



# THERMAL TEST REPORT

## AV600

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# Thermal Test

SK-515+SOM-6884+GTX-1050Ti

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**FANLESS**



**EXTERNAL FAN**



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### 1. SPECIFICATION

#### 1-1. PHOTOS



#### 1-2. SYSTEM CONFIGURATION

System Configuration	
<b>Motherboard</b>	SOM-6884 COM Express Compact R3.1
<b>CPU</b>	13th Gen. Intel® Core™ i7-13800HRE Total Cores: 14 # Performance-cores: 6 # Efficient-cores: 8  Max Turbo Frequency: 5.00 GHz Performance-core Max Turbo Frequency: 5.00 GHz Efficient-core Max Turbo Frequency: 4.00 GHz Processor Base Frequency: 2.50 GHz  Processor Base Power: 45 W Maximum Turbo Power: 115 W TDP: 45 W
<b>Memory</b>	SAMSUNG M425R2GA3BB0-CQKOL 16GB
<b>GPU</b>	NVIDIA GeForce® GTX1050Ti MXM 3.1 Graphic Module, Process Technology: 14 nm Form Factor: MXM 3.1, Type A (82mm x 70mm) Memory Amount: 4096 MB Processor Clock: 1392 MHz Memory Type: GDDR5 Memory Interface: 128 bit CUDA Cores: 768 Board Power: 50 W Digital Display (Maximum Resolution): 7680 x 4320 Display Interface: HDMI 2.0b Dual-link DVI Single-link DVI DisplayPort 1.2a(DisplayPort 1.2 Certified and DisplayPort 1.3/1.4 ready)

### 2. TEST PLAN

#### 2.1. Thermal Measurement Process

Test Purpose	<p>The purpose of performing thermal profile testing is to identify potential thermal issues with the EUT. Considering that semiconductor failure rates rise rapidly with increasing junction temperature, it can aid product reliability assessment.</p> <p>As the system cools down, the mode will change with stack selection, temperature/heat.</p> <p>Mapping can help develop the best tracking arrangements.</p>																												
Test Equipment	1. KSON THS-B4T-150 Chamber.																												
Quantity Tested	Minimum 1 Set																												
Test Software	<p>1. PassMark Burn-In Test(Ver.9.0) under Windows 10 Pro.</p> <p>2. AIDA64 stress GPU.</p>																												
Test Procedure	<p>1. Thermal pre-scan measurement: Temperature: <b>-30°C~60°C/60%RH</b></p> <p>2. Actual thermal measurement:</p> <p>2-1. Select the test point based on the infrared photo and connect the thermocouple to the hot spot.</p> <p>2-2. Place the EUT into the hot chamber and set the test temperature curve Specification.</p> <p>2-3. Open the hot cell and power up the EUT, enter the Windows 10 Pro (22H2) environment and perform a maximum power test + stress application.</p> <p>2-4. After the EUT executes the test software for 8 hours, record the maximum heat generation of each thermocouple point.</p> <p>2-5. Turn off the hot cell and EUT.</p> <p>2-6. Verify and check that the recorded information for each component complies with the operating temperature range listed in the specification/approval sheet for each component being tested.</p> <p>Environment defines for 45 hours.</p>																												
Test Diagram of Curves	<table border="1"> <caption>Thermal Profile Data Points</caption> <thead> <tr> <th>Time (hour)</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr><td>0.5</td><td>25</td></tr> <tr><td>1.5</td><td>-30</td></tr> <tr><td>9.5</td><td>-30</td></tr> <tr><td>10.0</td><td>-10</td></tr> <tr><td>10.5</td><td>-10</td></tr> <tr><td>11.0</td><td>25</td></tr> <tr><td>19.0</td><td>25</td></tr> <tr><td>19.5</td><td>40</td></tr> <tr><td>27.5</td><td>40</td></tr> <tr><td>28.0</td><td>50</td></tr> <tr><td>36.0</td><td>50</td></tr> <tr><td>36.5</td><td>60</td></tr> <tr><td>45.0</td><td>60</td></tr> </tbody> </table>	Time (hour)	Temperature (°C)	0.5	25	1.5	-30	9.5	-30	10.0	-10	10.5	-10	11.0	25	19.0	25	19.5	40	27.5	40	28.0	50	36.0	50	36.5	60	45.0	60
Time (hour)	Temperature (°C)																												
0.5	25																												
1.5	-30																												
9.5	-30																												
10.0	-10																												
10.5	-10																												
11.0	25																												
19.0	25																												
19.5	40																												
27.5	40																												
28.0	50																												
36.0	50																												
36.5	60																												
45.0	60																												



# Thermal Test

## SK-515+SOM-6884+GTX-1050Ti

### 2.2. TEST RESULT<TEST ITEM>

#### 2.2.1 TEMPERATURE CYCLE

# Aging test of various parts at different temperatures under maximum load and full load conditions.

EXTERNAL FAN	
Test Temperature	Test Result
-30°C	PASS
-10°C	PASS
25°C	PASS
40°C	PASS
50°C	PASS
60°C	PASS

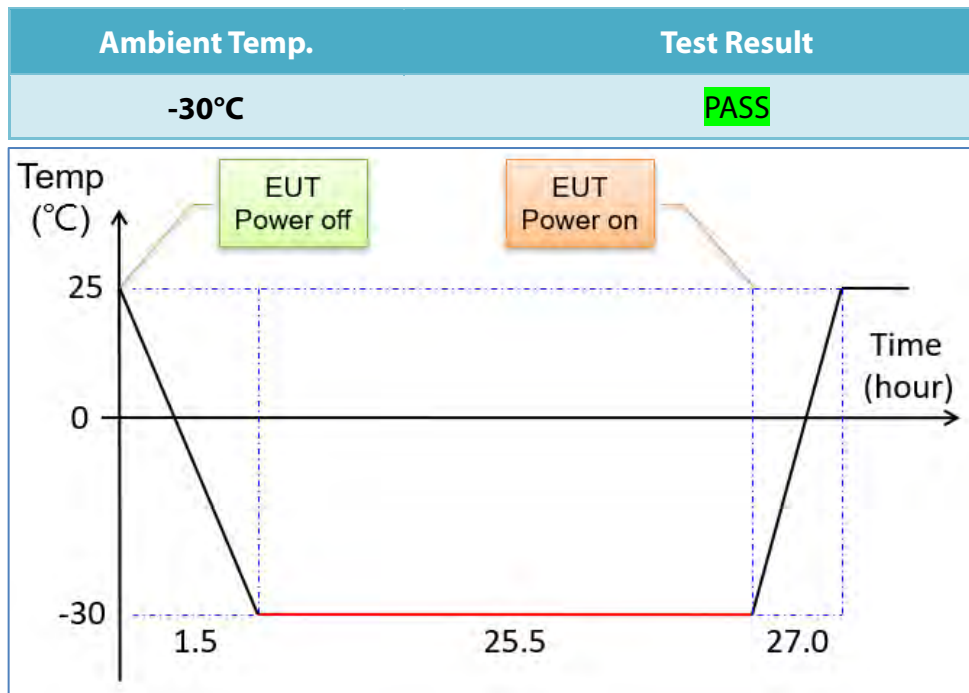
FANLESS	
Test Temperature	Test Result
40°C	PASS
50°C	PASS
60°C	PASS

# Thermal Test

## SK-515+SOM-6884+GTX-1050Ti

### 2.2.2 LOW-TEMPERATURE & BOOT-UP

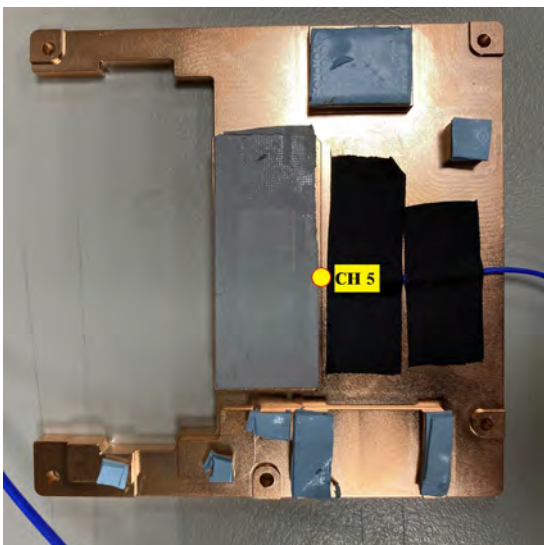
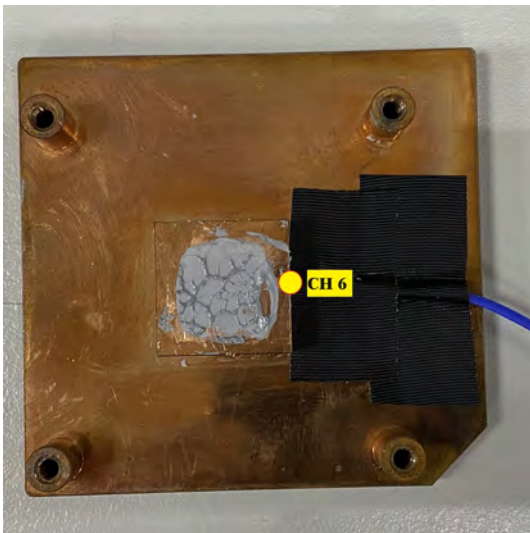
#Power supply under -30°C and ensure that the system boot up properly



# Thermal Test

SK-515+SOM-6884+GTX-1050Ti

## 3. THERMAL TEST POINT



Test Point No.	Test Point
CH1	CPU (INTEGRATED HEAT SPREADER)
CH2	GPU (INTEGRATED HEAT SPREADER)
CH3	DRAM
CH4	NVMe (SM681GC)
CH5	CPU Heat Sink
CH6	GPU Heat Sink
CH7	Intel S2293LF

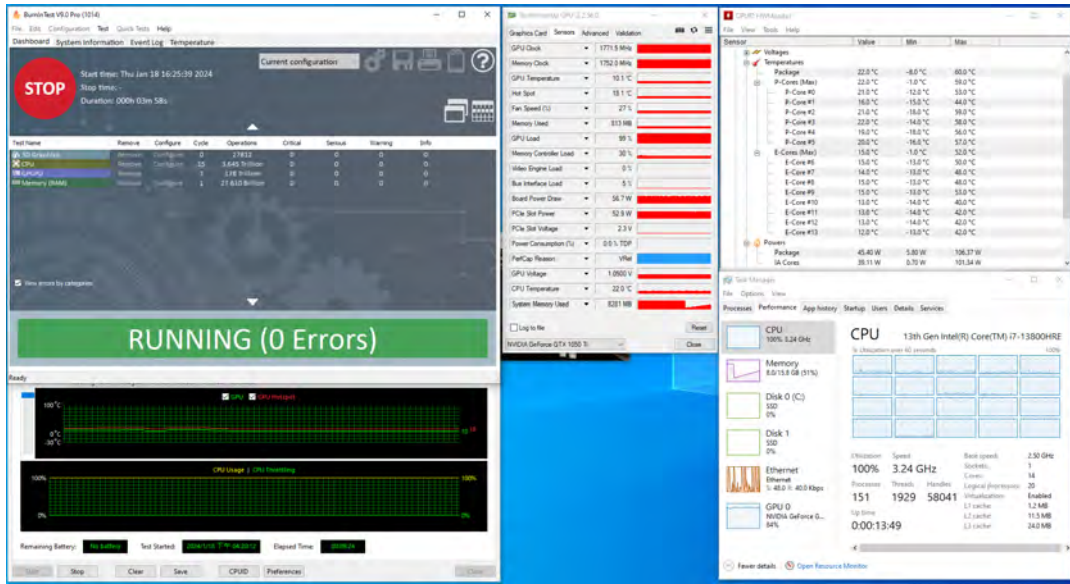


# Thermal Test

SK-515+SOM-6884+GTX-1050Ti

## 4. TEST PHOTO IN LAB (External Fan)

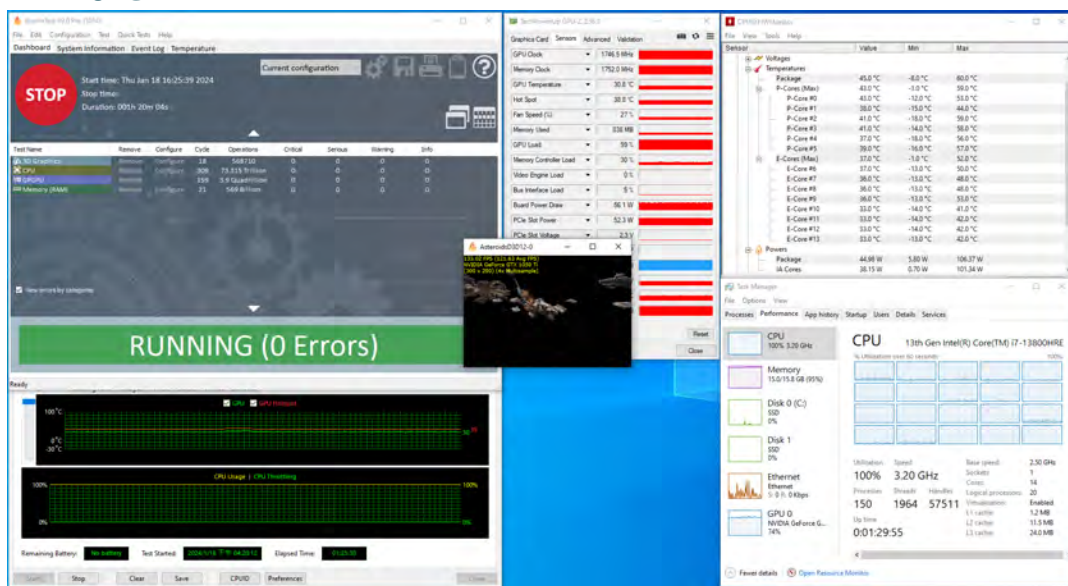
- Chamber in -30°C



Test Point	Ambient Temp.	-30°C
	<b>CPU Package Temperature</b>	22.0 °C
	P-Core Temperature	22.0 °C
	E-Core Temperature	15.0 °C
	<b>CPU Avg. Frequency</b>	3240 MHz
	P-Core Frequency	3491 MHz
	E-Core Frequency	2988 MHz
	<b>GPU Temperature</b>	10.1 °C
	<b>GPU Avg. Frequency</b>	1771.5 MHz
CH1	CPU	10.7 °C
CH2	GPU	10.0 °C
CH3	DRAM	10.1 °C
CH4	NVMe (SM681 GC)	0.8 °C
CH5	CPU HEATSINK	6.7 °C
CH6	GPU HEATSINK	6.8 °C
CH7	Intel S2293LF	3.2 °C

# Thermal Test SK-515+SOM-6884+GTX-1050Ti

## - Chamber in -10°C

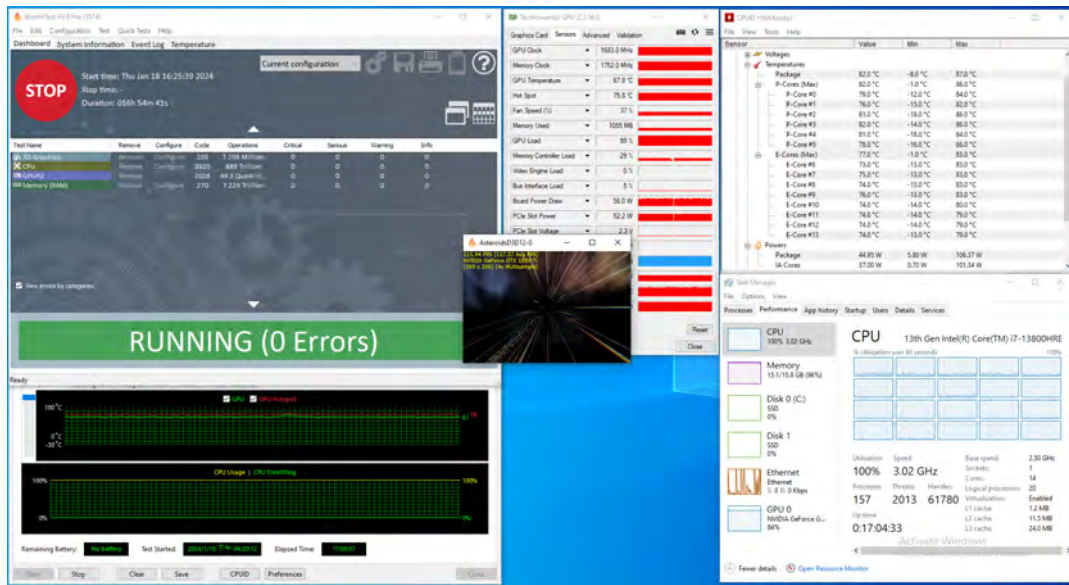


Test Point	Ambient Temp.	-10°C
	<b>CPU Package Temperature</b>	45.0 °C
	P-Core Temperature	43.0 °C
	E-Core Temperature	37.0 °C
	<b>CPU Avg. Frequency</b>	3200 MHz
	P-Core Frequency	3485 MHz
	E-Core Frequency	2910 MHz
	<b>GPU Temperature</b>	30.8 °C
	<b>GPU Avg. Frequency</b>	1746.5 MHz
CH1	CPU	24.4 °C
CH2	GPU	20.4 °C
CH3	DRAM	29.3 °C
CH4	NVMe (SM681GC)	14.5 °C
CH5	CPU HEATSINK	20.2 °C
CH6	GPU HEATSINK	18.0 °C
CH7	Intel S2293LF	17.7 °C



# Thermal Test SK-515+SOM-6884+GTX-1050Ti

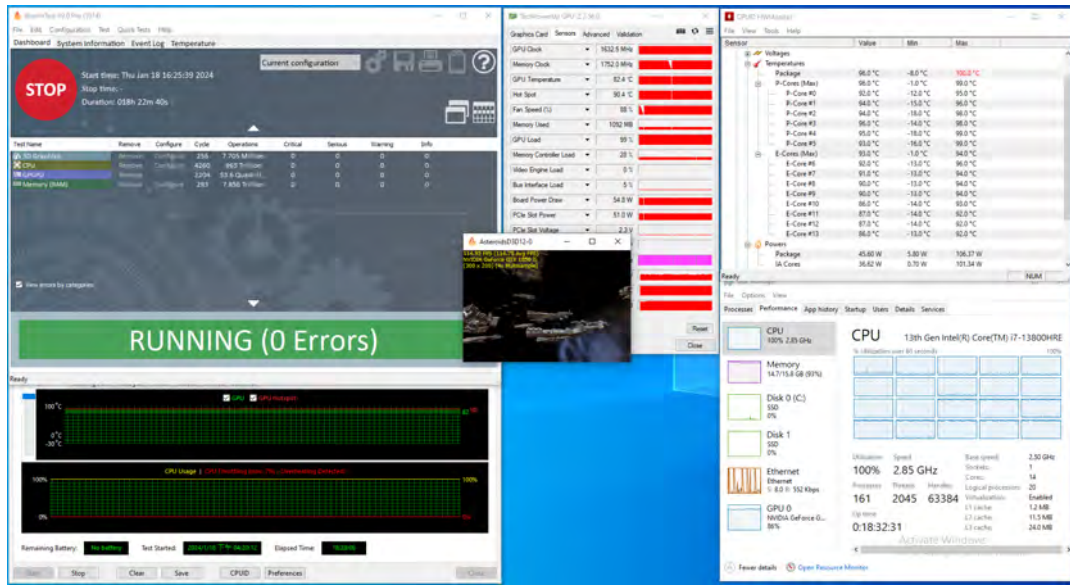
## - Chamber in 25°C



Test Point	Ambient Temp.	25°C
	<b>CPU Package Temperature</b>	82.0 °C
	P-Core Temperature	82.0 °C
	E-Core Temperature	77.0 °C
	<b>CPU Avg. Frequency</b>	3020 MHz
	P-Core Frequency	3290 MHz
	E-Core Frequency	2747 MHz
	<b>GPU Temperature</b>	67.8 °C
	<b>GPU Avg. Frequency</b>	1683.0 MHz
CH1	CPU	60.6 °C
CH2	GPU	56.1 °C
CH3	DRAM	63.2 °C
CH4	NVMe (SM681 GC)	49.6 °C
CH5	CPU HEATSINK	55.7 °C
CH6	GPU HEATSINK	53.8 °C
CH7	Intel S2293LF	53.2 °C

# Thermal Test SK-515+SOM-6884+GTX-1050Ti

## - Chamber in 40°C

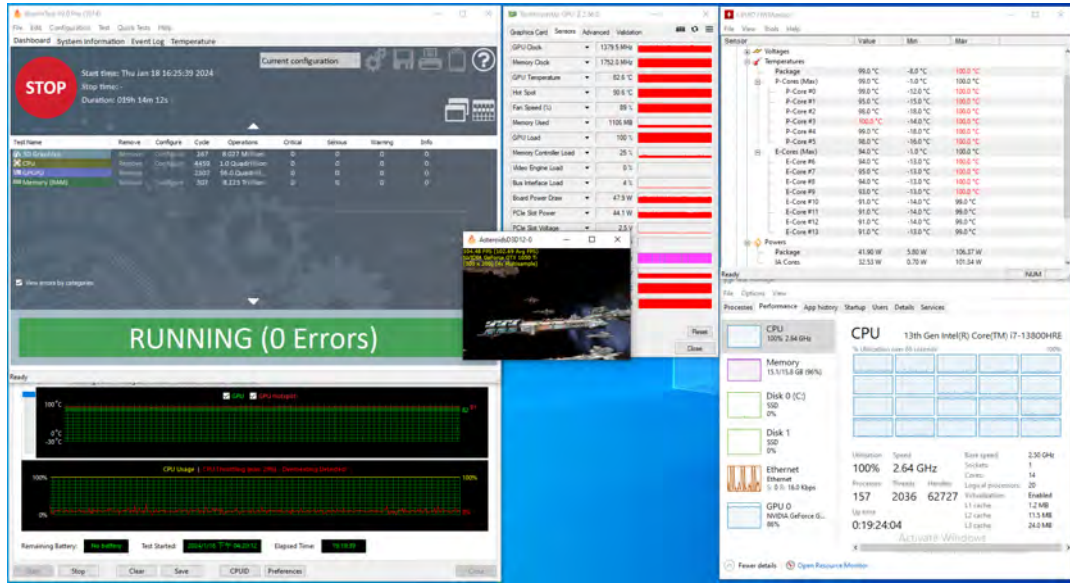


Test Point	Ambient Temp.	40°C
	<b>CPU Package Temperature</b>	96.0 °C
	P-Core Temperature	96.0 °C
	E-Core Temperature	93.0 °C
	<b>CPU Avg. Frequency</b>	2850 MHz
	P-Core Frequency	3086 MHz
	E-Core Frequency	2598 MHz
	<b>GPU Temperature</b>	82.4 °C
	<b>GPU Avg. Frequency</b>	1632.5 MHz
CH1	CPU IHS	76.4 °C
CH2	GPU IHS	70.1 °C
CH3	DRAM	80.5 °C
CH4	NVMe (SM681GC)	64.3 °C
CH5	CPU HEATSINK	70.4 °C
CH6	GPU HEATSINK	68.0 °C
CH7	Intel S2293LF	67.6 °C



# Thermal Test SK-515+SOM-6884+GTX-1050Ti

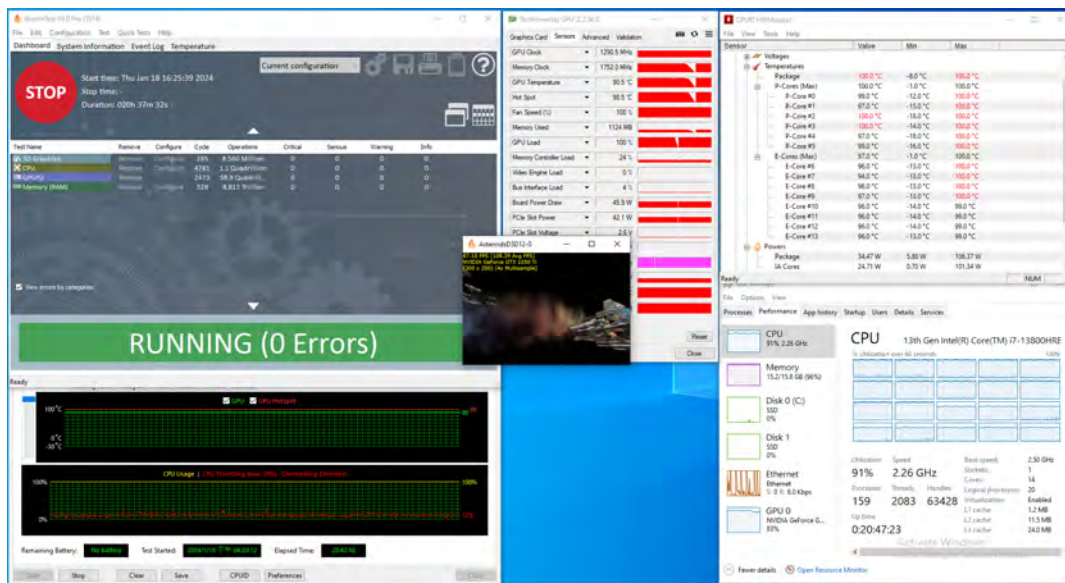
## - Chamber in 50°C



Test Point	Ambient Temp.	50°C
	<b>CPU Package Temperature</b>	99.0 °C
	P-Core Temperature	99.0 °C
	E-Core Temperature	94.0 °C
	<b>CPU Avg. Frequency</b>	2640 MHz
	P-Core Frequency	3092 MHz
	E-Core Frequency	2394 MHz
	<b>GPU Temperature</b>	82.6 °C
	<b>GPU Avg. Frequency</b>	1379.5 MHz
CH1	CPU	83.3 °C
CH2	GPU	74.4 °C
CH3	DRAM	86.6 °C
CH4	NVMe (SM681GC)	71.4 °C
CH5	CPU HEATSINK	77.1 °C
CH6	GPU HEATSINK	72.9 °C
CH7	Intel S2293LF	74.5 °C

# Thermal Test SK-515+SOM-6884+GTX-1050Ti

## - Chamber in 60°C



Test Point	Ambient Temp.	60°C
	<b>CPU Package Temperature</b>	<b>100.0 °C</b>
	P-Core Temperature	100.0 °C
	E-Core Temperature	97.0 °C
	<b>CPU Avg. Frequency</b>	<b>2260 MHz</b>
	P-Core Frequency	2494 MHz
	E-Core Frequency	2095 MHz
	<b>GPU Temperature</b>	<b>90.5 °C</b>
	<b>GPU Avg. Frequency</b>	<b>1290.5 MHz</b>
CH1	CPU	88.4 °C
CH2	GPU	82.3 °C
CH3	DRAM	93.6 °C
CH4	NVMe (SM681GC)	78.2 °C
CH5	CPU HEATSINK	82.7 °C
CH6	GPU HEATSINK	81.1 °C
CH7	Intel S2293LF	81.2 °C

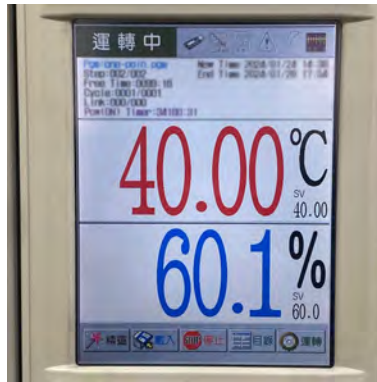
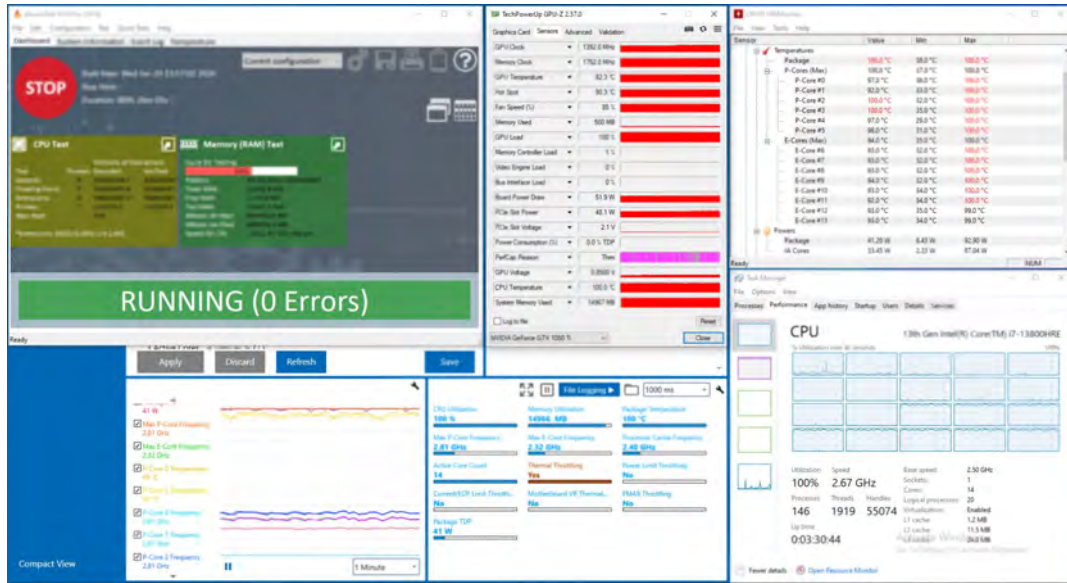


# Thermal Test

SK-515+SOM-6884+GTX-1050Ti

## 5. TEST PHOTO IN LAB (Fanless)

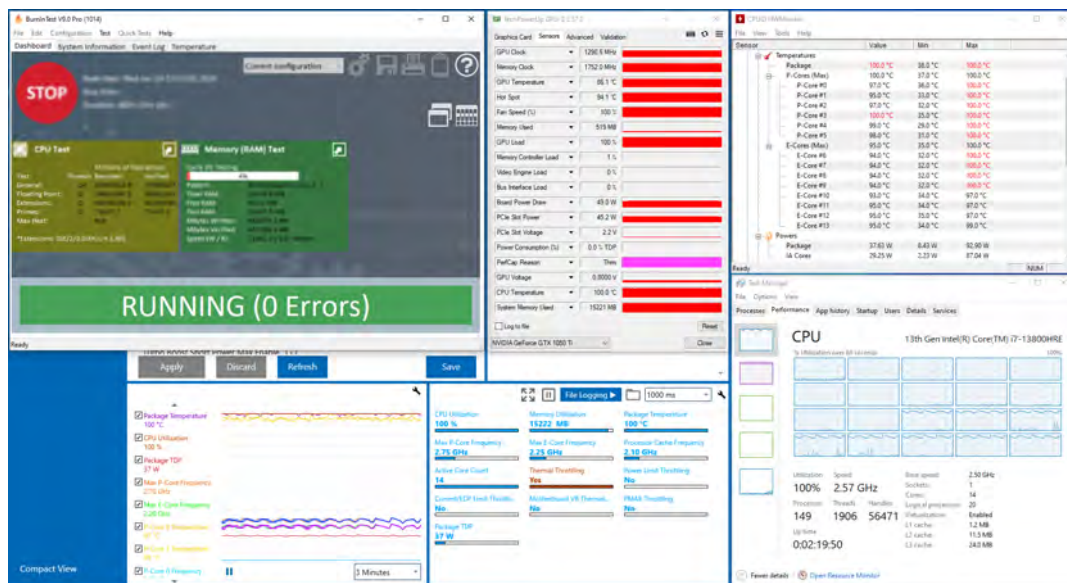
- Chamber in 40°C



Test Point	Ambient Temp.	40°C
<b>CPU Package Temperature</b>		<b>100.0 °C</b>
P-Core Temperature		100.0 °C
E-Core Temperature		94.0 °C
<b>CPU Avg. Frequency</b>		<b>2670 MHz</b>
P-Core Frequency		2810 MHz
E-Core Frequency		2320 MHz
<b>GPU Temperature</b>		<b>82.3 °C</b>
<b>GPU Avg. Frequency</b>		<b>1392 MHz</b>
CH1	CPU IHS	81.1 °C
CH2	GPU IHS	66.8 °C
CH3	DRAM	75.0 °C
CH4	NVMe (SM681GC)	64.2 °C
CH5	CPU HEATSINK	75.6 °C
CH6	GPU HEATSINK	70.3 °C
CH7	Intel S2293LF	71.3 °C

# Thermal Test SK-515+SOM-6884+GTX-1050Ti

## - Chamber in 50°C

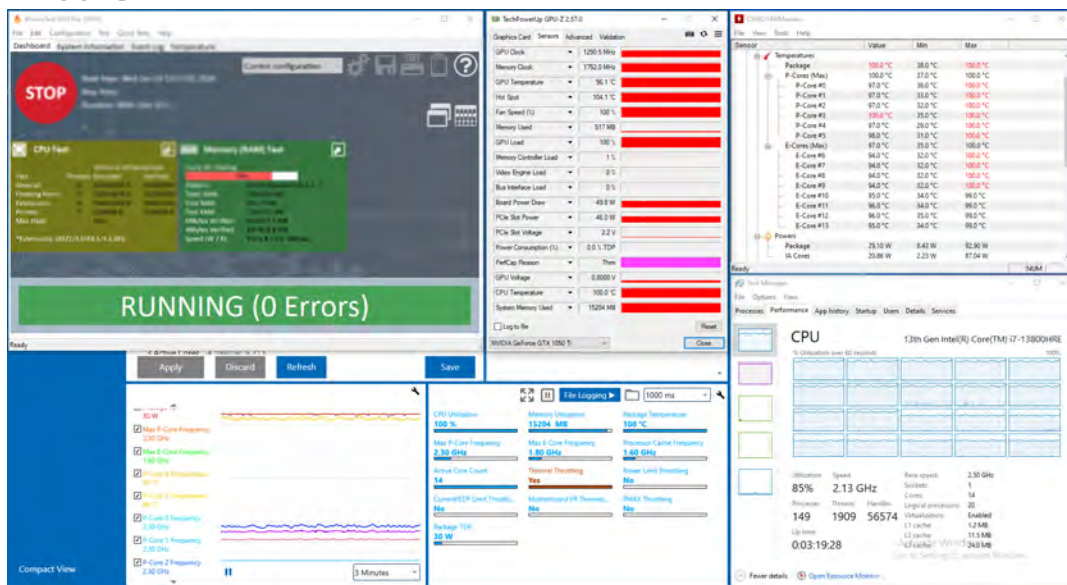


Test Point	Ambient Temp.	50°C
	<b>CPU Package Temperature</b>	<b>100.0 °C</b>
	P-Core Temperature	100.0 °C
	E-Core Temperature	95.0 °C
	<b>CPU Avg. Frequency</b>	<b>2570 MHz</b>
	P-Core Frequency	2750 MHz
	E-Core Frequency	2250 MHz
	<b>GPU Temperature</b>	<b>86.1 °C</b>
	<b>GPU Avg. Frequency</b>	<b>1290.5 MHz</b>
CH1	CPU	85.6 °C
CH2	GPU	73.2 °C
CH3	DRAM	82.2 °C
CH4	NVMe (SM681GC)	70.9 °C
CH5	CPU HEATSINK	80.5 °C
CH6	GPU HEATSINK	76.5 °C
CH7	Intel S2293LF	77.3 °C



# Thermal Test SK-515+SOM-6884+GTX-1050Ti

## - Chamber in 60°C



Test Point	Ambient Temp.	60°C
	<b>CPU Package Temperature</b>	<b>100.0 °C</b>
	P-Core Temperature	100.0 °C
	E-Core Temperature	97.0 °C
	<b>CPU Avg. Frequency</b>	<b>2130 MHz</b>
	P-Core Frequency	2300 MHz
	E-Core Frequency	1800 MHz
	<b>GPU Temperature</b>	<b>96.1 °C</b>
	<b>GPU Avg. Frequency</b>	<b>1290.5 MHz</b>
CH1	CPU	90.4 °C
CH2	GPU	82.0 °C
CH3	DRAM	88.4 °C
CH4	NVMe (SM681GC)	77.9 °C
CH5	CPU HEATSINK	85.4 °C
CH6	GPU HEATSINK	85.6 °C
CH7	Intel S2293LF	83.6 °C

# Thermal Test

SK-515+SOM-6884+GTX-1050Ti

## 6. THERMAL TEST RESULT(-30°C ~ +60°C)

CPU & GPU MEASURE TEMPERATURE AND FREQUENCY

Core Temp. CPU/GPU Frequency	Ambient Temp.	External Fan	External Fan	External Fan	External Fan	External Fan	External Fan
		-30°C	-10°C	25°C 60% RH	40°C 60% RH	50°C 60% RH	60°C 60% RH
<b>CPU Package Temperature</b>		22.0 °C	45.0 °C	82.0 °C	96.0 °C	99.0 °C	100.0 °C
P-Core Temperature		22.0 °C	43.0 °C	82.0 °C	96.0 °C	99.0 °C	100.0 °C
E-Core Temperature		15.0 °C	37.0 °C	77.0 °C	93.0 °C	94.0 °C	97.0 °C
<b>CPU Avg. Frequency</b>		3240 MHz	3200 MHz	3020 MHz	2850 MHz	2640 MHz	2260 MHz
P-Core Frequency		3491 MHz	3485 MHz	3290 MHz	3086 MHz	3092 MHz	2494 MHz
E-Core Frequency		2988 MHz	2910 MHz	2747 MHz	2598 MHz	2394 MHz	2095 MHz
<b>GPU Temperature</b>		10.1 °C	30.8 °C	67.8 °C	82.4 °C	82.6 °C	90.5 °C
<b>GPU Avg. Frequency</b>		1771.5 MHz	1746.5 MHz	1683.0 MHz	1632.5 MHz	1379.5 MHz	1290.5 MHz

Measure Point No.	Key Parts	Measure Temp.	-30°C	-10°C	25°C 60% RH	40°C 60% RH	50°C 60% RH	60°C 60% RH
CH1	CPU		10.7 °C	24.4 °C	60.6 °C	76.4 °C	83.3 °C	88.4 °C
CH2	GPU		10.0 °C	20.4 °C	56.1 °C	70.1 °C	74.4 °C	82.3 °C
CH3	DRAM		10.1 °C	29.3 °C	63.2 °C	80.5 °C	86.6 °C	93.6 °C
CH4	NVMe (SM681GC)		0.8 °C	14.5 °C	49.6 °C	64.3 °C	71.4 °C	78.2 °C
CH5	CPU HeatSink		6.7 °C	20.2 °C	55.7 °C	70.4 °C	77.1 °C	82.7 °C
CH6	GPU HeatSink		6.8 °C	18.0 °C	53.8 °C	68.0 °C	72.9 °C	81.1 °C
CH7	Intel S2293LF		3.2 °C	17.7 °C	53.2 °C	67.6 °C	74.5 °C	81.2 °C

Core Temp. CPU/GPU Frequency	Ambient Temp.	Fanless	Fanless	Fanless	Fanless	Fanless	Fanless
					40°C 60% RH	50°C 60% RH	60°C 60% RH
<b>CPU Package Temperature</b>					100.0 °C	100.0 °C	100.0 °C
P-Core Temperature					100.0 °C	100.0 °C	100.0 °C
E-Core Temperature					94.0 °C	95.0 °C	97.0 °C
<b>CPU Avg. Frequency</b>					2670 MHz	2570 MHz	2130 MHz
P-Core Frequency					2810 MHz	2750 MHz	2300 MHz
E-Core Frequency					2320 MHz	2250 MHz	1800 MHz
<b>GPU Temperature</b>					82.3 °C	86.1 °C	96.1 °C
<b>GPU Avg. Frequency</b>					1392.0 MHz	1290.5 MHz	1290.5 MHz

Measure Point No.	Key Parts	Measure Temp.				40°C 60% RH	50°C 60% RH	60°C 60% RH
CH1	CPU					81.1 °C	85.6 °C	90.4 °C
CH2	GPU					66.8 °C	73.2 °C	82.0 °C
CH3	DRAM					75.0 °C	82.2 °C	88.4 °C
CH4	NVMe (SM681GC)					64.2 °C	70.9 °C	77.9 °C
CH5	CPU HeatSink					75.6 °C	80.5 °C	85.4 °C
CH6	GPU HeatSink					70.3 °C	76.5 °C	85.6 °C
CH7	Intel S2293LF					71.3 °C	77.3 °C	83.6 °C

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