



S-72.423 Exercise 4. Solutions

1. DECT:

a) Describe (using a few sentences) the meaning of the following DECT acronyms:

- GAP
- GIP
- IAP and IIP
- RAP
- CAP

b) Explain the differences between closed-loop power control and open-loop power control. Why open-loop power control can be used in DECT?

SOLUTIONS:

a) See <http://www.handytel.com/technology/dect07.htm>

b) Explain the differences between closed-loop power control and open-loop power control. Why open-loop power control can be used in DECT?

- **Open-loop power control**
 - Depends solely on mobile unit
 - Uses the pilot signal
 - Not as accurate as closed-loop, but can react quicker to fluctuations in signal strength (important in CDMA)
- **Closed-loop power control**
 - Adjusts signal strength in reverse channel based on metric of performance
 - BS makes power adjustment decision and communicates to mobile on control channel
- **Example: GSM uses closed-loop with 8 power classes in BS (2.5-320 W) and 5 in mobile station (0.8-20 W)**

Open-loop power control and DECT:

The mobile estimates the path loss to the cell by measuring the received signal level and adjusts the uplink transmission power accordingly. Open-loop power control scheme can be used if we can assume that characteristics of channel are same in both directions (For example frequency). That is why open-loop power control can be used in TDD-systems like DECT. (Multipath fading is the same in uplink and downlink.)

2. **TETRA:**

- a) List TETRA Teleservices
- b) List TETRA Bearer Services for data transfer.

Solutions

More about TETRA on www.tetramou.com

a)

TETRA Teleservices
Individual Call
Group Call
Acknowledged Group Call
Broadcast Call

b)

TETRA Bearer Services
Circuit mode data 7.2/14.4/21.6/28.8 kbits/s
Circuit mode protected data 4.8/9.6/14.4/19.2 kbits/s
Circuit mode heavily protected data 2.4/4.8/7.2/9.6 kbits/s
Connection oriented packet data
Connectionless packet data

3. **WLAN:** In the IEEE 802.11 specification, the length of the SIFS period must be shorter than the DIFS period. Why?

SOLUTION:

The time period SIFS (Short Interframe Spacing) is used when the receiving station wants to confirm that the information was correctly received. It is desirable that the confirmation reaches the sender before anyone begins to send any new data. By using these lengths it is guaranteed that confirmations will arrive before new data.
DIFS (DCF = Distributed Coordination Function IFS)

[<http://kunz-pc.sce.carleton.ca/sce536/WirelessLans.pdf>]

4. **UMTS:** Describe (using a few sentences) the meaning of the following UMTS features and acronyms:
- FDD / TDD
 - UTRAN
 - Spreading factor
 - Processing gain
 - Soft handover
 - RRC
 - Outer loop power control
 - AMR
 - Admission control

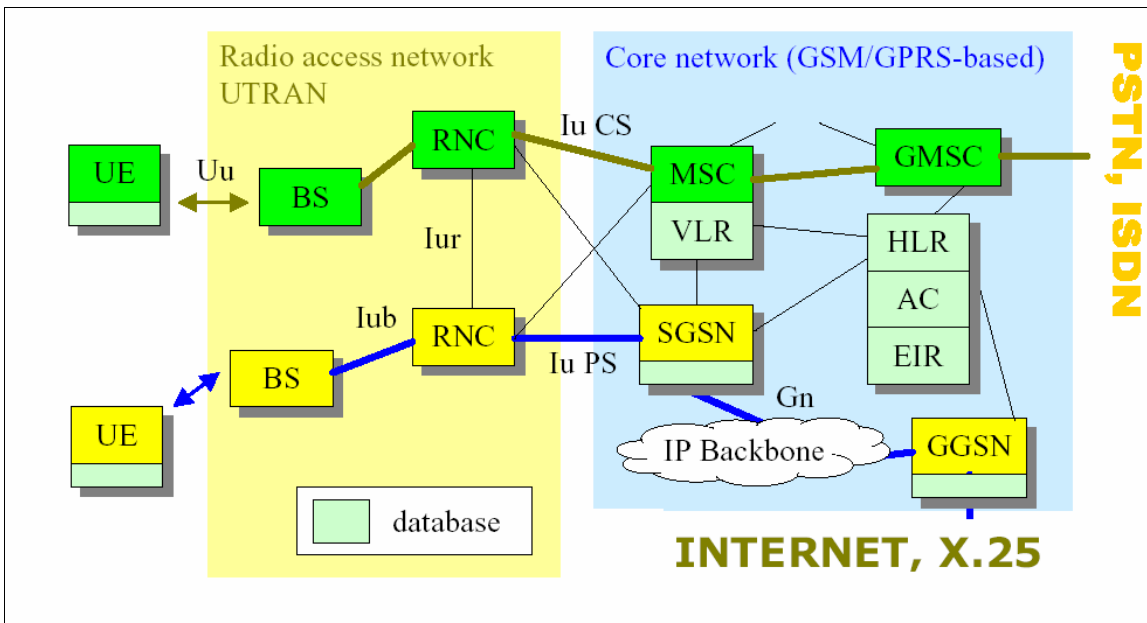
Solution

FDD / TDD

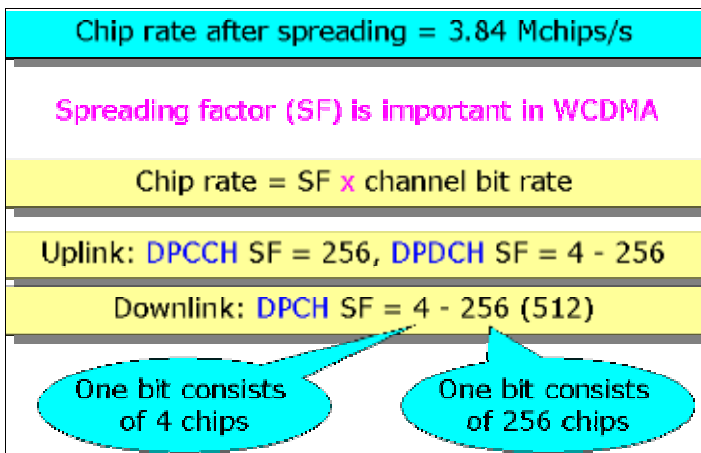
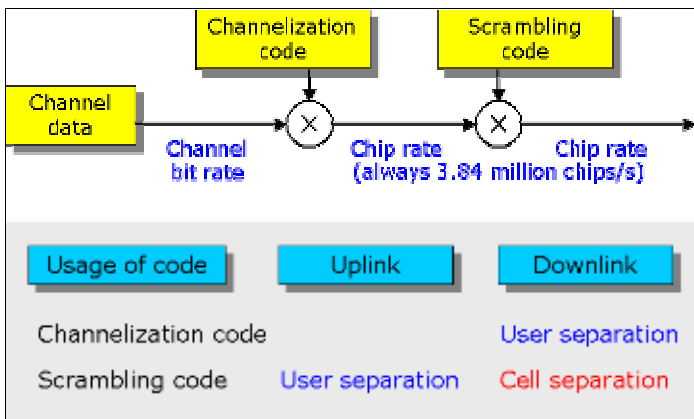
WCDMA has two basic modes of operation: FDD (Frequency Division Duplex) and TDD (Time Division Duplex). FDD allows continuous transmission in both directions requires a paired frequency band and is suited for symmetric bandwidth needs. In TDD Option same carrier frequency is utilized for uplink/downlink transmission using time division.

UTRAN

UMTS Terrestrial Radio Access Network



Spreading factor



Processing gain

Ojanperä, Prasad, Wideband CDMA for Third Generation Mobile Communications, Artech House Publishers, 1998 (page 34): "The ratio of transmitted bandwidth to information bandwidth is called the processing gain G_p of the spread-spectrum system..."

Soft handover

during soft handover, a mobile station is in the overlapping cell coverage area of different base stations. It is possible to make the connection to the new cell before leaving the current cell. Soft handover is used in CDMA to reduce the interference into other cells and improve performance through macro diversity.

RRC

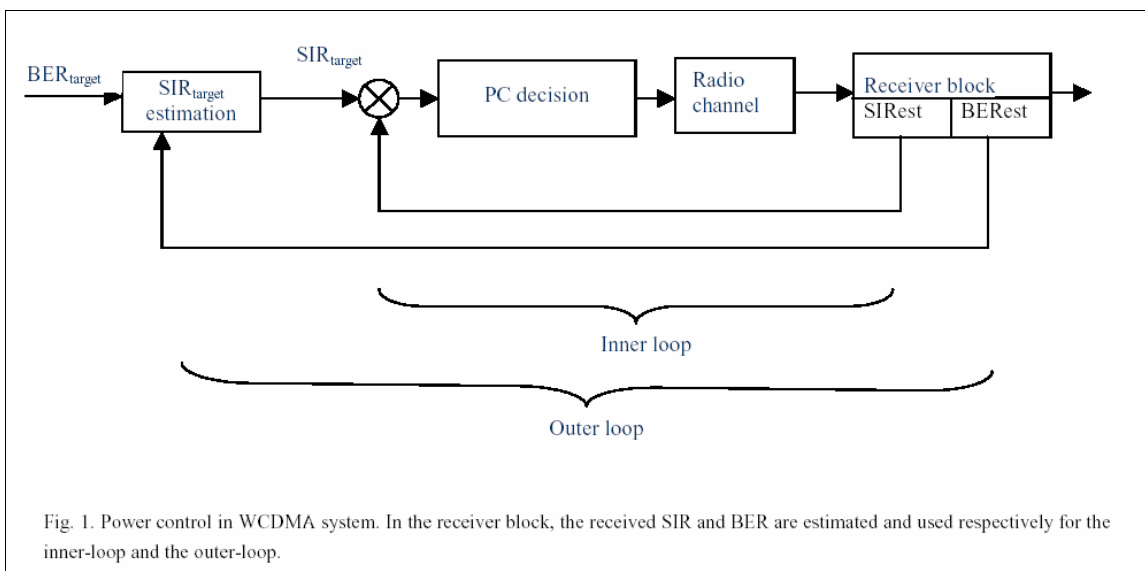
Radio Resource Control

RRC protocol

Over the Uu (air) interface, Radio Resource Control (RRC) messages carry all the relevant information required for setting up, modifying, and releasing **Radio Bearers** between UE and UTRAN. RRC also participates in the coordination of other Radio Resource Management (RRM) operations, such as measurements and handovers.

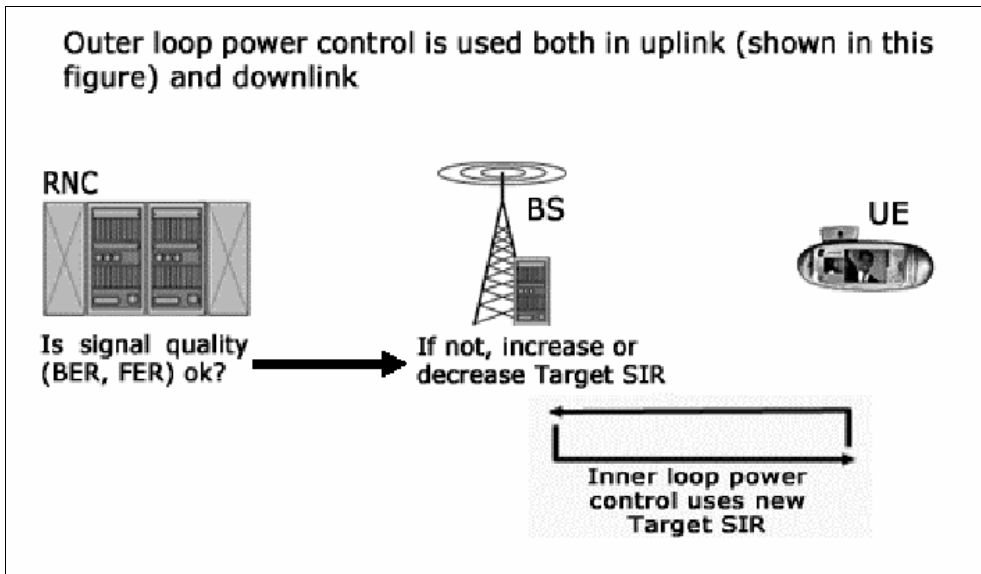
In addition, RRC messages may carry in their payload higher layer signalling information (MM = Mobility Management, CM = Connection Management, SM = Session Management) that is not related to the air interface or UTRAN.

Outer loop power control



[<http://www.ing.unipi.it/ew2002/proceedings/177.pdf>]

BER = Bit Error Rate
SIR = Signal-to-Interference Ratio



[Fig: Hongying Yin, *Power Control in Cellular System*, 2002, S-72.333]

AMR

Adaptive Multi-rate. The speech codec in UMTS will employ the adaptive Multi-rate technique.

Admission control

Ojanperä, Prasad, *Wideband CDMA for Third Generation Mobile Communications*, Artech House Publishers, 1998 (page 156): "The purpose of admission control is to ensure that there are free radio resources for the intended call with required SIR and bit rate... .. Admission control is always performed when a mobile station initiates communications in a new cell; either through a new call or handover... .. admission control procedure ensures that the interference created after adding a new call does not exceed a pre-specified threshold."