

What is a directional coupler ?

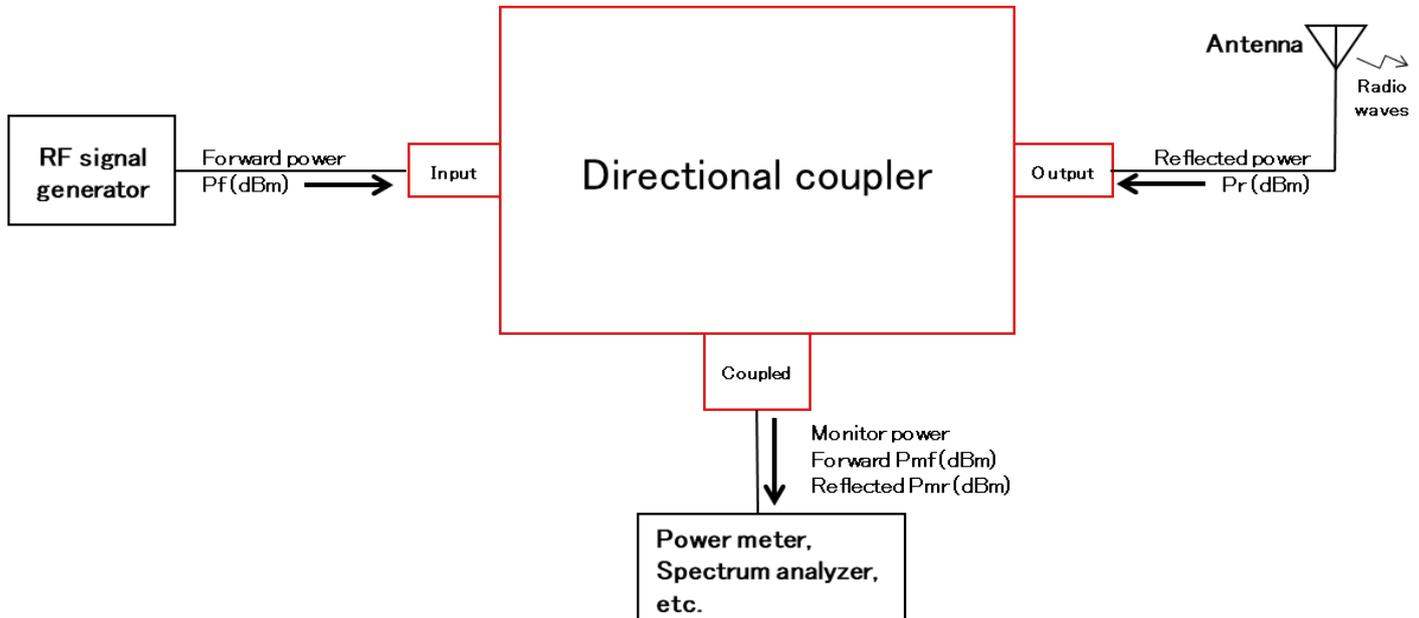
◇An example of forward power measurement using a 3-port directional coupler will be described.

[~*Application*~]

A directional coupler is used to measure the forward power that input into the input port.

For example, as shown in the figure below, it is used in a power monitor when an RF signal generator and an antenna are connected to transmit radio waves.

A directional coupler is explained using this example.



The main specifications of a directional coupler are Coupling : C (dB) and Directivity : D (dB).

"Coupling" is the ratio of the forward power Pf (dBm) that input into the input port to the forward monitor power Pmf (dBm) output from the coupled port.

The relation between the forward power Pf (dBm) and the forward monitor power Pmf (dBm) can be expressed by the following formula,

$$\underline{P_{mf} \text{ (dBm)} = P_f \text{ (dBm)} - C \text{ (dB)}}.$$

"Directivity" is the ratio of two output powers from the coupled port. One is from the input port and the other is from the output port.

The relation between the reflected power Pr (dBm) and the reflected monitor power Pmr (dBm) can be expressed by the following formula,

$$\underline{P_{mr} \text{ (dBm)} = P_r \text{ (dBm)} - C \text{ (dB)} - D \text{ (dB)}}.$$

When using a directional coupler with C = 10dB, D = 20dB and measuring under the conditions of Pf = 30dBm, Pr = 20dBm,

$$P_{mf} = 30\text{dBm} - 10\text{dB} = 20\text{dBm}$$

$$P_{mr} = 20\text{dBm} - 10\text{dB} - 20\text{dB} = -10\text{dBm}$$

Since the ratio of Pmf and Pmr is 30 dB (=1000 times), almost only the forward power component is measured as the monitor power.

It is also necessary to consider the insertion loss, which is one of the specifications of the directional coupler.

Insertion loss is the amount of attenuation between the input power into the input port and the output power from the output port.

※However, these formulas are ideal and may be affected by impedance mismatch etc. in actual measurement.

[~*System constitution*~]

- Handheld signal analyzer MSA500 series
- Handheld spectrum analyzer MSA400 series

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