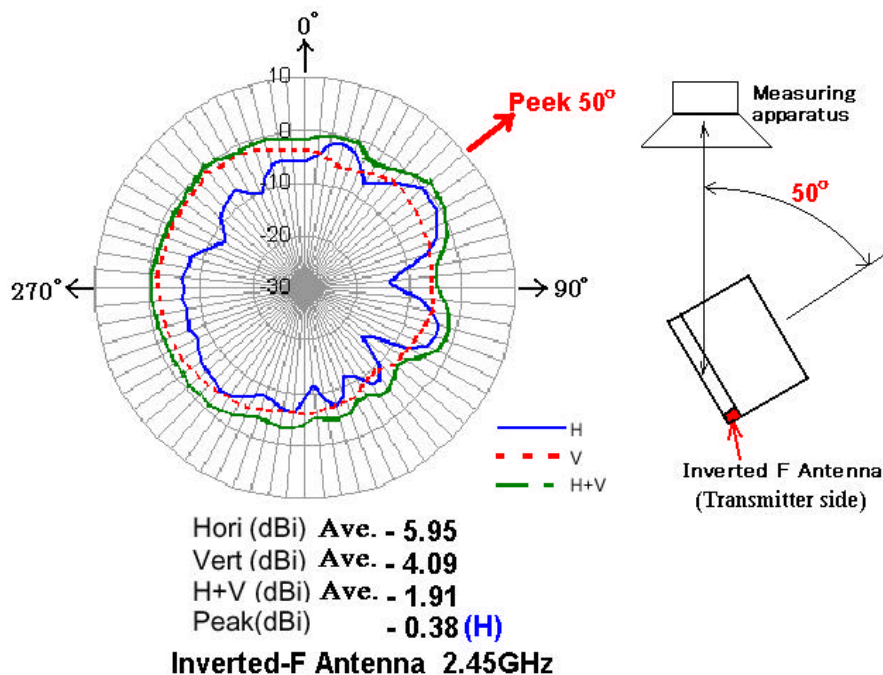# RF Exposure

1. IBM ThinkPad 802.11b Wireless LAN Mini-PCI Adapter(P/N: 26P8056)

  The applying equipment is a compact size laptop computer which is categorized as a mobile device by FCC CFR 47 Section 2.1091.   Therefore the separation distance between the antenna and the human body is 20cm or more.   As shown in the following photo, the applying equipment satisfies the requirement of antenna separation.

The separation distance between the antenna and the human body is approximately 31cm.

   The peak conducted output power of the applying equipment is 15.3dBm and the maximum antenna gain is -0.38dBi as shown below.

Hori (dBi) **Ave. - 5.95**
Vert (dBi) **Ave. - 4.09**
H+V (dBi) **Ave. - 1.91**
Peak(dBi)   **- 0.38 (H)**
Inverted-F Antenna 2.45GHz

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

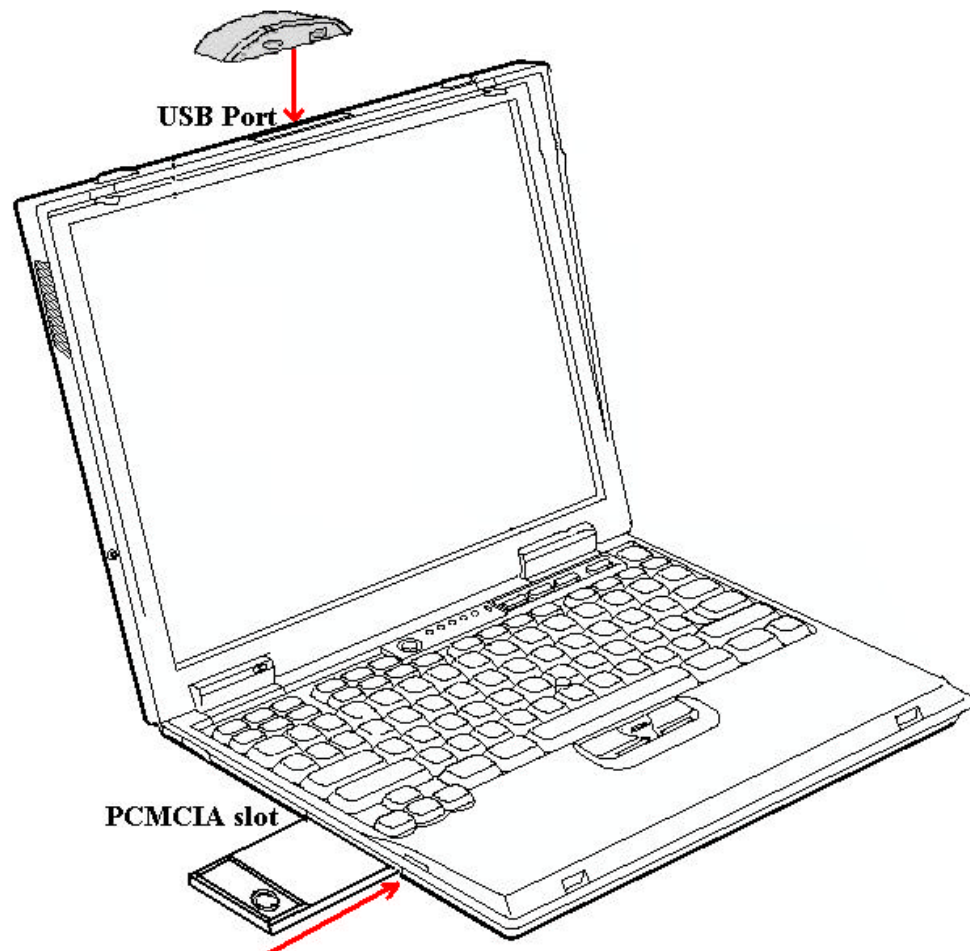$$EIRP = P + G = 15.3 \text{ dBm} - 0.38 \text{ dBi} = 14.92 \text{ dBm (31.0 mW)}$$

With this result, the maximum power density in 20cm distance is calculated as :

$$S_1 = EIRP/(4 \times R^2 \times \pi) = 0.0062 \text{ mW/cm}^2$$

2. User option Wireless cards

The applying equipment has two interfaces to connect user's option wireless cards. The following wireless cards are used in the PC slot or USB port of the equipment.

FCC ID   :   PI4BT-ULTRA
Grantee Name : TDK Systems Europe Ltd.
Product Name : Bluetooth Ultraport Module
EIRP in FCC test report : 1.4 mW
Granted Date :   May/22/2001

USB Port

PCMCIA slot

FCC ID : O2OBTPCM101		**: P4IBT-IBM-PCII**
Grantee Name : Deigianswer A/S		**: TDK Systems Europe Ltd.**
Product Name : Motorola Bluetooth 0dBm PC-Card		**: Bluetooth PC Card II**
(type no.: BTPCM100)		
EIRP in FCC test report : 2.7mW		**: 1.0 mW**
Granted Date : October/18/2000		**: August/21/2001**

The distance from the USB port to the human body is more than 20cm, also operators can maintain the sufficient antenna separation from the PC slot as shown in the photo.

The minimum antenna separation to satisfy the MPE limits ($1mW/cm^2$), and the maximum power density in 20cm distance of each card are :

Interface	FCC ID	EIRP	Min. separation to satisfy the MPE limits *1	Max. power density at 20cm *2
USB port	**PI4BT-ULTRA**	1.4mW	0.34cm	$S_2 = 0.00028 \ mW/cm^2$
PCMCIA slot	**O2OBTPCM101**	2.7mW	0.47cm	$S_3 = 0.00054 \ mW/cm^2$
	PI4BT-IBM-PCII	1.0mW	0.28cm	$S_4 = 0.00020 \ mW/cm^2$

$$*1 = \sqrt{EIRP / (1mW/cm^2 \times 4 \times \pi)}$$
$$*2 = EIRP/(4 \times 20cm^2 \times \pi)$$

When an operator will use the tree transmitters simultaneously during 30 minutes continuously in normal operation, the time-averaging exposure is : $(S_1 + S_2 + S_3) \times 30 = 0.21$
So the source-based time-averaging duty factor is considered as 100% duty.

Therefore the applying equipment meets the MPE requirements for general Population/ Uncontrolled exposure.

Prepared by T. Murota   **3/3**