



LMR AND THE P25 SUITE OF STANDARDS

Interoperable, Wireless Communications for the Public Safety Industry

Main Features

- The use of licensed RF spectrum – versus walkie-talkie communications which use unlicensed spectrum
- Simplex communications – only one speaker on an audio channel at one time
- “Push-To-Talk” (PTT) signaling – a Land Mobile Radio (LMR) user depresses and holds down a PTT button before and during speech to transmit audio

LMR is a broad term that encompasses all licensed two-way, “push-to-talk” mobile radio communications. LMR communications systems are intended for use by terrestrial users in vehicles (mobiles) or on foot (portables). LMR systems are used by emergency first responder organizations, public works organizations or companies with large vehicle fleets or numerous field staff to communicate quickly and efficiently with other users on the system.

Project 25 (P25) refers to a suite of standards for digital radio communications that has become the “de facto” standard for public safety radio systems in North America. The P25 standards suite was developed under the guidance of the

APCO (Association of Public Safety Communications Officials) organization and is published and administered by the Telecommunications Industry Association (TIA) standards body. The P25 suite of standards was developed to address a number of spectrum and interoperability issues related LMR radio communications.

- The Federal Communications Commission’s (FCC) mandate to improve radio spectrum efficiency
- The need to implement voice processing and advances in digital technologies and modulation techniques that improve voice quality
- The many proprietary implementations of APCO Project 16 and earlier LMR solutions that restricted component interoperability and competition
- The requirement for effective, efficient, and reliable intra- and inter-agency communications
- The growing emphasis on encryption and data



P25 System Definitions

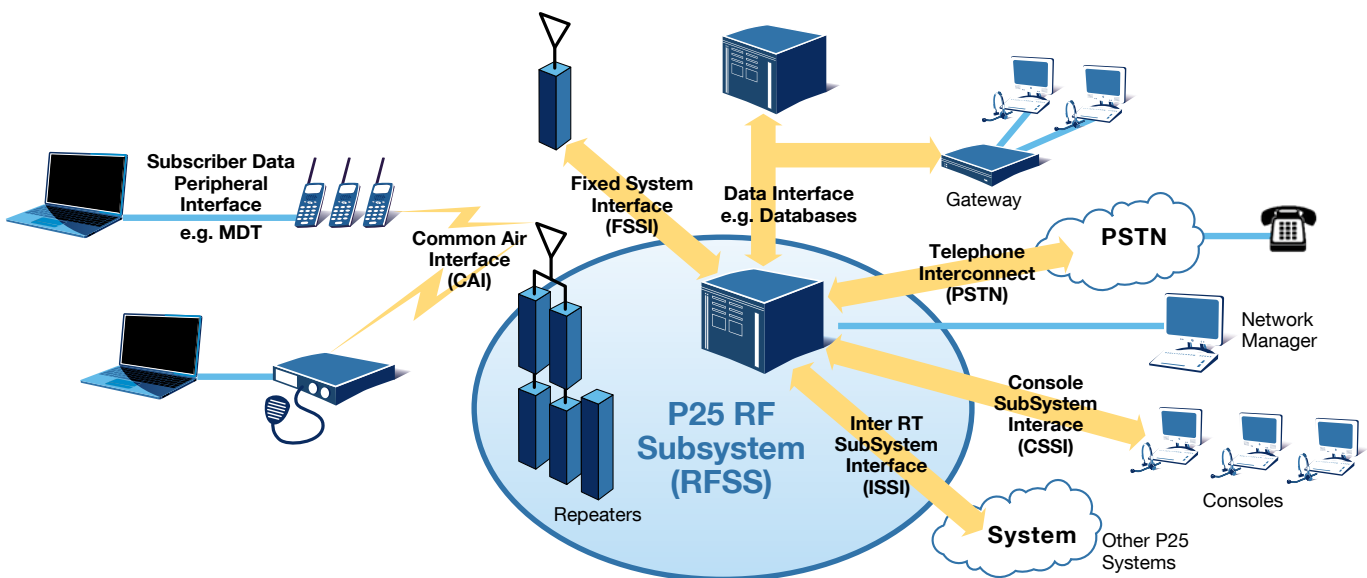
The P25 suite of standards has defined three types of systems – Phase 0, Phase 1 and Phase 2 systems.

- Phase 0 Systems – Phase 0 analog systems are used by public safety entities (and others) in bandwidths ranging from 12.5 KHz to 30 KHz. The common elements of these systems are FM analog modulation and analog-based signaling techniques such as CTCSS and CDCSS
- Phase 1 Systems – Phase 1 systems are defined by the TIA102 series of the P25 standard documents. The earliest standard documents were related to the CAI (Common Air Interface) using the following technologies:
 - Frequency Division Multiple Access (FDMA) spectrum which is divided into channels, each carrying one voice path
 - 12.5 KHz channel spacing which generally uses 25 or 30 KHz and is twice as efficient as traditional analog channels
 - C4FM modulation scheme which enables 9600 bps to be transmitted on a 12.5 KHz channel
 - Improved Multi-Band Excitation (IMBE) vocoder which enables speech to be digitally represented using a bandwidth of 4400 bps
- Phase 2 Systems – Phase 2 systems represent the next step in the migration process to achieve improved spectrum efficiency, with a 4:1 voice path spectrum utilization improvement over the original 25 KHz FDMA technologies. Phase 2 Time Division Multiple Access (TDMA) systems comply with the FCC’s voice spectrum efficiency rule of one voice path per 6.25 KHz equivalent bandwidth – providing two voice paths in a 12.5 KHz channel.

P25 Open Interfaces

An open P25 interface connects one network component with another. The P25 standard defines the electrical characteristics the connection must have, the signals that will be sent between the components over the connection, and what each signal will mean. The P25 suite of standards specifies eight open interfaces between the various components of an LMR system.

- Common Air Interface (CAI) – CAI specifies the type and content of signals transmitted by compliant radios. One radio using CAI should be able to communicate with any other CAI radio, regardless of the manufacturer
- Subscriber Data Peripheral Interface (SDPI) – SDPI specifies the port through which mobiles and portables can connect to laptops or data networks
- Fixed Station Interface (FSI) – FSI describes the signaling and messages between the P25 RF Subsystem (RFSS) and a conventional fixed station
- Console Subsystem Interface (CSI) – Similar to the fixed station interface, CSI defines the signaling and messages between the P25 RFSS and the console subsystem
- Network Management Interface (NMI) – NMI allows administrators to control and monitor network fault management and network performance management
- Data Network Interface (DNI) – DNI specifies the P25 RFSS connections to computers, data networks or external data sources
- Telephone Interconnect Interface (TII) – The TII interface between the RFSS and the Public Switched Telephone Network (PSTN) allows field personnel to use radios rather than cell phones to make connections through the PSTN
- Inter RF Subsystem Interface (ISSI) – ISSI permits users in one system to communicate with users in a different system, from one jurisdiction to another, from one agency to another, and from one city to another





The Advantages of P25 Standards

P25 standards are designed to ease the migration from analog to digital LMR systems, and offer a number of advantages over other LMR radio communication technologies.

- Existing 25 KHz channels can be reorganized into two 12.5 KHz channels. The same center frequency is used when narrowbanding from 25 KHz to 12.5 KHz channels
- Migration is smooth – P25-compliant radios can operate in digital or analog mode, and many analog radios are capable of working with P25 systems with simple software upgrades.
- P25 offers conventional and trunked modes with the basic and advanced functionality required by the geography or user’s mode of operation
- P25 Phase 1 uses the proven FDMA technology that is well understood and extremely reliable P25 Phase 2 uses reliable QPSK modulation for the downlink and a compatible CPM technology for the uplink, allowing efficient reuse of Phase 1 user-device RF “front ends.”
- P25 is an open standard that allows manufacturers to easily license patented technologies
- P25 is based on open interfaces and support full interoperability – allowing users to choose from a wide range of network products and suppliers

The Industry Leader

A pioneer and trusted leader in mission critical communications, Cassidian Communications, an EADS North America Company, provides key technologies for public safety, federal and corporate markets. Our full-circle security and communications portfolio includes 9-1-1 call center CTI applications for call processing, CAD, mapping and information management, as well as managed services, notification solutions and services and P25 Land Mobile Radio networks. Headquartered in Temecula, California.

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