

# Red Hat Linux 7.3 VT82C686B/VT8231/VT1211 Hardware Monitor Driver Installation Guide

Version 0.8, October 11, 2002

Copyright © 2002 VIA Technologies, Inc.

## 1. Summary

This guide shows under Red Hat Linux 7.3 how to install the LM\_Sensors package to enable the hardware monitoring functions for VIA south bridge chips VT82C686B and VT8231, and Low-Pin-Count Super I/O chip VT1211 that integrate a hardware monitor controller. The LM\_Sensors package includes necessary hardware monitor and SMBus drivers for other utilities to acquire system-wide PC health information such as voltage, temperature, and fan speed. For systems using VIA south bridge chips but with other vendors' hardware monitor chips, we provide a sample program for reading data via the SMBus to facilitate users' test and development. The information in the document is provided "AS IS", without guarantee of any kind.

## 2. File description

The package contains 9 files as described below.

2002/09/16	06:31p	559,880	lm_sensors-2.6.5.tar.gz	LM_Sensors package
2002/07/08	01:50p	5,804	i2c.c	sample program source
2002/08/26	03:32p	35,599	smbus_read_byte_data	SMBus read data sample program
2002/07/09	01:43a	143	via.mk	sample program make file
2002/09/27	12:18a	25,787	vt8231.c-sample	sample file
2002/08/27	02:01a	26,007	vt1211.c-sample	sample file
2002/09/27	06:59p	43,945	sensors.conf-vt1211	sample file
2002/09/27	06:59p	43,938	sensors.conf-vt8231	sample file
			Readme.doc	this file

Users are advised to download the latest LM\_Sensors package (e.g., ver 2.6.5 or later) from the website at <http://www2.lm-sensors.nu/~lm78/>.

## 3. Overview

The mission of the LM\_Sensors project is to provide complete hardware health monitoring drivers for Linux. The LM refers to National Semiconductor's legacy LM78 hardware monitor chip that can measure voltage, temperature, and fan speed. Hardware monitor controllers are interfaced to a system via the ISA I/O space or the SMBus/I2C, and some are integrated in system chips. For your reference, a

hardware monitor controller is integrated in VIA south bridge chips VT82C686A, VT82C686B, and VT8231, and Low-Pin-Count Super I/O chip VT1211; but not in VT8233, VT8233A, VT8233C, or VT8235.

Basically, the LM\_Sensors package has two types of drivers: one for SMBus/I2C controllers and the other for hardware monitor controllers. The following table shows what and how VIA chips are supported by the package.

LM_Sensors ver 2.6.5	
Driver Type	Supported Chip
SMBus	VT82C596A, VT82C596B, VT82C686A, VT82C686B, VT8231, VT8233, VT8233A
Hardware Monitor Controller	VT82C686A, VT82C686B, VT8231, VT1211

We will focus on the use of the integrated hardware monitor controller in chip VT82C686B, VT8231, or VT1211. For systems using VIA south bridge chips but with other vendors' hardware monitor chips, we provide a sample program for reading data via the SMBus to facilitate users' test and development.

#### 4. Patch & rebuild the kernel

Even though Red Hat Linux 7.3 has built-in support for LM\_Sensors, we recommend users patch the kernel regardless of what chips are being used on their systems.

##### (1) Prepare kernel source code

The kernel-headers and kernel-source are both required for installing the Smbus/I2C kernel module. You can install the source during your initial setup process by checking the box *.../ Package Group Selection/ Kernel Development/ System/kernel-source*. Alternatively, you may install the kernel source anytime by selecting “**Gnome RPM**”, or run the “**rpm -i kernel-source-2.4.18-3.i386.rpm**” command in the text mode. The kernel source file “**kernel-source-2.4.18-3.i386.rpm**” is located on the second installation CD under the path “**/RedHat/RPMS/**”.

##### (2) Decompress the LM\_Sensors package

Download and decompress the LM\_Sensors package ver 2.6.5 or later, by running the following command.

```
# tar zxvf lm_sensors-2.6.5.tar.gz
```

### (3) Patch the kernel

Run the following commands to patch the kernel.

```
# cd lm_sensors-2.6.5
# mkpatch/mkpatch.pl . /usr/src/linux-2.4 | patch -p1 -E -d
/usr/src/linux-2.4
```

### (4) Configure the kernel

Login the system as the root and run the following commands to configure the kernel.

```
# cd /usr/src/linux-2.4
# make mrproper
# make menuconfig (or "make xconfig" under GUN Desktop Environment)
```

Next, under the I2C support menu, enable “I2C mainboard interfaces” and set “Module” to the “VIA Technologies, Inc. VT596A/B, 686A/B, 8233” option; disable the “Intel 82371 AB, PII X4(E), 443MX, ServerWorks OSB4/CSB5, SMSC Vict” option to avoid the “dmi\_scan” driver’s bug in the lm\_sensors-2.6.5 package. Verify the sensors’ configuration screen under the “Character Devices” menu. Finally, save and exit the kernel configuration.

### (5) Build the kernel

Run the following commands to build the kernel. Ignore any warning messages.

```
# make dep ; make clean ; make bzImage
# make modules
# make modules_install
```

### (6) Boot the new kernel

Copy the newly built boot image “**bzImage**” from directory /usr/src/linux-2.4/arch/i386/boot to directory /boot and rename it as below.

```
# cp /usr/src/linux-2.4/arch/i386/boot/bzImage /boot/vmlinuz-test
```

Add the following four lines to the “/etc/lilo.conf” file for the new kernel image.

```
image=/boot/vmlinuz-test
label=linux-test
read-only
root=/dev/hda1
```

You may need to modify “hda1” according to your actual system settings. Run “lilo” and let the boot configuration take in effect. On the screen you should be able to see a message like below.

```
Added linux *      (link to old kernel image)
Added linux-test   (link to new kernel image)
```

Reboot the system and choose to boot “linux-test”, the newly built kernel.

## 5. Install & load the LM\_Sensors modules

### (1) Install the package

After patching and rebuilding the kernel, login as the root and check whether there exists a symbolic link “/usr/src/linux” pointing to the kernel source folder. If not, run the following commands to create such a link.

```
# cd /usr/src
# ln -s linux-2.4.18-3 linux
```

Then run the following commands to compile and install the package.

```
# cd lm_sensors-2.6.5
# make
# make install
# depmod -a
# ldconfig
# cp etc/sensors.conf.eg /etc/sensors.conf
```

Reboot the system. For more information, refer to Sections 4 and 5 of the “lm\_sensors installation guide” in the “lm\_sensors-2.6.5.tar.gz” package.

### (2) Load the modules

The modules that LM\_Sensors needs can be determined by running the “# sensors-detect” command. Follow “sensors-detect” step by step to load the needed modules. At the end “sensors-detect” will show what you have to add to the “/etc/rc.d/rc.local” and “/etc/modules.conf” files. An example for a system with VT82C686B is given below for your reference.

```
To load everything that is needed, add this to some /etc/rc.d/rc.local file:
...
# I2C adapter drivers
modprobe i2c-via-pro
modprobe i2c-isa
# I2C chip drivers
```

```

modprobe eeeprom
modprobe via686a
...
To make the sensors modules behave correctly, add these lines to either
/etc/modules.conf or /etc/conf.modules:
...
# I2C modules options
alias char-major-89 i2c-dev
...

```

Finally, reboot the OS. Note the “# sensors-detect” command cannot recognize VT1211 chip. Users have to add one line of “modprobe vt1211” to /etc/rc.d/rc.local in order to load the “vt1211.o” modules, similar to the line of “modprobe via686a” for VT82C686A/B.

## 6. Test hardware monitoring functions

Run the “# sensors” command to display measurement results of the hardware monitor. Given below are results from three systems with chip VT82C686B, VT8231, or VT1211.

### (1) VT82C686B

```

vi a686a-isa-6800
Adapter: ISA adapter
Algorithm: ISA algorithm
CPU core: +1.36 V (min = +1.79 V, max = +2.18 V) ALARM
+2.5V: +2.45 V (min = +2.24 V, max = +2.74 V)
I/O: +3.32 V (min = +2.95 V, max = +3.62 V)
+5V: +5.04 V (min = +4.47 V, max = +5.49 V)
+12V: +11.98 V (min = +10.31 V, max = +12.94 V)
CPU Fan: 5113 RPM (min = 16463 RPM, div = 2) ALARM
P/S Fan: 0 RPM (min = 5532 RPM, div = 2)
CPU Temp: +26.2 °C (limit = -40 °C, hysteresis = +12 °C) ALARM
SYS Temp: +27.3 °C (limit = -20 °C, hysteresis = +67 °C) ALARM
SBr Temp: +21.6 °C (limit = -67 °C, hysteresis = +50 °C) ALARM

```

Because some signal input channel arrangement in VT82C686B depends on motherboard layout, the measurement results might not be correct. As a result, some customization may be needed.

### (2) VT8231

```

vt8231-isa-6000
Adapter: ISA adapter
Algorithm: ISA algorithm
VCore1: +3.47 V (min = -0.05 V, max = +4.42 V)
+5V: +3.21 V (min = -0.08 V, max = +6.31 V)

```

```

+12V:      -0.18 V (min = -0.18 V, max = -0.18 V)
+3.3V:     +3.37 V (min = +4.18 V, max = +4.18 V)
fan1:      6488 RPM (min = 0 RPM, div = 2)
fan2:      0 RPM (min = 0 RPM, div = 2)
MB1 Temp:  +204.0 °C (limit = +255 °C, hysteresis = +0 °C)
Proc Temp:  +1.5 °C (limit = +196 °C, hysteresis = -67 °C)
MB2 Temp:   +0.0 °C (limit = +255 °C, hysteresis = +0 °C)
vid:       +2.05 V

```

Because the signal input channel arrangement in VT8231 depends on motherboard layout, the measurement results might not be correct. As a result, some customization may be needed.

### (3) VT1211

```

vt1211-isa-6000
Adapter: ISA adapter
Algorithm: ISA algorithm
VCore1:    +2.23 V (min = -0.05 V, max = +4.42 V)
+5V:       +4.81 V (min = -0.08 V, max = +6.31 V)
+12V:      +12.14 V (min = +14.52 V, max = +13.57 V)
+3.3V:     +3.37 V (min = +3.75 V, max = +2.50 V)
fan1:      4458 RPM (min = 0 RPM, div = 2)
fan2:      0 RPM (min = 0 RPM, div = 2)
MB1 Temp:  +153.0 °C (limit = +255 °C, hysteresis = +0 °C)
Proc Temp:  +40.8 °C (limit = +196 °C, hysteresis = -67 °C)
MB2 Temp:  +152.2 °C (limit = +255 °C, hysteresis = +0 °C)
vid:       +2.05 V

```

Because the signal input channel arrangement in VT1211 depends on motherboard layout, the measurement results might not be correct. As a result, some customization may be needed.

## 7. Customize the LM-Sensors package

Due to different board layout, users may get mismatch of voltage and temperature readings and their labels for VT8231 or VT1211 like below.

```

...
+5V:      +2.74 V (min = -0.05 V, max = +4.42 V)
VCore1:   +4.81 V (min = -0.08 V, max = +6.31 V)
+3.3V:    +12.14 V (min = +15.00 V, max = +15.00 V)
+12V:     +3.38 V (min = +0.73 V, max = +1.39 V)
...

```

Fortunately, the LM\_Sensors offers a way to correct the order of the labels. Refer to

two sample files, “sensors.conf-vt1211” and “sensors.conf-vt8231”, for VIA reference VT8092D and VT5278F boards, respectively. They demonstrate how to modify the section of “vt1211-\*” and “vt8231-\*” of “/etc/sensors.conf” for VT1211 and VT8231, respectively. As a result, the voltage and temperature readings will match with the correct labels like below.

(1) VT1211 (for VT8092D)

```
...
VCore:      +1.326 V (min = -0.31 V, max = +26.30 V)
+3.3V:      +3.37 V (min = -0.05 V, max = +4.42 V)
+12V:       +12.14 V (min = +14.52 V, max = +13.57 V)
Internal Vcc: +3.37 V (min = +3.75 V, max = +2.50 V)
...
```

(2) VT8231 (for VT5278F)

```
...
+12V:       +11.96 V (min = -0.18 V, max = +15.00 V)
+5V:        +5.11 V (min = -0.08 V, max = +6.31 V)
+2.5V:      +2.48 V (min = -0.04 V, max = +3.16 V)
VCore:      +1.34 V (min = -0.03 V, max = +2.63 V)
+3.3V:      +3.37 V (min = +4.18 V, max = +4.18 V)
...
```

Also some motherboards using VT82C686B may connect the input signals differently and may require some customization. Users need to swap the “temp1” and “temp2” labels in the section “via686a-\*” of the file “/etc/sensors.conf” as below.

```
...
label temp2 "SYS Temp"
label temp1 "CPU Temp"
label temp3 "SBr Temp"
...
```

## 8. Calibrate measurement results

Take systems using VT1211 or VT8231 for example, the system temperature readings are incorrect. This is because the LM\_Sensors does not correctly translate the input signal reading to temperature. Refer to Appendix B of a sample look-up table for correct temperature conversion. Users, however, are advised to contact their board manufacturers for the correct, hardware-dependent temperature conversion table.

We provide two sample programs, “vt1211.c-sample” and “vt8231.c-sample”, that modify the “vt1211.c” and “vt8231.c” files in the LM\_Sensors package by converting the register reading to temperature according to the table. After modifying both files and recompiling the LM\_Sensors, we now have the correct system temperature readings like below.

#### (1) VT1211

```
vt1211-isa-6000
Adapter: ISA adapter
Algorithm: ISA algorithm
VCore:      +1.326 V (min = -0.31 V, max = +26.30 V)
+3.3V:      +3.37 V (min = -0.05 V, max = +4.42 V)
+12V:       +12.14 V (min = +14.52 V, max = +13.57 V)
Internal Vcc: +3.37 V (min = +3.75 V, max = +2.50 V)
fan1:       4465 RPM (min = 0 RPM, div = 2)
fan2:       0 RPM (min = 0 RPM, div = 2)
MB1 Temp: +27.0 ° C (limit = +255 ° C, hysteresis = +0 ° C)
Proc Temp: +31.2 ° C (limit = +196 ° C, hysteresis = -67 ° C)
MB2 Temp: +26.0 ° C (limit = +255 ° C, hysteresis = +0 ° C)
vid:       +2.05 V
```

#### (2) VT8231

```
vt8231-isa-6000
Adapter: ISA adapter
Algorithm: ISA algorithm
+12V:      +11.96 V (min = -0.18 V, max = +15.00 V)
+5V:       +5.11 V (min = -0.08 V, max = +6.31 V)
+2.5V:     +2.48 V (min = -0.04 V, max = +3.16 V)
VCore:     +1.34 V (min = -0.03 V, max = +2.63 V)
+3.3V:     +3.37 V (min = +4.18 V, max = +4.18 V)
fan1:      6488 RPM (min = 0 RPM, div = 2)
fan2:      0 RPM (min = 0 RPM, div = 2)
Proc Temp: +1.2 ° C (limit = +196 ° C, hysteresis = -67 ° C)
MB1 Temp: +26.0 ° C (limit = +255 ° C, hysteresis = +0 ° C)
vid:      +2.05 V
```

## 9. Known issue

- (1) If you get an error message of “ERROR: Can’t get xxxx data!” after running the “#sensors” command, this is probably due to a mismatch of libsensors and sensors. Run the following commands to link to the correct libsensors.

```
# cd /usr/lib
```



```
# rm libsensors. so. 1
# ln -s ../local/lib/libsensors. so. 1. 2. 1 libsensors. so. 1
```

For other problems, refer to the “FAQ” at the website

<http://www2.lm-sensors.nu/~lm78/> for possible solutions.

- (2) The CPU temperature reading from VT8231 are incorrect. Contact the motherboard manufacturer or check future versions for a possible fix.

## 10. Get access to SMBus devices

For systems using VIA south bridge chips but with other vendors’ hardware monitor chips, we provide a sample program for reading data via the SMBus to facilitate users’ test and development. Execute the following make file to compile the “i2c.c” source code to build the “smbus\_read\_byte\_data” program.

```
# ./vi a. mk
```

The “smbus\_read\_byte\_data” program accepts 4 arguments whose syntax is described below.

```
smbus_read_byte_data <Adapter_num> <SMB_sl ave_addr> <SMB_sl ave_cmd> <Count>
```

Refer to the “i2c.c” file for information about these four arguments. Two samples are given below for your reference. Users, however, need to give those hardware-dependent arguments according to their actual system design.

```
# ./smbus_read_byte_data 0 0x50 0 60
dev: /dev/i 2c-0 sl ave_addr: 0x50 sl ave_cmd: 0x00 count: 0x60
80 08 07 0C 0A 01 40 00 04 75 75 00 80 08 00 01
0E 04 0C 01 02 20 00 A0 75 00 00 50 3C 50 2D 20
90 90 50 50 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 9C
2C 00 00 00 00 00 00 00 01 38 56 44 44 54 31 36
36 34 41 47 2D 32 36 35 41 31 20 01 00 01 0C 03

# ./smbus_read_byte_data 0 0x69 0 40
dev: /dev/i 2c-0 sl ave_addr: 0x69 sl ave_cmd: 0x00 count: 0x40
0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E
0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E
0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E
0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E 0E
```

## 11. Test configuration

The following hardware configurations were used for test.

Mother Board	VT5559B1P (PN133T +VT82C686B)
CPU	VIA C3 933 MHz
Memory	128 MB SDRAM

Mother Board	VT5278F (PM133 +VT8231)
CPU	PIII 933 MHz
Memory	128 MB SDRAM

Mother Board	VT8092D (CLE266 +VT8233+VT1211)
CPU	PIII 933 MHz
Memory	128 DDRAM

## Appendix A Use of the sensors command

- (1) The “/usr/bin/sensors” command is used to show the current readings of all sensors chips, and to set all limits as specified in the configuration file. The sensors program knows about certain chips, and outputs nicely formatted readings for them; but it can also display the information of unknown chips, as long as libsensors knows about them.

### (2) Options

-c config-file

Specify a configuration file. If no file is specified, the name `sensors.conf` is used. If the name does not contain a directory slash, or this parameter is not present, the following path is examined:  
/etc, /usr/lib/sensors, /usr/local/lib/sensors, /usr/lib, /usr/local/lib.

-h Prints a help text

-s Evaluates all `set` statements in the configuration file. You must probably be `root` to do this. If this parameter is not specified, no `set` statement is evaluated.

-u Treats all chips as unknown ones. Output will be of much lower quality; this option is only added for testing purposes.

-v Returns the program version.

-f Prints the temperatures in degrees Fahrenheit instead of Celsius.

## Appendix B Sample hardware monitor look-up table

Note: “8-bit (roundup)” refers to temperature displayed by the LM\_Sensors.

UIC for Temp(C)	R9 (K Ohm)	R10 (K Ohm)	VTSEN	16-Bit (truncate)	8-bit (roundup)	8-Bit (truncate)
-50	329.5	10	2.128146192	12581	49	49
-49	310.9	10	2.124402594	12673	50	49
-48	293.5	10	2.120485115	12769	50	49
-47	277.2	10	2.116384676	12869	50	50
-46	262	10	2.112118134	12974	51	50
-45	247.7	10	2.107644726	13084	51	51
-44	234.3	10	2.102977565	13198	52	51
-43	221.7	10	2.098096587	13318	52	52
-42	209.9	10	2.093018308	13442	53	52
-41	198.9	10	2.087767637	13571	53	53
-40	188.5	10	2.082268175	13706	54	53
-39	178.5	10	2.076407954	13850	54	54
-38	169	10	2.070234261	14001	55	54
-37	160.2	10	2.063900584	14156	55	55
-36	151.9	10	2.057295817	14318	56	55
-35	144.1	10	2.050440447	14487	57	56
-34	136.7	10	2.043262755	14663	57	57
-33	129.8	10	2.035885452	14843	58	57
-32	123.3	10	2.028237206	15031	59	58
-31	117.1	10	2.020213005	15228	59	59
-30	111.3	10	2.011963888	15430	60	60
-29	105.7	10	2.00321446	15645	61	61
-28	100.5	10	1.994295925	15863	62	61
-27	95.52	10	1.984930702	16093	63	62
-26	90.84	10	1.97528655	16330	64	63
-25	86.43	10	1.965342131	16573	65	64
-24	82.26	10	1.955064424	16825	66	65
-23	76.33	10	1.938738968	17226	67	67
-22	74.61	10	1.933575626	17352	68	67
-21	71.1	10	1.922359307	17627	69	68
-20	67.77	10	1.910782278	17911	70	69
-19	64.57	10	1.898682997	18208	71	71
-18	61.54	10	1.886228811	18514	72	72
-17	58.68	10	1.873465227	18827	74	73
-16	55.97	10	1.860349924	19148	75	74
-15	53.41	10	1.846930881	19477	76	76
-14	50.98	10	1.833150954	19815	77	77
-13	48.68	10	1.819056893	20161	79	78
-12	46.5	10	1.804638935	20514	80	80
-11	44.43	10	1.789879512	20876	82	81
-10	42.47	10	1.774831037	21245	83	82
-9	40.57	10	1.759129745	21630	84	84
-8	38.77	10	1.743126332	22023	86	86
-7	37.06	10	1.726789146	22423	88	87
-6	35.44	10	1.71017758	22831	89	89
-5	33.9	10	1.693249656	23246	91	90
-4	32.44	10	1.676066664	23667	92	92
-3	31.05	10	1.658571739	24096	94	94
-2	29.73	10	1.640824614	24532	96	95
-1	28.48	10	1.622896186	24971	98	97
0	27.28	10	1.604553789	25421	99	99

1	26.13	10	1.585832325	25880	101	101
2	25.03	10	1.566774629	26347	103	102
3	23.99	10	1.547622024	26817	105	104
4	23	10	1.528268685	27292	107	106
5	22.05	10	1.508573165	27775	108	108
6	21.15	10	1.488806097	28259	110	110
7	20.3	10	1.469058964	28744	112	112
8	19.48	10	1.448929622	29237	114	114
9	18.7	10	1.428714748	29733	116	116
10	17.96	10	1.408493942	30229	118	118
11	17.24	10	1.387765147	30737	120	120
12	16.56	10	1.367156022	31243	122	122
13	15.9	10	1.346118145	31759	124	124
14	15.28	10	1.325354639	32268	126	126
15	14.69	10	1.304627486	32776	128	128
16	14.12	10	1.28363991	33291	130	130
17	13.58	10	1.262820976	33801	132	132
18	13.06	10	1.241851574	34316	134	134
19	12.56	10	1.220777067	34832	136	136
20	12.09	10	1.200097146	35339	138	138
21	11.63	10	1.178986992	35857	140	140
22	11.2	10	1.158425155	36361	142	142
23	10.78	10	1.137519985	36874	144	144
24	10.38	10	1.116809223	37382	146	146
25	10	10	1.096366665	37883	148	147
26	9.632	10	1.075815375	38387	150	149
27	9.281	10	1.055482498	38886	152	151
28	8.944	10	1.035251631	39382	154	153
29	8.622	10	1.01523718	39873	156	155
30	8.313	10	0.995368982	40360	158	157
31	8.014	10	0.975494888	40847	160	159
32	7.729	10	0.955927345	41327	161	161
33	7.454	10	0.936440601	41805	163	163
34	7.192	10	0.917295144	42275	165	165
35	6.94	10	0.898321683	42740	167	166
36	6.698	10	0.879562094	43200	169	168
37	6.467	10	0.861140854	43652	171	170
38	6.245	10	0.842943653	44098	172	172
39	6.032	10	0.825010445	44538	174	173
40	5.827	10	0.807294946	44972	176	175
41	5.629	10	0.789743164	45403	177	177
42	5.438	10	0.772385273	45828	179	179
43	5.255	10	0.755346683	46246	181	180
44	5.08	10	0.738666135	46655	182	182
45	4.911	10	0.722185862	47059	184	183
46	4.749	10	0.706033669	47455	185	185
47	4.539	10	0.684559914	47982	187	187
48	4.443	10	0.674535359	48228	188	188
49	4.299	10	0.659246142	48603	190	189
50	4.16	10	0.644192843	48972	191	191
51	4.026	10	0.629398573	49335	193	192
52	3.0896	10	0.517561186	52077	203	203
53	3.771	10	0.600450032	50045	195	195
54	3.651	10	0.586452962	50388	197	196
55	3.536	10	0.572806225	50722	198	198
56	3.425	10	0.559412414	51051	199	199
57	3.318	10	0.546289923	51373	201	200
58	3.215	10	0.533457257	51687	202	201

59	3.116	10	0.520932987	51995	203	203
60	3.02	10	0.508606348	52297	204	204
61	2.927	10	0.496490327	52594	205	205
62	2.838	10	0.484731048	52882	207	206
63	2.751	10	0.473077358	53168	208	207
64	2.668	10	0.461810272	53444	209	208
65	2.588	10	0.450809808	53714	210	209
66	2.511	10	0.440088993	53977	211	210
67	2.436	10	0.429519009	54236	212	211
68	2.364	10	0.41925118	54488	213	212
69	2.285	10	0.407846614	54768	214	213
70	2.228	10	0.399526485	54972	215	214
71	2.163	10	0.389943451	55207	216	215
72	2.1	10	0.380557024	55437	217	216
73	2.039	10	0.37137497	55662	217	217
74	1.98	10	0.362405008	55882	218	218
75	1.924	10	0.353809034	56093	219	219
76	1.869	10	0.345287606	56302	220	219
77	1.816	10	0.337000992	56505	221	220
78	1.765	10	0.328956594	56702	221	221
79	1.716	10	0.321161693	56894	222	222
80	1.668	10	0.313462392	57082	223	222
81	1.621	10	0.305861865	57269	224	223
82	1.577	10	0.298690547	57445	224	224
83	1.533	10	0.29146451	57622	225	225
84	1.491	10	0.284515307	57792	226	225
85	1.451	10	0.277849626	57956	226	226
86	1.411	10	0.271137212	58120	227	227
87	1.373	10	0.264716685	58278	228	227
88	1.336	10	0.258423759	58432	228	228
89	1.3	10	0.252261357	58583	229	228
90	1.266	10	0.246405148	58727	229	229
91	1.232	10	0.240513485	58871	230	229
92	1.2	10	0.234935714	59008	231	230
93	1.168	10	0.229325979	59146	231	231
94	1.137	10	0.223860806	59280	232	231
95	1.108	10	0.218720609	59406	232	232
96	1.079	10	0.213553503	59532	233	232
97	1.051	10	0.208538841	59655	233	233
98	1.024	10	0.203679148	59775	233	233
99	0.9884	10	0.19723505	59933	234	234
100	0.9731	10	0.194452689	60001	234	234
101	0.9484	10	0.189944493	60111	235	234
102	0.9246	10	0.185581279	60218	235	235
103	0.9014	10	0.181309724	60323	236	235
104	0.8788	10	0.177131122	60426	236	236
105	0.8572	10	0.173121156	60524	236	236
106	0.836	10	0.169169903	60621	237	236
107	0.8155	10	0.165334384	60715	237	237
108	0.7958	10	0.161634819	60806	238	237
109	0.7763	10	0.157959493	60896	238	237
110	0.7576	10	0.154422434	60982	238	238