

RF Exposure Justification in co-locating with other transmitters

The Table-1 and Table-2 show the antenna systems authorized to use for the applying modular transmitter (FCC ID: **PPD-AR5BXB6**, IC: **4104A-AR5BXB6**).

The specifications of antennas and co-location with the specific WWAN and Bluetooth transmitters remain the same as the previous grant conditions.

Table-1 List of authorized host PC devices

Wireless LAN module	Host PC devices		Authorized date
FCC ID: PPD-AR5BXB6 IC: 4104A-AR5BXB6	M1	ThinkPad Z60t Series (14.1-inch wide screen)	July 14, 2005 FCC (Class II) July 13, 2005 IC (Class II)
	KS1 KS2	ThinkPad X60 Series (12.1-inch)	January 17, 2006 (Class I)
	D1 D2	ThinkPad T60 Series (14.0 & 15.0-inch)	January 17, 2006 (Class I)
	RP1 RP2 RP3	ThinkPad R60 Series (14.0 & 15.0-inch)	April 17, 2006 (Class I)
	M2	ThinkPad Z61t Series (14.1-inch widescreen)	
	W2	ThinkPad Z61m/Z61p/Z61e (15.4-inch widescreen)	
	C2	ThinkPad T60 Series (15.4-inch widescreen)	October 17, 2006 (Class I)
	D3	ThinkPad T61 Series (14.1-inch)	April 16, 2007 (Class I)
	ML1	ThinkPad T61/R61 Series (14.1-inch widescreen)	
	R4	ThinkPad R61 Series (15.0-inch)	
	C3	ThinkPad T61 Series (15.4-inch widescreen)	
	Wa1	ThinkPad R61 Series (15.4-inch widescreen)	
	KS3	ThinkPad X61 Series (12.1-inch)	

1. RF Exposure evaluation for the applying modular transmitter

The separation distances between human body and WLAN transmission antennas of the specific host PC devices are shown in Annex-1 in this exhibit.

The all transmission antennas maintain the separation distance with at least 202mm(Annex-1, Figure-6). Therefore the applying WLAN transmitter module (FCC ID: PPD-AR5BXB6, IC: 4104A-AR5BXB6) and the antenna systems are subjected to "Mobile device" pursuant to FCC CFR 47 Section 2.1091, or "RF Exposure Evaluation" category pursuant to IC RSS-102e clause 2.5.2.

[EIRP & MPE Evaluation]

The following table shows the highest conducted peak output power values of the applying modular transmitter device, and the maximum peak antenna gains of the new host device.

Transmission mode	P : conducted peak output power	G : peak antenna gain *1
2.4GHz band	0.190 W (22.8 dBm)	1.94 dBi
5.2GHz band	0.041 W (16.1 dBm)	2.90 dBi
5.5GHz band	0.060 W (17.8 dBm)	2.99 dBi
5.8GHz band	0.141 W (21.5 dBm)	2.99 dBi

*1: See Table-2 in more detail.

Table-2 List of authorized antennas

Host Unit			Antenna Manufacturer	LCD	Antenna type	Main Antenna						Auxiliary Antenna					
						Antenna P/N	Cable length	Frequency band (GHz)				Antenna P/N	Cable length	Frequency band (GHz)			
								2.4 -2.5	5.15 -5.35	5.47 -5.725	5.725 -5.85			2.4 -2.5	5.15 -5.35	5.47 -5.725	5.725 -5.85
C-note	C2	T60	Hitachi	15.4" wide	PIFA	HMT09-LV01	561mm	-0.38	0.52	0.70	-0.26	HMT10-LV01	475mm	1.13	0.54	1.52	0.77
	C3	T61/T61p	FOXCONN Galtronics	15.4" wide	PIFA	WDAN-L1CR3001-DF 50-52-05	504mm 376mm	-1.00 -1.88	1.51 2.77	1.23 2.42	1.86 2.42	WDAN-L1CR3003-DF 50-66-03	529mm 484mm	0.95 -0.68	0.39 -0.34	0.94 0.90	0.93 0.17
D-note	D1 D2	T60/T60p	Hitachi	14"	PIFA	HFT38	528mm	-0.54	2.77	1.77	1.69	HFT39	614mm	1.80	0.66	0.84	1.45
				15"			559mm	-0.42	1.20	1.41	1.87		484mm	-1.27	-1.91	-2.69	-0.49
			Hitachi	14"	PIFA	HFT38D4	528mm	-1.01	1.88	2.99	2.99	HFT39D4	614mm	1.87	1.97	2.26	2.44
				15"		HFT38D5	559mm	-0.34	1.29	1.09	1.43	HFT39D5	484mm	1.94	1.02	0.36	-0.04
			FOXCONN	14"	PIFA	023-0100-2400	528mm	0.20	1.45	-1.10	1.74	023-0100-2399	614mm	-1.00	0.80	0.40	0.10
				15"			559mm	-0.30	0.40	0.10	-1.10		484mm	-1.00	0.60	-0.30	-0.50
	D3	T61 / T61p	Hitachi	14"	PIFA	HMT12-MAIN	415mm	-0.13	2.12	1.53	2.83	HMT12-AUX	602mm	1.58	2.66	2.41	2.41
			FOXCONN			WDAN-L1DV3001-DF	415mm	-0.76	2.08	1.58	0.46	WDAN-L1DV3003-DF	602mm	0.00	-0.41	-0.26	0.07
			Galtronics			50-52-03	415mm	0.02	2.56	2.63	0.73	50-54-03	602mm	0.26	1.42	0.33	0.43
RP-note	RP1 RP2 RP3	R60/R60e	Hitachi	14"	PIFA	HFT47	520mm	-0.14	1.74	2.86	2.95	HFT48	370mm	1.67	-1.08	-0.55	0.43
				15"			550mm	-1.04	2.36	1.22	1.23		435mm	1.83	2.14	0.75	1.46
			Tyco	14"	PIFA	1770417-1	530mm	1.25	1.88	2.36	0.74	1770418-1	380mm	-1.12	0.69	1.26	0.25
				15"			535mm	1.18	1.30	1.70	2.42		435mm	-1.35	0.69	1.45	0.83
			Wistron NeWeb	14"	PIFA	81.EEF15.001	550mm	1.20	2.86	2.84	2.60	81.EEF15.002	405mm	0.95	2.76	2.89	2.52
				15"		81.EEF15.003	580mm	1.10	2.34	2.55	2.70	81.EEF15.004	470mm	1.50	2.10	2.35	2.40
	R4	R61	Hitachi	15"	PIFA	HFT47	550mm	-1.04	2.36	1.22	1.23	HFT48	435mm	1.83	2.14	0.75	1.46
			Tyco			1770417-1	535mm	1.18	1.30	1.70	2.42	1770418-1	435mm	-1.35	0.69	1.45	0.83
			Wistron NeWeb			81.EEF15.003	580mm	1.10	2.34	2.55	2.70	81.EEF15.004	470mm	1.50	2.10	2.35	2.40
ML-note	ML1	T61 / R61	NISSEI	14" wide	PIFA	3059797	465mm	-1.54	2.61	2.15	2.19	3059805	512mm	-0.01	0.86	1.42	1.60
M-note	M1	Z60t	FOXCONN	14" wide	PIFA	023-0100-2399	665mm	1.02	2.11	2.42	2.33	023-0100-2400	495mm	0.30	1.81	2.50	2.50
	M2	Z61t				023-0100-2399	680mm	-0.37	1.93	0.49	0.72	023-0100-2400	507mm	-1.76	1.21	1.28	1.17
W-note	W2	Z61m/Z61p/Z60e	FOXCONN	15" wide	PIFA	023-0100-4031	574mm	1.56	0.88	0.85	0.39	023-0100-4032	380mm	0.61	1.30	-0.30	-0.69
Wa-note	Wa1	R61/R61e	Hitachi	15.4" wide	PIFA	HMT14-MAIN	376mm	1.82	1.77	2.18	1.08	HMT14-AUX	484mm	1.54	2.62	2.83	1.47
KS-note	KS1 KS2	X60/X60s	Wistron NeWeb	12" w MF	PIFA	3A.EDU45.111	575mm	0.91	2.78	2.84	1.75	3A.EDU45.112	575mm	1.30	2.86	2.92	2.54
				12" w/o MF	PIFA	3A.EDU45.114	575mm	1.10	2.82	2.84	2.57	3A.EDU45.115	575mm	1.40	2.90	2.94	2.73
	KS3	X61/X61s	Wistron NeWeb	12" w MF	PIFA	25.90386.001	596mm	1.80	2.84	2.80	2.75	25.90386.001	640mm	1.83	2.83	2.73	2.73
						25.90383.001	596mm	1.78	2.83	2.82	2.74	25.90434.001	579mm	1.24	2.71	2.48	2.48
				12" w/o MF	PIFA	60.4B421.001	585mm	1.91	2.89	2.91	2.86	60.4B421.001	644mm	1.93	2.89	2.84	2.84
						60.4B422.001	585mm	1.88	2.87	2.84	2.75	60.4B537.001	575mm	1.87	1.57	2.50	2.48

Thus, EIRP and the maximum power density at 20cm distance are calculated as follows.

Transmission mode	EIRP = P + G (dBm)	EIRP (mW)	MPE Max. power density $S = \text{EIRP} / (4 \times \pi \times 20^2)$
2.4GHz band	24.74	297.9	0.059 mW/ cm ²
5.2GHz band	19.00	79.4	0.016 mW/ cm ²
5.5GHz band	20.79	119.9	0.024 mW/ cm ²
5.8GHz band	24.49	281.2	0.056 mW/ cm ²

With those results, the applying modular transmitter has found to comply with the FCC MPE limit (1.0 mW/cm²) according to FCC CFR 47 section 2.1091 for general Population/Uncontrolled exposure.

Also the applying modular transmitter has found to comply with the IC "RF Exposure Evaluation", EIRP limit (5W) according to IC RSS-102e clause 2.5.2.

2. RF Exposure evaluation with co-located WWAN transmitter

As shown in Annex-1, some host PC devices incorporate WWAN transmitter.

The WWAN Tx/Rx antennas and the WLAN antennas are co-located with at least 7mm (Annex-1, Figure-10). However both transmitter modules do not establish the network link connections simultaneously, but switch the operation each other within 11 seconds of hand over time when one is in active. (See Annex-2 in this exhibit.)

Therefore, any RF Exposure evaluation for the applying WLAN transmitter in co-locating with WWAN transmitters is not required.

3. RF Exposure evaluation with co-located Bluetooth transmitter

In addition, the host PC devices incorporate the following Bluetooth transmitter

Co-located Bluetooth device

Model Name	FCC ID, IC Cert. Number	Grantee Name	Granted Date	Conducted Tx power	Antenna gain	EIRP
J07H081	FCC ID: MCLJ07H081	HON HAI Precision Ind. Co., Ltd.	June/ 23 / 2005	3 mW	2 dBi (Peak)	4.8 mW
	IC: 2878D-J07H081		Sep. / 02/ 2005			

The four Bluetooth antennas of the applying host PC devices are regarded as "co-located" due to the antenna separation distance from the WLAN antennas, and the WLAN and Bluetooth devices transmit RF frequencies simultaneously.

Host PC model	WLAN-Bluetooth antenna separation distance
ThinkPad T61 Series 14.1-inch (D3)	178 mm
ThinkPad T61/R61 Series 14.1-inch windscreen (ML1)	185 mm
ThinkPad T61 Series 15.4-inch windscreen (C3)	186 mm
ThinkPad R61 Series 15.4-inch windscreen (Wa1)	183 mm
ThinkPad T60 Series 14.0/15.0-inch (D1 / D2)	250 mm
ThinkPad R60/R61 Series 14.0/15.0-inch (RP1/RP2/RP3/R4)	250 mm
ThinkPad T60 Series 15.4-inch windscreen (C2)	240 mm
ThinkPad Z60t/Z61t Series 14.1-inch windscreen (M1 / M2)	200 mm
ThinkPad Z61m/Z61p/Z61e Series 15.4-inch windscreen (W2)	225 mm
ThinkPad X60 Series 12.1-inch (KS1 / KS2)	205 mm
ThinkPad X61 Series 12.1-inch (KS3)	208 mm

The all Bluetooth antennas are assembled at the hinge section of each applying host PC device, and the separation distance from human body is 33mm or less. Therefore the Bluetooth transmitter module (J07H081) and the antenna systems are generally subjected to SAR evaluation.

However the Bluetooth device is exempted from SAR testing thanks to its low power of 3mW pursuant to the footnote 14 of the Section 3 in Supplement C to the FCC OET Bulletin 65, and meets the condition for a co-located non-dominant transmitter according to the "TCB Exclusions List" issued on July/2002.

Also, the Bluetooth device is exempted from SAR testing pursuant to IC RSS-102e clause 2.5.1.

Annex-1 Antenna Assembly

Figure-1 ThinkPad T60 series (D1 / D2)

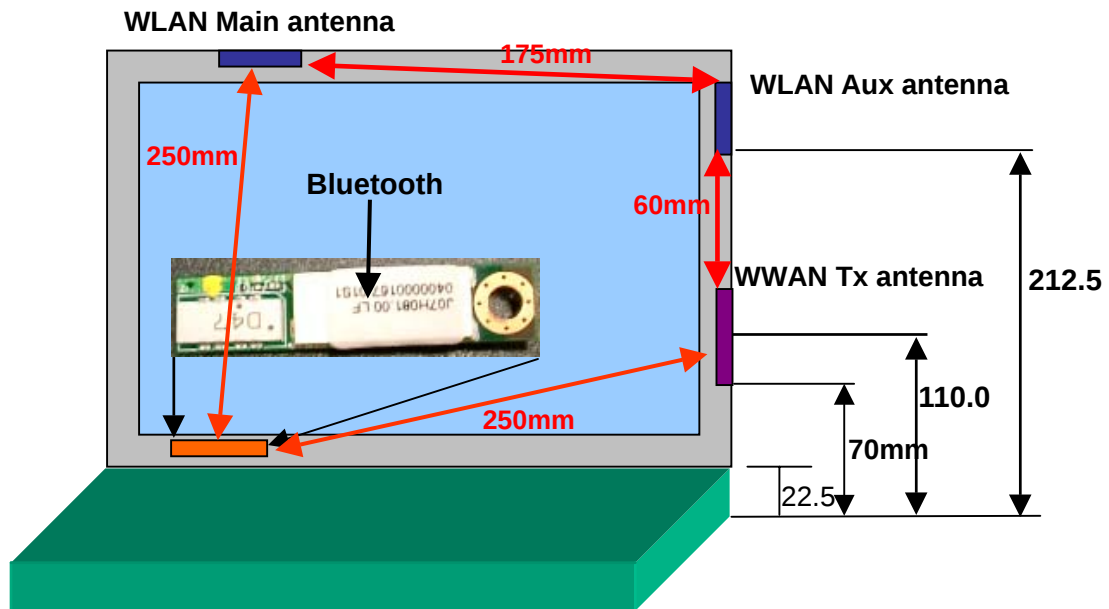


Figure-2 ThinkPad R60/R61 series (RP1 / RP2 / RP3 / R4)

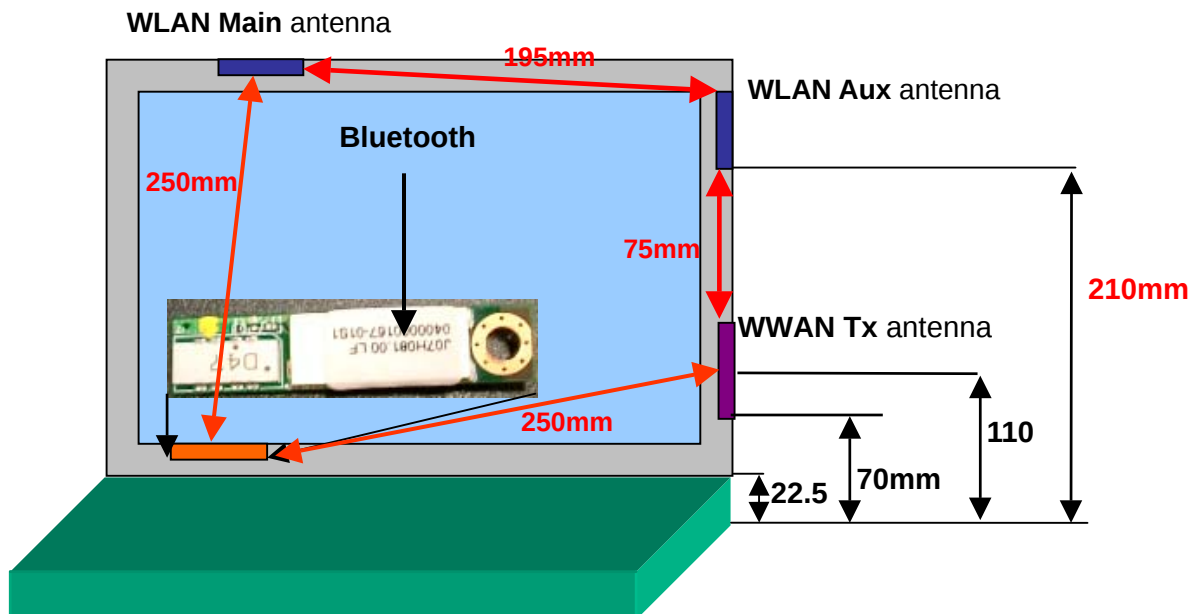


Figure-3 ThinkPad X60 series (KS1 / KS2)

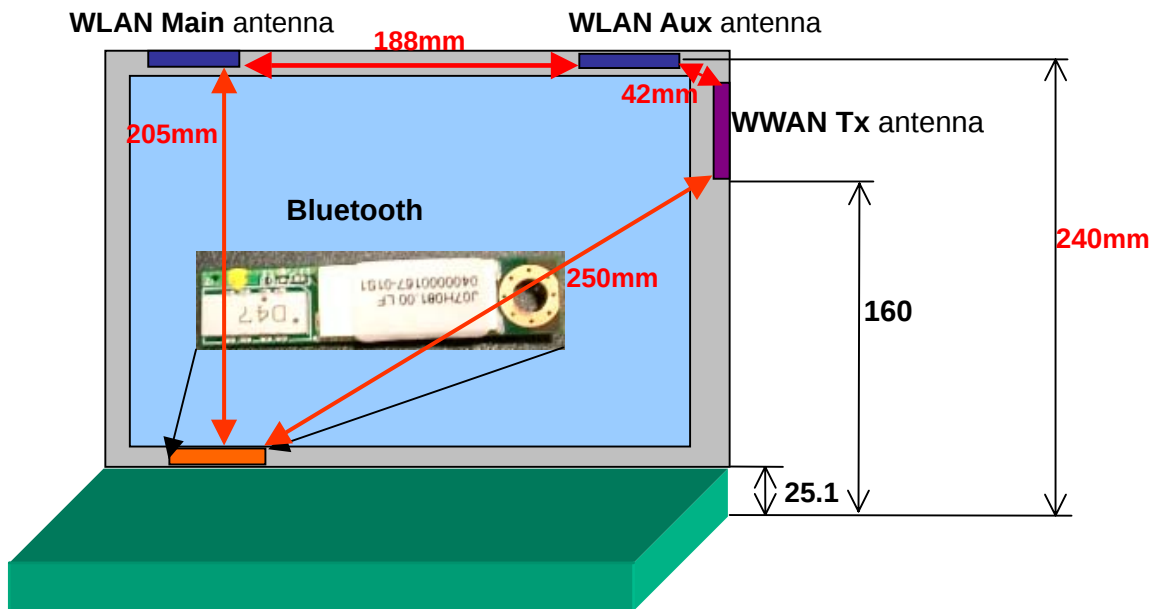


Figure-4 ThinkPad Z61m/Z61p/Z61e Series (W2)

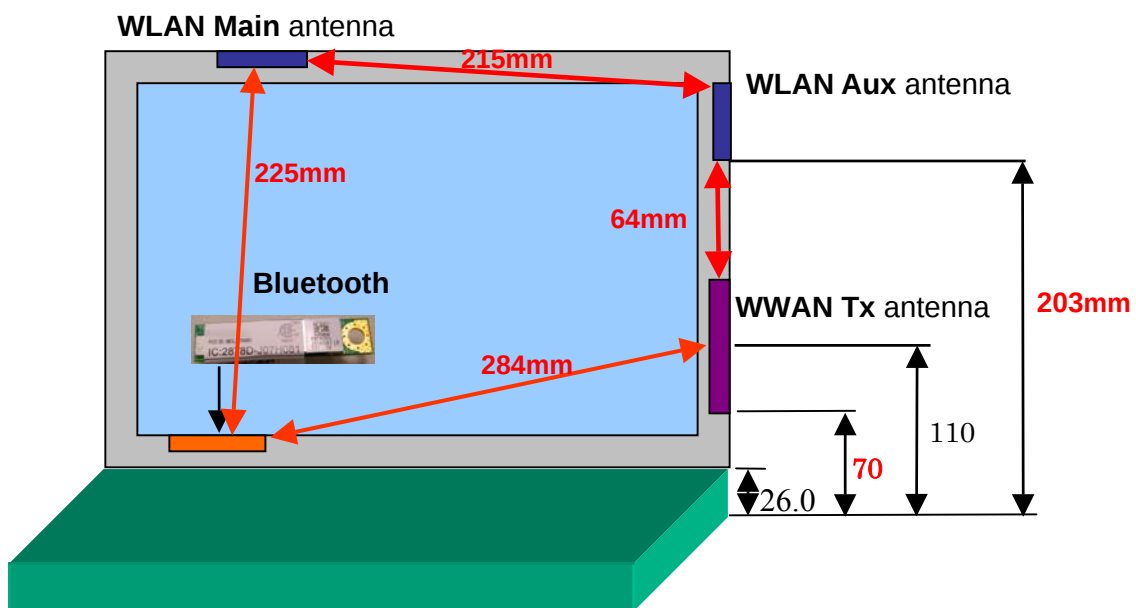


Figure-5 ThinkPad Z60t/Z61t Series (M1 / M2)

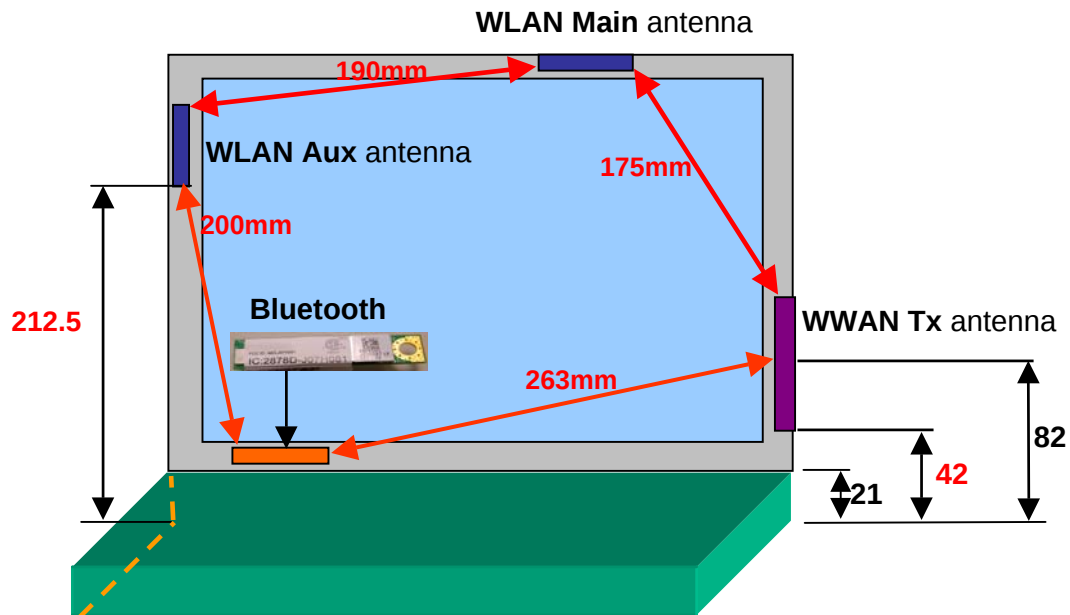


Figure-6 ThinkPad T61/R61 series 14.1-inch widescreen (ML1)

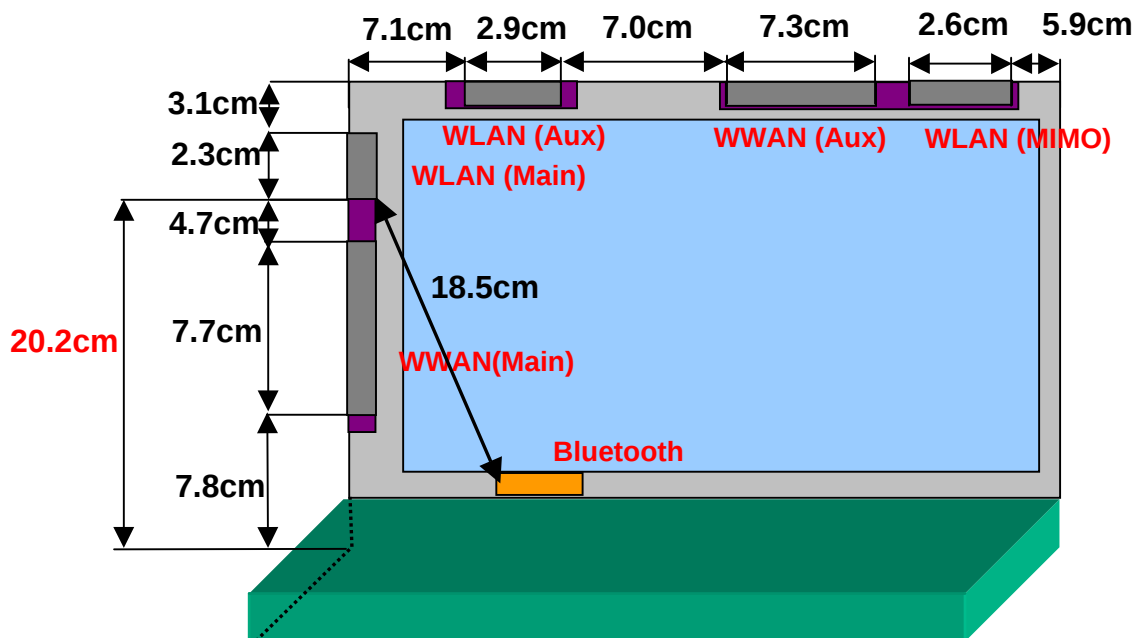


Figure-7 ThinkPad T60 15.4-inch widescreen (C2)

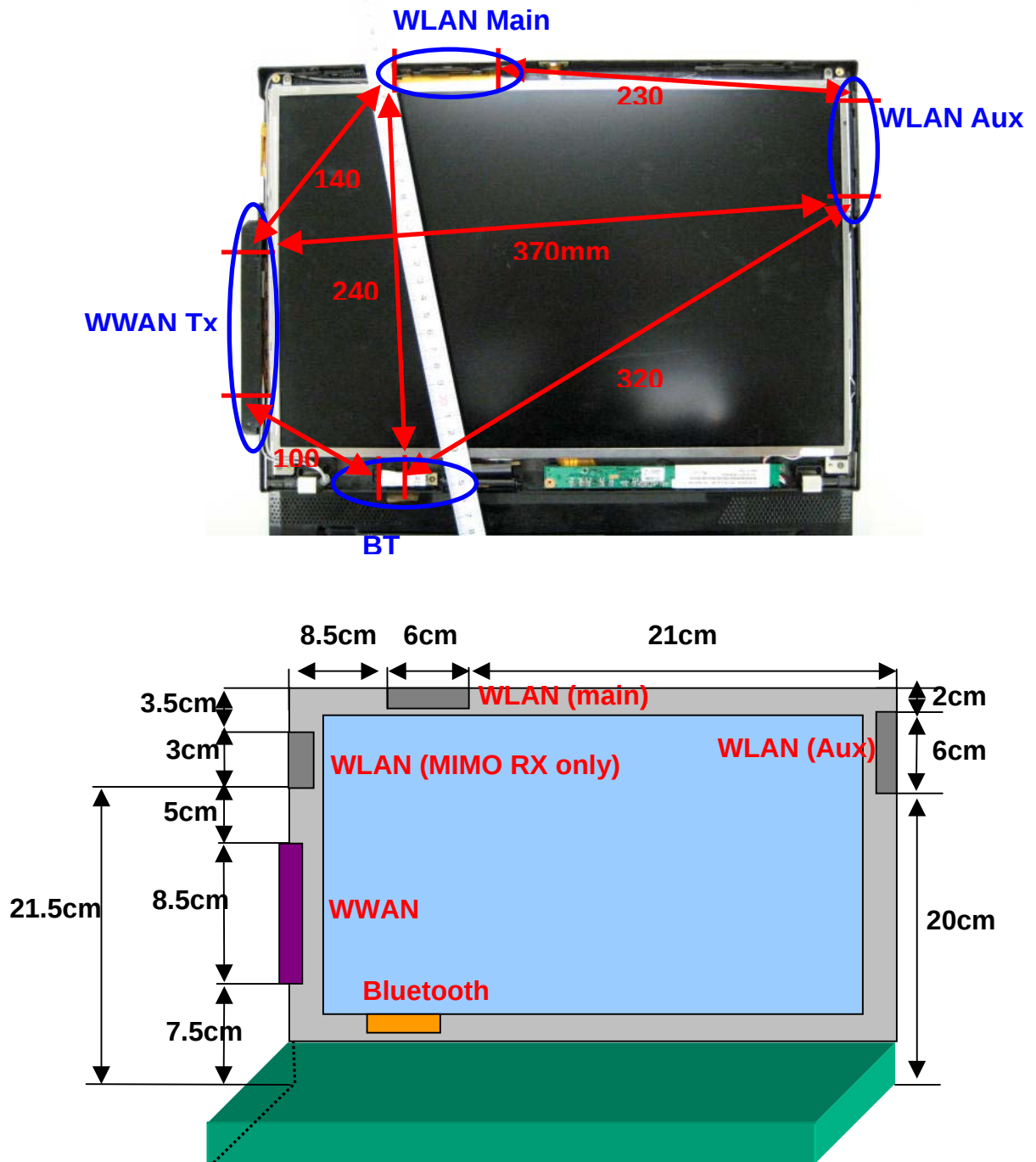


Figure-8 ThinkPad T61 series (D3)

Rear view without outer LCD cover

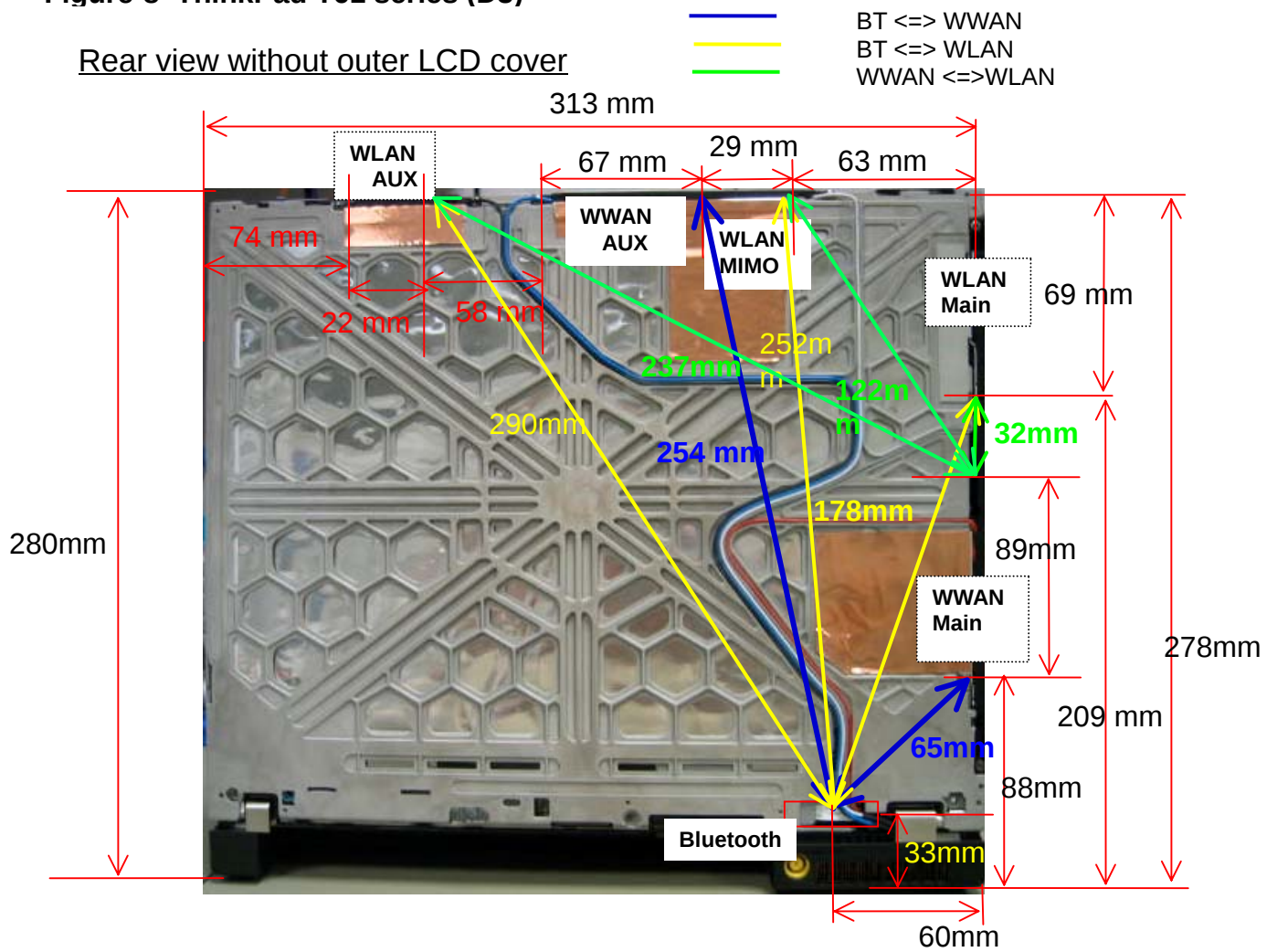


Figure-9 ThinkPad R61 15.4-inch widescreen (Wa1)

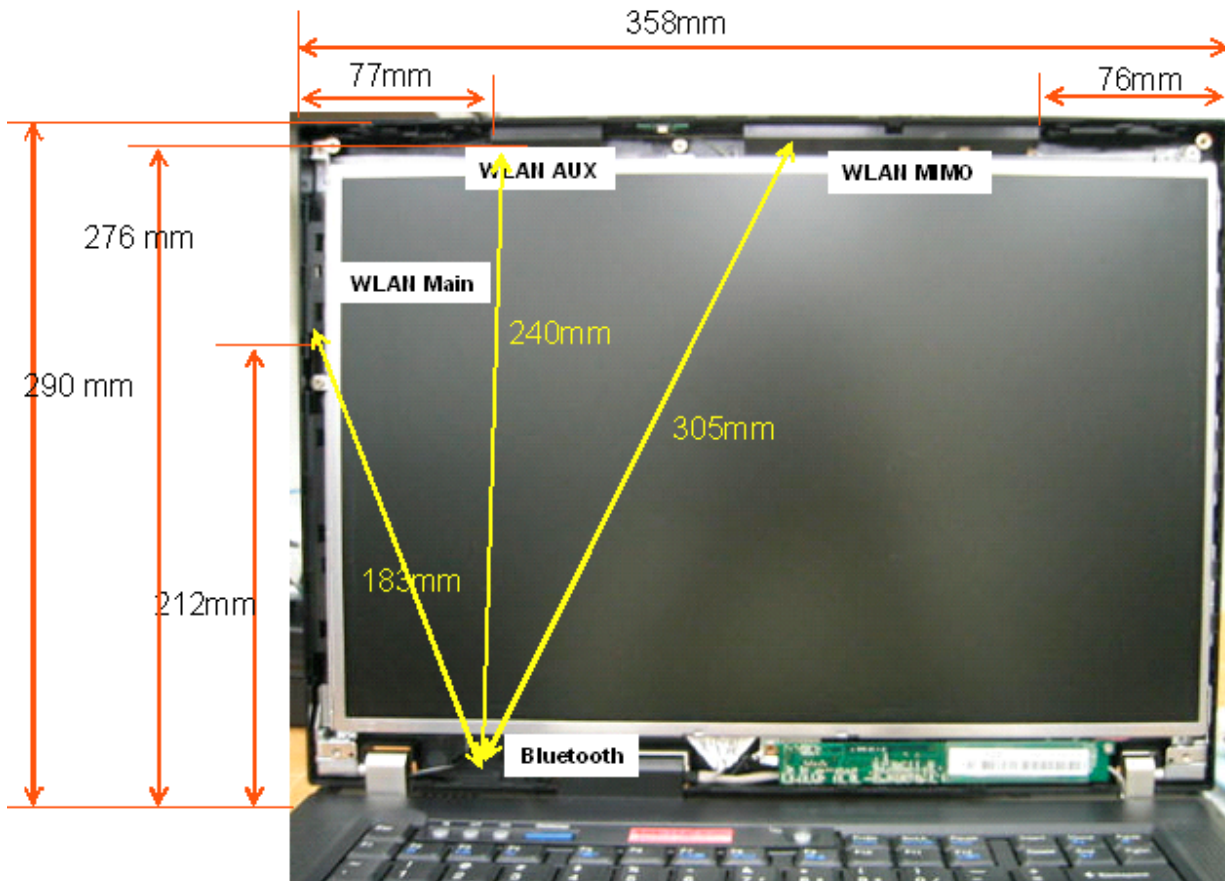


Figure-10 ThinkPad X61 series (KS3)

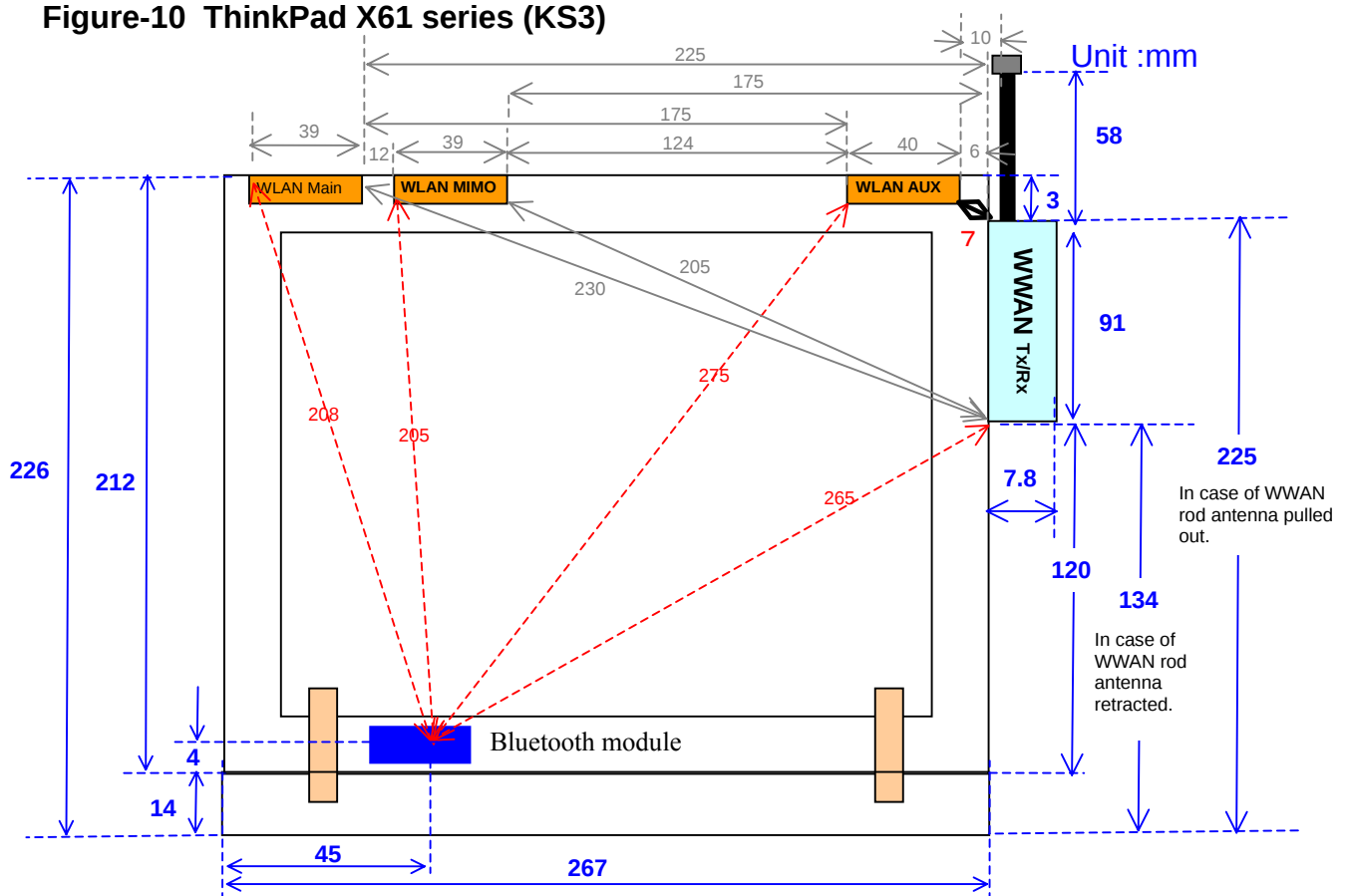
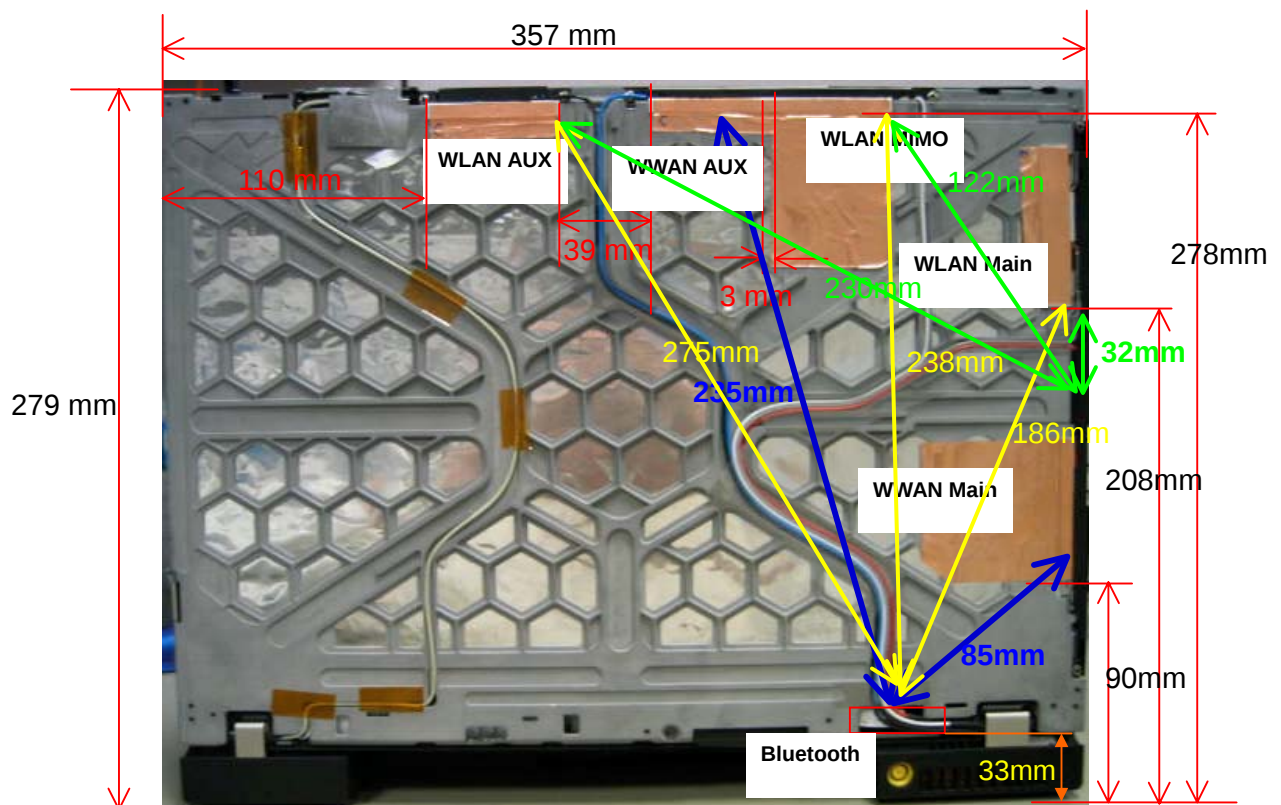


Figure-11 ThinkPad T61 15.4-inch widescreen (C3)



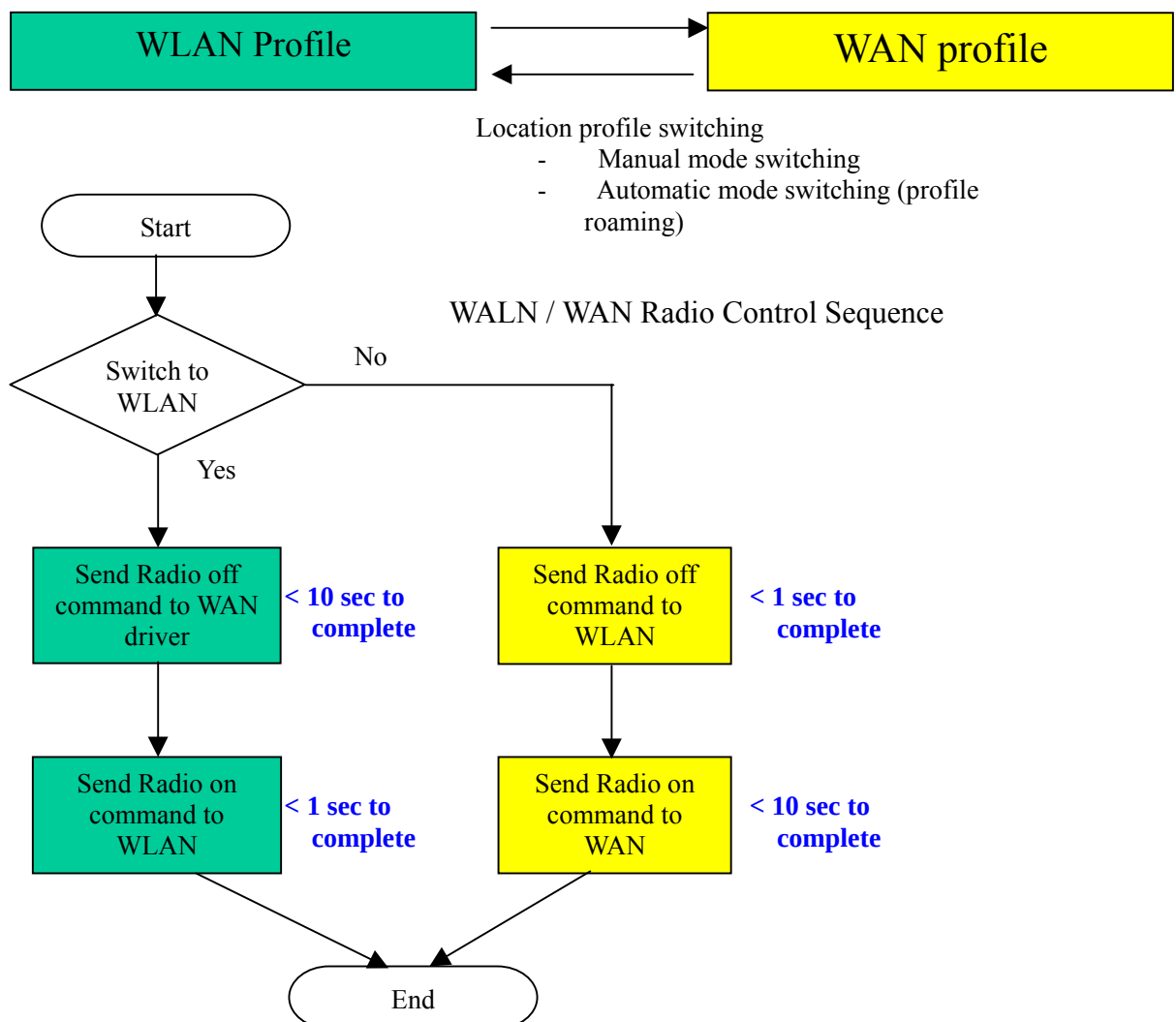
Rear view



Annex-2 Wireless LAN/WAN switching scheme within 11 seconds of handover time

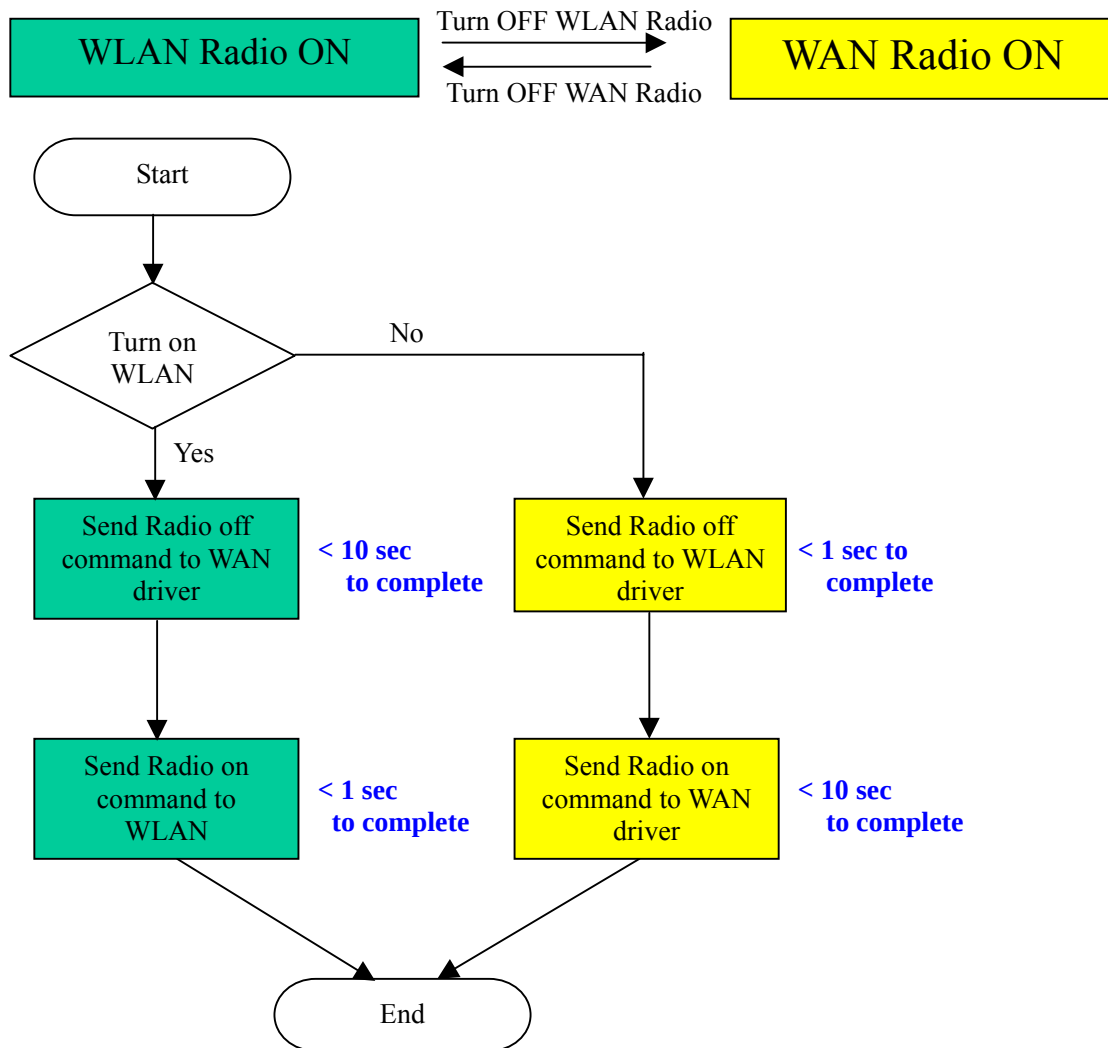
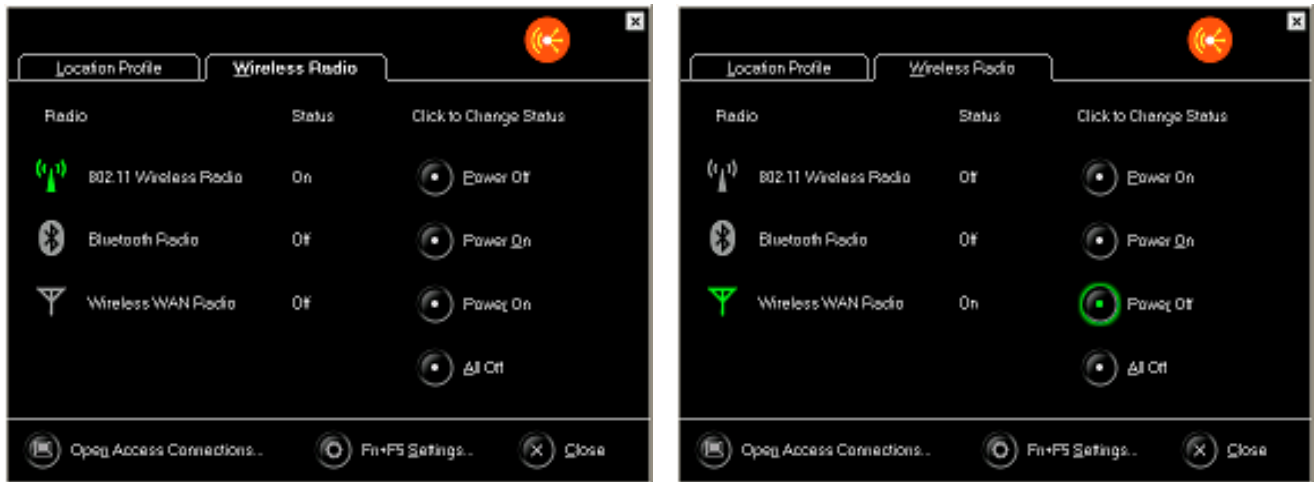
Location profile switching scenario

- Exclusive control for WLAN and WAN when WLAN and WAN location profile is applied by user (manual mode switching)
- Exclusive control when automatic location switching is performed by Access Connections (automatic profile roaming)



Radio control by software menu (Fn+F5 hot key)

Exclusive control when WLAN or WAN Radio ON is selected by hot key



Wireless WAN/LAN status indication

The sifting status from WAN(LAN) to LAN(WAN) is also indicated with the following LED. The switching time is actually shorter than 11 seconds of logical control limit time.



1.