

# Keysight Technologies E5061B ENA Series Network Analyzer

## Option 3L5/005 LF-RF Network Analyzer with Impedance Analysis, 5 Hz – 3 GHz

### Procedure overview

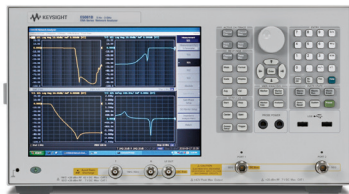
- Connect fixture to Gain-Phase test port
- Set measurement parameters
- Perform calibration
- Connect DUT then scale measurement trace
- Perform equivalent circuit analysis

### In this demo...

- Impedance measurement (Series-thru method, GP port)
- Calibration at the fixture
- Equivalent Circuit Analysis

### Required Instrument and fixture

E5061B-3L5/005/720 or E5061BEP-NZA  
(E5061BEP-NZA is the package solution which has all required option for impedance analysis)



Fixture  
16047E



DUT  
Leaded component

In this demo, a 0.1 uF leaded capacitor is measured. You can evaluate other components as well. Also, you can even evaluate SMD(chip) components if you have a test fixture for SMD components (16034E or 16034G).

### 1. Connect fixture to Gain-Phase test port



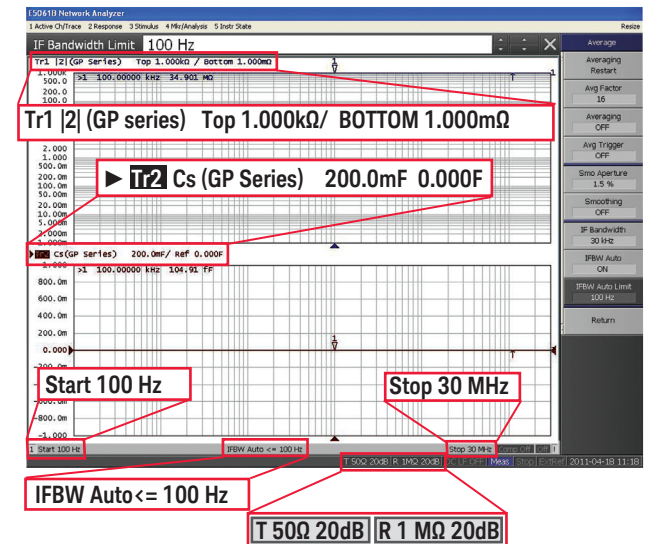
Legend: [Key name] = front panel hardware key  
Key name = soft key  
Number = front panel hardware numeric key

### 2. Set measurement parameters

- Press [Preset] then press OK  
Set measurement traces
- Press [Display] then press Num of traces , and 2  
Press Allocate Traces and x2
- Set measurement parameters  
Press [Meas] the press Impedance analysis menu  
Press Method then press GP Series (T 50 ohm, R 1 Mohm)  
Press [Z]  
Press [Trace Next] to select trace2 then press Cs  
Press [Trace Next] to select trace1  
Press [Scale] then Y-Axis and Log

What is the method under impedance analysis menu? There are several topologies (or methods) to measure impedance depending on the DUT's impedance range. With the GP Series (T 50 ohm, R 1 Mohm), Series-though method at GP (Gain-Phase) port of the E5061B (port impedance: T: 50 ohm, R: 1 Mohm) is used.

- Set log sweep parameters  
Press [Sweep Setup] then press Sweep type, and Log Freq  
Press [Start] then enter 100 Hz  
Press [Stop] then enter 30 MHz
- Set IF bandwidth  
Press [Avg] then press IFBW AUTO  
Press IFBW Auto Limit and enter 100 Hz



To measure impedance accurately, recommend to perform calibration. However, if you don't have calibration kit, you can skip step 3.

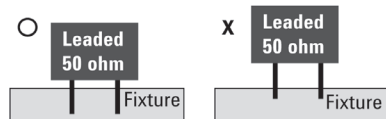
### 3. Perform calibration

- Select calibration kit  
Press [Cal] then press Cal Kit, and Leaded 50 ohm
- Measure calibration standard  
Press [Cal] then press Calibrate  
Press Impedance calibration  
Make open state then press Open  
Make short state then press Short  
Make load state then press Load
- Activate calibration  
Press Done

Refer to following figure to make each state for the standard measurement.



For load state, use leaded 50 ohm standard (5012-8846) equipped with E5061B-720



### 4. Connect DUT then scale measurement trace

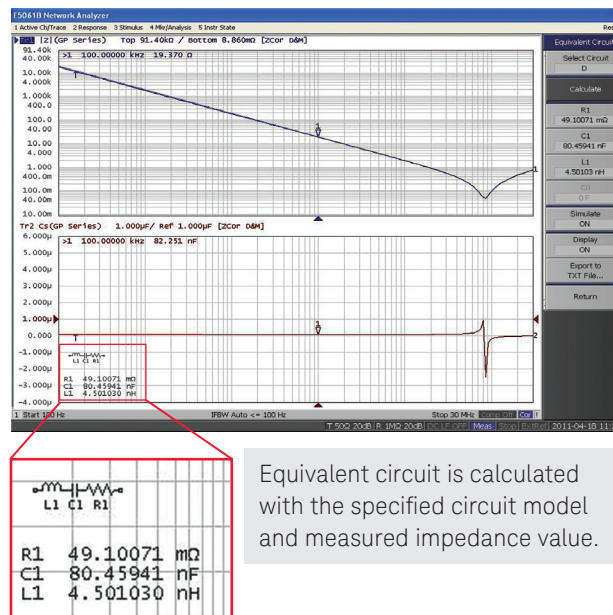
- Connect DUT to the fixture



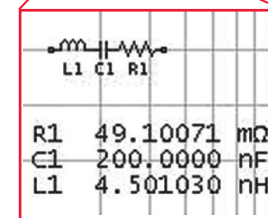
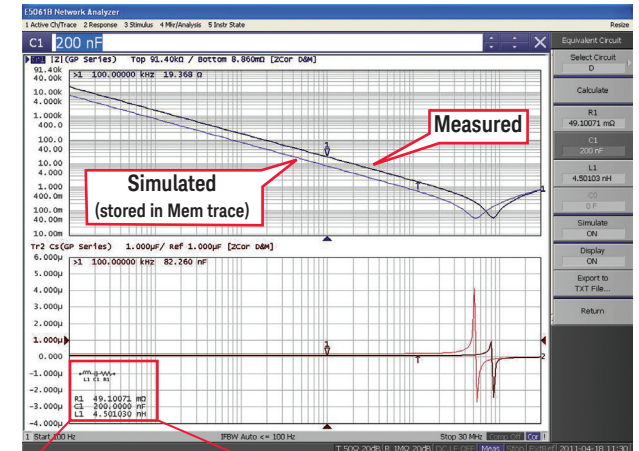
- Press [Scale] then press Auto Scale All

### 5. Perform equivalent circuit analysis

- Select equivalent circuit  
Press [Analysis] then press Equivalent Circuit  
Press Select circuit then press D  
Press Display to turn on analysis  
Press Calculate



- Perform simulation  
Press [Analysis] then press Equivalent Circuit  
Press Simulate  
Press C1 then change value by [↑] or [↓]



Measured trace and simulated trace can be compared by changing each component's value. Simulated trace is stored in the Memory trace.

Which is the right circuit model for my DUT? Models for equivalent circuit should be selected depending on the type of the DUT.

- Inductors with high core loss
- Inductors with high winding resistance or resistors with low resistance value
- Resistors with high resistance value
- Capacitors
- Resistors