

Harmonics, Spurs, and dBc

In addition to the carrier signal at frequency ω_0 , an oscillator will output many other signals!

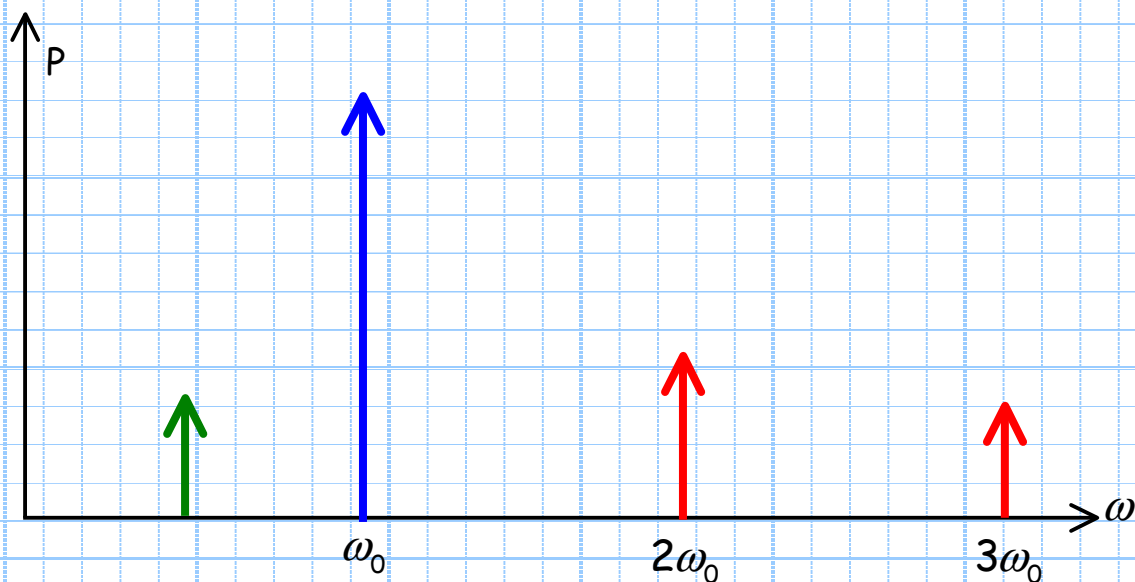
For example, an oscillator generally creates **harmonics**.

I.E., signals at $2\omega_0$, $3\omega_0$, etc.

Additionally, an oscillator may output signals at other **arbitrary** frequencies. We call these spurious signals, or "**spurs**".

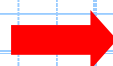
The carrier signal has, of course, some **power** we denote as P_C .

Generally speaking, the power of the **harmonics** and **spurs** will be significantly **less** than the **carrier** power P_C .



We can of course represent the power of the harmonics and spurs in **dBm** or **dBW**.

However, often what we are interested in is not what that power of the harmonics and spurs are **specifically**, but instead what the power of the harmonics and spurs are in **relation** to the carrier power P_c .

 We want spurs and harmonics to be small **in comparison** to P_c !

Therefore, we define a new **decibel** relationship:

$$\begin{aligned}\text{Power } P \text{ in dBc} &\doteq 10 \log_{10} \left(\frac{P}{P_c} \right) \\ &= P(\text{dBm}) - P_c(\text{dBm}) \\ &= P(\text{dBw}) - P_c(\text{dBw})\end{aligned}$$

For example, if $P_c = 10$ dBm and the power of the first harmonic is -40 dBm, then the power of the first harmonic can be expressed as -50 dBc.

In other words, the first harmonic is **50 dB smaller** than the carrier.