

B. Amplifiers

We will find that the signal power collected by a receiver antenna is often **ridiculously small** (e.g., less than one **trillionth** of a Watt!)

To accurately recover the information impressed on this signal, we must **increase** the signal power a whole bunch—**without** modifying or distorting the signal in any way.

We accomplish this with a RF/microwave amplifier—one of the few **active** components we will study.

But first, a few comments about the **decibel!**

HO: dB, dBm, dBw

HO: Amplifiers

Q: *By how much will an amplifier increase signal power?*

A: HO: Amplifier Gain

Q: *Can we increase this signal power an unlimited amount?*

A: NO! At some point we are limited by conservation of energy!

HO: Amplifier Output Power

Q: *So, just how precisely does an amplifier reproduce a signal at its output?*

A: HO: Intermodulation Distortion

Q: *Is intermodulation distortion really that big of a problem?*

A: It can be if there are **multiple** signals at the amplifier input!

HO: Two-Tone Intermodulation Distortion

Every good radio engineer knows and understands that parameters of the amplifier **spec sheet!**

HO: The Amplifier Spec Sheet

dB, dBm, dBw

Decibel (dB), is a specific function that operates on a **unitless** parameter:

$$dB \doteq 10 \log_{10}(x)$$

where x is unitless!

Q: A unitless parameter! What good is that ! ?

A: Many values are unitless, such as **ratios** and **coefficients**.

For example, amplifier **gain** is a unitless value!

E.G., amplifier gain is the ratio of the output power to the input power:

$$\frac{P_{out}}{P_{in}} = G$$

$$\therefore \text{Gain in dB} = 10 \log_{10} G \doteq G (dB)$$