Propagation models

- Cost 231 table of models

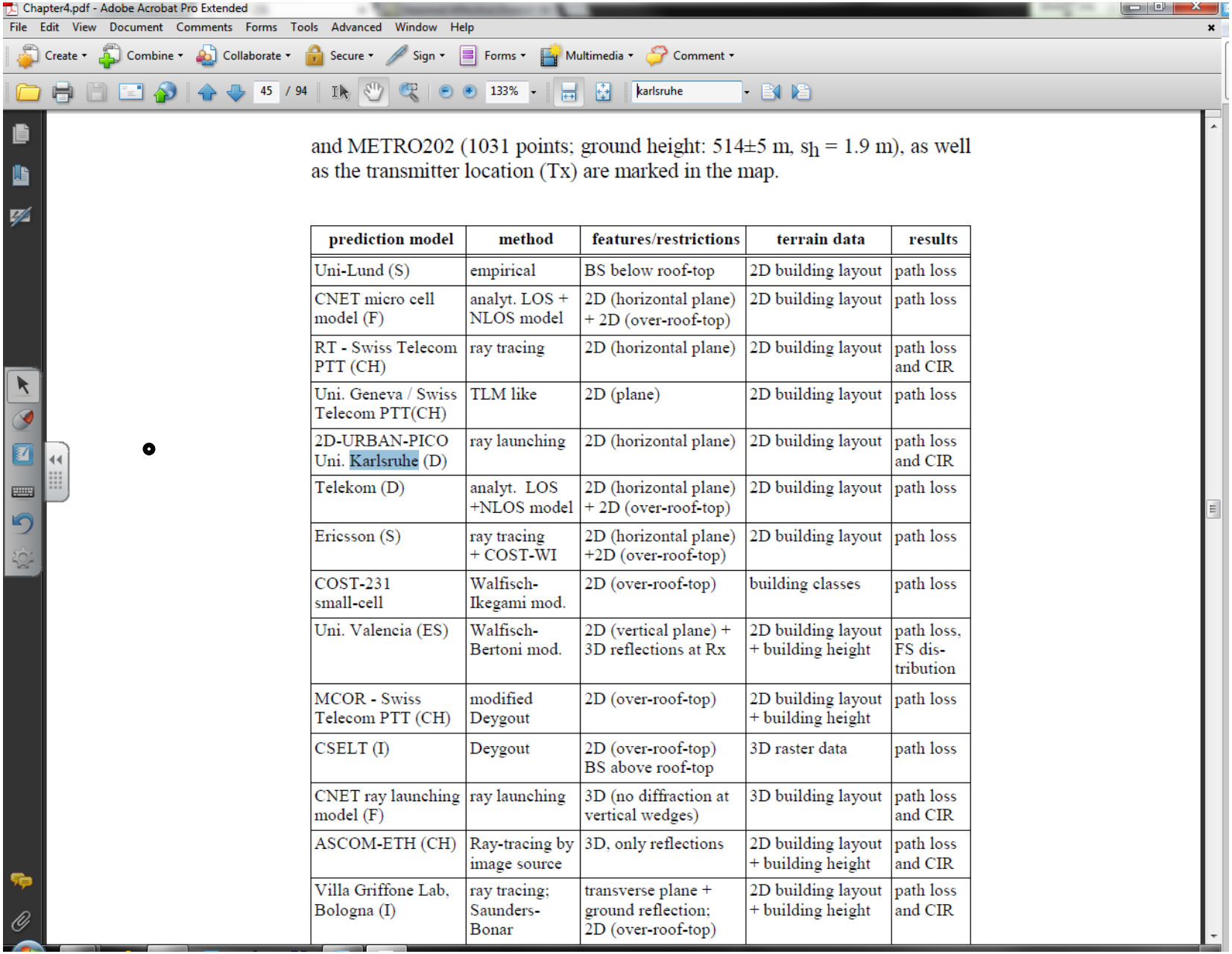
- models for micro- and macro-cells

1)

antenna height	below rooftop	rooftop	above rooftop
antenna height T_h			
output power P_{tx}			
Range R [m]			

2) identify model

3) implement model and compare with free space & Hata



and METRO202 (1031 points; ground height: 514±5 m, s_h = 1.9 m), as well as the transmitter location (Tx) are marked in the map.

prediction model	method	features/restrictions	terrain data	results
Uni-Lund (S)	empirical	BS below roof-top	2D building layout	path loss
CNET micro cell model (F)	analyt. LOS + NLOS model	2D (horizontal plane) + 2D (over-roof-top)	2D building layout	path loss
RT - Swiss Telecom PTT (CH)	ray tracing	2D (horizontal plane)	2D building layout	path loss and CIR
Uni. Geneva / Swiss Telecom PTT(CH)	TLM like	2D (plane)	2D building layout	path loss
2D-URBAN-PICO Uni. Karlsruhe (D)	ray launching	2D (horizontal plane)	2D building layout	path loss and CIR
Telekom (D)	analyt. LOS +NLOS model	2D (horizontal plane) + 2D (over-roof-top)	2D building layout	path loss
Ericsson (S)	ray tracing + COST-WI	2D (horizontal plane) +2D (over-roof-top)	2D building layout	path loss
COST-231 small-cell	Walfisch-Ikegami mod.	2D (over-roof-top)	building classes	path loss
Uni. Valencia (ES)	Walfisch-Bertoni mod.	2D (vertical plane) + 3D reflections at Rx	2D building layout + building height	path loss, FS dis-tribution
MCOR - Swiss Telecom PTT (CH)	modified Deygout	2D (over-roof-top)	2D building layout + building height	path loss
CSELT (I)	Deygout	2D (over-roof-top) BS above roof-top	3D raster data	path loss
CNET ray launching model (F)	ray launching	3D (no diffraction at vertical wedges)	3D building layout	path loss and CIR
ASCOM-ETH (CH)	Ray-tracing by image source	3D, only reflections	2D building layout + building height	path loss and CIR
Villa Griffone Lab, Bologna (I)	ray tracing; Saunders-Bonar	transverse plane + ground reflection; 2D (over-roof-top)	2D building layout + building height	path loss and CIR

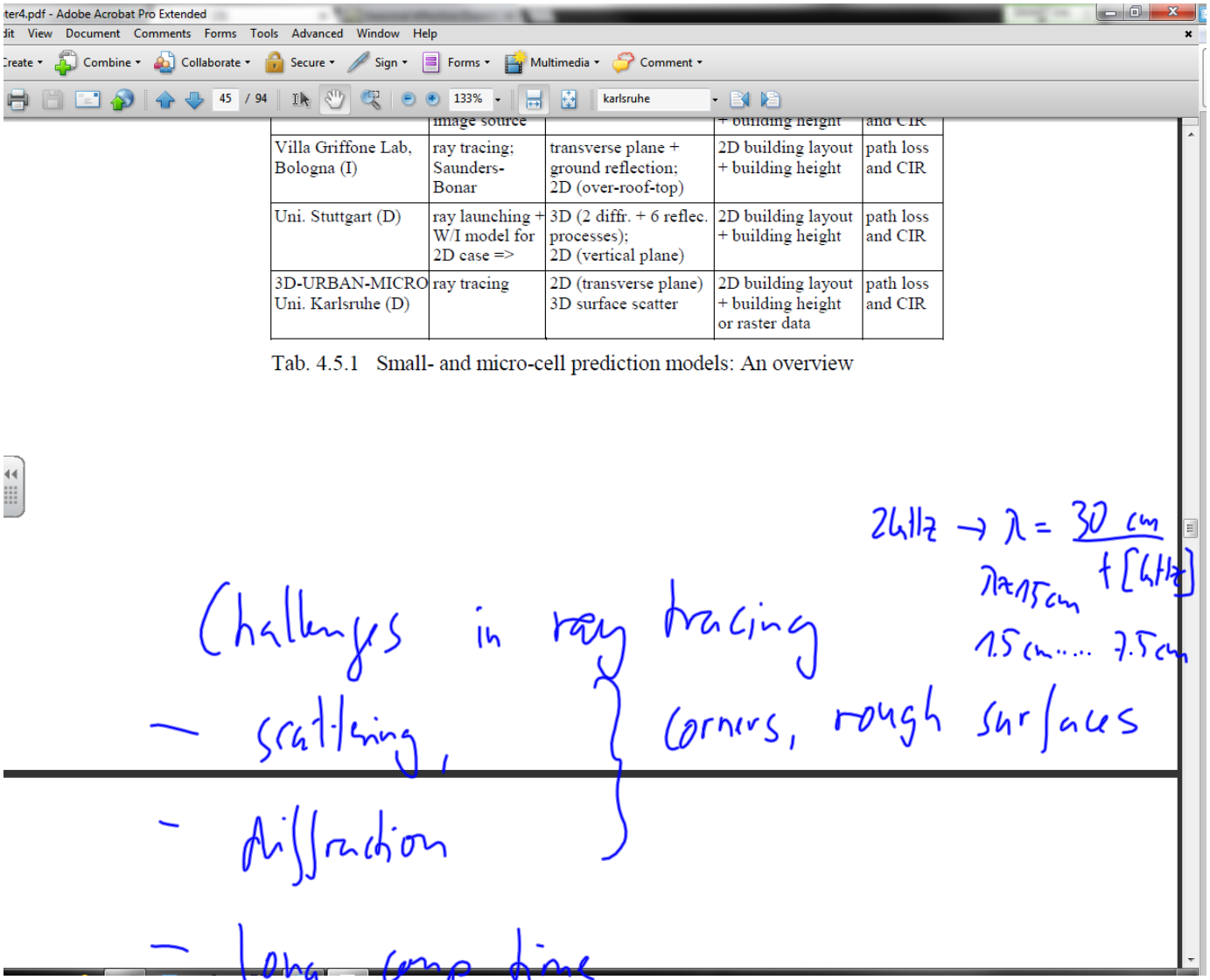


	image source		+ building height	and CIR
Villa Griffone Lab, Bologna (I)	ray tracing; Saunders-Bonar	transverse plane + ground reflection; 2D (over-roof-top)	2D building layout + building height	path loss and CIR
Uni. Stuttgart (D)	ray launching + W/I model for 2D case =>	3D (2 diffr. + 6 reflec. processes); 2D (vertical plane)	2D building layout + building height	path loss and CIR
3D-URBAN-MICRO Uni. Karlsruhe (D)	ray tracing	2D (transverse plane) 3D surface scatter	2D building layout + building height or raster data	path loss and CIR

Tab. 4.5.1 Small- and micro-cell prediction models: An overview

2 GHz → $\lambda = \frac{30\ cm}{f\,[GHz]}$

$\lambda \approx 15$ cm

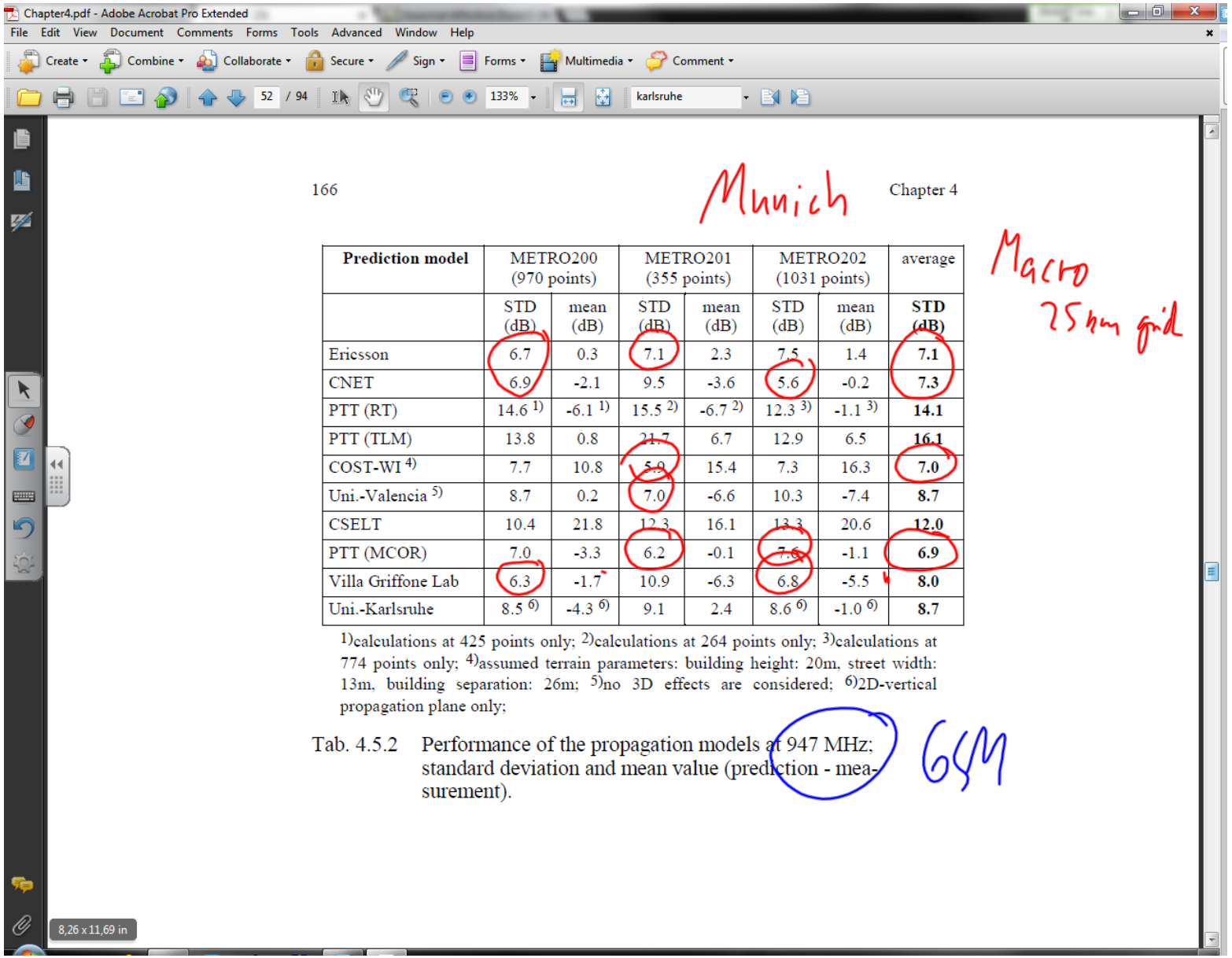
1.5 cm .... 7.5 cm

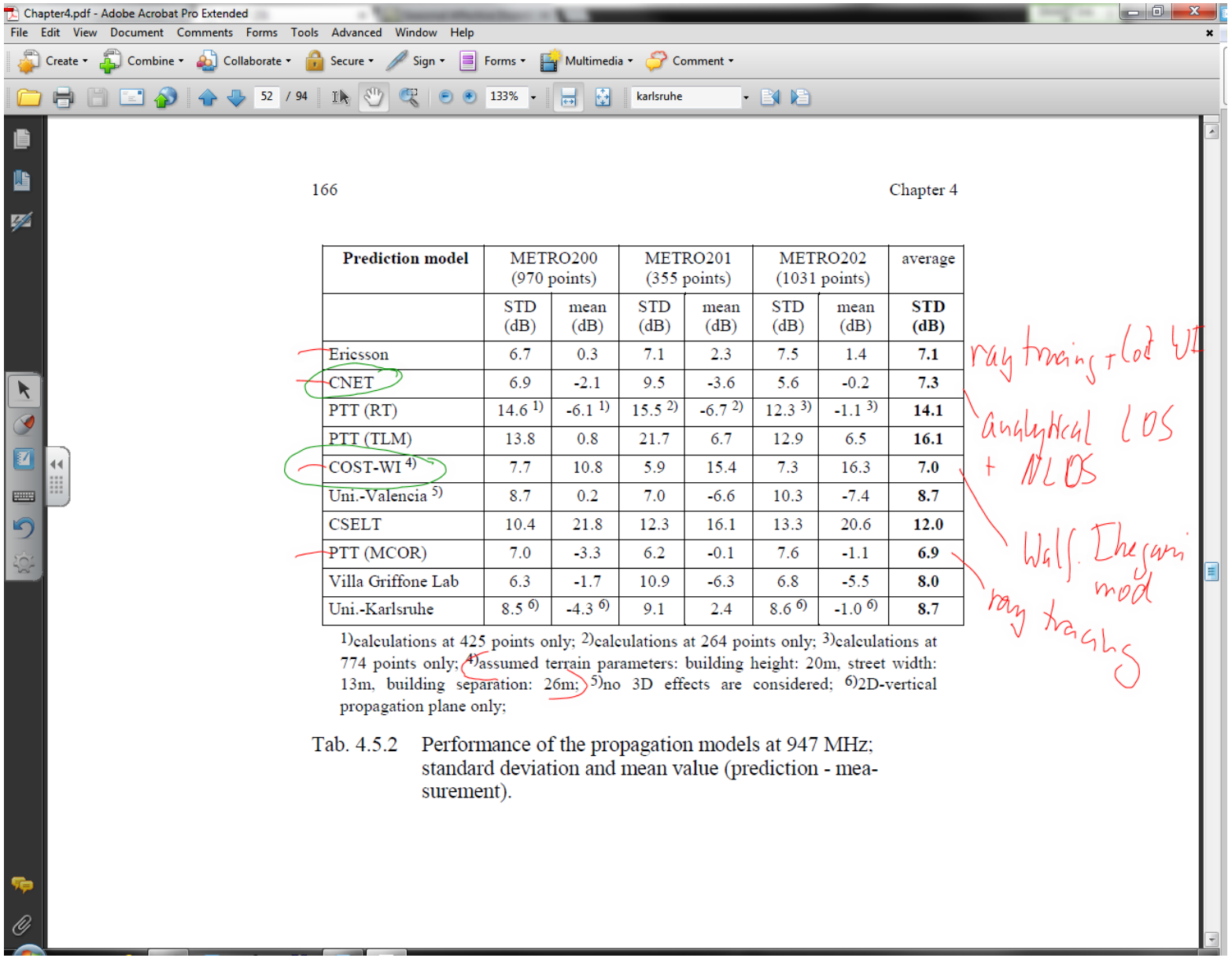
Challenges in ray tracing

- scattering,
- diffraction

} corners, rough surfaces

- long comp time
- identification of rays


Chapter4.pdf - Adobe Acrobat Pro Extended
File Edit View Document Comments Forms Tools Advanced Window Help
Create Combine Collaborate Secure Sign Forms Multimedia Comment
52 / 94
133%
karlsruhe
166
Chapter 4
Munich
Macro
25km grid
Prediction model	METRO200 (970 points)		METRO201 (355 points)		METRO202 (1031 points)		average
	STD (dB)	mean (dB)	STD (dB)	mean (dB)	STD (dB)	mean (dB)	STD (dB)
Ericsson	6.7	0.3	7.1	2.3	7.5	1.4	7.1
CNET	6.9	-2.1	9.5	-3.6	5.6	-0.2	7.3
PTT (RT)	14.6 1)	-6.1 1)	15.5 2)	-6.7 2)	12.3 3)	-1.1 3)	14.1
PTT (TLM)	13.8	0.8	21.7	6.7	12.9	6.5	16.1
COST-WI 4)	7.7	10.8	5.9	15.4	7.3	16.3	7.0
Uni.-Valencia 5)	8.7	0.2	7.0	-6.6	10.3	-7.4	8.7
CSELT	10.4	21.8	12.3	16.1	13.3	20.6	12.0
PTT (MCOR)	7.0	-3.3	6.2	-0.1	7.6	-1.1	6.9
Villa Griffone Lab	6.3	-1.7	10.9	-6.3	6.8	-5.5	8.0
Uni.-Karlsruhe	8.5 6)	-4.3 6)	9.1	2.4	8.6 6)	-1.0 6)	8.7
1)calculations at 425 points only; 2)calculations at 264 points only; 3)calculations at 774 points only; 4)assumed terrain parameters: building height: 20m, street width: 13m, building separation: 26m; 5)no 3D effects are considered; 6)2D-vertical propagation plane only;
Tab. 4.5.2 Performance of the propagation models at 947 MHz; standard deviation and mean value (prediction - measurement).
GSM
8,26 x 11,69 in



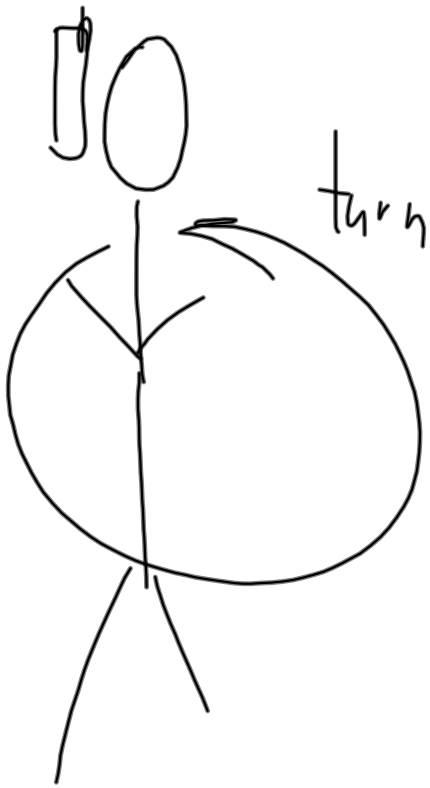
Prediction model	METRO200 (970 points)		METRO201 (355 points)		METRO202 (1031 points)		average
	STD (dB)	mean (dB)	STD (dB)	mean (dB)	STD (dB)	mean (dB)	**STD (dB)**
Ericsson	6.7	0.3	7.1	2.3	7.5	1.4	**7.1**
CNET	6.9	-2.1	9.5	-3.6	5.6	-0.2	**7.3**
PTT (RT)	14.6 [1)]	-6.1 [1)]	15.5 [2)]	-6.7 [2)]	12.3 [3)]	-1.1 [3)]	**14.1**
PTT (TLM)	13.8	0.8	21.7	6.7	12.9	6.5	**16.1**
COST-WI [4)]	7.7	10.8	5.9	15.4	7.3	16.3	**7.0**
Uni.-Valencia [5)]	8.7	0.2	7.0	-6.6	10.3	-7.4	**8.7**
CSELT	10.4	21.8	12.3	16.1	13.3	20.6	**12.0**
PTT (MCOR)	7.0	-3.3	6.2	-0.1	7.6	-1.1	**6.9**
Villa Griffone Lab	6.3	-1.7	10.9	-6.3	6.8	-5.5	**8.0**
Uni.-Karlsruhe	8.5 [6)]	-4.3 [6)]	9.1	2.4	8.6 [6)]	-1.0 [6)]	**8.7**

[1)]calculations at 425 points only; [2)]calculations at 264 points only; [3)]calculations at 774 points only; [4)]assumed terrain parameters: building height: 20m, street width: 13m, building separation: 26m; [5)]no 3D effects are considered; [6)]2D-vertical propagation plane only;

Tab. 4.5.2 Performance of the propagation models at 947 MHz; standard deviation and mean value (prediction - measurement).

Questions:

- Model comparison for 1800 MHz (2 GHz)
- Under rooftop (micro cell propagation)



700 power variation E2

~) P_R variation of >20dB

Specific model for tunnels