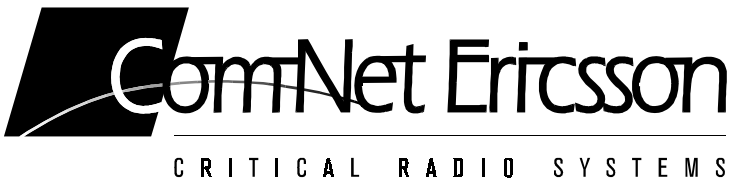
EDACS Explained



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1 EDACS Introduction

A Total Communications Solution

EDACS® is a complex, yet incredibly flexible, communications system designed to provide secure, reliable two-way radio communications for public safety, utility, government, military, and business and industrial organizations. With more than 450 systems in place worldwide, our technology and products are field-proven by the toughest customers in the industry.

Our success is due, in part, to the combined years of experience in two-way radio, public safety, and communications, of our associates. Many of our employees have worked in our various markets before joining us and bring an intimate knowledge of the customers' needs and desires that has proven to be invaluable.

We think you'll find their experience invaluable, as well, as you work with our associates to design and implement a communications system that meets the specific needs of your organization.

When considering a new two-way radio system, there are many objectives and options to measure. The best communications solutions employ a combination of technologies:

- A voice and data communications system that provides efficient, coordinated working conditions for people not normally at their desks.
- A telephony switch that allows users to make and receive telephone calls via fixed handsets or cordless telephones.
- Local area networks (LANs) and high-speed data-communications equipment that gives users access to central databases, e-mail and video services.
- A transmission backbone that ties all the services together into one network.

When designing a new communications infrastructure, or expanding an existing one, it pays to consider the total communications picture. Ideally, the system you choose should fulfill your immediate requirements and be capable of adapting to your needs for many years to come.

While this sounds fairly simple, implementing a new communications system is a complex process that requires experience and technological expertise to meet the specifications above. With our total focus on land mobile radio and more than 45 years in the industry, Com-Net Ericsson can ensure compatibility between the different systems, and provide fully integrated system design.

This document is a detailed overview of the main features, functions and configuration options of EDACS®, our state-of-the-art two-way communications system.

1.1 What is EDACS?

EDACS is a radio communications system that provides fault-tolerant, high-speed, wireless analog voice, digital voice and data communications. A group-oriented communications system allows groups of users to communicate with each other as if they were standing in the same room. The main advantages of this approach are improved coordination, efficient exchange of important information, and improved user safety. As it seamlessly integrates data, emergency calls, fault tolerance, and encrypted digital voice, EDACS represents the most sophisticated radio communications system in its class.

1.2 Summary of EDACS' Main Features and Benefits

The ultimate goal of any communications system is to allow members of an organization to work more efficiently by allowing them to exchange information with each other over long distances. In this way, communications allow an organization's operations to be carried out with greater speed and precision.

EDACS improves productivity and safety by providing voice and data communications in both point-to-point and point-to-multi-point (group) modes, with the following main features:

a) Group-oriented communications with special handling of emergency calls – Personnel can stay in touch with their colleagues at all times and emergency calls get through as quickly as possible. Communications are more efficient and safety is improved as there is always a reliable communication path to a point from which help can be obtained.

b) *Integrated voice and high-speed data (9.6kbit/s)* - Field personnel can obtain and save data in a central database. Mobile data facilities, in effect, bring the office out into the field, thereby improving effectiveness.

c) *Trunked fast access (less than 0.5 seconds)* – Ensures that personnel can get in touch with each other with the minimum of delay. It also improves radio channel efficiency, because fewer radio frequencies are needed to support the same number of users.

d) Wide-area capability – EDACS can provide economical coverage for everything from a small factory to a whole region or country.

e) High fault tolerance – Distributed processing and non-stop control channel operation ensure that EDACS systems keep on working, even if part of it is disabled, during a storm, for instance.

f) Modularity and expandability – EDACS' modular design makes it easy to increase radio coverage and add extra functions at a later date. A simple single site EDACS system can be expanded over time to a countrywide, multi-agency network. Backward and forward compatibility is maintained with all such developments in EDACS, so that each new EDACS system can interwork with previous and future generations. This flexibility protects valuable investment and helps meet long-term communication needs.

EDACS allows several user groups to share a common infrastructure, making it ideally suited to multi-agency operation, and

bringing significant operational and cost benefits. The system is under constant development, with technology enhancements and new features added regularly.

1.3 EDACS Configurations

EDACS has five configuration options, which can each be expanded to meet changing requirements for coverage or functionality at any time:

- Single Site
- Voted
- Simulcast
- Single Channel
- Multi-site

Single site EDACS systems are used to cover small geographical areas, such as a small to medium-sized town. The system comprises a single base station site with 3 to 24 channels and associated antenna system.

Voted EDACS systems allow several receiver sites to be used in conjunction with the transmitter site to improve signal reception from portable radios.

Simulcast EDACS systems use the simultaneous transmission and reception of identical audio and data information over two or more base stations with the same RF carrier frequency. Simulcast is used in situations where the number of frequencies available is limited, but the coverage area is too large for a single site, or where there is a need for consistent RF coverage in built-up areas.

Single Channel EDACS systems are primarily used in conjunction with single site, voted or simulcast systems to provide coverage in specific areas not covered by the main system (remote areas) and where there is a shortage of frequencies.

Multi-site EDACS systems can be created by adding a radio switch, called an Integrated Multi-site and Console Controller (IMC™), between two or more single site, voted, simulcast or single channel

systems. The IMC monitors activity at each of the connected sites and passes calls from one site to another. It is able to control traffic between sites in an intelligent way so that each site only assigns a working channel to a call when it has users who need to be involved. The IMC does this by keeping track of the users and their selected groups in the system. Several multi-site systems can be connected together to form an extended network. This capability makes EDACS an ideal communications solution for large geographical areas, such as a region, state or an entire country.

1.4 Fault-Tolerant Architecture

EDACS employs a distributed, fault-tolerant architecture, which ensures continued operation even after a component level or equipment level failure. The system features multiple, autonomous layers of control. Each monitors the other's performance and, if one fails, the others recognize the failure and provide alternate modes of operation.

EDACS avoids the expense of duplicated equipment by utilizing intelligent repeaters, each with distributed processing power. Should one repeater fail, the other repeater controllers automatically take over the functions of the failed unit.

Should the links between the radio system and the switch fail in a multi-site system, the system can continue to operate in trunking mode autonomously. All local functions are maintained at the radio site.

1.5 Modular Design

As a result of EDACS' modularity, any configuration can be upgraded to any other higher level, or tier, simply by adding modules. Therefore, equipment obsolescence is minimized and investments are protected. EDACS is a modular system in both hardware and software. EDACS systems may be connected together using an IMC (Integrated Multi-site Controller) to form multi-site systems covering large geographical areas. Linking multi-site systems together using a StarGate™ controller forms extended networks. Additional radio systems, radio system options, and radio switch options can be added at any time without forcing a total system rebuild.

The following shows how functionality in EDACS is layered, and how it is possible to add extra function blocks incrementally.

2 EDACS as a Standard System

2.1 Introduction

The Standard EDACS function block represents an EDACS system in its most basic form. EDACS systems typically consist of a single site with 3 to 24 trunked base stations connected to an antenna system. While simple in concept, single site systems still support the following array of functions:

- Trunking
- Continuously-available control channel
- Fast channel access with transmission trunking
- 24-channel capacity
- Group calls
- Flexible group hierarchy
- Emergency calls
- Individual calls
- Analog voice
- Digital voice
- Telephone interconnect support
- Digital data
- Status/message
- Fault tolerance

- Priority group scan
- Late entry
- Unit ID display
- Call queuing
- Transmitter busy lockout
- Transmit prompt tone

2.2 Trunking

Trunking is one of the basic functions of EDACS. EDACS was one of the first private mobile radio (PMR) systems to employ digital trunking techniques to overcome the lack of channel availability.

What Is Trunking?

A trunked radio system gets its name from the trunk line used in commercial telephone communications. Put simply, a trunk is a communications path between two or more points, typically between the telephone exchange and one or more users.

The telephone trunk is time-shared by several different users, but each user is unaware of this sharing of lines. The user places a call to another party, and the call is completed – the telephone system operations are transparent to the users.

A trunked radio system works in a similar way. The transmitting and receiving radio units may be thought of as the calling and receiving parties, and EDACS may be thought of as the telephone network.

Instead of telephone lines, EDACS uses radio channels to place calls. As with the telephone system, the radio users are not aware of which trunk or radio channel they are using. All that is apparent is that a communication path has been established between the radios.

Computer Control

In EDACS the multi-channel radio trunking system is controlled using powerful computers. This ensures highly efficient use of available radio spectrum and virtually eliminates the delay traditionally experienced by field units when trying to get a clear radio channel.

In traditional, large-scale PMR systems, the channels assigned to a talk group are independent of each other. Each user's mobile is set to operate on a single channel, and if this channel is occupied by another conversation, the user has to wait until it becomes free to talk, even if an adjacent channel is unoccupied. At best, this is irritating for the user, who may have to try many times to get a free channel. In an emergency, it could mean the difference between life and death.

The computer-controlled, digital trunking technique used by EDACS provides a solution to this problem by enabling many radios to share the same radio channels. Whenever the push-to-talk (PTT) button is pressed, the system finds a free radio channel and assigns it to the call. A new radio channel is assigned for each press of the PTT button, even during the same conversation.

If all EDACS channels are in use, the call is automatically queued until a new channel becomes free. Free channels are assigned to the queued calls on a first-in, first-out basis, unless there are overriding priorities assigned to the user or the group.

From the user's viewpoint, digital trunking ensures that a communication channel is available almost as soon as the PTT button is pressed. Even with the search for a free channel, calculation of priority level, and access authorization, call set-up takes less than 0.25 seconds at a single site and less than 0.5 seconds for a multi-site call. High-priority users will always receive the first available channel.

From the network perspective, trunking makes highly efficient use of the available radio spectrum.

2.3 Continuously-Available Control Channel

Two types of radio channel designations are used in EDACS: **Control** and **working** (traffic) channels. At any given time, each site has one control channel. The remaining channels are used as working channels.

The control channel is used to send digital information between radios and the computer equipment controlling the operation of the system.

Working channels are used to send the actual voice or data messages between radios, and between radios and the dispatch center.

Having a continuously available control channel ensures that call requests can always be accepted and that functions such as call queuing, emergency calls, and call prioritization are always available. Even if all voice channels are temporarily busy, dispatching personnel will be notified immediately of an emergency and who declared it through the digital signature on the control channel.

A simplified exchange between the radio unit and the site equipment might proceed as follows:

1. The radio continuously monitors the control channel, waiting for instructions.
2. To place a call, the user presses the PTT button on his radio.
3. The radio sends a digital message over the control channel to the site equipment, requesting a channel to communicate.
4. The site equipment selects an available working channel, and sends a return digital message containing the ID of the selected working channel over the control channel.
5. Both the calling and called radios receive the working channel assignment and set their transmit and receive frequencies to the new channel.
6. The calling radio exchanges a short digital handshake with the site equipment over the working channel.
7. The radio audibly signals the user that a channel has been assigned to let him know he can start talking.
8. The calling user keeps the PTT button pressed and transmits his message to the listening radios. When the calling user releases the PTT, the radios return to the control channel.

This function is implemented by having a number of base stations (3 to 24) located at the same radio site, each equipped with its own trunking controller which can be assigned either to control channel or

working channel processing. All trunking controllers are tied together by a high-speed data link, which forms a parallel processing system.

2.4 Fast channel access and transmission trunking

Due to EDACS' high-speed (9.6kbit/s) digital signaling, the whole call set-up process described above takes place very rapidly. Channel access time is less than 0.25 seconds, while channel drop time is 0.16 seconds.

These fast channel access and drop times provide the foundation for many of EDACS' advanced features. They also allow transmission trunking, which is more efficient than traditional message trunking. In operation, transmission trunked EDACS systems have been shown to be 20-25 percent more efficient than older message-trunked systems.

In *transmission trunking*, the process of assigning channels is repeated for every press of the PTT button. Subsequent transmissions are assigned to any of the available working channels, completely transparent to the user. This provides increased capacity, fewer queued calls and greater safety for users. It also allows bursts of traffic, such as data, to be transmitted over the system.

Transmission trunking is only made possible by the very fast channel access time offered by EDACS. It maximizes the efficiency with which radio channels are used, by making use of the pauses between speech to assign the channel to other calls, and consequently more calls can be supported, with less queuing. For this reason, Com-Net Ericsson encourages the use of transmission trunking for day-to-day communications.

Message trunking assigns a radio channel for the whole duration of the conversation. This conversation may extend for several transmissions (PTTs) by parties in the group. This makes message trunking ideal for critical situations, such as emergency calls, where an absolute guarantee of channel availability is required. Because most other calls are transmission trunked, emergency calls never have to wait very long for a radio channel to become free. However,

message trunking has a drawback. It keeps a radio channel tied up for longer periods of time, since it is held up even during the empty periods between PTTs. Therefore, message trunking should only be used when required.

In EDACS preferred mode of operation, group calls are transmission trunked, while emergency calls are message trunked. Message trunking parameters may only be adjusted and set for individuals and groups when the Enhanced Features function block is used. Most other trunking systems make all calls message trunked, thereby tying up valuable channel resources.

2.5 24-Channel Capacity

Each EDACS radio base station site can support up to 24 radio channels, enough for thousands of users. Multiple base station sites can be linked together using a radio switch to achieve higher density or wide-area coverage.

2.6 Group Calls

Group calls are the standard calls made on a trunked radio system. Groups are the trunked equivalent of conventional channels.

The key advantages of group calls are:

- Greater coordination of operations by allowing personnel to communicate with each other instantaneously.
- Improved safety through fast, simple operation.
- There is no need for personnel to remember numbers or codes to reach an individual user. A user can call another group without having to know who is currently in that group.

Groups are normally collections of users who need to communicate with each other regularly. For example, within a single citywide system, the North and South fire services could each have their own group, and the police force could be subdivided into several operating area groups.

A user only needs to press the PTT button on his radio and speak to place a group call. All users who have selected that talk group on their radios will hear the communications in that group. Many EDACS users have found that over 95 percent of their calls are group calls.

The dispatcher can also place group calls from any dispatch position. The dispatcher places the group call and will have the same response as a radio user who places a group call. A dispatcher using a C3 Maestro dispatch terminal is able to pre-empt an ongoing group call among field radios.

2.7 Flexible Group Hierarchy

Groups are split into a hierarchical structure, comprising the system, agencies, fleets, and subfleets. This structure permits flexible partitioning of users who may be split geographically and organizationally. In this way several user groups can co-exist on the same system, without unnecessary interference.

This makes EDACS particularly suitable for shared networks, where several organizations share the same radio infrastructure. For example, a community-wide system has been divided into a small number of agencies, such as police and fire services. These agencies can be split further into fleets, such as police districts 1 and 2, or North and South fire stations. Each police district can be further broken down into subfleets, such as detectives, traffic, patrols, etc.

All subordinate subfleets will hear a fleet call, and all subordinate fleets and subfleets will hear an agency call. This allows authorized users to make general announcements to certain user groups. In competing systems lacking a fleet structure, there is no convenient way to communicate with multiple groups simultaneously.

The agency/fleet/subfleet structure also can help in restricting information database access. Each department can only restrict access to their databases to their own system administrators.

In conjunction with the Group Scan function, this hierarchy allows unique inter-fleet or inter-agency communication patterns to be

established, to help ensure that the right people get the desired information as quickly as possible.

In the standard configuration, EDACS radios can be grouped together into more than 2,000 groups.

2.8 Call Queuing

When all channels are busy, a new call request is placed in a prioritized first-in, first-out call queue. The caller and all members of his talk group are notified – with a tone and a display window indication – that the call request has been queued. When a channel becomes free, the caller is alerted and may speak. Emergency calls always move ahead of other calls in the queue.

2.9 Emergency Calls

In a threatening situation, the emergency call function provides field units with instant access to colleagues and the dispatcher. Even on heavily loaded systems, emergency calls are handled quickly and efficiently.

An emergency call is initiated when a user presses the emergency button on the radio unit. The user is immediately assigned the highest call priority and is given a clear channel as soon as possible (in the rare event that one is not immediately available). Also, the radio will transmit voice for a period of two seconds after the emergency button has been pressed to allow the caller to speak without pressing the PTT button. Emergency calls on basic EDACS systems are message trunked, as channel efficiency is not the main concern.

Because the signaling takes place on the control channel, the dispatcher and all other radios in the talk group are notified of the emergency even before a voice channel is available. The emergency declaration and the unit declaring it are displayed at the dispatch control. The ID of the radio declaring the emergency channel is shown on the displays of the radios in the talk group, on the Communications Systems Director (CSD) terminal, on the dispatch console, and on supervisory control stations. In addition, an audible warning alarm is sounded. The emergency call may be placed on a

designated emergency group or on the currently selected group. Since the members of a person's work group are often best situated to respond to an emergency, the fact that all the radios in the work group see and hear the emergency is an advantage of EDACS. In some competing systems, only certain designated consoles see an emergency declaration.

2.10 Individual Calls

In EDACS, each radio has a unique ID number. This makes it possible to address any individual radio from the dispatch center or from another radio unit that has authority to do so.

Individual calls allow a one-to-one conversation, which is not overheard by anyone else on the system. Specific individual calls may be preprogrammed into a radio.

In the standard configuration, EDACS allows over 16,000 individual users to be defined in the system. However, systems with 40,000+ users have also been successfully implemented.

The mobile radio receiving an individual call will sound an audible ringing tone to alert its user that it’s receiving an individual call. The ID number of the calling radio will be displayed and saved. If the PTT button is pressed within a predetermined time, the called radio automatically contacts the originating radio. This logical hang-timer provides smooth communications, without the inefficiency and other problems associated with older, physical hang-timers.

2.11 Analog Voice

Analog, or clear, voice calls are normal, analog FM communications. This is the most common form of voice radio communication. Speech picked up by the radio’s microphone modulates the transmission frequency and is transmitted over a 25kHz or 12.5kHz wide channel. In EDACS, communications over the control channel, however, are still digital.

2.12 Aegis™ Digital Voice

Encrypted Aegis digital voice provides a totally secure communications system even against the most sophisticated eavesdroppers.

In EDACS Aegis digital voice communications, analog voice is converted into digital signals prior to transmission, using digital vocoder technology.

Aegis digital voice is transmitted using GFSK digital modulation over working channels at 9.6kbit/s, which is the same transmission rate as that of the control channel. This uniform design provides every EDACS radio base station with the inherent capability for supporting Aegis, as well as clear voice and data.

Aegis provides an additional level of security because ordinary scanners cannot decode it. It also offers a uniform digital communications solution. In multi-site systems, the digital signal is maintained throughout the transmission route and decoding is only performed in the radio units or at the dispatch center. This end-to-end digital transmission design makes EDACS ideally suited to digital voice encryption.

2.13 Telephone Interconnect Support (PBX Gateway)

The telephone interconnect feature of EDACS allows authorized users to make and receive calls to and from an external (public or private) telephone network directly from/to their radio units without dispatcher assistance. External telephone network users can make calls to a talk group or an individual. Telephone interconnect calls can be processed and routed to the PSTN or a PBX. Telephone interconnect can be provided in a basic EDACS system by connecting it to an IMC/CEC with a PBX Gateway.

2.14 Digital Data

In addition to analog and Aegis digital voice communications, EDACS can also carry data. All EDACS radio base stations have an inherent data capability.

EDACS is the only system of its kind that can fully integrate data transmissions with other forms of communications in this way. The process is known as voice/data trunking (VDT).

This flexibility avoids the traditional trade-offs required when operating with voice-only and data-only channels and improves the system's efficiency by preventing wasted channels. Like all other digital signaling in EDACS, data is transmitted at 9.6kbit/s, which makes EDACS a fast and efficient data communications platform.

Another key advantage is that a single radio can be used for both voice and data. Combined voice/data radios reduce network set-up, expansion, and replacement costs. Custom data applications are easy to implement, using a standard Application Programmer's Interface (API).

Adaptive Voice/Data Load Balancing

EDACS provides an efficient, fault-tolerant communications system that adaptively balances voice and data loading to meet changing needs. Voice and data calls are fully integrated into one radio system. Data calls are trunked in exactly the same way as voice calls.

This adaptive load balancing results from the fact that working channels are assigned to voice or data calls as requests are received.

Another advantage is increased fault tolerance. Because EDACS supports both voice and data on all of its channels, voice or data capability is never completely lost as long as there is at least one working channel still operating.

Because all radio channels in EDACS are capable of carrying voice and data, the system automatically adapts to the current balance of voice and data traffic.

Adding data capability is easy. Mobile data terminals (PCs) are simply connected to the built-in radio data interface (RDI) of the existing radios, and a host computer is added (if not already present) to run the application software. Data hosts may be connected to the system via an RF path for single-site applications, or via a Data Gateway connected to the radio switch for multiple sites.

Almost any intelligent data device with an RS-232 port can be connected to an EDACS radio. These might include mobile data terminals, GPS equipment used in AVL systems, or laptop computers. Com-Net Ericsson offers a PC-compatible API library for developing tailor-made data transmission applications, as well as providing ready-made solutions. There are several third-party suppliers of EDACS-compatible data applications. Some EDACS customers have also developed their own applications. On the host end, the EDACS Data Gateway (EDG™) connects the EDACS system to a LAN or individual PC using standard TCP-IP (Internet) protocols.

2.15 Status/Message

The EDACS status and message facility allows a radio user to alert a dispatcher or supervisor to his current operational status (for example, “En route” or “At scene”). Pressing a single key on the radio activates these pre-programmed messages. It also allows the user to send the dispatcher a short response message such as “understood” or “repeat message”.

This provides a highly efficient method of exchanging short, frequently used communications. Unlike voice communications, no working channel is required. The message information is carried as short digital data on the inbound control channel. This means that status messaging does not tie-up any of the voice or data channels. The message is then displayed on customized status/message modules at the dispatch console.

2.16 Fault Tolerance

Since EDACS systems are implemented using several trunked base stations, and because each base station may assume the role of the control channel, the systems are highly resilient to system failure. If a working channel fails, the control channel will detect the failure and stop assigning new calls to that base station. If the control channel fails, one of the remaining working channels will detect the failure and assign itself as a control channel. This process will continue until only one channel is left, at which time the system will revert to conventional, non-trunked operation. Some other trunking systems only allow four channels to be set as the control channel. The result could be an inability to communicate over the remaining channels.

2.17 Priority Group Scan

Priority group scan allows radios to monitor a number of groups, helping ensure that no important calls are missed.

Authorized radio units are directed into a group call if it is listed in the user's scan list. If the radio is equipped with encryption or digital voice, it will also scan into encrypted or digital voice groups.

Responding to scanned group calls is simply a matter of pressing the PTT button after the call has been received. The radio contains a logical 'hang' timer that allows it to remember which group it has just received. Also, groups can be given multiple scan priorities to help ensure the most important information takes precedence. Certain scan groups may be given a higher priority than the currently selected group, so radios can be set to always listen to the most critical conversation.

2.18 Late Entry

A user can late-enter a group call already in progress with this feature, even if his radio missed the original channel assignment. This is especially useful when the radio unit has just been switched

on, has just passed through a coverage null, or has just changed talk groups.

This function is made possible through the assignment updates continually transmitted over the control and working channels in EDACS. It works in both analog and digital voice modes. Most other trunking systems do not transmit updates on the working channels; therefore, while listening to one call, you may miss another of higher priority. EDACS will inform you of this, and your radio will switch to the more important call.

2.19 Unit ID Display

With this facility, the individual ID of the caller's radio unit is automatically displayed on the receivers' radios each time the caller makes a group, emergency, or individual call.

Radios with alphanumeric displays can be programmed to show a name or alias rather than a numeric ID.

This feature saves valuable time when personnel request assistance in an emergency, for example. Note that this ID is displayed for every transmission, regardless of communication mode (analog, digital, or encrypted voice). Also, the calling extension number can be shown when telephone interconnect calls are received.

2.20 Transmitter-Busy Lockout

For transmission trunked calls, when the originating unit's PTT is pressed, all receiving units are prohibited from stepping on the originating unit. If a receiving unit's PTT button is pressed, the transmitter is locked out, the radio sounds a warning tone and continues to monitor the call without interruption.

Transmitter-busy lockout does not interfere with the emergency call function. If a receiving unit needs to declare an emergency during a transmitter-busy lockout, the user needs only to press the emergency button. This causes an emergency signal to be transmitted over the control channel. The system will assign a new working channel and

all other units in the talk group in receive mode are updated to the new channel assignment for the emergency call. The radio belonging to the talk group that was transmitting will late-enter into the emergency call as soon as its PTT button is released.

2.21 Transmit Prompt Tone

A PC-programmable prompt tone alerts the radio user when he has been assigned a channel and is able to communicate, providing positive feedback to the user to help a conversation run smoothly.

3 EDACS as a Voted System

The Voted EDACS function block allows several receiver sites to be used in conjunction with the transmitter site to improve weak signal reception from portable radios. The system picks up signals at all receiver sites and automatically selects the signal with the best audio quality.

Voted EDACS systems contain all the functions of basic systems, with the addition of:

- Improved reception of weak signals.
- Fast 430ms access time for voted calls.
- Fault tolerance.

The Voted EDACS function block is seldom employed alone. It is usually used in conjunction with the Enhanced Trunking function block. Voted systems are implemented by using 3 to 24 base stations, which serve as the main, or transmitter, sites in conjunction with several receiver sites, which are spread around the transmitter sites. Each receiver site contains one receiver per base station channel and the Voter ties all receivers together.

The unique design of the EDACS system allows the Voter to select the best analog signal on the basis of signal quality, while selecting the best digital voice, data, and control channel signal on the basis of bit error rates. So the best signal is always selected, regardless of

communication mode. All Voted EDACS systems support both digital and analog communications.

Fault tolerance on Voted EDACS systems is improved over basic systems, by virtue of the increased number of receiver sites. This increases the likelihood that a call will succeed from anywhere in the coverage area, even in the event of a failure in one of the receiver sites.

4 EDACS as a Simulcast System

4.1 Introduction

The Simulcast EDACS function block enables the simultaneous transmission and reception of identical audio and data information over two or more base stations with the same RF carrier frequency. It contains all the functions found in the Voted EDACS function block, with the addition of:

- Improved signal strength from the system.
- Enlarged coverage area.
- Simulcast alarm capability.
- ProSync and Tri-Synchronization.
- Simulcast fault-tolerance.

Simulcast involves the simultaneous transmission and reception of identical audio and data information from two or more base station sites with the same radio frequency to improve signal strength and increase coverage.

4.2 Improved Signal Strength

Simulcast is implemented using several base station sites and receiver sites connected together through a voter and a signal distribution and synchronization system (Control Point).

The base station sites radiate synchronized signals on the same RF frequency. Up to 24 channels can be simulcast in parallel from several different base station sites. The signal is distributed using a high-stability path, such as microwave or fiber-optic transmission

links, from the Control Point to the transmitter sites. The simulcast function block is normally combined with the Enhanced Trunking function block.

4.3 Enlarged Coverage Area

Simulcast is most often employed where there is a limited number of frequencies available, where the coverage area is large, and where there is a need for high RF signal strength in built-up areas. By providing coverage in areas not covered by a single site, simulcast provides a cost-effective enlargement of the total coverage area.

4.4 Simulcast Alarm

A special alarm system is integrated into Simulcast EDACS systems. It provides status and fault information for every transmitter site in the system to monitor the system from a single point.

4.5 ProSync and Tri-Synchronization

If the signals from the different transmitter sites arrive out of phase or with the wrong timing, the resulting audio will be distorted or unintelligible. To ensure this does not occur, the Simulcast function block contains advanced, automatic synchronization methods such as ProSync and Tri-Synchronization. ProSync automatically synchronizes the high-speed digital control channel and digital voice signals, and Tri-Synchronization synchronizes digital and analog signals.

4.6 Simulcast Fault Tolerance

The Simulcast EDACS function block has the same basic fault tolerance as the basic or voted function blocks, but contains additional failure modes for the Simulcast portion of the system. If a communications link to one or more sites fails, these sites may be converted to by-pass operation, where the affected sites continue to operate in trunking mode by themselves on a subset of the total

channels available. Further, the possibility of communications link failure can be avoided by having the communications link (fiber or microwave) configured in a loop. If the link fails at one point, the signal will travel in the other direction of the loop. The system automatically adjusts for the timing differences that may occur.

5 Enhanced & Premium Trunking

5.1 Introduction

The Enhanced and Premium Trunking function blocks add advanced trunking features and alarm and traffic management functions to basic, voted or simulcast EDACS systems. Enhanced trunking EDACS systems contain a powerful Site Controller computer or a Site Interface Module (SIM) located with the trunked base stations.

Although it can be pre-programmed, the Site Controller computer normally receives configuration information from the Communications System Director (CSD), a powerful system management PC. It is, therefore, most common for both systems to be deployed together.

5.2 Site Controller

The Site Controller computer contains the additional processing power necessary to implement advanced, real-time communications functions. The additional premium functions provided by the Site Controller are:

- Eight priority levels.
- Call validation.
- Recent user priority.
- Programmable message and transmission trunking.
- High-speed link to CSD Management computer.
- Support for Dynamic Regrouping.
- Support for Multiple-Channel Partition.

5.3 Eight Priority Levels

In enhanced trunking EDACS, the usual two priority levels (regular and emergency) can be increased to eight. Emergency is still the highest priority call, but individual users and groups can be given different priority levels. The ranking of importance for a call typically depends upon the caller's level of responsibility, the nature of the activity, and the urgency of the information being transmitted.

During busy periods, EDACS queues calls. The queue is continually sorted by priority: Higher priority calls are moved ahead of others and assigned to working channels sooner. If two calls of equal priority are received, they are treated on a first-come, first-served basis. Through the CSD, priorities may be set for each user, group and communication mode (analog voice, digital voice, data, and telephone interconnect).

5.4 Test & Alarm Unit, Power Monitor Unit

The Test & Alarm Unit (Site Sentry Alarm & Control System) is an actual EDACS radio that automatically makes test calls on different radio channels to verify correct transmission and signaling. This is an ideal way to check the system, as the total transmission path from radio to the system is checked.

The Site Surecall System monitors the power output of the base stations and reports any problem back to the CSD.

The Site Sentry contains additional relay inputs and outputs which allow the Site Controller to accept inputs from external sources such as door/intrusion or smoke alarms.

5.5 Call Validation

Call Validation ensures that only permitted radios can access the system. By comparing the ID number of the transmitting radio with the unit database, only callers who have been defined as valid users are allowed to make a call.

5.6 Recent User Priority

The Recent User Priority function ensures that users already involved in a conversation are assigned a working channel before those who are just starting a conversation, provided their priority levels are the same. This helps conversations flow more smoothly on heavily loaded systems.

6 System Management - Communications System Director

6.1 Introduction

The Communications System Director (CSD) is a Windows NT based PC used for system databasing and control of an EDACS system. The CSD function block adds a user interface to one or more Site Controllers, IMCs/CECs and other equipment, to which it is connected using high-speed data links. The CSD provides a multi-user computer platform for managing communication parameters, executing special commands, and receiving activity and alarm communications.

The additional functions provided by the CSD are:

- Graphical User Interface (GUI).
- Multiple user access to shared database.
- Group definition database.
- Unit definition database.
- Site Monitor.
- Multi-site systems support.
- Database back up.
- Alarm notification.

6.2 User Interface

The CSD serves as a user interface that allows the users to create or make changes to the system database, view alarms and generate reports. The CSD employs easy-to-use, menu-driven software that runs on a powerful Pentium processor and industry-standard Windows NT operating system.

6.3 Multiple User Access to Shared Database

Several management terminals may share the same database. Further, user access may be restricted to certain functions or user groups. This means that multiple system administrators, serving different departments, for example, may use the same shared resource without interfering with each other. The CSD employs powerful client-server architecture to increase efficiency and allow sharing of databases.

6.4 Group Definition Database

The Group Definition Database contains definition texts, priority levels, transmission/message trunking, and miscellaneous traffic control parameters for every **group** in the EDACS system.

6.5 User Definition Database

The User Definition Database contains definition texts (name and organization), priority levels, transmission/message trunking, and miscellaneous traffic control parameters for every **user** in the EDACS system.

6.6 Site Monitor

The Site Monitor allows the dispatcher to monitor in real time that channels are busy and who is using them. It also allows the system administrator to see status information of the EDACS equipment, such as alarms.

6.7 Multi-Site Systems Support

The CSD enables the System Administrator to control multiple EDACS systems and perform statistical reporting on multiple systems from a central point.

Multi-site communication is achieved by adding a switch, called an Integrated Multisite and Console Controller (IMC™), between two or more basic, voted, simulcast or single channel systems. The CSD also updates the databases for the IMC.

6.8 Features of CSD

Extra software functions added to the enhanced trunking EDACS systems by the CSD include:

- Unit Enable/Disable allows the system administrator, from the CSD, to switch off any radio unit in the system and make it inoperative. This function is useful when any unit is lost or stolen. In addition, it is possible to reactivate the radio unit from the CSD should a lost unit be found again.

- Printed Activity, Alarm and System Statistics Reports allow the system administrator to analyze traffic patterns, perform event reconstruction and trouble-shoot so that the performance of the system can be fine-tuned and maintained.

- Archive of historical activity records.

- Detailed control of alarm inputs and auxiliary outputs on the Site Controller.

- Dynamic Regrouping allows field radios to be reconfigured into new groups. Radios can be programmed over the air from the CSD terminal.

  Also, special events may require that additional, short-term communications groups be set up to handle heavy road traffic. In threatening situations, such as a kidnapping, certain radios can be regrouped to deal with the emergency without affecting other radios in existing talk groups. The dynamic regrouping function can also be used to try out new communications groups, without having to reprogram all radios manually.

In addition to dynamic regrouping, it is common to patch groups or use mutual aid/tactical groups to achieve inter-agency communication, as these groups can be accessed by a user or the dispatcher directly and monitored using priority/ordinary group scan.

- Multiple Channel Partition (MCP) allows the channels on a system to be partitioned between different user groups so that they can each have their own dedicated radio channels. Normally, access time and channel availability are controlled through priority levels, as this is more channel efficient. However, MCP is useful in EDACS systems where several agencies want to share a common infrastructure but still maintain exclusive use of their group of RF channels.

7 LOCAL TELEPHONY

The Local Telephony function block, also called the “Hotline” Interconnect , enables calls to be made between external telephones and individual radios or groups.

Local Telephony is implemented using telephony interface modules connected to the base stations at an enhanced EDACS site. Parameters such as restrictions on who can make interconnect calls and toll call limitations are controlled from the CSD. Furthermore, call records management and billing options are available.

For multi-site systems, a central connection to the telephone network (PSTN or PBX) may be made at the radio switch (see Central Telephony).

8 SINGLE CHANNEL EDACS

The Single Channel EDACS function block provides trunking-like functions over a single radio channel, using a single base station plus trunking controller. This combination is normally referred to as SCAT (Single Channel Autonomous Trunking).

When it is not transmitting a call, the channel operates as a control channel, and when it receives a call request from a radio, it assigns itself as a working channel for the duration of the call. SCAT is normally employed in conjunction with basic, voted or simulcast EDACS systems to serve a local area not covered by the other radio systems or a remote area with little traffic.

The Single Channel EDACS function block provides the following features:

- Transmission trunking.
- Emergency calls.
- Individual calls.
- Group calls (digital or analog voice).
- Data calls.
- Support for telephone interconnect calls through the central telephony function.

The user's radio automatically roams into a SCAT site like any other EDACS site. Also, all calls are placed and received in the same manner as at a standard EDACS site.

In this cost-effective manner, a network can extend the features of EDACS coverage into remote areas where radio traffic is infrequent, while using a minimum number of frequencies.

9 LOCAL DATA

The Local Data function block provides a data connection for a single site, voted or simulcast EDACS system, by providing a means for interfacing to a host computer.

Local Data is implemented using a host computer and one or two fixed radio stations, which may be any EDACS mobile or portable radio unit set up to act as the transmission and reception paths for the host computer. The fixed radios connected to the host computer communicate with field mobile or portable units via the EDACS system. It is worth noting that all EDACS systems are capable of transmitting and receiving data messages.

The functions provided by the Local Data:

- Data communications between host computer and mobile/ portable.
- Data communications between host computer and radio group (not on voted or simulcast EDACS).
- Support for ProFile™, radio-programming tools that allow mobiles and portables to be reprogrammed over the air, eliminating the need to take the radios out of service for manual reprogramming.

10 RADIO SWITCH

The Radio Switch function block allows several EDACS systems (Basic, Voted, Simulcast or Single Channel) to be linked together seamlessly into a multi-site system. In this configuration, users served by the different radio sites can communicate with each other and make use of several add-on function blocks.

The Radio Switch is implemented using an EDACS Console Electronics Controller (CEC™) or Integrated Multisite and Console Controller (IMC™) radio switch to which sites, consoles, or other auxiliary functions can be connected. The CEC is intended for systems with only one site connected to it, while the IMC can connect multiple systems.

The features provided by the Radio Switch are:

- Support for all call types (voice, digital voice and data).

- Intelligent call distribution – calls are only distributed to the sites that have radio units who need to participate in the call, saving valuable channel capacity.

- Non-blocked switching – calls never have to wait because there are not enough connections in the switch, ensuring that important calls are always able to get through.

- Connection of up to 30 EDACS systems (Basic, Voted, Simulcast or SCAT) to the IMC (just one system may be connected to the CEC).

- Radio unit tracking and roaming – the IMC tracks each radio as it roams throughout the EDACS multi-site network, in much the same way that a cellular telephone network tracks mobile telephones. In addition to tracking the location of each radio, the IMC tracks the location of each trunked talk group in the network.

- Fault tolerance – As the CEC and IMC are parallel processing devices, a fault in one processor will not affect the others. If a processor fails in the IMC/CEC, only the site connected to that particular processor will be affected. To protect against single-point failures, each processor may be backed-up with a standby processor.

- Fast call routing and high traffic capacity – The IMC/CEC is specifically designed to handle the high traffic loads generated in EDACS systems. When an EDACS radio user places a group call, the IMC will automatically connect the correct EDACS radio sites and dispatch consoles within a fraction of a second. The call set-up time from one site to another connected through an IMC is less than 500ms. The IMC/CEC itself can handle up to 96 calls per second, which is high enough for even the most demanding situations.

- Database from CSD – If a CSD is used, it may be interfaced with the IMC/CEC. The IMC/CEC accesses the database from the CSD, simplifying system databasing by ensuring all information is accessed through just one terminal.

The IMC/CEC monitors activity at each of the connected sites and passes calls from one site to another. It is able to control traffic between sites in an intelligent way so that each site only assigns a working channel to a call when it has users who need to be involved. The IMC/CEC does this by keeping track of the users and their selected talk groups in the system. This ensures efficient use of valuable radio channels.

EDACS radios can roam freely between the radio systems connected to the IMC. Each radio unit constantly monitors the signal quality of the control channel on the currently selected system. If the signal quality falls below the required minimum, the radio unit scans the frequencies of the other systems' control channels and automatically logs in on the site with the best signal strength. This feature is called "ProScan".

EDACS ProScan™ uses an advanced algorithm that monitors the DRSSI (Digital Received Signal Strength Indicator) of the control and data channels, as well as analog signal strength for voice quality on analog channels. If signal strength falls below a predetermined minimum, the radios start searching for a better signal while still monitoring the current control channel. This allows a radio to proactively switch to another site before it loses coverage.

11 EXTENDED NETWORK

The Extended Network function block is an add-on for the Radio Switch that allows a large number of radio sites (Basic, Voted, Simulcast or Single Channel) and consoles to be joined together in one large, integrated network. Dispatchers and radio users can communicate over hundreds of miles. An Extended Network is created by adding a StarGate controller switch between three or more Radio Switches (CEC or IMC) – two IMCs can be interconnected using a Multi-Site Link – and provides the following:

- Support for up to eight Radio Switches (IMC/CEC) to be connected together.

- Radio unit tracking and roaming – Just like the Radio Switch, the StarGate controller tracks each EDACS radio as it roams throughout the Extended Network, in much the same way that a cellular telephone network tracks mobile telephones. In addition to tracking each radio, the StarGate controller tracks the location of each trunked talk group in the network.

- High capacity, 24-channel trunks – The IMCs are connected to the StarGate™ controller using high capacity, 24-channel (T1) or 32-channel (E1) links.

- Database from CSD – If a CSD is used, it may be interfaced with the StarGate controller. The StarGate controller accesses the database from the CSD, simplifying system databasing by ensuring all information is accessed through just one terminal.

- Support for individual, group and telephony calls.

12 CENTRAL DATA

The Central Data function block is an add-on for the Radio Switch that allows all sites connected to the same IMC/CEC to share one host connection, rather than adding a Local Data facility to each radio site. Central Data is implemented by connecting an Com-Net Ericsson Data Gateway (EDG, a powerful multi-tasking data gateway computer) to the IMC.

Central Data provides the following:

- Data communications between host computer and EDACS mobile/portable radios and groups.

- Support for IP protocols.

- Support for ProFile™, a radio-programming tool that allows mobiles and portables to be reprogrammed over the air, eliminating the need to take the radios out of service for manual reprogramming.

Central Data can be further utilized to enhance radio communications by adding applications such as Automatic Vehicle Location. AVL is implemented by connecting a central tracking computer to the EDG and fitting a GPS (Global Positioning Satellite) receiver to each mobile radio. AVL allows dispatchers and other system users to locate vehicles and personnel on the move. The GPS receiver uses signals from satellites to calculate geographical position, which is

transferred to the EDACS radio, which in turn passes the information through the network to the AVL computer. The AVL computer uses the information to plot the vehicle position on screen.

AVL provides the following:

- Differential AVL.
- Automatic position updating.
- Position plotting of units on a screen, superimposed on a digitized map.

For more information on AVL and other data applications, please contact Com-Net Ericsson.

13 CENTRAL TELEPHONY

The Central Telephony function block allows all sites connected to a Radio Switch (IMC) to share one common interface point for telephony communications. In addition, Central Telephony provides PBX-like functions above those provided by Local Telephony (see section 9). Central Telephony is implemented by connecting a PBX Gateway to the IMC. PBX Gateway is based on Ericsson's well-known and highly successful MD110 PBX.

Central Telephony provides:

- Direct calls between external telephones and EDACS radios and groups.
- Up to 30 simultaneous telephone calls.
- ISDN telephony interfaces.
- Least cost routing (LCR).
- Last Number Redial.
- Common Speed Dial.
- Do Not Disturb.
- Conference Calls.
- No Answer Transfer (Routing).
- Call Forwarding.
- Voice Mail (optional).
- Call hand-off and multi-site roaming.
- Call restrictions.

14 C3 MAESTRO Dispatch Console

The C3 Maestro function block provides full-featured radio dispatch functions. C3 Maestro is implemented by connecting a C3 Maestro dispatch console to a CEC/IMC Radio Switch. It operates on a powerful Pentium PC running Windows NT operating environment. The C3 Maestro provides:

- Individual and group call handling.
- Simultaneous monitoring of up to 112 groups.
- Simulselect and Group Patching.
- Calling Unit ID display.
- Call history (shows who has called).
- Special handling of emergency calls.
- Status/Message Display.
- Paging functionality.
- Handling of auxiliary inputs and outputs.
- Customized and intuitive graphical user interface.
- Support for a wide variety of user interfaces, including mouse, trackball, touchscreen, and a custom dispatch keyboard.
- Support for a wide variety of microphones and headsets.
- Multiple speakers for select and unselect audio.

15 VOICE LOGGING

Voice Logging can be provided via an interface to the Radio Switch to record communications on selected groups. In public safety applications, this ensures that vital communications can be stored and played back should the need arise. EDACS provides a logging recorder interface for a variety of voice recording products.

16 CONVENTIONAL INTERFACE (CI)

The Conventional Interface (CI) function block allows almost any conventional base station to be connected to the CEC/IMC Radio Switch, providing interoperability with older PMR systems. This capability enables smoother migration from conventional to trunked systems. The CI provides:

- Monitoring of traffic on conventional channels from a C3 Maestro dispatcher.
- Connection of conventional channels to an EDACS group to allow trunked and conventional users to communicate.

17 CONVENTIONAL NETWORK INTERFACE (CNI)

The Conventional Network Interface (CNI) allows older-generation PMR radio systems to be closely integrated into EDACS systems. It allows conventional PMR users to talk to the dispatcher and other radio users in EDACS systems, without operator assistance.

Each channel may be mapped to different groups, depending on the channel guard tone used by the conventional radios. Since the interface is frequency-independent, old low-band frequencies may be mapped to the new trunking groups.

CNI is implemented in a similar way to the CI.

18 DIGITAL DISPATCH

Digital Dispatch enables digital voice and digital encrypted voice to be carried all the way to the EDACS dispatcher. It converts the encrypted signals sent from field radios via the radio base stations to clear analog voice at the dispatch center and vice versa.

For example, if unwanted eavesdroppers could monitor microwave links, communications would still be secure because decoding only occurs at the dispatch center.

19 RADIO TERMINAL

The Radio Terminal function block includes those features and functions located in the EDACS mobile and portable radios. The type of radio terminal available varies according to frequency band, application and user needs. The following features are provided: (Note that not all features are available on all radios.)

- Half-Duplex Voice Communications - This is the normal communications mode or radio voice traffic. The user presses the PTT button and speaks into the microphone to transmit audio. The user then releases the PTT button to listen.

- Full-Duplex Voice Communications for Telephone Interconnect – Certain full-duplex mobile and portable radios are capable of the full-duplex operation normally used in ordinary telephone calls. Hence, the user can talk and listen at the same time without pressing and releasing the PTT button.

- Data Calls with RS-232 Connection for Mobile Data Terminals - Allows a mobile or portable radio to be attached to a mobile data terminal or laptop.

- Aegis™ Digital Voice Communications - Enables Aegis Digital Voice communications between radio users, dispatchers, and telephone users.

- Encrypted Voice Communications - An add-on to Aegis Digital Voice that allows digital encryption to be performed on digital voice transmissions. Several encryption schemes are available, each offering a very high level of security.

- AlphaNumeric Display with Menus for Radio Control - Most EDACS radios are equipped with an alphanumeric display. This helps the user operate the radio by providing information on settings and menu-driven control of certain radio functions. The display also shows information about received call, such as caller ID, emergency, or telephone numbers.

- Conventional Operation - All EDACS radios are also capable of conventional (non-trunked) operation. This mode of operation can be used when cooperating with users having older, non-trunked radios, or when several EDACS users are outside the system's coverage area.

- Free Entry of Telephone and Individual Radio Numbers - EDACS radios with a full keypad may be allowed to dial external telephone numbers or radio numbers freely on systems with the Local (ELI) or Central (PBX Gateway) telephone interconnect functions. Call restrictions can be defined per radio.

- Pre-Stored Lists with Telephone Numbers and Individual Radio Numbers - Lists of frequently called telephone or individual radio numbers can be entered in a list with associated alphanumeric description. This makes it easy to step through the list and find the number of a specific person.

- Macro Key Definition - Each key on certain EDACS radio types can be programmed to execute a macro command automatically. This powerful feature allows users to perform complex functions with the press of a single button on the keypad. Keys can be re-mapped to suit the needs of individual users or user groups.

- Flash Programming - Allows the radio personality, setup or software to be changed quickly using PC-based programming tools.

- ProFile™ - A management tool that allows the system administrator to flash radios remotely from a PC terminal. This function removes the need to take in the radios for reprogramming every time a radio parameter needs to be changed. By using sophisticated error-correction and detection protocols, ProFile ensures that a radio personality file has been received correctly before it is loaded into operating memory in the radio. Further, the user can interrupt the ProFile operation should a critical operation occur while the radio is being reprogrammed.

20 BEYOND TECHNOLOGY

Selecting a new radio system represents a major commitment of resources. The operating life span for such a network is often expected to be 10 to 20 years. A number of service options support this objective.

20.1 Software Services

Customers want and need to continuously follow technology improvements. Software Services provides the mechanism to meet this objective. Software Services provides regular software updates that incorporate new features and functions and enable new technology platforms.

Those customers who regularly commit to the software and hardware upgrades extend the operating life of EDACS. A system or network originally purchased 10 years ago, but regularly refreshed via Software Services, offers the same features as a new system installed today.

Software Services provides a cost-effective alternative to premature system replacement. Software Services allows gradual migration of system operation to incorporate the latest features, functions, and options without the disruption and cost of complete system swap out.

20.2 Maintenance Services

Com-Net Ericsson supports and assists with a variety of customer options for maintenance of their system and equipment. Customers may elect to be self-maintained, or contract with either Com-Net Ericsson or a local Authorized Service Center for maintenance services. The Field Service organization coordinates with the Sales organization to identify resources, alternatives, and recommended service plans to meet customer requirements.

Full Maintenance Service Contracts

Critical communications systems are just that - essential to the operation of the organization. To assure uninterrupted operation, a maintenance strategy, developed in conjunction with system design and implementation, often includes maintenance by Com-Net Ericsson. A complete program includes the following:

- **Preventative maintenance** = Provides periodic checks and alignment to keep the system operating at published specification levels and helps prevent failures.
- **Remedial maintenance** = Refers to activities required to correct reported malfunctions and equipment failures.
- **Demand services** = Include activities beyond the scope of the maintenance contract, such as installation and removal of radios, sirens, light bars, and other hardware.

The benefits of a full Com-Net Ericsson Maintenance Service Contract are as follows:

- A specified level of service, including response time for critical backbone equipment, preventative maintenance schedules, and normal working hours support for terminal equipment.
- Using calibrated test equipment, Com-Net Ericsson technicians assure reliable and consistent system operation.
- Local staffing, test equipment, and service vehicles.

20.3 Technical Training

Technical training develops your employees' knowledge and skills to maximize the value of your investment in radio systems. Whether these employees will operate, manage, or maintain the system, Technical Training offers a structured series of courses to assist implementation and operation of the radio system. Training is conducted at both the Com-Net Ericsson Technical Training Center and at customer facilities, upon request.

A new radio system is a major investment. Planning, operating, managing, and maintaining the system for peak performance requires dedicated personnel educated in the subject.

Skilled Trainers

Dedicated training professionals bring more than 100 years of combined experience and knowledge to provide world-class training. At the end of each course, the students evaluate both the content and the instructor to produce a customer satisfaction index (CSI). Customers consistently rate the Com-Net Ericsson training experience as one of the best, as demonstrated by a composite CSI rating of 4.6 out of 5.0 over the past several years.

Performance-Based Training

Performance-based training focuses on specific tasks that personnel must perform to do their jobs proficiently. This combines classroom instruction to introduce concepts followed by hands-on laboratory exercises that apply these same ideas. In addition, the hands-on exercises represent tasks, which reflect actual on-the-job scenarios.

Subsequent instruction builds cumulatively for a comprehensive understanding of the subject.

Planning for Training

While the logistic challenges of system implementation demand attention, the training strategy should receive equal consideration. The people in your organization will be most affected by new technology. A training strategy, which includes an appropriate curriculum, delivered at the right time, provides a strong foundation for enthusiastic acceptance of change.

But training needs extend beyond the initial implementation period. Whether new personnel join the maintenance staff or the manager responsible for the system changes, training should be planned for and budgeted. The Com-Net Ericsson Technical Training staff stands ready to assist you in planning and implementing your program.

20.4 Technical Assistance Center (TAC)

TAC support is designed to save you time when tackling technical issues. The TAC Team understands the time-sensitive nature of the work you do and the need to remedy problems as soon as possible.

TAC logs, tracks, and monitors all calls and response times, helping Com-Net Ericsson technical specialists give you the most comprehensive and timely service possible. For demanding maintenance support, **Priority TAC Support** provides 24 hours per day, seven days per week back-up expertise. All Com-Net Ericsson customers enjoy **Preferred TAC Support** at no additional charge.

Priority TAC Support

Continuous operation of a system to provide critical communications drives the importance of having assistance 24 hours a day, seven days per week. When the system malfunctions at 2 a.m., the personnel responsible for restoring flawless operation are reassured if they have back-up technical expertise available to assist.

Priority TAC Support provides this assurance. Priority TAC Support customers may obtain TAC support 24 hours a day, seven days a week, including holidays. Technical assistance and support are provided for fixed site equipment, mobiles, and portables. Priority TAC Support customers also receive subscriptions to the valuable TechLink and Technical Service Memo products at no additional charge. These publications keep our customers up-to-date with the latest product documentation, software, and hardware changes and important notices that can help improve the performance of an EDACS system.

Preferred TAC Support

Provided to all Com-Net Ericsson customers, Preferred TAC Support provides toll-free assistance. Customers call with operations, programming or maintenance questions or to request guidance on trouble-shooting. Preferred TAC Support is available via telephone Monday through Friday, 8:00 AM to 5:00 PM. While every effort is made for prompt response, the commitment is contact via return phone call or fax the next business day. Preferred TAC Support provides industry-leading assistance to resolve technical issues.

20.5 Service Parts

The Service Parts Operation maintains an extensive array of parts, replacement modules, accessories, options, and test fixtures to support maintenance of systems and terminal products. An order from a customer in the U.S. that is received before 2 p.m. will generally ship within 24 hours, if the parts are in stock, excluding weekends and holidays. International Orders are generally shipped within 72 hours. An order can also be held for lot shipment by customer request.

The Service Parts Catalog features an abundance of information including product programming options, product nomenclature, antennas, audio and accessory options, miscellaneous parts, board assemblies, mechanical parts breakdown and service accessories. A test equipment section is included to help service all Com-Net Ericsson equipment. Illustrated with drawings and pictures, the catalog is an indispensable resource for technicians.

20.6 EDACS – Your Communications Solution

The moment you purchase an EDACS system you join more than 450 Com-Net Ericsson customers worldwide who rely on this state-of-the-art technology for reliable and efficient communications.

Our communications solution has been chosen for voice and data communications by the U.S. military, large and small utilities, private businesses, and public safety agencies of all sizes.

Purchasing a system is only the first step. Installation and implementation of a new, complex system can be challenging. Our experienced associates and partners are with you every step of the way and will work with you to ensure that your system meets your communications needs. We also offer a wide range of services and technical support following the purchase of your system.

By taking advantage of our technology and software upgrades as they are available, you will ensure the longevity of your system and protect your investment in a private radio system. We have a

customer in Florida who purchased our first EDACS in 1988 and has upgraded to the very latest in technology while continuing to utilize most of the original infrastructure.

If you would like to speak with a Com-Net Ericsson customer, please let your sales representative know and he or she will give you the names and numbers of some our customers. You may also find more information about our products and services by visiting our web site at
www.com-netericsson.com

Com-Net Ericsson Critical Radio Systems is dedicated to providing safe and reliable communications system. We hope that you chose our EDACS system as your communications solution.

21 Glossary of Terms and Abbreviations

Agency: The second layer in the EDACS group hierarchy (below the system layer). Each agency contains a predefined collection of fleets and subfleets.

API: Application Programmer's Interface.

AVL: Automatic Vehicle Location.

BCU™: Billing and Correlation Unit.

CAL™: Centralized Activity Logger.

Call Queuing: When all channels on the system are busy, a call request is held in a first-in, first-out queue. The caller and all members of the talk group are notified that a call request has been queued. When a free channel is assigned, the caller is alerted and can proceed by pressing the PTT button.

CEC™: The Console Electronics Controller (CEC) is an EDACS Radio Switch to which a site, consoles, or other auxiliary functions can be connected. The CEC is intended for single-site systems.

Channel Access Time: The time between activation of the caller's PTT and the unmuting of the caller's radio(s). Fast access time contributes to system efficiency.

Channel Drop Time: The time between releasing the PTT and when the channel is actually available for another call. Fast drop time contributes to system efficiency.

CI: The Conventional Interface (CI) allows any conventional base station to be connected to an EDACS Radio Switch.

CNI™: The Conventional Network Interface (CNI) allows EDACS to interwork with a conventional radio repeater through a Radio Switch.

Control Channel: The radio channel on which system control information is continually transmitted and channel request/status information is received from the field units. Any one EDACS radio channel may serve as the control channel when not active on a working channel.

CSD: A multi-tasking computer that monitors system operation and generates management reports. Using the CSD, the EDACS administrator can enable, disable, and dynamically regroup radio units, among numerous other functions

Digitization: The conversion of continuous, analog radio wave forms into binary, digital data.

DRSSI: Digital Received Signal Strength Indicator.

Dynamic Regrouping: Real-time, over-the-air reprogramming of field units into new talk groups.

EDG™: EDACS Data Gateway

ELI™: Enhanced Local Interconnect

Emergency: An emergency message initiated by a caller is automatically transmitted over the control channel to the dispatcher and all talk group members. The system automatically assigns the highest priority to the call.

Encryption: Digitalization and scrambling of radio signals that makes unauthorized eavesdropping virtually impossible.

Failsoft™ Trunking: A mode of operation, unique to EDACS, which allows EDACS systems to continue operating in trunk mode even if the site controller fails.

Fleet: The third layer in the EDACS group hierarchy (below the system and agency layers). Each fleet includes a predefined number of subfleets.

GPS: Global Positioning Satellite.

Group (Talk Group): A collection of users who need to communicate with each other regularly. When a caller within the group places a call, the system collects all group members onto the same working channel.

Group Call: A call by any member of a group that puts all members of the group on the same channel, so that all can hear the call (the usual call type in EDACS).

Group ID: EDACS allows 2048 group addresses, or IDs, numbered from 0 to 2047.

Group Scan: Using group scan, a field radio monitors the control channel and joins all group calls on a predetermined scan list. A particular group can be selected as the priority group. If a call occurs on the priority group while the radio is monitoring another scan group, the radio will automatically late enter the priority group.

Identification (ID): A number uniquely associated with each field radio. This identification is automatically sent each time the radio transmits. EDACS can assign up to 16,382 different logical Ids.

IMC™: The Integrated mlti-site and Console Controller (IMC) is an EDACS Radio Switch that connects various EDACS components (sites, consoles, telephone interconnect, data gateway, CSD, logging recorder) together for coherent control of multisite EDACS networks. The IMC handles the tracking of radios and voice/data routing between systems in wide-area EDACS networks.

Individual Call: A private call on EDACS between one field radio and another field radio, or the dispatcher.

Late Entry: If a radio is powered up, or passes through a coverage null, while its talk group has a call in progress, the radio will late enter the call, even though it missed the original channel assignment.

Log In: An automatic indication from a field radio when powered up that informs the system about its active status, talk group selection, and specific operating site (if part of a multi-site system).

MCP: Multiple Channel Partition

Message Trunking: In message trunking the working channel remains assigned for the duration of the conversation.

Multi-Site: A network of multiple EDACS systems.

Network: EDACS systems can be linked in an intelligent wide-area network, with users able to roam from one system to another.

PMR: Private Mobile Radio

Priority Level: Pre-assigned priority levels for each group and individual determine which call request is assigned first when all working channels are busy. EDACS provides up to eight priority levels (emergency is always the highest).

PTT: Push To Talk.

RDI: Radio Data Interface.

RSSI: Received Signal Strength Indicator.

Simulcast: Simultaneous broadcast by two or more transmitters at different sites operating on the same radio frequency.

Single Channel: Single Channel EDACS systems comprise a single trunking card and EDACS radio repeater, intended for remote or low-density sites. In its idle state, a Single Channel system operates as a control channel. When a channel request is made, the system assigns the call to itself and becomes a working channel. This function is also referred to as SCAT™ (Single Channel Autonomous Trunking).

Site: A collection of EDACS equipment at a particular location.

Site Controller: A high-powered computer controlling the minute-by-minute trunking process and features such as telephone interconnect, dynamic regrouping, and queuing management.

System: Any stand-alone EDACS configuration. It may be Standard, Enhanced, Premium, Voted, or Simulcast. The standard feature set is identical in all systems.

Telephone Interconnect: This facility allows calls to be placed directly between an EDACS radio and the public telephone network.

Transmission: In transmission trunking, the process of assigning channels is repeated several times during a conversation. Subsequent transmissions are assigned to any of the available working channels, completely transparently to the user.

Trunking Card: The EDACS trunking card effectively handles the trunking functionality, without the need for a site controller. It performs the RF signal processing for the repeater station, resynchronizing received data, processing it, and sending it back to the repeater for transmission.

VDT: Voice and Data Trunking

Working Channel: All radio channels other than the single control channel operate as working channels. All voice and data communications are carried over working channels.