TEST SUMMARY

This report describes the EMC evaluation of the IBM PCI Token-Ring Adaptor PN 08L3222, a cost reduced version of 42H8862. 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	[X] EN 55022 (1994), CISPR-22 (1993) [ ] FCC Part 15	N-B 2-0001-026

Conducted Emissions

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

Attested by: Roger Pusthuman

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.

TABLE OF CONTENTS

PRODUCT INFORMATION

Date of Receipt

This product was received into the test lab on 04/01/98.

Product Description

The IBM PCI Token Ring Adaptor is a Token Ring LAN attachment feature for PCI bus equipped PC systems . This card supports cables terminated in both RJ45 and D-Shell connectors.

The Token Ring network is designed to operate under certain wiring restrictions, using shielded twisted pair (STP), or unshielded twisted pair (UTP) media cable. Media cable types are not intermixed on any given LAN. A cable lenght of 15 meters (50 feet) was used for testing as this is more typical of an actual user installation. The Token Ring LAN attachment provides either 4 or 16Mbps data transfer capability. Both data rates were investigated along with either connector type and media type used. The data that is reported uses the results at 16Mbps and UTP media.

The IBM PCI TOKEN-RING Adaptor meets CISPR 22B emission limits under the following conditions;

1. STP media cable is used or,
2. UTP media cable is used in conjunction with a shielded power cord installed on the host computer.

For an FCC Class B installation, the customer would use either:

1. IBM PN 60G1063, "IBM TokenRIng RJ45 STP Adaptor Cable", or
2. IBM P/N 6339098, "IBM Token Ring Network PC Cable", or
3. UTP media cable and a shielded IBM power cord PN# 6952304 or equivalent installed on the host computer

Change Description

The design change implemanted by this change intergrates the function of the LAN interface module and PCI Bus interface module of the previous design level into a single intergrated circuit module. No chnages were made to any crystal, oscillator, or clock frequency from the original design.

Test Dates

The IBM PCI Token-Ring Adaptor PN 08L3222 was tested on the following dates:

Test Performed	Tested Dates
Radiated Emissions	April 6, 1998
Power Line Conducted Emissions	April 2, 1998

Hardware Level

___ Prototype
_X_ Preproduction
___ Production

Related Submittal(s)/Grant(s)

ANO41H8862

Manufacturer of Equipment Under Test

IBM Corp.
NHD Div.
3039 Cornwallis Drive
Research Triangle Park, North Carolina 27709 U.S.A.

Equipment Tested

Description	Type Number	Part Number	Serial Number
PCI Token-Ring Adaptor	ANO41H8862	08L3222	test # 0F

EUT Cables

Type	Length (Feet)	Description	Part Number
Shielded twisted pair	50	Shielded media cable w/ D-Shell conn.	6339098
Shielded twisted pair	50	Shielded media cable w/ RJ-45 conn.	60G1063
Unshielded twisted pair	50	Unshielded media cable w/ RJ-45 conn.	NA

EUT Crystal/Oscillator/Clock Frequencies

Clock Type	Frequency
Oscillator	32 MHz
Crystal	4 MHz

Adapters / Peripherals / IO Devices

Name	Type Number	FCC ID	Serial Number	Cable Description
Host PC System	6885-4BH	ANO6885	SN-23-GP-027	Shielded Pwr cord pn 69522304
Monitor	8514	ANO9338514	SN-1108900	unshielded pwr cord & permanantly attached monitor cable with no ferrite cord
Printer (parallel port)	IBM 4019-E01	IYL4019	SN 11-ADX93	Shieled parallel cable w/o ferrite core & unshielded power cord
PC Keyboard	1391401	NA		Permanantly attached cable
IBM Mouse		DLZ6450350		Permanantly attached cable
Modem, (serial port)	5853	AMQ95Q58521	SN 23-0073122	Permanantly attached unshielded power cord, Shielded serial port cable w/o ferrite core.

Special Accessories or Modifications Required for Compliance

None.

Technical Description

The basic purpose of the IBM PCI TOKEN-RING adapter is to provide the capability for an PCI bus personal computer to transmit data to and receive data from other devices over theToken-Ring Local Area Network (LAN) at 4 or 16 Mbps. The digital signal rate when operating at 16 Mbit/sec is 32MHZ, and when operated at 4 Mbit / sec it is 8MHZ. This adapter implements the 32-bit PCI data bus.

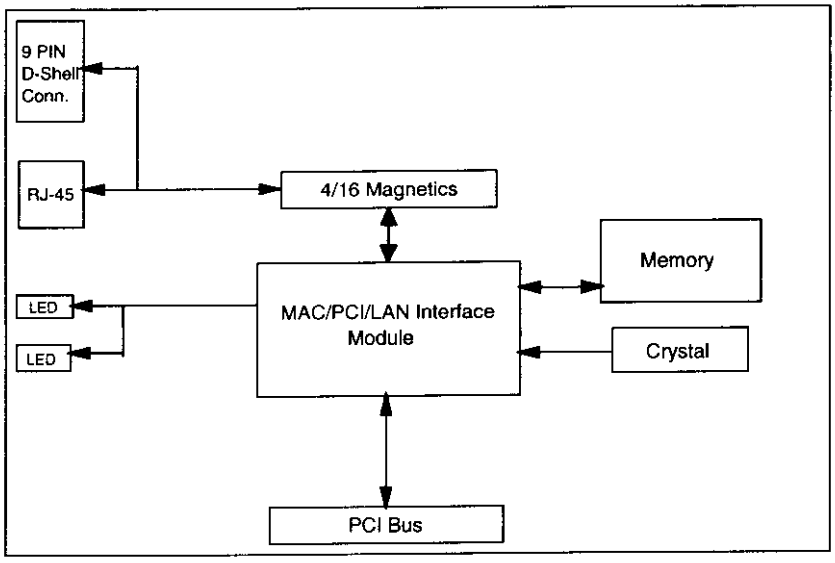
The MAC protocol / PCI bus / LAN interface chip runs on a 32MHZ signal clock generated internally by a 4MHZ crystal oscillator and phase lock loop. It contains data and address buffering and control for all PCI bus transactions, as well as the data serializer / deserializer, and Token-Ring MAC protocol hardware. The bus clocking is provided by the host PC system per the PCI specification (25MHZ. to 33MHZ. typical).

The data from the LAN is received and decoded and the data to the LAN is converted from the Manchester encoded data and clock signal to a differential signal for transmission onto the LAN by the analog section of the MAC protocol / PCI bus / LAN interface chip. This differential signal is 8MHZ for a 4Mbit / sec LAN, or 32MHZ for a 16 Mbit / sec LAN.

The analog token ring signals pass through an analog filter module, and through a common mode choke before being made available at the RJ45 or 9 - pin D shell connector on the card bracket.

The Token Ring network is designed to operate under certain wiring restrictions, using either shielded twisted pair (STP), or unshielded twisted pair (UTP) cable. Media types are not to be intermixed on any given LAN and only one LAN connection is used at a time.

Block Diagram



TEST CONFIGURATION

Exercise Software

The EUT exerciser program used during radiated and conducted measurements was designed to exercise the various system components, maximize the EUT Token Ring adapter card usage and by sending data blocks of "H"s to maximize emissions. This program resided on the EUT machine. This was the same program used to test the original card.

Description

The IBM PCI TOKEN-RING Adaptor was evaluated in a table-top personal computer (PC) possessing a PCI (local) bus . This PC was deemed by Development to be of typical usage. As required by ANSI C63.4(1992), a peripheral device was attached to each interface port. The TR adapter was attached to a remote system machine (server) over UTP media. Data was transferred over the Token Ring LAN from the EUT hardfile to the server hardfile and returned to the EUT.

The cables used were those deemed typical and representative of customer usage. Fifty-foot lengths of LAN cable were used to allow connection of the EUT in the chamber to the Token Ring server in the exerciser room.

Unshielded media was tested with a shielded IBM power cord, PN 6952304, and the results are documented in this report. A commerically available shielded power cord was also evaluated and found to be equivalent in performance.

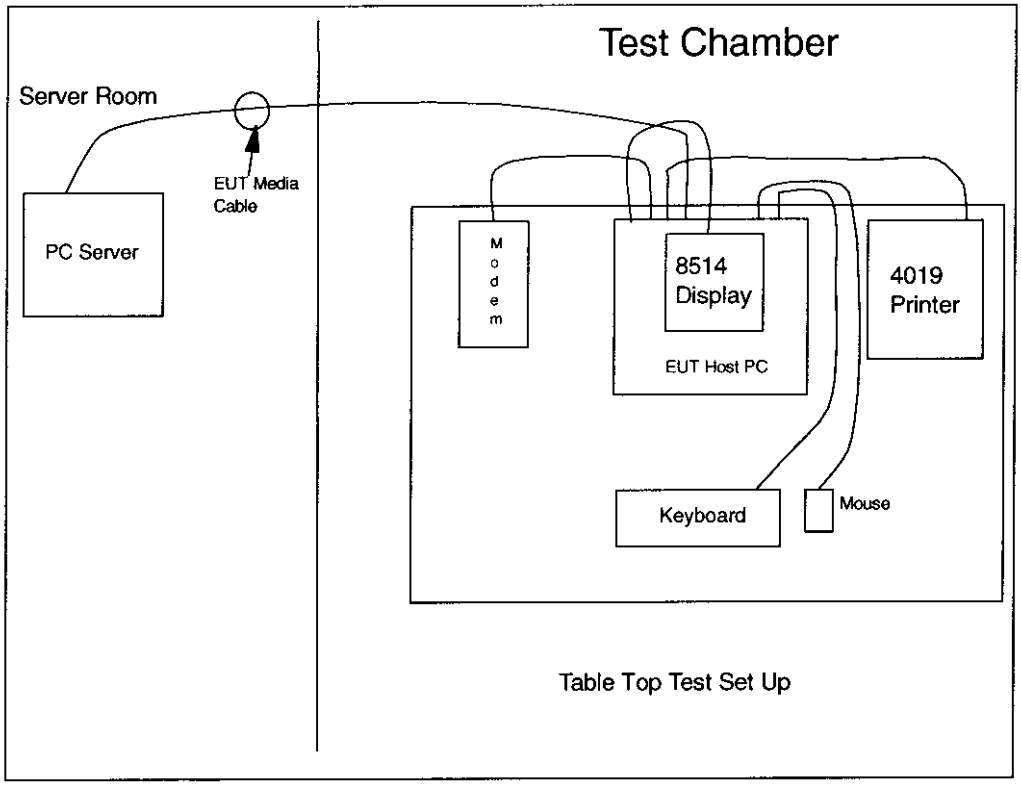
The following peripherals were attached to their respective PC interface ports:

* Monitor
* Printer (parallel port)
* Modem (connected to a serial port)
* Keyboard
* Mouse

Justification

Unshielded media cable and 16MBPS were determined to be the worst case test condition by comparative tests with both types of shielded media cable and data transmission speed.

Setup Diagram



TEST SITE INFORMATION

International Business Machines (IBM) Corporation
Networking Hardware Division EMC Test Facilities
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

- 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-02T(ITE)

- NVLAP Lab Code 200200-0
  Valid until: June 30, 1998

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: February 1, 1996 (31040/SIT, 1300F2)

- VCCI - Japan, Registration Number: R-413
  Dated: June 4, 1996
  Valid until: January 31, 1999

- New Zealand

- Taiwan - Accreditation No. SL2-IN-E-02T(ITE)
  NVLAP Lab Code 200200-0
  Valid until: June 30, 1998

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 CISPR-22 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		6/97	6/98
HP RF Pre-Selector	85685A	17843		2/97	2/98
HP Quasi-Peak Adapter	85650A	18075		6/97	6/98
HP Preamp	8447D	13989		3/97	3/98
HP Spectrum Analyzer	8566B	18073		6/97	6/98
HP Preamp	8449B	22024		2/96	2/98
EMCO Biconical Antenna	3108	13455		6/97	6/98 checked weekly
EMCO Log-periodic Antenna	3147	26639		8/97	8/98 checked weekly
EMCO Mast and Controller	1053	21810		2/97	2/98
EMCO Mast and Controller	1053	21811		2/97	2/98

Radiated Data:

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	QP Limit dBµV/m	Margin Limit dB
36.878	V	100	186	15.10	11.62	0.90	0	0	0	27.62	30.00	-2.38
255.999	V	100	84	44.42	12.12	3.34	27	0	0	32.98	37.00	-4.02
48.004	V	100	268	13.59	10.42	1.01	0.00	0	0	25.02	30.00	-4.98
46.003	V	100	339	12.92	10.94	0.98	0.00	0	0	24.84	30.00	-5.16
778.294	V	207	23	30.52	20.75	6.75	27	0	0	31.00	37.00	-6.00
59.872	V	312	0	13.14	9.70	1.12	0	0	0	23.96	30.00	-6.04

Attested by: Roger Poethuman

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 EN 55022 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 CISPR-22 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	25014		6/97	6/98
HP 85650A Quasi-Peak Adapter	85650A	15734		6/97	6/98
HP Preselector	85685A	24931		12/97	12/98
EMCO LISN (110 V)	3825/2	13459		7/97	7/98
EMCO LISN (220v)	3825/2	13460		7/97	7/98
EMCO LISN (peripherals)	3825/2	23522		7/97	7/98
EMCO LISN	3825/2	23523		7/97	7/98

Conducted Data:

115 V, 60 Hz

Frequency MHz	Phase	QP Measured dBµV	Average Measured dBµV	Atten dB	QPActual dBµV	Average Actual dBµV	QPLimit dBµV	Average Limit dBµV	Margin From Limit dBµV
0.317	2	32.00	31.10	11.00	43.00	42.10	59.78	49.78	-7.7
0.190	1	34.29	34.40	11.00	45.29	45.40	64.03	54.03	-8.6
16.001	2	29.97	29.00	11.00	40.97	40.00	60.00	50.00	-10.0
1.140	1	26.72	23.72	11.00	37.72	34.70	56.00	46.00	-11.3
9.285	1	27.77	15.20	11.00	38.77	26.20	60.00	50.00	-21.2
14.005	2	25.24	16.80	11.00	36.24	27.80	60.00	50.00	-22.2
NOTE: A product is compliant if the average limit is met using quasi-peak measurement data.									

Attested by: Roger Pasturaux

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 EN 55022 Class B Computing Device Limits.

APPENDIX

FCC Compliance Label

See identification photos.

Location of FCC Label on EUT

See identification photos.

FCC Publication Compliance Statements

See attached.

Identification Photos

See attached.