Abstracts

Equivalent Circuit of the Bolometer Detector

A small-signal dynamic equivalent circuit is established for the output voltage of a dc-biased bolometer (barretter) detector. The circuit consists of a voltage generator υ_g, whose output is an undistorted replica of the incident RF-power modulation envelope, followed by a series resistor R_1 of dynamic origin, a shunt capacitor C that represents heat storage in the bolometer wire, and a series resistor R_0 equal to the dc resistance, usually 200 ohms. The resistance R_1 is independent of signal level, and is typically about 220 ohms for an 8.75-mA bolometer and about 120 ohms for a 4.5-mA bolometer. At a modulation frequency f_m near 0 Hz, the equivalent audio source impedance of the bolometer is $R_1 + R_0$. The common belief that the source impedance is R_0 in the weak-signal case is, therefore, refuted. Formulas are derived giving v_g / P_{RF} and R_1 as functions of basic, easily determined bolometer parameters. The time constant for open-circuit load is $\tau_{oc} = R_1 C$, where τ_{oc} is determined best by measurement, since catalog values of τ_{oc} often are seriously in error. The capacitance is $C = \tau_{oc} / R_1$. With one type of bolometer τ_{oc} measures about 110 μs, while various catalogs state values of 250 to 350 μs. The equivalent circuit is confirmed quantitatively by measurements of output voltage and source impedance versus modulation frequency.

❑ Return to main document.

Click on title for a complete paper.