Keysight Technologies

Differences in Application Between Power Dividers and Power Splitters

Application Note

KEYSIGHT TECHNOLOGIES

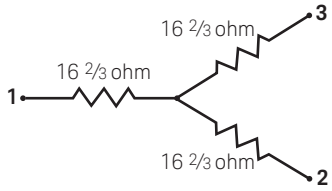
Introduction

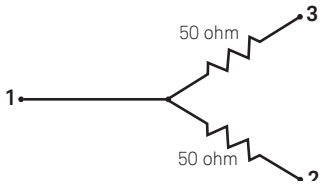
Power dividers are an RF microwave accessory constructed with equivalent 50 Ω resistance at each port. These accessories divide power of a uniform transmission line equally between ports to enable comparison measurements. Power dividers provide a good impedance match at both the output ports when the input is terminated in the system characteristic impedance (50 Ω). Once a good source match has been achieved, a power divider is used to divide the output into equal signals for comparison measurements. The power divider also can be used in test systems to measure two different characteristics of a signal, such as frequency and power, for broadband independent signal sampling. Besides dividing power it also can act as power combiners because they are bi-directional.

Power splitters are constructed of two resistors. They are used for leveling and ratio measurement applications to improve the effective output match of microwave sources. The two-resistor configuration also provides 50 Ω output impedance to minimize measurement uncertainty in source leveling or ratio measurement applications.

Characteristics of power dividers and power splitters

Power dividers	Power splitters
– Divide a signal equally for comparison measurements – All ports have equivalent 16 ⅔ resistance – Can be used as power combiners – SWR 3:1	– Used in ratio measurements and leveling loop applications – Only the input port has a 50 Ω resistance, the other two ports have 83.33 Ω impedance – SWR 1:1





Key specifications of Keysight Technologies, Inc. 11636C power dividers and 11667C power splitter

11636C power dividers	11667C power splitters
– Operating frequency: DC to 50 GHz – ± 0.3 dB amplitude tracking – ± 2° phase tracking – Low SWR 1.67	– Operating frequency: DC to 50 GHz – < 0.4 dB tracking between output ports – Excellent output: 1.10 SWR at the auxiliary port

Power Divider and Power Splitter Applications

Power divider applications

Low power signal distribution to two antennas

In this application, a power divider divides the power into two antennas at the same time. Figure 1 shows how to make a simple connection to a power divider which distributes the low power signal equally into two antennas at one time.

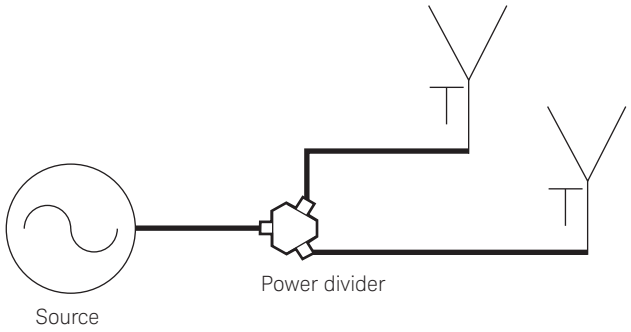


Figure 1. Simple test setup for power dividing application

Intermodulation distortion (IMD) measurements

Power dividers can be used as power combiners for IMD measurements. IMD measurements require a signal with the appropriate phase relationships among the carriers to simulate real life conditions and provide repeatable results. A power divider accurately combines two signals from the two difference signal sources into one signal for the device under test (DUT). A spectrum analyzer is used to examine the output of DUT while it is being stimulated with multi-tone test signal.

Figure 2 shows the traditional measurement setup used to measure the IMD product with a two-tone test stimulus.

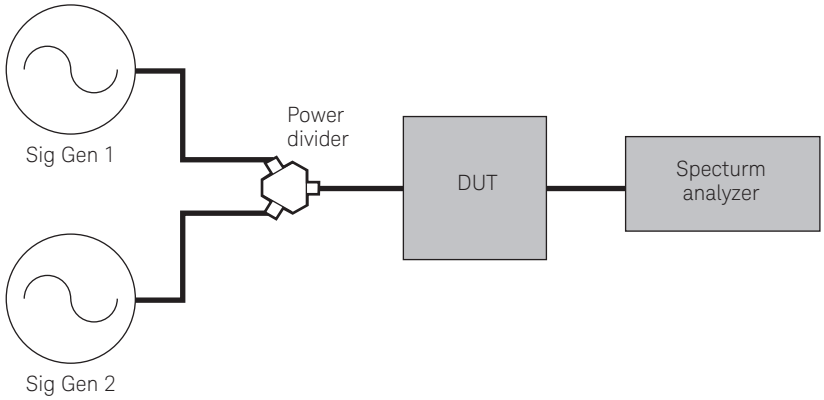


Figure 2. Power divider test setup for IMD measurements

Diversity gain measurements

The electromagnetic field in multipath environments is very strong in some positions and very weak in others. A power divider can be used to measure the diversity gain of the handset. Figure 3 shows how to connect a power divider

This measurement setup is used to measure the diversity gain of digitally-enhanced cordless telecommunication (DECT) devices. The base station sends a slot through a power divider to a wall antenna selected by the switch. The handset then radiates the signal back to the base station. The handset is placed in a reverberation chamber so that a spectrum analyzer can receive and measure the radiated power of the signal.

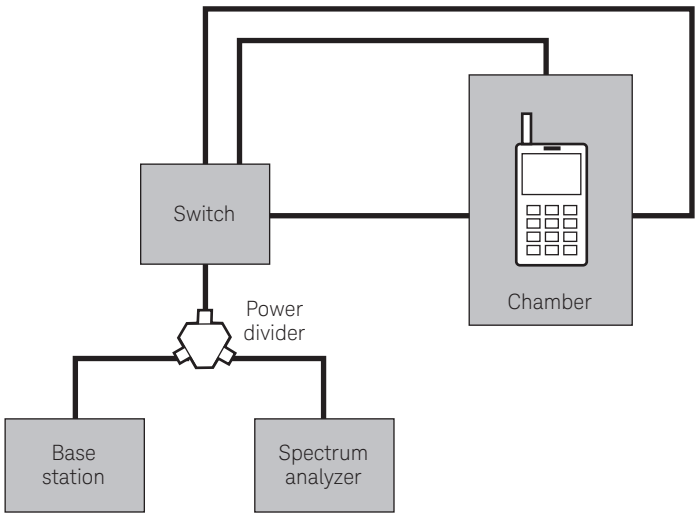


Figure 3. Power divider test setup for diversity measurements

Power splitter applications

Gain, compression and isolation measurements

Power splitters can be use for gain, gain compression and power testing. Figure 4 shows the basic test setup for amplifier gain, compression and power testing. The power splitter provides signal ratioing that improves the source match and removes re-reflected signals so gain measurements can be taken at different RF power levels without re-calibrating.

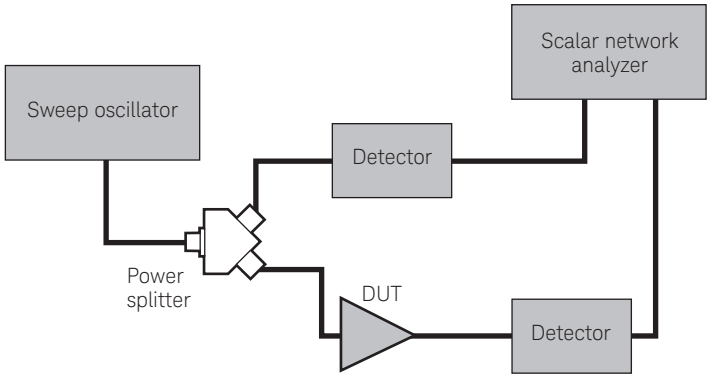


Figure 4. Simple test setup for power dividing application

Ratioing or leveling

The effective source match can be improved by ratioing or leveling the source externally. These two methods also provide similar source match improvement. Figure 5 shows the source leveling technique that uses an external crystal detector. Figure 6 shows the source leveling technique using a power meter.

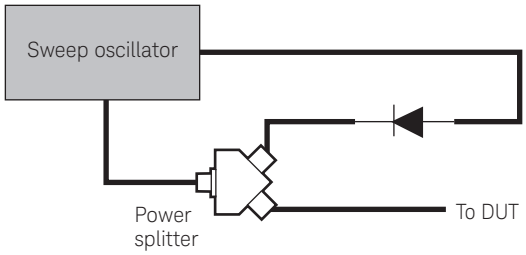


Figure 5. Power splitter test setup for leveling with a crystal detector

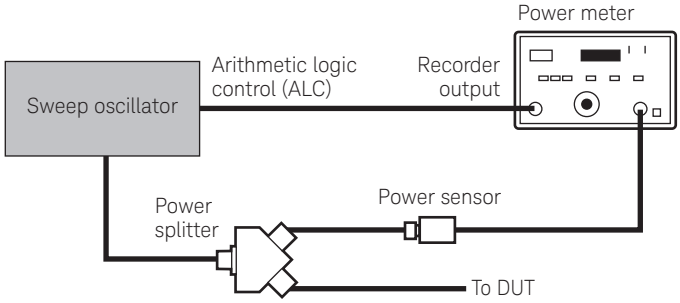


Figure 6. Power splitter test setup for leveling with a power meter

Conclusion

Power dividers and power splitters perform different functions in test systems and, as seen in the applications above, are not interchangeable. For simple power dividing and combining, the three-resistor power divider should be used. For ratio measurement and leveling, the two-resistor power splitter is the right choice.

For more information on test accessories go to:
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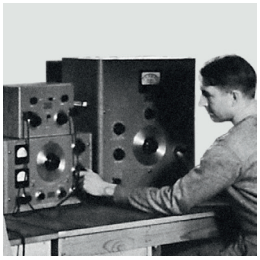
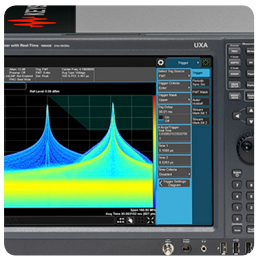


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