ANO35H3636 FCC Class B Report
IBM Turbo 16/4 Token-Ring PC Card 2
P/N 34L1499

Feature List

Feature Description	Part Number
NA	

Document Number 99-EMCB7M-135
July 31, 1999

The results of this test report relate only to the equipment tested.
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EMC Manager/Date: Harry Jones 8/12/99

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Networking EMC Test

DISTRIBUTION

Tom Glembocki	BPDA/662, RTP
EMC Engineering File	B7MA/B063, RTP

MEASUREMENT/TECHNICAL REPORT
IBM Turbo 16/4 Token-Ring PC Card 2
FCC ID: ANO35H3636
Date: July 31, 1999

This report concerns (check one):

_X_ Original Grant
___ Class I change
___ Class II change
___ FCC Class A

Equipment type:_Communication Peripheral__(ex.: computer, printer, modem, PC peripheral, etc)

Request issue of grant (check one):

_X_ Immediately upon completion of review.
___ Defer grant per 47 CFR 0.457(1)(ii) until _____.

IBM agrees to notify the Commission by: _____ of the intended date of announcement of the product so that the grant can be issued on that date.

Measurement procedure used: (Check one)

_X_ ANSI C63.4 (1992)
___ Other

If other, describe _____

Report prepared by:

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TEST SUMMARY

This report describes the EMC evaluation of the IBM Turbo 16/4 Token Ring PC Card 2. It was tested to and does meet the following EMC requirements. The results reported here only pertain to the item tested.

Radiated Emissions

Class	International Standards	IBM Standards
[ ] A [X] B	[ ] EN 55022 (1994), CISPR-22 (1993) [X] FCC Part 15, Canadan ICES-003	N-B 2-0001-026

Conducted Emissions

Class	International Standards	IBM Standards
[ ] A [X] B	[ ] EN 55022 (1994), CISPR-22 (1993) [X] FCC Part 15, Canada ICES-003	N-B 2-0001-026

Attested by: Michael Gowdey

Any questions or concerns regarding the content of this report should be directed to the IBM Research Triangle Park, North Carolina, U.S.A., EMC Engineering department.

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PRODUCT INFORMATION

Date of Receipt

This product was received into the lab on April 10, 1999.

Test Dates

The IBM Turbo 16/4 Token-Ring PC Card 2 was tested on the following dates:

Test Performed	Tested Dates
Radiated Emissions	April 13, 1999
Power Line Conducted Emissions	April 23, 1999

Description

The IBM Turbo 16/4 Token-Ring PC Card 2 is a credit-card-sized adapter that provides an interface between computers and token-ring networks. The PC Card is designed to operate in computers with PC Card slots that comply with the standards for the Personal Computer Memory Card International Association (PCMCIA) Release 2.1, Type II slots.

Special features include:

- Fully compatible and up to 90% faster than the IBM Auto 16/4 Credit Card Adapter
- Includes Remote Program Load (RPL)
- Full-Duplex ready
- Supports the DMI interface
- Includes RJ-45 cable and STP media access adapter for easy connection to either UTP or STP cabling
- The cable must be connected to the PC Card in order to be recognized by the computer
- Compliance with PCMCIA and IEEE 802.5 standards, Revision 2.
- Auto Ring Speed.

Hardware Level

__	Prototype	_X_	Preproduction	__	Production

Related Submittal(s)/Grant(s)

None

Manufacturer of Equipment Under Test

IBM Corporation
3039 Cornwallis Drive
Research Triangle Park, North Carolina 27709 U.S.A.

Equipment Tested

Description	Type Number	Part Number	Serial Number	FCC ID
Turbo 16/4 Token-Ring PC Card 2		34L1499	EMC-2	ANO35H3636

Adapters / Peripherals / IO Devices

Name	Type Number	Part Number	Serial Number	FCC ID
IBM Thinkpad 701C Notebook Computer w/ External Floppy Diskette Drive	2630-5TU		23-NZX80	ANO2630C
PCMCIA Memory Adapter	SD-10		M0071003569	N/A
IBM Thinkpad 750C Laptop Computer	9545-706		97-H5BH8	ANO9545C
IBM 8228 Token-Ring Concentrator	8228	6091014	23-LA006	N/A

Cables

Type	Length	Description	Part Number	EC Level
Catagory 4 Unshielded Twisted Pair (UTP)	50 Feet	UTP LAN Cable	N/A	N/A
IBM Cabling System Cable, Shielded	50 Feet	STP LAN Cable	N/A	N/A

Oscillator/Clock Frequencies

Clock Type	Frequency
Oscillator	4MHz

Special Accessories or Modifications Required for Compliance

None.

TEST CONFIGURATION

Exercise Software

The EUT exercise software program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to typical use. The following actions are performed in a continuous loop. In some configurations a subset of the activities are performed.

- The laptop memory is exercised.
- A full screen of "H"'s displayed in 25x80 text mode (720x400 pels).
- The floppy drive is exercised.
- The hard drive is exercised.
- The Token Ring port is exercised through client/server file transfers.

The Token Ring adapter is being treated as another hard drive. LAN software is installed to emulate the hard drive function. Data is being sent to the IBM Thinkpad 750C in a separate exerciser room.

Description

The Turbo 16/4 Token Ring PC Card is used in a notebook computer and can be used in a variety of configurations. The first configuration uses a 3 meter cable with Unshielded Twisted Pair (UTP) cabling connected to a network. The next configuration uses a same cable as above but uses a STP Connector that converts the RJ45 connector to the ICS (IBM Cabling System) Connector and a shielded cabled network.

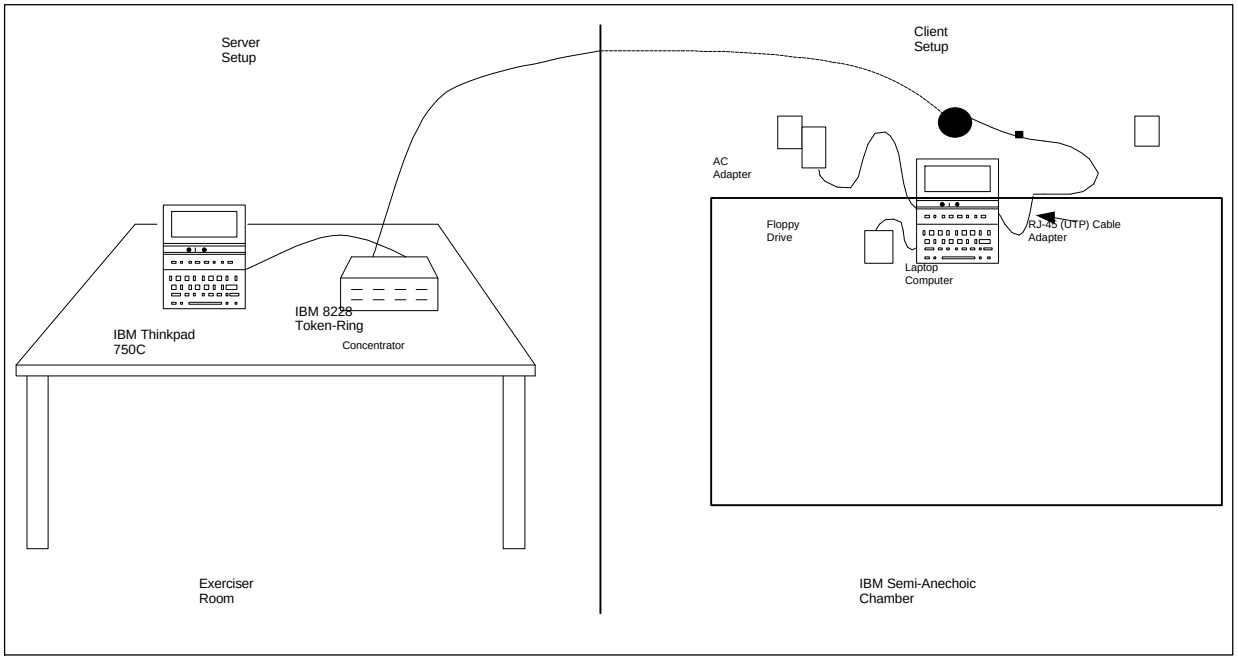
Both configurations can be connected to either 16Mbps or 4Mbps networks. After several tests, the worst case configuration was determined to be:

- An IBM Thinkpad 701C Laptop with external Floppy Disk Drive
- IBM Turbo Token-Ring PC Card 2 with 3 Meter UTP Adapter
- PCMCIA Memory Adapter
- IBM Turbo Token-Ring PC Card transferring Token Ring Data to a Server located in a separate exerciser room using 50 feet of UTP Catagory 4 cable.

Justification

See Description above for justification.

Setup Diagram



TEST SITE INFORMATION

International Business Machines (IBM) Corporation
IBM RTP PSG EMC Test Labs
P.O. Box 12195
Research Triangle Park, North Carolina 27709
U.S.A.

Emissions Test Facilities

The IBM Networking Hardware Division (NHD) emissions test facilities are two RF Semi-anechoic chambers designed for radiated emissions measurements at antenna-to-EUT distances up to 10 meters and antenna scan heights of 1 to 4 meters. The 065 emissions test facility is made up of 4 shielded rooms. The 063 emissions test facility is made up of 3 shielded rooms.

- Semi-Anechoic Chamber
- Control Room
- Exerciser Room A
- Exerciser Room B (not in 063)

The Control Room contains all measurement test equipment and Exerciser Rooms A and B are used to isolate machinery and equipment that are not part of the emissions measurement.

Agency Approvals

The IBM NHD building 065 semi-anechoic chamber is a registered test facility with the following regulatory agencies.

- FCC - Federal Communications Commission (U.S.A.)
  Acceptance Letter Dated: March 3, 1997 (31040/SIT, 1300F2)
- NEMKO - Norway, Authorization Number: 323-EMC
- MOC - Korea
- VCCI - Japan, Registration Numbers: C-175 and R-178
  Dated: March 17, 1997 ; Valid until: March 2, 2000
- New Zealand
- Czech Republic, Registration Number: EZU-V-004/94
- Taiwan - Accreditation No. SL2-IN-E-1006(ITE)
- NVLAP Lab Code 200200-0 ; Valid until: June 30, 2000 *(accreditation pertains only to radiated and conducted emissions testing)*

The IBM NHD building 063 semi-anechoic chamber is a registered test facility with the following regulatory agencies.

- FCC - Federal Communications Commission (U.S.A.)
  Acceptance Letter Dated: December 30, 1998 (Registration Number: 90666)
- VCCI - Japan, Registration Number: R-878
  Dated: March 29, 1999 ; Valid until: December 28, 2001
- New Zealand
- Taiwan - Accreditation No. SL2-IN-E-1006(ITE)
- NVLAP Lab Code 200200-0 ; Valid until: June 30, 2000 *(accreditation pertains only to radiated and conducted emissions testing)*

Test Methodology

The test procedure used was ANSI C63.4 (1992). There were no deviations from this test procedure. Radiated testing was performed at an antenna to EUT distance of 10 meters.

RADIATED EMISSIONS

The Equipment Under Test meets all FCC Class B radiated emissions requirements. The worst case emissions are shown in the following tables.

Test Procedure

An initial real time measurement was made with the antenna in a fixed polarization. Two frequency ranges were measured based on the calibration ranges of the antennas. The biconical antenna was used from 20 to 201 MHz, and the log periodic was used from 199 to 1000 MHz. The antennas were set at fixed heights and the cables were manipulated to obtain maximum emissions.

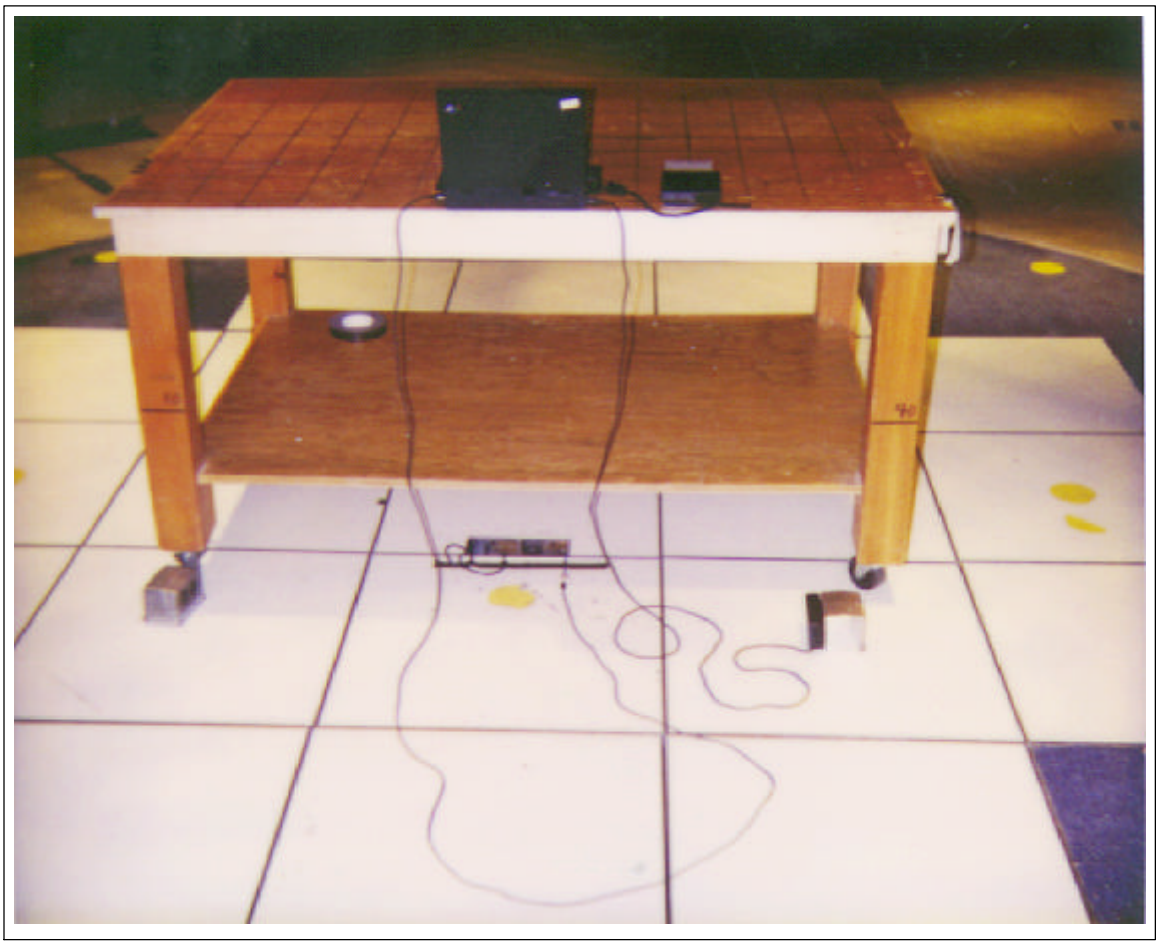
The product was rotated with the antennas positioned as previously described, and the peak spectrum profile for each polarization was recorded. Radiated emissions within 10 dB of the limit were remeasured using a spectrum analyzer equipped with a quasi-peak adapter and a bandwidth of 120 KHz was used for frequencies up to and including 1 GHz. For measurements above 1 GHz, both a peak and average detector were used, and the resolution bandwidth was 1 MHz. For each configuration, a minimum of 6 emissions were recorded. The EUT was rotated and the antennas scanned to capture the maximum emission at each reported frequency.

Test Equipment

Test Equipment	Model	TES #	BT #	Last Calibration Date	Calibration Due Date
HP Spectrum Analyzer	8568B	19011		6/18/98	6/18/99
HP Quasi-Peak Adapter	85650A	15734		8/10/98	8/10/99
HP RF Preselector	85685A	24934		10/8/98	10/8/99
HP Preamp	8447D	19914		3/17/99	3/17/2000
HP Preamp	8447D	13990		5/98	5/99
EMCO Biconical Antenna	3108	26157		8/98	8/10/99
EMCO Log Periodic	3147	23521		8/98	8/10/99
EMCO Mast and Controller	1053	21809		2/17/99	2/17/2000
EMCO Mast and Controller	1053	21813		2/17/99	2/17/2000
EMCO Turntable and Controller	2090	31800		12/15/98	6/15/99
Note: The entire data collection system is checked weekly using an EMCO Model 4610 Standard Source					

Configuration Photos:

Front View
Radiated Emissions
Photograph Showing the EUT Configuration for Maximum Emissions



Rear View
Radiated Emissions
Photograph Showing the EUT Configuration for Maximum Emissions

Radiated Data: Collected in 063 SAC (see Agency Approvals)

FCC Test Voltage: 115 V, 60 Hz

Frequency MHz	Pol	Height cm	Az deg	Measured Level dBµV/m	Antenna Factor dB	Cable Loss dB	PreAmp Gain dB	Atten dB	Fall Off dB	Actual Level dBµV/m	FCC QP Limit dBµV/m	Margin Limit dB
112.000	V	101	142	41.46	10.08	1.81	27	6	0	31.87	43.50	-11.63
160.000	V	101	125	41.39	11.61	2.36	27	6	0	33.98	43.50	-9.52
59.664	V	101	55	44.07	8.38	1.34	27.66	6	0	32.13	40.00	-7.87
56.634	V	101	232	48.22	8.96	1.33	27.67	6	0	36.84	40.00	-3.16
81.824	V	101	263	47.58	7.57	1.49	28	6	0	35.07	40.00	-4.93
264.005	V	101	96	49.64	12.49	2.72	28	0	0	36.84	46.00	-9.16
216.002	V	101	24	48.25	10.97	2.54	28	0	0	33.61	46.00	-12.39
256.000	V	101	96	55.77	12.25	2.70	28	0	0	42.69	46.00	-3.31

Attested by: Michael Gowdy

Note: A search was made of the frequency spectrum from 30 MHz to 1000 MHz and the measurements reported are the highest emissions relative to the FCC Class B Computing Device Limits.

Field Strength Calculation

Sample Field Strength Calculation

$FI = V_r + CL + AF - AG$
where,

FI = Field Intensity
V_r = Voltage at the receiver
CL = Cable Loss
AF = Antenna Factor
AG = PreAmplifier Gain

For example at 240.001 MHz if the measured voltage is 37.04 dBµV, the field intensity would be calculated:

FI = 37.04 + 3.22 + 12.34 - 25.84 = 26.76 dBµV/m (21.78 µV/m).

CONDUCTED EMISSIONS

The Equipment Under Test meets all FCC Class B power line conducted emissions requirements. The worst case emissions are shown in the following tables.

Test Procedure

Peak spectral data of each of the product's power-line conductors over the range of 0.15 to 30 MHz was recorded using a spectrum analyzer. Conducted emissions within 10dB of the limit were remeasured using a spectrum analyzer using quasi-peak and average detection, and a bandwidth of 9 KHz. For each configuration, a minimum of 6 emissions were recorded. The cables were manipulated to maximize the emissions.

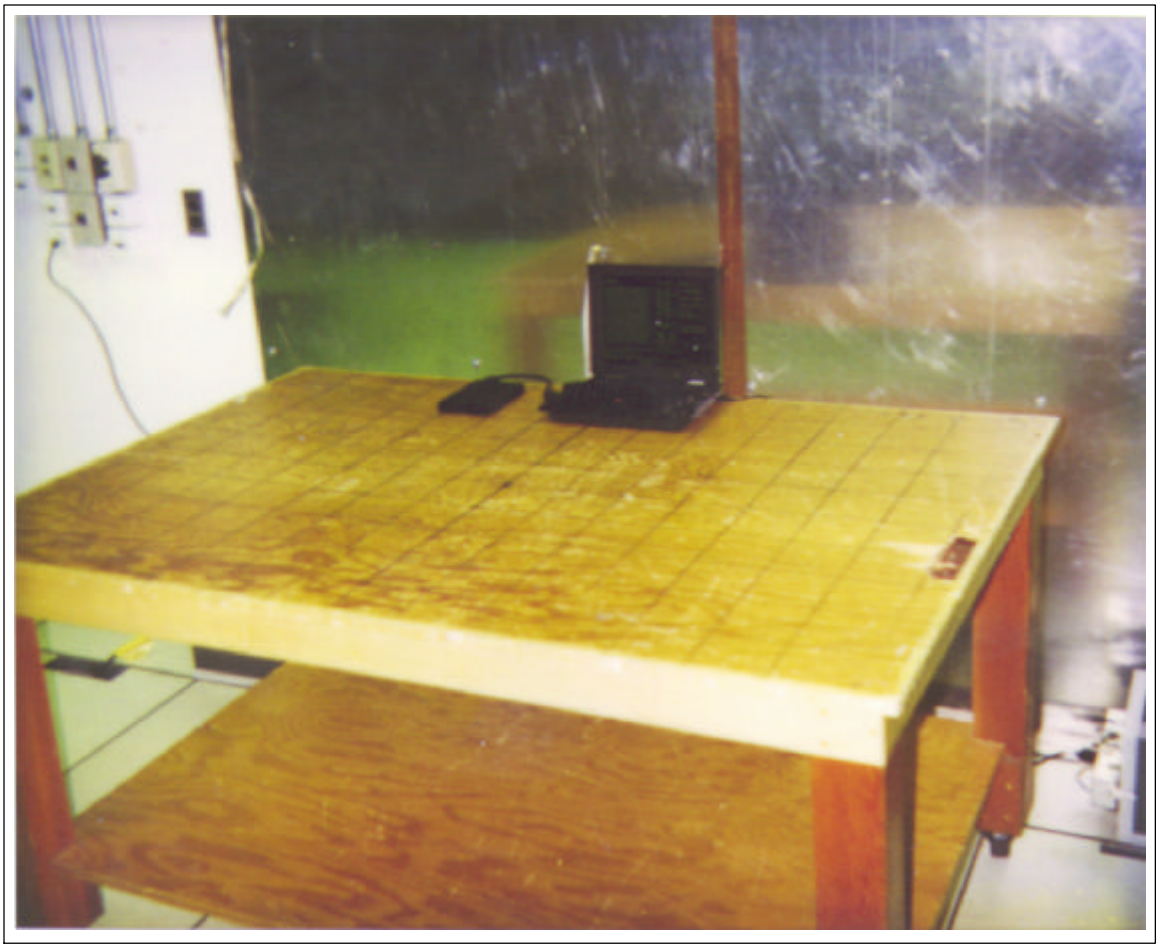
For table top products the EUT along with its peripherals were placed on a 1.0 by 1.5 meter wide, 0.8 meter high wooden table situated on an earth-grounded conducting surface (horizontal reference plane) at least 2.5 by 2.0 meters wide (this plane was covered with an insulating material). The EUT was powered by a 50 ohm line impedance stabilization network (LISN) which was bonded to the horizontal reference plane. All peripheral equipment was powered by a second LISN which was also bonded to the horizontal reference plane. Power to both LISNs was filtered to reduce ambient noise interference. The EUT was adjusted to maintain a 0.4 meter distance from a vertical reference plane. The vertical reference plane was at least 2.0 meters wide by 2.0 meters tall and was bonded to the horizontal reference plane. The excess power cable between the LISN and the EUT was bundled. The power cables associated with the peripheral equipment was left unbundled.

The floor-standing EUT is setup in a typical configuration with the EUT standing on a conducting ground plane. Peripherals and I/O devices attached to the EUT and installed in a typical configuration, maintaining normal spacing between cabinets and enclosures.

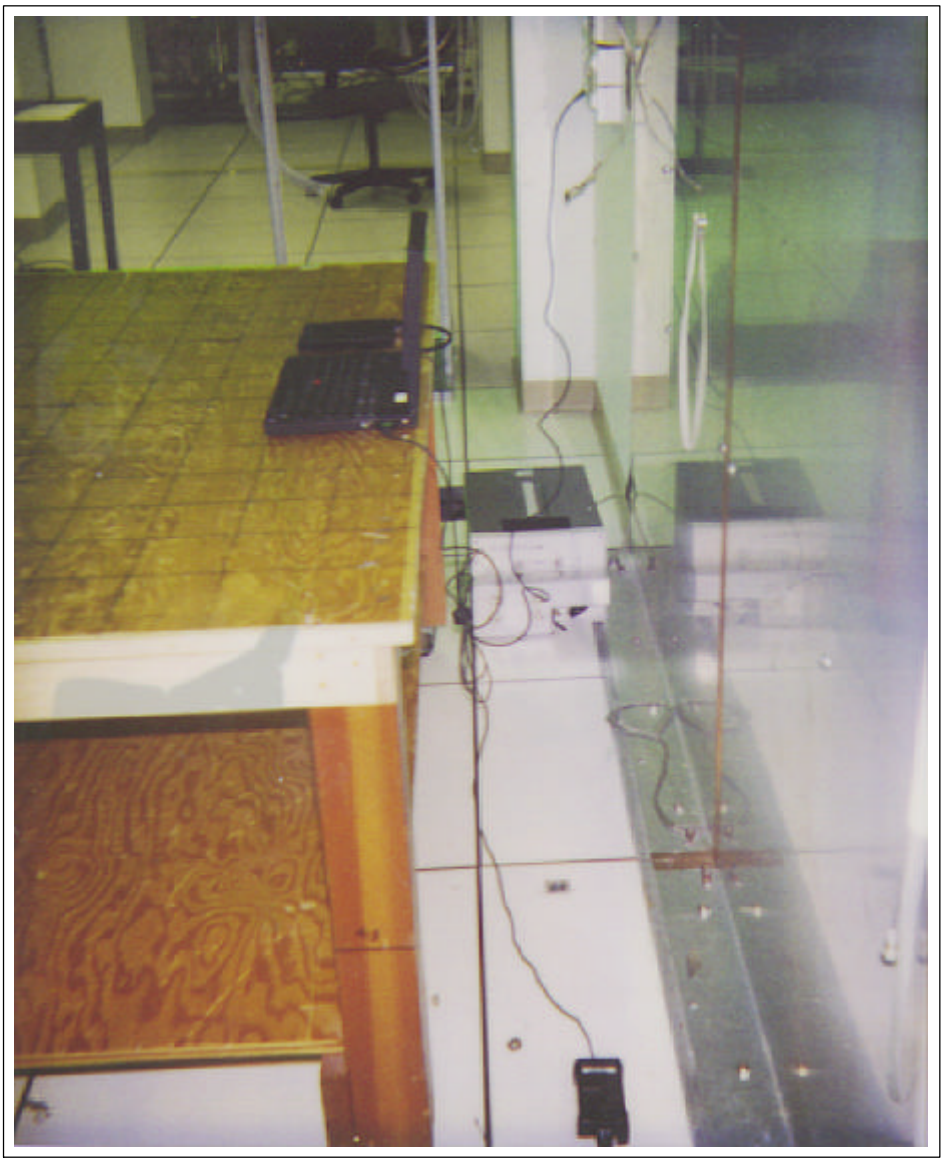
Test Equipment

Test Equipment	Model	TES Number	Brass Tag Number	Last Calibration Date	Calibration Due Date
HP 8568B Spectrum Analyzer	8568B	14749		12/11/98	12/11/99
HP 85650A Quasi-Peak Adapter	85650A	18075		8/98	8/30/99
HP Preselector	85685A	17822		12/11/98	12/11/99
EMCO LISN (peripherals)	3825/2	13460		7/9/98	7/9/99
EMCO LISN	3825/2	23523		7/9/98	7/9/99

Configuration Photos:



Front View
Conducted Emissions
Photograph Showing the EUT Configuration for Maximum Emissions



Rear View
Conducted Emissions
Photograph Showing the EUT Configuration for Maximum Emissions

Conducted Data:

FCC Test Voltage: 115 V, 60 Hz

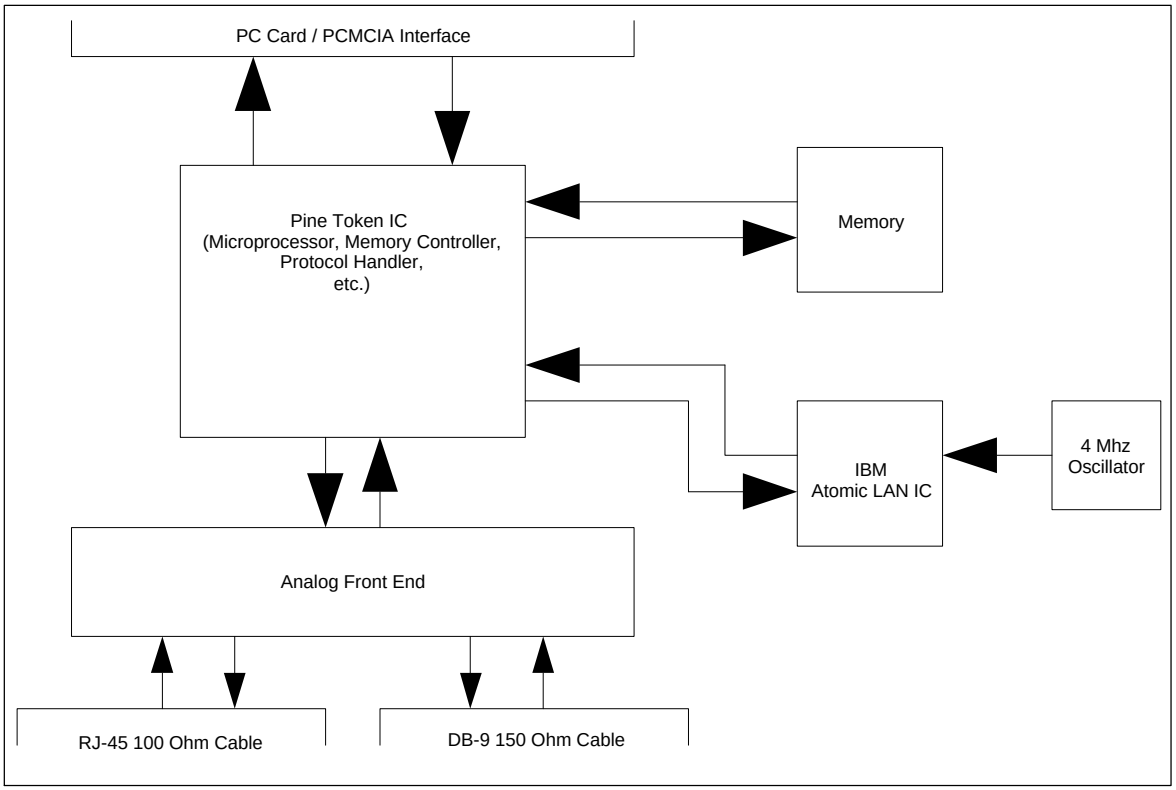
Frequency MHz	Phase	QPMeasured dBµV	Average Measured dBµV	Atten dB	QPActual dBµV	Average Actual dBµV	FCC QPLimit dBµV	Average Limit dBµV	Margin From Limit dBµV
23.048	2	30.07	23.10	11.00	41.07	34.10	48.00	N/A	-19.9
9.219	2	27.44	23.50	11.00	38.44	34.50	48.00	N/A	-9.6
10.033	2	27.70	23.20	11.00	38.70	34.20	48.00	N/A	-9.3
21.420	2	29.02	23.00	11.00	40.02	34.00	48.00	N/A	-21.0
3.118	2	26.26	24.60	11.00	37.26	35.60	48.00	N/A	-10.7
0.678	2	26.51	23.30	11.00	37.51	34.30	48.00	N/A	-10.5
0.813	2	24.28	19.40	11.00	35.28	30.40	48.00	N/A	-12.7
16.000	1	29.37	27.20	11.00	40.37	38.20	48.00	N/A	-7.6
NOTE: A product is compliant if the average limit is met using quasi-peak measurement data.									

Attested by: Michael Gondy

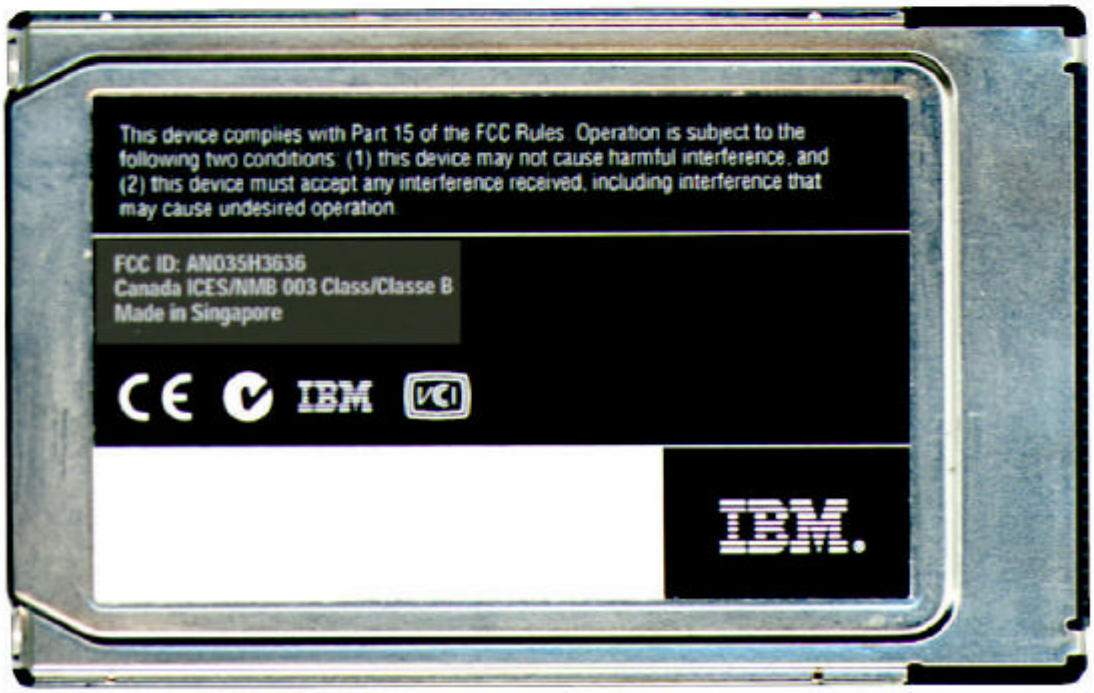
Note: A search was made of the frequency spectrum from 0.15 MHz to 30 MHz and the measurements reported are the highest emissions relative to the FCC Class B Computing Device Limits.

APPENDIX

Block Diagram



FCC Compliance Label



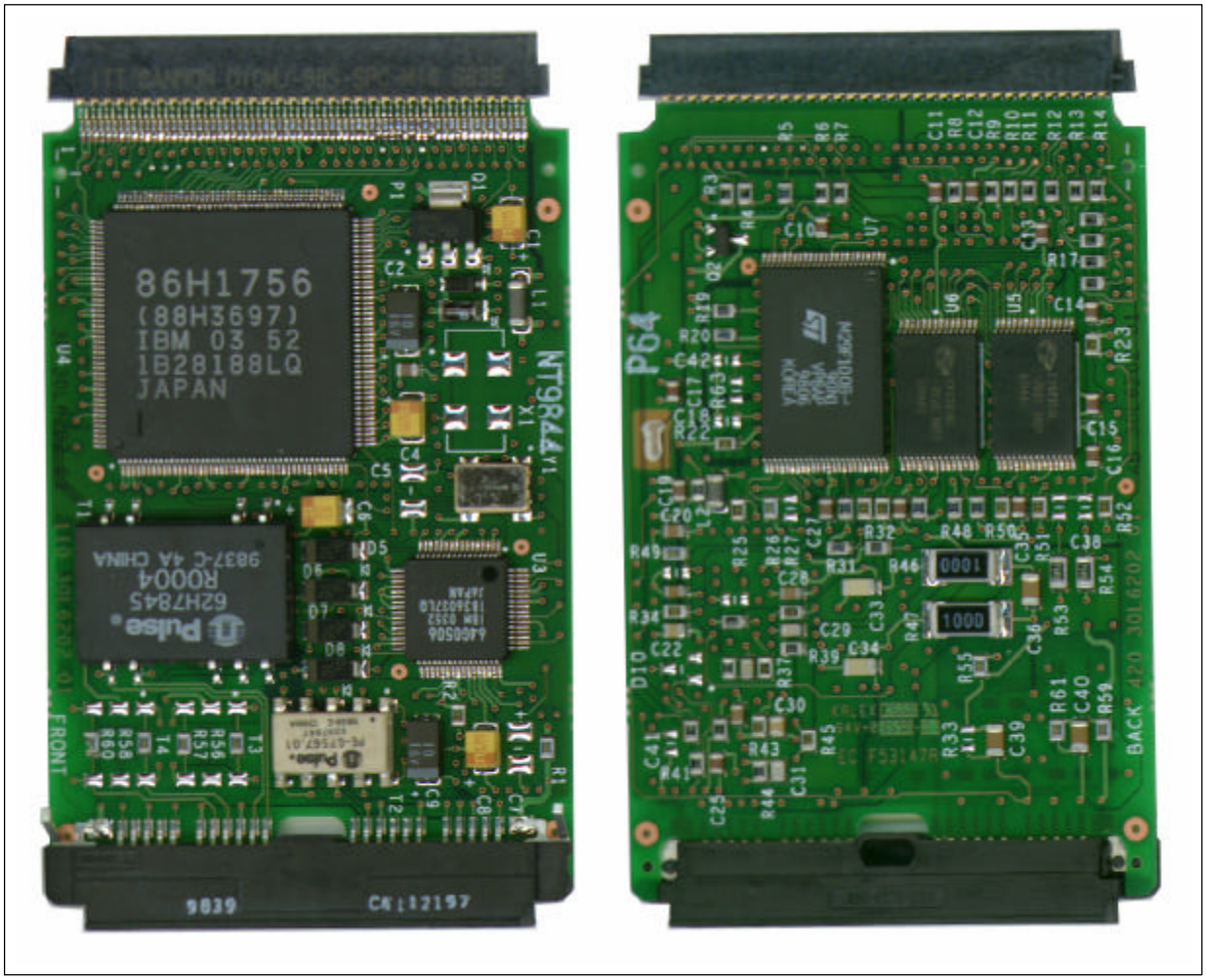
Location of FCC Label on EUT

See Photograph above.

FCC Publication Compliance Statements

See attached.

Identification Photos


86H1756
(88H3697)
IBM 03 52
1B28188LQ
JAPAN
NT9844
FRONT
BACK
P64