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IEEE Standard for Electrical Characterization of Printed Circuit Board and Related Interconnects at Frequencies up to 50 GHz

STANDARDS

IEEE Electromagnetic Compatibility Society

Developed by the
Standards Development Committee

IEEE Std 370™-2020

IEEE

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Standards Development Committee
of the
IEEE Electromagnetic Compatibility Society

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Abstract: Standard and recommended practices for ensuring the quality of measured data for high-frequency electrical interconnect at frequencies up to 50 GHz are provided. This might include, but is not limited to recommending design of test fixtures, as well as methods and processes for ensuring the accuracy and consistency of measured data for signals with frequency content up to 50 GHz. The standard and general practice should be applicable for frequencies higher than 50 GHz as well. The methods and techniques contained herein have been validated only to 50 GHz as of this writing.

Keywords: causality, consistency tests, de-embedding electrical measurement, fixture, IEEE 370, interconnect, passivity, reciprocity, S-parameters, verification

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Introduction

This introduction is not part of IEEE Std 370-2020, IEEE Standard for Electrical Characterization of Printed Circuit Board and Related Interconnects at Frequencies up to 50 GHz.

As high-speed serial link data rates increase (beyond 25 Gbps), the need for accurate interconnect measurements becomes critical. However, standard practices are lacking on how to measure interconnects at high frequencies.

Most high-frequency instruments, such as vector network analyzers (VNAs) and time-domain reflectometers (TDRs), can make good measurements at the end of a coaxial interface. Typical devices to be tested do not have coaxial interfaces, so test fixtures are often required to be inserted between an instrument's coaxial interface and the device under test (DUT), such as a printed circuit board (PCB), package, connector, cable, etc. There are various de-embedding approaches already commercially available, however, the de-embedding algorithms are often proprietary, and verification of the accuracy of the de-embedded S-parameters is left to the user.

A poorly designed test fixture can lead to inaccurate de-embedded S-parameters. There is no IEEE standard that specifies the electrical requirements of a properly designed test fixture to achieve high-quality de-embedded results.

The quality of measured S-parameters of DUT can vary widely. There is no IEEE standard to check and validate the quality of S-parameters before they are distributed for use. This has created many complications for engineers who are utilizing the measured S-parameters for high-speed interconnect analysis. An IEEE standard is needed to check post measurement S-parameter data.

The IEEE P370 workgroup was established to address the above issues. Three task groups (TGs) were formed under the workgroup:

— TG1: Fixture Design Criteria

— TG2: De-embedding Verification

— TG3: S-parameter Integrity

This document is the outcome of the joint efforts of P370 members.

Contents