System Test Report

IV320-RH-KD

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Performance Test

IV320-RH-KD

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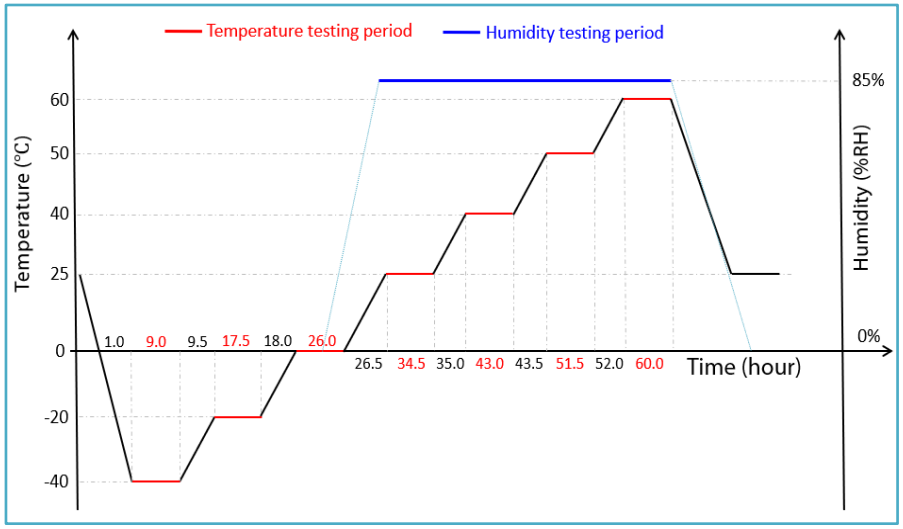
1. SPECIFICATION

1-1. System Configuration

Motherboard	SK515M+COM Express CPU module MXM Type 3.1 Support NVIDIA® GTX® / RTX® GPU PCI/104 Express Expansion Slot for Modular Open Structure Multi-Expansion Slots include Dual Mini PCIe Express Slots, 1x M.2 Slot Wide Range DC 9V~36V Input Extreme Temperature Support -40°C to 85°C
CPU	Intel® Core™ i7-13800HRE Processor Total Cores: 14 # of Performance-cores: 6 # of Efficient-cores: 8 Total Threads: 20 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 Cache 24 MB Intel® Smart Cache TDP: 45 W
Memory	64GB DDR5 SO-DIMM wide temp. (0C02AM425R4GD00L*2pcs)
Storage	2* 2TB SATA SSD wide temperature (2 x Swappable Tray) (0I05077SL02TB00L*2pcs)
GPU	Nvidia RTX A4500 Embedded GPU BIOS Version: 94.04.81.00.30 CUDA parallel-processing cores: 5888 CUDA® cores GPU base/boost clock: 930 MHz / 1500 MHz Max Power Consumption: 80 W
Power Module	SK708 (0L18SK708000P3PF*1pcs)
RS485 Serial Port	EGP2-X401 M.2 to 4 x RS232/422/485 Module

2. TEST PLAN

2.1. THERMAL MEASUREMENT PROCESS

Test Purpose	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. As the system cools down, the mode will change with stack selection, temperature/heat. Mapping can help develop the best tracking arrangements.
Test Equipment	1. KSON THS-B4T-150 Chamber.
Quantity Tested	Minimum 1 Set
Test Software	1. Stress CPU: PassMark Burn-in Test Software Ver 9.0 2. Stress GPU: AIDA64 extreme590 3. LAN Speed Test: iPerf3
Test Procedure	1. Thermal pre-scan measurement: Temperature: **-40˚C～60˚C** Humidity: **85%RH (Temperature above 25℃)** 2. Actual thermal measurement: 2-1. Select the test point based on the infrared photo and connect the thermocouple to the hot spot. 2-2. Place the EUT into the hot chamber and set the test temperature curve Specification. 2-3. Open the hot cell and power up the EUT, enter the Windows 10 Pro environment and perform a maximum power test + stress application. 2-4. After the EUT executes the test software for 8 hours, record the maximum heat generation of each thermocouple point. 2-5. Turn off the hot cell and EUT. 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.
Test Diagram of Curves	Environment defines for 60 hours. 

2.2. TEST RRESULT <TEST ITEM>

2.2.1. Temperature Cycle

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

Test Temperature	Test Result
-40˚C	PASS
-20˚C	PASS
0˚C	PASS
25˚C / 85%RH	PASS
40˚C / 85%RH	PASS
50˚C / 85%RH	PASS
60˚C / 85%RH	PASS

2.2.2. I/O Function

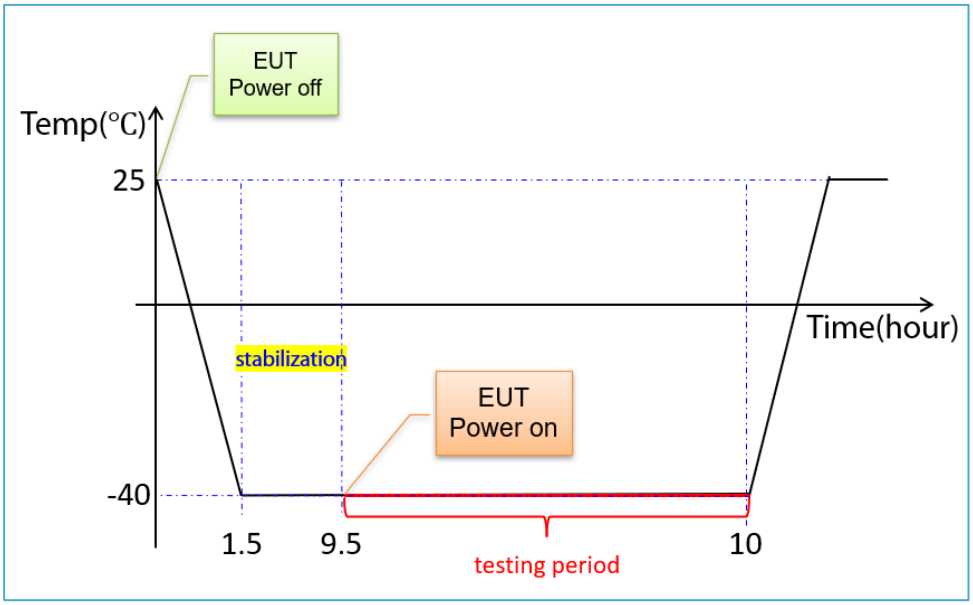
#Confirm the system specifications and I/O connection to ensure that they are functioning properly

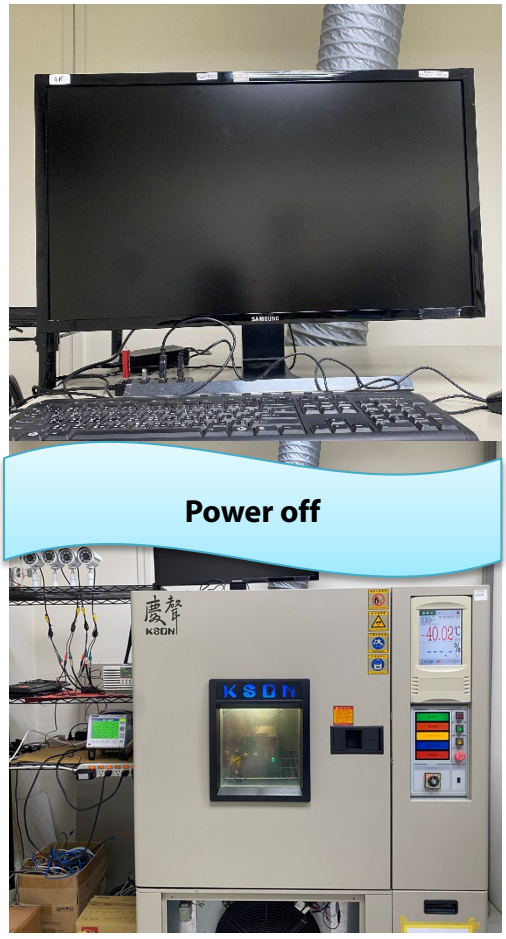
Item	Test Criteria	Result
X1Port - LAN **(2.5Gbps)**	Connection 1G/2.5G/10G/100G SWITCH HUB transfer data test, it can work normally.	PASS
X2 Port - LAN **(2.5Gbps)**	Connection 1G/2.5G/10G/100G SWITCH HUB transfer data test, it can work normally.	PASS
X3 Port – CANBus **(COM 5)**	Connect to the test computer to exchange messages.	PASS
X3 Port – CANBus **(COM 6)**	Connect to the test computer to exchange messages.	PASS
X4 Port – RS485 **(COM 3)**	Connect to the test computer to exchange messages.	PASS
X4 Port – RS485 **(COM 4)**	Connect to the test computer to exchange messages.	PASS
X4 Port – RS485 **(COM 7)**	Connect to the test computer to exchange messages.	PASS
X4 Port – RS485 **(COM 8)**	Connect to the test computer to exchange messages.	PASS
X8 Port - USB3.0	Connect a PassMark USB 3.0 Loopback Plugs for testing, it can work normally.	PASS
X9 Port - USB3.0	Connect a PassMark USB 3.0 Loopback Plugs for testing, it can work normally.	PASS
X10 Port - Mini DP	Check work well. (Max Resolution: 4K at 3840 x 2160)	PASS

2.2.3. Low-temperature & Boot-up

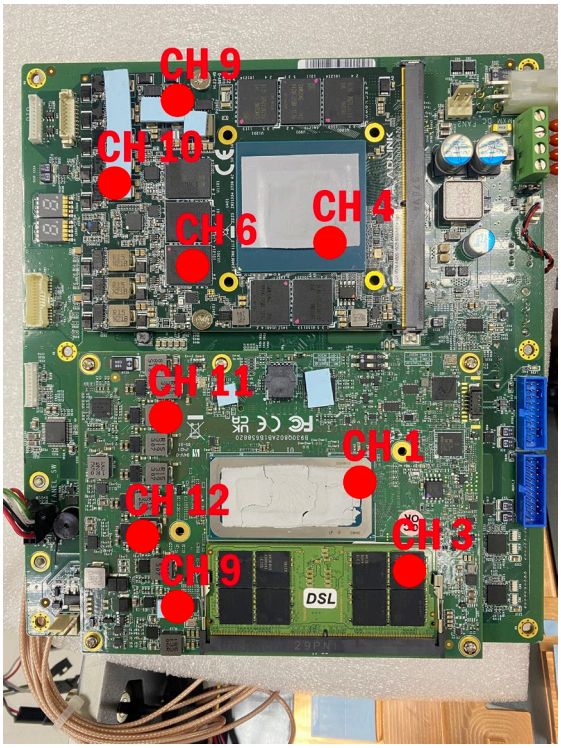
#Power supply under -40°C and ensure that the system boot up properly

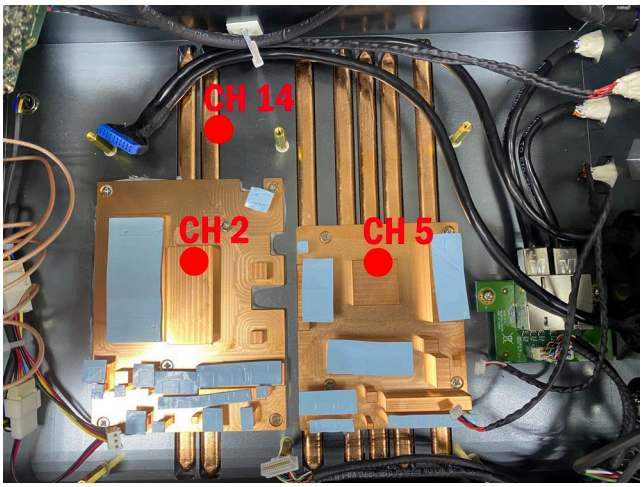
Ambient Temp.	Test Result
-40°C	PASS

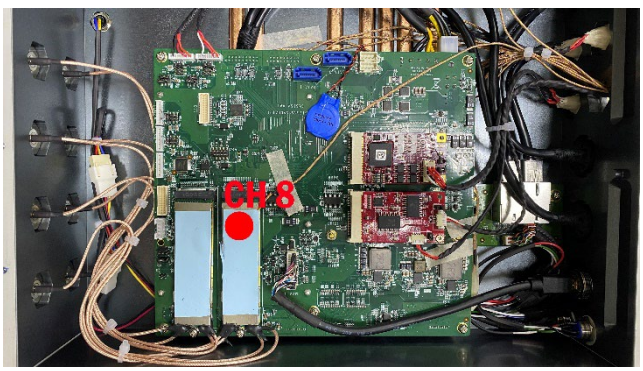




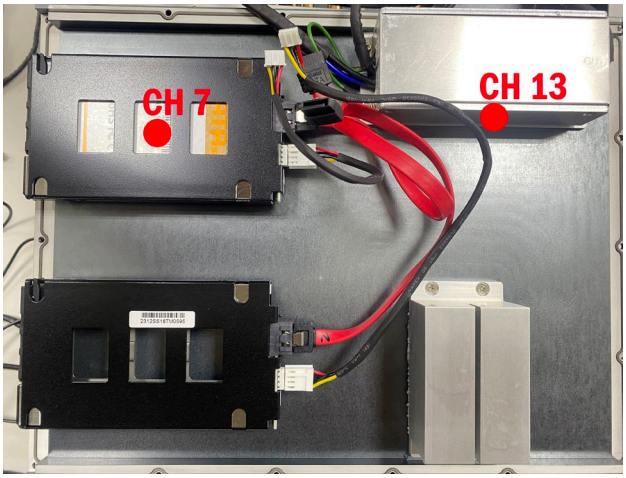
3. THERMAL TEST POINT





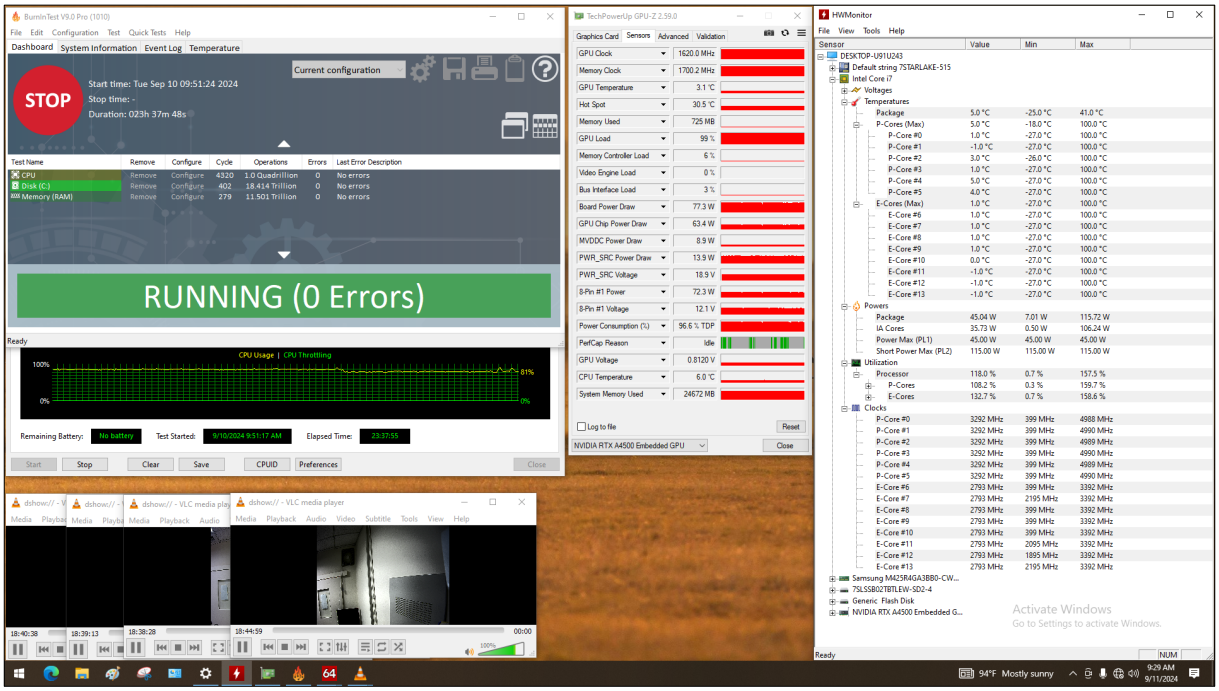


Test Point	Test Point
CH1	CPU
CH2	CPU TOP Heatsink
CH3	DDR5 SO-DIMM
CH4	NVIDIA A4500 GPU
CH5	GPU TOP Heatsink
CH6	GPU DRAM
CH7	SATA SSD
CH8	M.2 Capture Card
CH9	TPU3802 CHOKE
CH10	TPU3802 MOSFET
CH11	PL3 CHOKE
CH12	PL7 MOSFET
CH13	SK708
CH14	TOP Heatsink



4. TEST PHOTO IN LAB

- Chamber in -40°C



Test Point	Ambient Temp.	-40°C
	CPU P-Cores Max Temperature	5.0 ℃
	CPU E-Cores Max Temperature	1.0 ℃
	CPU P-Cores Frequency (Unit: GHz)	3.3 GHz
	CPU E-Cores Frequency (Unit: GHz)	2.8 GHz
	GPU Temperature	3.1 ℃
	GPU Hot Spot Temperature	30.5 ℃
	GPU Frequency (Unit: MHz)	1620.0 MHz
CH1	CPU	-16.7 ℃
CH2	CPU TOP Heatsink	-21.0 ℃
CH3	DDR5 SO-DIMM	-21.6 ℃
CH4	NVIDIA A4500 GPU	-9.5 ℃
CH5	GPU TOP Heatsink	-16.8 ℃
CH6	GPU DRAM	-20.9 ℃
CH7	SATA SSD	-27.2 ℃
CH8	M.2 Capture Card	-29.4 ℃
CH9	TPU3802 CHOKE	-18.0 ℃
CH10	TPU3802 MOSFET	-8.5 ℃
CH11	PL3 CHOKE	-21.2 ℃
CH12	PL7 MOSFET	-22.0 ℃
CH13	SK708	-28.5 ℃
CH14	TOP Heatsink	-27.1 ℃

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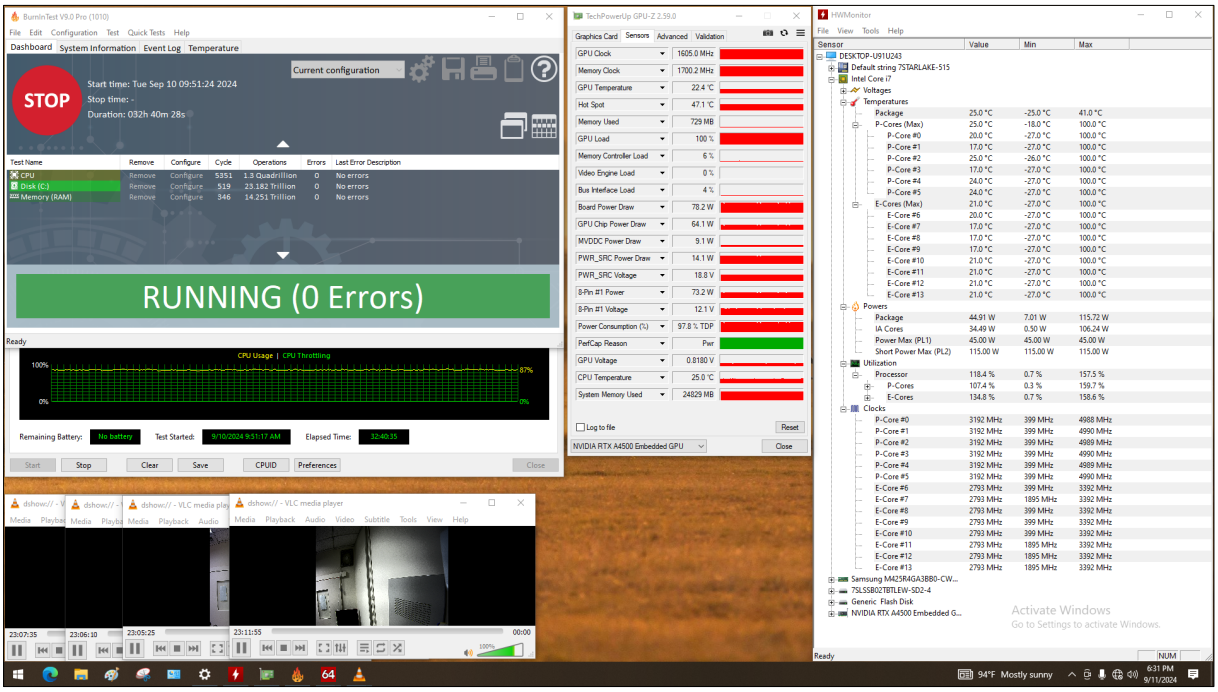
- Chamber in -20°C



Test Point	Ambient Temp.	-20°C
	CPU P-Cores Max Temperature	25.0 ℃
	CPU E-Cores Max Temperature	21.0 ℃
	CPU P-Cores Frequency (Unit: GHz)	3.2 GHz
	CPU E-Cores Frequency (Unit: GHz)	2.8 GHz
	GPU Temperature	22.4 ℃
	GPU Hot Spot Temperature	47.1 ℃
	GPU Frequency (Unit: MHz)	1605.0 MHz
CH1	CPU	5.0 ℃
CH2	CPU TOP Heatsink	0.5 ℃
CH3	DDR5 SO-DIMM	0.2 ℃
CH4	NVIDIA A4500 GPU	11.7 ℃
CH5	GPU TOP Heatsink	4.9 ℃
CH6	GPU DRAM	0.6 ℃
CH7	SATA SSD	-6.1 ℃
CH8	M.2 Capture Card	-7.2 ℃
CH9	TPU3802 CHOKE	2.9 ℃
CH10	TPU3802 MOSFET	12.3 ℃
CH11	PL3 CHOKE	0.6 ℃
CH12	PL7 MOSFET	0.1 ℃
CH13	SK708	-6.2 ℃
CH14	TOP Heatsink	-5.4 ℃

Performance Test

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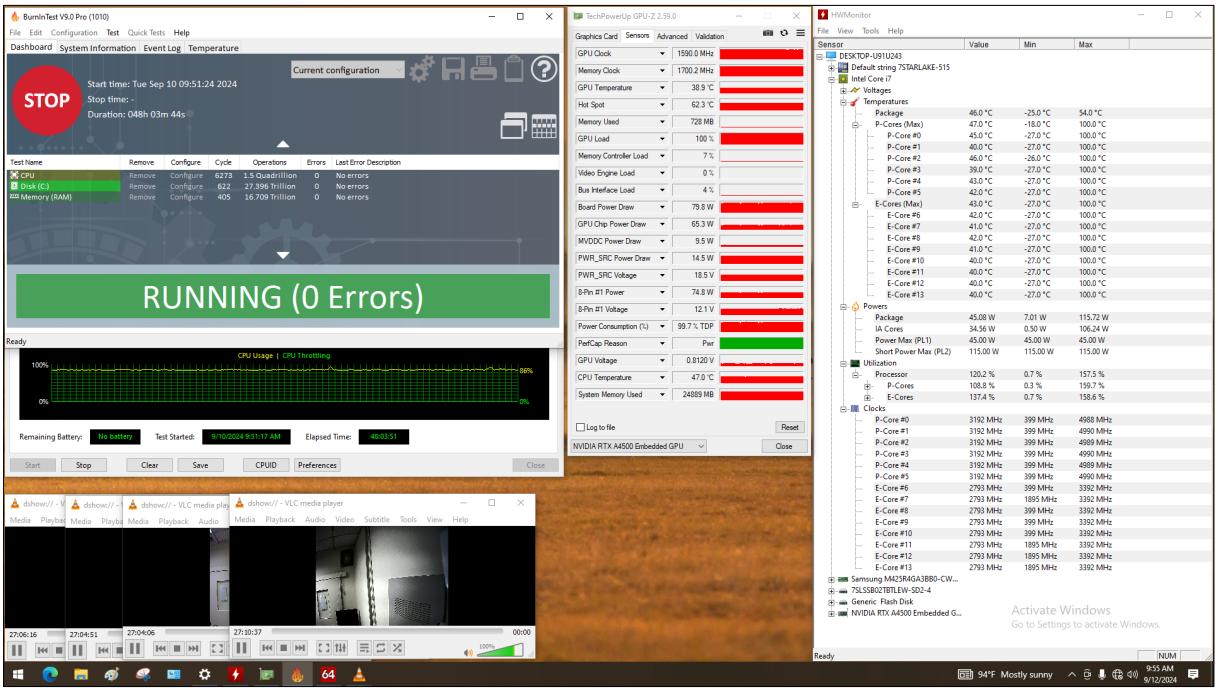
- Chamber in 0°C



Test Point	Ambient Temp.	0°C
	CPU P-Cores Max Temperature	47.0 ℃
	CPU E-Cores Max Temperature	43.0 ℃
	CPU P-Cores Frequency (Unit: GHz)	3.2 GHz
	CPU E-Cores Frequency (Unit: GHz)	2.8 GHz
	GPU Temperature	38.9 ℃
	GPU Hot Spot Temperature	62.3 ℃
	GPU Frequency (Unit: MHz)	1590.0 MHz
CH1	CPU	24.7 ℃
CH2	CPU TOP Heatsink	20.7 ℃
CH3	DDR5 SO-DIMM	20.6 ℃
CH4	NVIDIA A4500 GPU	29.3 ℃
CH5	GPU TOP Heatsink	23.0 ℃
CH6	GPU DRAM	19.2 ℃
CH7	SATA SSD	16.3 ℃
CH8	M.2 Capture Card	13.6 ℃
CH9	TPU3802 CHOKE	22.4 ℃
CH10	TPU3802 MOSFET	31.0 ℃
CH11	PL3 CHOKE	20.5 ℃
CH12	PL7 MOSFET	19.9 ℃
CH13	SK708	15.0 ℃
CH14	TOP Heatsink	16.8 ℃

Performance Test

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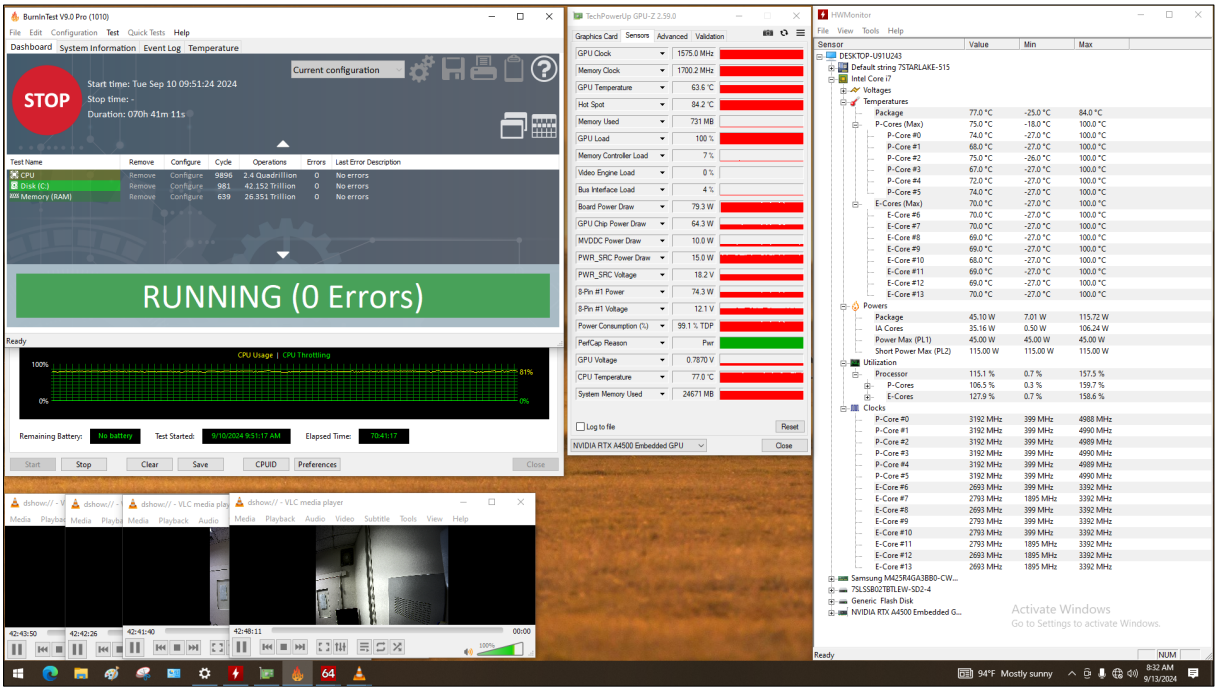
- Chamber in 25°C / 85%RH



Test Point	Ambient Temp.	25°C
	CPU P-Cores Max Temperature	75.0 ℃
	CPU E-Cores Max Temperature	70.0 ℃
	CPU P-Cores Frequency (Unit: GHz)	3.2 GHz
	CPU E-Cores Frequency (Unit: GHz)	2.8 GHz
	GPU Temperature	6.6 ℃
	GPU Hot Spot Temperature	84.2 ℃
	GPU Frequency (Unit: MHz)	1575.0 MHz
CH1	CPU	50.5 ℃
CH2	CPU TOP Heatsink	46.4 ℃
CH3	DDR5 SO-DIMM	46.0 ℃
CH4	NVIDIA A4500 GPU	55.0 ℃
CH5	GPU TOP Heatsink	48.9 ℃
CH6	GPU DRAM	44.9 ℃
CH7	SATA SSD	42.6 ℃
CH8	M.2 Capture Card	39.3 ℃
CH9	TPU3802 CHOKE	47.6 ℃
CH10	TPU3802 MOSFET	54.4 ℃
CH11	PL3 CHOKE	46.1 ℃
CH12	PL7 MOSFET	45.4 ℃
CH13	SK708	41.3 ℃
CH14	TOP Heatsink	42.6 ℃

Performance Test

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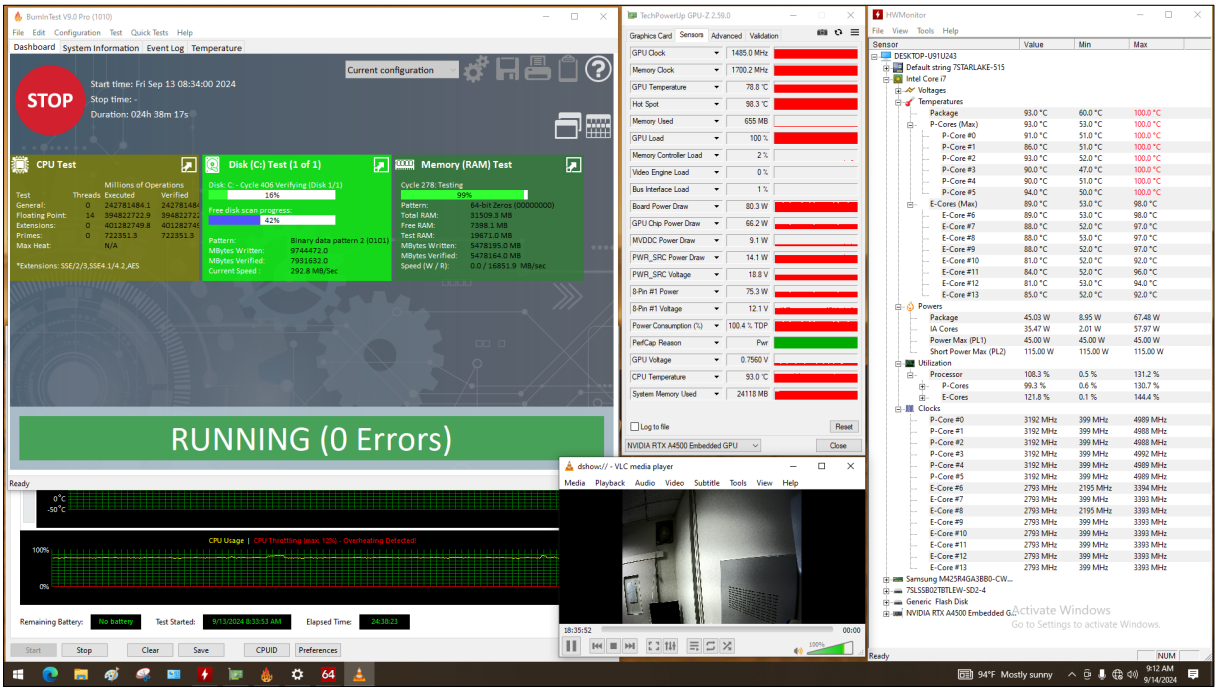
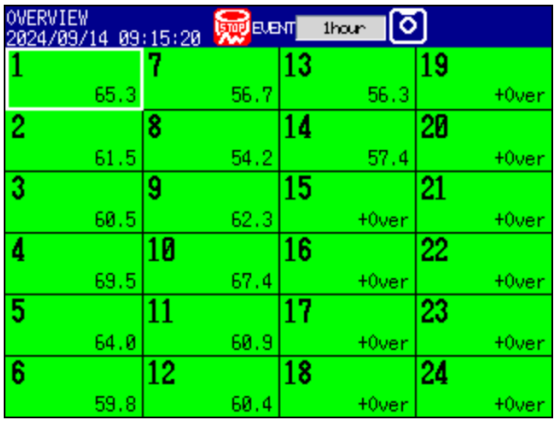
- Chamber in 40°C / 85%RH



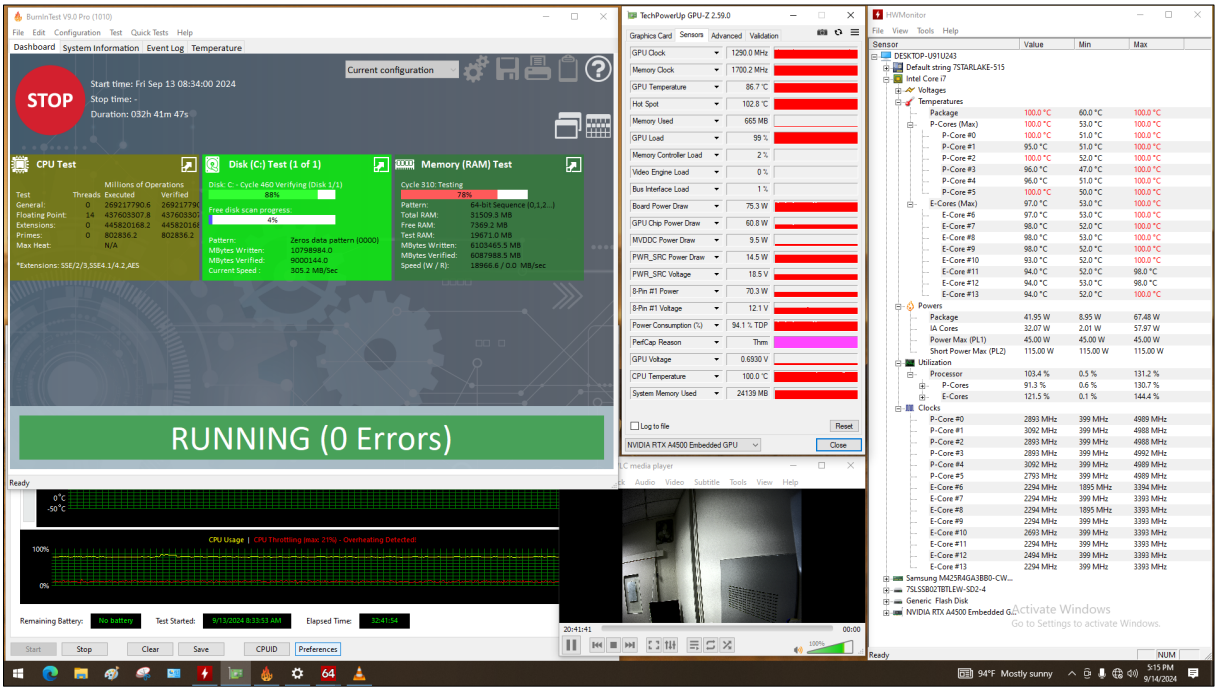


Test Point	Ambient Temp.	40°C
	CPU P-Cores Max Temperature	93.0 °C
	CPU E-Cores Max Temperature	89.0 °C
	CPU P-Cores Frequency (Unit: GHz)	3.2 GHz
	CPU E-Cores Frequency (Unit: GHz)	2.8 GHz
	GPU Temperature	78.8 °C
	GPU Hot Spot Temperature	98.3 °C
	GPU Frequency (Unit: MHz)	1485.0 MHz
CH1	CPU	65.3 °C
CH2	CPU TOP Heatsink	61.5 °C
CH3	DDR5 SO-DIMM	60.5 °C
CH4	NVIDIA A4500 GPU	69.5 °C
CH5	GPU TOP Heatsink	64.0 °C
CH6	GPU DRAM	59.8 °C
CH7	SATA SSD	56.7 °C
CH8	M.2 Capture Card	54.2 °C
CH9	TPU3802 CHOKE	62.3 °C
CH10	TPU3802 MOSFET	67.4 °C
CH11	PL3 CHOKE	60.9 °C
CH12	PL7 MOSFET	60.4 °C
CH13	SK708	56.3 °C
CH14	TOP Heatsink	57.4 °C

Performance Test

IV320-RH-KD

- Chamber in 50°C / 85%RH



Test Point	Ambient Temp.	50°C
	CPU P-Cores Max Temperature	100.0 °C
	CPU E-Cores Max Temperature	97.0 °C
	CPU P-Cores Frequency (Unit: GHz)	3.1 GHz
	CPU E-Cores Frequency (Unit: GHz)	2.3 GHz
	GPU Temperature	86.7 °C
	GPU Hot Spot Temperature	102.8 °C
	GPU Frequency (Unit: MHz)	1290.0 MHz
CH1	CPU	74.5 °C
CH2	CPU TOP Heatsink	70.8 °C
CH3	DDR5 SO-DIMM	69.8 °C
CH4	NVIDIA A4500 GPU	78.1 °C
CH5	GPU TOP Heatsink	73.1 °C
CH6	GPU DRAM	69.1 °C
CH7	SATA SSD	66.0 °C
CH8	M.2 Capture Card	63.9 °C
CH9	TPU3802 CHOKE	71.2 °C
CH10	TPU3802 MOSFET	75.8 °C
CH11	PL3 CHOKE	70.0 °C
CH12	PL7 MOSFET	69.5 °C
CH13	SK708	65.9 °C
CH14	TOP Heatsink	66.8 °C

Performance Test

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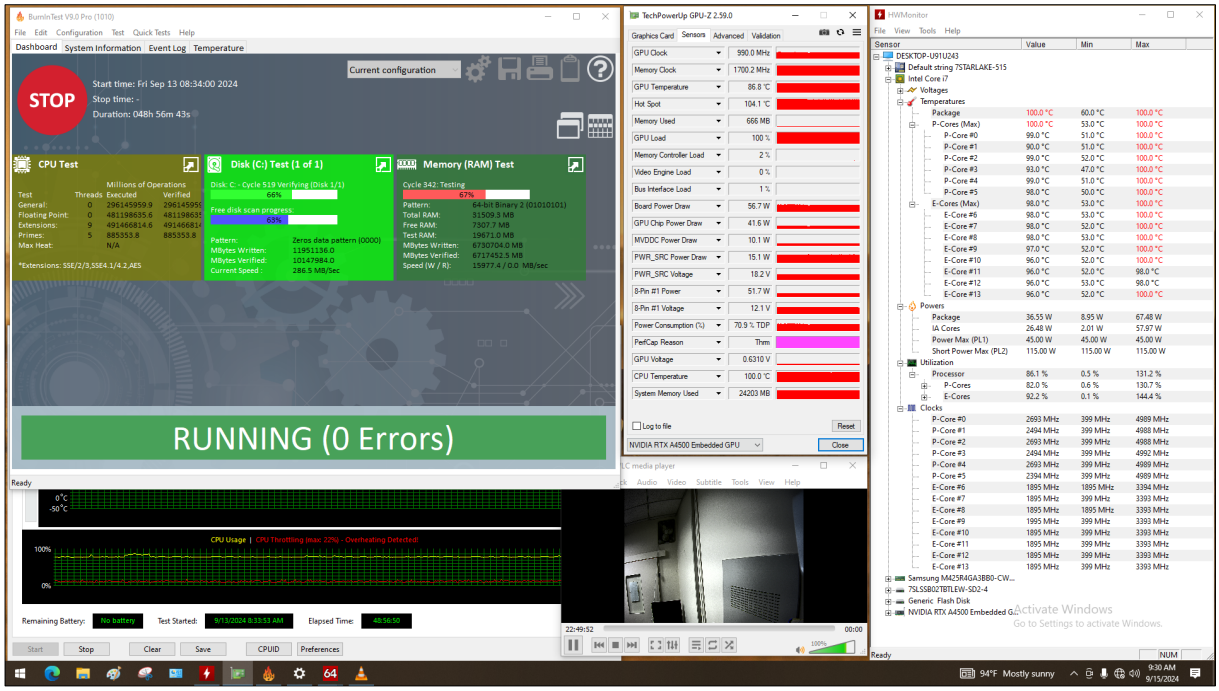
- Chamber in 60°C / 85%RH



Test Point	Ambient Temp.	60°C
	CPU P-Cores Max Temperature	100.0 °C
	CPU E-Cores Max Temperature	98.0 °C
	CPU P-Cores Frequency (Unit: GHz)	2.7 GHz
	CPU E-Cores Frequency (Unit: GHz)	1.9 GHz
	GPU Temperature	86.8 °C
	GPU Hot Spot Temperature	104.1 °C
	GPU Frequency (Unit: MHz)	990.0 MHz
CH1	CPU	79.1 °C
CH2	CPU TOP Heatsink	75.5 °C
CH3	DDR5 SO-DIMM	74.9 °C
CH4	NVIDIA A4500 GPU	80.9 °C
CH5	GPU TOP Heatsink	77.1 °C
CH6	GPU DRAM	74.1 °C
CH7	SATA SSD	69.9 °C
CH8	M.2 Capture Card	69.6 °C
CH9	TPU3802 CHOKE	75.4 °C
CH10	TPU3802 MOSFET	78.8 °C
CH11	PL3 CHOKE	74.8 °C
CH12	PL7 MOSFET	74.5 °C
CH13	SK708	70.9 °C
CH14	TOP Heatsink	72.1 °C

5. THERMAL TEST RESULT(-40˚C ~ +60˚C)

CPU & GPU Temperature and Frequency / Thermocouple Measurements

Temperature / Frequency \ Ambient Temp.	-40°C	-20°C	0°C	25°C 85% RH	40°C 85% RH	50°C 85% RH	60°C 85% RH
CPU P-Cores Max Temperature (Unit: °C)	5.0	25.0	47.0	75.0	93.0	100.0	100.0
CPU E-Cores Max Temperature (Unit: °C)	1.0	21.0	43.0	70.0	89.0	97.0	98.0
CPU P-Cores Frequency (Unit: GHz)	3.29	3.19	3.19	3.19	3.19	3.09	2.69
CPU E-Cores Frequency (Unit: GHz)	2.79	2.79	2.79	2.79	2.79	2.29	1.90
GPU Temperature (Unit: °C)	3.1	22.4	38.9	6.6	78.8	86.7	86.8
GPU Hot Spot Temperature (Unit: °C)	30.5	47.1	62.3	84.2	98.3	102.8	104.1
GPU Frequency (Unit: MHz)	1620	1605	1590	1575	1485	1290	990

Thermocouple measuring point \ Ambient Temp.		-40°C	-20°C	0°C	25°C 85% RH	40°C 85% RH	50°C 85% RH	60°C 85% RH
CH1	CPU	-16.7	5.0	24.7	50.5	65.3	74.5	79.1
CH2	CPU TOP Heatsink	-21.0	0.5	20.7	46.4	61.5	70.8	75.5
CH3	DDR5 SO-DIMM	-21.6	0.2	20.6	46.0	60.5	69.8	74.9
CH4	NVIDIA A4500 GPU	-9.5	11.7	29.3	55.0	69.5	78.1	80.9
CH5	GPU TOP Heatsink	-16.8	4.9	23.0	48.9	64.0	73.1	77.1
CH6	GPU DRAM	-20.9	0.6	19.2	44.9	59.8	69.1	74.1
CH7	SATA SSD	-27.2	-6.1	16.3	42.6	56.7	66.0	69.9
CH8	M.2 Capture Card	-29.4	-7.2	13.6	39.3	54.2	63.9	69.6
CH9	TPU3802 CHOKE	-18.0	2.9	22.4	47.6	62.3	71.2	75.4
CH10	TPU3802 MOSFET	-8.5	12.3	31.0	54.4	67.4	75.8	78.8
CH11	PL3 CHOKE	-21.2	0.6	20.5	46.1	60.9	70.0	74.8
CH12	PL7 MOSFET	-22.0	0.1	19.9	45.4	60.4	69.5	74.5
CH13	SK708	-28.5	-6.2	15.0	41.3	56.3	65.9	70.9
CH14	TOP Heatsink	-27.1	-5.4	16.8	42.6	57.4	66.8	72.1

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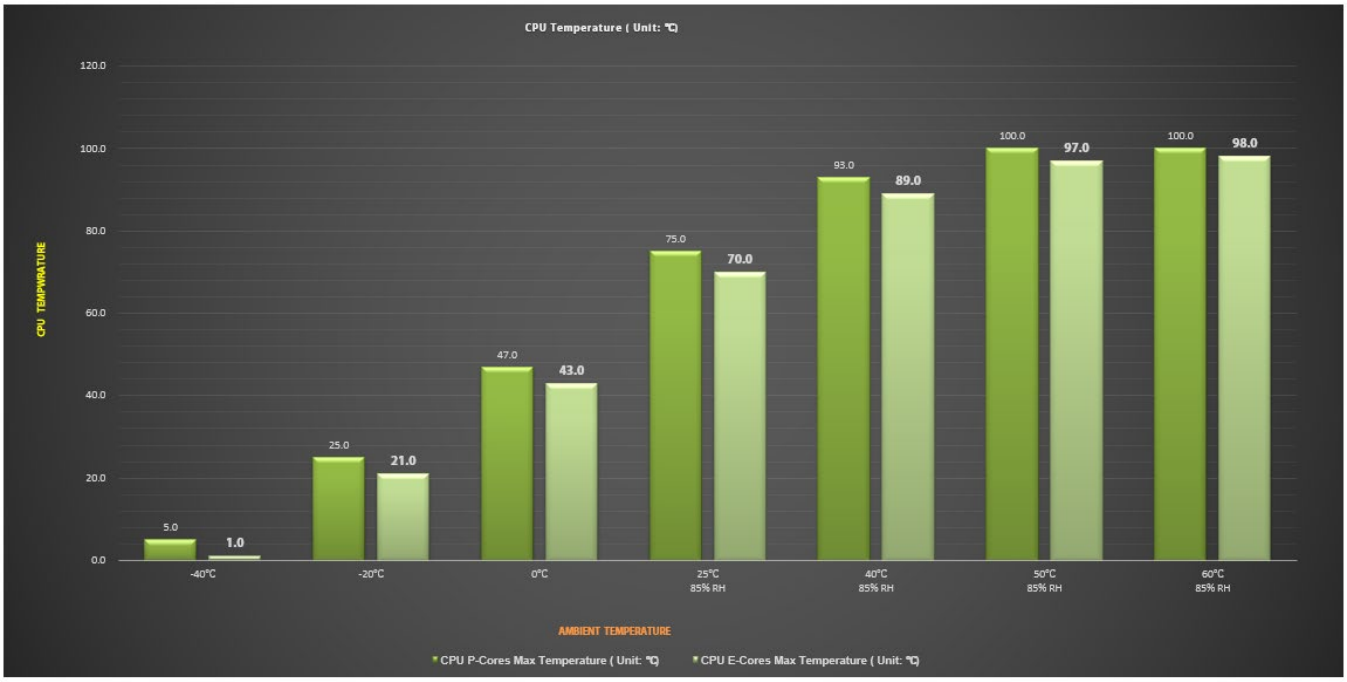

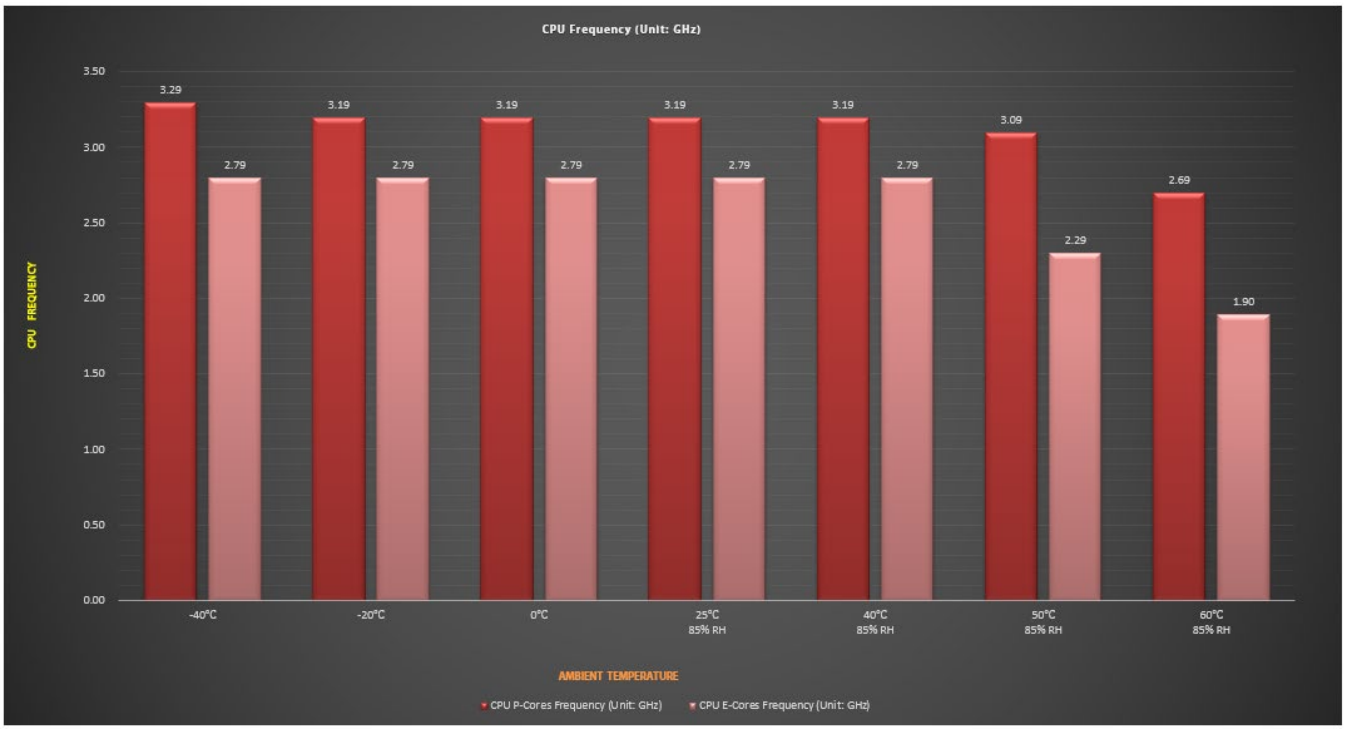

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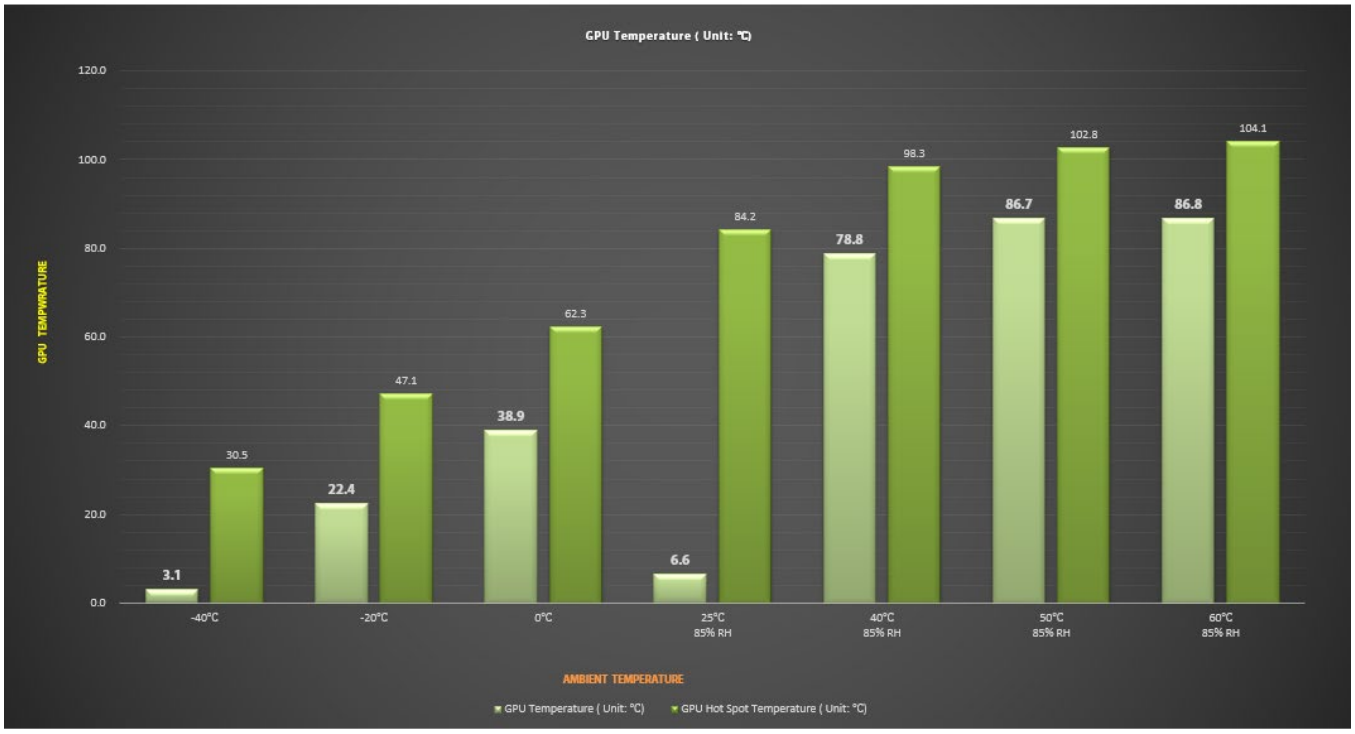
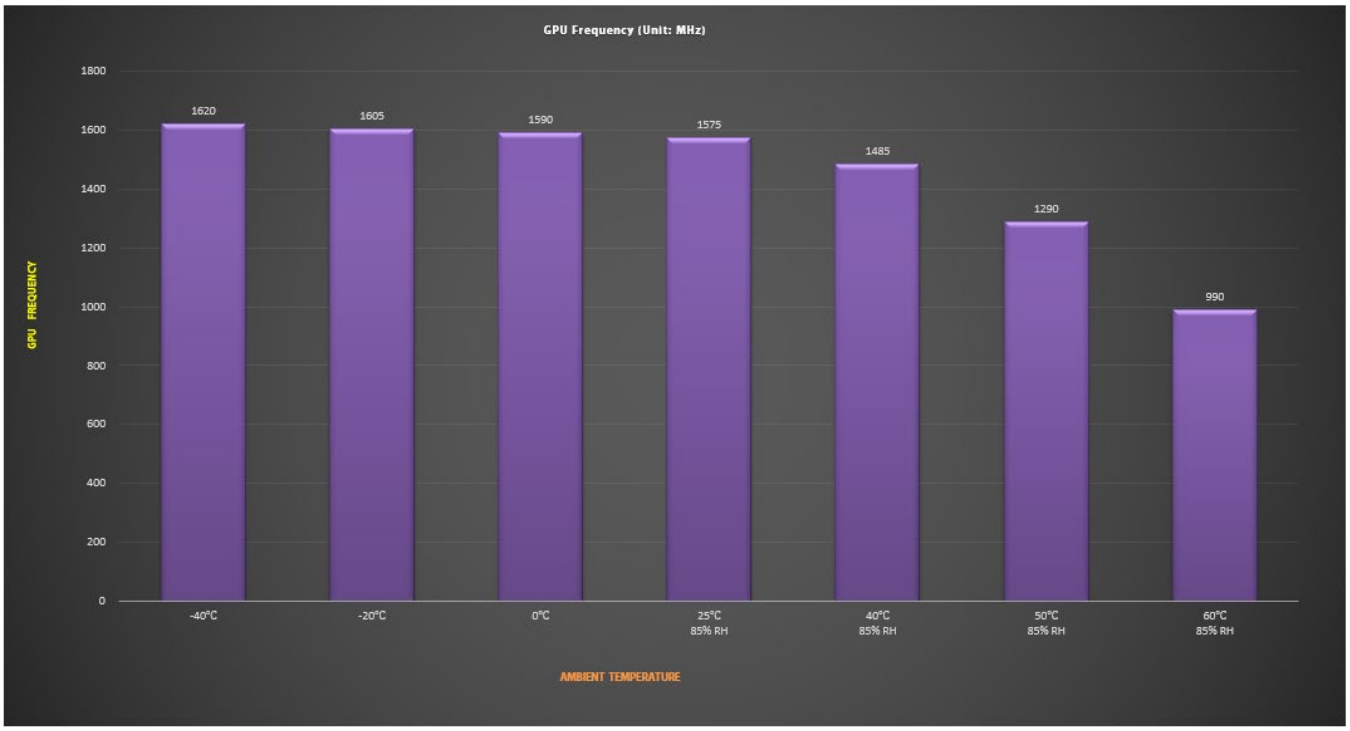
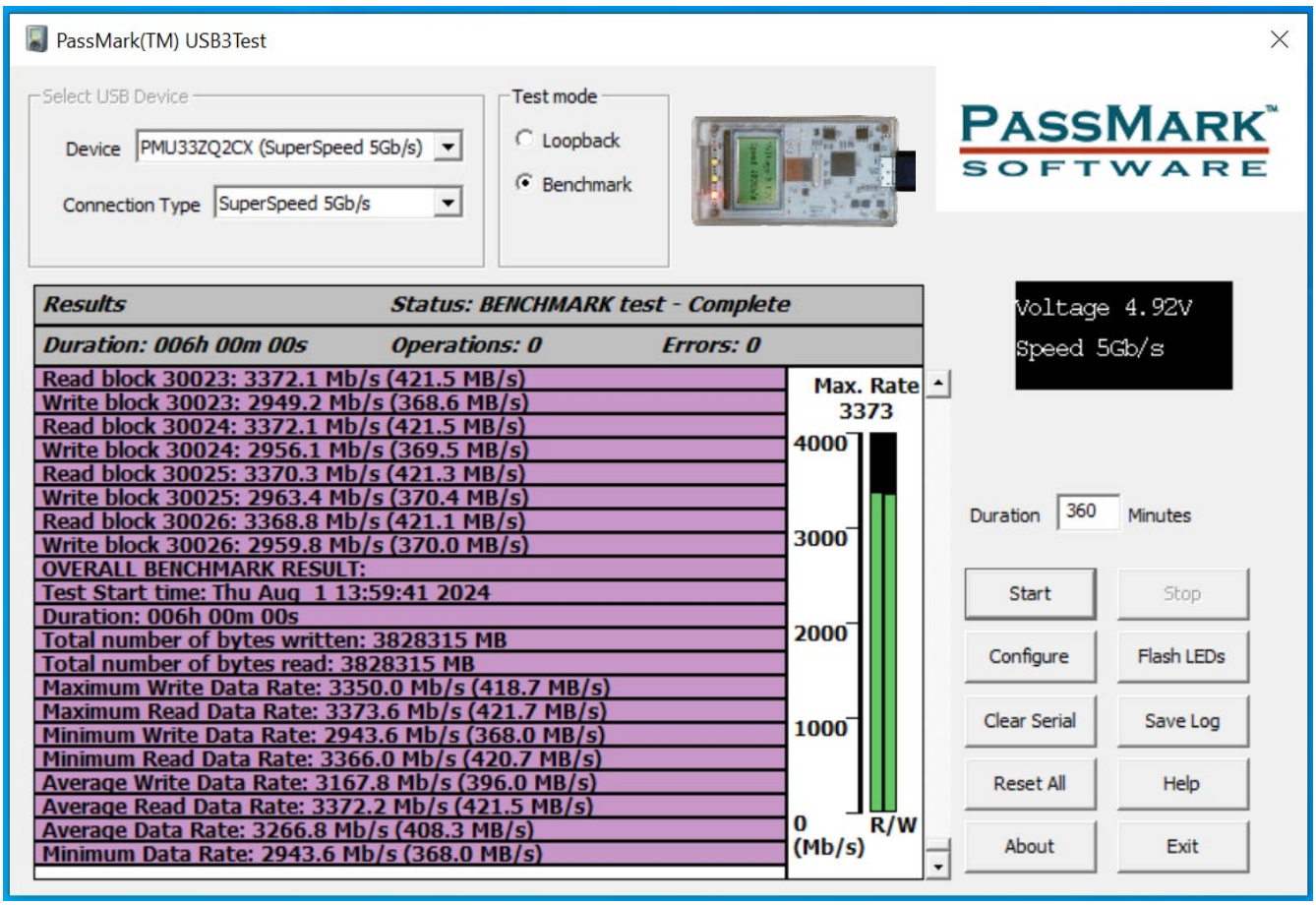




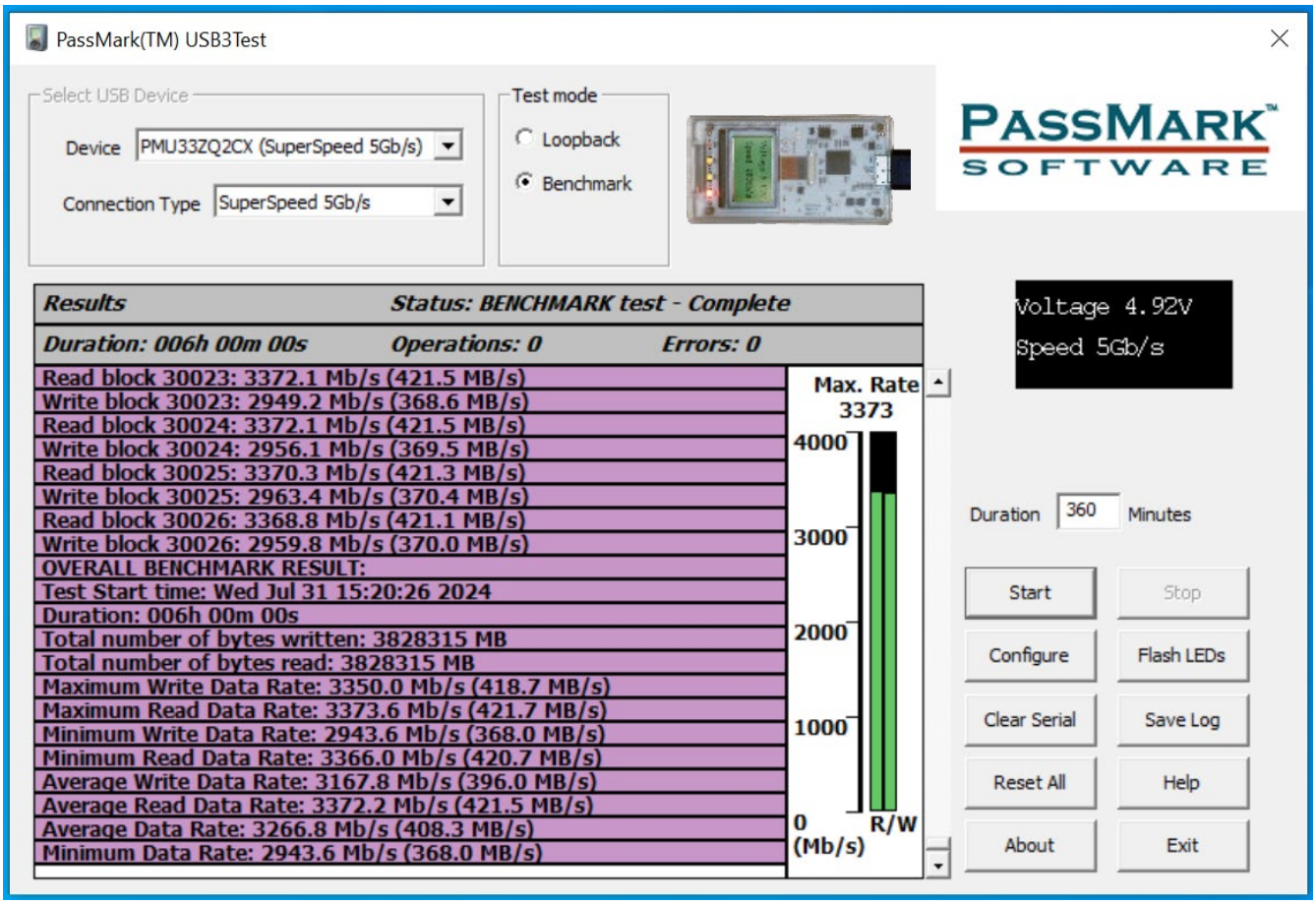
6. I/O FUNCTION TEST

6-1. USB 3.0



6-2. USB 3.0

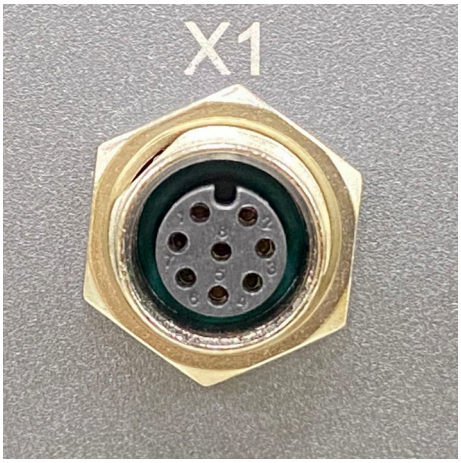

X9
GTC
GTC

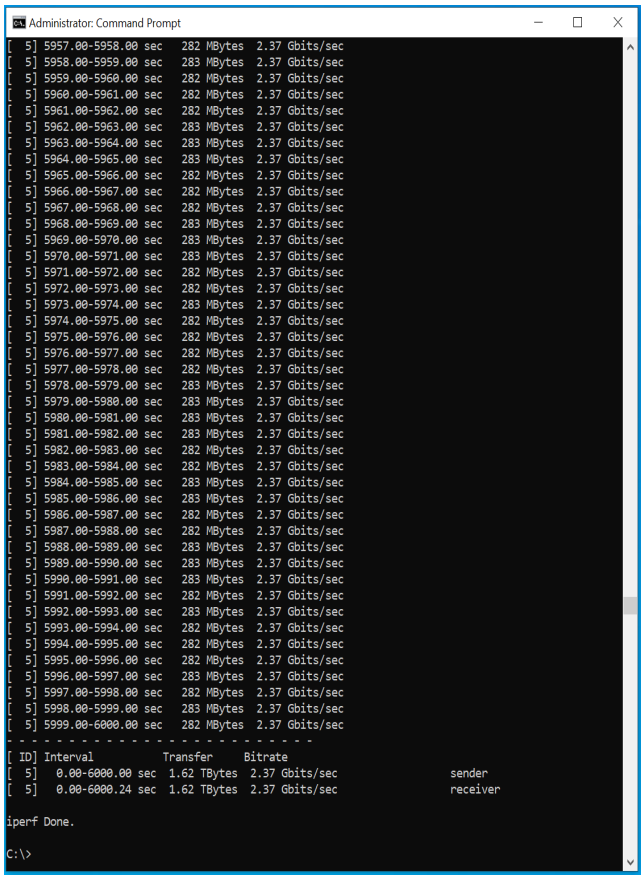

PassMark(TM) USB3Test
Select USB Device
Device
PMU33ZQ2CX (SuperSpeed 5Gb/s)
Connection Type
SuperSpeed 5Gb/s
Test mode
Loopback
Benchmark
PASSMARK SOFTWARE
Results
Status: BENCHMARK test - Complete
Duration: 006h 00m 00s
Operations: 0
Errors: 0
Read block 30023: 3372.1 Mb/s (421.5 MB/s)
Write block 30023: 2949.2 Mb/s (368.6 MB/s)
Read block 30024: 3372.1 Mb/s (421.5 MB/s)
Write block 30024: 2956.1 Mb/s (369.5 MB/s)
Read block 30025: 3370.3 Mb/s (421.3 MB/s)
Write block 30025: 2963.4 Mb/s (370.4 MB/s)
Read block 30026: 3368.8 Mb/s (421.1 MB/s)
Write block 30026: 2959.8 Mb/s (370.0 MB/s)
OVERALL BENCHMARK RESULT:
Test Start time: Wed Jul 31 15:20:26 2024
Duration: 006h 00m 00s
Total number of bytes written: 3828315 MB
Total number of bytes read: 3828315 MB
Maximum Write Data Rate: 3350.0 Mb/s (418.7 MB/s)
Maximum Read Data Rate: 3373.6 Mb/s (421.7 MB/s)
Minimum Write Data Rate: 2943.6 Mb/s (368.0 MB/s)
Minimum Read Data Rate: 3366.0 Mb/s (420.7 MB/s)
Average Write Data Rate: 3167.8 Mb/s (396.0 MB/s)
Average Read Data Rate: 3372.2 Mb/s (421.5 MB/s)
Average Data Rate: 3266.8 Mb/s (408.3 MB/s)
Minimum Data Rate: 2943.6 Mb/s (368.0 MB/s)
Max. Rate
3373
4000
3000
2000
1000
0
(Mb/s)
R/W
Voltage 4.92V
Speed 5Gb/s
Duration
360
Minutes
Start
Stop
Configure
Flash LEDs
Clear Serial
Save Log
Reset All
Help
About
Exit

Performance Test

IV320-RH-KD

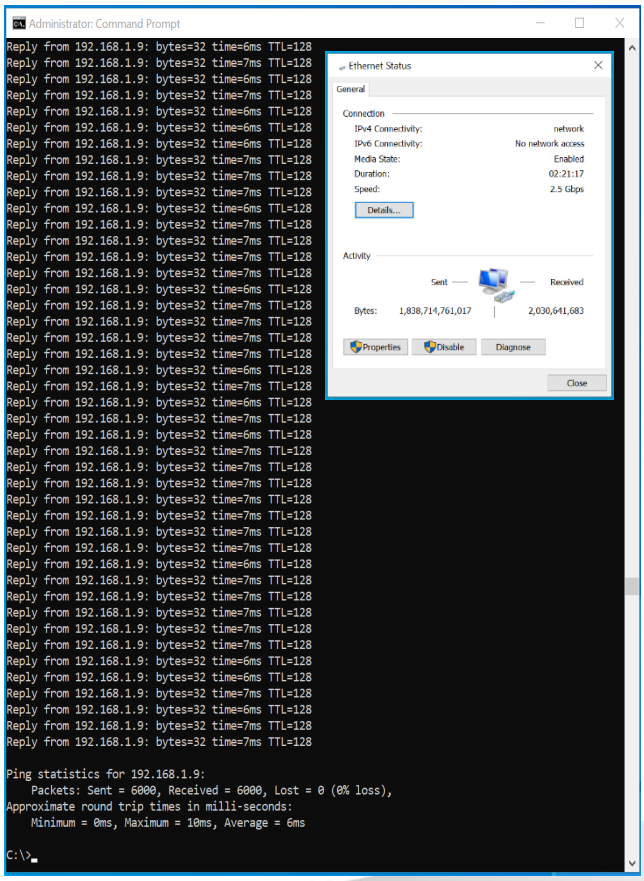
6-3. LAN (2.5Gbps)





LAN SPEED TEST

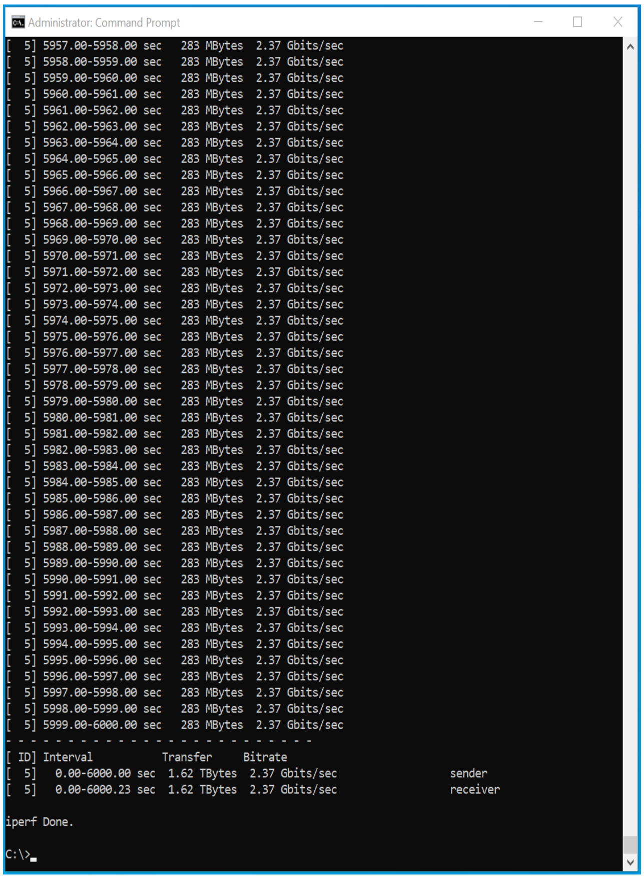
DATA PACKET TEST



Performance Test

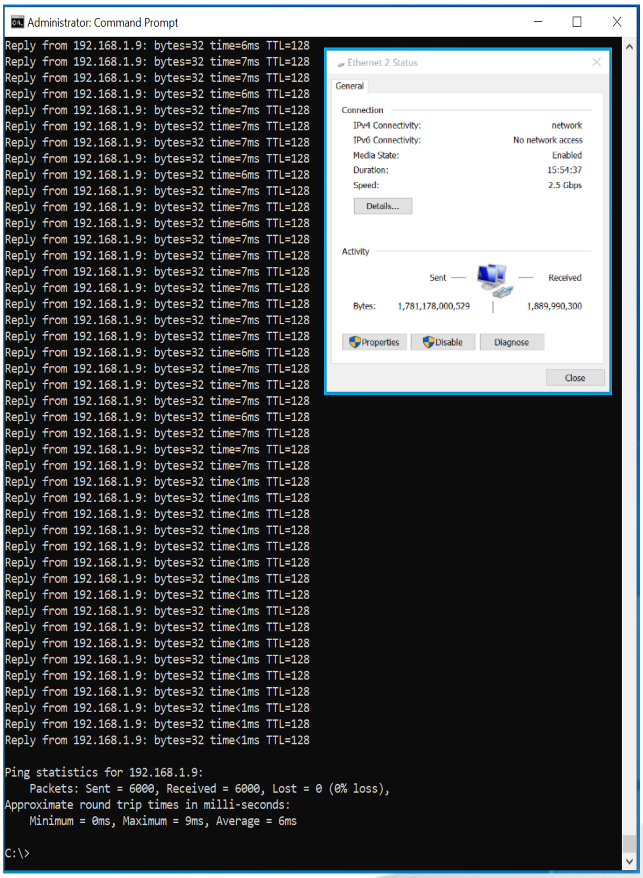
IV320-RH-KD

6-4. LAN (2.5Gbps)

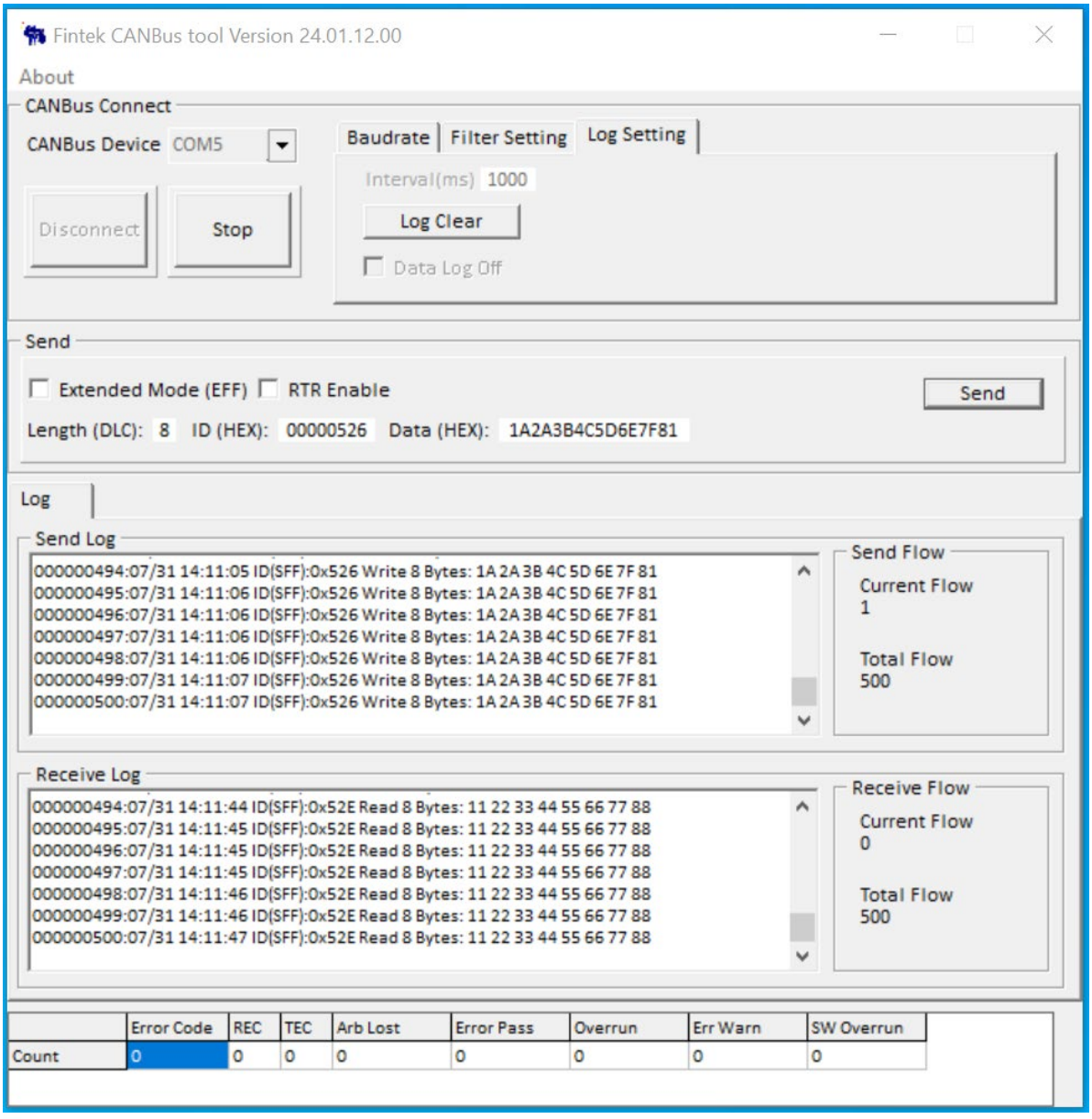


LAN SPEED TEST

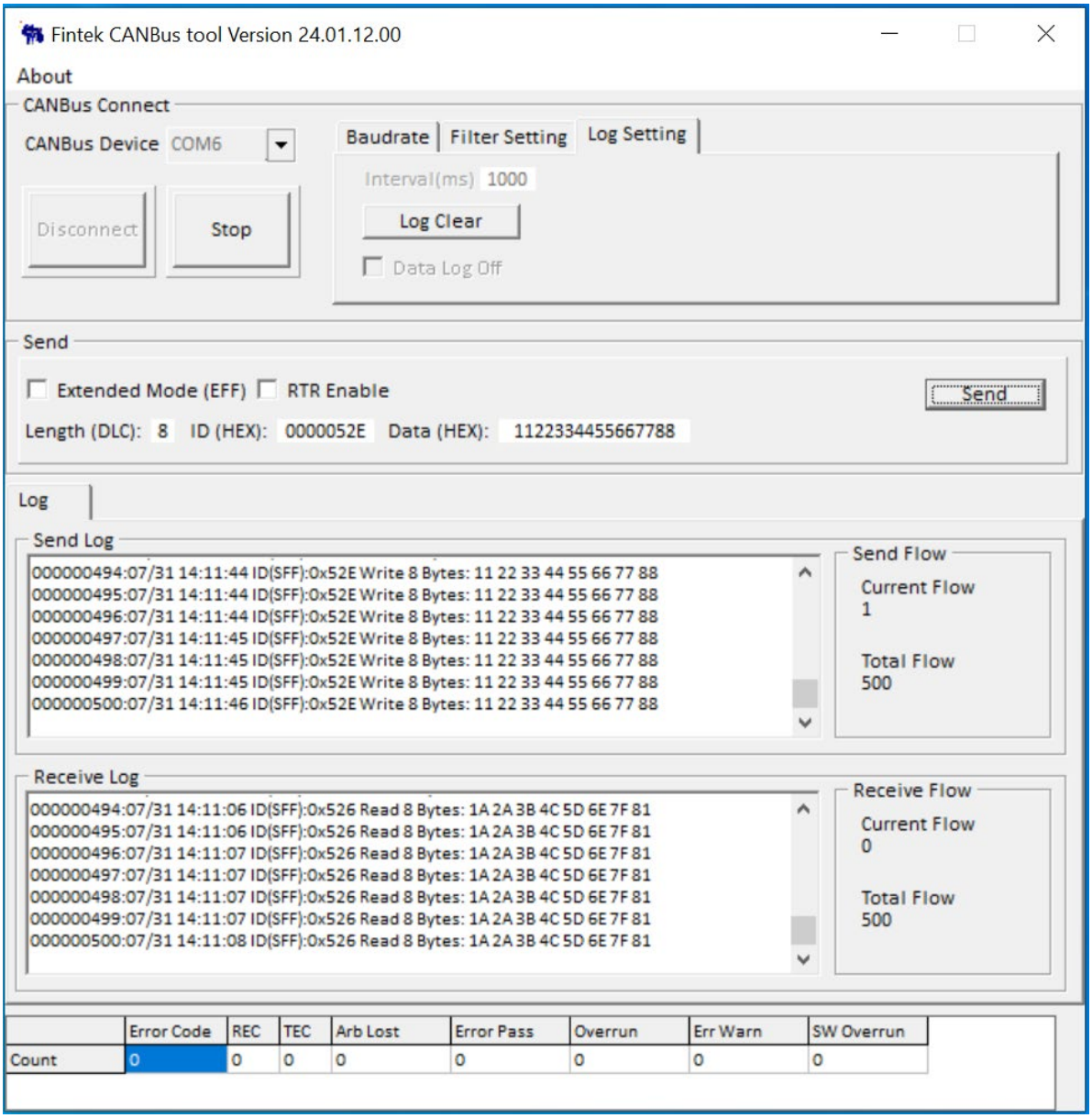
DATA PACKET TEST



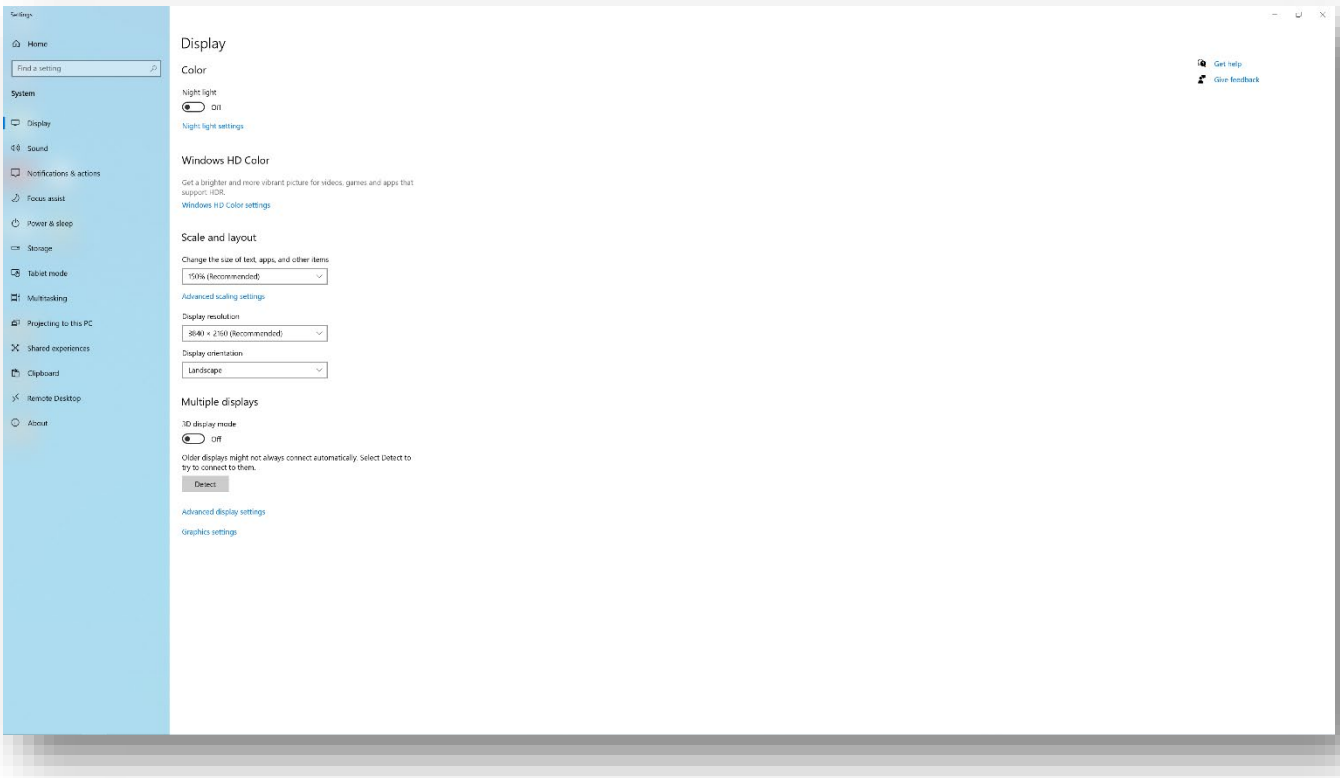
6-5. CANBus (COM 5)



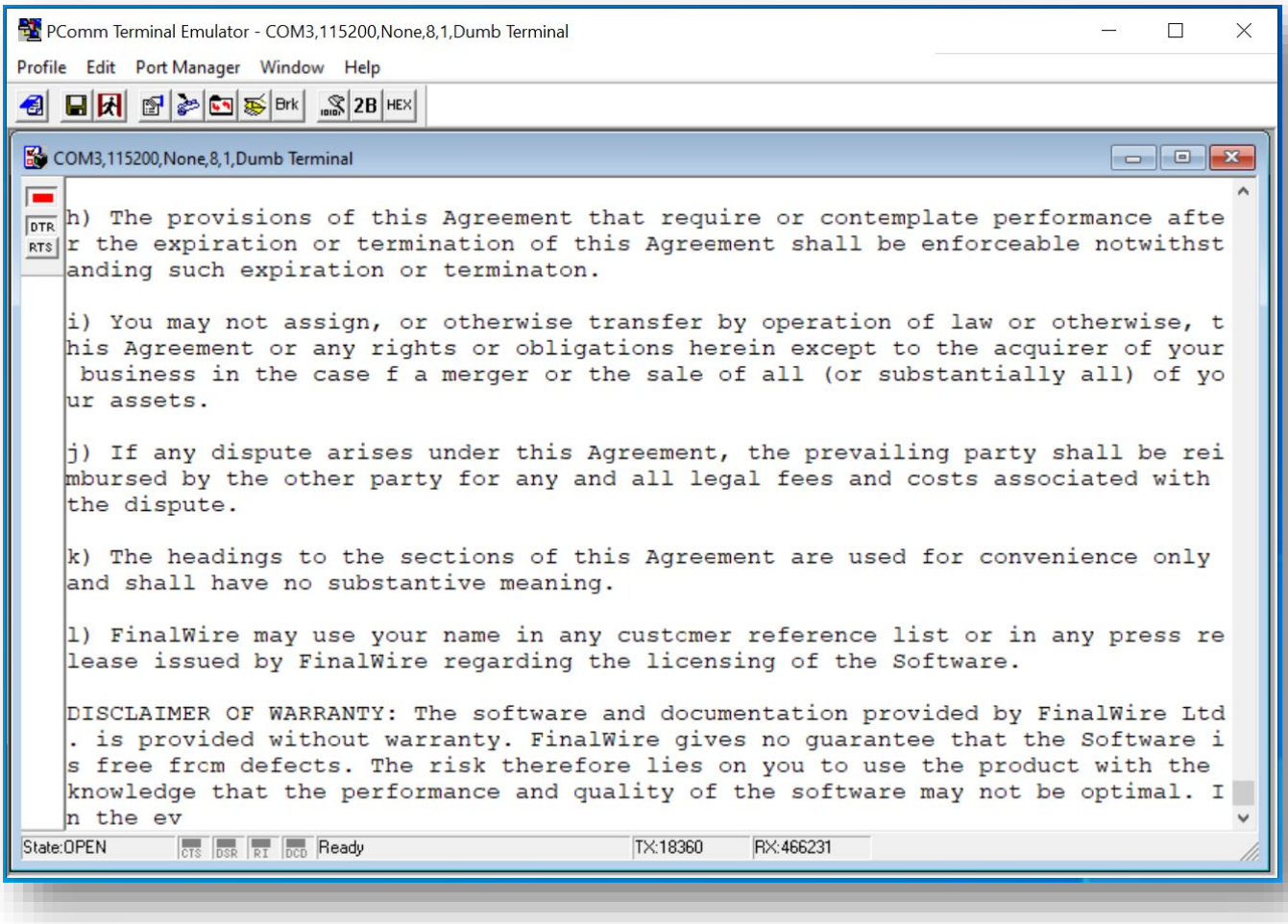
6-6. CANBus (COM 6)



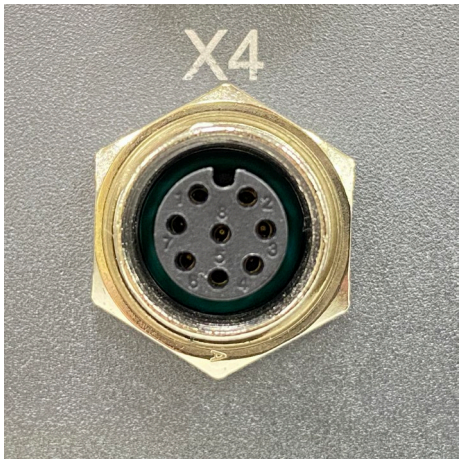
6-7. Mini Display Port

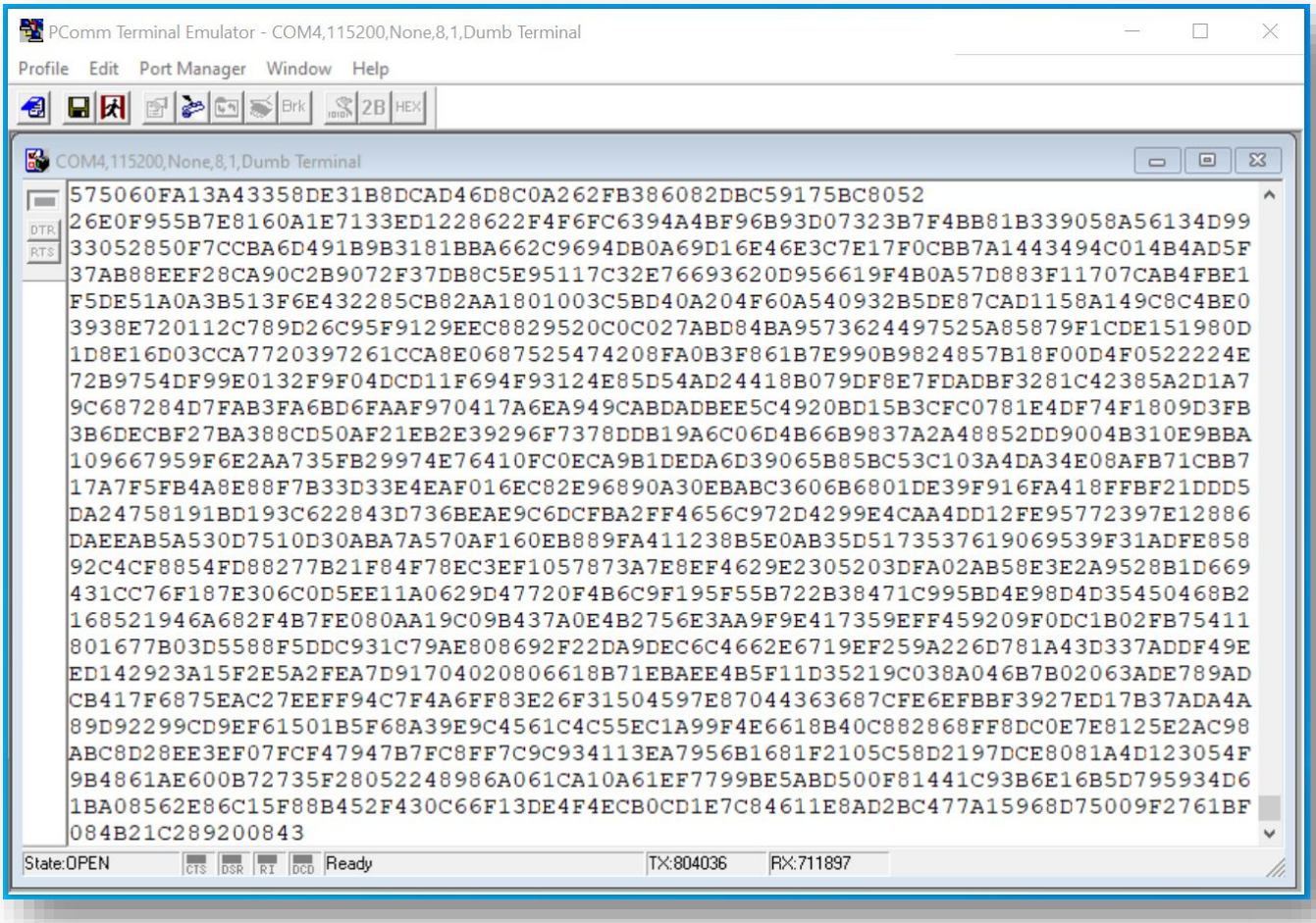


6-8. Serial Port RS485 (COM 3)

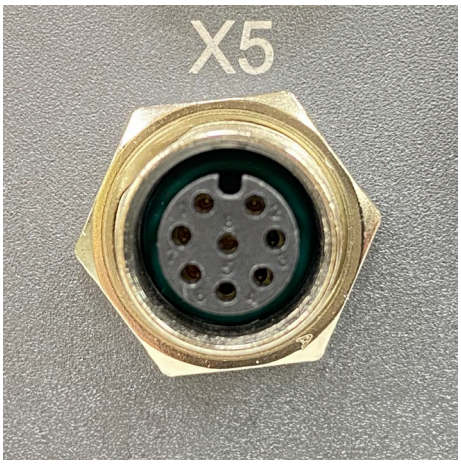


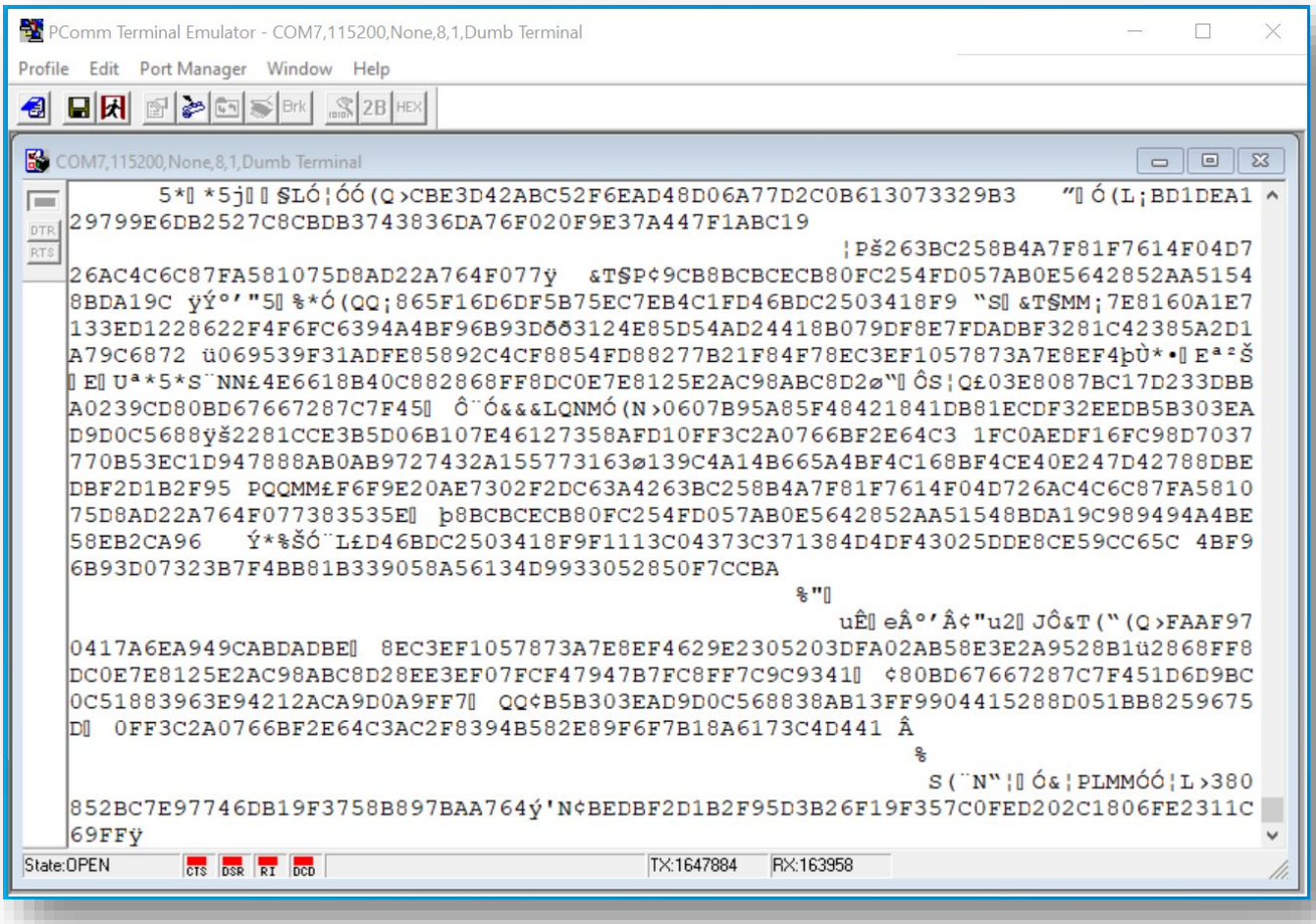
6-9. Serial Port RS485 (COM 4)



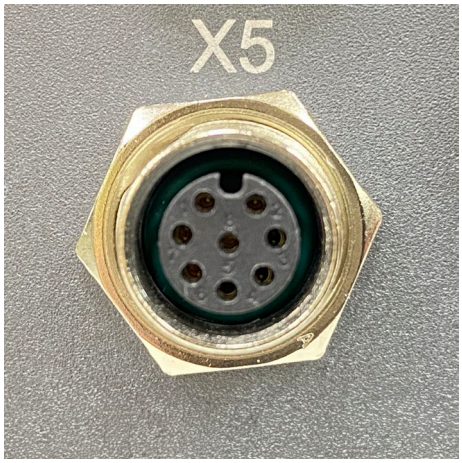


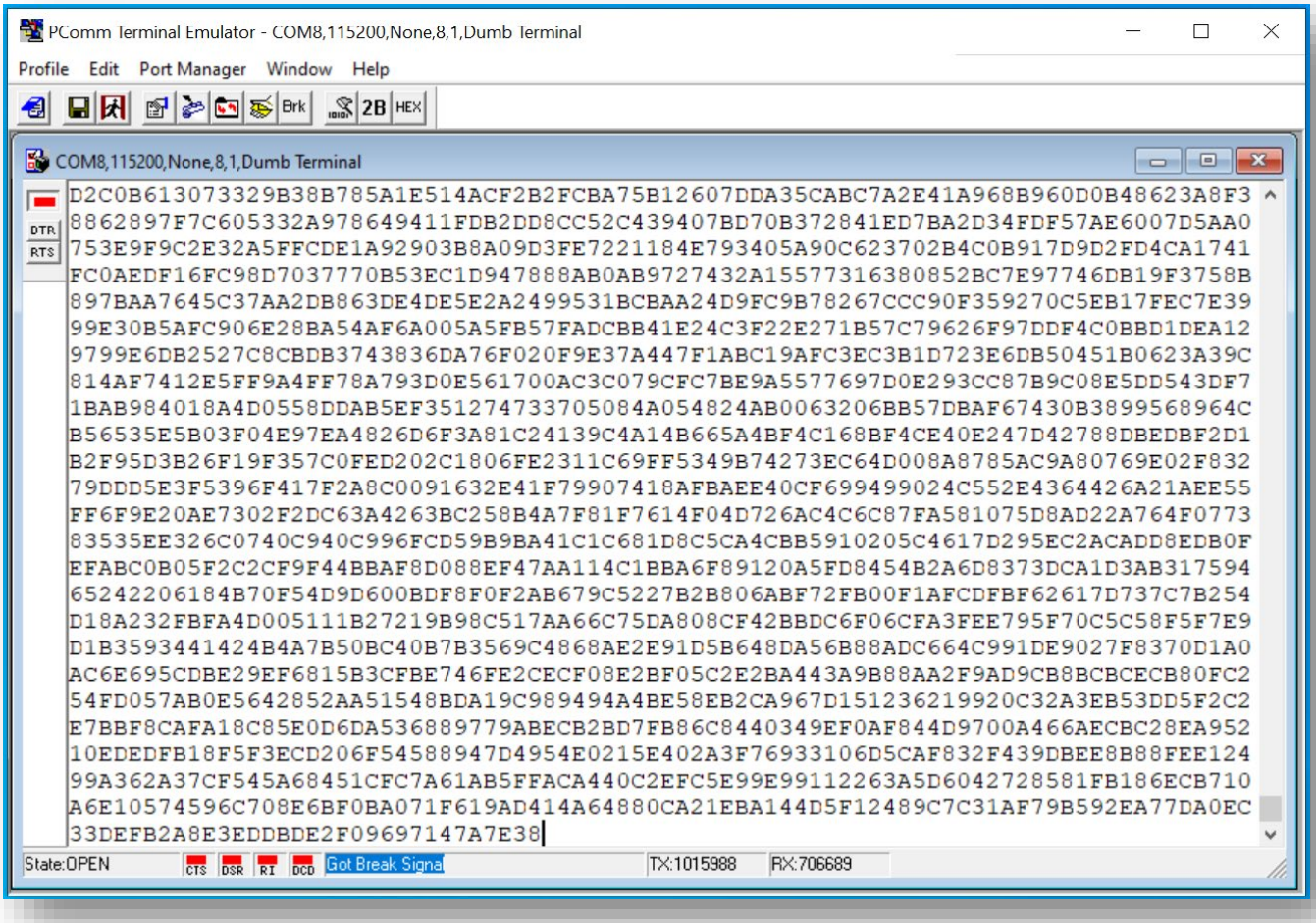
6-10. Serial Port RS485 (COM 7)





6-11. Serial Port RS485 (COM 8)





6-12. 3G-SDI (Port 1,3,5,7)

6-13. 3G-SDI (Port 2,4,6,8)