RF device Evaluation

To determine RF device performance, design and test engineers generally measure electrical characteristics such as S-parameters, frequency bandwidth, distortion, etc.

Analyzers (network analyzers, spectrum analyzers, etc.) are commonly used to perform these measurements. Since most RF devices do not have an on-chip bias circuit, in addition to an analyzer a voltage or current source is usually required to power and bias the device (in conjunction with a bias resistor). This document outlines how to perform MMIC RF amplifier S-parameter measurements using the Keysight B2961A as the DC bias source.

Using the Keysight B2961A/62A as a precise bias source

- The B2961A/62A’s voltage source mode can be used to bias amplifiers. The applied bias current will be the difference between the source and device voltages divided by the value of the external bias resistor used.
- In situations where characteristics over temperature or multiple bias current values need to be observed, it is more convenient to use the B2961A/62A’s current source mode as opposed to its voltage source mode since the device voltage will vary depending on both temperature and bias current
- The Keysight B2961A/62A’s internal feedback mechanisms enable it to source precise and stable voltages and currents at their specified setting values despite varying load conditions. In addition, users can easily switch between voltage and current sourcing without changing any cable connections.

Features of B2961A/62A Low Noise Power Source

A revolutionary power supply for precision low-noise voltage and current sourcing

- Superior 6.5 digit 100 nV/10 fA resolution
- Wide 210 V/3 A (10.5 A pulse) bipolar range
- Outstanding 10 μVrms ultra low noise
- Innovative Source Functions
- Intuitive Graphical User Interface

Benefits

- More precision test & evaluation
- Reveals true DUT characteristics
- More efficient test & evaluation

Gali 21 is a product from Mini-Circuits
The B2961A/62A bias source facilitates network analyzer S-parameter measurements

In tests where amplifier characteristics under various bias current conditions need to be observed, it is best to use the B2961A as a current source. This mode is not only more efficient and easier to use, but it also provides a more precise and repeatable current bias. A repeatable and stable current bias is critical, especially when evaluating device performance variability and design margin in the development phase.

DUT: Gali 21 on Test Board
VNA: Keysight PNA series
Bias source: B2961A in the voltage source mode

Ideally, the best means to bias this amplifier would be to use a constant current DC source since it provides a stable operating point. However, combining a constant voltage source and a bias resistor is the most practical way to bias this circuit, because the device voltage varies from device to device and drifts with temperature changes. The net result is variations in bias current that affect the amplifier characteristics (e.g.: P1dB). The amount of current deviation is strongly related to the inaccuracy of the bias source voltage (and the bias resistor); therefore, the B2961A’s precise and stable voltage sourcing and current monitoring capabilities make it an ideal choice to bias this circuit.

Keysight B2961A/B2962A Low Noise Power Source Key Specifications and Characteristics

<table>
<thead>
<tr>
<th>Product Number</th>
<th>Option</th>
<th>Max output</th>
<th>Min source Resolution</th>
<th>Output Noise 10 to 20 MHz</th>
<th>Source Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DC</td>
<td>Pulse</td>
<td>Voltage</td>
<td>Current</td>
</tr>
<tr>
<td>B2961A</td>
<td>......</td>
<td>210 V/3.03 A</td>
<td>200 V / 10.5 A</td>
<td>100 nV</td>
<td>10 fA</td>
</tr>
<tr>
<td>B2962A</td>
<td>LN1</td>
<td>42 V/105 mA</td>
<td>42 V / 105 mA</td>
<td>100 nV</td>
<td>10 pA</td>
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<tr>
<td></td>
<td>LN2</td>
<td>210 V/3.03 A</td>
<td>200 V / 3.03 A</td>
<td>100 nV</td>
<td>10 pA</td>
</tr>
</tbody>
</table>

1. Supplemental characteristics
2. 10 A pulse range is not supported

Related applications:
- Power /bias source for:
  - Other types of amplifiers
  - Active mixers
  - Oscillators
  - Passive devices, e.g. bias tees

www.keysight.com/find/precisionSOURCE
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