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Deploying Project 25 TDMA Phase II Subscriber Radios

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Objectives

- Objectives
- 1. Understand P25 Phase II TDMA Technology
- 2. Understand Interoperability aspects of P25 Phase II
- 3. Review deployments of P25 TDMA Phase II Subscriber equipment

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Understanding P25 Phase II TDMA Technology

Project 25 Phase I:

- P25 Phase I FDMA
 - Frequency Division Multiple Access (FDMA) technology to separate talk paths.
 - One Voice Channel per 12.5 KHz Bandwidth
 - Operates at 9,600 bits per second (bps)
 - Occupies 12.5 KHz of bandwidth (1 voice channel/ 12.5 KHz)
 - Vocoder operates at 7200 bps

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Understanding P25 Phase II TDMA Technology

Project 25 Phase II:

- P25 Phase I TDMA
 - Time Division Multiple Access (TDMA) technology to separate talk paths
 - Two Voice Channels per 12.5 KHz Bandwidth
 - Operates at 12,000 bits per second (bps)
 - Occupies 12.5 KHz of bandwidth (2 voice channels/ 12.5 KHz)
 - 6.25 KHz Equivalent Bandwidth
 - Vocoder operates at 3600 bps

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Understanding P25 Phase II TDMA Technology

Differences Between Phase I and Phase II:

- Technology Improvements
 - Phase II Modulation is more efficient – Higher Bit Rate
 - Increased Bit Rate is split into two voice channels
 - Additional Bit Rate required for signaling
 - Enhanced Half Rate Vocoder
 - Improved Forward Error Correction

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Understanding P25 Phase II TDMA Technology

Differences Between Phase I and Phase II:

Project 25 Phase I – 9600 bps			
Voice Channel 1			
Full Rate Vocoder 7200 bps		Control/Sync 2400 bps	
Voice Data 4400 bps	FEC 2800 bps	Control/Sync 2400 bps	

Efficiency Improvement gained in Phase II – 2400 bps

Project 25 Phase II – 12000 bps			
Voice Channel 1 (Blot 0)		Voice Channel 2 (Blot 1)	
Half Rate Vocoder 3600 bps	Control/Sync 2400 bps	Half Rate Vocoder 3600 bps	Control/Sync 2400 bps
Voice Data 2450 bps	FEC 1150 bps	Voice Data 2450 bps	FEC 1150 bps
Control/Sync 2400 bps		Control/Sync 2400 bps	

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Understanding P25 Phase II TDMA Technology

Regulatory Issues Relevant to Phase III:

- FCC Mandated 6.25 KHz Equivalent Technology for 700 MHz
 - 700 MHz No new 12.5 KHz Licenses after 2005
 - 700 MHz 6.25KHz Equivalent by January 2017
 - FCC has indicated 6.25KHz mandates to other bands would be forthcoming
 - FCC has granted waivers to the 2017 deadline
 - It remains to be seen what the regulatory environment will bring

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Understanding P25 Phase II TDMA Technology

Why Should You Consider Phase II?

- Greater Operational Flexibility
 - 2 to 1 Improvement in Voice channel availability
 - Free existing voice channels for use as data channels
 - Graceful migration from Phase I to Phase II

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Understanding P25 Phase II TDMA Technology

Operational Impact

FDMA Control Channel	Phase I FDMA Voice Channel	Phase I FDMA Voice Channel	Phase I FDMA Voice Channel	Phase I FDMA Voice Channel	← Phase I = 1 Control Channel & 4 Voice Channels ← Phase II = 1 Control Channel & 8 Voice Channels Phase II Provides Twice the Voice Channels as Phase I
Enhanced FDMA Control Channel	Phase II FDMA Voice Channel				
12.5 KHz	12.5 KHz	12.5 KHz	12.5 KHz	12.5 KHz	

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Understanding P25 Phase II TDMA Technology

Operational Impact

FDMA Control Channel	Phase I FDMA Voice Channel	Phase I FDMA Voice Channel	Phase I FDMA Voice Channel	Phase I FDMA Voice Channel	← Phase I = 1 Control Channel 4 Voice Channels
Enhanced FDMA Control Channel	Phase II FDMA Voice Channel				
12.5 KHz	12.5 KHz	12.5 KHz	12.5 KHz	12.5 KHz	← Phase II = 1 Control Channel 4 Voice Channels 2 Data Channels
					Phase II Provides Twice the Voice Channels as Phase I

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Understanding Interoperability Aspects of Phase II

Backwards Compatibility:

- Phase II Equipment is Compatible with Phase 0 and Phase I
 - Analog Conventional Operation
 - P25 Phase I Conventional Operation
 - P25 Phase I Trunked Operation
 - AES/DES Operation

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Understanding Interoperability Aspects of Phase II

Phase II was Designed with Migration in Mind:

- Phase II is Based on the Need for Migration
 - Phase II Utilizes the Phase I Control Channel
 - Concurrent Operation of Phase I and Phase II
 - Phase II Coverage is Similar to Phase I
 - Enhanced Dual Rate Vocoder - Phase I and Phase II
 - Maintain Encrypted Operation

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Understanding Interoperability Aspects of Phase II

Graceful Migration:

- Utilize System Features to Manage Phase II Migration
 - New Subscriber Purchases Should Support Phase II
- Phase II Systems Allow:
 - Dynamic Dual Mode Operation
 - Phase II by Talkgroup
 - Phase II by Site
 - Phase I to Phase II Interoperation
- Migrate Your System to Phase II as Time and Budget Allow

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Understanding Interoperability Aspects of Phase II

System Issues in a Phase I/Phase 2 Environment:

- Configured for Phase I Operation Only
 - Phase I and Phase II Subscribers Will Operate as Phase I
- Configured for Phase II Operation Only
 - Only Phase II Subscribers can Operate
 - Phase I Subscribers 'Out of Range'

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Understanding Interoperability Aspects of Phase II

System Issues in a Phase I/Phase 2 Environment:

- Configured for Dynamic Dual Rate Operation
 - Phase II Capable Infrastructure Determines Phase I or Phase II
 - If All Registered/Affiliated Radios are Phase II
 - Call is Phase II
 - If A Given Site Has a Registered/Affiliated Phase I Radio
 - Call is Phase I
- Site or System Wide?
 - Some Infrastructure Vendors Support Dynamic Rate Across Sites
 - Some Sites Operate Phase I while Others Operate Phase II

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Deployments of Phase II Subscriber Units

RELM Wireless Phase II Subscriber Deployments:

- Single County Simulcast System
- Multi-County Simulcast/Non-Simulcast System
- Statewide System

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Deployments of Phase II Subscriber Units

Single County Phase II TDMA System:

- Virginia
- 6 Site Simulcast System
- 800 MHz, 10 Channel
- Phase II From the Start
- Talkgroups all TDMA

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Deployments of Phase II Subscriber Units

Multi-County Phase II TDMA System:

- Texas
- 700 MHz and 800 MHz Channels
- Simulcast and Non-Simulcast Sites
- Channel Density from 5 to 22 Channels per Site
- Migrating from APCO 16 to P25 to P25 Phase II
- FDMA Only, TDMA Only and Dynamic Talkgroups

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Deployments of Phase II Subscriber Units

State Wide Phase II TDMA System:

- Southeast US
- Only 700 MHz Channels
- Over 125 Sites - Simulcast and Non-Simulcast Sites
- Channel Density from 5 to 12 Channels per Site
- Built as Phase II – Initial Subscriber Phase I
- FDMA Only, TDMA Only and Dynamic Talkgroups

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