



GENERIC SPECIFICATION

REF.: RAD-GEN-COUP-001

Date:
January 29th, 10

ED/REV:
3 / A

PAGE:
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Titre / Title

**RF, COAXIAL
HYBRID COUPLERS
POWER DIVIDERS
and
DIRECTIONAL COUPLERS
GENERIC SPECIFICATION**

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DOCUMENTATION CHANGE NOTICE

REVISION OR ISSUE	DATE	CHANGE
1/-	26/03/03	Creation – Replacement of RAD-GEN-SPA-COUPLER-001 specification
2/-	18/04/03	Updated with deleted paragraph 12 “detail specifications for variants”. A TDS (Technical Data Sheet) document is written for each type of couplers.
2/A	20/05/03	Updated with minor corrections
2/B	30/07/03	Added TNC connectors access
2/C	14/10/03	Updated with minor correction: §9.9.1: vibration cycling 1000-2000Hz –6dB/oct instead of –12dB/oct
2/D	31/08/06	Updated with minor corrections on reference documents issues, Figure 2.1-1 added for derating parameter information. Operating life test (§9.15) conditions updated.
3/-	28/11/06	Wording changed to take into account power dividers. Correction of mistakes: § 9.6.3 : formula gives coupling loss instead of IL § 9.6.8 : Insertion loss calculation by power ratio inverted. Operating life test (§9.15) conditions updated
3/A	29/01/10	Addition of test chart VI for EM units



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1. GENERAL

1.1. SCOPE

This specification details the ratings, physical and electrical characteristics, for RF coaxial Hybrid Couplers, Power Dividers and Directional couplers for space applications. It contains the appropriate inspection and test schedules and also specifies the data documentation requirements

1.2. APPLICABLE DOCUMENTS

The following documents form a part of, and shall be read in conjunction with, this specification. The relevant issues shall be those in effect at the date of placing the purchase order.

MIL PRF 39012 General Specification : RF Coaxial Connectors.

ESCC 20400 Internal Visual Inspection

ESCC 20500 External Visual Inspection

ESCC 24800 Resistance to solvents of Marking, Material and Finishes

IEC publications 60068-2, Basic Environmental Testing Procedures

1.3. TYPE VARIANT : TECHNICAL DATA SHEET

For each type of variant, the full electrical and physical characteristics are given by an individual Technical Data Sheet.

2. CHARACTERISTICS

2.1. ELECTRICAL CHARACTERISTICS

2.1.1. *Maximum ratings*

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the RF coaxial Power Dividers, Hybrid and Directional Couplers specified herein, are scheduled in the relevant Technical Data Sheet.

For Power Dividers & Hybrid Couplers

N	CHARACTERISTICS	SYMBOL	VALUES		UNIT	COMMENTS
			MIN	MAX		
1	Frequency Range	F	See TDS		GHz	-
2	VSWR Input Output	RLi	See TDS		-	See §9.6.7
		RLo	See TDS		-	
3	Amplitude Unbalance	AMb	See TDS		dB	See §9.6.5
4	Phase Unbalance	PHb	See TDS		°	See §9.6.6
5	Isolation Input Output	ISOi	See TDS		dB	See §9.6.9
		ISOo	See TDS		dB	
6	Insertion Loss	IL	See TDS		dB	See §9.6.8
7	RF Power	P	See TDS		W	See Power Capability Analysis Documents
8	RF Leakage	E	See TDS		dB _i	-
9	Weight	W	See TDS		g	-
10	Interfaces Input Output	-	See TDS		-	-
		-	See TDS		-	-
11	Operating Temperature Range	Top	See TDS		°C	- -
12	Storage Temperature Range	Tst	See TDS		°C	- -

For Directional Couplers

No	CHARACTERISTICS	SYMBOL	VALUES		UNIT	COMMENTS
			MIN	MAX		
1	Frequency Range	F	See TDS		GHz	-
2	Coupling	C	See TDS		dB	See §9.6.1
3	VSWR	RLp	See TDS		-	See §9.6.2
	Primary Line Secondary Line	RLs	See TDS		-	
4	Insertion Loss (Coupling loss included)	IL	See TDS		dB	See §9.6.3
5	Directivity		See TDS		dB	See §9.6.4
6	RF Power	P	See TDS		W	See Power Capability Analysis Documents
7	RF Leakage	E	See TDS		dBi	-
8	Weight	W	See TDS		g	-
9	Interfaces			See TDS		
	Input	-		See TDS	-	-
	Output Coupled Output	- -		See TDS See TDS	- -	- -
10	Operating Temperature Range	Top	See TDS		°C	-
11	Storage Temperature Range	Tst	See TDS		°C	-

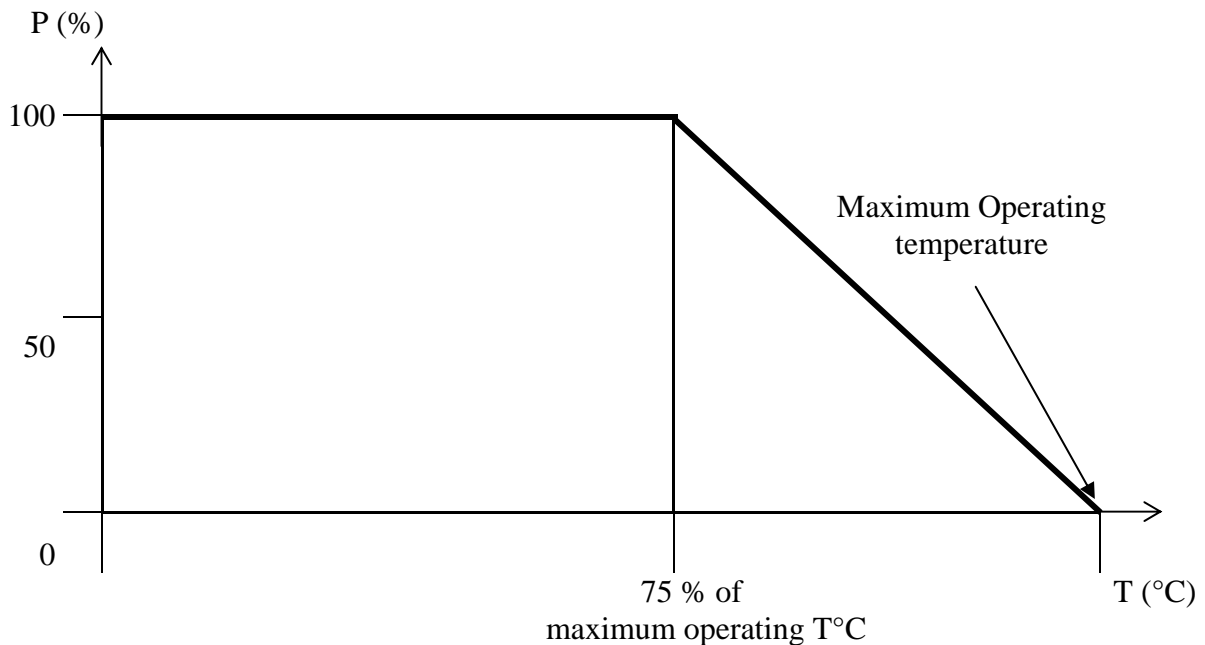


Figure 2.1-1 – Power versus temperature (hybrid & directional couplers)

2.1.2. Functional diagrams

The 3 dB, 90° hybrid coupler, splits power equally to the output ports with a 90° fixed phase difference between output ports as shown in Figure 2.1-2 – Hybrid Coupler Functional diagram

These 3 dB, 90° hybrid couplers can be used as power dividers and combiners.

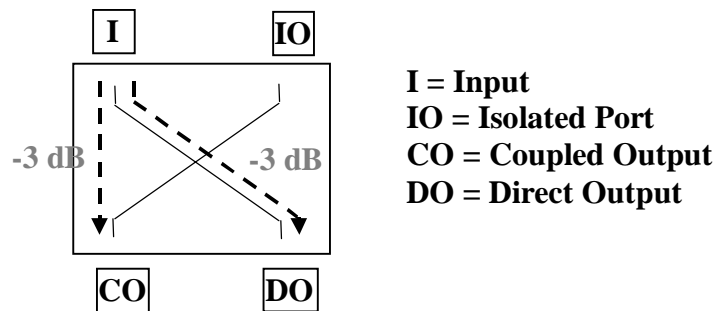


Figure 2.1-2 – Hybrid Coupler Functional diagram

The directional coupler draws a sample of power to the coupled output ports by a known amount as shown in Figure 2.1-3 - Directional Coupler Functional Diagram

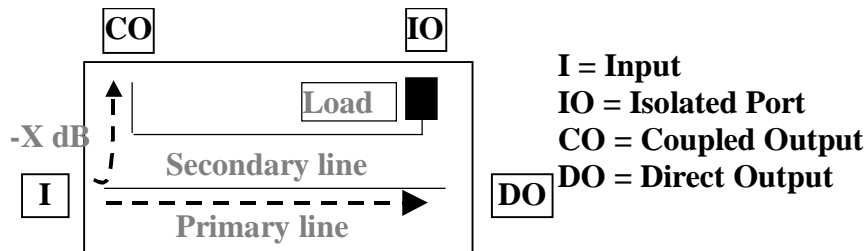


Figure 2.1-3 - Directional Coupler Functional Diagram

In phase (Wilkinson) N ways power dividers splits power, ideally divided equally, between the N output ports as shown in Figure 2.1-4 – Power Dividers Functional Diagram

A N way divider can also combine N input signals providing they are of the proper input phase and amplitude relationship. The output is the sum of the N signals but each has 1/N unit of power.

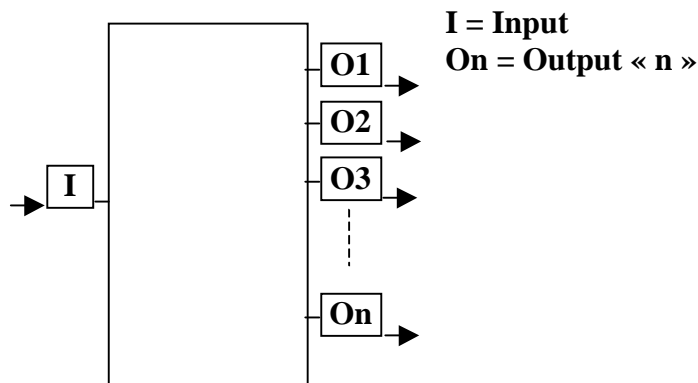



Figure 2.1-4 – Power Dividers Functional Diagram

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3. MECHANICAL CHARACTERISTICS

3.1. PHYSICAL DIMENSIONS

The physical dimensions of the RF coaxial Power Dividers, Hybrid and Directional couplers specified herein are scheduled in individual Technical Data Sheet.

Dimensions pointed by an arrow shall be measured for dimension check measurements.

3.2. ACCESS

Input and output access shall be connector, type SMA or TNC, female contact, per MIL PRF 39012 General Specification for, RF Coaxial Connectors.

3.3. MATERIAL AND FINISHES

3.3.1. Connectors

Material for SMA, TNC connectors shall be passivated stainless steel for connector body and beryllium copper - gold plated for the centre contact.

3.3.2. Body


The divider or coupler body shall be made of aluminium 5754 H111 or 6061 T6, chromated finish. No paint shall be used to allow RF shielding with Electrodag 503 coated with Epoxy Patch Hysol 151.

3.4. WEIGHT

The weight of the RF coaxial Power Dividers, Hybrid and Directional couplers specified herein are given in individual Technical Data Sheet.

3.5. LIFE

The RF coaxial Power Dividers, Hybrid and Directional couplers specified herein shall be designed to guarantee a storage life of 5 years then an operating life of 15 years.

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4. REQUIREMENTS

4.1. GENERAL

The test requirements for qualification approval of a component shall comprise:
qualification testing, see chart IV.

The test requirements for procurement of components shall comprise:
final production tests, see chart II,
electrical measurements, see chart III,
and a level of lot acceptance testing, see chart V, to be specified by the Orderer.

The conditions and methods of tests shall be in accordance with this specification and the individual Technical Data Sheet.

Radiall shall be responsible for the performance of tests and inspections required by the applicable specifications. These test and inspections shall be performed at the plant of l'Isle d'Abeau or at any approved external facility under the control of Radiall Quality Department.

4.2. DELIVERABLE COMPONENTS

Components delivered to this specification shall be processed and inspected in accordance with the relevant Flow Chart Document (FCD).

4.2.1. Lot identification

A lot shall be constituted of the totality of devices manufactured with the same procedure during the same space of time and with homogeneous materials. Each manufacturing lot shall be referenced by a lot number, which shall figure on each control document FCD. Date code shall be used as lot number. Each deliverable device shall be traceable to its production lot. Devices delivered to this specification shall have completed satisfactorily all tests to the testing level and lot acceptance level specified in the Purchase Order.

4.2.2. Failures modes and lot failure


Failure modes:

Mechanical failure: any device, which fails according the criteria given for visual and mechanical inspection, is counted as a mechanical failure.

Electrical failure: any device, which fails one or more limits given for RF and EMC parameters, is counted as an electrical failure.

Other failures: in addition, the following failures may occur:

- electrical catastrophic failure,
- handling failure.
- lost components

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Failed devices:

A device counts as one failed device if one or more failure modes as mentioned above are encountered.

Procedure at unit failure:

When a failure occurs, Radiall shall:

- a) Notify the Orderer within 24 working hours after the detection of the failure.
- b) Investigate for the modes and the cause of the failure.
- c) Perform failure analysis with associated report.

Lot failure:

In case of one or more failed units occurs during screening tests, the decision about rejection or acceptance of the lot will be taken after Orderer decision.

4.3. LOT ACCEPTANCE LEVELS

This specification defines 2 levels of Lot Acceptance Testing, see chart V.

The Lot Acceptance levels are designed 3 and 2, they are comprised of tests as follow:

Level 3 – LAT 3 – Dimensional subgroup.

Level 2 – LAT 2 – Endurance subgroup plus Dimensional subgroup.

The tests in level 3 are considered to be non destructive. At completion, FM sample so tested may form part of the delivery lot.


The tests in level 2 are considered to be destructive. At completion, FM sample so tested shall not form part of the delivery lot. Sample for LAT 2 must be ordered apart to the FM samples.

The required Lot Acceptance Testing level shall be specified in the purchase order.

4.4. MARKING

The marking by label shall include at least:

- a) Input / output identification,
- b) RADIALL identification.
- c) Reference number, coupling
- d) Serial number, Date code
- e) Ordered part number or program and phase given in the Purchase Order.

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5. FINAL PRODUCTION TESTS

5.1. GENERAL

All components for delivery, including those submitted to Lot Acceptance Tests, shall be subjected to tests and inspections in accordance with chart II.

The Test shall be performed in the order shown.

Any components that do not meet these requirements shall be removed from the lot.

5.2. TEST METHODS AND CONDITIONS

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

5.3. DOCUMENTATION


Documentation of final production test data shall be in accordance with the requirements of paragraph 11 of this specification.

5.4. FINAL PRODUCTION TESTS (CHART II)

Chart II: Final production tests

Production and controls in accordance with manufacturer in process operations		
§ 10.1	Internal Visual Inspection	100 %
Final assembly		
§ 4.4	Marking and Serialisation	100 %
§ 10.7	Electrical measurements at room temperature	100 %
§ 10.11	Thermal cycling	100 %
§ 10.9.1	Vibration cycling	100 %
§ 10.7	Electrical measurements at room temperature	100 %
§ 10.2	External Surface Inspection	100 %
§ 10.3	Dimension check, weight and marking	1 sample
To Chart III		

The applicable test methods and conditions are specified in the referenced paragraph.

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6. ELECTRICAL MEASUREMENTS

6.1. GENERAL

All components for delivery, including those submitted to Lot Acceptance Tests, shall be subjected to tests and inspections in accordance with chart III.

The Test shall be performed in the order shown.

Any components that do not meet these requirements shall be removed from the lot.

6.2. TEST METHODS AND CONDITIONS

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

6.3. DOCUMENTATION


Documentation of electrical measurements test data shall be in accordance with the requirements of paragraph 11 of this specification.

6.4. ELECTRICAL MEASUREMENTS (CHART III)

Chart III: Electrical measurements

Components from Final Production Tests		
§ 10.8	Electrical measurements at high and low temperatures	100 %
§ 10.7	Electrical measurements at room temperature	100 %
§ 10.2	External Surface Inspection	100 %
§ 10.13	RF leakage	100 %
To Chart V or Delivery		

The applicable test methods and conditions are specified in the referenced paragraph.

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7. QUALIFICATION TESTING

7.1. GENERAL

Qualification shall be in accordance with requirement of chart IV of this specification. The tests to chart IV shall be performed on the qualification test sample, chosen at random from production lot.

The Test shall be performed in the order shown.

Qualification testing shall be performed by the Radiall's Quality assurance personnel using dedicated quality assurance equipment whenever possible.

7.2. TEST METHODS AND CONDITIONS

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

7.3. DOCUMENTATION

Documentation of qualification test data shall be in accordance with the requirements of paragraph 11 of this specification.

7.4. QUALIFICATION TESTS (CHART IV) - 1 SAMPLE

Production and controls in accordance with manufacturer in process operations		
§ 10.1	Internal Visual Inspection	QM sample
Final assembly		
§ 4.4	Marking and Serialisation	QM sample
§ 10.2	External Surface Inspection	QM sample
§ 10.13	RF Leakage	QM sample
§ 10.7	Electrical measurements at room temperature	QM sample
§ 10.9.2	Sine Vibration	QM sample
§ 10.9.3	Random Vibration	QM sample
§ 10.2	External Surface Inspection	QM sample
§ 10.7	Electrical measurements at room temperature	QM sample
§ 10.10	Mechanical shock	QM sample
§ 10.2	External Surface Inspection	QM sample
§ 10.7	Electrical measurements at room temperature	QM sample
§ 10.12	Thermal Vacuum Test	QM sample
§ 10.8	Electrical measurements at High and Low temperature	QM sample
§ 10.7	Electrical measurements at room temperature	QM sample
§ 10.13	RF Leakage	QM sample
§ 10.14	Power Handling	QM sample
§ 10.7	Electrical measurements at room temperature	QM sample
§ 10.2	External Surface Inspection	QM sample
§ 10.3	Dimension check, Weight and Marking	QM sample

8. LOT ACCEPTANCE TESTING

8.1. GENERAL

The sample (4 items) assigned to Lot Acceptance Testing shall be subjected to tests and inspections in accordance with chart V of this specification. Sample shall be chosen randomly from the proposed delivery lot, components which have successfully passed the tests in chart II and Chart III.

The Test shall be performed in the order shown.

Lot Acceptance testing shall be performed by the Radiall's production personnel using production test equipment.

Couplers and Power Dividers that do not meet the specified requirements for each test shall be rejected. The primary lot shall be rejected if one failure occur.

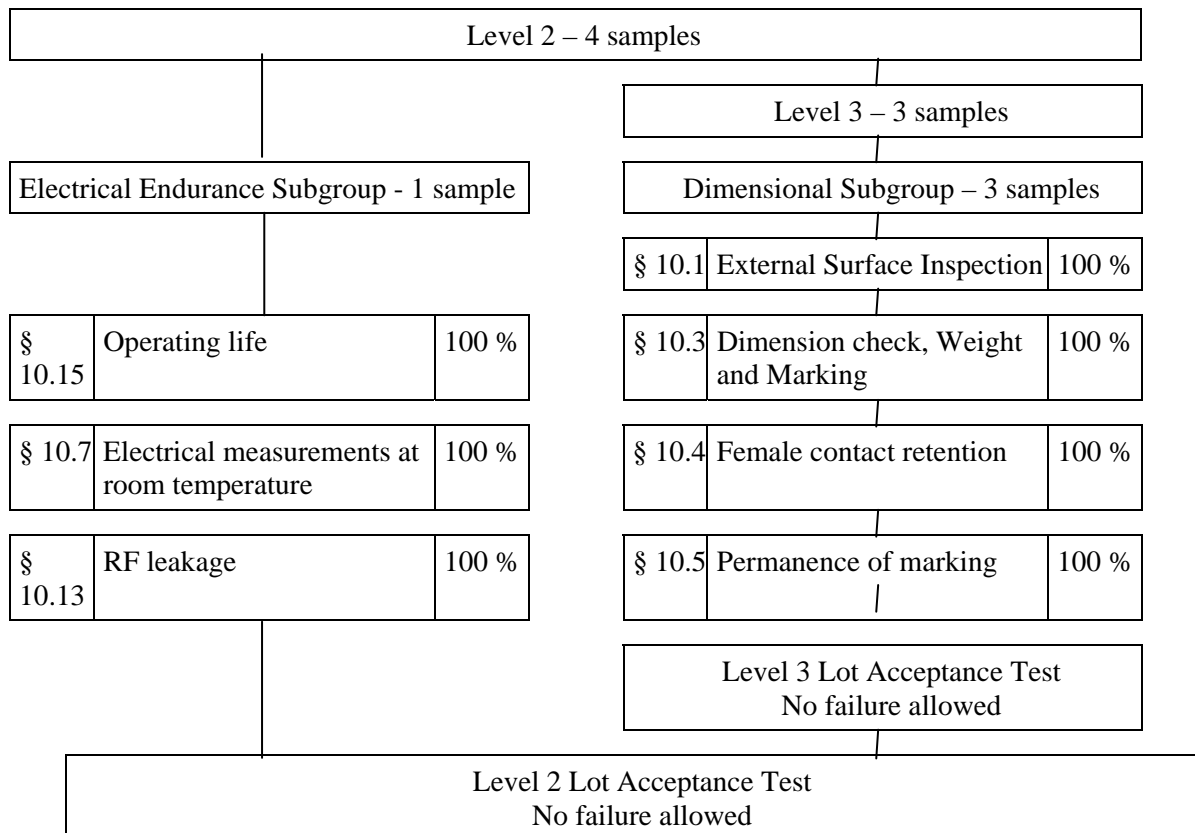
8.2. TEST METHODS AND CONDITIONS

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


8.3. DOCUMENTATION

Documentation of Lot Acceptance Test data shall be in accordance with the requirements of paragraph 10 of this specification.

8.4. LOT ACCEPTANCE TESTS (CHART V)



If the quantity of Flight parts ordered is less than 3, the Dimensional Subgroup sample size shall be reduced to equal to the quantity ordered. These parts shall be delivered as Flight parts.

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9. ENGINEERING MODEL TESTING

9.1. GENERAL

All EM units for delivery shall be subjected to tests and inspections in accordance with chart VI. The Test shall be performed in the order shown. Any components that do not meet these requirements shall be removed from the lot.

9.2. TEST METHODS AND CONDITIONS

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


9.3. DOCUMENTATION

Documentation of electrical measurements test data shall be in accordance with the requirements of paragraph 10 of this specification.

9.4. ENGINEERING MODELS TESTS (CHART VI)

Chart VI : Engineering Models Testing – EM units

Production and controls in accordance with manufacturer in process operations		
§ 10.1	Internal Visual Inspection	100 %
Final assembly		
§ 4.4	Marking and Serialisation	100 %
§ 10.3	Dimension check, weight and marking	1 sample
§ 10.8	Electrical measurements at high and low temperatures	100 %
§ 10.7	Electrical measurements at room temperature	100 %
§ 10.13	RF leakage	100 %
§ 10.2	External Surface Inspection	100 %
To Delivery		

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10. TEST METHODS AND TEST PROCEDURES

10.1. INTERNAL VISUAL INSPECTION

This inspection shall be performed in accordance with the requirements of ESCC Basic Specification n° 20400.

10.2. EXTERNAL SURFACE INSPECTION

This inspection shall be performed in accordance with the requirements of ESCC Basic Specification n° 20500 for external surface inspection.

10.3. DIMENSION CHECK, WEIGHT AND MARKING

This inspection shall be performed in accordance with the requirements of ESCC Basic Specification n° 20500 for dimension check and marking.

10.4. FEMALE CONTACT RETENTION

The female contact of every connector used on the components shall be submitted to a withdrawal test with “go no go” weights and pins as specified in the MIL PRF 39012 General Specification for RF Coaxial Connectors.

10.5. PERMANENCE OF MARKING

This inspection shall be performed in accordance with the requirements of ESCC Basic Specification n° 24800.

10.6. ELECTRICAL MEASUREMENTS

For Directional Couplers:

10.6.1. Coupling

The coupling of Directional Couplers shall be determined, over the frequency range specified in the Technical Data Sheet, 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.


The coupling, over the frequency range specified in the Technical Data Sheet, shall be included in the range of width = coupling accuracy, centred on nominal coupling.

Nominal coupling $- \frac{1}{2}$ coupling accuracy \leq coupling \leq nominal coupling $+ \frac{1}{2}$ coupling accuracy

10.6.2. V.S.W.R.

The V.S.W.R. of Directional Couplers shall be measured over the frequency range specified in the Technical Data Sheet.

The V.S.W.R. of each port shall be measured with the unused ports terminated in matched load.

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10.6.3. Insertion loss

The insertion loss of Directional Couplers shall be determined, over the frequency range specified in the Technical Data Sheet, 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. The insertion loss of directional couplers when measured as defined above includes coupling loss:

$$\text{Coupling loss} = 10 \cdot \log \left(1 - 10^{\frac{-C}{10}} \right).$$

10.6.4. Directivity

The directivity of Directional Couplers shall be computed over the frequency range specified in the Technical Data Sheet, from the ratio, positive and expressed in dB, of the available power at the output of the secondary line for the two direction of excitation, at equal power level, of the primary line. The secondary line shall be terminated in matched detector.

For Power Dividers and Hybrid couplers

10.6.5. Amplitude unbalance

The amplitude unbalance of Hybrid Couplers is the maximum difference (peak to peak), over the frequency range specified in the Technical Data Sheet, between the measured coupling (dB) at two any output ports: co-linear outputs of Power Dividers and coupled and direct outputs of hybrid couplers. Where the limits is expressed as ± X dB compared to the average output level, it shall be interpreted to allow a maximum difference of 2×X dB.

10.6.6. Phase unbalance

The phase unbalance of Power Dividers or Hybrid Couplers shall be measured, over the frequency range specified in the Technical Data Sheet, between two any output ports. The co-linear output ports and the adjacent isolated port of an hybrid coupler terminated in matched loads.

10.6.7. V.S.W.R.

The V.S.W.R. of Power Dividers or Hybrid Couplers shall be measured over the frequency range specified in the Technical Data Sheet.

The V.S.W.R. of each port shall be measured with the unused ports terminated in matched loads.

10.6.8. Insertion loss

The insertion of Hybrid Couplers shall be determined, over the frequency range specified in the Technical Data Sheet, by subtracting 3 dB from the average between the measured coupling (dB) at the two outputs. At a single frequency point, if coupling is 3.3 dB for one output, 3.7 for the second output, insertion loss is considered by rough calculation as $(3.3 + 3.7)/2 - 3 = 0.5$ dB.

The exact Insertion Loss of Power Dividers or Hybrid Couplers can only be achieved by computation of S parameters data. Insertion Loss = $10 \text{ Log } ((P_{\text{out1}} + P_{\text{out2}} + P_{\text{outi}} + P_{\text{outn}}) / P_{\text{in}})$

10.6.9. Isolation

The isolation of Hybrid Couplers shall be determined, over the frequency range specified in the Technical Data Sheet, as the ratio of the input power to the power from the isolated port.

The isolation of Power Dividers shall be determined, over the frequency range specified in the Technical Data Sheet, as the ratio of power between two any output ports.

10.7. ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURES

The parameters to be measured at room temperature in respect of electrical characteristics are scheduled in Table 1 - Electrical Measurements at Room Temperature.

Graphs shall be recorded in an electronic format file in the test data base.

This data file shall retained at RADIALL in an easily accessible depot and remains available for any further analysis.

For final production tests, electrical measurements and lot acceptance tests, measurement results: minimum, maximum, average values pointed out over the frequency range and Pass/Fail test results shall be recorded on the EIDP.

For qualification tests, maximum values pointed out over the frequency range and Pass/Fail test results and measurements graphs shall be included in the test report.

Table 1 - Electrical Measurements at Room Temperature

Power Dividers & Hybrid Couplers		Directional Couplers	
Characteristics	Test method	Characteristics	Test method
Amplitude unbalance	§ 10.6.5	Coupling	§ 10.6.1
Insertion loss	§ 10.6.8	Insertion loss	§ 10.6.3
Isolation	§ 10.6.9	Directivity	§ 10.6.4
V.S.W.R	§ 10.6.7	V.S.W.R	§ 10.6.2
Phase unbalance	§ 10.6.6		

10.8. ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURES

The parameters to be measured at high and low operating temperatures in respect of electrical characteristics are scheduled in Table 2 - Electrical Measurements at High and Low Temperatures.

Graphs shall be recorded in an electronic format file in the test data base.


This data file shall retained at RADIALL in an easily accessible depot and remains available for any further analysis.

For final production tests, electrical measurements and lot acceptance tests, measurement results: minimum, maximum, average values pointed out over the frequency range and Pass/Fail test results shall be recorded on the EIDP.

For qualification tests, maximum values pointed out over the frequency range and Pass/Fail test results and measurements graphs shall be included in the test report.

Table 2 - Electrical Measurements at High and Low Temperatures

Power Dividers & Hybrid Couplers		Directional Couplers	
Characteristics	Test method	Characteristics	Test method
Amplitude unbalance	§ 10.6.5	Coupling	§ 10.6.1
Insertion loss	§ 10.6.8	Insertion loss	§ 10.6.3
Isolation	§ 10.6.9	Directivity	§ 10.6.4
V.S.W.R	§ 10.6.7	V.S.W.R	§ 10.6.2

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10.9. VIBRATIONS

10.9.1. Vibration cycling

All components for delivery shall be subjected to vibration cycling in accordance with the requirements of IEC 60068-2-34 - Basic Environmental Testing Procedures Part 2: Test FD: Random Vibration Wide Band - General Requirements. Conditions shall be as specified in Table 3 - Vibration cycling
The vibration cycle: single sweep without return, shall be applied in the three mutually perpendicular axes as defined by the Technical Data Sheet. The duration shall be 1 minute per axis.

Table 3 - Vibration cycling

Parallel and Perpendicular to Mating plane	
Range (Hz)	Level
20 - 50	+ 6 dB / Oct
50 - 1000	0.74 g ² / Hz
1000 - 2000	- 6 dB / Oct
Global : 33 grms	

10.9.2. Sine vibration

The specimens for Qualification shall be subjected to sinusoidal vibration in accordance with the requirements of IEC 60068-2-6 - Environmental Testing - Part 2: Tests - Test FC: Vibration [Sinusoidal]. Conditions shall be as specified in Table 4 - Sinusoidal vibration.
The vibration cycle: single sweep without return, shall be applied in the 3 mutually perpendicular axes as defined by the Technical Data Sheet. The sweep rate shall be 2 octave / minute.

Table 4 - Sinusoidal vibration

Parallel and Perpendicular to Mating plane	
Range (Hz)	Level
5 – 23.3	11 mm (0-peak)
23.3 - 80	24 g
80 – 100	30 g

10.9.3. Random vibration

The specimen for qualification shall be subjected to random vibration in accordance with the requirements of IEC 60068-2-34 - Basic Environmental Testing Procedures Part 2: Test FD: Random Vibration Wide Band - General Requirements. Conditions shall be as specified in Table 5 - Random vibration.
The vibration cycle: single sweep without return, shall be applied in the three mutually perpendicular axes as defined by the Technical Data Sheet. The duration shall be 2 minutes per axis.

Table 5 - Random vibration

Parallel and Perpendicular to Mating plane	
Range (Hz)	Level
20 - 50	+ 6 dB / Oct
50 - 1000	1.3 g ² / Hz
1000 - 2000	- 6 dB / Oct
Global : 43.7 grms	

10.10. MECHANICAL SHOCK

The specimen for qualification shall be subjected to mechanical shock test in accordance with the requirements of IEC 60068-2-27 - Basic Environmental Testing Procedures Part 2: Tests - Test EA and Guidance: Shock. Conditions shall be as specified in Table 6 – Mechanical Shock. The shock shall be applied one time in the three mutually perpendicular axes as defined by the Technical Data Sheet.

Table 6 – Mechanical Shock

For Qualification Level		Parallel and Perpendicular to Mating plane
1200 g – 0.25 ms	Shape	Half sine
	Peak acceleration	1200 g
	Pulse duration	0.25 ms

10.11. THERMAL CYCLING

The component shall be subjected to thermal cycles in accordance with the requirements of IEC 60068-2-14 - Basic Environmental Testing Procedures Part 2: Tests - Test N Change of Temperature. The number of cycles shall be 5 with 30 minutes at each extreme storage temperature, temperature change rate shall be $\geq 2^{\circ}\text{C}/\text{mn}$.

10.12. THERMAL VACUUM

The specimen for qualification shall be subjected to Thermal Vacuum test. Conditions shall be according the profile given in Figure 10.12-1 - Thermal vacuum test profile

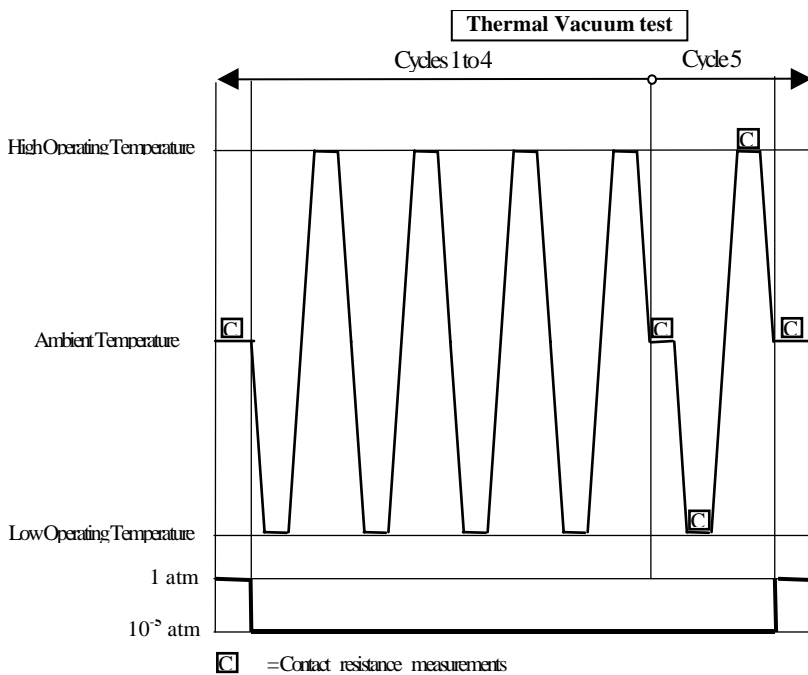



Figure 10.12-1 - Thermal vacuum test profile

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10.13. RF LEAKAGE

RF leakage measurements (shielding effectiveness) shall be performed according to reverberating chamber test method MIL STD 1344 method 3008, over the frequency range specified in the Technical Data Sheet.

10.14. POWER HANDLING

Power handling test shall be defined for continuous RF power test, applicability and test conditions to be defined by purchase order.

10.15. OPERATING LIFE

Operating life test consist in power application cycles, power (taking into account derating regarding temperature) shall be applied in cycles of 1 hour with power “On” and one hour with power “Off” for a duration of 1000 hours.

Radiall requests test to be performed at maximum operating temperature then, taking into account derating, no power shall be applied during test

Intermediate electrical measurements at room temperature shall be performed at 168 then 500 hours. After not less than 1000 hours, the components shall be allowed to cool at room temperature.

11. DATA DOCUMENTATION

The documentation provided with each component delivered shall be compiled in an EIDP, electronic format (pdf documents) in a single CD Rom including:

- Cover sheets
 - Certificate of conformance to this specification
 - Non conformance sheet (if any)
 - Test Plan Document with dedicated Test Procedure Document
 - Interface Control Drawing
 - Final Production and Electrical Measurements data
- All data shall clearly indicate that the results are in compliance with specification requirements, shall include ambient temperature and completion date of each test, shall indicate test personnel identification and shall be certified by a responsible company official.
- Lot Acceptance Test data (if required in the Purchase Order)

If a qualification is required, Qualification test results shall be compiled in a specific test report.

12. DELIVERY

For procurement and for each order, the items included in the delivery shall be:

- The delivery of parts
Rejected pieces shall not be delivered as a part of the quantity on the Purchase Order.
- The components used for Lot Acceptance Test (if required in the Purchase Order)
Sample units that have been subjected to Lot Acceptance Tests shall not be delivered as a part of the quantity on the Purchase Order. They shall be suitable marked (permanent marking) as LAT sample units, and identified as to purchase order.
- The relevant data documentation

12.1. PACKAGING AND DESPATCH

Devices shall be packaged separately so that they suffer to change any characteristic or loss of inherent reliability during shipment and in a manner acceptable to a common carrier.