

Small Form Factor High-Performance PC Build

System Integration | Thermal Management | Hardware Optimization | Small Form Factor Design



MINI-ITX

i9-9900K @ 4.8 GHz

RTX 2080 SUPER

32 GB DDR4

6 YEARS IN SERVICE

Project Overview

Built in 2020, this project focused on combining high-end desktop performance with the reduced footprint of a Mini-ITX platform. The NZXT H210i enclosure was built around an Intel Core i9-9900K and EVGA GeForce RTX 2080 Super, with component selection driven by performance, compatibility, cooling requirements, power delivery, and physical fit.

The compact enclosure required the processor, graphics card, liquid CPU cooler, full-size modular power supply, memory, NVMe storage, fans, tubing, and wiring to coexist within a tightly constrained internal volume. The original hardware configuration has remained in regular service for approximately six years without component upgrades.

Original System Configuration

Component	Specification
Case	NZXT H210i Mini-ITX
CPU	Intel Core i9-9900K - 8 cores / 16 threads
CPU Configuration	4.8 GHz overclock
Motherboard	ASUS ROG Strix Z390-I Gaming
GPU	EVGA GeForce RTX 2080 SUPER XC ULTRA - 8 GB GDDR6
Memory	Corsair Vengeance RGB Pro - 32 GB (2x16 GB) DDR4-3200
CPU Cooling	Corsair H115i RGB Platinum AIO
Primary Storage	Samsung 970 EVO 1 TB NVMe SSD
Power Supply	Corsair RM750 - 750 W, 80 Plus Gold, fully modular

Packaging, Compatibility & Thermal Management



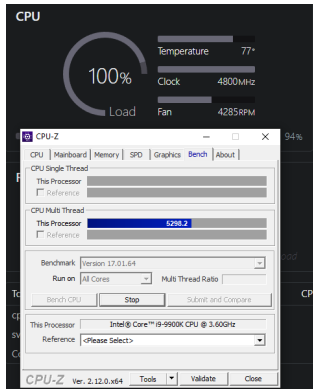
Internal packaging and clearance: full-performance desktop hardware integrated within the limited volume of the Mini-ITX enclosure.

Design Requirements & Constraints

The design goal was to retain enthusiast-class desktop capability in a substantially smaller chassis. Mini-ITX packaging introduced tighter limits on component dimensions, airflow, cable routing, radiator placement, connector access, and future expandability. The RTX 2080 Super became one of the most restrictive components, occupying much of the available space above the power-supply shroud and competing with cooling hardware and wiring for clearance.

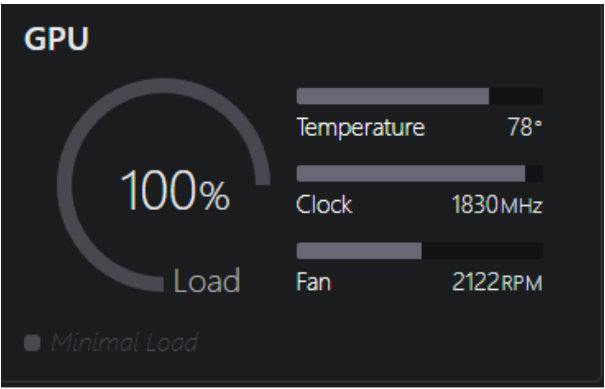
Compatibility therefore had to be considered at the system level rather than as a collection of independent parts. A fully modular Corsair RM750 reduced unnecessary cabling, while NVMe storage avoided additional internal drive cabling. The H115i liquid cooler provided dedicated CPU cooling while fitting within the same constrained package.

Current Thermal Validation



CPU-Z STRESS TEST

100% CPU | 4.8 GHz | ~77 C



3DMARK STEEL NOMAD

100% GPU | ~1,830 MHz | ~78 C

Approximately six years after assembly, current testing shows the original cooling configuration continuing to manage full CPU and GPU test loads. During CPU-Z testing, the i9-9900K operated at 100% load and 4.8 GHz at approximately 77 C. During 3DMark Steel Nomad testing, the RTX 2080 Super reached 100% GPU load at approximately 1,830 MHz and 78 C.

Optimization, Reliability & Results

Overclocking & Optimization

After the initial build, the i9-9900K was configured for 4.8 GHz operation. The objective was reliable everyday performance rather than the highest possible short-duration benchmark frequency. Processor voltage and stability were evaluated during tuning; lower-voltage settings introduced instability, so the final configuration prioritized consistent operation.

The 4.8 GHz configuration has remained in use for approximately five years without observed stability problems during normal operation. Current CPU-Z testing continues to show the processor operating at 4.8 GHz under 100% CPU load.

Results & Long-Term Performance

The system achieved the original goal of combining high-performance desktop hardware with a compact Mini-ITX footprint. The original CPU, GPU, motherboard, memory, NVMe storage, power supply, and liquid-cooling system remain in service approximately six years after assembly, with no hardware upgrades.

Its continued use across gaming, VR, heavily modded games, schoolwork, research, and general computing provides a long-term practical validation of the original component-selection and integration decisions. The project demonstrates the importance of treating packaging, cooling, power delivery, compatibility, and optimization as interconnected parts of a complete system.

6 YEARS IN SERVICE	NO HARDWARE UPGRADES	~5 YEARS @ 4.8 GHz	ORIGINAL COOLING SYSTEM
--------------------	----------------------	--------------------	-------------------------

Skills Demonstrated

Computer Hardware & Integration

PC Assembly | Component Selection | Mini-ITX Systems | Hardware Compatibility | System Integration | Component Installation

Thermal & Mechanical Considerations

Thermal Management | Airflow Planning | Component Clearance | Space-Constrained Packaging | Liquid Cooling | Cable Routing

Performance & Optimization

CPU Overclocking | System Configuration | Performance Tuning | Stress Testing | Thermal Monitoring | Stability Testing

Technical Problem Solving

Troubleshooting | Compatibility Analysis | Constraint Management | Performance Evaluation | Long-Term System Maintenance

Project Summary

This project documents the design, assembly, optimization, and long-term operation of a high-performance Mini-ITX desktop computer built in 2020. Six years of service on the original hardware, combined with current CPU and GPU stress-test results, provide evidence of the system's continued performance and the durability of its original integration and thermal-management decisions.