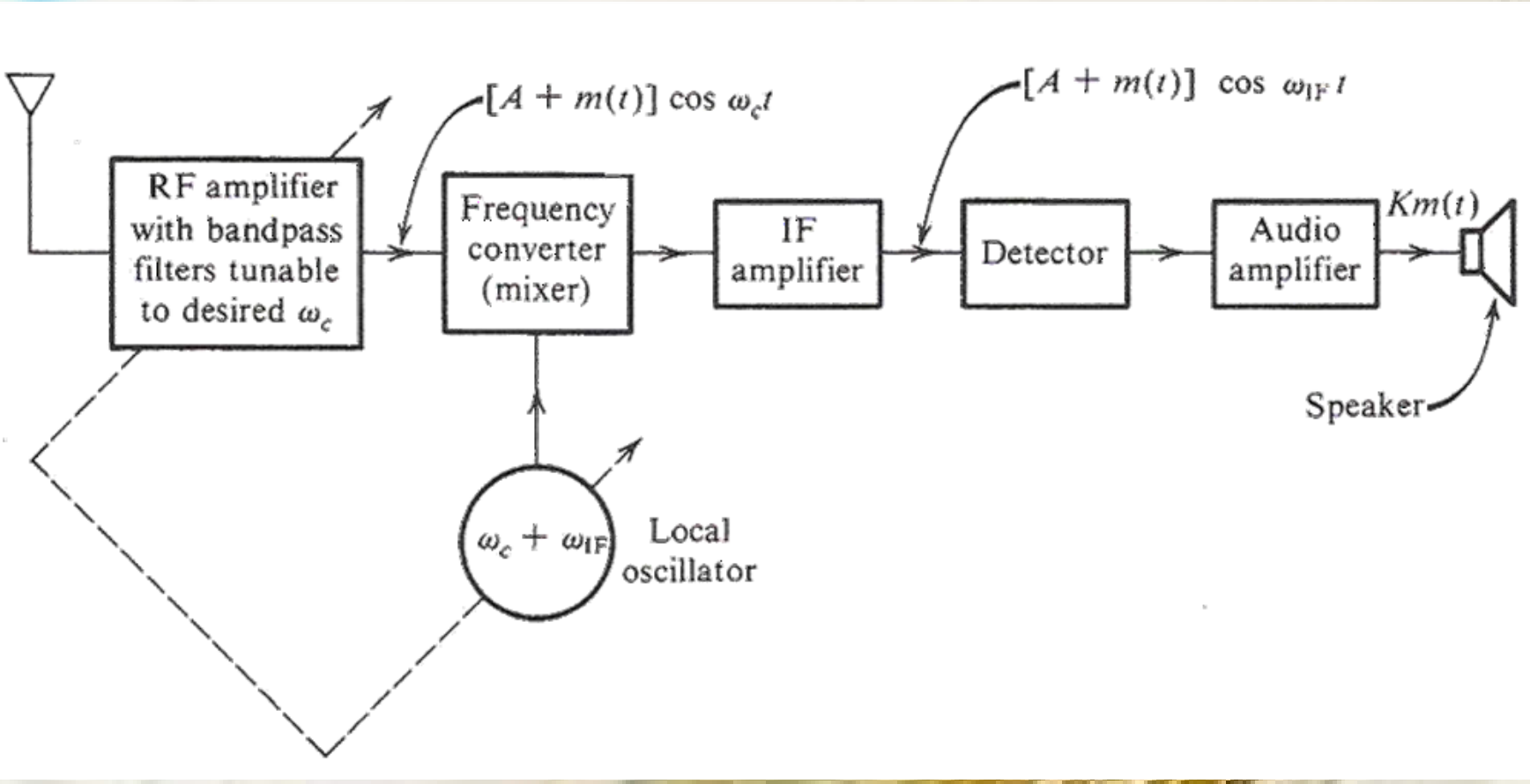
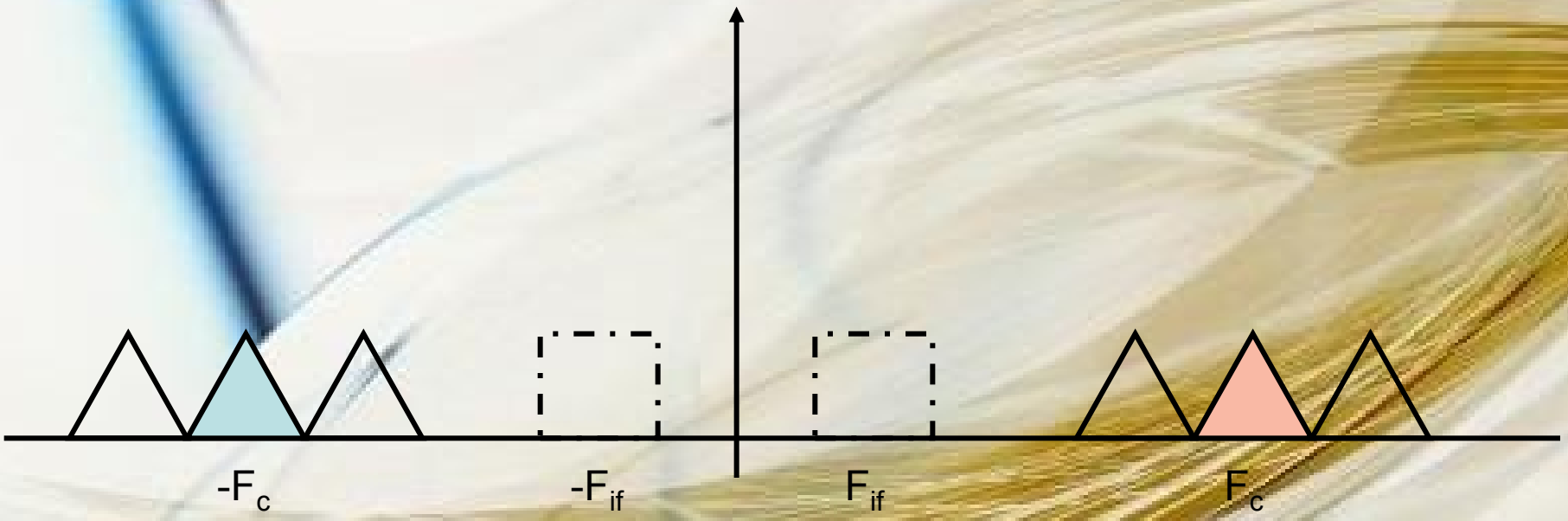
Super heterodyne receiver



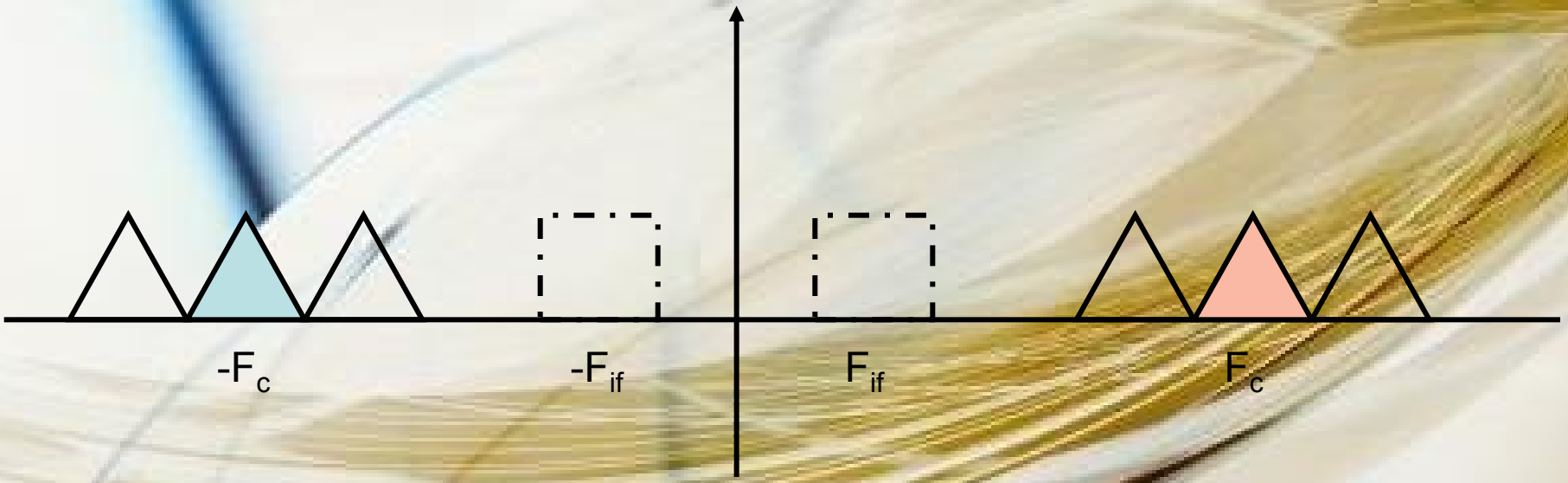
What is the intermediate frequency f_{if}?

- It is fixed frequency located at 455 kHz
- The IF filter is band-pass with center frequency of 455 kHz and bandwidth equal to the bandwidth of one AM channel approximately =10 kHz.

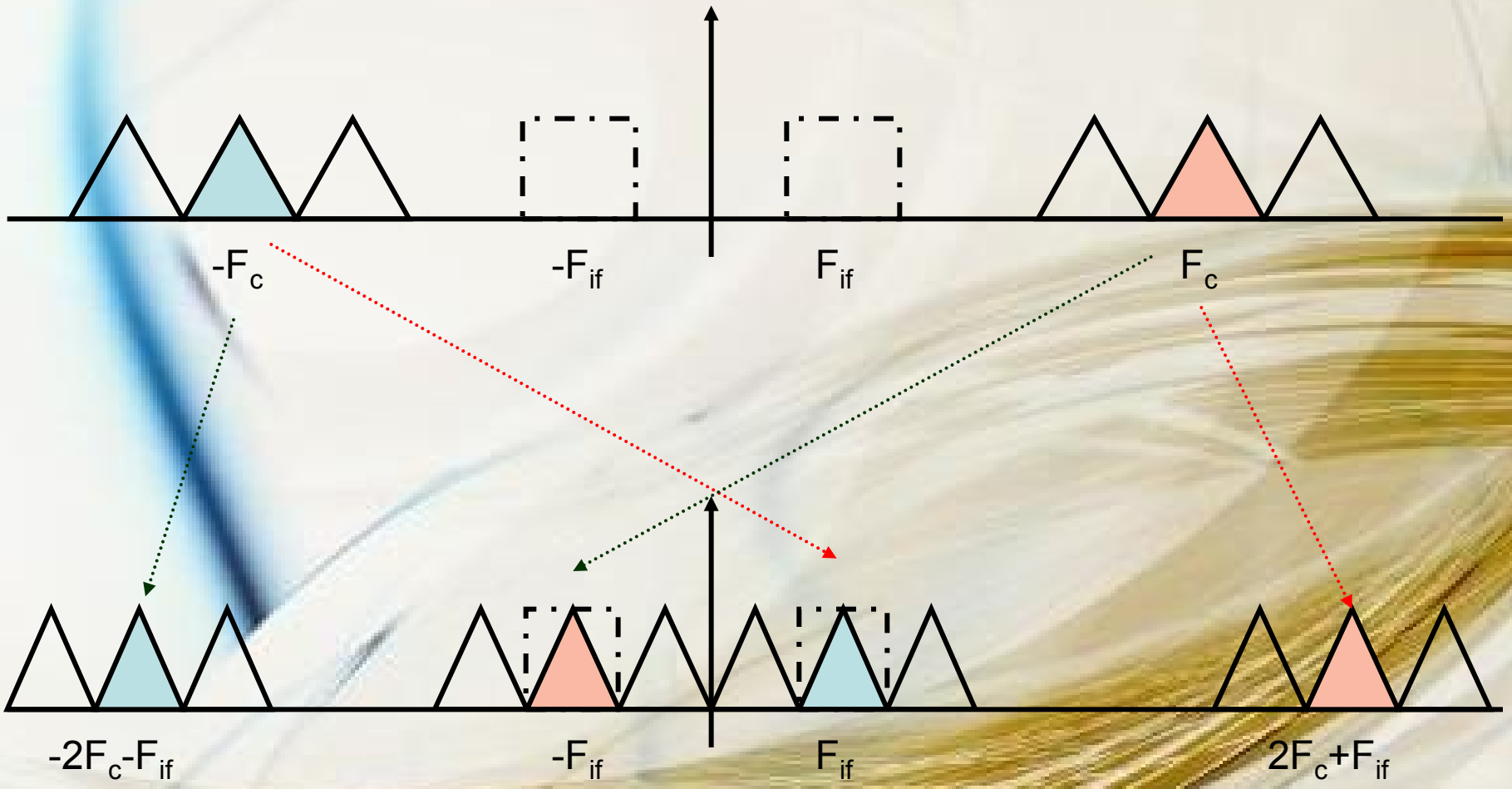


Why do we need the IF Stage?

- It is too difficult to design a tunable and sharp filter. So we design sharp & fixed filter.
- The channel to be filtered out should first be frequency shifted to the IF frequency by a frequency converter as shown in the super heterodyne Figure



Up conversion Fc+Fif



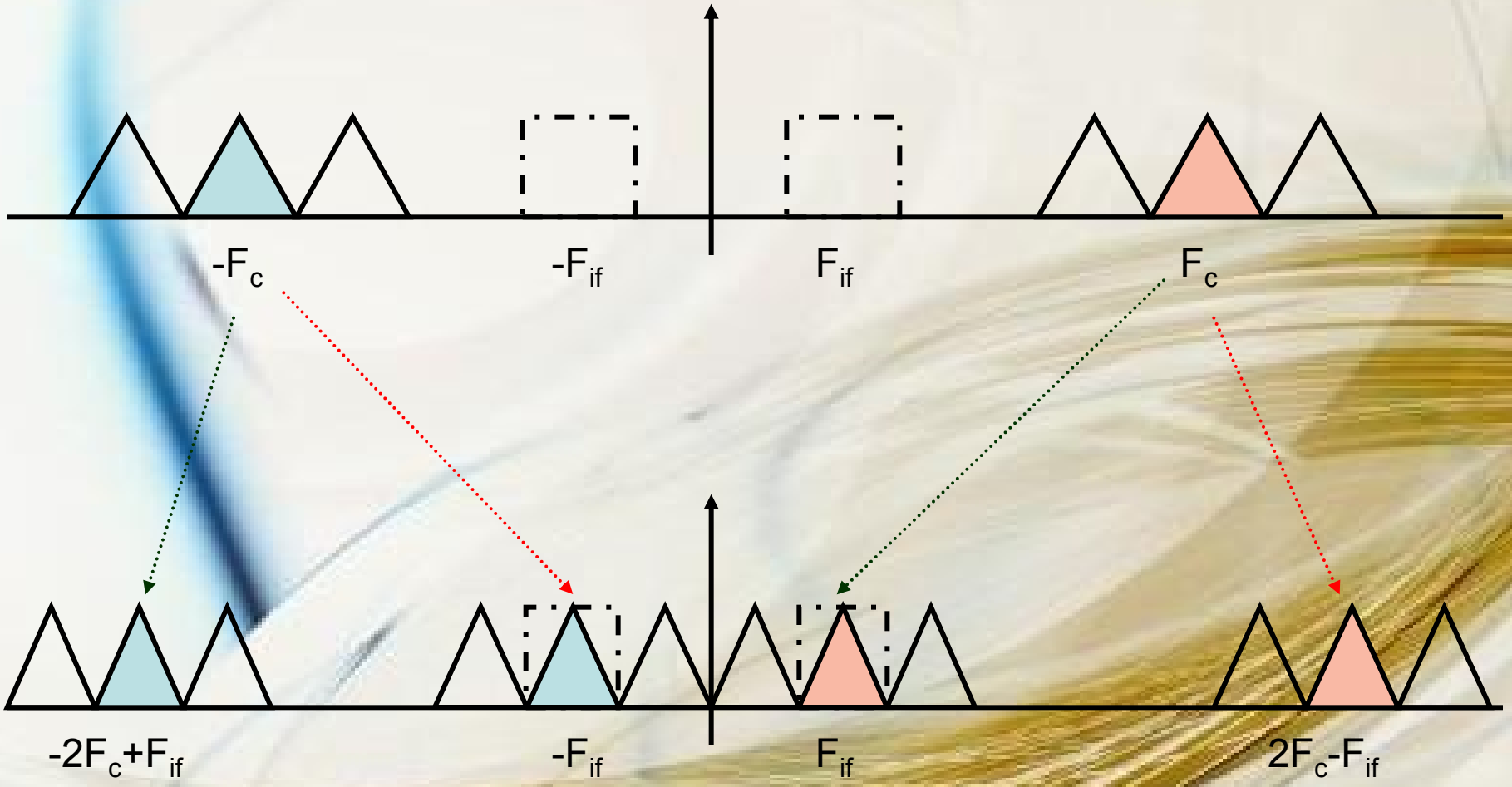
Second Image

Subtract Fc+Fif

First Image

Add Fc+Fif

Down conversion Fc-Fif



Second Image

Subtract Fc-Fif

First Image

Add Fc-Fif

Why up conversion is better than down conversion?

The range of radio station on AM is: 550kHz→1600kHz

Up (Fc+Fif): 1005kHz→2055kHz

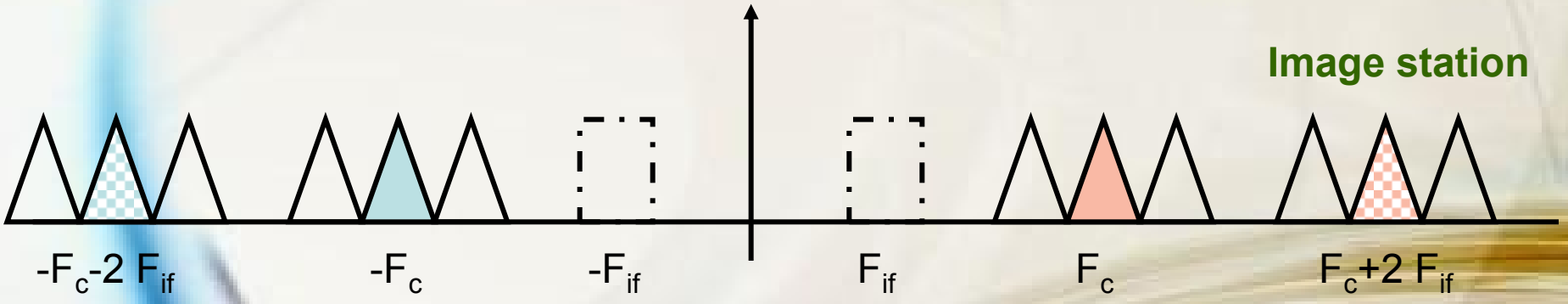
ratio frequency is 1:2

down (Fc-Fif): 95kHz→1155kHz

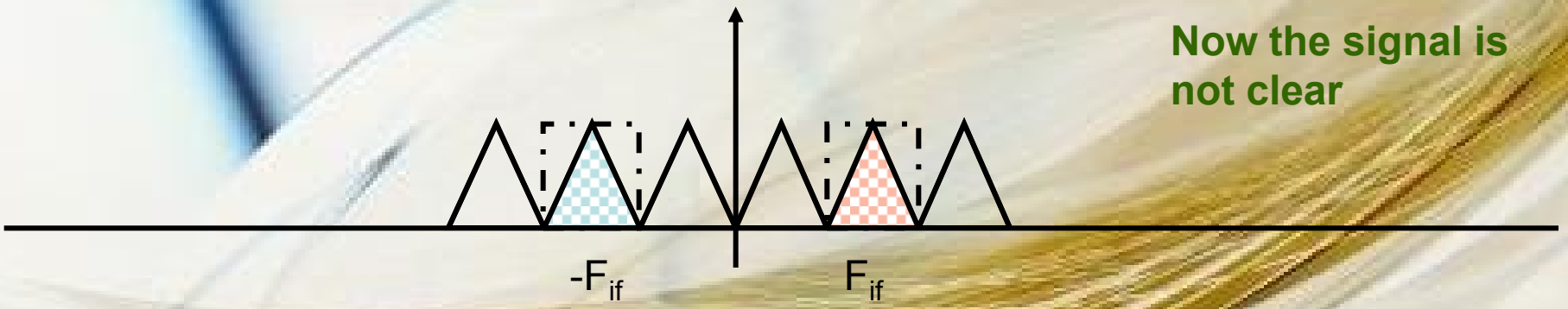
ratio frequency is 1:12

We see the ratio frequency in up conversion is smaller than in down conversion which means it is easier to design.

Why we filter at RF stage?



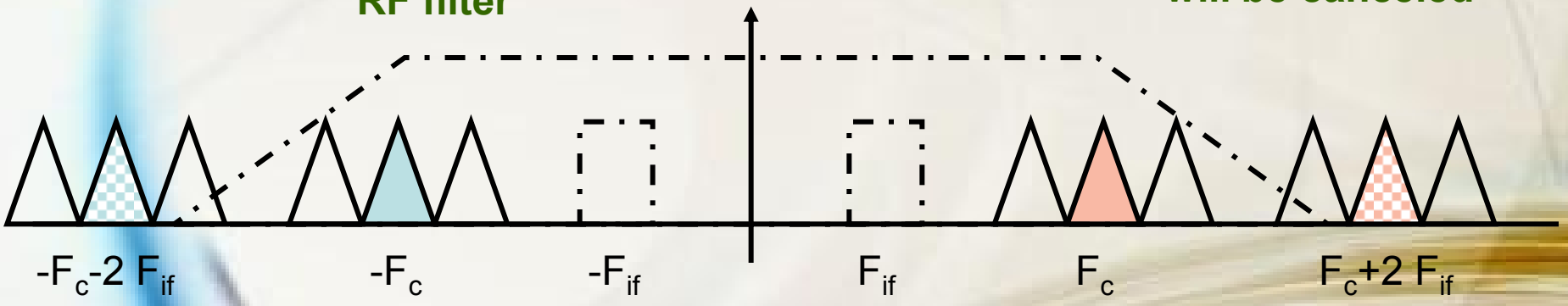
After up conversion



The image station is a station that is spaced by 2*Fif from the desired station as shown in the figure

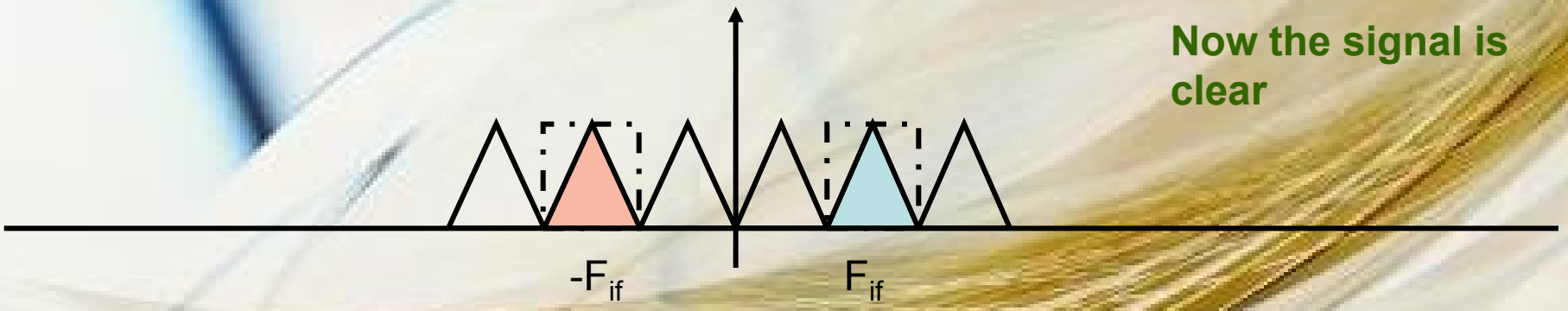
The image station will be canceled

RF filter

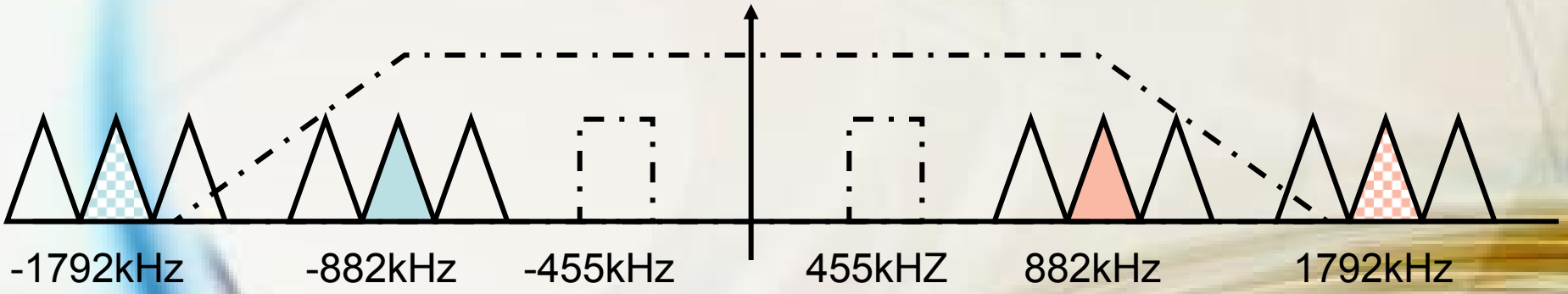


After up conversion

Now the signal is clear



For example: we take Fc=882kHz (the Holy Quran station)



After up conversion

Now the signal is clear