

FCC Part 15, Subpart C (Intentional Radiator)

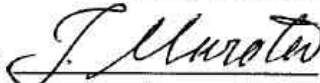
**Product Name: ThinkPad X30 Series
Multiple Transmitters model**
(Machine type : 2672/2673)

FCC ID: ANOTK1TP10HOP

May 14, 2002

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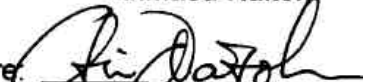
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Operational Description

1. Objective

This is a Certification Compliance Report for FCC Part 15, Subpart C (Intentional Radiator).

- The applying equipment : ThinkPad X30 Series
- FCC ID : ANOTK1TP10HOP

2. Product Description

The applying equipment is a compact size laptop computer integrating IEEE 802.11b Wireless LAN and Bluetooth functions inside.

The specification of the applying equipment is as follows :

- The **Wireless LAN feature** consists of an OEM card (Intel Corp., IEEE802.11b Wireless LAN Mini-PCI card) and IBM original integrated antennas (Inverted F-figure type antenna × 2).
 - The **Bluetooth feature** consists of an OEM card (TDK Systems Europe Ltd., Bluetooth standard card) and IBM original integrated antenna (Inverted F-figure type antenna × 1).
- The all wireless features (antennas and cards) are built in the applying equipment by IBM .

Table 1 : Specification of PC main body

Model Identification		ThinkPad X30 Series
Machine Type Number		2672, 2673
PC Functions	Max. size	273mm(10.7")(W) : 223mm(8.8")(D) : 24.9-30.2mm(0.98-1.19")(H)
	Max. weight	3.7 lbs
	Hard disk	2.5" Max. 60GB
	Memory	256MB
	Bay Device	none
	Power	AC adapter, Battery (Li-Ion)
	Ports & Slots	Parallel, CRT, Headphone, Microphone, Line In, USBx2, 4MB IR, Port Replicator/Slicer/Docking, Ethernet, Modem, PCMCIA slot (type-2 x 1), CF Slot (type2 x1)
	CPU	Mobile Intel® Pentium® III processor-M, 1.06GHz or 1.20GHz
	LCD	12.1 inch TFT XGA
Integrated Wireless feature		IEEE802.11b Wireless LAN, Bluetooth

Table 2 : Specification of IEEE802.11b Wireless-LAN feature

IBM internal product name	IBM High Rate Wireless LAN Mini-PCI Adapter with Modem II			
Carrier Frequencies	2412MHz – 2462MHz			
Occupied BW at 20dB below (Band-edge)	2403.65MHz – 2470.79MHz			
Channels	Total 11 channels (default setting ch. # : 1, 6, 11)			
Channel BW at 20dB below	Max. 17.16 MHz / ch			
Channel spacing	5 MHz			
Conducted emission Power	17.1 dBm			
Antenna gain	1.42 dBi			
Antenna type	Inverted F-figure type antenna Tx/Rx switching antenna : IBM P/N: 46L4677 Rx antenna : IBM P/N: 46L4676			
Antenna cable type and length	Tx/Rx switching antenna : coax 380 mm Rx antenna : coax 520 mm			
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

Table 3 : Specification of Bluetooth feature

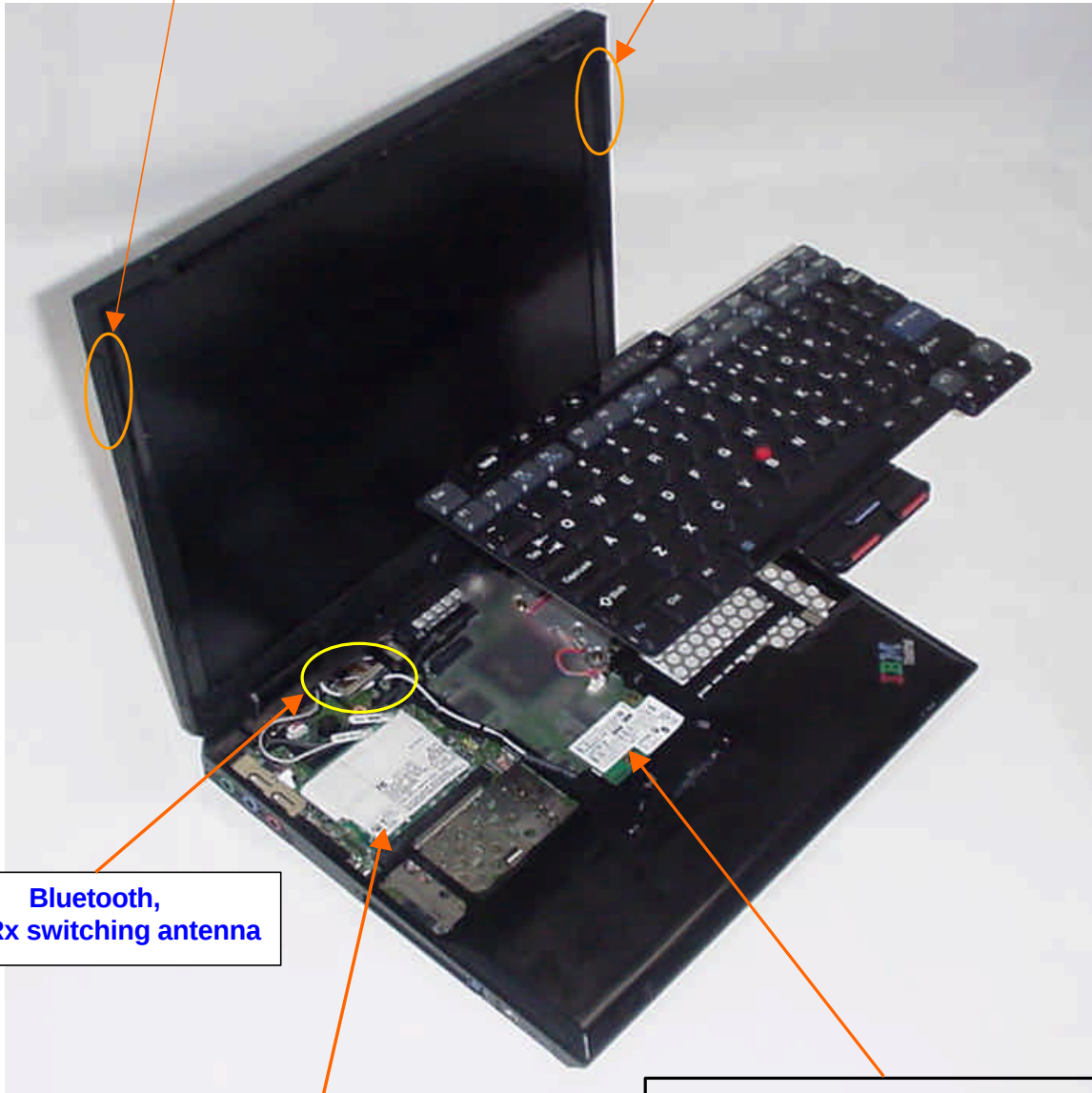
IBM internal product name	IBM Bluetooth Daughter Card			
Carrier Frequencies	2402MHz – 2480MHz			
Occupied BW at 20dB below (Band-edge)	2401.690MHz – 2480.442MHz			
Channels	Total 79 channels (Inquiry / Paging mode : 32 channels)			
Channel BW at 20dB below	Max. 0.73 MHz / ch			
Channel spacing	1 MHz			
Conducted emission Power	3.6 dBm			
Antenna gain	2.43 dBi			
Antenna type	Inverted F-figure type antenna IBM P/N: 46L4680			
Antenna cable type and length	coax 185mm			

3. Mounting structure of Wireless features

The left antenna in LCD is used for both RF transmission and receiving with half duplex switching mode. The right antenna is used for RF receiver only. When the Wireless LAN card is in RF receiving state, one of the antennas is selected automatically to have a good quality of radiocommunication.

**Wireless LAN,
Tx / Rx switching antenna**

Wireless LAN, Rx antenna



**Bluetooth,
Tx / Rx switching antenna**

**OEM Bluetooth standard card
supplied by TDK Systems Europe Ltd.
(no FCC ID)**

**OEM IEEE802.11b Wireless LAN Mini-PCI card
supplied by Intel Corp..**

**Reference: The card is also granted as a LMA
device (FCC ID: J3OM3AWEB56GA).**

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

The host unit with full peripheral devices including the applying wireless modules as an unintentional radiator is classified as a Digital Device under the FCC Part 15 Subpart B or the Industry Canada Class B Emission Compliance (ICES-003), and subject to DoC.

5. Circuitry description of the Wireless LAN PC card

Because of the confidentiality request by the original card manufacturer (Intel Corp.), the circuitry description of the wireless LAN card should be held in confidence per the FCC 47 CFR Section 0.459.

6. Circuitry description of the Bluetooth card

Reference: Bluetooth Daughter Board hardware specifications
by TDK Systems Europe Ltd.

Refer to circuit drawings in “Schematic Diagrams of IBM Bluetooth Daughter Card”.

The first page shows the main assembly layout of the card.

Sheet 1 of 3 refers to the bluetooth core (control circuit).

Sheet 2 of 3 refers to the RF section.

Sheet 3 of 3 contains no actual circuit information, only the interconnection between vias on the PCB.

Most of the functionality of the circuitry is contained within the CSR Bluecore chip. The PCB contains, in addition to the Bluecore chip, a flash memory (U2), a low noise RF amplifier,(U6) antenna switching (U5), and a linear power supply regulator (U3).

The antenna socket is routed by U5 RF changeover switch to either the input of the low noise RF amplifier U6, or the output of the PA stage, U4. Bluetooth IC U1 delivers the RF send signal via a Multilayer Balun, B1, to U4. Antenna switching is controlled from the Bluecore chip U1.

U4 provides extra power gain to compensate for the fall off in RF output from the U1 at elevated temperatures.

The Bluecore chip contains RF receiver and transmitter circuitry, 10K of 16 bit words of RAM, organized into circular buffers for temporary storage of incoming and outgoing data, a memory manager, DSP as part of the radio block, and internal 16 bit microcontroller. The flash memory U2 serves to hold settings and program code for the Bluecore chip U1.

The Bluecore chip can interface to a USB port, and optionally to an RS232 interface. In this design the USB port only is used.

A separate power supply regulator is used (U3), because it can provide a higher current capability than the regulator within the Bluecore chip, which would need an external pass transistor and extra components. This is a low-dropout regulator providing a nominal 3.0V internal supply.

The Bluecore-01 contains a USB controller and is directly connected via a 40 way Hirose DF12-40DS-0.5V to a mating 40W compatible connector on the motherboard. All functions of the Bluecore IC are controlled via the USB bus from the motherboard. The Bluecore control is also via the USB bus, including firmware upgrades.

An alternative control / programming interface for the Bluecore IC is via it's SPI interface, accessible by fitting the optional connector JP1. This is a contingency measure which will also allow the flash device to be programmed before the USB port is configured.