

RF Exposure

1. Antenna Gains of applying transmitters

Figure A: **Main** Antenna Gain of IEEE802.11b Wireless LAN Adapter

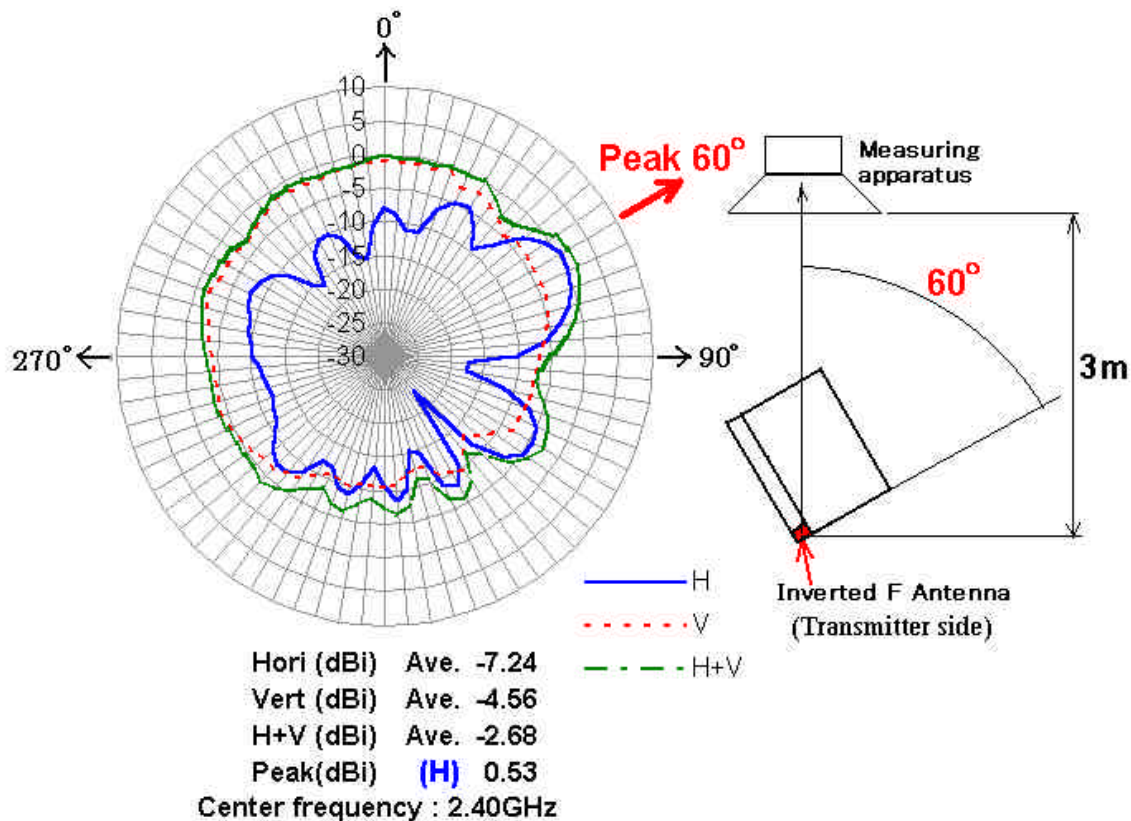


Figure B: **Auxiliary** Antenna Gain of IEEE802.11b Wireless LAN Adapter

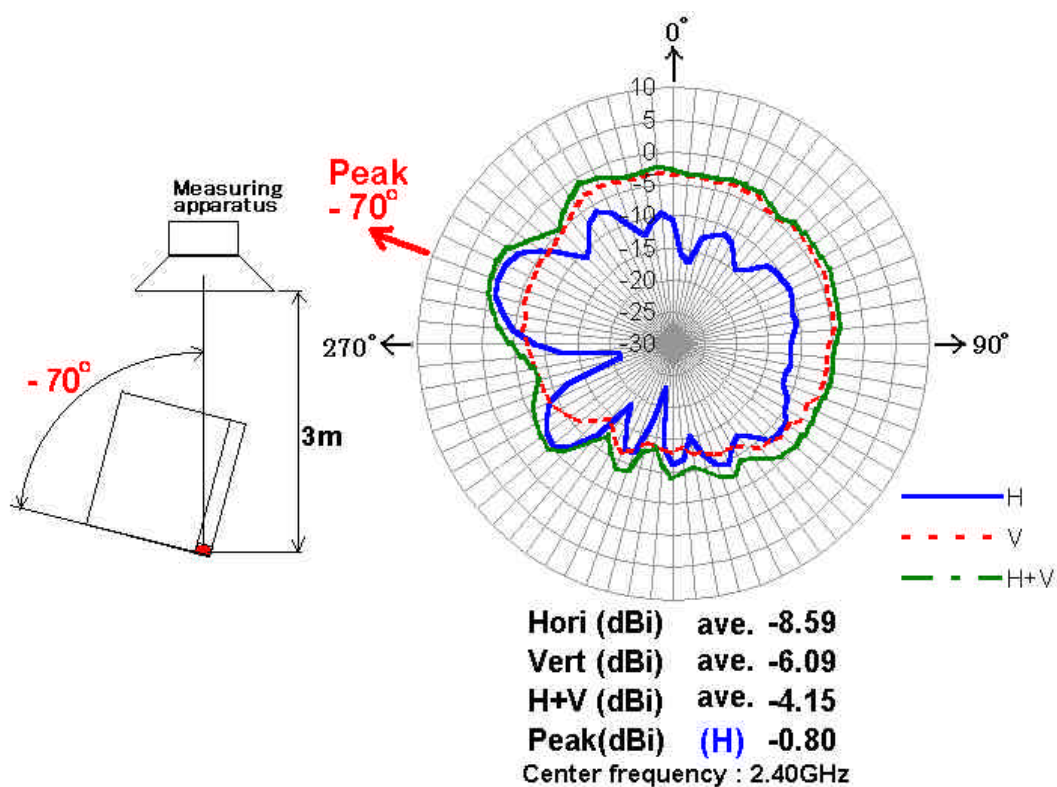
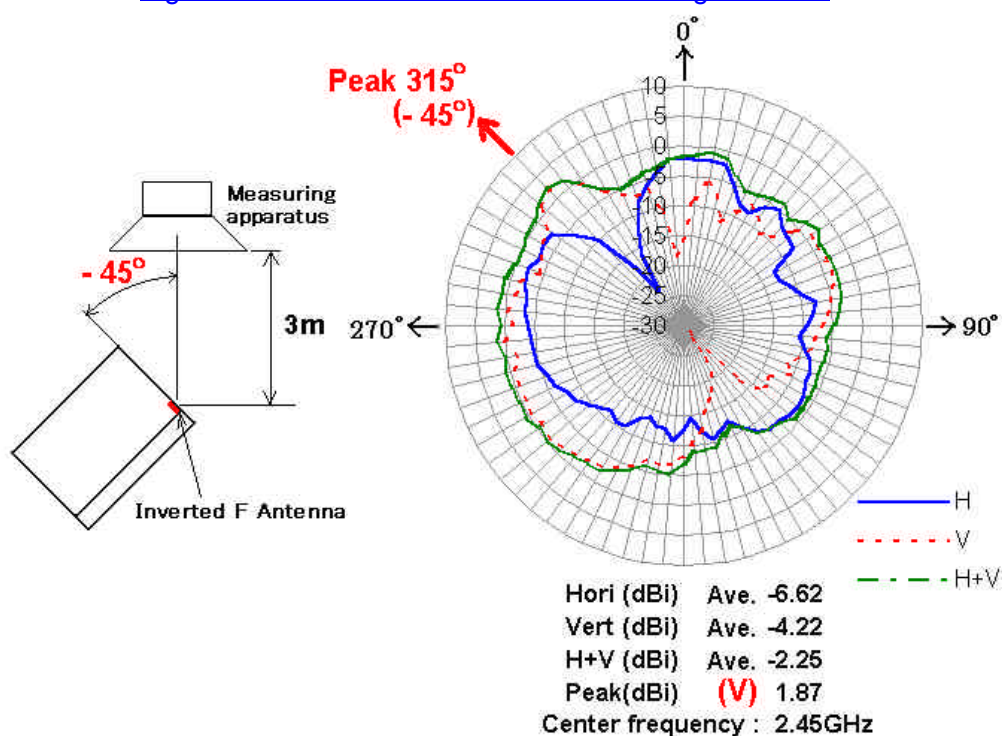
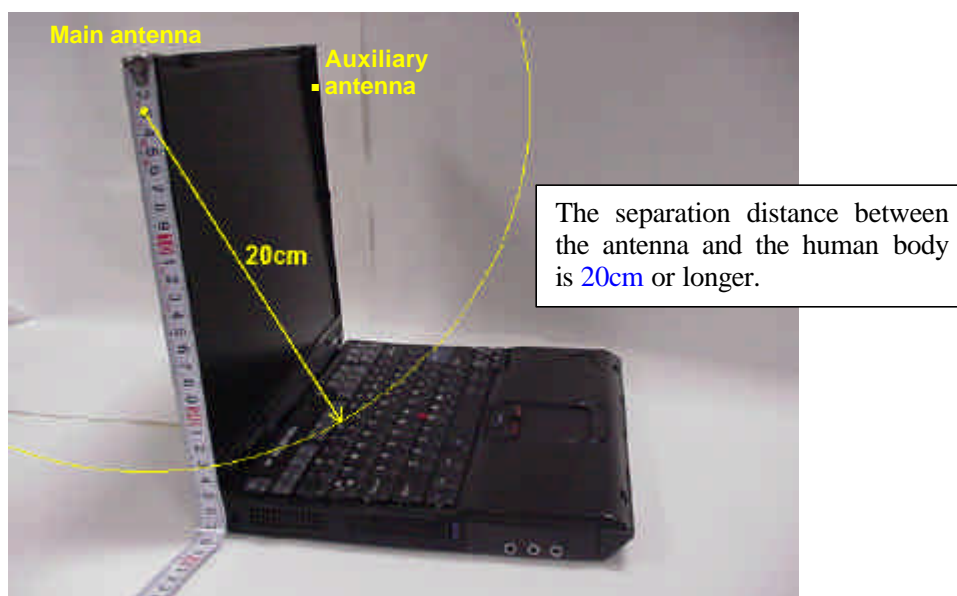


Figure C: Antenna Gain of Bluetooth Daughter Crad

2. RF Exposure evaluation of Cisco Aironet Wireless 802.11b

As shown in the following photos, the WLAN's antenna positions of IBM ThinkPad T30 Series are located at the top of display (LCD) bezel for both the main and auxiliary antennas. The separation distances between the antennas and the human body are 20cm or more. Therefore the equipment of this configuration 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 93.3mW(19.7dBm) and the maximum antenna gain is 0.53dBi. (See the previous Figure A.)

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

$$\text{EIRP} = P + G = 19.7 \text{ dBm} + 0.53 \text{ dBi} = 20.23 \text{ dBm} (105.44 \text{ mW})$$

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

$$S = \text{EIRP}/(4 \times R^2 \times \pi) = 0.021 \text{ mW/cm}^2$$

Since the applying WLAN transmitter does not function to emit the radio frequency from the both diversity antennas simultaneously, the above value is the maximum RF exposure to the persons.

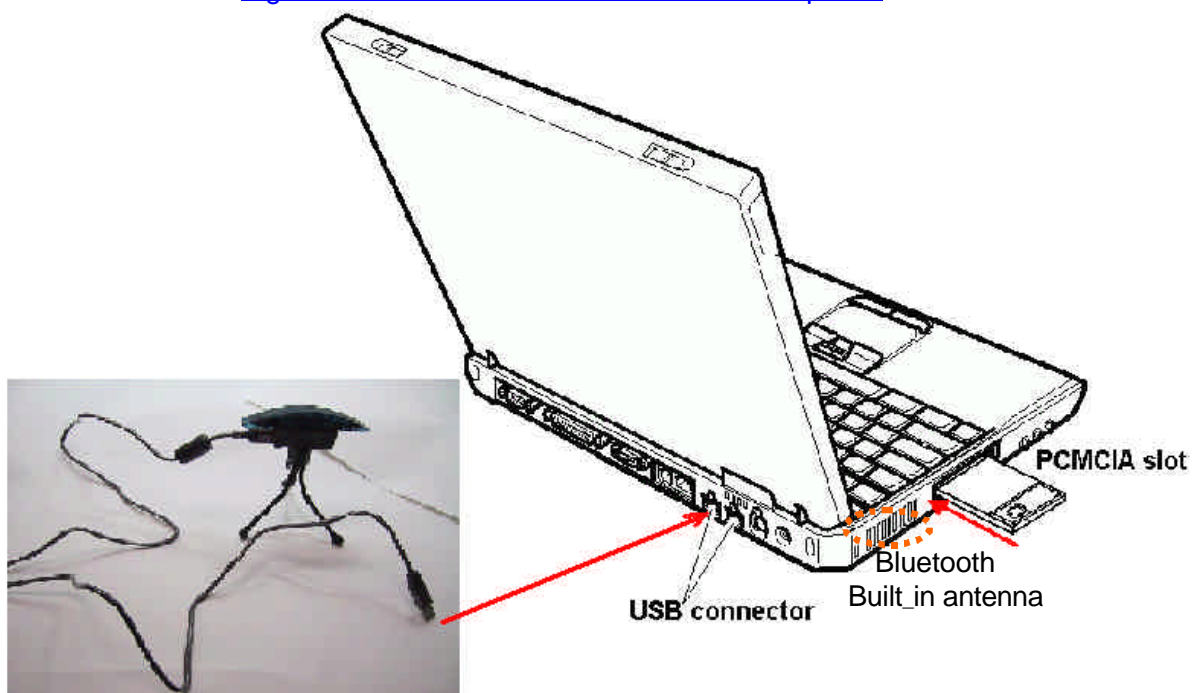
The maximum power density at 20cm distance of the WLAN transmitter is 0.021 mW/ cm², which is below the MPE limit (1.0 mW/ cm²). Therefore the applying WLAN transmitter with the built_in antenna meets the MPE requirements for general Population/Uncontrolled exposure.

3. RF Exposure evaluation of Bluetooth transmitters

The applying laptop PC (ThinkPad X30 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		Bluetooth PC Card II	August/21/2001	1.0mW
Applying transmitter	ANOCORN1SHR	IBM Japan, Ltd.	Bluetooth Daughter Card		2.45mW

Figure D. [Interfaces to connect Wireless options](#)



When a customer operates the applying PC on his lap, the sufficient separation distance (min. 20cm) between the antennas of above transmitters and the person's body (lap) can not be maintained. (note: approximately 1.5 cm from the PC Card slot, or 2.5 cm from the built_in Bluetooth antenna).

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 is 4.85mW. Therefore these transmitters also satisfy the RF exposure evaluation regarding CFR 47 Part 15.247(b)(4) without a SAR compliance test report.

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

Note1) **Draft version** including unannounced products being under FCC certification process.

Note2) The current service level is available on the following Web URL.

<http://www.pc.ibm.com/qtechinfo/MIGR-39377.html>

(Entrance Page)

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TP Wireless Systems – 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:

System Unit approved products	FCC IDs	PC options allowed multiple transmission		
		#1	#2	#3
ThinkPad A22 wireless models	ANOM380211B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ThinkPad A30 Series (A30, A31) wireless models	ANOVNCBDC80211B	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ThinkPad R30 Series wireless models (R30, R31)	ANOECH126P8056	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ThinkPad R32 Series wireless models	ANODS1WLIV	NG	<input type="radio"/>	<input type="radio"/>
ThinkPad T23 wireless models	ANOTR4WGA1BAN	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ThinkPad T30 Series wireless models	ANOCORN1TASUHOP ANOCORN1SHR	NG	<input type="radio"/>	<input type="radio"/>
ThinkPad X22 wireless models	ANOSY3W26629DX	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ThinkPad X23, X24 wireless models	ANOSY4W2662DFJ	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ThinkPad X30 Series wireless models	ANOTK1TP10HOP ANOTK1TP10SHR	NG	<input type="radio"/>	<input type="radio"/>

NG: not permitted to emit RF frequency with other transmitters simultaneously
 #1: FCC ID: O2OBTPCM101 Option Name: [Bluetooth PC Card](#)
 #2: FCC ID: P14BT-ULTRA Option Name: [Bluetooth UltraPort Module from IBM](#)
 #3: FCC ID: P14BT-IBM-PCII Option Name: [Bluetooth PC Card II](#)

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

When you use a Bluetooth option or wireless PCMCIA card in your ThinkPad xxx computer, please make sure of the following:


1. Please visit the IBM site at www.ibm.com/pc/support 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.

Document id: MIGR-39377
 Last modified: 2002-06-03
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<http://www.pc.ibm.com/qtechinfo/MIGR-43693.html>

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TP Wireless Systems – Approved wireless mini-PCI Options & 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:	
			Option 1	Option 2
Cisco Aironet Wireless 802.11b	ANOU58H004	ThinkPad R32, T30, X30		
IBM High Rate Wireless LAN Mini-PCI Adapter	ANOM3AWEB56GA		O	O

Option 1: FCC ID: PI4BT-ULTRA Option Name : [Bluetooth UltraPort Module from IBM](#)
Option 2: FCC ID: PI4BT-IBM-PCII Option Name: [Bluetooth PC Card II](#)

Solution

The User's Guide of each LMA adapter in the above table has the following information in "Wireless regulatory Notice – USA Federal Communications Commission (FCC)" section:

Use of other Wireless options in your ThinkPad

This adapter is approved for simultaneous use with one or more wireless option PC Cards in the PC Card slot and USB port of your ThinkPad computer.

Please make sure of the following conditions on use of other option wireless cards.

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 this adapter.
2. When you use any other RF option device that is not listed on the IBM site, all other wireless features including this adapter in your ThinkPad computer are required to be turned off.
3. Users are requested to follow the RF Safety instructions on other RF option devices that are included in the user's manual of each RF option device.

Document id: MIGR-39377
Last modified: 2002-06-03
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