

Quark RMR
Metabolic Cart

*"Assess, Monitor, Evaluate
Exercise Capacity..."*



The gold standard for metabolic
measurements in applied human physiology

PREVIEW

This brochure includes features that may be available in upcoming versions.



COSMED
The Metabolic Company

- Measurement of Oxygen Consumption over the entire human physiological range
- Best in class O₂/CO₂ gas analyzers (Paramagnetic, NDIR)
- Different flowmeters available for Resting and Exercise applications
- Gas Exchange measurements via Breath by Breath or optional Mixing Chamber
- Powered by OMNIA, the most comprehensive software platform in the industry
- Independently validated for rest and exercise protocols



Quark RMR is a metabolic cart engineered for accurate and precise gas exchange analysis across the full physiological spectrum: from resting metabolism to maximal exercise. Designed to meet the rigorous demands of human physiology and applied research settings, Quark RMR delivers high-fidelity measurement of oxygen consumption (VO₂) and carbon dioxide production (VCO₂), supporting a broad array of metabolic, performance, and clinical studies. Built with modularity at its core, Quark RMR offers a scalable configuration platform that adapts to diverse investigative protocols. Whether used for basal metabolic rate evaluation, exercise physiology research, or ventilator-dependent patient assessment, its flexible design allows laboratories to tailor the system to specific experimental needs and upgrade as project scope evolves.

At the heart of its measurement precision is a combination of robust sensor technology and validated methodologies. The system features a fast-response paramagnetic O₂ sensor and a durable infrared CO₂ analyzer, both engineered for long-term stability and minimal drift, ensuring consistent performance without frequent recalibration. Quark RMR supports both Breath-by-Breath analysis and optional Adaptive Mixing Chamber technology, providing methodological flexibility across research paradigms and study populations.

Quark RMR has been independently validated against gold-standard techniques across the entire physiological range, including spontaneous breathing and mechanical ventilation. This comprehensive validation underscores its scientific reliability for both basic and translational research applications.

Maintenance has been streamlined through a plug-and-play hardware architecture that reduces system downtime and minimizes operating costs. Key components can be replaced without complex procedures, allowing researchers to focus on data collection rather than system servicing.

Powered by OMNIA, COSMED's integrated software platform, Quark RMR facilitates intuitive protocol design, guided calibration, and real-time data visualization. OMNIA's built-in quality control and data verification tools ensure high measurement integrity, while its compatibility with modern laboratory information systems simplifies integration within multi-instrument research environments.

Quark RMR is more than a metabolic cart, it is a flexible research platform designed to advance physiological understanding through accurate, reproducible, and scalable metabolic measurement.

Metabolic Testing	
Resting Energy Expenditure (REE) with Canopy Hood	●
Resting Energy Expenditure (REE) with Mask	●
Resting Energy Expenditure (REE) with Ventilator (for mechanically ventilated subjects)	○
Cardio Pulmonary Exercise Testing (CPET) with Breath by Breath technology	○
Cardio Pulmonary Exercise Testing (CPET) with Adaptive Mixing Chamber technology	○
Diagnostic 12-leads Stress testing ECG	○
High/Low FiO ₂	○
Lung Function Testing	
Spirometry (FVC, SVC, MVV etc.)	○
Walk Tests (6MWT, ISWT, ESWT, custom protocols), Titration Test, Overnight Pulse Oximetry	○

● Standard ○Optional

Resting Energy Expenditure (REE)

Quark RMR offers a scientifically robust solution for the accurate assessment of Resting Energy Expenditure (REE) across a wide range of research protocols in human physiology.

Engineered for low-flow precision, the system captures breath-by-breath measurements of oxygen consumption (VO_2) and carbon dioxide production (VCO_2), along with derived ventilatory and metabolic parameters, ensuring valid data even at minimal ventilation rates.

A dedicated low-flow turbine flowmeter enhances measurement resolution during minimal ventilatory activity, supporting both canopy and mask-based REE testing. This feature is essential for capturing subtle metabolic differences in resting subjects and is validated for individuals weighing over 15 kg, aged 6 years and older.

Whether evaluating basal metabolic rates in athletic populations, assessing energy expenditure in clinical nutrition trials, or quantifying metabolic efficiency in aging or disease, the Quark RMR delivers the resolution, flexibility, and reliability demanded in modern human physiology research.

CANOPY DILUTION

Included in the standard configuration, the canopy dilution method offers a comfortable, non-invasive solution for resting measurements.

The system features an integrated blower unit, software-controlled via the OMNIA platform, which features a real-time interface to help maintain a stable fraction of expired CO_2 (F_{ECO_2}) during the test.

An adult canopy hood is standard, while a pediatric version is available for expanded study populations.

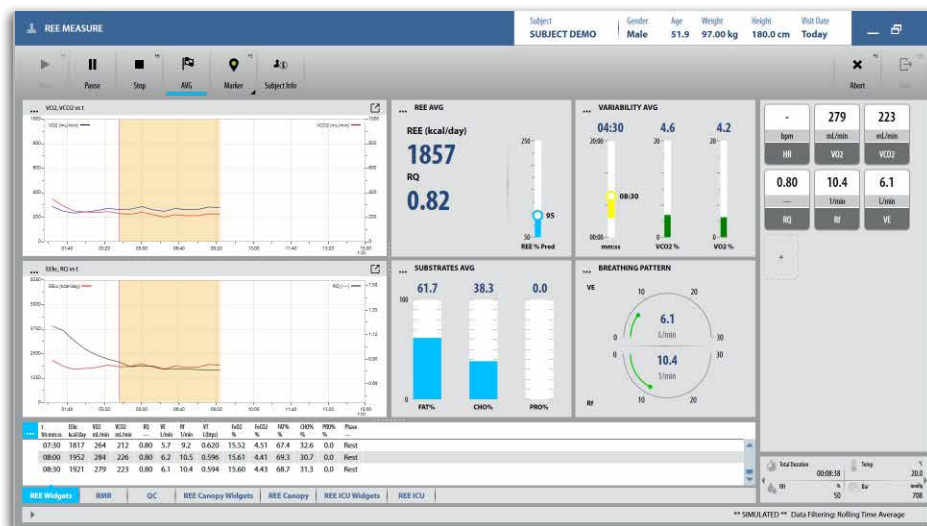
The canopy veil is crafted from single-use medical-grade LDPE, supporting both hygiene and convenience.

The canopy itself is easy to clean and disinfect, making it suitable for repeated daily use in high-throughput settings.

MASK AND MOUTHPIECE

In scenarios where a canopy setup is impractical or undesired, the Quark RMR allows REE measurements using multi-use silicone oro-nasal face masks, available in a range of adult and pediatric sizes.

For additional flexibility, a mouthpiece configuration with antibacterial filters and nose clips offers another validated option. These setups ensure researchers can select the method best aligned with their study design and subject tolerance.



REE test real-time panel including graphs, tabular data and widgets for quick results interpretation



REE test results editing page including advanced tool for calculating the average Resting Energy Expenditure



REE by dilution with canopy hood



REE breath by breath by face mask and with mouth-piece and AB filter

Cardio Pulmonary Exercise Testing

When equipped with the optional CPET module, Quark RMR evolves into a powerful system for detailed investigation of cardio-respiratory response to exercise. Combining fast-response gas analyzers with advanced analytical tools, the system provides breath-by-breath resolution of VO_2 , VCO_2 , and related ventilatory and metabolic parameters across all exercise intensities, from steady-state submaximal protocols to high-intensity performance tests.

With its modular design, high-speed gas analyzers, and robust analytical framework, Quark RMR's CPET module is purpose-built for exercise physiology research. Whether the focus is endurance capacity, ventilatory efficiency, or metabolic thresholds, it delivers the accuracy, flexibility, and scientific rigor needed for academic and applied performance studies alike.

CPET BY BREATH BY BREATH

In its standard CPET configuration, Quark RMR uses a high-flow turbine flowmeter paired with fast-response gas analyzers to enable true breath-by-breath capture of metabolic kinetics. Tests are typically conducted using multi-use silicone face masks, available in pediatric and adult sizes, or with a mouthpiece and nose clip setup. For high-intensity protocols, dual-inspiratory-valve mask variants are available to minimize inspiratory resistance and reduce internal condensation, an essential feature for endurance and performance studies.

The breath-by-breath mode captures fast physiological changes in real-time, supporting kinetic analysis and phase-specific ventilatory tracking.

CPET BY ADAPTIVE MIXING CHAMBER

To overcome the inherent limitations of both traditional breath-by-breath and conventional mixing chamber methods, COSMED offers as an option the Adaptive Mixing Chamber AMIS 24. Unlike static mixing chambers, AMIS 24 automatically adjusts its internal volume (4–15 L) in real-time to match the subject's ventilation rate. This dynamic adaptability ensures a constant and rapid washout time across the full range of exercise ventilations (50–300 L/min), making it suitable for studies involving high-frequency breathing.

AMIS24 adaptive design provides Douglas-bag-like accuracy with near breath-by-breath temporal resolution, making it ideal for any type of protocol and for high-intensity performance testing.



PROTOCOL FLEXIBILITY

OMNIA's built-in protocol editor allows for full customization of both rest and exercise phases, including ramp, step, or interval-based loading. Whether replicating standardized protocols or designing bespoke regimens, users have full control over pacing and structure.

ERGOMETER INTEGRATION

The system interfaces natively with a wide range of ergometers, including COSMED bikes and treadmills, Ergoline, h/p/cosmos®, Monark, Trackmaster, and more. An optional ergometer module further expands compatibility to LODE, Technogym, Imbramed, Woodway®, Cyclus2, and additional research-grade equipment, ensuring seamless hardware integration across experimental setups.



ADVANCED CPET ANALYSIS TOOLS

OMNIA offers a rich suite of tools designed to support high-resolution physiological research and in-depth metabolic analysis during cardiopulmonary exercise testing (CPET).

- Automated identification of first (VT1/LT1) and second (VT2/LT2) ventilatory or lactate thresholds using multiple validated methods. Thresholds are visually displayed and manually adjustable to support expert review.
- Comprehensive metrics for maximal oxygen uptake ($\text{VO}_{2\text{max}}$), including criteria validation and peak effort detection, ensuring reliable evaluation of cardiorespiratory fitness across protocols.
- Real-time calculation and graphical display of the ventilatory efficiency slopes (VE/VCO_2) and intercepts — critical for assessing ventilatory control and detecting exercise-induced abnormalities in pathophysiological studies.
- Integration of tidal breathing loops during exercise for identifying mechanical ventilatory limitations, particularly relevant in pulmonary or cardiovascular physiology investigations.
- Personalized exercise prescription zones based on metabolic landmarks, including $\text{VO}_{2\text{max}}$, VO_2 at VT1 and VT2, and VO_2 reserve, facilitating precise workload calibration in athletic and clinical research.
- Multistage steady-state analysis supports investigation of submaximal kinetics and efficiency during constant-load testing, crucial in both endurance studies and clinical rehabilitation trials.
- Built-in tools for multiple regressions, correlations, and comparisons across CPET and REE data, supporting deeper explorations of aerobic efficiency, substrate utilization, or training adaptations.

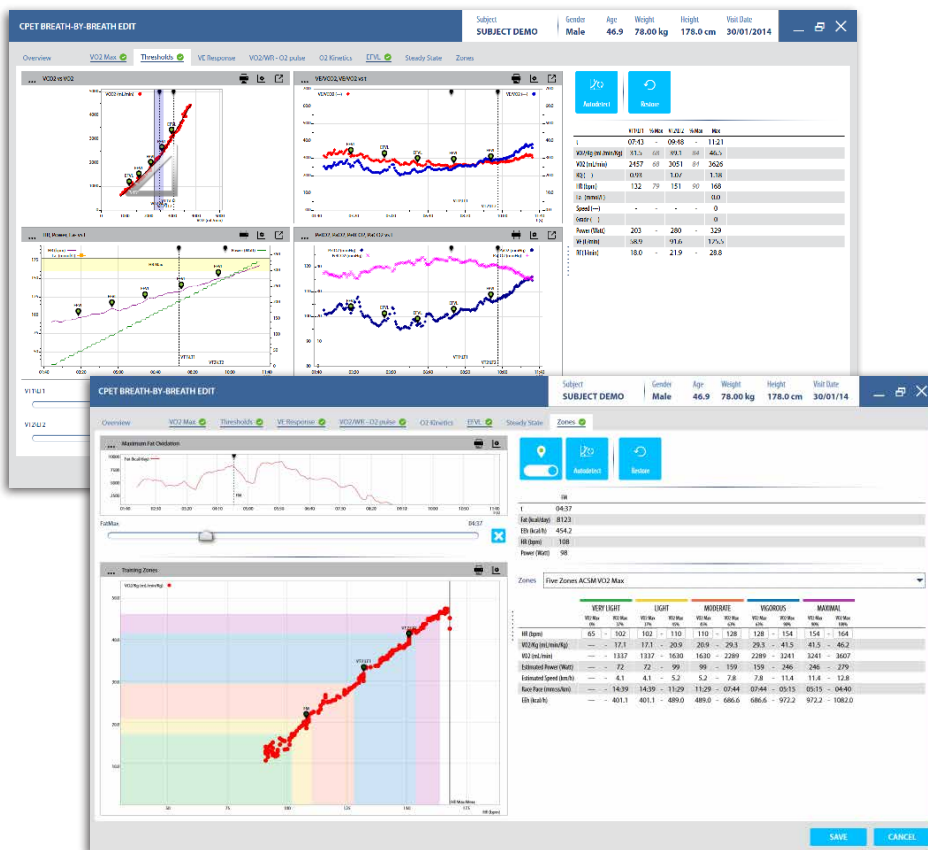
Users can choose between pneumotach and turbine flowmeters to suit specific protocols or subject characteristics.

Pediatric studies benefit from animated visual incentives and user-adjustable effort grading, supporting accurate data collection even in younger or less cooperative participants.

Automated bronchial provocation management, with or without the integrated dosimeter, further expands the system's capacity

for studying airway reactivity and reversibility — essential in physiology studies investigating asthma, COPD, or exercise-induced bronchoconstriction.

By adding the Spirometry Module, users unlock a powerful toolset for longitudinal studies, interventional trials, or any project requiring reliable and reproducible respiratory metrics.



Powerful post editing tools for calculation of the main parameters including custom training zones.

Spirometry

Available as an optional extension, the Spirometry Module is designed for accuracy and flexibility, supporting a full range of standard maneuvers, including FVC, SVC, MVV, and pre/post-bronchodilator tests.

Real-time quality control with automatic trial selection ensures results are consistent with ATS/ERS standards, while integration with Global Lung Initiative (GLI) reference equations — including z-scores — enhances interpretability across diverse study cohorts.



Automatic steady state identification

OMNIA Software

OMNIA is COSMED's integrated software environment that powers the Quark RMR system, combining advanced testing control, real-time visualization, and intelligent data management in a streamlined, research-ready interface. Designed to adapt to the demands of both clinical and physiological research, OMNIA supports the full workflow — from calibration and acquisition to interpretation and export — within a flexible, modular framework.

INTUITIVE AND EFFICIENT

With its clean, task-oriented interface, OMNIA simplifies complex testing procedures. Calibration routines are guided and automated, covering gas sensor checks, flowmeter verification, and mixing chamber calibration. During testing, real-time quality indicators and built-in coaching tools support both the operator and subject, ensuring reliable, artifact-free data from start to finish.

COMPREHENSIVE INTERPRETATION SUITE

OMNIA delivers powerful tools for in-depth data interpretation and post-processing. Users can isolate and export specific test segments, apply smoothing, custom averaging, and artifact removal. Automatic interpretations, both as text-strings and numerical data, are applied based on the latest international standards, facilitating reproducibility and reducing analysis time. Built-in physiological markers and parameters are calculated automatically. Thresholds and zones can be defined for exercise prescription or comparative analysis across sessions.

CUSTOMIZABLE REPORTING

Data output is fully configurable to match the requirements of both clinical and scientific users. Single-test, multi-test, or trend-based reports can be tailored with specific tables, graphs, z-scores, gauges, and interpretation aids. Export options include PDF, XML, and XLS formats, while XML import enables smooth data integration from external systems. Reports can be easily adapted to highlight specific metrics relevant to different study protocols or research objectives.

DATA SECURITY AND ACCESS CONTROL

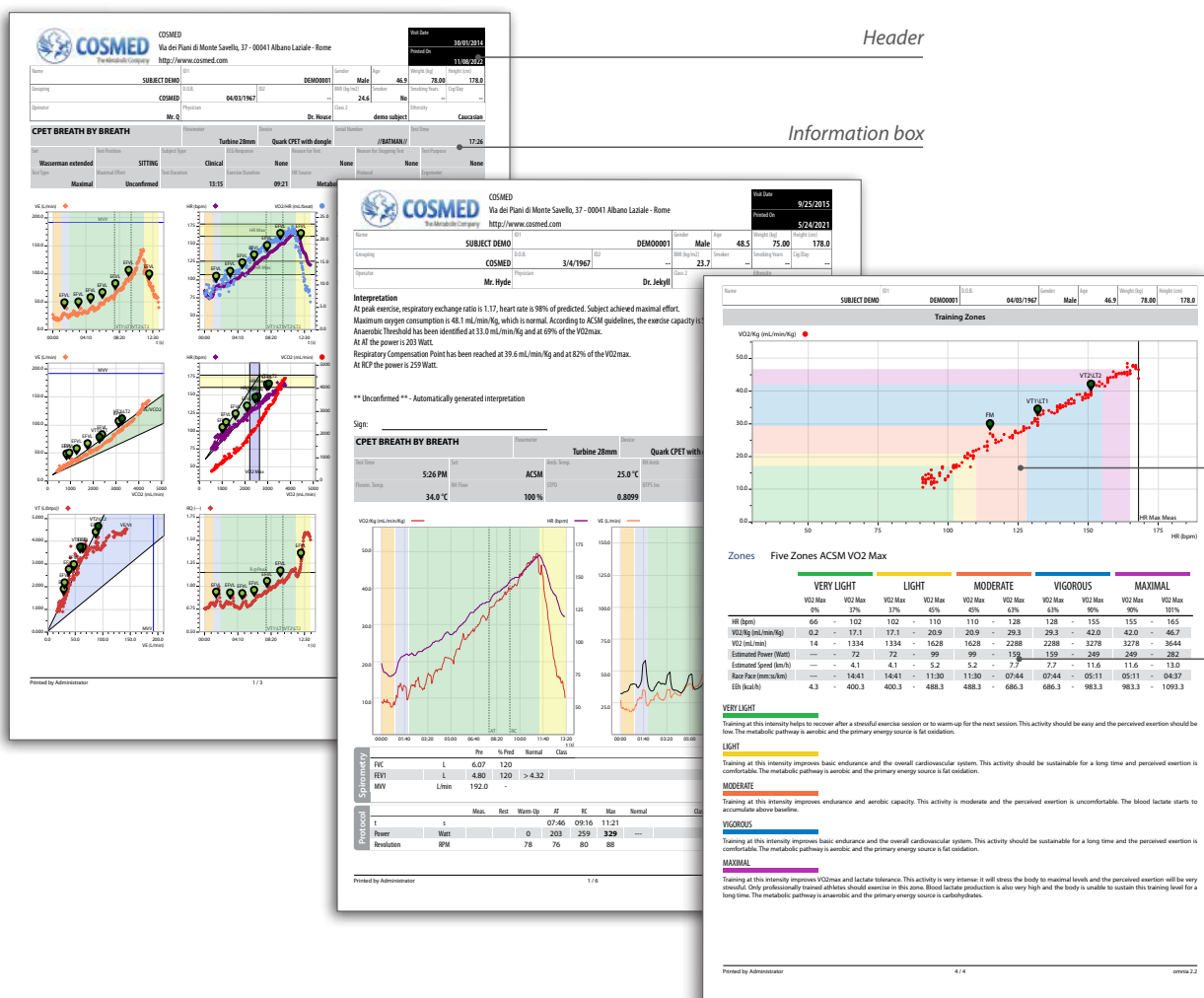
OMNIA features a robust SQL database structure, enabling secure storage of virtually unlimited test records. Role-based user permissions (Administrator, Physician, Technician) and event logging provide full control over system access and data handling. The software meets both GDPR and HIPAA standards, with built-in encryption and automated backup prompts to safeguard data integrity in high-throughput environments.

SEAMLESS CONNECTIVITY

Built for modern interoperability, OMNIA integrates directly with hospital and research information systems via HL7, DICOM, and GDT protocols. In networked configurations, client-server architecture enables coordinated multi-station testing and centralized data management across labs or departments.

ALL-IN-ONE ECOSYSTEM

From resting metabolic rate to VO_2 kinetics and full cardiopulmonary exercise testing, OMNIA provides a unified operational environment across all COSMED devices. Whether managing a single workstation or a research lab network, it delivers consistency, scalability, and long-term reliability.



Options and Accessories

ADAPTIVE MIXING CHAMBER AMIS 24

COSMED's variable-volume AMIS 24 overcomes the limitations of conventional mixing chambers in CPET testing by adapting to ventilation rates up to 300 L/min.

HIGH/LOW FIO₂ KIT

For specialized research or clinical protocols, the Quark system supports testing under enriched or reduced oxygen environments. This high/low FIO₂ option is particularly useful in applications such as high-altitude simulation, Eucapnic Voluntary Hyperventilation testing, hypoxia training, pulmonary rehabilitation, or VO₂ kinetics analysis under variable oxygen conditions. Integration is smooth and monitored through OMNIA, ensuring safety and measurement consistency.

METABOLIC SIMULATOR

Validates system performance through adjustable simulated breathing and gas exchange, ensuring consistent accuracy in clinical and research environments.

DIAGNOSTIC-QUALITY ECG DEVICES

COSMED ECG systems include 12-lead wired and wireless configurations for high-fidelity cardiac monitoring, ST-segment evaluation, and arrhythmia detection. A single-lead chest strap ECG is also available for simplified data collection during routine CPET. All configurations offer full integration with OMNIA software.

INTEGRATED OXIMETRY

SpO₂ is continuously monitored during exercise using the Nonin® Xpod pulse oximeter, with multiple probe types available for adult and pediatric applications. The Nonin® WristOx 3150 offers accurate oximetry ideal for walk tests, oxygen titration studies, and overnight monitoring, with full data integration into the OMNIA platform.

BLOOD PRESSURE MONITORING

The SunTech® Tango M2 is designed specifically for exercise testing, providing accurate, motion-tolerant blood pressure readings during CPET or stress tests.

CARDIAC OUTPUT MEASUREMENT

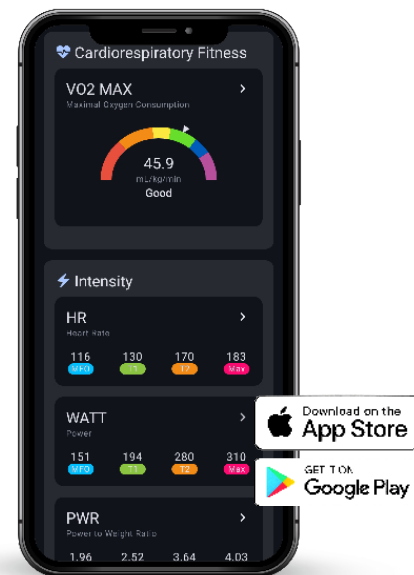
PhysioFlow® Q-Link™ and Enduro™ systems offer non-invasive, real-time cardiac output monitoring. These portable, battery-operated devices are optimized for use during exercise, providing reliable stroke volume and heart rate data for hemodynamic profiling.

MY NRG APP

My NRG App is a COSMED free app to retrieve metabolic data collected during CPET and REE tests. Results, collected by simply scanning a QR code, can be stored into a personal database or synced with applications such as HealthKit® and Google Fit™.

MODULAR CARTS

A selection of medical-grade and standard carts, with optional isolation transformers (230/120V), supports system mobility and safety. All models accommodate gas cylinders and dual monitors.



COSMED My NRG App



COSMED Q-12 – 12-Lead ECG



COSMED Q-Beat – Single-Lead ECG



Blood Pressure Monitor (Tango®)



Cardiac Output Monitor (Physioflow®)



COSMED Metabolic Simulator is an advanced verification tool to simulate human subject gas exchange and respiratory pattern for both clinical and research settings

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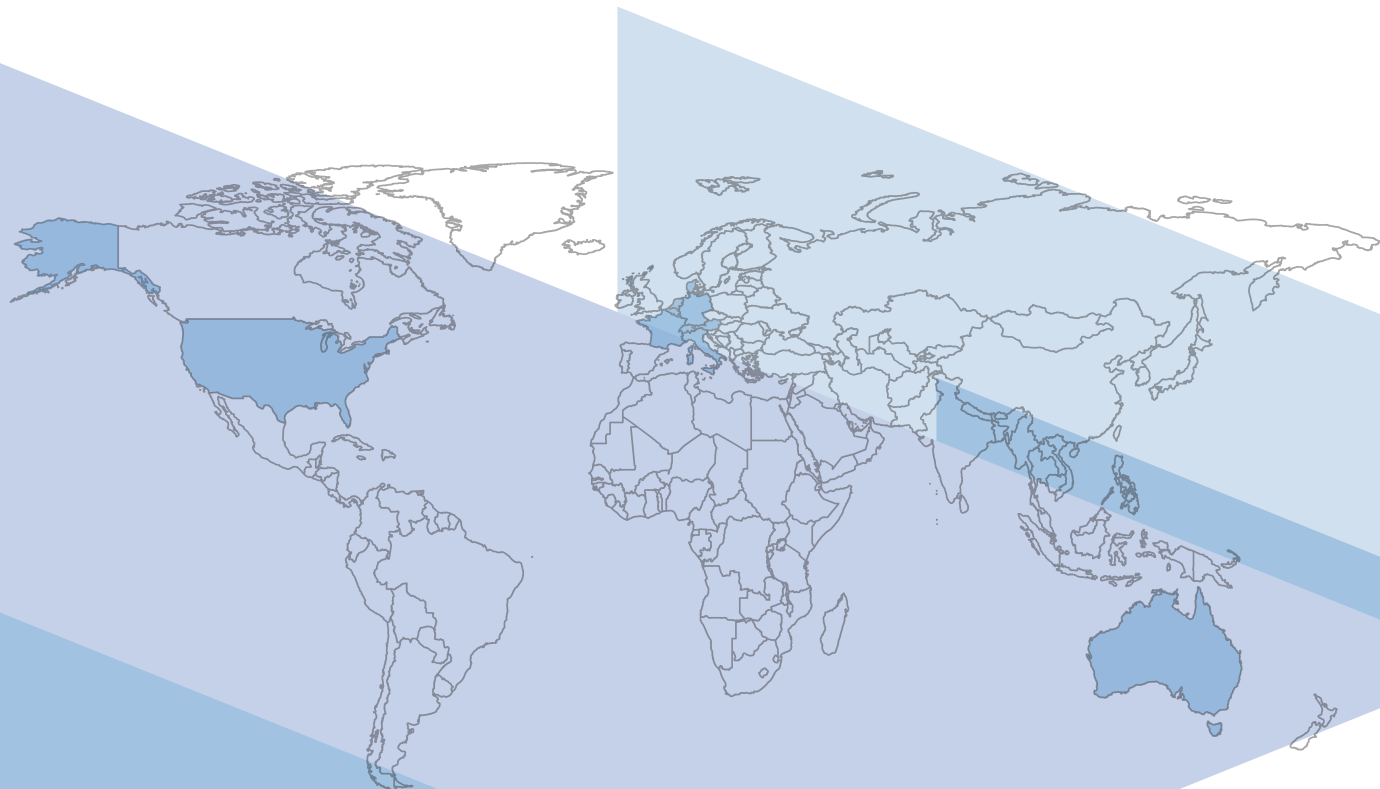
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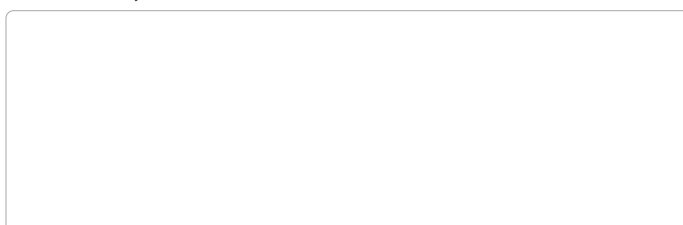
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To know more



COSMED Quark RMR is a medical device.

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