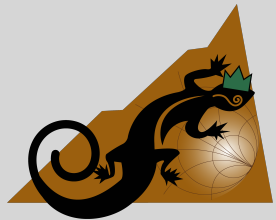


AUTOMATIC FIXTURE REMOVAL (AFR)

Brian Walker, Sr RF Design Engineer, SME



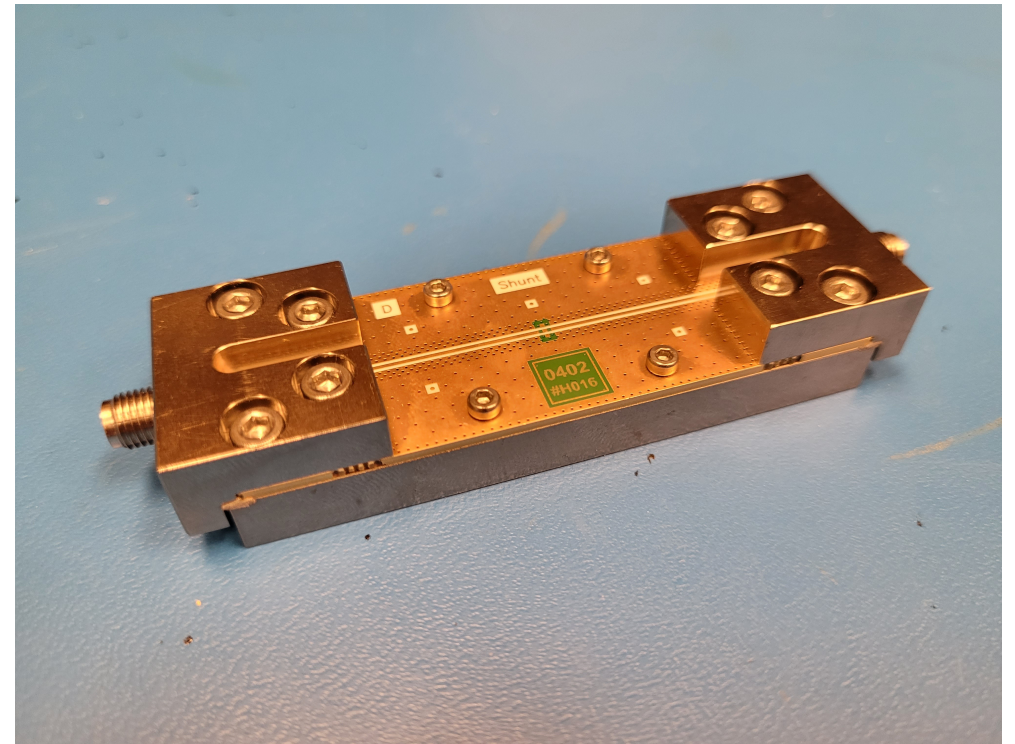
COPPER MOUNTAIN
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AGENDA

- What is AFR For?
- What are the Alternatives?
- SOLT
- TRL
- AFR Methods
- AFR Demonstration

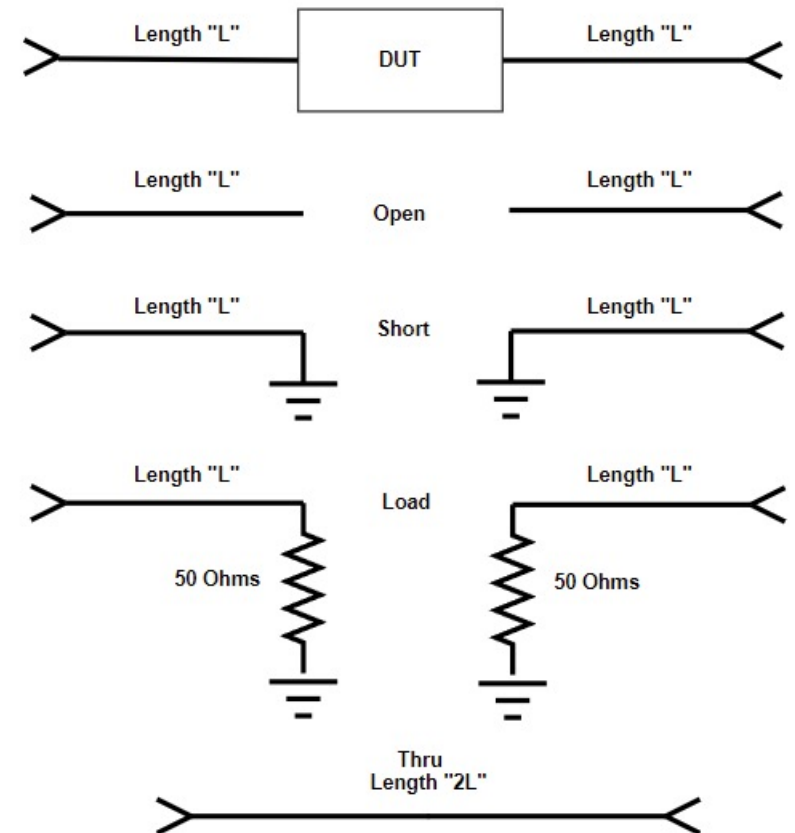
WHAT IS AFR FOR?

- It is often necessary to measure a device or component while it is mounted in a fixture or installed on a PCB
- De-Embedding the fixture can be challenging
- Port Extension is usually not good enough
 - Extension only fixes phase and does not remove fixture reflections



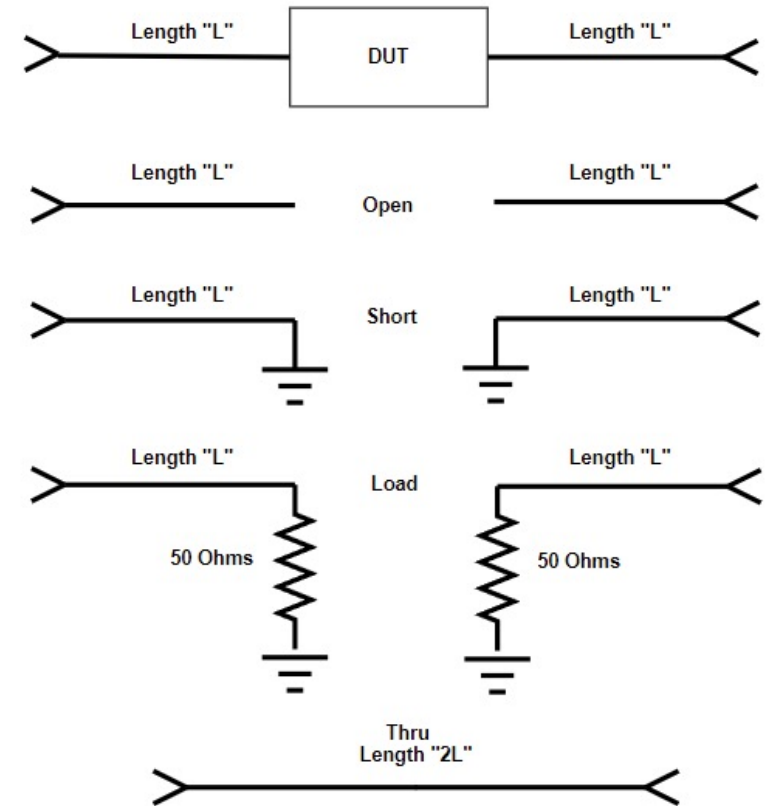
HOW MIGHT A FIXTURE BE DE-EMBEDDED?

- One could create a fixture with the same two connections to the Device Under Test, (DUT) with Open, Short, Load and Thru standards installed



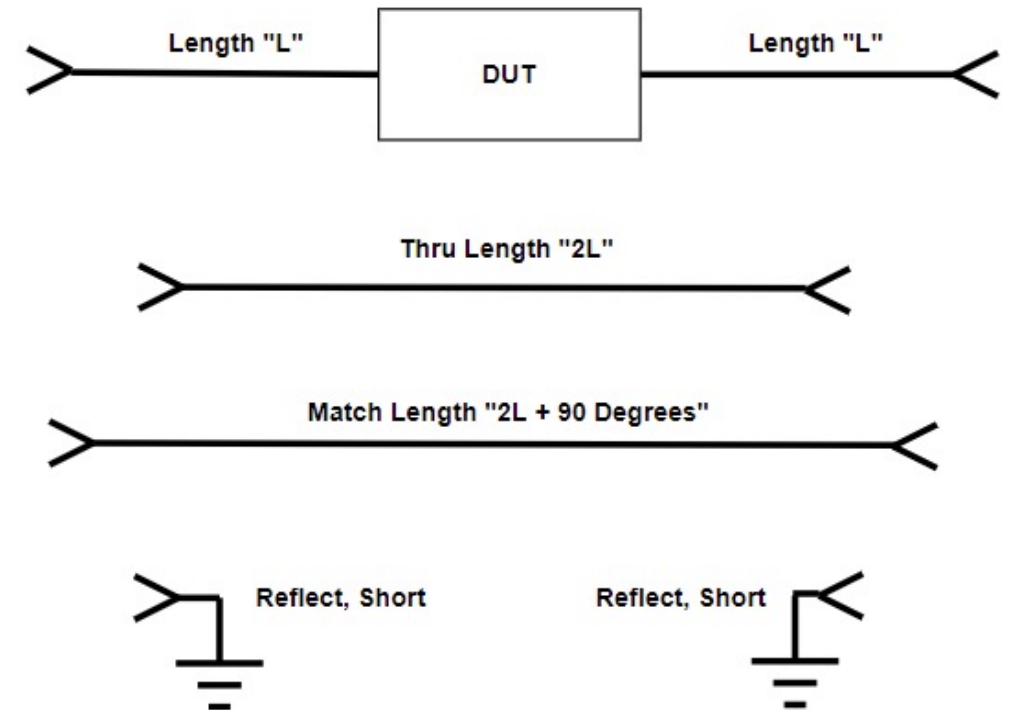
SOLT

- There are several problems with this approach:
 - The imperfect “Open” will have fringing E fields which will introduce error
 - The imperfect “Short” will have parasitic inductance which will introduce error
 - Return loss of the connectors, trace and “Load” will likely not be much better than 15 dB resulting in unacceptable calibration errors



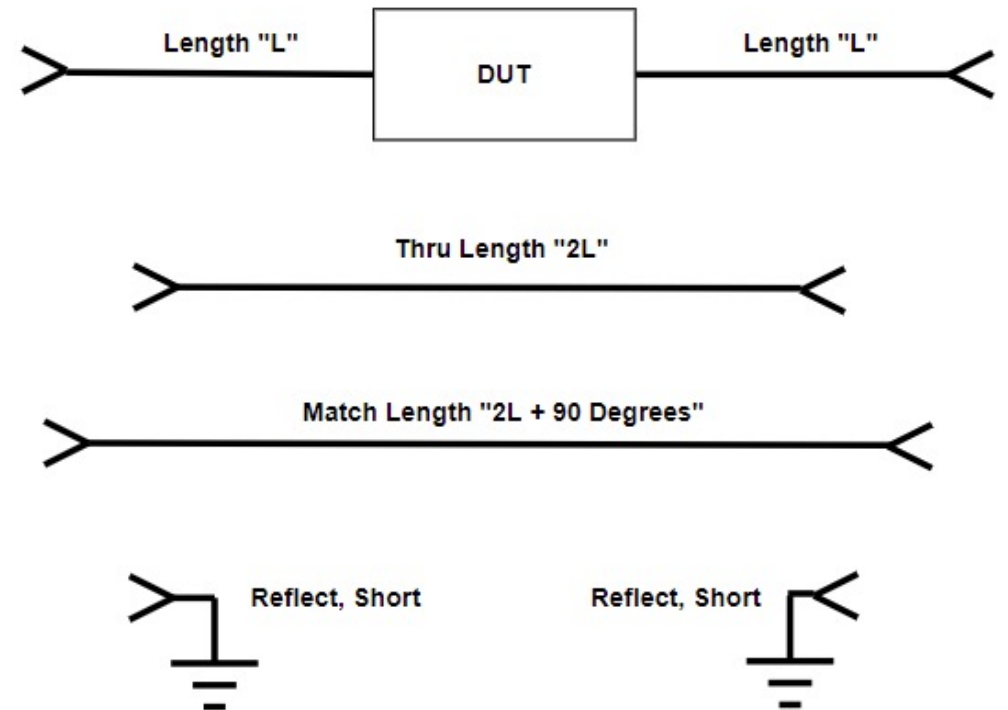
TRL

- One could create a TRL fixture with a “Thru” line, a 90 degree longer “Match” line and a pair of Shorts for the “Reflect” calibration
- The length $2L$ Thru will put the reference plane in the center which is the desired result



TRL

- There are a few problems with this approach:
 - TRL is band-limited. Calibration applies for Match line length of 20 degrees to 160 degrees longer than the Thru
 - The “Match” line including connectors, should have return loss better than 25 to 30 dB which is extremely difficult



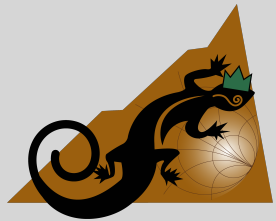
AFR

- AFR offers three methods of fixture de-embedding
- Time Gating
 - Appropriate for fixtures with DUT connections of 2 wavelengths or greater and some connection impedance variation
- Filtering
 - Appropriate for fixtures with short or long DUT connections but with good connection impedances
- Bisection
 - For fixtures with shorter DUT connections

AFR DEMONSTRATION

The screenshot displays the 'CMT Automatic Fixture Removal' software interface. At the top, a progress bar shows six steps: 1. Description (highlighted in orange), 2. Fixture connection, 3. VNA setup, 4. VNA calibration, 5. Fixture measurement, and 6. Results. Below the progress bar is a 'Configure fixtures' section with a help icon. It features two checked checkboxes for 'Fixture A' and 'Fixture B'. Each has a 'Num of ports' dropdown menu set to '1'. To the right, there is a section for 'Select the method for fixture parameters calculation' with a 'Method' dropdown menu set to 'Time Gating'. Below this is a 'Recall the saved configuration setup where applicable' section with a 'Recall setup' button. Further down, it shows 'Available VNA ports: 4' and 'Fixture ports: 2', with a 'Plug-in preset' button. At the bottom, there is a status bar with a settings icon, the text 'C4420 SN:00000001 SV:20.1.3/3 Plug-in v1.1.0', and 'BACK' and 'NEXT' buttons.

QUESTIONS



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