
British Standard Specification for
**Microwave passive components of
assessed quality: Generic data and
methods of test**

Composants passifs à micro-ondes de qualité assurée: Données génériques et méthodes d'essai

Gütebestätigte passive Mikrowellenbauelemente: Fachgrunddaten und Prüfverfahren

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Foreword

This British Standard, having been prepared under the direction of the Electronic Components Standards Committee, is the generic specification for microwave

passive components in the system of standards for electronic components of assessed quality.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

British Standard Specification for

Microwave passive components of assessed quality: Generic data and methods of test

Section one. Subjects common to qualification approval and capability approval

1.1 General matters

1.1.1 Scope

This British Standard forms part of the system of common standard specifications for electronic components of assessed quality and should be read in conjunction with the standards in the BS 9000 series.

This standard specifies the requirements to be applied to the release of products using either qualification approval or capability approval procedures.

It applies to all microwave passive components as defined in 1.3 and gives the terms, definitions, symbols, test methods and other material necessary to implement fully the detail specifications for these components. The material herein is applicable only when called up by the detail specification.

1.1.2 Related documents

BS 308	Engineering drawing practice
BS 2011	Basic environmental testing procedures (IEC 68)
BS 3939	Graphical symbols for electrical power, telecommunications and electronics diagrams (IEC 117)
BS 5775	Specification for quantities, units and symbols
BS 6001	Sampling procedures and tables for inspection by attributes
BS 9000	General requirements for electronic components of assessed quality
BS 9220	Rigid waveguide tubing of assessed quality: generic data and methods of test
BS 9450	Custom-built integrated circuits of assessed quality: generic data and methods of test
PD 9002	BS 9000 component selection guide
IEC 50	International Electrotechnical Vocabulary Chapter 901 Magnetism Section 901-05 Terms and definitions relating to non-reciprocal electromagnetic components
IEC 53	Hollow metallic waveguides Part 1 General requirements and measuring methods

1.1.3 Terminology

For the purposes of this British Standard the following terms and definitions apply.

1.1.3.1 microwave passive component. A component designed to carry out a specific function in a microwave circuit.

NOTE. For the purposes of the specification, components containing microwave active devices, such as semiconductors, electron tubes and gas discharge devices, are excluded. The term microwave as used in this definition is considered to embrace all frequencies from 100 MHz to 300 GHz.

1.1.3.2 circulator. A multi-port component in which the power to any port is transmitted to the next port according to a given order of sequence.

1.1.3.3 phase-shift circulator. A circulator containing at least one non-reciprocal phase-shifter.

1.1.3.4 (wave) rotation circulator. A circulator containing at least one non-reciprocal polarization rotator.

1.1.3.5 junction circulator. A circulator in which the multi-port structure consists of a junction between transmission lines.

NOTE. Junction circulators may be built in several ways, characterized by the symmetry of the junction. To denote these circulator types, the word 'junction' is usually omitted and a qualifying prefix used instead. Examples of this practice are the terms 'Y-circulator' and 'T-circulator', where the capitals are used to describe the configuration of junction employed.

In the case of waveguide junction circulators, further qualification may be needed, e.g. as illustrated by the term 'H-plane Y-circulator'. Such qualifying prefixes should comply with normal waveguide terminology.

1.1.3.6 lumped-element circulator. A junction circulator in which the ports are connected to a network of lumped impedance elements.

1.1.3.7 lumped-element isolator. An isolator in which the two ports are connected by a network of lumped impedance elements.

1.1.3.8 isolator. A two-port component having much greater attenuation in one direction of propagation than in the other.

1.1.3.9 (wave) rotation isolator. An isolator containing at least one non-reciprocal polarization rotator.

1.1.3.10 resonance (absorption) isolator. An isolator whose operation depends upon resonance absorption in a gyromagnetic material or medium.

1.1.3.11 field-displacement isolator. An isolator whose operation depends upon field displacement caused by a gyromagnetic material or medium.

1.1.3.12 gyromagnetic effect. The phenomenon by which the magnetization of a material or medium subjected to a magnetostatic field, upon disturbance, relaxes back to equilibrium by damped precessional motion about the direction of that field.

1.1.3.13 gyromagnetic component. A component that utilizes a gyromagnetic material or medium.

1.1.3.14 gyromagnetic material (medium). A material (medium) capable of displaying the gyromagnetic effect.
NOTE. Due to the gyromagnetic effect, the electromagnetic wave propagation properties of a gyromagnetic material (medium) exhibits a characteristic behaviour related to tensor permeability.

1.1.3.15 gyromagnetic resonator. A gyromagnetic material or medium of a given geometry.

1.1.3.16 reciprocal phase shifter. A two-port component whose propagation medium provides the same phase shift for the two directions of propagation.

1.1.3.17 non-reciprocal phase-shifter. A two-port component whose propagation medium provides different phase shifts for the two directions of propagation.
NOTE. The amount of phase-shift may be changed continuously (analogue phase-shifter) or be stepped (digital phase-shifter).

1.1.3.18 gyrator. A non-reciprocal phase-shifter having a differential phase shift of ϕ radians.

NOTE. The use of the word gyrator to denote gyromagnetic components in general is deprecated.

1.1.3.19 differential phase-shift. The difference in phase-shift between the two directions of propagation in a non-reciprocal phase-shifter.

NOTE. The use of this term for other types of phase difference, such as between states in a digital phase-shifter, is deprecated.

1.1.3.20 non-reciprocal polarization rotator. A waveguide structure, usually of circular cross-section, whose propagation medium provides that the direction of polarization, i.e. that of the transverse electric field, for a linearly polarized wave is rotated clockwise in one direction of propagation and anti-clockwise in the other direction.

NOTE. This is also known as a non-reciprocal wave rotator.

1.1.3.21 filter. A two-port reciprocal component that provides a high attenuation level to unwanted frequencies and minimal attenuation to the required frequencies. The main subgroups of filter are band pass, low pass, high pass and bandstop.

1.1.3.22 gyromagnetic filter. A filter containing at least one gyromagnetic resonator.

NOTE. The use of terms like 'YIG filter' or 'garnet filter' for such components is deprecated.

1.1.3.23 limiter (ferrite). A two-port component with a non-linear transmission characteristic arising from the onset of spin wave instabilities characteristic upon incident power levels.

1.1.3.24 gyromagnetic power limiter. A power limiter containing at least one gyromagnetic resonator, whose operation depends upon non-linear saturation effects in that resonator.

1.1.3.25 latching phase shifter (ferrite). A two-port component that under the action of a current pulse through control wires allows a change in phase length of the transmission line with reference to a zero insertion phase length.

1.1.3.26 directional coupler (including hybrid junction).

A transmission-line component characterized physically by two (or three, for certain bidirectional couplers) juxtaposed transmission lines and an associated coupling structure through which a transfer of energy from one line to the other is effected; its electrical behaviour is characterized ideally by such interaction between the two lines that excitation in a single direction in either line produces a response in the companion line in one direction only.

1.1.3.27 unidirectional coupler. A directional coupler so designed as to provide a nominal response in the secondary line to propagation in the primary line, in one direction only.

1.1.3.28 bidirectional coupler. A directional coupler so designed as to provide separate and simultaneous nominal responses in the secondary lines to each of the two directions of propagation in the primary line.

1.1.3.29 coaxial and waveguide switches. A component in which one or several transmission lines can be connected to one or several other transmission lines with low attenuation, and with high attenuation between uncoupled lines.

NOTE 1. The definition includes electromechanical switches but not semiconductor switches or TR cells.

NOTE 2. Switching between lines can be effected either manually or automatically by means of a power operated mechanism.

NOTE 3. Coaxial switches covered by this standard are designed for use with coaxial transmission line systems; uses include antenna switching, receiver or component protection, load divider circuits, and the control of display signals.

NOTE 4. Waveguide switches covered by this standard are intended for use in waveguide transmission lines for the switching of transmitters, receivers, antennae, etc. in a waveguide connected system.

1.1.3.30 secondary line. The line of a directional coupler that is coupled to the primary line by means of the coupling structure.

NOTE. In a unidirectional coupler there is one secondary line. In a bidirectional coupler the secondary lines have a nominal response to a different direction of propagation in the primary line. In some bidirectional couplers the secondary lines are physically separate, in others they run physically together.

1.1.3.31 transition. A structure used to interconnect two differing transmission lines.

NOTE. If the modes of propagation also differ then the transition functions as a mode transducer.

1.1.3.32 terminations. A one port load that terminates a section of a transmission system in a specified manner.

NOTE. Loads can be tunable and fixed, with short and open circuits.

1.1.3.33 attenuator. A component for reducing the amplitude of a signal without introducing appreciable distortion, including absorption and reflection types.

1.1.3.34 rotating joint. A coupling for transmission of electromagnetic energy between two transmission lines designed to permit mechanical rotation of one line relative to the other.

1.1.3.35 impedance matching network. A network for accomplishing load matching by adjusting the load circuit impedance by the insertion of a network between two parts of the system to produce the desired power transfer.

1.1.3.36 antenna. That part of a radio transmitting or receiving installation which is devised to radiate or to collect radio waves.

1.1.3.37 isolation (of a multi-port component).

The attenuation between the two ports in the non-preferred direction of propagation, all ports being terminated by reflectionless terminations.

NOTE. This is usually expressed in decibels.

1.1.3.38 centre frequency. The arithmetic mean of the limits of a given frequency range.

1.1.3.39 insertion loss. The attenuation produced by adding a component into a signal transmission path.

1.1.3.40 forward direction (of an isolator or a circulator). That direction of a transmission path in which energy propagates with much lower attenuation than in the opposite (reverse) direction.

1.1.3.41 reverse direction (of an isolator or a circulator). That direction of a transmission path in which energy propagates with much higher attenuation than in the opposite (forward) direction.

1.1.3.42 forward loss. Insertion loss in the forward direction of an isolator or a circulator.

1.1.3.43 reverse loss. Insertion loss in the reverse direction of an isolator or a circulator.

1.1.3.44 cross-coupling (of a circulator having four or more ports). The attenuation between input port and any other port that is not adjacent to the input port according to the order of sequence.

NOTE. The cross coupling should not be confused with the reverse loss occurring between adjacent ports.

1.1.3.45 return loss. The ratio (in dB) of the power incident upon a discontinuity in a transmission line to the power reflected from that discontinuity.

1.1.3.46 hermetically sealed component. A component permanently sealed by fusion to prevent transmission of air, moisture, vapour and other gases.

1.1.3.47 sealed component. A component that is sealed by a gasket under pressure (or any other method), for protection against humidity or contaminating atmosphere.

1.1.4 Letter symbols, signs and abbreviations

The following symbols apply in addition to those specified in BS 5775.

Insertion loss	A_i
Return loss	A_r
Isolation	A_s

1.1.5 Graphical symbols

For the purposes of this British Standard, graphical symbols shall be in accordance with BS 3939.

1.1.6 Marking of the component and packing

The following symbols or codes shall be clearly and durably marked on the component in the following order of preference as space permits. All symbols and codes except terminal marking and operating conditions shall also appear on the primary pack, e.g. carton, box, plastic envelope, etc. used as initial protection or wrapping for delivery.

- Manufacturer's part designation number, serial number and special marking relating to hazard and special operating conditions.
- Manufacturer's factory identification code.
- Date code.
- BS number of the detail specification.

1.1.7 Eligibility for qualification approval and capability approval

1.1.7.1 Manufacturers wishing to obtain qualification approval for components shall use sections one and two of this standard (see **2.1.1**).

1.1.7.2 Manufacturers wishing to obtain capability approval for components shall use sections one and three of this standard (see **3.2.1**).

1.1.8 Structurally similar components

Only applicable to qualification approval (see **2.1.2**).

1.1.9 Delayed delivery

Components held for a period exceeding that stated in the appropriate detail specification following acceptance inspection shall be re-examined before release by applying all (or selected) group A tests.

1.1.10 Supplementary procedure for qualification approval

Only applicable to qualification approval (see **2.1.3**).

1.1.11 Certified test records (CTRs)

See **2.1.4** or **3.2.8** as applicable.

1.1.12 Standard ratings and characteristics

Not applicable.

1.1.13 Unchecked parameters

See **1.1.13** of BS 9000 : Part 2 : 1972.

1.1.14 Procedure to be followed in the event of failure at group C or D inspection

See **2.1.5** or **3.2.2** as applicable.

1.1.15 Ordering information

Ordering information shall be stated in the appropriate detail specification.

1.1.16 Release prior to completion of group B tests

Not applicable.

1.1.17 Inspection procedures for low rates of production

Only applicable to qualification approval (see **2.1.6**).

1.1.18 Inspection procedures for continuous production

Only applicable to qualification approval (see **2.1.7**).

1.2 Test procedures**1.2.1 Test and measurement conditions**

1.2.1.1 General. All tests and measurements shall be carried out under the standard atmospheric conditions for testing as specified in **5.3** of BS 2011 : Part 1.1 : 1980 unless otherwise stated.

The limits quoted in detail specifications are absolute.

The test limits used for quality conformance inspection shall be inset from the absolute limits by the amount

necessary to allow for measurement uncertainty. However, for some of the measurement methods included in this British Standard this is not always practicable. In such cases, test methods and limits shall be negotiated with the NSI.

1.2.1.2 Health and safety hazards. This British Standard calls for the use of substances and/or test procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use according to the Health and Safety at Work etc. Act, 1974. Particular attention is drawn to the following hazards, although the list is not necessarily exhaustive.

(a) *RF burns.* Components shall be so designed that personnel cannot come into contact with r.f. connectors or open waveguides that are transmitting power which may cause burns to the skin.

(b) *RF radiation.* Personnel shall not be exposed to strong r.f. fields, even at relatively low frequencies. Absorption of r.f. energy by the human body is dependent on frequency and, although at frequencies below 30 MHz most energy passes straight through the body with little heating effect, it still presents a hazard. To minimize leakage of r.f. energy all r.f. connectors, waveguide coupling flanges and cavities shall be correctly fitted and the transmission lines efficiently coupled to a load, before the component is energized with r.f. In particular, care has to be taken to ensure that the eyes are not subjected to r.f. radiation.

(c) *Beryllium oxide ceramics.* This material may be used in some components (usually marked with a blue band). Beryllium oxide dust, or fumes containing it, are highly toxic if inhaled or if particles enter the body via a cut or abrasion. Avoid handling beryllium oxide ceramics; if they are touched, wash the hands before smoking or eating. Do nothing to beryllium oxide ceramics that may produce dust. Cleaning information is available from the manufacturer. Information on the procedure to be followed if a beryllium oxide ceramic is broken shall be provided with the component.

(d) *Implosion and explosion.* All evacuated or pressurized components store potential energy which is released if they are broken. The energy level is low in small devices, but may be considerable in larger ones.

Such components shall be stored and transported in their approved package. During installation or replacement any glass or ceramic seals should be treated with care and not subjected to scratching or physical force. The user shall be protected against implosion or explosion of the component when it is installed in equipment.

1.2.2 Visual inspection

Unless otherwise specified, visual inspection shall be performed under normal factory lighting conditions and without visual aids.

Visual inspection for good appearance and workmanship shall include the following where applicable:

- (a) outline;
- (b) quality of seals;
- (c) alignment of connectors;
- (d) straightness of pins or leads, etc.;

- (e) cleanliness and surface finish of parts and electrical (especially r.f.) contact surfaces;
- (f) clarity of marking;
- (g) correctness of marking, including marked values;
- (h) position of marking;
- (j) finish;
- (k) materials.

The materials and finish for external parts shall comply with the detail specification.

1.2.3 Dimensioning and gauging procedures

Dimensional measurements shall be carried out either by the use of conventional measuring instruments (vernier calipers, rules, micrometers, etc.) or by gauges. The gauges shall comply with the requirements given on the inspection drawing of the component. All drawings shall state the projection used, preferably third angle. Tolerances shall be in accordance with BS 308.

1.2.4 Electrical test procedures

1.2.4.1 Alternative methods of test. See 20.5 of BS 9000 : Part 1 : 1981.

1.2.4.2 Measuring equipment. All measuring equipment shall be verified to ensure satisfactory operation over the required frequency range.

1.2.4.3 Operating and/or installation procedures. Where applicable, the operating and/or installation procedures given in the detail specification shall be followed.

1.2.4.4 Temperature conditions. Where the measurement of temperature is required for operating conditions or temperature coefficients, either steady conditions shall be maintained for a sufficient time to ensure that all parts of the component have reached their equilibrium temperature or, alternatively, the temperature at a stated part of the component shall be measured rather than the ambient temperature.

1.2.4.5 Matched termination. Where a 'matched termination' is specified in a test procedure, it shall have a return loss as specified in the detail specification over the frequency range in which the component is being measured.

1.2.4.6 General precautions. The following general precautions shall be taken.

- (a) The inside of all connectors and waveguide terminations shall be clean and free from dust or swarf.
- (b) Connection surfaces shall be clean and without burrs.

NOTE. It is essential that they mate properly and tightly and care should be taken to reduce r.f. leakage to a minimum.

- (c) Coaxial cables in the microwave system shall be rigid air lines.

NOTE. Braided cables are not conducive to precision in microwave measurements.

- (d) Precision connectors shall be used on all test gear. If necessary, a standard test adaptor of known performance shall be used to connect to the component under test.

- (e) Regular checks shall be made on all connectors for mechanical wear and they shall be replaced when the wear becomes excessive.

- (f) All sources, loads and transmission lines shall be matched so that the effects of standing waves are reduced to a minimum.

- (g) Return loss shall normally exceed 32.5 dB at the interconnections to the various items of test equipment comprising the test rig.
- (h) Suitable filters shall be used to remove harmonics or subharmonics generated by signal sources or non-linear devices such as semiconductor diodes. Filters generally have a poor return loss so matching pads shall be used in conjunction with them.
- (j) All equipment shall be calibrated at the operating frequencies and shall be capable of the required accuracy of measurement. Wherever possible there shall be traceability to national standards.
- (k) Swept frequency techniques are to be preferred to spot frequency measurements as they are more likely to show problems, such as unwanted resonance effects. Checks shall be made outside the operating frequency band for spurious responses that may affect the specified performance.
- (l) Care shall be taken to ensure that electromagnetic or magnetic fields do not affect the validity of the measurement results.
- (m) The uncertainties of the accuracy of the measurement system shall be assessed and acceptance limits shall take this into account.

1.2.5 Mechanical test procedures

1.2.5.1 Where mechanical tests are required, these shall be as specified in the appropriate detail specification.

1.2.5.2 Where the component is to be mounted for a particular test, as defined in the detail specification, it shall be fastened to a suitable fixture using the normal means of attachment, e.g. screws into tapped holes in the component case.

1.2.6 Environmental test procedures

1.2.6.1 Cold. The test shall be carried out in accordance with test Aa of BS 2011 : Part 2.1A : 1977 using the degree of severity and time period specified in the detail specification. Unless otherwise specified, the component shall be non-operating.

After recovery, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.2 Dry heat. The test shall be carried out in accordance with test Ba of BS 2011 : Part 2.1B : 1977 using the degree of severity and time period specified in the detail specification. Whilst at the high temperature, measurements may be called up as specified in the detail specification. Unless otherwise specified the component shall be non-operating.

After recovery, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.3 Damp heat, steady state. The test shall be carried out in accordance with BS 2011 : Part 2.1Ca : 1977 using the degree of severity specified in the detail specification. The component shall be non-operating. On completion the component shall be removed from the chamber and subjected to the standard recovery conditions. If standard conditions for assisted drying are to be applied, these conditions shall be specified in the detail specification.

After recovery, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.4 Accelerated damp heat or damp heat cyclic.

The test shall be carried out in accordance with BS 2011 : Part 2.1Da : 1977 or BS 2011 : Part 2.1Db : 1981. The number of cycles shall be in accordance with the detail specification.

The component shall be non-operating. On completion the component shall be removed from the chamber and subjected to the standard recovery conditions. If standard conditions for assisted drying are to be applied, those conditions shall be specified in the detail specification.

After recovery, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.5 Shock. The component shall be mounted on the shock machine as specified in 1.2.5.2.

The test shall be carried out in accordance with BS 2011 : Part 2.1Ea : 1977. Three shocks shall be applied in each direction of three mutually perpendicular axes, for a total of 18 shocks. The severity and pulse shape shall be as specified in the detail specification.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.6 Bump. The component shall be mounted as specified in 1.2.5.2. The test shall be carried out in accordance with BS 2011 : Part 2.1Eb : 1977. The acceleration, duration of pulse and number of bumps shall be as specified in the detail specification, the specified number of bumps being applied in each direction of each of the three mutually perpendicular axes.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.7 Vibration. The component shall be mounted as specified in 1.2.5.2. The test shall be carried out in accordance with BS 2011 : Part 2.1Fc : 1983. The test procedure and severity (frequency range, vibration amplitudes and duration of endurance conditioning) shall be specified in the detail specification. The component shall be vibrated in each of three mutually perpendicular axes. Monitoring, when applicable, shall be in accordance with the detail specification.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.8 Acceleration, steady state. The component shall be mounted as specified in 1.2.5.2. The test shall be carried out in accordance with BS 2011 : Part 2.1Ga : 1977.

The component shall be subjected to acceleration at the severity stated in the detail specification, in each direction of three mutually perpendicular axes. Monitoring, when applicable, shall be in accordance with the detail specification.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.9 Mould growth

NOTE. The purpose of the test is to assess the resistance to mould of materials and finish.

The test shall be carried out in accordance with BS 2011 : Part 2.1J : 1977 at the severity specified in the detail specification.

Mould growth shall not exceed scale 1.

On completion, post conditioning tests shall be carried out as specified in the detail specification.

1.2.6.10 Salt mist

NOTE. The purpose of the test is to assess the resistance to corrosion of materials and finish.

The test shall be carried out in accordance with BS 2011 : Part 2.1Kb : 1977 at the severity specified in the detail specification.

On completion, the sample(s) shall be washed in running water, allowed to dry, and subjected to post conditioning tests as specified in the detail specification.

1.2.6.11 Low air pressure. Where this test is specified as a complete test or part of a combined test, it shall be carried out in accordance with BS 2011 : Part 2.1M : 1977 using the severity specified in the detail specification.

Unless otherwise specified in the detail specification, the test shall be carried out at standard atmospheric conditions for testing, for a period of 15 min.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.12 Change of temperature. The test shall be carried out in accordance with test Na or Nb of BS 2011 : Part 2.1N : 1977. The high and low test temperatures shall be the upper and lower category temperatures of the component to be specified in the detail specification.

The number of cycles, period of exposure to both high and low temperatures, and whether the component is operating during the test shall be specified in the detail specification.

On completion, the component shall be removed from the chamber and exposed to the standard recovery conditions.

After recovery, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.13 Resistance to fluids

NOTE. The purpose of the test is to assess the effect on materials and finish of accidental contamination by certain specified fluids.

The test shall be carried out in accordance with test Rb of BS 2011 : Part 2.1R : 1976. The test procedure shall be in accordance with the detail specification.

The following shall be stated in the detail specification:

- (a) the types of test fluid;
- (b) a statement of the hazards expected to arise from the use of the test fluid, if any.

At the end of the storage period the component shall be removed from the chamber and exposed to the standard conditions for recovery.

After recovery, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.14 Climatic sequence. The test shall be carried out in accordance with procedure 1 of BS 2011 : Part 2.1Z/ABDM : 1968 using the degrees of severity specified in the detail specification.

Intermediate measurements between conditioning cycles shall not be applied.

On completion the component shall be exposed to the standard recovery conditions.

After recovery, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.15 Sulphur dioxide test for contacts and connections.

The test shall be carried out in accordance with BS 2011 : Part 2.1Kc : 1977. The test procedure shall be in accordance with the detail specification.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.16 Solderability. The test shall be carried out in accordance with test Ta of BS 2011 : Part 2.1T : 1981. The test procedure shall be in accordance with the detail specification.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.17 Soldering; resistance to soldering heat. The test shall be carried out in accordance with test Tb of BS 2011 : Part 2.1T : 1981 as applicable. The test procedure shall be in accordance with the detail specification.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.18 Robustness of terminations. The test shall be carried out in accordance with BS 2011 : Part 2.1U : 1977. The test procedure shall be in accordance with the detail specification.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.6.19 Sealing

1.2.6.19.1 Gross leak. The test shall be carried out in accordance with test Qc of BS 2011 : Part 2.1Q : 1981. The test procedure shall be in accordance with the detail specification.

1.2.6.19.2 Fine leak. The test shall be carried out in accordance with test Qk of BS 2011 : Part 2.1Q : 1981. The test procedure shall be in accordance with the detail specification.

1.2.6.20 Dust and sand. A suitable test is under consideration.

1.2.7 Endurance test procedures

1.2.7.1 Non-operating endurance (storage). Initially the component shall be subjected to those tests specified in the detail specification and the results recorded. The component shall then be stored for the period specified in the detail specification.

On completion of the non-operating endurance period, the specified tests shall be repeated.

The following conditions shall be prescribed in the detail specification:

- (a) duration of storage;
- (b) tests before storage;
- (c) tests after storage;
- (d) environmental conditions during storage, if other than standard atmospheric conditions.

1.2.7.2 Operating endurance. Components shall be operated as prescribed in the detail specification.

Components undergoing endurance testing shall be measured at the time intervals specified in the detail specification.

NOTE 1. The time intervals specified may be extended to allow the manufacturer to perform the required tests during normal factory working hours. At the discretion of the manufacturer, tests may be performed at more frequent intervals.

NOTE 2. Components that are rejected for mechanical defects, i.e. dimensions, etc. which do not affect the electrical parameters listed under the post test requirements may be used for endurance tests.

On completion, the component shall be subjected to post conditioning tests as specified in the detail specification.

1.2.8 Index of test methods

1.2.8.1 General. Many of the basic test methods to be used for assessing microwave passive components are very similar.

For convenience of identification in detail specifications, the following numbering system for measurement methods has been used.

Index of test methods

Title	Method
Return Loss	1001
Attenuation	1002
Phase Shift	1003

The above measuring methods are the preferred low power swept frequency measurements. Other methods of measurement may be given in the appropriate detail specification.

1.2.8.2 Conditions to be specified in the detail specification. The maximum peak or mean power to be applied to the component for test measurements shall be specified in the appropriate detail specification.

Insulation resistance (as applicable) shall be specified in the appropriate detail specification; it shall be measured between the inner contact and the outer conductor of the connector. The value of resistance shall be that indicated after an electrification time of 1 min or earlier if stability is reached.

Voltage proof (as applicable) components shall withstand the voltage specified by the appropriate detail specification without breakdown or flashover.

1.2.8.3 Individual components used in the test system. Individual components used in the test system shall be

as follows.

(a) *Swept amplitude analyser.* This shall have a dynamic range adequate for the measurement involved and be capable of displaying changes of 0.1 dB where the attenuation is less than 10 dB.

(b) *Broad-band directional coupler.* The directivity of the directional coupler shall preferably be greater than 40 dB and track better than 1 dB. A VSWR bridge may be more convenient.

(c) *Directional coupler terminations.* These shall preferably have a return loss greater than 40 dB.

(d) *Detectors.* These shall be matched and the matching shall be better than 0.2 dB.

(e) *Modulator.* Where a modulator is used for high attenuation measurements, the output return loss shall normally exceed 32.3 dB.

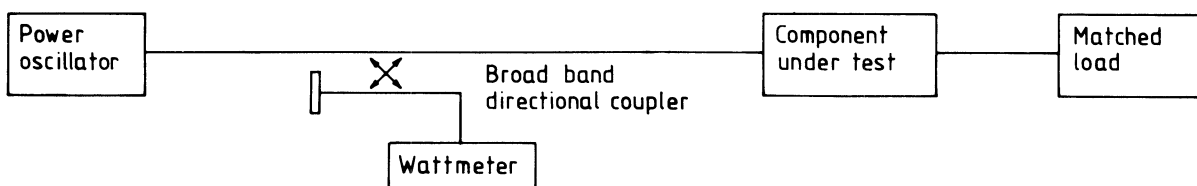
NOTE. It may be necessary to insert a matching pad or isolator between the modulator and directional coupler to achieve good matching.

(f) *Oscillators.* These shall be frequency controllable.

NOTE. Where possible, a suitable filter should be used to ensure harmonics do not affect the measured results.

1.2.8.4 System calibration. System calibration shall be carried out by using precision variable attenuators or pads, precision matched terminations and terminations that have a known mismatch characteristic. All these components shall be calibrated and their performance traceable to national standards.

1.2.8.5 Measurement of high power. When it is necessary to measure high power, a directional coupler of suitable coupling may be used to extend the range of the wattmeter. If very high attenuations are required, directional couplers may be used in cascade provided that all unused ports are terminated in a matched load. All components shall have adequate power handling capability.



* Voltage standing wave ratios are expressed as a value greater than 1.