

## DTMF specifications

DTMF (which stands for dual tone multifrequency) is the usual technique used for dialing on the PSTN. Each dialing digit is coded by the addition of two sinusoidal signals of different frequencies. The table below summarizes this coding:

	1209 Hz	1336 Hz	1477 Hz	1637 Hz
697 Hz	<i>1</i>	<i>2</i>	<i>3</i>	<i>A</i>
770 Hz	<i>4</i>	<i>5</i>	<i>6</i>	<i>B</i>
852 Hz	<i>7</i>	<i>8</i>	<i>9</i>	<i>C</i>
941 Hz	<i>*</i>	<i>0</i>	<i>#</i>	<i>D</i>

The duration of a dialed digit is always longer than 65 ms, and the delay between two dialed digits (no signal) is longer than 80ms. The DTMF signals are sampled at 8KHz and encoded by 8 bits. The frequency tolerance is equal to 1.5%. For example, the frequencies for a '1' are:  $697 \pm 10.455$  Hz,  $1209 \pm 18.135$  Hz. The signal to noise ratio is more than 20dB. The dial tone is a sinusoidal signal. Its frequency is equal to 440Hz.

**Work to realize** - Use Matlab to realize a program detecting the dial tone and decoding the DTMF signals. In other words, your program takes as input a signal corresponding to a dialing, and gives as output the corresponding phone number. You can test your program on the provided .wav files. These files are recordings of dialing signals.

Justify your method and all the parameters used in your program.