Duplexer or Diplexer

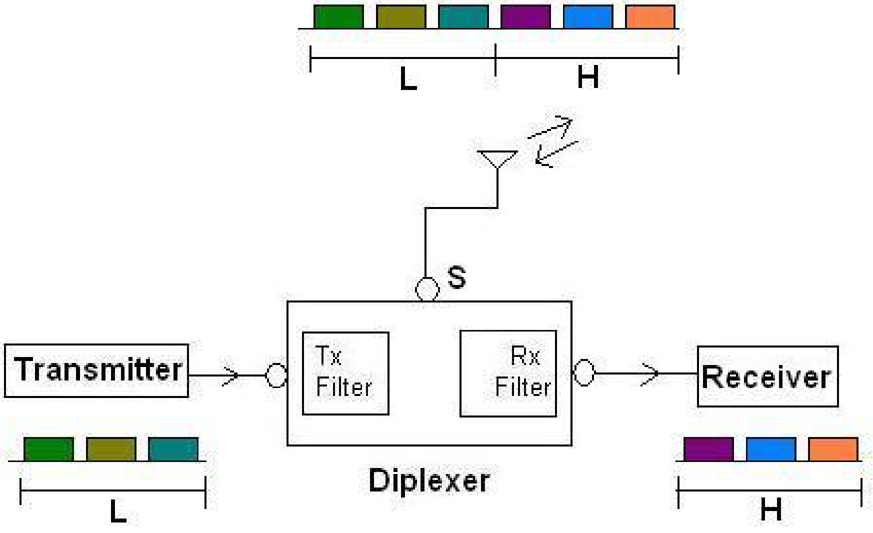


Fig 1

Quoting" http://www.rfwireless-world.com/Terminology/diplexer-versus-duplexer.html"

"As shown there are two RF ports in a ***diplexer*** *other than output port, the device RF triplexer will have three ports other than one output port. A* ***duplexer*** *is a device that allows use of the single antenna by both transmitter and receiver."*

Confused?
Essentially there is no difference, be it a Diplexer that has the capability to handle power isolating the Rx, or the design allowing the split of the ports to handle power in both directions.
To the purists, the definition stated in the linked site is correct, but in practice a device that either combines two differing frequencies to one antenna, or two antennas to one dual band radio, is essentially the same device, no matter what you call it.

Fig 2

What is a Duplexer?

Essentially it's the combination of two pass band with stop band filters.

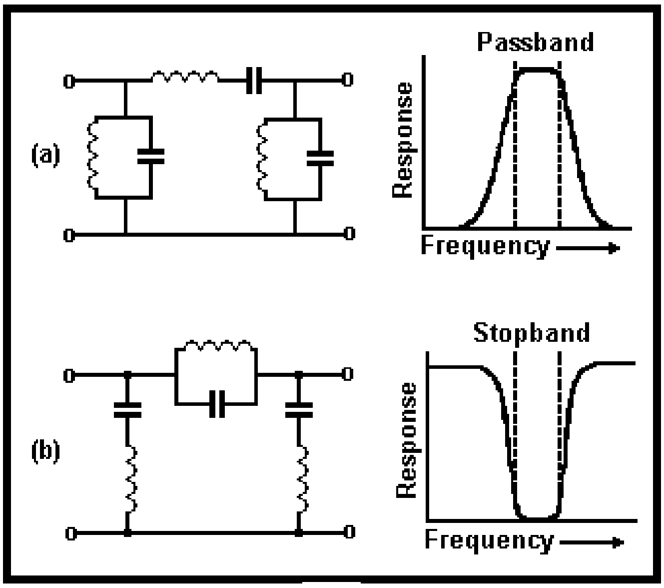


Fig 3

One port will pass the group of wanted frequencies and block the unwanted ones that exist on the other port, with the complement on the other port. (Insertion loss 0.2dB)

From the specifications we can see this where the insertion loss is that loss of the pass band filter and the isolation (Rejection) that of the Stop Band filter (Isolation 40 dB)

Let's evaluate what these figures are about in practical terms.

You have a transmitter with 20 W what is the power loss on the output port
(If you need to brush up on Decibels) Click Link
http://www.arrl.org/files/file/Instructor%20resources/A%20Tutorial%20on%20the%20Dec-N0AX.pdf

The filter spec states 0.2dB
This seems to be a small amount, in practical terms your loss is 0.90014 W What I am showing is that in real terms the loss is almost 1/20 of what you are feeding into the duplexer port, examining several manufacturers specifications the average loss figure are in the range of 0.1 to 0.5dB, Usually this loss is directly related to the stop band filter, the greater the unwanted frequencies rejection the greater the insertion loss.

The Duplexer in Fig 2 shows a rejection figure of 40 dB, using the same power level of 20 Watts, the unwanted frequency power is attenuated to 0.002 W (2mW)
There are units that have greater rejection, The one I use has 60dB this 0.00002 W (0.02mW) One hundred times better.
In choosing a Duplexer, select one with the lowest insertion loss and the highest rejection value.

Applications

Two Radios to one antenna. (The block Diagram does not show the stop band components)
This arrangement can be used to combine a VHF radio and a UHF radio to a dual band antenna.

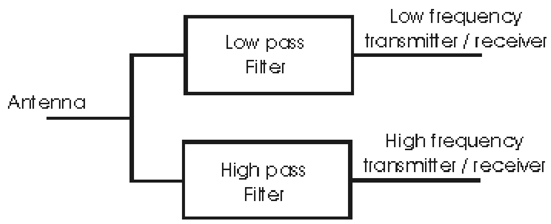


Fig 4

Dual band Radio with Power Amplifier on one band only

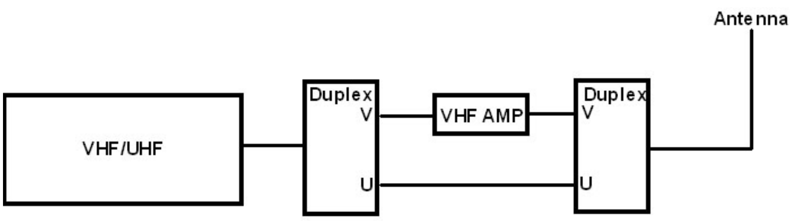


Fig 5

Dual Band Radio and two antennas

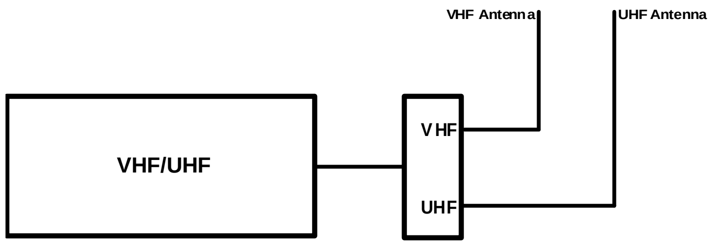


Fig 6

Cavity Duplexer

The cavity duplexer, follows the same concept, that of a pass band and stop band filter combined to pass a frequency and reject another, the bandwidth is very small, usually that of the allocated channel spacing.

Its obvious that to achieve the kind of performance a high Q type of filter is required, this is achieved by making 1/4 wave resonant chambers, in fact an enclosed 1/4 wave antenna .

The pass band must be wide enough to accommodate the center frequency, plus and minus the modulation side bands.
Conversely the stop band section must reject the unwanted frequency, plus and minus the side bands.

Unlike the LC duplexer that allows a wide range of frequencies, this system is used in repeaters that operate in the same band, as is the case in a two meter repeater.

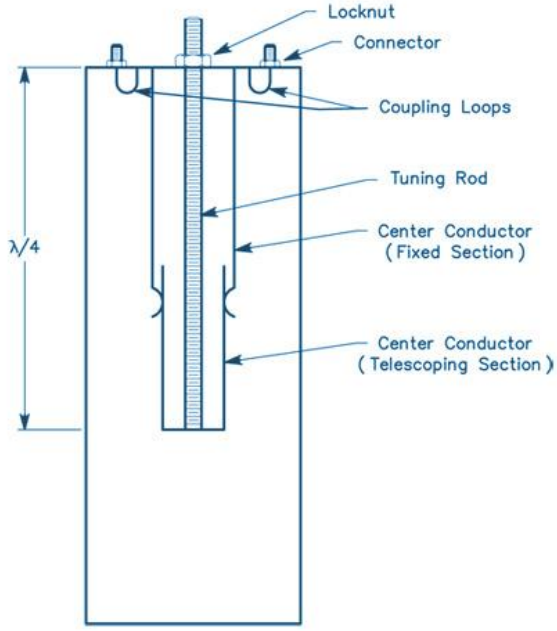


Fig 7

Figure 7 shows the internals of a pass band cavity resonator, in simple terms, the chamber forms a parallel resonant circuit, this with a very high Q, the implication is that the wanted frequency passes from one port to the other, all other frequencies are attenuated. The amount of attenuation in a well made unit is about 30. dB This is the reason that one uses at least three cavities in series to achieve the required pass band.

Fig 8

Fig 8 shows a combination of 3 notch on the input frequency and 3 on the TX frequency, this is a typical configuration found on amateur radio repeater.

The preferred method is to use .notch cavities, this because it offers the least of signal attenuation loss, the cavity is a very low impedance to the notch unwanted frequency.

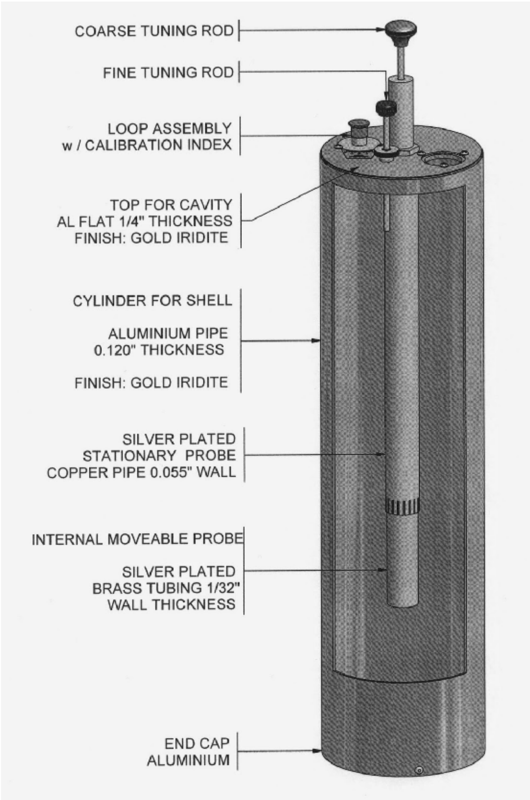
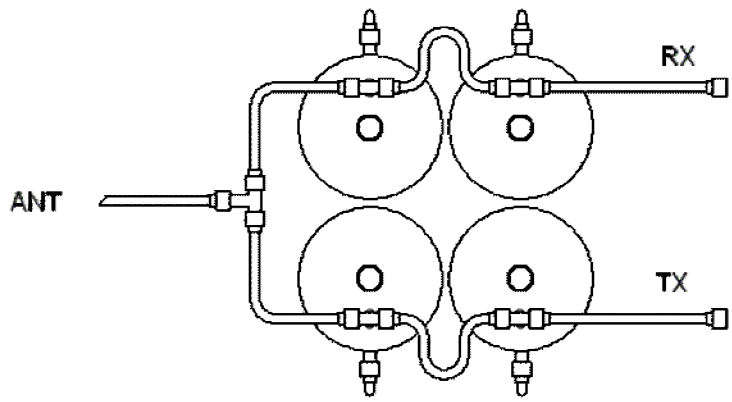


Fig 9

Here is an approach, using notch cavities instead of pass band; the RX is tuned to reject the TX, with TX tuned to reject RX.



4 ELEMENT BP/BR DUPLEXER

Fig 10

With Fig 10, the kind of specs are Rejection better than 60dB, insertion loss < 1 dB

De VK2YMU