



# DMR Trunking, Interoperability Process and future extensions

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# Tier III Trunking Content

- Overview
- Trunking Control channel aspects
- Trunking procedures (Samples)

## Services and Facilities

- Generic services:
  - MS Access control and management using a control channel and a random access protocol
  - MS Location within the system radio coverage by radio site identification and registration
  - Control Channel hunting
  - System acquisition authorization
  - A Unified Data Transport mechanism to support the short data service, the supplementary user data service and extended addresses through gateways
  - Broadcast of system parameters to MS
  - MS Authentication
  - Feature Not Supported
  - MS dynamic power control
  - MS Pre-emption control

## Services and Facilities

- Primary voice services:
  - Talkgroup call service
  - Individual call service
- Secondary voice services:
  - All MS call service
  - Broadcast voice call service
  - Open voice channel mode call service
- Primary Data Services:
  - Short Data Service
  - Packet Data Service

## Services and Facilities

- Supplementary Service:
  - Supplementary user data transfer service
  - MS stun and revive
  - MS Kill
  - Answer Call Service
  - Cancel Call Service

## Device Addresses

- MS Addresses
  - A Tier III MS shall be personalized with at least one **individual identity** and may be a member of one or more talkgroups
- Services and Gateway Addresses
  - The Tier III protocol defines additional addresses to identify Services and Gateways

## Tier III services

### A DMR TS

- Can allocate resources for a range of services including individual call, talkgroup call, line connected call, and a selection of data services
- May send supplementary data between MS and the network during the call set-up phase using the Supplementary Data Transfer Service to poll for, or deliver additional information using a Unified Data Transport method

### A MS can initiate or receive calls from

- An individual MS
- A line-connected terminal device including a PABX extension or PSTN destination
- A talkgroup, or transmit to all MSs in the system

## Tier III services

For individual voice calls, a system may employ two strategies –

- **Off Air Call Set-Up (OACSU)**
- **Full Off Air Call Set-Up (FOACSU)**

## Physical Link Organization

### Radio Frequency Allocation

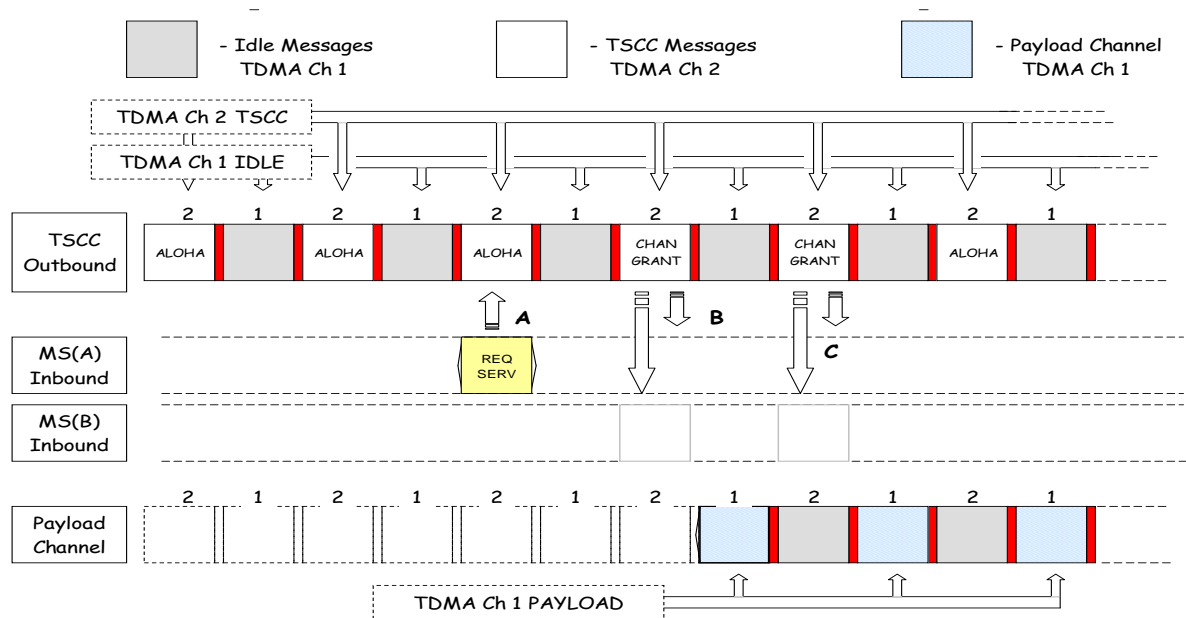
- Physical radio channels may be specified by either:
  - A logical channel plan and/or
  - A mechanism whereby the absolute transmitter and receiver frequencies are specified

### Colour Code (CC)

- The default colour code is 0000.
- In Tier III systems MS shall be polite to own colour code
- MS may maintain a list of logical channel numbers and their corresponding colour code assignments

# Overview

## A talkgroup call example



# Trunking control channel aspects

## Trunking methods

- Message trunking
  - In practice used for mixed individual and group call scenario
- Transmission trunking
  - In practice used for a predominant group call scenario
- Quasi-Transmission trunking
  - In practice used for a predominant group call scenario

# Trunking control channel aspects

## Modes of control channel

- Dedicated TSCC
- Non-Dedicated TSCC
- Operation in shared spectrum

# Trunking control channel aspects

## Multiple control channel per site

- Each site can have up to two control channel on a physical channel
- The MS population can be subdivided to access only one of the defined control channel

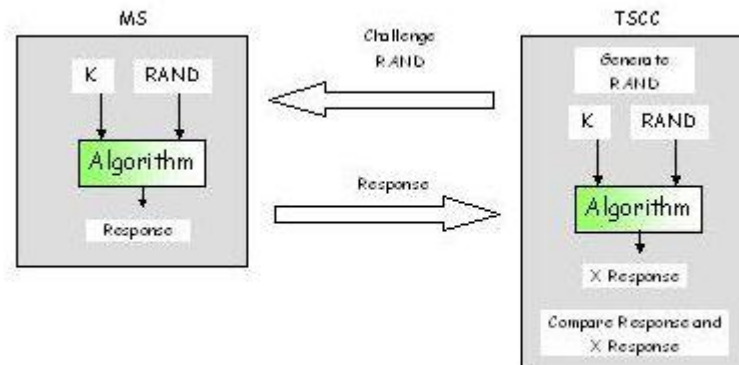
## Random Access Control

- Access to the control channel are made via random access unless
  - Access is inhibited by Mask (subdivision of MS population)
  - Access is inhibited by the Service Function (i.e. for registration access only)
  - The slot chosen is withdrawn (for example for short data message on CC)

# Trunking procedures (Samples)

The following slides show examples of Tier III trunking procedures that are new for B&I trunking standards

- Registration with challenge and response Authentication



# Trunking procedures (Samples)

- Mass registration
  - TSCC can re-establish those registration records from the MS that are currently confirmed on that TSCC
- Power save
  - MS and TSCC negotiating a time where MS is accessible.  
Range for 1:2 to 1:128 power save frames
- MS power control (closed loop )
  - Ability of the TSCC to control the power output of an transmitting MS
- Transmitter pre-emption
  - Cease transmission immediately or
  - Stop transmission at the end of the next voice frame

# Trunking procedures (Samples)

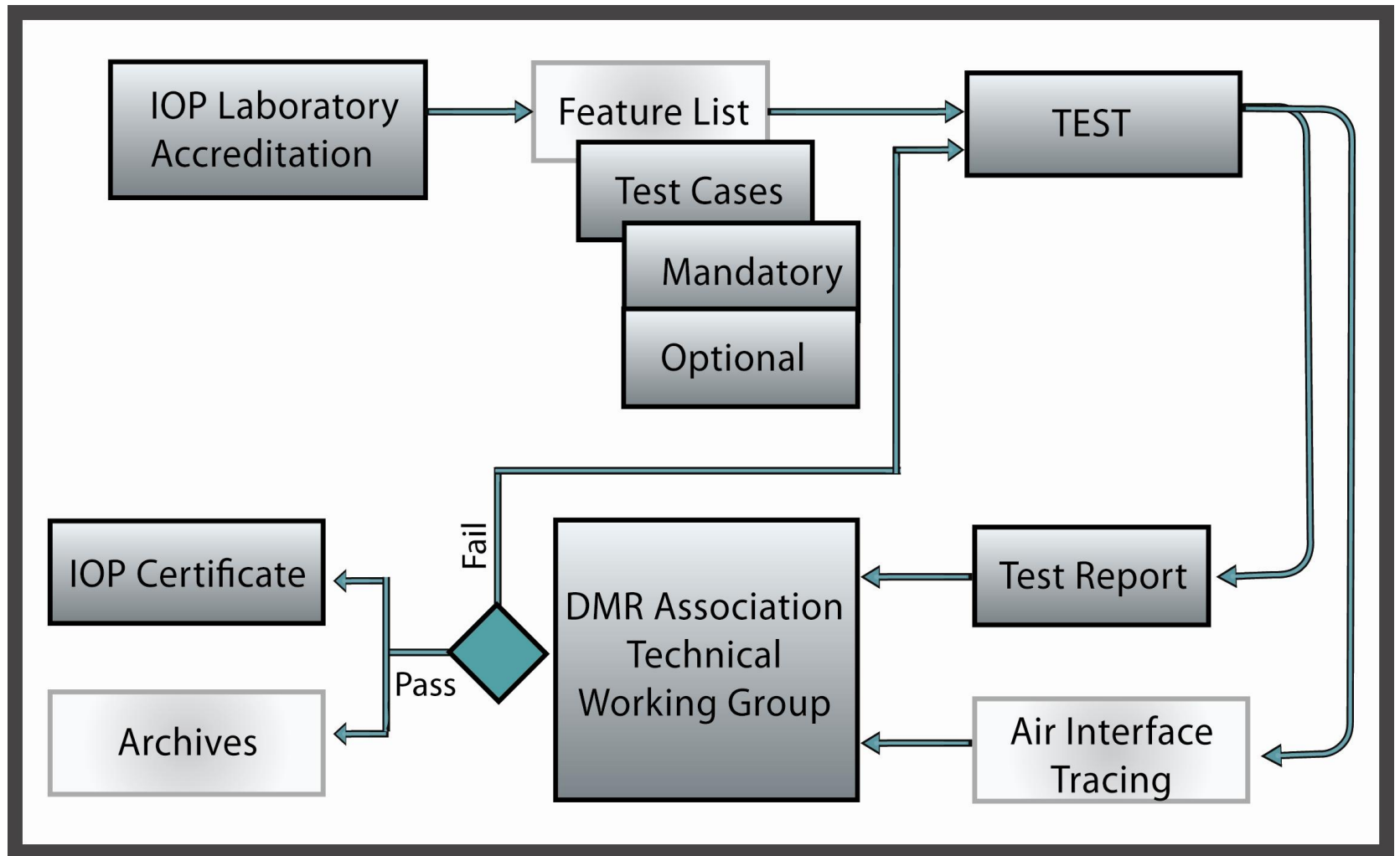
- MS stun / revive
  - Stun /Revive can either be executed with authentication or without authentication
- MS Kill
  - Kill can either be executed with authentication or without authentication
- IP Connection Advice
  - Allows an MS to forward an IP connection address to the Tier III network. It provides the facility to add or delete IP addresses connected to the MS
- MS Radio Check
  - A TS can check if a MS is listening using the radio check

# DMR Interoperability Process

# Principles and background

- Reviewed P25 and TETRA as examples of high quality interoperability
- Both processes are extremely thorough as fits requirements of govt public safety users and contracts worth \$100's millions
- Reviewed ETSI DMR Special Task Force conformance work from time of DMR standardisation
- Took elements of P25, TETRA and ETSI processes and simplified to make appropriate for DMR customers

# Test Process



# Test Process

- DMR Association Technical Working Group appoints a Interoperability co-ordinator who follows a defined documented process (as in P25)
- Have set written quality standards and processes for labs wanting to run tests – reference to ISO 9001 processes
- All labs wanting to run a test session must self-declare compliance with these standards and be acknowledged by Technical Working Group
- Labs can be challenged to demonstrate compliance in the event of complaints/persistent problems

# Test Process

- Tests performed according to tightly agreed documented specifications. There are tests for both Tier 2 and Tier 3 features
- Pre-defined test report formats have been created
- Log files of tests must be collected (As in TETRA)
- Laboratory managers and vendors must sign off all testing

# Tests

- **DMR Association Technical Working Group has defined two types of test for tier 2 and tier 3**
- **Compulsory tests based on requirements in the standard**
- **Optional tests**
- **For tier 2 today**
  - Compulsory: Group Call, Individual Call (PATCS) Individual Call, OACSU, All Call, Emergency call
  - Optional: Call Alert, Radio Check, Remote Monitor, Emergency Alarm, Radio Inhibit and Radio Uninhibit
- **For tier 3 compulsory list similar, optional list is extensive**
  - Compulsory: Registration, OACSU, Group Call, Individual Call, Status call
  - Optional: 38 tests based on the ETSI standard

# Certifications process

- All test results and logs submitted to DMR Association Technical Working Group meeting
- Test results documents are inspected and log files checked by TWG to make sure no inconsistencies with test results.
- Documentation all kept on secure file and certificates issued giving summary of tests.
- In the event of a dispute between vendors certificates will not be issued
- See [http://dmrassociation.org/?page\\_id=339](http://dmrassociation.org/?page_id=339) for certifications and Summary test results.

# Future additions and extensions

# Future developments

- DMR Technical Working Group created to work on future developments to DMR
- Proposed enhancements are debated within the working group to decide how to proceed
- Individuals or groups allocated to progress future developments
- All work reviewed by the DMR Technical Working Group
- Results may reside within the DMR Association or be standardised through ETSI

# Work in progress

- The DMR Technical Working Group is currently working on the following future developments
  - Direct Mode
    - Work is advanced and will allow 2 independent concurrent voice communications in direct mode.
    - Proposal to be tabled at the next ETSI ERMTGDMR working group meeting.
  - Security
    - Air interface aspects and 40bit key length encryption defined. Addition of DES, AES 128 bit key length and AES 256 bit key length is progressing.
    - Proposal accepted and draft specification progressing.
    - Further security additions in discussion.

# Work in progress

## – Application Interface

- Agreement reached on protocol concept for infrastructure. This is based on SIP. Work is progressing and expected to have a specification by end of 2011.
- MS interface not yet decided.

## – Location

- Agreement reached on mandatory and optional Location functionality (bearer independent) for Tier II and Tier III. This is using TETRA LIP as a base.
- Next step is to define the air interface messages in support of the location functionality.

Thank you for your time and  
attention