Some Clarification about CPCH Channel Assignment

Tdoc R1-00-0141

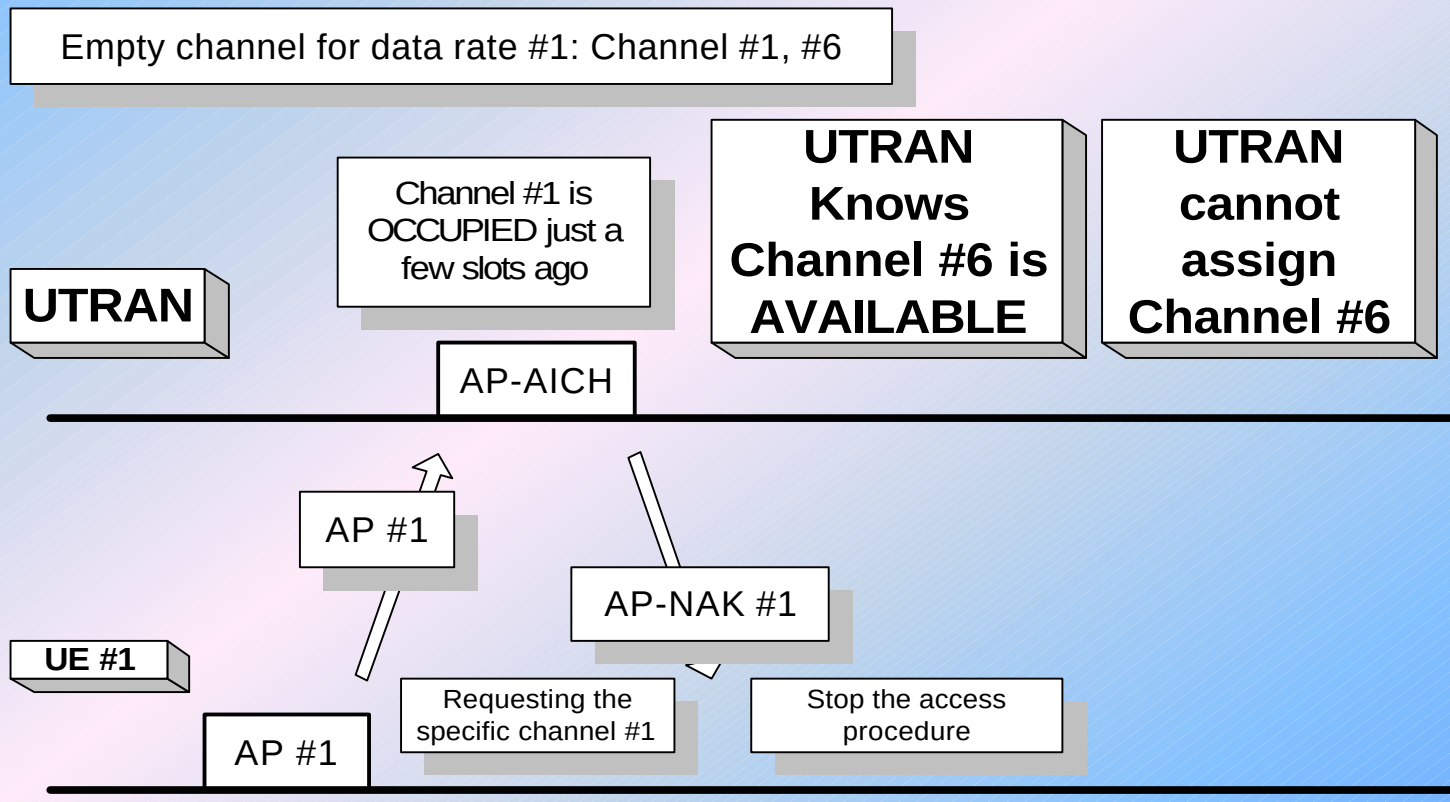
2000. Jan. 20
Beijing, China

Samsung Electronics Co. Ltd

Contents

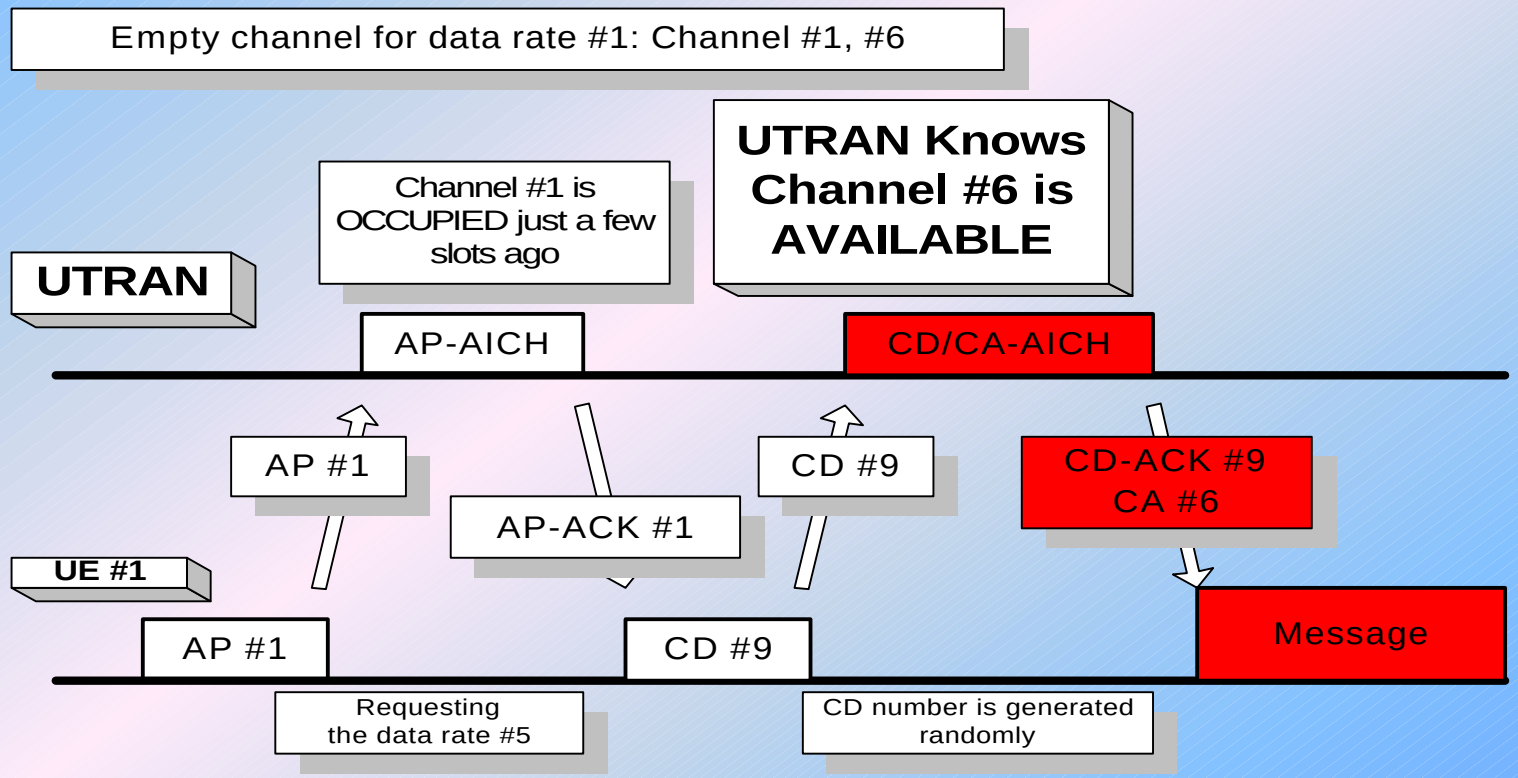
Introduction (1)

UE Selection Method:
channel selection FAIL even when resource is AVAILABLE



Introduction (2)

Versatile Channel Assignment Method:
Channel Assignment SUCCESS



Simulation Parameters

(1) CPCH data rate construction and CPCH capacity

Number of CPCH channel (Nc) = 9

Channel Bit Rate	60	120	240	480	960
Case 1	4	2	1	1	1
Case 2	4	3	0	1	1

- Total Capacity

Case 1 : 2.16 Mbps

Case 2 : 2.04 Mbps

(2) UE's data rate distribution

Channel Bit Rate	60	120	240	480	969
Case 1	4/9	2/9	1/9	1/9	1/9
Case 2	4/9	3/9	0	1/9	1/9

Simulation Parameters

(3) Message Length : 3 ~ 10 frame (uniform distribution)

(4) Access slot time : 1.33 ms

(5) power control preamble : 4 * 1.33 ms

(6) 1 frame: 10 ms

(7) AP and CD transmission

- AP transmission and response has no error. (error free).

  Transmission and response: 4 Access slots

- CD preamble transmission and response has no error. (error free).

  Transmission and response: 4 Access slots

- AP_AICH, CD_AICH, and CD/CA_AICH are error-free.

(8) Data distribution: Poisson

(9) Starting Transmission at Access Slot

(10) N_max = 10

Simulation Parameters

(10) N_max = 10

(11) Backoff

- Backoff 1 : Backoff after monitoring

  CA: Requested data rate is larger than broadcasting maximum rate

  CM: Channels are busy at Requested data rate

  Geometric distribution

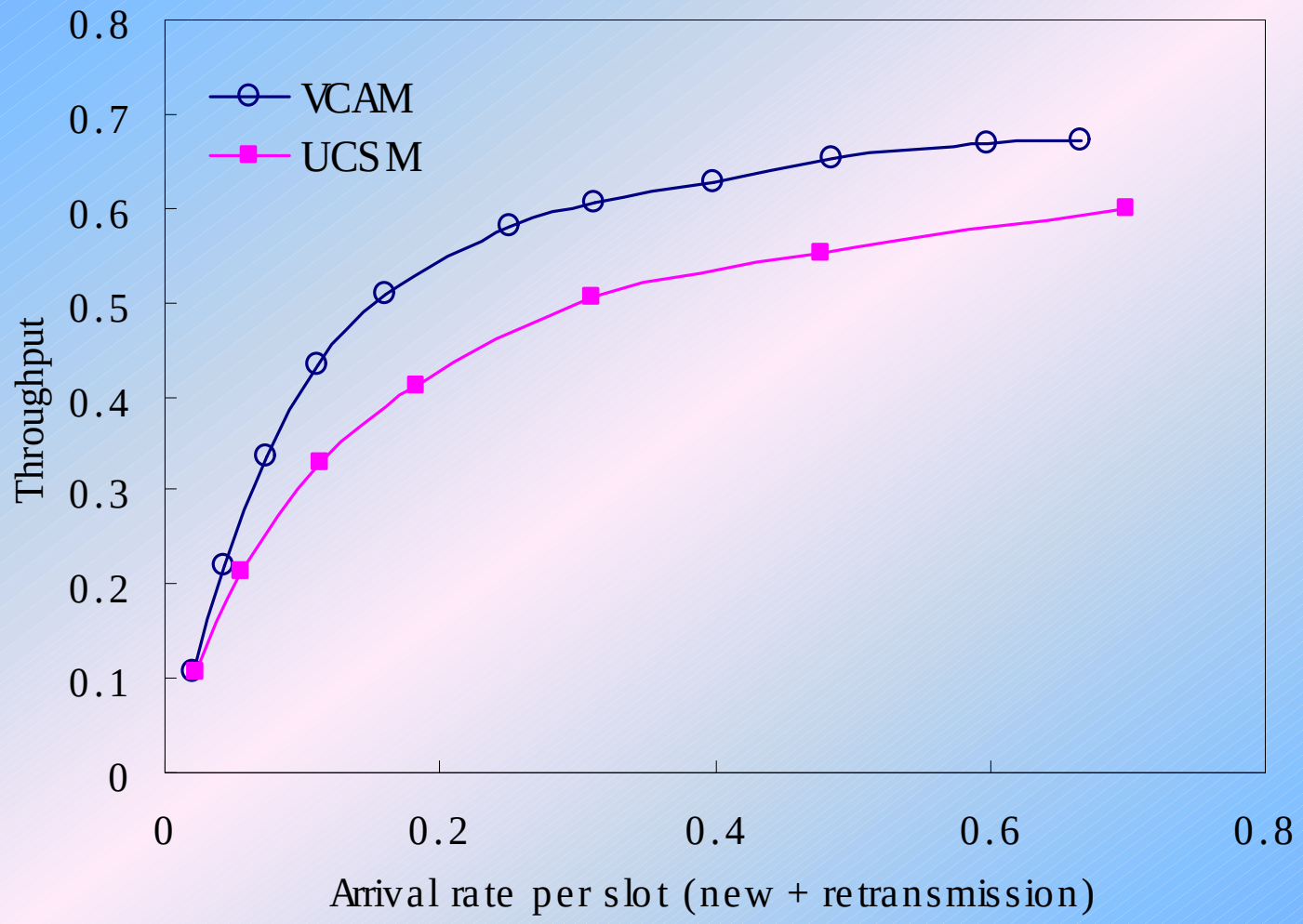
- Backoff 2 :

  Receiving NAK after receiving

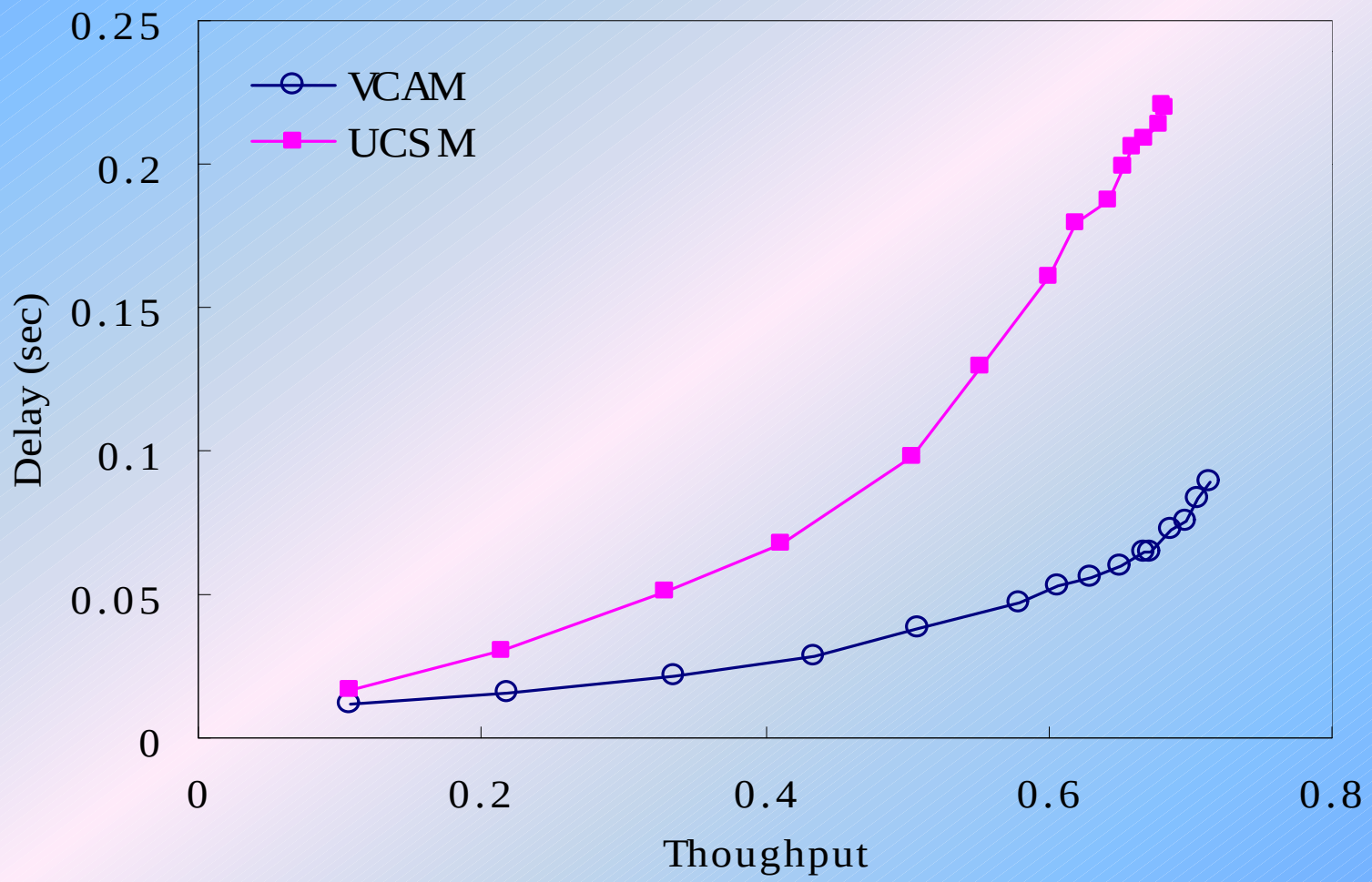
- Backoff 3 : Collision

  Collision NAK

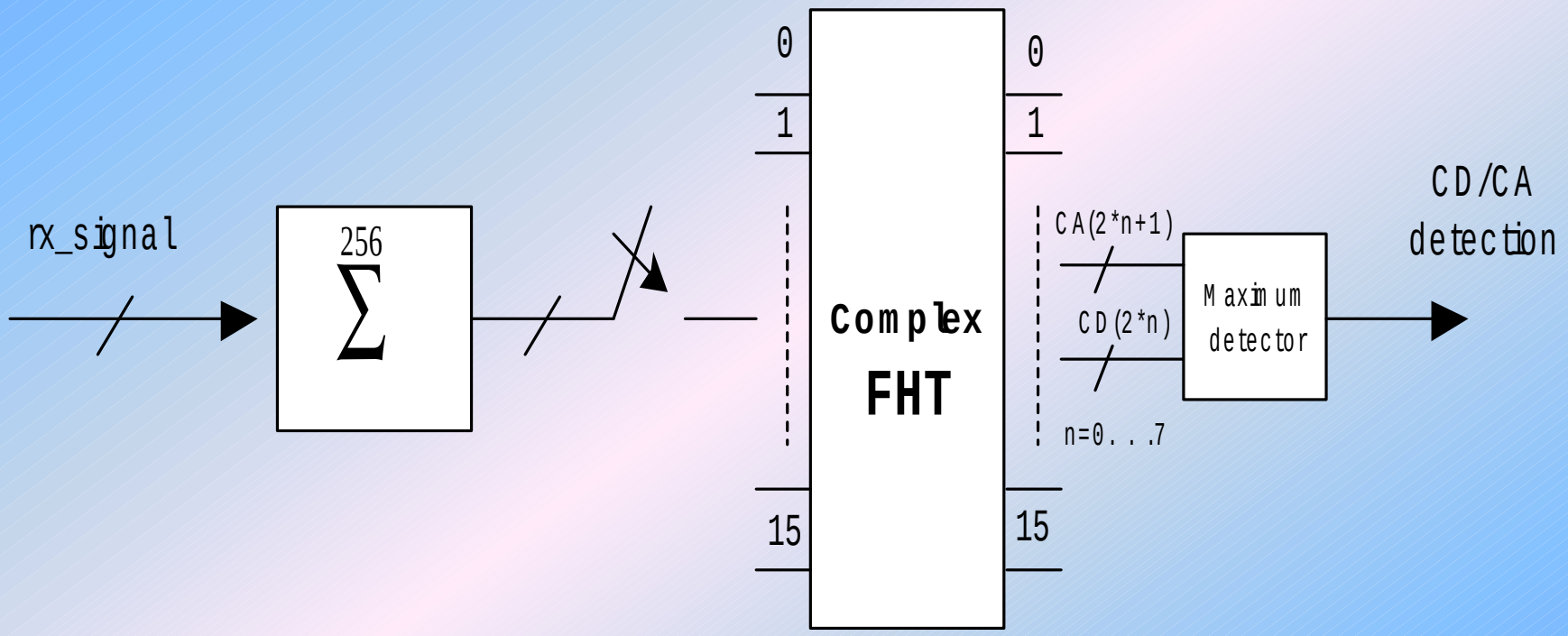
New Simulation Results(1)



New Simulation Results(2)



Structure of CD/CA-AICH detector

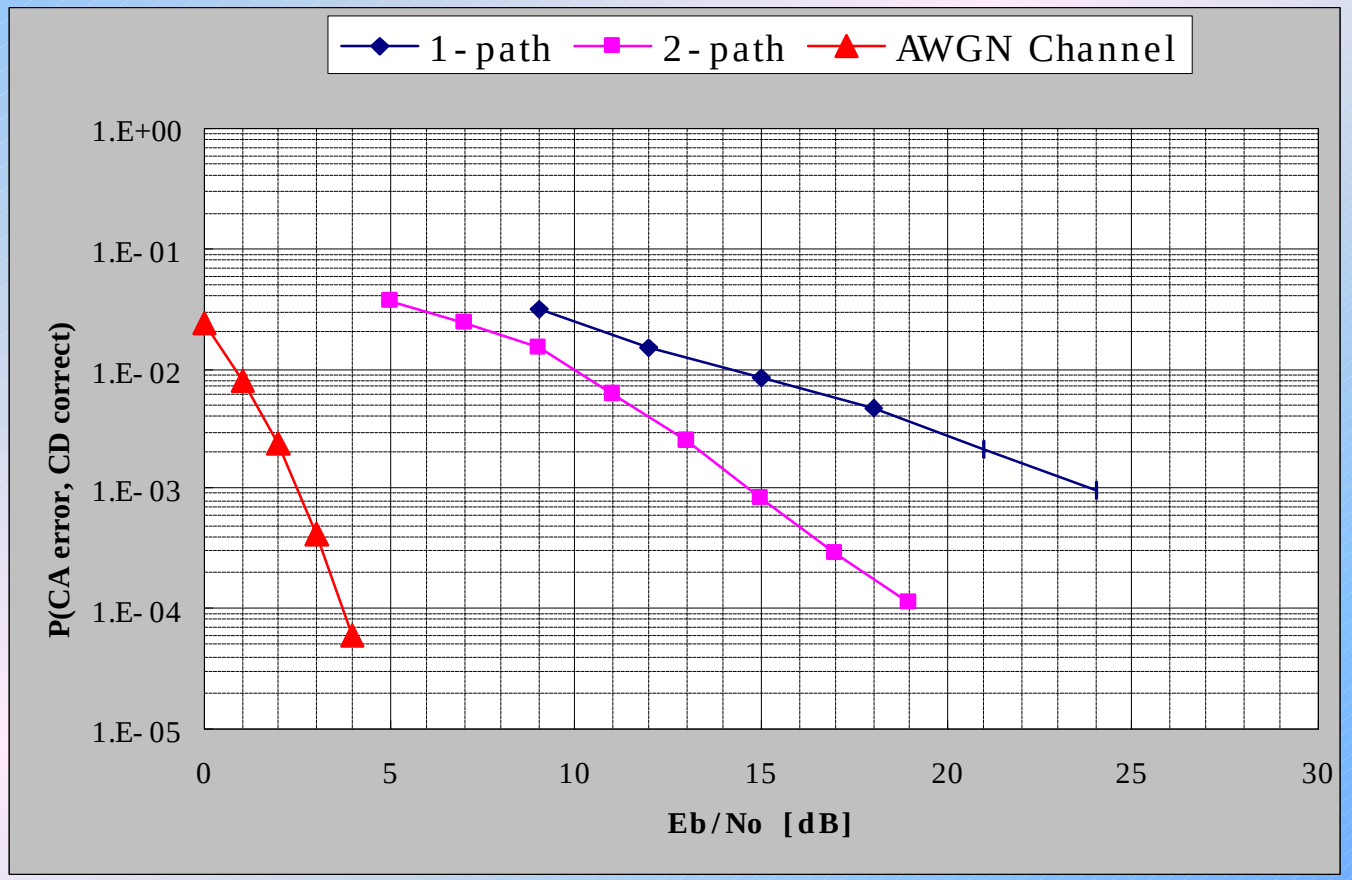


UE H/W complexity

- Signatures of CA-AICH and CD-AICH
  - Same as that of RACH AP-AICH
  - Mapping with CD/CA-AICH
    - 8 CD signature with binary modulation = 16 CD-AICH
    - 8 CA signature with binary modulation = 16 CA-AICH
- In UCSM (UE Channel Selection Method)
  - Detect Only CD-AICH
  - One correlator : 4096 (=256*16) complex additions
- In VCAM (Versatile Channel Assignment Method)
  - CD and CA can be detected at the same time
  - Total complexity = 4160 (=256*16+16*$\log_2$16) complex additions
- Additional complexity is negligible

P(CA error, CD correct)

- Simulation condition
  - 3km/h 1-path/2-path, and AWGN



Downlink operating range

- Downlink transmission power in connection
  - 25.101

Physical Channel	Power
CPICH	CPICH_Ec/Ior = -10 dB
PCCPCH	PCCPCH_Ec/Ior = -12 dB
SCH	PCCPCH_Ec/Ior = -12 dB
PICH	PICH_Ec/Ior = -15 dB
DPCH	The power needed to meet the BER/BLER target
OCNS	Necessary power so that total transmit power spectral density of BS (Ior) adds to one

- Relation between Eb/Io and Ec/Ior

$$\frac{E_b}{I_o} = PG \times \frac{E_c}{I_{or}} \times \frac{\hat{I}_{or}}{I_o} \times \frac{1}{2}$$

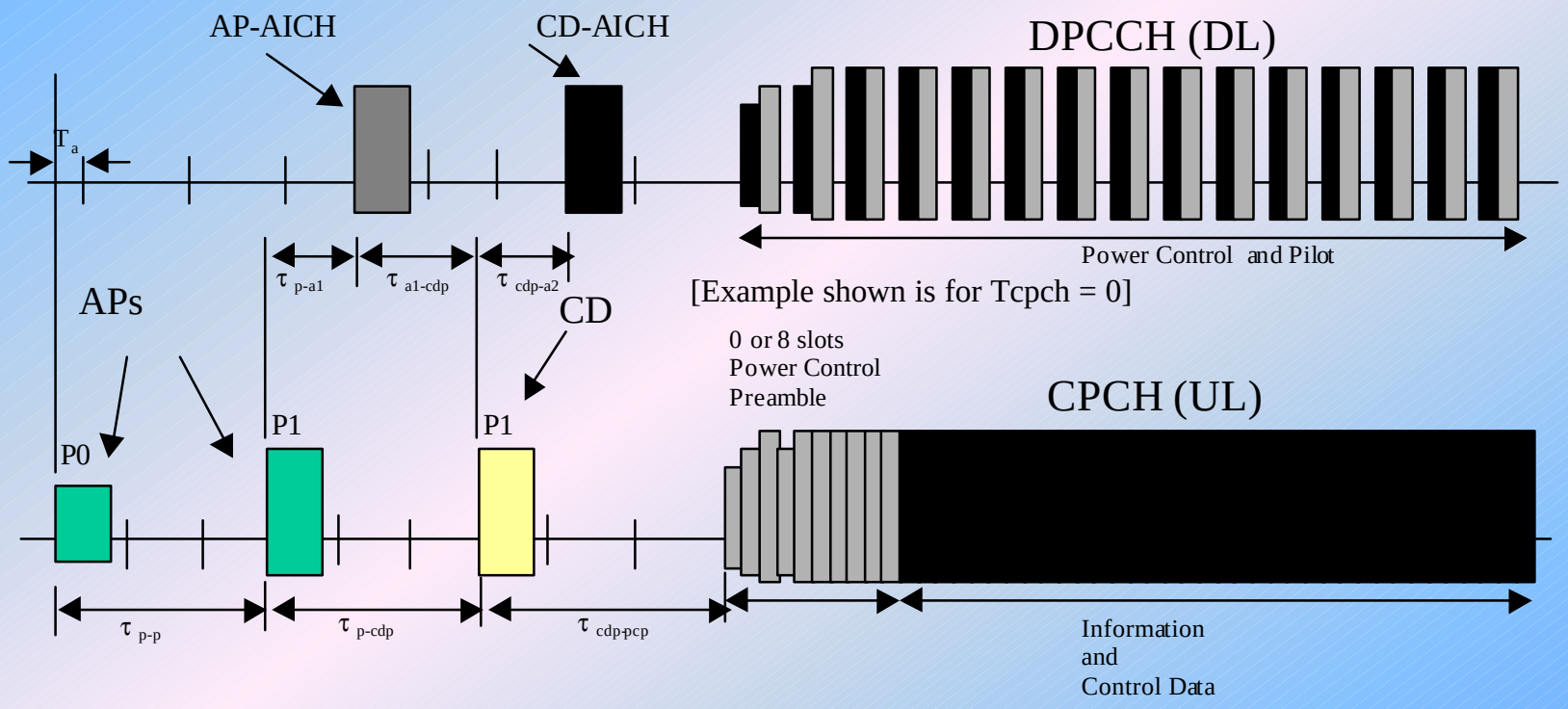
Discussion (1)

- Collision in RACH
  - UTRAN sends ‘NAK’ to UE but detected as ‘ACK’
- Collision in UE Selection of CPCH
  - UTRAN sends ‘NAK’ to UE but detected as ‘ACK’
  - More than one UE can send the same CD preamble, and bot h UEs get CD-AICH
- Collision in VCAM of CPCH
  - CA-AICH error

Discussion (2)

- If collision occurs in VCAM, easily monitored
  - UTRAN can detect collision by using of CPCH physical channel BER, DPDCH BER, Transport Channel Block rate and so on.
  - UE can detect and stop transmission based on the downlink DPCCH associated with CPCH
    - frame synchronization
    - CRC error
- Escape procedure
  - If UTRAN detects collision
    - Power down command through downlink DPCCH
  - If UE detects collision
    - Stop CPCH transmission

Monitoring Abnormal Situation



Abnormal situation

- Abnormal situation can occur
  - when 3km/h two path channel, no TX diversity
  - P(CA error, CD correct) = 0.01@10dB
  - Other UE is occupying the same channel = 1/16
  - Missing DL frame synchronization error = 1/15
- When Tx diversity is applied, 2~4dB gain is obtained and can reduce CA-AICH error

Conclusion

- Performance issue
  - Considerable performance gain over UE channel selection m ethod I throughput and access delay
- UE complexity issue
  - Only minor increase in complexity
- Abnormal situation
  - Only occurs when
    - CA-AICH is error while CD-AICH is correct
    - Other UE is occupying the same channel
  - Can be monitored by UE or UTRAN
    - Physical state (BER, BLER,…) measurement
    - frame synchronization
    - CRC error