System Thermal Test Report

Model: The Tower 500
Version: 20220517A
NO:RS202205090001
A. Introduction

B. Test Configuration

C. Conclusion
A. Introduction

1. Objective
2. Equipment
3. Procedure
Our objective is to find out if the Tower 500 can efficiently extract the heat generated by the latest components, so we built a system with an Intel i9-12900K and a GIGABYTE AORUS GeForce RTX™ 3090 XTREME and put it to the test. The passing criteria we set was to keep the internal temperature under 45°C while the system is running at Full load, with two pre-installed fans and a AIO 360 installed.
2. Equipment

The equipment we used in the thermal testing includes:

1. Temperature & Humidity Chamber
2. Data Acquisition Device
3. Thermocouple

The Temp. & Humidity Chamber ensures consistency in the testing environment, particularly temperature and humidity. The temperature was set at 25°C and the humidity at 50% in the chamber.

The Data Acquisition Device helps us to directly collect the data through thermocouples, which is the most important equipment for our testing. We set up the thermocouple inside the case at various points to measure the temperature.

We used AIDA64 Extreme and FurMark ROG Edition to push 100% load on the CPU and GPU and tested for 30 minutes.
3. Procedure

Testing steps:

1. Ready the systems

2. Place the chassis into the Temp. & Humidity Chamber

3. Set the thermocouple at the specified places

4. Set up the Temp. & Humidity Chamber - temperature at 25 °C and the humidity at 50%

5. Turn on the Temp. & Humidity Chamber and start testing (for 30 minutes)

6. Check the data acquired from the Data Acquisition device

7. End testing
B. Test Configuration

1. Laboratory Equipment
2. Chassis Hardware List
3. Chassis Fan Allocation
4. Chassis Thermal Airflow
5. Chassis Measured Points
6. Thermal Stress Test
7. AIDA64 & FurMark Test
8. Graphics Performance Testing
9. Acoustic Test
1. Laboratory Equipment

- Thermocouple
- Sound Level Meter
- Thermal Imaging Camera
- Temperature Data Acquisition
- Temperature & Humidity Chamber
# 2. Chassis Hardware List

<table>
<thead>
<tr>
<th>Component</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis</td>
<td>The Tower 500 Snow</td>
</tr>
<tr>
<td>Motherboard</td>
<td>ASUS ROG MAXIMUS Z690 HERO</td>
</tr>
<tr>
<td>CPU</td>
<td>Intel Core i9-12900K (TDP 125W/OC 241W)</td>
</tr>
<tr>
<td>GPU</td>
<td>GIGABYTE AORUS GeForce RTX™ 3090 XTREME</td>
</tr>
<tr>
<td>RAM</td>
<td>TOUGHRAM Z-ONE RGB DDR5 64G (16G x 4)</td>
</tr>
<tr>
<td>SSD</td>
<td>Plextor PX-128M6V</td>
</tr>
<tr>
<td>PSU</td>
<td>Toughpower TF1 1550W - TT Premium Edition</td>
</tr>
<tr>
<td>CPU Cooler</td>
<td>TOUGHLIQUID Ultra 360 All-In-One Liquid Cooler</td>
</tr>
<tr>
<td>Fans</td>
<td>AIO: TOUGHFAN Turbo 120mm x 3 Chassis: Standard Fan x 2 (Rear)</td>
</tr>
<tr>
<td>Software</td>
<td>1. AIDA64 Extreme</td>
</tr>
<tr>
<td></td>
<td>2. FurMark ROG Edition V0.8.10.0</td>
</tr>
<tr>
<td></td>
<td>3. CPU-Z Ver.1.97.0 x64</td>
</tr>
<tr>
<td></td>
<td>4. Core Temp V1.17.1</td>
</tr>
<tr>
<td>Full load</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Camera</td>
<td>Testo 885-2 Thermal Imaging Camera</td>
</tr>
</tbody>
</table>

NO:RS202205090001
3. Chassis Fan Allocation
4. Chassis Thermal Airflow

Cool Airflow Inlets

Top

Left

Bottom

Front

Hot Airflow Exhausts

Right

Rear
### 5. Chassis Measured Points

<table>
<thead>
<tr>
<th>Measure Point</th>
<th>Description</th>
<th>Thermocouple Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chassis Top Fan (None)</td>
<td>101</td>
</tr>
<tr>
<td>2</td>
<td>VGA Fan (Intake)</td>
<td>102</td>
</tr>
<tr>
<td>3</td>
<td>VGA Rear Slot (Exhaust)</td>
<td>103</td>
</tr>
<tr>
<td>4</td>
<td>Chassis Front (Intake)</td>
<td>104</td>
</tr>
<tr>
<td>5</td>
<td>Chassis Right (Intake)</td>
<td>105</td>
</tr>
<tr>
<td>6</td>
<td>Chassis Left (Intake)</td>
<td>106</td>
</tr>
<tr>
<td>7</td>
<td>Chassis Middle-Right (Exhaust)</td>
<td>108</td>
</tr>
<tr>
<td>8</td>
<td>Chassis Middle-Left (Intake)</td>
<td>110</td>
</tr>
<tr>
<td>9</td>
<td>Chassis Rear VGA Fan (Exhaust)</td>
<td>111</td>
</tr>
<tr>
<td>10</td>
<td>Chassis Rear CPU Fan (Exhaust)</td>
<td>112</td>
</tr>
<tr>
<td>11</td>
<td>PSU Rear (Exhaust)</td>
<td>113</td>
</tr>
<tr>
<td>12</td>
<td>AIO Fan (Intake)</td>
<td>114</td>
</tr>
<tr>
<td>13</td>
<td>Chassis Bottom (Intake)</td>
<td>115</td>
</tr>
</tbody>
</table>
6. Thermal Stress Test

- Setting up the chamber temperature and humidity
- Temperature: 25°C
- Humidity: 50%
- Recording Data
6. Thermal Stress Test

Temperature Data Recoding
We expected to see higher temperature at the exhaust points and relatively lower temperature at the intake positions. The highest temperature was found at the AIO exhaust, which is reasonable given the CPU was running at full load. Most of the intake positions recorded a temperature lower than 30°C since they were drawing air from environment. Two critical positions we were looking at are **NO. 102 VGA Fan** and **NO. 114 AIO Fan**, which were drawing internal air to cool two of the most important components.
We used **AIDA64 Extreme** (stress both CPU and FPU) and **FurMark ROG Edition** (resolution: 3840 x 2160) to push **100% load** on the CPU and GPU for 30 minutes.

| Full load | Idle | 5/6/2022 | 11:20 AM | 00:46 | 5001 MHz | 61375 MB | 210 MHz | 33°C | 35°C | CPU Package | CPU IA Cores | CPU GT Cores | GPU | GPU Hotspot | CPU Package | CPU GT Cores | GPU TDP% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Date | Time (HH:MM) | Uptime (HH:MM) | CPU Clock | Free Memory | GPU Clock | Motherboard | CPU | CPU Package | CPU IA Cores | CPU GT Cores | GPU | GPU Hotspot | CPU Package | GPU GT Cores | GPU TDP% |
| | | 5/6/2022 | 11:10 AM | 00:37 | 4900 MHz | 61089 MB | 1440 MHz | 37°C | CPU | 81°C | CPU Package | 92°C | CPU GT Cores | 50°C | GPU | 73°C |
| | | 5/6/2022 | 11:20 AM | 00:46 | 5001 MHz | 61375 MB | 210 MHz | 33°C | 35°C | CPU Package | 92°C | CPU IA Cores | 92°C | CPU GT Cores | 50°C | GPU | 73°C |
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**AIDA64 Extreme**

**FurMark**

**Idle**

**Full load**

NO:RS202205090001
CPU & GPU Thermal Stress Test

The Tower 500

CPU
- Intel Core i9-12900K
- Ambient Temperature: 25°C
- Humidity: 50%
- Loading with AIDA64 & FurMark

GPU
- AORUS-RTX3090 XTREME
- Ambient Temperature: 25°C
- Humidity: 50%
- Loading with AIDA64 & FurMark

ΔT, Load Temp., Idle Temp.

Temperature - Degree C
Lower is Better
8. Graphics Performance Testing

Time Spy Extreme Score 9,700

Graphics score 9,842
CPU score 8,971

Estimated game performance
Sorry, no data available.

System information
- GPU: NVIDIA GeForce RTX 3090
- Display 
- CPU: 12th Gen Intel Core i9-12900K
- GUI: v2.22.7336 64
- Time: 2022-05-06 11:34 +08:00
- SystemInfo: v5.49.1085
9. Acoustic Sound Pressure Level Test

Test Environment: Thermaltake Taipei Office
Test Model: The Tower 500
Test Ambience: 21.7 °C (Temperature) / 69% R.H. (Relative Humidity)
Microphone position: 50 cm / in front of PC system
Background Noise: **37.7 dBA.**
9. Acoustic Sound Pressure Level Test

Idle – 38.6dBA

3DMARK Loading – 41dBA

Full load – 47.7dBA
Loading with AIDA64 & FurMark
9. Acoustic Sound Pressure Level Test

The Tower 500

Test Condition

**Full Load**
Loading with AIDA64 & FurMark

1. CPU Fan 12cm x 3, 2500 rpm
2. Chassis Fan 12cm x 2, 1318 rpm
3. GPU Fan 10cm x 3, 1872 rpm

**3DMARK**

1. CPU Fan 12cm x 3, 1245 rpm
2. Chassis Fan 12cm x 2, 1148 rpm
3. GPU Fan 10cm x 3, 2064 rpm

**Idle**

1. CPU Fan 12cm x 3, 890 rpm
2. Chassis Fan 12cm x 2, 1331 rpm
3. GPU Fan 10cm x 3, 0 rpm

**Background Noise**

- Ambient Temperature: 21.7°C
- Humidity: 69%

Sound Pressure Level (dBA):
- Full Load: 47.7
- 3DMARK: 41
- Idle: 38.6
- Background Noise: 37.7

CPU: Intel Core i9-12900K
GPU: GIGABYTE RTX 3090 XTREME
C. Conclusion
AIDA64 Extreme (stress both CPU and FPU) and FurMark ROG Edition (resolution: 3840 x 2160) to push 100% load on the CPU and GPU for 30 minutes.

- INTEL I9 12900K, CPU Temp. (Max): 81°C
- GIGABYTE AORUS GeForce RTX™ 3090 XTREME, GPU Temp. (Max): 73°C

Through the thermal image, we found that the internal heat was effectively directed to designated exhaustion vents, keeping the system operating at a cooler temperature. This finding validates how efficient Tower 500 is regarding cooling performance.
Thank you!