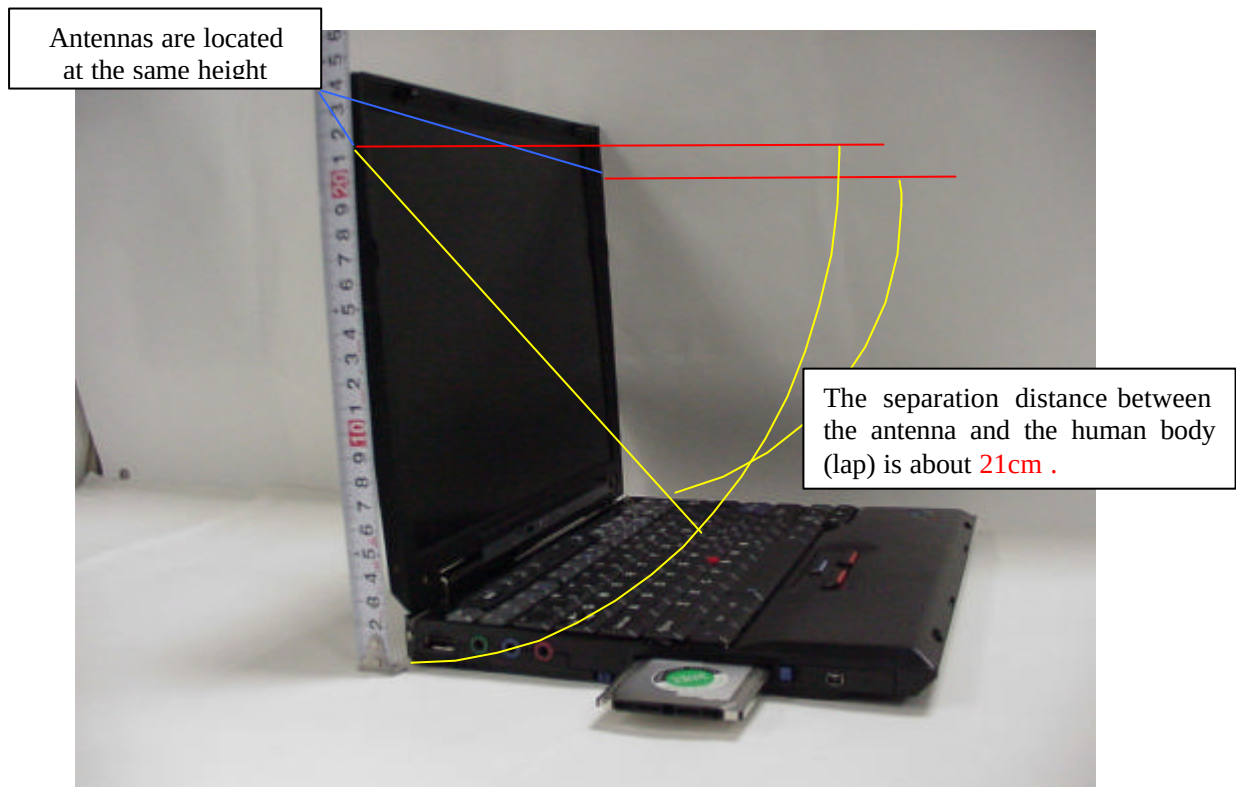


RF Exposure

1. RF Exposure evaluation for the applying transmitter

Evaluation for ThinkPad X30 Series

As shown in the following photo, both main and auxiliary WLAN antennas of the applying laptop PC, IBM ThinkPad X30 Series, are located at the upper part of the display (LCD) bezel. The separation distances between the antennas and the human body are 20cm or more. Therefore the laptop PC can be categorized as a mobile device by FCC CFR 47 Section 2.1091.



The highest conducted peak output power of the Test Report is 97.7mW (19.9dBm) and the maximum antenna gain is 1.28 dBi (See page 6/9 of the exhibit "Host Unit Information of Thinkpad X30 Series").

Therefore the peak radiated output power (EIRP) is calculated as follows.

$$\text{EIRP} = P + G = 19.9 \text{ dBm} + 1.28 \text{ dBi} = 21.18 \text{ dBm} (131.2\text{mW})$$

Then, the maximum power density at 20cm distance is calculated as :

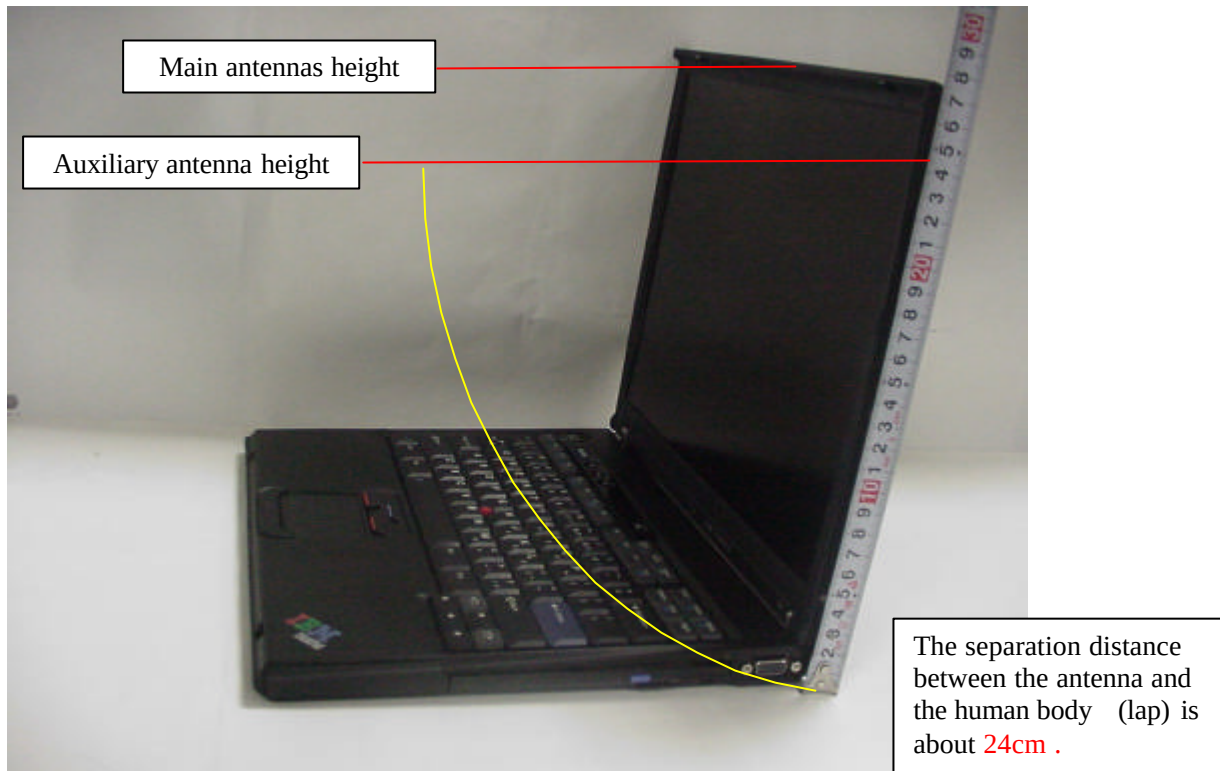
$$S = \text{EIRP} / (4 \times R^2 \times \pi) = 0.0261 \text{ mW/cm}^2$$

Since the applying laptop PC's WLAN transmitter does not function to emit the radio frequency from both diversity antennas simultaneously, the above value is the maximum RF exposure to the persons and is below the MPE limit (1.0 mW/cm^2). Therefore the laptop PC meets the MPE requirements for General Population/Uncontrolled exposure.

Evaluation for ThinkPad T40 Series

As shown in the following photo, the main antenna, an inverted F-figure type antenna, is built in the top portion of the LCD, and the auxiliary antenna, a coupled floating element antenna, is built in the upper right side of the LCD.

The separation distances between the antennas and the human body are 20cm or more. Therefore the laptop PC can be categorized as a mobile device by FCC CFR 47 Section 2.1091.



The highest conducted peak output power of the Test Report is 97.7mW (19.9dBm) and the maximum antenna gain is 0.99 dBi (See page 6/11 of the exhibit "Host Unit Information of Thinkpad T40 Series").

Therefore the peak radiated output power (EIRP) is calculated as follows.

$$\text{EIRP} = P + G = 19.9 \text{ dBm} + 0.99 \text{ dBi} = 20.89 \text{ dBm} (122.7 \text{ mW})$$

Then, the maximum power density at 20cm distance is calculated as :

$$S = \text{EIRP} / (4 \times R^2 \times \pi) = 0.0244 \text{ mW/cm}^2$$

Since the applying laptop PC's WLAN transmitter does not function to emit the radio frequency from both diversity antennas simultaneously, the above value is the maximum RF exposure to the persons and is below the MPE limit (1.0 mW/ cm²). Therefore the laptop PC meets the MPE requirements for General Population/Uncontrolled exposure.

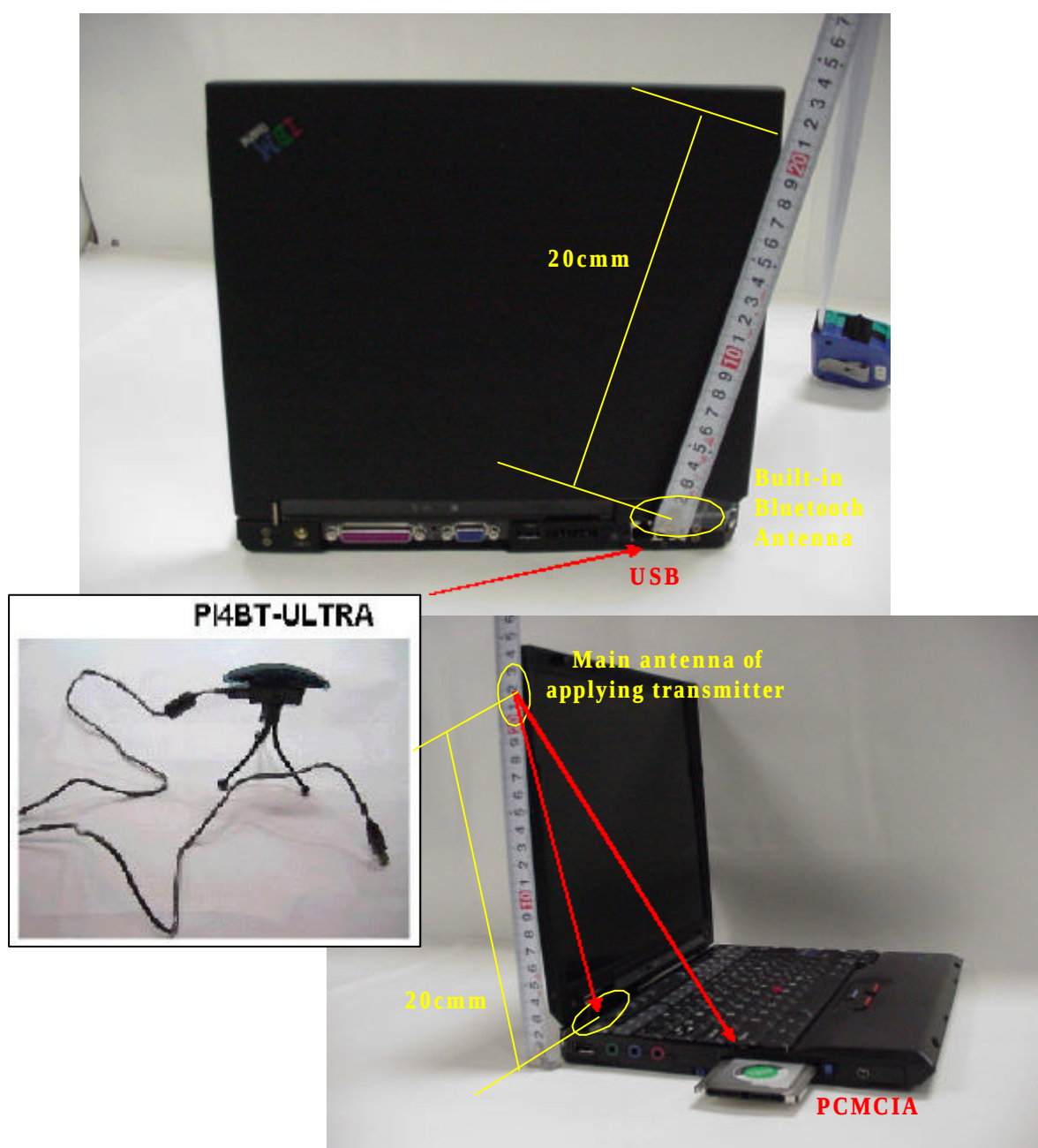
2. RF Exposure evaluation for Bluetooth transmitters

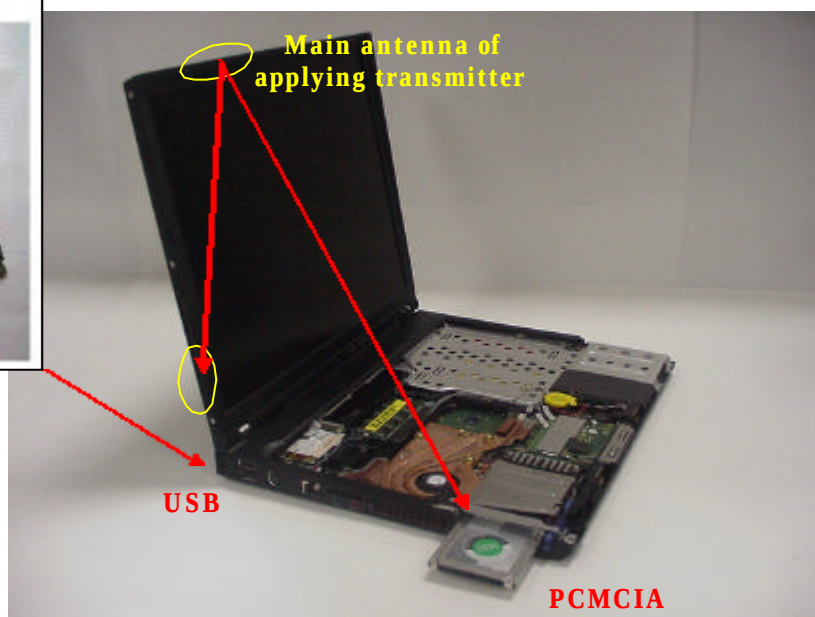
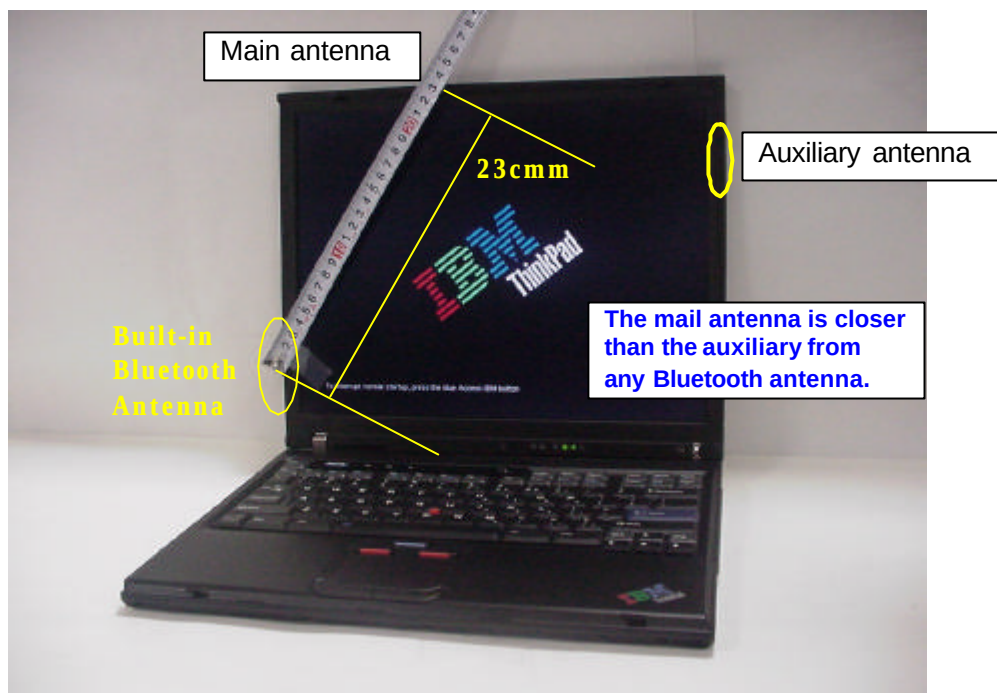
The applying laptop PCs (ThinkPad X30 Series and T40 Series) support three kinds of Bluetooth devices as follows.

	FCC ID	Grantee Name	Product Name	Granted Date	ERP in FCC Test Report
User's option	PI4BT-ULTRA	TDK Systems Europe Ltd.	Bluetooth Ultraport Module	May/22/2001	1.4 mW
	PI4BT-IBM-PCII		Bluetooth PC Card II	August/21/2001	1.0mW
Built-in type LMA Transmitter	ANO20020100MTN	IBM Japan, Ltd.	IBM integrated Bluetooth with 56K Modem	Under inspection with this application	2.58mW ^{*1}

*1: Refer the separate application document for FCC ID:ANO20020100MTN.

ThinkPad X30 Series Interfaces to connect Wireless options



ThinkPad T40 Series Interfaces to connect Wireless options

The main and auxiliary antennas of the applying transmitter in the LCD section are assembled apart from each Bluetooth antenna shown in the previous page with 20 cm or more distance.

Therefore the RF exposure evaluation for those Bluetooth transmitters is able to be done independently of the applying antennas. In other word, a collocated SAR testing is not required.

When a customer operates the applying PC on one's lap, the sufficient separation distance (minimum 20cm) between the above Bluetooth antennas and the person's body (lap) can not be maintained. That is, for the Bluetooth PC Card II (FCC ID:PI4BT-IBM-PCII) the minimum separation distance is approximately 1.5cm and for the built-in Bluetooth antenna the minimum separation distance is approximately 2.5cm. (Refer the separate application document for FCC:ANO20020100MTN).

But the footnote of the Section 3 in Supplement C to OET Bulletin 65 states ¹⁴ If a device, its antenna or other radiating structures are operating at closer than 2.5 cm from a person's body or in contact with the body, SAR evaluation may be necessary when the output is more than 50 – 100 mW, depending on the device operating configurations and exposure conditions.”

The total output power of the three Bluetooth transmitters in the previous table does not exceed 5mW. Therefore these transmitters also satisfy the RF exposure evaluation regarding CFR 47 Part 15.247(b)(4) without a SAR compliance test report, and can operate with the applying transmitter simultaneously.

IBM Web site guides to customers about the **grant condition** related to those collaborating transmitter devices. See page 4 of this exhibit.

3. IBM Web site for user's guidance concerning the co-located transmitters

Note) The contents will be available after the product announcement.

<http://www.pc.ibm.com/qtechinfo/MIGR-43693.html>

The screenshot shows the IBM PC support website. The main heading is "TP Wireless Systems – Approved wireless Mini PCI Options and Additional RF option devices receive FCC certification". Below this, there are sections for "Applicable countries/regions" (United States), "Service hints & tips", and "Affected configurations".

BIOS group 1

LMA (Limited Modular Approval) adapters	FCC IDs	Approved ThinkPad models	PC options allowed multiple transmission		
			#1	#2	#3
IBM High Rate Wireless LAN Mini PCI Adapter	ANOM3AWEB56GA	R32 Series T30 Series	NG	O	O
Cisco Aironet Wireless 802.11b	ANOU58H004	X30 Series(X30)			

BIOS group 2

LMA (Limited Modular Approval) adapters	FCC IDs	Approved ThinkPad models	PC options allowed multiple transmission		
			#1	#2	#3
Cisco Aironet Wireless 802.11b	ANOU58H004	R40 Series T40 Series	O	O	O
Intel PRO/Wireless LAN 2100 3B Mini PCI Adapter	ANO20020201CLK	X30 Series(X31)			
IBM High Rate Wireless LAN Mini PCI Adapter III	ANO20020200BRX	R40 Series			

NG: Not authorized to use by the FCC rule, nor recognized by BIOS.

#1: FCC ID: ANO20020100MTN [IBM Integrated Bluetooth with 56K Modem](#)

#2: FCC ID: P14BT-ULTRA [Bluetooth UltraPort Module from IBM](#)

#3: FCC ID: P14BT-IBM-PCI [Bluetooth PC Card II](#)

Solution

The supplementary document of ThinkPad's "Service and Troubleshooting Guide" has the following information in "Wireless regulatory information – USA Federal Communications Commission (FCC)" section:

Use of wireless options

Please make sure of the following conditions on use of wireless features.

1. Visit the IBM site at www.ibm.com/pc/qtechinfo/MIGR-43693.html and confirm the updated list of RF option devices that have been approved to cooperate with the integrated wireless feature.
2. When you use any other RF option device that is not listed on the IBM site, all other wireless features including the integrated transmitter in your ThinkPad computer are required to be turned off.
3. Users are requested to follow the RF Safety instructions on wireless option devices that are included in the RF option device's user's manual.

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