

RF Exposure

1. Antenna Gains of applying transmitters

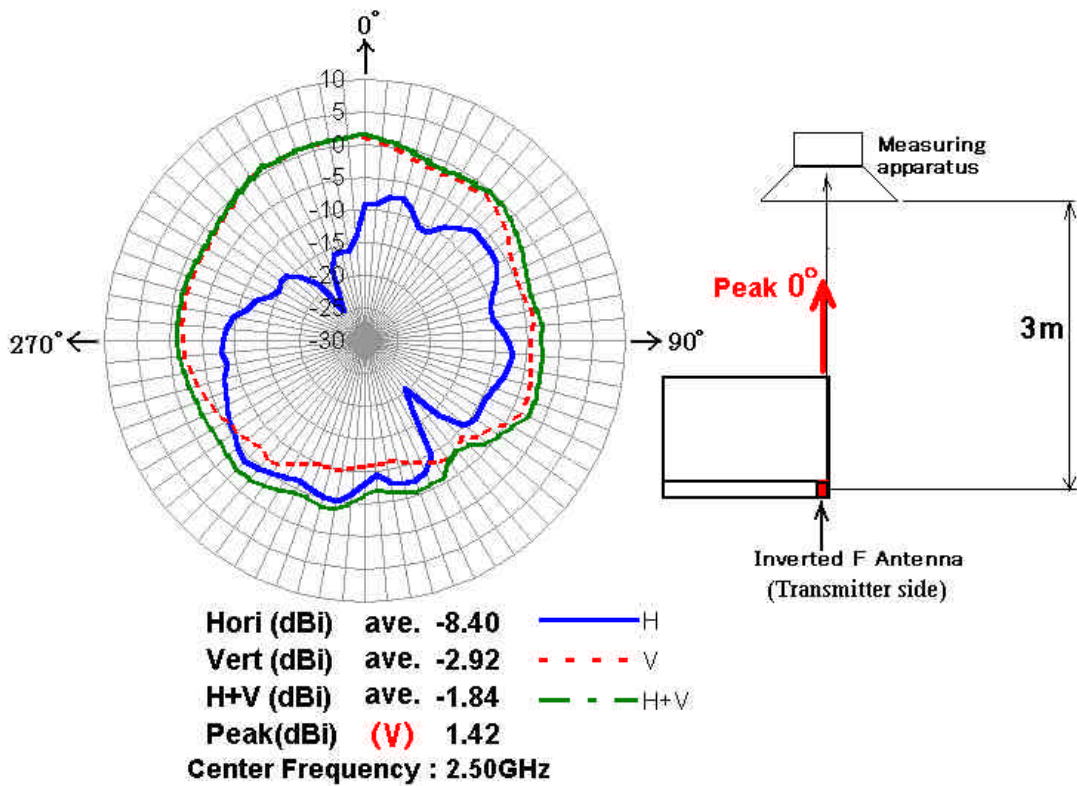


Figure A: Main Antenna Gain of IEEE802.11b Wireless LAN Adapter

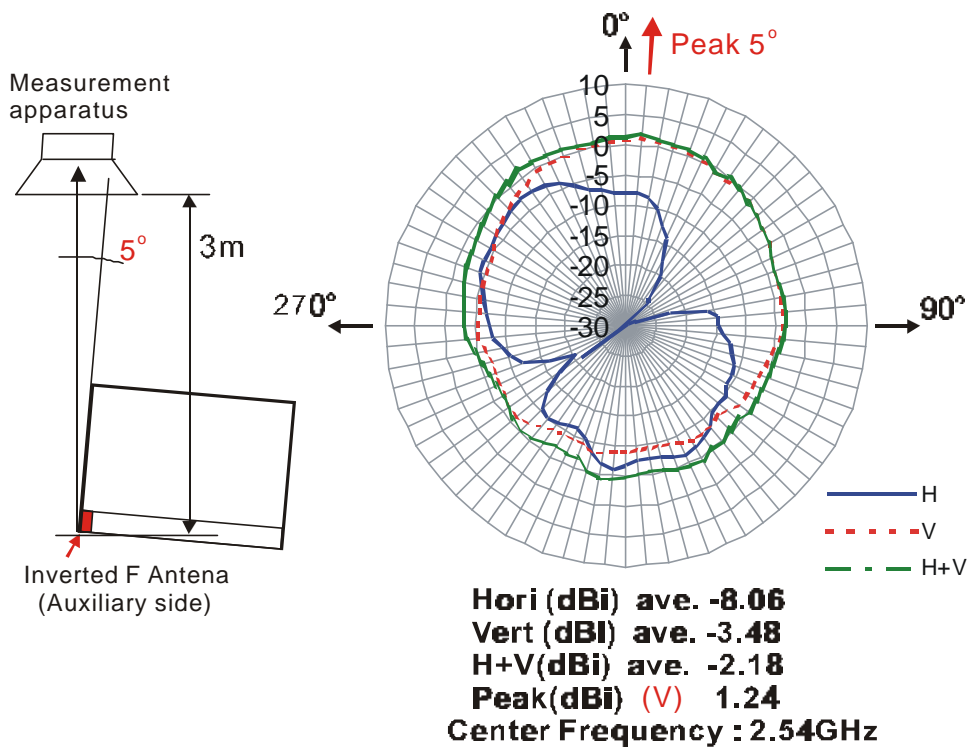


Figure B: Auxiliary Antenna Gain of IEEE802.11b Wireless LAN Adapter

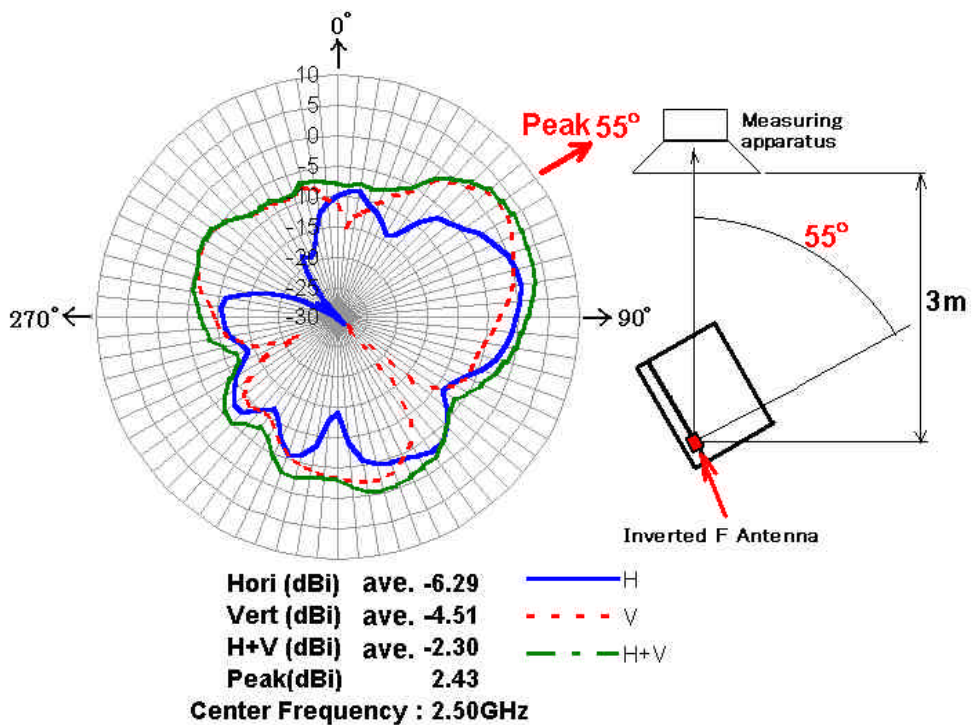
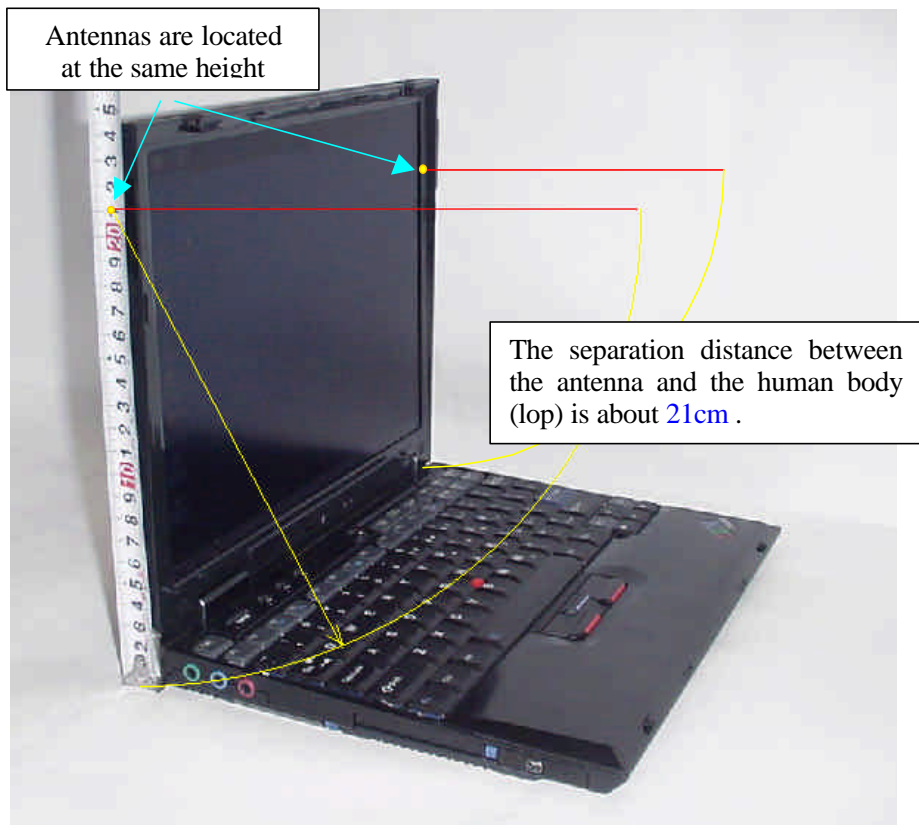


Figure C: Antenna Gain of Bluetooth Daughter Card

2. RF Exposure evaluation of Cisco Aironet Wireless 802.11b

The applying equipment is a compact size laptop computer. The built_in antenna for the integrated mini-PCI wireless LAN transmitter is categorized as a mobile device by FCC CFR 47 section 2.1091, because two antenna are located at the same height hence the separation distance between the antennas and the human body is 20cm or more. As shown in the following photos, the applying equipment satisfies the requirement of antenna separation.



The conducted peak output power of the IEEE802.11b Wireless LAN Adapter is 19.9dBm and the maximum antenna gain is 1.42dBi as shown the previous Figure A.

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

$$EIRP = P + G = 19.9 \text{ dBm} + 1.42 \text{ dBi} = 21.32 \text{ dBm} (135.5 \text{ mW})$$

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

$$S_1 = EIRP / (4 \times R^2 \times \pi) = 0.0270 \text{ mW/cm}^2$$

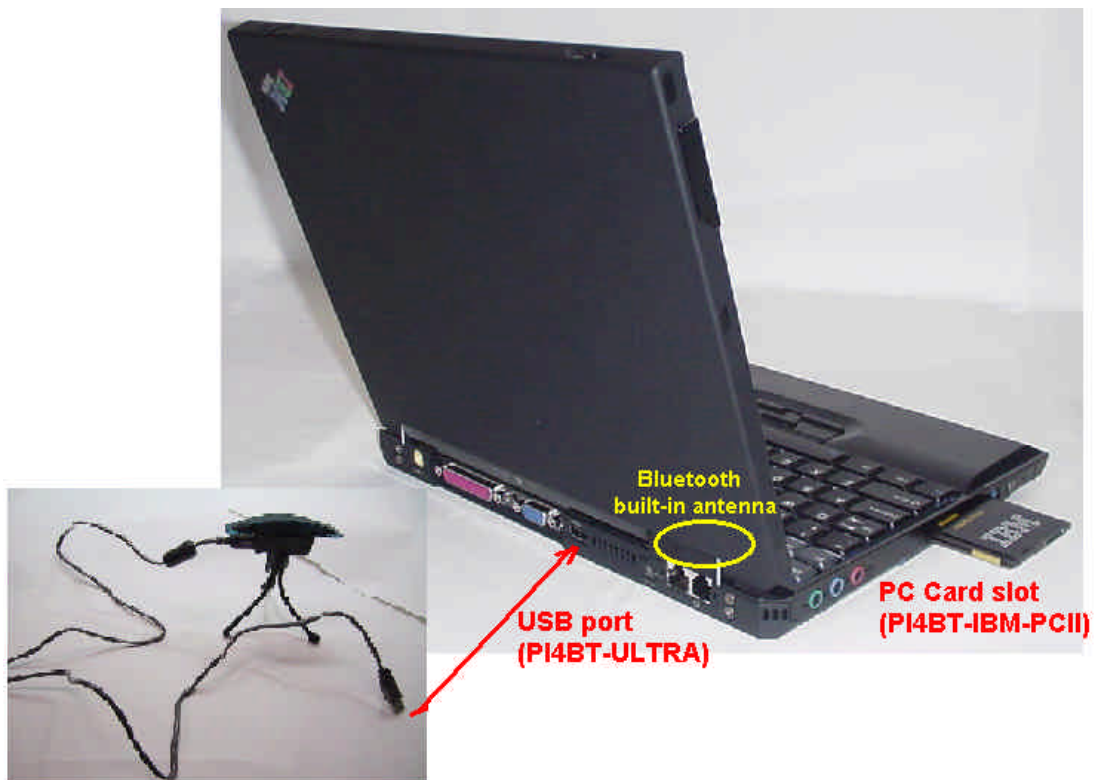
Since the applying WLAN transmitter does not function to emit the radio frequency from the both diversity antennas simultaneously, the above value is the maximum RF exposure to the persons.

The maximum power density at 20cm distance of the WLAN transmitter is 0.027 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	EIRP 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	ANOTK1TP10SHR	IBM Japan, Ltd.	Bluetooth Daughter Card		2.29mW



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 above table is 4.7mW. 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)

The screenshot shows the IBM support website interface. The main content area is titled "TP Wireless Systems - Additional RF Option devices receive FCC certification". Below this, there are sections for "Applicable countries/regions" (United States) and "Service hints & tips". The primary section is "Affected configurations", which includes a table of system units and their FCC IDs. The table has columns for "System Unit approved products", "FCC IDs", and "PC options allowed multiple transmission" (with sub-columns #1, #2, #3). The table lists various ThinkPad models and their corresponding FCC IDs, with some marked as "NG" (not permitted) or "wireless ready model". Red arrows from the text "Link to EMA page" point to the "wireless ready model" links in the table.

System Unit approved products	FCC IDs	PC options allowed multiple transmission		
		#1	#2	#3
ThinkPad A22 wireless models	ANOM380211B	○	○	○
ThinkPad A30 Series (A30, A31) wireless models	ANOVNCBDC80211B	○	○	○
ThinkPad R30 Series wireless models (R30, R31)	ANOCH126P8056	○	○	○
ThinkPad R32 Series wireless models:	ANODS1WLIV	NG	○	○
	Cisco & wireless ready model			
ThinkPad T23 wireless models	ANOTR4WGA1BAN	○	○	○
ThinkPad T30 Series wireless models	ANOCORN1TASUHOP	NG	○	○
	ANOCORN1SHR			
wireless ready model				
ThinkPad X22 wireless models	ANOSY3W26629DX	○	○	○
ThinkPad X23, X24 wireless models	ANOSY4W2662DFJ	○	○	○
ThinkPad X30 Series wireless models	ANOTK1TP10HOP	NG	○	○
	ANOTK1TP10SHR			
wireless ready model				

NG: not permitted to emit RF frequency with other transmitters simultaneously
 #1: FCC ID: O2OBTPCM101 Option Name: [Bluetooth PC Card](#)
 #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 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>

(Linked Page)

The screenshot shows the IBM PC support website. At the top, there is a search bar and navigation links for Home, Products & services, Support & downloads, and My account. Below this is a language selection dropdown and a 'PC support home' button. The main content area features a title: 'TP Wireless Systems – Approved wireless mini-PCI Options & Additional RF Option devices receive FCC certification'. This is followed by sections for 'Applicable countries/regions' (listing United States) and 'Service hints & tips'. A section titled 'Affected configurations' states that additional RF Option devices receive FCC certification for use on specific models. A table lists these configurations, including LMA adapters, FCC IDs, and approved ThinkPad models (R32, T30, X30). Below the table, it specifies two options: Option 1 (Bluetooth UltraPort Module from IBM) and Option 2 (Bluetooth PC Card II). A 'Solution' section explains that the User's Guide for each LMA adapter contains FCC regulatory information. A 'Use of other Wireless options in your ThinkPad' section provides instructions for simultaneous use with other wireless options. The page footer includes document ID (MIGR-39377), last modified date (2002-06-03), and copyright information (© 2002 IBM Corporation).

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			

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
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