Adjacent channel interference in the Codan 8800 Digital Microwave Radio

Definition

Adjacent channel interference is caused by unwanted power received from an adjacent channel transmitter. It may cause diminished performance of the target receiver.

Regulatory requirements

Regulatory authorities apply rules that specify the relative level of the interfering signal when compared to that of the wanted signal from a transmitter. These rules are known as Carrier to Interferer (C/I) ratios. A typical example of C/I ratios used by a regulatory authority when assigning a radio transmitting frequency is shown in Table 1.

Table 1: Typical C/I ratios

Frequency offset (MHz)	C/I ratio			
	Wanted signal 7 MHz bandwidth	Interfering signal 7 MHz bandwidth	Wanted signal 14 MHz bandwidth	Interfering signal 14 MHz bandwidth
0	20 dB		20 dB	
7	–15 dB			
14			–15 dB	

Consider a scenario where both the wanted and interfering signals are digitally modulated and occupy an RF bandwidth of 7 MHz as highlighted in the shaded area of Table 1.

- If the wanted and interfering signals are on the same frequency (0 MHz frequency offset) then the interfering signal level must be 20 dB lower than the wanted signal level.
- If 7 MHz offsets the wanted and interfering signals, the interfering signal level may be 15 dB above the wanted signal level.

In a Digital Microwave Radio (DMR), the rejection of interfering signals is mainly achieved by the Intermediate Frequency (IF) filtering capability of the receiver.

Good network design through site location, frequency selection, and using cross-polar discrimination in antenna systems can assist with the rejection of unwanted adjacent channel interference.

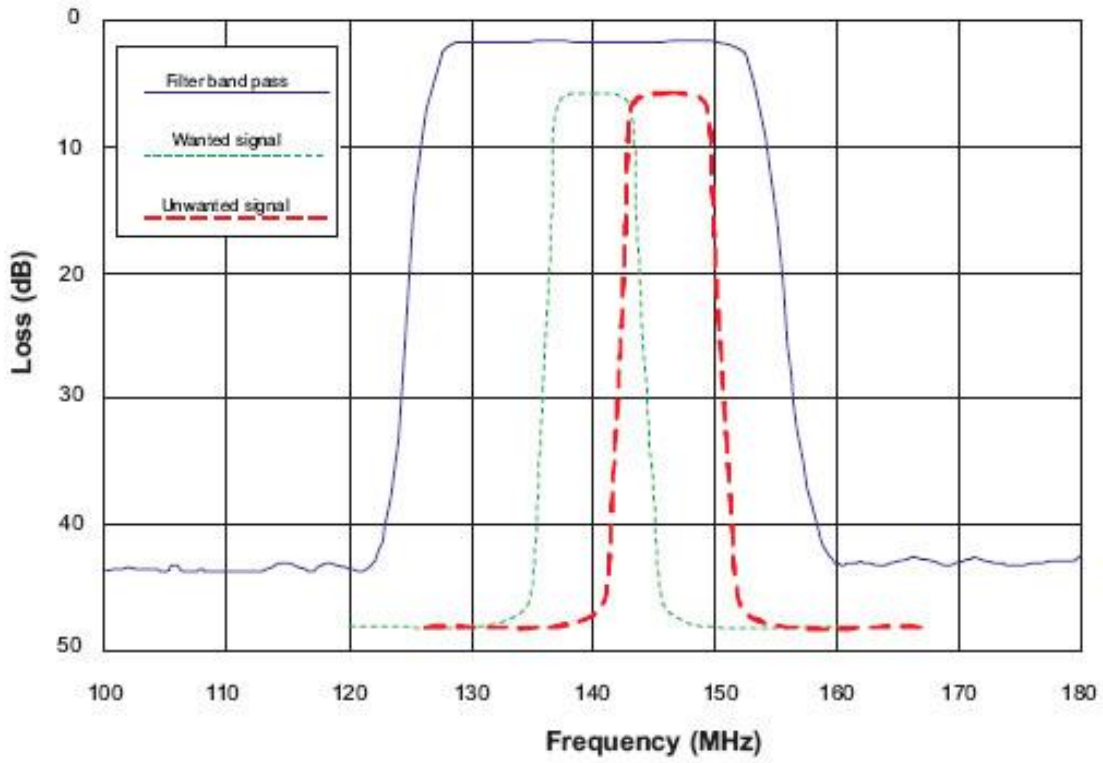
Design considerations

One of the considerations made during the design of a radio receiver is its ability to reject interfering signals. This characteristic is known as the receiver.s selectivity. Receiver selectivity is typically determined by the filtering applied in the receiver IF stages. Most modern DMRs achieve this filtering with a device known as a Surface Acoustic Wave (SAW) filter.

Where the bandwidth of a DMR is software programmable, the most cost-effective method of IF filtering is to use a SAW filter with a bandwidth allowing the highest possible transmission capacity. The Codan 8800 series DMR uses a 44 MHz bandwidth SAW filter in the receiver IF stage. This technique is known as broadband IF filtering.

By having a broad filter in the receiver IF, it is possible for unwanted adjacent channel signals to pass through the receiver and affect performance (see Figure 1).

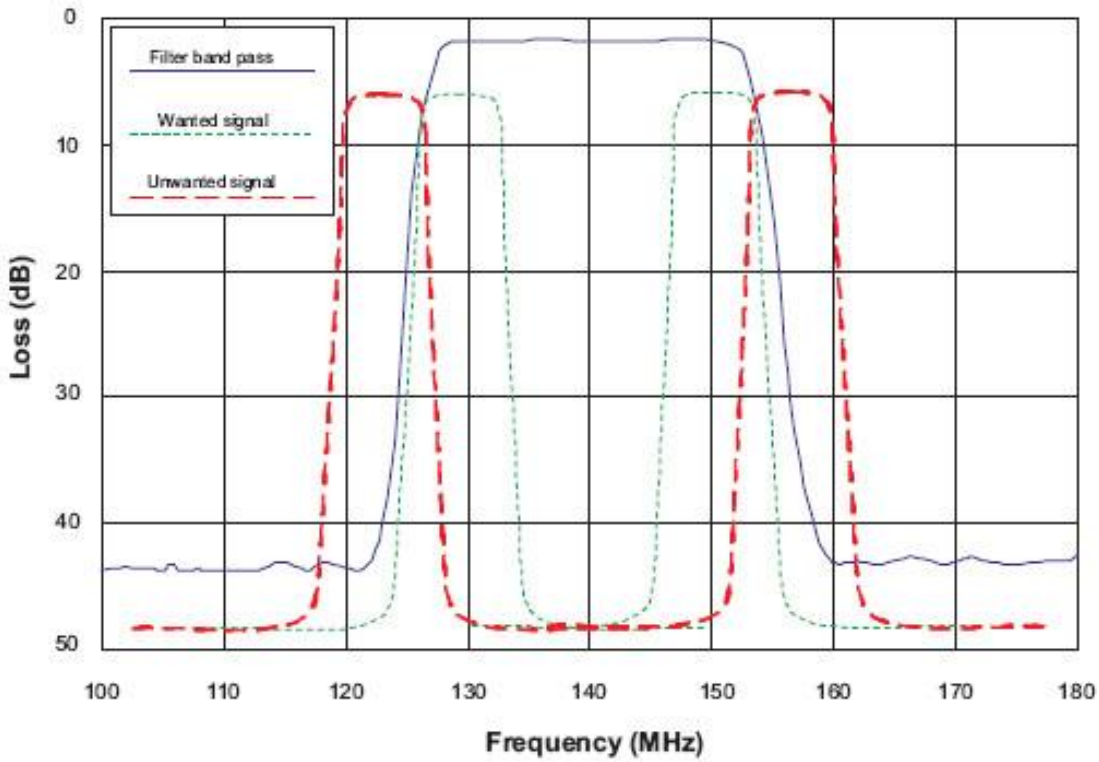
Figure 1: Interfering signal



Codan's SAW filter implementation

To overcome the receiver selectivity limitation of broadband IF filtering, Codan has implemented the ability to dynamically alter the receiver IF. When an interfering signal is received, the IF changes frequency to push the interfering signal outside the band pass of the SAW filter, and hence improve the rejection of the unwanted interference as shown in Figure 2.

Figure 2: Receiver IF response



If the interfering signal is on the channel above the wanted signal, the IF is shifted up in frequency until the interfering signal is moved outside the upper limit of the SAW filter band pass.

If the interfering signal is on the channel below the wanted signal, the IF is shifted down in frequency until the interfering signal is moved outside the lower limit of the SAW filter band pass.

Conclusion

Adjacent channel rejection in the 8800 Series Digital Microwave Radio DMR is achieved through:

- **effective rejection of interfering signals by IF SAW filtering**
- **dynamic control of IF, which further enhances the ability of a DMR receiver to reject interfering signals, thus allowing for deployment in congested environments**

Digital Microwave Radio

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http://digital-microwave-radio.at-communication.com/en/digital_microwave_radio_8800_channel.html