

# Agilent Cary 635 FTIR Spectrometer

A modular system inspired by real-world applications





## The Cary 635 FTIR spectrometer – modularity built for you

Fourier transform infrared spectroscopy (FTIR) is a key analytical technique, employed in labs worldwide for its versatility, simplicity, and ability to rapidly provide qualitative and quantitative information with minimal sample preparation.

The [Agilent Cary 635 FTIR Spectrometer](#) provides outstanding reliability, robustness, and performance. The instrument is easy to use and requires little to no technical training, supporting applications and analyses ranging from routine to sophisticated. Obtain high-throughput, high-quality results in an ultracompact, affordable, and simple-to-use package.

### Cary 635 FTIR components: 5-10-10-year warranty

Engineered for durability and precision, the spectrometer is backed by a 5-year warranty on the light source, as well as 10-year warranties on the interferometer and the laser diode.



# A versatile solution ready to meet your analytical needs

Readily configure the Cary 635 FTIR spectrometer with a wide variety of [sampling modules](#), allowing you to achieve optimal analysis in each and every task.



## Benefits of the modular design:



**Easily handle a range of sample types.** The unparalleled flexibility of each module facilitates the accurate analysis of solids, liquids, powders, and gases.



**Optimize performance for any analysis.** The modules are engineered specifically for use with the Cary 635 FTIR engine, ensuring high-level performance across applications. A large 25 mm optical aperture and short internal optical path provide performance levels associated with far larger lab FTIR systems.



**Rapidly adapt to changing needs.** The Cary 635 FTIR can be reconfigured in just seconds to meet real-world challenges in real time. Simply click the module to the front of the engine.



**Experience unparalleled simplicity.** This easy-to-use, intuitive instrument cuts training costs and reduces user variability. Permanently aligned optics require zero user alignment when changing modules.

The modules are automatically recognized by the [Agilent MicroLab software](#) using radio frequency identification (RFID). The software then applies all relevant parameters without any user intervention. The MicroLab software provides step-by-step guidance with instructive, sampling module-specific pictures for easy navigation through the entire analytical workflow.



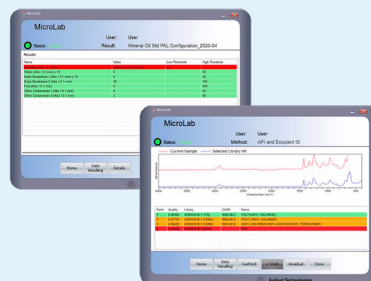
1

Start the analysis



2

Follow picture-driven software guidance



3

Instantly receive color-coded, actionable results

# Configure your Cary 635 FTIR solution

Tailored to meet your evolving needs, the Cary 635 FTIR sampling modules and accessories are fully interchangeable, ensuring access to a range of analytical applications.





## Available components:

### Cary 635 FTIR engines

The engine is the heart of the Cary 635 FTIR spectrometer and houses key optical elements, such as the interferometer, laser, light source, and detector. The Cary 635 FTIR sampling modules easily attach to the front of the engine. The sampling accessories swap out seamlessly and merge with the optical-mechanical system, offering excellent performance, simplicity, and flexibility for high-traffic labs.

The following engine options are available:

#### Zinc selenite (ZnSe) optics

The Agilent Cary 635 FTIR engine with ZnSe optics offers a spectral range that is suitable for most FTIR applications. ZnSe is inert to moisture, which allows for instrument operation even in humid environments.

Spectral range: 5,100 to 600  $\text{cm}^{-1}$

#### Potassium bromide (KBr) optics

The Agilent Cary 635 FTIR engine with KBr optics offers a broader spectral range for specific applications. KBr is susceptible to moisture and therefore requires operation in a humidity-controlled environment.

Spectral range: 7,000 to 350  $\text{cm}^{-1}$



## Transmission sampling modules

### Transmission module

The Agilent transmission module for the Cary 635 FTIR spectrometer acts as a traditional FTIR sample interface, where infrared light passes through the sample and the transmitted light is collected by the instrument detector. Transmission FTIR is a versatile analytical technique capable of analyzing a diverse range of sample types. The transmission module includes a card slide mount holder designed to accommodate various samples and sampling devices. Certain samples, such as polymer films or self-supporting materials, can be measured directly using the card slide mount holder in the transmission module, while other samples may necessitate preparation prior to analysis.

Liquid samples can be analyzed using demountable liquid cells with defined optical pathlengths or as small drops placed between salt plates. Powders are commonly mixed with KBr salt and pressed into thin pellets for measurement. Alternatively, powders can be blended with a few drops of Nujol to form a mull, which is then positioned between salt plates for transmission measurement. Transmission measurements of gases or vapors use specialized gas cells.

Each of these sampling methods may require specific holders, all of which can be seamlessly integrated into the Cary 635 FTIR transmission module.



## DialPath module

The unique technology of the Agilent DialPath module overcomes the challenges of transmission measurements of liquids, making these measurements as easy as using attenuated total reflectance (ATR). Perform fixed-pathlength transmission measurements of liquids without a conventional infrared flow or demountable cell—eliminating leaking cells, bubbles, inaccurate pathlengths, and complex cleaning. Using the DialPath module, a small drop of a liquid sample is placed on the sample window in the DialPath's open position. To perform a measurement, the DialPath head is rotated to select ("dial in") the fixed pathlength required.

Available in three preset pathlengths, the accessory can measure multiple peaks of varying intensity in the same sample in a single analysis with no need for dilution. This versatility supports both qualitative library matching and quantitative analysis across a wide range of concentrations and peak intensities. Additionally, this accessory is useful for the measurement of polymer thin films.

| Module           | Wavelength Range              | Effective Pathlength                                                                                           | Sample Type                                                                        |
|------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| DialPath Modules | 5,100 to 600 cm <sup>-1</sup> | 30, 50, 100 µm (± 0.25 µm repeatability)<br>50, 100, 200 µm (± 0.25 µm repeatability)<br>Custom up to 1,000 µm | Liquids (varying viscosities and volatilities), thin polymer films (< 50 µm thick) |



## TumblIR modules

The Agilent TumbIR modules use the same technology as the DialPath modules. This module is the best solution when only one fixed pathlength is needed.

| Module         | Wavelength Range              | Effective Pathlength           | Sample Type                                                                                               |
|----------------|-------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------|
| TumbIR Modules | 5,100 to 600 cm <sup>-1</sup> | Fixed between 100 and 1,000 µm | Liquids (varying viscosities and volatilities), thin polymer films (< 50 µm thick); oil and fuel analysis |



## Additional reading

Technical overview:

[DialPath Sampling Accessory](#)

Application notes:

[Fast, Easy, and Reliable Measurements of Liquid Samples Using Transmission FTIR](#)

[Quantitative Analysis of MEA-Triazine Hydrogen Sulfide Scavengers](#)

[Significantly Improved Measurement of Liquid Samples Using the Cary 630 FTIR Spectrometer with DialPath Accessory](#)

# ATR sampling modules

## Single-reflection ATR modules

ATR is the most widely used FTIR sampling method. ATR sampling allows for quick and easy measurement of nearly all sample types, except for gases. The use of single-reflection ATR modules is straightforward. For liquids, adding a small drop covering the ATR sensor suffices. For solids or powders, applying pressure using the swivel press ensures optimal contact with the sensor. Different press tips are available for varying sample types. For measurements of thin films, a spacer can help apply pressure evenly. The 360-degree swivel press facilitates easy sample access and cleaning while maintaining the optimal pressure.

The type of crystal material used determines the pathlength of light traveling into the sample. For the Cary 635 FTIR, the following crystal materials are available:

Diamond (Di) is frequently used due to its physical and chemical resistance. It is suitable for neat or pure substances, including liquids, particulates, powders, and hard materials, as well as strong acids or bases.

Zinc selenide (ZnSe) is a semiconductor-type material that is relatively hard, has a broad wavelength range, and is insoluble in water. It can analyze aqueous solutions with pH values ranging from 5 to 9. Due to the short pathlength of infrared light into the sample, this sensor works well for neat samples that are relatively concentrated or pure. The single-reflection ZnSe module is appropriate for measuring softer materials and viscous liquids.

Germanium (Ge) is a brittle, hard, semimetallic element with a high index of refraction, resulting in a shorter depth of infrared light penetration into the sample. It is suitable for analyzing materials that are highly absorbing or have highly scattering components, such as polymers containing carbon black, O-rings, gaskets, and black rubber tires.



| ATR Module                                        | Wavelength Range                                                                         | Effective Pathlength                                                                                                                       | Sample Type                                                                         |
|---------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Single-Reflection Zinc Selenide (ZnSe) ATR Module | 5,100 to 600 $\text{cm}^{-1}$                                                            | 1.1 $\mu\text{m}$ at 4,000 $\text{cm}^{-1}$<br>2.6 $\mu\text{m}$ at 1,700 $\text{cm}^{-1}$<br>7.3 $\mu\text{m}$ at 600 $\text{cm}^{-1}$    | Neat or concentrated; soft solids, pastes, gels, liquids; not strong acids or bases |
| Single-Reflection Diamond (Di) ATR Module         | 6,300 to 350 $\text{cm}^{-1}$ <sup>a</sup><br>5,100 to 600 $\text{cm}^{-1}$ <sup>b</sup> | 1.1 $\mu\text{m}$ at 4,000 $\text{cm}^{-1}$<br>2.6 $\mu\text{m}$ at 1,700 $\text{cm}^{-1}$<br>7.3 $\mu\text{m}$ at 600 $\text{cm}^{-1}$    | Hard solids, particulates, polymers, pastes, liquids; all pH ranges                 |
| Single-Reflection Germanium (Ge) ATR Module       | 5,100 to 600 $\text{cm}^{-1}$                                                            | 0.15 $\mu\text{m}$ at 4,000 $\text{cm}^{-1}$<br>0.36 $\mu\text{m}$ at 1,700 $\text{cm}^{-1}$<br>1.02 $\mu\text{m}$ at 600 $\text{cm}^{-1}$ | Carbon black-filled polymers                                                        |

<sup>a</sup> with KBr engine, <sup>b</sup> with ZnSe engine

## Multireflection ZnSe ATR module

Compared to single-reflection ATR modules, the Agilent multireflection ZnSe ATR module uses a longer crystal to allow multiple reflections of the light beam. With its increased pathlength, the multireflection ZnSe ATR module delivers unsurpassed sensitivity to measure lower-concentration components in pastes, gels, and liquids. Solutes in diluted or concentrated aqueous solutions (pH 5–9) can also be analyzed. The ZnSe crystal in this module is recessed slightly in its stainless steel holder, making it ideal for analyzing nonviscous liquid samples. This module is not recommended for use with solid materials; therefore, it is not used with a pressure clamp.



| ATR Module                      | Wavelength Range              | Effective Pathlength                                                                                                                      | Sample Type                                                                                             |
|---------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Multireflection ZnSe ATR Module | 5,100 to 600 $\text{cm}^{-1}$ | 5.5 $\mu\text{m}$ at 4,000 $\text{cm}^{-1}$<br>13.0 $\mu\text{m}$ at 1,700 $\text{cm}^{-1}$<br>36.5 $\mu\text{m}$ at 600 $\text{cm}^{-1}$ | Lower-concentration components, more dilute solutions; pastes, gels, liquids; not strong acids or bases |

## Additional reading

Technical overview:

[ATR Sampling Accessories for Agilent Cary 635 FTIR Spectrometers](#)

Application notes:

[Material Identification of Plastics Throughout Their Life Cycle by FTIR Spectroscopy](#)

[Quantification and Chemical Identification of NO<sub>x</sub> Reduction Agent AdBlue \(AUS32\) Using ATR-FTIR](#)

[Fuel Blend Analysis using the Cary 630 Spectrometer and 5 Bounce ZnSe ATR accessory](#)

[Pharmaceutical Packaging Materials Quality Control and USP 661.1 Compliance: Agilent Cary 630 FTIR](#)

# Reflectance sampling modules

## Diffuse reflectance module

The Agilent diffuse reflectance module enables the acquisition of quantitative and qualitative information from powdered or solid samples. This sampling technique is more sensitive than ATR while remaining easy to use. Furthermore, because powdered samples are often mixed with KBr powder for the analysis, the loading of the sample in KBr can be adjusted to obtain the required sensitivity. The diffuse reflectance module uses a four-position sample holder that slides into a slot on the right side of the accessory. The first position of the holder contains a diffuse reflectance gold mirror, which is used for background collection. The other three positions can be used for samples. Both a diffuse gold reference standard and a diffuse polystyrene standard are included with the multiposition sample plate.



| Module                     | Wavelength Range              | Sample Type              |
|----------------------------|-------------------------------|--------------------------|
| Diffuse Reflectance Module | 5,100 to 600 $\text{cm}^{-1}$ | Powders, tablets, solids |



## 45-degree specular reflectance module

Spectral reflectance measurements are generally used for samples designed to reflect light across the IR spectral range from flat surfaces, such as mirrors, glass, windows, and thin-film coatings on highly reflective substrates. The Agilent 45-degree specular reflectance module is intended for measurements of spectral reflectance at an angle and for measurements of relatively thin films on reflective substrates. Easily slide this accessory into the card slide mount holder in the transmission module of the Cary 635 FTIR spectrometer.



| Module                             | Wavelength Range                                                                        | Measurement/Sample Type                                                                        |
|------------------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 45-Deg Specular Reflectance Module | ZnSe system: 5,100 to 600 cm <sup>-1</sup><br>KBr system: 7,000 to 350 cm <sup>-1</sup> | Reflectance at angle; mirrors, glass, windows, and thin-film coatings on reflective substrates |

## 10-degree specular reflectance module

The Agilent 10-degree specular reflectance module is used for IR measurements of near-normal reflectance. Samples are simply placed over the opening on the reflectance module's top plate.



| Module                             | Wavelength Range                                                                        | Measurement/Sample Type                                                                                      |
|------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| 10-Deg Specular Reflectance Module | ZnSe system: 5,100 to 600 cm <sup>-1</sup><br>KBr system: 7,000 to 350 cm <sup>-1</sup> | Reflectance at a near-normal angle; mirrors, glass, windows, and thin-film coatings on reflective substrates |

## Additional reading

Application notes:

[Quantitative Determination of Common Types of Asbestos by Diffuse Reflectance FTIR Using the Agilent Cary 630 Spectrometer](#)

[Quantitative Measurement of Active Pharmaceutical Ingredients Using the Diffuse Reflectance Cary 630 FTIR](#)

[Determining the Effects of Angle on the Infra-red Reflectance Properties of Thin Films in Architectural Glass Using the Agilent Cary 630 FTIR](#)

[Measuring the Reflective Properties of Architectural Glass Using the Agilent Cary 630 FTIR with 10 Degree Specular Reflectance Accessory](#)

Further information:

[Agilent Cary 635 FTIR Spectrometer](#)

[Cary FTIR Sampling Accessories](#)

[Agilent MicroLab Software](#)

[FTIR Analysis & Applications Guide](#)

[FTIR Spectroscopy Basics – FAQ](#)

[Transmission FTIR Spectroscopy](#)

[ATR FTIR Spectroscopy](#)

[Reflectance FTIR Spectroscopy](#)

**To learn more:**

[www.agilent.com/chem/cary635](http://www.agilent.com/chem/cary635)

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