What is SafeLink?

SafeLink is a whole concept in secure, high reliability radio designed specifically for high risk medical alarm applications. There are many cheap radio based systems on the market for application such as car door locking, wireless door bells, burglar alarms and walkie-talkies. In most cases the technology employed is totally unsuitable for this safety critical use, and yet at times gets applied. SafeLink has been designed for the highest integrity with the following features.

- Most radio systems simply send a voice or data message when required. However radio can be unreliable as anyone with a cellphone can appreciate. The radio signal can fail because of interference, blockage of the radio path, failure of the transmitter or simply the receiver moved out of range. Using a unique check message sent approximately every 10 seconds the SafeLink Pager can warn the carer if the radio link should fail, before there is a need to alert a distress condition. This enables the operation and 100% protection to be restored.

- Radio receivers come in two main flavours, Super-regenerative and Super-hetrodyne. The first is cheap but very prone to blocking by interference. There have been numerous incidents of cars stranded because the radio operated anti-theft device failed in a car-park due to this lack of immunity. The second, while more expensive, is highly selective and sensitive giving good immunity from interference and long range, and is the method used in Safelink.

- For domestic and care home situations a range of 50-100 metres is probably sufficient, and will encompass even the garden area. Such ranges are quoted for even the cheapest types of system. However this is "open site", ideal condition range. Radio waves are absorbed and reflected by building materials, furnishings and equipment. They are also absorbed by damp air and interference from other radio equipment can lower the receiver sensitivity. The range of the SafeLink system has been optimised for low speed alarm communication (by the various design choices below) and over 400 meters has been recorded in true open site conditions under dry conditions. Thus there is plenty of margin to assure the user of good coverage in more typical residential situations.

- The choice of frequency is paramount in the search for a reliable high range system. The legislation in the EEC and elsewhere allows for three major frequency bands in low-power license free applications. Using such bands removes the need for the operator to license the installation, but more important the low power levels (1000 times less than a cellphone) makes interference with other medical equipment highly unlikely. Only the most sensitive monitoring equipment (ECG and EEG for instance) needs to checked when the system is first installed. The frequency bands available are 418MHz, 433MHz and 818MHz. The first is typically used by the cheap products such as car key fobs and door bells. It is very close to the frequencies used by some high power national pager networks and hence notoriously prone to interference. Also the products using this frequency seldom take care to avoid creating blanket interference which makes it a poor choice for safe systems. It may even soon become unavailable as a license free frequency. Consequently most professional products such as computer modems, speech walkie-talkies and burglar-alarms are moving to 818MHz, which also gives higher data rate capability. However the higher frequencies are prone to greater absorption and reflection, which reduces their range. Such is the rush for wireless data communication that this band is rapidly becoming crowded. Hence SafeLink uses 433MHz as it only requires very low data rate and can gain benefit from the greater range.

- The form of the message has a strong influence on range and reliability. Cheap systems just turn the transmitter on and off to create a data pattern. This is hard for the receiver to rapidly detect. SafeLink uses a balanced modulation called Manchester Encoding, which gives the receiver the best type of signal to detect. The speed of the data is very low and the receiver has been specifically designed to reject high speed data. This increases the system immunity to other radio sources and general radio noise.

- The message data is encoded with 24 data bits which gives a possible 16 million messages and there is an additional 16 bits of error checking information. This uses a random number sequence (called Cyclic Redundant Checksum) so that a message is easily detected with high reliability.

- The message lasts 11msec and with a repeat check message every 10 seconds the typical average battery current is 15 A. Thus the Alert-iT monitors are capable of offering this high integrity even when operating for many months from small coin cells. This could not be the case if a bi-directional radio network was used, as receivers are more power hungry.

- A message is transmitted 6 times on the first occasion to increase certainty of reception.

- For units that are using the Safelink capability the alarm message then repeats approximately every 10 seconds. However the time is increased by a small margin dependent on the address of the sending equipment. Thus if there is a clash of data from two transmitters, there will be no clash on the next transmission. There is a very low probability of continuous clashes producing an radio fail alarm over the 2 minute monitoring window.

- Non-safelink messages are repeated every 2 minutes, which ensures that the message will be successfully received without excessive battery consumption.

- There is an 11msec gap after sending a message, which is used by repeater units to extend the network range. These units simply repeat any received message instantly the message ends, with crystal controlled timing accuracy. Thus even if two or three repeaters send at the same time, they will be locked onto each other and no data clash will occur.

- Obviously the alert functions depends on the continuity of power in the Pager. The Pager is designed to operate from an internal battery either normally or in the event of mains power failure. If the battery gets near to exhaustion then a warning alarm is given, while full monitoring is still maintained. The Pager can be set by the Supervisor so that it cannot be turned off without using a password and should the user remove the batteries, a warning message is displayed to this effect until the Supervisor clears it with his password

The SafeLink concept has been designed from the very start to be a high reliability, high integrity radio link suitable for medical alarms. The radio receiver, the encoding method, the frequency and power levels have all be chosen for this purpose. None of this is true of the cheap radio systems designed for low risk applications such as key-fobs and modems.

Despite these measures we cannot claim that any alarm system embodying SafeLink will be infallible. For instance the user could become separated from the Epilepsy sensor by falling out of bed. We can claim that the 24 hour protection offered by such systems will be more vigilant than peraonal monitoring. In life threatening conditions it should be used as part of a wider monitoring programme

UT1051