



LyoWave TurboDry™ is a tunable high-frequency microwave heating platform designed to accelerate the manufacturing process for frozen and lyophilized pharmaceutical systems. Utilizing cutting-edge solid-state RF amplifier technology, TurboDry™ technology delivers proven performance for small molecules, vaccines, biologics, reagents, and medical devices. Key advantages include:

Uniformity and Efficiency: Operating at frequencies specifically targeting water ice, TurboDry™ combines proprietary electronic mixing and metasurface scattering elements to achieve an electric field uniformity over 5 times greater than traditional 2.45 GHz microwave systems at a fraction of the power.

Volumetric Heating: Dielectric heating eliminates the need for conduction from temperature-controlled shelves and abolishes throughput bottlenecks placed on novel dosage forms such as lyobeads, nested vials and syringes, bulk powders, and shell/spin frozen systems.

Precision Control: Specialized optical temperature sensors combined with a proprietary closed-loop control architecture provide accurate and robust control over product temperature during drying and thawing operations.

Seamless Integration: Modular and minimally invasive, TurboDry™ easily retrofits onto new and existing laboratory and pilot-scale freeze-drying systems in minutes.

Parameter	Specification
Frequency	>12 GHz
Power	Up to 100W per module
Modulation	Sinusoid, sawtooth, random, constant
Interface	Modbus TCP
Dimensions	24.6" x 24.3" x 8.5"
Electrical	120V/10A

Key Features

Solid-State RF Source



- >12 GHz output at power levels up to 100W per module.
- Patented electromagnetic mixing **improves heating uniformity by 5x** relative to 2.45GHz systems.

Standardized Communication



- Standard Modbus communication interface provides monitoring and control capability.
- Local or remote operation.

Temperature Measurement



- Specialized optical probes provide calibrated temperature measurement accuracy of +/- 0.2°C and resolution of 0.1°C.

Advanced Field Mixing



- Enhanced electromagnetic mixing using patented metasurface scattering technology and modulation.

Remote Sensing



- Non-invasive infrared imaging of product temperature in real time.
- Time-lapse image logging and user-defined point tracking for simplified post-processing and analysis.

Closed-Loop Control



- RF power and frequency modulation based on real-time feedback from temperature sensors.
- Precise control of product temperature to accelerate development time and optimize the drying process.

Application Areas

Vials and Syringes



- Conventional vial drying (>1.5-2x speedup).
- Nested RTU vials and syringes.
- Spin/shell frozen containers.

Bulk Materials and Powders



- Microsphere pellets and lyobeads (>5x speedup).
- Spray-frozen powders.
- Bulk drug product or substance.

Diagnostic Reagents and Tissues



- Reagents for molecular diagnostics freeze-dried in PCR tubes and well plates.
- Bulk tissue freeze-drying.

Dry Substance



- Rapid and uniform thawing (>5x speedup) of biologics to reduce agglomeration induced by cryoconcentration.