GSM – CCH – DCCH

- While previous channels have been unidirectional, the following channels are bidirectional.
- As long as a mobile station has not established a CH with the base station, it uses the ***stand-alone dedicated control channel*** (SDCCH) with low data rate 782 bit/s for signalling.
- This can compromise authentication, registration or other data needed for setting up a TCH.
- Each TCH and SDCCH has a ***slow associated dedicated control channel*** (SACCH) associated with it, which is used to exchange system information such as the channel quality and signal power level.

GSM – CCH – DCCH

- Finally , if more signalling information needs to be transmitted and a TCH already exist, GSM uses a ***fast associated dedicated control channel*** (FACCH)
- The FACCH uses the time slots which are otherwise used by the THC. This is necessary in the case of handover where base station and mobile station have to exchange large amounts of data in less time.

GSM – frame hierarchy

- These previous mentioned channels cannot use time slots arbitrarily.
- GSM specifies a very complex multiplexing scheme that integrates several hierarchies of frames.

GSM – frame hierarchy

- If we take a TCH/F for user data transmission, each TCH/F will have an associated SACCH for slow signalling.
- If fast signalling is necessary, the FACCH uses the time slots for THC/F.

GSM – frame hierarchy

A typical usage pattern of a physical channel for data transmission now look like this:

TTTTTTTTTTTTSTTTTTTTTTTTTx

TTTTTTTTTTTTSTTTTTTTTTTTTx

•With **T** indicating the user traffic in the TCH/F and **S** indicating the signalling traffic in SACCH.

•Twelve slots with user data are followed by a signalling slot. Again twelve slots with user data follow, then an unused slot.

•This pattern of 26 slots is repeated over and over again.

GSM – frame hierarchy

- In this case, only 24 out of 26 physical slots are used for TCH/F.
- Now recalling that each normal burst for data transmission carries 114 bits of user data and is repeated every 4.615 ms. This results in a data rate of 24.7 kbps.
- As the TCH/F only uses 24/26 slots, the final data rate is 22.8 kbps as specified for the TCH/F.
- The SACCH has a capacity of 950 bits/s.

GSM – frame hierarchy

- This periodic pattern of 26 slots occur in all TDM frames with a TCH.
- The combination of these are called ***multi-frame***, 120 ms.
- This type of multi-frame is used for TCHs, SACCH for TCHs and FACCHs.
- As these logical channels are all associated with user traffic, the multiframe is called ***traffic multiframe***.

GSM – frame hierarchy

- TDM frames containing data for other logical channels are combined into ***control multi-frames***.
- Control multi-frames consist of 51 TDM frames and have a duration of 235.4 ms.
- The logical frame hierarchy continues, combining 26 control multiframes with 51 traffic multiframes to form a ***superframe***.
- ***2048 superframes*** form a ***hyperframe*** with a duration of almost 3.5 hours.
- There are 2715648 TDM slots for one hyperframe.

GSM – frame hierarchy