# Introduction

Accurate Vector Network Analyzer (VNA) measurement of a Device Under Test (DUT) mounted on a printed circuit board fixture requires some form of de-embedding to eliminate the effects of the fixturing. Port extension, on-board calibration, and TRL might be exploited for this purpose, but each of these methods has limitations and drawbacks. The Automatic Fixture Removal (AFR) program from Copper Mountain Technologies (CMT) provides a superior method of fixture removal for measurements made with CMT VNAs.

A Device Under Test (DUT) may be mounted on a printed circuit board if it isn't otherwise connectorized. The effects of the circuit board and connectors must be eliminated to measure the DUT alone.
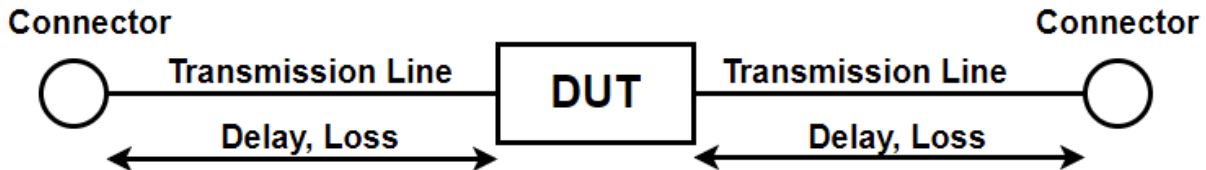


Figure 1 - PCB Mounted DUT

The input and output connectors will invariably generate reflections, and the transmission lines will add delay and loss. If a circuit board is to be used to carry a DUT, you can fabricate a board with connectors and a thru line, which may be used to evaluate the performance of the connectors and traces alone. This fabricated board may also be evaluated with the 2x thru method in the AFR program. The thru line should be as long as the input and output traces of the PCB fixture put together.

For best results, the fixture characterization using the AFR program should be performed to as high a frequency as possible, even if the DUT measurements occur only at lower frequencies. The higher frequencies provide more time domain resolution, and the de-embedding process is therefore more accurate. On the other hand, there can be no discontinuities or resonances in the fixture response over the frequencies of characterization or the process will fail. The insertion loss and return loss of the fixture must be reasonably smooth with no glitches. If resonances do occur, the highest frequency used during the AFR process must be well below them.