

There are four main commercial terahertz (THz) technologies suitable for industrial use.

Time-domain spectroscopy

Time-domain spectroscopy (TDS) uses a pulsed THz signal activated by a laser.

The transmitter and receiver are fibre-coupled.

Achievable specifications (under optimal conditions):

- Bandwidth: 0.1-6 THz
- Frequency resolution:
 - 0.5 GHz using delay
 - 1.5 GHz using ECOPS
 - > 100 MHz using ASOPS
- Spatial resolution: 250-1000 μm, depending on frequency
- Depth resolution: 5-10 μm

Frequency-modulated continuous wave

Frequency-modulated continuous wave (FMCW) uses a THz signal activated by a laser.

The transmitter and receiver are fibre-coupled.

Achievable specifications (under optimal conditions):

- Bandwidth: 0.1-4 THz
- Frequency resolution: 1 GHz
- Spatial resolution: 500-1000 μm, depending on frequency
- Depth resolution: 20 μm

Electronic FMCW operates at a fixed frequency up to 0.6 THz.

Continuous wave photonic-based frequency domain

Continuous wave photonic-based frequency domain (CW) uses a THz signal activated by a laser.

The transmitter and receiver are fibre-coupled.

Achievable specifications (under optimal conditions):

- Bandwidth: 0.05-3.2 THz
- Frequency resolution: 10 MHz
- Spatial resolution: 500-1000 μm, depending on frequency
- Depth resolution: N/A

Vector network analysis

Vector network analysis (VNA) uses a THz signal generated electronically.

The transmitter and receiver are waveguide-coupled in a rigid configuration.

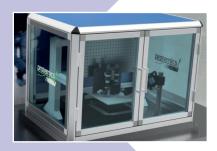
Achievable specifications (under optimal conditions):

- Bandwidth: 0.01-1.2 THz
 - > Note: Several sets of frequency extenders and waveguides are required to access the bandwidth.
 - Measurements are performed in waveguide-defined sub-octave bands.
- Frequency resolution: 1 MHz
- Spatial resolution: 2-5 mm, depending on frequency
- Depth resolution: N/A



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Application	THz technology
 Coatings monitoring and inspection Thickness of every layer in mono- and multilayer coatings Coating thickness uniformity Coating porosity Layer adhesion/delamination 	TDS FMCW
Conductivity and other electrical properties of thin films	TDS FMCW CW VNA
Corrosion/damage under coatings	TDS FMCW CW
 Material inspection Complex permittivity Substance identification Porosity Moisture content Presence of contaminants 	TDS FMCW CW VNA
 Imaging internal structures Layer thickness/uniformity Defects Voids Cracks and faults Debonding Delamination 	TDS FMCW
Trace gas sensing	CW VNA
Moisture content	TDS FMCW CW VNA

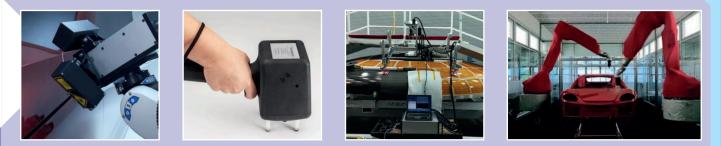


20,36 ps











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