Applications Information

Power Supply Characteristics

886LCD-M Family

This note describes the power supply characteristics of the 886LCD-M Family board including static power consumption and power-on load characteristics.

Revision history

Revision	Date	Description/changes
0	July 4th 2006	Minor corrections and document completely reformatted
Revision 1.3	23-05-05	Measurements added
Revision 1.2	20-05-05	Improved overview
Revision 1.1	19-04-05	100Mbit and Celeron 600MHz info added
Revision 1.0	09-03-05	Initial 868LCD-M Power Supply characteristics

Power Supply Characteristics of 886LCD/mITX

In order to ensure safe operation of the board, the ATX power supply must monitor the supply voltage and shut down if the supplies are out of range – refer to the hardware manual for actual power specification.

The 886LCD/mITX board is powered through the ATX connector and the additional 12V separate supply for CPU as specified in the ATX specification; besides this the power supplied to the board must be within the ATX specification.

The requirements to the supply voltages are as follows:

Supply	Min	Max	Note
Vcc3	3.168V	3.432V	Should be ±4% for compliance with the ATX specification
Vcc	4.75V	5.25V	Should be ±5% for compliance with the ATX specification
+12V	11.4V	12.6V	Should be ±5% for compliance with the ATX specification
–12V	–13.2V	–10.8V	Should be ±10% for compliance with the ATX specification
-5V	-5,50V	-4.5V	Not required for the 886LCD/mITX board
5VSB	4.75V	–5.25V	Should be ±5% for compliance with the ATX specification

Test system configuration

The following items were used in the test setup:
1. 886LCD-M/Flex (710180-4500) mounted 256MB SDRAM (333MHz) 2x EZ128DDR16M168-333INF.
2. Pentium-M 166/400MHz, FSB 400MHz (Banias) CPU (1MB L2 Cache) or Intel Mobile Celeron 600/400MHz (0MB L2 Cache) BGA.
3. Standard Pentium-4 active CPU cooler.
4. PS/2 keyboard & mouse
5. CRT
6. Primary Master HDD (Fujitsu MPG3102AT 10.24GB).
7. ATX PSU (Antec 550W)
8. Tektronix TDS 620B, P6243 probes
9. Fluke Current Probe 80i-100S AC/DC
10. Ethernet Ports 1, 2, 3 are enabled.

Test setup
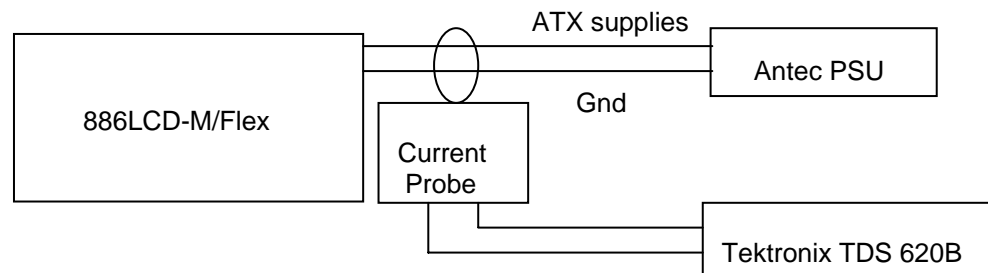
Note: The Power consumption of CRT, FDD and HDD is not included. If DDR Memory type is changed then possible also power consumption will change.

Power Consumption

The idle/full power consumption of the 886LCD-M is measured under:
1. DOS prompt idle/full CPU load.
2. WindowsXP idle/full CPU load.

Power consumption test results summary

886LCD-M board (3x1000MB LAN) w. Pentium M 1600/400MHz (Banias), 256MB DDR RAM (333MHz)

Power State	Net	Current (I)	Power (W)
DOS FULL LOAD	+5VDC	4.240A	21.0W
DOS FULL LOAD	+3.3VDC	2.542A	8.6W
DOS IDLE	+5VDC	4.028A	20.3W
DOS IDLE	+3.3VDC	2.532A	8.6W
DOS IDLE	+12VDC	0.424A	4.6W
SUSPEND S1	+5VDC	1.758A	8.8W
SUSPEND S1	+3.3VDC	2.560A	8.8W
SUSPEND S3	+5VSB	1.007A	5.16W
SUSPEND S4	+5VSB	1.007A	4.95W
SUSPEND S5	+5VSB	0.892A	4.6W
WINDOWS XP IDLE	+5VDC	2.212A	11.1W
WINDOWS XP IDLE	+3.3VDC	2.568A	8.7W
WINDOWS XP FULL LOAD	+5VDC	4.704A	23.7W
WINDOWS XP FULL LOAD	+3.3VDC	2.572A	8.7W

886LCD-M board (3x100MB LAN) w. Pentium M 1600/400MHz (Banias), 256MB DDR RAM (333MHz)

Power State	Net	Current (I)	Power (W)
DOS FULL LOAD	+5VDC	4.560A	22.8W
DOS FULL LOAD	+3.3VDC	1.082A	3.7W
DOS IDLE	+5VDC	4.028A	20.3W
DOS IDLE	+3.3VDC	0.768A	2.6W
DOS IDLE	+12VDC	0.424A	4.6W
SUSPEND S1	+5VDC	1.758A	8.8W
SUSPEND S1	+3.3VDC	1.016A	3.5W
SUSPEND S3	+5VSB	0.516A	2.65W
SUSPEND S4	+5VSB	0.535A	2.74W
SUSPEND S5	+5VSB	0.2840A	1.65W
WINDOWS XP IDLE	+5VDC	2.212A	11.1W
WINDOWS XP IDLE	+3.3VDC	1.062A	3.6W
WINDOWS XP FULL LOAD	+5VDC	4.704A	23.7W
WINDOWS XP FULL LOAD	+3.3VDC	1.062A	3.6W

886LCD-M board (3x1000MB LAN) w. Intel Mobile Celeron 600/400 (BGA), 256MB DDR RAM (333MHz)

Power State	Net	Current (I)	Power (W)
DOS FULL LOAD	+5VDC	2.276A	11.5A
DOS FULL LOAD	+3.3VDC	2.568A	8.7W
DOS IDLE	+5VDC	2.268A	11.4A
DOS IDLE	+3.3VDC	2.532A	8.6W
DOS IDLE	+12VDC	0.424A	4.6W
SUSPEND S1	+5VDC	1.636A	8.2W
SUSPEND S1	+3.3VDC	2.560A	8.8W
SUSPEND S3	+5VSB	1.007A	5.16W
SUSPEND S4	+5VSB	1.007A	4.95W
SUSPEND S5	+5VSB	0.892A	4.6W
WINDOWS XP IDLE	+5VDC	1.900A	9.5W
WINDOWS XP IDLE	+3.3VDC	2.720A	8.7W
WINDOWS XP FULL LOAD	+5VDC	3.020A	15.1W
WINDOWS XP FULL LOAD	+3.3VDC	2.572A	8.7W

Board power consumption guide lines

Configuration: Windows XP, 256MByte/ 330MHz DDR, 1pcs Fan, 1000MB Ethernet x3, no PCI&AGP.

Total power consumption meassured:

Power State	CPU Speed	Power consumption
Full load	1600Mhz	37.0W
Idle	1600Mhz	24.4W
S1	1600Mhz	22.2W
S3	1600Mhz	5.16W
S4	1600Mhz	4.95W
S5	1600Mhz	4.60W

Power State	CPU Speed	Power consumption
Full load	600Mhz (BGA)	28.4W
Idle	600Mhz (BGA)	22.8W
S1	600Mhz (BGA)	21.6W
S3	600Mhz (BGA)	5.16W
S4	600Mhz (BGA)	4.95W
S5	600Mhz (BGA)	4.60W

Minimum recommended power supply specifications:

Net	Current (I)	Peak Current
+5VDC	8.0A	40.0A(3ms)
+3.3VDC	4.0A	14.0A(3ms)
+12VDC	0.6A	6.0A(4ms)
+5VSB	1.2A	3.5A(14ms)
-12 VDC	0.2A	1.0A(4ms)
-5VDC	N/A	N/A

Note: Minimum recommended power supply specifications do not include attachment of AUDIO Speakers (AMP-out), USB, AGP, PCI devices. If these devices are added to the board, additional power requirements must be taken into account. Refer to the "Detailed Device Power consumption" section.

Recommended Power Supply specifications:

Net	Current (I)	Peak Current
+5VDC	18.0A	50.0A(3ms)
+3.3VDC	7.0A	20.0A(3ms)
+12VDC	6.0A	8.0A(4ms)
+5VSB	2.0A	5.0A(14ms)
-12 VDC	0.5A	1.0A(4ms)
-5VDC	N/A	N/A

Note: Recommended power supply specifications, includes attachment of COM, Fan, 4xAudio Speakers 4/8ohm, USB, AGP, PCI devices.

Worst case Power Supply specifications:

Net	Current (I)
+5VDC	32.0A
+3.3VDC	34.0A
+12VDC	8.0A
+5VSB	2.0A
-12 VDC	0.5A
-5VDC	N/A

Note: Worst case power supply specifications, includes maximum load of the following devices: 4xAudio Speakers 4/8ohm, Fansx3, COMx4, USBx4, AGPx1, PCIx3 devices.

Detailed Device Power consumption

When adding or changing functionality the following table can be used as guide line in combination with recalculation of total power consumption.

Powered though Net	Device	Current / [A]	Comment
+5VDC	Codec	0.1	
+5VDC	COM ports	0.05	
+5VDC	SIO	0.1	
+5VDC	USB	2	
+5VDC	PCI cards	15	According to PCI spec 2.2 section 4.3.4.1
+5VDC	AGP	2	According to AGP specification 2.0 section 4.3.10
+5VDC	GMCH (+V1.5S)	0.7	
+5VDC	GMCH (+V1.2S)	0.552	
+5VDC	DDR memory (+V2.5S)	3.45	
+5VDC	Banias core	5.635	
+5VDC	VCCP	0.725	
+5VDC	ICH(S)	0.366	
+5VDC	VTT (+V1.25S)	1.2	
+3.3VDC	CODEC	0.1	
+3.3VDC	Flash	0.05	
+3.3VDC	SIO	0.03	
+3.3VDC	ETH1	0.5	
+3.3VDC	ETH2	0.5	
+3.3VDC	ETH3	0.5	
+3.3VDC	PCI cards	22.8	According to PCI spec 2.2 section 4.3.4.1
+3.3VDC	AGP	6	According to AGP specification 2.0 section 4.3.10
+3.3VDC	ICH(S)	0.7	
+3.3VDC	LVDS con	2	
+3.3VDC	GMCH	0.1	
+3.3VDC	Banias (+V1.8)	0.2	
+3.3VDC	CLKGEN	0.25	
+12VDC	Fans	0.4	
+12VDC	COM ports	0.15	
+12VDC	Audio AMPs	0.4	
+12VDC	PCIx3	1.5	According to PCI spec 2.2 section 4.3.4.1
+12VDC	AGP	1	According to AGP specification 2.0 section 4.3.10
+12VDC	LVDS con	2	
+5VSB	DDR Memory	0.2	
+5VSB	SIO	0.02	
+5VSB	USB	0.1	
+5VSB	ICH(S)	0.217	
+5VSB	PCI_VAUX	0.45	

Appendix

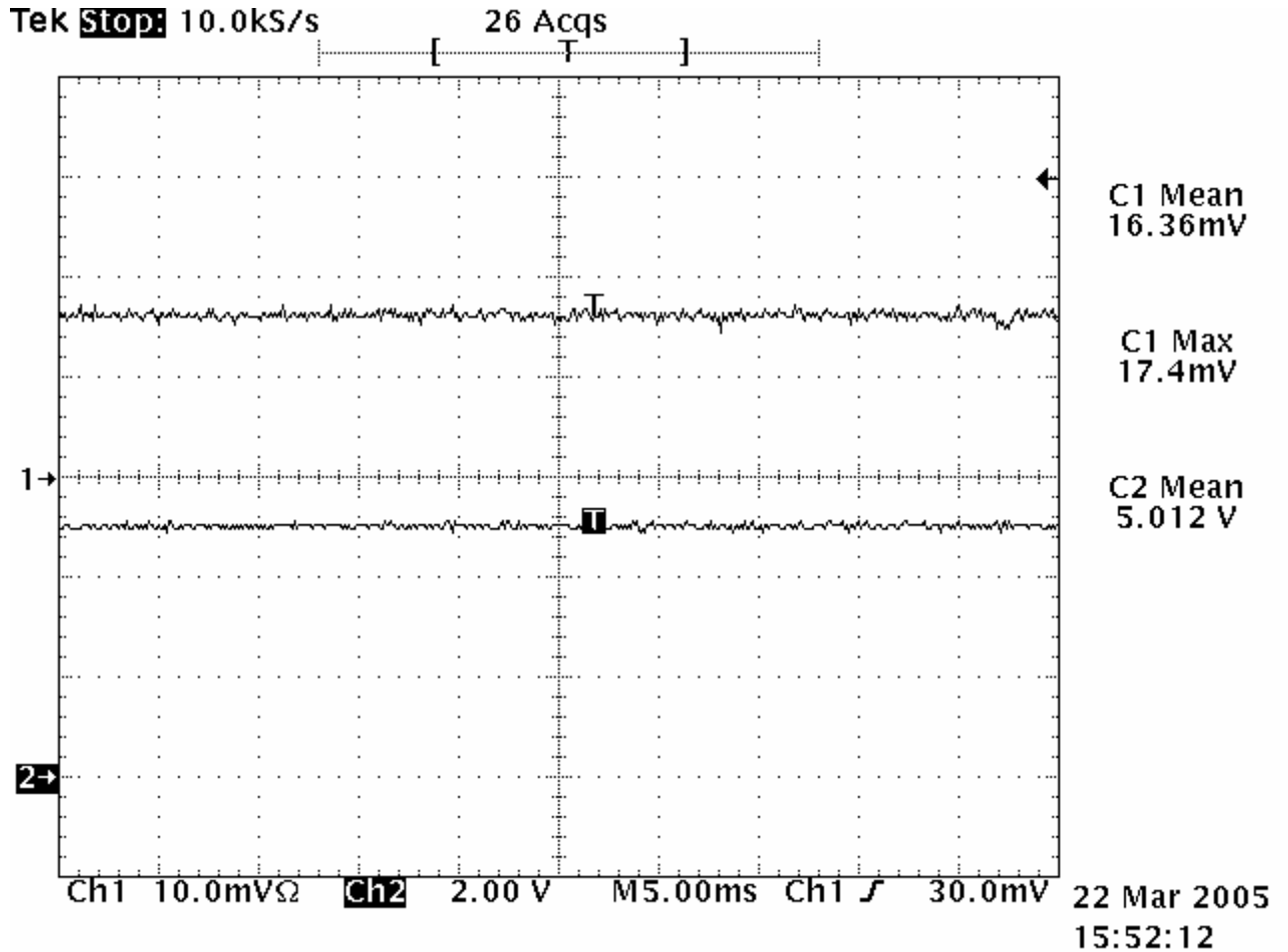**+5V Pentium-M 1600/400 DOS PROMT**
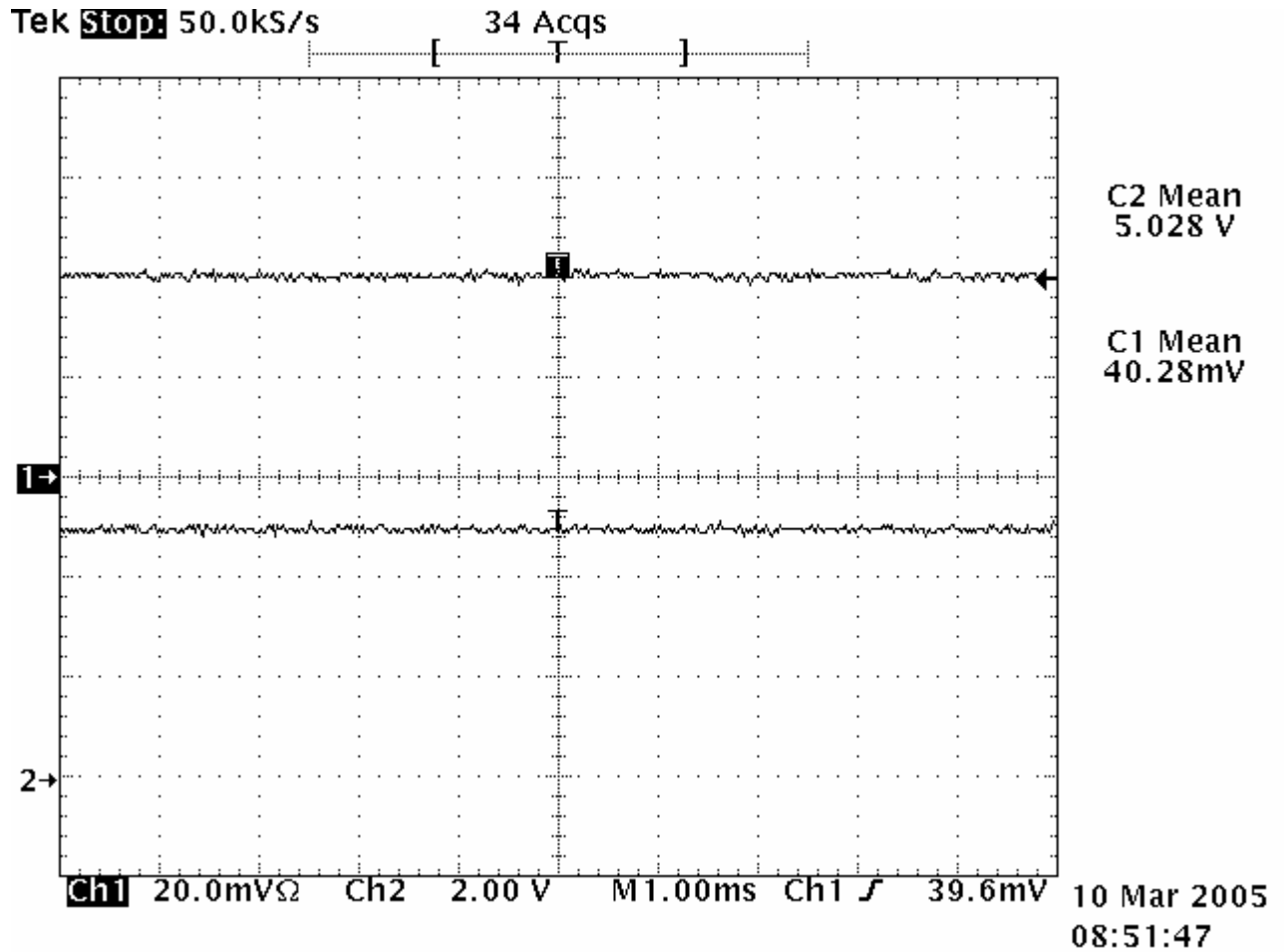
IDLE, 1000MB LAN x 3.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
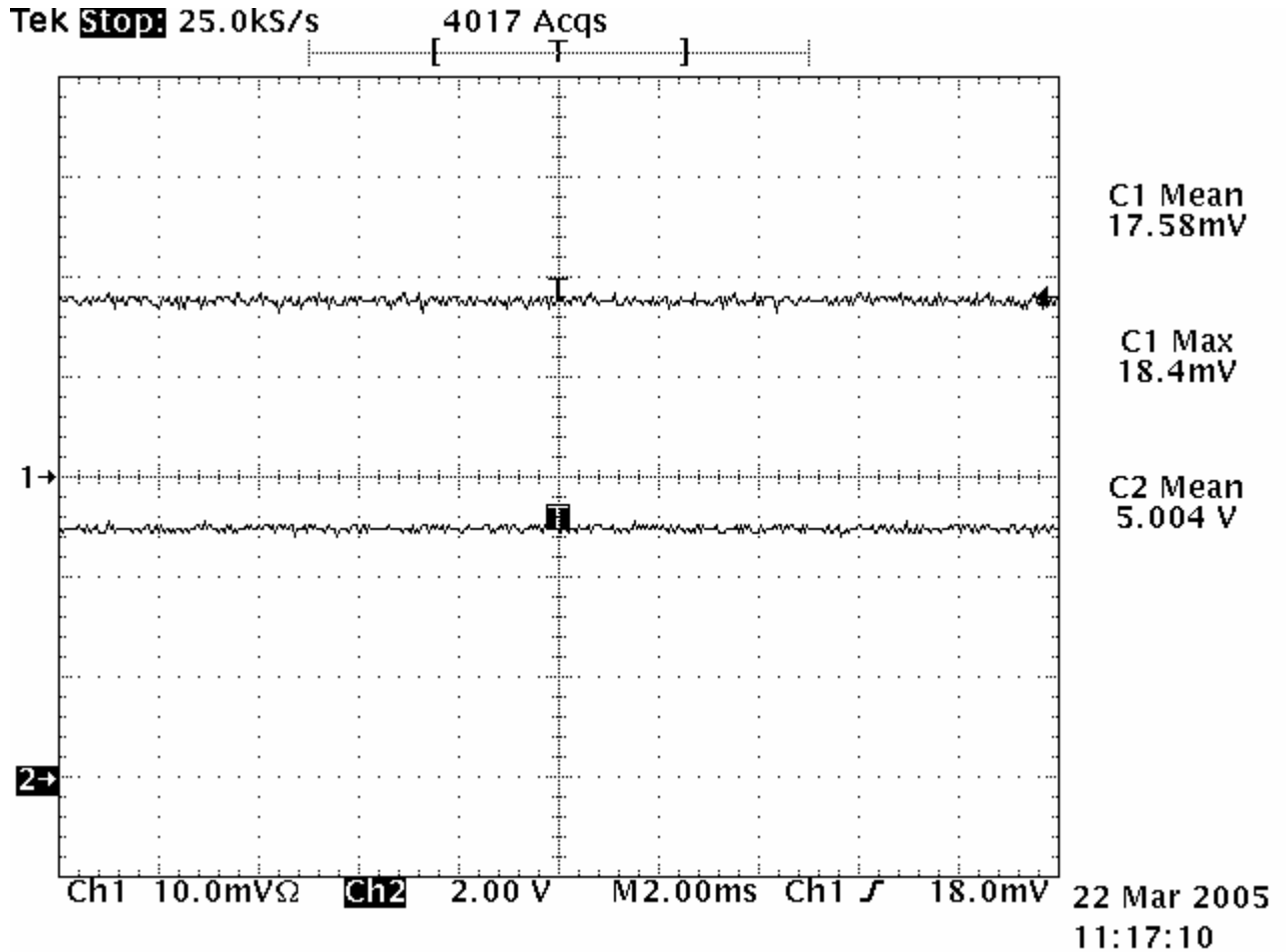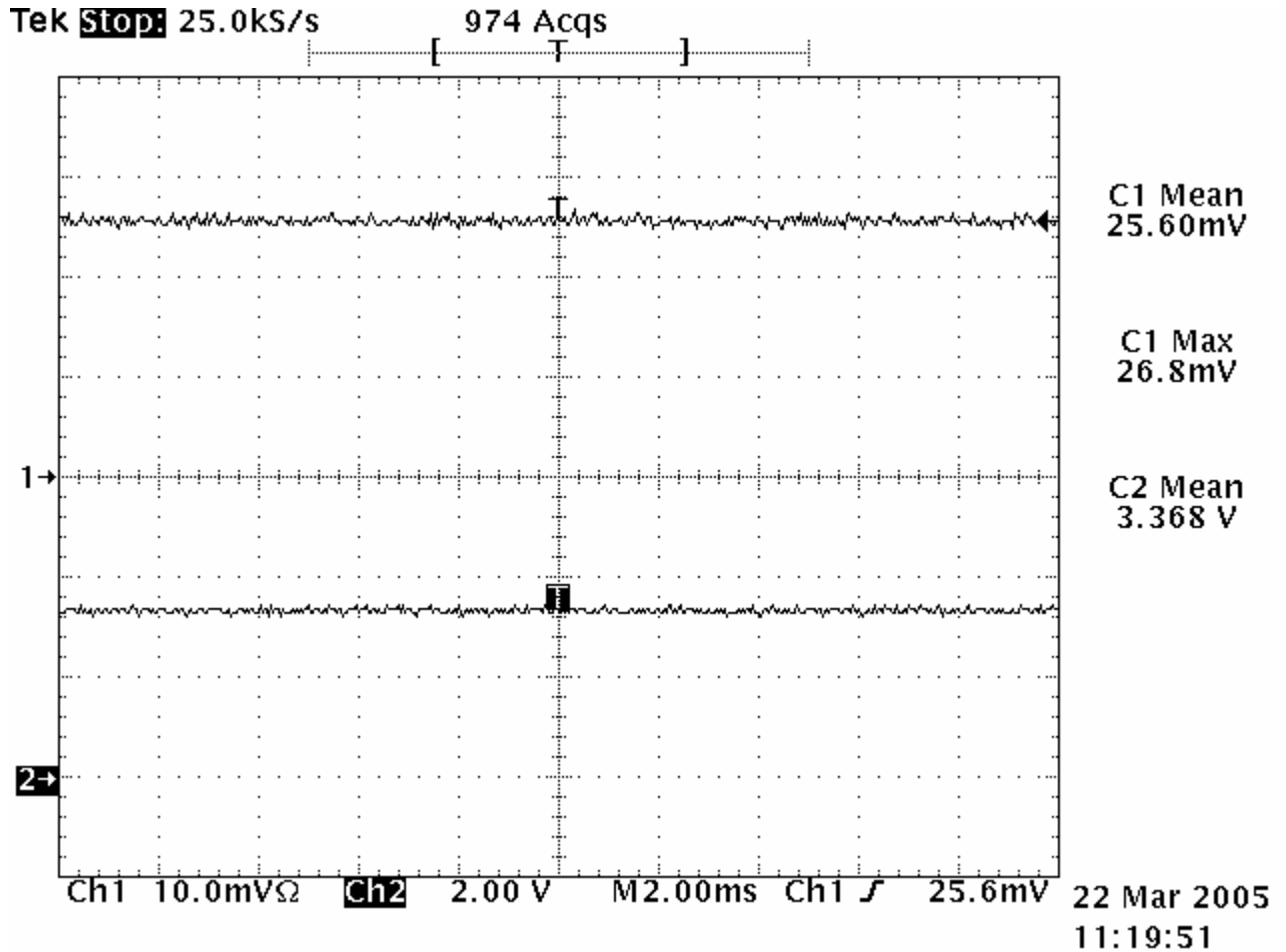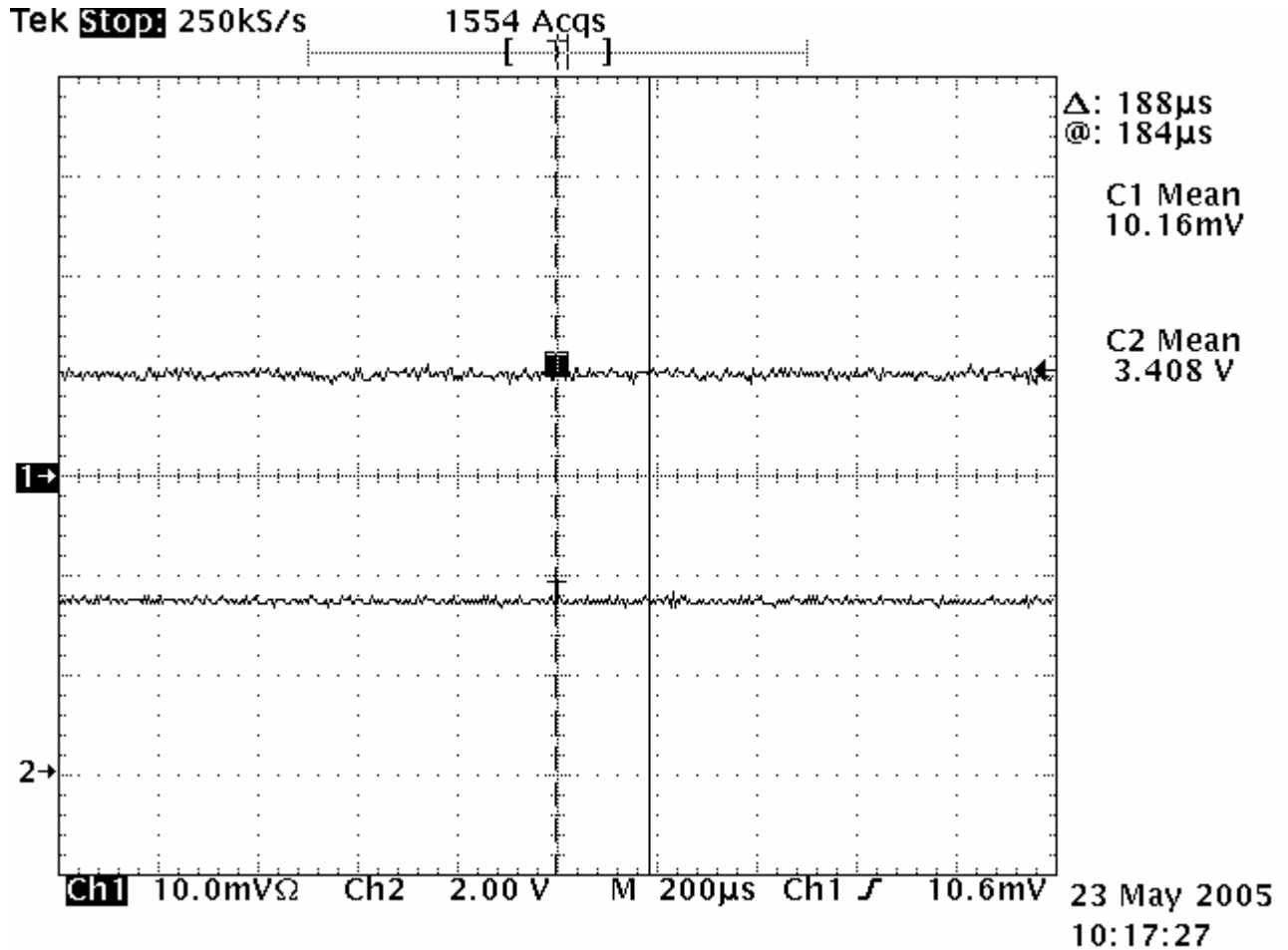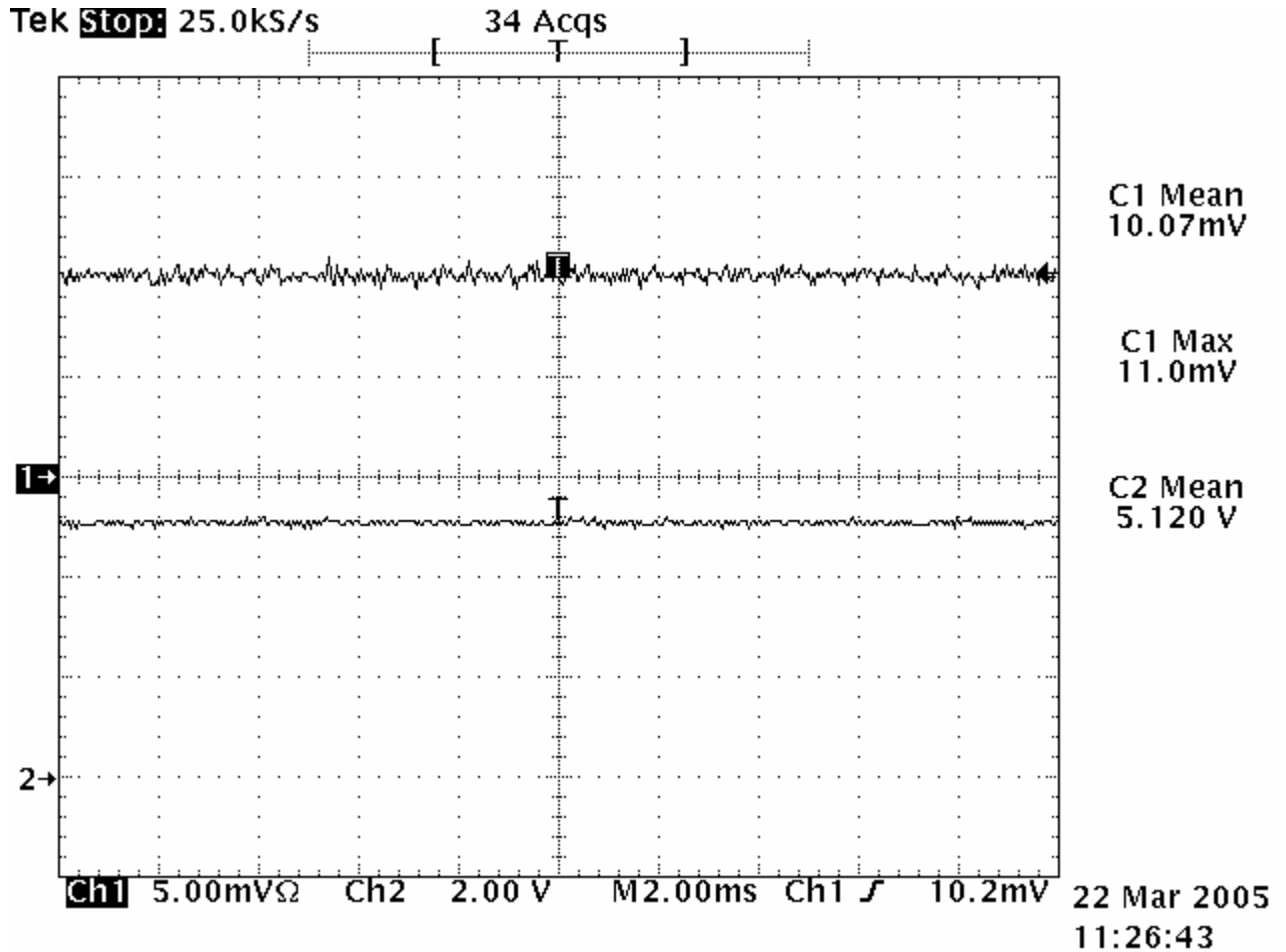Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 4.028*5.028 = 20.3W
Amp(I)= 4.026A

+5V Intel Mobile Celeron 600/400 (BGA) DOS PROMT

IDLE, 1000MB LAN x 3.
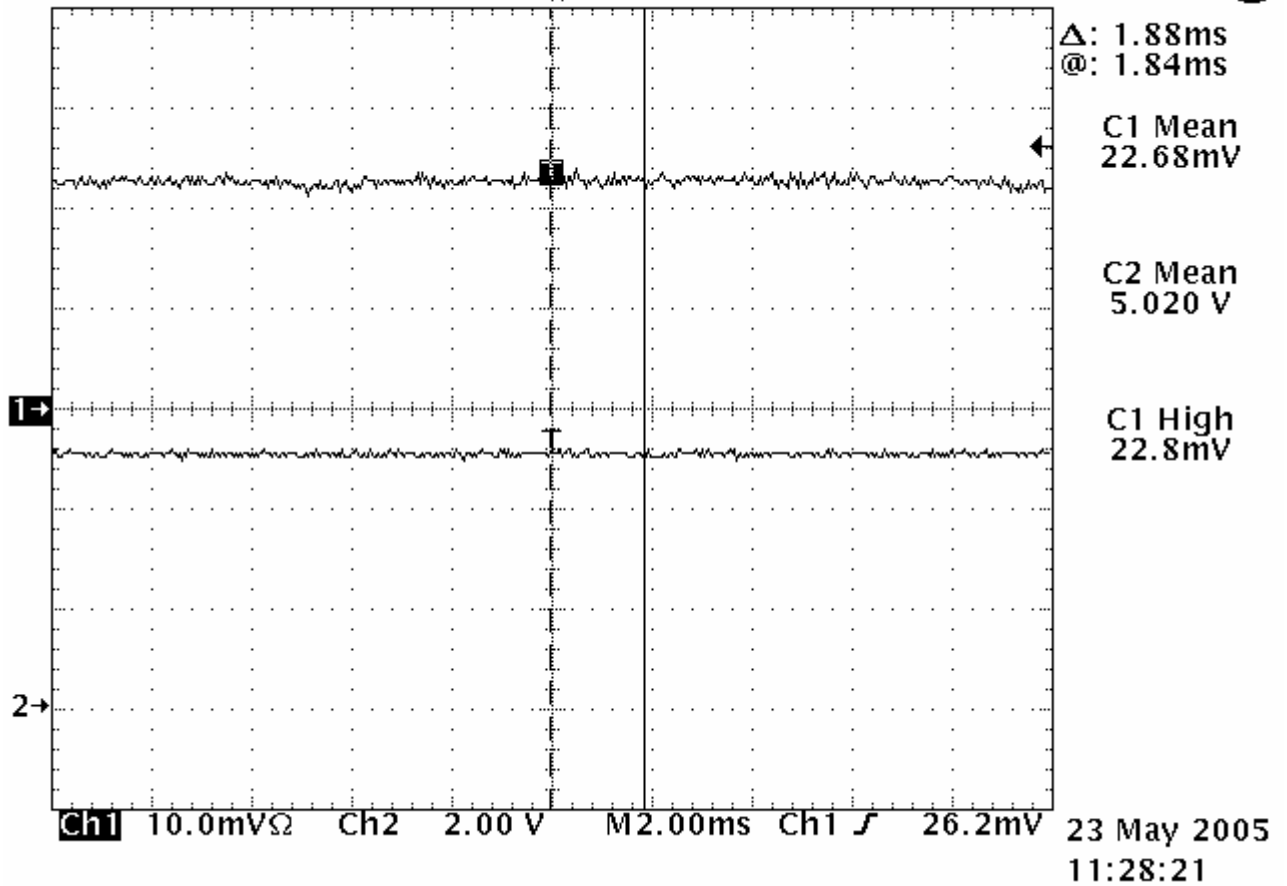
Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 2.280*5.020 =11.5W
Amp(I)= 2.280A

+3.3V Pentium-M 1600/400 DOS PROMT

IDLE, 100MB LAN x 3.
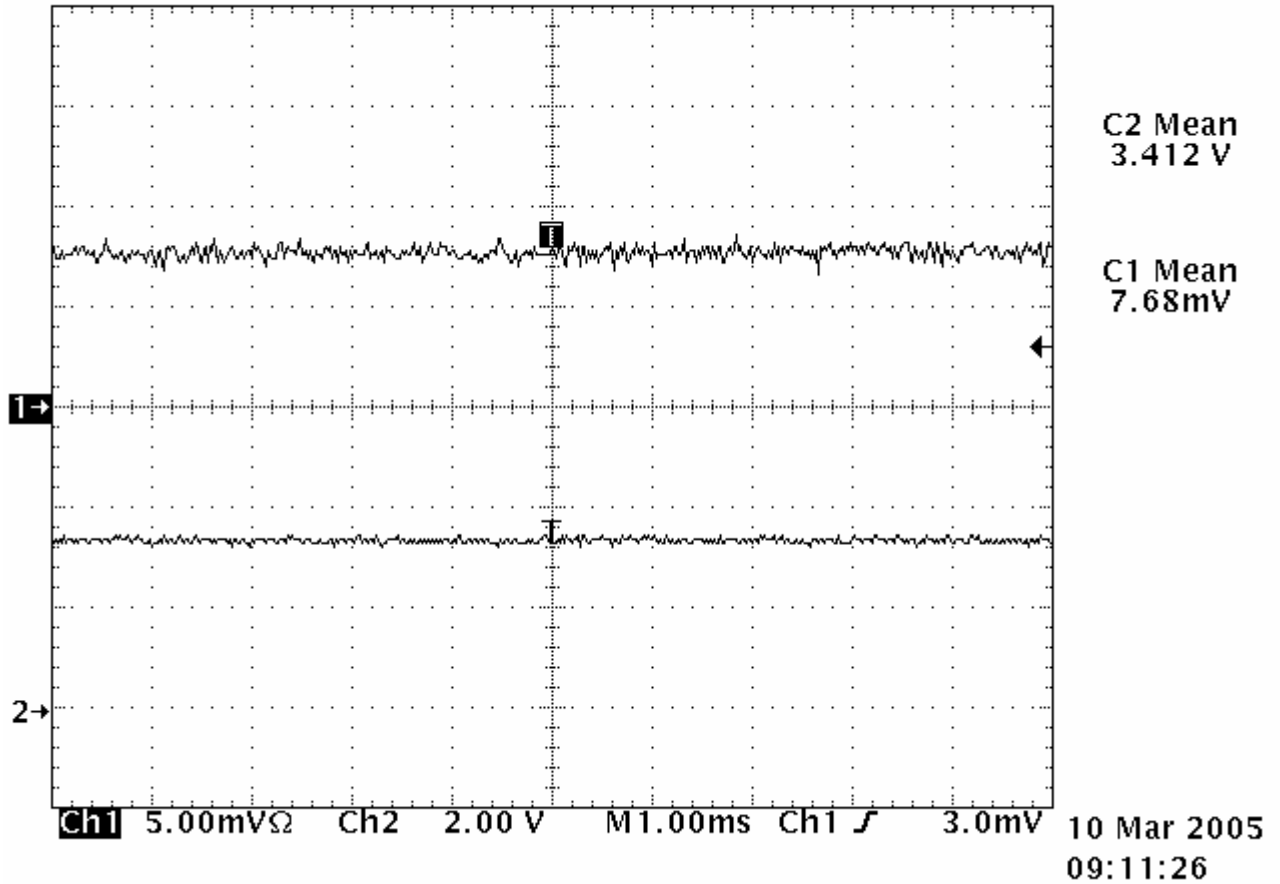
Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
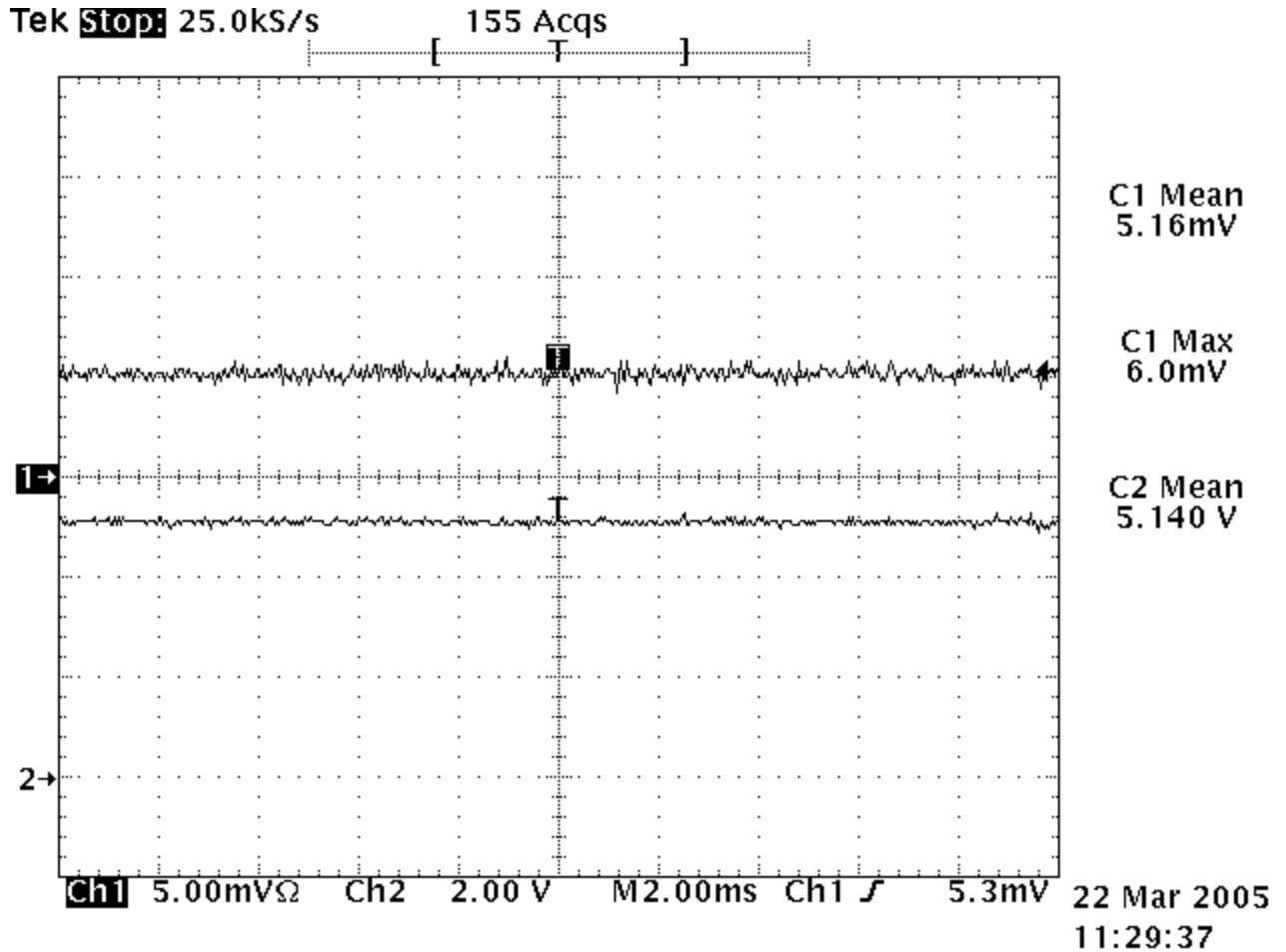Channel 2 (The upper graph) shows the PSU 3.3VDC voltage

Power(P)= 0.768*3.412 = 2.6W
Amp(I)= 0.768A

+3.3V Pentium-M 1600/400 DOS PROMT
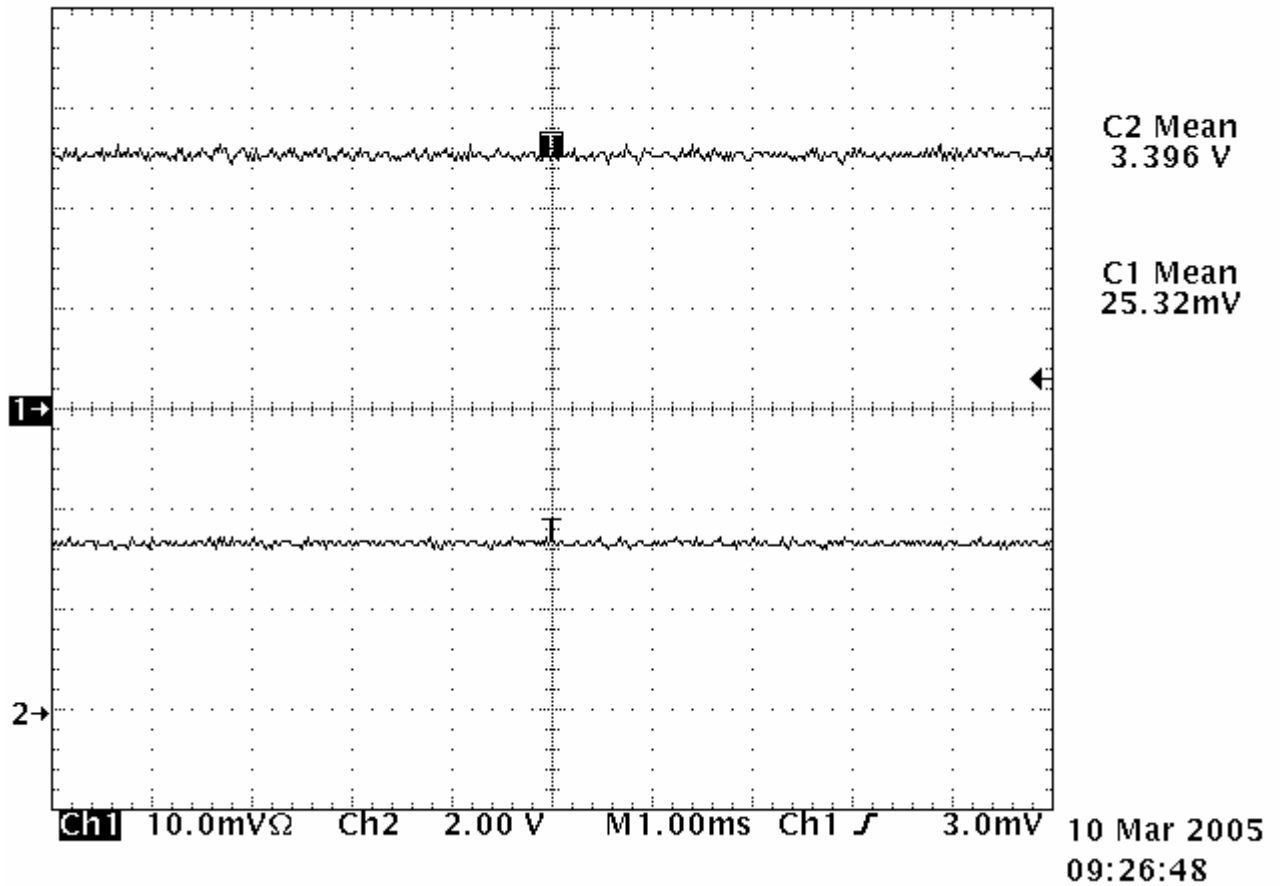
IDLE, 1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
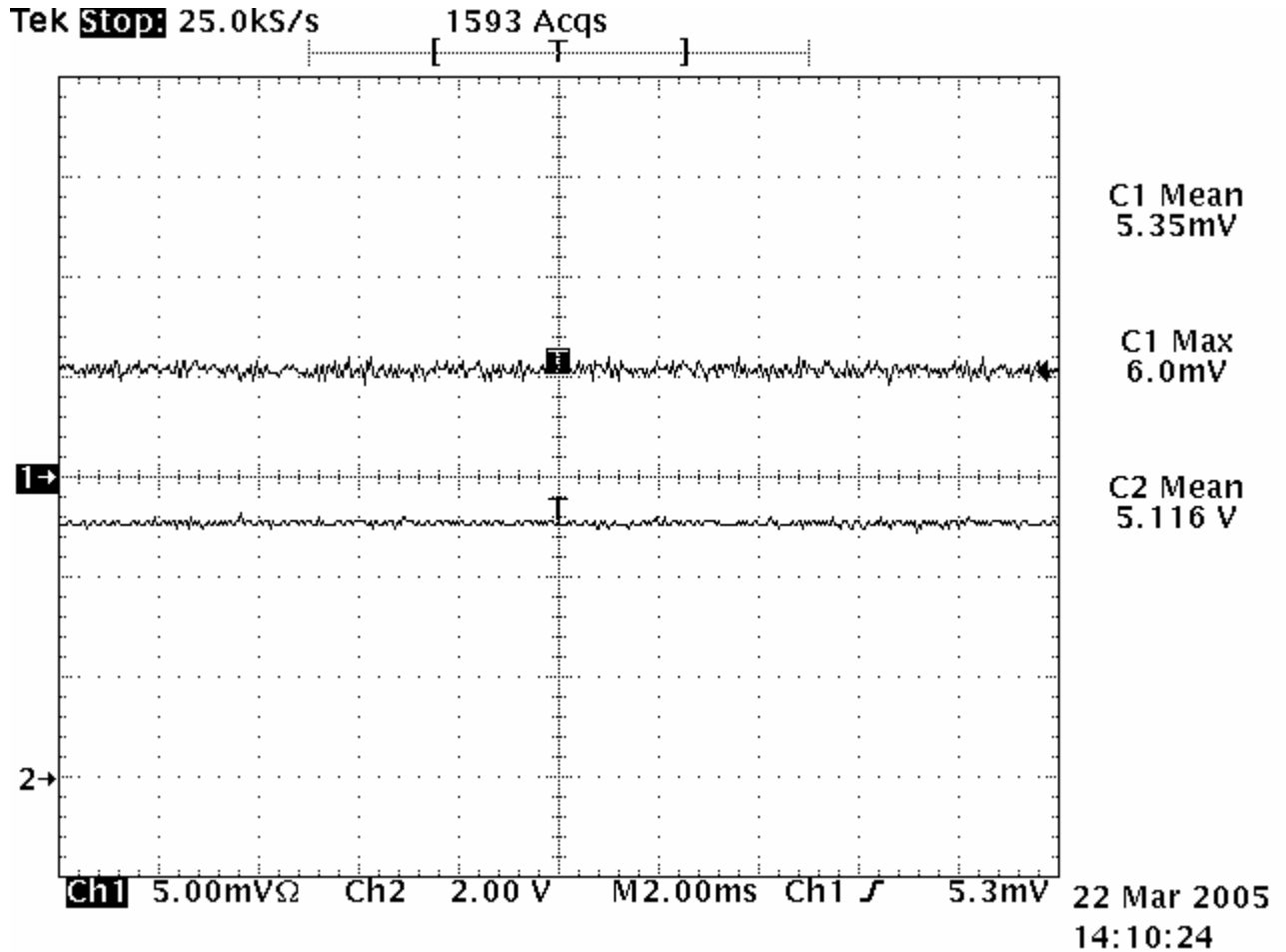Channel 2 (The upper graph) shows the PSU 3.3VDC voltage

Power(P)= 2.532*3.396 = 8.6W
Amp(I)= 2.53A

+5V Intel Mobile Celeron 600/400 (BGA) SUSPEND S1

Suspend, 1000MB LAN x 3

Above plot shows measurements when the board is in S1.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 1.636*5.012 = 8.2W
Amp(I)= 1.636A

+5V Pentium-M 1600/400 SUSPEND S1

Suspend, 1000MB LAN x 3

Above plot shows measurements when the board is in S1.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
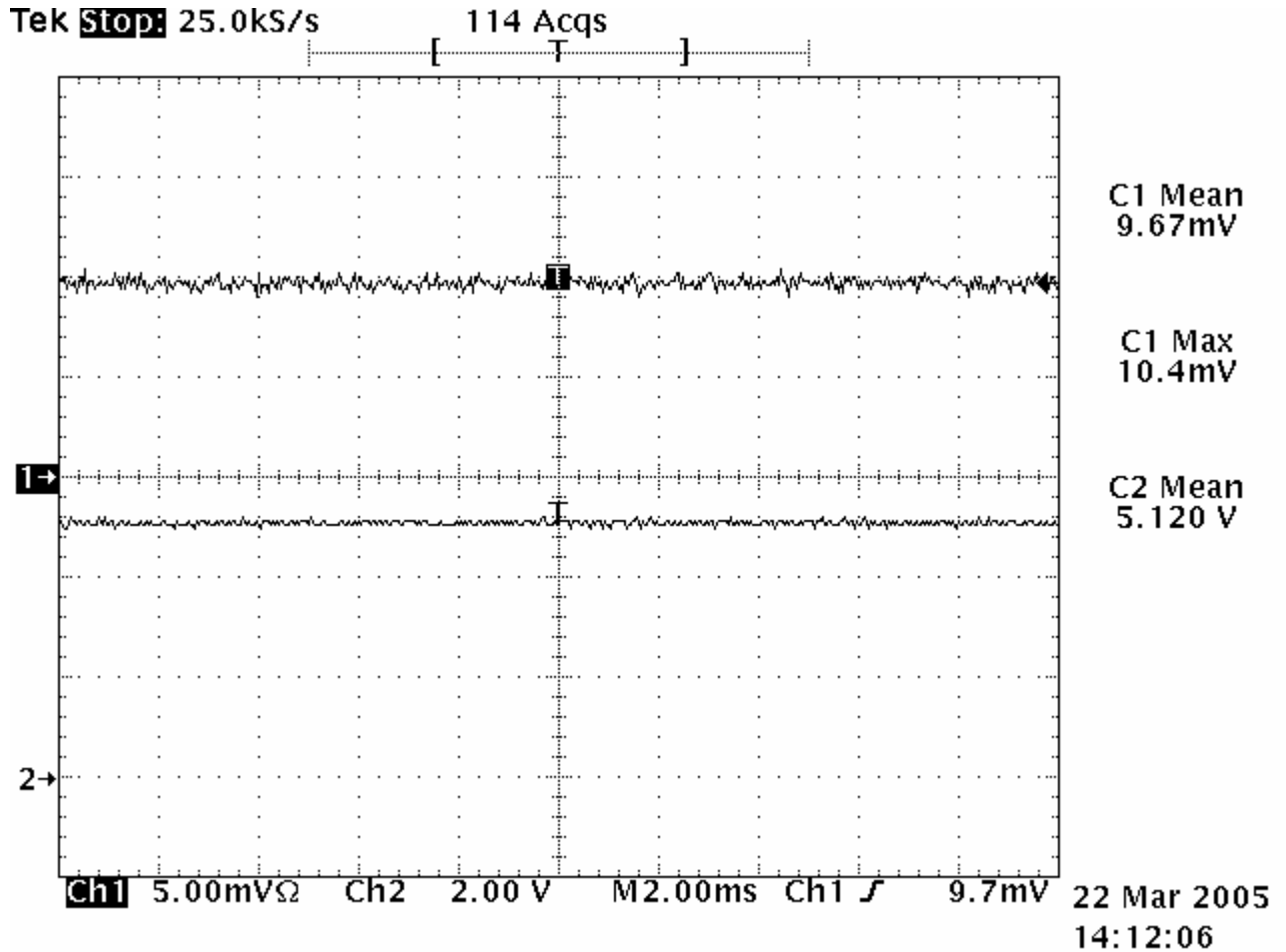Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 1.758*5.004 = 8.8W
Amp(I)= 1.758A

+3.3V Pentium-M 1600/400 SUSPEND S1

Suspend, 1000MB LAN x 3

Above plot shows measurements when the board is in S1.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
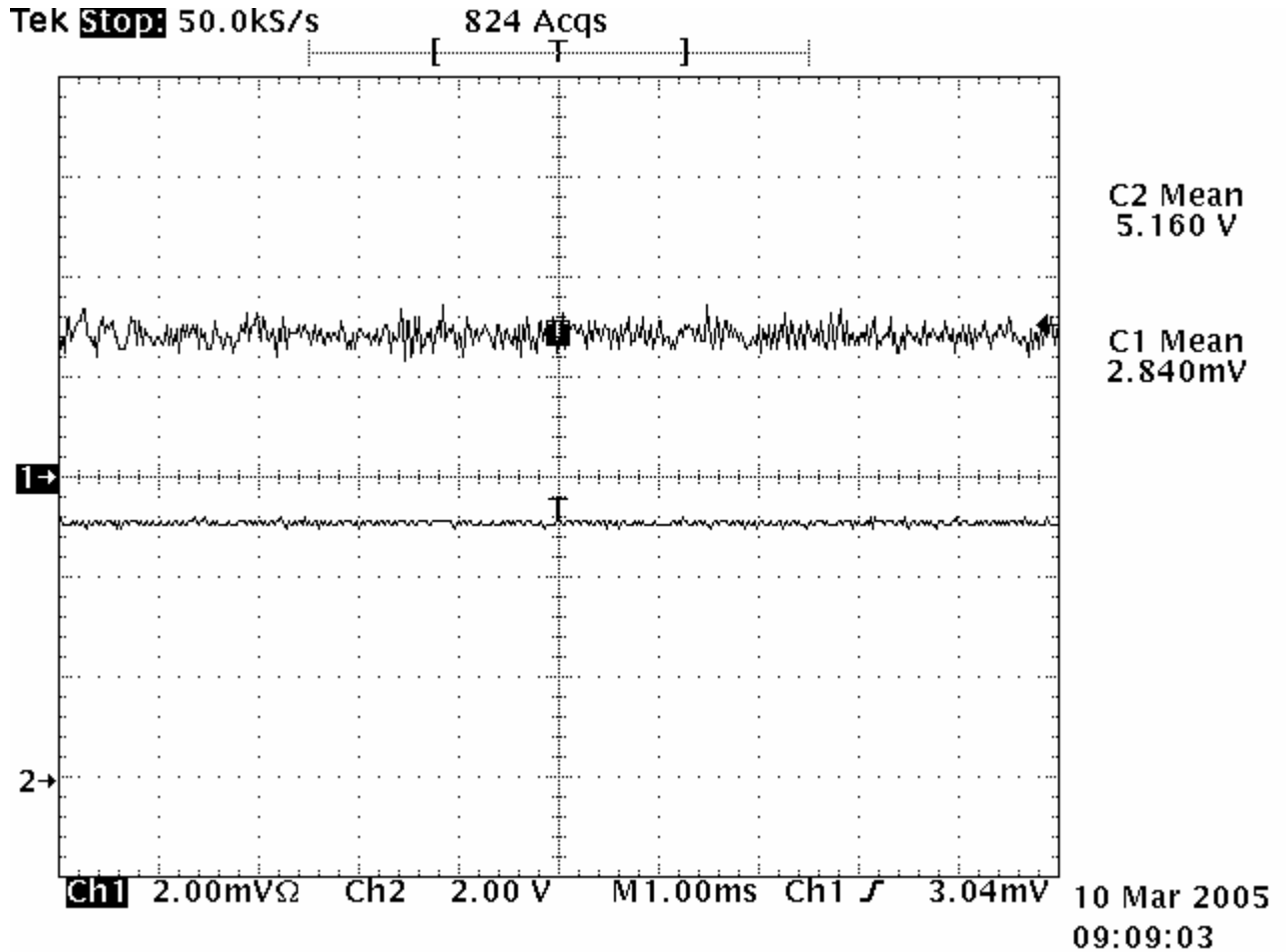Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 2.560*3.368 = 8.8W
Amp(I)= 2.560A

+3.3V Pentium-M 1600/400 SUSPEND S1

Suspend, 100MB LAN x 3

Above plot shows measurements when the board is in S1.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
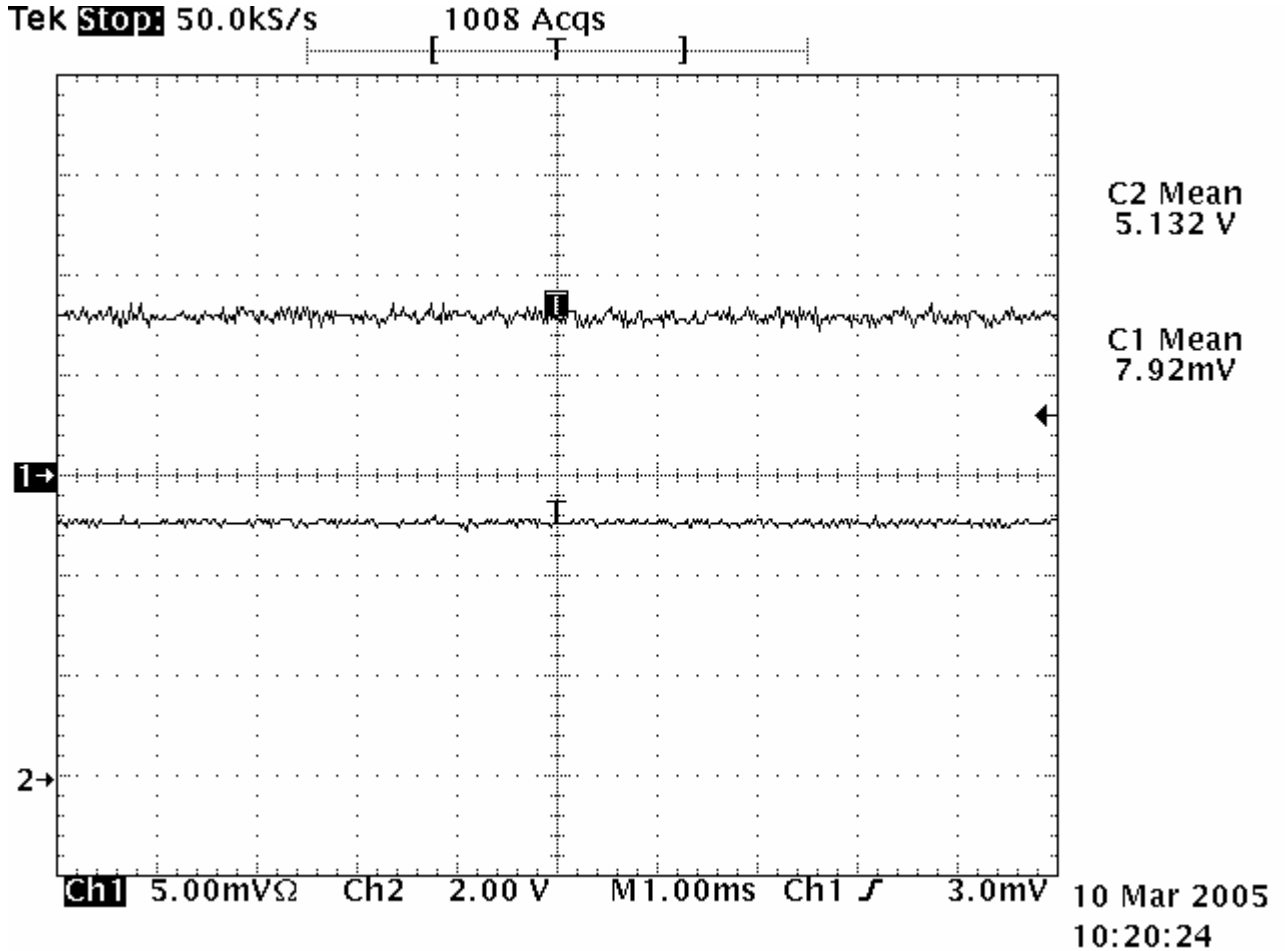Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 1.016*3.408 = 3.5W
Amp(I)= 1.016A

+5SBV Pentium-M 1600/400 SUSPEND S3

Suspend, 1000MB LAN x 3

Above plot shows measurements when the board is in S3.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 1.007*5.120 = 5.16W
Amp(I)= 1.007A

+5SBV Pentium-M 1600/400 SUSPEND S3

Suspend, 100MB LAN x 3

Tek Stop: 25.0kS/s   155 Acqs

C1 Mean 5.16mV

C1 Max 6.0mV

C2 Mean 5.140 V

Ch1 5.00mVΩ   Ch2 2.00 V   M2.00ms Ch1 ʃ   5.3mV   22 Mar 2005 11:29:37

Above plot shows measurements when the board is in S3.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 0.516*5.140 = 2.65W
Amp(I)= 0.516A

+5SBV Pentium-M 1600/400 SUSPEND S4

Suspend, 100MB LAN x 3

Above plot shows measurements when the board is in S4.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 0.535 *5.116 = 2.74W
Amp(I)= 0.535A

+5SBV Pentium-M 1600/400 SUSPEND S4

Suspend, 1000MB LAN x 3

Above plot shows measurements when the board is in S4.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 0.967*5.120 = 4.95W
Amp(I)= 0.9672A

+5SBV Pentium-M 1600/400 SUSPEND S5

Suspend, 100MB LAN x 3

Above plot shows measurements when the board is in S5.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 0.2840*5.160 = 1.65W
Amp(I)= 0.2840A

+5SBV Pentium-M 1600/400 SUSPEND S5

Suspend, 1000MB LAN x 3

Above plot shows measurements when the board is in S5.

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VSBDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VSBDC voltage

Power(P)= 0.892*5.132 = 4.6W
Amp(I)= 0.892A

+12V Pentium-M 1600/400 DOS PROMT

IDLE, 1000MB LAN x 3, (one fan only)
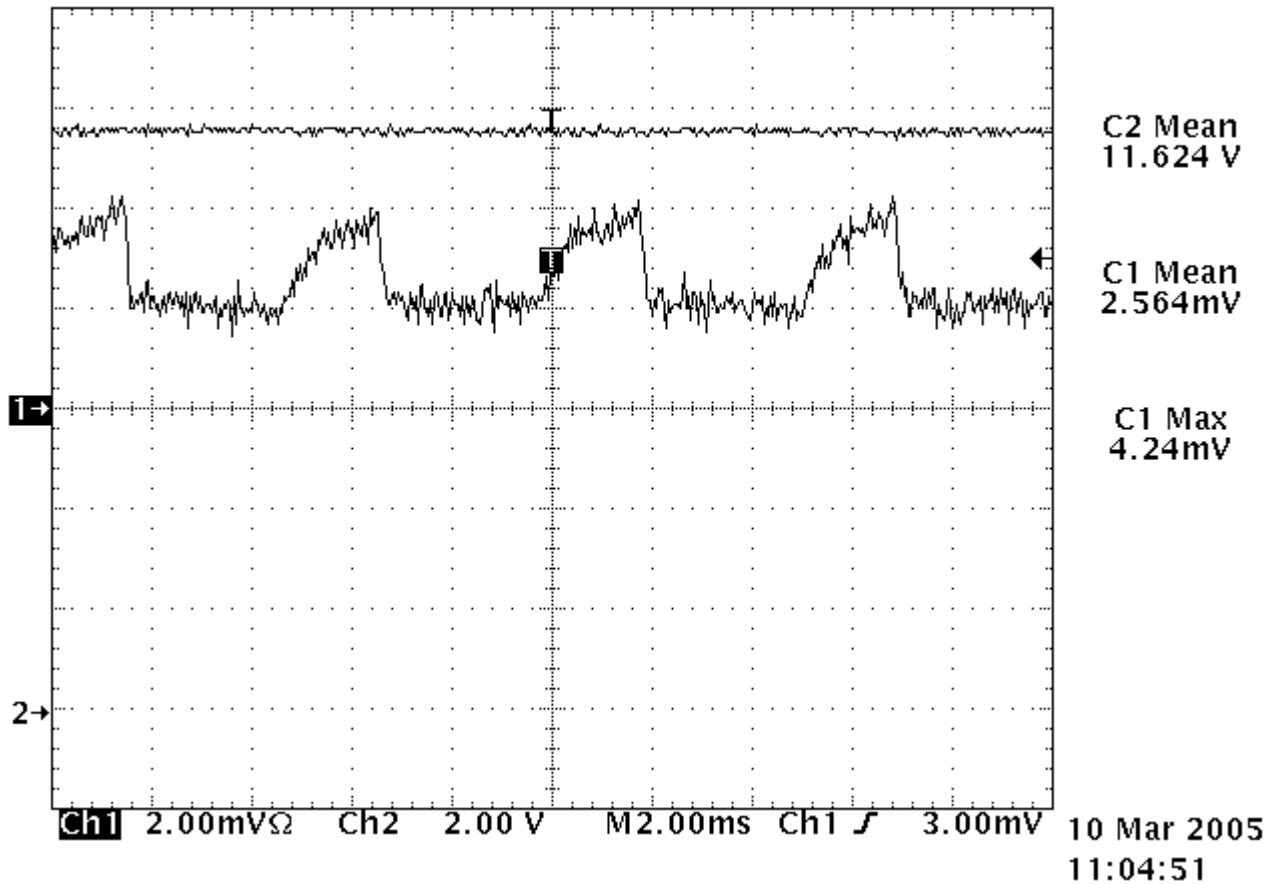
Channel 1 (The lower graph) shows the Current draw made from the PSU +12VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU +12VDC voltage

Power(P)= 0.424*11.624 = 4.6W Peak
Amp(I)= 0.424A Peak

+5V Pentium-M 1600/400 DOS PROMT
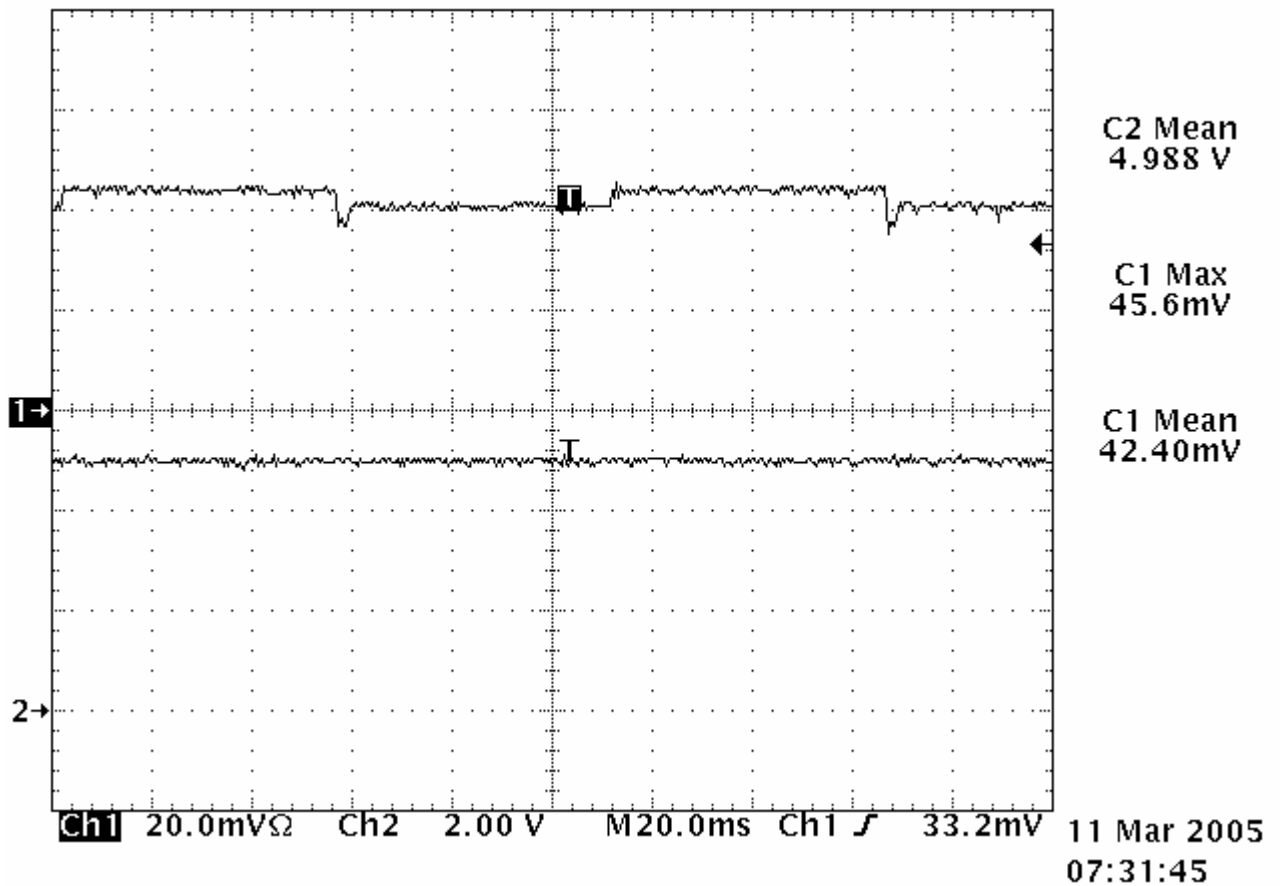
FULL CPU LOAD, 1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 4.560*4.988 = 22.8W (Peak)
Power(P)= 4.240*4.988 = 21.W (Mean)

Amp(I)= 4.560A (Peak)
Amp(I)= 4.240A (Mean)

+5V Intel Mobile Celeron 600/400 (BGA) DOS PROMT

FULL CPU LOAD, 1000MB LAN x 3
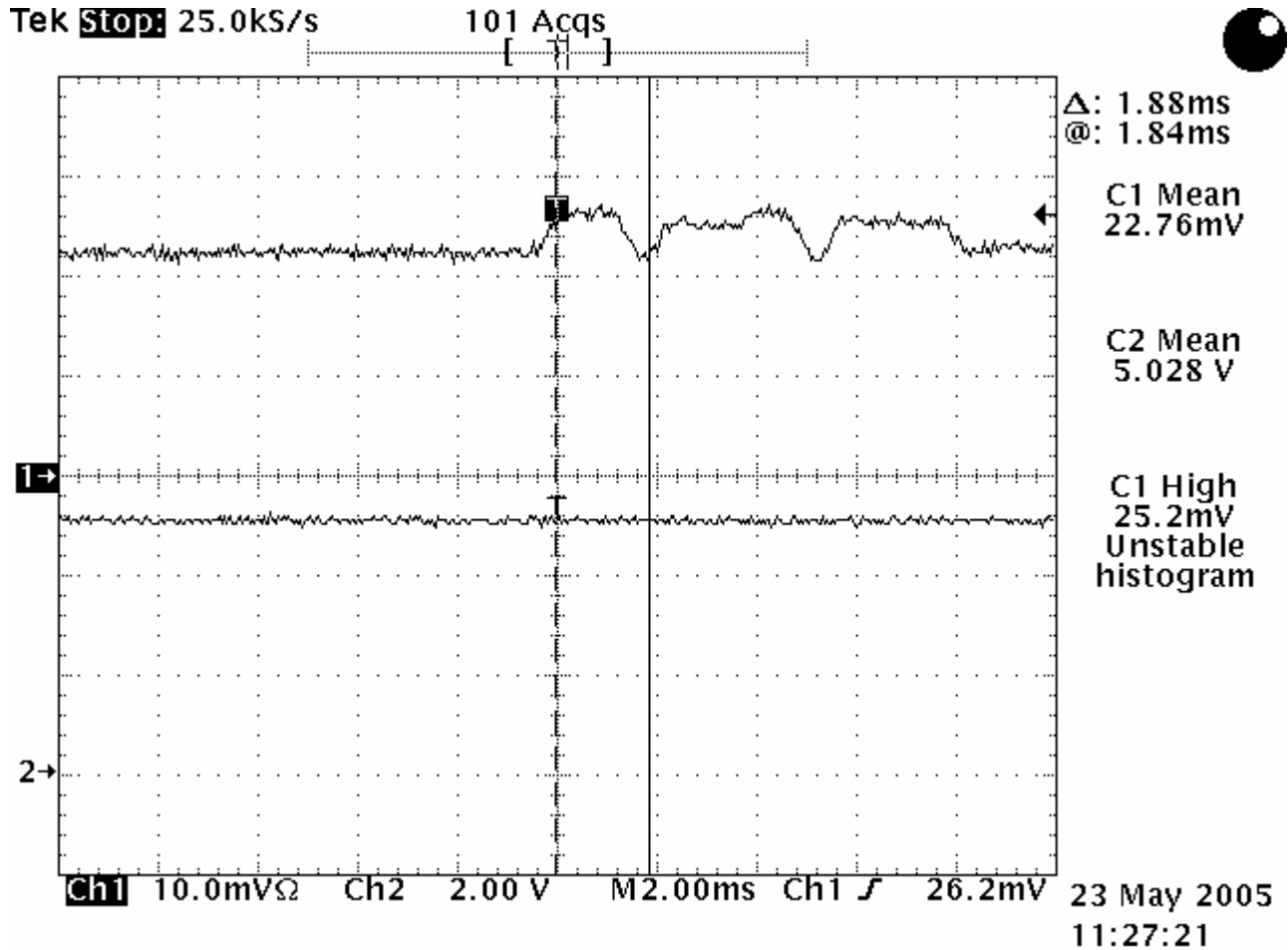
Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 2.520*5.028 = 12.7W (Peak)
Power(P)= 2.276*5.028 = 11.5W (Mean)

Amp(I)= 2.520A (Peak)
Amp(I)= 2.276A (Mean)

+3.3V Pentium-M 1600/400 DOS PROMT
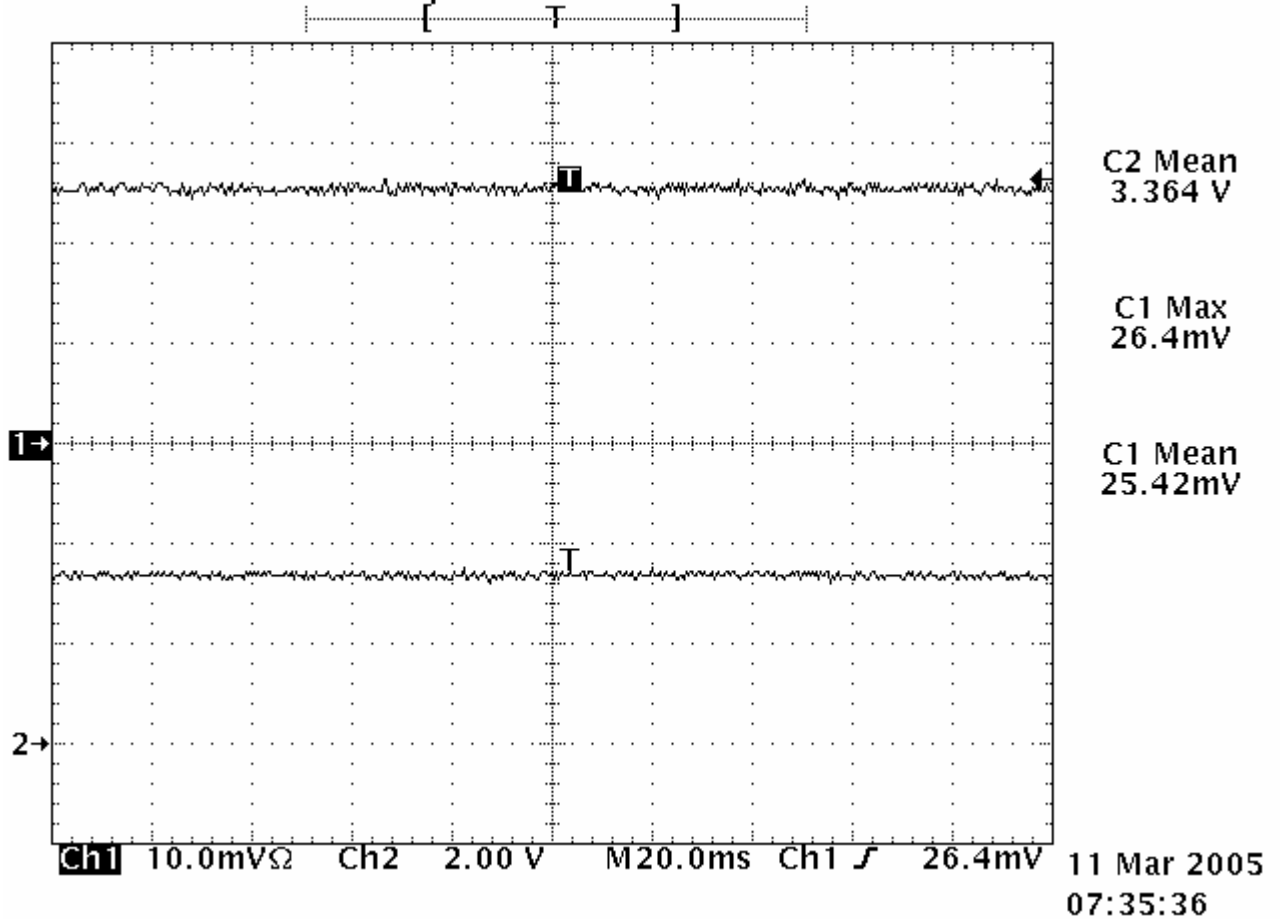
FULL CPU LOAD, 1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 3.3VDC voltage

Power(P)= 2.640*3.364 = 8.9W (Peak)
Power(P)= 2.542*3.364 = 8.6W (Mean)

Amp(I)= 2.640A (Peak)
Amp(I)= 2.542A (Mean)

+3.3V Pentium-M 1600/400 DOS PROMT

FULL CPU LOAD, 100MB LAN x 3
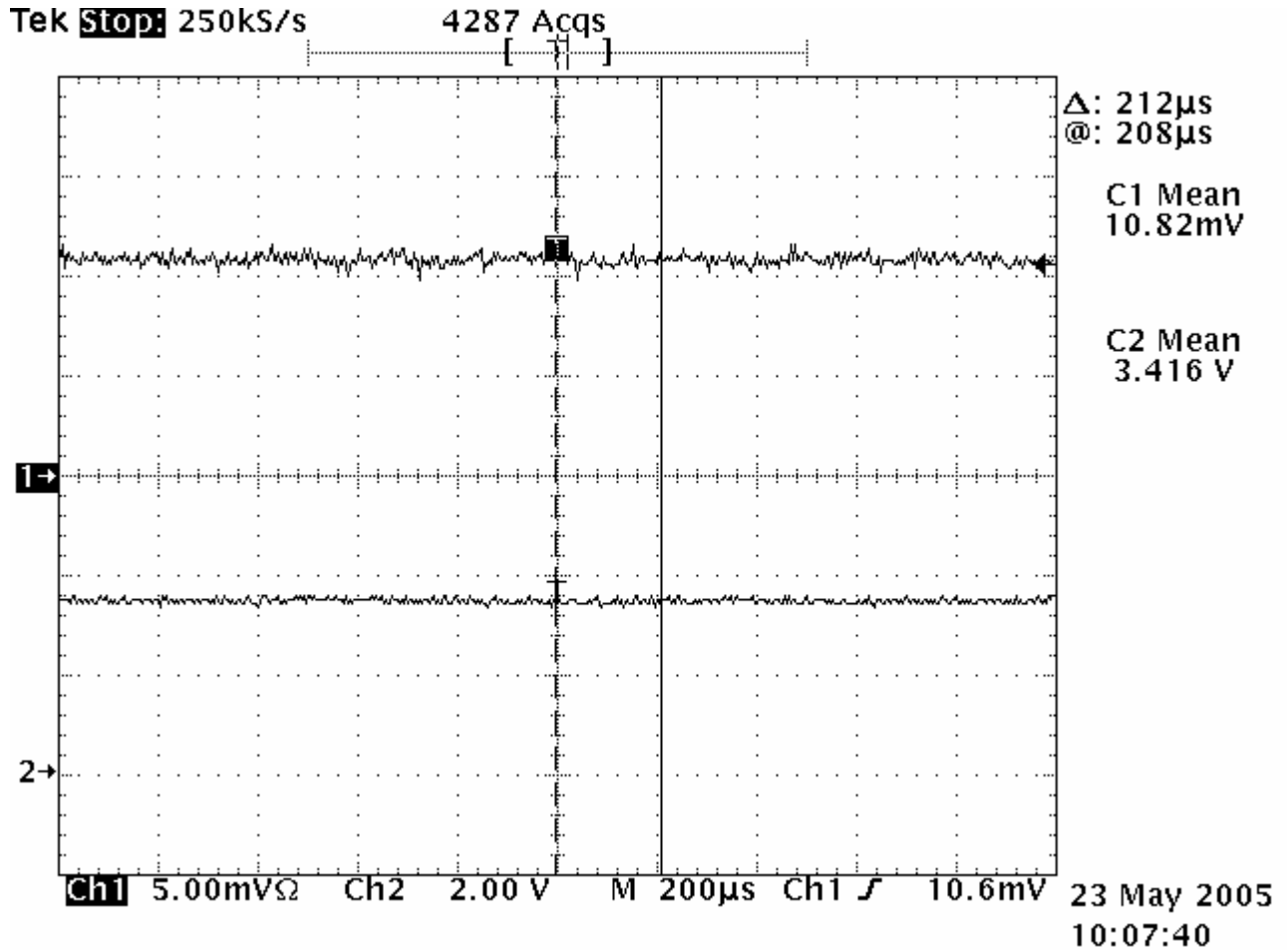
Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 3.3VDC voltage

Power(P)= 1.082*3.416 = 3.7W (Mean)

Amp(I)= 1.082A (Mean)

+5V Intel Mobile Celeron 600/400 (BGA) Windows XP

IDLE, 1000MB LAN x 3
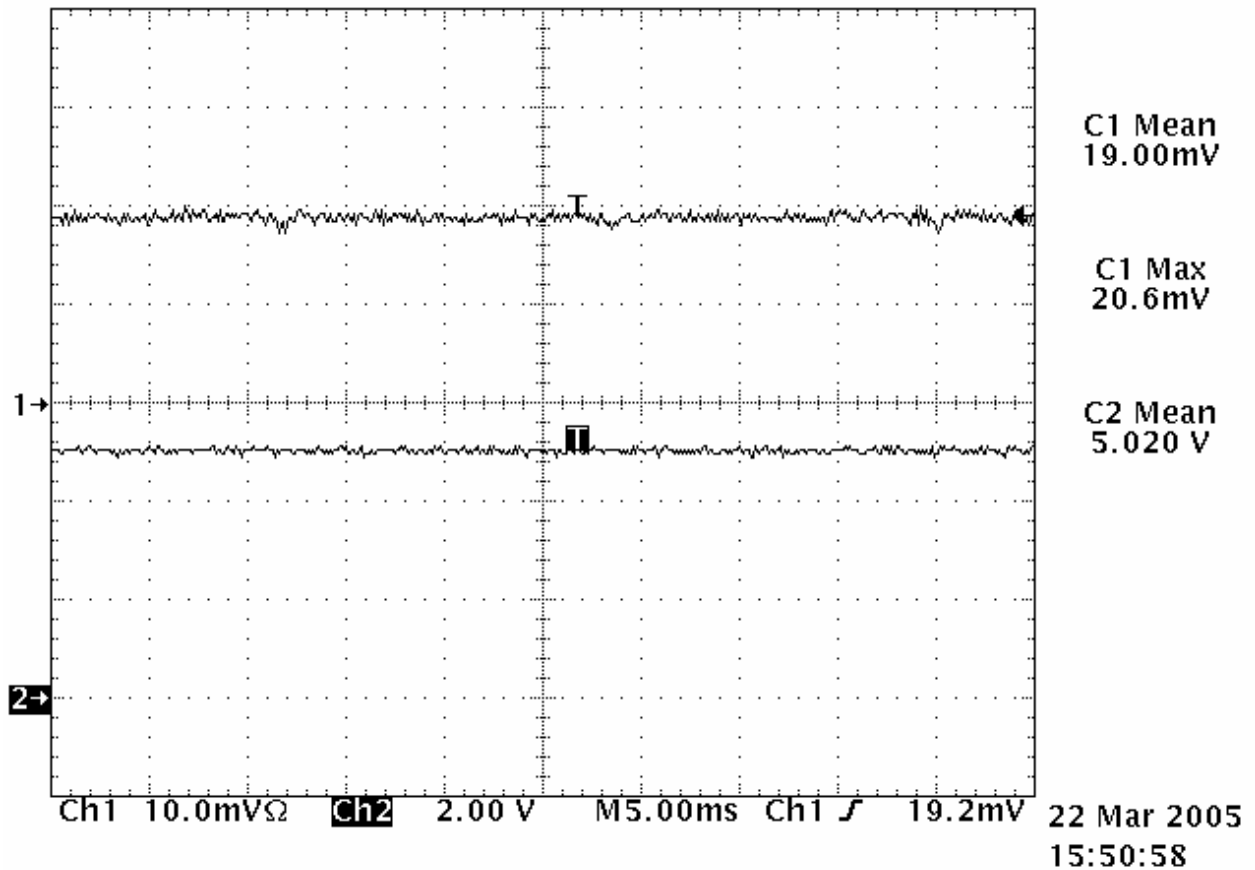
Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 1.900*5.020 = 9.5W
Amp(I)= 1.900A

+5V Intel Mobile Celeron 600/400 (BGA) Windows XP

FULL CPU LOAD, 1000MB LAN x 3
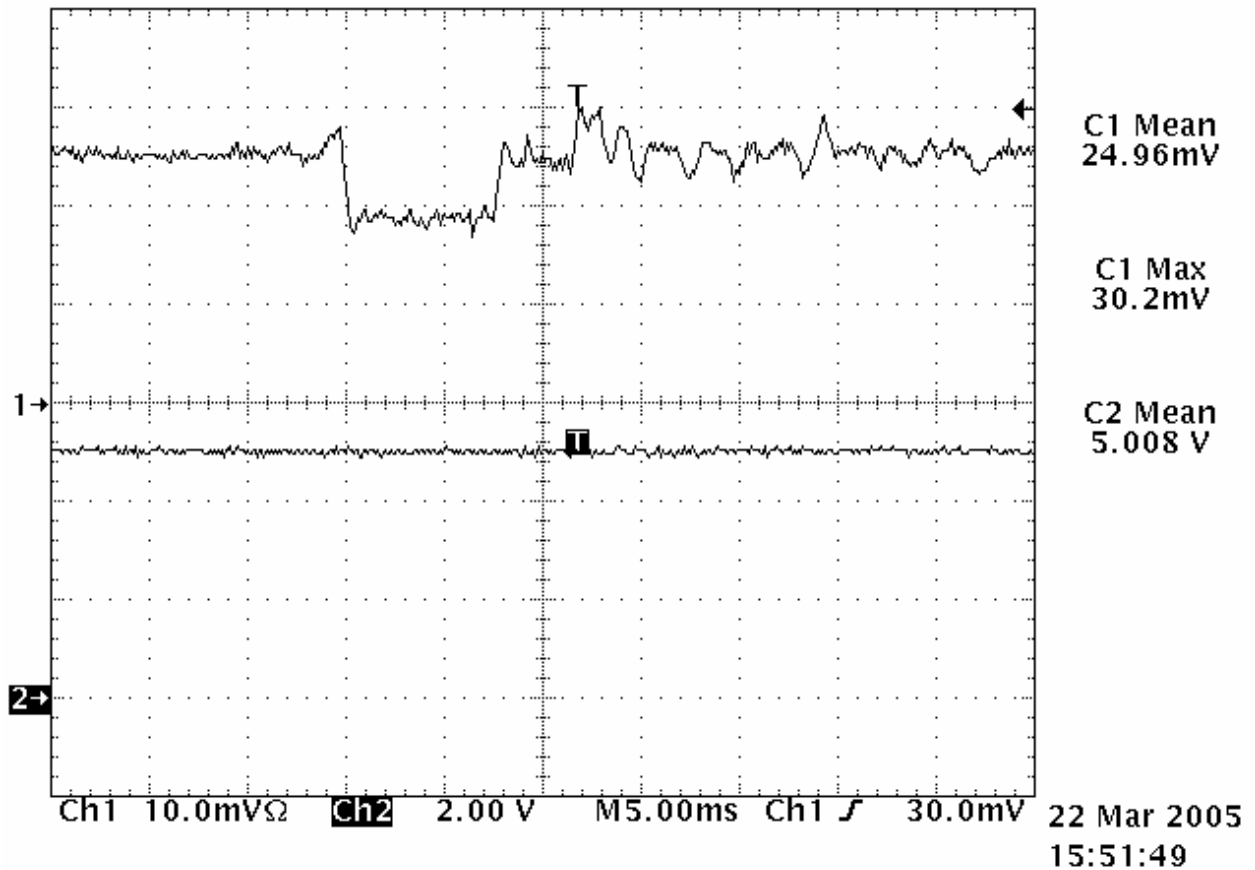
Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 3.020*5.008 = 15.1W (Peak)
Amp(I)= 3.020A

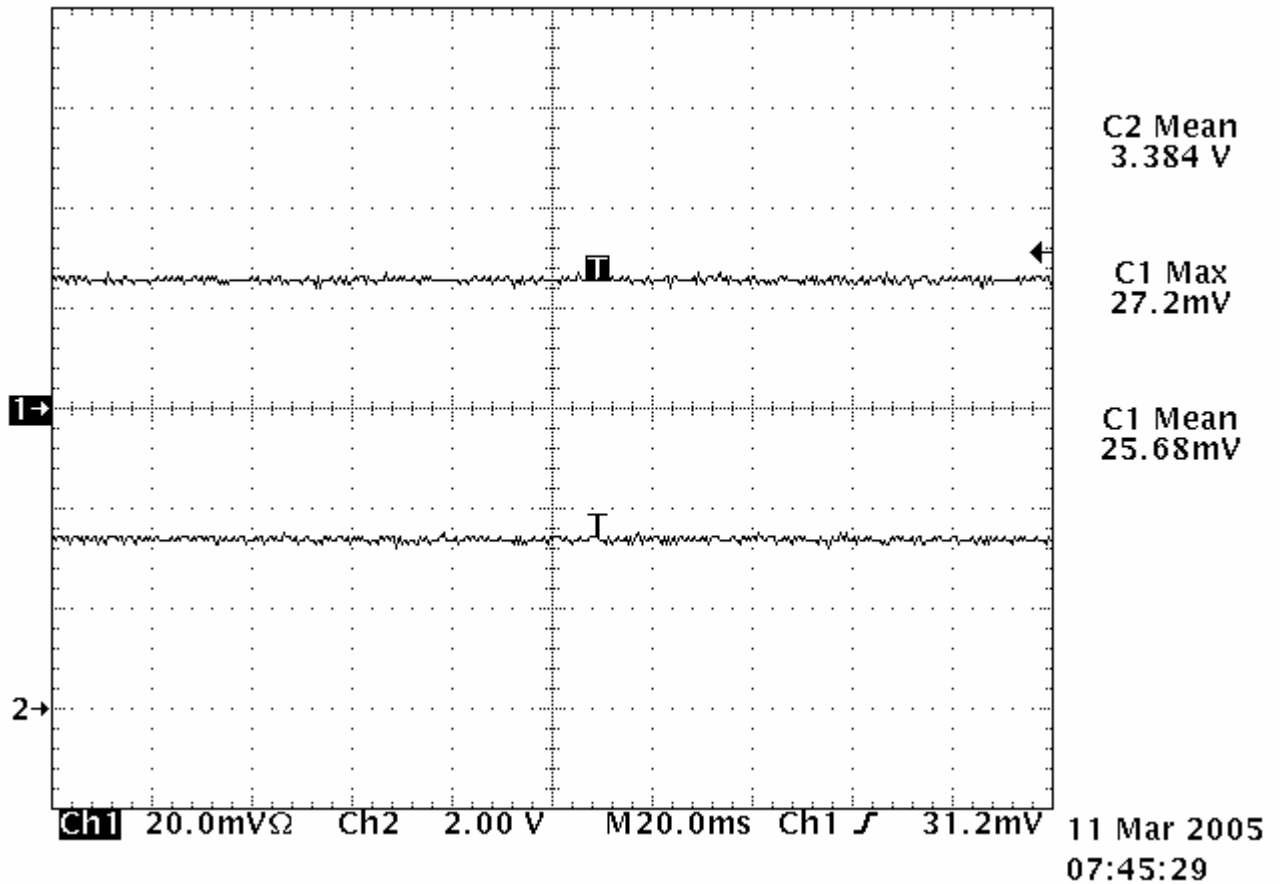**+5V Pentium-M 1600/400 Windows XP**
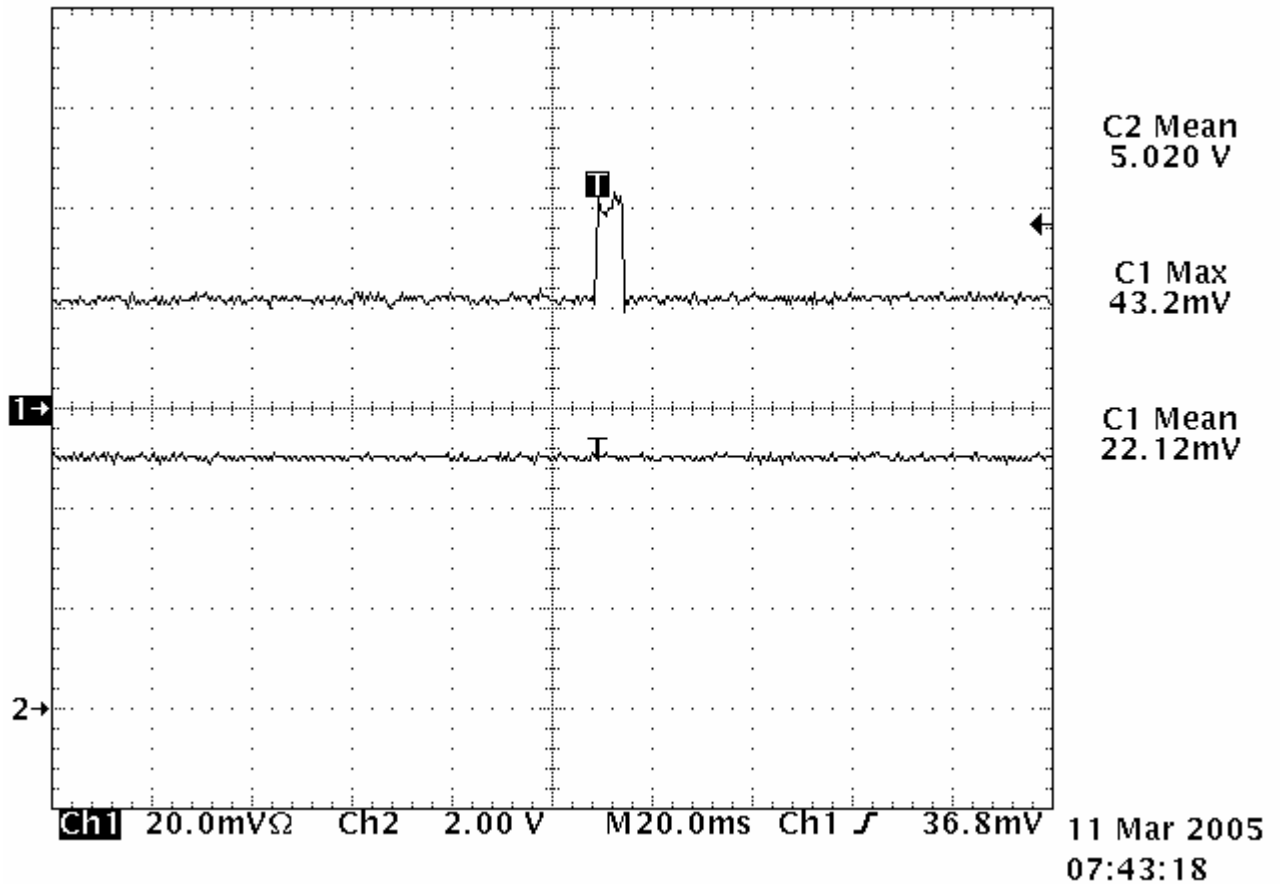
IDLE, 1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 4.320*5.020 = 22.0W (Peak)
Power(P)= 2.212*5.020 = 11.1W (Mean)

Amp(I)= 4.320A (Peak)
Amp(I)= 2.212A (Mean)

+5V Pentium-M 1600/400 Windows XP
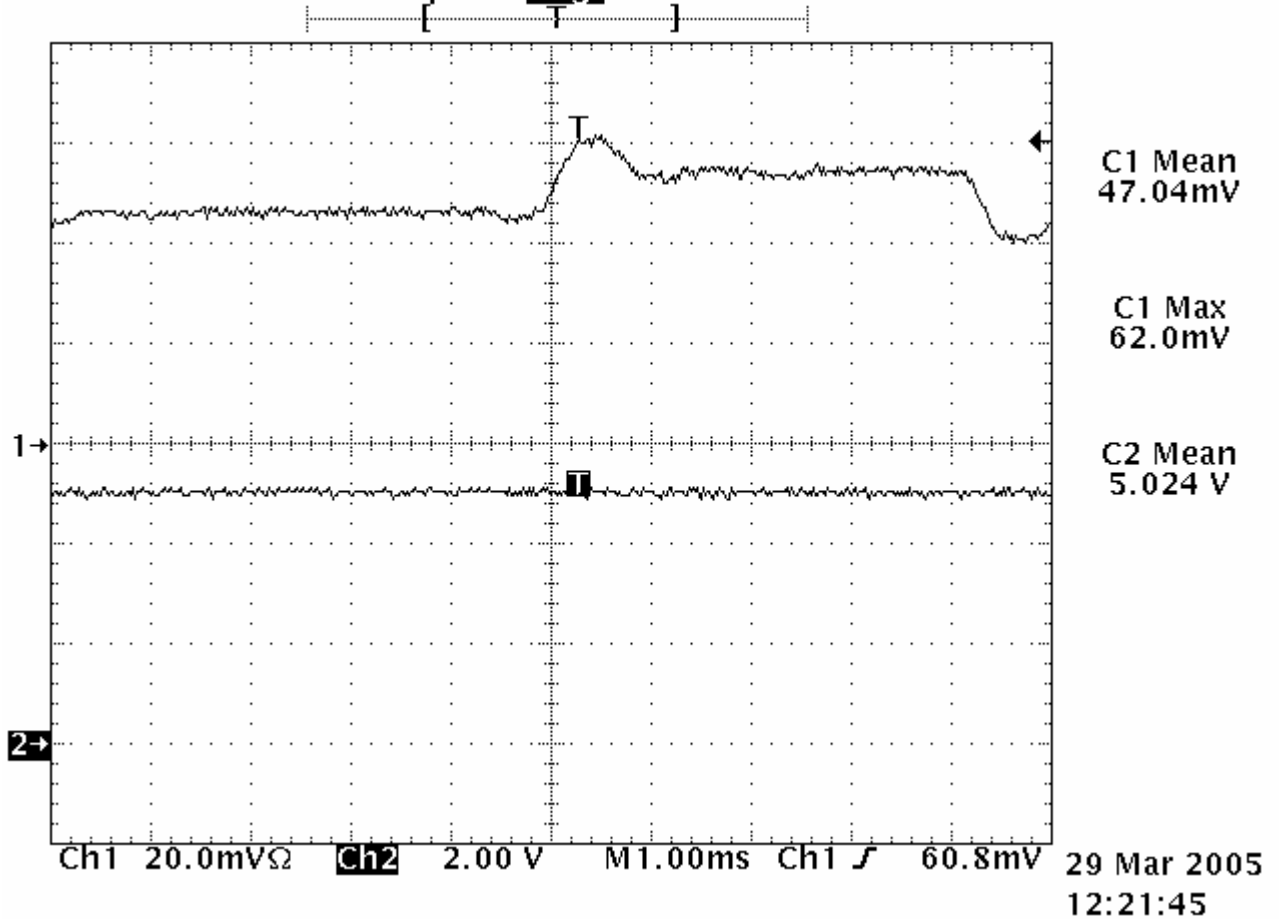
FULL CPU LOAD, 1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 6.200*5.024 = 31.1W (Peak)
Power(P)= 4.704*5.024 = 23.7W (Mean)

Amp(I)= 6.200A (Peak)
Amp(I)= 4.704A (Mean)

+3.3V Pentium-M 1600/400 Windows XP

IDLE, 1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 2.720*3.384 = 9.2W (Peak)
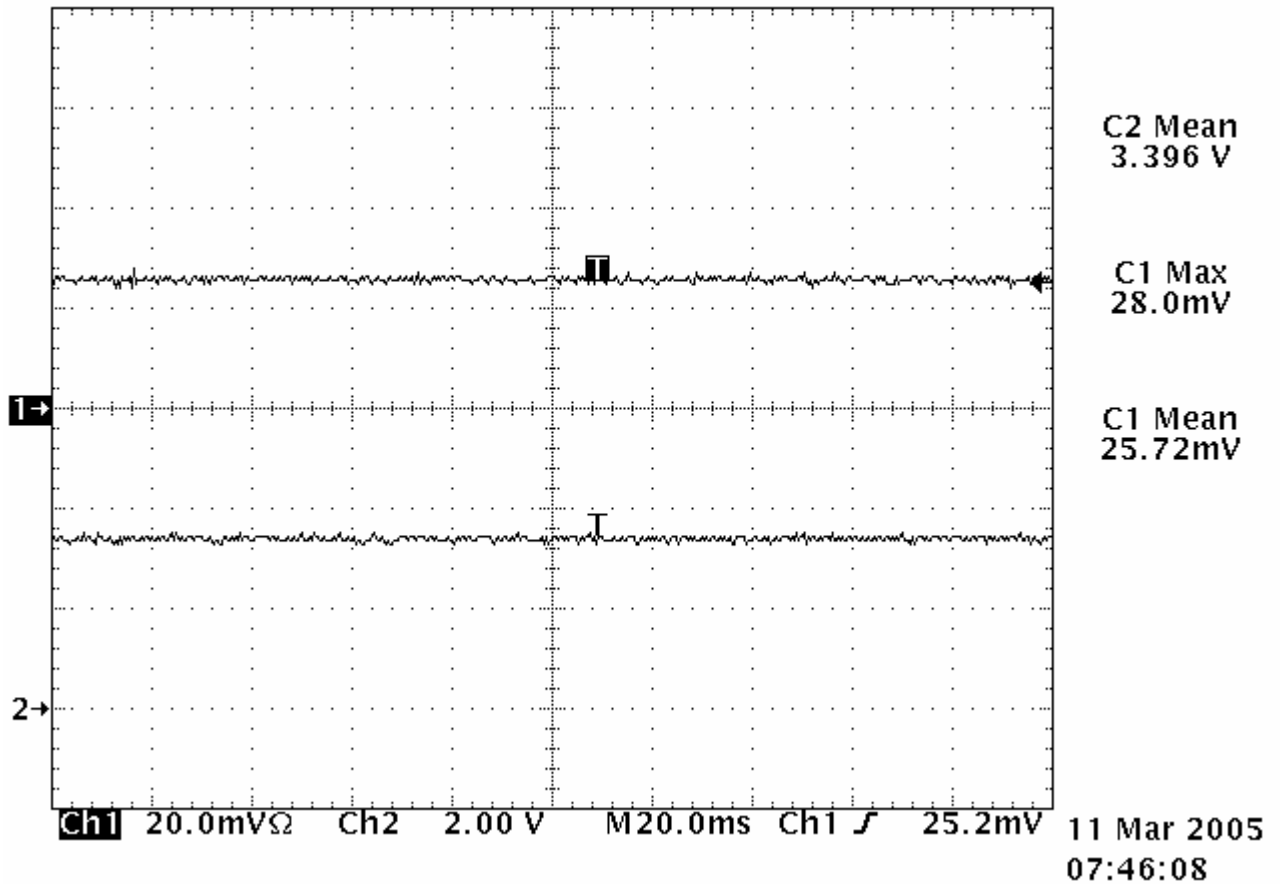Power(P)= 2.568*3.384 = 8.7W (Mean)

Amp(I)= 2.720A (Peak)
Amp(I)= 2.568A (Mean)

+3.3V Pentium-M 1600/400 Windows XP

FULL CPU LOAD, 1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 2.800*3.396 = 9.5W (Peak)
Power(P)= 2.572*3.396 = 8.7W (Mean)

Amp(I)= 2.800A (Peak)
Amp(I)= 2.572A (Mean)

+3.3V Pentium-M 1600/400 Windows XP

FULL CPU LOAD, 100MB LAN x 3
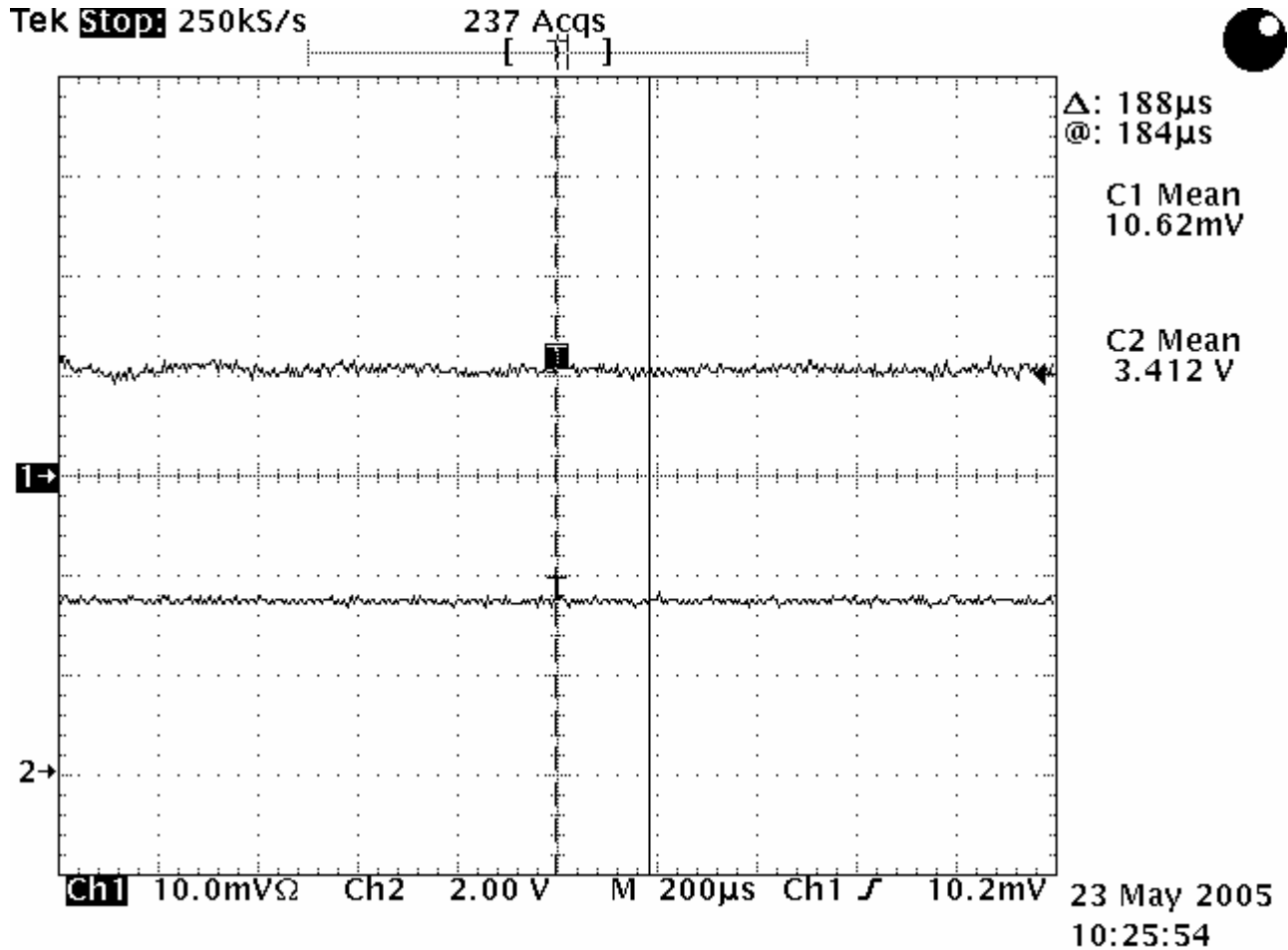
Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Power(P)= 1.062*3.412 = 3.6W (Mean)

Amp(I)= 1.062A (Mean)

## Dynamic Power Consumption (Inrush current)

The dynamic power consumption of the 886LCD-M board is measured with the Fluke Current Probe 80i-100S AC/DC in a similar setup as the above (Pentium M, 1600/400MHz, 256MB DDR RAM (333MHz), 3x1000MB LAN).

Power-On Load Characteristic
The 10%-95% voltage ramp rate must be between 2-200mSec and the voltages must settle to a point within the specified range within 1.0 second after power is applied or the PS-ON# is activated (driven low).
The following plots show the load characteristic of the 886LCD-M board when the supply voltage 5.0 (Vcc) is raised from 0 to 5V (power-on). The PSU is powered up and the PS_ON is shorted to ground and a switch is put in series with the four Vcc wires. The switch is turned on and the voltage and current measured during the power-up.

+5V Pentium-M 1600/400 Power-on inrush current
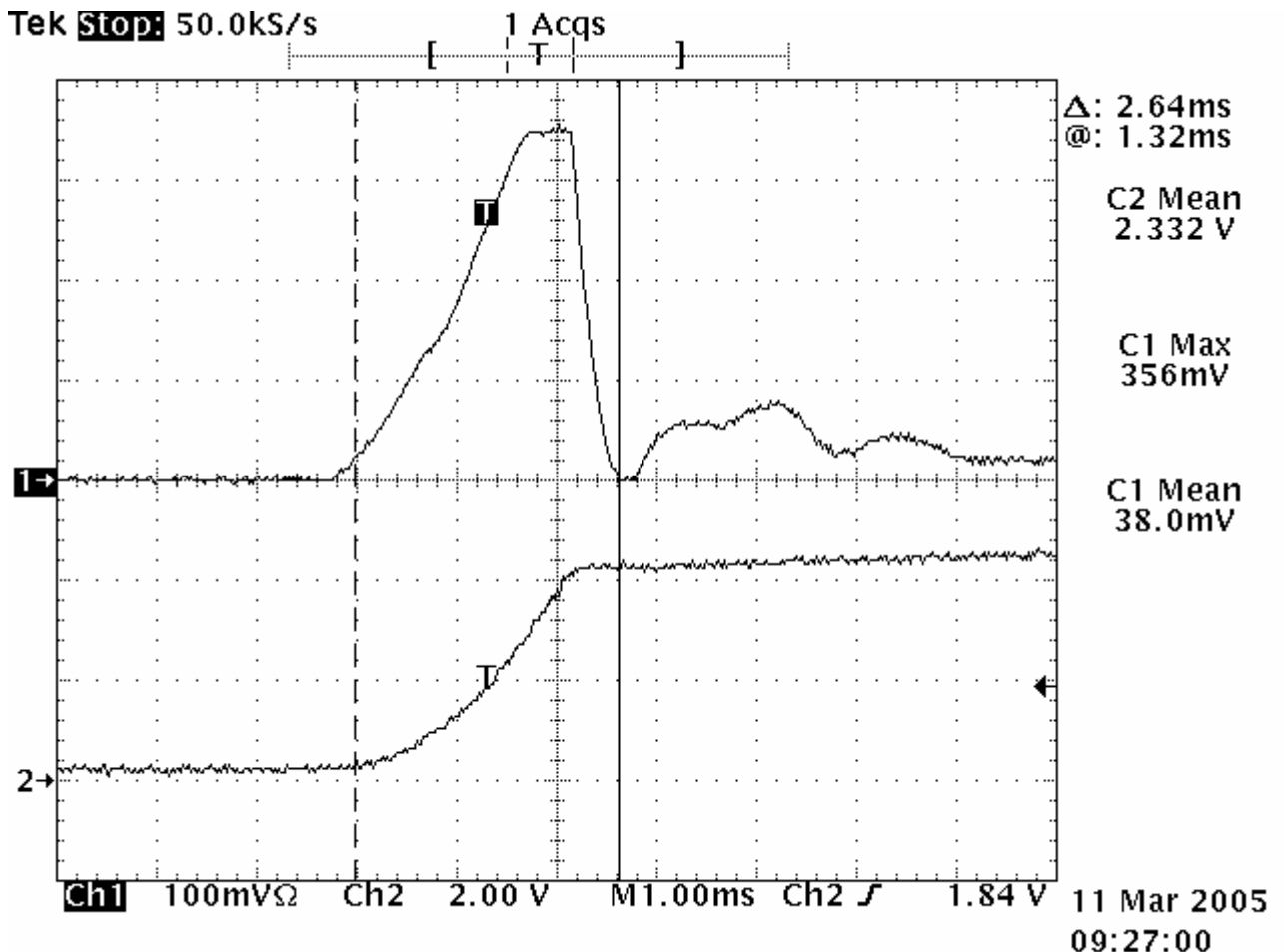
1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Inrush current = 35.6A.
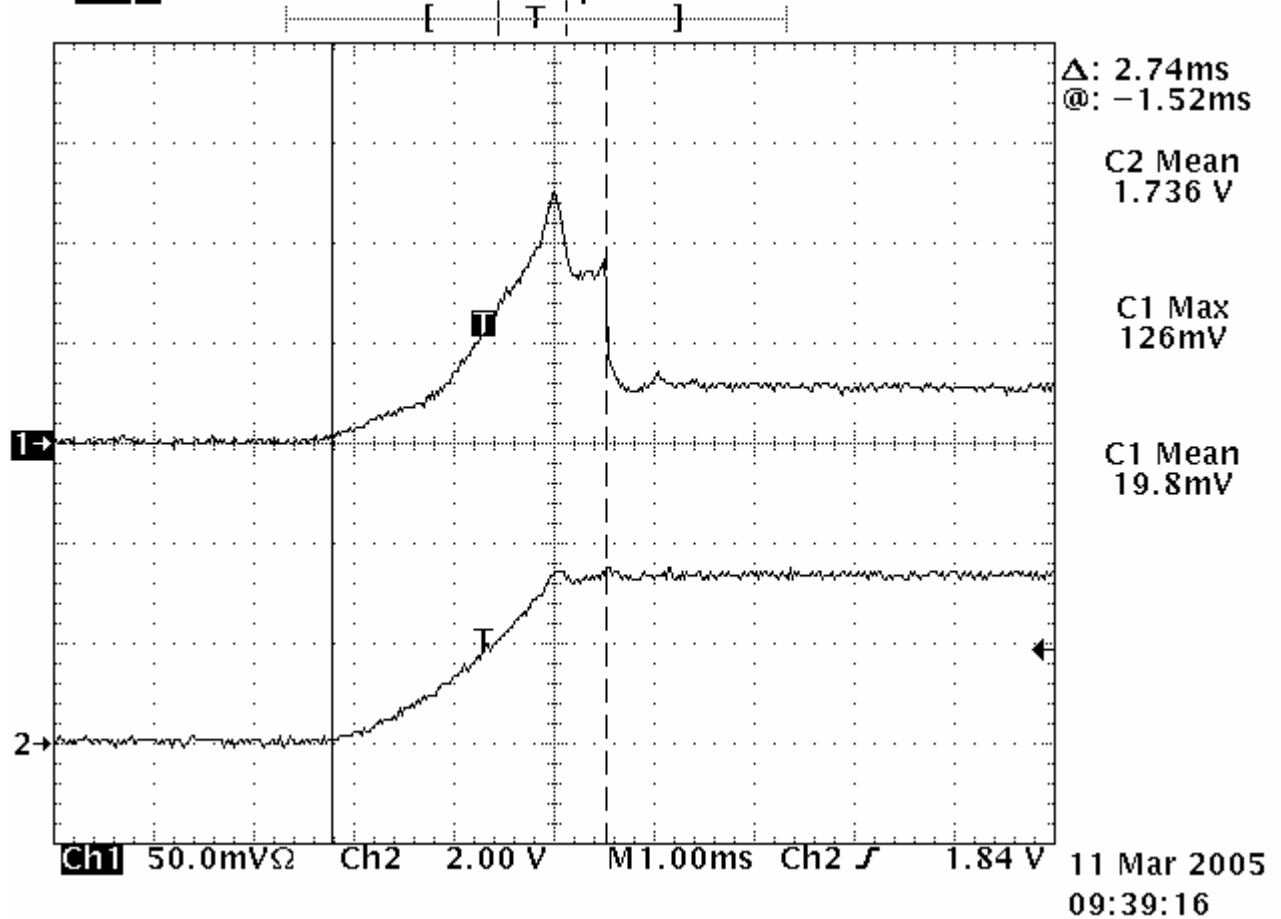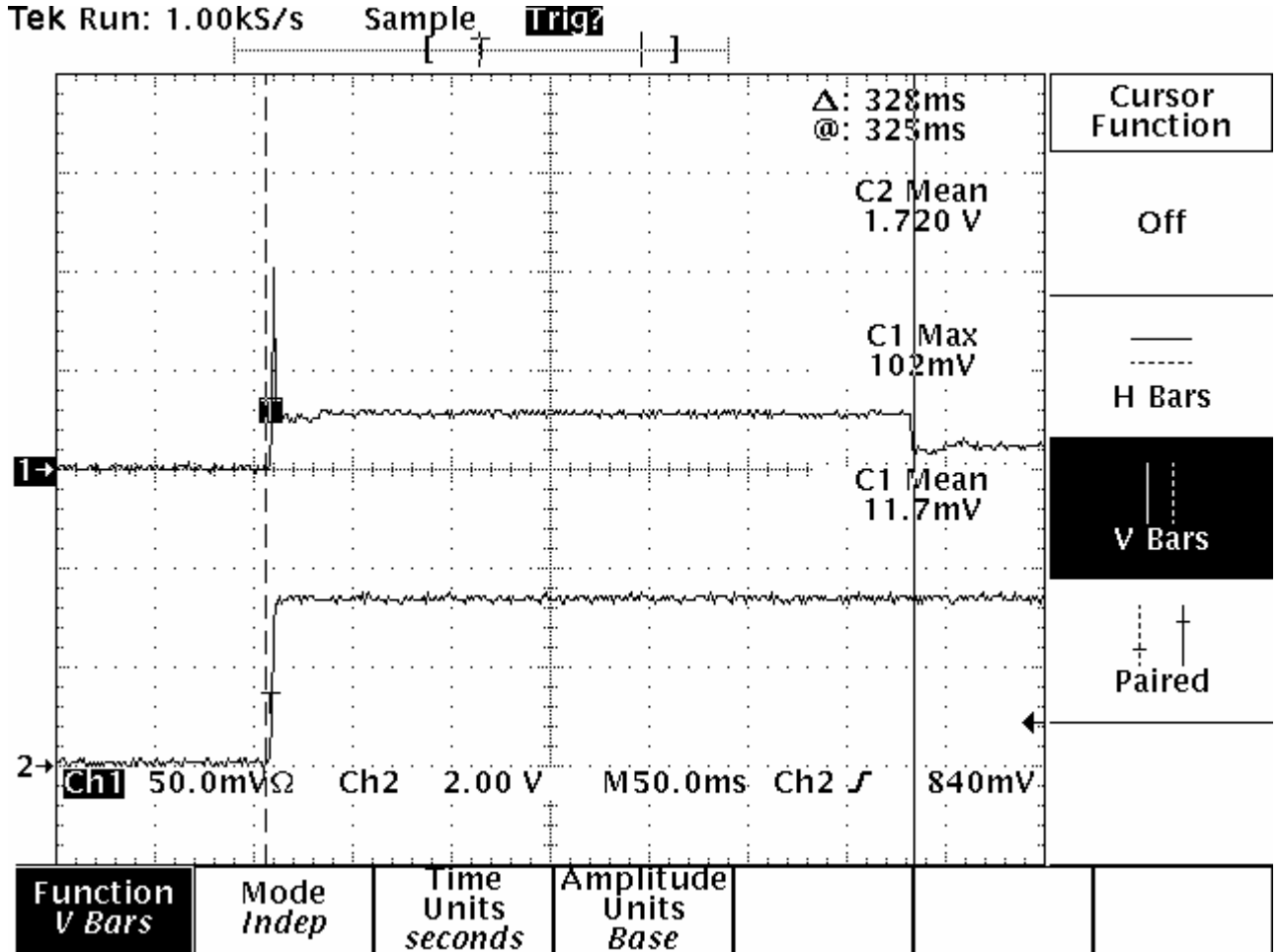Initial Inrush current Width = 2.64ms.

+3.3V Pentium-M 1600/400 Power-on inrush current

1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Inrush current = 12.6A.
Initial Inrush current Width = 2.74ms.

+3.3V Pentium-M 1600/400 Power-on inrush settle time.

1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +3.3VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Inrush settle current = 3.0A.
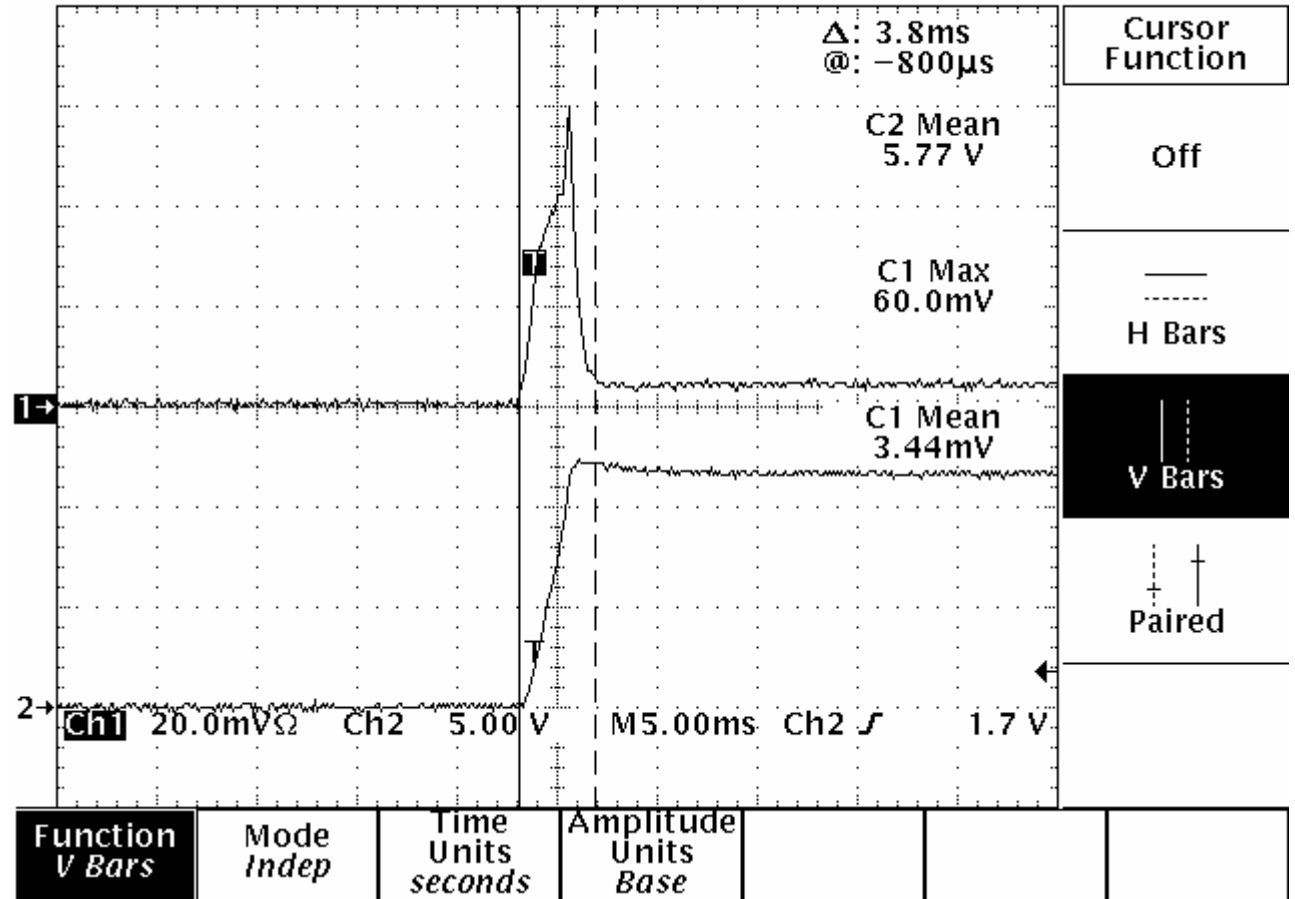Initial Inrush current Width = 328ms.

+12V Pentium-M 1600/400 Power-on inrush current

1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +12VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

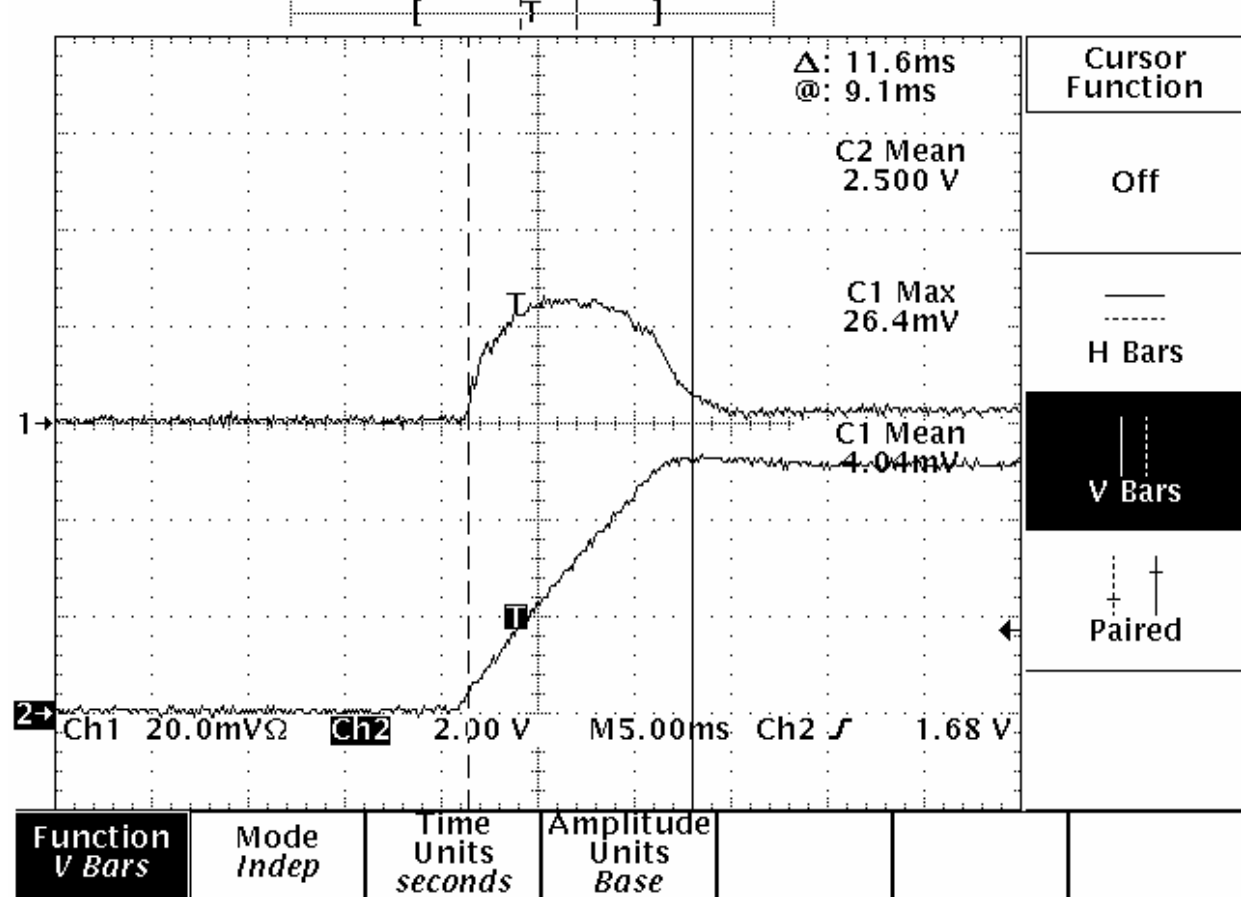Inrush current = 6.0A.
Initial Inrush current Width = 3.8ms.

+5VSB Pentium-M 1600/400 Power-on inrush current

1000MB LAN x 3

Channel 1 (The lower graph) shows the Current draw made from the PSU +5VDC- 10mV equals 1A.
Channel 2 (The upper graph) shows the PSU 5VDC voltage

Inrush current = 2.6A.
Initial Inrush current Width = 11.6ms.