

## Noise Figure at 70 MHz IF - Upconverter

The following is an analysis on the impact to system performance resulting from the Noise Figure specified for 70 MHz IF upconverters. While Cross does specify this parameter on several of our models to be 20 dB, (max), this 70 MHz IF Noise Figure (NF) is not a very meaningful specification for 70 MHz IF frequency upconverters. This can be shown by the following analysis;

**A) The total noise power for a 0 dB noise figure and a bandwidth of 36 MHz is as follows:**

$$P(0) = -174 \text{ dBm/Hz (@ } 290^{\circ}\text{K)} + 10\log(36\text{E}6) = -174 + 76 = \mathbf{-98 \text{ dBm}}$$

**B) The total noise power for a 20 dB noise figure (noise figure adds directly to the noise power) is:**

$$P(20) \text{ 20dB NF} = (-98 + 20) = \mathbf{-78 \text{ dBm}}$$

**C) The carrier to noise ratio at a -35 dBm 70 MHz IF input level with a 20 dB noise figure (typical min input level for these converters) is:**

$$C/N = -35 - (-78) = \mathbf{43 \text{ dB}}$$

**E) Satellite links usually operate at system C/N ratios of less than 15 dB and often below 10 dB.**

**F) The 70 MHz IF noise figure could degrade to the point that the frequency upconverter C/N ratio was as high as 25 dB with no measureable system S/N degradation (assuming a 15 dB system C/N is required for the link). For a 25 dB C/N, the 70 MHz IF noise power would be -60 dBm, at the minimum input signal strength of -35 dBm:**

$$C/N = -35 - (-60) = \mathbf{25 \text{ dB}}$$

**G) This would allow a 38 dB 70 MHz IF noise figure (NF = -60-(-98)) to exist for the upconverter confirming that:**

**H) A 70 MHz IF noise figure specification is not a meaningful requirement as shown above.**