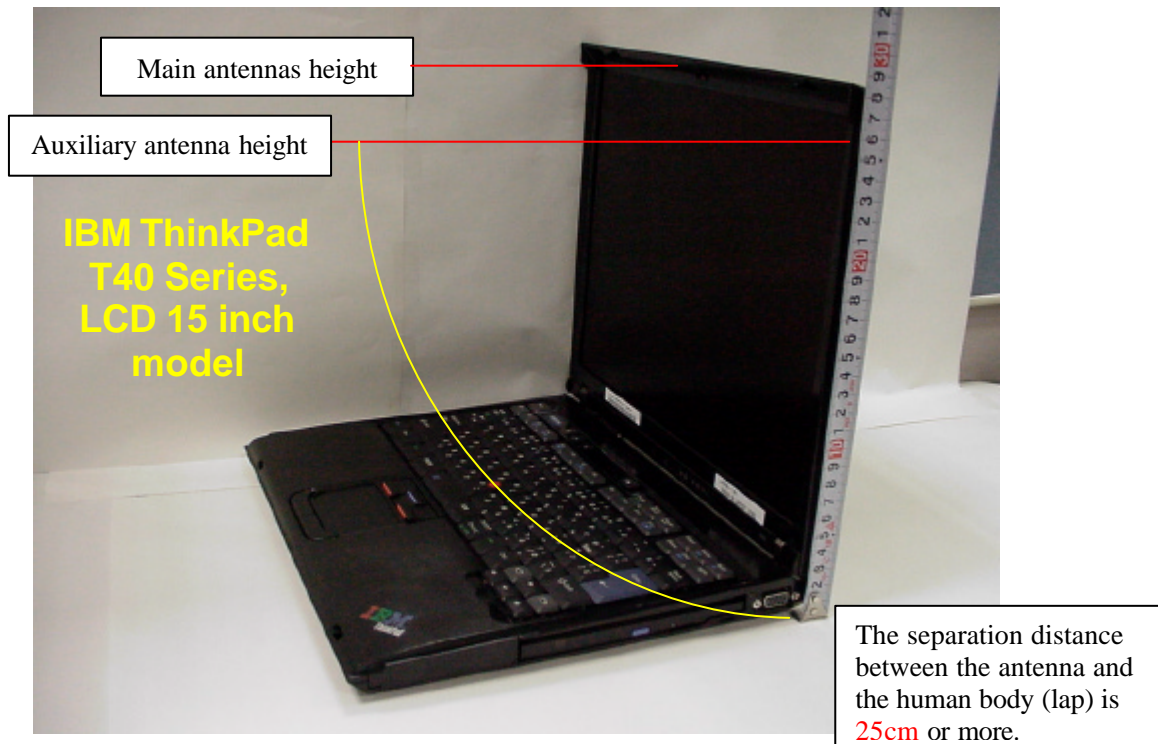


# RF Exposure evaluation

## 1. RF Exposure evaluation for the applying LMA transmitter

As shown below, the both transmission antennas (main and auxiliary) of the host PC devices (IBM ThinkPad T40 Series, LCD 15 inch model) are located at the upper portions of display (LCD) section, and the separation distance between each antenna and the human body is 20cm or more. Therefore the applying LMA transmitter and each antenna system is categorized as a mobile device by FCC CFR 47 Section 2.1091.



### [MPE evaluation]

The following table shows the highest conducted peak output power values of the applying modular device, and the maximum peak antenna gain of the host device.

Transmission mode	<b>P</b> : conducted peak output power	<b>G</b> : peak antenna gain
2.4GHz band DSSS	17.18 dBm (52.2 mW)	1.24 dBi
2.4GHz band OFDM	16.92 dBm (49.2 mW)	

With those results, the maximum power density at 20cm distance is calculated as follows.

Transmission mode	EIRP = P + G (dBm)	EIRP (mW)	Max. power density $S = \text{EIRP} / (4 \times 20^2 \times \pi)$
2.4GHz band DSSS	18.42	69.5	0.0138 mW/ cm <sup>2</sup>
2.4GHz band OFDM	18.16	65.5	0.0130 mW/ cm <sup>2</sup>

Since the applying modular transmitter device does not function to emit the radio frequency from both diversity antennas simultaneously, the above results are the maximum values of RF exposure to the persons, and are far below the MPE limit (1.0 mW/cm<sup>2</sup>). Therefore the LMA transmitter meets the MPE requirements for general Population/Uncontrolled exposure.

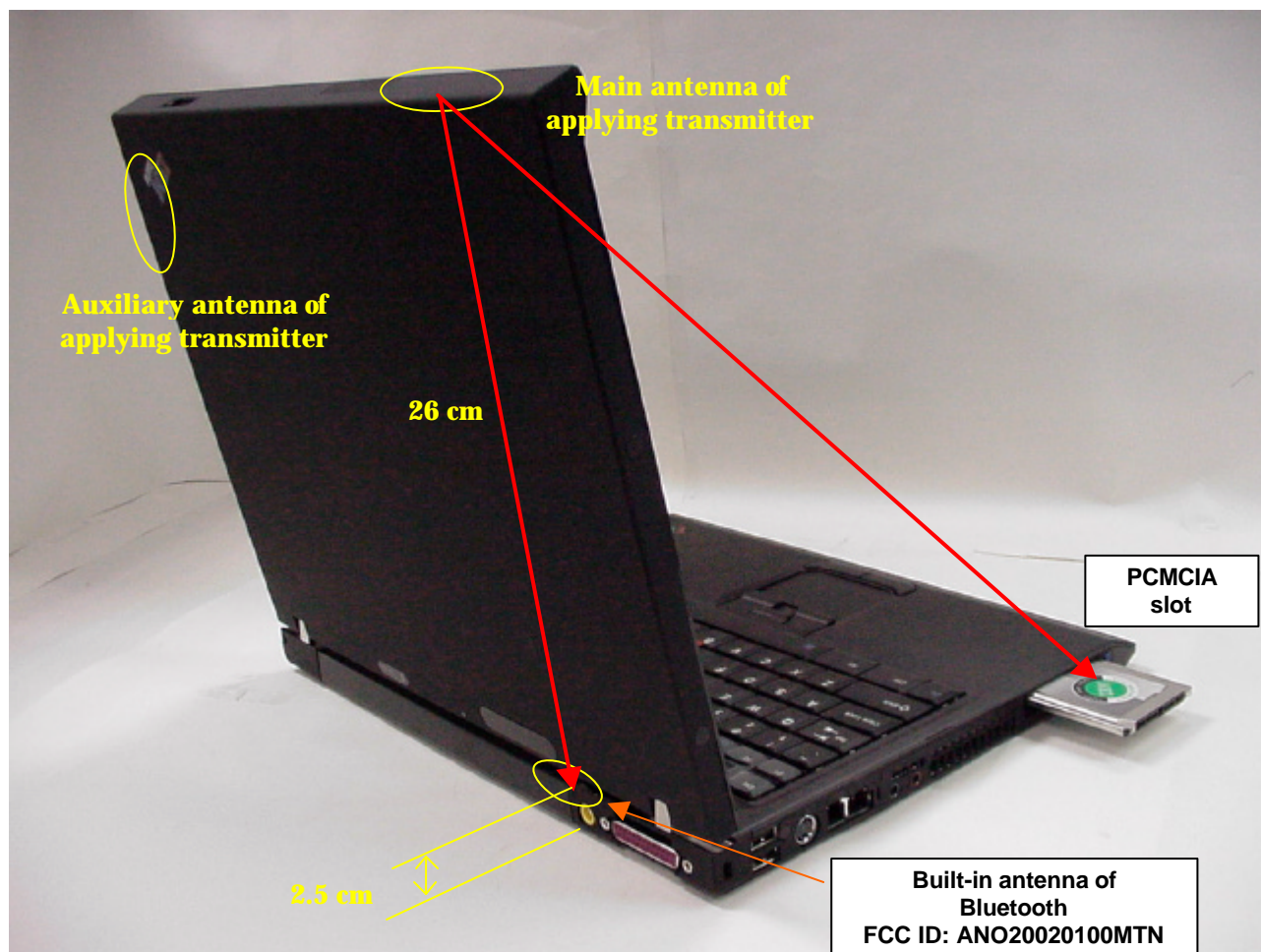
## 2. RF Exposure evaluation with co-located Bluetooth transmitters

The specific laptop PC, IBM ThinkPad T40 Series support the following two kinds of Bluetooth devices.

Option type	FCC ID	Grantee Name	Product Name	Granted Date	Power in Test Report
PCMCIA	PI4BT-IBM-PCII	TDK Systems Europe Ltd.	Bluetooth PC Card II	August/21/2001	1.0mW
Built-in LMA Transmitter	ANO20020100MTN	IBM Japan, Ltd.	IBM integrated Bluetooth III with 56K Modem	Feb/26/2003 (T40 14")	2.5mW
				*1 (T40 15")	

\*1: under certification process with this application.

### Collocated Bluetooth options for ThinkPad T40 Series. LCD 15 inch Model



The main and auxiliary antennas located at LCD section of the host device (ThinkPad T40 Series) are assembled apart from each Bluetooth antenna with 26 cm or more as shown in the previous page.

Therefore, those co-located Bluetooth transmitters are allowed to evaluate the RF exposure compliance independently of the applying modular transmitter. In other word, the SAR testing for the applying transmitter in use of co-locating with those Bluetooth transmitters is not required, when the Bluetooth transmitters could satisfy the RF exposure requirement with those own transmission powers.

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.

However, the footnote 14 of the Section 3 in Supplement C to OET Bulletin 65 states :

“<sup>14</sup> ..... 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 two Bluetooth transmitters in the previous table does not exceed 5mW (far below 50mW). Therefore these transmitters also satisfy the RF exposure requirement regarding CFR 47 Part 15.247(b)(5) without a SAR compliance test report, and can operate with the applying transmitter simultaneously.

IBM Web site provides customers the grant conditions for the co-locating use and approved co-located Bluetooth devices. See the next page.

### 3. IBM Web site

Note) Some info is not available until the product announcement.

<http://www.pc.ibm.com/qtechinfo/MIGR-53286.html>

The screenshot shows the IBM support website interface. At the top, there is a search bar and navigation links: Home, Products & services, Support & downloads, and My account. Below this, there is a language selection dropdown and a row of links: PC support home, Login, Profile, My page, Ask an expert, and Help. The main content area is titled "TP Wireless Systems – Approved wireless Mini PCI options and additional RF option devices receive FCC certification". It includes a section for "Applicable countries/regions" with "United States" selected, and a "Service hints & tips" section. A table titled "Affected configurations" lists additional RF Option devices that receive FCC certification for use on. The table has columns for LMA (Limited Modular Approval) adapters, FCC IDs, Approved ThinkPad models, and PC options allowed multiple transmission (with sub-columns #1, #2, and #3). The table lists two adapters: IBM 11b/g Wireless LAN Mini PCI Adapter and Intel PRO/Wireless 2200BG Mini-PCI Adapter, each with their respective FCC IDs and a list of approved ThinkPad models (R50 Series, T40 Series, X30 Series (X31), X40 Series). The table also indicates whether each option is approved (O) or not approved (NG) for multiple transmission. Below the table, there are notes and a solution section. The notes mention that the information is from the "ThinkPad Wireless Systems I – Approved wireless Mini PCI options and additional RF option devices receive FCC certification" document. The solution section states that 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". It advises users to make sure of the following conditions on use of wireless features: 1. Visit the IBM site at www.ibm.com/pc/qtechinfo/MIGR-53286.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. At the bottom right, there is a copyright notice: "Document id: MIGR-53286 Last modified: 2003-01-31 Copyright (C) 2003 IBM Corporation".

**TP Wireless Systems – Approved wireless Mini PCI options and additional RF option devices receive FCC certification**

**Applicable countries/regions**  
United States

**Service hints & tips**

**Affected configurations**  
Additional RF Option devices receive FCC certification for use on:

LMA (Limited Modular Approval) adapters	FCC IDs	Approved ThinkPad models	PC options allowed multiple transmission		
			#1	#2	#3
IBM 11b/g Wireless LAN Mini PCI Adapter	ANO20030500CMR	R50 Series	O	NG	O
		T40 Series	O	NG	O
		X30 Series (X31)	O	O	O
		X40 Series	O	NG	NG
Intel PRO/Wireless 2200BG Mini-PCI Adapter	ANO20040501CX2	R50 Series	O	NG	O
		T40 Series	O	NG	O
		X30 Series (X31)	O	O	O
		X40 Series	O	NG	NG

**NOTES:**  
View [ThinkPad Wireless Systems I – Approved wireless Mini PCI options and additional RF option devices receive FCC certification](#)

**NG:** Not authorized to use by the FCC rule, or not recognized by BIOS.

#1: FCC ID: ANO20020100MTN ; [IBM Integrated Bluetooth III with 56K Modem](#)  
#2: FCC ID: PI4BT-ULTRA ; [Bluetooth UltraPort Module from IBM](#)  
#3: FCC ID: PI4BT-IBM-PCII ; [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-53286.html](http://www.ibm.com/pc/qtechinfo/MIGR-53286.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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