Long Range Digital Radio Features

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NVIS Communications

Long Range Digital Radio (LRDR) represents the evolution of HF long distance communications from analogue based to digital for voice, messaging and data communications. LRDR is a long distance communications medium utilizing the HF spectrum to provide a voice quality and data transmission experience similar to cellular and P25 communications, while also providing the capability for encryption, IP and Ethernet connectivity and all standard HF capabilities. Radio systems using LRDR radios leverage these advanced features to provide an outstanding user experience, high reliability and advanced capabilities not found in radio systems using conventional radios. These advanced features allow critical infrastructure entities to build a highly reliable, user-friendly contingency radio system to support emergency actions and restoration operations. This white paper provides an overview of these advanced features and how they contribute to building day-to-day and contingency radio systems.

No Operator Licensing

LRDR operations only requires the licensing of the station and not the operators. Any employee or volunteer may operate their entity's LRDR stations which does not restrict who can actually use the HF radio equipment. The LRDR operator only requires basic training in using the radios. They do not need to understand radio and electronics theory, nor any detailed rules and regulations.

Advanced User Interface with Smartphone-Like Operation

The target audience for advanced LRDR equipment is the smart phone capable user. The radio's user interface is modeled after common smart phones with easy to follow menus and even the ability to customize the user interface. This customization capability allows the LRDR system owner to tailor the user interface to the system's users. This makes both learning and operating the LRDR equipment much easier. LRDR systems also support multiple languages if needed by the system owner.

Software Defined Radio (SDR)

Conventional and digital radios capability are fundamentally limited by the hardware architecture. However, a Software Defined Radio (SDR) has capability substantially defined by its software and can transform to adopt new capability as future standards evolve. SDR provides you with access to the most advanced capabilities available today, and future-proofs your investment via firmware upgrades. These can include: new over-the-air waveforms; linking and data standards; interface protocols; and specific customer requirements. SDR offers customer protection of value of investment.

Automatic Link Establishment (ALE) Frequency Selection

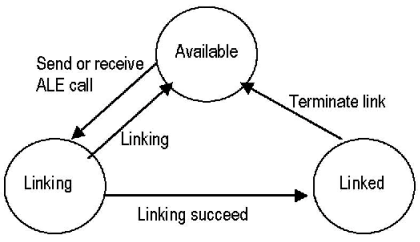
Classical HF radio operation requires a trained and highly skilled operator and uses one frequency of operation at a time. The operator must select the frequency to be used. One single frequency cannot be effective at all times so that operator has to be very competent in the nuances of HF radio operations in order to select the appropriate frequency to use. In addition, all stations must be on the same channel in order to communicate. Selection of the proper frequency is dependent on: knowledge of propagation, time of day/season, and luck.

ALE uses the "four S's:"

- **S**mart radio,
- **S**uite of frequencies to form a network,
- **S**ounding (selective) other stations in the network and
- **S**electing (automatically) the best frequency for transmitting to the desired station. This capability provides greatly improved operational capability without requiring an operator with specialized knowledge of propagation and HF operations.

HOW DOES ALE WORK?

The smart radios in the system continuously scan all frequencies in their network. ALE radios automatically collect channel quality data in order to allow the stations to link efficiently. Each radio receives and responds to soundings from other stations in the network. Each radio maintains a Link Quality Analy-



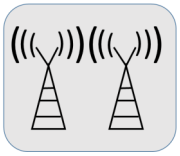
sis (LQA) database of responding stations with the unique selfID of stations in the network; each network frequency and the corresponding link quality (signal strength) of each sounding connection. All this occurs in the background with no operator assistance required.

In order to contact a station in the network, the user simply selects the desired station from a cellphone-like contact list and enters a call/connect command, usually a single button. The user's smart radio uses the data in its LQA database and initiates a call to the desired station. In very short order, the calling station and the called station connect on an acceptable frequency and both stations are alerted with a distinct signal tone and a display notice. The users on each station can now communicate!

Digital Voice

Digital voice provides a voice quality experience similar to cellular phones and ensures continued operation in degraded and fading channels. With digital voice, the user no longer is subjected to listening to the "hiss" familiar to analog radios. Monitoring a channel using digital voice provides the user with the same experience as found with land mobile radio systems, no sound other than actual voice transmissions. Digital voice, by its very nature, will provide usable communications in conditions that traditional analog voice will fail.

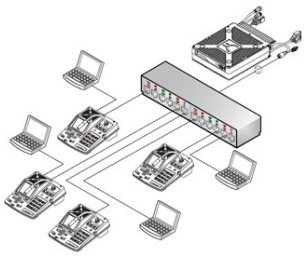
Dual Antenna Capable



Many commercial HF radios have only a single antenna connection. This limits the radio to using only one antenna without adding an external antenna switch that the user has to know when and how to switch between antennas. In an ALE network where a station needs to use two antennas to support the required station coverage, a single antenna connection and an external switch will not work. With dual antenna connections, two different (long and short range, for example) antennas may be connected and programmed to the proper channel. This allows for automatic connection to the proper antenna without user intervention or knowledge. This allows for programming of channels to a specific antenna for best coverage which supports optimized coverage through selection of the antenna with the best voice quality.

Multiple Control Points

Many contingency HF radio systems need to have multiple locations (control points or CP) from which their radio(s) may be operated. These locations may include EOCs, dispatch centers, system manager's office and remote support personnel/contractors. Instead of purchasing a radio for each location, LRDR systems support as many as four (4) simultaneous control points to operate a single RF unit (RFU). These control points can be connected to the RFU in various ways depending on the vendor. Control points can be connected directly with proprietary cables, using IP (Internet Protocol which is commonly used for data transfer) through LAN/WAN on either wireless or Ethernet cabling and through the network. Again, depending on the vendor, control point hardware options can include full control capability with desktop units, control heads, handheld units and virtual control points using PC software.



In addition, some vendors offer limited control features using an IOS or Android smartphone application. Depending on the vendor, individual control points attached to a single radio can have a unique Self Address (ID) supporting ALE calls. A call can be made to a single CP and each CP can monitor the other if required. These features can be enabled or disabled by the user or system manager. Multiple control points provide extreme flexibility to support a multitude of different operational and maintenance configurations.

Text Messaging, Email-Like Services and File Transfer

LRDR can support various digital data modes when equipped with an optional internal or external modem. These features include text messaging (like SMS messaging done with cell phones), email-like services and file transfer. Most also support a very limited 90 character text messaging feature (AMD) that displays on the receiving radio's display and does not require a data modem. Email-like services can be restricted to just the radio network or interconnected to an internal or external (Internet) email system allowing for email interoperability with non-radio system-based email addresses.

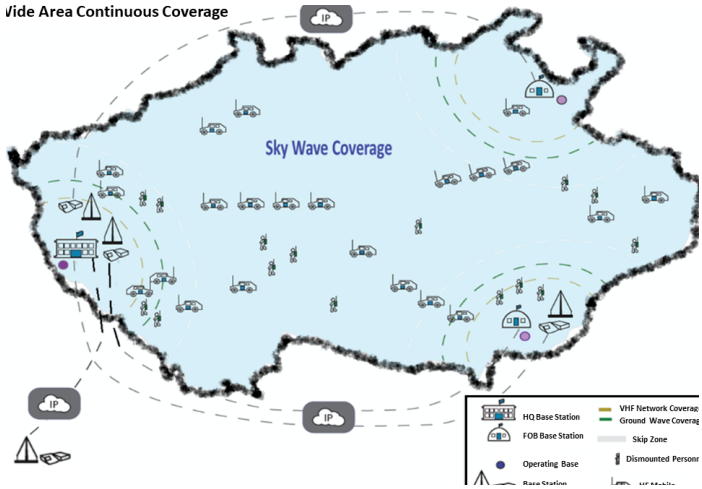
File transfer, although at a very slow (1200 baud or so) rate, can support the transfer of pictures, complex documents and even software patches and radio programming profiles. With ALE link automation, and the addition of automatic data validation using a data modem, even large files, that may take a considerable amount of time to transmit, can be sent across the network. Radio systems used to manage data transfers are particularly important in critical infrastructure systems, and they also serve the use cases for EMCOMM, life, health, and safety, Search and Rescue, etc.

High Security Features Including Encryption

Contingency radio systems often are used to transmit sensitive information. Hospitals need to exchange HIPPA protected data. Government stations exchange critical sensitive operation and security data. Cyber security response teams exchange sensitive operational data as they work to overcome advisories and restore data networks and computer systems. Modern commercial HF radio systems offer commercial grade encryption and are capable of using add-on equipment (internal and external) to achieve military grade encryption. LRDR operators are not prevented from transmiting encrypted messages supporting the transmission of sensitive information.

Wide Area Continuous Coverage

Leveraging the capabilities of LRDR features, a network with wide area continuous coverage can be deployed that is independent of terrain, has no gaps in coverage nor dependence on any line of sight (LOS) radio frequency links .



Carefully sited LRDR base stations are located to provide continuous coverage over the desired area of operations. These stations are linked together via IP using the Internet, a proprietary IP network or a hybrid combination. Then using advanced ALE features such as best in call and first in call, when a mobile or base radio in the area of operations initiates a call to “base”, the network will automatically select the best network base station and then route the call to the desired station. This all occurs automatically in the background and the user only has to select the desired station to contact.

With these features, it is easy to deploy reliable voice and data coverage over large areas of any terrain without the need to place large numbers of LMR repeater and remote base radio systems, complex computer controlled voting systems and RF links to providing similar coverage with LMR systems.

Automatic Remote System Management

Under the covers, an LRDR system is complex in order to provide a highly functional and user friendly system to its users. In order for a LRDR system to remain in top condition and, for systems intended for contingency operations, ready of immediate operation in degraded environments, it must be well maintained. Since most of the time these systems are in “Blue Sky” conditions, a technology dependent solution can be used to manage the network.

Automatic remote system management can provide comprehensive system management activities without the need for a physical staff activities. This cloud based hosted service can: perform sub-daily (configurable) connection tests between selected stations and daily power and SWR checks. Remote management can also include firmware and profile update services. Comprehensive reporting and SMS/email alerting provides system managers with detailed daily reports of system health and capability. It can also allow for third-party support taking this burden off of the system owner.

In Summary

By electing to acquire and deploy a LRDR system using modern HF radios with their advanced features, you will have a highly user friendly, resilient and dependable radio system that can support day-to-day operations as well as meet contingency communications requirements. Work with your value added system integrator to leverage these capabilities and build a system that will exceed your needs.

About NVIS Communications, LLC

NVIS Communications is a Systems Integrator and the Exclusive Partner/Distributor for Codan HF equipment in the US, Mexico and The Caribbean. NVIS works with Critical Infrastructure, i.e. Electricity, Gas, Oil, Water, Telecommunications and Cable TV Broadcasting, as well as Public Safety at the Federal, State, and Local Levels to help them design and implement resilient communications systems built on a HF-ALE core. NVIS also works closely with the Department of Homeland Security’s SHARES program to further critical infrastructure entity participation in SHARES.

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