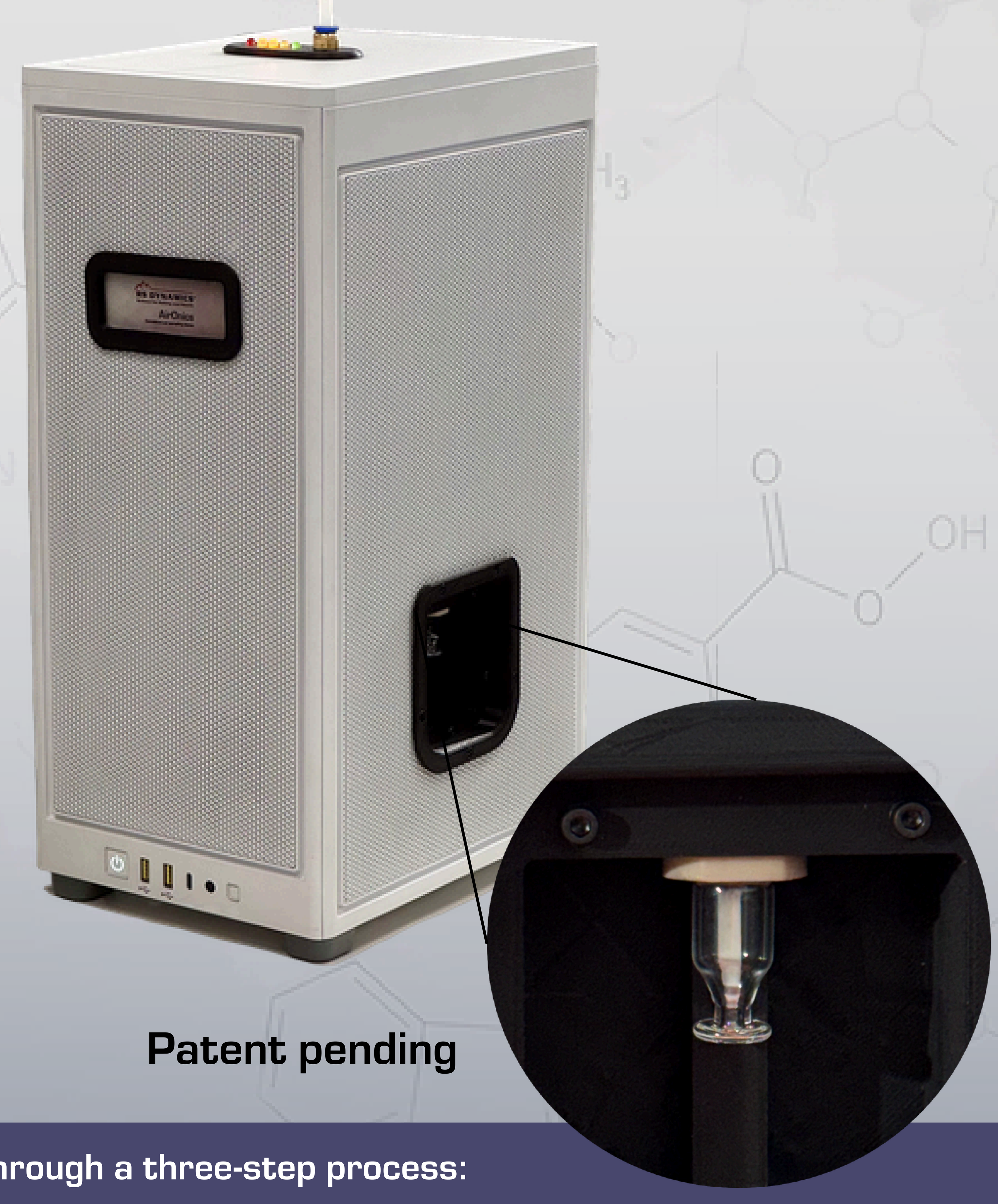
Swiss-based company with 35 years history

Medical
RS DYNAMICS®
Future Diagnostics in your Hand

www.rsdynamics.com

AirOnics®

Exhaled Breath Sampling Platform with Highly Enriched Liquefied Output



AirOnics® captures and concentrates exhaled breath samples into an organic solvent mixture that is stable and ready for analysis.

Key Benefits:

- Non-invasive exhaled breath sample collection
- Ultra-trace sample enrichment - up to 100 000
- Unprecedented capture capability at ppt concentrations
- Direct compatibility with MS-based analytical platforms
- Broad variability setup allowing different analytical approaches

Patent pending

AirOnics® achieves these unique performance parameters through a three-step process:

1. Intelligent, CO_2-Gated Sampling:

The patient exhales into a single-use, contamination-free inlet. An integrated CO_2 sensor precisely gates the collection, ensuring only the most valuable, deep-lung air (alveolar breath) is sampled. This intelligent triggering maximizes the capture of endogenous metabolic biomarkers while discarding inert dead-space air.

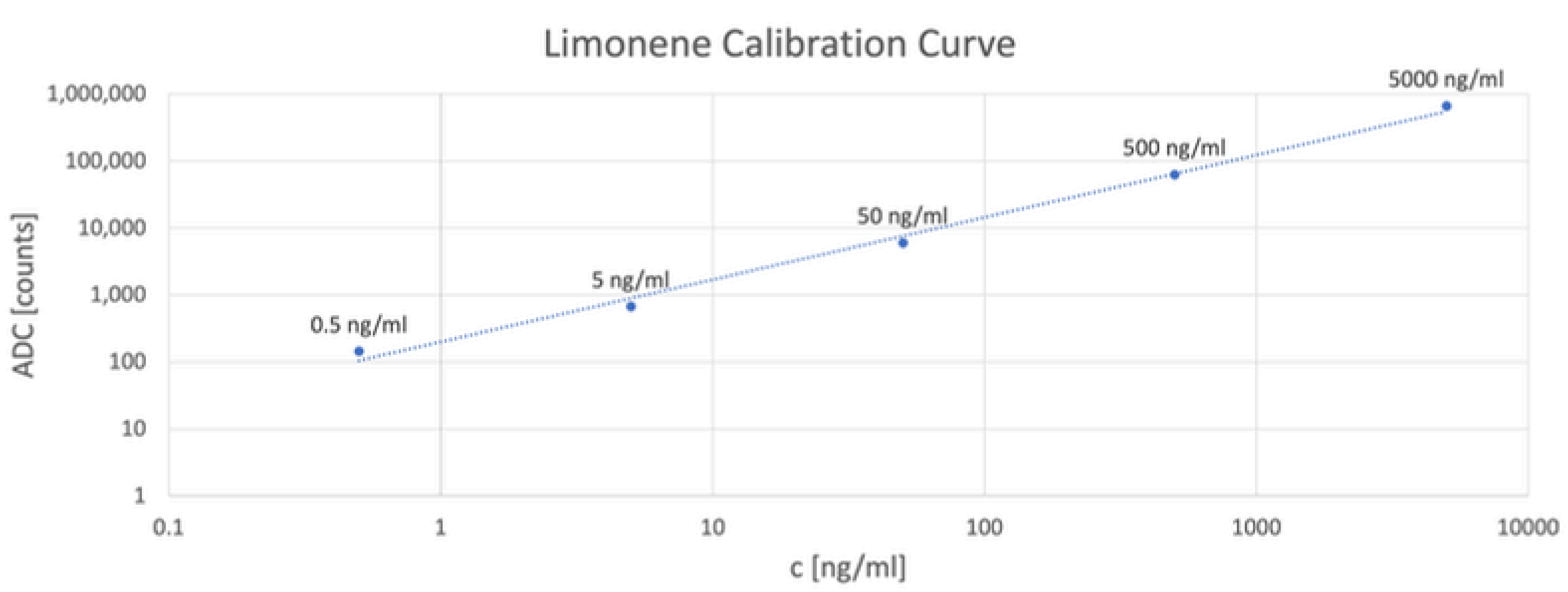
2. Aerosolization and Enrichment:

The captured breath is directed into a temperature-controlled, heated reaction chamber. Here, it is mixed with a micro-sprayed organic solvent, creating a fine aerosol. This process efficiently transfers volatile organic compounds (VOCs) and other biomarkers from the gaseous phase into the solvent droplets.

3. Condensation and Pre-Concentration:

The aerosol is then passed through a second, cooled thermal zone. This temperature drop induces condensation, converting the aerosol back into a liquid. This phase change dramatically reduces the sample volume, resulting in a final, stable 1 mL liquid sample where the biomarkers are concentrated by a factor of up to 100,000.

Analysis



Principle explained

In general the AirOnics® works as a mass exchanger with continuous contact of phases (gas and liquid) where mass transfer occurs in the whole volume of apparatus. The intensity of analyte mass transfer $< j_{An} >_\tau$ of in gas phase compounds to liquid phase can be described by the relationship:

$$< j_{An} >_\tau = -[J_D - J_T] \qquad < j_{An} >_\tau = -[\frac{\rho D_A}{\frac{d< X_A >_\tau}{dn}} - \rho < X_A V_n^* >_\tau]$$

where V_n^* denotes the fluctuation of a mixture weighed according to the mass amount, D_A is the diffusion coefficient of analyte, ρ is the density of the medium, X_A is the analyte concentration in the gas phase and $\frac{d< X_A >_\tau}{dn}$ is the analyte concentration gradient. In case of the enrichment by means of the balanced aerosol accumulation the turbulent component of the mass flow J_T is the most important.

The following relationship describes the collection efficiency of the compounds of interest with of the balanced accumulation.

$$\frac{Q_{iL}}{Q_{iG}} = \frac{K_i \frac{U_L}{U_G}}{1 + K_i \frac{U_L}{U_G}}$$

Where K_i is the distribution constant of the analyte between the liquid and the gas phase, U_L and U_G are the liquid and gas phase volume flows, respectively, through the aerosol enrichment unit (AEU). Q_{iG} and Q_{iL} are the amount of VOC entering the AEU in the gas phase and the amount of VOC absorbed in the liquid mixture leaving the miniaturised exhaled breath collector.

Results

Samples are collected by the AirOnics® exclusively from the end-tidal expiratory phase (ETEP), which is identified by a CO_2 sensor based on the carbon dioxide concentration in the exhaled breath. The highly enriched liquefied sample obtained from exhalation procedure is collected and stored in a vial, ready for mass spectrometry (MS) or other analytical techniques.

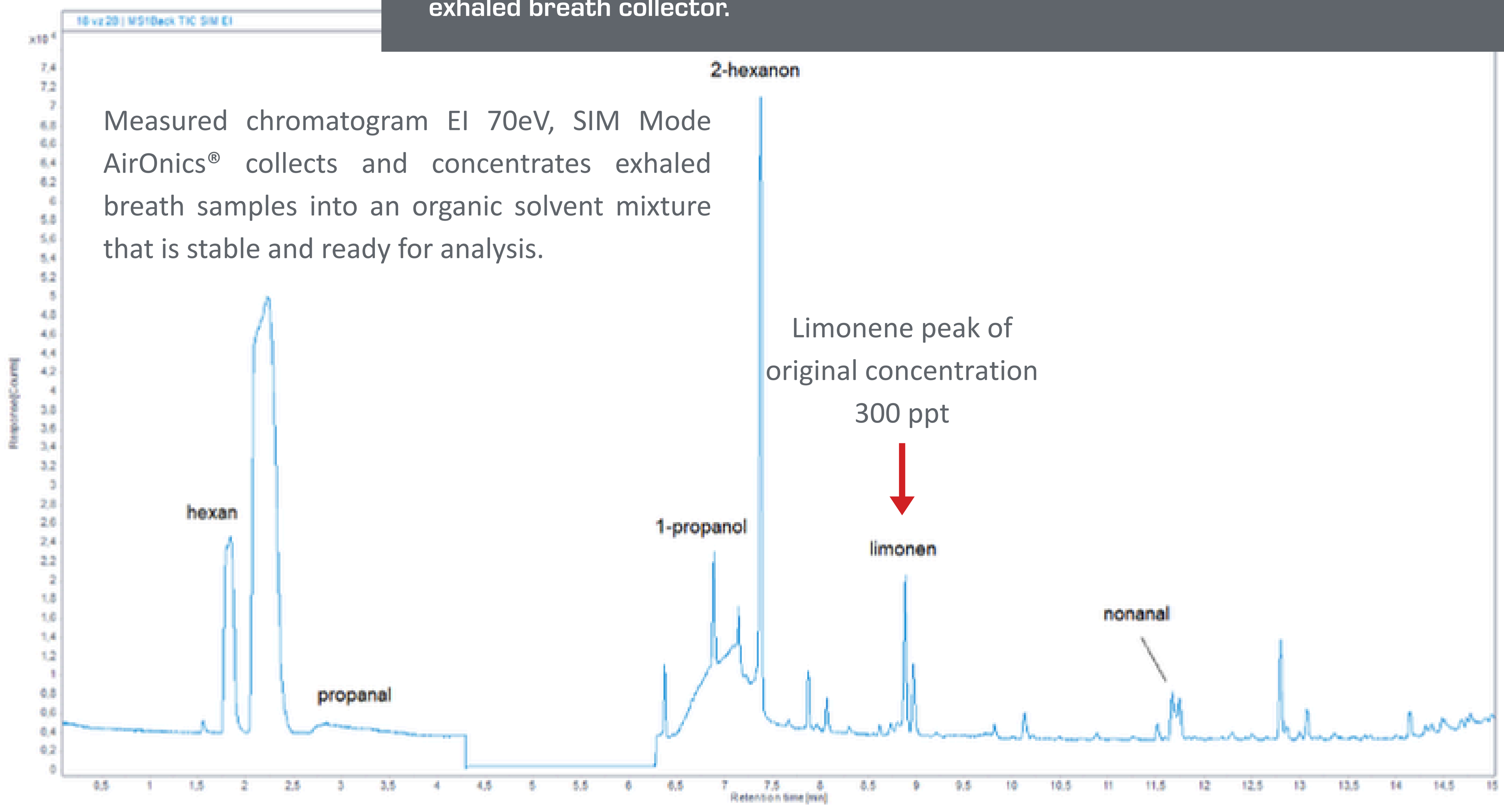
AirOnics® is capable of collecting trace amounts of chemical compounds from breath samples at concentrations as low as the ppt (parts-per-trillion) level level as well as particles in respiratory breath, including of bacteria and viruses.

The AirOnics® sampling process can be repeated without limitations in time or sampling capacity.

Constructed entirely from inert materials, AirOnics® prevents the degradation of collected chemical compounds.

AirOnics® is compatible with a variety of sorbent solvents, depending on the target volatile organic compounds (VOCs).

If a nonpolar liquid, such as n-heptane, is used as the absorption liquid, two phases will form in the stored vial: the upper phase is n-heptane, and the lower phase is aqueous, which contains most of the polar compounds absorbed into it. If the absorbent liquid is miscible with water such as ethanol we obtain a homogeneous liquid sample that can be directly analyzed using various analytical techniques.



Headquarters:
RS DYNAMICS LLC
Bleichistrasse 8
Postfach 7630
6302 Zug
Switzerland

Visitors:
RS DYNAMICS LLC
Technopark Zurich, 4th floor
Technoparkstrasse 1
8005 Zurich
Switzerland

Technical Support:
RS DYNAMICS s.r.o.
Starochodovská 1359/76
149 00 Prague
Czech Republic
European Union

AirOnics® is the product of RS DYNAMICS MEDICAL LLC

Medical
RS DYNAMICS®
Future Diagnostics in your Hand
info@rsdynamics.com