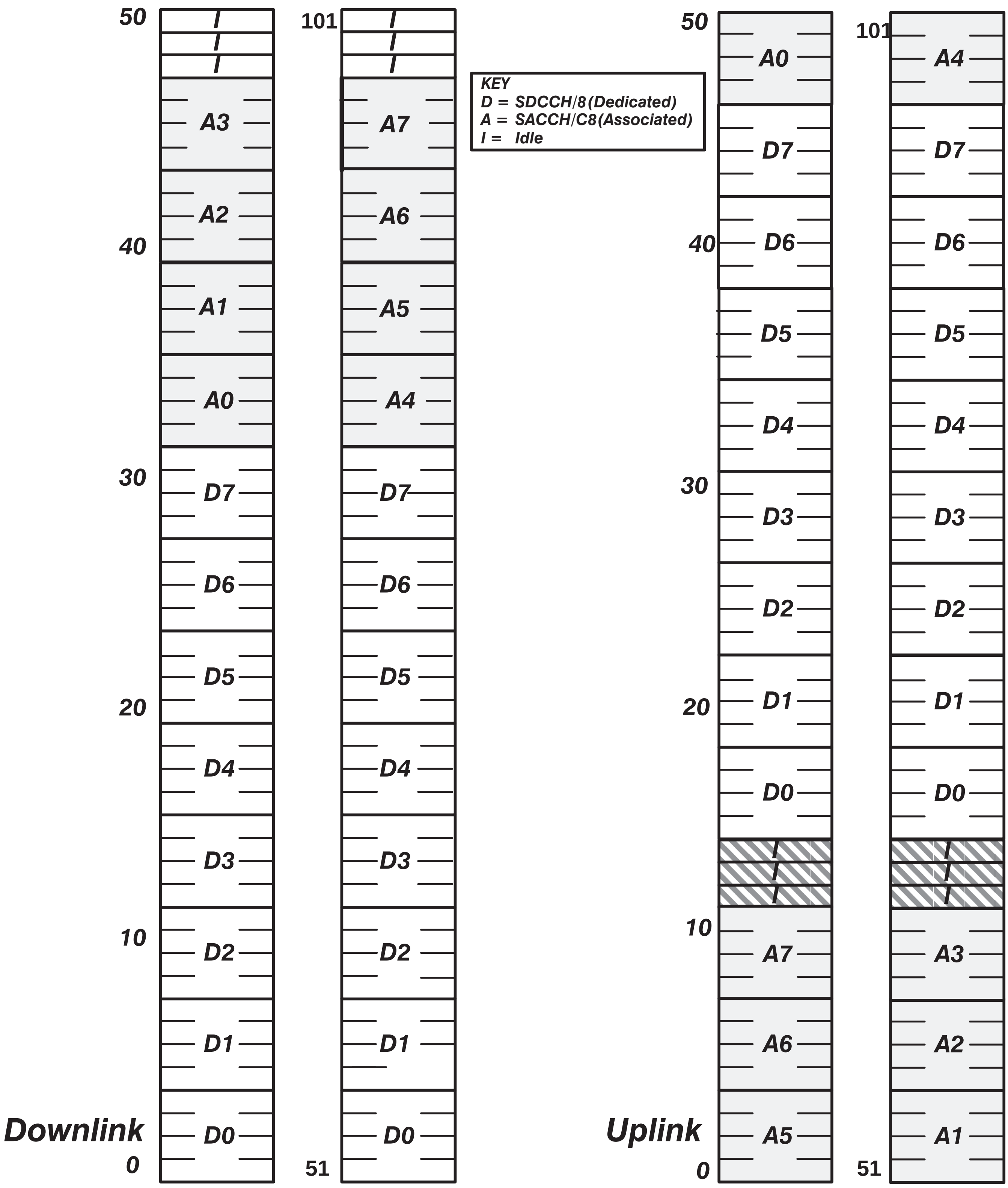
DCCH/8 Multiframe

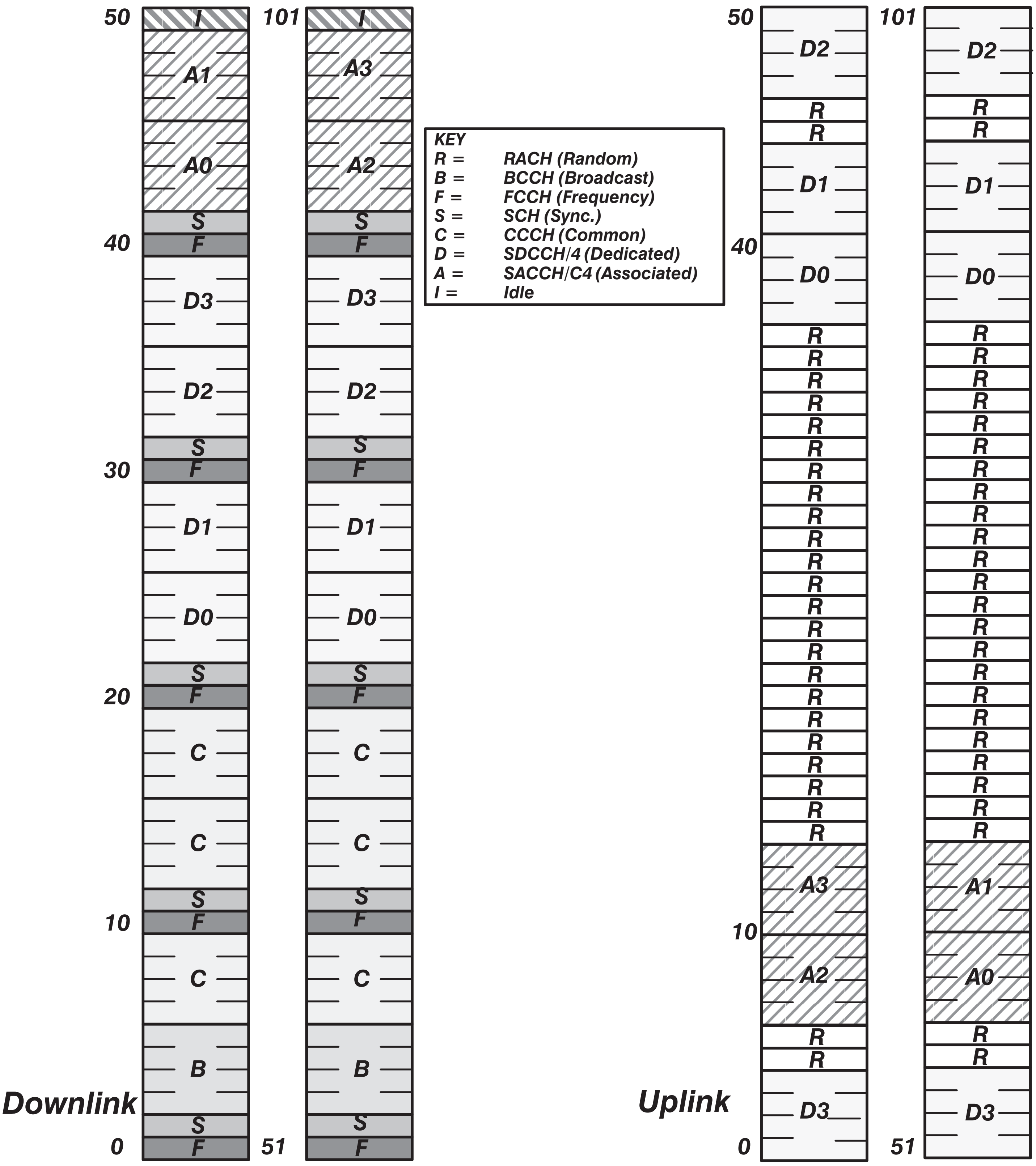


The 51-frame Control Channel Multiframe – Combined Structure

As we can see in the diagram opposite, each of the control channel types are present on a single timeslot. The number of MSs which can effectively use this cell is therefore reduced, as we now only have 3 CCCH groups and 4 SDCCHs, which translates into fewer pages and simultaneous cell setups.

A typical use of this type of control channel timeslot is in rural areas, where the subscriber density is low.

Combined Multiframe



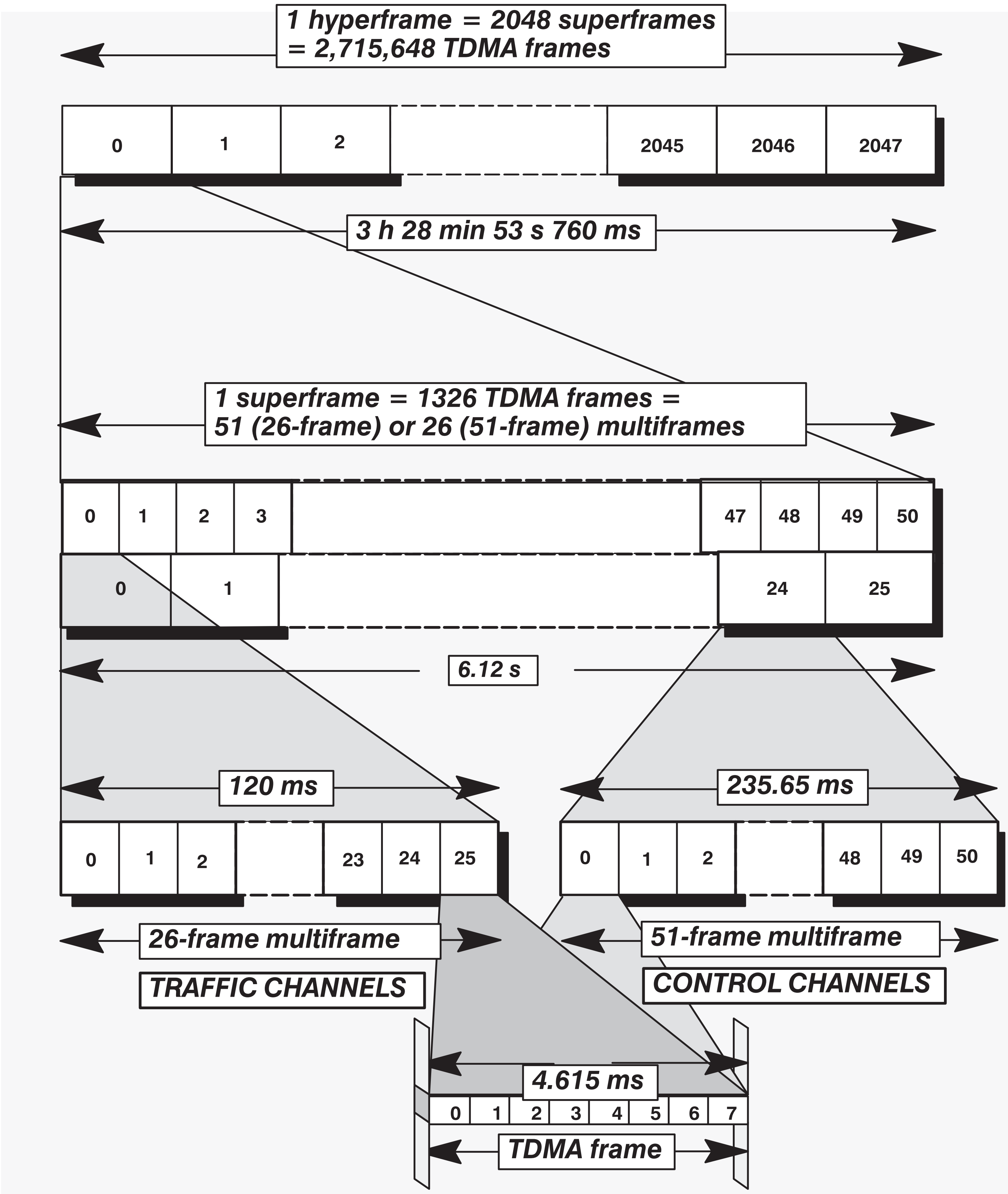
Superframes and Hyperframes

It is not by accident that the control channel multiframe is not a direct multiple of the traffic channel multiframe. From the diagram, it can be seen that any given frame number will only occur simultaneously in both multiframes every 1326 TDMA frames (26 x 51). This number of TDMA frames is termed a “superframe” and it takes 6.12 s to transmit. This arrangement means that the timing of the traffic channel multiframe is always moving in relation to that of the control channel multiframe and this enables a MS to receive and decode BCCH information from surrounding cells.

If the two multiframes were exact multiples of each other, then control channel timeslots would be permanently ‘masked’ by traffic channel timeslot activity. This changing relationship between the two multiframes is particularly important, for example, to a MS which needs to be able to monitor and report the RSSIs of neighbour cells (it needs to be able to ‘see’ all the BCCHs of those cells in order to do this).

The “hyperframe” consists of 2048 superframes, this is used in connection with ciphering and frequency hopping. The hyperframe lasts for over three hours, after this time the ciphering and frequency hopping algorithms are restarted.

Superframe and Hyperframe

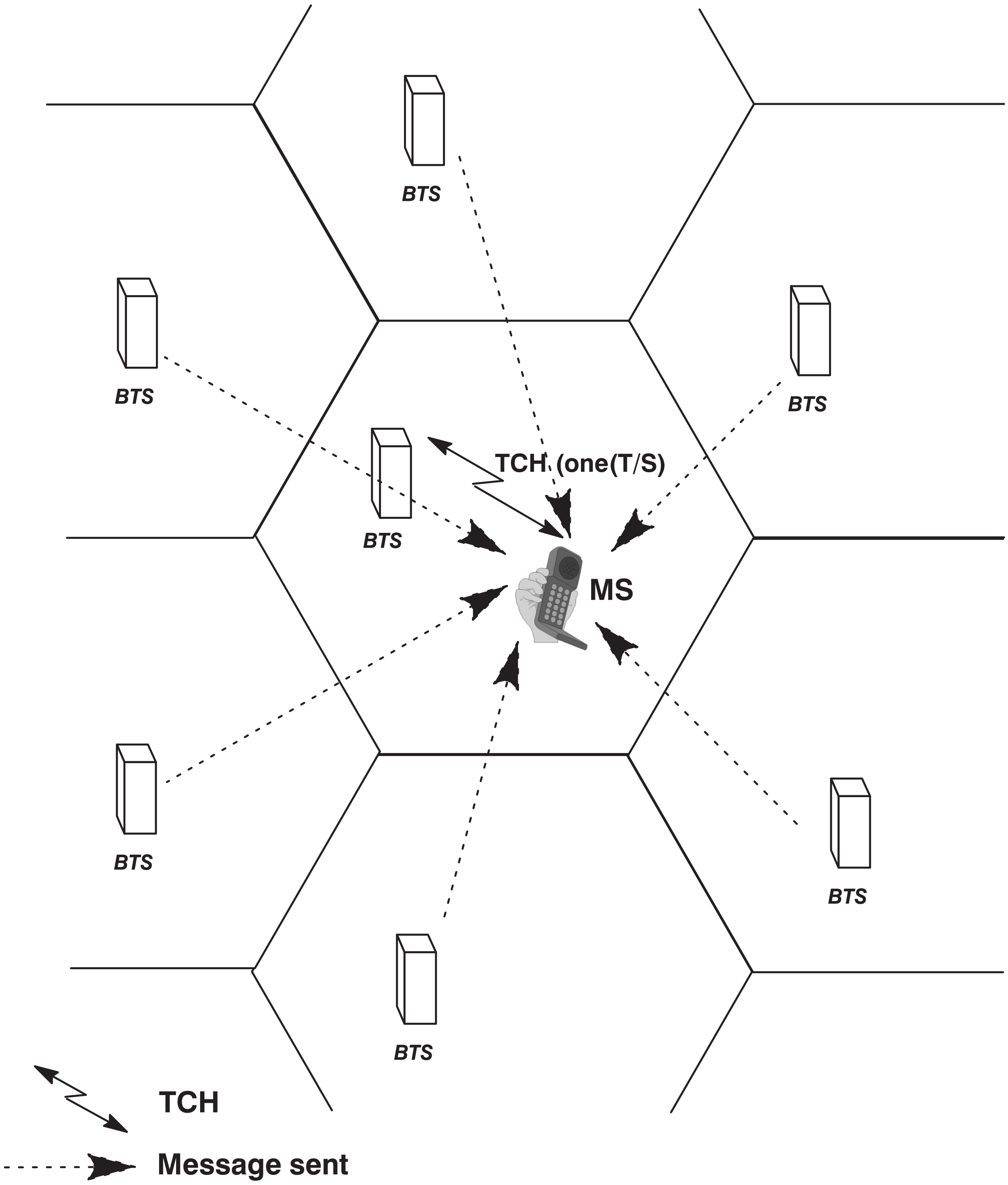


Mobile Activity – Transmit and Receive Timeslots

Overview

As the MS only transmits or receives its own physical channel (normally containing TCH and SACCH) for one-eighth of the time, it uses the remaining time to monitor the BCCHs of adjacent ‘target’ cells. It completes the process every 480 ms, or four 26-TCH multiframes. The message that it sends to the BSS (on SACCH, uplink) contains the Receive Signal Strength Indication (RSSI) of the adjacent cells, plus that of the link to the BSS itself, plus an indication of the *quality* of the current connection. This quality measurement is somewhat similar to a bit error rate test. Just as the mobile completes one series of measurements, it completes sending the previous series to the BSS and starts to send the latest series; thus the processes of compilation and transmission form a continuous cycle.

Mobile Activity



GSM Basic Call Sequence

The diagram opposite reminds us of the basic components and processes involved in setting up a call between a GSM MS and an ordinary “land” telephone.

- **In the MS to Land direction**

  The BTS receives a data message from the MS which it passes it to the BSC. The BSC relays the message to the MSC via C7 signalling links, and the MSC then sets up the call to the land subscriber via the PSTN. The MSC connects the PSTN to the GSM network, and allocates a terrestrial circuit to the BSS serving the MS’s location. The BSC of that BSS sets up the air interface channel to the MS and then connects that channel to the allocated terrestrial circuit, completing the connection between the two subscribers.

- **In the Land to MS direction**

  The MSC receives its initial data message from the PSTN (via C7) and then establishes the location of the MS by referencing the HLR. It then knows which other MSC to contact to establish the call and that MSC then sets up the call via the BSS serving the MS’s location.

The actual processes are, of course, considerably more complex than described above. Also, there are many different GSM call sequence and handover scenarios – enough to form the subject of their own training programme! In this course we consider in detail just the MS to Land and Land to MS call sequences and the intra-MSC (inter-BSS) handover sequence. This will give you a good appreciation of the messaging that occurs in the GSM system, and how the PLMN interacts with the PSTN.

GSM Basic Call Sequence