Quark PFT

Pulmonary Function Testing

"When one breath does matter"



Full modularity and networking for truly customised lung function testing solutions

COSMED

The Metabolic Company

“Lab system maximizes the technology and testing abilities to give all-round performance, high-quality measurements and excellent repeatability[1]”

- **Modular, expandable Lung Function and Metabolic Testing in one-single device**
- **Powered by OMNIA The most comprehensive software platform in the industry**
- **Compliant with ATS/ERS 2019 Spirometry and 2017 DLCO Guidelines**
- **VA calculation with Mass Balance technique during DLCO**
- **Best in Class components for Lung Function and Cardio Pulmonary Exercise Testing**



Quark PFT is a modular and compact Pulmonary Function Testing system that allows accurate, repeatable, low cost tests over time. It has been designed to meet any physician’s requirement, whether it is needed for a fully featured PFT lab or private practice.

Quark PFT is powered by OMNIA, the ultimate software platform entirely designed and developed by COSMED. OMNIA provides an innovative and user-friendly interface that allows operators to navigate and access features and testing quickly without the need of a long training. OMNIA is available in a multi-language environment either for stand-alone or small to large network environments. All Quark PFT modules comply with ATS/ERS standards.

Design

- **True modular design architecture.** It allows to configure Quark PFT according to any kind of requirement. This cost-effective solution gives the opportunity to scale at any time to a more complex configuration.
- **Powered by OMNIA.** A contemporary, simple and ergonomic software interface with intuitive workflow and hierarchy. Based on either Express or Standard SQL database to store unlimited data securely guaranteeing lifetime data ownership.
- **Quick and easy calibration procedures.** Standard (i.e. flowmeter and gas sensors) and advanced calibration procedures to verify accuracy, including pneumotach linearization, and verification of all flowmeters.
- **Automatic interpretation of tests.** Based on the latest scientific guidelines supported by a powerful algorithm that automatically processes results and provides interpretation text strings, including numerical results and graphical data (gauges).
- **Network ready.** OMNIA is available both as a single stand-alone workstation or in a Client-Server configuration for small or very large network environments.

Hardware Architecture

Quark PFT has been designed with a truly modular architecture that allows both easy upgrade and simplified service procedures. Major components, such as gas sensors (Paramagnetic or GFC) or assembled electronics, are manufactured in single boards that can be easily swapped by technical personnel provided with a minimal training on the Quark PFT technology.



(1) “ERS 2004: Lung function testing equipment: a manufacturer’s unbiased viewpoint” K. Hogben, 2004 ERS Buyers’ Guide to Respiratory Care Products p. 42-64

Spirometry

Quark PFT basic configuration includes all features and hardware for spirometry testing (FVC, SVC, MMV and Pre/Post Bronchial Provocation).

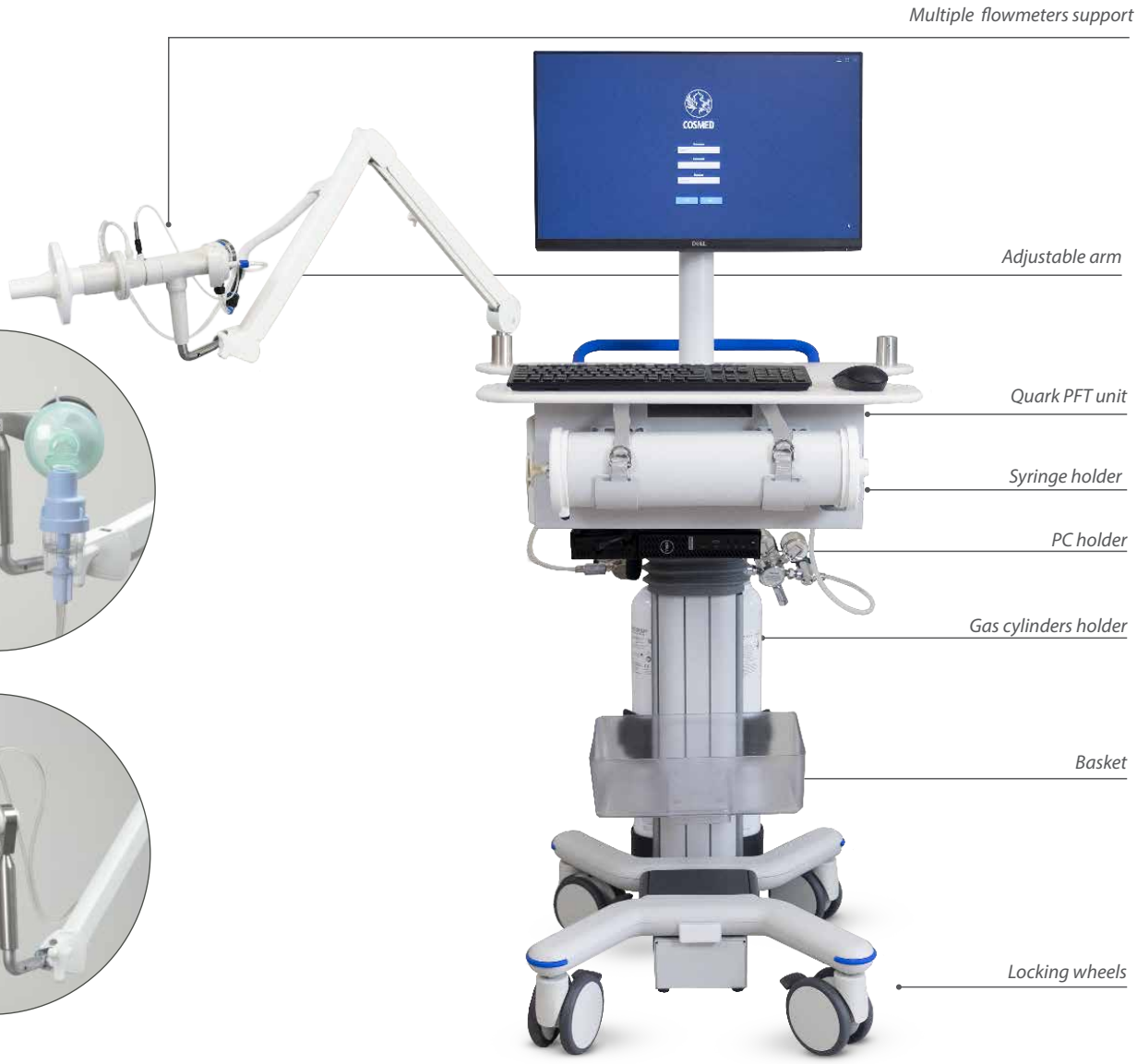
- Choice of different flowmeter configurations (pneumotach or turbine).
- New trial selection and Quality Control functions (in compliance with ATS/ERS guidelines).
- Innovative pediatric incentive with user-defined effort grade on both volume and flow.
- GOLD COPD interpretation on FVC Post BD.
- Automatic control of the Broncho-Challenge protocols with or without the integrated dosimeter.
- Global Lung Initiative (GLI) predicteds (including z-score).

Lung Function Testing	Quark PFT	Q-Box
Spirometry (FVC, SVC, MVV, Broncho Challenge)	●	●
Body Plethysmography (TGV, sRaw, sGaw, Pre/Post, Challenge)	○	●
Diffusing Lung Capacity (Single Breath, IntraBreath, Membrane Diffusion)	○	○
Lung Volumes (N_2 Washout Multi-Breath, Closing Volume, LCI)	○	-
Respiratory Mechanics (MIP/MEP, P0,1)	○	●
Forced Oscillation Technique (Rrs, Xrs, Ax)	○	○
Airway Resistance by Occlusion Technique (Rint/Rocc)	○	○
Integrated Dosimeter	○	○
6MWT and walk tests	○	○
Metabolic Testing		
Cardio Pulmonary Exercise Testing (VO_2max, Sub Max VO_2, Anaerobic Threshold)	○	-
Diagnostic 12-leads Stress testing ECG	○	-
Resting Energy Expenditure (REE)	○	-
High/Low FiO_2 (altitude simulation)	○	-
Cardio Pulmonary Exercise Testing, by "Physical Mixing Chamber"	○	-

● Standard ○ Optional







Body Plethysmography (TGV/RAW)

"Gold Standard" lung volume measurement can be performed with the addition of a variable-pressure plethysmographic body box module. The large cabin provides comfort and ease of access both for adults and special populations.

- Large constant-volume cabin.
- Quick calibration and fast stabilization times.
- Advanced quick release arm mechanism for one-hand height adjustment.
- Adjustable breathing valve for optimal patient comfort during testing.
- Simulate TGV test with open door to coach patient's compliance.
- Integrated, transparent compensation box for external pressure interference.
- User-defined testing sequence of TGV, sRAW, SVC and IC captures.
- Real-time review of all performed TGV and RAW captures.
- Polytropic factor calibration and body box leakage check for optimal performances.
- Automatic interpretation statements according to measured TLC.
- sRAW measurements during quiet breathing (thermal drift compensated).
- Possibility to capture multiple RAWs with a single click.
- Possibility to calculate TLC by using an Inspiratory Capacity or a complete Slow Vital Capacity maneuver.
- In-vitro accuracy verification by a simulated test performed with optional Erlenmeyer Flask.

Lung Diffusing Capacity (DLCO)

The DLCO module allows the measurement of diffusing capacity of Carbon Monoxide in the lungs with different techniques. The measurement is performed through the continuous analysis of CO and CH_4 (tracer) fractions with fast analyzers.

- Dedicated CO analyzer designed for DLCO, independent of $FeCO_2$.
- "Zero wet" correction to compensate CO back-pressure and humidity interference.
- Advanced editing (automatic and custom selection of washout and alveolar gas volume).
- Alveolar Volume calculation by Mass Balance technique (ATS/ERS 2017 DLCO Guidelines).
- Mouth pressure signal during testing for real time quality control.
- Estimated TLC during DLCO, corrected for obstructive patients.
- Membrane Diffusion automatically enabled if multiple $DLCO_{sb}$ or $DLCO_{ib}$ manoeuvres are performed.
- Coach subjects before testing without using gas mixture.
- Both automatic and user-defined DLCO quality control grading.
- Breath-hold time settings according to multiple standards (Jones, Ogilvie, ESP).

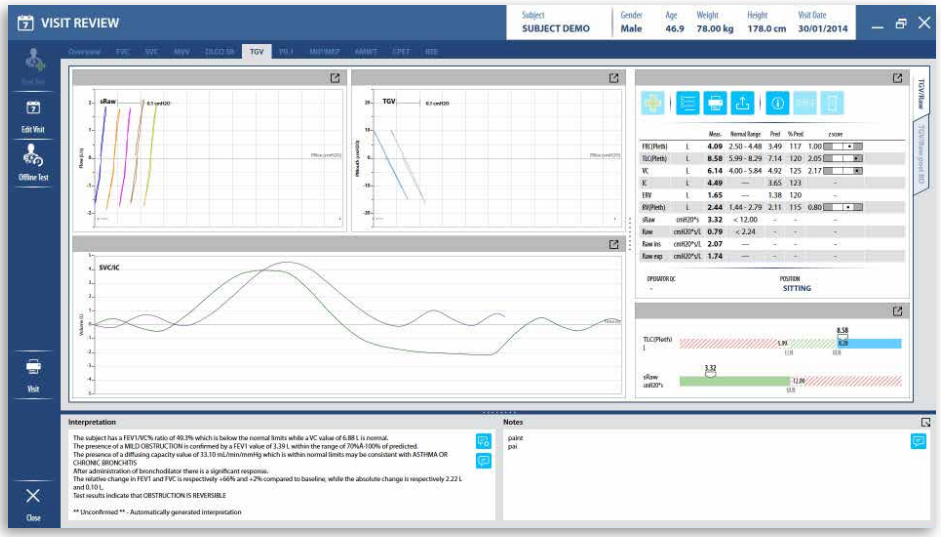
Lung Volumes (FRC - Nitrogen Washout)

The lung volumes module adds the possibility to test Functional Residual Capacity (FRC) via single or multi-breath Nitrogen Wash-Out.

- Use of fast O_2 (Paramagnetic or GFC) and CO_2 analyzers.
- Real time N_2 Wash-Out plot together with several indicators for the control of the respiratory pattern.
- Automatic detection of washout curve phases (N_2WO Single Breath).
- Automatic and manual detection of the 4 phases composing the wash-out curve, including the slope of the alveolar plateau.
- Lung Clearance Index (LCI).
- Adjustable end-test criteria in case of leaks occurred during testing (N_2WO Multi-Breath).



Lung Diffusing Capacity (above) and Body plethysmography (below) results



Forced Oscillation Technique

The Forced Oscillation Technique module allows the measurement of the mechanical properties of the respiratory system during tidal breathing.

- Total respiratory impedance measurement by Pseudo Random Noise signal.
- Frequency range and acquisition time according to ATS/ERS 2019 Respiratory Oscillometry Guidelines.
- Quick and easy assessment during normal breathing.
- Ideal for uncooperative patients such as children or elderly people.
- Recognized reference method for pre-school children assessment.
- Test loads for easy calibration and verification procedures.

Respiratory Mechanics

Available as standard testing feature or as an optional feature, according to user configuration. The respiratory mechanics module includes:

- Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP).
- Respiratory Drive assessment (P0.1), including measurement with enriched O_2 or CO_2 inspiratory mixture.

Walk tests (Integrated Oximeter)

Integration with Nonin® 3150 WristOx2 oximeter (Bluetooth® Low Energy) and pre-defined protocols to provide physiological data during standardized, non-metabolic tests such as 6MWT, Incremental and Endurance Shuttle Walk Tests, Titration and the High Altitude Simulation Test, as well as user-defined protocols.

Exclusive features include:

- Plethysmographic pulse oximetry signal for visual feedback.
- Steps quality control.

Airway Resistance (Rocc)

The airways resistance by occlusion technique (Rocc) is fast and reliable, more suitable for airway resistance measurement in patients unable to perform body plethysmography (critically ill, children). The patient is asked to breathe spontaneously through a mouthpiece while an occlusion valve interrupts the airflow for a fraction of time.

- Hardware consists of a special handle incorporating a dedicated low flow pneumotach and an occlusion valve.
- Possibility to measure Occlusion Resistance pre and post BD (after bronchodilator administration).



Forced Oscillation Technique module

Integrated Dosimeter

The optional dosimeter module includes all hardware and software components to run a broncho challenge test by means of an integrated dosimeter.

- Automatic control of bronchial challenge tests through an integrated dosimeter.
- Automatic measurement of the actuation time of the dosimeter valve with high time resolution.
- Default set of testing protocols.
- Broncho challenge protocols editor to easily create your custom testing protocol.
- Dedicated nebulizer arm support for increased usability.



Integrated Dosimeter



Nonin® WristOx 3150 pulse oximeter for walking and titration tests

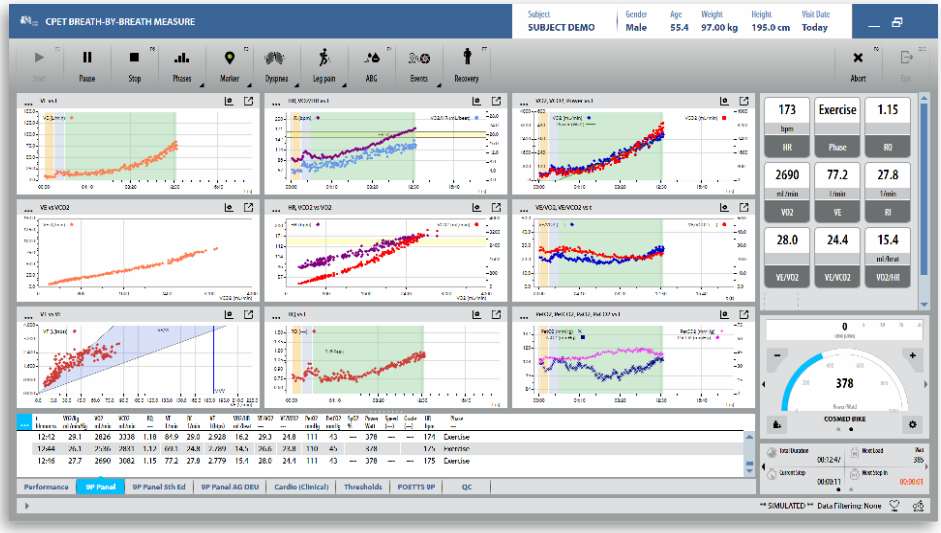


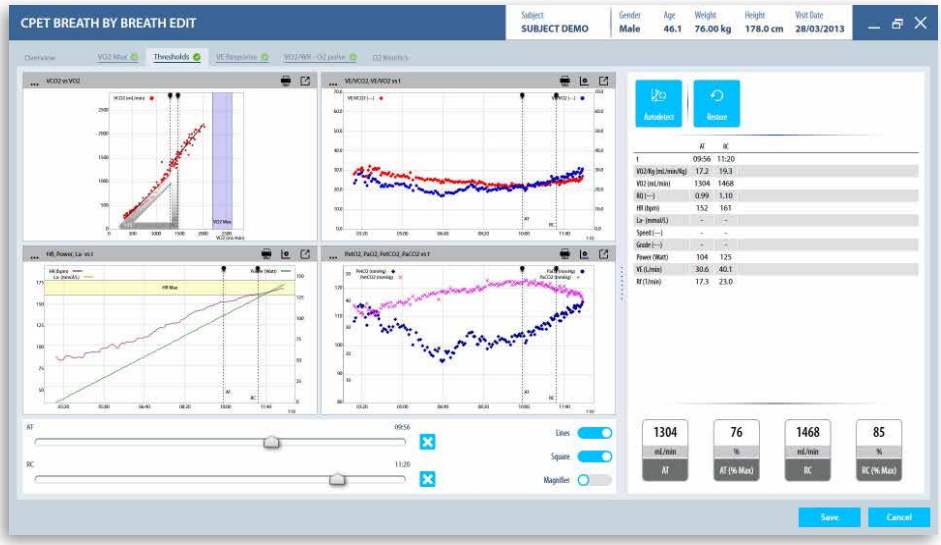
Airway Resistance

Metabolic (CPET/REE)

Quark PFT can be transformed in a compact metabolic cart for the assessment of pulmonary gas exchange and ventilatory response during clinical exercise test. High quality components and super-fast analyzers ensure unsurpassed accuracy, reliability and real breath-by-breath analysis.

- Breath by Breath metabolic module for both Cardio Pulmonary Exercise Test (CPET) and Resting Energy Expenditure (REE) assessment.
- Ergonomic multi-use silicone face masks (available in 5 sizes).
- Possibility to upgrade the Metabolic module with additional integrated diagnostic quality **12-lead Stress ECG**, either in wireless or patient cable configurations (optional).
- Independently validated for both exercise and resting applications.
- Data and graphs displayed through standard or custom defined 'Dashboards' (9-Panel Plot, etc.).
- Comprehensive interpretation tool following latest standards.
- Exercise Flow-Volume loops (EFVL) for the evaluation of ventilatory limitation.
- Built-in, intuitive protocols editor.
- Access data in spreadsheet format for advanced data elaboration (filtering, smoothing, etc.).
- Manual or pre-set ergometer control allows smooth protocols and dynamic changes.





Options and Accessories

- **Mixing Chamber** .7-Liters physical mixing chamber is the ideal solution for highly accurate measurements during exercise in research and sport applications.
- Integrated **Pulse Oximeter** monitors with a broad range of sensors (finger, earlobe or forehead).
- **Canopy Hood** for Gold Standard Resting Energy Expenditure (REE) measurements on spontaneously breathing subjects.
- Integration with **Blood Pressure** and **Cardiac Output** monitors.
- **High/Low FiO2** option for exercise gas exchange measurements with enriched gas mixture.

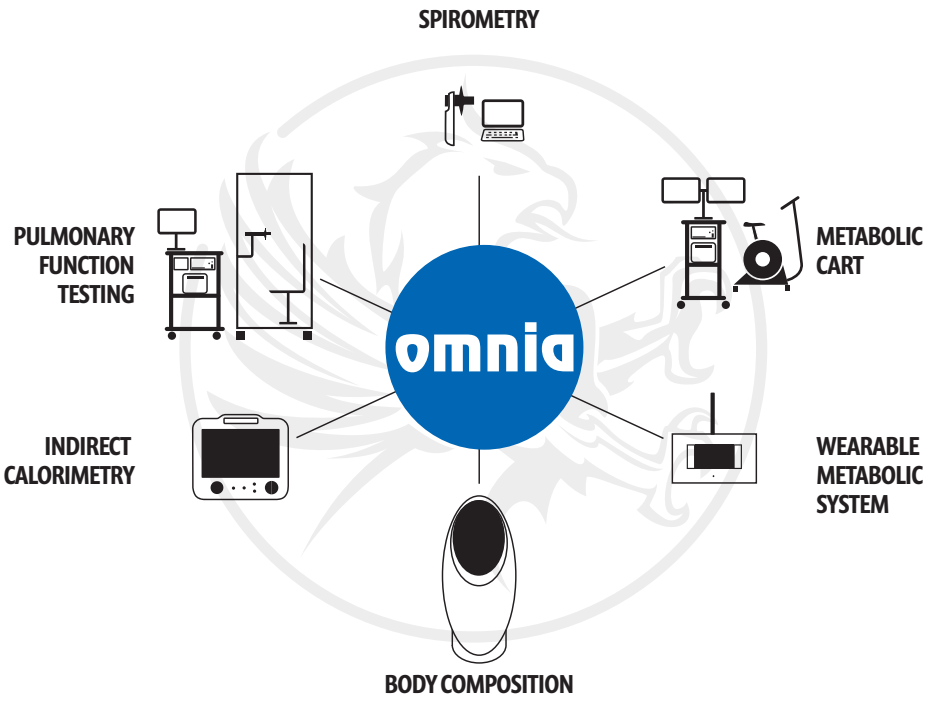


- **Wide selection of ergometers**, available from COSMED, including treadmills, cycle-ergometers, arm-ergometers and recumbent bikes, suitable for any clinical and research application.

Networking

OMNIA Network is based on a Client-Server architecture and allows to operate different COSMED devices through simultaneous access of data and run tests via a virtually unlimited number of COSMED products.

- Based on standard SQL database to store data securely.
- Access and security compliance according to international guidelines.
- Standard network license supports up to five clients and can be extended to unlimited clients.
- User management system allows to define users' profiles and rights to each software feature.
- With the optional OMNIA Connector module, OMNIA can exchange data with Hospital Information Systems (HIS) or Electronic Medical Records (EMR) via HL7® or DICOM® protocols. Shared data are managed through a dedicated worklist with visit status always updated.





Custom printouts including gauges, tabular data, QC information, charts and comprehensive interpretation statements.

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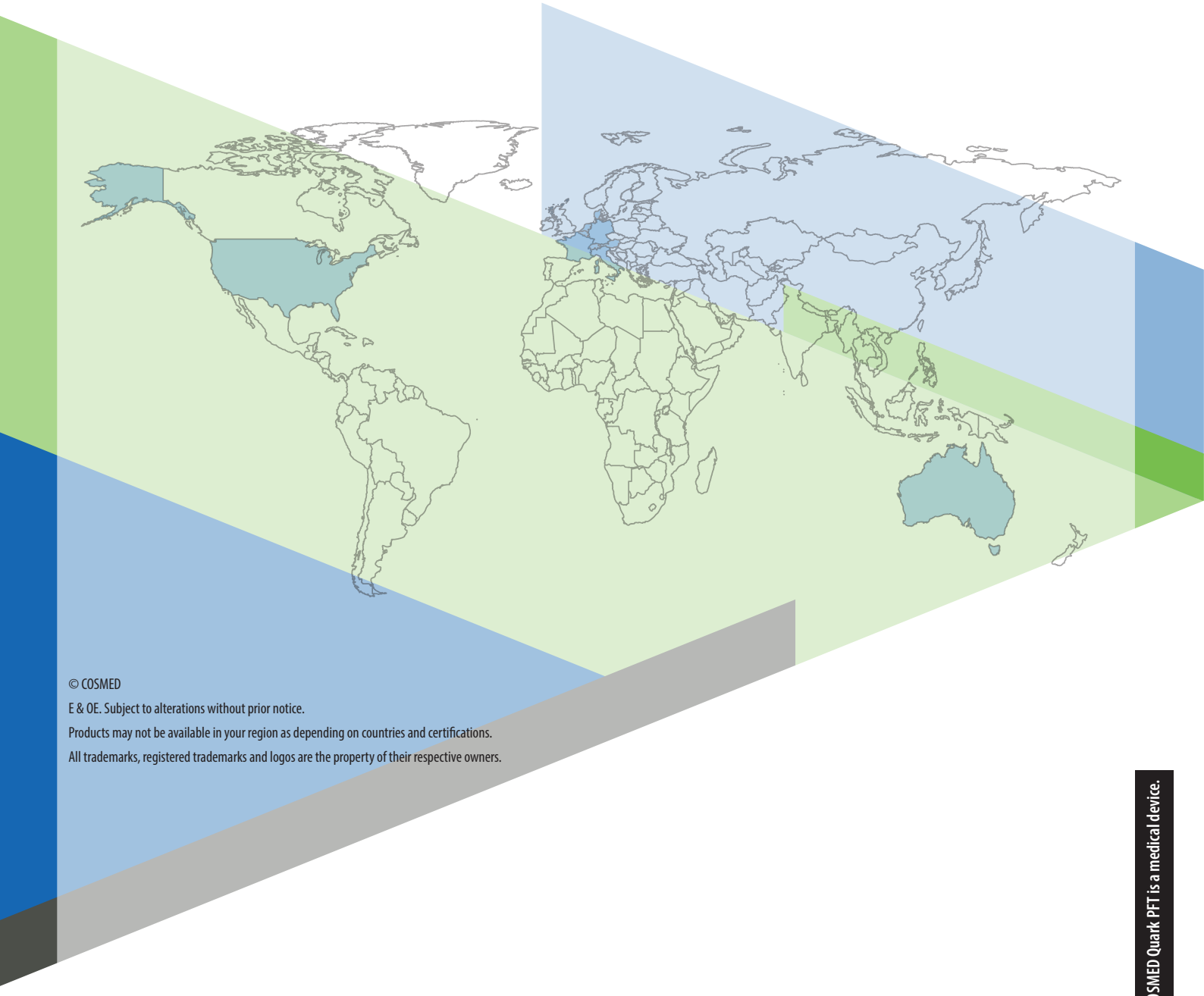

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