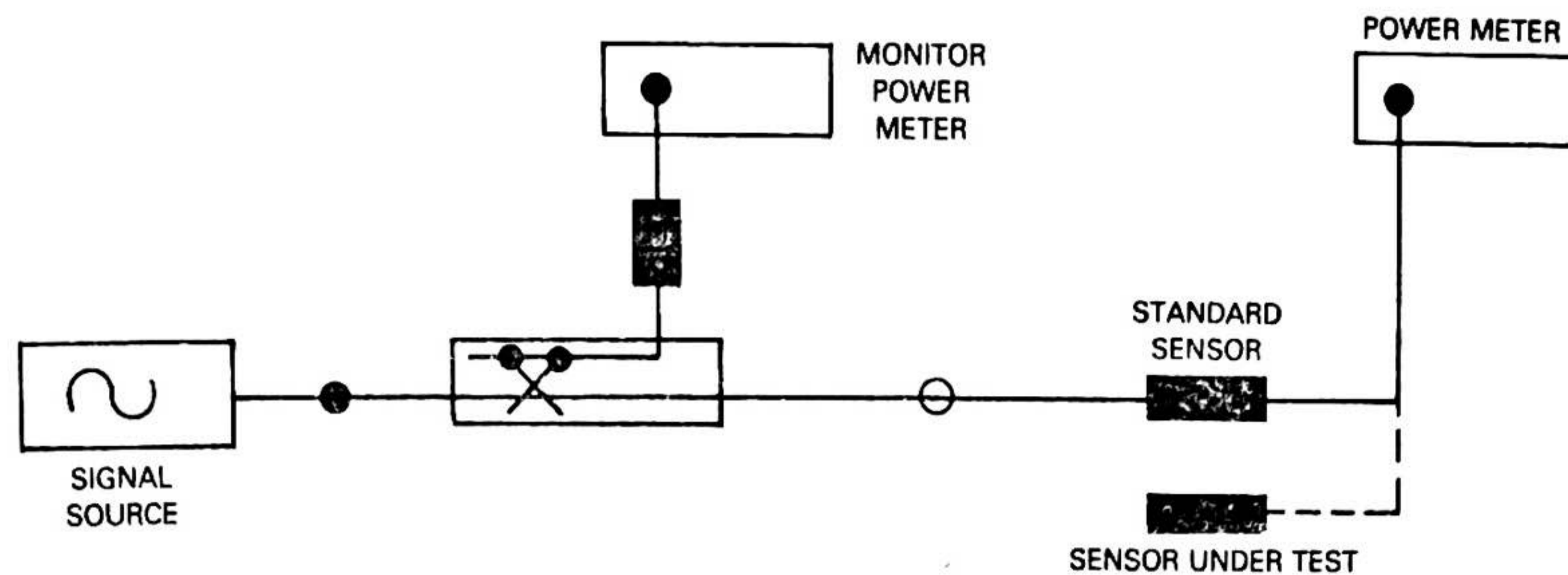


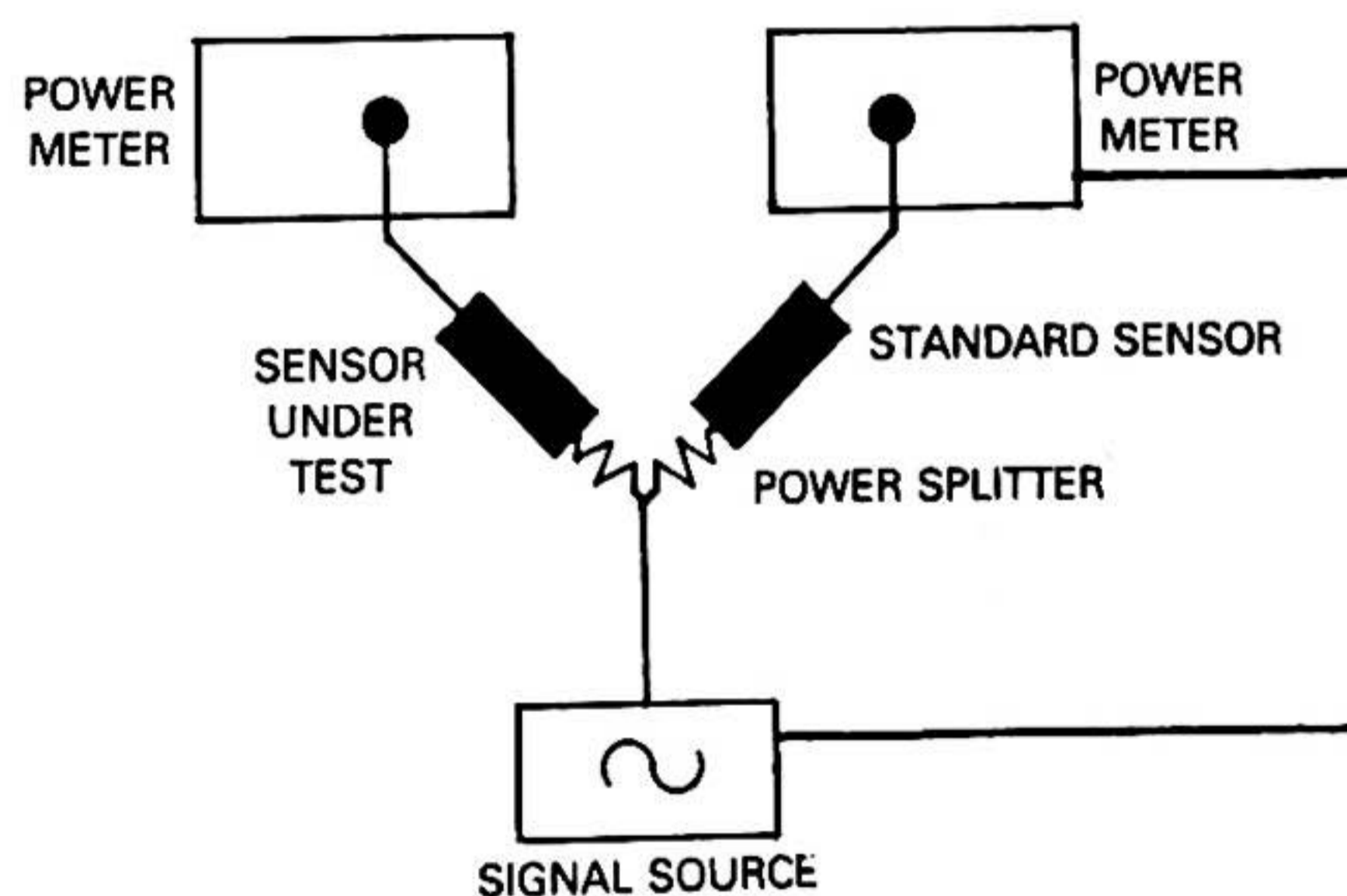
3. **Microwave to low frequency conversion** – two widely used sensor calibration configurations are based on either a coupler or splitter system.

**Coupler system** – compares a standard sensor with a sensor to be tested – typical uncertainty 14.7%.



- Advantages** – relatively low cost, sensitivity can be varied by choice of coupling  
**Disadvantages** – coverage limited to frequency response of coupler, poor source match, coaxial to waveguide adaptors needed to connect sensor to coupler at high frequencies.

**Splitter system** – splitter is used to effectively level system therefore test sensor is compared against a known reference signal – typical uncertainty 4.3%.



- Advantages** – good source match therefore **ACCURATE**, coaxial splitters available to high frequencies.

### Resultant Improvements in Uncertainty

The 3-D plot shows how measurement uncertainties can be substantially reduced by using some of the techniques outlined above. Incorporated were the addition of a power linearity factor, use of the splitter system to measure calibration factor, auto zero on all ranges and digital averaging to reduce noise.

## Waveguide Measurements

The principle of making measurements on waveguide and millimetre wave components is basically the same as those outlined above. Waveguide directional couplers may be used as they have high directivity and will interface directly with the DUT. At sub-millimetre wave frequencies, a waveguide to coaxial transition must be used in front of the detector. The match of the detector will be degraded by the VSWR of the transition, so it should be the best that is available. Also, when making return loss measurements, it is not possible to use the average of an open and short circuit, as an open circuit waveguide radiates. The recommended practice is to use a precisely flat, metal plate bolted to the reflected signal coupler. This is then used to establish 100% reflection against which to determine the reflection calibration.

### WAVEGUIDE MEASUREMENTS

