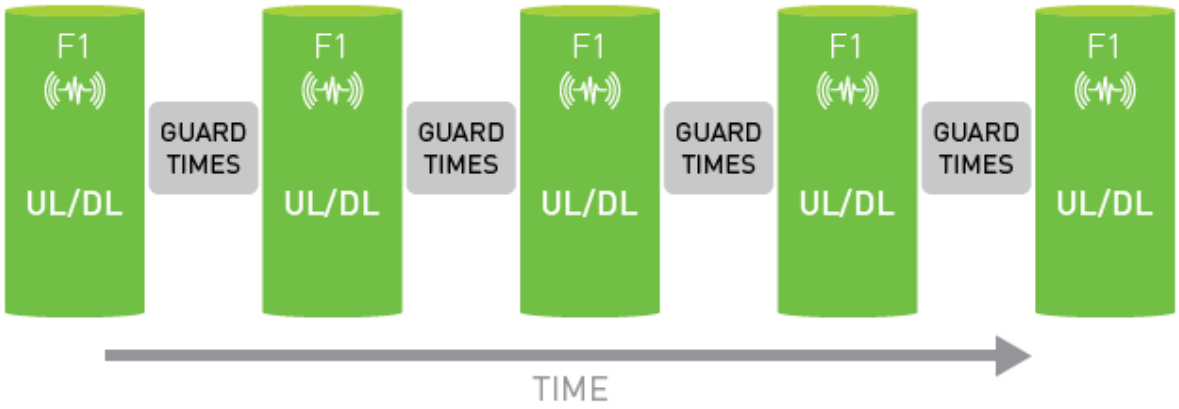
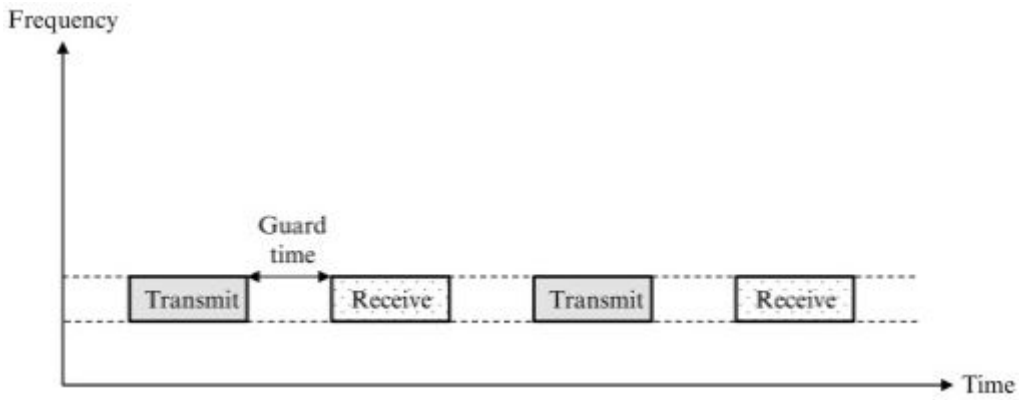
Time-division duplexing (TDD)

Time-division duplexing (TDD) is a method for emulating full-duplex communication over a half-duplex communication link. The transmitter and receiver both use the same frequency band but transmit and receive traffic at different times. TDD uses the same frequency band by assigning alternating time slots for transmit and receive operations. The information to be transmitted, whether it's voice, video, or computer data, is in a serial binary format. Each time slot may be 1 byte long or could be a frame of multiple bytes.



In time-division duplexing (TDD), time is used to separate the transmission and reception of the signals, rather than frequency (like in FDD), and thus a single frequency is assigned to a user for both directions. TDD provides a simultaneous bidirectional flow of information. Duplexers are therefore not required, and thus the cost of a TDD system is not very high, as the transmitter and receiver use the same components like filters and mixers.



TDD uses two-time slots, one for upstream (transmission) and the other for downstream (reception). A guard time between transmit and receive streams is allocated. Time-division duplexing facilitates concurrent send and receive by assigning transmitted signals in the one-time slot and received signals in another time slot. They share the same frequency channel.

TDD is used by Wi-Fi Networks and Some 4G/LTE Networks as well. Click here to see the LTE Bands that use TDD technology.

Advantages of TDD

- It is more spectrum friendly, allowing the use of only a single frequency for operation and dramatically increasing spectrum utilization, especially in license-exempt or narrow-bandwidth frequency bands.
- It allows for the variable allocation of throughput between the transmit and receive directions, making it well suited to applications with asymmetric traffic requirements, such as video surveillance, broadcast, and Internet browsing.
- Radios can be tuned for operation anywhere in a band and can be used at either end of the link. As a consequence, only a single spare is required to serve both ends of a link.
- The cost of TDD Systems is lower as they can use the same components for Tx and Rx functions.

Disadvantages of TDD

- The switch from transmit to receive incurs a delay that causes traditional TDD systems to have greater inherent latency when compared to FDD systems.
- As TDD operates based on allocated time slots, it requires stringent phase/time synchronization to avoid interference between UL (Uplink) and DL (Downlink) transmissions.
- Multiple co-located radios can interfere with one another unless they are synchronized.
- Traditional TDD approaches yield poor TDM performance due to latency.
- For symmetric traffic (50:50), TDD is less spectrally efficient than FDD, due to the switching time between transmit and receive.