

FCC Part 15, Subpart C (Intentional Radiator)

Product Name: ThinkPad i Series 1300
(1171-5BU/5WF/5WU/7WF/7WU)
ThinkPad 130
(1171-5WJ/7WJ)

FCC ID: ANO12P701Z

November 28, 2000

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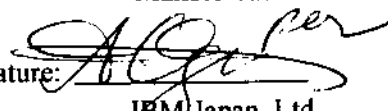
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MEASUREMENT/TECHNICAL REPORT – Part 15 Subpart C (Intentional Radiator)

ThinkPad i Series 1300, ThinkPad 130
(1171-5BU/5WF/5WU/7WF/7WU) (1171-5WJ/7WJ)

FCC ID : ANO12P701Z

November 17, 2000

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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1. OPERATION DESCRIPTION (GENERAL INFORMATION)

1.1 Objective

This is a Certification Compliance Report for FCC Part 15, Subpart C (Intentional Radiator).
The names of applying equipment are ThinkPad i Series 1300, and ThinkPad 130.

1.2 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 miniPCI IEEE802.11b Wireless LAN card) and IBM original integrated 2 antennas(inverted F-figure type, and slot type antenna). These models feature as follows;

Table 1 : Specification of PC main body

Model Identification		ThinkPad i Series 1300					ThinkPad 130	
Product number (Order code)		1171-5WU	1171-5BU	1171-5WF	1171-7WU	1171-7WF	1171-5WJ	1171-7WJ
PC Functions	Max. size	313mm(W) : 252mm(D) : 36.6mm(H)						
	Max.Weight	2.675Kg						
	Hard disk	2.5" 10 GB						
	Memory	64MB						
	Power	AC adapter, Battery(LiIon)						
	I/O Interface	CD-ROM drive, 56Kbps software modem, PCMCIA slot (type-2 x 1 or type-3 x 1), USB(x2), external CRT/Keyboard/Mouse/FDD, Headphone, Mic-in, RJ-11, Printer(parallel I/F)						
	CPU	Intel® Mobile Celeron® 650			Celeron 700		Cel. 650	Cel. 700
	LCD	12" TFT			13" TFT		12" TFT	13" TFT
	Keyboard	English		French	English	French	Japanese	
	Pre installed Software	Win ME	Win ME AAL *1	Win ME				

*1 : AAL (Anytime Anywhere Learning) is a name of a pre-installed application

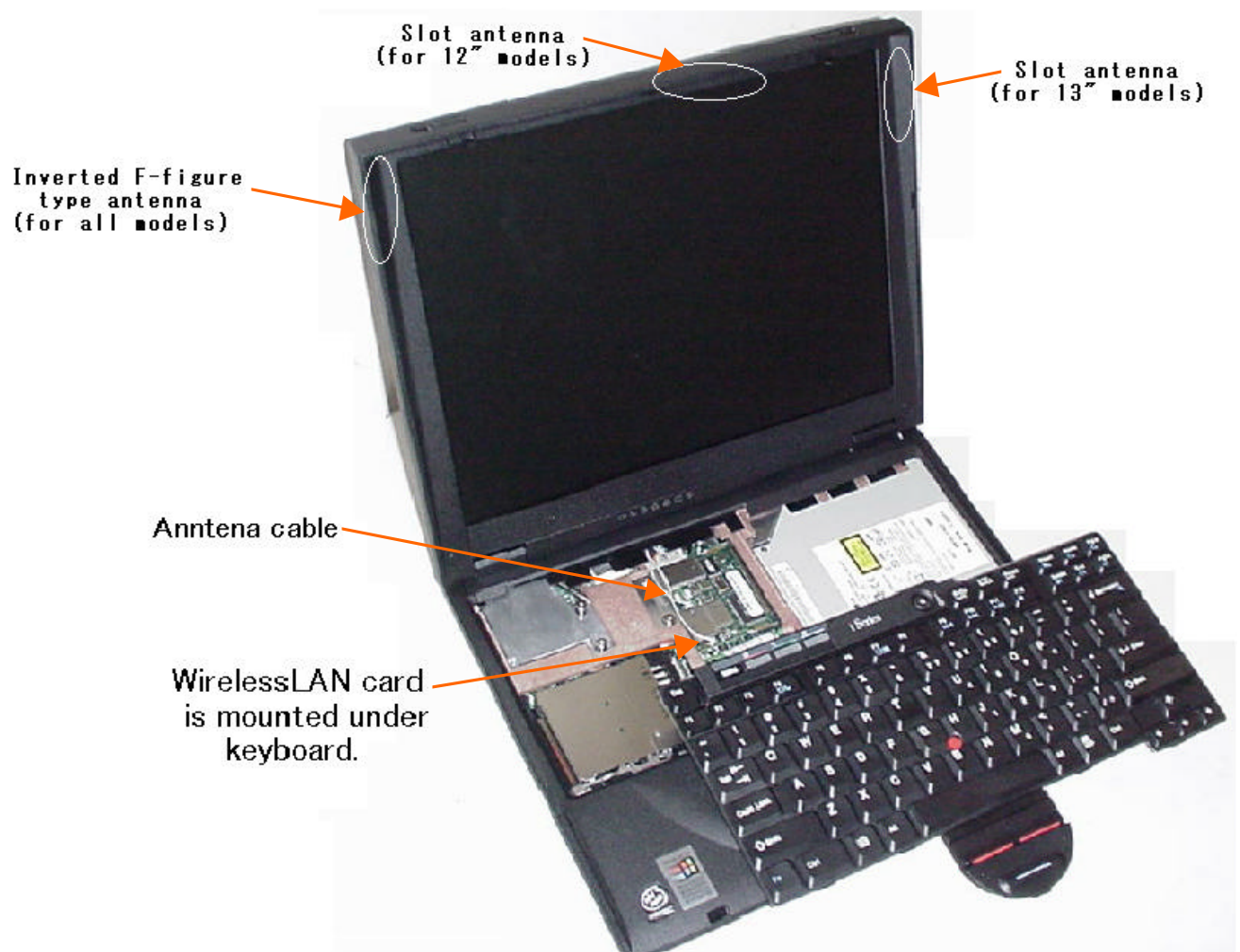
Table 2 : Specification of Wireless-LAN feature

Model Identification		Common for both models			
Wireless Function		Reference page of test report			
	Radio Frequency	2412MHz(ch.1) – 2462MHz(ch.11) (11 of 13)			
	Conducted emission Power	17.5 dBm (APPENDIX A11)			
	Antenna gain	- 1.2 dBi (11 of 13)			
	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

1.3 Mounting structure of Wireless-LAN card and Antenna

note) The inverted F-figure type antenna is common for all models, and used for both RF transmission and receiving with half duplex switching mode. The slot antenna is used for RF receiver only. When the wireless card is in RF receiving state, it selects one of antennas(inverted F or slot) automatically which tends to have a good quality of communication.

Figure 1: Locations of IEEE802.11b Wireless-LAN mini-PCI card and Antenna



1.4 Circuitry description of the Wireless-LAN mini-PCI card

The various numbers of parts given in the following explanation are corresponding to the numbers in the Block diagram shown in Chapter 5.2.

1.4.1 Transmitter functions

A) Digital Signal Processor. (22)

Function : Generate spread signal with an Barker sequence of 11, the original raw data rate of two Megabits is transformed to a symbol rate of one Mega Baud and multiplied with eleven and modulated with a DQPSK (Differential Quadrature Phase Shift Keying) Modulation. 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 where 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 special connector.

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).

1.4.2 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 Analogue 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 2 Megabits.

1.4.3 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.

1.4.4 General circuits

- W) Antenna Diversity.
Depending on the signal strength and signal quality the Digital processor (22) can select between two antenna's 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.
- Z) The MAC is used to do the handshaking with the miniPCI bridge chip bus (1) and handling the IEEE protocol. Also used to load the PLL frequencies and dividers, also used to interface to the EEPROM which contains all parameters for the PLL's and the Call code.

1.5 Related Submittal(s)/Grant(s)/Notes

There are no related submittals and grants.

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

1.6 Compliance Summary

The applying equipment (ThinkPad i Series 1300, and ThinkPad 130) does comply with the Part 15 Subpart C. Tests were performed by A-Pex International Co. Ltd.(test house) except the processing gain measured by Lucent Technologies.

1.7 Condition of EUT

The physical condition of the EUT tested:

☐ Prototype
☒ Preproduction
☐ Production

1.8 Dates of Receipt of EUT

The EUT was logged into Yamato EMC Engineering on October 23, 2000.

1.9 Dates of Measurements done by test house

Measurements were performed on October 31 through November 15, 2000.

1.10 EUT Details

Table 3 shows test system details.

Table 3 EUT and Peripheral Equipment List for Radiated and Conducted Emissions

Model & S/N	FCC ID	Description	Cable Description
ThinkPad i Series 1300 (S/N : AA-005LM)	ANO12P701Z	IBM Notebook PC ThinkPad i Series 1300 (1171-7WU, English, 13"LCD type) CPU: Intel Celeron 700MHz	
P/N 02K6544	N/A	Universal AC adapter 56W	Unshielded power cord

6. SCHEMATIC DIAGRAMS

The schematic diagrams are the Confidential documents and should be held in confidence per 47 CFR section 0.459.

7. USER'S MANUAL

Please refer to the separated exhibit file "[TP-i1300-Manual.pdf](#)".
The manual title is "ThinkPad i Series 1200/1300 User's Reference".
There are 2 models introduced, but the wireless model applied to this application is "[ThinkPad i Series 1300](#)" only.

The manual for the other applying equipment "[ThinkPad 130](#)" is omitted, since this model is Japanese version. The language is different, but the contents are the same.