

Duplexer

Duplexer is a microwave switch i.e., it acts like a switch. It is a device that allows bidirectional communication over a single channel. A single antenna is used for both transmitting and receiving by including duplexer, which isolates transmitter and receiver respectively. Thus, common antenna is used during communication.

Duplexer protects the receiver from high power as it is isolated during transmission. The different types of duplexers are,

1. Branch type duplexer
2. Balanced type duplexer.

1. Branch Type Duplexer

Branch type duplexer is one of the earliest duplexers.

Figure (2) explains the principle of operation of the duplexer.

It consists of two gas-discharge tube namely, TR (Transmit Receive) switch and ATR (Anti-transmit Receive) switch.

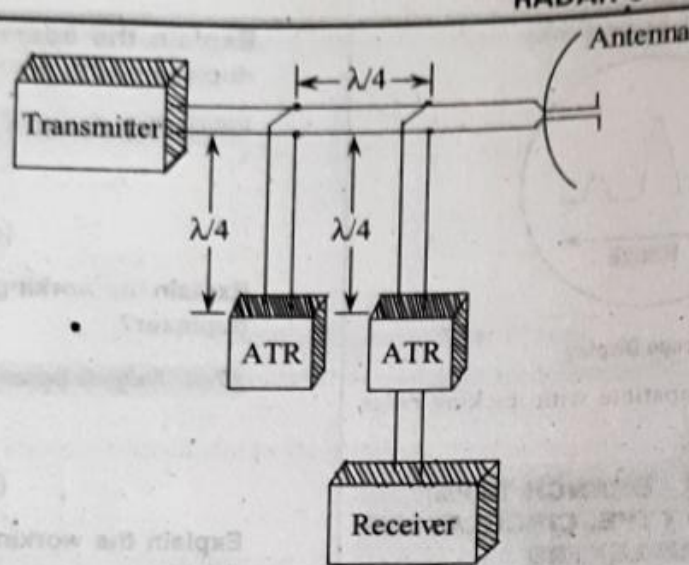


Figure (2): Principle of Branch Type Duplexer

When the transistor is turned ON, the TR and ATR tubes breakdown or fire. The prevention of transmitter power entering the receiver is possible by the short circuit action of TR switch in fired condition. The TR switch appears as a short circuit at the receiver and as an open circuit at the transmitter since, it is located a quarter wavelength from the main transmission line. Thus, it does not effect the flow of transmitted power. Since ATR is displaced a quarter wavelength from the main transmission line, the short circuit produced during the fired condition appears as an open circuit on the transmission line and thus has no effect on transmission.

During reception, neither TR nor ATR is fired, due to the OFF state of transmitter. The open circuit of ATR switch appears as a short circuit across the transmission line. The transmitter is effectively disconnected from the transmission, since the short circuit is located a quarter-wave from the receiver branch-line. Thus, the total echo signal power is directed to the receiver.

Disadvantages

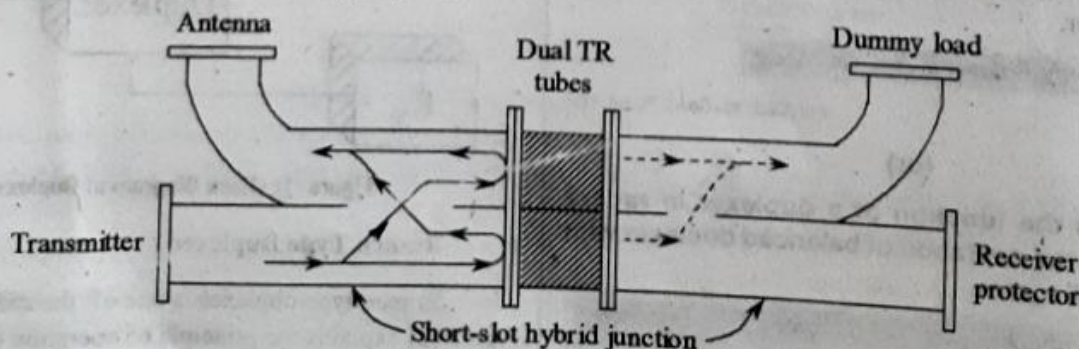
1. The bandwidth is limited to 5 percent only.
2. The power handling capability is also limited.
3. The decoupling between transmitter and receiver is lower than at other duplexers.

Application

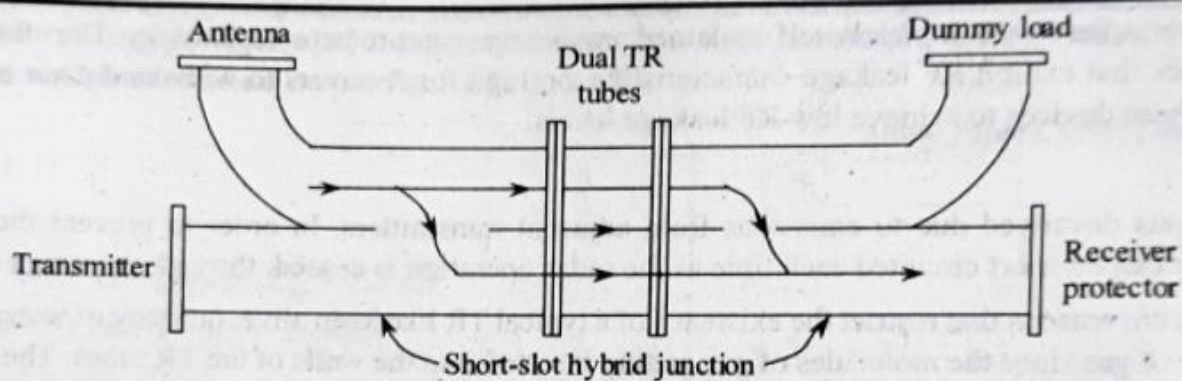
It is used in low-cost radars.

2. Balanced Duplexer

The drawbacks of branch type duplexer can be overcome with another type of duplexer called balanced duplexer shown in figure (3). It is based on the short-slot hybrid junction with two sections of waveguides. This may be considered as a broadband directional coupler with 3 dB coupling ratio.



(a) Transmit Condition



(b) Receive Condition

Figure (3): Balanced Duplexer Using Dual TR Tubes and Two Short-slot Hybrid Junctions

During the transmission, the first short-slot hybrid junction is responsible for dividing the power equally into each waveguide. During the reception, all the TR tubes are unfired and the echo signals pass through the duplexer and into the receiver. The power splits equally at the first junction and whose energy is recombined in the receiving arm.

Advantages

1. Power handling capability is very high.
2. It has wide bandwidth over 10 percent with proper design.