ICOM

GOVERNMENT & SYSTEMS

P25 Systems

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

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

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

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

Data
- IP packets
- Integrated with Voice and Control

Over the Air Rekeying OTAR

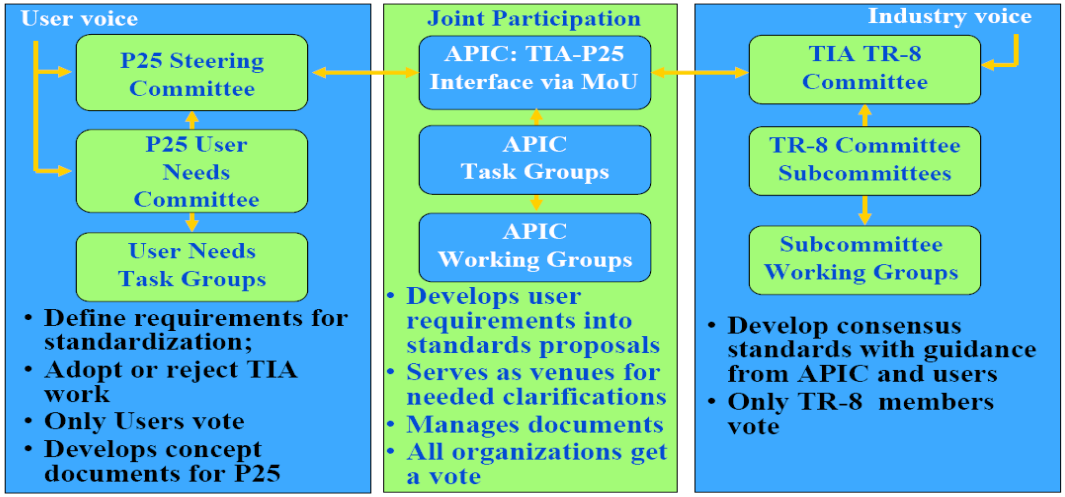
P25 Phases

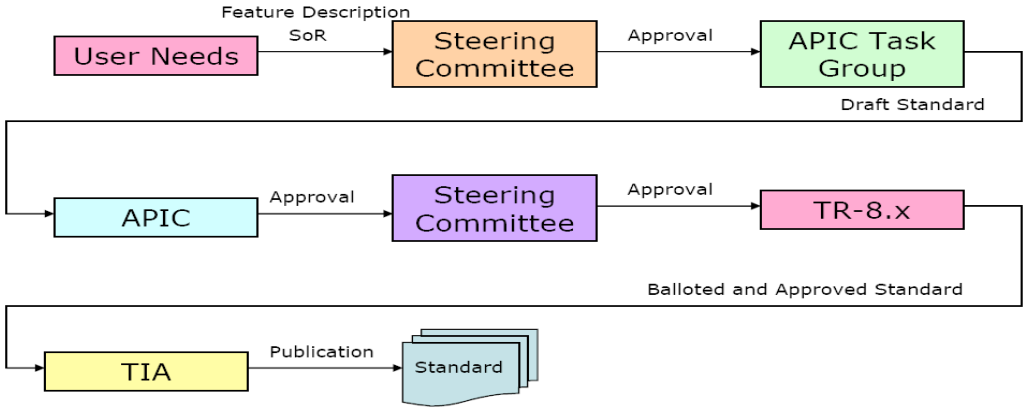
- *Phase 0* refers to legacy/proprietary (i.e., non-P25) requirements and standards for an analog air interface and for the supporting legacy system (i.e., radios and infrastructure).

- *Phase 1* refers to P25 requirements and standards for a digital common air interface (FDMA) using a12.5 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





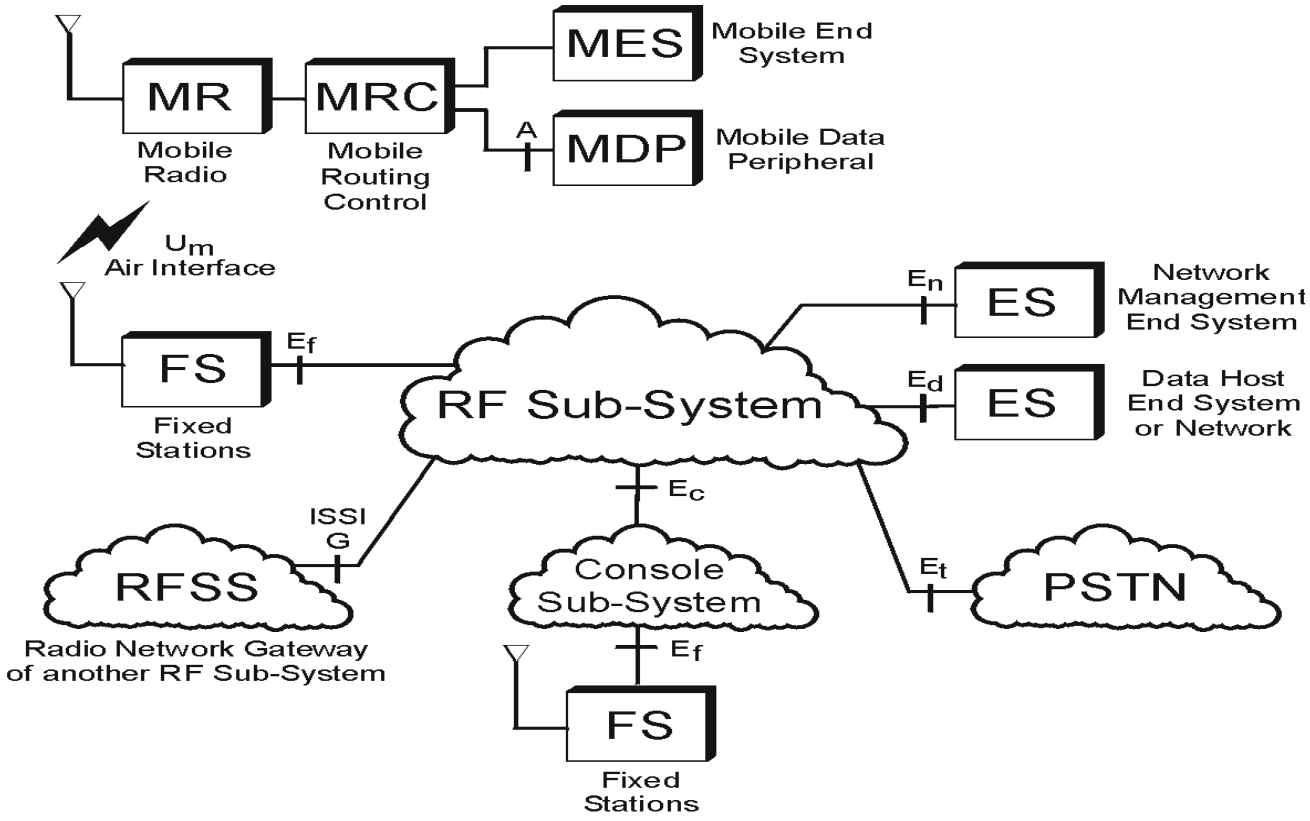
P25 State of requirement (SOR)

- 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



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 RFSS = Trunking site

Dispatch Console Sub System

P25 System Interoperability

Following diagram shows P25 trunking system interoperability from different vendors

- **ISSI = Inter-RF Sub System Interface**

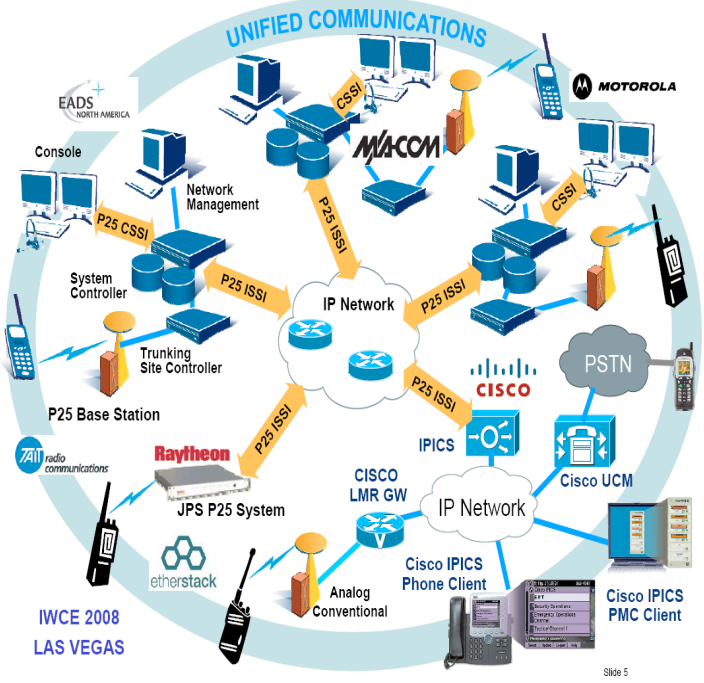
  This is IP gateway interfacing between different trunking sites (= RFSS).

- **CSSI = Console Sub System Interface**

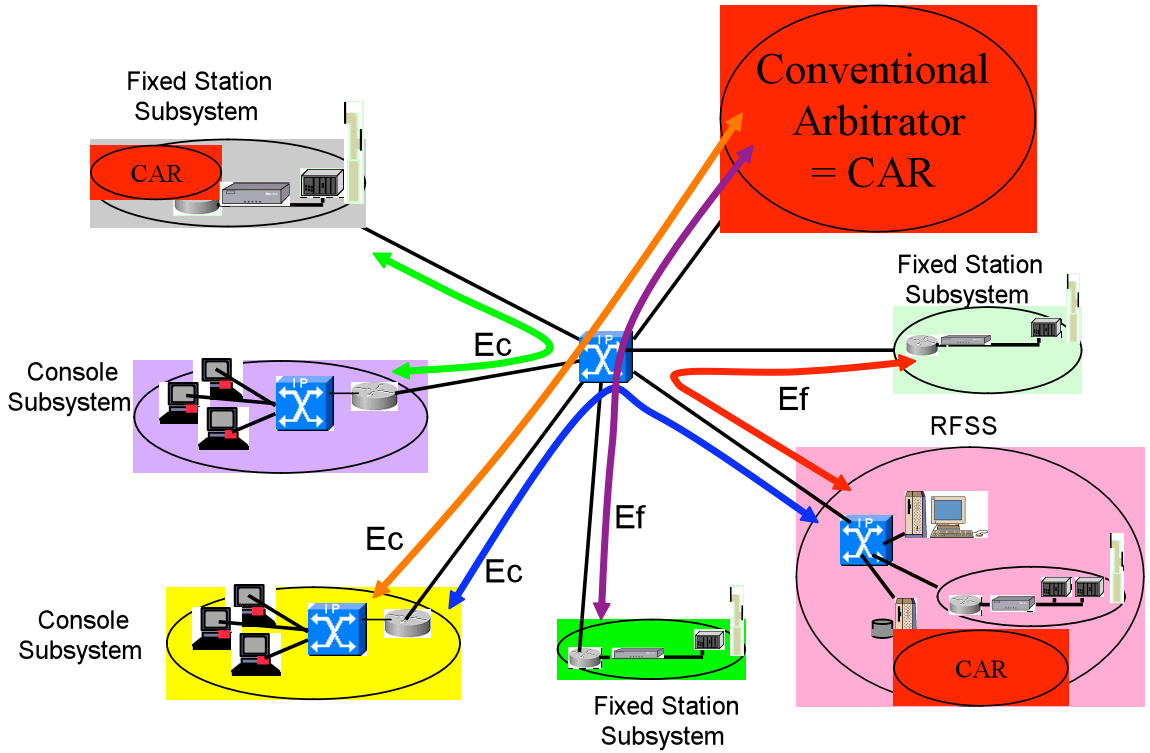
  This is IP gateway interfacing between dispatch consol sub system and Trunking RF repeater site (Or conventional repeater)

- **FSI = Fixed Station Interface**

  This is IP gateway interfacing conventional repeater (Or base station) and dispatch console sub system.



P25 System Architecture

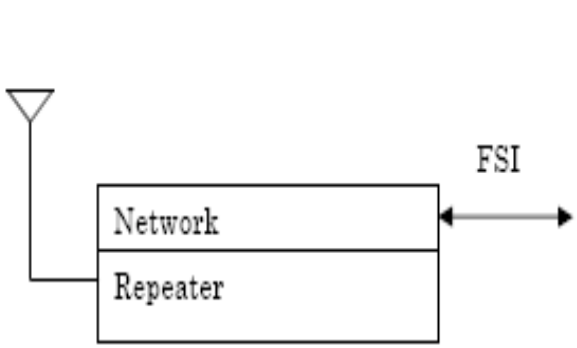


P25 console system uses standard IP gateway for connecting each sub system components

- Ec = CSSI
- Ef = FSI

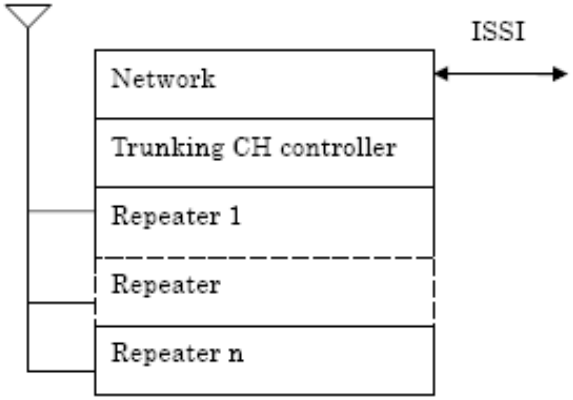
P25 Repeater Requirement

Conventional System



Conventional repeater must have FSI port to connect dispatch console.

Trunked System



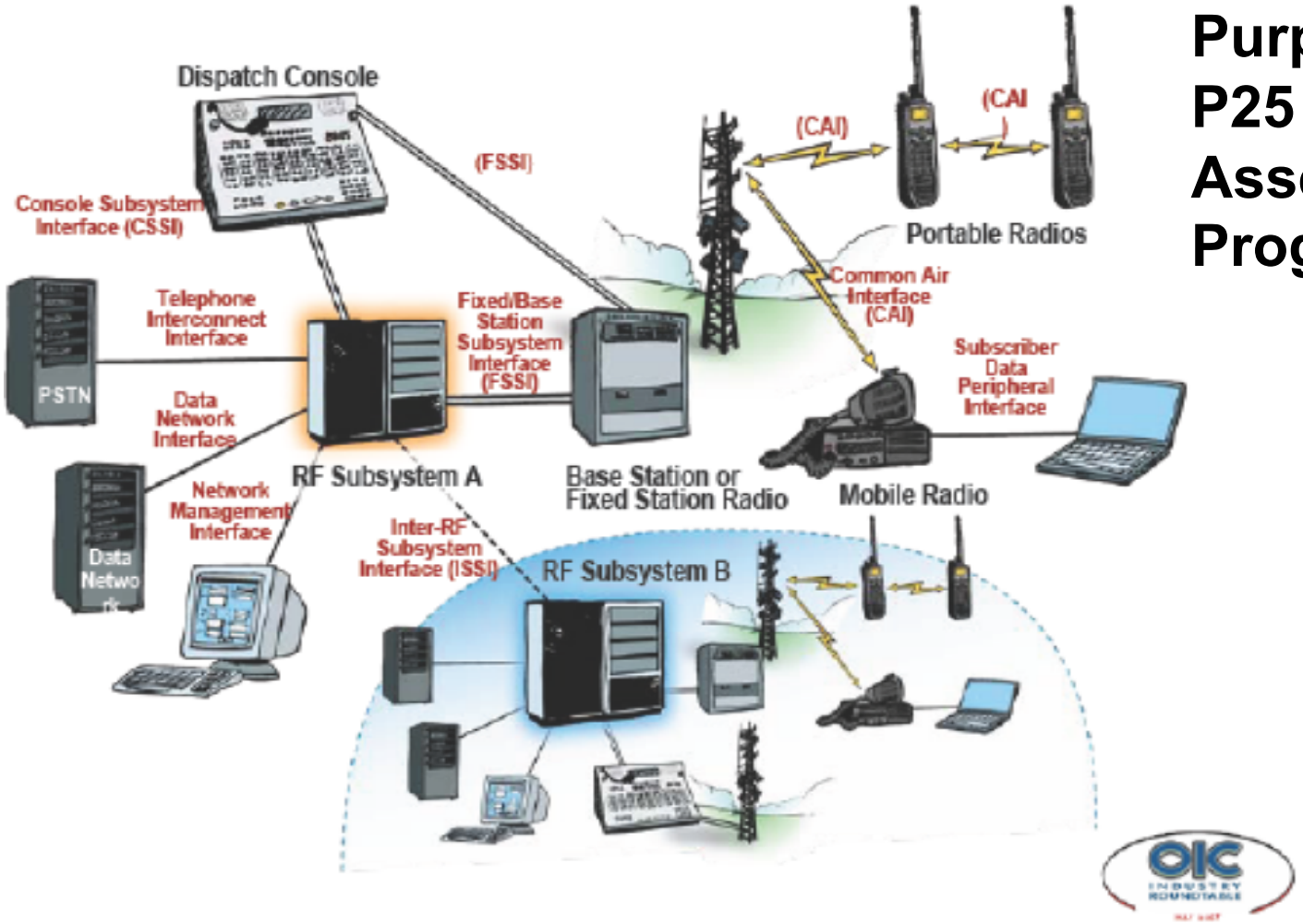
Trunk repeaters are controlled by trunked channel controller, and each site is connected via ISSI for roaming.

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**

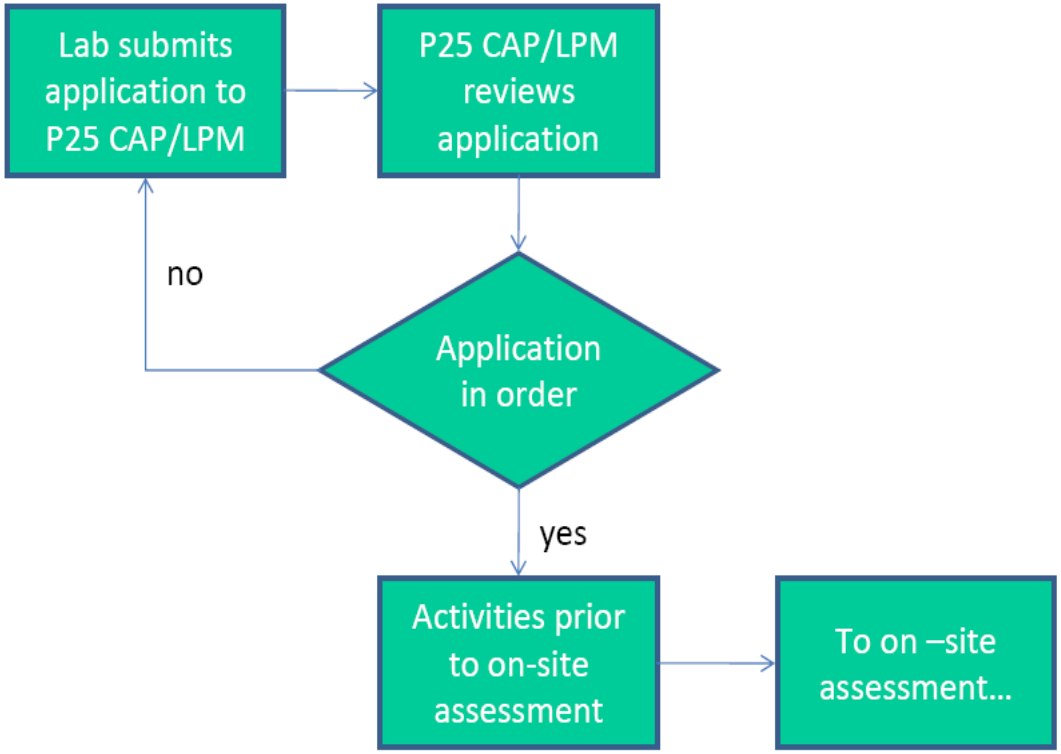
- **Participating manufacturers must publish a Suppliers Declaration of Compliance (SDoC) with standardized summary test report**

- **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)**

NIST

Laboratory Recognition Process



Test items and related documents

CAI Performance

- ANSI/TIA-102.CAAA-B, Digital C4FM/CQPSK Transceiver Measurement Methods, December 2004
- ANSI/TIA-102.CAAB-B, Land Mobile Radio Transceiver Performance Recommendations – Project 25 – Digital Radio Technology, C4FM/CQPSK Modulation, July 2004
- 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
- (08-01-0004) Performance Summary Test Report Template(2007-10-09).

Test items and related documents (cont'd)

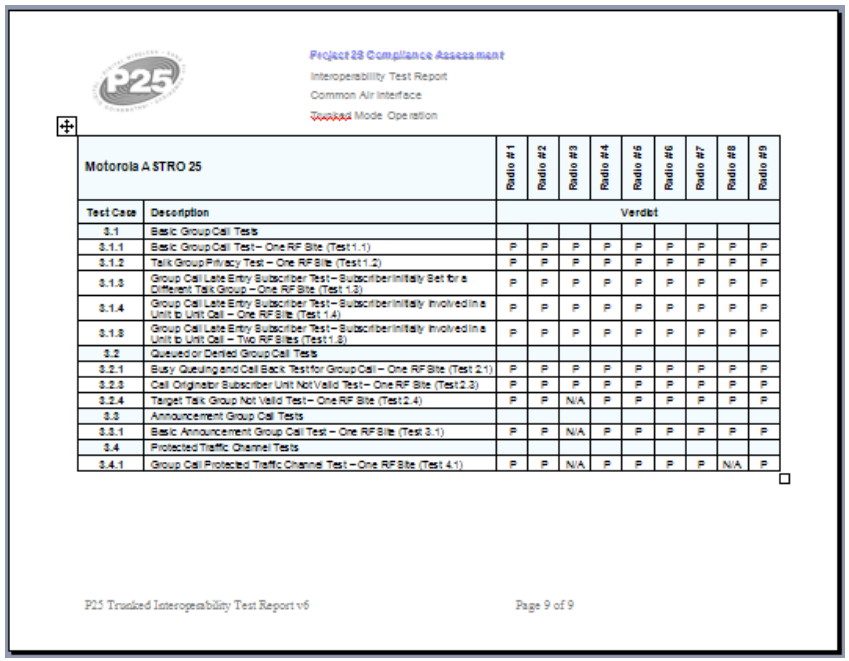
CAI Conformance

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

CAI Interoperability Trunked Mode

- TIA-102.CABC-A, Project 25 Interoperability Testing for Voice Operation in Trunked Systems
- TSB-102.XXXX, Definition of Compliance Assessment – Trunking Interoperability
- (08-01-0005) Trunked Interoperability Test Report Template(2007-10-09).

Summary Test Report



Project 25 Compliance Assessment
Interoperability Test Report
Common Air Interface
Trunked Mode Operation

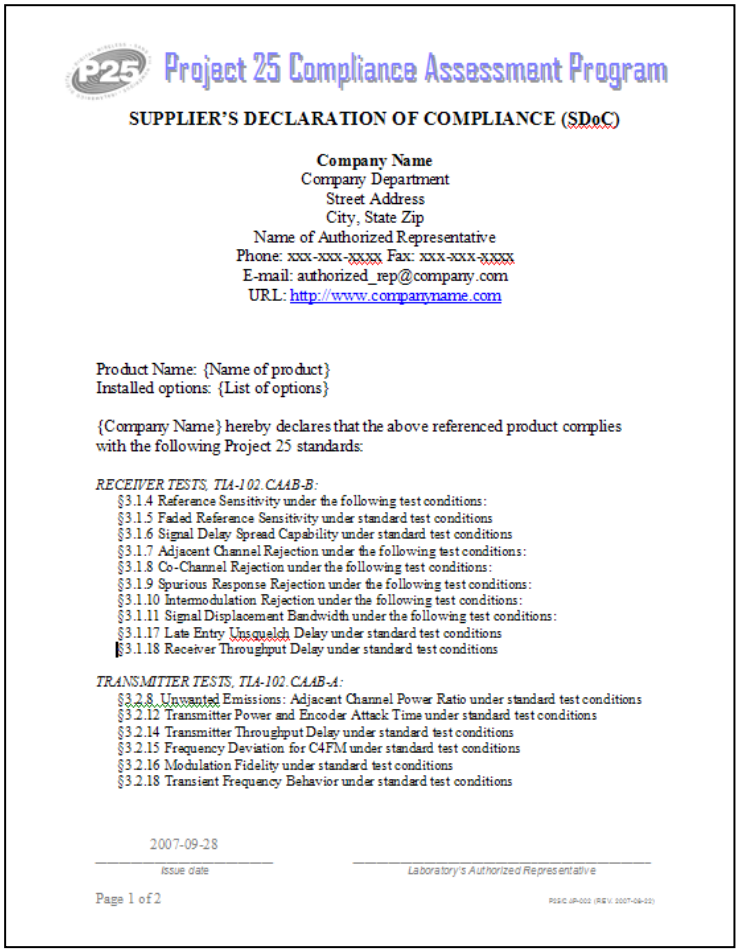
Motorola ASTRO 25		Radio #1	Radio #2	Radio #3	Radio #4	Radio #5	Radio #6	Radio #7	Radio #8	Radio #9
Test Case	Description	Verdict								
3.1	Basic Group Call Tests									
3.1.1	Basic Group Call Test – One RF Site (Test 1.1)	P	P	P	P	P	P	P	P	P
3.1.2	Talk Group Privacy Test – One RF Site (Test 1.2)	P	P	P	P	P	P	P	P	P
3.1.3	Group Call Late Entry Subscriber Test – Subscriber Initially Set for a Different Talk Group – One RF Site (Test 1.3)	P	P	P	P	P	P	P	P	P
3.1.4	Group Call Late Entry Subscriber Test – Subscriber Initially Involved in a Unit to Unit Call – One RF Site (Test 1.4)	P	P	P	P	P	P	P	P	P
3.1.5	Group Call Late Entry Subscriber Test – Subscriber Initially Involved in a Unit to Unit Call – Two RF Sites (Test 1.5)	P	P	P	P	P	P	P	P	P
3.2	Queued or Denied Group Call Tests									
3.2.1	Busy Queuing and Call Back Test for Group Call – One RF Site (Test 2.1)	P	P	P	P	P	P	P	P	P
3.2.3	Call Originator Subscriber Unit Not Valid Test – One RF Site (Test 2.3)	P	P	P	P	P	P	P	P	P
3.2.4	Target Talk Group Not Valid Test – One RF Site (Test 2.4)	P	P	N/A	P	P	P	P	P	P
3.3	Announcement Group Call Tests									
3.3.1	Basic Announcement Group Call Test – One RF Site (Test 3.1)	P	P	N/A	P	P	P	P	P	P
3.4	Protected Traffic Channel Tests									
3.4.1	Group Call Protected Traffic Channel Test – One RF Site (Test 4.1)	P	P	N/A	P	P	P	P	N/A	P

P25 Trunked Interoperability Test Report v6 Page 9 of 9

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

aration of Compliance (SDoC)



Project 25 Compliance Assessment Program

SUPPLIER'S DECLARATION OF COMPLIANCE (SDoC)

Company Name
Company Department
Street Address
City, State Zip
Name of Authorized Representative
Phone: xxx-xxx-xxxx Fax: xxx-xxx-xxxx
E-mail: authorized_rep@company.com
URL: http://www.companyname.com

Product Name: {Name of product}
Installed options: {List of options}

{Company Name} hereby declares that the above referenced product complies with the following Project 25 standards:

RECEIVER TESTS, TIA-102.CAAB-B:
§3.1.4 Reference Sensitivity under the following test conditions:
§3.1.5 Faded Reference Sensitivity under standard test conditions
§3.1.6 Signal Delay Spread Capability under standard test conditions
§3.1.7 Adjacent Channel Rejection under the following test conditions:
§3.1.8 Co-Channel Rejection under the following test conditions:
§3.1.9 Spurious Response Rejection under the following test conditions:
§3.1.10 Intermodulation Rejection under the following test conditions:
§3.1.11 Signal Displacement Bandwidth under the following test conditions:
§3.1.17 Late Entry Unsquelch Delay under standard test conditions
§3.1.18 Receiver Throughput Delay under standard test conditions

TRANSMITTER TESTS, TIA-102.CAAB-A:
§3.2.8 Unwanted Emissions: Adjacent Channel Power Ratio under standard test conditions
§3.2.12 Transmitter Power and Encoder Attack Time under standard test conditions
§3.2.14 Transmitter Throughput Delay under standard test conditions
§3.2.15 Frequency Deviation for C4FM under standard test conditions
§3.2.16 Modulation Fidelity under standard test conditions
§3.2.18 Transient Frequency Behavior under standard test conditions

2007-09-28
Issue date

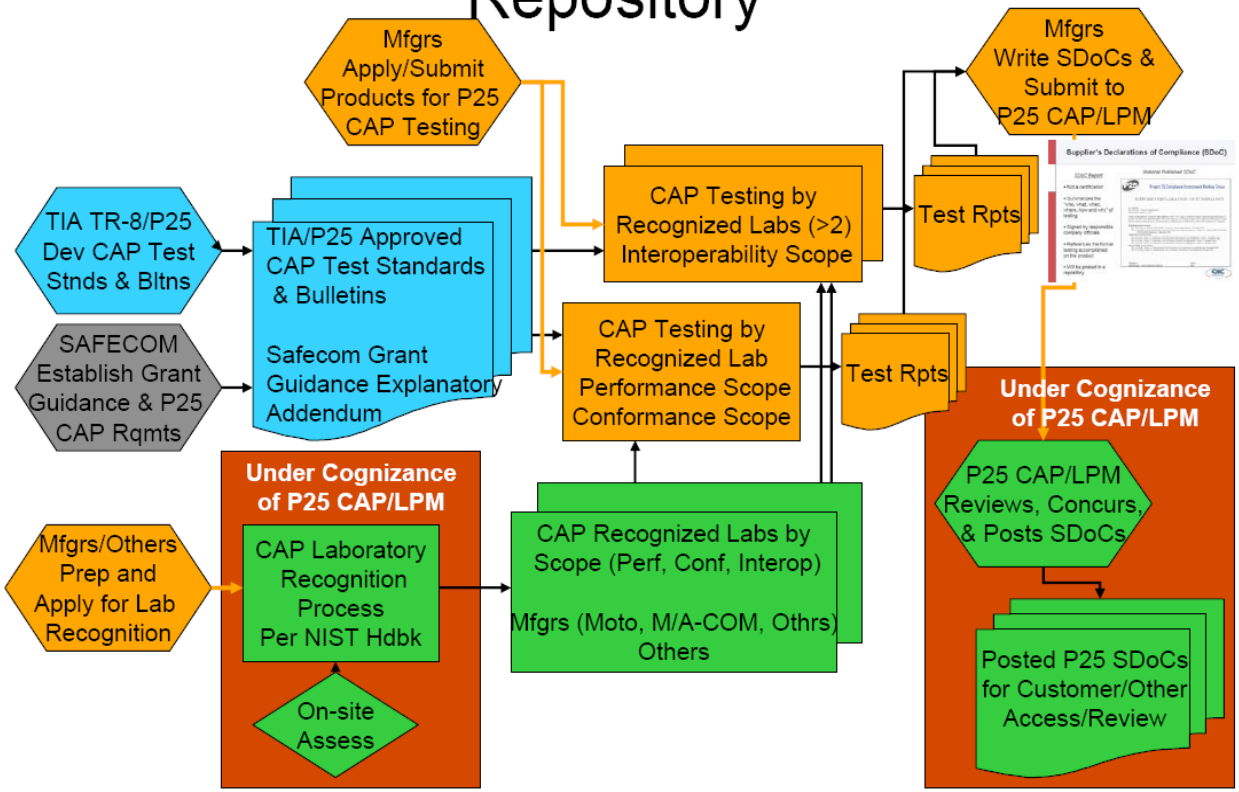
Laboratory's Authorized Representative

Page 1 of 2

SDoC Report

- Summarizes the "Who, what, when, where, how and why" of testing
- Singed 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



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