

## Designing Oscillators with low 1/f-noise

One key parameter of oscillators is the purity of the oscillator signal. While harmonics can be filtered out by a simple lowpass-filter, the spurious around the signal have to be minimized by construction of the oscillator.

For low 1/f noise, the following items have to be taken into account:

- High Q-factor of the resonator
- Low 1/f-noise of the used active components

High Q-factor is equivalent to low losses in all parts. The following details should be checked:

- Q of resonator device
- series resistance of capacitors
- series resistance of tuning diode
- loss of printed circuit board

Low 1/f noise of the transistor in the oscillator is very important, because the 1/f noise appears assideband noise around the carrier frequency of the oscillator output signal.

There are some basic rules to select the right transistor for an optimized design:

- The best oscillator transistor is a device with the lowest possible  $f_T$ .  
A good rule of thumb is:  $f_T \leq 2 \times f_{osz}$  .
- The 1/f noise is directly related to the current density in the transistor. Large transistors with high  $I_{c,max}$  used at low currents have best 1/f performance. Please take into account, that the  $f_T$  drops down at low currents and the capacitances of a large transistor are higher.

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