NATIONAL CERTIFICATION LABORATORY

8370 Court Avenue, Suite B-1
Ellicott City MD 21043
(410) 461-5548

FCC REPORT OF RADIO INTERFERENCE

for

BCM Advanced Research, Inc.
15255 Alton Parkway
Irvine, CA 92718

FCC ID: JHSFR500

May 26, 1998

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1.0 Introduction

This report has been prepared on behalf of BCM Advanced Research, Inc., to support the attached Application for Certification of a Part 15 Class B Digital Device. The Equipment Under Test was the BCM Advanced Research **FR-500 ATX Pentium Desktop Computer**.

Radio-Noise Emissions tests were performed according to the ANSI C63.4- 1992, Chapter 11 titled "Measurement of Information Technology Equipment". The measuring equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

Testing was performed at National Certification Laboratory in Ellicott City, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch. FCC acceptance was granted on May 26, 1993.

1.1 Summary

The BCM Advanced Research **FR-500 ATX Pentium Desktop Computer** complies with the limits for a Class B Digital Device.

2.0 Description of Equipment Under Test (EUT)

The EUT Features:

MICRO-PROCESSORS	CLOCK SPEEDS
Pentium-266	66 MHz
Pentium-233	66 MHz
OTHERS	**OSCILLATORS**
2 AT Slots	Motherboard:
3 PCI Slots	
SVGA Video Port	14.318 MHz
4 SIMMS	32.768 KHz
2 Serial Ports	
1 Parallel Port	
Sound/Game Ports	
2 USB Ports	

2.1 EMI Countermeasures

The following modifications were made to the EUT, by the project engineer to assure compliance to Class B specifications:

None.

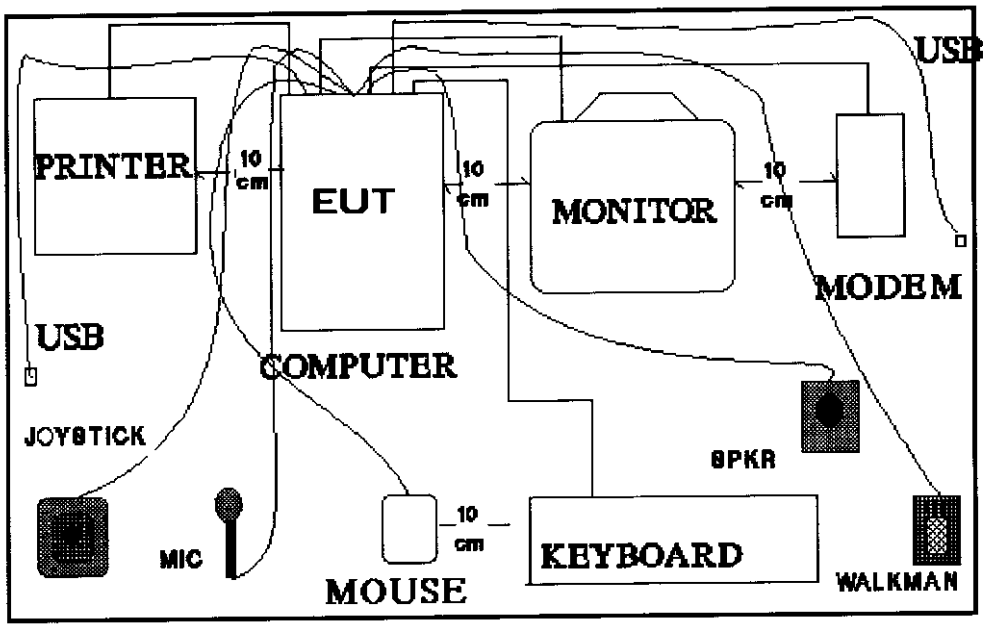
3.0 Test Program

A program was written to send a continuous stream of "H's" to the video, serial, and parallel ports of the computer. Only 66 MHz clock-based CPUs were tested. Worst case emissions are recorded in the data tables.

BASIC program used:

```
10 FOR N=1 TO 35
15 FOR M=1 TO 80
20 PRINT "h";:
25 NEXT M
30 NEXT N
40 OPEN "COM1:1200,E,7,1,CSO,DSO" FOR OUTPUT AS #1
50 OPEN "COM2:1200,E,7,1,CSO,DSO" FOR OUTPUT AS #2
52 FOR I=1 TO 160
54 PRINT #1,"H";:
56 PRINT #2,"H";:
58 NEXT I
60 FOR J=1 TO 80
65 LPRINT "H";:
70 NEXT J
75 CLOSE
80 GOTO 10
```

TEST CONFIGURATION



4.0 Test Configuration

The computer system and support equipment were setup on the test table in a manner which follows the general guidelines of ANSI C63.4, Section 6.2.1. The support equipment consisted of a keyboard, video monitor, printer, speaker, mic., radio, joystick, mouse and modem as prescribed in Section 11.2 (ANSI C63.4). The computer was centered on the table with it's backplane flush with the rear of the table.

The video monitor was placed on top of the computer with its front flush with the front of the EUT. The modem was placed 10 cm from the right side of the EUT, while the printer was set on the opposite side of the EUT, also 10 cm away. The keyboard was placed in front of the monitor, and flush with the front of the test table. All other equipment such as mice, audio devices, and joystick were placed in the front of the table on either side of the keyboard, maintaining 10 cm spacings. Two unterminated USB serial cables were connected to the EUT, and placed on either side of the computer to maximize emissions.

Serial, video and parallel I/O cables were draped over the back edge of the table, and the keyboard and mouse cables were placed on top of the table. Cables were more than 40 cm from the ground plane during radiated and conducted tests. The video monitor was powered from the auxilliary 120 VAC outlet on the computer which produced worst-case emissions.
Photographs and interconnection diagrams are provided in Exhibit 1.

5.0 Conducted Emissions Scheme

The EUT is placed on an 80 cm high 1 X 1.5 m non-conductive table. Power to the CPU is provided through a Solar Corporation 50 Ω/50 μH Line Impedance Stabilization Network bonded to a 2.2 X 2 meter horizontal ground plane, and a 2.2 X 2 meter vertical ground plane. The LISN has its AC input supplied from a filtered AC power source. A separate LISN provides AC power to the peripheral equipment. I/O cables are moved about to obtain maximum emissions.

The 50 Ω output of the LISN is connected to the input of the spectrum analyzer and emissions in the frequency range of 450 kHz to 30 MHz are searched. The detector function is set to quasi- peak and the resolution bandwidth is set at 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth for final measurements. All emissions within 20 dB of the limit are recorded in the data tables.

6.0 Radiated Emissions Scheme

The EUT was initially scanned in the frequency range 30 to 2000 MHz indoors, at a distance of 1 meter to determine its emissions

profile. The EUT was then placed on an 80 cm high 1 X 1.5 meter non-conductive motorized turntable for radiated testing on the 3-meter open area test site. The emissions from the EUT are measured continuously at every azimuth by rotating the turntable. Biconical, horn, and log periodic broadband antennas are mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna is varied between 1 and 4 meters. Cables are varied in position to produce maximum emissions. Both the horizontal and vertical field components are measured.

Measurements from 30 -1000 MHz: The output from the antenna is connected to the input of the spectrum analyzer. The detector function is set to quasi-peak. The resolution bandwidth of the spectrum analyzer system is set at 120 kHz for the range 30 - 1000 MHz with all post-detector filtering no less than 10 times the resolution bandwidth.

Measurements from 1 - 2 GHz: The output from the horn antenna is connected to the input of a 30 dB preamp, which is in turn attached to the spectrum analyzer. The detector function is set to Peak. The resolution bandwidth of the spectrum analyzer system is set at 1 MHz for the range 1- 2 GHz. All emissions within 10 dB of the limit are recorded in the data tables.

To convert the spectrum analyzer reading into a quantified E-field level to allow comparison with the FCC limits, it is necessary to account for various calibration factors. These factors include cable loss (CL) and antenna factors (AF). The AF/CL in dB/m is algebraically added to the Spectrum Analyzer Voltage in dbμV to obtain the Radiated Electric Field in dBμV/m. This level is then compared with the FCC limit.

Example:

Spectrum Analyzer Volt: VdBuV

Composite Factor: AF/CLdB/m

Electric Field: EdBμV/m = VdBμV + AF/CLdB/m

Linear Conversion: EuV/m = Antilog (EdBμV/m/20)

FCC CLASS B RADIATED EMISSIONS DATA

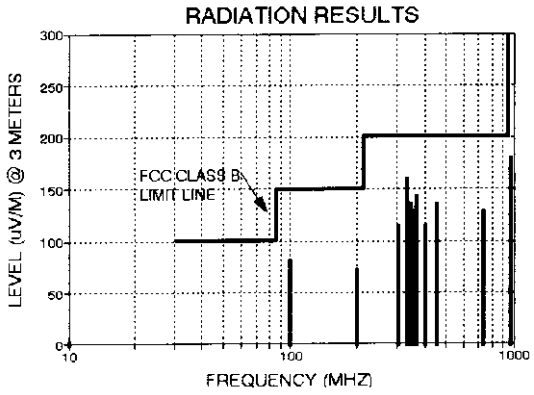
FCC ID: JHSFR500

CLIENT: BCM
EUT: FR500 DT
CPU: PENTIUM-266
CLOCK: 66 MHZ

3-METER TEST		QP LVL				DATE: 5/20/98	
FREQ MHz	POL H/V	SPEC A dBuV	AF/CL dB/m	E-FIELD dBuV/m	E-FIELD uV/m	LIMIT uV/m	MRG dB
100.18	H	26.0	12.0	38.0	79.4	150.0	-5.5
199.91	H	18.0	19.0	37.0	70.8	150.0	-6.5
304.17	H	24.0	17.0	41.0	112.2	200.0	-5.0
332.25	H	28.0	16.0	44.0	158.5	200.0	-2.0
344.88	V	25.5	17.0	42.5	133.4	200.0	-3.5
350.90	H	25.0	17.0	42.0	125.9	200.0	-4.0
366.85	H	25.0	18.0	43.0	141.3	200.0	-3.0
401.00	V	22.0	19.0	41.0	112.2	200.0	-5.0
451.16	H	22.5	20.0	42.5	133.4	200.0	-3.5
733.17	V	18.0	24.0	42.0	125.9	200.0	-4.0
966.54	V	20.0	25.0	45.0	177.8	500.0	-9.0

TEST ENGINEER

STEVEN DAYHOFF



FCC CLASS B CONDUCTED EMISSIONS DATA

FCC ID: JHSFR500

CLIENT: BCM
EUT: FR500 DT
CPU: PENTIUM-266
CLOCK: 66 MHZ

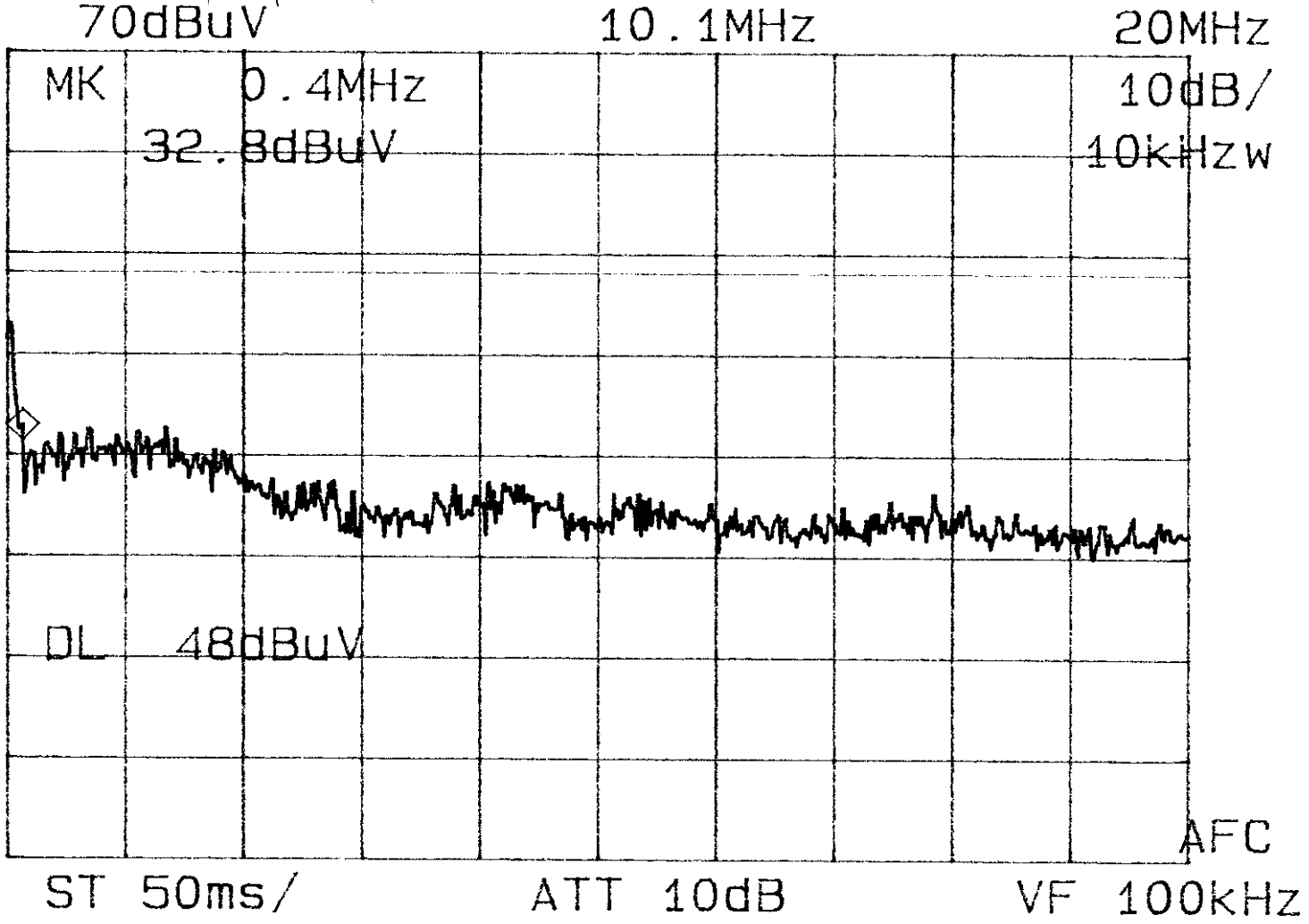
LINE 1 - NEUTRAL

FREQ MHz	VOLTAGE dBuV	QP LEVEL VOLTAGE uV	FCC LIMIT uV	MARGIN dB
0.423	32.8	43.7	250	-15.2
2.235	31.6	38.0	250	-16.4

LINE 2 - PHASE

FREQ MHz	VOLTAGE dBuV	QP LEVEL VOLTAGE uV	FCC LIMIT uV	MARGIN dB
0.425	26	20.0	250	-22
1.354	28.7	27.2	250	-19.3

FR 500
Conducted - L1



FR500
Conducted - L2

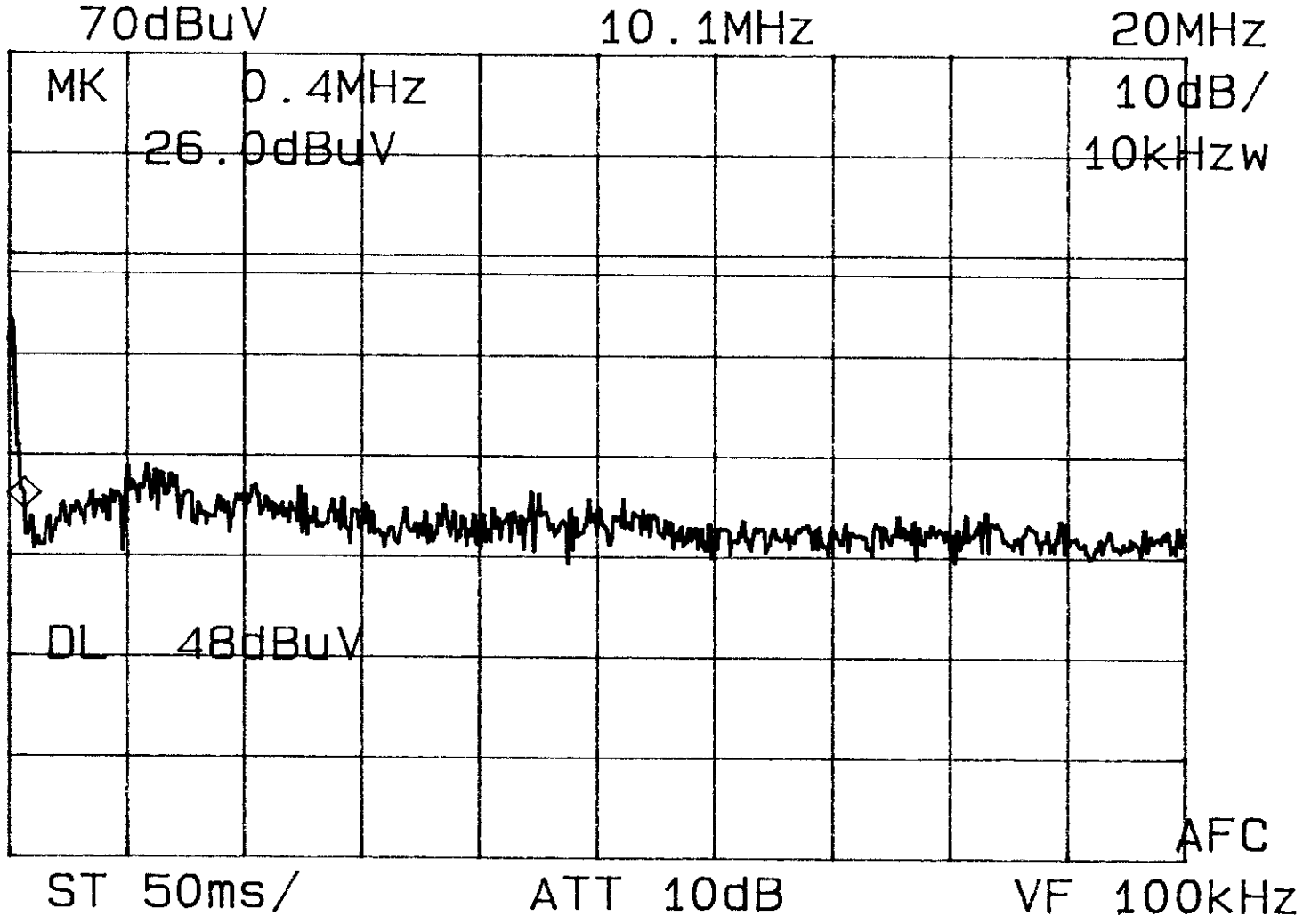


Table 1

Support Equipment

MANUFACTURER	FCC ID #	SERIAL #
MONITOR:		
Relisys 1564ME SVGA	E80TE1564	30266672
SERIAL DEVICE:		
US Robotics 2400B Modem	CJE794COURIER2400	30-039207
PARALLEL DEVICE:		
Epson T-1000 Printer	BKM9A8P7ORA	OAOO59174
KEYBOARD:		
Fujitsu	C9S4D5KB4700	None
MOUSE:		
Logitech Logitech	DZL6QBC DZLMO4	48ULTSL1901 LTR52807047
AUDIO DEVICES: DAL Speaker Sony Mic. Toshiba AM/FM Radio V-Tech Joystick		

Table 2

Interface Cables Used

EUT to Printer	1.5 meter bundled to 1 meter in length shielded
EUT to Modem	1 meter in length - shielded
Modem (connected to telephone jack)	Standard RJ-11 cable bundled to 40 cm unshielded
EUT Power	Shielded 120 VAC power cord
All other I/O cables such as monitor, keyboard, mouse are permanently attached to the peripherals - presume shielded.	
Note: There are no ferrite beads attached to any I/O cables for this test. ***Note:*** Two unterminated USB cables were connected to the EUT: 1 meter in length - shielded.	

Table 3

Measurement Equipment Used

The following equipment is used to perform measurements:

EQUIPMENT	SERIAL NUMBER
Wavetek 2410A 1100 MHz Signal Generator	1362016
EMCO Model 3110 Biconical Antenna	1619
EMCO Model 3146 Log Periodic Antenna	1222
EMCO Model 3115 Ridged Horn Antenna	1574
Advantest Model R4131D Spectrum Analyzer	54378A
Solar 8012-50-R-24-BNC LISN	927230
4 Meter Antenna Mast	None
Motorized Turntable	None
RG-233U 50 ohm coax Cable	None

EXHIBIT 1

EUT PHOTOGRAPHS