

Modulation Characteristics of the 340 Telemetry Transmitter

Modulation for the ST500 transmitter module in the 340 telemetry transmitter is a composite or sum of four separate signal sources. These sources are: 1) low frequency tones at 10, 20, 40, and 80 HZ , 2) demodulated ultrasound at 200 to 500 HZ, 3) a FM subcarrier at 1.75 KHZ, and 4) a FM subcarrier at 2.7 KHZ. The output stage, as well as serving as the summing amplifier for these signals, also incorporates a 1st order lowpass function at 3.4 KHZ. A bode plot of the output stage is shown in FIG 1.

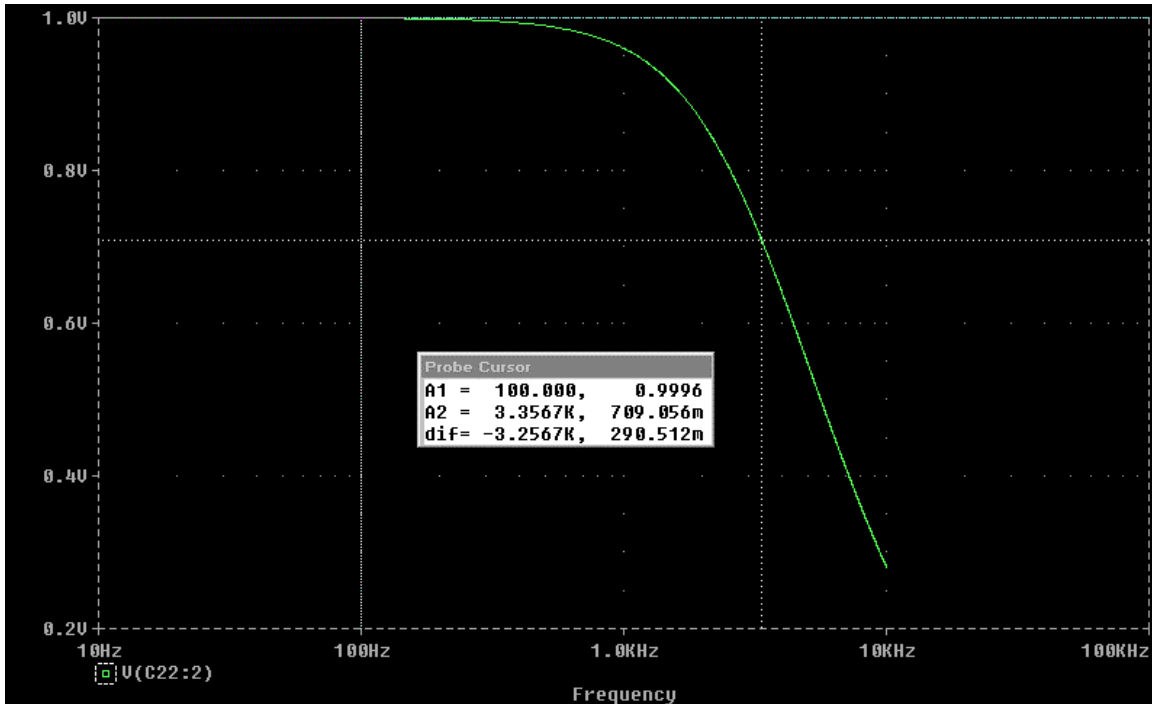


FIG 1. Bode plot of modulation output stage.

Prior to combining the four signals in the modulation output stage, each source is passed through separate lowpass or bandpass filters. FIG 2 shows the lowpass function for the low frequency tones, FIG 3 is the bandpass plot for the ultrasound signal, FIG 4 is the 1.75 KHZ subcarrier filter, and FIG 5 is the 2.7 KHZ subcarrier filter. All plots are shown at the output of the composite modulation stage.

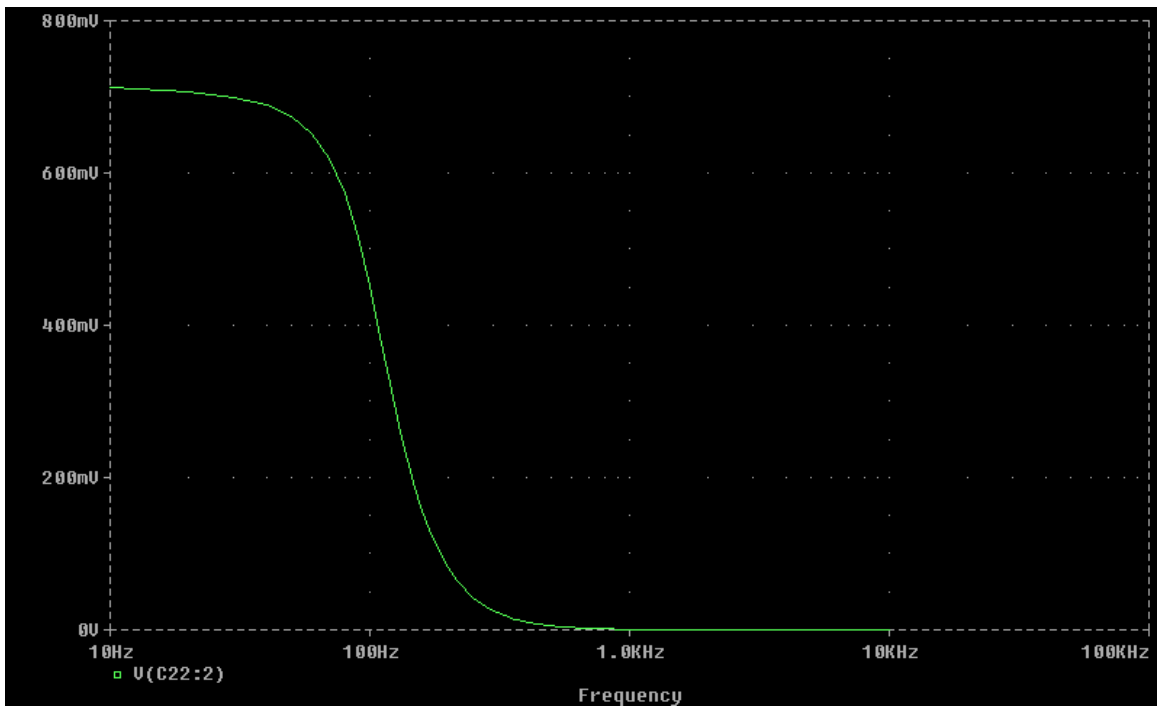


FIG 2. Bode plot of tone lowpass filter.

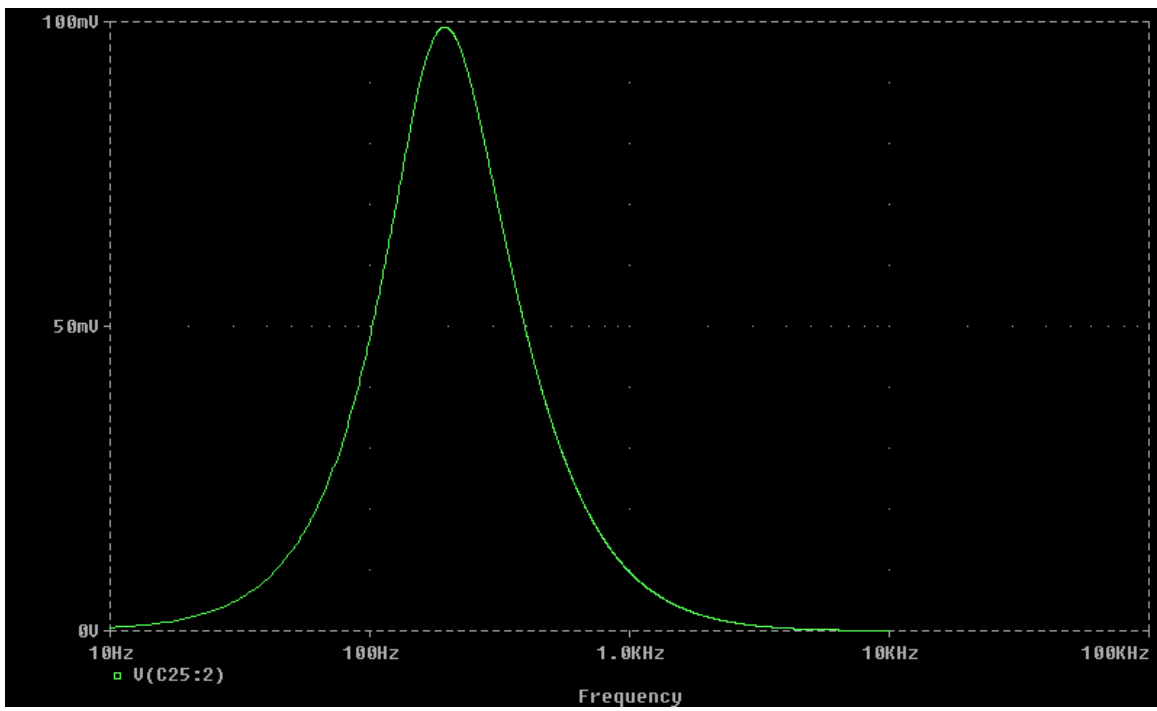


FIG 3. Bode plot of ultrasound bandpass filter.

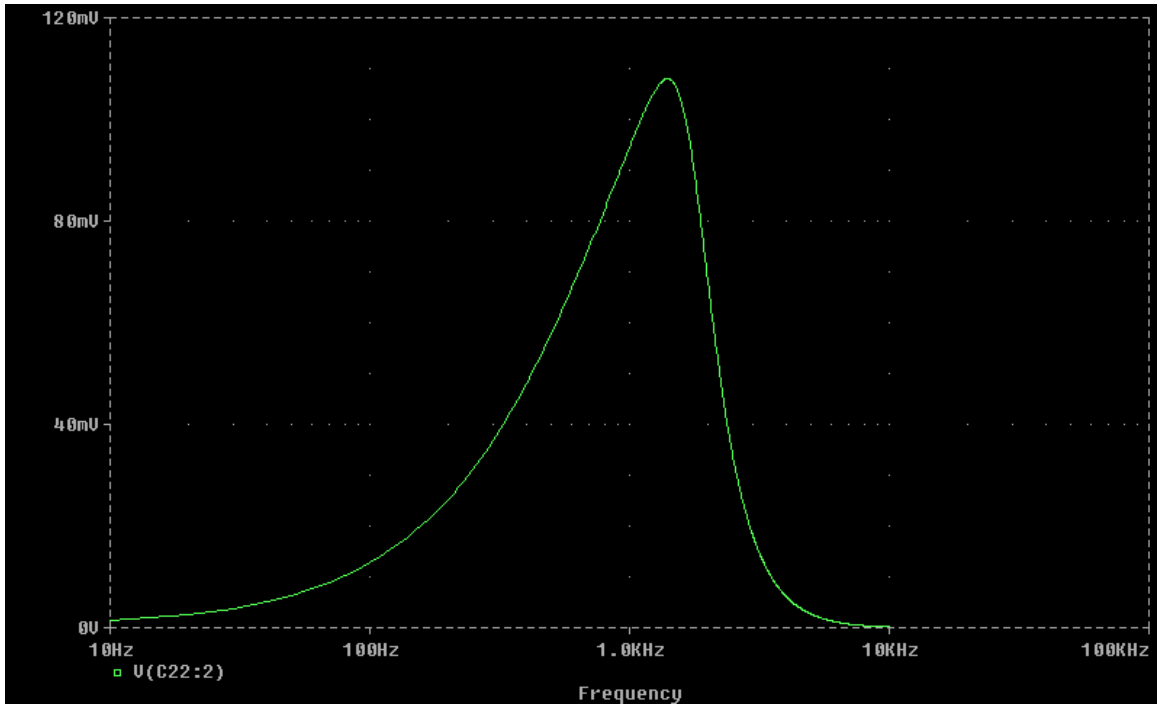


FIG 4. Bode plot of 1.75 KHz subcarrier bandpass filter.

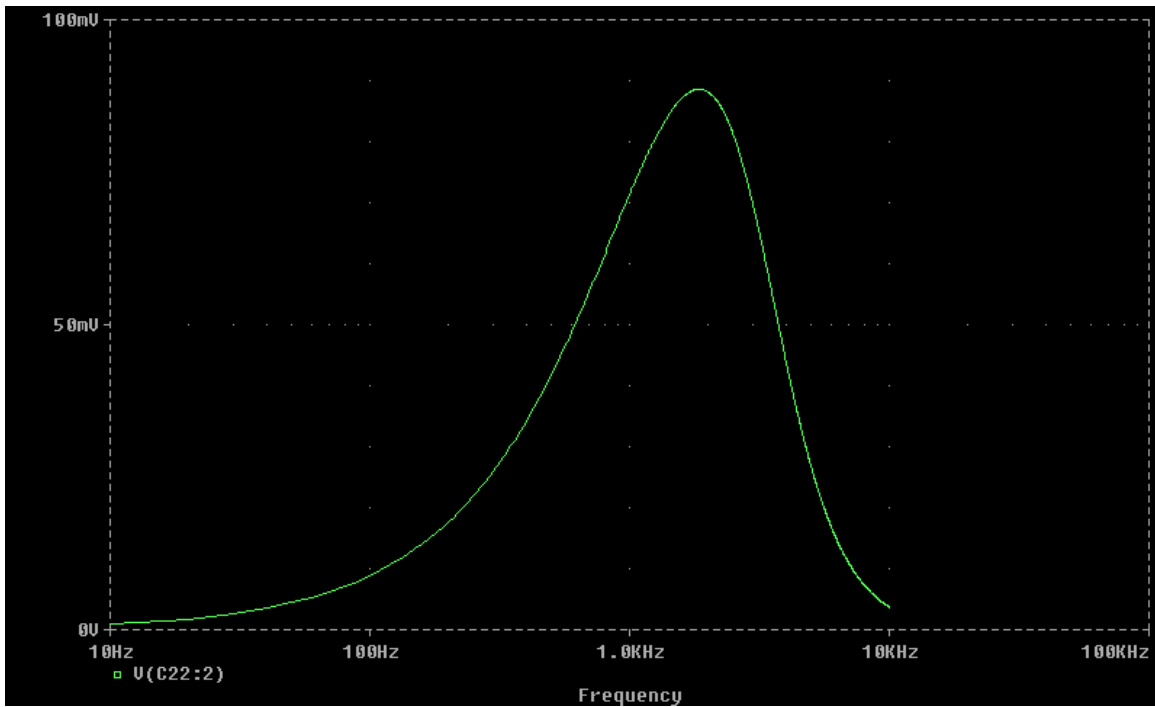


FIG 5. Bode plot of 2.7 KHz subcarrier bandpass filter

Modulation limiting is achieved in this design through the use of pre-limited or saturated drive signals. The input sources for the four filters detailed above are derived either from CMOS logic devices, or from amplifiers which operate normally in saturation. In both these cases, the output levels from these devices are constant and equal to their supply rails. No fault condition generated by improper use of the input accessories associated with this device can effect this. The filtered pre-limited signals are combined at a fixed ratio in the modulation output stage to produce the composite modulation source for the ST500 module. FIG 6 shows a .5 second “snapshot” of the composite modulation.

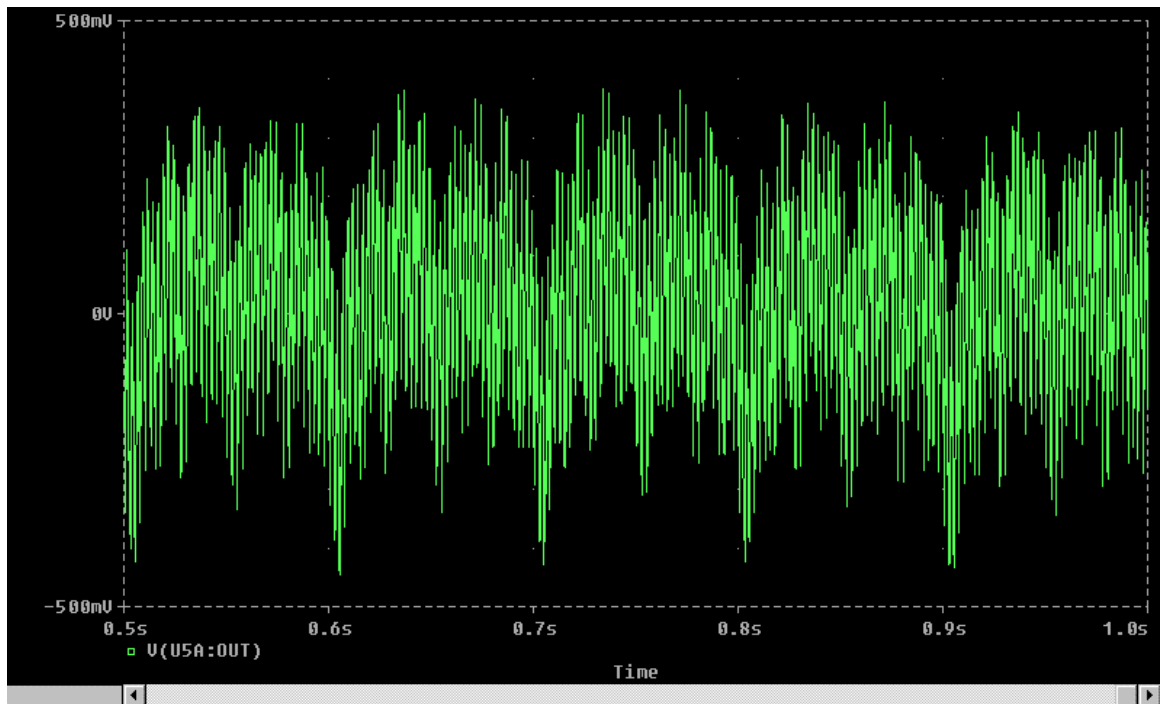


FIG 6. Composite modulation

FIG 7 shows a spectral plot of the composite modulation over the 0 to 10 KHZ range. FIG 8 shows an expanded view from 0 to 3 KHZ.

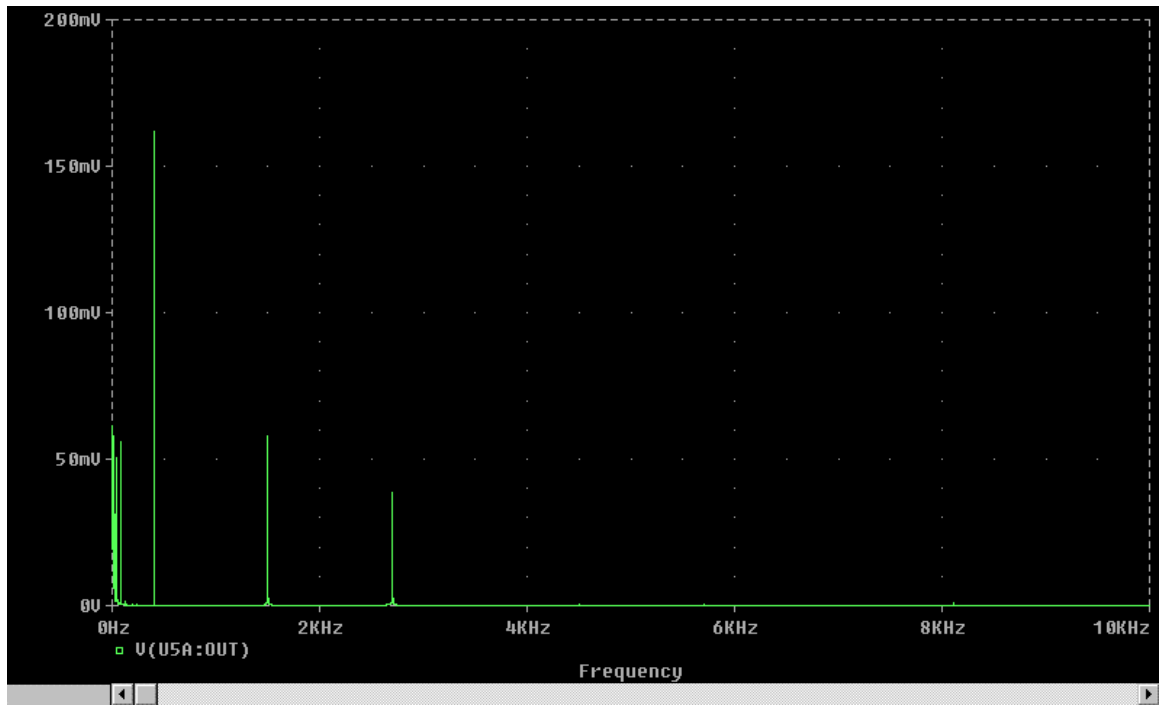


FIG 7. Spectral plot of composite modulation.

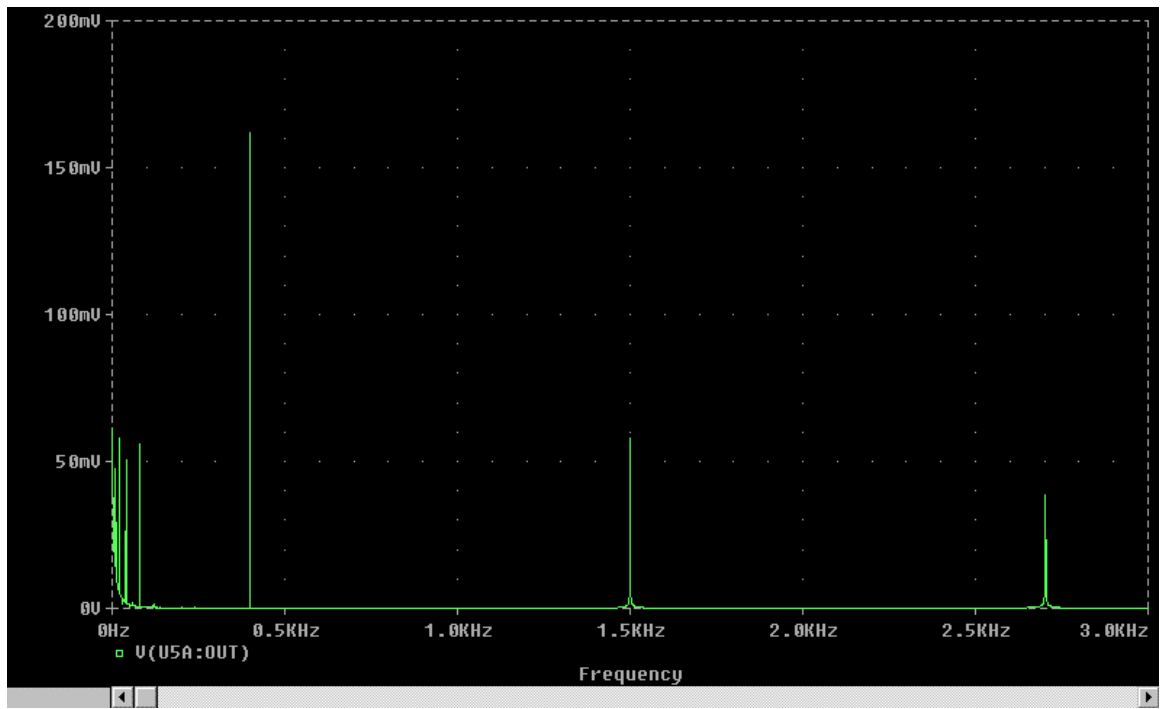


FIG 8. Spectral plot, expanded view.

