ERA-SM Kit Test Board: Instructions for Use (AN-60-019)

1.0 Introduction

ERA-SM models are a series of wide-band surface-mount amplifiers. Two test boards have been constructed in such a way as to make them useful for evaluating all the devices.

In the first board, ERA-TB, all components external to the ERA* amplifier, such as bias resistor, DC blocking capacitors, RF choke, and zener protection circuit have been placed and soldered onto the Test Board. The circuit is meant for easy evaluation of the surface-mount ERA amplifiers. In this board, measured performance of the device under test is affected by these external components. Table 2 shows the influence on insertion loss. Add the values given in Table 2 to the measured gain to get actual ERA gain.

In the second board, TB-289, only the ERA-SM unit (the device under test) is mounted. This will eliminate the influence of external components and provide the true performance of the device. Moreover, the ERA can be tested at any value of bias current consistent with the catalog specifications, whereas bias with ERA-TB is set by the on-board resistors. For example, ERA-8SM has typical device voltage of 3.7V and recommended bias current of 36mA. For 10V supply the required bias resistor is 175 ohms, which is not included in ERA-TB. It would be necessary to use a 9V supply and R3 in ERA-TB, to obtain the required 147-ohm resistor for 9V (R3 + R6 = 142 + 4.7 = 147 ohms).

2.0 First Board, ERA-TB:

ERA amplifiers have different device voltages and operating currents. This test board has been configured to use a fixed supply voltage, 10V, irrespective of the amplifier. DC current flowing through the amplifier is set by suitable selection of bias resistors. This is accomplished by soldering jumper wires across the dashed-line positions 1 to 5 shown in Figure 1. The positions are defined in Table 1. Figure 2 shows the layout.

Table 1 Test Board components and jumper wire shorting location:

Component	Value	Function
C1,C2	0.39 μF	DC blocking
L1	MCL Model ADCH-80A	RF choke
R1	189Ω	Sets bias current
R2	163Ω	Sets bias current
R3	142Ω	Sets bias current
R4	59Ω	Sets bias current
R5	70Ω	Sets bias current
R6	4.75Ω	Protects Zener
D1	Zener, 10V	Protects against excessive supply voltage
C3	0.1μF	Bypass capacitor; Bypass noise of supply voltage

Model No.	Short at Position
ERA-1SM	2
ERA-2SM	2
ERA-21SM	2
ERA-3SM	1
ERA-33SM	3
ERA-4SM	1,3
ERA-5SM	1,3
ERA-50SM	1,3
ERA-51SM	1,3
ERA-6SM	5
ERA-8SM	3 (Use 9V supply)
ERA-5XSM	1,3

*Where this Application Note uses the abbreviated designation ERA, the surface-mount version ERA-SM is meant.

Frequency (GHz)	Insertion Loss (dB)
1	0.64
2	1.03
3	1.63
4	1.32
5	1.46
6	1.90
8	3.21

Table 2: Insertion Loss of Test Board ERA-TB

2.1 Procedure

Follow these steps to use the Test Board, ERA-TB.

1. Solder selected ERA-SM unit onto the Test Board.
2. Make DC connection by soldering jumper wires in accordance with Table 1, depending on the selected ERA model. All other positions should be open.
3. Calibrate the Network Analyzer.
4. First, connect the RF output port of the Test Board to the Network Analyzer.
5. Then, apply +10 V DC.
6. Finally, connect the RF input port of the Test Board to the Network Analyzer and apply RF input. Gain is now displayed on the Network Analyzer.

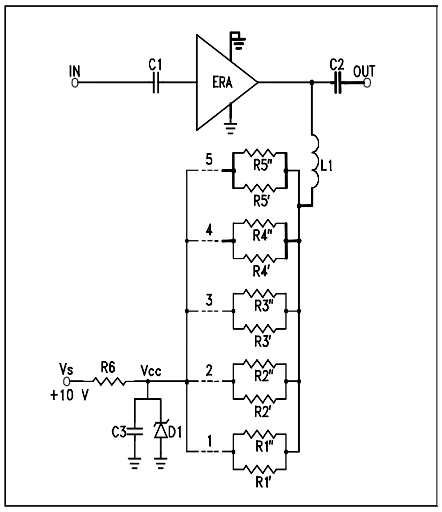

Figure 1
Schematic of Test Board ERA-TB

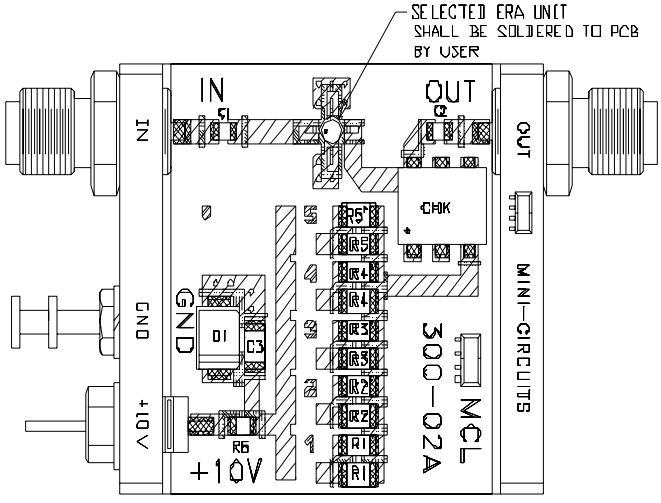

Figure 2
Layout of Test Board ERA-TB

3.0 Second Board, TB-289

This Test Board has a PC board with 50-ohm input and output lines and an ERA-SM unit soldered onto it, mounted on a metal frame. Input and output connections are by means of SMA connectors. Figure 3 shows the layout. To test this, the user needs to add a DC Block at input and a Bias-Tee at output, external to TB-289. Modern network analyzers such as Agilent 8753 and 2-port PNA have these components built in. Using the procedure in 3.1.1, a fixed DC current from a current source is applied through the Network Analyzer DC port. The measured gain of the DUT in this set up is what is published in the Mini-Circuits catalog. See Figure 4 for the test set up using the Network Analyzer's DC block and Bias-Tee. Figure 5 shows an alternative test set up using a DC Block (such as Mini-Circuits BLK-18) and Bias-Tee (such as Mini-Circuits ZFBT-6G); the procedure in 3.1.2 appl

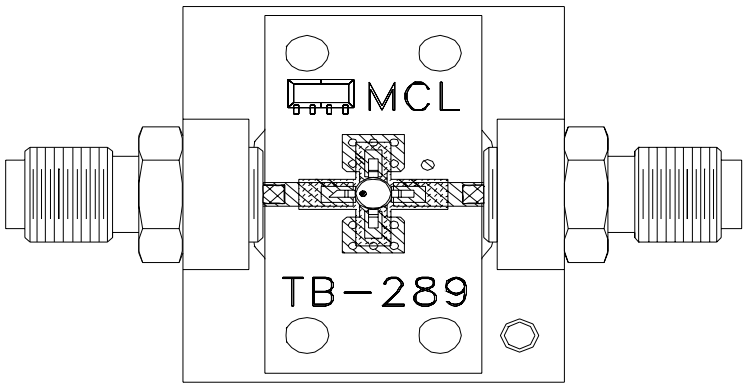

Figure 3 Layout of Test Board TB-289

3.1 Procedure

Solder selected ERA-SM unit onto Test Board TB-289, and then follow these steps.

3.1.1 Where the setup uses the Network Analyzer's DC Bock and Bias Tee (see Figure 4):

1. Calibrate the Network Analyzer.
2. Connect the RF output port of the Test Board to the Network Analyzer.
3. Set the DC current source to the current specified for the particular ERA model in the Catalog.
4. Connect the DC current source to the DC port of the Network Analyzer.
5. Finally, connect the RF input port of the Test Board to the Network Analyzer and apply RF input. Gain is now displayed on the Network Analyzer.

3.1.2 Where the setup uses external DC Bock and Bias Tee (see Figure 5):

1. Connect the DC Block and Bias Tee to the Network Analyzer.
2. Calibrate the Network Analyzer together with the DC Block and Bias Tee.
3. Connect the RF output port of the Test Board to the RF port of the Bias Tee.
4. Set the DC current source to the current specified for the particular ERA model in the Catalog.
5. Connect the DC current source to the DC port of the Bias Tee.
6. Finally, connect the RF input port of the Test Board to the DC Block and apply RF input. Gain is now displayed on the Network Analyzer.

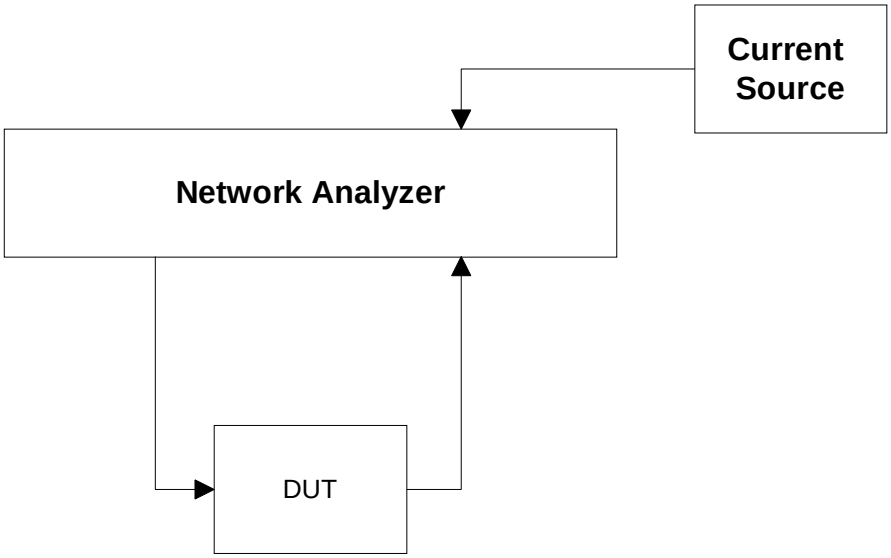

Figure 4 Test Setup for Using Test Board TB-289

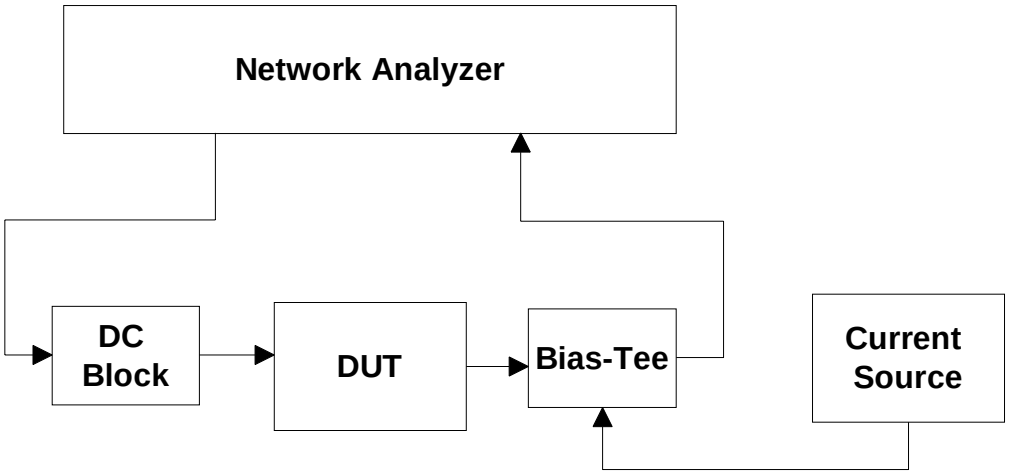

Figure 5 Alternative Test Setup for Using Test Board TB-289