Agilent 8800 ICP-QQQ

Technology Transformed
Performance Redefined

Specifications

Agilent 8800 ICP-QQQ hardware and performance specifications

The Agilent 8800 ICP-QQQ is the world's first and only triple quadrupole ICP-MS — a truly ground-breaking instrument that transforms the ICP-MS landscape.

The 8800 ICP-QQQ combines the proven matrix tolerance and dynamic range capabilities of the 7700 Series ICP-MS with the incomparable power of MS/MS for interference removal. The result is a unique analytical tool that can handle even the most difficult samples and applications with ease.

Agilent Technologies

8800 ICP-QQQ technical and performance highlights include:

- Unique tandem mass spectrometer configuration
- Innovative MS/MS mode for unprecedented interference removal in the collision/reaction cell
- Optimized vacuum system gives higher signal to noise than conventional quadrupole ICP-MS
- The highest abundance sensitivity ever seen in ICP-MS (theoretically $<10^{-14}$)
- Many critical hardware components and ICP-MS MassHunter software platform shared with the proven 7700 Series ICP-MS

Agilent 8800 ICP-QQQ overview

ICP-QQQ: redefining ICP-MS performance

The revolutionary Agilent 8800 Triple Quadrupole ICP-MS (ICP-QQQ) combines the proven capabilities of the 7700 Series quadrupole ICP-MS (ICP-QMS) with the unique performance of MS/MS, only possible on a true tandem MS instrument.

The term "triple quadrupole" is used in organic mass spectrometry to describe instruments with two separate quadrupole mass filters in series, separated by a chamber (or cell) housing an ion guide, where collision and reaction processes take place.

The collision/reaction cell may contain one of several different types of ion guide (quadrupole, hexapole, or octopole), but according to convention, instruments that contain any of these ion guides are commonly referred to as "triple quadrupole" mass spectrometers. The key aspect of the triple quadrupole configuration is that all such instruments possess two separate mass filters, one before and one after the collision/reaction cell. In ICP-MS, this configuration is unique to the 8800 ICP-QQQ.

The triple quad configuration of the Agilent 8800 ICP-QQQ offers fundamentally improved performance for interference removal in the collision/reaction cell, particularly in reaction mode.

Collision mode in ICP-QMS (using He cell gas) is effective in removing polyatomic interferences in high matrix samples. However He mode cannot provide complete removal of intense interferences on some key analytes such as P, S and Se, or enable ppt-level analysis in high-purity materials. For high-purity materials analysis using ICP-QMS, reaction mode (using a reactive cell gas) can be more effective than He mode for certain analytes.

But reaction mode on ICP-QMS often gives erratic results due to the inability to reject non-target ions prior to the cell. This leads to the formation of unpredictable, sample-dependent product ions from the variable reaction processes in the cell, especially when matrices are complex or variable. The Agilent 8800 ICP-QQQ solves these problems, enabling reaction mode to be used to its full potential.

Agilent 8800 ICP-QQQ operating modes

The 8800 ICP-QQQ can operate in three distinct modes, determined by the mass range transmitted by Q1:

- Single quad mode with Q1 acting as a simple ion guide, allowing all masses to pass to the cell (SQ Ion Guide)
- Single quad mode with Q1 acting as a bandpass filter (SQ Bandpass), where the mass range transmitted through Q1 varies with the Q2 set mass
- MS/MS mode where Q1 operates as a 1 amu mass filter (MS/MS). This mode is unique to the tandem MS configuration of the 8800 ICP-QQQ

The unique power of MS/MS mode

Unparalleled accuracy

MS/MS mode on the 8800 ICP-QQQ unleashes the full power of reaction chemistry by eliminating the variability associated with reaction mode on quadrupole ICP-MS systems.

With ICP-MS/MS, the first quadrupole rejects all ions apart from the target mass, which ensures that the composition of the ion beam entering the cell is consistent. This controls the interference removal processes in reaction mode, which results in more accurate and reliable data — regardless of sample type.

Flexible MS/MS acquisition

In addition to the normal MS/MS acquisition mode where, for each analyte, Q1 is set to the target precursor ion mass and Q2 is set to the target product ion mass, the 8800 ICP-QQQ also provides three unique MS/MS research modes. These modes extend ICP-QQQ performance beyond the range of conventional ICP-QMS, provide unmatched insight into fundamental reaction processes, and are invaluable for method development:

- **Precursor Ion Scan**—Q1 scans a user-defined mass range, while Q2 is set to a single fixed mass, measuring all the reaction product ions at that mass, formed from the different ions entering the cell as Q1 scans the mass range
- **Product Ion Scan**—Q1 is set to a fixed precursor ion mass, while Q2 scans a user-defined mass range, to measure all reaction product ions formed from that single precursor ion
- **Neutral Gain Scan**—Q1 and Q2 scan together, a fixed mass-shift apart. For example Q2 scans at Q1+16 amu for O-atom addition reactions

Incomparable performance

The 8800 ICP-QQQ also sets new performance benchmarks in no gas mode and collision mode, with much higher signal to noise than ICP-QMS. Moreover, MS/MS on the 8800 ICP-QQQ delivers the best abundance sensitivity ever seen in ICP-MS (specification of $<10^{-10}$; theoretically $<10^{-14}$), further improving data integrity in high matrix samples.

Total flexibility

Although designed and engineered to satisfy the demands of high throughput routine laboratories, the 8800 ICP-QQQ also offers complete flexibility in operation, making it a perfect research instrument. An array of advanced MS/MS acquisition modes is available, enabling unprecedented insight into reaction processes, as well as supporting advanced method development and operation.

Auto-optimization and pre-set methods

Despite its extraordinary performance and incomparable flexibility, the 8800 ICP-QQQ remains a powerful and easy-to-use workhorse for routine analysis. Productivity tools that have been proven in the 7700 Series ICP-MS are also included in the 8800 ICP-QQQ:

- **One-Click Plasma Setting** is provided, for simpler, more reproducible plasma optimization. Agilent's unique High Matrix Introduction (HMI) capability is included as standard on every 8800 ICP-QQQ, and the 8800 ICP-QQQ semiconductor configuration includes pre-set plasma conditions for cool plasma as well as normal hot plasma operation.
- **Expert AutoTuning** delivers faster, more consistent tuning, giving reproducible instrument performance, even with multiple operators. One-touch torch positioning and tool-free removal and refitting of the sampling cone speed up routine maintenance.
- **Built-in Pre-set Method templates** deliver proven instrument conditions and acquisition parameters for a range of common sample types and applications.

Reduced operating costs

Many consumables are common to both the 8800 ICP-QQQ and 7700 Series ICP-MS, and many critical components are shared across both platforms. This means that components have been field-proven in the busiest commercial and research laboratories. It also ensures ready availability of spares, reduced service contract prices, and fast service response that is geared to the demands of busy routine laboratories. The 8800 ICP-QQQ also benefits from a low exhaust flow rate, giving lower lab preparation costs, especially important in clean rooms.

The 8800 ICP-QQQ uses Agilent's ICP-MS MassHunter software, providing consistency with the 7700 Series ICP-MS operating software. The MassHunter software platform is also similar across Agilent's LC/MS and GC/MS systems, simplifying and reducing the cost of staff training.

Significantly smaller footprint

At only 1060 mm wide and 143 kg, the 8800 ICP-QQQ is significantly smaller and much lighter than some conventional quadrupole ICP-MS systems — saving on valuable bench space, minimizing shipping costs and simplifying lab planning.

Reduced environmental impact

Stainless steel panels are used throughout the cabinet, reducing the amount of paint and harmful chemicals used during manufacturing.

Agilent is committed to eliminating toxic compounds from electronic components, promoting recyclability of plastics, and using recycled packing materials.

The advanced engineering of the 8800 ICP-QQQ ensures small cabinet size and low weight, which minimizes the environmental impact due to shipping.

Model selection guide

Agilent 8800 ICP-QQQ

Exceptional flexibility in a mainframe engineered for routine use.

The standard 8800 ICP-QQQ (option #100) includes four argon gas line mass flow controllers plus a fifth option gas line for addition of alternative gases such as O_2:Ar for organics, or He carrier for laser ablation.

HMI capability is standard on the 8800 ICP-QQQ, reducing sample preparation time and costs by significantly increasing matrix tolerance for the direct analysis of % level total dissolved solids (TDS) samples.

Pre-set Plasma Conditions allow consistent setup from day to day and between operators — essential for reliable data quality in high throughput labs. Optimum plasma conditions are simply selected using One-click Plasma Setting.

The combination of HMI and Pre-set tuning conditions simplifies setup for variable samples while delivering consistently accurate results and superior performance in routine applications.

All 8800 ICP-QQQ systems feature the Agilent's third generation octopole reaction system (ORS^3) with four cell gas lines, providing the ultimate combination of He collision mode and a range of flexible reaction modes suitable for all analytes and sample types.

The ORS^3 significantly improves cell performance in collision (He) and reaction mode. On the 8800 ICP-QQQ, variable bias voltages provide flexible control of ion energies, which opens new avenues in studies of ion-molecule reaction thermodynamics.

The triple quad configuration of the 8800 ICP-QQQ supports MS/MS operation, simplifying method development in reaction mode, and enabling routine analysis using highly reactive cell gases, a first for ICP-MS.

Agilent 8800 ICP-QQQ – semiconductor option

The Agilent 8800 ICP-QQQ semiconductor configuration (option #200) uses the same instrument hardware configuration as the standard model, but replaces the sample introduction, interface cones and ion lens system with versions suitable for very high sensitivity measurement of high purity chemicals.

The standard glass concentric nebulizer is replaced with a high efficiency PFA nebulizer; the standard nickel interface cones are replaced with Pt-tipped interface cones; and the standard matrix tolerant ion lens is replaced with a high-transmission ion lens. These changes provide significantly higher sensitivity suitable for the ultra-trace analysis of high-purity semiconductor reagents. All other parts of the instrument are the same as the standard configuration (option #100).

The 8800 ICP-QQQ semiconductor version includes methods, tuning and acquisition templates to simplify operation for all typical semiconductor applications.

Specifications

Sample introduction system

The standard sample introduction system includes an efficient, low-flow concentric nebulizer, a temperature-controlled spray chamber and a high precision, 10-roller peristaltic pump. All components are optimized for high throughput routine analyses of samples with TDS up to 0.2% (2000 ppm).

Nebulizer

Concentric nebulizer, made from glass (on the standard 8800 ICP-QQQ) or PFA (on the 8800 ICP-QQQ semiconductor configuration) with low sample flow rate as standard (~0.2 mL/min).

Spray chamber

Quartz, low-volume, Scott-type double-pass spray chamber, provides improved removal of larger aerosol droplets, compared to cyclonic or impact-bead designs. Peltier-cooling eliminates the need for a separate external cooling water supply.

- Controlled temperature range: -5 °C to +20 °C (with instrument cooling water at 15–30 °C)

Peristaltic pump

Low-pulsation, high-precision 10-roller peristaltic pump, with three separate channels, for precise delivery of sample and internal standard (ISTD), plus spray chamber drain.

High matrix introduction capability

Agilent's patented HMI Aerosol Dilution technology is standard on the 8800 ICP-QQQ, extending the TDS range to % level, while eliminating the added costs, time and potential errors of conventional liquid dilution.

Plasma

RF generator

High power-transfer efficiency and maintenance-free solid state digital drive 27 MHz RF generator with variable-frequency impedance matching. Provides significantly improved tolerance of changes in sample matrix; even highly volatile organic solvents can be introduced without affecting plasma stability.

- RF power range: 500 W to 1600 W
- Step size 10 W

Torch

Easy-mount, one-piece quartz torch with 2.5 mm internal diameter (i.d.) injector. The exceptionally wide torch injector supports the industry's most robust plasma, to efficiently decompose the sample matrix. This minimizes matrix deposition on the interface and ion lens, reducing signal drift and minimizing routine maintenance.
The torch self-aligns in x and y-directions within the mounting bracket, ensuring consistent repositioning following routine maintenance or when switching between torches.

Plasma gas control

The 8800 ICP-QQQ includes a four channel Agilent mass flow controller (AMFC) for precise and stable control of argon gas flows:

- Plasma (cool) gas
- Auxiliary gas
- Nebulizer gas
- Make-up or dilution (HMI) gas

A further AMFC channel controls a 5th gas flow for option gas addition, such as for organic solvent analysis (using a blend of O_2 in Ar) or Laser Ablation (He carrier gas).

Torch position

Stepper-motor controlled in three axes (horizontal, vertical and sampling depth), with a step size of 0.1 mm. Expert AutoTuning delivers quick and reliable auto-alignment following maintenance.

- Horizontal and vertical position: ±2 mm
- Sampling depth: 3 to 28 mm (~18 mm is essential for superior Cool Plasma performance)

ShieldTorch system

Agilent's unique Shield Torch System (STS) reduces plasma potential and thereby precisely controls ion energy — essential for tuning stability, optimum cell performance and for effective cool plasma operation.

Interface

Sampling cone

1 mm diameter orifice, Cu base with Ni tip (standard 8800 ICP-QQQ) or Pt tip (8800 ICP-QQQ semiconductor configuration). Easy access to the interface region for routine maintenance; no tools are required for removal/refitting of sampling cone. The sampling cone-retaining ring insures reliable thermal contact and reproducible fitting, even with different operators, giving dependable long-term performance.

Skimmer cone

0.4 mm diameter orifice, Ni (standard 8800 ICP-QQQ) or Pt-tipped/Cu base (8800 ICP-QQQ semiconductor configuration). Precisely controlled skimmer tip temperature ensures minimal matrix condensation, providing good tolerance to high matrix samples. Small skimmer orifice reduces matrix contamination of the high vacuum region, reducing maintenance.

Ion lens

The redesigned extraction and off-axis ion lens of the 8800 ICP-QQQ provides high ion transmission (high sensitivity) and low backgrounds, combined with uniform mass response (same sensitivity across the mass range).

The lens is in front of the gate valve, and so can be accessed easily for scheduled cleaning, without venting the vacuum system.

Extraction lens

Positioned behind the skimmer cone, the extraction lens focuses the ions as they enter the intermediate vacuum stage, providing high ion transmission across the mass range. The lens operates at fixed voltage for simple, reliable tuning and superior matrix tolerance.

Off-axis Omega lens

Protects the first quadrupole (Q1), ORS^3, and high vacuum region from contamination, by rejecting neutral species from the ion beam. The low voltage of this deflector lens contributes to the minimal mass bias and low background noise characteristics of the 8800 ICP-QQQ.

Octopole reaction system

The 8800 ICP-QQQ incorporates a new, 3rd generation collision/reaction cell, the ORS^3, which provides exceptional interference removal. The ORS^3 is longer and narrower than the previous ORS cell used on Agilent's 7500 Series ICP-QMS, and operates at higher frequency, higher cell gas pressure and higher kinetic energy discrimination (KED) bias voltage. This delivers improved performance in He mode, ensuring the 8800 ICP-QQQ can perform superbly in collision mode as well as reaction mode.

Octopole

Comprises a thermally-stabilized cell with 12 MHz octopole ion guide operated with fixed RF amplitude for the full mass range. Permits fast analysis with uniform conditions, for stability and consistent interference removal. An octopole ion guide minimizes ion scattering at high cell pressures providing high ion transmission and sensitivity.

Cell gas control

The 8800 ICP-QQQ has four cell gas flow controllers as standard:

- Maximum flow rate of 12 mL per minute (typically used for He cell gas)
- Maximum flow of 10 mL/min (typically used for H_2)
- Maximum flow of 10 mL/min, corrosive gas resistant (typically used for NH_3 in He)
- Maximum flow of 1 mL/min (typically used for heavier reaction gases such as O_2)

This combination of cell gas controllers on the 8800 ICP-QQQ ORS^3 provides unparalleled flexibility to ensure optimum performance can be achieved for all applications, while also facilitating method development and research into reaction processes.

The different cell gas modes can easily be acquired sequentially in one visit to the sample, enabling easy comparison of data from different modes. Cell gas changes occur automatically and with minimal switching time (~5 sec), due to the low internal volume of the octopole-based cell.

Mass analyzers

The 8800 ICP-QQQ's tandem mass spectrometer configuration incorporates two Agilent-manufactured quadrupole mass analyzers, each with the optimum hyperbolic rod profile and both operating at high (3 MHz) frequency.

A hyperbolic profile quadrupole provides superior ion transmission, resolution and abundance sensitivity at standard settings, so eliminating the need for multiple resolution settings to separate adjacent peaks. Higher operating frequency ensures that ions travelling down the axis of the quadrupole are subjected to more RF cycles and therefore non-target (off-mass) ions are rejected more efficiently.

The first quadrupole mass filter (Q1) is located after the off-axis ion lens, and filters the ions arriving from the plasma, selecting the masses which are allowed to enter the ORS^3. The second quadrupole mass filter (Q2) is located after the ORS^3, and filters the ions that emerge from the collision/reaction cell, selecting only the masses which are passed to the detector.

The primary function of Q1 is to control the ions that are permitted to enter the collision/reaction cell. Pre-filter and post-filter rods control fringing fields and improve rejection of non-target ions.

Each of the two quadrupoles of the 8800 ICP-QQQ has the following performance specifications:

- Mass range: 2–260 amu
- Mass scan speed:
  - Slew rate (Li to U, no intervening peaks): 56.6 million amu/sec
  - Scan speed (Li to U, plus data collection at 40 intervening masses): >3000 amu/sec
- Abundance sensitivity in Single Quad mode (measured at Cs):
  - Low Mass side: 5×10^{-7}
  - High Mass side: 1×10^{-7}

In MS/MS mode, the overall abundance sensitivity (AS) of the ICP-QQQ system is derived from the product of Q1 AS x Q2 AS (so $10^{-7} \times 10^{-7} = 10^{-14}$). However, this is impossible to measure in practice, as the signal difference exceeds the dynamic range of the detector. The guaranteed AS performance specification for the 8800 ICP-QQQ in MS/MS mode is 10^{-10}.

Detector

Electron multiplier detector

Unique, auto-switching, dual-mode discrete dynode electron multiplier (DDEM) detector provides a full nine orders dynamic range with standard hardware and operating conditions.

Fast measurement of transient signals is provided (with a 3 ms TRA sweep time, as required for single nanoparticle analysis), due to the use of a proprietary analog amplifier, which operates at the same short integration time (100 µs) in both pulse and analog mode.

- Minimum dwell time: 100 µsec
- Dynamic range: 9 orders

Vacuum system

Four-stage differential vacuum system using one split-flow turbo molecular pump, a second turbo pump for the ORS^3 chamber, and a single external rotary pump for fast pump-down and simple maintenance. The vacuum pumping efficiency of the 8800 ICP-QQQ has been enhanced, contributing to the very high ion transmission and high sensitivity.

Unique AutoRecover mode returns the 8800 ICP-QQQ to standby (pumping) state when electrical power is resumed after a power failure, saving valuable time. No need to manually start the vacuum system following an overnight power failure.

The rotary pump is external to the cabinet and so can be located conveniently in the laboratory, or in an external service corridor (may require the extended 3 m vacuum hose option). The rotary pump hose on the Agilent 8800 ICP-QQQ is chemically inert for superior resistance to highly corrosive acids.

Software

Agilent's ICP-MS MassHunter Workstation software provides comprehensive functionality and ease-of-use features for the 8800 ICP-QQQ. With simplified Expert AutoTuning, extensive use of Pre-set methods and powerful context-sensitive help, even novice operators will quickly be producing reliable and consistent results. MassHunter includes:

- Pre-defined acquisition modes for precursor ion scan, product ion scan and neutral gain scan, to help with QQQ method development
- Batch-at-a Glance interactive data table with real-time update, including all sample data, ISTD/QC signal trend and calibration curves
- Built-in outlier and LabQC checks
- Fast, simple data report layout and export to Microsoft® Excel (provided with MassHunter software), or export to LIMS for final reporting

MassHunter Data Analysis is common to all Agilent MS platforms, so simplifying cross-training of staff, and reducing training costs.

Optional software

The power of ICP-MS MassHunter can be extended through a choice of software options.

User access control

Provides multi-level user logon control for enhanced security and audit, with three levels of access authority, record of user name, operating system lock and more.

Together with Agilent's Spectroscopy Database Administrator (SDA), DataStore, or OpenLab Enterprise Content Manager (ECM), ICP-MS MassHunter with User Access Control satisfies compliance requirements of the US FDA's 21 CFR Part 11.

Chromatographic software

Fully integrated LC or GC module control, method setup, and chromatographic data analysis tools for analysis of samples using LC- or GC-ICP-MS. Permits system configuration, method setup, single-PC sequencing, automatic recalibrations, retention time and ion ratio updates, Compound Independent Calibration, Snapshot, automated report generation and more.

Accessories and peripherals

Agilent offers a full range of configurable accessories and peripherals for the 8800 ICP-QQQ.

Agilent integrated autosampler (I-AS)

A compact, fully-integrated autosampler with cover and pumped rinse station. Ideal for ultra-trace analysis and small sample volumes (0.5 mL), and with flexible rack configurations offering maximum capacity of 89 vials, plus three rinse vials.

Integrated sample introduction system for discrete sampling (ISIS-DS)

ISIS-DS delivers reduced matrix loading and improved productivity in high-throughput laboratories. In addition to DS, ISIS can be configured for low-pressure chromatography, hydride generation, matrix elimination and more.

Parallel-path nebulizer (MiraMist)

Suitable for samples containing suspended particulates. Available in PTFE or PEEK.

Inert (HF-resistant) kit

O-ring-free, PFA sample introduction kit provides lowest contamination levels for the determination of sub-ppt level impurities in high-purity reagents. The kit includes a demountable torch with platinum or sapphire injector.

Organic solvent introduction kit

Includes proprietary narrow-injector torch, and solvent-resistant sample introduction parts required for the direct analysis of volatile organic solvents.

LC-ICP-QQQ speciation kits

Includes all necessary tubing, connectors and cables for seamless interfacing of an Agilent LC to the 8800 ICP-QQQ. Pre-configured kits are available, with column, connectors and methodology for the turn-key analysis of As species in urine and waters, and Cr species in water.

GC-ICP-QQQ interface

Connects an Agilent 7890 GC to the 8800 ICP-QQQ. Unique, fully heated, inert (Sulfinert-lined), flexible transfer line and demountable torch with heated injector. The transfer line can be heated to 300 °C, eliminating connections and cold spots to enable routine analysis of labile and high boiling point compounds.

Laser ablation

The 8800 ICP-QQQ can be integrated with any commercially available laser ablation system for the direct analysis of solid samples. With its robust plasma, high sensitivity, low backgrounds, fast simultaneous detector and nine orders dynamic range, the 8800 ICP-QQQ is ideally suited to measuring both transient and steady-state signals from laser ablation.

Support and training

Agilent is renowned for producing reliable, high quality and highly productive ICP-MS systems with low cost of ownership and expert applications and service support.

Wherever you are located, if you need support with hardware, software or applications, Agilent has a global network of factory-trained ICP-MS specialists ready to help. Services include:

- Preventive maintenance (PM) to deliver consistent operation and minimize downtime
- Troubleshooting, maintenance and repair
- Software support services
- Compliance services including IQ and OQ of both ICP-MS hardware and software
- Comprehensive warranty extension and service contracts, including peripherals and coupled LC/GC systems
- Class room training and on-site training delivered by experts

The Agilent value promise

10 years of guaranteed value. In addition to continually evolving products, we offer something else unique to the industry — our 10-year value guarantee. The Agilent Value Promise guarantees you at least 10 years of instrument use from date of purchase, or we will credit you with the residual value of the system toward an upgraded model. Not only does Agilent offer a safe initial purchase, we ensure your investment is as valuable to you long-term.

The Agilent service guarantee

Should your Agilent instrument require service while covered by an Agilent service agreement, we guarantee repair or we will replace your instrument for free. No other manufacturer or service provider offers this level of commitment to keeping your laboratory running at maximum productivity.

For more information

Visit www.agilent.com/chem/icpqqq.

Or call 1-800-227-9770 (in the U.S. and Canada) for a free information pack. In other countries, please call your local Agilent representative or your Agilent Authorized Distributor.

Site service requirements and safety

Dimensions		
Mainframe	Width	1060 mm (42 in) (main cabinet, excluding peripump)
	Depth	620 mm (24 in) (main cabinet, excluding power cord)
	Height	595 mm (23 in) (main cabinet, excluding exhaust chimney)
	Weight	143 kg (315 lb)
Largest shipping container	Width	1510 mm (60 in)
	Depth	1080 mm (43 in)
	Height	1030 mm (41 in)
	Weight	173 kg (382 lb)

Environmental		
Operating temperature	Range	15–30 °C
	Rate of change	<2 °C/hr (max. change 5 °C)
Operating humidity	Range	20% to 80% (non condensing)

Utility		
Electricity supply	Voltage	Single Phase, 200–240 V, 50/60 Hz
	Current	30 A
Cooling water	Inlet temperature	15–40 °C
	Minimum flow rate	5 L/min
	Inlet pressure	230–400 kPa (33–58 psi)
Argon gas supply	Minimum purity	99.99%
	Maximum flow rate	20 L/min
	Supply pressure	500–700 kPa (73–102 psi)
Cell gas supply	Minimum purity	99.99%
	Maximum flow rate	12 mL/min for He 10 mL/min for H_2, NH_3/He 1 mL/min for low-flow cell gas (e.g. O_2)
	Supply pressure	90–130 kPa (13–18.8 psi) for He 20–60 kPa (2.9–8.7 psi) for H_2, O_2, NH_3/He
Exhaust duct	Vent type	Single vent, 150 mm diameter
	Flow rate	5–7 m^3/min

Regulatory compliance

Safety	IEC 61010-1:2001 / EN 61010-1:2001, CAN/CSA C22.2 No.61010-1-04,UL No.61010-1
EMC	IEC 61326-1:2005 / EN61326-1:2006, ICES-001:2006, AS/NZS CISPR 11:2004
ISO	Manufactured at an ISO 9001 and ISO 14001 certified facility

Hardware configuration for standard 8800 ICP-QQQ mainframe (#100) and semiconductor configuration (#200)

	Standard (#100)	Semiconductor (#200)
Nebulizer (concentric)	MicroMist (borosilicate glass)	MicroFlow MFN 100 (PFA)
Spray chamber (Scott double-pass)	Quartz	Quartz
Torch (with ShieldTorch system)	Quartz, 2.5 mm ID Injector	Quartz, 2.5 mm ID Injector
Plasma mass flow controllers (Ar)	4	4
Additional (5^{th}) gas line for alternative carrier gas, such as Ar/O_2 for organics, or He for laser	Included	Included
High Matrix Introduction (HMI) capability	Included	Included
Interface Cones	Ni (stainless steel skimmer base)	Pt (brass skimmer base)
Ion Lens Type	x-Lens	s-Lens
Collision/reaction cell gas lines: one for He (max. 12 mL/min), two high-flow (max. 10 mL/min), one low-flow (max. 1 mL/min)	4	4

Guaranteed performance for standard 8800 ICP-QQQ mainframe (#100) and semiconductor configuration (#200)

For each specification, the actual instrument factory test data or Certificate of Guaranteed Performance is included with every 8800 ICP-QQQ instrument.

Specification	Units	Element/Ratio	8800 ICP-QQQ #100	8800 ICP-QQQ #200
Sensitivity	Mcps/ppm	Li (7)	100	100
	Mcps/ppm	Co (59)	N/A	40 (cool plasma)
	Mcps/ppm	Y (89)	350	700
	Mcps/ppm	Tl (205)	200	250
Background	cps	No gas	0.2 (9, 238)	0.2 (9, 238)
Oxide ratio	%	CeO^+/Ce^+	1.5	3
Doubly-charged ratio	%	Ce^{++}/Ce^+	3	6
No gas mode DL	ppt	Be (9)	0.1	0.1
	ppt	Fe (56)	N/A	2 (cool plasma)
	ppt	In (115)	0.05	0.05
	ppt	U (238)	0.05	0.05
He mode DL+	ppt	As (75)	20	N/A
	ppt	Se (78)	40	N/A
H2 mode DL*	ppt	Fe (56)	N/A	3
	ppt	Se (78)	1	1
O2 mode DL*	ppt	S (as SO^+)	200	200
	ppt	P (as PO^+)	50	50
Short term stability (20min.)*	%RSD	Li, Y, Tl	<3	<3
Long term stability (2hr)*	%RSD (%Drift)	Li, Y, Tl	<3 (4%)	<3 (4%)
Isotope ratio precision*	%RSD	$^{107}Ag/^{109}Ag$	<0.2	<0.2
Abundance sensitivity*	M-1/M, M+1/M	Cs (m=133)	$1x10^{-10}$ (L, H)	$1x10^{-10}$ (L, H)

+ Note 1: He mode DLs are performed in a matrix of 100 ppm Ca and 2% HCl.
* Note 2: Tests marked * are performed in MS/MS scan mode. All other tests performed in single-quad mode.

www.agilent.com/chem

Published May 13, 2013
Publication number: 5991-2447EN

Agilent Technologies