APPLICATION NOTE AN-110

Protected or "Hot Standby" T1 Links Using 4.9 GHz Microwave "SafeTLink"

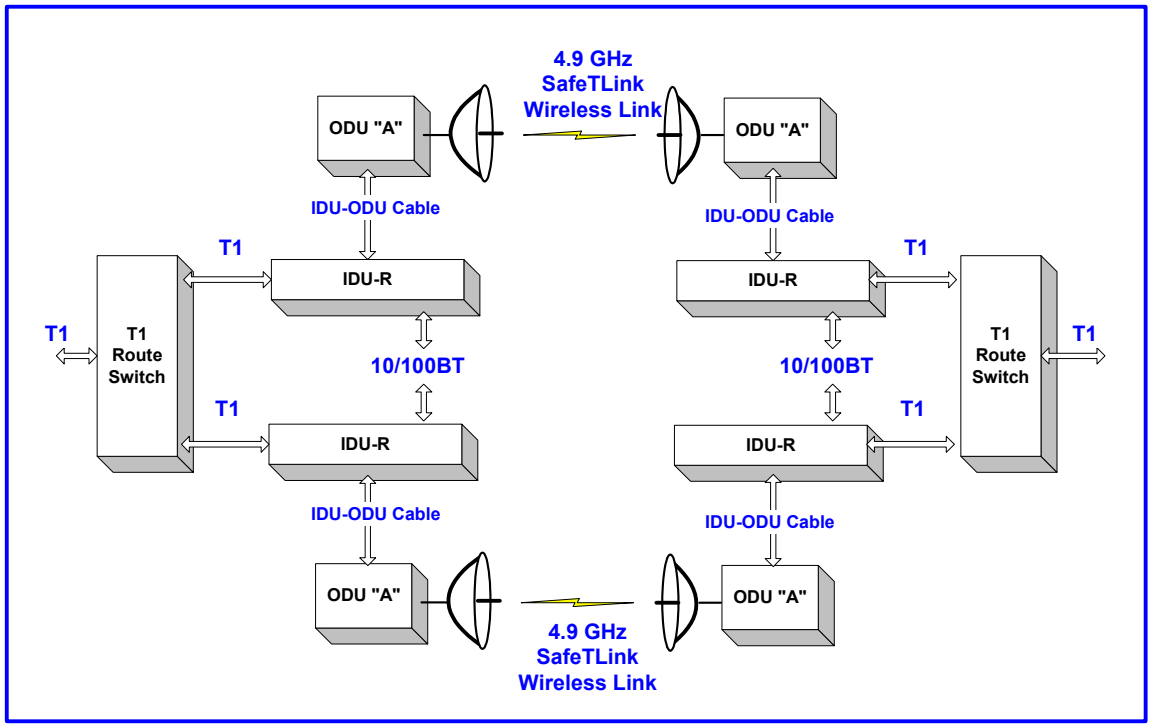
Critical public safety communications links often require automatic switching to an alternate circuit to prevent interruption of service. This application note describes how two parallel LPN Wireless 4.9 GHz T1 links can be configured to provide a fully-redundant, protected T1 path.

Microwave links can be used to connect remote receiver or repeater sites. The 4.9 GHz SafeTLink wireless link can replace costly and sometimes unreliable leased lines. The T1 circuits provided by the SafeTLink system have low end-to-end latency, and very low latency variation, making the SafeTLink suitable for voting receiver, trunking or simulcast applications.

The SafeTLink ODU (right) contains all the electronics for the wireless link. User interfaces – Standard T1 digital telephone signals – are carried from the ODU to the indoor user equipment. In addition, 10/100 Base T Ethernet traffic is carried in parallel with the T1 for data, video, network control and is available for emerging applications.

The block diagram below shows a fully redundant pair of SafeTLink wireless paths between two sites. Each link carries full-duplex T1 signals. Both T1 paths carry the same data. At the two ends of the system, there is a T1 switch that selects between the two T1 signals.

The two radio links could be on the same frequency but different antenna polarizations. Both ODUs at each end could use a common antenna that has dual polarization feeds. This approach improves frequency spectrum use.



At each end, the SafeTLink provides a standard T1 circuit. This T1 circuit is a digital TDM standard operating at 1.544 Mbps (mega bits per second), and contains 24 DS0 time slots, each slot carrying 64 Kbps (kilobits per second), full duplex. Some models of the SafeTLink also provide an Ethernet path for data, video, LAN extension and other applications.

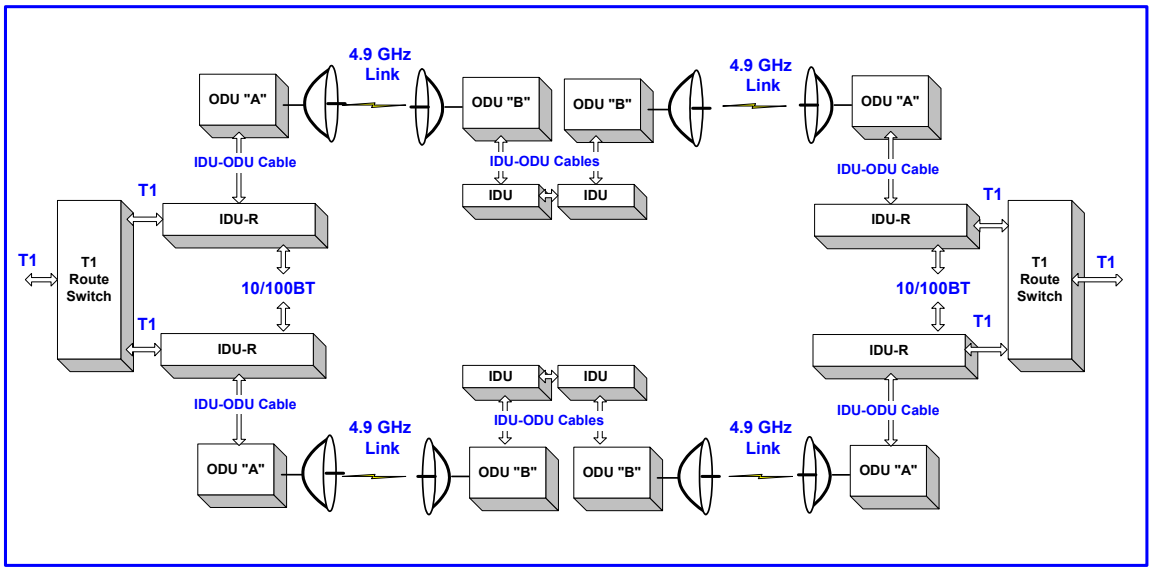
LPN Wireless manufacturers the ODU and IDU-R equipment shown in the diagram, but not the hot-standby T1 Switch. There are a number of T1 Switch vendors. Some manufacturers refer to this function as a T1 Route Switch, a T1 standby switch, or a T1 protection switch. The T1 Switch selects between the T1 paths.

One T1 Switch that we have worked with is the Larus 5702. See www.cxrlarus.com/products/NetworkAccess for information on their product. The Larus 5702-2A is a 1U, rack-mounted, 2-port T1 switch specifically designed to monitor a pair of T1 lines, and to provide switching between them in the event of failure or degradation. The route switch delivers the better of the two T1 paths to the user.

Some of these switches contain memory and can provide a lossless transition from one T1 to the other. That is, no data is lost if the two T1 lines are carrying the same data and synchronized. Other T1 switches do create a brief interruption in the T1 during the switch from one to the other T1 source.

The T1 protection switch can be set to shift between the two T1 lines based on several criteria. It can monitor the T1 line BER. It can trigger if the T1 analog signal level drops below threshold. It can be remotely commanded by T1 alarm signals embedded in the framing. It can be manually switched by an alarm generated by the radio or other local equipment.

This same approach can be used to protect a multiple-hop system. For example, the wireless network below has two ends separated by a repeater. The T1 Switches at each end provide the same hot-standby feature as for a single link. In this system, all four hops could use the same frequency pairs, if antenna sidelobe isolation is considered during network design.



In this network, the four ODUs at the central site are connected with the small-format IDUs. The T1 circuits and the Ethernet are cross-connected so that the site retransmits all signals, full duplex. DS0 or Ethernet can be “dropped” to this site as well, if needed for local use. If DS0 are dropped, they will either be unprotected, or will need their own T1 Switch to select between the two radio paths.

The two pairs of 4.9 GHz SafeTLink systems could even be at two different central sites, to protect further against a signal outage due to power losses or tower damage.

This application note is not a detailed design guide, but it does point out some design approaches than can be used to protect circuits requiring a high level of availability and greater redundancy.