Part I

• P25 background Information
  • P25 Basic
  • TIA and P25 development process
  • P25 SOR (State of Requirement)
  • PTIG (Project 25 Technology Interest Group)
P25 Basic Elements
Note: This slide addresses phase 1 P25 only

Trunking
- Control Channel
- Trunking Signal Blocks
- Unit & Group Addressing

Encryption
- Multi-algorithm
- Multi-key
- Encrypted Voice, Data, & Control

Conventional
- Talk Around
- Conventional Signal Blocks
- Unit & Group Addressing

CAI
- 12.5 kHz channels
- 9.6 kbps
- C4FM modulation
- FDMA channel access
- Error correction codes
- IMBE vocoder

Data
- IP packets
- Integrated with Voice and Control

Over the Air Rekeying OTAR
P25 Phases

• **Phase 0** refers to legacy/proprietary (i.e., non-P25) requirements and standards for an analog air interface and for the supporting legacy system (i.e., radios and infrastructure).

• **Phase 1** refers to P25 requirements and standards for a digital common air interface (FDMA) using a 12.5 kHz channel and for the supporting system (i.e., radios and infrastructure).

• **Phase 2** refers to P25 requirements and standards for a digital common air interface (TDMA- or FDMA-based) using a 6.25 kHz channel or equivalent bandwidth and for the supporting system (i.e., radios and infrastructure)
Project 25/TIA Standards Process Map

User voice
- P25 Steering Committee
- P25 User Needs Committee
- User Needs Task Groups
  - Define requirements for standardization
  - Adopt or reject TIA work
  - Only Users vote
  - Develops concept documents for P25

Joint Participation
- APIC: TIA-P25 Interface via MoU
- APIC Task Groups
- APIC Working Groups
  - Develops user requirements into standards proposals
  - Serves as venues for needed clarifications
  - Manages documents
  - All organizations get a vote

Industry voice
- TIA TR-8 Committee
- TR-8 Committee Subcommittees
- Subcommittee Working Groups
  - Develop consensus standards with guidance from APIC and users
  - Only TR-8 members vote

Feature Description
- User Needs
- Steering Committee
- APIC Task Group
- Approval
- Draft Standard
- TR-8.x
- Balloted and Approved Standard
- TIA
- Publication
- Standard
P25 State of requirement (SOR)

- SOR is developed by P25 user needs committee (UNS) = End user
  - P25 SoR to develop ANSI/TIA standards, TIA Telecommunications Systems Bulletins (TSBs), and P25 standards and specifications to facilitate the procurement and operation by the public safety communications community and other narrowband private land mobile radio users of interoperable multi-vendor equipment implementing the Project 25 Standard.

- SOR normally will be updated once a year
- Latest update was August 2007
Part II

• P25 system general Information
  • P25 System Diagram
    – System components
    – System Definition
    – System Inter-Operability
    – System Architecture Image
    – Repeater/Base Station
P25 System diagram

- **MR** Mobile Radio
- **MRC** Mobile Routing Control
- **MES** Mobile End System
- **MDP** Mobile Data Peripheral
- **FS** Fixed Stations
- **RF Sub-System**
  - **RFSS** Radio Network Gateway of another RF Sub-System
  - **ISSI G**
  - **Console Sub-System**
  - **PSTN** Public Switched Telephone Network
  - **ES** Network Management End System
  - **Network Management End System or Network**
  - **Data Host End System or Network**
  - **E_f**
  - **E_c**
  - **E_d**
  - **E_t**
  - **U_m** Air Interface

Diagram represents the integration and communication flow within the P25 System.
P25 System Definition

P25 backbone consists of following components

- RFSS = RF Sub System
- CSS = Console Sub System
- Network Management (Server)
- Data host (Server)
- PSTN
- Fix Station (Conventional Repeater or Base station)
- Digital Voice Recorder
- KMF (Key Management Facility)
P25 System Interoperability
Following diagram shows P25 trunking system interoperability from different vendors

- **ISSI = Inter-RF Sub System Interface**
  This is IP gateway interfacing between different trunking sites ( = RFSS).

- **CSSI = Console Sub System Interface**
  This is IP gateway interfacing between dispatch console sub system and Trunking RF repeater site (Or conventional repeater)

- **FSI = Fixed Station Interface**
  This is IP gateway interfacing conventional repeater (Or base station) and dispatch console sub system.
P25 System Architecture

P25 console system uses standard IP gateway for connecting each subsystem components

- Ec = CSSI
- Ef = FSI
P25 Repeater Requirement

Conventional System

![Diagram of Conventional System]

Conventional repeater must have FSI port to connect dispatch console.

Trunked System

![Diagram of Trunked System]

Trunk repeaters are controlled by trunked channel controller, and each site is connected via ISSI for roaming. P25CC from Raytheon-JPS comes with ISSI.
Part III

• P25 Interoperability
  • P25 Compliance Assessment Program (P25 CAP)
    – Overview (P25 CAP Key features)
    – P25 Test Labs Application
    – Products Testing Documents
    – Summary Test Reports
    – SDoC (Supplier-Declaration of Compliance)
    – Summarized test report
    – DHS Grant Money
Purpose of P25 Compliance Assessment Program
Key P25 CAP Program Features

• The program will review 1st, 2nd, or 3rd party labs who will participate in the CAP program
  Note: CAP Program allows Manufacture to become approved test lab.
  Currently, Motorola, Tyco, EFJ, Relm and Thales have a interest to become CAP test lab.

• Manufactures must use approved laboratory to participate in the program

• Participating manufacturers must publish a Suppliers Declaration of Compliance (SDoC) with standardized summary test report

• SDOCs will be housed on a common website, and DHS grantees are expected to purchase equipment with approved SDOCs

• Initial phase of the program is focused on the Common Air Interface (CAI)
Laboratory Recognition Process

- Lab submits application to P25 CAP/LPM
- P25 CAP/LPM reviews application
  - Application in order
    - yes: Activities prior to on-site assessment
    - no: To on-site assessment...
Test items and related documents

CAI Performance

- TSB-102.XXXX, Definition of Compliance Assessment – Trunked Mode Fixed Station Transceiver and Related Infrastructure Performance
- TSB-102.XXXX, Definition of Compliance Assessment – Conventional Mode Fixed Station Transceiver Performance
- TSB-102.XXXX, Definition of Compliance Assessment – Transceiver Performance; Conventional Mode Subscriber
- TSB-102.XXXX, Definition of Compliance Assessment – Transceiver Performance; Trunking Mode Subscriber
Test items and related documents (cont’d)

**CAI Conformance**
- TIA-102.BAAB-B, APCO Project 25 Common Air Interface Conformance Test, March 2005

**CAI Interoperability**

**Trunked Mode**
- TSB-102.XXXX, Definition of Compliance Assessment – Trunking Interoperability
Summary Test Report

Notional Summary Test Report

- CAPPTG defined summary test reports with key product configuration info, test cases executed and test case verdicts
- Participating labs must use approved, common report formats
- Summaries available upon request
- Company proprietary detailed test reports subject to independent review by auditors

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<th>Verdict</th>
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Supplier’s Declaration of Compliance (SDoC) Report

- Summarizes the “Who, what, when, where, how and why” of testing
- Signed by responsible company officials
- References the formal testing accomplished on the products
- Will be posted in a repository
P25 CAP – Posting Test Results to Repository

- **Total Picture of P25 CAP**
  - **Mfrs Apply/Submit Products for P25 CAP Testing**
  - **TIA TR-8/P25 Dev CAP Test Stnds & Blts**
  - **SAFECON Establish Grant Guidance & P25 CAP Rqmts**
  - **Mfrs/Others Prep and Apply for Lab Recognition**
  - **TIA/P25 Approved CAP Test Standards & Bulletins**
  - **Safecon Grant Guidance Explanatory Addendum**

**Under Cognizance of P25 CAP/LPM**
- **CAP Laboratory Recognition Process Per NIST Hdbk**
- **On-site Assess**

**CAP Testing by Recognized Labs (>2) Interoperability Scope**
- **CAP Testing by Recognized Lab Performance Scope Conformance Scope**

**Test Rpts**

**Mfrs Write SDoCs & Submit to P25 CAP/LPM**

**P25 CAP/LPM Reviews, Concurs & Posts SDoCs**
- **Posted P25 SDoCs for Customer/Other Access/Review**
Part IV

• P25 Trend In Future
  • FCC Regulation
  • P25 Development phase
FCC

• 2011
  FCC requires 6.25kHz or equivalent for products certification

• 2017
  All public safety agencies have to migrate 6.25kHz or equivalent
P25 System in future

Present = Phase 1

• FDMA conventional or trunking
  - Base station: 9600bps C4FM modulation
    LSM for simulcast (Linear PA required)
  - Subscriber: 9600bps C4FM modulation

• Requires backward compatible with phase 0 (= Analogue)
• Standard option for OTAR and data application
P25 System in future (cont’d)

Future = Phase 2

• 2 slot TDMA trunking
  Base station: 12Kbps D-QPSK Modulation (Linear PA required)
  Subscriber: 12Kbps PCM Modulation

• Requires backward compatible with Phase 1
  Phase 1 trunking control channel will have 2 slot TDMA control channel message

Other activity

• Currently TIA has 4slot TDMA as well as 6.25kHz FDMA proposals