

## **A Representative Waveform of CO<sub>2</sub> Breath Signals**

**Authors:** Michal Ronen PhD, Keren Davidpur BSc, Yossef Cohen BSc, Eylon Katz BSc and Joshua L. Colman BSc, Covidien - Respiratory and Monitoring Solutions, Jerusalem

**Background:** Several measured physiological parameters provide recurring signals and waveforms, e.g., CO<sub>2</sub> in the breath. These waveform shapes, dimensions and recurring patterns may provide clinicians valuable information regarding the patient physiology.

Typically, the relevant waveforms are presented in monitoring displays as a moving wave in real time. This type of presentation does not lend itself to evaluation of either their characteristic and dominant waveform shapes or the patterns they create. A tool has been developed help provide bedside clinicians an enhanced ability to easily to recognize, analyze, compare and evaluate the information that may be hidden within waveforms.

**Methods:** The method used for producing the representative waveform (RW) is based on splitting each waveform into both its scalar (dimensional) values and shape characteristics, filtering out artifacts and then applying mathematical operators on each of them separately for a chosen group of waveforms, this in order to calculate for the group their dominant and representative shape characteristic and averaged scalar values.

**Results:** A working algorithm and software package for display on PC, Tablet or a CO<sub>2</sub> monitor with input coming from a Covidien Capnograph has been completed. The software algorithm tool is used to anchor a visual representation of the patient's dominant breath shape and dimensions. Further capabilities include:

- Displaying previous RW's, to enable comparison with baseline or reference points as defined by the user
- Displaying predefined CO<sub>2</sub> waveform patterns for comparison that are indicative of a healthy breathing pattern or of a disease state.
- A feature permitting scrolling, browsing and event marking is provided for retrospective evaluations.
- A waveform confidence index is also provided.

**Conclusions:** Representative Waveform has been developed as a software tool. It provides innovative visualization tools to simplify assessment of patient condition from Capnography waves' morphology and patterns. The methodology could be applied on other periodic signals.

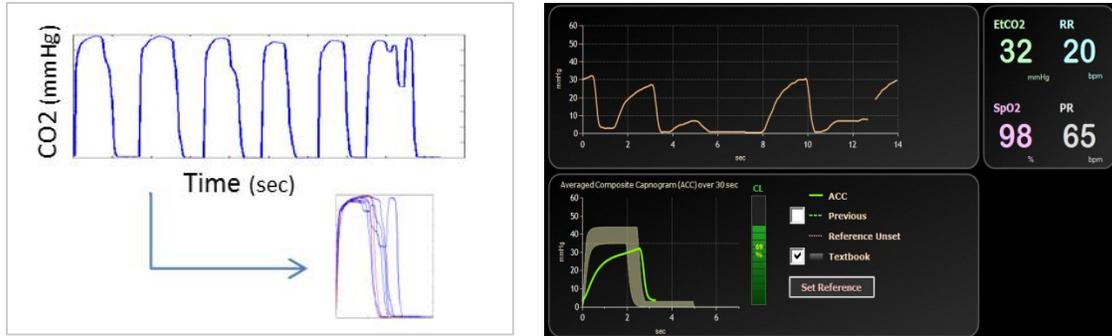


Figure 1: A) A representative waveform (red) of a group of CO2 waves. B) A display of the RW tool, with the representative waveform on the lower pan (green) and the 'text-book' waves range (gray).