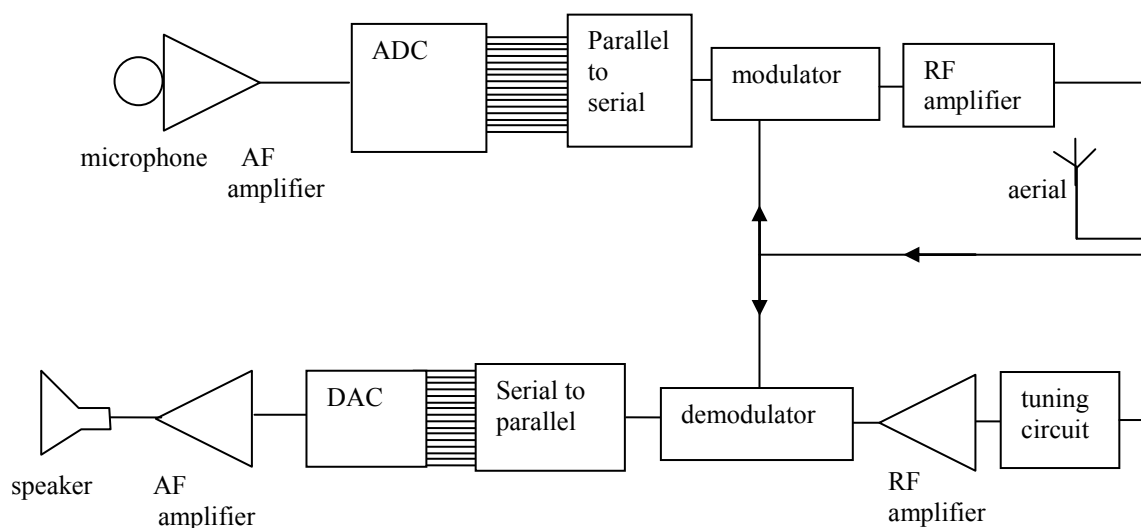


**Answers to Coursebook questions – Chapter F6**

- 1 An advantage would be that with large cell areas fewer base stations would be needed and costs would be lower. A disadvantage would be that with such a large cell radius the power emitted by both the base stations and the phones themselves would be very large and might cause health problems.
- 2 The antenna size is of the order of the wavelength. With frequencies of the order of 10 GHz, the wavelength and hence the antenna size are of order 3 cm.
- 3 
$$I = \frac{P}{4\pi d^2} = \frac{5.0}{4\pi \times (3.0 \times 10^3)^2} = 4.4 \times 10^{-8} \text{ W m}^{-2}.$$
- 4 Advantages include longer-lasting batteries before recharging and smaller cell sizes that can better cover a given geographical area.
- 5 When the phone is turned on it sends a signal that identifies the phone to a number of nearby base stations each situated at the centre of a cell. The base stations will communicate the signal to the central computer in the cellular exchange. The first job of the cellular exchange is then to choose the base station that has the strongest signal to the phone – this is essentially the base station closest to the phone. The cellular exchange will then allocate a carrier frequency to be used between that phone and that base station. The cellular exchange computer monitors the exchange of signals between phone and base station and if the signals become weak or if the phone moves from one cell into another, then another base station and another frequency will be assigned.
- 6 **a** The bit rate is  $8000 \times 8 = 64000 = 64 \text{ kbit s}^{-1}$ .
- b** The quality is only very slightly affected but the big advantage is the gain in the bandwidth that is achieved in this way.
- 7 
$$\frac{270}{13} \approx 20.$$

- 8 At the very least it should contain the following blocks (switching between emitting and receiving is not shown):



The audio signal that is input to the phone is amplified and converted to a digital signal which is transmitted through a parallel to serial converter. The signal is then modulated, amplified and transmitted through the aerial. The aerial also receives signals through an appropriate tuning circuit. The received signal is amplified and demodulated, i.e. the information signal it contains is extracted. From a serial to parallel converter the digital signal is made into an analogue signal in the digital to analogue converter. The signal is again amplified in an audio amplifier, which then drives a loudspeaker.