

Uplink and Downlink Channel:

In satellite communication,

downlink- signal from earth base station to satellite

uplink- signal from satellite back to earth

In mobile communication,

downlink: signal from base station to mobile station (cellphone)

uplink: signal from mobile station(cellphone) to base station

frequency bands are always allocated for uplink and downlink signals, often separated by a gap (maybe for future allocation, since the span of 'guard bands' are relatively very less compared to the actual information-carrying bands)

If you observe the uplink and downlink channels carefully, you would notice that the uplink frequencies are higher than the corresponding downlink frequencies in the case of satellite communication, whether in the case of mobile communication, it's just the reverse.

satcomm: C-band : U/L-6 GHz, D/L-4 GHz

Ku band: U/L-14 GHz, D/L-12 GHz

mobcomm: GSM-900: U/L-890-915 MHz, D/L- 935-960 MHz

GSM-1800: U/L-1710-1785 MHz, D/L- 1805-1880 MHz

Why is the uplink frequency higher than the downlink frequency in satellite communication?

The answer is simple too. It's all about power considerations.

In satcomm, the signals have to cross the atmosphere which presents a great deal of attenuation. The higher the frequency, the more is the signal loss and more power is needed for reliable transmission.

So now you would say why use higher frequencies if signal loss is more and you need more power? It's because lower frequencies get reflected by atmospheric bands and cannot penetrate to get through to the satellite.

Now, a satellite is a light-weight device which cannot support high-power transmitters on it. So, it transmits at a lower frequency (higher the frequency, higher is the transmitter power to accommodate losses) as compared to the stationary earth station which can afford to use very high-power transmitters. This is compensated by using highly sensitive receiver circuits on the earth station which is in the line-of-sight (LOS) of the satellite.

In mobcomm, a similar point holds. A mobile is a portable device which cannot afford high-power transmission as it has a small battery with limited power. The 'free space path loss' comes to play. The higher the transmitting frequency, the higher is the loss. Since a mobile station (cellphone) cannot afford to transmit at high power to compensate for this loss, it must transmit on a lower frequency as a lower frequency presents lesser free space path loss. Therefore, mobile-to-base station (uplink) frequencies are lower than base station-to-mobile(downlink) frequencies.