reached with the Manufacturer. Any other matters relevant shall be discussed and/or resolved such that between them, the Manufacturer and E.A. establish a firm basis from which the Detailed Evaluation will proceed.

6.2 EVALUATION OF A MANUFACTURER

A survey of the Manufacturer's production, inspection and testing facilities shall be carried out by the E.A., particular attention being given to the existence and adequacy of formal updated documentation and control procedures relating to the component to be evaluated.

For an ESA/SCC qualification, this survey shall be performed in accordance with the requirements of ESA/SCC Basic Specification No. 20200.

6.3 EVALUATION TEST PROGRAMME

To establish the suitability of all aspects of the technology and function of the component for the envisaged application, the E.A., in conjunction with the Manufacturer, shall draw up an Evaluation Test Programme (E.T.P.).

The E.T.P. shall be performed on a sample representative of the variations of size, technology, material and, if appropriate, the constructional techniques employed in the manufacture of the component family.

The E.T.P. shall include step-stress and steady state stress testing designed to determine failure modes and to establish the margins between strength and the specified conditions for use.

For E.T.P., accelerated tests may be performed at an accelerated factor either known in advance or determined on the basis of the test results. The stresses applied shall include electrical, temperature and, if appropriate, mechanical, chemical and climatic. Tests to confirm physical integrity (i.e. robustness of terminations, leakage, electrical parameter measurements, etc.) shall also be included and, in the case of failure, a failure analysis shall be performed to confirm the failure mode expected.

The E.T.P. shall include a D.P.A. of components representative of all the materials and constructional techniques employed.

In certain cases, the requirements for an E.T.P. can be minimised by the substitution of a bona fide documented proof of relevant current test data from the Manufacturer.

During the definitions of the E.T.P., the E.A. shall carefully review any such data submitted, equating it where possible to the requirements originally formulated.

Examples for which data might be considered in this context are:-

(a) Qualification and approval to National or International specification systems.

(b) Satisfactory production and yield data for military hi-rel or other stringent requirements.

(c) Evaluations carried out by, or on behalf of ESA, to ESA PSS-01-60.

(d) Manufacturer's in-house production and testing data for the component.

The list is not necessarily exhaustive.

The components submitted to the E.T.P. shall be unscreened components produced in accordance with the same techniques, processes and materials and drawn from the same line that will be employed for the production of components for which qualification is intended. The quantity of components to be used for the E.T.P. shall be agreed by the E.A. and the Manufacturer.

6.4 BASIC SPECIFICATIONS

For the purpose of the evaluation, the E.A. will consider the use of Manufacturer's versions of the Basic Specifications normally called up by the ESA/SCC Generic Specifications (e.g. Internal Visual Inspection, X-ray and SEM Inspection, etc.). Such substitutes may be authorised where the substitute material can be shown to be equal to, or more stringent than, the ESA/SCC version. In the case of a dispute, the appropriate ESA/SCC Basic Specification shall be the reference document.

7. EVALUATION REPORT

On completion of the evaluation, the E.A. shall prepare an evaluation report. This report shall include:-

(a) Component description and data.

(b) References to all documentation employed for the evaluation.

(c) A summary of the C.A. on the component.

(d) An assessment of the Manufacturer's facilities.

(e) A report on the E.T.P. together with a summary of results.

(f) Reference to the Manufacturer's alternative test data accepted as satisfying part or all of the E.T.P. (see Para. 5.3).

8. FINAL DOCUMENTATION REVIEW

The E.A. shall review the Detail Specification and all other relevant documents resulting from the evaluation. If these are satisfactory, they shall be approved and frozen at the issues then current.

9. CERTIFICATION OF EVALUATION

Following a satisfactory component evaluation phase, the E.A. shall formally certify its approval of the evaluation.

10 ANCILLARY SPECIFICATIONS

The following supplementary specifications have been issued:-

ESA/SCC 2263000 - Evaluation Test Programme for Capacitors.

ESA/SCC 2263202 - Evaluation Test Programme for Ferrite Microwave Components (Isolators and Circulators).

ESA/SCC 2263400 - Evaluation Test Programme for Connectors.

ESA/SCC 2263502 - Evaluation Test Programme for Surface Acoustic Wave (SAW) Devices.

ESA/SCC 2263600 - Evaluation Test Programme for Relays.

ESA/SCC 2264000 - Evaluation Test Programme for Resistors.

ESA/SCC 2265000 - Evaluation Test Programme for Discrete Non-Microwave Semiconductors.

ESA/SCC 2265010 - Evaluation Test Programme for Discrete Microwave Semiconductors.

ESA/SCC 2269000 - Evaluation Test Programme for Monolithic Integrated Circuits.

CHART I - EVALUATION ACTIVITIES

1. Manufacturer provides data sheet, manufacturing records and test information
2. Review and consider suitability for foreseen requirements
   - Suitable
   - Not suitable → No further action
3. Obtain production samples and perform Construction Analysis (C.A.)
4. Review C.A. results with 2 above and decide whether or not to proceed to Detailed Evaluation Phase
   - Yes
   - No → No further action
5. Draft Detail Specification if one does not already exist
6. Discuss 3, 4 and 5 above with Manufacturer and agree Detail Specification
   - Agree
   - Problems → (return to 6)
7. Evaluation of Manufacturer
   - Satisfactory
   - Problems → (return to 7)
8. Relate C.A. results, Generic and Detail Specification requirements to Manufacturer's existing Test Results
9. Define Evaluation Test Programme
10. Perform Evaluation Test Programme
11. Evaluation Report → Corrective Action → (return to 10)
12. Review and freeze Detail Specification and information for P.I.D.
13. Certify Evaluation