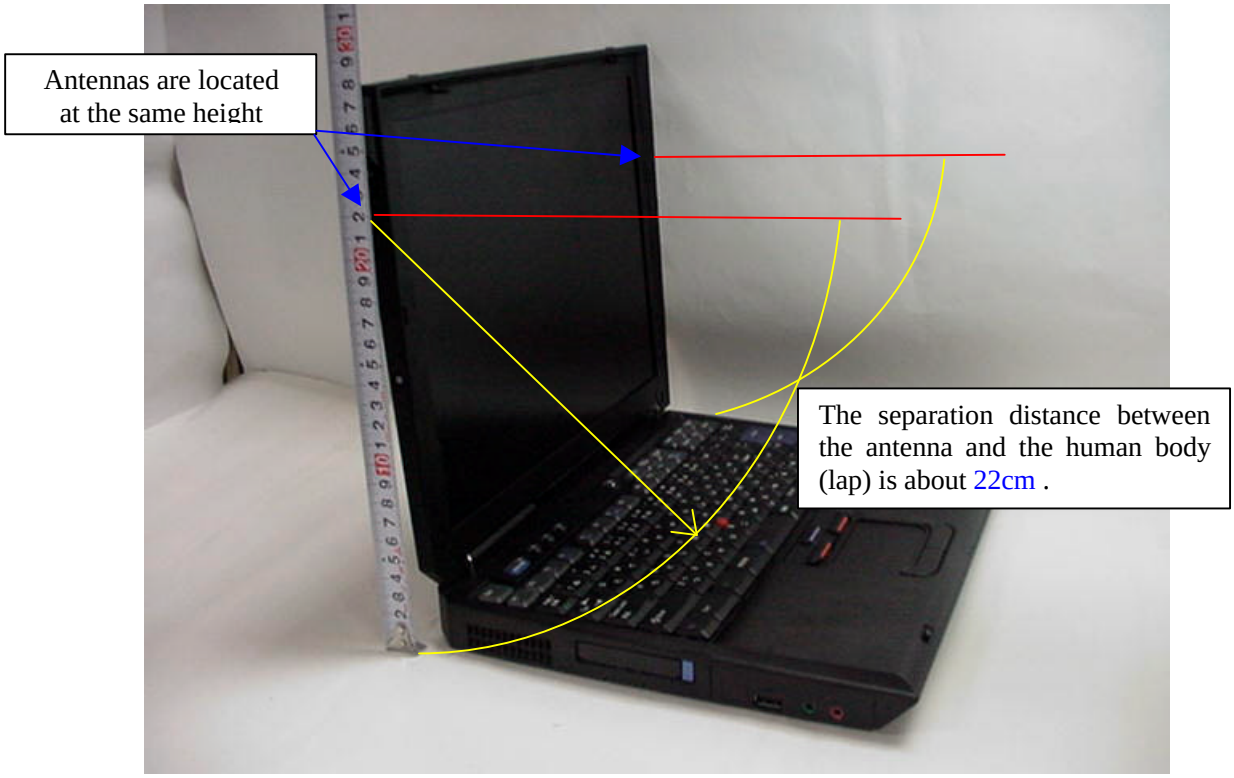
# RF Exposure evaluation

## 1. RF Exposure evaluation for the applying transmitter

As shown in the following photo, both main and auxiliary WLAN antennas of the applying laptop PC, IBM ThinkPad R40 Series, are located at the top of 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.




### [MPE evaluation]

The following table shows the highest conducted peak output power values measured for each transmission mode and the maximum peak antenna gains of the applying modular device.

| Transmission mode | **P**: conducted peak output power | Test report number | **G**: peak antenna gain |
|---|---|---|---|
| 2.4GHz band DSSS | 17.3dBm (53.8mW) | FCC 19-0224-0 | + 0.83 dBi |
| 2.4GHz band OFDM | 17.4dBm (55.0mW) | FCC 19-0237-0 | + 0.83 dBi |
| 5.8GHz bnad OFDM | 16.7dBm (46.8mW) | FCC 19-0224-0 | + 0.85 dBi |

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 $S = EIRP/(4 \times 20^2 \times \pi)$ |
|---|---|---|---|
| 2.4GHz band DSSS | 18.13 | 65.02 | 0.0130 mW/ $cm^2$ |
| 2.4GHz band OFDM | 18.23 | 66.53 | 0.0133 mW/ $cm^2$ |
| 5.8GHz bnad OFDM | 17.55 | 56.89 | 0.0114 mW/ $cm^2$ |

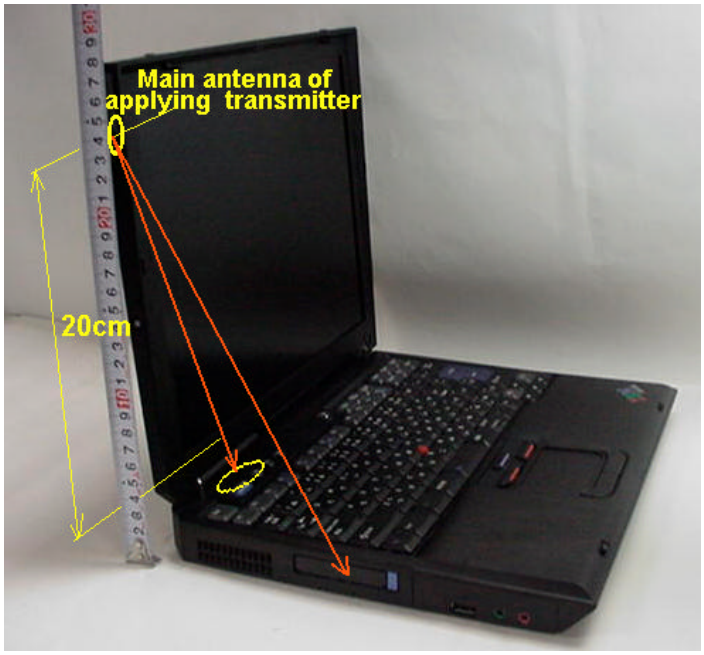
Since the applying modular transmitter device does not function to emit the radio frequency from both diversity antennas simultaneously, the above results are the maximum values of RF exposure to the persons, and are far below the MPE limit (1.0 mW/ $cm^2$ ). Therefore the LMA transmitter meets the MPE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

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

The applying laptop PC (ThinkPad R40 Series) supports 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 | | Blutooth PC Card II | August/21/2001 | 1.0mW |
| Built-in type LMA transmitter | ANO20020100MTN | IBM Japan, Ltd. | IBM integrated Blutooth with 56K Modem | February/26/2003 | 2.5mW |

Interfaces to connect Wireless options

The main and auxiliary antennas placed at LCD section of the host device (ThinkPad R40 Series) are assembled apart from each Bluetooth antenna shown in the previous page with 20 cm or more.
Therefore the RF exposure evaluation for those Bluetooth transmitters is allowed to be examined independently of the applying WLAN antennas. In other word, the SAR testing for the applying transmitter in co-locating with those Bluetooth options is not required thanks to the following reasons.

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.
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** concerning those collaborating transmitter devices. See the next page.

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

Note) The info for the applying LMA transmitter is not available until the product announcement.

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

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## 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:

**BIOS group 1**

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

**BIOS group 2**

| LMA (Limitted Modular Approval) adapters | FCC IDs | Approved ThinkPad models | PC options allowed multiple transmission | | |
|---|---|---|---|---|---|
| | | | #1 | #2 | #3 |
| IBM 11a/b/g Wireless LAN Mini PCI Adapter | ANO20030400LEG | R40 Series | O | O | O |
| Cisco Aironet Wireless 802.11b | ANOU58H004 | R40 Series<br>T40 Series<br>X30 Series (X31) | O | O | O |
| Intel PRO/Wireless LAN 2100 3B Mini PCI Adapter | ANO20020201CLK | | | | |
| IBM High Rate Wireless LAN Mini PCI Adapter III | ANO20020200BRX | R40 Series | O | O | O |
| | | G40 Series | NG | NG | O |

NOTES:

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

#1: FCC ID: ANO20020100MTN Option Name: IBM Integrated Bluetooth with 56K Modem

#2: FCC ID: PI4BT-ULTRA Option Name: Bluetooth UltraPort Module from IBM

#3: FCC ID: PI4BT-IBM-PCII Option Name: Bluetooth PC Card II

**Solution**

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

Please make sure of the following when you use a Bluetooth option or wireless option PC Card in your ThinkPad computer.

1. Visit the IBM site at www.pc.ibm.com/qtechinfo/MIGR-44156.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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