DMR

DIGITAL MOBILE RADIO ASSOCIATION

DMR Feature Evolution

IWCE

Connecting Critical Communications

Las Vegas, 30th March 2023

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Agenda

- ETSI DMR and the DMR Association
- DMR as a “Green” technology
- Encryption
- Location Information Protocol (LIP)
- USBD Data Polling
- Voice Interrupt
- Emergency Pre-emptive Call
- Dynamic Group Number Assignment (DGNA)
- TG Subscription (Affiliation)
- Voice Call with Embedded Data
- Channel Authorization
- Full Duplex Calls

DMR Tiers and Features - ETSI DMR Standard Parts

DMR Tier 1: Unlicensed

- Products for license-free, non-professional use: PMR446

DMR Tier 2: Conventional

- Professional licensed conventional radio systems operating in PMR frequency bands 30 to 1000 MHz. Targeted at users who need smooth migration from analogue with existing spectrum & licensing, spectral efficiency, advanced voice features and integrated IP data services in licensed bands

DMR Tier 3: Trunked

- Professional trunking operation in frequency bands 30 to 1000 MHz. The ETSI Tier III standard is derived from MPT1327 and is based on Tier II building blocks and features with plenty of additional added-value features

DMR Tiers and Features - ETSI DMR Standard Parts

Current (March 2023) Standard

- ETSI TS 102 361-1 V2.5.1 (2017-10) DMR Air Interface Protocol
- ETSI TS 102 361-2 V2.4.1 (2017-10) DMR Voice and Generic Services
- ETSI TS 102 361-3 V1.3.1 (2017-10) DMR Data Protocol
- ETSI TS 102 361-4 V1.11.1 (2021-01) DMR Trunking Protocol

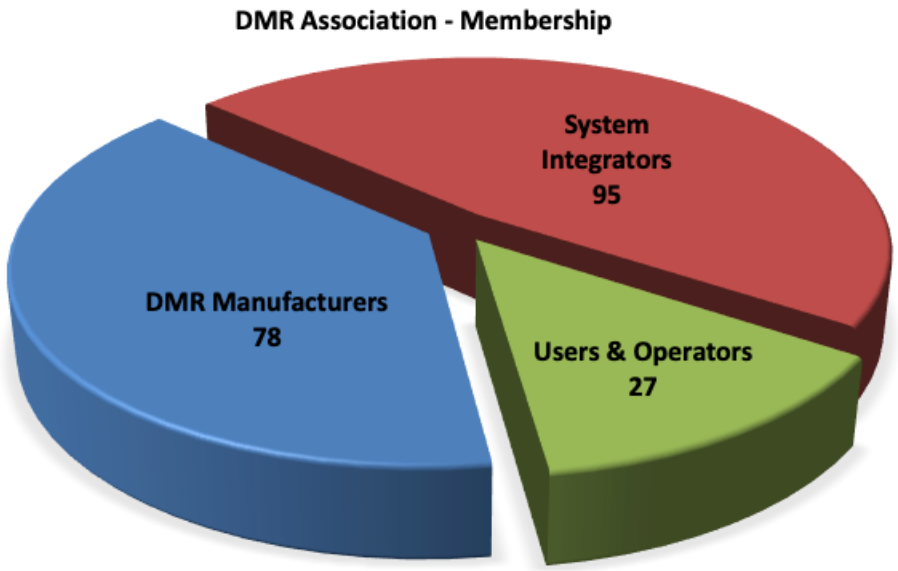
- ETSI TR 102 398 V1.4.1 (2018-11) DMR General System Design

ETSI World Class Standards

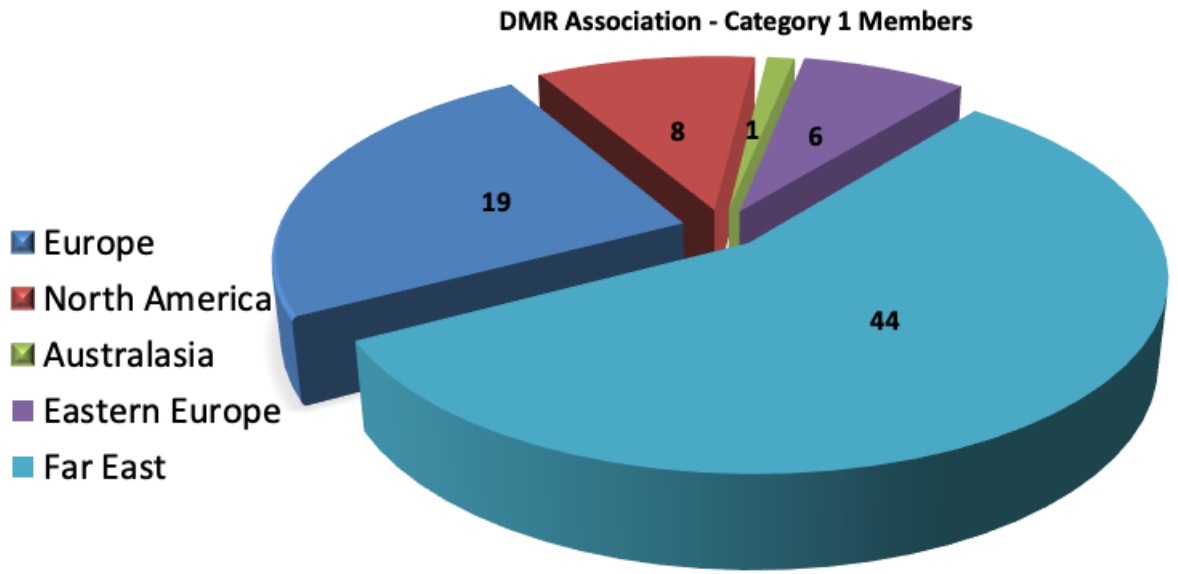
*All these documents can be **freely** downloaded from the ETSI or DMR Association websites:*

www.etsi.org
www.dmrassociation.org

DMR Association



Total of 200 Members Globally



As of Nov 2022

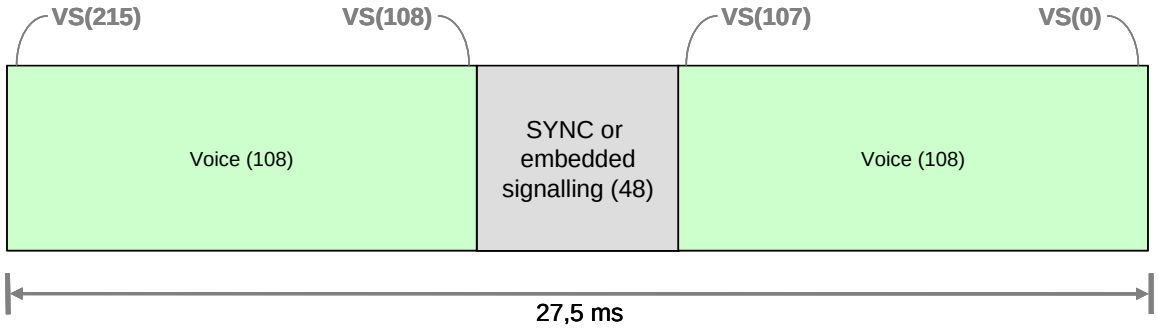
The DMR Association: Mission and Objectives

For DMR we do:

- Operate an equipment interoperability testing and certification program
- Communicate with the user community to capture new requirements
- Enhance the feature set of DMR with new functions
- Offer education and updates about the standard
- Give advice to regulators to ascertain an environment in which the technology can flourish

Encryption

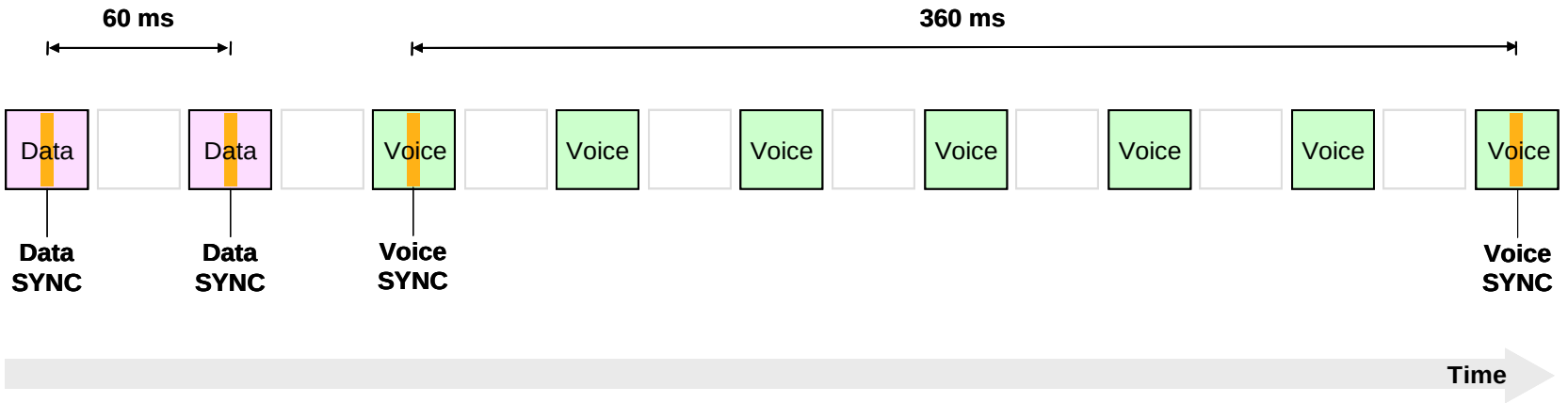
- Solution for voice is tightly coupled to the vocoder selected by the DMR Association
  - ETSI TG DMR did not select any vocoders, it only defined the vocoder socket



- Encryption is defined in the DMR Association
  - ARC4 – 40 bit
  - DES – 64 bit
  - AES128 – 128 bit
  - AES256 – 256 bit
- Solution encrypts voice and data payload
  - Voice Call Late Entry supported

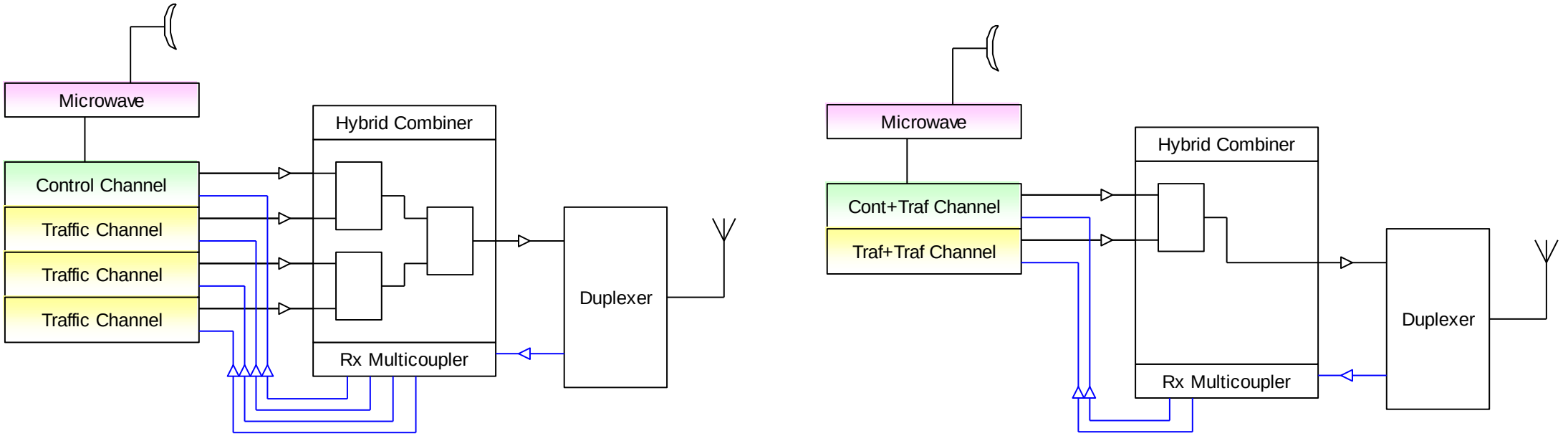
DMR as a “Green” Technology

- 2 Slot TDMA Protocol with 4 Level FSK modulation
  - Greater power amplifier efficiency than linear modulation schemes
    - Less power consumption for equivalent range
  - 40% greater radio battery life than analog or digital with similar modulation



DMR as a “Green” Technology

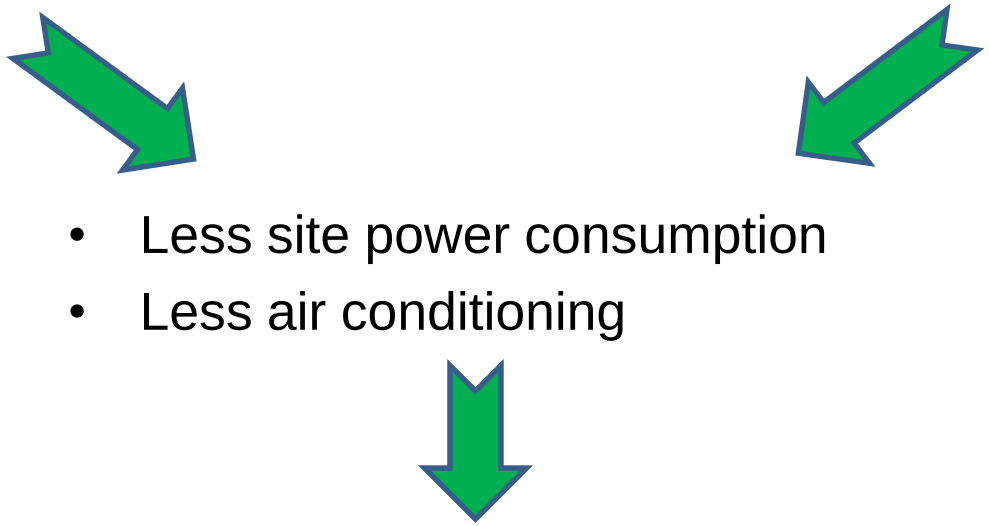
- 2 Slot TDMA Protocol with 4 Level FSK modulation
  - One repeater can support 2 simultaneous calls
  - Antenna combining loss cut in half



DMR as a “Green” Technology

- **Green means fewer greenbacks too**

- Reduced combining loss
- Reduced repeater power for same ERP



- Less site power consumption
- Less air conditioning

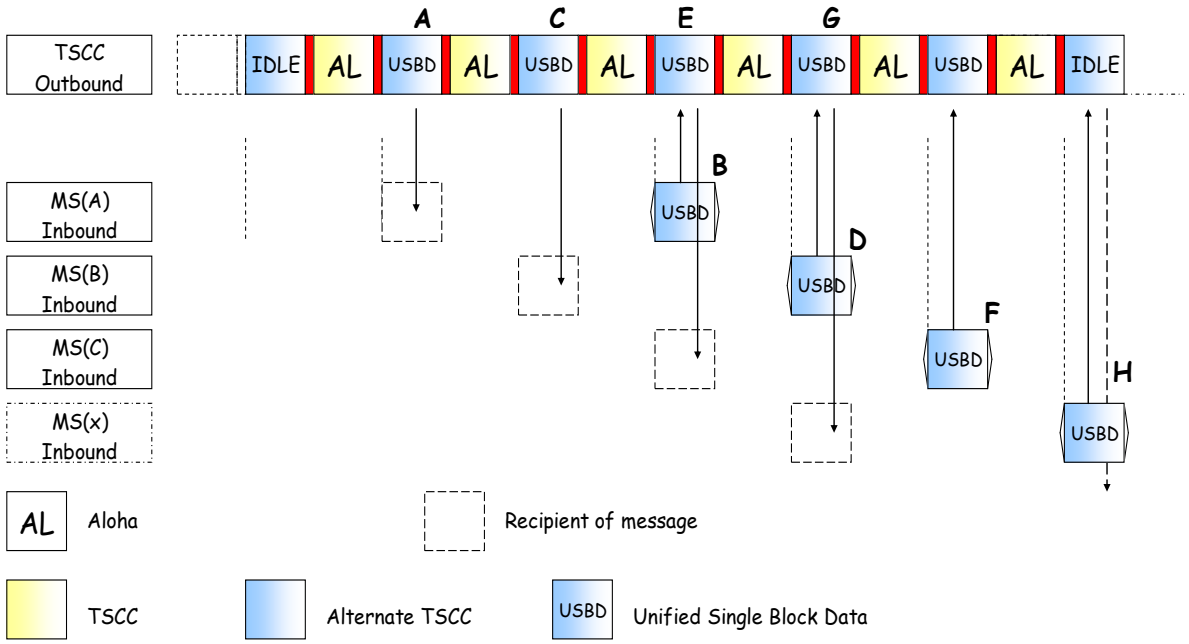
- Less Electricity Cost

Location Information Protocol (LIP)

- DMR Association selected LIP for interoperable location solutions
  - LIP was defined in ETSI for Tetra
    - ETSI TS 100 392-18-1
  - Application protocol supports
    - Over the air configuration of triggers
    - Over the air modification of triggers
  - Example triggers
    - PTT
    - Emergency
    - Periodic
    - Distance
    - Immediate

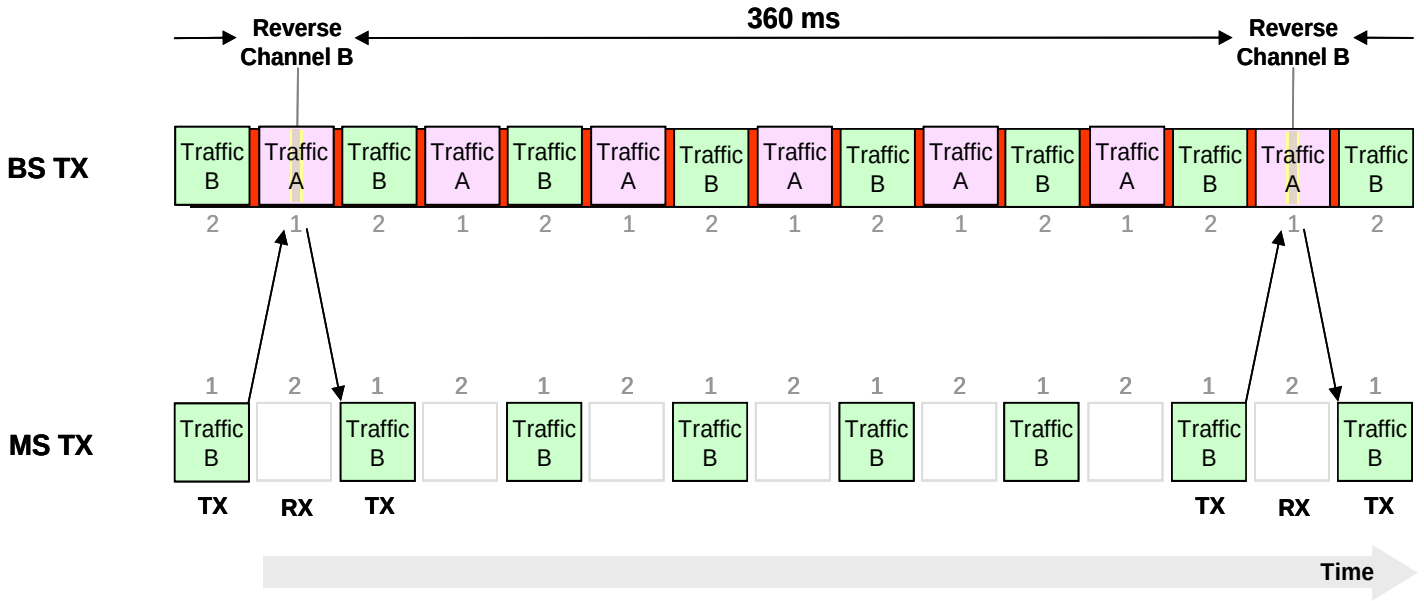
Taking Advantage of a 2 Slot TDMA Protocol

- USBD Data Polling
  - Poll radios for LIP short location reports
    - A single 30 ms burst carries the location information
      - Latitude and Longitude
      - Velocity
      - Direction of Travel
    - The polled location reports support DMR Association Encryption
    - Polling can occur on the control channel
    - Polling can occur on the control channel repeater's alternate slot
      - Up to 1000 location updates per minute per site
    - Supported triggers
      - Periodic
      - Immediate



Taking Advantage of the Reverse Channel

- Voice Interrupt
  - During a voice call a receiving radio can stop the transmission of another radio
    - Interrupt Request and Response sent on Control Channel
    - Interrupt Signaling sent on Payload Channel



  - Call continues (call hangtime) enabling the interrupting radio to initiate a new transmission

Taking Advantage of the Reverse Channel

- Emergency Pre-emptive Call
  - A radio requests a payload channel for an emergency call
  - What happens when no payload channels are available at the site?
    - Trunk Controller selects a payload channel for the emergency call
    - Old Method
      - The current call on the payload channel is terminated
        - » Receiving radios return to the control channel
        - » Transmitting radio continues to transmit
      - Call grants for the emergency call are sent out on the control channel
      - Contention at repeater receiver between emergency transmission and non-emergency transmission
    - New Method
      - The current call on the payload channel is terminated
        - » Receiving radios return to the control channel
        - » Transmitting radio stops transmitting and returns to the control channel – accomplished via RC signaling
      - Call grants for the emergency call are sent out on the control channel
      - NO contention at repeater receiver during emergency transmission

Dynamic Group Number Assignment

- Add a Single Talkgroup and Alias
  - Add a single Talkgroup and it's associated Alias into a radio
  - Example Use Case: Replace current talkgroup with a new temporary talkgroup
    - Includes the Talkgroup Alias

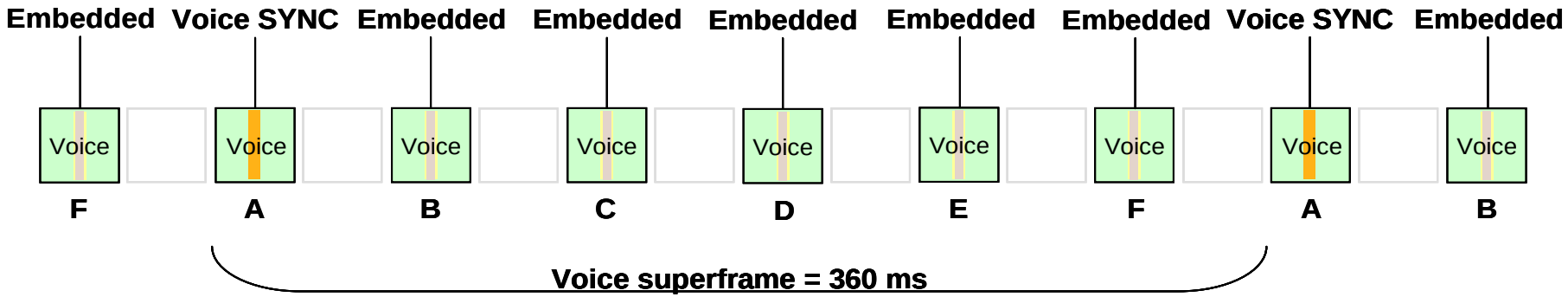
- Add up to 16 Talkgroups
  - Add up top 16 Talkgroups to a radio
  - Example Use Case: Add multiple Talkgroups to a radio
    - Some manufactures utilize this in the transportation markets

TG Subscription (Affiliation)

- Talkgroup Subscription allows a radio to inform the system of talkgroup(s) of interest.
  - A radio can subscribe to up to 7 talkgroups
- The system can make use of this information, when setting up a talkgroup call
- The system only includes radio sites that contain subscribed radios
- This results in optimized system frequency usage and better grade of service
  - The call is not set-up on radio sites that do not contain subscribed MS units

Embedding Data within Voice

- DMR supports embedding data into a voice transmission
  - Superframe bursts B – E
  - Originally utilized to support Late Entry with call specifics
    - Call Type
    - Source Radio ID
    - Target ID (Radio or Talkgroup)
    - Service Options
      - Emergency
      - Privacy
      - Priority Level

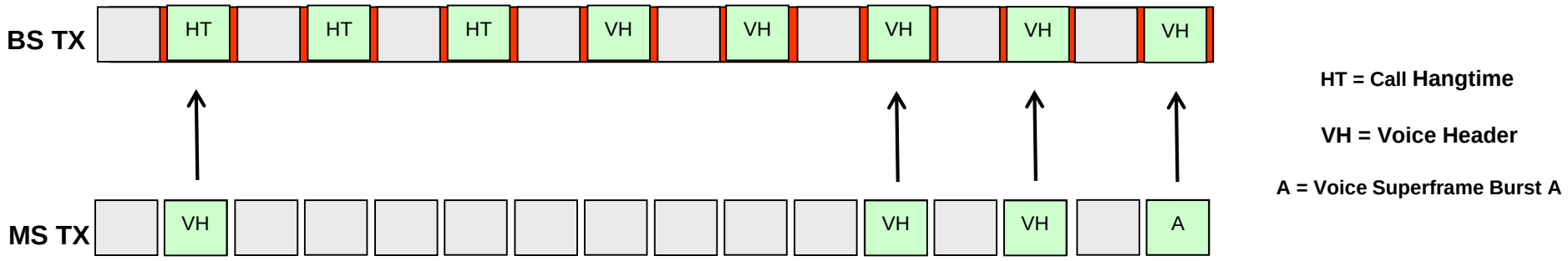


Embedding Voice within Data

- Location
  - LIP short location report is embedded into the voice transmission
    - No need to hold off location information during a call
  - Trigger examples
    - PTT
    - Emergency PTT
- Talker Alias
  - Radio users name can be transferred during a voice call
    - Depending on character encoding, max length between 10 and 23 characters
  - Applicable when radios shared across multiple users
    - User enters name (alias) that is to be transmitted with each voice transmission
    - Target radios then able to display current users name

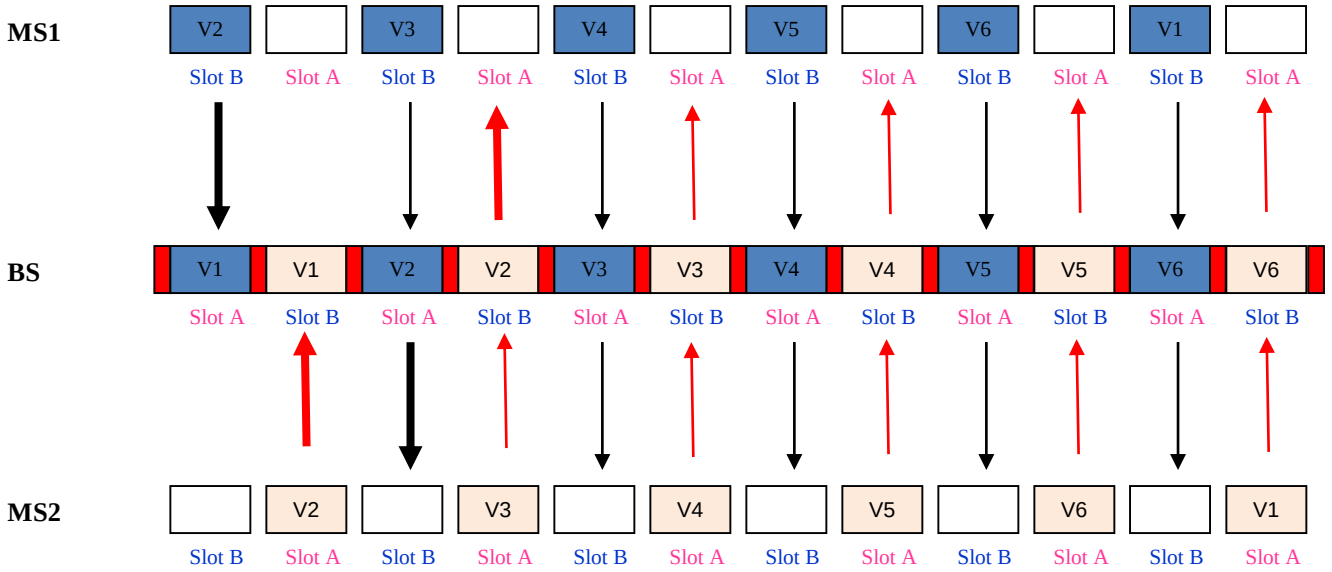
Channel Authorization

- What happens during a group call when someone asks a question?
- RF contention at the repeater from multiple responding radio users
- DMR solves this issue in both Tier 2 and Tier 3 systems
  - Mechanism to select 1 of many responses to eliminate the RF contention scenario



Full Duplex Calls

- Phone Calls (2 calls per repeater)
- Individual Calls (1 call per repeater)



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