5.9 Exercises

E 5–1
You have been offered a superconducting magnet which claims to have a homogeneity of "1 part in 10^8". Your intention is to use it to record phosphorus-31 spectra at Larmor frequency of 180 MHz, and you know that your typical linewidths are likely to be of the order of 25 Hz. Is the magnet sufficiently homogeneous to be of use?

E 5–2
A careful pulse calibration experiment determines that the 180° pulse is 24.8 μs. How much attenuation, in dB, would have to be introduced into the transmitter in order to give a field strength, $(\omega_1/2\pi)$, of 2 kHz?

E 5–3
A spectrometer is equipped with a transmitter capable of generating a maximum of 100 W of RF power at the frequency of carbon-13. Using this transmitter at full power the 90° pulse width is found to be 20μs. What power would be needed to reduce the 90° pulse width to 7.5 μs? Would you have any reservations about using this amount of power?

E 5–4
Explain what is meant by "a two bit ADC" and draw a diagram to illustrate the outcome of such a ADC being used to digitize a sine wave.

Why is it generally desirable to improve the number of bits that the ADC uses?

E 5–5
A spectrometer operates at 800 MHz for proton and it is desired to cover a shift range of 15 ppm. Assuming that the receiver frequency is placed in the middle of this range, what spectral width would be needed and what would the sampling interval (dwell time) have to be?

If we recorded a FID for 2 s with the spectral width set as you have determined, how many data points will have been collected?

E 5–6
Suppose that the spectral width is set to 100 Hz, but that a peak is present whose offset from the receiver is +60 Hz. Where will the peak appear in the spectrum? Can you explain why?