# Superheterodyne Radios

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Concept

- Concept is to convert the received signals to a constant frequency that can be processed easily, as the circuits used for processing can be optimized for one frequency called the Intermediate Frequency, or IF

- This can be done by "mixing" the desired signal with a locally generated signal from a "Local Oscillator"

- By mixing a varying input signal to the local oscillator signal, we obtain the sum and difference of both the frequencies; the IF is optimized for one of these frequencies

- IF filter allows the signal at its resonant frequency to flow through it and rejects the rest; the signal is then demodulated, where the audio is recovered and amplified
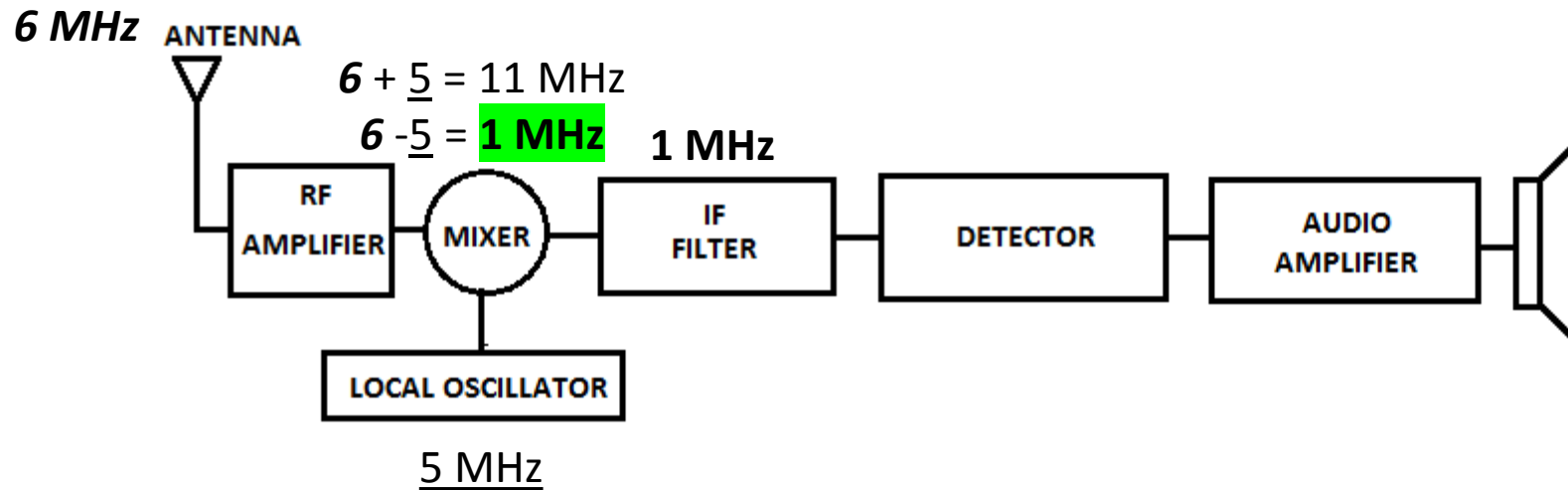
Example

- Let us assume that we have built a radio with an IF of 1 MHz and we would like to listen to a radio transmission (f_1) on 6 MHz
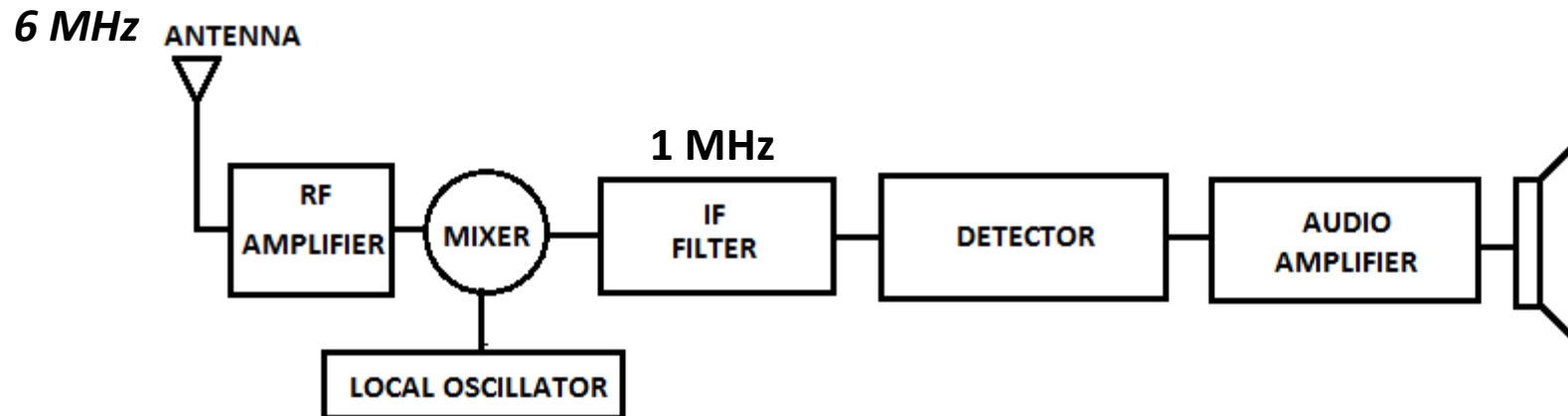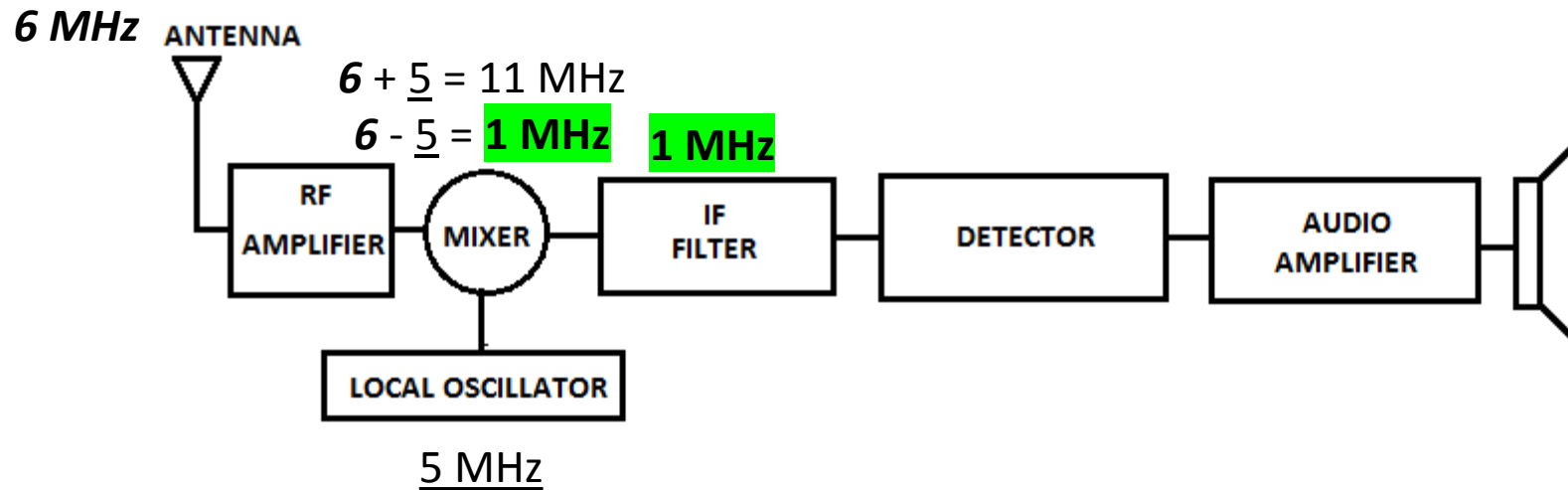
Example

- A locally generated signal (f_2) of 5 MHz is fed into a mixer that outputs a sum and difference of both frequencies

6 MHz ANTENNA

6 + <u>5</u> = 11 MHz

6 -<u>5</u> = **1 MHz**   **1 MHz**

RF AMPLIFIER — MIXER — IF FILTER — DETECTOR — AUDIO AMPLIFIER

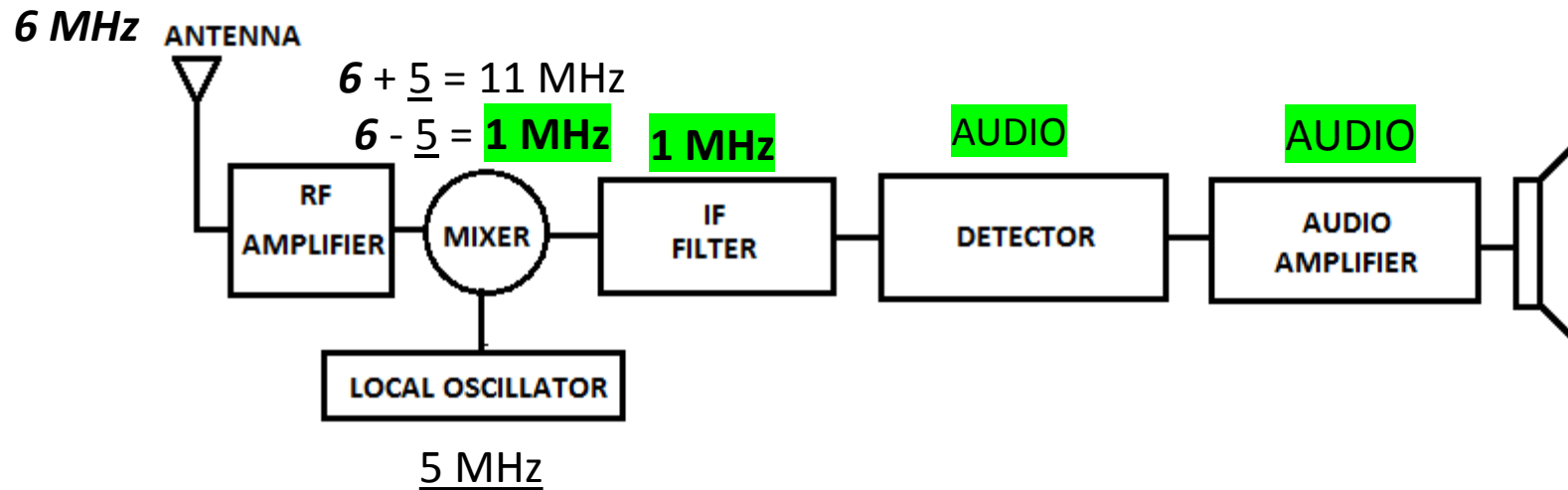LOCAL OSCILLATOR

<u>5 MHz</u>

SIARS

Example

- The IF filter is designed to let only frequencies at which it is resonant to pass through, in this case 1 MHz

Example

- The detector picks out the audio component in the IF signal and passes it on to the audio amplifier which boosts the weak audio signal into something audible

6 MHz ANTENNA

6 + 5 = 11 MHz

6 - 5 = **1 MHz**   **1 MHz**   AUDIO   AUDIO

RF AMPLIFIER — MIXER — IF FILTER — DETECTOR — AUDIO AMPLIFIER

LOCAL OSCILLATOR

5 MHz

The Problem! : Image Frequency

- Let us assume that there is another unwanted transmission on 4 MHz; with the Local Oscillator running at 5 MHz, the mixer will output 1 MHz, which can very well get filtered by the IF and demodulated into audio!
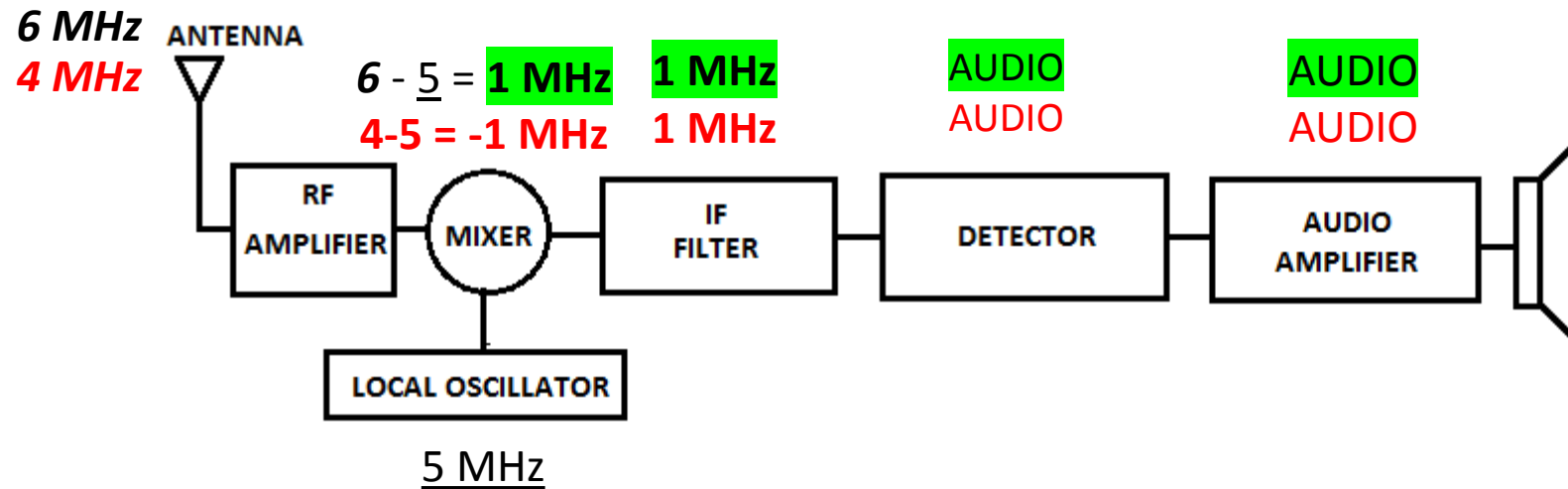
The Solution

- The solution to the image problem is very simple! ; By adding a filter which rejects unwanted frequencies, before the mixer circuit