

# What are Radio Frequency bands and its uses?

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RF is the lowest portion of the electromagnetic spectrum, familiar as a medium of analog and modern digital wireless communication systems. It spreads in the range between 3 kHz and 300 GHz. All known transmission systems work in the RF spectrum range, including analog radio, aircraft navigation, marine radio, amateur radio, TV broadcasting, mobile networks, and satellite systems. Let's take a look at each of the Radio Frequency bands and their uses.

Extremely Low Frequency (ELF)

Frequency starting from 3Hz to 3 kHz is known as Extremely Low Frequency or ELF range in the electromagnetic spectrum. According to IEEE band designation, these ranges are divided into three sub-bands:

ELF – Extremely Low Frequency, ranging from 3Hz to 30Hz.

SLF– Super Low Frequency, ranges from 30 to 300Hz.

ULF – Ultra Low Frequency, ranging from 300 to 3000Hz (3 KHz).

This range is highly vulnerable to disturbance and easily distorted by atmospheric changes. Designing a system in this range is challenging because the larger wavelengths require long antennas, which are practically impossible to achieve.

Scientists use this frequency band in seismic studies to understand natural activities in the Earth's atmosphere and communication with submarines.

Very Low Frequency (VLF)

Very Low Frequency is the starting range of RF and practical radio transmission systems which span from 3 kHz to 30 kHz. However, the design and implementation of the antenna system are extremely complicated due to the wavelength.

It has been used in submarines and still using in time radio stations which synchronizes clock signals between two remote locations.

Low Frequency (LF)

Low frequency is in the range of 30 kHz to 300 kHz. One of the important

properties of LF signals is that they will get reflected by the earth's ionosphere and thus, it is suitable for long-distance communication. Since it's a long wavelength and less attenuation from big terrains like mountains, it is generally called a ground wave.

Amateur radio operators use low-frequency signals; it is one of the most important sources of information transfer when another kind of communication source fails during some situations like natural disasters. Other areas are military applications like submarines, RFID tags in near-field communication, and some low-frequency radio broadcasting.

### Medium Frequency (MF)

Medium frequency was one of the most popular frequency bands since the beginning of wireless radio transmission in the early nineteenth century. MF operates in the range of 300 kHz to 3 MHz. The transmitters, receivers, and antenna design is relatively less complex than other high-frequency transmission bands.

Medium Frequency has been widely used in AM radio transmission, navigation systems for ships and aircraft, emergency distress signals, coast guards, and other experimental applications.

### High Frequency (HF)

High-frequency signals range between 3 MHz and 30 MHz. This frequency band is also known as a short wave. It also gets reflected by the earth's ionosphere, and it is one of the suitable bands for long-distance communication.

### Conclusion

RF is a broad spectrum, and many of its characteristics have not been experimented with yet. It has a lot of possibilities in medical applications like MRI technology (even up to 12 Tesla for medical research), seismography, and oceanic studies. RF transceivers are significant components in interplanetary missions such as the Mars exploration. Our future digital communication systems may rely on high-frequency bands of the RF spectrum since they can support higher bandwidth

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