

1. RF Exposure Evaluation for ThinkPad R32

a) Built_in Antenna Gains of ThinkPad R32

Figure A: Main Antenna Gain

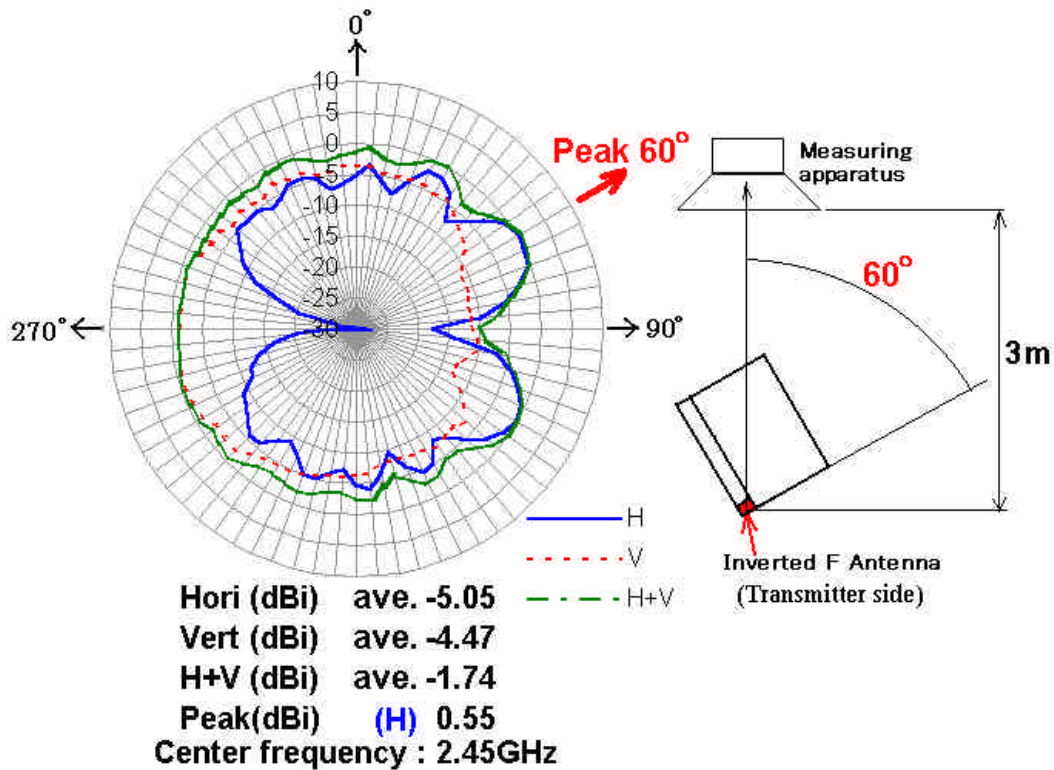
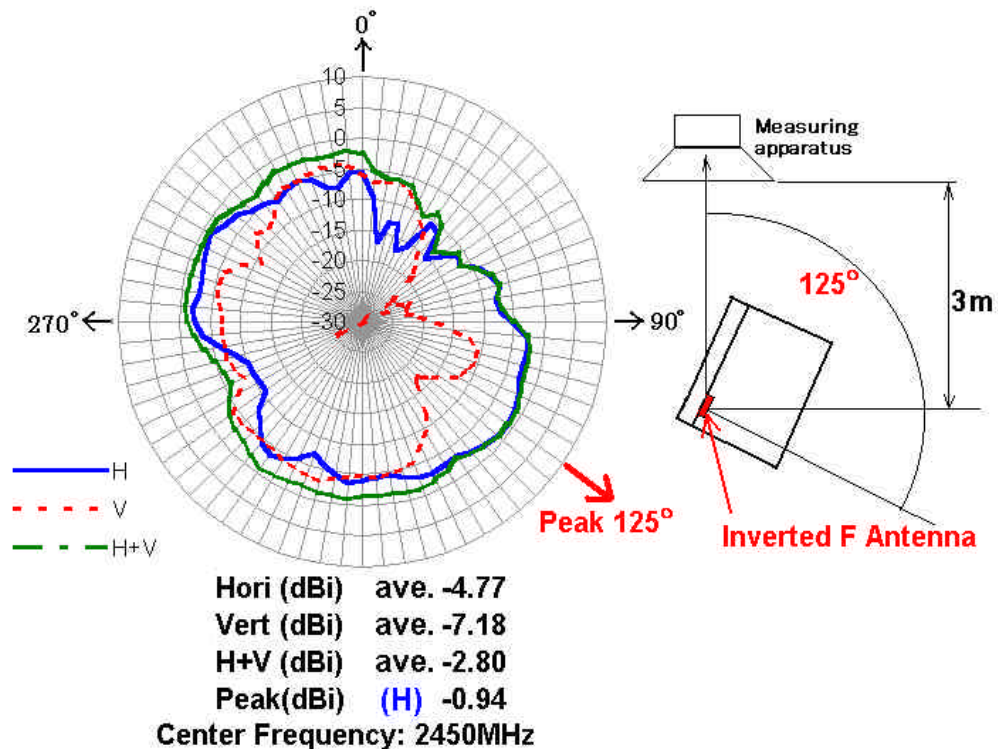


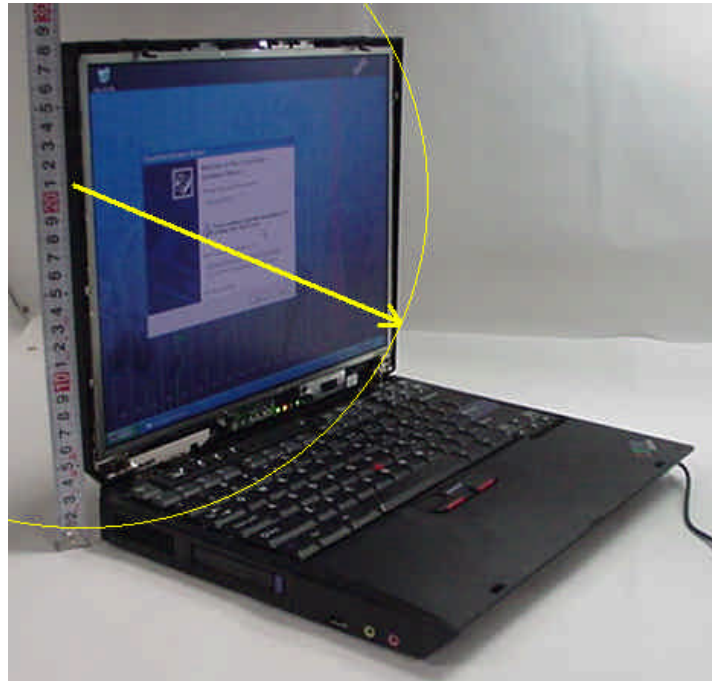
Figure B: Auxiliary Antenna Gain



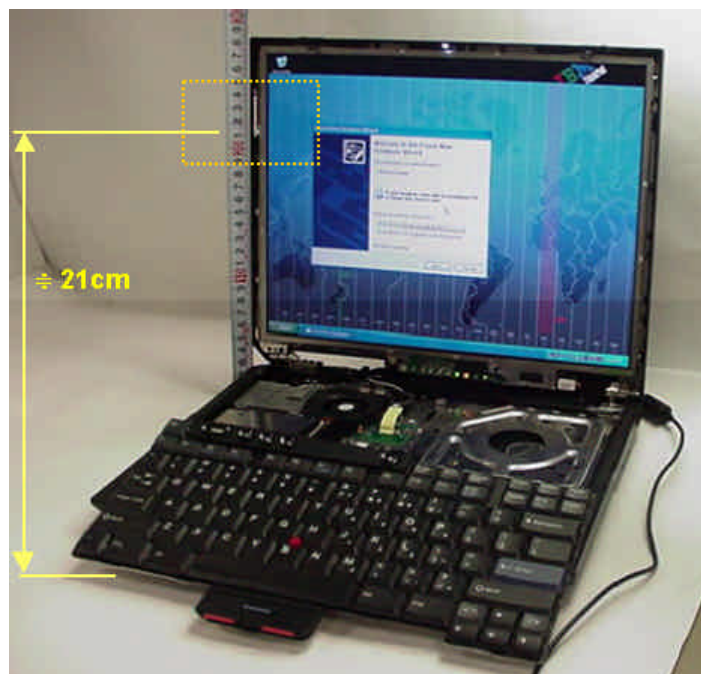
b) RF Exposure evaluation with the R32 Main antenna

The applying equipment is a standard size laptop computer. The separation distance between the main antenna built in the LCD section and the person's body is 21cm or more. So the applying transmitter with the main antenna is categorized as a mobile device by FCC CFR 47 section 2.1091

Figure C. Separation distance of the main antenna from human body



The separation distance between the antenna and the human body is **21cm** or more.



The conducted peak output power of the IEEE802.11b Wireless LAN Adapter is 19.9 dBm and the maximum antenna gain is 0.55dBi as shown in the Figure A.

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

$$\text{EIRP} = P + G = 19.9 \text{ dBm} + 0.55 \text{ dBi} = 20.45 \text{ dBm} (110.92 \text{ mW})$$

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

$$S_1 = \text{EIRP} / (4 \times R^2 \times \pi) = 0.022 \text{ mW/cm}^2$$

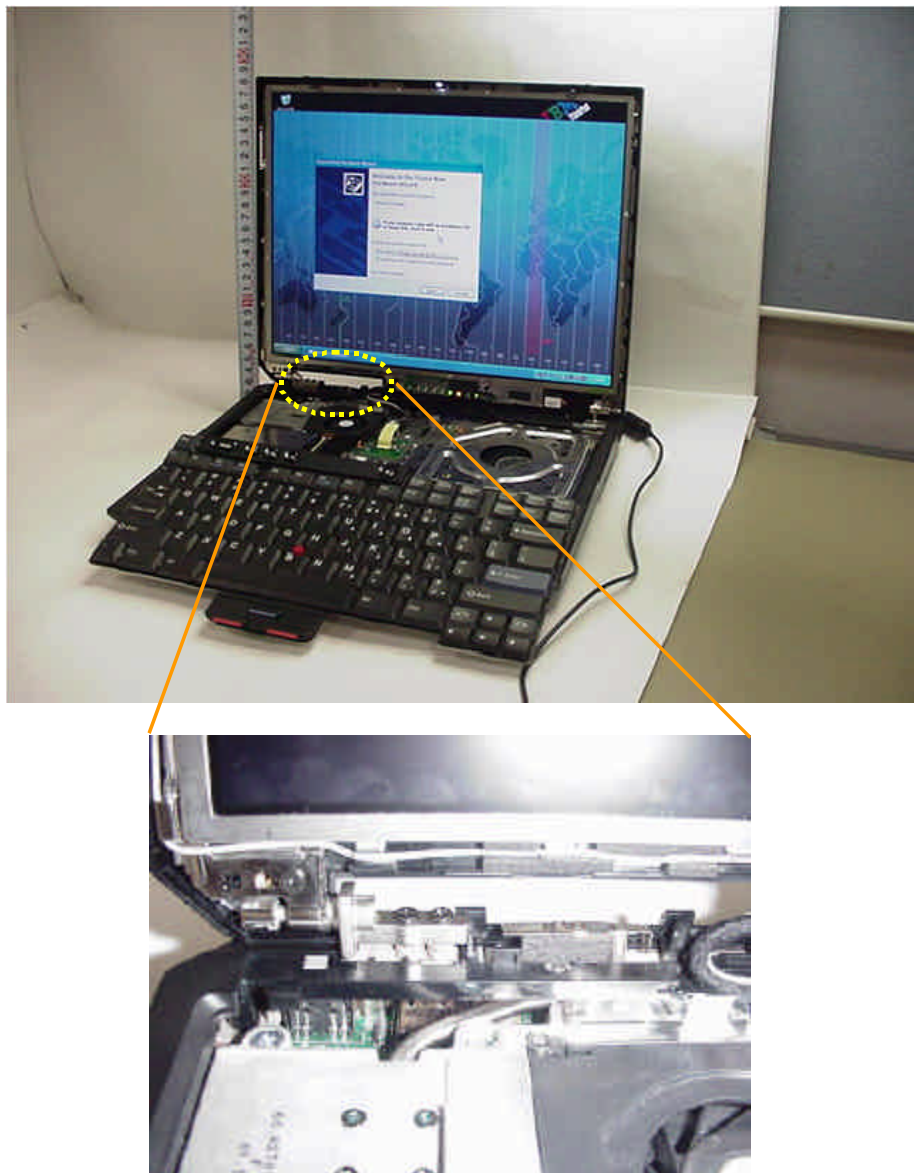
The maximum power density at 20cm distance of the applying LMA transmitter is 0.022mW/ cm², which is below the MPE limit (1.0 mW/ cm²). Therefore the LMA transmitter with the main antenna meets the MPE requirements for general Population/Uncontrolled exposure.

c) RF Exposure evaluation with the R32 Auxiliary antenna

The RF exposure energy from the auxiliary antenna in the hinge location meets the limit of SAR compliance according FCC CFR 47 section 2.1093. Please refer the measurement result of the separated SAR test report (**R32 Series – IDX SAR.pdf**).

Therefore the applying transmitter and both built_in antennas of ThinkPad R32 Series conform to the RF Exposure requirement.

[Figure D. The auxiliary antenna location](#)



2. RF Exposure Evaluation for ThinkPad T30

a) Built_in Antenna Gains of ThinkPad T30

Figure E: Main Antenna Gain

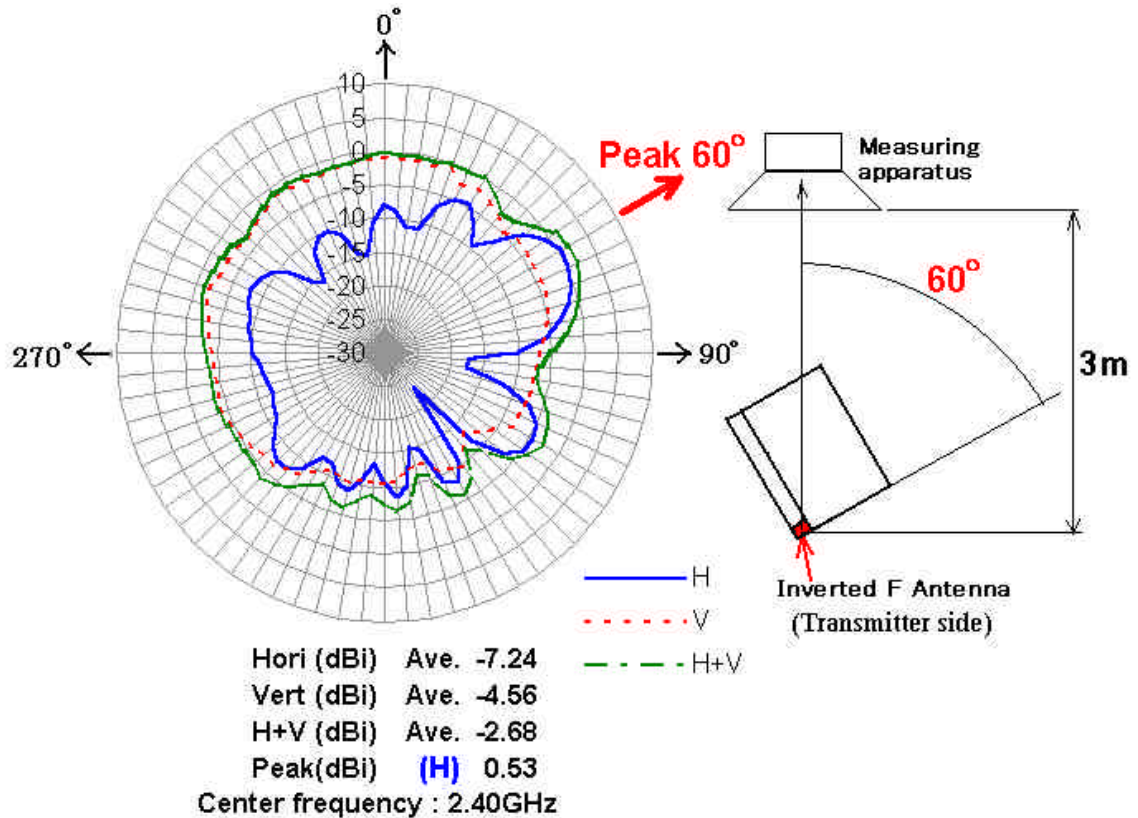
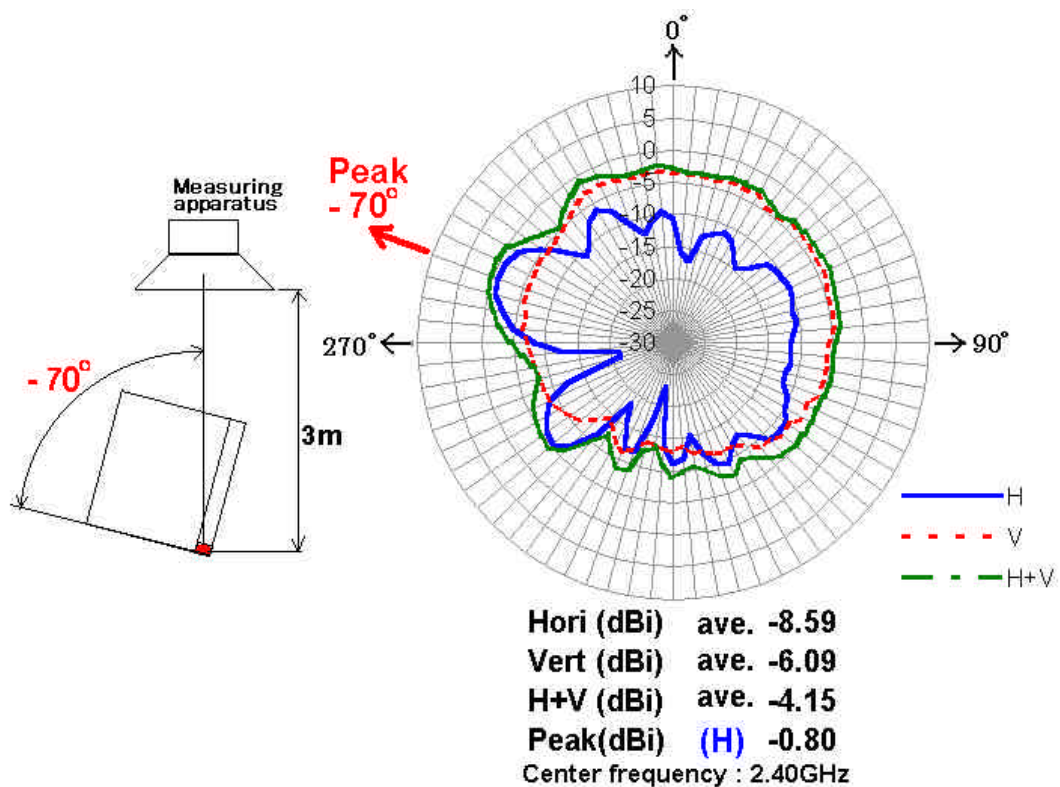
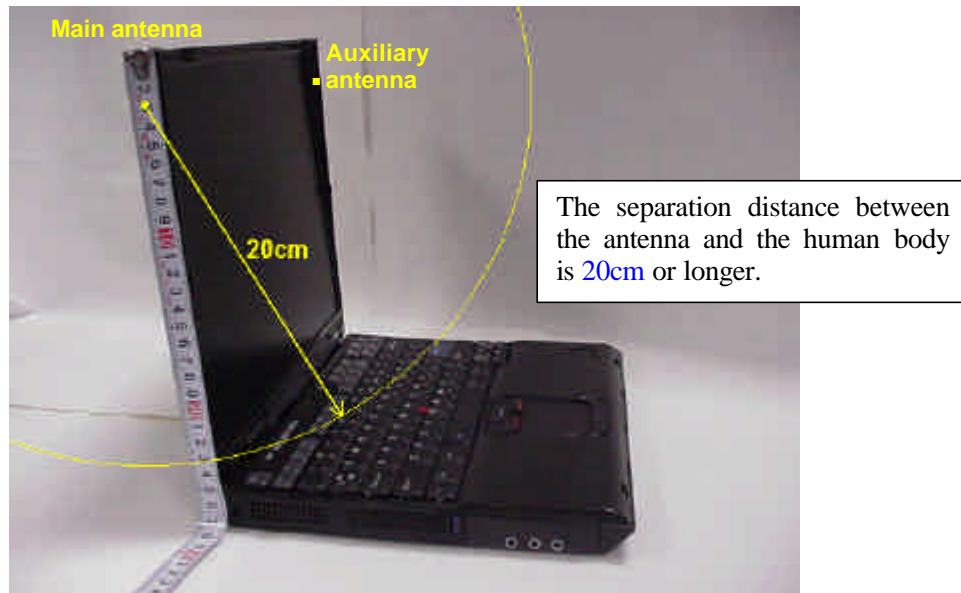


Figure F: Auxiliary Antenna Gain



b) RF Exposure evaluation with the T30 antennas

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 E.)

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 :

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

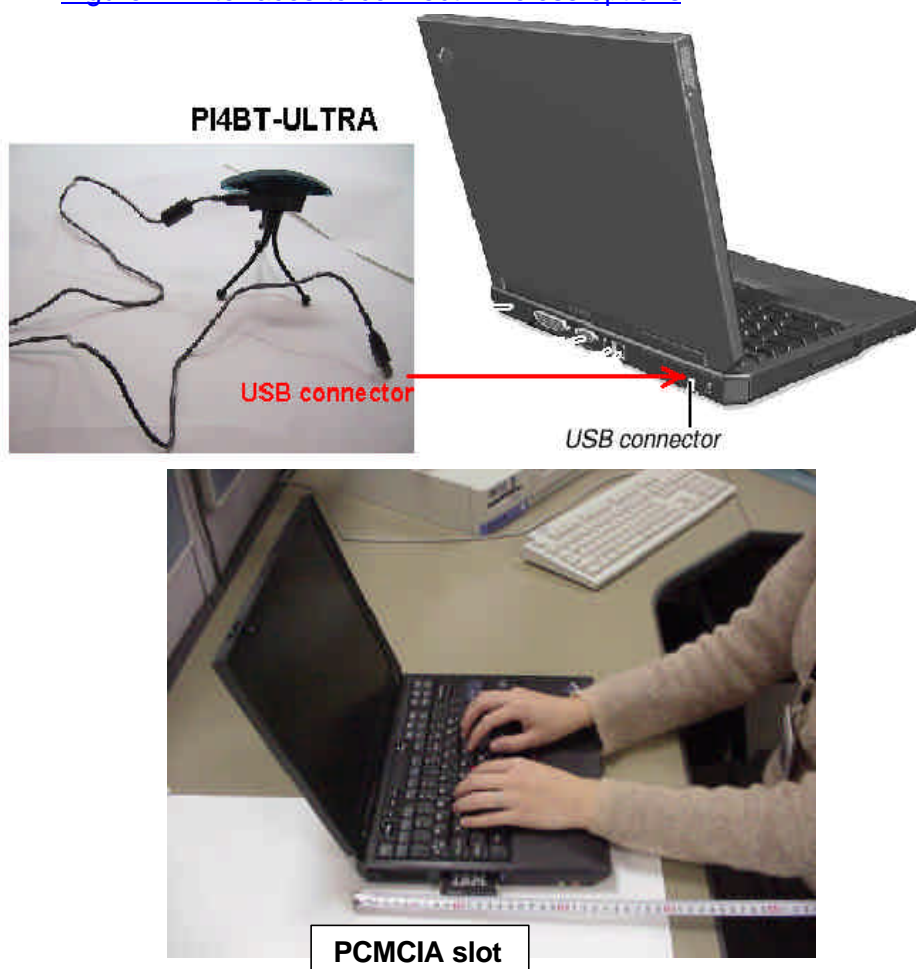
Since the applying WLAN transmitter does not function to emit the radio frequency from the both diversity antennas simultaneously, the above value is the maximum RF exposure to the persons and is below the MPE limit (1.0 mW/ cm²). Therefore the LMA transmitter with the antenna system of subjected laptop PC meets the MPE requirements for general Population/Uncontrolled exposure.

3. RF Exposure evaluation of option Bluetooth transmitters

The host devices to operate with the applying LMA transmitter support the following two Bluetooth PC options which function with the applying transmitter simultaneously.

Interface	FCC ID	Grantee Name	Product Name	Granted Date	EIRP in FCC test report
USB port	PI4BT-ULTRA	TDK Systems Europe Ltd.	Bluetooth Ultraport Module	May/22/2001	1.4 mW
PC card slot	PI4BT-IBM-PCII		Bluetooth PC Card II	August/21/2001	1.0mW

Figure E. 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 (approximately 1.5 cm for the supported PCs).

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 two Bluetooth transmitters in the above table is 2.4mW. Therefore those transmitters can co-locate with the dominant transmitter(the applying LMA transmitter) without SAR evaluation.