For a cascaded system, the noise figure of the overall system may be computed from the noise figures and gains of the individual components. That is,

$$F_{sys} = F_1 + \frac{F_2 - 1}{G_1} + \frac{F_3 - 1}{G_1 G_2} + ... \tag{B.7}$$

or equivalently

$$T_{e_{sys}} = T_1 + \frac{T_2}{G_1} + \frac{T_3}{G_1 G_2} + ... \tag{B.8}$$

where gains are in absolute (not dB) values. The following examples illustrate how to compute the noise figure of a mobile receiver station, and consequently the average receiver noise floor that is used in a link budget.

Example B.1
If a wireless link provides an SNR of 20 dB to the receiver antenna input terminals, and the receiver is specified to have a noise figure of 6 dB, what is the SNR at the detector stage of the receiver?

Solution
Using the concept of noise figure, it is easy to compute the SNR going into the detector stage from Equation (B.5).

Since the receiver amplifies the signal and the noise by the same factor, and the noise out is *F* times the noise in, then

$$\text{SNR}_{\text{OUT}} = \frac{\text{SNR}_{\text{IN}}}{F}$$

or, in dB values, $\text{SNR}_{\text{OUT}} = \text{SNR}_{\text{IN}} - F$.

Thus, for this example,

$$\text{SNR}_{\text{OUT(dB)}} = 20 - 6$$
$$\text{SNR}_{\text{OUT(dB)}} = 14 \text{ dB}$$

The output SNR (SNR just prior to demodulation) is equal to 14 dB, even though the receiver input SNR is 20 dB.

Example B.2
Consider an AMPS cellular phone with a 30 kHz RF equivalent bandwidth. The phone is connected to a mobile antenna as shown in Figure B.2. If the noise figure of the phone is 6 dB, the coaxial cable loss is 3 dB, and the antenna has an effective temperature of 290 K, compute the noise figure of the mobile receiver system as referred to the input of the antenna terminals.