A harmonic is a signal or wave whose frequency is an integral (whole-number) multiple of the frequency of some reference signal or wave. The term can also refer to the ratio of the frequency of such a signal or wave to the frequency of the reference signal or wave. Let f represent the main, or fundamental, frequency of an alternating current (AC) signal, electromagnetic field, or sound wave. This frequency, usually expressed in hertz, is the frequency at which most of the energy is contained, or at which the signal is defined to occur. If the signal is displayed on an oscilloscope, the waveform will appear to repeat at a rate corresponding to f Hz. For a signal whose fundamental frequency is f, the second harmonic has a frequency 2f, the third harmonic has a frequency of 3f, and so on. Let w represent the wavelength of the signal or wave in a specified medium. The second harmonic has a wavelength of w/2, the third harmonic has a wavelength of w/3, and so on. Signals occurring at frequencies of 2f, 4f, 6f, etc. are called even harmonics; the signals at frequencies of 3f, 5f, 7f, etc. are called odd harmonics. A signal can, in theory, have infinitely many harmonics. Nearly all signals contain energy at harmonic frequencies, in addition to the energy at the fundamental frequency. If all the energy in a signal is contained at the fundamental frequency, then that signal is a perfect sine wave. If the signal is not a perfect sine wave, then some energy is contained in the harmonics. Some waveforms contain large amounts of energy at harmonic frequencies. Examples are square waves, sawtooth waves, and triangular waves. In wireless communications and broadcasting, transmitters are designed so they emit a minimum of energy at harmonic frequencies. Normally, a wireless device is intended for use at only one frequency. Signal output at harmonic frequencies can cause interference to other communications or broadcasting. For example, a broadcast signal at 90.5 MHz (in the standard FM band) would have a second harmonic at 181 MHz, a third harmonic at 271.5 MHz, a fourth harmonic at 362 MHz, and so on. Some or all of these harmonic signals could, if strong, disrupt activities in other wireless services.

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