Microwaves
German University in Cairo
Dozent: Gerald Oberschmidt

1 Mixing Frequencies

The input signal to a mixer is at 0.1 GHz, the LO is at 1 GHz. Calculate all positive and real frequencies of order 3 for LO and order 2 for RF! And identify the technical importance of selected frequencies!

2 Intercept-Mixer

The input signal to a mixer is at 1.1 GHz and at 1.15 GHz, the LO is at 1 GHz. Calculate all positive and real frequencies of order -1 (downconversion) for LO and maximum combined order 3 for RF! And identify the most disturbing and wanted signals frequencies!

3 Mixer Conversion

The input signal to a mixer is of RF-power -20 dBm, at 12 GHz, and -40 dBm, at the image frequency.
The LO-power is of 17 dBm, 10 GHz. The mixer is straight downconversion. At output we find measure

Frequency/GHz	Power/dBm	Comment
2	-27	
2	-60	RF off
10	-13	
12	-50	

Caluclate the relevant performance measures of the mixer! and comment on what to so in order to improve certain parameters!

4 Mixer Noise

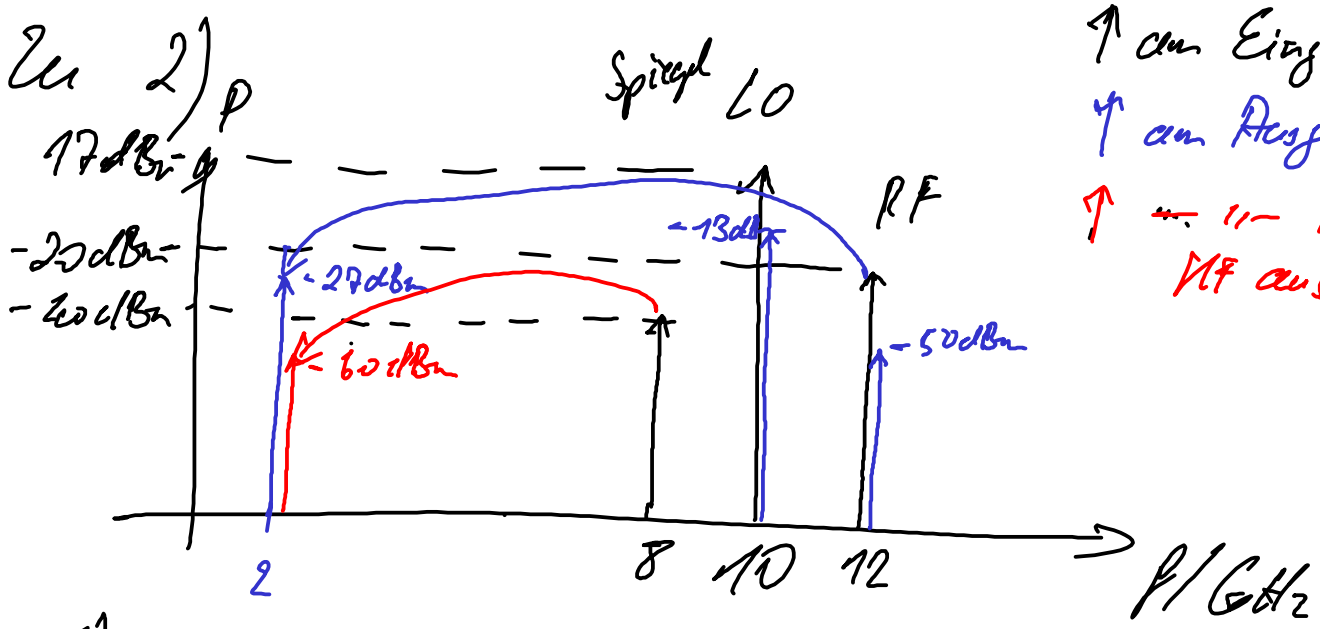
A mixer has the following measured parameters Conversion $c = -7\,\text{dB}$, input noise 2.00 dB above thermal noise at 290 K with bandwidth of 1 MHz. Output noise in double sideband configuration is $N_{out,DSB} = -112.01\,\text{dBm}$. Converion for LSB and USB are the same, noise performance as well.
Calculate the DSB-Noisefigure, SSB-noise-figure and the filtered DSB-noise figure!

$c = 0{,}2$ $N_{in} = k \cdot T \cdot B \cdot \underbrace{10^{9^2}}_{2\,\text{dB}} = 6{,}31 \cdot 10^{-12}\,\text{mW}$

Ausgangsrauschen projeziert an den Eingang $N_{out \to in} = \underbrace{10^{-11^2}}_{-112\,\text{dB}} / c = 3{,}15 \cdot 10^{-11}\,\text{mW} = N_{out}$

↑ Projektion am Eingang

zu 2)



↑ am Eingang
↑ am Ausgang
↑ ... ist HF aus.

zu 4)

$$F_{DSB} = 1 + \frac{N_{max}}{N_{in}} = 6 = 7{,}78\,dB$$

Formel aus Skript

$$F_{SSB} = 2 \cdot F_{DSB} = 12 = 10{,}79\,dB$$

$$F_{SSB,Filter} = 1 + 2 \cdot \frac{N_{max}}{N_{in}} = 11 = 10{,}41\,dB$$