MEASUREMENT / TECHNICAL REPORT

Siemens PC Systeme GmbH & Co. KG

Model: Keyboard K252

FCC ID: HSS01TASTK252

March 17, 1999

This report concerns:	Original grant	☐ Class II change
Equipment type:	Keyboard	

Request issue of grant:

Immediately upon completion of review

☐ Defer grant per 47 CFR 0.457(d)(1)(ii) until _____ date _____. Company Name agrees to notify the Commission by _____ date _____ of the intended date of announcement of the product so that the grant can be issued on that date.

Measurement procedure used:

ANSI C63.4-1992

☐ FCC/OET MP-4(1987)

☐ other _____

Limits on compliance with: CISPR 22 resp. FCC class B

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Applicant for this device:

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Table of Contents

1 General Information

1.1 Product Description

The Siemens keyboard K252 with the product number S26381-K252 is a MF-II-compatible keyboard for personal computers. The connection between the keyboard and the personal computer is done by a cable which has on one end a western plug connector and on the other end a PS/2-connector.

Functions and features:

Industry standard	MF-II-compatible
System compatibility	AT, XT and PS/2 system, automatic AT/XT switch over
Keyboard to system unit	western plug to PS/2/DIN (2m / 4m variable length)
Design	- Low-profile compact design, special ergonomic key design - adjustable keyboard slope
Technology	Chip on board (COB) and membrane for key matrix

Electrical:

Power consumption	< 50 mA at 5 V

Temperature:

Operating temperature	5° C to 40° C (as per IEC721)

Dimensions at minimum adjustment angles and without palm rests:

Dimensions (H x W x D)	25 mm x 459 mm x 160 mm

Adjustment range:

Keyboard slope:	6° and 12°

Standards met:

Product safety:	EN 60950 VDE 0805
Ergonomics:	“Safety-tested“ mark (ZH1/618) ISO 9241-4 / EN 29241-4 ISO 9995, DIN 2137
Electromagnetic Compatibility:	CE symbol to EC Guideline 89/336/EWG (EN 55022/B, EN 50082-1)

1.2 Related Submittal Grant

N/A

1.3 Tested System Details

The FCC IDs for all equipment, plus description of all cables used in the tested system are:

Pos	Model Number (Serial Number)	FCC ID	Description	Cable Description (length in [cm])
1	Siemens Scenic Pro M7 (350 MHz)	HSSSCENICM701	PC	unshielded power cord [292]
2	Siemens MCM 1705 NTD S26361-K471-V150	A3LCGH760	Monitor	unshielded power cord [175] shielded video cable [186]
3	Siemens S26381-K252	HSS01TASTK252	Keyboard **EUT**	shielded keyboard cable [200/400]
4	Microsoft MS 2.1A	C3KKMP3	Mouse	shielded mouse cable [183]

Pos	Model Number (Serial Number)	FCC ID	Description	Cable Description (length in [cm])
5	Hewlett Packard HP 2225C+ (3019S70991)	DSI6XU2225	Printer, parallel I/F	unshielded power cord [185], shielded centronics parallel cable [190]
6	Hewlett Packard HP 2225D+ (3012S70819)	DSI6XU2225	Printer, serial I/F	unshielded power cord [185], shielded serial cable [190]
7	Hewlett Packard HP 2225D+ (2952S61299)	DSI6XU2225	Printer, serial I/F	unshielded power cord [185], shielded serial cable [190]
8	Siemens	N/A	USB cable	shielded cable, terminated [86]
9	Siemens	N/A	USB cable	shielded cable, terminated [86]

1.4 Test Methodology

Both, conducted and radiated tests were performed according to the procedures in ANSI C63.4-1992. Radiated testing was performed at an antenna to EUT distance of 10 meters. All radiated emission measurements were done in an anechoic chamber. Limits for radiated and conducted are in compliance with CISPR 22.

1.5 Test Facility

The anechoic chamber and conducted measurement facility used to collect the emission data is located at Siemens PC Systeme GmbH & Co. KG, Buergermeister-Ulrich-Strasse 100, 86199 Augsburg, Germany.
This site has been fully described in a report dated January 24, 1997 submitted to your office, and accepted in a letter dated March 03, 1997 (31040/SIT).

1.6 Referenced Rules Sections

N/A

2 Product Labeling

2.1 FCC ID Label: see attached files

2.2 Location of Label on EUT: see attached files

3 System Test Configuration

3.1 Justification

The system was configured for testing in a maximum fashion (as a customer can use it). Each type of external ports was connected with a peripheral unit (e.g. serial port connected to a serial printer, external keyboard port connected to a keyboard and so on). The EUT was configured with a cable of 2 m and 4 m length.
Two configurations were measured:

1) Keyboard K252 connected to system unit via 2 m cable

2) Keyboard K252 connected to system unit via 4 m cable

Both measurement results are applicable.

3.2 Video mode Justification

The system was tested in video graphic mode 1024 x 768/100 Hz, because this is the most commonly used resolution and reflects the worst case.

3.3 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to typical use.

The used sequence is:

- scrolling “H“ with applicable video mode (see 3.2)
- internal Floppy drive writes to the HD and reads back
- internal CD-ROM writes to the HD
- “H`s“ are sent to the printer ports
- data is sent to USB ports

3.4 Special Accessories

As shown in Figure 3.1, all interface cables used for compliance testing are shielded like normally supplied by the manufacturer. All cable connectors feature integral metal hoods for shielding.

3.5 Equipment Modifications

To achieve compliance to Class B levels, the following modifications were made during compliance testing:

no modifications

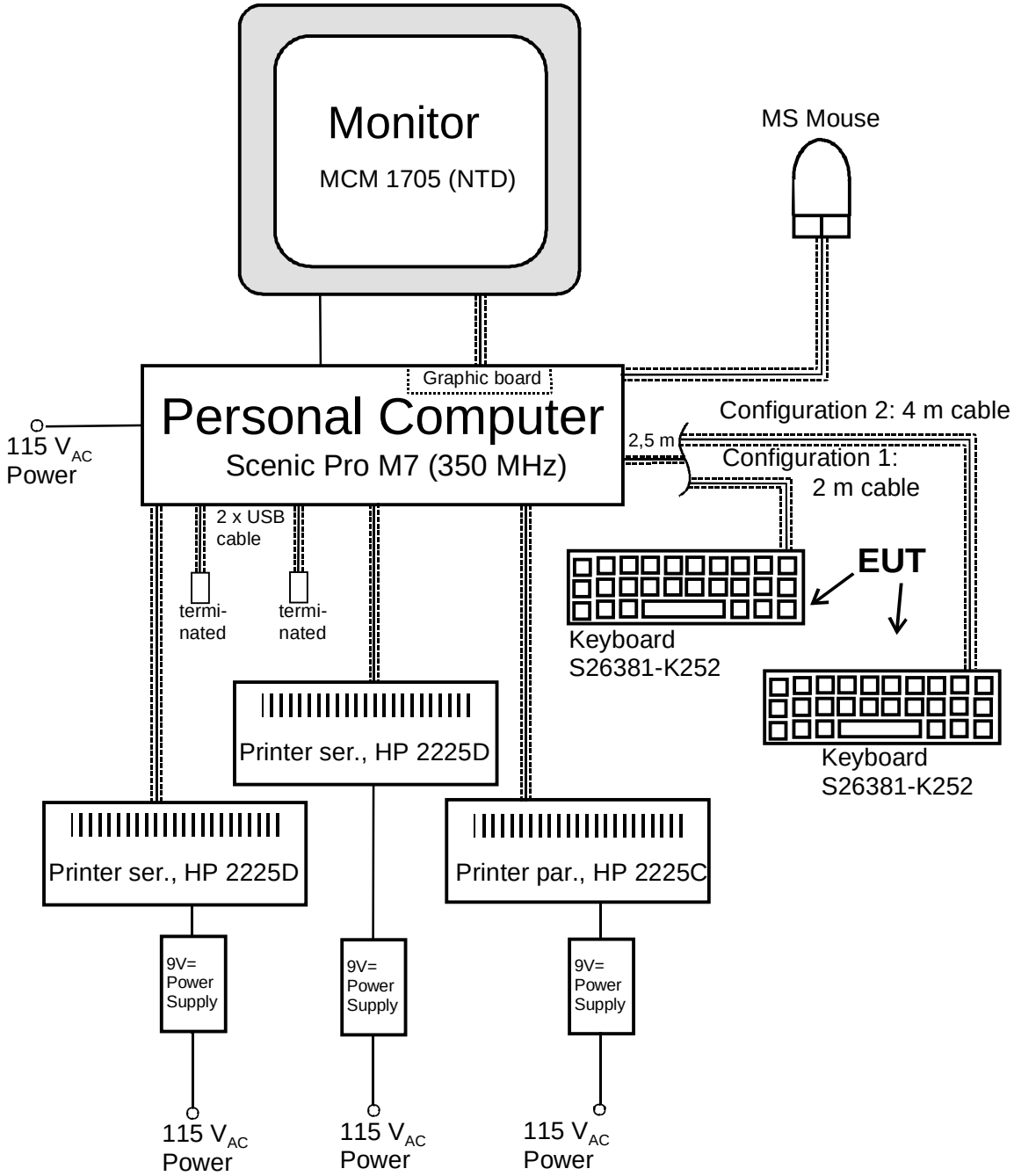
Applicant Signature _____ Date _____

Typed/Printed Name _____ Position _____

3.6 Configuration of Tested System

All necessary tests were carried out like figure 3.1. The system was used according to paragraph 1.1. During test for conducted emission the EUT was connected to a LISN. All peripherals were supplied by a second LISN. The equipment was configured according to ANSI C63.4-1992 Fig 11.

Figure 3.1 Configuration of Tested System



4 Block Diagram of EUT

see fig 4.1 page 17

4.1 Block Diagram Description **(see fig. 4.1)**

The major parts of the system are (fig 4.1).

- Keyboard Controller
- Key matrix

The keyboard works exactly like a traditional keyboard.

4.2 Clockfrequency of EUT

Ceramic resonator frequency: 2.0 MHz ± 15 %

The external clock frequency is divided by 2 in the keyboard controller.

4.3 Theory of Operation

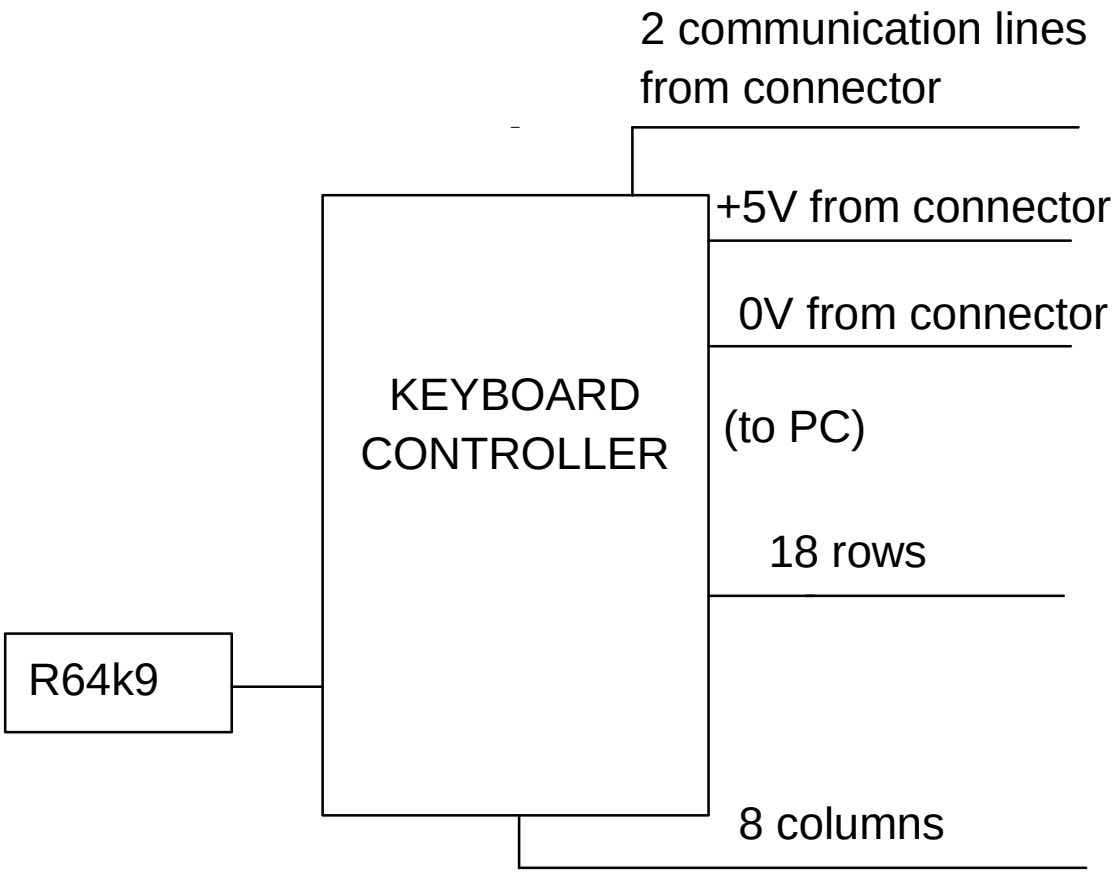
The keyboard works exactly like a traditional keyboard.

The control of all keyboard functions is done by a micro controller MOTOROLA MC68HC05SU3. The external frequency is 2 MHz, the internal is 1MHz.

The controller scans a matrix of 18 x 8 (144 keys). The matrix is scanned all time by the controller with a high level pulse. The input is an A/D-converter part of the controller which analyses, if a key is pressed or released.

The communication to the system is realised by two lines, a clock- and a data line. It is a synchronous data transmission.

Figure 4.1 Block Diagram of the EUT



Frequency: 2 MHz +/- 15%

5 Conducted and Radiated Emission Measurement Photos: see attached files

5.1 Test setup, conducted emission, front side view

5.2 Test setup, conducted emission, rear side view

5.3 Test setup, radiated emission, front side view

5.4 Test setup, radiated emission, rear side view

6 Conducted Emission Data

6.1 Test Procedure

The initial step in collecting conducted emission data is a Rohde & Schwarz Test Receiver (ESHS10). During first scan all data in peak mode is measured, then all significant peaks are explored either in quasi-peak mode or in average mode. In case of low noise (no peak value reaches the quasi peak limit), only average checks are done.

6.2 Measured Data

The conducted emission was measured the following way:

1. Peak noise on L
2. Peak noise on N

During the emission measurement the printers and the monitor are supplied with power via a second LISN. Two configurations were measured:

Configuration a: Keyboard K252 with 2 m cable
Configuration b: Keyboard K252 with 4 m cable

Judgement: Passed by

	Frequency [MHz]	Measured [dB(µV)]	Kind of value	Limit [dB(µV)]	Configuration
neutral	0.186	36.00	AV	54.2	a
neutral	0.186	37.40	AV	54.2	b
phase	0.420	28.30	AV	47.4	b

	Frequency [MHz]	Measured [dB(µV)]	Kind of value	Limit [dB(µV)]	Configuration
phase	0.468	27.60	AV	46.5	b
phase	0.510	45.50	QP	56	b
phase	0.510	45.30	QP	56	a
neutral	0.516	32.90	AV	46	A
phase	0.516	32.80	AV	46	b
neutral	0.564	28.10	AV	46	b
phase	0.564	27.30	AV	46	a

AV: average
QP: quasi peak

Test Personnel:

Tester Signature: _____ Date: _____

Printed Name: R. Schaufler

Measurement Protocols: see attached files

Configuration a:
Keyboard K252 with 2 m cable

Configuration b:
Keyboard K252 with 4 m cable

6.3 Referenced Rules Sections

N/A

6.4 Test Instrumentation Used, Conducted Measurement

Type	Manufacturer/ Model No.	Serial No.	Last Cal.	Cal. Interval
Receiver	ESHS10 Rohde & Schwarz	842884/011	May 98	12 months
Receiver	ESH3 Rohde&Schwarz	879676/014	May 98	12 months
LISN	NSLK 8126 Schwarzbeck	8126160	May 98	12 months
LISN	ESH3-Z5 Rohde&Schwarz	846695/27	May 98	12 months
LISN	ESH2-Z5 Rohde&Schwarz	871884/004	May 98	12 months
Pulse limiter	ESH3-Z2 Rohde & Schwarz	60813	May 98	12 months

7 RADIATED EMISSION DATA

7.1 Test Procedure

The radiated emission was measured between 30 MHz and 1000 MHz. The bandwidth of the EMI-receiver was set to 120 kHz and the detector was set to peak. During prescan all data in peak mode are accumulated automatically. At final measurement the detector was set to CISPR quasi peak and values above the acceptance line were verified automatically.

The test was performed in a semi anechoic chamber in a distance of 10 meters between antenna and EUT. During tests the EUT was turned 360° the receiving antenna was moved from 1 to 4 meters and the antenna polarisation was changed from horizontal to vertical for finding the maximum levels of emission.

For the whole range one antenna was used:

30 MHz to 1000 MHz: Bilog antenna

After automatic tests during manual verification the cables and the equipment were placed and moved within the range of position in order to find the maximum of emission.

For further data see enclosed test results.

7.2 Measured Data

The EUT was measured with the Pentium II 350 MHz in video mode 1024 x 768.

Configuration a:
Keyboard K252 with 2 m cable

Judgement: Passed by

Frequency [MHz]	Level* [dB(µV/m)]	10 Meter Limit [dB(µV/m)]	Exceeding [dB]	Ant Pol	Height in [m]	Angle in deg
108.75000	24.60	30.000	-5.300	hor	3.4000	270.00
132.90000	26.00	30.000	--3.900	hor	4.0000	270.00
141.27000	23.20	30.000	-6.700	ver	1.0000	150.00
144.99000	24.50	30.000	-5.400	hor	4.0000	60.00
200.04000	20.20	30.000	-9.700	ver	1.0000	300.00
500.25000	29.00	37.000	-7.900	hor	1.6000	240.00
800.46000	30.60	37.000	-6.300	ver	2.2000	60.00

all levels are quasi-peak levels

Configuration b:
Keyboard K252 with 4 m cable

Judgement: Passed by

Frequency [MHz]	Level* [dB(µV/m)]	10 Meter Limit [dB(µV/m)]	Exceeding [dB]	Ant Pol	Height in [m]	Angle in deg
103.59000	20.90	30.000	-9.000	ver	1.6000	330.00
108.75000	24.60	30.000	-5.300	ver	1.6000	180.00
113.04000	22.90	30.000	-7.000	ver	1.0000	30.00
122.46000	26.60	30.000	-3.300	ver	1.0000	90.00
141.27000	23.40	30.000	-6.500	ver	1.0000	150.00
894.72000	30.10	37.000	-6.800	ver	2.2000	270.00

all levels are quasi-peak levels

*****The correction factor is considered automatically by the test receiver.
A table of correction factors is listed in paragraph 7.4.

Test Personnel:

Tester Signature: _____ Date: _____

Printed Name: R. Schaufler

Measurement Protocols: see attached files

Configuration a:
Keyboard K252 with 2 m cable

Configuration b:
Keyboard K252 with 4 m cable

7.3 Referenced Rules Sections

N/A

7.4 Test Instrumentation Used, Radiated Measurement

Type	Manufacturer/ Model No.	Serial No.	Last Cal.	Cal. Interval
Receiver	ESMI Rohde & Schwarz	840607/006	Sep. 98	12 months
Antenna	CBL 6112 Chase	0003	May 98	12 months

7.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor automatically to the measured value. The display of the Receiver shows the corrected value. The complete table of correction factors is given on next page. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF

where FS = Field Strength

AF = Antenna Factor

CF = Cable Attenuation Factor

Assume a receiver reading of 28,5 dBµV is obtained. The Antenna Factor of 10,5 and a Cable Factor of 1,3 is added, giving a field strength of 40,3 dBµV/m.

FS = 28,5 + 10,5 + 1.3 = 40,3 dBµV/m

The 40,3 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m =
Common Antilogarithm [(40,3 dBµV/m)/20] =

103,5 µV/m

7.6 Table of Correction Factors

Frequency range: 30 MHz to 1000 MHz

Frequency [MHz]	Correction Bilog Antenna with Pre-amplifier [dB]	Correction Cable [dB]	Correction Antenna + Cable [dB]
30,0	17,90	0,65	18,55
35,0	15,20	0,67	15,87
40,0	12,80	0,68	13,48
45,0	10,00	0,73	10,73
50,0	8,20	0,74	8,94
55,0	6,90	0,82	7,72
60,0	6,50	0,84	7,34
70,0	6,40	0,90	7,30
80,0	7,20	0,95	8,15
90,0	9,30	0,99	10,29
100,0	11,10	1,10	12,20
120,0	12,10	1,14	13,24
140,0	11,30	1,27	12,57
160,0	10,60	1,35	11,95
180,0	9,60	1,45	11,05
200,0	9,50	1,51	11,01
250,0	12,40	1,71	14,11
300,0	13,80	1,84	15,64
350,0	15,00	2,00	17,00
400,0	16,40	2,18	18,58

Frequency [MHz]	Correction Bilog Antenna with Pre-amplifier [dB]	Correction Cable [dB]	Correction Antenna + Cable [dB]
450,0	16,90	2,35	19,25
500,0	17,40	2,43	19,83
550,0	19,00	2,62	21,62
600,0	18,70	2,73	21,43
650,0	19,70	2,88	22,58
700,0	19,00	2,91	21,91
750,0	20,00	3,01	23,01
800,0	19,90	3,21	23,11
850,0	22,90	3,32	26,22
900,0	20,70	3,40	24,10
950,0	21,00	3,49	24,49
1000,0	25,00	3,69	28,69

8 Photos of tested EUT: see attached files

8.1 Front side of EUT

8.2 Rear side of EUT

8.3 Opened case, inside view of EUT

9 Internal Photos of EUT: see attached files

9.1 Printed circuit foil, front side view

9.2 Printed circuit foil, rear side view

10 User Manual: see attached files

For FCC statement please refer to user manual page 4.