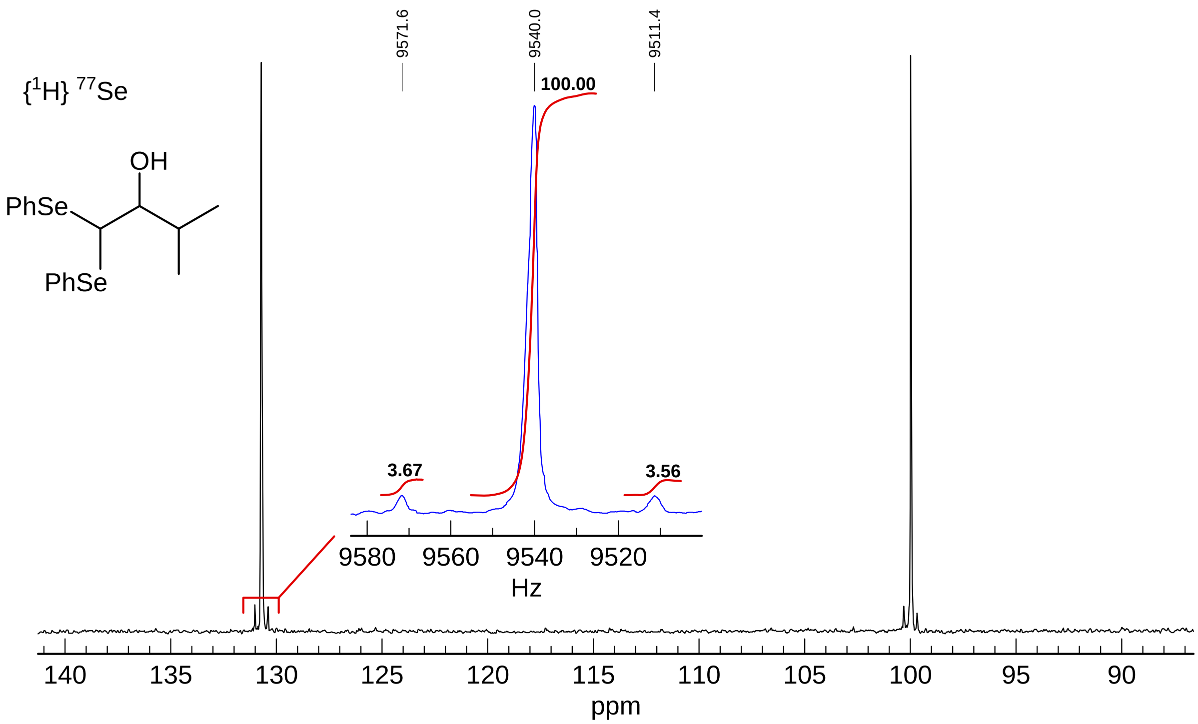
Problem R-05P ($C_{17}H_{20}OSe_2$). Reproduced below is the 95.4 MHz proton decoupled ^{77}Se NMR spectrum of 1,1-bisphenylseleno-3-methyl-2-butanol (the chemical shifts are arbitrarily referenced).

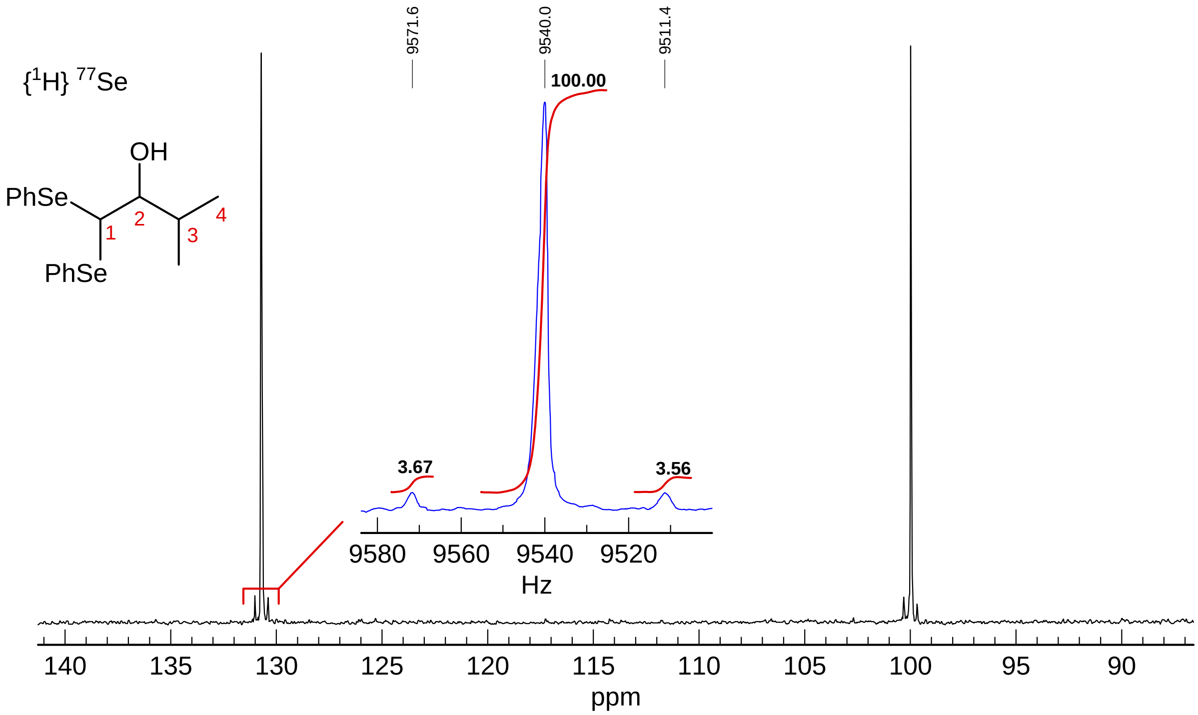


(a) What is the ^1H frequency of the spectrometer?

(b) Explain why there are two signals.

(c) Analyze one of the signals (an expansion of the downfield peak is shown).

Problem R-05P ($C_{17}H_{20}OSe_2$). Reproduced below is the 95.4 MHz proton decoupled ^{77}Se NMR spectrum of 1,1-bisphenylseleno-3-methyl-2-butanol (the chemical shifts are arbitrarily referenced).



(a) What is the ^{1}H frequency of the spectrometer?

^{77}Se I = ½, 7.5% abundant, 19.07 MHz (^{1}H = 100)

^{1}H Frequency: $\frac{\gamma_H}{\gamma_{Se}} \times 95.4 = \frac{100}{19.07} \times 95.4 = 500.26$ MHz

(b) Explain why there are two signals.

The asymmetric center at C^2 makes the two PhSe groups diastereotopic ($\Delta\delta_{Se\text{-}Se}$ = 31 ppm).

(c) Analyze one of the signals (an expansion of the downfield peak is shown).

The central peak at 9540 Hz is from the fraction of molecules having ^{77}Se in the selenium at 131 ppm, and all the isotopes of the slenium at 100 ppm other than ^{77}Se. The satellites on the 131 ppm peak are from those molecules having ^{77}Se at both seleniums (they add up to 7.23% of the central peak). The two seleniums are coupled to each other:

$^2J_{Se\text{-}Se}$ = 60.2 Hz