Berks County, PA

Trunking Overview

Trunking Overview for Users

Trunking

Trunking is a telephone company concept that refers to the automatic sharing of a small number of communications paths among a large number telephone subscribers. In two-way radio systems trunking refers to the automatic and dynamic sharing of a small number of radio channels between a large number of radio users.

A trunking system efficiently distributes message traffic among the available channels and reduces channel waiting time.

Channels

Trunking Features

Faster System Access

Users have faster system access since all repeaters in the system are typically made available to all users. In addition, voice channels are assigned automatically, eliminating the need for the user to monitor and wait for a clear channel.

Better Channel Efficiency

All channels are typically shared by all users, resulting in an overall decrease in channel congestion.
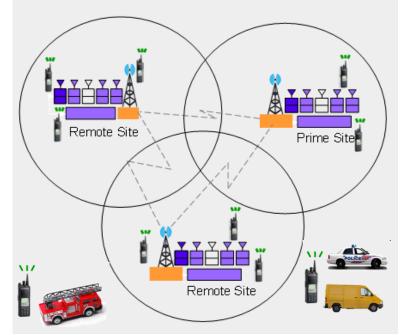
User Privacy

Groups of users can be assigned exclusive use of a voice channel for the duration of a conversation. Users in other groups cannot listen to that channel.

Trunking Infrastructure

A trunking system consists of:
- One or more towers
- Multiple Repeaters
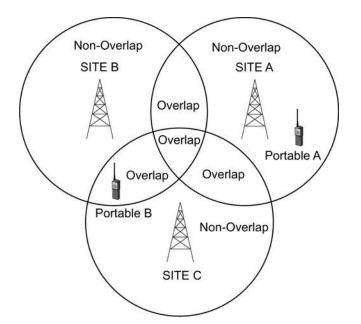- Multiple Frequencies
- Central Controller(s) (Zone Controller(s))

Your System

- **P25 Compliant** - Project 25 (P25 or APCO-25) is a suite of standards for digital radio communications for use by federal, state/province and local public safety agencies in North America to enable them to communicate with other agencies and mutual aid response teams in emergencies.
- **Simulcast**
- **Digital**

Simulcast

- Broadcast of audio by a number of transmitters on a single radio frequency.

- The advantage of this is wide area coverage with minimal frequencies.

- When radio keyed all towers transmit and use the same frequency for both transmit and receive.

Digital vs. Analog

Digital Trunking
- Frequencies are pooled and assigned when the radio user presses the PTT button

  Advantages –
  - Users have access to more talkgroups/channels
  - Utilizes idle frequencies - frequencies are available to all users.

Conventional Analog
- Frequencies are strapped to dedicated channels (the same frequency is always used for transmissions)

  Disadvantage –
  - Limited Channel availability - Multiple users attempt to use limited frequencies (too many users, too few frequencies)

Talkgroups

Trunking allows individual users to be combined into *Talkgroups.*

A **TALKGROUP** is a group of users that have a common need to communicate with each other in order to accomplish their job.
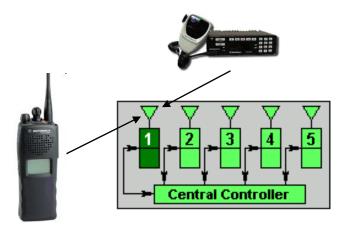

1 2

3 4 5

Turning On Your Radio

When you turn your radio on, it affiliates with the network through the Control Channel on the site nearest your location.

- When no one is transmitting on your selected Talkgroup/Channel, your radio is still "talking" to the Control Channel. (Note: This transmission is transparent to the user.)
- Your radio may be programmed with "Talk Permit Tones." You should not begin your transmission before you hear the tones.
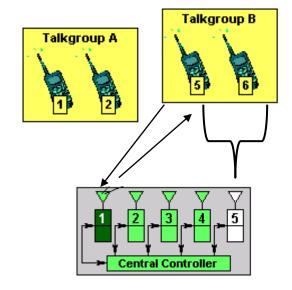
Call Processing Event Sequence

The following is an example of what occurs between the time you press the PTT (Push to Talk) button and the time you hear the talk permit tones (less than ½ second).

In this example, Channel 1 is the Control Channel and Channels 2 through 5 are voice channels.

Step 1:

When you press the PTT button, the Control Channel receives the request and forwards the request to the Central Controller that a radio on. Talkgroup/Channel "B" wants to talk to all other users on the system selected to the same talkgroup/channel.

Call Processing Event Sequence (Con't)
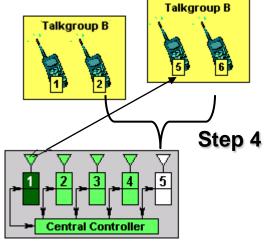
Step 2:

The Central Controller then communicates with the "Control Channel" at every tower and asks if they have any radios turned to Talkgroup/Channel "B" affiliated on their site.

Step 3:

Based on the replies from the control channels, the central controller reaches into the pool, and chooses a specific frequency for the transmission. In our example, this is channel 5.
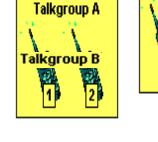
Step 4:

The Central controller then sends a message to all of the control channels that if they have any users selected to Talkgroup/Channel "B", they should send those users to channel 5.
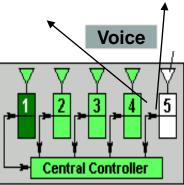
Call Processing Event Sequence (Con't)

Step 5:

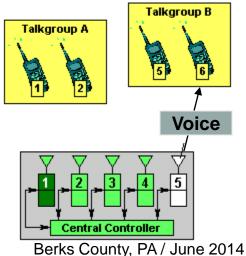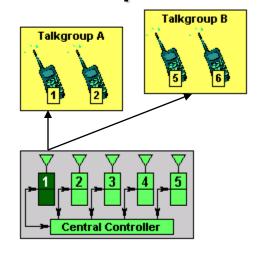All radios monitoring the control channel receive this message and travel over to channel 5.

Call Processing Event Sequence (Con't)

Step 6:

- When the transmission is completed, all of the radios selected to Talkgroup/Channel "B" automatically return to the control channel.
- The Previously assigned voice channel returns to the pool and is available for other transmissions. (NOTE: This process may occur multiple times during a "conversation" and is transparent to the radio users.)

- The radio user never knows what specific frequency they are transmitting on and they don't care. They are primarily concerned that they can transmit to and received from other radio users selected to the same talkgroup/channel.

The Central Controller "promises" the radio users that if they are selected to the same talkgroup/channel and affiliated with **any** tower on the system, they will be able to communicate with each other.

Step 6:

Trunking System Design

Trunking systems are designed or sized based on the concept that:

1. It is highly improbable that a large number of users will want to transmit at exactly the same time.

   It is important to remember that whether you have 2 radios or 200 radios selected to the same talkgroup/channel, they only use 1 frequency.

2. Most conversations are relatively short. The system has a *"Time out Timer"* set to 60 seconds (system default). If the PTT is pressed continuously for 56 seconds, a dull tone will be heard. At 60 seconds, the central controller will take the frequency away. The transmission will no longer be heard and you must rekey the radio to receive a new channel assignment.

Talkgroup Unavailable

There are two types of tones that indicate that a talkgroup is unavailable on the trunking system.

The first tone is a "Talkgroup/Channel Prohibit ".

When a radio user attempts to key up their radio and the talkgroup/channel where they are selected, is already transmitting (i.e."talkover" another user), they will receive a "Talkgroup/Channel Busy (Prohibit tone").

Talkgroup/Channel Prohibit tone 🔊

What should I do if I hear a "Talkgroup/*Channel Prohibit*" tone?

De-key the radio (release the PTT button) and listen for other transmissions.

When the transmission ends, re-key the radio (press the PTT button), wait for the "Talk Permit" tones, then begin transmitting.

The same tone when you are out of range of the trunking system. In this case, in addition to the tone, an "*OUT OF RANGE*" message will appear on the display of the radio.

Out of Range Tone 🔊

Talkgroup Unavailable (Con't)

The second tone is a "System Busy" tone.

What is a "*System Busy*" tone?

A "System Busy" occurs if the radio user keys their radio and no frequencies are available for assignment, the user will receive a "System Busy" tone.

System Busy Tone

What should I do if I receive a "*System Busy*" tone?

Release the PTT button and wait for the three quick tones (talk permit tones). Within three seconds of hearing these tones, press and hold the PTT button to transmit your message.

Talk Permit Tones

NOTE: After receiving the Talk Permit Tones, the radio user must press the PTT (re-key the radio) within 3 seconds or the frequency will be reassigned to the next user in queue.

17

Introduction to Radio System Backup Modes

Trunking Systems contain many layers of redundancy or "back up" to ensure that communications continue in even extreme situations.

Back up modes that are transparent to the radio user are:

- Rotation of control channels

- Repeater "skipped" if off the air

- Redundant communication methods connecting infrastructure

Back-up modes that are visible to the radio user are:

- Site Trunking

- Failsoft

Site Trunking

Definition: Zone Controller lost connection to the

   Prime Site controllers

How does this affect the radio user?

- Radios operate as they would in a normal trunking environment
- The radio will display Site Trunking
- You <u>will</u> have PTT tones
- You <u>will</u> still be able to communicate with users in your zone/site (you will not be able to communicate with users in other zones)
- The EMERGENCY button will work, but may not be displayed in Dispatch
- You <u>will not</u> have communication with Dispatch

Failsoft

Failsoft at the Zone Level – The Central Controller has failed.

Examples of Major Failures:

NOTE: This occurrence is extremely rare!

- Prime Site Controllers Fail
- All Four Control Channels Fail
- All Voice Channels Fail

What Happens to the radios in Failsoft?

- Radios operate as they would on a conventional repeater system
- Each talkgroup is mapped to a specific frequency
- Low level alert tone is broadcast every 10 seconds
- "FAILSOFT" is displayed on the radio
- PTT tones are not available
- Multiple Talkgroups may share the same failsoft channels
- Emergency button functionality is not available

What should the radio user do?

- If they are selected to the talkgroup/channel where they should be working, leave the radio where it is selected and listen for transmissions.
- If not, they should select the talkgroup/channel where they should be working and listen for transmissions.