Noise Figure impact in 36 MHz BW, 70 MHz Downconverters

The following is an analysis of the impact to system performance resulting from the Noise Figure specified for 2016 Downconverters (10 dB typ., 15 dB max, see https://www.crosstechnologies.com/data_sheets/2016-25_DATA_SHEET.pdf).

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

P(0) = -174 dBm/Hz (@ 290°K) + 10log(36E6) = -174 + 76 = **-98 dBm**

B) The total noise power for 10 dB and 15 dB noise figures (noise figure adds directly to the noise power) are:

P(10NF) for a 10dB NF = (-98 + 10) = **-88 dBm**
P(15NF) for a 15dB NF = (-98 + 15) = **-83 dBm**

C) 2016 Downconverter input level is usually specified at -70 dBm, minimum. For 10 dB and 15 dB noise figures, this gives a carrier to noise ratio (C/N) at this IF input level of (-70 –P(NF)):

C/N for a 10dB noise figure = -70 - (-88) = 18 dB
C/N for a 15dB noise figure = -70 - (-83) = 13 dB

D) Satellite links usually operate at system C/N ratios of 10 dB or less.

F) If the C/N of the 2016 Downconverter is 10 dB better it contributes only 10log(1.1) = 0.4 dB to the system C/N which would result in virtually unmeasurable S/N and therefore BER degradation on a system basis.

G) This says that for a system operating C/N of 10 dB, the 2016 Downconverter input level could be as low as:
1) -63 dBm for the 2016 maximum noise figure of 15 dB and
2) -68 dBm for the 2016 typical noise figure of 10 dB before it would result in any measurable link C/N degradation.