Noise Temperature Measurement

A selection of methods is listed, with varying degrees of ease and accuracy.

1. Crude Method

1.1 Needed

- A solid-state noise source
- A power supply for it
- A variable or switched attenuator with a value that can be read, or a selection of fixed attenuators.
- Some means of looking at the receiver output. The simple_ra total power indication could be adequate.

1.2 Method

- Connect the noise source through a fixed (known) attenuator to the receiver input. You can do this injection through the calibration coupler with the receiver input terminated. When this is connected, the output is proportional to $T_R + T_0$, where T_R is the receiver noise temperature and T_0 is the ambient temperature (the noise source and attenuators act as a matched load at the ambient temperature, when in doubt, use 290 or 300K.
- Turn on the noise source and adjust the attenuation in series with the noise source so that the receiver output voltage doubles. Then $T_N/L = T_R + T_0$. Where T_N is the noise output of the diode in Kelvins and L is the total attenuation between the noise source and the receiver input ($L=10^{(A/10)}$) where A is the attenuation in dB.
- Repeat the first step to ensure the receiver output has not changed.
- Repeat as desired.

1.3 What's Wrong With This Method

- There is the implicit assumption that the output voltage is proportional to input power. This means the receiver amplification is assumed linear.
- It also assumes that the demodulation process is a perfect “square law”.

2. A Better Method

2.1 Needed

- A solid-state noise source
- A power supply for it
- A variable or switched attenuator with a value that can be read, or a selection of fixed attenuators.
- Some means of looking at the receiver output. The simple_ra total power indication could be adequate.

2.2 Method

- With the input terminated and the noise source switched off, take a note of the demodulation output voltage.
- Put a 3dB attenuator in the receiver train, as close to the demodulation end as possible. The output voltage will drop, but due to linearity and demodulation issues, it might not drop to exactly half the original value.
- Turn on the noise source and adjust the attenuation in series with the noise source until the demodulation voltage is equal to its original value.
- The theory is the same as in 1, but this method eliminates or greatly minimized the effects of detector and demodulator non-linearity.