IST EMC LAB.

E M I S S I O N T E S T R E P O R T

Test report file No. : **03-IST-029/FB** Date of issue : Feb. 11, 2003

Model / Type No. : LT7070 ■ Basic □ Alternate

Kind of product : Personal Computer

Brand name : Daewoo

Applicant : Daewoo Computer Co., Ltd

Manufacturer : Daewoo Computer Co., Ltd

License holder : Daewoo Computer Co., Ltd

Address : SUNGRIM B/D, 257, CHEOLSAN3-DONG, GWANGMYEONG -SI, GYEONGGI-DO, KOREA.

Test result according to the regulation(s)

■ Positive □ Negative

at page 3.

This test report with appendix consists of 20 pages.
The test result only responds to the tested sample.
It is not allowed to copy this report even partly without the allowance of the Test Laboratory.
This equipment is complied with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992.

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DIRECTORY

A) Documentation.

B) Test Data.

C) Appendix

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TEST REGULATIONS

The tests were performed according to the following regulations ;

■ - FCC Part 15, Subpart B (Unintentional Radiators, Class B)

Information of Test Laboratory

IST EMC Lab.
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EQUIPMENT UNDER TEST

Equipment Description :

Size :	375 (W) x 192 (D) x 377 (H) mm (without foot)
CPU :	Intel Pentium4 , 2.8 GHz
I/O port :	PS/2 Port(2), Serial Port(1), VGA Port(1), USB Port(2), Parallel Port(1), Game/MIDI Port(1) LAN Port(1)
Power Supply :	200 W, 115/230 V, 50/60 Hz 5.0 A/2.5 A

EUT Type :

☒ Table-Top.
☐ Floor-Standing.
☐ Table-Top and Floor-Standing(Combination).

Operation – mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

☐ Standby.
☒ Operational Condition : Scrolling "H" pattern, With activating the CD-ROM and the Sound system by playing the movie.

Configuration of the equipment under test :

Following peripheral devices and interface cables were connected during the measurement :

Equipment	Type	Maker/Brand	Serial No.
Monitor	103H	Daewoo	N/A
Keyboard	SDL2500	Samsung Electro-mechanice	KB2L001CPXAA
Mouse 1 (PS/2)	MO19KCA	PRIMAX	020300019
Mouse 2 (Serial)	M-M28	LOGITECH	LCA53305547
USB Cable	N/A	N/A	N/A
Printer	A0302380	Northern Telecom	25L9S60856
Head set	NM-V33	TOCO	N/A
Laptop PC	CN4000	Daewoo	26N711230031
Joy stick	X03-5740	Microsoft	85791-579-8892384-00000

Connecting Interface Cables :
- Unshielded AC power cable : 1.8 m
- Unshielded USB cable : 1.5 m
- Shielded printer's signal cable : 1.5 m
- Unshielded Head set cable : 1.8 m
- Unshielded Joy stick cable : 1.8 m

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TEST CONDITIONS

The **measurement of the conducted emissions (Interference voltage)** was performed in a shielded room.

Test location :

☒ Shielded room. No.1 ☐ Compact chamber 2

Used testing instruments :

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESH 3	Test Receiver	Rohde & Schwarz	Jul. 25, 2002	892108/018
3725/2	LISN	EMCO	Aug. 22, 2002	9101-2068
KNW-407	LISN	Hyup-Rip	Aug. 21, 2002	8-883-10
ESH 3-Z2	Pulse Limiter	Rohde & Schwarz	Jul. 25, 2002	357.8810.52

Test - accessories :

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

Measurement Procedures :

Conducted emissions measurments were made in accordance with ANSI C-63.4-1992, “Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The measurement were performed over the frequency range of 0.45MHz to 30MHz using a 50Ω/50uH LISN as the input transducer to an EMI/Field Intensity Meter. The measurements were made with the detector set for “Peak” amplitude within an IF bandwidth of 10kHz or for “quasi-peak” within a bandwidth of 9kHz.

All used test-instruments as well as the test-accessories are calibrated regularly.

Test Engineer :

J. H. Yeun / Test Engineer
IST EMC Lab.

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The **measurement of the radiated emissions (Electric field)** in the frequency range from 30 MHz to 15GHz was performed in horizontal and vertical antenna polarization at a open-site and a compact chamber which meet the site attenuation requirement of ANSI C63.4-1992 and a test distance of :

Location :	☒ Open Site No. 1	☐ Open Site No. 2
	☒ Compact Chamber No. 1	☐ Compact Chamber No. 2
Distance :	☒ 3 meters	☐ 10 meters

Used testing instruments :

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESVP	Test Receiver	Rohde & Schwarz	Aug. 16, 2002	861744/004
VULB 9160	Antenna	Schwarzbeck	Jul. 10, 2002	3048
3115	Horn Antenna	EMCO	May 23, 2002	9012-3602
8566B	Sepectrum Analyzer	Hewlett Packard	Aug. 16, 2002	3340A08191
85650A	Quasi-Peak Adaptor	Hewlett Packard	Aug. 16, 2002	3303A01745
85685A	RF Preselector	Hewlett Packard	Aug. 16, 2002	3221A01455

Test - accessories :

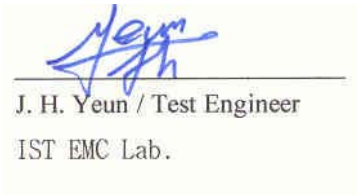
Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

Measurement procedures

Radiated measurements were in accordance with ANSI C63.4-1992 “Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”. The measurements were performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a EMI/Field Intensity Meter. The measurements were made with the detector set for “quasi-peak” within a bandwidth of 120kHz.
Above 1 GHz, peak detector function mode is used. The radiated measurements above 1 GHz were performed at a compact chamber which meet the site attenuation requirement of ANSI C63.4-1992..

All used test-instruments as well as the test-accessories are calibrated regularly.

Test Engineer :



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TEST RESULT

Conducted emissions : 150 kHz - 30 MHz

The requirements are.

☒ KEPT ☐ NOT KEPT

Min. limit margin

3.3 dB at 0.489 MHz

Remarks : See test-data at pages 12 ~ 14.

Radiated emissions (electric field) 30 MHz - 15 GHz

The requirements are.

☒ KEPT ☐ NOT KEPT

Min. limit margin

13.5 dB at 463.3 MHz

Remarks : See test-data at page 15 ~ 19.

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Measurement Uncertainty Calculation

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

Contribution (Conducted Emissions)	Probability Distribution	Uncertainty (±dB) 0.15-30MHz
Receiver Specification	Rectangular	1.5
LISN Coupling Specification	Rectangular	1.5
Cable and Input Attenuator Calibration	Normal (k=2)	0.5
Mismatch to Reciver	U-Shaped	-0.8 / +0.7
System Repeatability	Normal (k=1)	0.2
Combined Standard Uncertainty	Normal (k=2)	-1.85 / +1.71
Expanded Uncertainty U	Normal (k=2)	-3.7 / +3.42

$U_{c,\min\ us}$ = -1.85, $U_{c,plus}$ = 1.71

U = -3.70 / +3.42 (k=2, 95.45% confidence level)

Contribution (Radiated Emissions)	Probability Distribution	Uncertainties(±dB) 3 m
Antenna		
Factor	Normal (k=2)	0.9968
Frequency Interpolation	Rectangular	0.1039
Height Variation	Rectangular	-2.6 / +1.5
Directivity Difference	Rectangular	-1.0 / +0
Phase Center Location	Rectangular	1.0
Cable Loss	Normal (k=2)	0.5
Receiver		
Voltage Accuracy	Normal (k=2)	2.0
Pulse Response	Rectangular	1.5
Absolute Repetition Rate	Rectangular	1.5
Mismatch to Receiver $\lvert \Gamma_{antenna} \rvert$ = 0.33 $\lvert \Gamma_{receiver} \rvert$ = 0.33	U-Shaped	-1.0 / +0.9
System Repeatibility	Std Deviation	0.5
Combined Standard Uncertainty	Normal	-2.6048 / 2.2775
Expanded Uncertainty U	Normal (k=2)	-5.21 / +4.55

$U_{c,\min\ us}$ = -2.6048, $U_{c,plus}$ = 2.2775

U = -5.21 / +4.55 (k=2, 95.45% confidence level)

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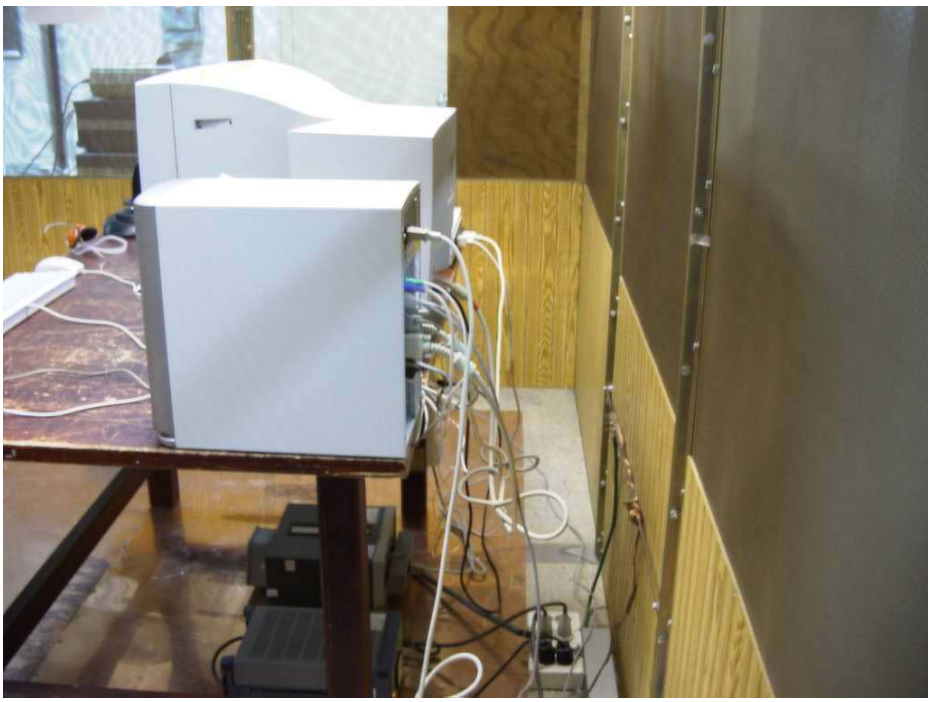
TEST SETUP (Photos)

Type : LT7070

Conducted Emissions 0.15 MHz - 30 MHz



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TEST SETUP (Photos)

Type : LT7070

Radiated Emissions 30 MHz - 1000 MHz

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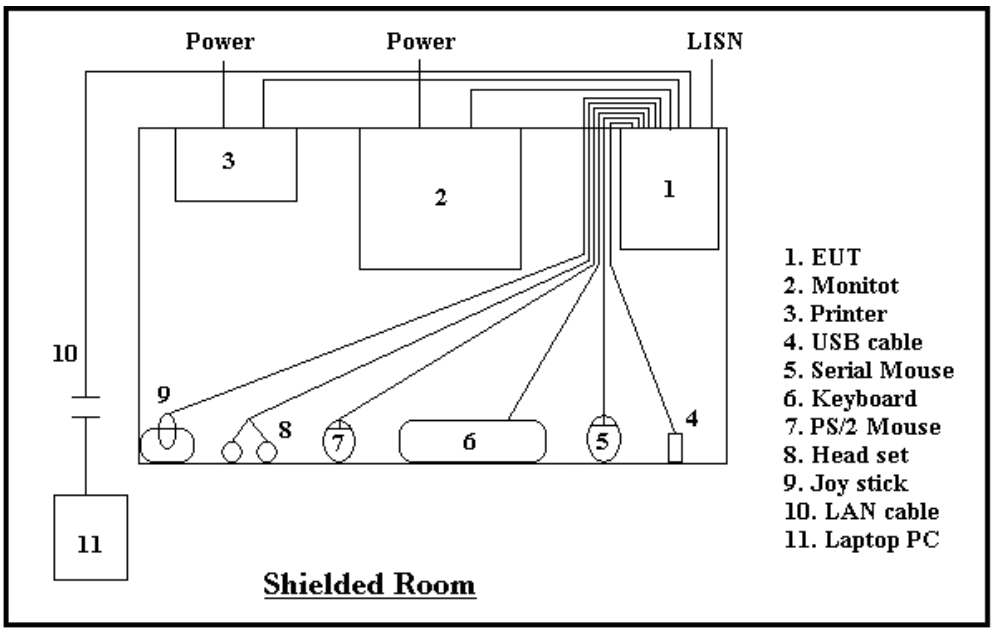
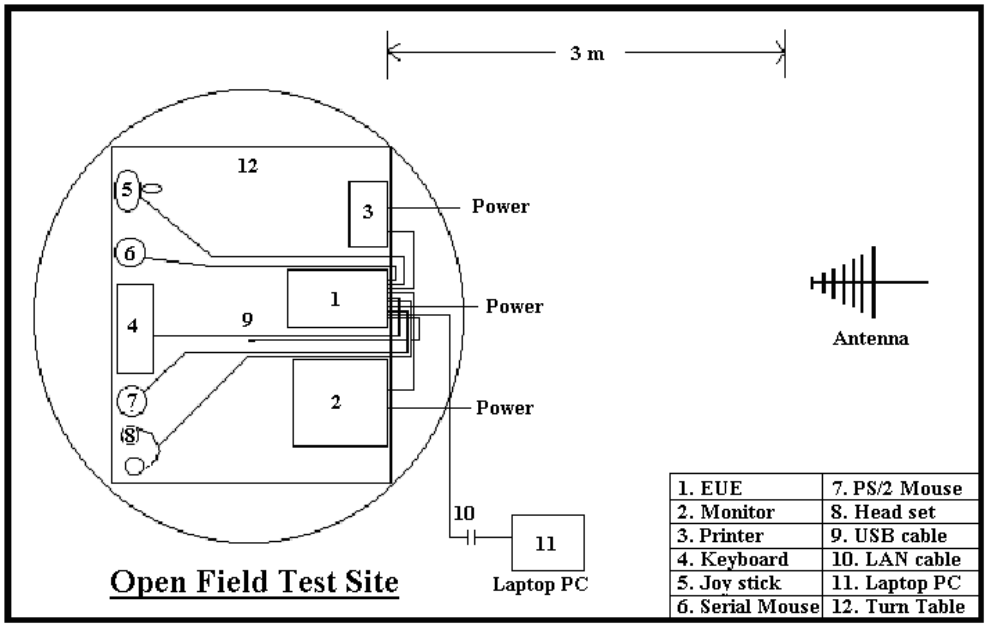
TEST SETUP (Drawings)

Type : LT7070



Conducted Emissions 0.15 MHz - 30 MHz



Radiated Emissions 30 MHz - 1000 MHz

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Conducted Emission Test Data

Type	LT7070	
Manufacturer	Daewoo Computer Co., Ltd.	
Operation mode	Scrolling "H" pattern, With activating the CD-ROM and the Sound system by playing the movie.	
Environmental Conditon	Temperature	: 14 °C
	Humidity	: 38 %
	Atmospheric pressure	: 1000 mbar
Date	Feb. 08, 2003	

Highest Emissions ralative to the limit

Frequency [MHz]	Reading [dBμV]		Phase	Insertion LISN	Limit [dBμV]		Margin [dB]	
	Q-peak	AV			Q-peak	AV	Q-peak	AV
0.197	51.2	47.1	L1	0.8	63.7	53.7	11.7	5.8
0.329	42.7	41.8		0.8	59.5	49.5	16.0	6.9
0.394	44.0	43.4		0.8	58.0	48.0	13.2	3.8
0.489	42.8	42.1		0.8	56.2	46.2	12.6	3.3
1.514	41.1	38.8		0.8	56.0	46.0	14.1	6.4
7.241	40.7	37.7		0.8	60.0	50.0	18.5	11.5
0.197	48.2	42.9	N	0.8	63.7	53.7	14.7	10.0
0.395	43.0	41.4		0.8	58.0	48.0	14.2	5.8
4.740	40.6	38.7		0.8	56.0	46.0	14.6	6.5
6.847	44.6	43.2		0.8	60.0	50.0	14.6	6.0
Cable loss are less than 0.1 dB								

*L1 : Live Line
**N : Neutral Line
*** **Please refer to data graphs at page 13 ~ 14.**

Coverage factor of k=2 will ensure that the level of confidence will be approximately 95.45%,
Uncertainty U = -3.70 / +3.42 [dB]

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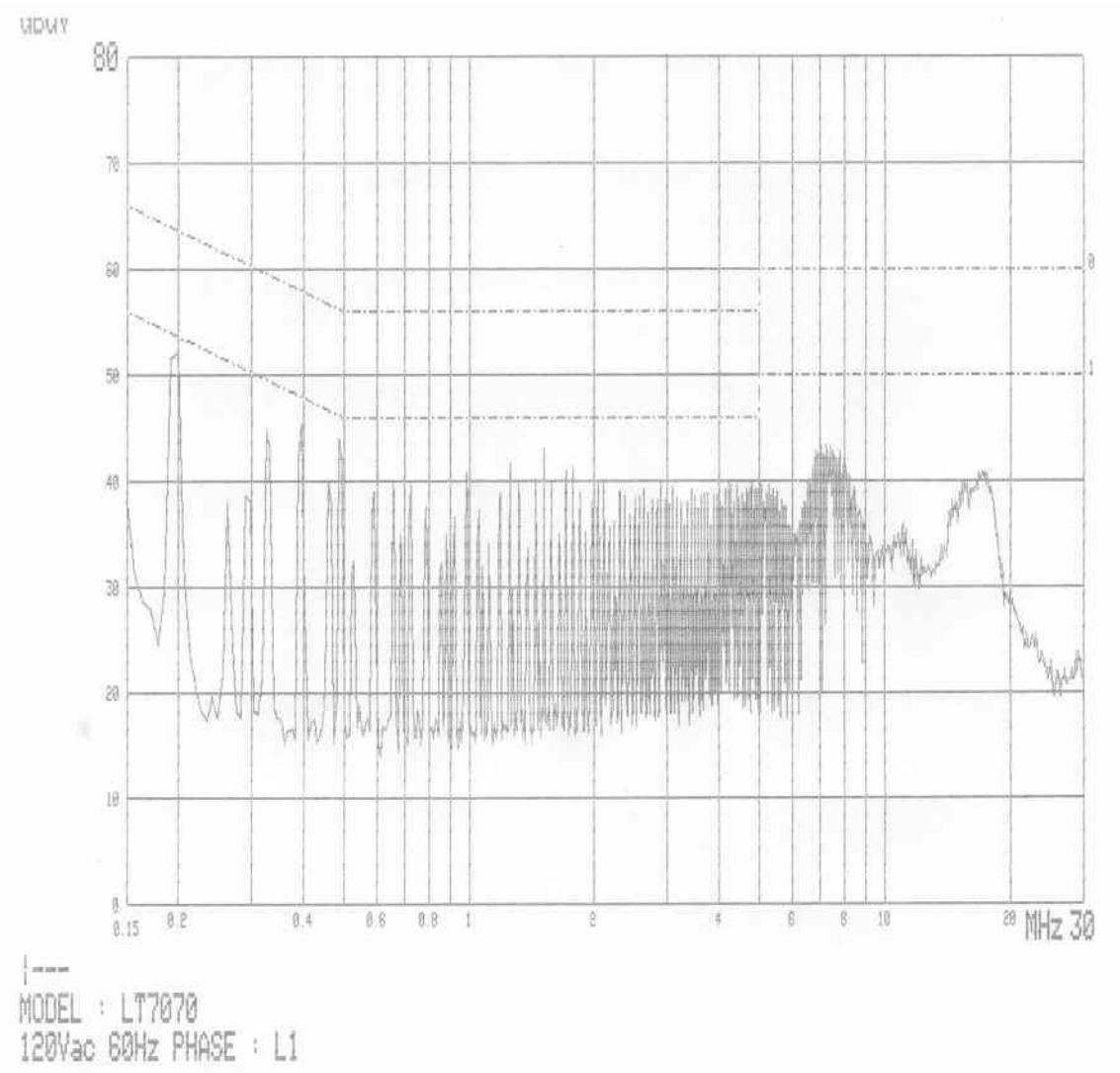

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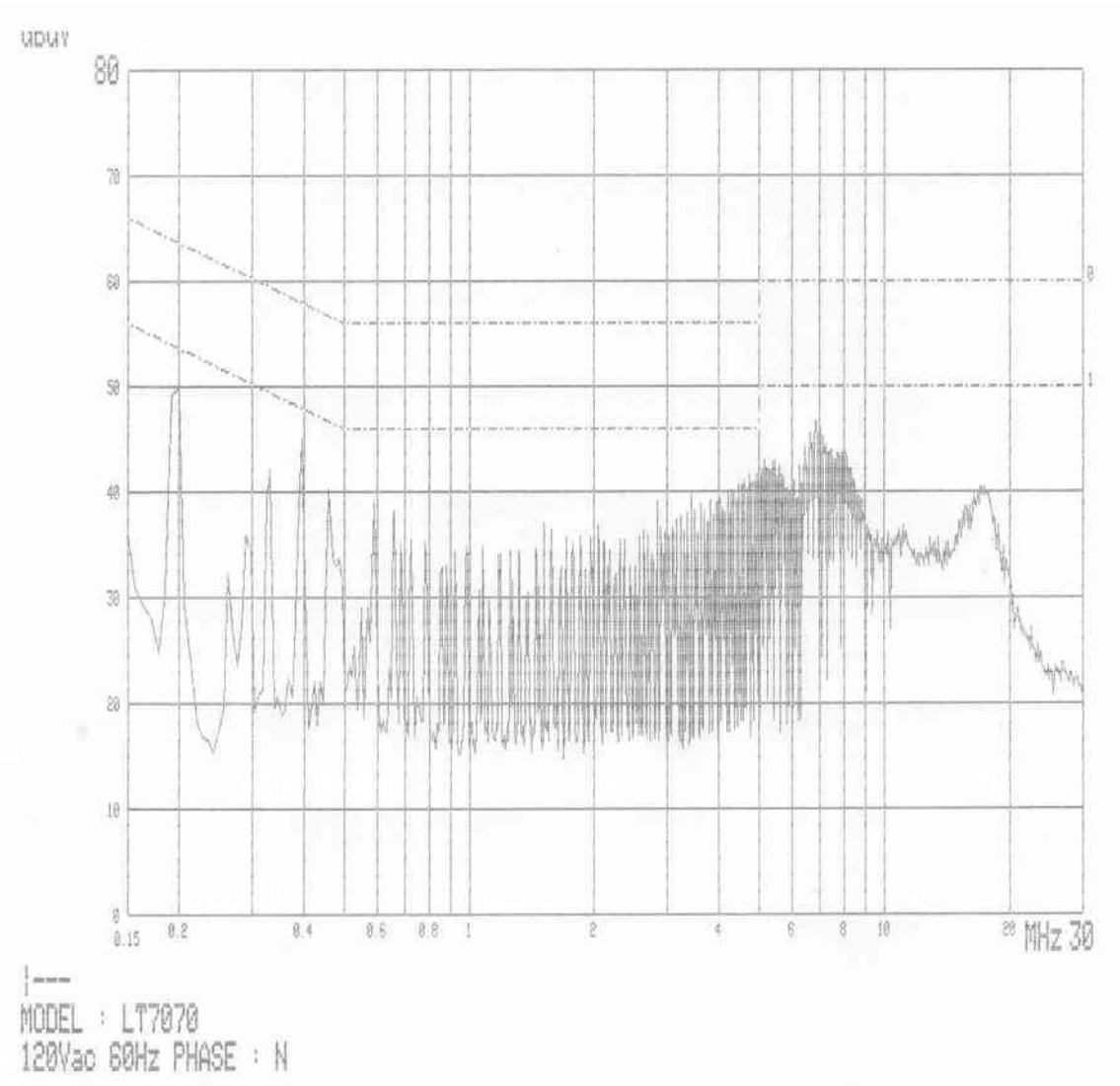

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Radiation Test Data

Type	LT7070	
Manufacturer	Daewoo Computer Co., Ltd.	
Operation mode	Scrolling "H" pattern, With activating the CD-ROM and the Sound system by playing the movie.	
Environmental Conditon	Temperature	: 12 °C
	Humidity	: 38 %
	Atmospheric pressure	: 1000 mbar
Test distance	3 m	
Antenna	VULB9160 (under 1 GHz), 3115 (over 1 GHz)	
Date	Feb. 04, 2003	

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB]	Cable Loss [dB]	PreAmp. Gain [dB]	Angle [deg]	Height [cm]	Polar [H/V]	Result [dBuV]	Limit [dBuV]	Margin [dB]
45.8	15.3	9.9	1.2		162	100	V	26.4	40.0	13.6
68.1	9.5	10.1	1.6		0	100	V	21.2	40.0	18.8
76.3	13.4	8.4	1.6		0	100	V	23.4	40.0	16.6
80.6	16.2	7.7	1.6		0	100	V	25.5	40.0	14.5
272.0	8.7	11.6	3.0		253	100	H	23.3	46.0	22.7
274.9	14.5	11.7	3.0		255	100	H	29.2	46.0	16.8
312.0	14.3	11.7	3.3		180	100	H	29.3	46.0	16.7
372.2	11.3	12.1	3.7		253	100	V	27.1	46.0	18.9
425.7	13.6	13.7	4.4		180	100	V	31.7	46.0	14.3
463.3	13.5	14.3	4.7		0	100	V	32.5	46.0	13.5
1,112.0	41.3	5.4	7.8	23.0	-	-	-	11.5	54.0	-
1,172.0	43.5	5.6	7.8	23.0	-	-	-	13.9	54.0	-
1,220.0	46.7	5.8	7.8	23.0	-	-	-	17.3	54.0	-
1,439.0	47.8	6.6	7.8	23.0	-	-	-	19.2	54.0	-
1,539.0	38.9	6.9	7.8	23.0	-	-	-	10.6	54.0	-
1,649.0	36.5	7.3	7.8	23.0	-	-	-	8.6	54.0	-
1,692.0	36.8	7.4	7.8	23.0	-	-	-	9.0	54.0	-
1,745.0	37.8	7.5	7.8	23.0	-	-	-	10.1	54.0	-
13,988.0	41.9	11.7	7.8	23.0	-	-	-	18.4	54.0	-

Above 1 GHz, peak detector function mode is used with 23dB gain of preamp. The result value above 1 GHz was summed to the corrective factor. Please refer to the description of next page.

Coverage factor of k=2 will ensure that the level of confidence will be approximately 95.45%, Uncertainty U = -5.21 / +4.55 [dB]

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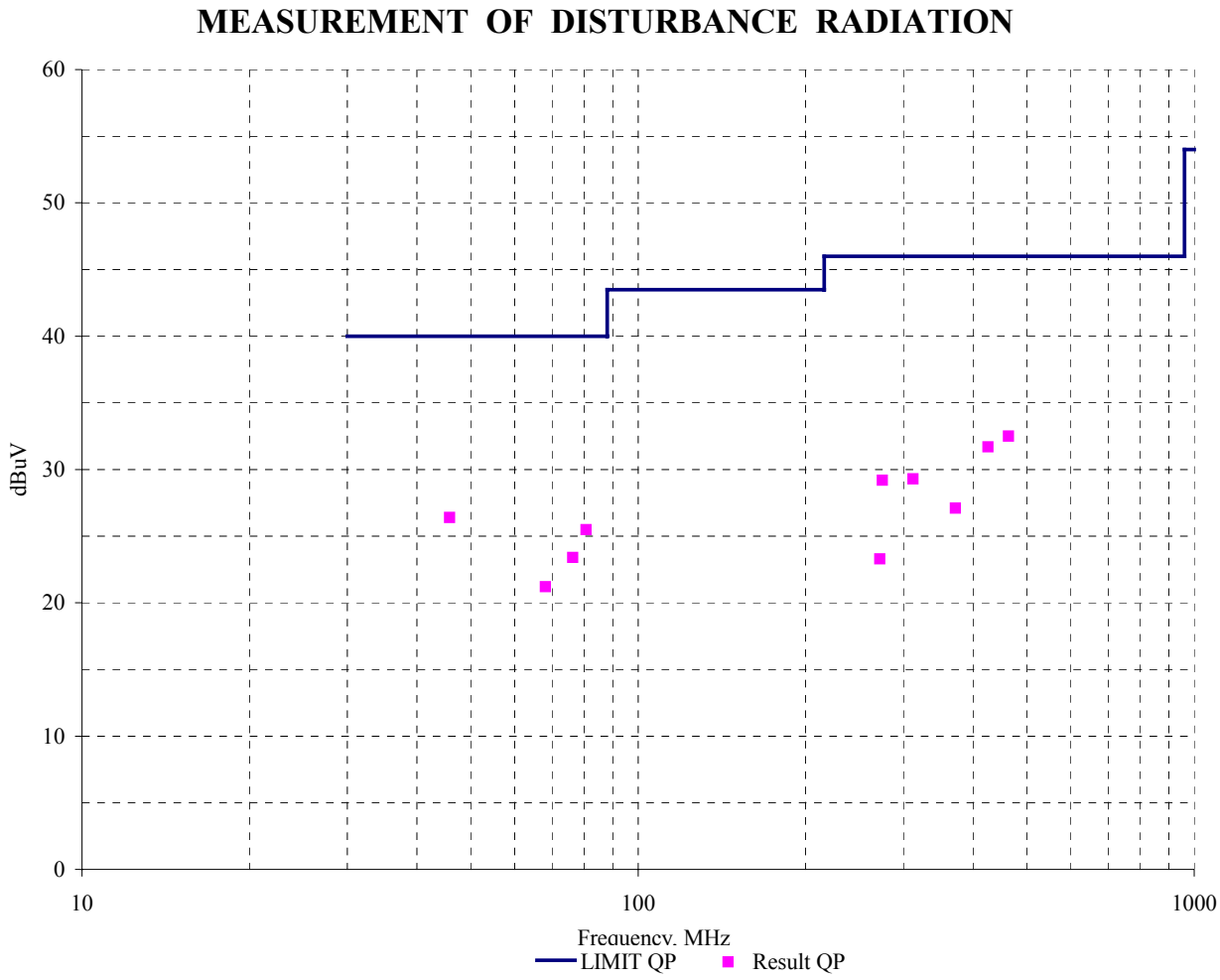

Measured Data from 1 GHz to 15 GHz

Above 1 GHz, peak detector function mode is used with 23dB gain of preamp. The following graphs show that all data of full frequencies are meet with the limit.

We automatically change our antenna polarity, when measure radiated emission.

The spectrum plot was obtained with peak detect mode and maximum hold mode. It was used for plot the HP8566B spectrum analyzer, EMCO 3115 Horn antenna and HP85685A RF preselector.

(Section 15.35)

The peak value evaluation at the frequency of 1.439 GHz is

47.8 dB(measured) + 6.6 dB(antenna factor) + 7.8 dB(cable loss)
– 23 dB(gain of preamp) – 20 (corrective factor)
= 19.2 dB (less than average limit 54.0 dB)

The peak value evaluation is less than the average limit, EUT have the margin relative to peak value more than 10 dB for radiated emission for the above 1 GHz.

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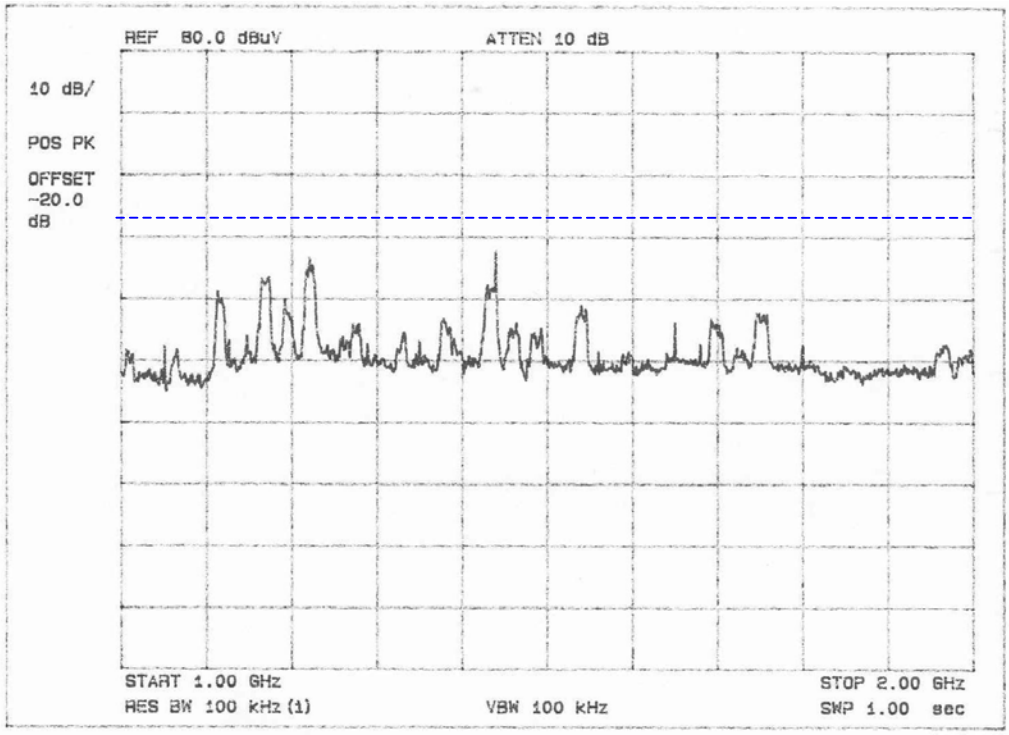
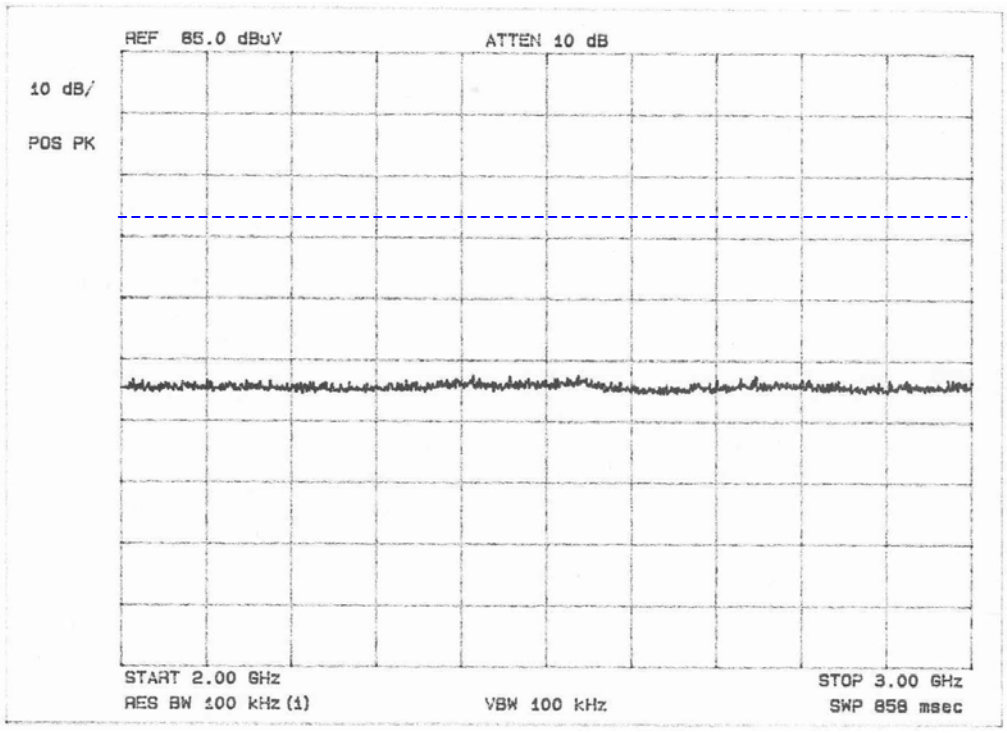


Radiated Emission Test 1GHz ~ 2GHz (Polor: Vertical & Horizontal)



Radiated Emission Test 2GHz ~ 3GHz (Polor: Vertical & Horizontal)

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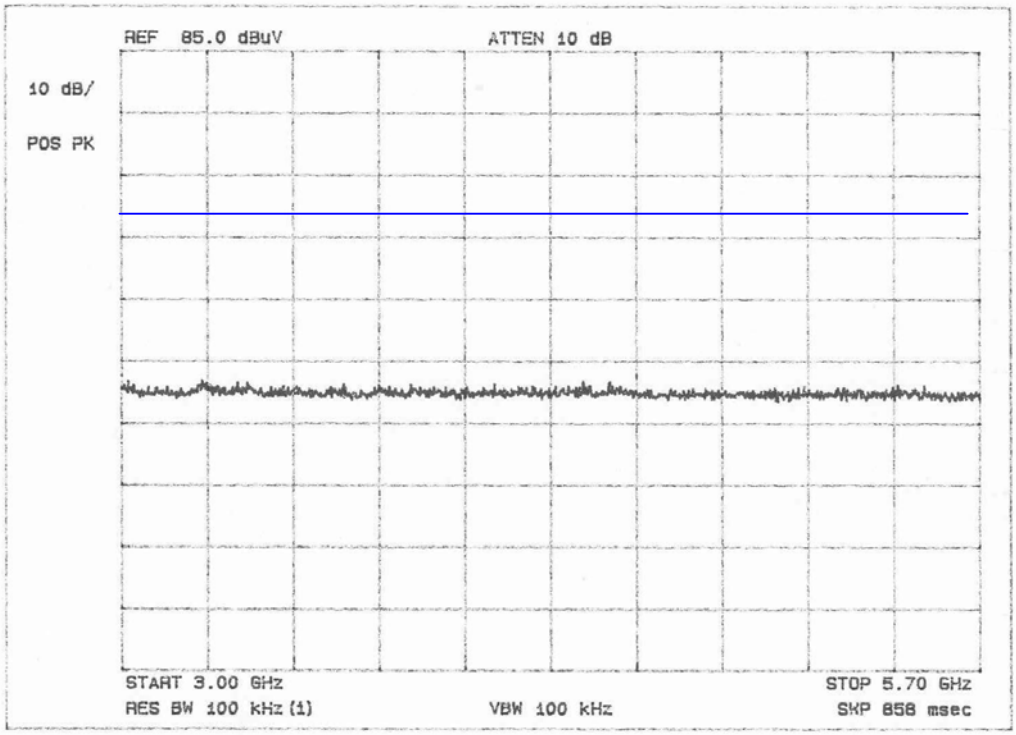
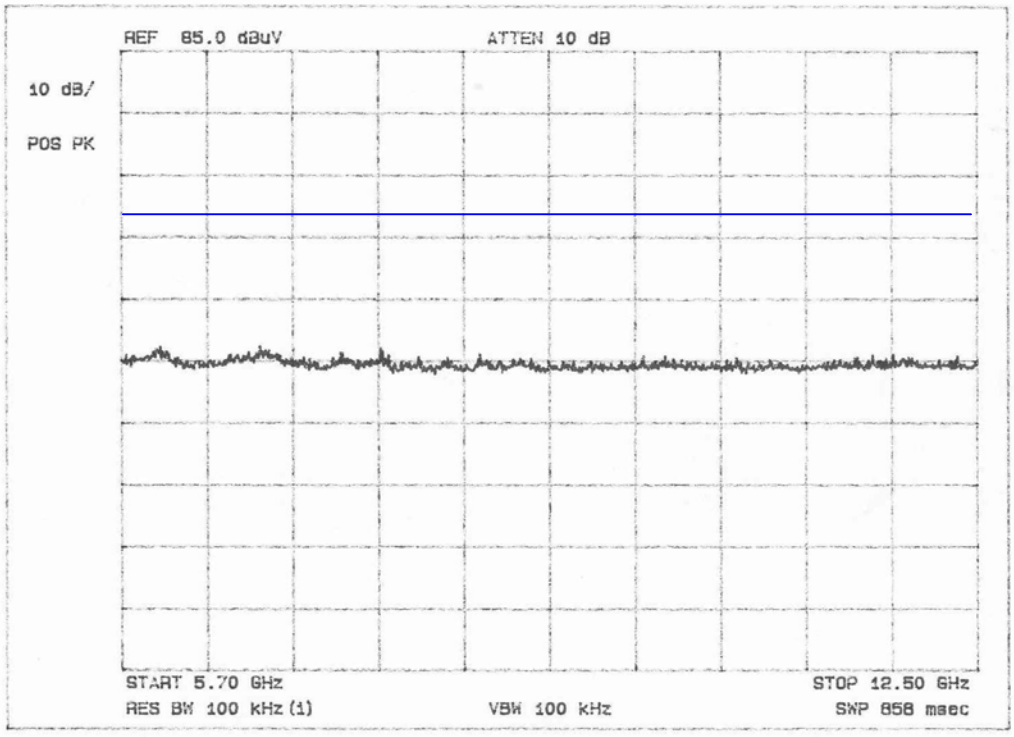


Radiated Emission Test 3GHz ~ 5.7GHz (Polor: Vertical & Horizontal)



Radiated Emission Test 5.7GHz ~ 12.5GHz (Polor: Vertical & Horizontal)

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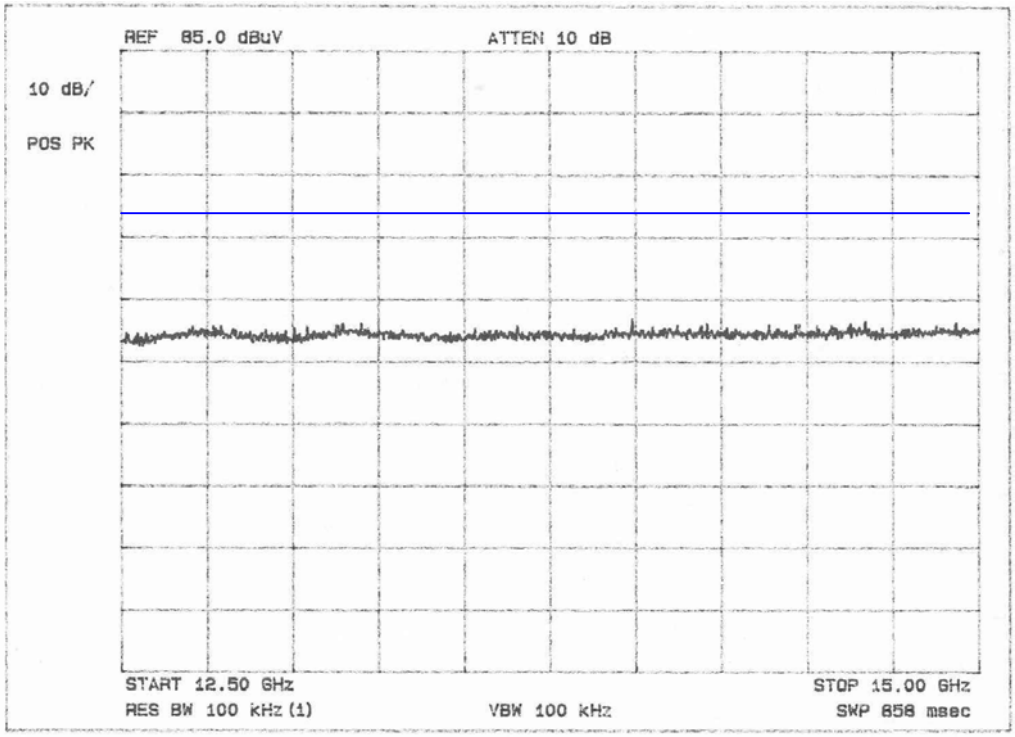

Radiated Emission Test 12.5GHz ~ 15.0GHz (Polor: Vertical & Horizontal)

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SUMMARY

GENERAL REMARKS :

The equipment is not modified anything, mechanical or circuit to improve EMI status during a measurement and complied the regulation "Part 15 subpart B Class B of CFR 47"

FINAL JUDGMENT :

The requirements according to the technical regulations are

☒ Kept ☐ Not kept

The equipment under test does

☒ Fulfill the general approval requirements mentioned on page 3.
☐ Not fulfill the general approval requirements mentioned on page 3.

Begin of testing : Feb. 04, 2003

End of testing : Feb. 08, 2003

Reviewed by :

Joon H. Lee. EMC Manager
IST EMC Lab.

Approved by :

G. Chung Chief of EMC Lab.

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