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:

$$\text{Power P in } \mathbf{dBc} \doteq 10 \log_{10}\left(\frac{P}{P_C}\right)$$
$$= P(\text{dBm}) - P_C(\text{dBm})$$
$$= P(\text{dBw}) - P_C(\text{dBw})$$

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.