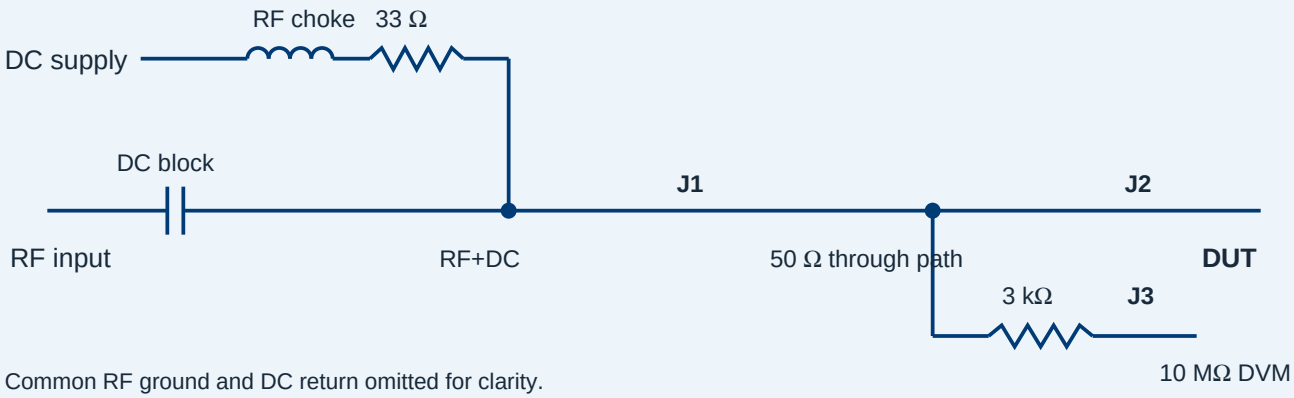
Using a Pick-Off Tee to Measure DC Bias

A bias tee combines RF and DC on one connection to a device under test (DUT). DC resistance in the bias feed drops voltage as the DUT draws current. A DC-coupled Taylor Sense-Tee placed near the DUT samples the local voltage so you can trim the supply under load.

FIGURE 1 / RF + DC BIAS AND VOLTAGE SENSE



Common RF ground and DC return omitted for clarity.

Connecting the pick-off tee

J1 connects to the bias tee RF+DC output and receives the combined RF signal and DC bias.
J2 connects to the DUT input and continues the main 50 Ω signal path.
J3 connects to a high-impedance DC voltmeter and samples the local line voltage through a 3 kΩ resistor.

Place the pick-off tee as close as practical to the DUT. The meter measures the voltage at the tap relative to its reference. Any voltage drop between the tap and the DUT, or along the DUT's return path, can affect how closely that reading represents the voltage across the DUT terminals.

Setting a 5.00 V bias at 100 mA

Assume the DUT requires **5.00 V** while drawing **100 mA**, and the bias tee and wiring upstream of the tap have a combined DC resistance of **33** Ω. At that current, the upstream voltage drop is:

$$\mathbf{V_{drop} = I_{DUT} \times R_{upstream} = 0.100\ A \times 33\ \Omega = 3.30\ V}$$

The required supply voltage is therefore approximately **8.30 V**. The upstream resistance dissipates **0.33 W** at this operating point. Use 8.30 V as the calculated setting for this load, then trim the supply while monitoring the tap voltage. If the DUT current changes, the upstream voltage drop changes with it.

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Accounting for voltmeter loading

The **3 kΩ** pick-off resistor and the voltmeter's input resistance form a voltage divider:

$$V_{meter} = V_{tap} \times R_{meter} / (3\ k\Omega + R_{meter})$$

With a **10 MΩ** meter, a tap voltage of **5.000 V** produces a reading of approximately **4.9985 V**. The resulting loading error is **1.50 mV**, or **0.030%**, before accounting for meter accuracy or RF effects. For tighter tolerances, use the meter's specified input resistance on the selected range to correct the reading.

A **DC-coupled 50 Ω input** at J3 would read only about **82 mV** at the same 5.000 V tap voltage. Use a high-impedance DC input when the objective is to read the bias voltage directly.

Verifying the reading with RF applied

J3 carries a sample of the RF signal along with the DC bias. The meter's DC input resistance alone does not determine how it loads the tap at RF. Input capacitance and test leads can change the RF voltage at the meter, and RF rectification inside the meter can shift the displayed DC value.

Compare the readings with RF off and on while keeping the DUT in the same DC operating state, where practical. If RF pickup affects the reading, add a **DC-pass low-pass filter** between J3 and the voltmeter. Verify the filter's DC loading, RF attenuation, and power rating for the setup.

Choosing between a pick-off tee and Kelvin sensing

A Kelvin bias tee provides a dedicated sense path at its RF+DC port. A separate resistive pick-off tee can be added to an existing bias setup and positioned closer to the DUT. That makes it practical for checking and adjusting local bias during RF testing. When the measurement must capture the voltage directly across the DUT terminals, place the sense connections at the DUT's supply and return terminals.