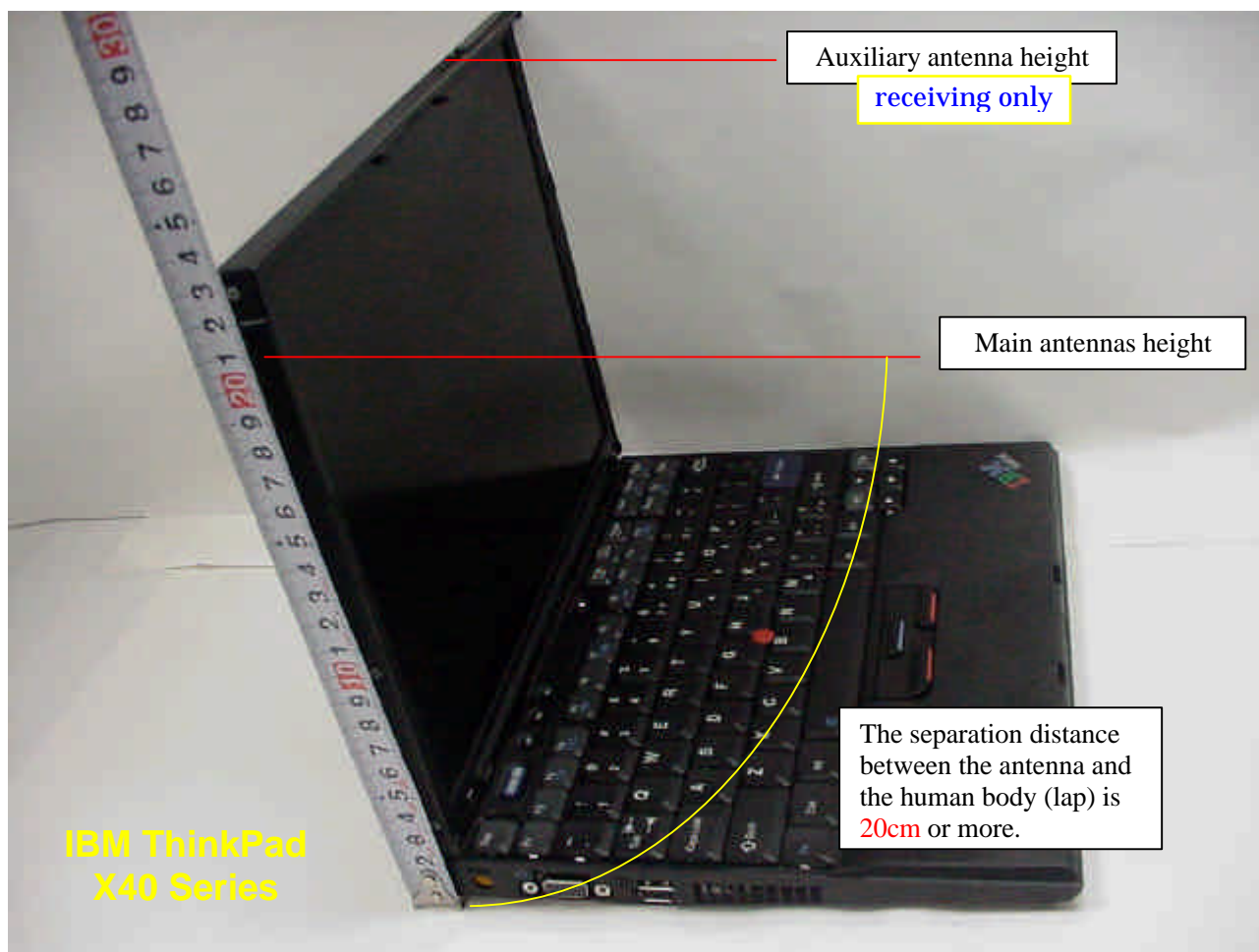


# RF Exposure evaluation

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

As shown below, the transmission antenna (the main antenna) of the supported host PC device (IBM ThinkPad X40 Series) is located at the left top portion of display (LCD) section. Thus the separation distance between the Tx antenna and the human body is 20cm or more. Therefore the applying modular transmitter and the host antenna system is categorized as a mobile device by FCC CFR 47 Section 2.1091.

Note) The auxiliary antenna is not used for transmission but receiving only, so it is not subjected to the RF exposure evaluation.



### [MPE evaluation]

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

<b>P</b> : conducted peak output power	<b>G</b> : peak antenna gain of transmission antenna ( <b>main</b> antenna)
17.3 dBm (53.7 mW)	+ 0.39 dBi

With this result, the maximum power density at 20cm distance is calculated as follows.

EIRP = P + G (dBm)	EIRP (mW)	Max. power density $S = \text{EIRP} / (4 \times 20^2 \times \pi)$
17.69	58.8	0.0117 mW/ cm <sup>2</sup>

The result is far below the MPE limit (1.0 mW/ cm<sup>2</sup> ) that keeps the sufficient margin for use of continuous RF exposure environment in normal operation. Therefore the LMA transmitter meets the MPE requirements for general Population/Uncontrolled exposure.

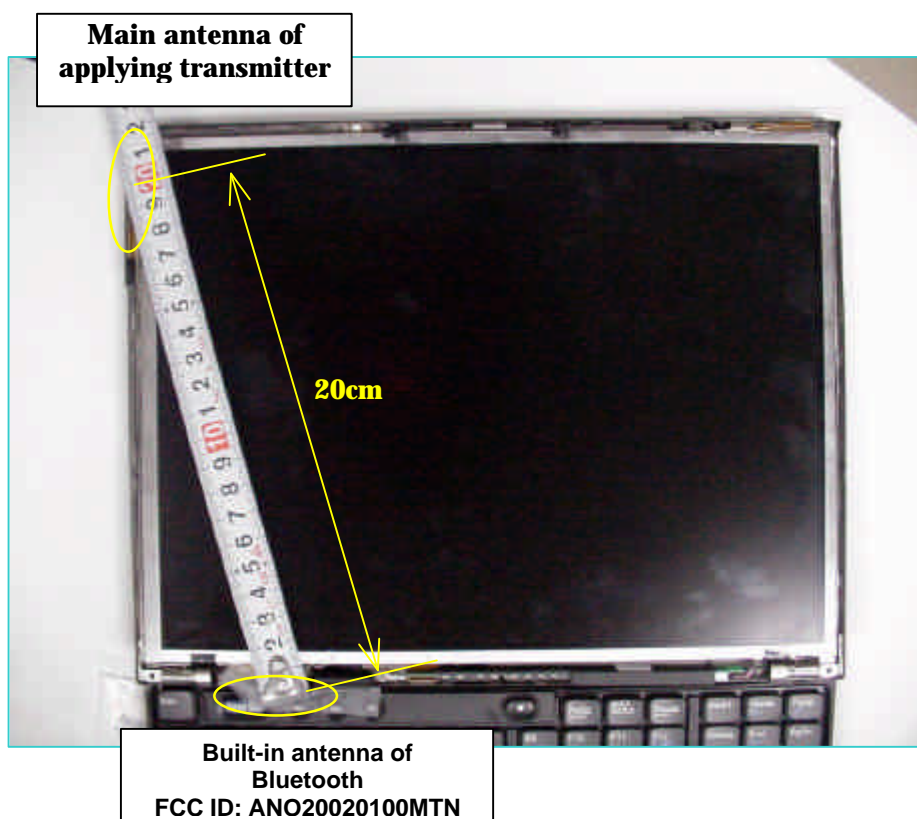
## 2. RF Exposure evaluation with co-located Bluetooth transmitters

The applying host device (ThinkPad X40 Series) supports the following co-located Bluetooth device, which is to be certified separately for the same host.

	FCC ID	Grantee Name	Product Name	The latest Granted Date	ERP in FCC Test Report
Built-in type LMA transmitter	ANO20020100MTN	IBM Japan, Ltd.	IBM integrated Bluetooth III with 56K Modem	Sep/29/2003 *1	2.5mW

\*1: under going Class II permissive change process for the same host

### Co-located Bluetooth options for ThinkPad X40 Series



The transmission antenna (main antenna) located at LCD section of the host device (ThinkPad X40 Series) is assembled apart from the co-located Bluetooth antenna with approximate 20 cm separation as shown in the previous page.

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

When a customer operates the applying PC on one's lap, the sufficient separation distance (minimum 20cm) between the above Bluetooth antenna and the person's body (lap) can not be maintained.

But the footnote 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 output power of the Bluetooth transmitter is far below 50mW. Therefore it also satisfies the RF exposure requirement regarding CFR 47 Part 15.247(b)(4) without a SAR compliance test report, then can operate with the applying transmitter simultaneously.

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

### 3. IBM Web site

Note) The info of the applying LMA transmitter is not available until 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". A table lists various wireless adapters and their approved ThinkPad models, along with PC options allowed for multiple transmission. The table has columns for the adapter, FCC ID, approved models, and three transmission options (#1, #2, #3). The "X40 Series" is highlighted in the table. Below the table, there are "NOTES" and a "Solution" section. The "NOTES" section includes a table of FCC IDs and option names. The "Solution" section provides instructions on how to use wireless options.

**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 High Rate Wireless LAN Mini PCI Adapter	ANOM3AWEB56GA	R32 Series T30 Series X30 Series (X30)	NG	O	O
Cisco Aironet Wireless 802.11b	ANOU58H004	R32 Series T30 Series X30 Series (X30) R40 Series T40 Series X30 Series (X31)	NG	O	O
Intel PRO/Wireless LAN 2100 3B Mini PCI Adapter	ANO20020201CLK	R50 Series R40 Series T40 Series X30 Series (X31) X40 Series	O	NG	O
IBM 11a/b/g Wireless LAN Mini PCI Adapter	ANO20030400LEG	R50 Series R40 Series T40 Series X30 Series (X31) X40 Series	O	NG	O
IBM High Rate Wireless LAN Mini PCI Adapter III	ANO20020200BRX	G40 Series R40 Series	NG	NG	O

[show next page](#)

**NOTES:**

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

#1: FCC ID: ANO20020100MTN	Option Name: <a href="#">IBM Integrated Bluetooth with 56K Modem</a>
#2: FCC ID: PI4BT-ULTRA	Option Name: <a href="#">Bluetooth UltraPort Module from IBM</a>
#3: FCC ID: PI4BT-IBM-PCI	Option Name: <a href="#">Bluetooth PC Card II</a>

**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](http://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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