polarization compatability.

7. Ground station 2m antenna gain: This figure is readily available from the antenna manufacturer. In the example we will use the KLM 16C which has a specified gain of 11 dBc.

8. Ground station 2m feedline loss: Assuming your preamplifier is located in the shack and not at the antenna feedpoint, this figure is simply obtained from the ARRL handbook based upon the type of feedline and its length. In the example, 1.5 dB is assumed based on 75 feet of type 8214 foam polyethylene coaxial cable.

9. Receive preamplifier noise figure and gain: This figure is readily available from the manufacturer. A typical example, the popular Janel QSA-5, shows 15 dB gain and a 2 dB noise figure.

10. 2 meter receiver (or multi-mode transceiver) noise figure: This parameter is not easily determined. No manufacturer supplies the noise figure for the front end of their radios. However, Amateurs who have measured a variety of radios have concluded they generally range from 3 dB at best to 8 dB at worst. For this analysis, assume 5 dB.

With all the particular variables that will be the source of the analysis identified, a method of finding each variable's contribution to our ability to hear must be determined. The method here chosen is found in the *RSGB VHF/UHF* handbook. All variables that comprise major sources of threshold sensitivity are converted to the common denominator of noise temperature. This parameter, (in °K) as well as noise figure (in dB), minimum discernable signal (in dBm, and sensitivity (in microvolts) are all measures of the weakest signal that can be heard in a receiving system. It is not possible to analyze the contribution of each of the above ten elements without choosing one measure of receiver threshold sensitivity. For the purposes of this analysis the variables will be converted to noise temperature and added together to arrive at a system noise temperature. Then they will be converted back to the more recognizable system (or effective) noise figure and minimum discernable signal (MDS).

Noise Contribution Of Each Element Described

The first variable that must be determined is the background noise level (or noise floor) of the sky at the frequency of interest (2m). Most sources agree that the background noise level on 2m amounts to a standing noise figure of 2 dB, i.e., in order to hear the noise level of the sky at 2m, a preamplifier mounted at the antenna would have to have a noise figure of 2 dB or less. Therefore, this 2 dB background noise figure must be converted to a sky noise temperature.

$$\begin{aligned}\text{Noise Temp.} &= [\text{Antilog}\ (0.1 \times \text{NF}) - 1] \times 290\,^\circ\text{K} \\ &= [(\text{Antilog}\ .2) - 1] \times 290\,^\circ\text{K} \\ &= (1.585-1) \times 290\,^\circ\text{K} = 169.6\,^\circ\text{K}\end{aligned}$$

The sky noise temperature is then 170 °K.

The next variable for which noise temperature contribution must be determined is feedline loss. In the example, assume a feedline loss of 1.5 dB, which corresponds to 75 feet of RG8/U foam coax. To calculate the noise temperature contribution of this loss, first convert 1.5 dB loss to its equivalent loss ratio:

Loss Ratio = 1.412

The equivalent sky temperature therefore is equal to the cold sky temperature of 170 °K divided by the feedline loss ratio.

170 °K/1.412 = 120 °K

The equivalent feeder loss temperature is calculated as in the initial conversion from 2 dB sky noise figure to sky temperature.

$$\begin{aligned}\text{Noise Temp.} &= (\text{loss ratio} - 1) \times 290\,^\circ\text{K} \\ &= (1.412 - 1) \times 290\,^\circ\text{K} = 119.5\,^\circ\text{K}\end{aligned}$$

This must be reduced by the loss ratio of the line, 1.412, which yields a final figure of 119.5/1.412 = 84.6 °K.

Next, analyze the noise contribution of the 2 dB noise figure of the 15-dB gain preamp.

2 dB NF expressed as a ratio = 1.585

Noise Temp = (1.585 − 1) × 290 °K = 170 °K

The coupling loss from our preamp to the multimode 2m transceiver is a result of the interconnection cables and RF connection. It is assumed to be 0.2 dB. Expressed as a ratio, this is 1.047.

Noise Temp = (1.047 − 1) × 290 °K = 13.7 °K.

This must be reduced by the gain ratio of the preamp and since its gain is 15 dB, the gain ratio is:

Antilog (0.1 × dB gain)

Antilog (0.1 × 15) = 31.6

Therefore, the noise contribution of our coupling loss is:

13.7 °K/31.6 = 0.43 °K

The combined noise temperature contribution of the preamp and 2-meter multimode transceiver must now be calculated.

It is already known that the 2m rig has a NF of 5 dB. Expressed an a ratio, Antilog .1XNF = 3.16

Noise Temp = (3.16 − 1) × 290 °K = 627 °K

This figure must be reduced by the gain ratio of the preamp 31.6. Therefore, the noise contribution of the 2m multimode rigs front end is:

$$\frac{(5\ \text{dB NF})\ 627\,^\circ\text{K}}{(\text{preamp gain})\ 31.6} = 19.8\,^\circ\text{K}$$

Finally, to determine the system noise temperature:

Equivalent Sky Noise Temperature	120	°K
Equivalent Feeder Loss Noise Temp	84.6	°K
Preamp Coupling Loss Temp	0.43	°K
Preamplifier Noise Temp (2 dB NF)	170	°K
Noise Contribution of 2m XCVR	19.8	°K
System Noise Temperature	394.8	°K

At this point the receiver threshold sensitivity can be determined using the system noise temperature (T_s) and one equation:

$P_n = 10 \log_{10} KT_sB$

where:

P_n = Receiver Threshold Sensitive in dBW