ALERT Feedback

ALERT Feedback is intended as an open forum for the exchange of information on technical issues and problems related to ALERT systems. Readers are invited to submit contributions at the address given on the back page of the newsletter.

Why do we lose reports from the Sensors on our ALERT System?

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I'm sure this question arises in the minds of most ALERT system managers and users. The primary cause is contention between the signals of the various devices as they send in their reports. To fully understand why this is happening, and the result, I would like to offer a simple explanation.

Obviously, the greater the number of reporting units on a system the greater the problem becomes. Further, the limited number of frequencies available for systems demand the reuse of channels, resulting in intersystem interference. When receiving and transmitting sites are located at high elevations, the problem is exacerbated. It is not unusual in areas with mountains rising to over 10,000 feet, to have signal path lengths in excess of 100 to 150 miles. "Ducting" caused by temperature inversion layers can also greatly extend unwanted signal paths.

ALERT systems operate in the frequency modulated or (FM) mode. This results in a phenomenon peculiar to FM. In amplitude modulation (AM) when there are two signals on a single frequency at the same time, there is a "hetrodyne". This is a beat note equivalent to the exact difference in the frequency of the two signals. It is virtually impossible for them to be on the identical frequency, as the stability of the transmitters is not that accurate. Thus, the signal may vary from a few cycles per second (Hertz) to as much as several hundred Hertz. The resultant hetrodyne is audible as the direct frequency of this difference. This holds true, regardless of the difference of the strength of each signal.

The peculiarity of FM is that the receiver will only recognize this hetrodyne effect when the signals are of approximately the same strength. Without attempting to confuse the reader with technical details, signal strengths are often measured in decibels (dB). When there is a 6 dB difference in strengths at the receiver (6 dB equals twice as strong), a "capture effect" takes place and the stronger signal virtually eliminates the weaker one. In actual practice, this 6 dB may not be strong enough, and it can take as much as 12 dB (four times the strength) to absolutely capture a receiver.

When this happens, the weaker signal is completely eliminated. In any ALERT system, the signals reaching the receiver - whether it be a repeater system, or a simplex (single frequency system), the weaker system will be lost without a trace. These signals may emanate from within the system, or from without. They may be actual signals, or even noise or spurious signals - the result will be the same.

Fortunately, the ALERT transmitters are so designed that each accumulated report (such as precipitation) is given a serial number, so that even if a single report is missing, the total will be accurate. On event-reporting, such as wind, stream flows or the like, depending on the frequency of the report, the loss of a single report becomes almost insignificant.

One further result of competing signals is that, as

*(See **FEEDBACK,** pg. 7)*

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stated, signals of approximately equal strength can hetrodyne even in an FM system. Since the ALERT systems use frequency shift keying (FSK), consisting of two audio tones, this hetrodyne can occasionally result in translation of data. This could explain the random reports from any sensor which do no seem to make much sense.

Ideally, an ALERT system would be so engineered that there is a log of the signal strength from each and every remote sensor. While this can be accomplished by taking actual field strength measurements, it is rarely done. If so, one would find that there is a dramatic difference in the strength of signals received from each location. Thus, some locations which deliver weak signals into the system are much more prone to losing reports than those which have line of sight, or are in close proximity to the receiver, resulting in very strong received signals. This can be a major problem when the strong signals occur at very frequent intervals, such as from a wind sensor at a weather station.

If it is deemed critical, steps can be taken to increase the signal from certain remote sites. This can usually be accomplished by using high gain directional antennas. It may also be advantageous to use directional antennas at a receiving site to increase received signal strengths from a particular direction. However, this will always result in lowering the strength of signals received from other directions. If there is a non-critical station close to the receiver, power could be lowered, or frequency of reports decreased, to favor other more important stations.

The purpose of this dissertation is to help the reader understand what takes place in the radio portion of the system. Some ALERT equipment incorporates a receiver as well as a transmitter at ALERT reporting stations. It can be programmed to inhibit the transmitter when the receiver hears a signal, and to transmit when the channel is clear. While this can be advantageous in many instances, it can also be detrimental in a repeater type system. Since the associated repeater station will respond to any signal above its threshold level, it may be turned on by both spurious signals and weak signals from other systems. If this is the case, the wanted signal from the sensor would not be transmitted while the repeater was on the air, even though if it could do so, and its signal would be strong enough to "capture" the repeater receiver from the undesired signal.

This further points out the need to carefully engineer each system, as well as each individual device location, to achieve the best results. Prioritize the importance of each reporting location, and attempt to construct the system so that signals from the most vital sites have the best chance of getting through at any time. It is important also to check the frequency of occurrence and the signal strength of interference from other systems or sources. This must be done at the receiver, as they will not show up on the screen of your computer, except perhaps on "Show Reports".

(**OREGON,** *from pg. 3*)

Feb. 6, flood warnings had been issued for the Willamette and Columbia Rivers.

The flood resulted in eight fatalities throughout the state:

* Doug Andrews, 45, of Brownsville died on February 7 after abandoning his car in Linn County
* Lois Schuerman, 62, of Albany died on February 8 after her car went into a drainage ditch
* Amber Bargfrede, 8, of Scio died on February 7 after being swept away in flood waters when she went outside to get a newspaper
* Jaqueline Jank, 62, of Troutdale died when her home slid into Sandy River on February 7. She did not make it to the roof where her

(*See* **OREGON,** *pg. 17*)