

# Signals Plus Interference

## 5/31/04

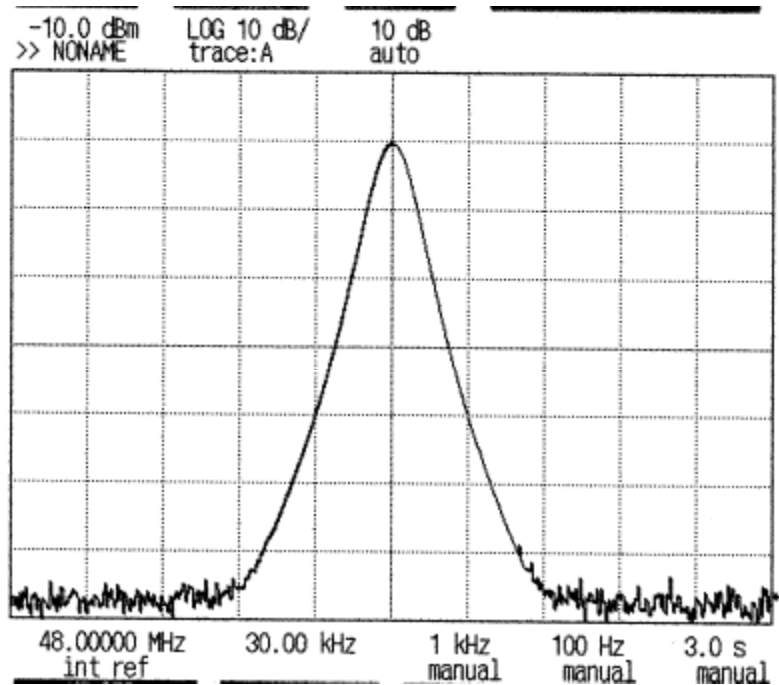


Figure 1. The spectrum of a Minimum Sideband ( Ultra Narrow Band ) modulated signal. The apparent spread is actually the shape of the filter in the spectrum analyzer. The true spectrum is a single frequency line with no spread. 30 kHz was chosen here because it is the Cellular` telephone allocated bandwidth. The spectrum is independent of data rate.

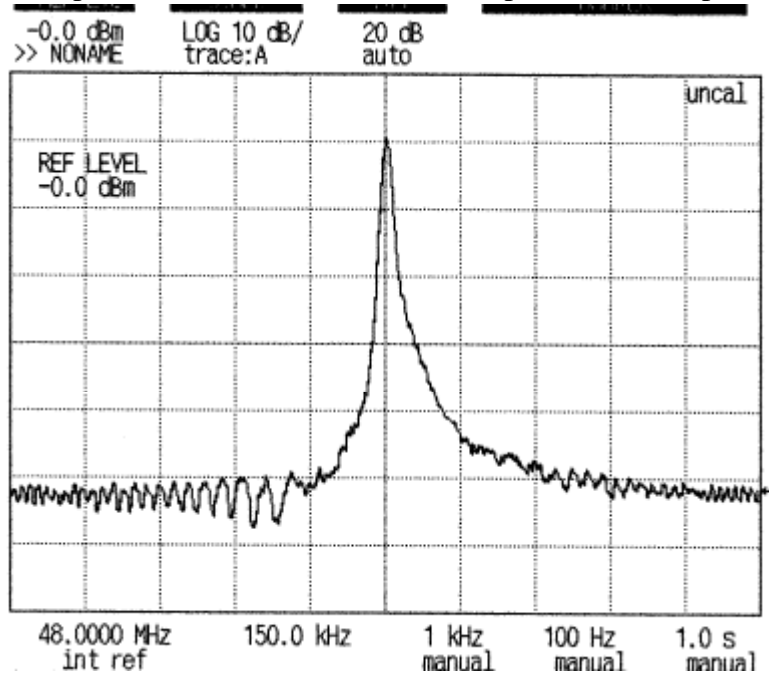


Figure 2. Swept bandpass of the Ultra Narrow Band filter used with MSB, The 3 dB bandwidth is 1kHz. This filter can be used as high as 6 Mb/s data rate.

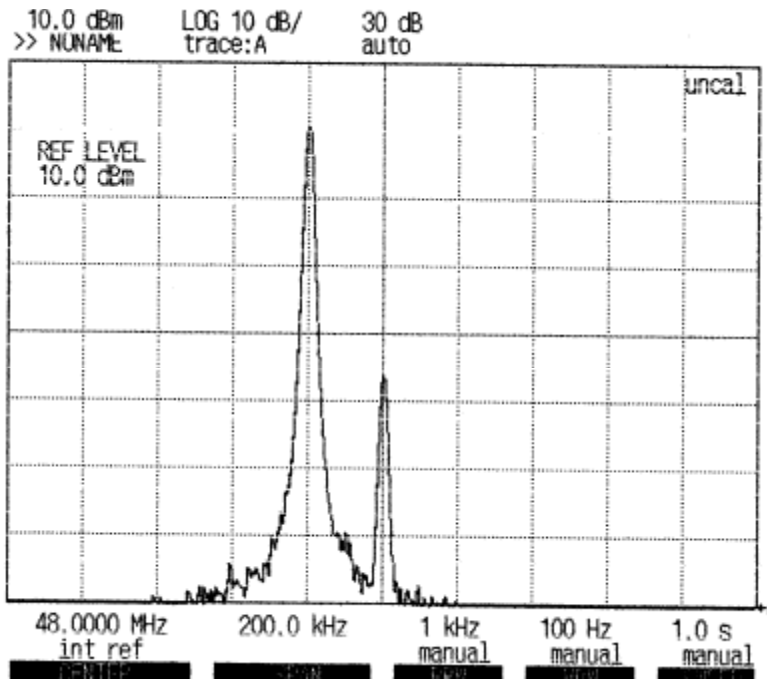


Figure 3. The 48 MHz MSB signal is seen at the center with a strong interferor 20 kHz lower. The interference is rejected by the filter and does not cause data rate errors at this level. (+37 dB).

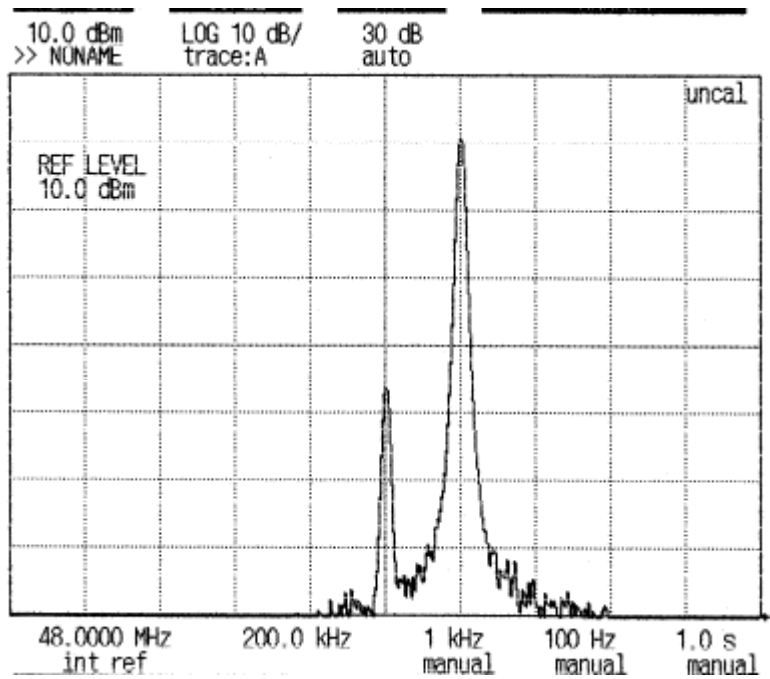


Figure 4.  
The same interference level +20 kHz above the desired signal at 48 MHz.  
No interference is caused.

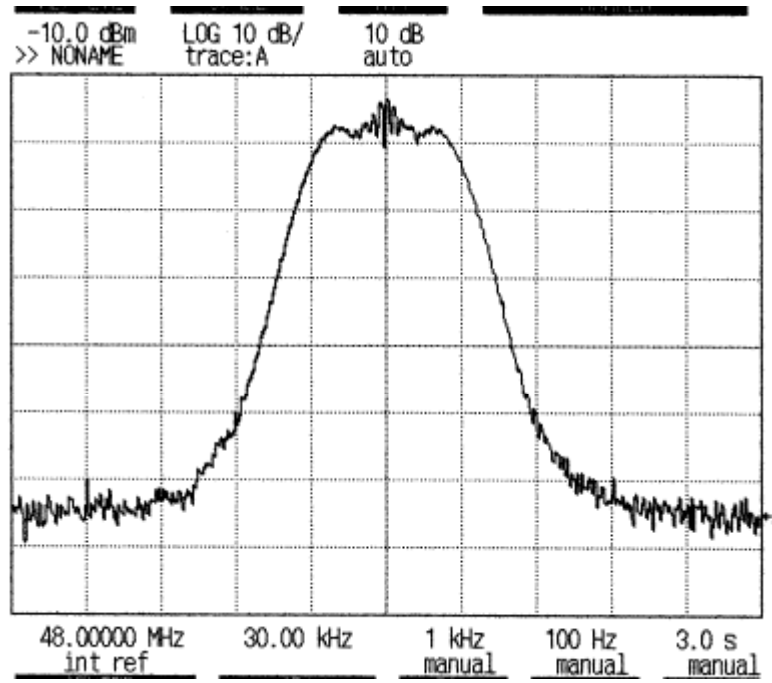


Figure 5. A frequency modulated signal having the same level as the signal in Figure 1 is superimposed. 400 Hz modulation. (  $C/I = 0$  dB ). The deviation is  $\pm 2.7$  kHz. The BER is approximately  $10^{-2}$ .

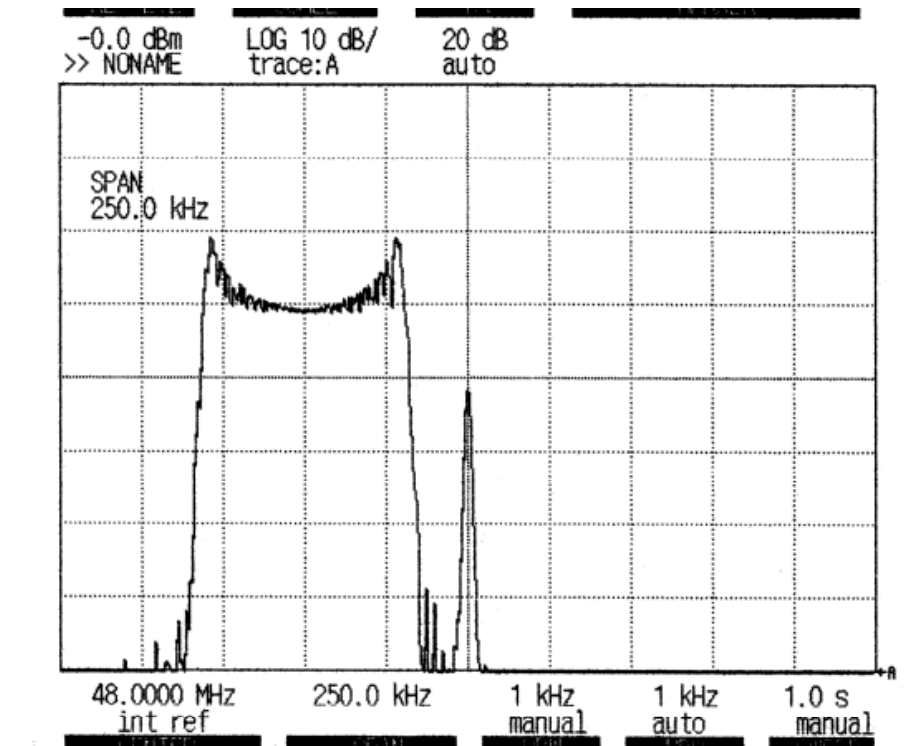


Figure 6. An interfering channel with FM,  $\pm 30$  kHz deviation at 400 Hz rate has been added 50 kHz below the desired MSB channel. There is no decrease in BER from the desired signal alone.

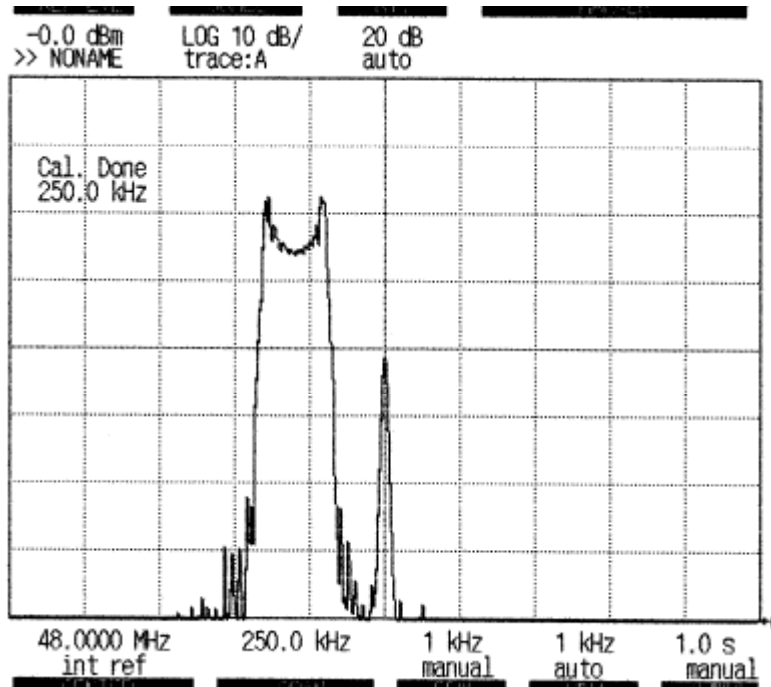


Figure 7. FM interference at the same power level as in Fig. 6, but spaced 30 kHz below the desired signal and the deviation reduced to  $\pm 10$  kHz. There is no effect on BER.

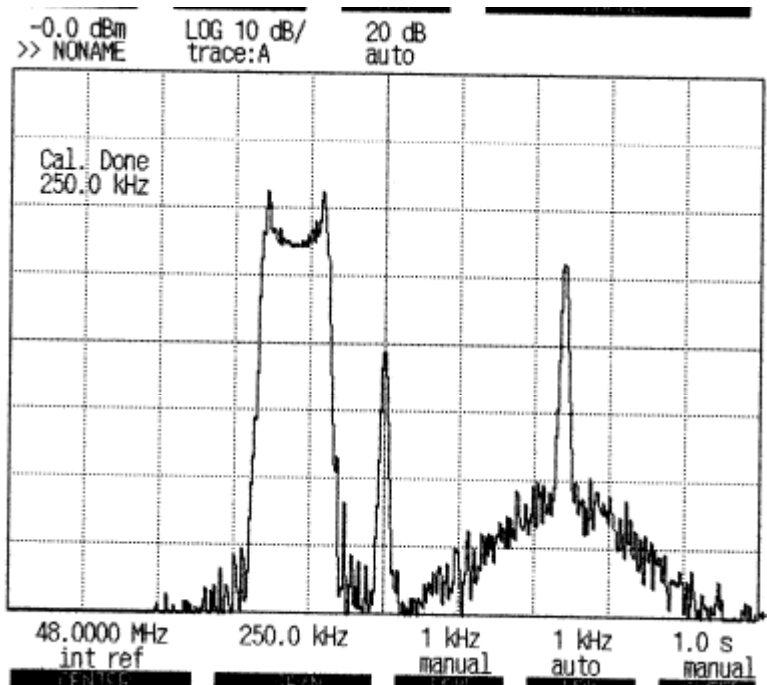


Figure 8. A second MSB channel ( 48.06 MHz ) has been added 60 kHz above the desired channel ( 48.00 MHz.). A reduction in BER is just becoming noticeable. The filter shoulders reduce, or remove, the interfering signals. It is desired to keep the filters as near passive as possible to avoid cross modulation in the amplifying stages, which will affect BER..

The 48.06 MHz MSB signal generator carrier oscillator is a programmable ECS unit that has considerable phase noise. A clean oscillator would be required to meet FCC regs.

