

APCO-25 Overview

APCO-25, Project 25 or P25 is a set of standards for radio communications for public safety, security, public service and commercial applications developed among others by The Association of Public Safety Communications Officials International (APCO). It is standardized by the US Telecommunications Industry Association (TIA) and supports both voice and data transmissions. P25 compliant radios can communicate in analog mode with non-P25 radios and in analog and digital mode with P25 radios. APCO-25 offers conventional as well as trunked radio modes.

P25 is deployed in two phases:

Phase I defines an air interface with 12.5 kHz bandwidth, and 9.6 kb/s air link rate, using C4FM (Continuous 4-Level Frequency Modulation) or CQPSK modulation techniques. The system is also backwards compatible with legacy radios using 25 kHz analog FM.

Phase II defines a two-slot TDMA air interface with 12.5 kHz bandwidth and 12 kb/s air link rate, using Harmonized Continuous Phase Modulation (H-CPM) and Harmonized Differential Quadrature Phase Shift Keyed Modulation (H-DQPSK) schemes.

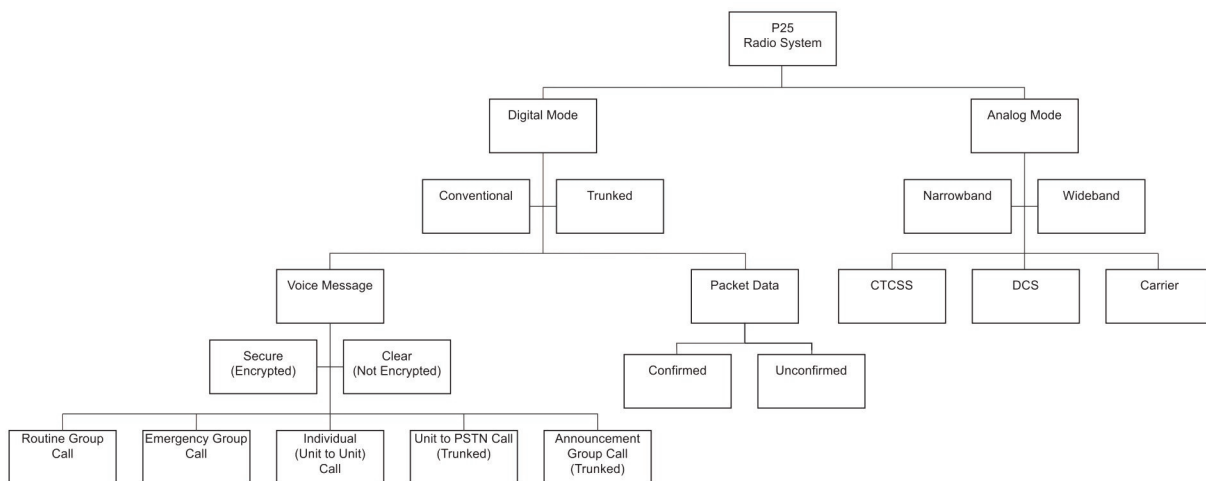


Fig. 1 APCO-25 Functions

APCO-25 Architecture

The TIA TIA-102 suite of documents contains the standards related to P25. A number of interfaces are defined allowing manufacturers to consider the actual implementation of the building blocks as proprietary as long as the interfaces are public. The Common Air Interface of the APCO-25 Phase 1 system is described in TIA-102.BAAA-A, and the

physical layer of the Phase II is defined in TIA-102.BBAB.

Phase I uses the full rate (7.2 kbps) IMBE vocoder, whereas the Phase II employs the half-rate (3.6 kbps) AMBE+2 vocoder to digitize the analog audio.

APCO-25 Digital Radio

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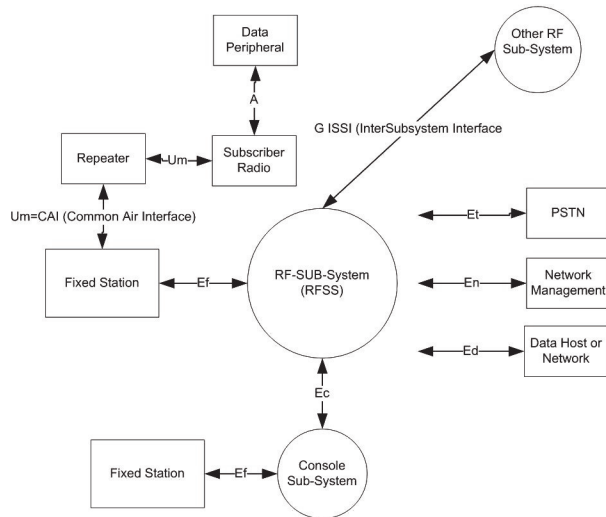


Fig. 2 APCO-25 System Architecture

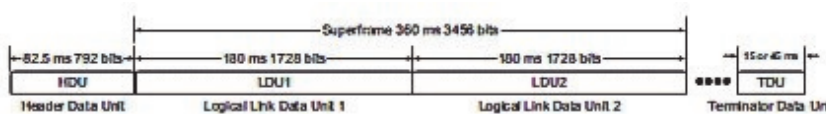


Fig. 3 Message Structure

APCO-25 Message Structure

A P25 voice message structure (see fig. 3) contains a Header Data Unit (HDU), alternating Logical Link Data Units (LDU1, LDU2) and a Terminator Data Unit (TDU). The HDU initializes link control functions and encryption keys, the LDUs contain the digitized voice samples and the TDU terminates the voice message. All data units start with a frame synch word and a Network ID (NID) and are protected by various FEC schemes (BCH, Golay, Reed-Solomon, Trellis and Hamming codes). For every 70 bits a 2 bit status symbol is inserted. Custom applications may insert 2x16 bits of 88.89 bps low speed data into LDU1 and LDU2. The system allows routine and emergency group calls and individual calls, where each device has its own ID as well as one or more talk-group IDs. Voice may be in clear or encrypted. The algorithm used is identified in the ALGID field of the HDUs and LDU2s. Also available is a standardized OTAR (Over-The-Air-Rekeying) function which greatly fa-

ilitates the transfer of encryption keys. P25 Packet Data Units (PDU) may have an arbitrary length, but like other data units they start with frame synch and a NID followed by at least one Header Block (HB) and a number of optional Data Blocks (DB). The HB and the last DB are protected by a CRC code – if a packet is received in error an automatic request for repetition is generated. A data message to be transmitted is split into fragments, which are then split into packets and finally split into data blocks that are protected by a Trellis code. These blocks are sent as a single data packet and reassembled in the receiver. Data may be sent with confirmed or unconfirmed delivery, i.e., with or without acknowledgement.

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APCO-25 Implementation

WAVECOM implementation of APCO-25 decoder is restricted to Phase I digital, conventional mode. Consequently it will not decode analog FM systems.

Each call is marked as a group or individual call with its source and destination addresses. The decoded voice calls can be monitored live using the default sound card of the system and they are also automatically saved under the default Data-Output

directory as .wav files. Live sound streaming can be disabled using the mute button on the upper pane. The contents of the decoded data packets are printed out as raw data and are not further analyzed.

The Offset should be set to the center frequency of the channel to be decoded. The Polarity of the signal is detected automatically.

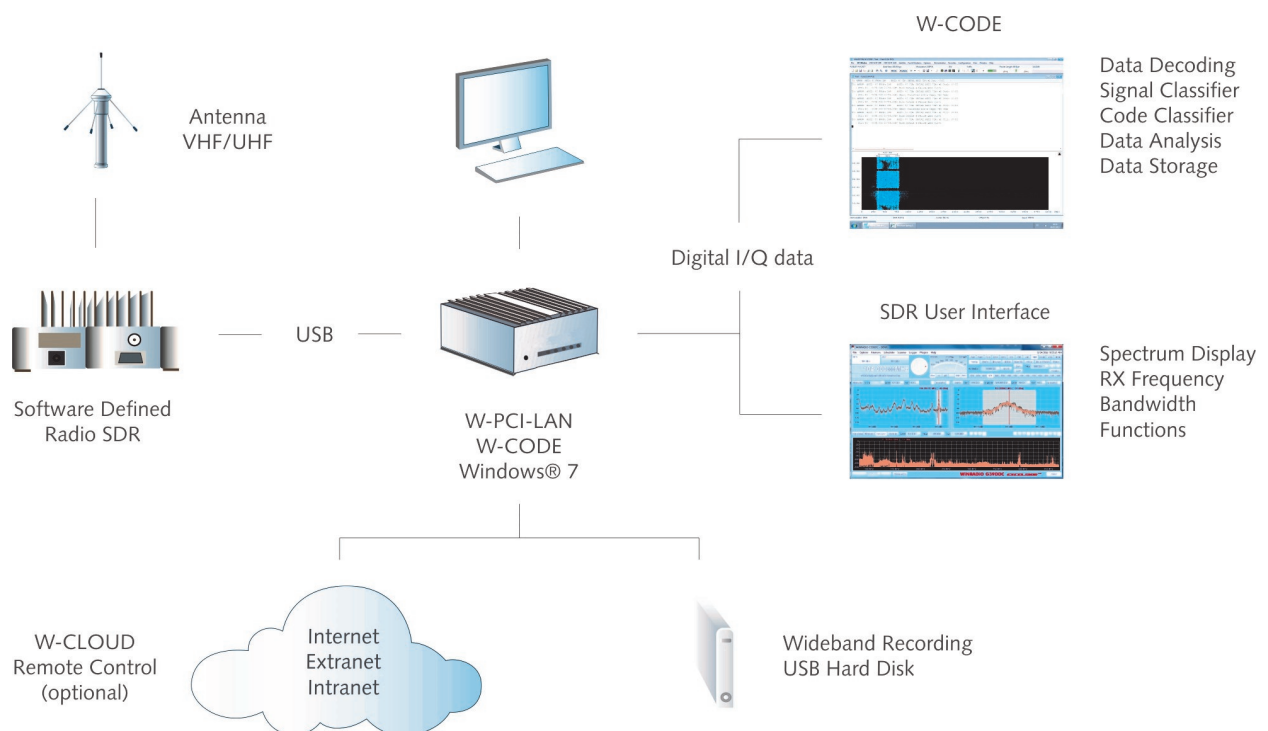


Fig. 4 Configuration for optimal APCO-25 decoding results

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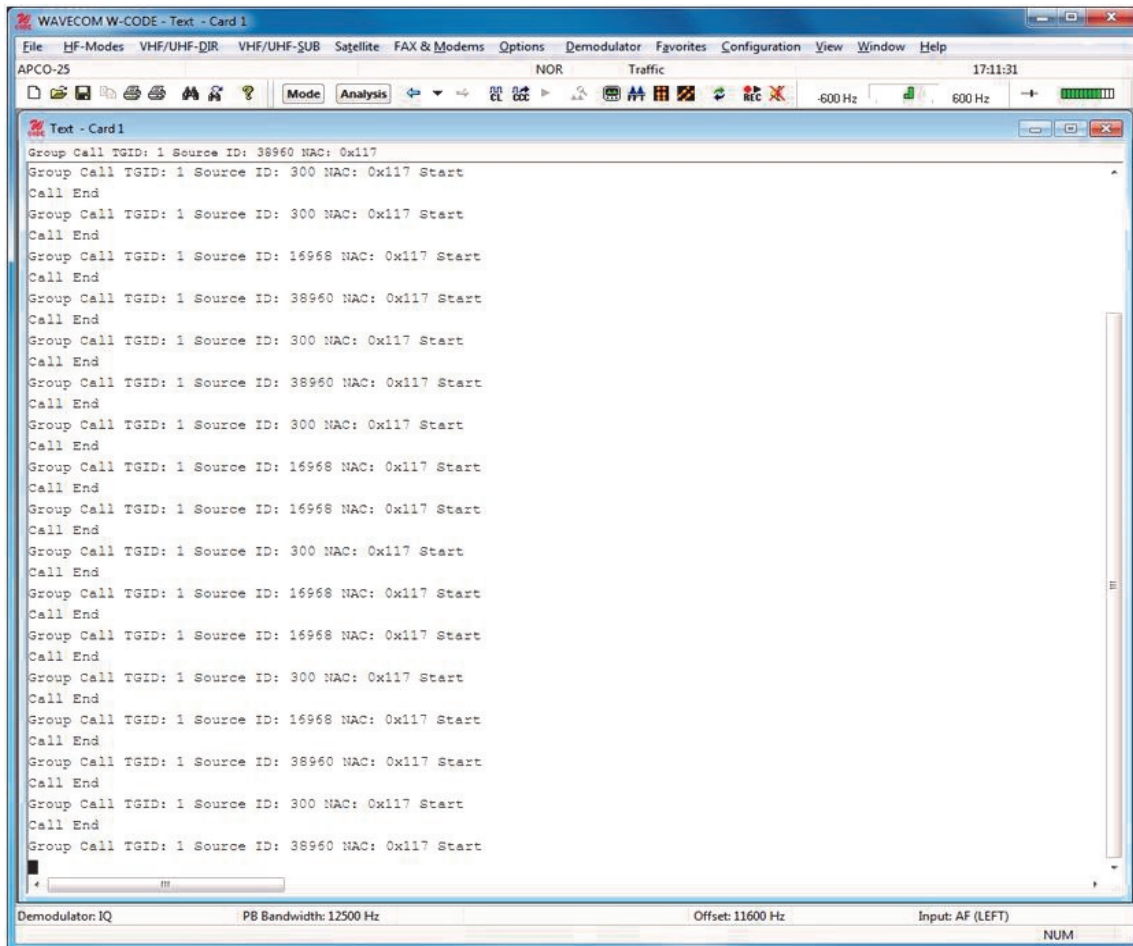


Fig. 5 W-CODE APCO-25 sample screen

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Since more than thirty years Wavecom Elektronik AG has developed, manufactured and distributed high quality devices and software for the decoding and retrieval of information from wireless data communication in all frequency bands. The nature

of the data communication may be arbitrary, but commonly contains text, images and voice. The company is internationally established within this industry and maintains a longstanding, world-wide network of distributors and business partners.

Product Information

Products	http://www.wavecom.ch/product-summary.php
Datasheets	http://www.wavecom.ch/brochures.php
Specifications	http://www.wavecom.ch/product-specifications.php
Documentation	http://www.wavecom.ch/manuals.php
Online help	http://www.wavecom.ch/content/ext/DecoderOnlineHelp/default.htm
Software warranty	One year free releases and bug fixes, update by DVD
Hardware warranty	Two years hardware warranty
Prices	http://www.wavecom.ch/contact-us.php

System Requirements

	<i>Minimum</i>	<i>Recommended</i>
CPU	Core i5 or Core i7 2.8 GHz	Core i7-6700 3.4 GHz
Memory	8 GB RAM	16 - 32 GB RAM
OS	Windows 7	Windows 10 32-bit or 64-bit

Distributors and Regional Contacts

You will find a list of distributors and regional contacts at <http://www.wavecom.ch/distributors.php>

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