

## WILL A PRESELECTOR SOLVE DESENSE PROBLEMS?

A preselector is a low-cost solution to desensitization problems in repeaters for cases where receiver overload is the cause. In many cases, however, the cause of desense is transmitter noise, not receiver overload.

All transmitters generate a spectrum of noise. The level of this noise decreases as the frequency of observation moves away from the carrier frequency. It also varies with the transmitter design and the condition of its components. The part of the transmitter noise spectrum that exists at the frequency of the receiver is usually much stronger than the receiver sensitivity, hence can drown out weak signals. The effect on repeater operation is indistinguishable from receiver overload because noise from the transmitter sounds exactly like receiver noise on weak signals.

It is for this reason that duplexers have cavities on both the transmitter and the receiver. The receiver cavities pass received signals and reject the transmitter frequency. Thus, they prevent the receiver from being overdriven by the transmitter signal. The transmitter cavities pass the transmitted signal to the antenna but reject NOISE at the receiver frequency, which would otherwise drown out weak signals.

## ANALYZING THE CAUSE

The first thing to do in any repeater is to make sure that the transmitter and receiver are shielded from each other adequately. No filter can do any good if signals are bypassing it. Disconnect transmitter output from the duplexer and connect it to a shielded dummy load. Radiate a signal to the receiver and key the transmitter. If there is any desense you need better shielding.

Next, reconnect the transmitter and connect the receiver input to a shielded signal generator. Repeat the test. There should be no desense. If either of these tests fail, don't waste time on other experiments until the shielding is improved and these tests are passed.

Now a simple test can be made to determine whether the trouble is caused by receiver overload or transmitter noise. Connect a meter to a signal-strength indicator (such as limiter current) test point in the receiver. Disable the repeater transmitter and send a constant-strength signal into the receiver, sufficient to increase the limiter current noticeably. Now key the transmitter and observe any change in the reading.

- If the reading decreases the receiver is being overloaded
- If the reading increases the signal is being swamped by noise

Receiver overload decreases the reading because a signal that is too strong for the receiver reduces the gain of the overdriven stage.

Transmitter noise increases the reading because it appears in the receiver as an additional signal, which increases limiter current in the normal way.

There is one other possibility—no change. If this is the case BOTH conditions probably exist and one offsets the other. At any rate both symptoms need to be treated to effect a cure.

## WHERE A PRESELECTOR CAN HELP

If your problem is due to transmitter noise a preselector won't help. In fact if the preselector increases the sensitivity of the receiver the problem may seem worse because it's simply increasing the sensitivity to the noise as well as the signal.

If the problem is overload the preselector can help by providing additional attenuation of the transmitter signal which is causing the overload.

## INTERMODULATION CONSIDERATIONS

A second condition which a preselector can cure is intermod. The most obvious cause of intermod is when the receiver is being driven too hard by at least one signal in the spectrum. The resulting overdrive causes a receiver stage to behave as a mixer. If another signal is present at a susceptible frequency it can mix with the primary signal and produce a new spectrum of signals, any one of which is received as interference. The tip-off of intermod is that if both signals are modulated, you can hear both audio signals in the receiver. If one of the signals involved is your own transmitter there will be an audio howl due to feedback, as well as the other station's audio.

When the intermod is being generated IN THE RECEIVER the preselector is likely to help due to its ability to attenuate the undesired signals.

Another cause of intermod which won't be helped by a preselector is outside of the repeater station. If there are rusty joints on the repeater tower, they may exhibit nonlinear effects in the same manner as diodes do. Since they are a part of a substantial metal structure that behaves as an antenna such joints are a surprisingly efficient intermod source. In this case nothing you can do to the repeater (except possibly a drastic reduction in transmitter power) can help, since the interference is being generated externally and radiated to the receiver antenna at the receiver frequency. Since the receiver is SUPPOSED to receive that frequency no amount of filtering can help.

The solution is to clean up the tower, and any other conduction objects in the antenna field by either bonding or insulating all metallic joints. Adding a preselector in a case of external intermod exaggerates the condition because of increased sensitivity.

## TESTING WITH A PRESELECTOR

When you evaluate a preselector, make your first tests with the transmitter turned off. Compare receiver sensitivity with and without the preselector connected. After proving that the preselector functions properly, key the transmitter. If signals desensitize now, repeat the limiter current test to determine whether an overdrive condition or a transmitter noise condition exists. It may be that an overdrive condition was masking a transmitter noise condition, and addition of the preselector unmasks it by clearing up the overdrive condition. If so, you must take steps to reduce transmitter noise.

## TRANSMITTER NOISE

One could try different transmitters until a quieter one is found. It is unlikely that you could find so much difference among transmitters to clear up a severe case completely because they all generate noise.

What you can do is touch up the transmitter alignment to minimize noise. Often reductions on the order of 20db occur by this simple expedient. The procedure is to observe the internal transmitter test points. However, radiate a test signal into the receiver while you do the tuning. As each transmitter adjustment is peaked you may note that the noise level on the received signal varies. Usually on one side of the peak the noise is stronger than it is on the other side. Retune to the side having the least noise - but stay very near to the peak to avoid detuning the transmitter too much. Normally a succession of such adjustments will yield full transmitter performance with substantial reduction of noise output.

If you find conditions that can be helped with a preselector, we'll be happy to sell you the best available.