Product
White Paper

CODAN
RADIO COMMUNICATIONS

HiveNet – The Heartbeat of a Network

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HiveNet – The Heartbeat of a Network

HiveNet is a wide area conventional repeater network that is easily deployable and field agile.

Essentially, HiveNet is a network of repeaters that are linked together through RF links allowing the network to be self-healing (linked repeaters can be added or removed at any time). This allows for a widely configurable system with an expandable area of coverage for mobile and portable radios (subscribers).

HiveNet is available as an analog only or analog and P25 digital (mixed mode) repeater network giving the users full forwards and backwards compatibility with existing legacy equipment. In P25 Digital mode, HiveNet will pass all encrypted voice and data transparently through the repeater network. The HiveNet does not require or contain any encryption in order to pass the encryption through the repeater and links.

HiveNet repeaters and links can be any frequency band (VHF, UHF, 700/800/900 MHz). One common example is to have VHF repeaters with UHF links. HiveNet is based on a transportable repeater solution (Codan's ET-4) but can be installed as a fixed network infrastructure.

Each HiveNet repeater is lightweight (under 50 lbs / 22.6 kg) and is housed in a compact watertight polyethylene case as shown in Figure 1. The transportable repeater includes soft grip handles, in-line wheels, press and pull latches and a telescoping handle. Codan equipment is low power consumption, allowing the HiveNet to operate from internal batteries, vehicle batteries or additional add-on external batteries and rapidly deployable, flexible solar panels all mounted in watertight, lightweight polyethylene cases.

Figure 1: HiveNet Transportable Radio

Operational Description

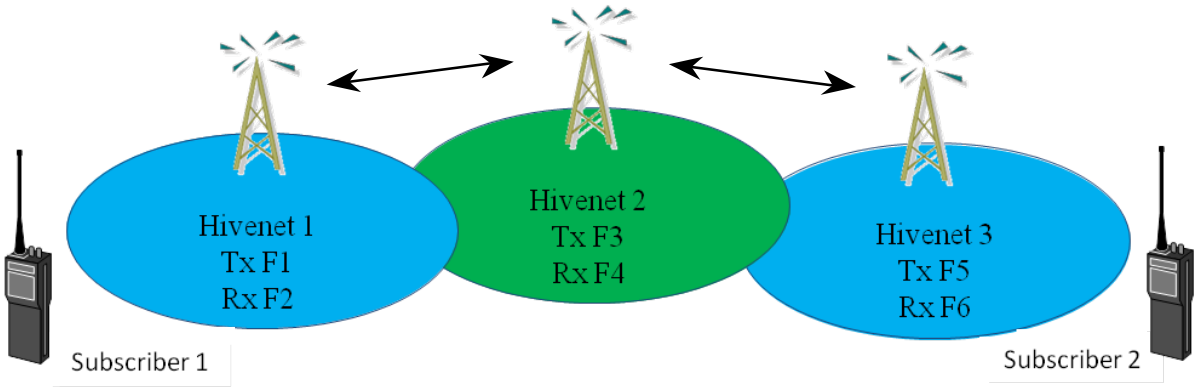

Figure 2: HiveNet Wide Area System

A HiveNet repeater network can be configured as two or more separate repeaters connected together. Figure 2 shows a system of three HiveNet repeaters in use. Each repeater provides radio coverage for a local geographic region utilizing a different transmit / receive frequency pair. The repeater sites are RF linked together such that transmitted information from Subscriber 1 is received at HiveNet 1, then linked to and rebroadcast from each HiveNet repeater in the system, allowing Subscriber 2 to receive the information from HiveNet 3. This allows each subscriber to transmit information to any other subscriber anywhere on the network.

Technical Description

HiveNet repeaters are made up of two transceivers, the repeater (sometimes referred to as the "Drop"), and the Link. The Drop repeaters are on separate frequencies, while the link frequencies are matched (and reversed). Figure 3 shows two HiveNet repeaters linked together with frequency pairs. The Link is referred to as a "Switched Link", meaning that the receiver and transmitter are never active at the same time.

A Switched Link is typically half-duplex, allowing use of a duplexer or antenna relay for the antenna connection.

- An antenna relay allows for a more frequency agile link, transceiver frequencies can be changed without the need for any duplexer retuning.
- A duplexer allows the Switched Link to be changed to a Repeating Link if the system needs to be expanded for more HiveNet repeaters.
- Simplex (same) frequencies can also be used on a two site Switched Link HiveNet with an antenna relay, but every HiveNet repeater must Link directly to each other (no "Chains" of links).

The use of different repeaters all transmitting at the same time on different frequencies is called multicasting.

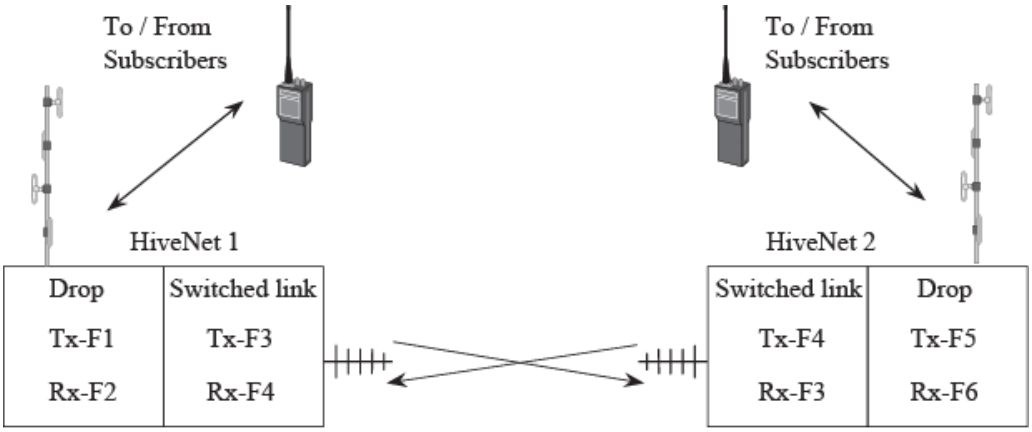

Figure 3: HiveNet Network of Two Repeaters

HiveNet repeaters can be linked together to form different configurations depending on requirements. For larger systems a repeating link may be required as a centralized "hub" for the network as shown in Figure 4. Repeating Links are full duplex and require a duplexer for the antenna connection, and possibly multiple antennas with a power splitter or a multi-directional antenna.

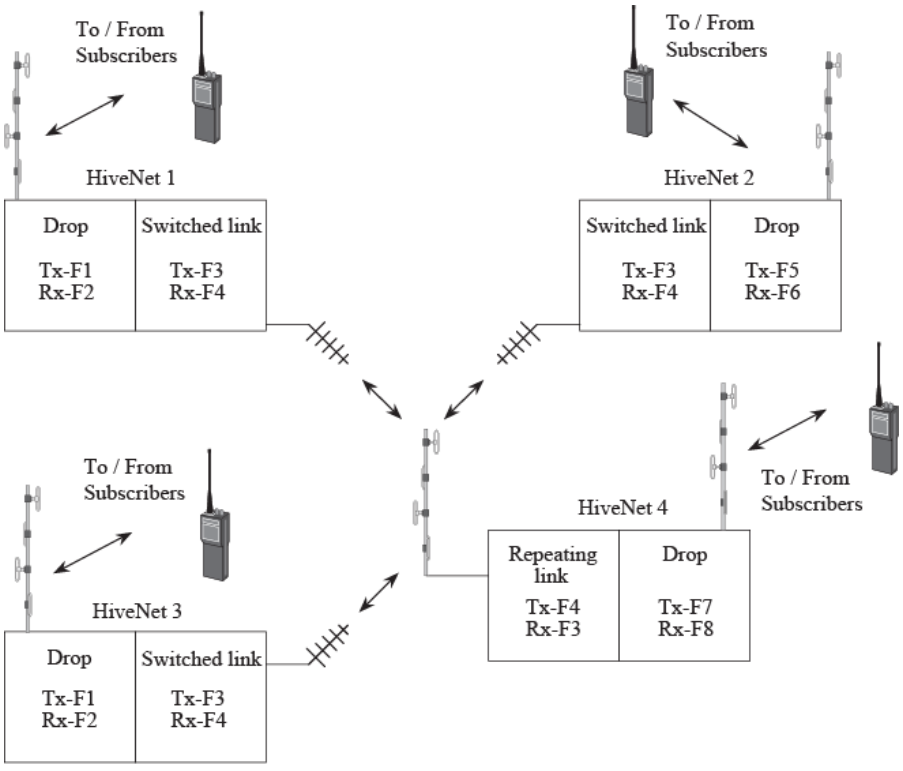

Figure 4: HiveNet Network of Four Repeaters

Some HiveNet configurations may also require multiple switched links in order to former a “chain” of repeater links as shown in Figure 5. This requires another set of frequencies and another transceiver pair, but can allow more customizing of the configuration.

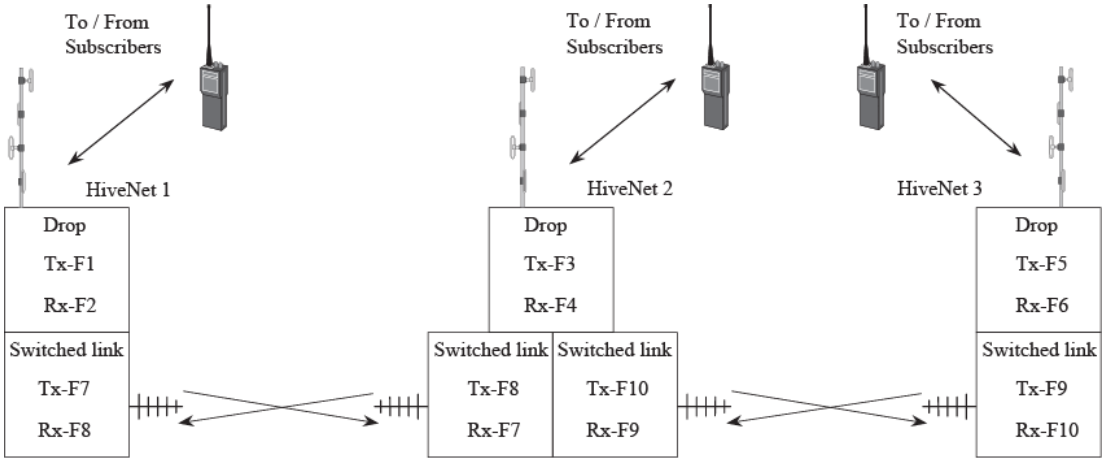

Figure 5: HiveNet with Multiple Links

Optional P25 Digital Ping Feature

A conventional radio system requires the users to set the subscriber radio on the frequency pair of the nearest repeater by manually turning the channel selector knob. This requires more training and attention on the part of the radio user.

Subscriber radios can be programmed to scan the repeater transmit frequencies to lock onto the repeater when it is transmitting. Standard scanning results in the subscriber selecting and using the first channel in the scan list it finds an active (transmitted) signal. Since the repeater talk-out range is generally greater than the subscriber talk-in range, standard scanning does not always result in the optimal channel (typically the closest repeater) for the subscriber to operate on.

In Vote Scan operation, each channel is qualified by measuring the received signal strength of each repeater at the subscriber radio. The subscriber then votes from the repeater sites, selecting either the best signal or the first signal that exceeds a pre-programmed received level threshold.

In order to keep the subscriber locked onto the best (typically closest) repeater site when the subscriber is keyed, the repeaters need to have traffic on the transmitter regularly. Since the radio users may not have consistent radio traffic, the HiveNet repeater can be programmed to ping after an inactive time interval allowing the vote-scanning subscriber radios to lock onto the best repeater. The ping uses the P25 standard “silent” message, so that users will not hear the radio traffic, but it will activate the vote-scan capability in the subscriber.

The optional digital ping software timer is configured to key the transmitter after a specified time (interval) with no activity, with a message of programmable duration (length) as shown in Figure 6.

Ping Interval range: 10 sec to 120 secs.

Ping Length: 1 sec to 15 secs (rounded to nearest LDU length – 180 mS)

The maximum Ping Length is less than 50% Ping Interval. e.g. Ping length < 5s if Ping interval set to 10s.

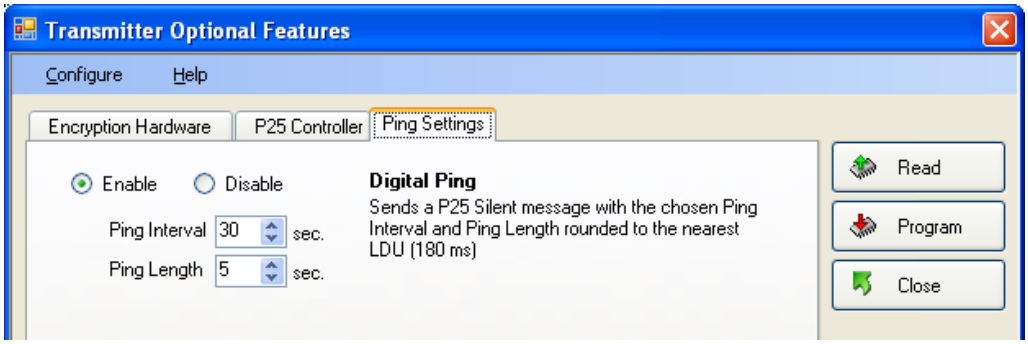

Figure 6: Optional Digital Ping Settings

Undercover Body Comms Kit

An optional undercover Body Comms Kit in a rugged custom carrying case is available from Codan and contains:

- 6 mini-P25 AES 256 encryption enabled Vertex portable radios with drip antennas
- 12 Li-Ion batteries
- A keyloader
- 6 single unit chargers
- 6 micro-digital Bluetooth wireless ear piece/mikes that are completely unseen and sit inside the ear canal
- 6 neck loops with key fob PTTs for the keying the radios
- A variety of equipment-carrying vests and harnesses

Figure 7: Undercover Body Comms Kit

HiveNet Customers

The British Columbia Ministry of Forests in Canada operates a HiveNet system consisting of over 350 fixed HiveNet sites on remote solar powered mountain tops. Each radio network connects 7 to 15 HiveNet sites to each other and the local Forest District office, allowing radio users to roam within that network. Each network can be connected to the neighboring Forest District network by the users through the use of a DTMF code activated on the keypad of the hand-held radio. When a large scale forest fire or other critical communications requirement is needed, a transportable HiveNet network can be rapidly deployed to add additional radio coverage to the affected area.

The U.S. National Interagency Fire Center (NIFC) has successfully uses transportable HiveNet repeaters in its national cache for wildland firefighting and other emergency requirements. The HiveNet system is ideal for national deployment because of its simplicity of use and extreme agility in configuring for the demands of the communications requirements across the entire country.

A government organization utilizes the HiveNet for undercover operations such as tracking wanted suspects as shown in Figure 8. Undercover personnel follow suspects using hidden VHF P25 encrypted subscriber radios for communications. As agents move through different areas of the operation, the radio scans to an available repeater. HiveNet repeaters are programmed to ping after an inactive time interval allowing scanning radios to lock onto the closest (best) repeater. The repeaters are mounted inside of vehicles and are fully mobile, reconfiguring the system topography. All traffic heard by a single repeater will transmit out all other repeaters via the UHF link connection allowing all agents to communicate regardless of the associated repeater. The number of repeaters is only limited by physical distance of a single UHF link.

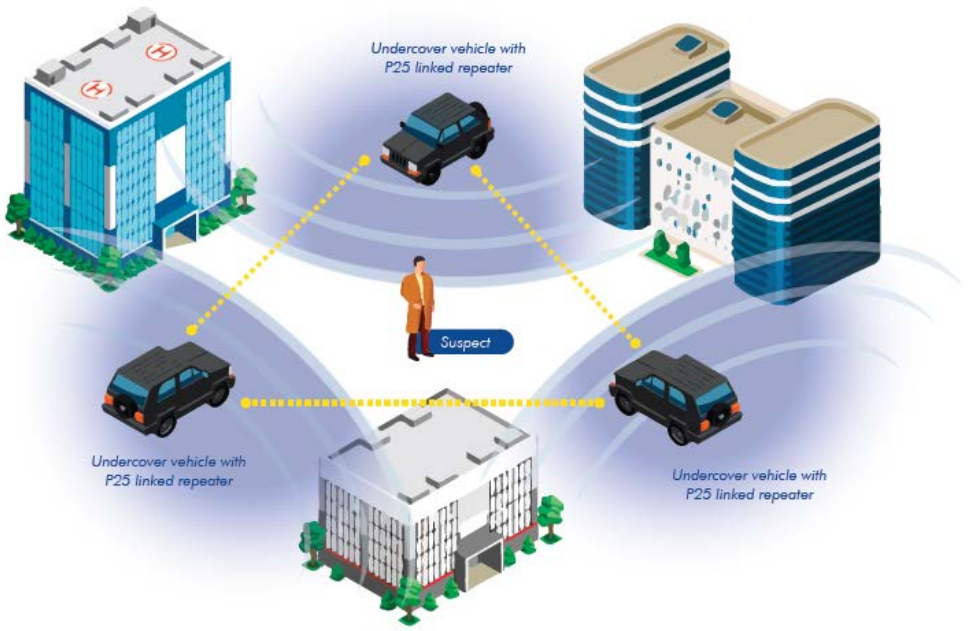

Figure 8: Undercover Tactical HiveNet

A County Sheriff's department uses three HiveNet repeaters to fill in an area of the county that is not covered by the existing radio infrastructure. The HiveNet is temporarily deployed as required in an area of rugged terrain.

The HiveNet is operated as a dual-channel system with channel one in analog mode for Search and Rescue and channel two in P25 mode for Law Enforcement.

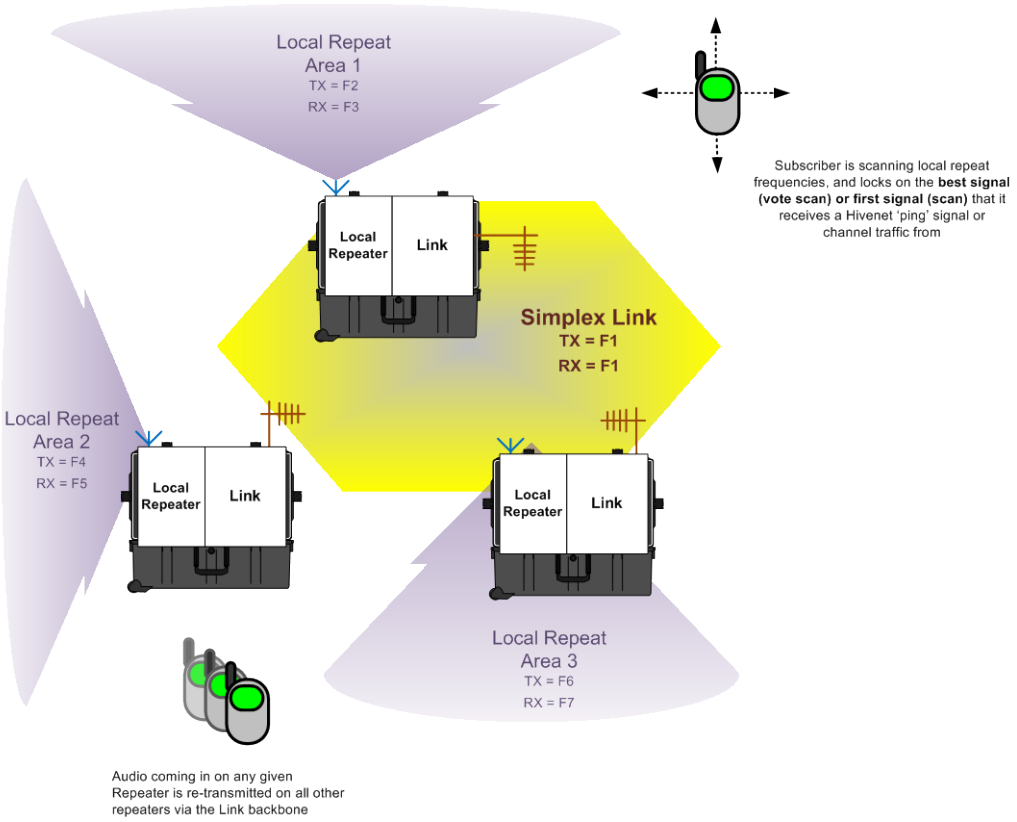

Figure 9: HiveNet Network