RF Exposure

1. Antenna Gains of applying transmitters

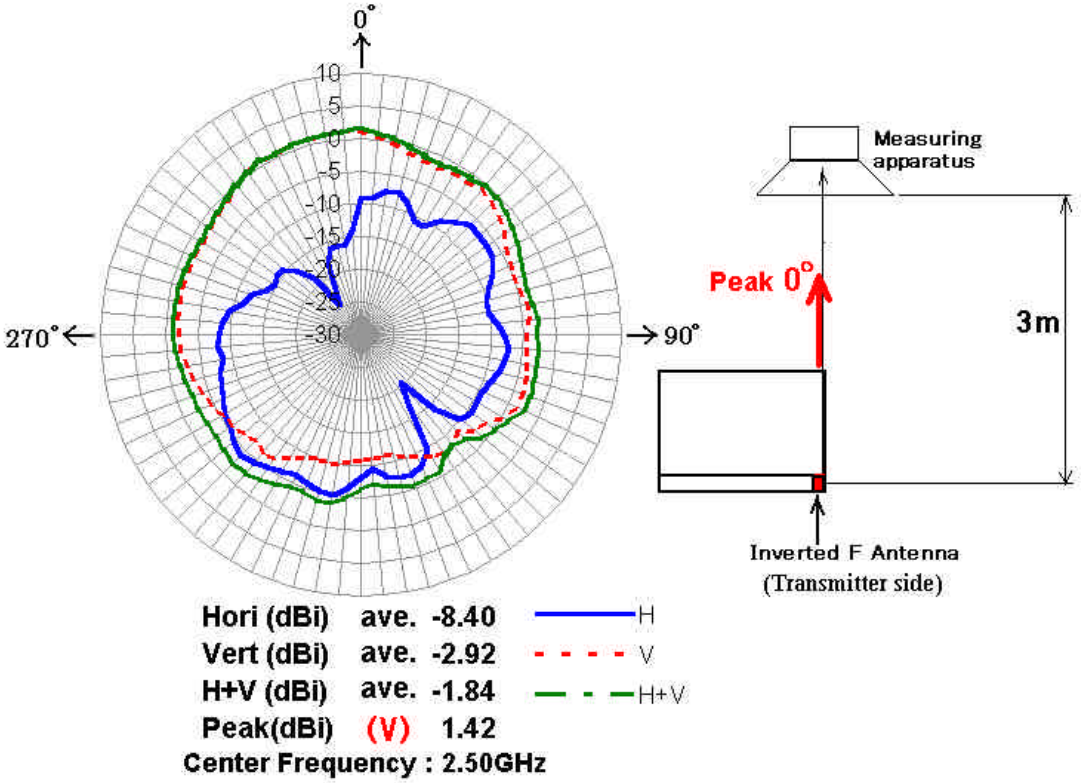


Figure A: Antenna Gain of IEEE802.11b Wireless LAN Adapter

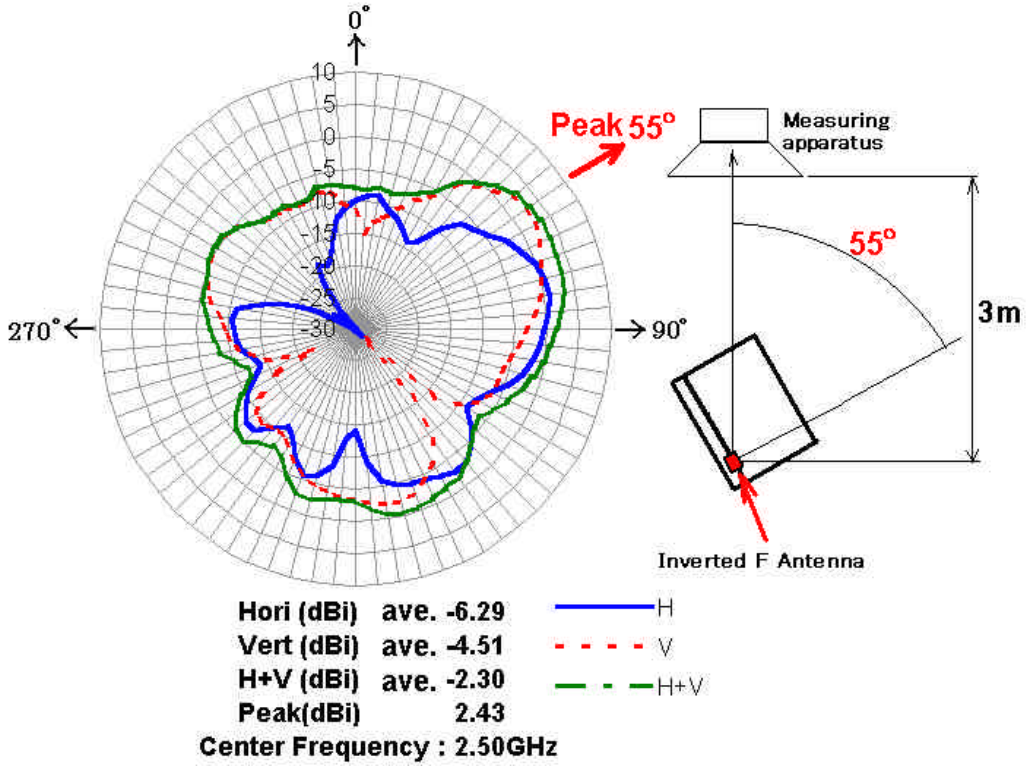
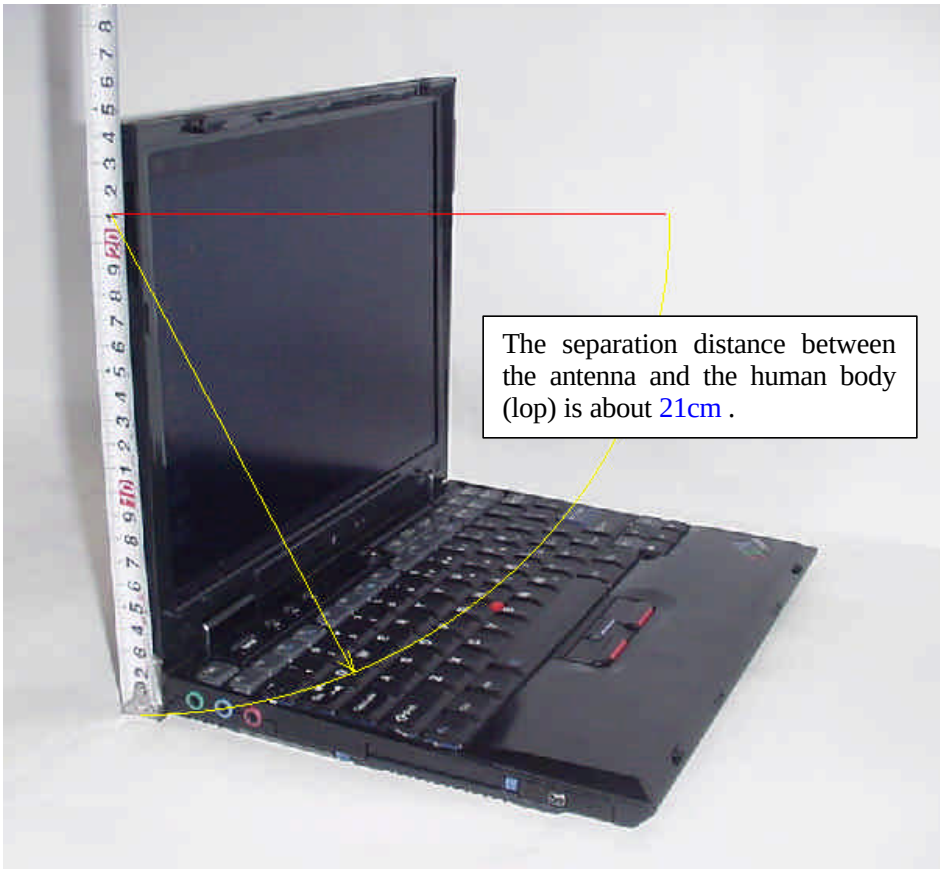


Figure B: Antenna Gain of Bluetooth Daughter Crad

2. RF Exposure evaluation of IBM High Rate Wireless LAN Mini-PCI Adapter with Modem II

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 the separation distance between the antenna 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 17.1dBm 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.

$$EIRP = P + G = 17.1\ dBm + 1.42\ dBi = 18.52\ dBm\ (71.1\ mW)$$

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

$$S_1 = EIRP/(4 \times R^2 \times \pi) = 0.0142\ mW/cm^2$$

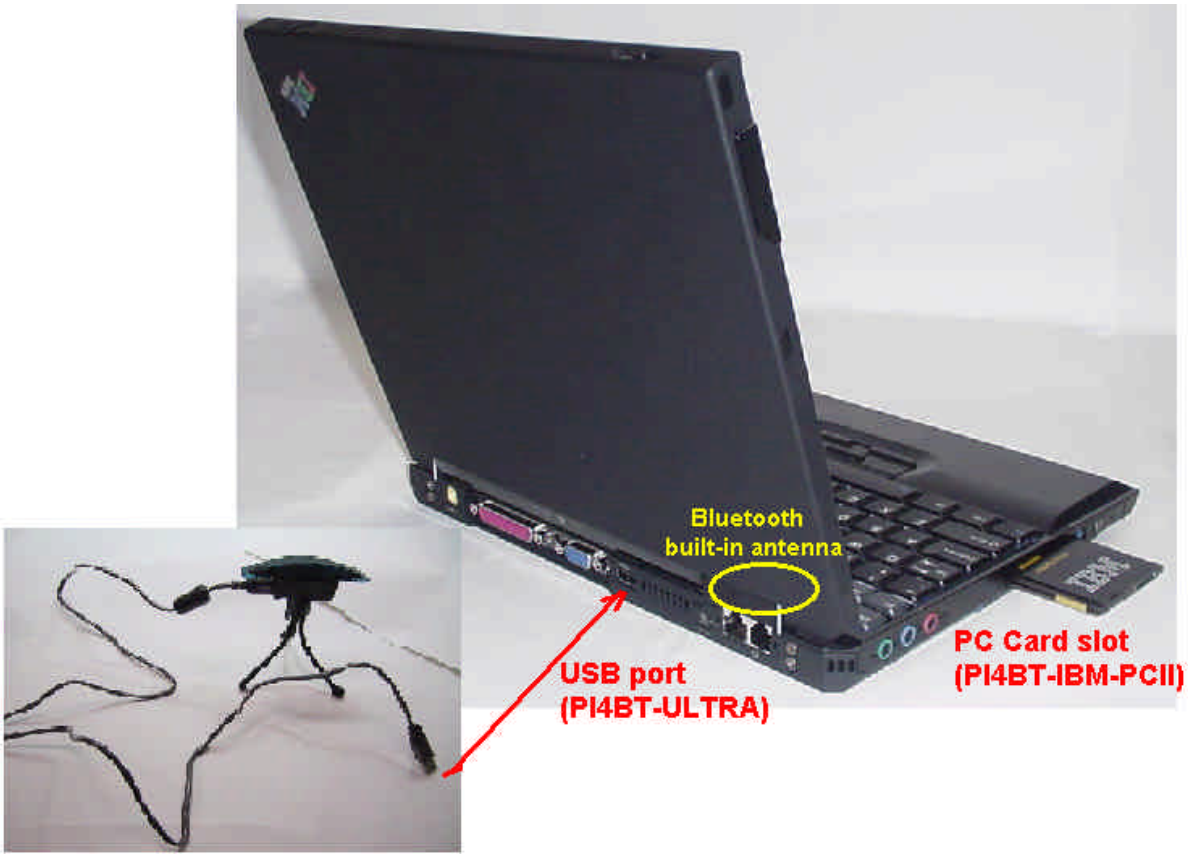
When an operator will use the transmitter during 30 minutes continuously in normal operation, the time-averaging of exposure is : $S_1 \times 30 = 0.425 < (1mW/cm^2) \times 30$

So the source-based time-averaging duty factor is considered as 100% duty. Therefore the WLAN transmitter 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		Blutooth PC Card II	August/21/2001	1.0mW
Applying transmitter	ANOTK1TP10HOP	IBM Japan, Ltd.	Blutooth 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.

But the footnote of the Section 3 in Supplement C to OET Bulletin 65 states "[14] Both conducted and radiated output power should be considered in near-field exposure conditions. The output indicated in the above (500 mW) is appropriate when the device and its antenna are both operating at more than 2.5 – 3.0 cm from a person's body, such as certain hand-held terminals. 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."

Also the latest conditions for co-located transmitters of Web guidance (http://hraunfoss.fcc.gov/eas_public/LSI_GET/37) states “SAR compliance for co- located transmitters in standalone independently operated product
– when SAR evaluation is required for TCB approval, except for the transmitter(s) with the highest output (non- simultaneously transmitting dominant transmitters – AMPS/ TDMA/ CDMA), the output of other co-located transmitters should be less than 2% of the source- based time-averaged conducted and radiated output power levels of the dominant transmitter or 5 mW, whichever is higher.”

When the antenna separation from a person’s body is closer than 2.5 cm, the near field estimation (i.e. the source- based time-averaging) is not proper method for the RF exposure evaluation.
So 5 mW should be considered as the criteria of SAR evaluation for the co-location of transmitters.

The total output power of the three Bluetooth transmitters in the above table is 4.69mW. Therefore those transmitters can co-locate with the dominant transmitter(WLAN) without SAR evaluation.