Example 7.8, Zero IF, Expanded

and Fig. 7.21 corrected

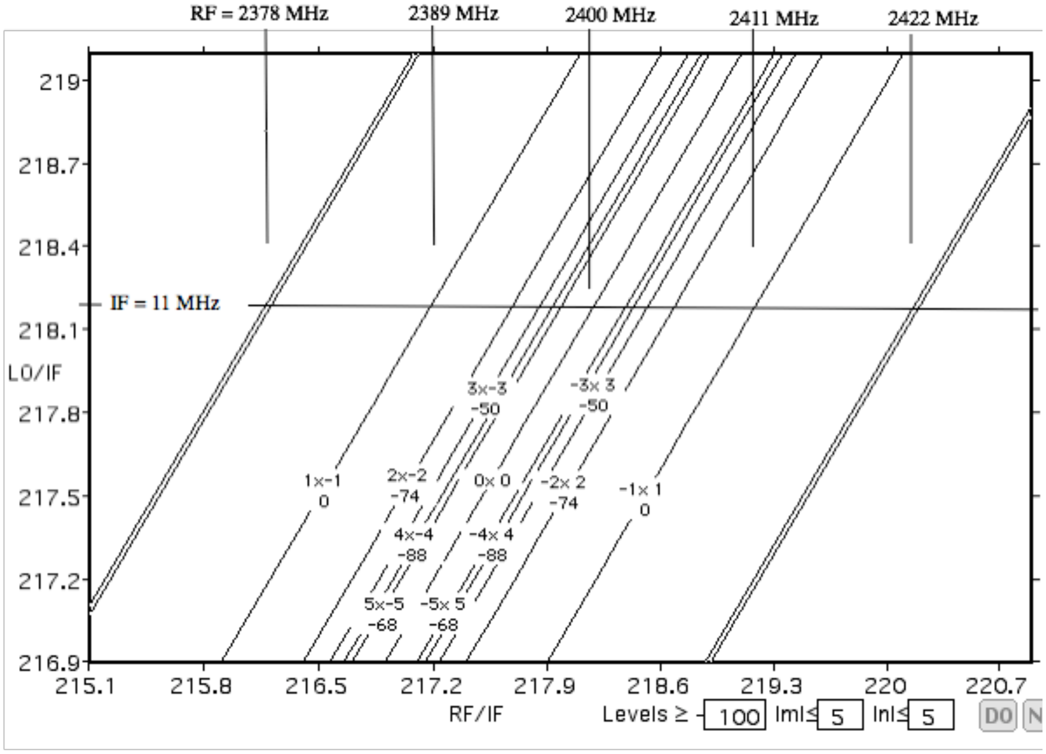
Figure 7.21 in the text shows the spurs (and signals) at the maximum IF, 22 MHz, but the rectangle outlining the passband is drawn incorrectly. It should appear to lie on the -1×1 and 1×-1 response curves (rather than veering to the right of them as it rises). In fact, these response curves move toward each other and away from the passband edges as the IF decreases (as the curves rise in the figure), but the separation is too small to see in Fig.7.21.

Figure 7.21*b*, below, shows the region around the highest IF frequency (22 MHz) correctly. Above it is Fig. 7.21*a*, which shows the response curves in the region of mid IF, 11 MHz, so that the separation of the responses from the passband edges is apparent. As the IF decreases, the frequency separation between responses decreases. For example, the separation between the -1×1 and 1×-1 curves at any IF must equal twice the IF, so the curves must be half as far apart at 11 MHz as they are at 22 MHz. At 22 MHz IF, both the response separation and the passband width are 44 MHz but, at 11 MHz IF, the response separation is reduced to 22 MHz, whereas the passband is still 44 MHz wide. (Since ΔRF/IF = 22 MHz/11MHz = 44 MHz/22 MHz, they appear to have the same separation in the normalized plot.)

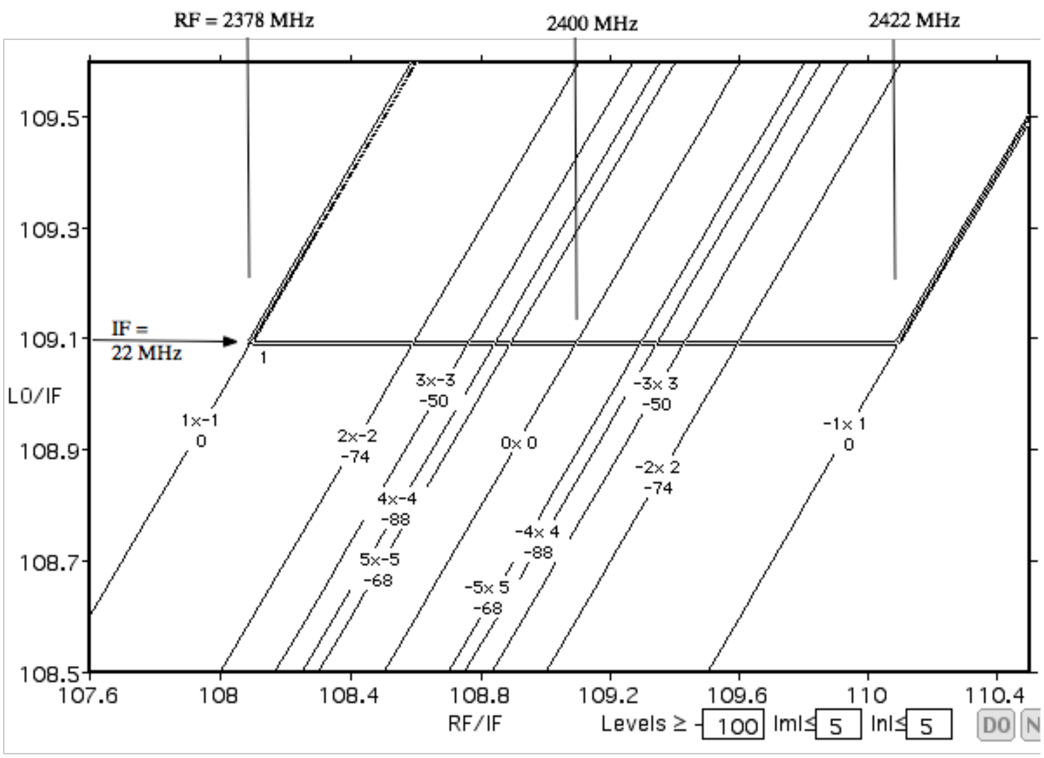
Figure 7.21*c* gives a different view of the same information. It is a plot (un-normalized) of IF versus RF with the LO fixed at 2400 MHz. The x axis shows the RF band covering 2400±22 MHz and the y axis shows the IF band from 0 to 22 MHz. If a signal is received at 2405 MHz, for example, a signal will be produced in the IF at 5 MHz and spurs will occur at 10, 15 and 20 MHz. As indicated, the 15 MHz 3×3 spur will be the largest at -50 dBc.

A spur is often of concern because it permits interference by an undesired signal. While the spur may be weak compared to the undesired signal that produces it, that signal may be much larger than the desired signal, permitting the spur still to produce significant interference. In the zero IF case, assuming that only the desired signal is in the RF band, these *n*×*n* spurs are the *n*th harmonics of the desired (1×1) signal. In common usage, wherein the signal carries digital information in the form of a constellation[2] of points representing discrete combinations of amplitude and phase (Fig. 9.1), these harmonics can move those points from their defined locations, thus increasing the probability of error in the presence of noise (Section 9.2.1). However, their given level is relative to the desired signal, rather than to something that may be much larger.

[2] Note that the constellation is a modulation-domain view of the amplitudes and phases that ignores the transitions between them. However, the required bandwidth depends on the speed of those transitions and the spur plot is a frequency-domain view of the frequencies contained in the spectrum that is generated by the transitions.



(a)



(b)

Figs. 7.22*a* and 7.22*b* LO = 2480 MHz. Passband outlined with double lines.

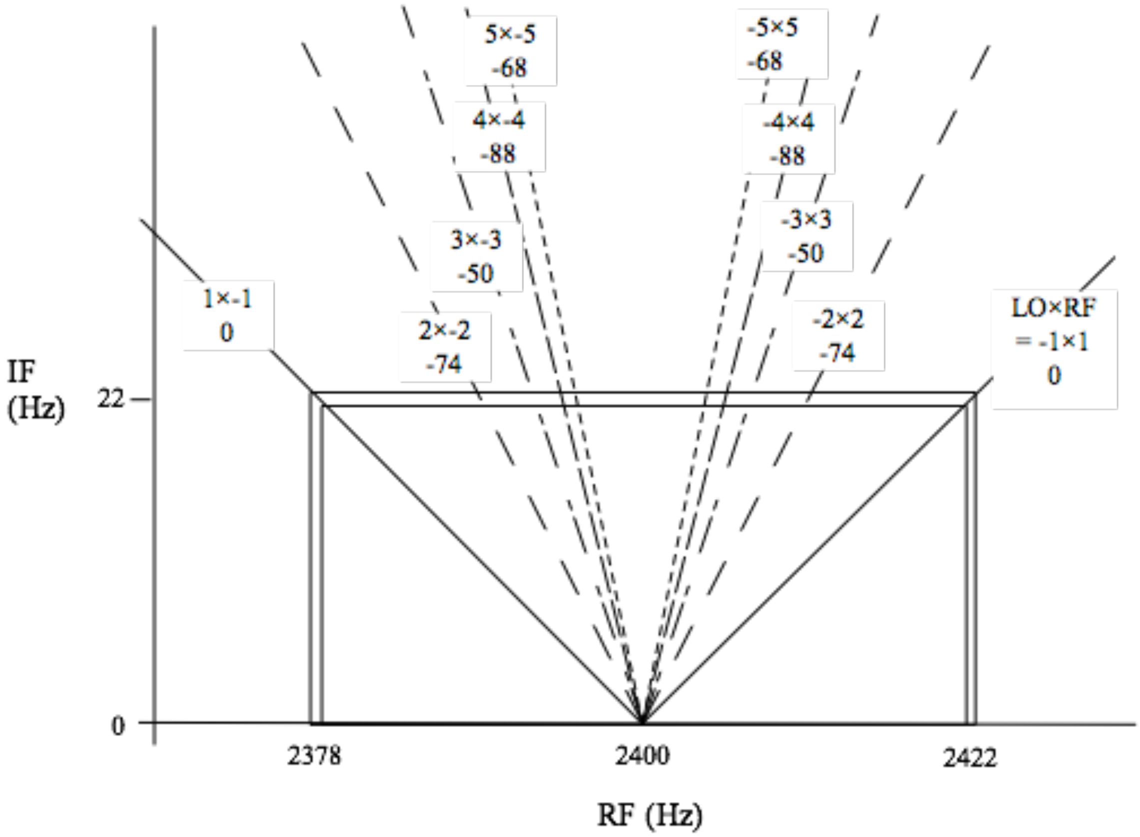


Fig. 7.22*c* LO = 2480 MHz. IF versus RF.

