选型指南

Material EM Parameter Testing: Frequency Range, Fixtures and Sample Prep

Selection points for material electromagnetic parameter test systems: frequency coverage 100MHz–500GHz, fixture options including coaxial air line, waveguide cavity, coaxial probe and free-space method, with scenario comparisons and sample size requirements.

Frequency ranges by test objective



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The comprehensive material electromagnetic parameter test system covers **100MHz–500GHz** and measures complex permittivity, complex permeability and related parameters.

The low-loss material dielectric test system reaches **0.4GHz–170GHz** for high-accuracy complex permittivity measurement of low-loss materials.

The high-temperature material EM parameter system reaches **1GHz–500GHz**, with some models at a maximum test temperature of **1600°C**.

The material absorbing/shielding performance system reaches **100MHz–500GHz**, measuring reflectivity and shielding effectiveness.

Selection conclusion: for routine absorbing and shielding material evaluation, 100MHz upward covers most scenarios; for high-accuracy permittivity of low-loss materials, the 0.4GHz–170GHz option prioritizes accuracy over bandwidth; for EM parameters under high-temperature conditions, a heated high-temperature system is mandatory.

How the four fixture methods map out

One system can adapt to different materials and bands by swapping fixtures — the cost item most often overlooked during selection:

Fixture	Band characteristics	Sample form
Coaxial air line	Low frequency band, low cost	Annular bulk samples
Waveguide cavity	Millimeter-wave bands, high mode purity	Bulk samples machined to specified dimensions
Coaxial probe	Broadband, non-contact	Powders, non-formed materials
Free-space test device	Large samples, real-environment simulation	Large panels, full-size absorbing sheets

The coaxial air lines come in two connector types: N-type (80mm air line length) and 7mm type (multiple lengths). Confirm the connector form along with the fixture, or the fixture and instrument will not mate.

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Sample preparation is the real bottleneck



The coaxial transmission line procedure: machine the sample into a ring and place it inside the fixture → perform full two-port calibration → insert the sample → compute the wideband EM parameters from the loaded S-parameters, fixture data and sample thickness.

This method is **fast and broadband**. For powder samples, a pressing mold can be configured to prepare annular samples of 3.04mm inner diameter and 7mm outer diameter.

This directly affects project feasibility: molds are needed and thickness must be controlled, so clarify the sample form and dimensions at the quotation stage — otherwise the solution tends to be reworked.

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Extra requirements for high-temperature systems



Beyond the vector network analyzer, heating equipment, high-temperature fixtures and system software, the high-temperature system is supplied with various additional fixtures according to material type and frequency needs.

Three points to confirm at selection: maximum test temperature, sample size limits, and heating/cooling rate requirements. Published models reach 1600°C, covering the full range from ambient to high temperature.

FAQ

Q What frequency range do material EM parameter systems cover?

A The comprehensive system covers 100MHz–500GHz, the low-loss dielectric system reaches 0.4GHz–170GHz, the high-temperature system reaches 1GHz–500GHz, and the absorbing/shielding system covers 100MHz–500GHz. Choose according to the material’s operating band and accuracy requirements.

Q What shape must samples be machined into?

A The coaxial transmission line method requires annular samples placed inside the fixture

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powder samples. After full two-port calibration, EM parameters are computed from the loaded S-parameters, fixture data and sample thickness.

Q Can EM parameters be measured at high temperature?

A Yes. The high-temperature system covers 1GHz–500GHz with some models at a maximum of 1600°C, measuring complex permittivity, complex permeability and reflectivity under high-temperature conditions. It consists of a vector network analyzer, heating equipment, high-temperature fixtures and system software.

Q Are EM parameter testing and shielding effectiveness testing the same system?

A They are different metrics, but can share a source. EM parameter testing measures intrinsic parameters like complex permittivity and permeability; absorbing/shielding testing measures reflectivity and shielding effectiveness. Both reach 100MHz–500GHz, but they are different systems with different fixtures and computation methods.

This guide is based on the official product pages and solution descriptions /solutions/tech/sys-col-246/. Parameters are quoted verbatim, without secondary processing.

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