The Radio Transmitter

There are 5 main components of a transmitter:

1) The signal \( a(t) \)

2) The radio frequency (RF) source

3) The modulator

4) The amplifier

5) The antenna

\[ a(t) \rightarrow \text{modulator} \rightarrow \text{amplifier} \rightarrow \text{antenna} \]

The Radio Transmitter System
Let's examine each component:

1) **The signal** \( a(t) \) - This is the information we are trying to transmit. It may be in either **digital** or **analog** form. It also may have been encoded to remove redundancy, in a process known as **source coding**.

2) **RF source** - Generates **electromagnetic** energy at RF/microwave frequencies that are suitable for electromagnetic propagation (subject to FCC restrictions!).

3) **Modulator** - Places signal \( a(t) \) (i.e., the information) onto the RF signal, known as the carrier. Accomplished by modulating some parameter of the carrier signal - e.g., magnitude, phase, frequency, or some combination thereof. In general, this process is called **channel coding**. Its goal is to maximize the **rate** at which information is sent, while minimizing the effect of unknown **channel** parameters.

4) **Power Amplifier** - Increases the power (i.e., energy flow) of the modulated carrier signal, without (hopefully) distorting it.

5) **Antenna** - Acts as the **coupling** mechanism between the bounded e.m. wave of a transmission line and the unbounded propagating wave in space. Often, an antenna is required to launch the unbounded wave in a specific **direction**.