

The P25 Standard Provides Superior Communication Solutions for Public Transportation

White Paper

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SUMMARY

Project 25 (P25) has delivered a mobile radio communications standard that meets the exacting needs of public safety users. It provides for digital voice and data services in both trunked and conventional formats. Being digital, it delivers noise-free audio right to the limits of radio coverage. Optionally encryption that does not degrade the audio and is virtually impossible to crack, provides the users with total privacy.

Voice services on P25 are well suited to transport needs. However a standard developed with such a clear public safety user group in mind needs careful consideration when used for other applications. The P25 standard defines some strict over the air parameters and these set limitations on the data solutions that can be provided. This paper discusses the benefits and some of the areas that need to be considered when using P25 in a transport application.

INTRODUCTION

As part of the transition of public safety radio from analog to digital, the Association of Police Communications Officers (APCO) identified a need to define a suitable radio standard. APCO commissioned a group of public safety and radio industry, experts forming the Project 25 team. This group delivered the standard known as P25. At the time of writing, Phase 1 is available and work is ongoing to ratify and deliver an advanced Phase 2. For the purposes of this discussion the efficacy of P25 Phase 1 only, will be considered.

There is no doubt that for many of the emergency service needs, P25 offers an excellent voice solution. This paper will highlight some of these and show how these will also bring benefits to transport operations.

In terms of data communications which has seen only limited use in public safety applications, some issues relating to the usable formats need to be considered. This paper will look at some transport data applications and how these may be addressed by using P25 data. In conclusion, this paper will look at the overall benefits of using P25 in transit operations.

P25 FOR VOICE

Transit has a long history of using mobile radio for operational purposes. This may be for the resolution of issues relating to vehicles or alerting such vehicles to accidents or incidents that might cause congestion or delays on their routes. Transit police have also used mobile radio for many years. Analog mobile radio has two major shortcomings that digital overcomes. The first is that as you reach the edges of the radio coverage, the messages sent over frequency modulated analog equipment become very noisy. This noise manifests itself as loud bursts that are especially annoying when the speech content is faint.

The second issue is that if any form of effective encryption (scrambling) is used, it has a detrimental effect on the radio's range performance. P25 digital radio

overcomes both of these. It provides noise-free audio right up to the edges of the radio coverage. This is due to the fact that it is digital audio which is supported within an error correcting transfer regime. The voice encoding (vocoding) algorithm also provides very effective noise cancelling at the microphone source. This can be especially effective in a transport environment where vehicle noise can be significant. In terms of the second issue which was encryption, P25 was specifically developed to provide public safety users with leading edge secure voice communications. The digital data stream used to transfer P25 speech is readily manipulated by the encryption schemes and no degradation in speech quality or range is encountered.

Advanced encryption standards are supported which provide a high degree of protection. To further enhance security, the encryption keys (codes that can be changed in a similar way to passwords) can be changed over the radio network. This avoids the expense involved in physically connecting to each terminal.

It is worth noting that encryption can be provided as an option. Going to P25 digital alone will reduce dramatically the number of eavesdroppers.

The operational range of P25 Phase 1 digital services is similar to that of analog radio and it can also be accommodated within existing frequency allocation and meet the needs of the FCC narrowbanding mandate.

NORMAL OPERATIONS

In normal transport operations, radio is used for a range of services. The table below outlines typical messages and how P25 offers some benefits.

MESSAGE TYPE	TYPICAL FORM	AUDIENCE	P25 ADVANTAGE
Route change or disruption	A steam pipe has fractured on 1st Avenue. All Service 9 buses are to divert into 5th Avenue, then into Better lane and back onto 1st Avenue via Cane Park	Routecall or Fleetcall	Some radios will be near the edges of the coverage area. P25 will improve this audio
Lost property	“Has any Service 103 vehicle had a black wallet handed in?”	Individual or group talk-group	In this case a secure call might be of some value
Service problem	“Bus 450 you are running 6 minutes behind schedule do you have a problem?”	Individual call	The clearer audio delivered by P25 might provide some benefit with this call

DISCUSSIONS WITH DRIVERS DURING ACCIDENTS OR INCIDENTS

In the event a vehicle is involved in an accident, the driver may want to discuss the situation with the dispatch operator. Using an analog system, the operator is open to these sensitive discussions being overheard on readily available scanners. This may then lead to information being made available to the media. With P25, this information may be encrypted to such a level that it remains totally private. The additional benefit of improved voice quality and clarity at the range limits may reduce the time taken to impart the vital messages during these difficult events.

DURING EMERGENCIES/CRISES

During an emergency or time of crisis help is often required from other services. If the radio equipment operates in the same frequency band as other services, it can be set up to communicate either in P25 digital format or in analog fallback mode. In the event that infrastructure is compromised during a major weather event, direct vehicle to vehicle communications is possible over useful ranges. It is common in many areas for the transport operators to be involved in local emergency evacuation plans. Again vehicle to vehicle operation and the encryption capability can be used to provide viable and secure communications during such emergencies.

P25 DATA SERVICES

As alluded to earlier, P25 data services can be used to deliver data services over a variety of complex radio networks. P25 data can be supported on both conventional and trunked system. Also simulcast techniques can be employed. The table below describes how P25 data messages may be used for transit applications.

MESSAGE TYPE	FROM AND TO	P25 FORMAT	DATA THROUGH
AVL	All active vehicles to the control centre	Dual TSBK	3kb/s
Log on and route start	Individual vehicles logging on or starting/finishing a route to control centre	Packet Data	2.5kb/s
Headway	Control to a specific vehicle or driver	Single TBSK	3kb/s
Traffic light priority	Vehicle to traffic light set	Dual TBSK(repeated)	3kb/s
Vehicle update or driver message	Dispatch to vehicle(s) or vice versa	Packet Data	2.5kb/s

From this table it can be seen that P25 data offers significant value. It should be emphasised care must be used to tailor the specific data service and format with the particular transport application. If this activity is done with care, sufficient data throughput can be achieved even to support large fleets. Both the infrastructure and the terminals on a P25 system can be configured to support IP-based data services.

CONCLUSION

As P25 can be deployed in existing frequency allocations and offers similar operational range it provides a straightforward migration path. P25 also offers an excellent voice solution for transport operations. The clarity of voice and noise reduction will reduce the number of repeated messages which is especially important during incidents or emergencies. Transport data applications can be supported providing care is taken to design the system around them. Often a one size fits all view is considered, but this will lead to poor performance in some aspects of the data service. The tools exist within P25 to deliver good data services where adequate consultation and design has been employed in the development of the system from the earliest stage. Overall P25 delivers robust and secure communications in the most difficult operating environments. It therefore is a superior solution for transport operations.

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