FCC Part 15, Subpart C (Intentional Radiator)

Product Name: ThinkPad A22

(2628-WxU/WxF/WxJ/VxU/VxF/VxJ)

FCC ID: ANOM380211B

March 27, 2001

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MEASUREMENT/TECHNICAL REPORT – Part 15 Subpart C
(Intentional Radiator)

ThinkPad A22
(2628-WxU/WxF/WxJ/VxU/VxF/VxJ)

FCC ID : ANOM380211B

March 27, 2001

This report concerns: (check one)
Original Grant ✓
Class I change
Class II change

Equipment type: Wireless LAN device in Computer (computer, printer, modem, etc.)

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The measurement results contained in this report relate only to the item which was tested.

Measurement procedure used is ANSI C63.4-1992 unless otherwise specified.
Other test procedure: _____

The FCC has issued provisional acceptance of this test laboratory for Declaration of Conformity testing per letter dated June 30, 2000.

APPLICANT ANTI-DRUG ABUSE CERTIFICATION:
By checking yes, the applicant certifies that, in the case of an individual applicant, he or she is not subject to a denial of federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse of 1988, 21 U.S.C. 853(a), or, in the case of a non-individual applicant (e.g. corporation, partnership or other unincorporated association), no party to the application is subject to a denial of federal benefits, that includes FCC benefits, pursuant to that section. For the definition of a "party" for these purposes, see 47 CFR 1.2002(b).

(Yes) or No

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Operational Description

1. Objective

This is a Certification Compliance Report for FCC Part 15, Subpart C (Intentional Radiator). The name of applying euipment is ThinkPad A22.

2. Product Description

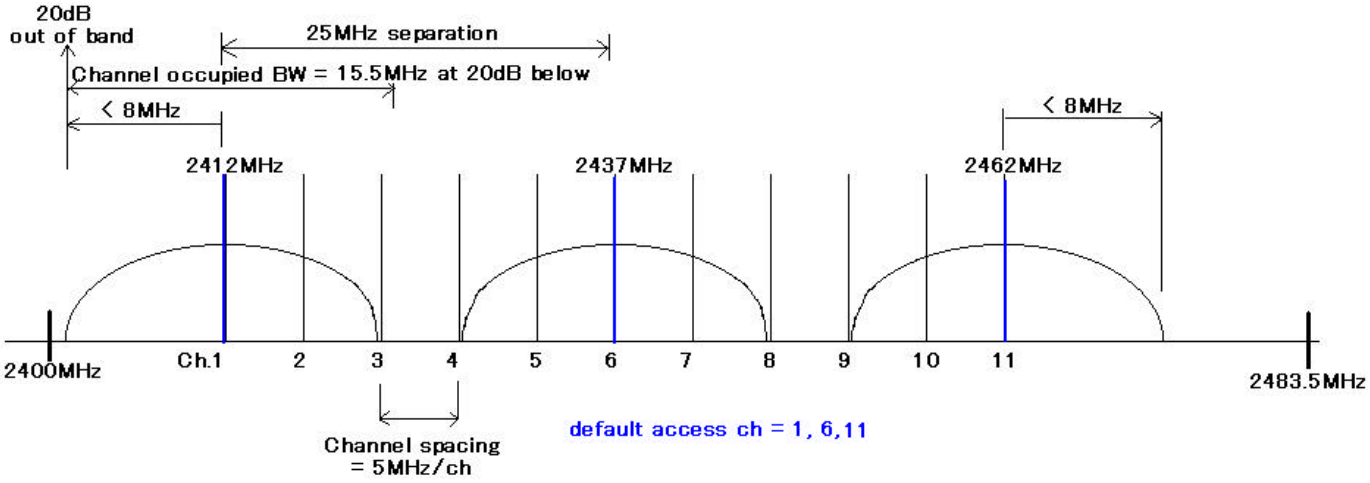
The applying equipment is a portable type notebook personal computer integrating IEEE 802.11b Wireless LAN function inside. The wireless module consists of an OEM card(Lucent PCI IEEE802.11b Wireless LAN card) and IBM original integrated 2 antennas(Inverted F-figure type antennas).
The feature of the applying equipment is as follows :

Table 1 : Specification of PC main body

Model Identification		ThinkPad A22					
Product number (Order code)		2628-WxU	2628-WxF	2628-WxJ	2628-VxU	2628-VxF	2628-VxJ
PC Functions	Max. size	317mm(W) : 267.5mm(D) : 36.7mm(H)					
	Max.Weight	3.178Kg					
	Hard disk	2.5” 30 GB			2.5” 10 GB		
	Memory	128MB			64MB		
	Bay Device	DVD-ROM			CD-ROM		
	Power	AC adapter, Battery(LiIon)					
	I/O Interface	56Kbps software modem, PCMCIA slot (type-2 x 1), USB(x1), external CRT/Keyboard/Mouse, TV-out, Headphone, Mic-in, Internal FDD, IR port, RJ-11, RJ-45, Printer(parallel I/F), Serial port					
	CPU	Intel® Mobile Geyserville® 1GHz			Intel® Mobile Geyserville® 900MHz		
	LCD	14” TFT					
	Keyboard	English	French	Japanese	English	French	Japanese
	Pre installed Software	Win 2K, Win ME, Win 98SE, Win 95, Win NT					

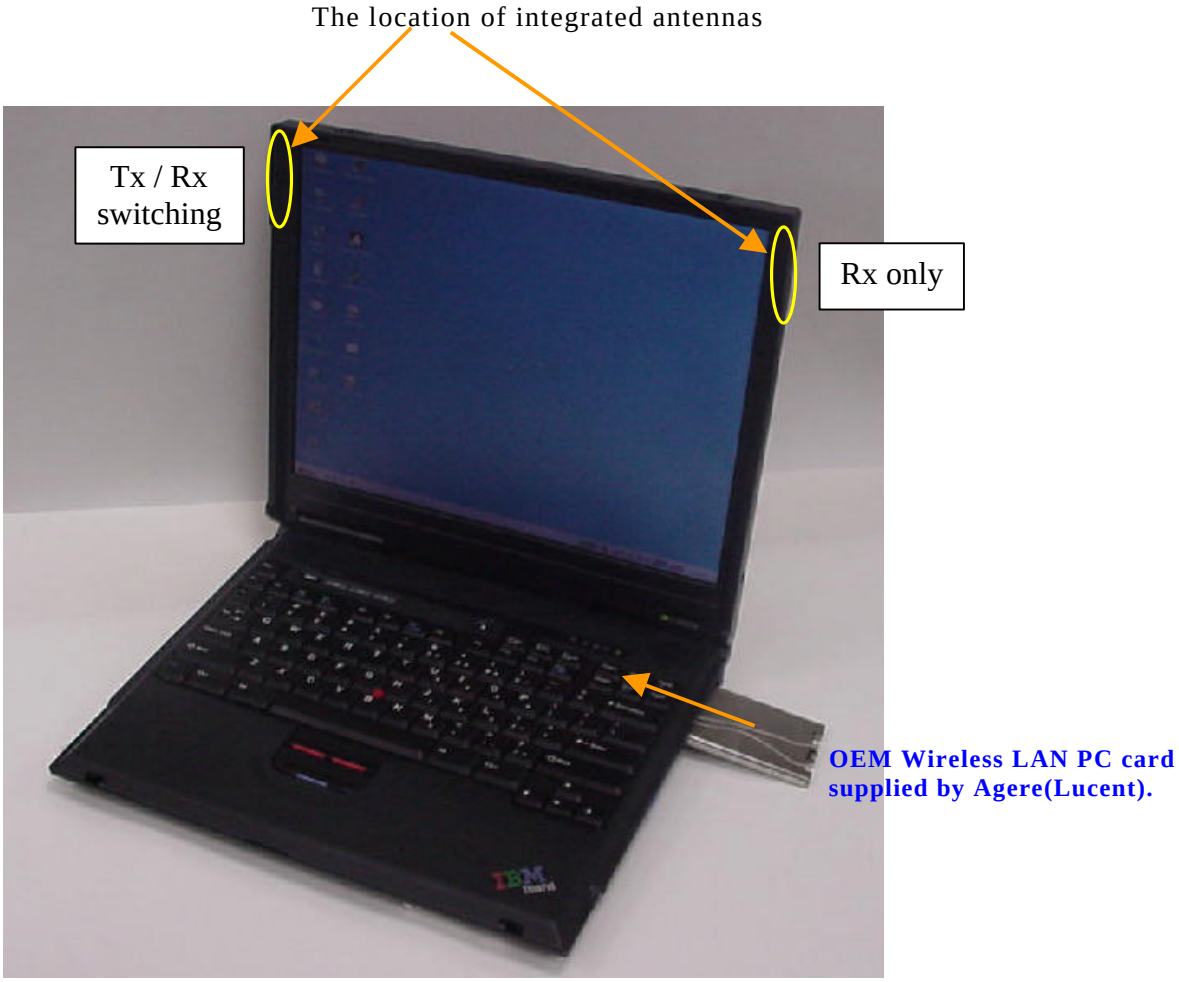
Table 2 : Specification of Wireless-LAN feature

Carrier Frequencies	2412MHz - 2462MHz			
Occupied BW at 20dB below	2404.23MHz - 2469.57MHz			
Channels	Total 11 channels (default setting ch. # : 1, 6, 11)			
Channel BW at 20dB below	Max. 15.5MHz / ch			
Channal spacing	5 MHz			
Conducted emission Power	15.6 dBm			
Antenna gain	1.4 dBi			
Antenna type	Inverted F-figure type antenna x 2			
Antenna cable length	Tx/Rx switching antenna : 830mm Rx antenna : 630mm			
Bit rate	1 Mbit/sec	2 Mbit/sec	5.5 Mbit/sec	11 Mbit/sec
Chip/symbol rate	11	11	8	8
Bit/symbol rate	1 (DBPSK)	2 (DQPSK)	4 (CCK)	8 (CCK)
Chip/bit rate	11	5.5	2	1



3. Mounting structure of Wireless LAN PC card and Antenna

note) The left side of inverted F-figure type antenna is used for both RF transmission and receiving with half duplex switching mode. The right side one is used for RF receiver only. When the Wireless PC card is in RF receiving state, one of the antennas is selected automatically which tends to have a good quality of communication.



4. Related Submittal(s)/Grant(s)/Notes

- The device without Wireless LAN function is classified as a digital device under Part 15 Subpart B and subject to DoC.

5. Circuitry description of the Wireless LAN PC card

DESCRIPTION OF THE BLOCK DIAGRAM

The various parts of the Block diagram are numbered and an explanation is given of these blocks.

First the transmitter will be described:

A) Digital Signal Processor. (22)

Function : Generate spreaded signal with an Barker sequence of 11, the original raw data rate of 1, 2, 5.5 or 11 Megabits is transformed to a symbol rate of one MegaBaud and multiplied with eleven and modulated with a DQPSK (Differential Quadrature Phase Shift Keying) Modulation for 1 and 2 Mbps or DQPSKCCK (CCK = Complementary Code Keying) for 5.5 and 11 Mbps. The unfiltered data comes out of I and Q and goes to the up/down mixer (6)

B) The above signals are mixed in (6) in a so called quadrature modulator with the Intermediate Frequency (IF) of 352 MHz.

C) The upmixer is fed by the VCO of 704 MHz, which is divided by 2 to 352 MHz.

D) The SAW (8) filters all unwanted mixing products, such that only the 352 MHz band remains.

E) This signal goes into the RF upmixer (9) SA2420 were it is mixed with the RF VCO with a range of 2050 to 2150 MHz.

F) The Rx/Tx switch (17) brings the signal to the variable attenuator (10), where the output level is controlled.

G) The signal is fed through a 2.4- 2.5 GHz bandpass filter (11) to remove all unwanted mixer products, and thus to get a clean signal for further processing.

H) The signal is amplified in (12), with approx 23 dB to an output level of approx. 15 dBm

I) This signal goes to the RX/TX antenna (23/24) via the special connector with a switch inside to disable the antenna.

J) The output power is controlled with a so called power feed back loop (15) in which the output power is compared with a DAC value from (10)

Receiver functions.

K) The receive signal enters the antenna passes the RX/TX switch (14) and (13) this is set to RX mode.

L) The signal goes through the 2.4 GHz filter (16) to remove all unwanted spectral components in order to deliver a clean signal for the receiver.

M) A Low Noise Amplifiers (LNA) (in 9) is used to amplify the weak signal to a level fitted for down mixing.

N) The AGC (27) can amplify or attenuate the signal according to the Digital signal processor required input with a step size of 26 dB.

O) Again the Rx/Tx switch in the Rx mode is passed and also the same filter as in transmit mode (18).

P) The down mixer (9) mixes the 2.4 GHz with the 2.1 GHz to the 352 MHz IF.

Q) The signal of 352 MHz is amplified again (9) and filtered by a SAW filter (19) to give a clean signal for the second mixer.

R) The Downmixer (6) mixes the 352 MHz signal down to the I and Q signals, also the auto gain control can increase the level to the required level via line 20.
S) The very low amplitude baseband I and Q signal is amplified in the AMPs (6) to a level fitted for the Analog to Digital converters (22), which make it a proper signal for the digital signal processor.

T) The digital signal processor (22) removes the spreading as present on the signal with a so called autocorrelation function. The resulting output of the processor is a received data rate of 1, 2, 5.5 or 11 Megabits.

VCO , PLL and OSC.

U) These three form one entity to generate a single tone signal for down mixing.
There are two of these blocks available, one for the IF LO (7 and 6) (352MHz) and one for the RF LO (25 and 26) of 2050 to 2150 MHz.
V) All the PLL's and the processor (2) have one reference Crystal of 22 MHz (4) with an accuracy of 25 ppm.

General circuits:

W) Antenna Diversity.
This functin may be placed on the radio board or on extended board (as part of external antenna.
Depending on the signal strength and signal quality the Digital processor (22) can choose between the two antenna's (23) and (24) which gives the best signal. This is done initial during the training sequence in the received signal.

X) Automatic Gain control.
Depending on the signal strength and signal quality the Digital processor (22) can choose to increase or decrease the signal level at the digital input, this is done by reducing or increasing the gain in the receiver via the LNA-AGC (in 9).

Y) The Signal processor (22) can read via the MAC (2) the registers for programming all parameters for transmit/receive functions

Z) The MAC is used to do the handshaking with the PCMCIA bus (1) and handling the IEEE protocol. Also used to load the PLL frequencies and dividers, also used to interface to the FlashROM which contains all parameters for the PLL's and the Callcode.

AA) Not shown is the regulator to supply the 3.3 Volt out of the 5 Volt out of the PCMCIA Bus (1)