Tdoc TSG R4#4 (99)250

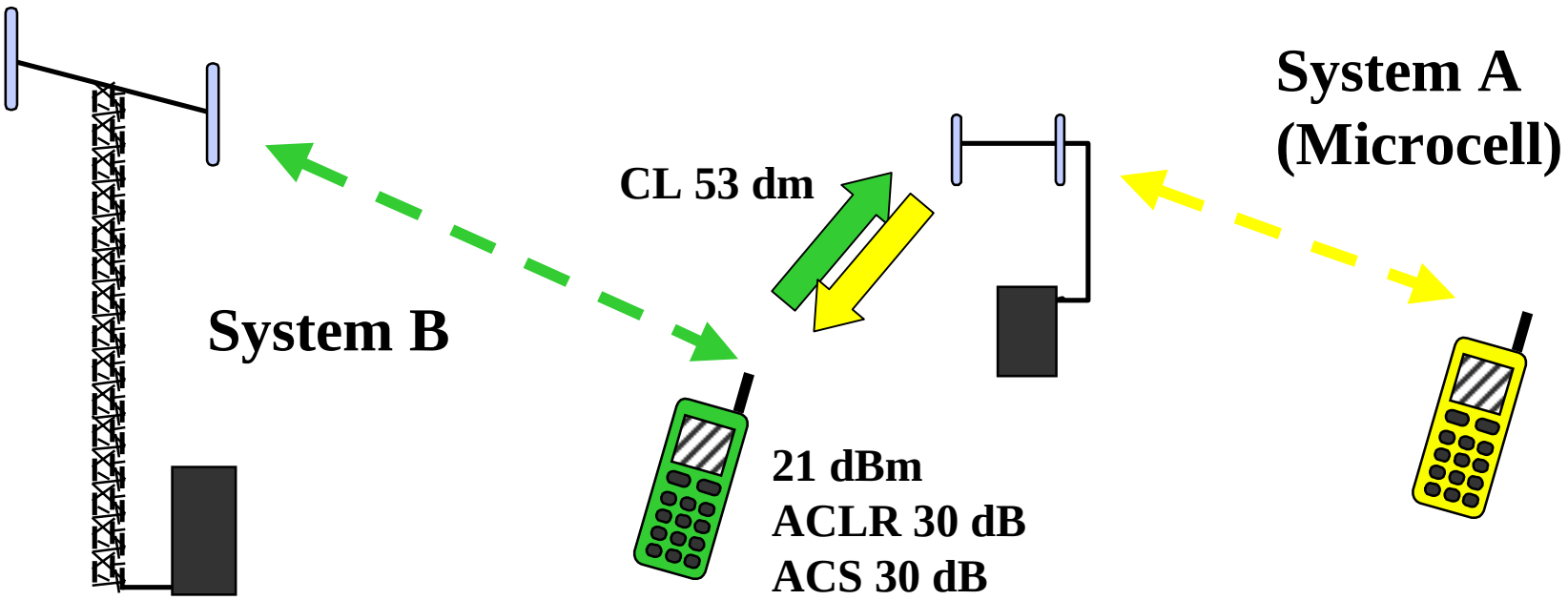
Worst Case Microcell Adjacent Channel Interference Scenarios

Johan Sköld

Ericsson Research

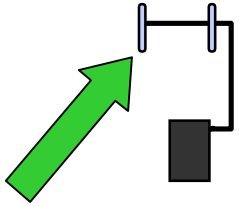
Agreed worst case microcell scenario

- **Additional assumptions**
  - **UE ACS = UE ACLR**
  - **Micro BS output power 30 dBm**



Resulting up- and downlink interference levels

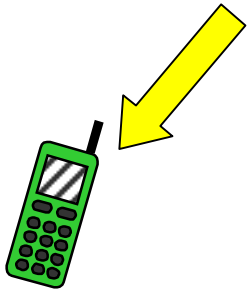
Uplink B→A



Tx power	21 dBm
ACLR	-30 dB
CL	-53 dB
Rx interf.	**-62 dBm**

Too high interference for System A UL

Downlink A → B



Tx power	30 dBm
CCH+TCH	23 dBm
CL	-53 dB
ACS	-30 dB
Rx interf.	**-60 dBm**

User B DL does not work

- **But, system A UL is <u>not</u> interfered with, since connection for user B is dropped.**

Does B drop before A is interfered with?

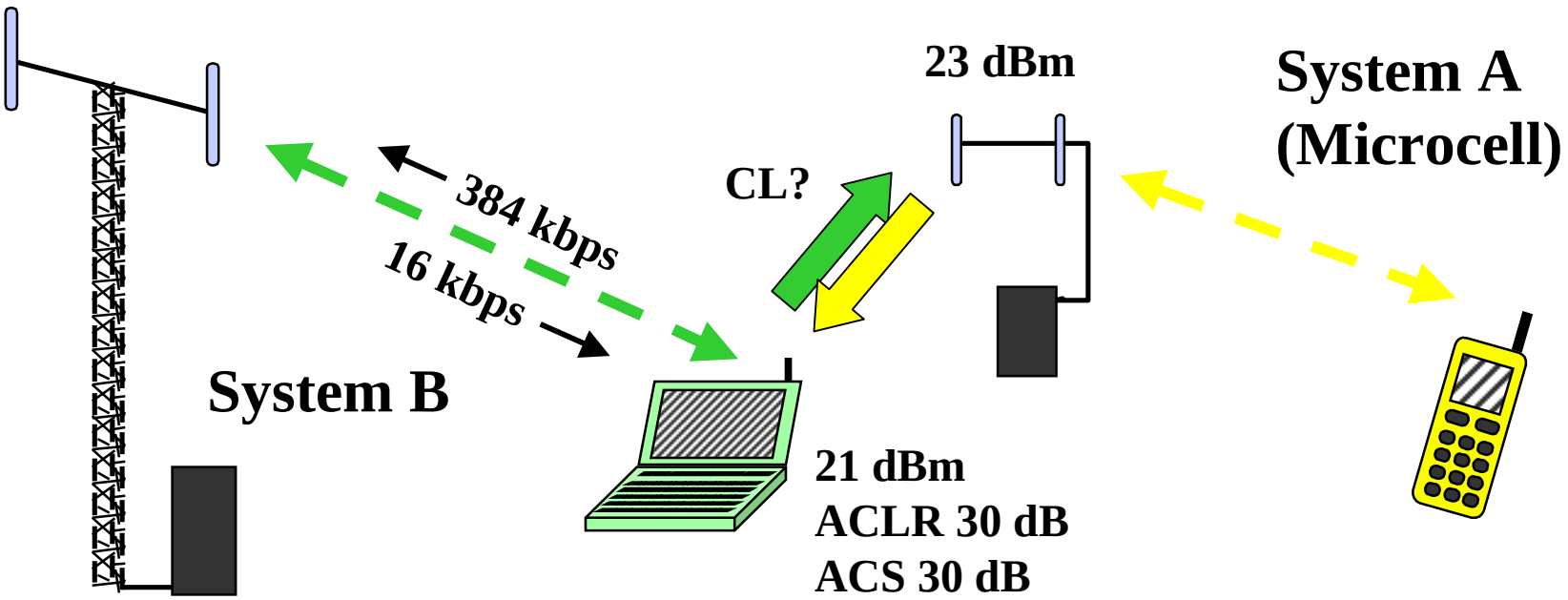
Assume worst case:

- Terminal B uses maximum power (21 dBm)
- Terminal B transmits high data rate (384 kbps)
- Terminal B receives very low data rate (16 kbps)
- Microcell A is lightly loaded (20% → Only few users affected!)
- Terminal B is very close to Microcell A

- This is a worst worst worst worst worst case.

Worst 5 case scenario

- **User B has extremely asymmetric data rates**
- **User B is at its range limit *and* close to micro BS**
- **Microcell A is very lightly loaded**



Operation for user B (1)

Uplink (384 kbps = 56 dBHz)

- Assume 5 dB NF, E_b/N_0 = 2 dB and 2 dB margin
- Rx sensitivity P_{Rx}=-174 +56 + 5 + 2 + 2 = **-109 dBm**

Link budget at range limit:

Tx power	21 dBm
Rx sensitivity	-109 dBm
Coupling Loss	**130 dB**

Operation of System B (2)

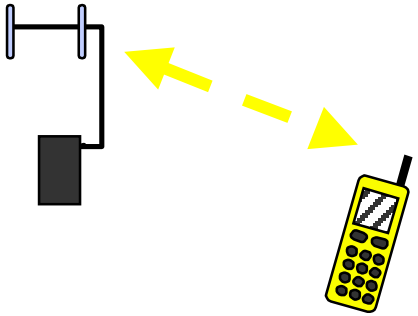
Downlink (16 kbps ⇒ 24 dB Processing Gain)

- Assume E_b/N_0 = 4 dB and 2 dB margin
- Interference requirement **C/I =** 4 + 2 - 24 = **-18 dB**

Interference budget at range limit:

Tx power	30 dBm	(1 W max per user)
Coupling Loss	-130 dB	
Rx power	**-100 dBm**	
C/I	-18 dB	
Max interference	**-82 dBm**	

Impact on System A



Uplink

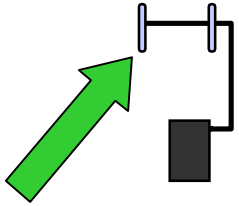
- Assume 5 dB NF, Noise BW 4.096 MHz (= 66 dBHz)
- Rx noise floor P_{Rx}= -174 +66 + 5 = **-103 dBm**
- A 30 dBm BS can be de-sensitized 13 dB with full range

Interference budget at range limit:

Rx noise floor	-103 dBm	
De-sensitization	13 dB	
Interference level	**-90 dBm**	**(Maximum for full range)**

Worst 5 case interference levels

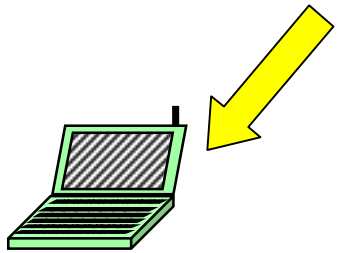
Uplink B→A



Tx power	21 dBm
ACLR	-30 dB
CL	*-75 dB*
Rx interf.	**-84 dBm**

System A UL receives more than -90 dBm interference

Downlink A → B



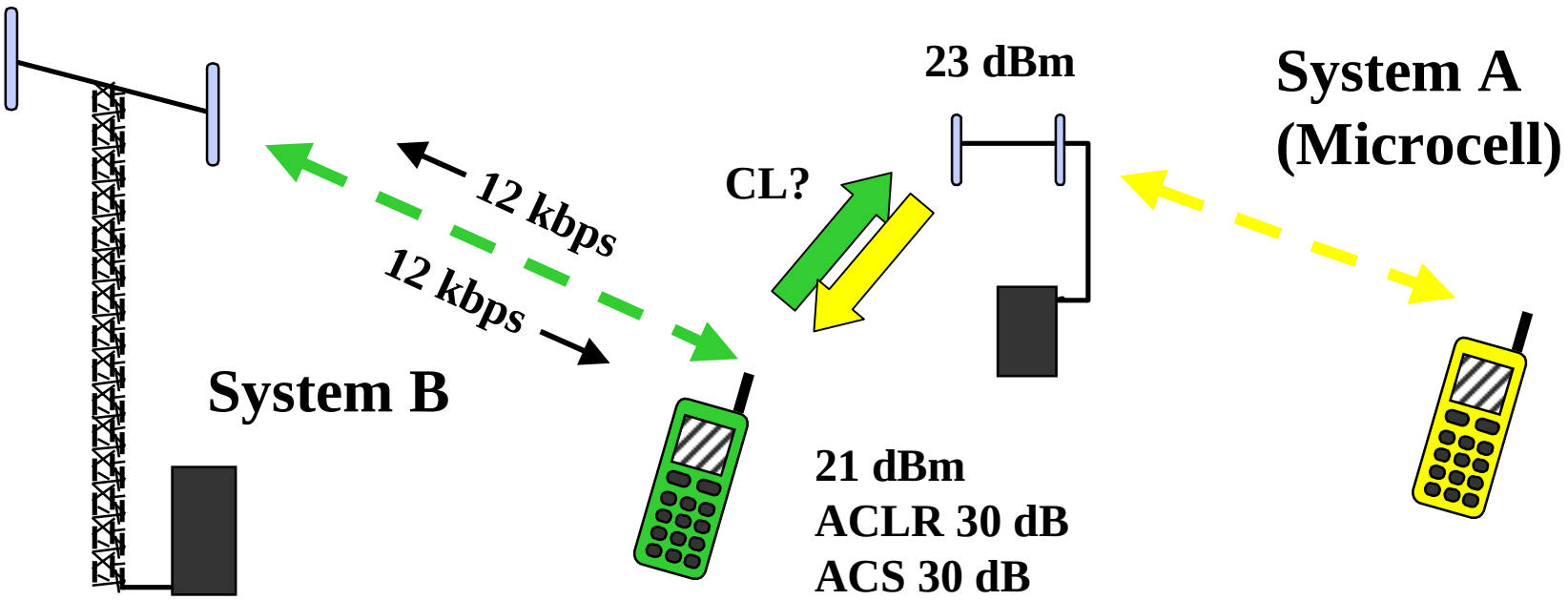
Tx power	(30 dBm)
CCH+TCH	23 dBm
ACS	-30 dB
Rx interf.	-82 dBm
Resulting CL	***-75 dB***

User B DL at the limit of being dropped

System A UL gets 6 dB extra noise rise, which in this case most likely does not affect the system.

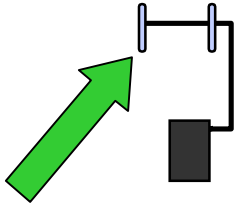
“Regular” worst case scenario

- **User B has a symmetric service**
- **User B is still at its range limit *and* close to micro BS**



“Regular” worst case interference levels

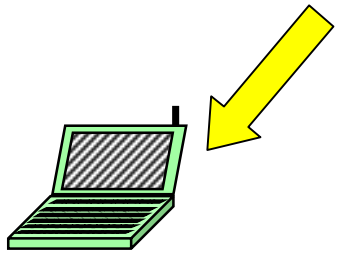
Uplink B→A



Tx power	21 dBm
ACLR	-30 dB
CL	*-89 dB*
Rx interf.	**-98 dBm**

System A UL has no impact

Downlink A → B



Tx power	30 dBm
CCH+TCH	23 dBm
ACS	-30 dB
Rx interf.	-96 dBm
Resulting CL	***-89 dB***

User B DL is at the limit of being dropped

User B is dropped before system A is affected.

Conclusion for microcell uplink ACLR

- **Escape mechanism:**
  - For a user interfering with a micro BS, both up- and downlink has to work
  - Normally the interferers downlink fails before there is impact to the microcell uplink
- Even in a worst worst worst... case, the impact to the micro cell is very small.
- In a “regular” worst case the escape mechanism avoids any impact.