

# Electromagnetic Emission

## FCC MEASUREMENT REPORT

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### VERIFICATION OF COMPLIANCE

#### FCC Part 15 Certification Measurement

**PRODUCT** : Personal Computer  
**MODEL/TYPE NO** : Casper Alfa  
**FCC ID** : QMACasper Alfa  
**APPLICANT** : Casper Bilgisayar Sistemleri A.S.  
Sivritas Sok. No:16 Alphan 80310 Mecidiyekoy /  
Istanbul Turkey  
Attn. : Feray Karaman / Engineer of Q.A Dept.  
**FCC CLASSIFICATION** : Part 15 Class B Unintentional Radiators  
Computing Device (JBC)  
**FCC RULE PART(S)** : FCC Part 15 Subpart B  
**FCC PROCEDURE** : Certification  
**TRADE NAME** : CASPER COMPUTER  
**TEST REPORT No.** : E02.0902. FCC.570N  
**DATES OF TEST** : August 30 ~ 31, 2002  
**DATES OF ISSUE** : September 2, 2002  
**TEST LABORATORY** : ETL Inc ( FCC Registration Number : 95422)  
371-51, Gasan-Dong, Geumcheon-Gu, Seoul, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074

This Personal Computer, Model Casper Alfa has been tested in accordance with the measurement procedures specified in ANSI C63.4-1992 at the ETL/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B : Unintentional Radiators.

I attest to the accuracy of data. All measurement herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.



Name : Yo han, park

Title : Chief Engineer & Lab.Manager

**E-RAE Testing Laboratory Inc.**  
371-51, Gasan-Dong, Geumcheon-Gu,  
Seoul, 153-023, Korea

## **Table of Contents**

### **ATTACHMENT A: COVER LETTER(S)**

#### **FCC Measurement Report**

- 1. Introduction**
- 2. Product Information**
- 3. Description of Tests**
- 4. Test Condition**
- 5. Test Results**
  - 5.1 Summary of Test Results**
  - 5.2 Conducted Emissions Measurement**
  - 5.3 Radiated Emissions Measurement**
- 6. Sample Calculations**
- 7. List of test Equipment used for Measurement**

**Appendix A. FCC ID Label and Location**

**Appendix B. Test Setup Photographs**

**Appendix C. External Photographs**

**Appendix D. Internal Photographs**

**Appendix E. Block Diagram**

**Appendix F. User Manual**

## FCC MEASUREMENT REPORT

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**Scope** – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

### General Information

**Applicant Name** : Casper Bilgisayar Sistemleri A.S.

**Address** : Sivritas Sok. No:16 Alphan 80310  
Mecidiyekoy / Istanbul Turkey

**Attention** : Feray Karaman / Engineer of Q.A Dept.

- **EUT Type** : Personal Computer
- **Model Number** : Casper Alfa
- **FCC Identifier** : QMACasper Alfa
- **S/N** : N/A
- **Modulation** : N/A
- **FCC Rule Part(s)** : Part 15 Subpart B Unintentional Radiators
- **Test Procedure** : ANSI C63.4-1992
- **FCC Classification** : Part 15 Class B Unintentional Radiators  
Computing Device (JBC)
- **Dates of Tests** : August 30 ~ 31, 2002
- **Place of Tests** : ETL Inc  
EMC Testing Lab (FCC Registration Number : 95422)  
584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,  
Kyounggi-Do, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074
- **Test Report No.** : E02.0902.FCC.570N

## 1. INTRODUCTION

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The measurement test for radiated and conducted emission test were conducted at the open area test site of E-RAE Testing Laboratory Inc. facility located at 584, Sangwhal-ri, Ganam-myun, Youju-kun, Kyoungki-do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-1992 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 and 10 meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1992 and registered to the Federal Communications Commission(Registration Number : 95422 ).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-1992) was used in determining radiated and conducted emissions from the Casper Bilgisayar Sistemleri A.S. , Model : Casper Alfa

## 2. PRODUCT INFORMATION

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### 2.1 Equipment Description

The Equipment Under Test(EUT) is the Casper Bilgisayar Sistemleri A.S.  
Please refer to Users manual

### 2.2 General Specification

- Chassis Type : Plastic & Metal Cover
- List of Each OSC. Or X-Tal. Freq. ( $\geq 1$ MHz) : X-TAL – 25.0MHz, 14.3MHz, 28.244MHz
- Chipset Brand & Part No. : IT8708F-A – ITE, FW82801BA – INTEL, RS56-PCI – CONEXANT  
: CM18738/PCI-6ch-MX – ESDX, SM0416028A – SM-COM  
: A276308A-70 – AMIC, K4S560832D-TC75 – SAMSUNG
- Number of Layers : Main board – 6Layers, VGA Card – 4 Layers  
: MODEM - 4 Layers, S-DRAM - 4 Layers
- FDD : 1.44"
- DVD-ROM : Buffer Memory – 512KB, Flash Memory – 128KB  
Average Access Time: CD (90ms), DVD (110ms)  
Data Transfer Rate: DVD (16X - 21,600KB/sec), CD (48X - 7,200KB/sec)
- MODEM : ITU-T V.90, K56flex, V.34(33.6Kbps), V.32 bis, V.32, V.22 bis, V.22, V.23  
V.21; Bell 212A and 103  
V.42 LAPM and MNP 2-4 error correction / V.42 bis and MNP 5data compression  
V.25 ter and EIA/TIA 602 command set  
FAX – ITU-T V.34 fax V.17, V.29, V.27 ter, and V.21 ch2  
EIA.TIA 578 Class 1 and T.31 Class 1.0 commands
- HDD : 40.0GB, Enhanced IDE Hard Drive
- VGA Card : Interface – AGP2.0 compliant, Fully support AGP 1X/2X/4X with fast writes  
: Pentium, Pentium , Pentium , AMD-K6, K6/3D now, processor  
Based computer system with AGP interface.  
VGA / Super VGA monitor, supporting minimum 640 X 480 resolution  
Any Motherboard with AGP bus

nVIDIA Riva TNT 2 M64, 2D/3D Graphics Process Unit

4 rendering pipelines capable of delivering 4 pixels per clock

Anisotropic filtering, 100% hardware triangle setup engine 300MHz RAMDAC

DVD&HDTV-ready motion compensation for MPEG-2 decoding

Support frame buffer interface 64 bit, 32MB SDRAM

- CPU : Intel Pentium 4 Processor
- Motherboard : PCI-nased HRTF 3D positional audio, Digital audio interface  
Onboard LAN, Smart card reader support  
Latest Pentium 4 478/ Northwood processor
- SMPS : Input: 100-127V / 19.0A, 45~66Hz, 200-240V/ 14.5A  
Output: +12V/15A, -12V/0.8A, +5V/30A, +5VSB/2.0A, +3.3V/28A  
-5V/0.5A, Max 350W  
The combine power on +3.3V&+5V Total 210W Max  
The combine power on +3.3V&+5V&+12V Total 330W Max

### 3. DESCRIPTION OF TESTS

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#### 3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with § 12.2 in ANSI C63.4-1992 "Measurement of Information Technology Equipment ". The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50 /50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

- Procedure of Test

The line-conducted facility is located inside a shielded room 1m X 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5m away from the side wall of the shielded room. Two EMCO 3825/2 LISN are bonded to the shielded room. The EUT is powered from the EMCO LISN and the support equipment is powered from the another EMCO LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner  $\phi$  1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the EMCO LISN. Non-inductive bundling to a 1m length shortened all interconnecting cables more than 1m. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the R3261A Spectrum Analyzer to determine the frequency producing the max. emission from the EUT. The frequency producing the max. level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 to 30MHz. The bandwidth of the Spectrum Analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

### 3. DESCRIPTION OF TESTS

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#### 3.2 Radiated Emission Measurement

Radiated emission measurements were in accordance with § 12.2 in ANSI C63.4-1992 "Measurement of Information Technology Equipment ". The measurements were performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Quasi-peak" within a bandwidth of 120KHz.

- Procedure of Test

Preliminary measurements were made at 3 meter using broadband antennas, and spectrum analyzer to determined the frequency producing the max. emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using SchwarzBeck Log-Bicon antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 10-meters. The test equipment was placed on a wooden turn-table. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the max. emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.



## 4. TEST CONDITION

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### 4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

### 4.2 EUT operation

The EUT was connected as user's guide. And during the test executed test program for EMI Test Program with "H" Pattern display on Monitor and "H" Pattern printing on Printer.

### 4.3 Support Equipment Used

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

#### EUT – Personal Computer (Casper Bilgisayar Sistemleri A.S.)

FCC ID	: QMACasper Alfa
Model Name	: Casper Alfa
Serial No.	: N/A
Manufacturer	: Casper Bilgisayar Sistemleri
Power Supply Type	: Switching
Power Cord	: Non-shielded, Detachable:1.2m
Port	: Parallel: 1, USB: 2, Keyboard: 1, Mouse: 1, RS-232: 2, RGB: 1 RJ-45:1, Audio in: 1, Audio out: 1, MIC in: 1, TEL: 2

#### Support Unit 1 – Monitor (SAMSUNG)

FCC ID	: N/A
Model Name	: PN17LT
Serial No.	: P225AVAT502027
Manufacturer	: SAMSUNG ELECTRONICS CO., LTD.
Power Supply Type	: Switching
Power Cord	: Non-Shielded, Detachable, 1.2m
Data cable	: Shielded detachable 15-pin D-sub and ferrite core on signal cable

#### Support Unit 2 – Keyboard (SAMSUNG)

FCC ID	: DOC
Model Name	: SEM-DT35
Serial No.	: 24064117
Manufacturer	: Samsung Electro-Mechanics Co., Ltd.
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: Shielded: 1.2m

Support Unit 3 - MOUSE (LOGITECH)

FCC ID : JNZ201213  
Model Name : M-S48a  
Serial No. : HCA13711225  
Manufacturer : LOGITECH  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Shielded, 1.2m

Support Unit 5 – USB MOUSE (LOGITECH)

FCC ID : JNZ211360  
Model Name : M-U48a  
Serial No. : N/A  
Manufacturer : LOGITECH  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Shielded, 1.0m

Support Unit 6 – Serial Mouse (PETRA)

FCC ID : JKGMUS5S01  
Model Name : MUS5S  
Serial No. : E183027  
Manufacturer : PETRA  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Un-Shielded, 1.2m

Support Unit 7 – Printer (SINDORICO)

FCC ID : N/A  
Model Name : Colorcab330  
Serial No. : 11-03098  
Manufacturer : LEXMARK INTERNATIONAL INC.  
Power Supply Type : Switching  
Power Cord : Non-Shielded, Detachable, 1.2m  
Data Cable : Shielded, 1.5m

Support Unit 8 – EAR MIC (JE TECH)

FCC ID : N/A  
Model Name : N/A  
Serial No. : N/A  
Manufacturer : JE TECH  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Non-Shielded, 1.0m

## 5. TEST RESULTS

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### 5.1 Summary of Test Results

This equipment is Power Supply system from PC of USB port, The Conducted Test data is PC Power Test data  
The measurement results were obtained with the EUT tested in the conditions described in this report.  
Detailed measurement data and plots showing the maximum emission of the EUT are reported.

Test Rule Parts	Measurement Required	Result
15.107(e)	Conducted Emissions Measurement	Passed by – 14.40 dB
15.109(e)	Radiated Emissions Measurement	Passed by – 4.70 dB

The data collected shows that the Casper Bilgisayar Sistemleri A.S., Personal Computer, Casper Alfa complies with technical requirements of above rules part 15.107 and 15.109 Class B Limits.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement.  
No EMI suppression device(s) was added and/or modified during testing.

## 5. TEST RESULTS

### 5.2 Conducted Emissions Measurement

EUT	Personal Computer / Casper Alfa (SN:N/A)
Limit apply to	15.107(e) : CISPR Pub.22(1997) Class B
Test Date	August 30, 2002
Operating Condition	"H" Pattern display & Printing
Environment Condition	Humidity Level : 40 %RH, Temperature :25
Result	Passed by – 14.40 dB

### Conducted Emission Test Data

The following table shows the highest levels of conducted emissions on both polarization of live and neutral line.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 9 KHz )

Frequency [MHz]	Reading [dB $\mu$ V]		Phase (*H/**N)	Limit [dB $\mu$ V]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Q.Peak	Average
0.176	46.00	-	N	64.67	54.67	18.67	-
0.210	43.10	-	H	63.20	53.20	20.10	-
0.316	38.80	-	H	59.81	49.81	21.01	-
0.635	32.00	-	H	56.00	46.00	24.00	-
1.690	35.50	-	H			20.50	-
2.327	41.60	-	H			14.40	-
4.750	40.10	-	N			15.90	-
7.850	38.20	-	H	60.00	50.00	21.80	-
9.530	38.30	-	H			21.70	-
21.23	37.90	-	H			22.10	-
29.50	38.20	-	N			21.80	-

#### NOTES :

- \* H : HOT Line , \*\*N : Neutral Line
- Margin value = Limit – Reading
- Measurement were performed at the PC AC Power Inlet in the frequency band of 150kHz ~ 30MHz according to the CISPR 22 Class B
- If the Reading Quasi-Peak value is bellowed the Average Limit, Do not test Average Mode.



Test Engineer : C. S. Kim

## 5. TEST RESULTS

### Line: HOT Line

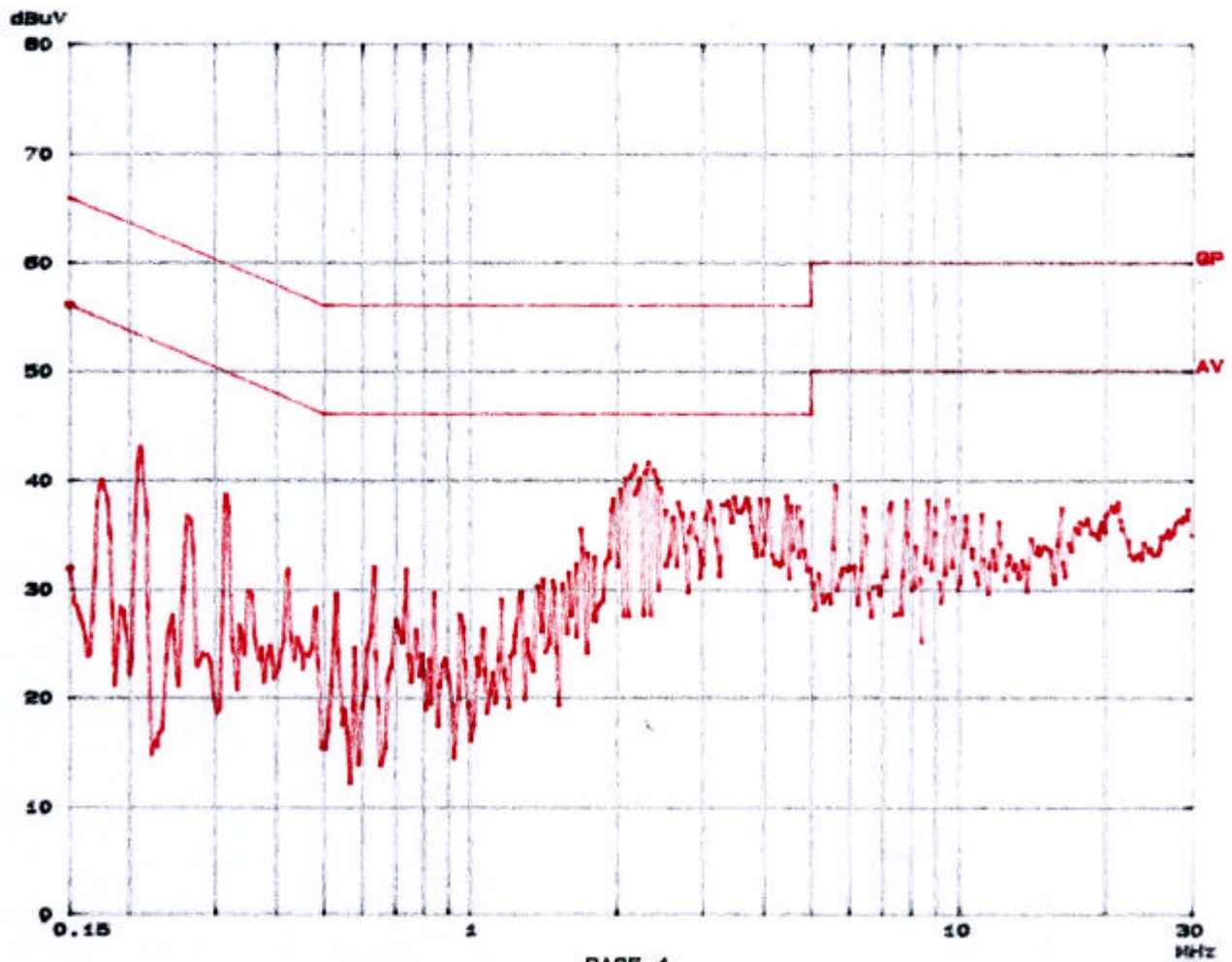
ETL INC.  
CONDUCTED EMISSION

EUT: Personal Computer  
Manuf: Casper Bilgisayar Sistemleri A.S.  
Op Cond: EMI TEST PROGRAM  
Operator: CHON SIK KIM  
Test Spec: EN 55022 CLASS B  
Comment: HOT

#### Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	500k	2k	10k	PK	20ms	AUTO	LN OFF	60dB
500k	5M	5k	10k	PK	20ms	AUTO	LN OFF	60dB
5M	30M	10k	10k	PK	20ms	AUTO	LN OFF	60dB

Final Measurement: x GP  
Meas Time: 1 s  
Subranges: 50  
Acc Margin: 3dB  
Transducer No. 1  
Start 150k  
Stop 30M  
Name EN55022





## 5.TEST RESULTS

### Line: Neutral Line

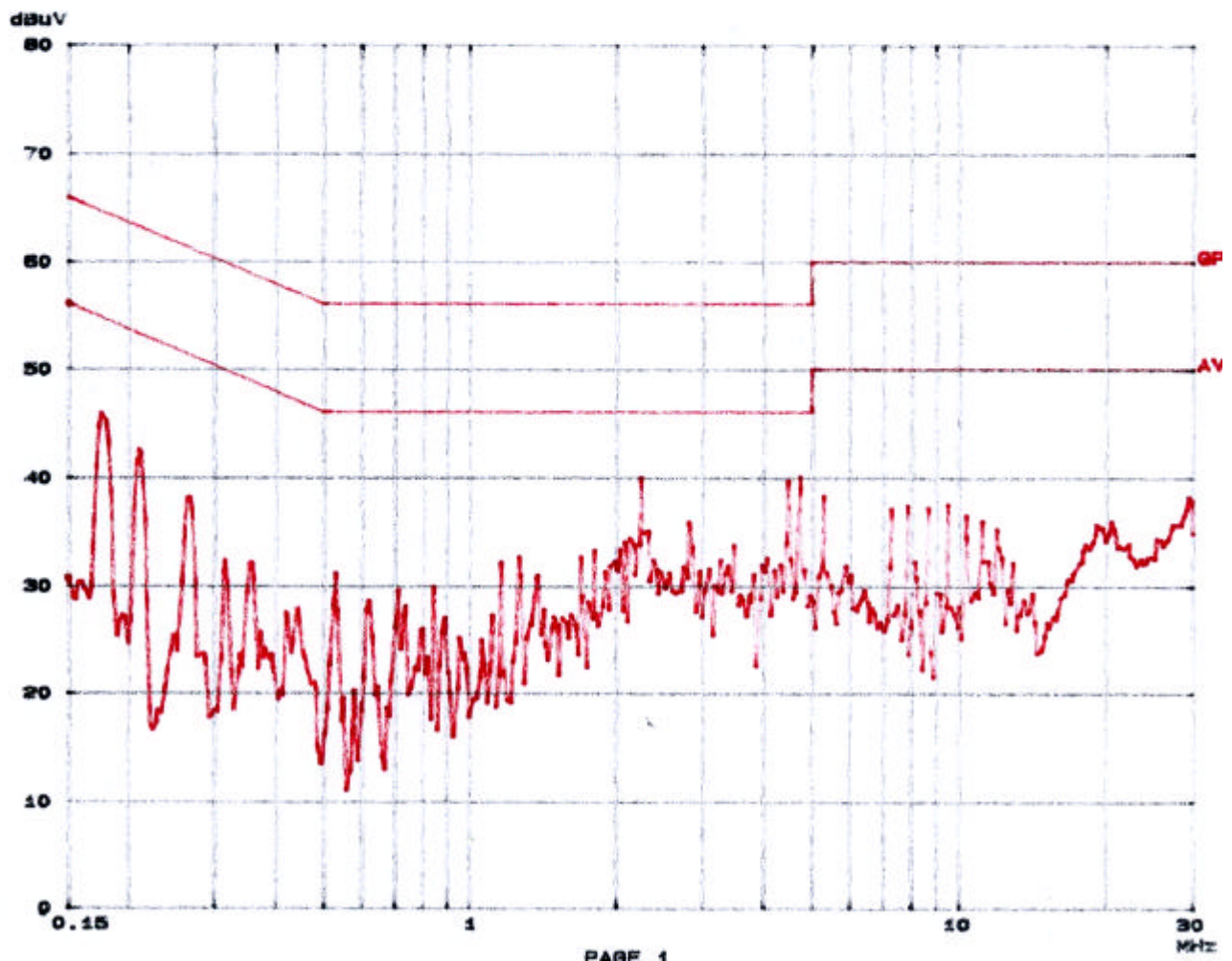
#### ETL INC. CONDUCTED EMISSION

EUT: Personal Computer  
Manuf: Casper Bilgisayar Sistemleri A.S.  
Op Cond: EMI TEST PROGRAM  
Operator: CHON SIK KIM  
Test Spec: EN 55022 CLASS B  
Comment: NEUTRAL

#### Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150k	500k	2k	10k	PK	20ms	AUTO	LN OFF	60dB
500k	5M	5k	10k	PK	20ms	AUTO	LN OFF	60dB
5M	30M	10k	10k	PK	20ms	AUTO	LN OFF	60dB

Final Measurement: x GP Transducer No. Start Stop Name  
Meas Time: 1 s 1 150k 30M EN55022  
Subranges: 50  
Acc Margin: 3dB



## 5. TEST RESULTS

### 5.3 Radiated Emissions Measurement

EUT	Personal Computer / Casper Alfa (SN:N/A)
Limit apply to	15.109(e) : CISPR Pub.22(1997) Class B
Test Date	August 31, 2002
Operating Condition	" H " Pattern display & Printing
Environment Condition	Humidity Level : 41 %RH, Temperature : 25
Result	Passed by - 4.70dB

### Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 120 kHz )

Measurement Distance : 10 meters

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Emission Level [Db $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
113.03	5.36	V	10.37	2.60	18.33	30.0	11.67
245.90	8.68	H	10.99	4.10	23.77	37.0	13.23
250.08	5.43	H	11.38	4.20	21.01		15.99
415.23	5.80	H	15.04	5.40	26.24		10.76
472.61	9.72	H	16.88	5.70	32.30		4.70
528.08	6.15	H	17.31	6.30	29.76		7.24

#### NOTES :

1. \* H : Horizontal polarization , \*\* V : Vertical polarization
2. Emission Level = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Emission Level
4. The measurement was performed for the frequency range 30MHz ~ 1000MHz according to the CISPR 22 Class B



Test Engineer : C. S. Kim

## 6. SAMPLE CALCULATION

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### Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

$$dB(\mu V/m) = 20 \log_{10} (\mu V / m) : \text{Equation 1}$$

$$dB\mu V = dBm + 107 : \text{Equation 2}$$

Example 1 : @ 2.327 MHz

Class B Limit	=	631 uV = 56.00 dBuV
Reading	=	41.60 dBuV
Convert to uV	=	120.3 uV
Margin	=	41.60 - 56.00 = -14.40
	=	-14.40 dB below Limit

Example 2 : @472.61 MHz

Class B Limit	=	70.80 uV = 37.0 dBuV/m
Reading	=	9.72 dBuV
Antenna Factor + Cable Loss	=	22.58 dB
Total	=	32.30 dBuV/m
Margin	=	32.30 - 37.0 = -4.70
	=	-4.70 dB below Limit



## 7. TEST EQUIPMENT LIST

### List of Test Equipments Used for Measurements

	Test Equipment	Model	Mfg.	Serial No.	Cal. Date
<input checked="" type="checkbox"/>	Spectrum Analyzer	R3261A	Advantest	21720033	01-10-25
<input checked="" type="checkbox"/>	Receiver	ESVS 10	R & S	835165/001	02-03-21
<input checked="" type="checkbox"/>	Receiver	ESHS30	R & S	84190/002	02-01-24
<input checked="" type="checkbox"/>	Spectrum Analyzer	E7402A	HP	US39110107	03-05-21
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9208-1995	01-12-27
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9006-1669	01-12-27
<input checked="" type="checkbox"/>	Preamplifier	HP8447D	HP	2944A07626	02-01-10
<input type="checkbox"/>	Preamplifier	HP 8347A	HP	2834A00544	02-05-23
<input checked="" type="checkbox"/>	TriLog Antenna	VULB9160	Schwarz Beck	3082	01-06-19
<input type="checkbox"/>	LogBicon	VULB9165	Schwarz Beck	2023	01-05-28
<input checked="" type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	964	02-05-04
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	965	02-05-04
<input checked="" type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	949	02-05-04
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	950	02-05-04
<input type="checkbox"/>	Double Ridged Horn	3115	EMCO	9809-2334	01-09-20
<input type="checkbox"/>	Magnetic Loop Antenna	6502	EMCO	9810-2111	01-12-11
<input checked="" type="checkbox"/>	Turn-Table	DETT-03	Daeil EMC	-	N/A
<input checked="" type="checkbox"/>	Antenna Master	DEAM-03	Daeil EMC	-	N/A
<input checked="" type="checkbox"/>	Plotter	7440A	H.P	2725A 75722	N/A
<input checked="" type="checkbox"/>	Chamber	DTEC01	DAETONG	-	N/A
<input type="checkbox"/>	Impedance Matching Pad	6001.01.A	SUNNER	3252	01-09-22
<input checked="" type="checkbox"/>	Thermo Hygograph	3-3122	ISUZU	3312201	02-01-10
<input checked="" type="checkbox"/>	BaroMeter	-	Regulus	-	-