RF, COAXIAL, POWER DIVIDERS, COMBINERS AND COUPLERS

ESCC Generic Specification No. 3404

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DOCUMENTATION CHANGE NOTICE

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DCR No.	CHANGE DESCRIPTION
1411	Specification upissued to incorporate changes per DCR.

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1 INTRODUCTION

1.1 SCOPE

This specification defines the general requirements for the qualification, qualification maintenance, procurement, and delivery of RF, Coaxial, Power Dividers, Combiners and Couplers for space applications. 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 components qualified in accordance with one of the following ESCC methods:

- Qualification of Standard Components per ESCC Basic Specification No. 20100.
- Technology Flow Qualification per ESCC Basic Specification No. 25400.

It is also primarily applicable to the procurement of components so qualified.

This specification may also be applied to the procurement of unqualified components, recommendations for which are given in ESCC Basic Specification No. 23100.

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 starting qualification or placing the Purchase Order.

2.1 ESCC SPECIFICATIONS

- No. 20100, Requirements for the Qualification of Standard Electronic Components for Space Application.
- No. 20400, Internal Visual Inspection.
- No. 20500, External Visual Inspection.
- No. 20600, Preservation, Packaging and Dispatch of ESCC Components.
- No. 20900, Radiographic Inspection of Electronic Components.
- No. 21001, Destructive Physical Analysis of EEE Components.
- No. 21300, Terms, Definitions, Abbreviations, Symbols and Units.
- No. 21700, General Requirements for the Marking of ESCC Components.
- No. 22600, Requirements for the Evaluation of Standard Electronic Components for Space Application.
- No. 22800, ESCC Non-Conformance Control System.
- No. 23100, Recommendations on the use of the ESCC Specification System for the Evaluation and Procurement of Unqualified Components.
- No. 24500, Reduced EMC Test Method for Radiated Emission and Radiated Susceptibility.
- No. 24600, Minimum Quality System Requirements.
- No. 24800, Resistance to Solvents of Marking, Materials and Finishes.
- No. 25400, Requirements for the Technology Flow Qualification of Electronic Components for Space Application.

For qualification and qualification maintenance or procurement of qualified components, with the exception of ESCC Basic Specifications Nos. 20100, 21700, 22800, 24600 and 25400, where Manufacturers' specifications are equivalent to, or more stringent than, the ESCC Basic Specifications listed above, they may be used in place of the latter, subject to the approval of the ESCC Executive.

Such replacements shall be clearly identified in the applicable Process Identification Document (PID).

For procurement of unqualified components, where Manufacturers' specifications are equivalent to or more stringent than the applicable ESCC Basic Specifications listed above, they may be used in place of the latter subject to the approval of the Orderer.

Such replacements may be listed in an appendix to the appropriate Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

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

2.2 OTHER (REFERENCE) DOCUMENTS

- REP005, ESCC Qualified Parts List.
- REP006, ESCC Qualified Manufacturers List.
- ECSS-Q-ST-60, Space Product Assurance: Electrical, Electronic and Electromechanical (EEE) Components
- ECSS-Q-ST-70-37, Determination of the Susceptibility of Metals to Stress-corrosion Cracking.
- ECSS-E-20-01, Multipaction Design and Test.
- MIL-STD-202, Test Method Standard - Electronic and Electrical Component Parts.

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) ESCC Detail Specification.
(b) ESCC Generic Specification.
(c) ESCC Basic Specification.
(d) Other documents, if referenced herein.

3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

The terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply. In addition the following definitions shall apply:

Non-integral coaxial connector:	A discrete coaxial connector component mounted on the power divider, combiner or coupler.
Integral coaxial connector:	A built-in coaxial connector interface manufactured with piece parts.
Resistive Element:	Any kind of resistor or resistive load that is part of the component.
Chip Resistor:	A discrete chip or SMD resistor procured as an EEE component.
Embedded Resistor:	A resistive element integrated into a PCB board by means of a deposit of the resistive layer or a buried chip resistor.
Chip Load:	A matched chip termination procured as an EEE component.

4 REQUIREMENTS

4.1 GENERAL

The requirements for the qualification of a component shall be in accordance with ESCC Basic Specification No. 20100.

The requirements for Technology Flow Qualification and listing of qualified component types shall be in accordance with ESCC Basic Specification No. 25400.

The test requirements for procurement of both qualified and unqualified components (see Chart F1) shall comprise:

- Special In-Process Controls.
- Screening Tests.
- Periodic Testing (for qualified components only).
- Lot Validation Testing if stipulated in the Purchase Order.

4.1.1 Specifications

For qualification, qualification maintenance, procurement and delivery of components in conformity with this specification, the applicable 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 ESCC 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 ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components), to use an approved external facility.

4.1.4 Inspection Rights

The ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components, if stipulated in the Purchase Order) reserves the right to monitor any of the tests and inspections scheduled in the applicable specifications.

4.1.5 Customer Source Inspection

4.1.5.1 Pre-Assembly Customer Source Inspection

If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility prior to assembly (including, for example, performance of Pre-Assembly Inspection, review of Special In-Process Controls data). Details of the inspections to be performed or witnessed and the required period of notification shall be as stipulated in the Purchase Order.

4.1.5.2 Final Customer Source Inspection

If stipulated in the Purchase Order, the Orderer may perform a source inspection at the Manufacturer's facility at the end of Screening Tests or during Lot Validation Testing, if applicable, (including, for example, witness of final Room Temperature Electrical Measurements, performance of External Visual Inspection, review of the data documentation package). Details of the inspections to be performed or witnessed and the required period of notification shall be as stipulated in the Purchase Order.

4.2 QUALIFICATION AND QUALIFICATION MAINTENANCE REQUIREMENTS ON A MANUFACTURER

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

To obtain and maintain the qualification of a component produced using a qualified Technology Flow, a Manufacturer shall satisfy the requirements of ESCC Basic Specification No. 25400.

4.3 DELIVERABLE COMPONENTS

4.3.1 ESCC Qualified Components

Components delivered to this specification shall be processed and inspected in accordance with the relevant Process Identification Document (PID).

4.3.2 ESCC Components

Each component, irrespective of qualification status, identified with an ESCC component number and delivered to this specification shall:

- be traceable to its production lot.
- have satisfactorily completed all the tests required by the relevant issues of the applicable specifications.
- be produced from lots that are considered by the Manufacturer to be capable of passing all applicable tests, and sequences of tests, that are defined in Chart F4. 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, demonstrably, it could not have passed these tests at the time of manufacture, this shall be grounds for rejection of the delivered lot.

4.3.3 Lot Failure

Lot failure may occur during Special In-Process Controls (Chart F2), Screening Tests (Chart F3) or Qualification, Periodic Testing and Lot Validation Testing (Chart F4).

Should such failure occur during qualification, qualification maintenance or procurement of qualified components the Manufacturer shall initiate the non-conformance procedure in accordance with ESCC Basic Specification No. 22800. The Manufacturer shall notify the Orderer and the ESCC Executive by any appropriate written means, within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing or analysis shall be performed on the failed components until so instructed by the ESCC Executive.

Should such failure occur during procurement of unqualified components the Manufacturer shall notify the Orderer by any appropriate written means within 5 working days, giving details of the number and mode of failure and the suspected cause. No further testing or analysis shall be performed on the failed components until so instructed by the Orderer. The Orderer shall inform the Manufacturer within 5 working days of receipt of notification what action shall be taken.

4.4 MARKING

All components procured and delivered to this specification shall be marked in accordance with ESCC Basic Specification No. 21700.

4.5 MATERIALS AND FINISHES

Specific requirements for materials and finishes are specified in the Detail Specification. Where a definite material or finish is not specified, a material or finish shall be used so as to ensure that the component meets the performance requirements of this specification and the Detail Specification. Acceptance or approval of any constituent material or finish does not guarantee acceptance of the finished product.

All materials and finishes of the components specified in the Detail specification shall comply with the restrictions on materials specified in ESCC Basic Specification No. 22600.

All metallic materials shall meet stress-corrosion resistance Class 1 or Class 2 of ECSS-Q-ST-70-37.

4.6 COAXIAL CONNECTORS

4.6.1 Non-Integral Coaxial Connectors

All non-integral coaxial connectors (and contacts) shall be as specified in the applicable connector ESCC Detail Specification as referenced in the power divider, combiner or coupler ESCC Detail Specification. Non-integral coaxial connectors shall be ESCC Qualified as evidenced by a listing in the current ESCC Qualified Parts List REP005 or ESCC Qualified Manufacturers List REP006.

If ESCC qualified, non-integral coaxial connectors are not available, ECSS-Q-ST-60 requirements for Class 1 components shall apply.

4.6.2 Integral Coaxial Connectors

Integral coaxial connectors (including piece parts and contacts) shall meet all the materials, interface, performance, inspection and test requirements of the ESCC Detail Specification for the equivalent non-integral ESCC qualified coaxial connector.

4.7 RESISTIVE ELEMENTS

All resistive elements incorporated into deliverable components shall originate from a single lot.

For all resistive elements procured as EEE components, ECSS-Q-ST-60 requirements for Class 1 components shall apply.

For qualified components, the specification for the resistive element shall be agreed with the ESCC Executive and form part of the PID.

5 PRODUCTION CONTROL

5.1 GENERAL

Unless otherwise specified herein or in the Detail Specification, all lots of components used for qualification and qualification maintenance, Lot Validation Testing and for delivery shall be subject to tests and inspections in accordance with Chart F2 in the sequence shown.

All components shall be serialised after assembly, prior to the subsequent tests and inspections

Any components which do not meet these requirements shall be removed from the lot and at no future time be resubmitted to the requirements of this specification.

The applicable test requirements are detailed in the paragraphs referenced in Chart F2.

For qualified components the full production control provisions are defined in the PID.

5.1.1 Rework

Any rework procedures shall be agreed with the ESCC Executive (for qualification, qualification maintenance, or procurement of qualified components) or the Orderer (for procurement of unqualified components).

For qualified components, any rework procedures shall be specified in the PID.

5.2 SPECIAL IN-PROCESS CONTROLS

5.2.1 Plating Thickness Verification

If specified in the Detail Specification, the thickness of the plating shall be measured and verified, as specified in Para. 8.1. The form of the sample and the plating requirements shall be as specified in the Detail Specification.

5.2.2 Resistive Element Burn-in and Operating Life

5.2.2.1 Resistive Element Burn-in

All chip resistors and chip loads incorporated into deliverable components shall be successfully subjected to Resistive Element Burn-in as specified in Para. 8.2.1. Resistive Element Burn-in shall be performed prior to assembly of the elements into components. Traceability of each element to the associated component serial number shall be maintained.

Resistive Element Burn-in may be omitted if the element is ESCC Qualified as evidenced by a listing in the current ESCC Qualified Parts List REP005 or ESCC Qualified Manufacturers List REP006.

5.2.2.2 Resistive Element Operating Life

All lots of resistive elements incorporated into deliverable components shall be subjected to Resistive Element Operating Life as specified in Para. 8.2.2, on a sample of 15 individual elements selected in accordance with ECSS-Q-ST-60.

When embedded resistors are used, the PCB manufacturer shall produce one associated test coupon per PCB panel to be delivered to the component Manufacturer. The design of the associated test coupons shall be representative of the PCBs to be delivered and shall enable Resistive Element Operating Life to be performed. Resistive Element Operating Life shall be performed on each test coupon.

If any failure occurs, the resistive element lot shall be considered as failed.

This test is considered as destructive. Resistive elements subjected to this test shall be removed from the lot.

Resistive Element Operating Life may be omitted if the element is ESCC Qualified as evidenced by a listing in the current ESCC Qualified Parts List REP005 or ESCC Qualified Manufacturers List REP006.

5.2.3 Contact Engagement and Separation Forces

Only applicable to components with integral coaxial connectors with female contacts.

A sample of 13 female centre contacts shall be tested for Contact Engagement and Separation Forces as specified in Para. 8.3. If any failure occurs, the lot of contacts shall be rejected.

5.2.4 Pre-Assembly Inspection

Pre-Assembly Inspection shall consist of internal and external visual inspection of all the different elements of the components in accordance with Para. 8.4.

5.2.5 Dimension Check

Dimension Check shall be performed in accordance with Para. 8.5 on a 100% basis for critical dimensions as specified in the Detail specification, and on 3 samples for non-critical dimensions. In the event of any failure, a 100% Dimension Check shall be performed.

5.2.6 Weight

Weight shall be measured in accordance with Para. 8.6 on 3 samples. In the event of any failure, a 100% measurement shall be performed.

5.2.7 Room Temperature Electrical Measurements

Electrical measurements shall be performed in accordance with Para. 8.7.5.

5.2.8 External Visual Inspection

External Visual Inspection shall be performed in accordance with Para. 8.5 on 3 samples. In the event of any failure, a 100% inspection shall be performed.

5.2.9 Documentation

Documentation of Special In-Process Controls shall be in accordance with Para. 9.5.

6 SCREENING TESTS

6.1 GENERAL

Unless otherwise specified herein or in the detail specification, all lots of components used for qualification and qualification maintenance, Lot Validation Testing, and for delivery, shall be subjected to tests and inspections in accordance with Chart F3 in the sequence shown.

Any components which do not meet these requirements shall be removed from the lot and at no future time be resubmitted to the requirements of this specification.

The applicable test methods and conditions are specified in the paragraphs referenced in Chart F3.

6.2 FAILURE CRITERIA

6.2.1 Environmental and Mechanical Test Failure

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. Rapid Change of Temperature, Random Vibration, etc.

6.2.2 Parameter Limit Failure

A component shall be counted as a parameter limit failure if one or more parameters exceed the limits shown in Room Temperature Electrical Measurements or High and Low Temperatures Electrical Measurements in the Detail Specification.

6.2.3 Other Failures

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

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

6.3 FAILED COMPONENTS

A component shall be considered as a failed component if it exhibits one or more of the failure modes described in Para. 6.2.

6.4 LOT FAILURE

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

6.4.1 Lot Failure during 100% Testing

If the number of components failed on the basis of the failure criteria specified in Para. 6.2 exceeds 10% (rounded upwards to the nearest whole number) of the components submitted to Chart F3 testing, the lot shall be considered as failed.

6.4.2 Lot Failure during Sample Testing

A lot shall be considered as failed if the number of allowable failures during sample testing, as specified herein or in the Detail Specification, is exceeded.

Unless otherwise specified, if a lot failure occurs, a 100% testing may be performed but the cumulative percent defective shall not exceed that specified in Para. 6.4.1.

6.5 DOCUMENTATION

Documentation of Screening Tests shall be in accordance with Para. 9.6.

7 QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING

The requirements of this paragraph are applicable to the tests performed on components or test structures as part of qualification or qualification maintenance in accordance with either ESCC Basic Specification No. 20100 or 25400 as applicable. They are also applicable to Lot Validation Testing as part of the procurement of qualified or unqualified components.

7.1 QUALIFICATION TESTING

7.1.1 General

Qualification testing shall be in accordance with the requirements specified in Chart F4. The tests of Chart F4 shall be performed on the specified sample chosen at random from components which have successfully passed the tests in Chart F3. 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 F4.

The conditions governing qualification testing are specified in ESCC Basic Specification No. 20100.

7.1.2 Distribution within the Qualification Test Lot

Where a Detail Specification covers a range or series of components that are considered similar, then the Qualification Test Lot shall be comprised of component types so selected that they adequately represent all of the various mechanical, structural and electrical peculiarities of that range or series.

The distribution shall be as specified by, or agreed with, the ESCC Executive.

If considered necessary to adequately represent the range or series of component types, the quantity of components included in the Qualification Test Lot may be increased as specified by, or agreed with, the ESCC Executive.

7.2 QUALIFICATION WITHIN A TECHNOLOGY FLOW

The qualification of a component produced using a qualified Technology Flow shall be in accordance with ESCC Basic Specification No. 25400.

7.3 QUALIFICATION MAINTENANCE (PERIODIC TESTING)

Qualification is maintained through periodic testing and the test requirements of Para. 7.1 shall apply. For each subgroup, the sample size and the period between successive subgroup testing shall be as specified in Chart F4. The conditions governing qualification maintenance are specified in ESCC Basic Specification No. 20100.

Qualification of a component, produced using a qualified Technology Flow, is maintained by maintenance of the Technology Flow Qualification itself in accordance with ESCC Basic Specification No. 25400.

7.4 LOT VALIDATION TESTING

For procurement of qualified components Lot Validation Testing is not required and shall only be performed if specifically stipulated in the Purchase Order.

For procurement of unqualified components the need for Lot Validation Testing shall be determined by the Orderer (ref. ESCC Basic Specification No. 23100).

When Lot Validation Testing is required, it shall be based on the tests of Chart F4. The testing to be performed and the sample size shall be as stipulated in the Purchase Order.

When procurement of more than one component type is involved from a family, range or series, the selection of representative samples shall also be stipulated in the Purchase Order.

7.5 FAILURE CRITERIA

The following criteria shall apply to qualification, qualification maintenance and Lot Validation Testing.

7.5.1 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. Random Vibration, Shock, Rapid Change of Temperature, etc.

7.5.2 Electrical Failures

The following shall be counted as component failures:

- Components which fail one or more of the applicable limits at each of the relevant data points specified for testing in Intermediate and End-Point Electrical Measurements in the Detail Specification.

7.5.3 Other Failures

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

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

7.6 FAILED COMPONENTS

A component shall be considered as failed if it exhibits one or more of the failure modes detailed in Para. 7.5.

When requested by the ESCC Executive (for qualification, qualification maintenance or procurement of qualified components) or the Orderer (for procurement of qualified or unqualified components), failure analysis of failed components shall be performed under the responsibility of the Manufacturer and the results provided.

Failed components shall be retained at the Manufacturer’s plant until the final disposition has been agreed and certified.

7.7 LOT FAILURE

For qualification and qualification maintenance, the lot shall be considered as failed if one component in any subgroup of Chart F4 is a failed component based on the criteria specified in Para. 7.5.

For procurement, the lot shall be considered as failed if one component in any test specified for Lot Validation Testing is a failed component based on the criteria specified in Para. 7.5.

In the case of lot failure, the Manufacturer shall act in accordance with Para. 4.3.3.

7.8 QUALIFICATION, QUALIFICATION MAINTENANCE AND LOT VALIDATION TESTING SAMPLES

All tests of Chart F4 are considered to be destructive and therefore components so tested shall not form part of the delivery lot.

7.9 DOCUMENTATION

Documentation of Qualification, Periodic Testing and Lot Validation Testing shall be in accordance with Para. 9.7.

8 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.

For a qualified component, documentation supporting the change shall be approved by the ESCC Executive and retained by the Manufacturer. It shall be copied, when requested, to the ESCC Executive. The change shall be specified in an appendix to the Detail Specification and in the PID.

For an unqualified component the change shall be approved by the Orderer. The change may be specified in an appendix to the Detail Specification at the request of the Manufacturer or Orderer, subject to the approval of the ESCC Executive.

8.1 PLATING THICKNESS VERIFICATION

If specified in the Detail Specification, the thickness of the plating shall be measured and verified using either a non-destructive method or by microsectioning. In the event of conflict, the microsectioning method shall govern. The plating thickness requirements specified in the Detail Specification shall apply.

8.2 RESISTIVE ELEMENT BURN-IN AND OPERATING LIFE

8.2.1 Resistive Element Burn-in

Testing shall be performed on individual resistive elements (prior to their assembly into the component).

Elements shall be subjected to a burn-in with the following conditions:

- Duration: 168 hours minimum
- Test Temperature: maximum operating temperature of the element, as specified in the relevant specification.
- DC Power Applied: Rated dissipation at maximum operating temperature of the element, as specified in the relevant specification.
- Data Points:
  Resistance shall be measured as specified in the relevant specification, both before and after the test. All values obtained shall be recorded and be traceable to the associated component serial number.

8.2.2 Resistive Element Operating Life

Testing shall be performed on element lots.

For embedded resistors, testing shall be performed on all resistors of all test coupons prior to assembly of the components.

Resistive elements shall be subjected to Operating Life with the following conditions:

- Duration: 2000 ±48 hours
- Test Temperature: maximum operating temperature of the element, as specified in the relevant specification.
- Test Conditions:
  Chip loads and chip resistors shall be tested after being mounted onto a suitable substrate.

  Resistive elements shall be tested such that a direct voltage, or full wave rectified AC voltage, provided the ripple does not exceed 5%, is applied to the resistive element.

  The voltage shall be applied in cycles of 1.5 hour 'on' and 0.5 hour 'off' throughout the test. The 0.5 hour 'off' periods are included in the total test duration.

  The voltage shall be either the rated or limiting element voltage, whichever is less, of the resistive element, as specified in the relevant specification. The applied voltage shall be within ±5% of this voltage.

  The size of the testing chamber and the number of elements under test shall be such that when all elements are fully loaded, the heat produced by them shall be less than that required to maintain the atmosphere in the chamber at the specified temperature. The chamber heaters shall be suitably spaced from the elements and shall be shielded so as not to be directly influenced by the radiation of the elements. For the purpose of this test, it shall be assumed that the ambient temperature of the elements is the specified temperature.

- Data Points:
  Resistance and Change in Resistance shall be measured, as specified in the relevant specification, at 0 hour, 1000 ±48 hours and 2000 ±48 hours. Change in Resistance shall be related to the 0 hour measurements.

  Insulation Resistance shall be measured, as specified in the relevant specification, at 0 hour and 2000 ±48 hours.

  At each data point, the removal from the chamber shall take place at the end of the 0.5 hour 'off' period and the elements shall be subjected to standard atmospheric conditions for recovery until thermal equilibrium is reached, up to a maximum of 2 hours, prior to electrical measurements. The interval between the removal from and return to the test conditions for any element shall not exceed 12 hours

8.3 CONTACT ENGAGEMENT AND SEPARATION FORCES

Only applicable to components with integral coaxial connectors with female contacts.

The female centre contacts shall be tested as follows:

- A force which is gradually increased shall be applied with force speed not exceeding 1mm/s until the steel test pin properly engages with, or separates from, the female contact. The polished steel test pins shall be as specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector.

  The oversize test pin shall be engaged and separated from each female contact 3 times and then the Engagement Force shall be measured with the maximum diameter test pin.

  Subsequently, the minimum diameter test pin shall be engaged and separated once to measure the Separation Force.

  The Engagement Force and the Separation Force shall meet the limits specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector.

8.4 PRE-ASSEMBLY INSPECTION

Prior to assembly, the different elements of the components shall be inspected in accordance with the requirements of ESCC Basic Specification Nos. 20400 and 20500, as applicable.

8.5 EXTERNAL VISUAL INSPECTION AND DIMENSION CHECK

External Visual Inspection shall be performed in accordance with ESCC Basic Specification No. 20500.

Dimension Check (during Special In-Process Controls only) shall be performed in accordance with ESCC Basic Specification No. 20500 and the Detail Specification.

8.5.1 Connector Interface Dimension Check

Only applicable to components with integral coaxial connectors.

The relative position of the contact and the insert to the reference plane shall be checked in accordance with ESCC Basic Specification No. 20500 and the ESCC Detail Specification for the equivalent non-integral coaxial connector.

8.6 WEIGHT

The weight of the component shall meet the requirement of the Detail Specification.

8.7 ELECTRICAL MEASUREMENTS

8.7.1 General

All equipment shall have the same characteristic impedance.

For components with coaxial connectors (integral or non-integral), suitable connector savers may be used for performance of electrical tests to minimise the number of mating and unmating cycles. The effect of the savers on the measurements shall be taken into account.

In any case, the total number of mating/umating operations performed on each connector, for each component, shall be recorded against component serial number.

Where a parameter is specified over a frequency range, a plot of the parameter over the frequency range shall be produced.

8.7.2 Power Dividers, Combiners (see Figure 1)

8.7.2.1 Transmission loss (Per Path)

Transmission loss shall be measured over the frequency range specified in the Detail Specification for each path.

8.7.2.2 Amplitude Balance

Amplitude Balance is the maximum difference (peak to peak) over the frequency range specified in the Detail Specification, between the measured Coupling Factor (dB) at any two output ports of the component: co-linear outputs of power dividers, or co-linear inputs of combiners

Where the limit is expressed as ±X dB compared to the average output level, it shall be interpreted to allow a maximum difference of 2×X dB.

8.7.2.3 Phase Balance

Phase Balance shall be measured over the frequency range specified in the Detail Specification, between any two output (input) ports of the component. The co-linear output (input) ports and the adjacent isolated port of a hybrid coupler shall be terminated in matched loads.

8.7.2.4 Voltage Standing Wave Ratio (VSWR)

VSWR shall be measured over the frequency range specified in the Detail Specification. VSWR of each port shall be measured with the unused ports terminated in matched loads.

8.7.2.5 Insertion Loss (Per Path)

For power dividers, Insertion Loss shall be determined for each path by subtracting the coupling/dividing loss nominal value of the divider from the measured Transmission Loss value which shall be measured over the frequency range defined in the Detail Specification.

For combiners, Insertion Loss shall be determined for each path as the ratio, expressed in dB, of input power to the power available at the outputs, with the unused ports terminated in matched loads.

8.7.2.6 Isolation

Isolation of power dividers and combiners shall be determined over the frequency range specified in the Detail Specification, as the ratio of power between any two output (input) ports.

8.7.2.7 Insertion Loss Variation (in the frequency band)

Insertion Loss Variation is the difference between the minimum and the maximum variation of the Transmission Loss in the frequency band for each path.

8.7.2.8 Insertion Loss Stability (over the temperature range)

Insertion Loss Stability is the difference between the measurement at low and high temperature of the Transmission Loss in the frequency band for each path.

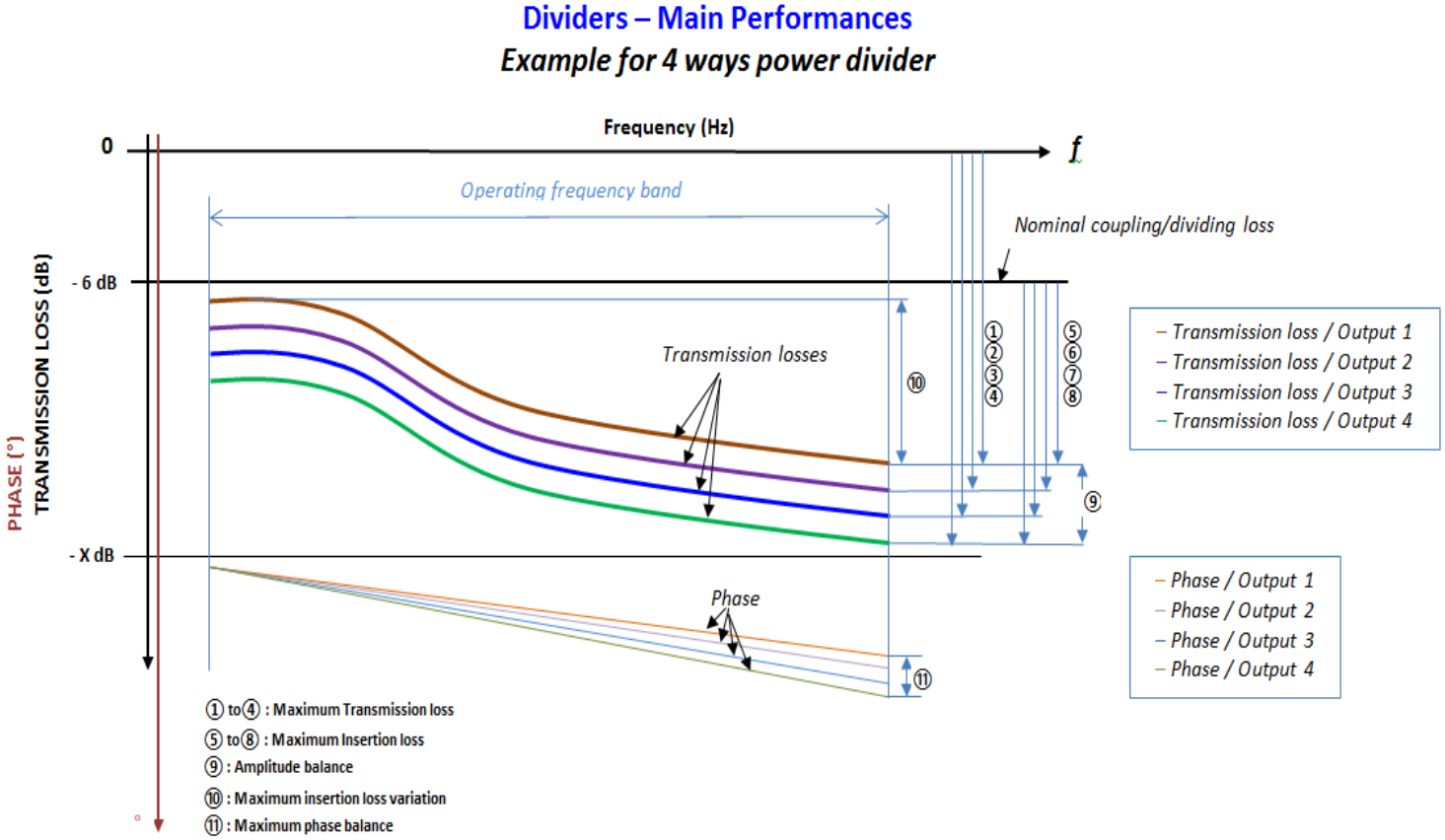


FIGURE 1

8.7.3 Hybrid Couplers (see Figure 2)

8.7.3.1 Transmission loss (Per Path)

Transmission loss (or coupling factor) shall be measured over the frequency range specified in the Detail Specification and for each path coupler entry.

8.7.3.2 Average Coupling

Average Coupling is the arithmetic average of the measured Coupling Factor (in dB) between input and the outputs measured for each coupler entry over the frequency range specified in the Detail Specification.

8.7.3.3 Amplitude Balance

Amplitude Balance is the maximum difference (peak to peak) over the frequency range specified in the Detail Specification, between the measured Coupling Factor (dB) at any two output ports of the component: coupled and direct outputs of hybrid couplers.

Where the limit is expressed as ±X dB compared to the average output level, it shall be interpreted to allow a maximum difference of 2×X dB.

8.7.3.4 Phase Balance

Phase Balance shall be measured over the frequency range specified in the Detail Specification, between any two output (input) ports of the component. The co-linear output (input) ports and the adjacent isolated port of a hybrid coupler shall be terminated in matched loads.

8.7.3.5 *Voltage Standing Wave Ratio (VSWR)*

VSWR shall be measured over the frequency range specified in the Detail Specification. VSWR of each port shall be measured with the unused ports terminated in matched loads.

8.7.3.6 Insertion Loss (Per Path)

Insertion Loss shall be determined for each path by subtracting the nominal value of the divider or coupler from the measured Average Coupling value which shall be measured over the frequency range defined in the Detail Specification.

8.7.3.7 Isolation

Isolation of hybrid couplers shall be determined over the frequency range specified in the Detail Specification, as the ratio of the input power to the power from the isolated port.

8.7.3.8 Insertion Loss Variation (in the frequency band)

Insertion Loss Variation is the difference between the minimum and the maximum variation of the Transmission Loss in the frequency band for each path.

8.7.3.9 Insertion Loss Stability (over the temperature range)

Insertion Loss Stability is the difference between the measurement at low and high temperature of the Transmission Loss in the frequency band for each path.

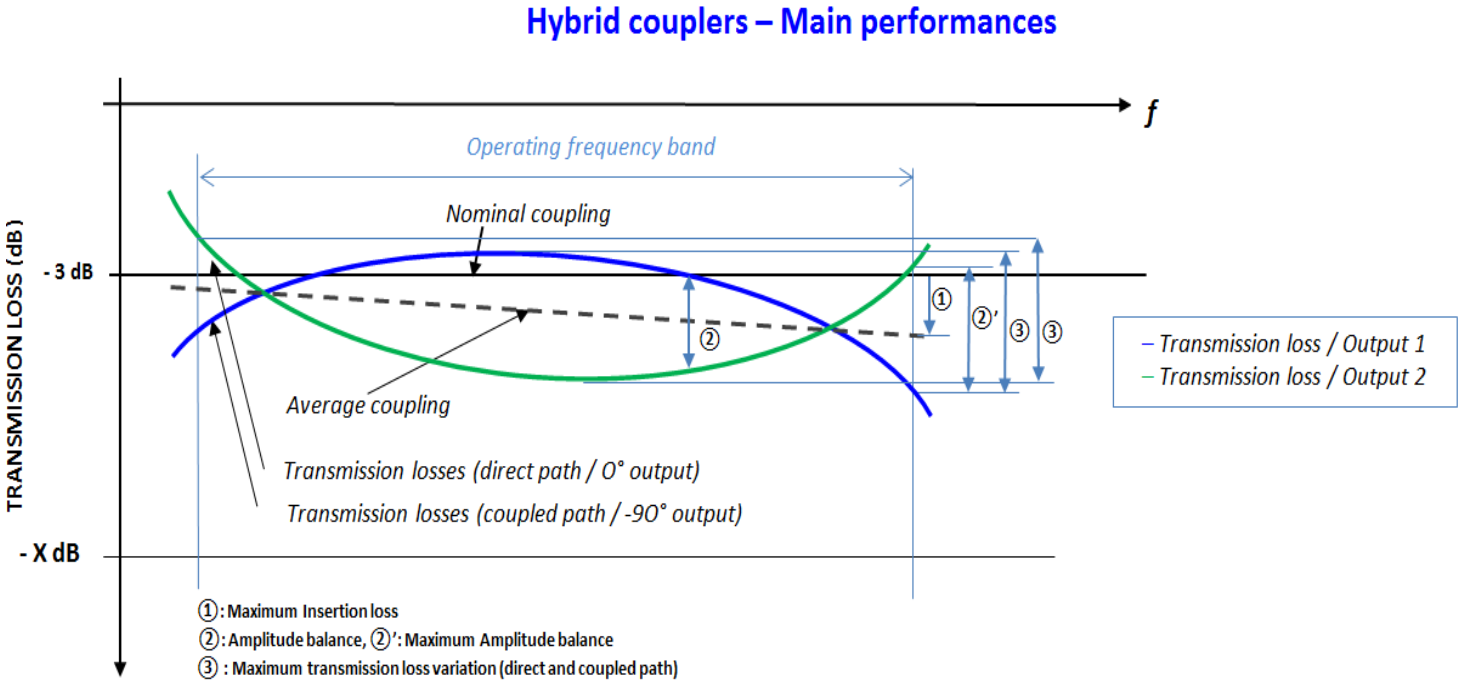


FIGURE 2

8.7.4 Directional Couplers (see Figure 3)

8.7.4.1 Coupling Factor

Coupling Factor shall be determined over the frequency range specified in the Detail Specification, as the ratio, expressed in dB, of power input to the primary line to the power available at the outputs of the secondary line, with the output end of the primary line properly terminated.

Coupling Factor of bi-directional couplers shall be determined separately for each secondary line.

8.7.4.2 *Coupling Variation*

Coupling Variation shall be determined by taking the difference between the maximum and the minimum coupling over the frequency range specified in the Detail Specification. Such difference shall be taken as a positive number or zero.

Coupling Variation of bi-directional couplers shall be determined separately for each secondary line.

8.7.4.3 Coupling Stability (over the temperature range)

Coupling Stability is the difference between the measurement at low and high temperature of the Coupling in the frequency band for each path

8.7.4.4 Voltage Standing Wave Ratio (VSWR)

VSWR shall be measured over the frequency range specified in the Detail Specification. VSWR of each port shall be measured with the unused ports terminated in matched loads.

8.7.4.5 Insertion Loss

Insertion Loss shall be determined over the frequency range specified in the Detail Specification, as the ratio expressed in dB, of power input to the primary line to the power available at the outputs of the primary line, with the output end of the secondary line properly terminated.

Insertion Loss, when measured as defined above, includes the coupling loss.

8.7.4.6 *Directivity*

Directivity shall be computed over the frequency range specified in the Detail Specification, from the ratio, positive and expressed in dB, of the available power at the output of the secondary line for the two directions of excitation, at equal power level, of the primary line. The secondary line shall be terminated in a matched detector.

Directivity of bi-directional couplers shall be determined separately for each secondary line.

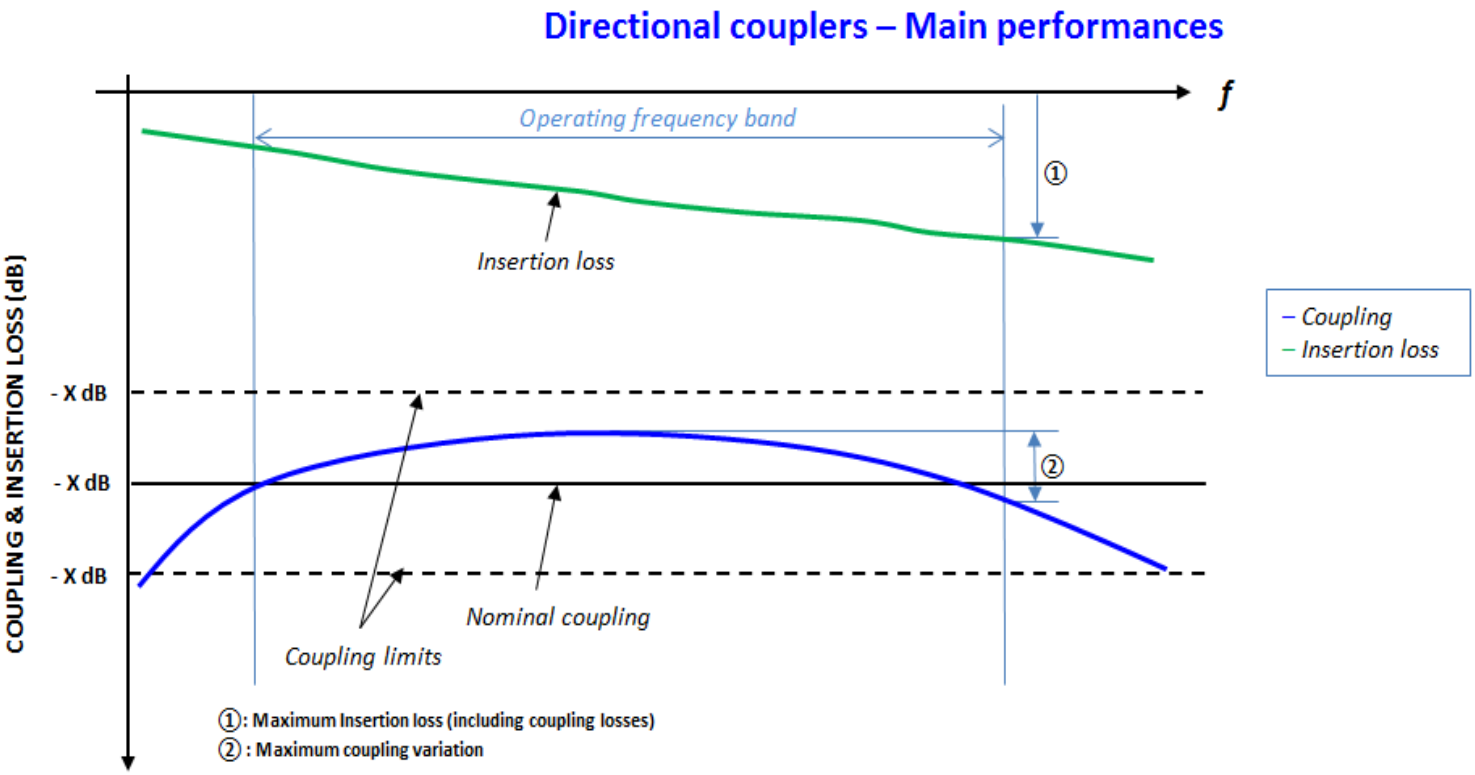


FIGURE 3

8.7.5 Room Temperature Electrical Measurements

Room Temperature Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers.

8.7.6 High and Low Temperatures Electrical Measurements

If specified in the Detail Specification, High and Low Temperatures Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers.

8.7.7 Intermediate and End-Point Electrical Measurements

At each of the relevant data points during Qualification, Periodic Testing and Lot Validation Testing (Chart F4), Intermediate and End-Point Electrical Measurements shall be performed as specified in the Detail Specification. All values obtained shall be recorded against serial numbers and the parameter drift calculated if specified.

8.8 TEMPERATURE CYCLING

For components with coaxial connectors (integral or non-integral), suitable connector savers may be used.

Components shall be subjected to Temperature Cycling with the following conditions:

- Number of cycles:
  (a) For Screening Tests (Chart F3):
  3 cycles with 30 minutes at each storage temperature extreme as specified in Maximum Ratings in the Detail Specification. The temperature transfer slope between the extremes shall not exceed 10°C/minute.
  (b) For Qualification Testing, and Periodic Testing for renewal of qualification after lapse (Chart F4):
  200 cycles with 30 minutes at each storage temperature extreme as specified in Maximum Ratings in the Detail Specification. The temperature transfer slope between the extremes shall not exceed 10°C/minute.
  (c) For Periodic Testing for extension of qualification (Chart F4):
  100 cycles with 30 minutes at each storage temperature extreme as specified in Maximum Ratings in the Detail Specification. The temperature transfer slope between the extremes shall not exceed 10°C/minute.

- Data Points
  On completion of testing and after a recovery period of 24 ±2 hours at room temperature conditions, the components shall be visually examined and there shall be no evidence of damage or loosening of parts.

  During Qualification, Periodic Testing and Lot Validation Testing (Chart F4) only, electrical measurements as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification shall be performed. If parameter drift is specified, initial measurements also shall be performed.

8.9 RANDOM VIBRATION

For components with coaxial connectors (integral or non-integral), suitable connector savers or coaxial loads may be used.

MIL-STD-202, Test Method 214 with the following conditions:

- Random Vibration Test Curve:
  (a) During Screening Tests (Chart F3):
    - 36grms overall
    - 10 to 50Hz: +3dB/octave
    - 50 to 1000Hz: $0.8g^2/Hz$
    - 1000 to 2000Hz: -3dB/octave

  (b) During Qualification, Periodic Testing and Lot Validation Testing (Chart F4):
    - 50grms overall
    - 10 to 50Hz: +3dB/octave
    - 50 to 1000Hz: 1.5g2/Hz
    - 1000 to 2000Hz: -3dB/octave

- Duration:
  (a) During Screening Tests (Chart F3): 60s in each of the 3 mutually perpendicular axes
  (b) During Qualification, Periodic Testing and Lot Validation Testing (Chart F4): 180s in each of the 3 mutually perpendicular axes
- Mounting:
  The components shall be mechanically connected to the vibration generator either directly or by means of a fixture. Mounting fixtures shall enable the components 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 means of mounting shall be clamped by the body.

- Data Points:
  On completion of testing, the components shall be visually inspected and there shall be no evidence of damage or loosening of parts.

  During Qualification, Periodic Testing and Lot Validation Testing (Chart F4) only, electrical measurements as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification shall be performed.

8.10 THERMAL STABILITY OF INSERTION LOSS

Thermal Stability of Insertion Loss shall be measured for each path.

The components shall be subjected to temperature cycling between minimum and maximum operating temperature as specified in Maximum Ratings in the Detail Specification. The temperature gradient shall be 3 ±1°C/minute and the dwell time at each temperature extreme shall be 15 minutes as a minimum.

The following requirements shall apply:

(a) During Screening Tests (Chart F3):
- Power Applied During Cycling: 0dBm minimum.
- Number of Temperature Cycles: 2

- Data Points During Cycling:
  Insertion Loss shall be continuously monitored and recorded once every 100ms as a minimum or alternatively an analogue recorder may be used. Unless otherwise specified, Insertion Loss shall be measured at the components' centre frequency.

- Accept/Reject Criteria:
  - Insertion Loss measurements shall be continuous with no discontinuities, steps or spikes during cycling.
  - Insertion Loss measurements shall exhibit a maximum change of 0.05dB during any given period of 1 minute during cycling. Gradual variation of Insertion Loss due to change of temperature shall be excluded when assessing this change.
  - If any Insertion Loss discontinuities, steps or spikes of less than 0.05dB are detected during the 2 cycles, the test may be extended to a total of 12 cycles with the following acceptance criteria:
  - No single Insertion loss discontinuity, step or spike shall exceed 0.05dB.
  - The sum of consecutive Insertion loss discontinuities, steps or spikes in any one temperature cycle shall not exceed 0.05dB in any direction.

(b) During Qualification, Periodic Testing and Lot Validation Testing (Chart F4):

- Power Applied During Cycling: 0dBm minimum.
- Number of Temperature Cycles: 10

- Data Points During Cycling:
  Insertion Loss shall be continuously monitored and recorded once every 100ms as a minimum or alternatively an analogue recorder may be used. Unless otherwise specified, Insertion Loss shall be measured at the components' centre frequency.
- Accept/Reject Criteria:
  - No single Insertion loss discontinuity, step or spike shall exceed 0.05dB.
  - The sum of consecutive Insertion loss discontinuities, steps or spikes in any one temperature cycle shall not exceed 0.05dB in any direction.
  - Insertion Loss measurements shall exhibit a maximum change of 0.05dB during any given period of 1 minute during cycling. Gradual variation of Insertion Loss due to change of temperature shall be excluded when assessing this change.

8.11 COUPLING PROOF TORQUE

Not required for components with ESCC qualified non-integral coaxial connectors.

The component under test shall be engaged with the applicable mating gauge as specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector, and the coupling nut shall be tightened to the torque specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector. After 1 minute, the connected pair shall be disconnected.

- Data Points:
  On completion of testing, the component shall be visually inspected. The coupling mechanism shall not be dislodged and the interface dimensions of the component shall remain as specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector.

8.12 MATING AND UNMATING FORCES

During Screening Tests (Chart F3): Not required for components with ESCC qualified non-integral coaxial connectors.

The component under test shall be mated with its mating gauge as specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector. During the entire mating/unmating cycle (until the component is fully mated or unmated), the necessary torque shall not exceed the value specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector.

During Qualification, Periodic Testing and Lot Validation Testing (Chart F4): Unless otherwise specified, the number of mating/unmating cycles shall be 50.

8.13 POWER THERMAL VACUUM

Only applicable if required in the Detail Specification.

Unless otherwise specified, components shall be subjected to operating test(s) under thermal vacuum, as follows:

- Applied Power: Rated RF Power as specified in Maximum Ratings in the Detail Specification, at the components' centre frequency. Power shall only be applied after pressure and temperature stabilisation and shall be applied gradually in steps from zero to full Rated RF Power.
- Operating Condition: see (a) to (d) below.
- Test Chamber Temperature: Maximum operating temperature as specified in Maximum Ratings in the Detail Specification.
- Pressure: < 1.3mPa (from room ambient condition)
- Duration:
  (a) During Screening Tests (Chart F3): 1 hour, after pressure and temperature stabilisation.
  (b) Qualification, Periodic Testing and Lot Validation Testing (Chart F4): 6 hours, after pressure and temperature stabilisation.
- Data Points: see (a) to (d) below.

(a) For Power Dividers:
- Operating Condition: Port 1 shall be selected as the input, all the other ports as outputs.
- Data Points:
  Input VSWR, Insertion Loss and Reference Point Temperature shall be shall be continuously monitored and recorded once every 1s as a minimum or alternatively an analogue recorder may be used, in accordance with the Detail Specification as follows:
  i. During Screening Tests (Chart F3): in High and Low Temperatures Electrical Measurements.
  ii. During Qualification, Periodic Testing and Lot Validation Testing (Chart F4): in Intermediate and End-Point Electrical Measurements.

  Reference Point Temperature shall be in accordance with Para. 8.14.

(b) For Combiners:

- Operating Condition: Port 1 shall be selected as the output, all the other ports as inputs.
- Data Points:
  Input VSWR, Insertion Loss and Reference Point Temperature shall be shall be continuously monitored and recorded once every 1s as a minimum or alternatively an analogue recorder may be used, in accordance with the Detail Specification as follows:
  i. During Screening Tests (Chart F3): in High and Low Temperatures Electrical Measurements.
  ii. During Qualification, Periodic Testing and Lot Validation Testing (Chart F4): in Intermediate and End-Point Electrical Measurements.

  Reference Point Temperature shall be in accordance with Para. 8.14.

(c) For Directional Couplers:

- Operating Condition: Port 1 shall be selected as the input, Port 2 as the main line output, Port 3 as the coupled line output.
- Data Points:
  Input VSWR, Insertion Loss of the main line, Coupling Factor and Reference Point Temperature shall be shall be continuously monitored and recorded once every 1s as a minimum or alternatively an analogue recorder may be used, in accordance with the Detail Specification as follows:
  i. During Screening Tests (Chart F3): in High and Low Temperatures Electrical Measurements.
  ii. During Qualification, Periodic Testing and Lot Validation Testing (Chart F4): in Intermediate and End-Point Electrical Measurements.

  Reference Point Temperature shall be in accordance with Para. 8.14.

(d) For Hybrid or 3dB Couplers:

- Operating Condition:
  Step 1 (duration as above): Port 1 shall be selected as the input, Ports 2 and 4 as the outputs, Port 3 shall be connected to a matched load.
  Step 2 (duration as above): Port 3 shall be selected as the input, Ports 2 and 4 as the outputs, Port 1 shall be connected to a matched load.
- Data Points:
  Input VSWR, Insertion Loss for both lines and Reference Point Temperature shall be shall be continuously monitored and recorded once every 1s as a minimum during step 1 and 2 or alternatively an analogue recorder may be used, in accordance with the Detail Specification as follows:
  i. During Screening Tests (Chart F3): in High and Low Temperatures Electrical Measurements.
  ii. During Qualification, Periodic Testing and Lot Validation Testing (Chart F4): in Intermediate and End-Point Electrical Measurements.

  Reference Point Temperature shall be in accordance with Para. 8.14.

8.14 REFERENCE POINT TEMPERATURE

The localised temperature of the reference point on the surface of the component, as specified in the Detail Specification, shall be measured during the applicable test using a suitable method to an accuracy of ±1°C. The limits specified in the Detail Specification shall apply.

8.15 MULTIPACTION

Only applicable if required in the Detail Specification.

Verification with respect to multipaction shall be performed in accordance with ECSS-E-20-01. The multipaction classification type shall be as specified in the Detail specification. Unless otherwise specified, the following conditions shall apply:

- Applied Power: Rated RF Power as specified in Maximum Ratings in the Detail Specification in both forward and reverse directions, in addition to the test margins in accordance with ECSS-E-20-01.
- Test Temperature: Room ambient.

Verification in accordance with ECSS-E-20-01 may be accomplished by one of the following verification routes:

- Analysis only.
- Qualification test on a single sample from the lot.
- Batch acceptance test on 3 samples from the lot.
- Unit acceptance testing on all components in the lot.

In the event that verification is not achieved, the lot shall be considered as failed.

8.16 CORONA LEVEL

Only applicable if required in the Detail Specification.

Coronal Level testing shall be performed depending on the margin demonstrated by analysis or test as follows:

- margin ≥ 6dB: no test is required.
- 3dB < margin < 6dB: test shall be performed on a single sample components.
- margin ≤ 3dB: 100% test is required.

If analysis or test margin cannot be demonstrated as required, 100% of the components shall be subjected to corona testing under thermal vacuum. Unless otherwise specified, the following conditions shall apply:

- Frequency : Minimum, maximum and centre frequency as specified in the Detail Specification.
- Power: Rated RF Power, CW mode, as specified in Maximum Ratings in the Detail Specification.
- Mounting: The component shall be mounted in a thermal vacuum chamber by means of a port-plate. The chamber shall be filled with air or dry nitrogen. Precautions shall be taken to avoid any condensation during testing. Test Temperature shall be +22 ±3°C (sensor Sr).
- Test procedure: Start pumping sequence, from ambient pressure, while CW RF power is ON. Maintain the CW RF power for one hour duration once the pressure in the vacuum chamber has reached 5mPa.

- Data Points
  During testing VSWR and Insertion loss shall be continuously monitored as specified in Room Temperature Electrical Measurements in the Detail Specification as well as any corona discharge with at least 2 detection methods. No corona effect shall be detected by any of the relevant methods.

  Note: Corona effect shall be detected with the most relevant methods (global methods based on the RF signal analysis: Transmit power, Reflected power, 3rd harmonic, phase nulling, Close-to-carrier noise; Local methods: Optical detection, Electron probe) to be agreed by the ESCC Executive.

8.17 RF LEAKAGE

The components shall be subjected to a radiated emission sniff test in accordance with ESCC Basic Specification No. 24500.

For power dividers, the output shall be terminated in a matched load.

For combiners, the output shall be terminated in a matched load and the power applied on all the inputs simultaneously.

For couplers, any port may be selected as the input; the output and the unused port shall be terminated in a matched load.

Unless otherwise specified, the following conditions shall apply:

- Power Applied During Testing: 10dBm, unless otherwise specified in the Detail Specification.
- Test Temperature: Room ambient.

- Data Points:
  Radiated emission limits are specified in the Detail Specification.

8.18 RADIOGRAPHIC INSPECTION

Only applicable if required in the Detail Specification.

ESCC Basic Specification No. 20900.

8.19 MECHANICAL SHOCK

For components with coaxial connectors (integral or non-integral), suitable connector savers may be used.

Unless otherwise specified in the Detail Specification, MIL-STD-202, Test Method 213 with the following conditions:

- Shape of shock pulse: Half-sine.
- Peak acceleration: 1500g.
- Duration of pulse: 0.3ms.
- Number of shocks: 18 (3 shocks in each direction along the 3 perpendicular axes of the test specimen).

- Mounting: The components shall be mechanically connected to the shock machine either directly or by means of a fixture. Mounting fixtures shall enable the components to be shocked 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 means of mounting shall be clamped by the body.

- Data Points:
  On completion of testing, the components shall be visually inspected and there shall be no evidence of damage or loosening of parts.

  Electrical measurements as specified in Intermediate and End-Point Electrical Measurements in the Detail Specification shall be performed.

8.20 CONNECTOR ENDURANCE

Not required for components with ESCC qualified non-integral coaxial connectors

The components shall be subjected to a specified number of mating and unmating cycles at a specified rate using a suitable mating connector of the same type.

Unless otherwise specified, the number of cycles shall be 50 and the rate shall be no more than 12 cycles per minute. During each cycle the components shall be fully mated to the specified torque as specified in the ESCC Detail Specification for the equivalent non-integral coaxial connector, and then fully unmated.

Unless otherwise specified, the threads of rotational parts shall not be lubricated before or during endurance testing. Solvents and tools shall not be used for cleaning.

- Data Points:
  On completion of testing, Mating and Unmating Forces shall be measured in accordance with Para. 8.12. The components shall be visually inspected and there shall be no evidence of physical damage. Any wear to the contacts or threads as a result of the endurance testing shall not be considered as physical damage.

8.21 PERMANENCE OF MARKING

ESCC Basic Specification No. 24800.

8.22 DESTRUCTIVE PHYSICAL ANALYSIS (DPA)

ESCC Basic Specification No. 21001.

9 DATA DOCUMENTATION

9.1 GENERAL

For the qualification, qualification maintenance and procurement for each lot a data documentation package shall exist in a printed or electronic form.

This package shall be compiled from:

(a) Cover sheet (or sheets).
(b) List of equipment (testing and measuring).
(c) List of test references.
(d) Special In-Process Controls data (Chart F2).
(e) Screening Tests data (Chart F3).
(f) Qualification, Periodic Testing and Lot Validation Testing (when applicable) data (Chart F4).
(g) Failed components list and failure analysis report (when applicable).
(h) Certificate of Conformity.

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

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

Whenever possible, documentation should preferably be available in electronic format suitable for reading using a compatible PC. The format supplied shall be legible, durable and indexed. The preferred storage medium is CD-ROM and the preferred file format is PDF.

9.1.1 Qualification and Qualification Maintenance

In the case of qualification or qualification maintenance, the items listed in Para. 9.1(a) to (h) are required.

9.1.2 Component Procurement and Delivery

For all deliveries of components procured to this specification, 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).

9.1.3 Additional Documentation

The Manufacturer shall deliver additional documentation containing data and reports to the Orderer, if stipulated in the Purchase Order.

9.1.4 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 for review, if requested, by the Orderer or the ESCC Executive (for qualified components).

9.2 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 ESCC Generic Specification, including issue and date.
(c) ESCC Component Number and the Manufacturer's part type number.
(d) Lot identification.
(e) Range of delivered serial numbers.
(f) Number of the Purchase Order.
(g) Information relative to any additions to this specification and/or the Detail Specification.
(h) Manufacturer's name and address.
(i) Location of the manufacturing plant.
(j) Signature on behalf of Manufacturer.
(k) Total number of pages of the data package.

9.3 LIST OF EQUIPMENT USED

A list of equipment used for tests and measurements shall be prepared. 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.

9.4 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.

9.5 SPECIAL IN-PROCESS CONTROLS DATA (CHART F2)

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

For Plating Thickness Verification and Contact Engagement and Separation Forces (as applicable), the measurements shall be recorded.

For Resistive Element Burn-In (as applicable), the results shall be recorded, and be traceable to component serial number.

For Resistive Element Operating Life, the results including drift calculations shall be recorded.

For Room Temperature Electrical Measurements, the results shall be recorded against component serial number.

9.6 SCREENING TESTS DATA (CHART F3)

A test result summary shall be compiled showing the total number of components submitted to, and the total number rejected after each of the tests. For each test requiring electrical measurements, the results shall be recorded against component serial number. The total number of mating/umating operations performed on each connector, for each component, shall be recorded against component serial number. In addition, data shall include all results recorded during the following tests:

- Thermal Stability of Insertion Loss
- Power Thermal Vacuum (as applicable)
- Multipaction (if applicable)
- Corona Level (if applicable)
- RF Leakage
- Radiographic Inspection (if applicable)

9.7 QUALIFICATION, PERIODIC TESTING AND LOT VALIDATION TESTING DATA (CHART F4)

9.7.1 Qualification Testing

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup. Data shall include all results recorded during each test. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test, the drift calculation shall be recorded against component serial number. For Destructive Physical Analysis, a DPA report shall be produced in accordance with ESCC Basic Specification No. 21001.

9.7.2 Periodic Testing for Qualification Maintenance

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup. Data shall include all results recorded during each test. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test, the drift calculation shall be recorded against component serial number. For Destructive Physical Analysis, when applicable, a DPA report shall be produced in accordance with ESCC Basic Specification No. 21001.

In addition to the full test data a report shall be compiled for each subgroup of Chart F4 to act as the most recent Periodic Testing summary. These reports shall include a list of all tests performed in each subgroup, the ESCC Component Numbers and quantities of components tested, a statement confirming all the results were satisfactory, the date the tests were performed and a reference to the full test data.

9.7.3 Lot Validation Testing

A test result summary shall be compiled showing the components submitted to and the number rejected after each test in each subgroup (as applicable). Data shall include all results recorded during each test. Component serial numbers for each subgroup shall be identified. For each test requiring electrical measurements, the results shall be recorded against component serial number. Where a drift value is specified during a test, the drift calculation shall be recorded against component serial number. For Destructive Physical Analysis, a DPA report shall be produced in accordance with ESCC Basic Specification No. 21001.

9.8 FAILED COMPONENTS LIST AND FAILURE ANALYSIS REPORT

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

(a) The reference and description of the test or measurement performed as defined in this specification and/or the Detail Specification during Special In-Process Controls, Screening Tests and Qualification, Periodic Testing and Lot Validation Testing.

(b) Traceability information including serial number of the failed component.

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

(d) Detailed failure analysis (if requested by the ESCC Executive or Orderer).

9.9 CERTIFICATE OF CONFORMITY

A Certificate of Conformity shall be established in accordance with the requirements of ESCC Basic Specification No. 20100 or 25400.

10 DELIVERY

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

(a) The delivery lot.

(b) The components used for Lot Validation Testing (as applicable), but not forming part of the delivery lot, if stipulated in the Purchase Order.

(c) The relevant documentation in accordance with the requirements of Paras. 9.1.2 and 9.1.3.

In the case of a component for which a valid qualification is in force, all data of all components submitted to Lot Validation Testing shall also be copied, when requested, to the ESCC Executive.

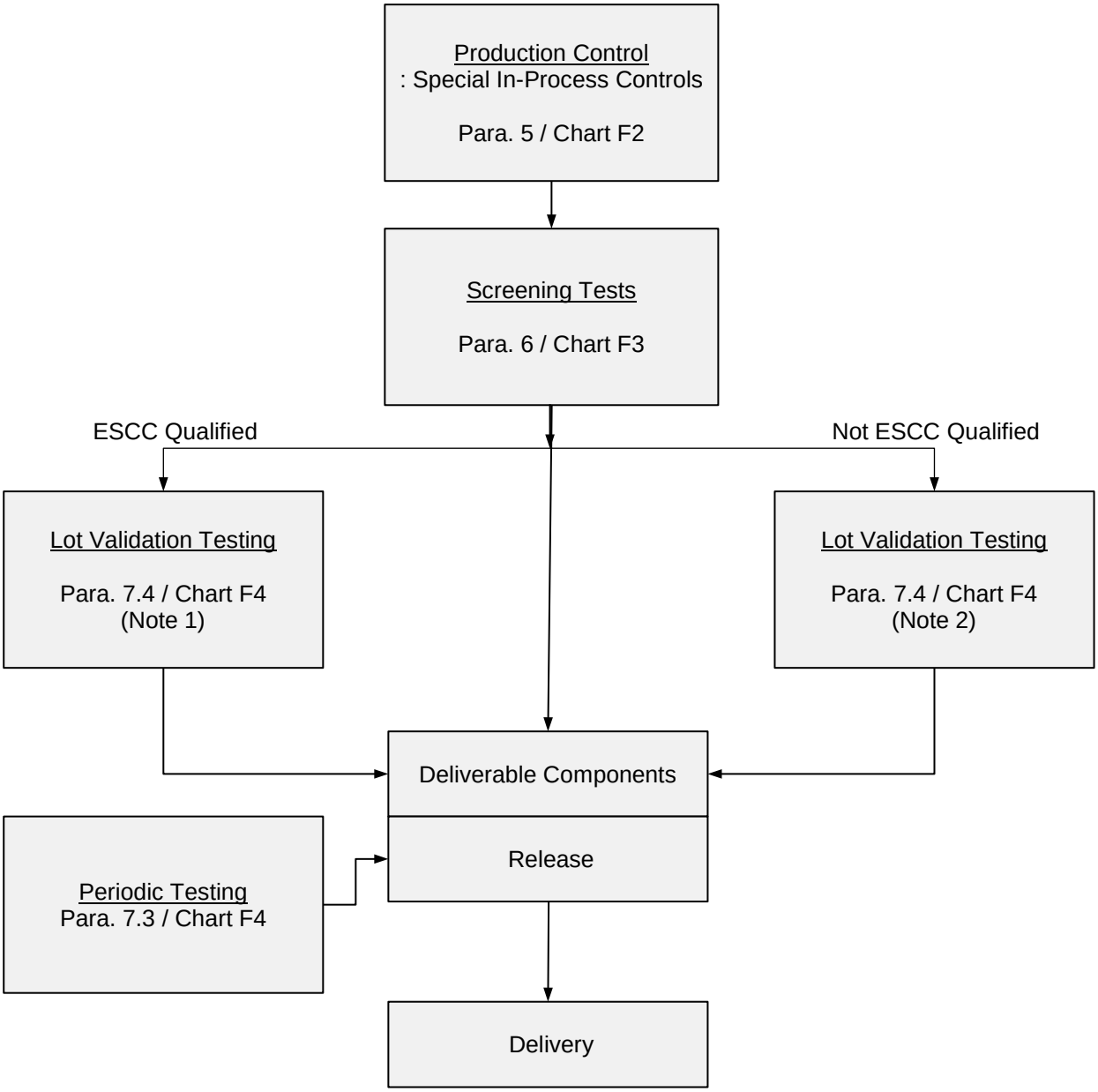
For qualification or qualification maintenance, the disposition of the Qualification Test Lot and its related documentation shall be as specified in ESCC Basic Specification No. 20100 or 25400 and the relevant paragraphs of Section 9 of this specification.

11 PACKAGING AND DISPATCH

The packaging and dispatch of components to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 20600.

12 CHARTS

12.1 CHART F1 - GENERAL FLOW FOR PROCUREMENT



NOTES:

1. Lot Validation Testing is not required for qualified components unless specifically stipulated in the Purchase Order.
2. For unqualified components the need for Lot Validation Testing shall be determined by the Orderer and the required testing shall be as stipulated in the Purchase Order (ref. ESCC Basic Specification No. 23100).

12.2 CHART F2 - PRODUCTION CONTROL

COMPONENT LOT MANUFACTURING	
SPECIAL IN-PROCESS CONTROLS	
Para. 5.2.1	Plating Thickness Verification (1) (2) (3)
Para. 5.2.2.1	Resistive Element Burn-in (3) (4)
Para. 5.2.2.2	Resistive Element Operating Life (2) (5) (6)
Para. 5.2.3	Contact Engagement and Separation Forces (2) (3) (7)
Para. 5.2.4	Pre-Assembly Inspection
Para. 5.1	Assembly and Serialisation
Para. 5.2.5	Dimension Check
Para. 5.2.6	Weight (1) (2)
Para. 5.2.7	Room Temperature Electrical Measurements
Para. 5.2.8	External Visual Inspection (2)
TO CHART F3 – SCREENING TESTS	

NOTES:

1. If required by the Detail Specification.
2. Performed on a sample basis.
3. Test may be performed at any point prior to Pre-Assembly Inspection.
4. Not required for ESCC qualified resistors.
5. May be performed on test coupons for components using PCB’s with embedded resistors.
6. Test may be performed at any point during Chart F2.
7. Only applicable to components with integral coaxial connectors with female contacts.

12.3 CHART F3 - SCREENING TESTS

PACKAGED COMPONENTS FROM PRODUCTION CONTROL	
Para. 8.8	Temperature Cycling
Para. 8.9	Random Vibration
Para. 8.10	Thermal Stability of Insertion Loss
Para. 8.11	Coupling Proof Torque (1)
Para. 8.12	Mating and Unmating Forces (1)
Para. 8.5.1	Connector Interface Dimension Check (1)
Para. 8.13	Power Thermal Vacuum (2)
Para. 8.15	Multipaction (2)
Para. 8.16	Corona Level (2)
Para. 8.7.6	High and Low Temperatures Electrical Measurements
Para. 8.7.5	Room Temperature Electrical Measurements
Para. 8.17	RF Leakage
Para. 8.18	Radiographic Inspection (2) (3)
Para. 8.5	External Visual Inspection
Para. 6.4	Check for Lot Failure (4)
TO CHART F4 WHEN APPLICABLE	

NOTES:

1. Not required for components with ESCC qualified non-integral coaxial connectors.
2. If required in the Detail Specification.
3. May be performed at any point during Screening Tests after Random Vibration.
4. Check for Lot Failure shall take into account all failures that may occur during Screening Tests.

12.4 CHART F4 - QUALIFICATION, PERIODIC TESTING AND LOT VALIDATION TESTING

Testing Subgroup 24 Months Period	
3 Components (1) (2)	
Para. 8.12	Mating and Unmating Forces
Para. 8.9	Random Vibration
Para. 8.19	Mechanical Shock
Para. 8.8	Temperature Cycling
Para. 8.10	Thermal Stability of Insertion Loss
Para. 8.13	Power Thermal Vacuum (3)
Para. 8.20	Connector Endurance (4)
Para. 8.17	RF Leakage
Para. 8.5	External Visual Inspection
Para. 8.21	Permanence of Marking
1 Component (5)	
Para. 8.22	Destructive Physical Analysis (5)

NOTES:

1. For distribution within the subgroups see Para. 7.1.2 for qualification and qualification maintenance and Para. 7.4 for Lot Validation Testing.
2. No failures are allowed.
3. If required in the Detail Specification.
4. Not required for components with ESCC qualified non-integral coaxial connectors.
5. Not required for Periodic Testing for extension of qualification. Required only for Qualification Testing and for Periodic Testing for renewal of qualification after lapse. 1 of the components subjected to testing above shall be selected at random for DPA.