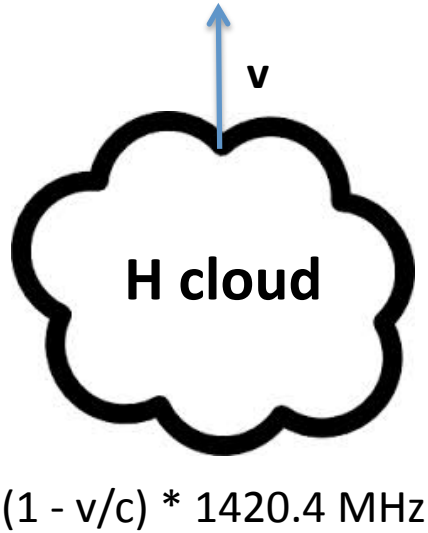
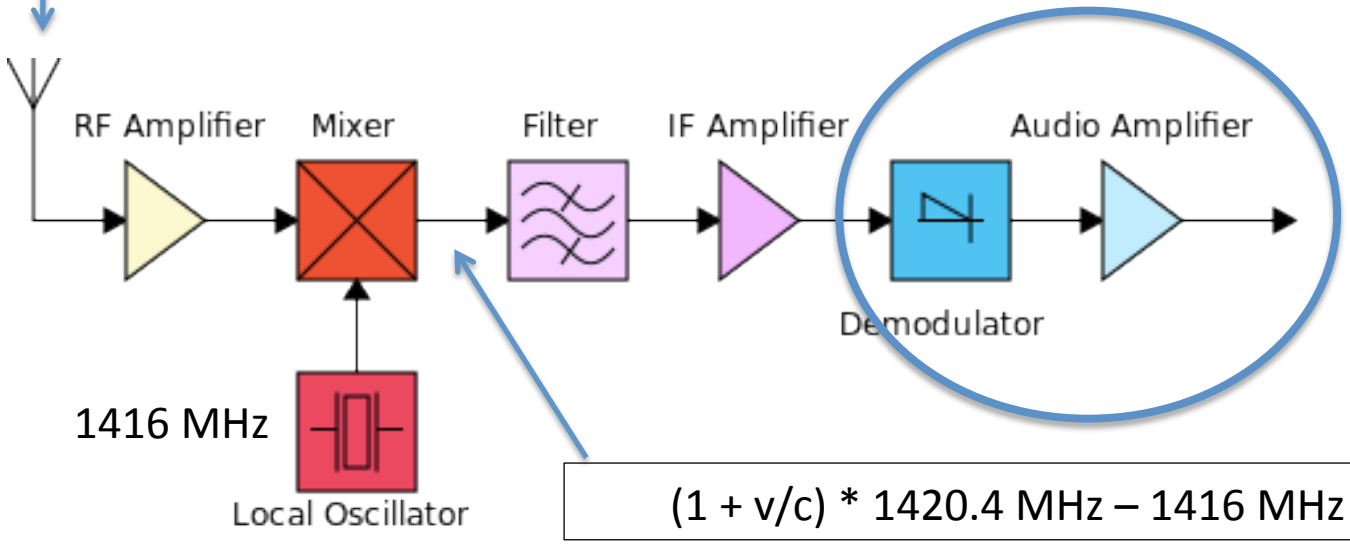
Superheterodyne Receiver

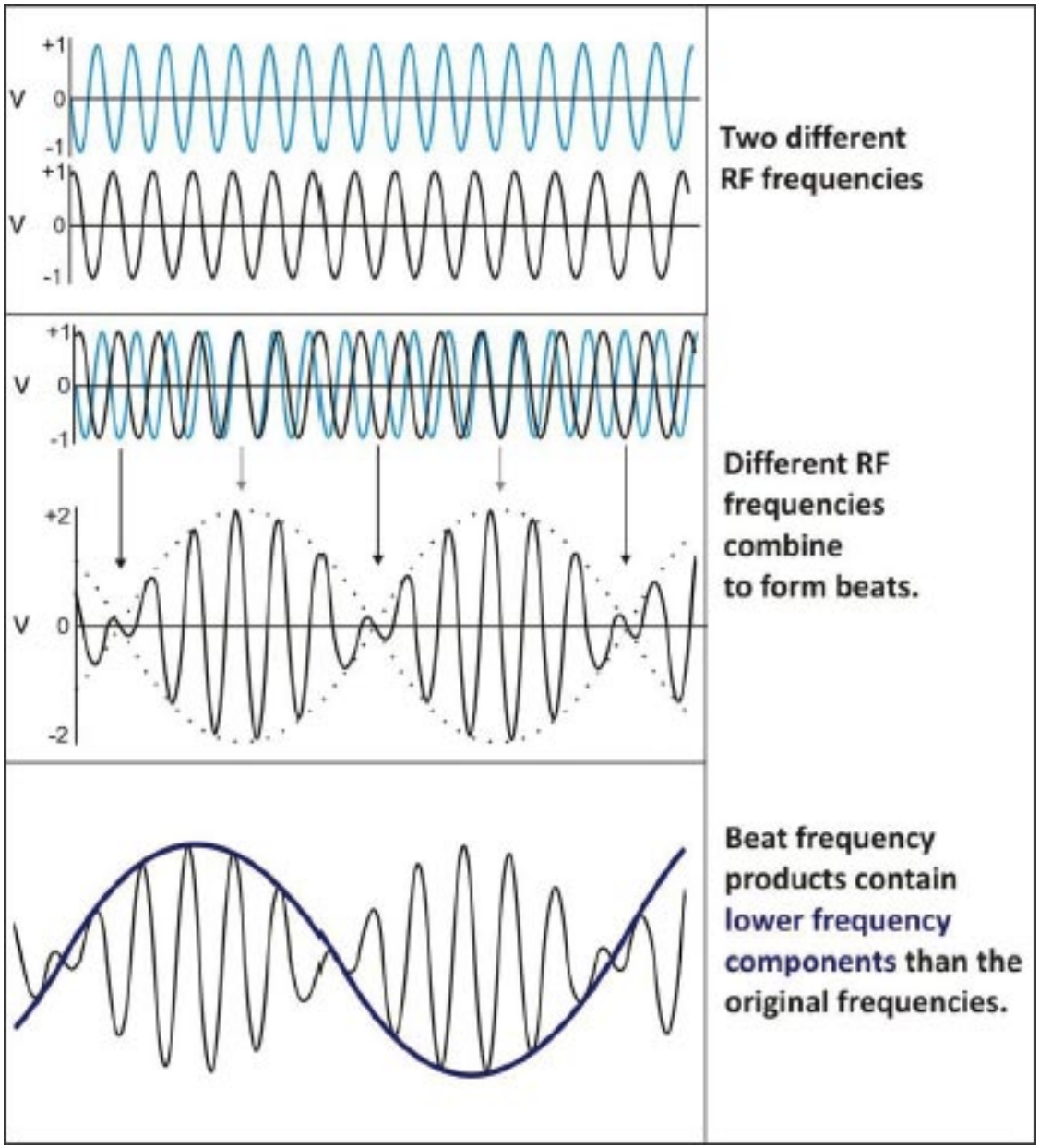
Demodulation can now happen at 10 MHz in computer (with FFT)



(1 - v/c) * 1420.4 MHz



(1 + v/c) * 1420.4 MHz – 1416 MHz


+1
V
0
-1
+1
V
0
-1
Two different
RF frequencies
+1
V
0
-1
+2
V
0
-2
Different RF
frequencies
combine
to form beats.
Beat frequency
products contain
lower frequency
components than the
original frequencies.

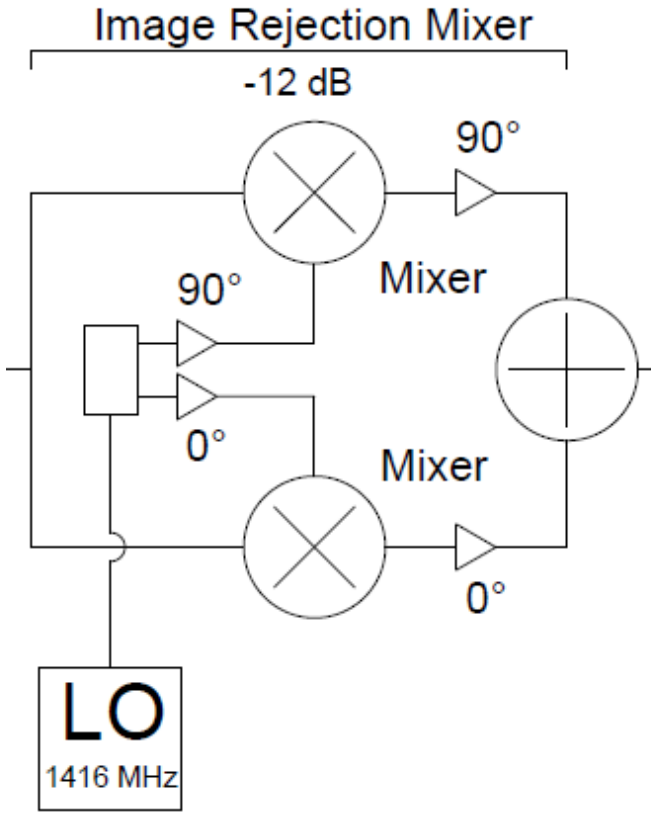


Image Rejection

Two frequencies mix with the local oscillator to produce same output from mixer:

For example, both 1420 MHz and 1412 MHz produce 4 MHz IF when mixed with 1416 MHz LO.

The SRT receiver mixes incoming signal with sine and cosine of LO, and recombines with phase shift to reject image frequencies below 1416 MHz.

$$\sin(2\pi f_1 t)\sin(2\pi f_2 t) = \frac{1}{2}\cos 2\pi(f_1 - f_2)t - \frac{1}{2}\cos 2\pi(f_1 + f_2)t$$

$$\sin(2\pi f_1 t)\cos(2\pi f_2 t) = \frac{1}{2}\sin 2\pi(f_1 - f_2)t + \frac{1}{2}\sin 2\pi(f_1 + f_2)t$$