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Introduction to DMR and the DMR Association

www.taitradio.com

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Learning Objectives:

1. Know what DMR and ETSI stand for.
2. Understand who the DMR Association is and what they do.
3. Clarify the differences between DMR Tiers I, II and III.
4. Learn some of the features and business benefits of DMR.

DMR and ETSI

Digital Mobile Radio (DMR) is a digital radio standard specified for professional mobile radio (PMR) users developed by the European Telecommunications Standards Institute (ETSI), and first ratified in 2005.

DMR Association

DMR Association background

- 2005 – DMR-MOU Association (Memorandum of Understanding)
- 2009 - MOU members set up the DMR Association
- Membership is divided into categories:
 - Category 1 – Equipment Manufacturers (24)*
 - Category 2 – Application Developers, System Integrators, Peripheral Equipment Manufacturers, Test Houses (9)*
 - Category 3 – Users, Regulators and Operators (8)*
 - Partners – Others (2)*

*As of 28Aug12

DMR Association Activities

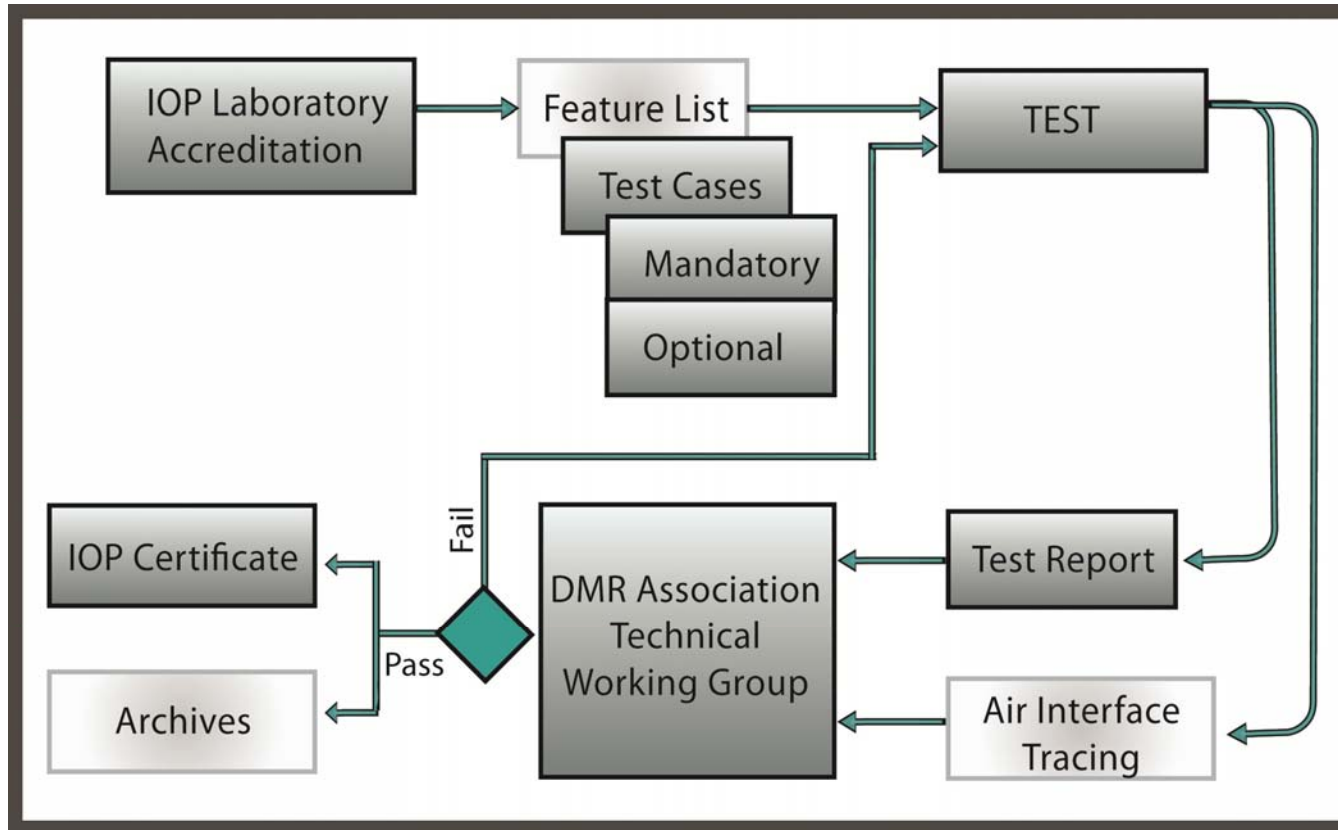
- Creating an interoperability testing and certification program
- Working with regulators to develop a favorable environment for DMR networks to flourish
- Increasing awareness about the DMR standard through education, promotion and discussion

DMR Association website

www.dmrassociation.org

DMR Interoperability

DMR IOP process



Source www.dmrassociation.org

Interoperability testing

- IOP testing has been defined for:
 - Standard Tier 2 voice functionality
 - Additional Tier 2 voice functionality
- IOP testing for Tier 3 is underway
 - 20 June 2012 – The Digital Mobile Radio (DMR) Association announces the first successful completion of DMR Tier III interoperability testing.

DMR Standard

DMR Standard documentation

[TS 102 361-1: the DMR air interface protocol](#)

[TS 102 361-2: the DMR voice and generic services and facilities](#)

[TS 102 361-3: the DMR data protocol](#)

[TS 102 361-4: the DMR Trunking protocol](#)

[TR 102 398: DMR General System Design](#)

What is the DMR standard

- Open standard
- Targets migration to digital of existing conventional and analog trunked systems
- Achieves more efficient use of spectrum
- 3 Tiers of products specified
 - Tier I – Unlicensed, low power, low cost
 - Tier II – DMR Licensed Conventional
 - Tier III – DMR Licensed Trunked

Tier I Definition

- License free operation in 446.100-446.200 MHz
TX power of 500mW, Integral antenna
- TDMA two slot (DMR) in 12.5Khz
- or FDMA (dPMR) in 6.25Khz
- State of the art Forward Error Correction

Tier II Definition

- Digital conventional operation
- Systems, mobiles and hand portables
- Licensed 66MHz - 960MHz
- Advanced Voice features
- Integrated IP data services
- TDMA two slot in 12.5kHz
- 4FSK modulation
- State of the art Forward Error Correction

Tier II Call Features

- Group call
- Individual call
- All call
- Broadcast call
- Radio stun and revive
- Remote monitor
- Radio check
- Call alert
- PTT ID
- Emergency call options

Tier III Definition

- Digital trunked operation
- Systems, mobiles and hand portables
- Licensed frequency bands 66MHz - 960MHz
- TDMA two slot in 12.5kHz
- 4FSK modulation
- Enhanced Voice
- 128 character status messaging
- 288 bits data short messaging in a variety of formats
- Packet data services, including IPv4 and IPv6
- State of the art Forward Error Correction

DMR Tier III Services (1 of 3)

- Call features
 - Broadcast call
 - Priority call
 - Emergency call
 - Status call
 - Divert own call
- Gateway calls
 - Telephone call
 - PABX call
 - IP call

DMR Tier III Services (2 of 3)

- Other gateways (Trunking)
 - Registration
 - Authentication
- Trunking Services
 - MS stun
 - MS revive
 - MS kill
 - Poll MS
 - MS check
 - Defined structure for location information transport
 - Mass registration
 - Sleep mode for Control Channel operation (more...)

DMR Tier III Services (3 of 3)

- IP data
- Short data messages
- Confirmed and unconfirmed data
- Raw air interface data rate 9600 kbps
 - Useable rate two slots 6533 kbps no FEC, headers
- What does this mean for the users
 - AVL
 - Text dispatch
 - Workforce management
 - Email

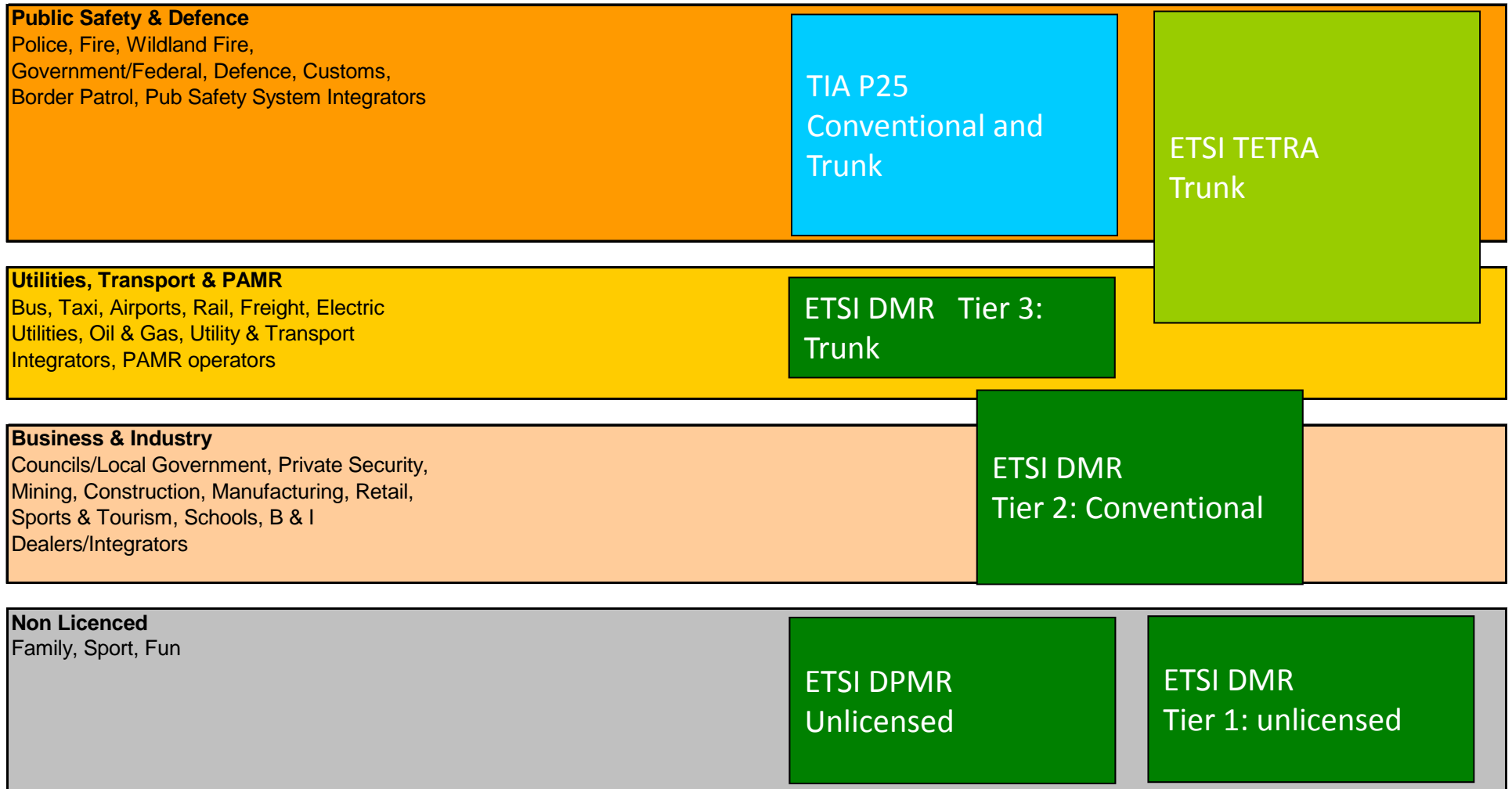
DMR Standards – what's not defined

- The choice of vocoder
 - DMR MOU has agreed to use the DVSI AMBE2+ vocoder
- Non application interface (AI) connections from repeater
 - PSTN, PABX, Repeater to repeater,
 - Encryption

DMR Standard - Summary of Tiers

- Tier I
 - License free operation in 446.100-446.200 MHz
TX power of 500mW, Integral antenna
 - TDMA two slot (DMR) in 12.5Khz or FDMA (dPMR) in 6.25Khz
- Tier II
 - Digital conventional operation
 - Licensed higher TX power
 - TDMA two slot in 12.5kHz
 - 4FSK Modulation
- Tier III
 - Digital Trunked operation
 - Licensed higher TX power
 - TDMA two slot in 12.5kHz
 - 4FSK Modulation

Digital Standards Market Positioning

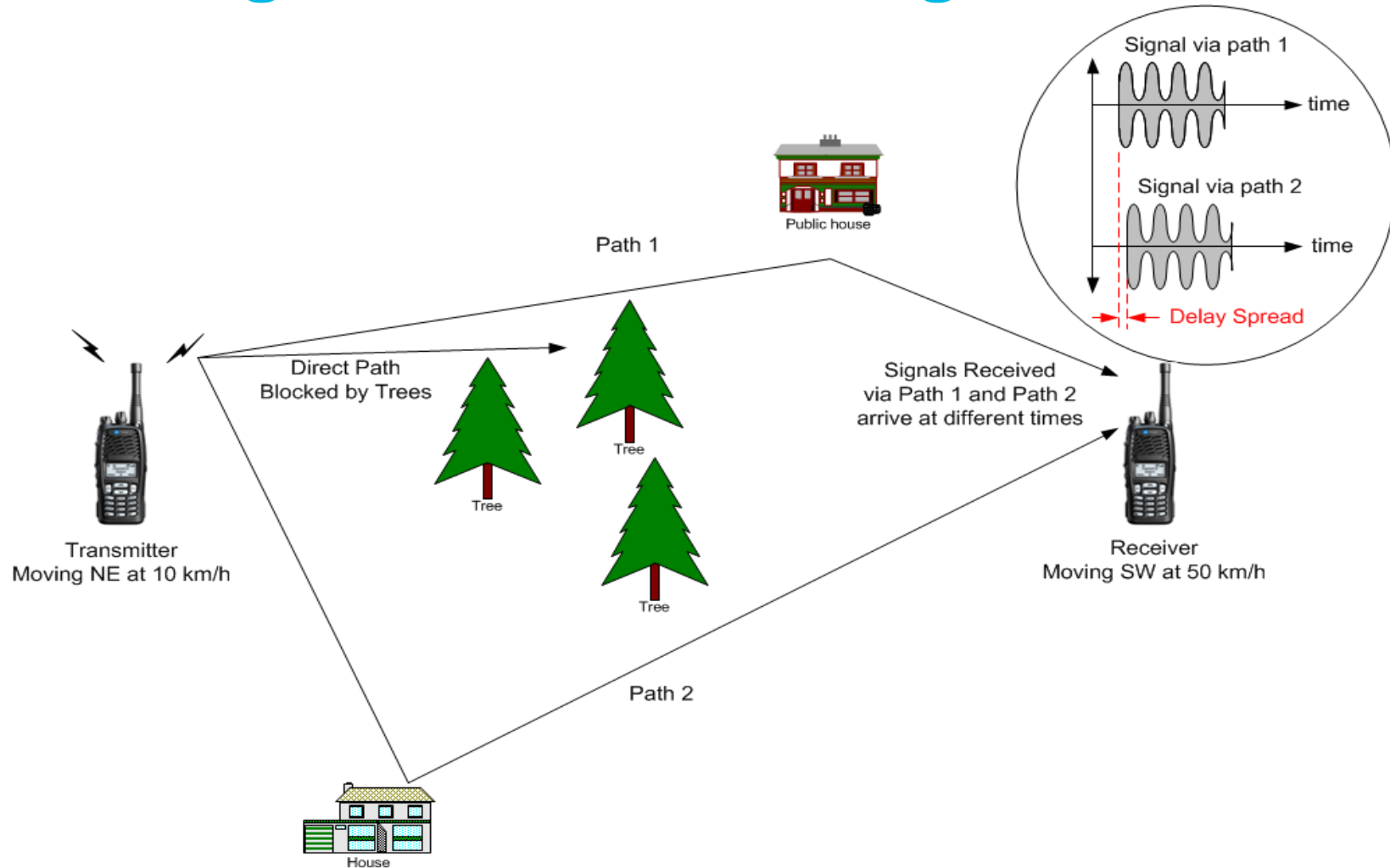


DMR Features and Benefits

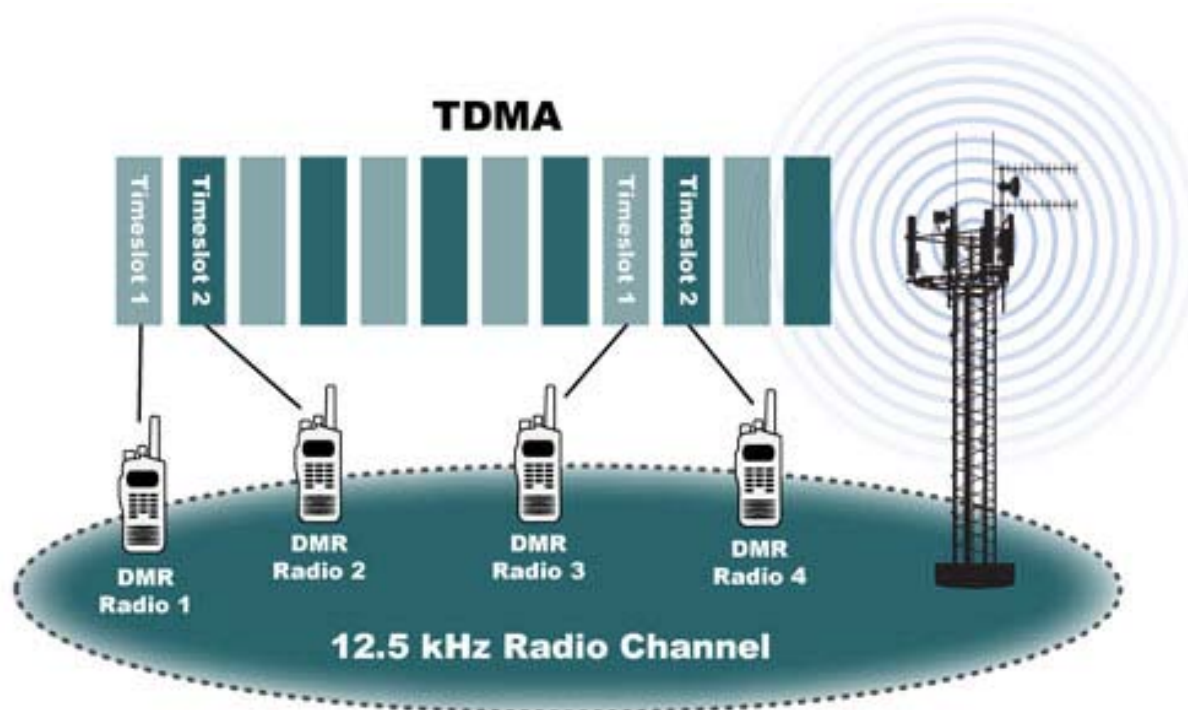
Coverage – DMR Theoretical Coverage

- A 1mS Guard Slot exists between neighboring TDMA slots
- If DSP Clock has accuracy of +/-2ppm, this accounts for 0.5mS
- Remaining 0.5mS available to account for propagation delays
- In 0.5mS, the signal from Tx A travels: $3 \times 10^8 \text{ m/s} \times 0.5\text{mS} = 150\text{km}$
- In practice, this number is halved to account for Uplink and Downlink
- So, the theoretical range limit of the DMR TDMA system is 75km.

Coverage – Same as Analogue FM

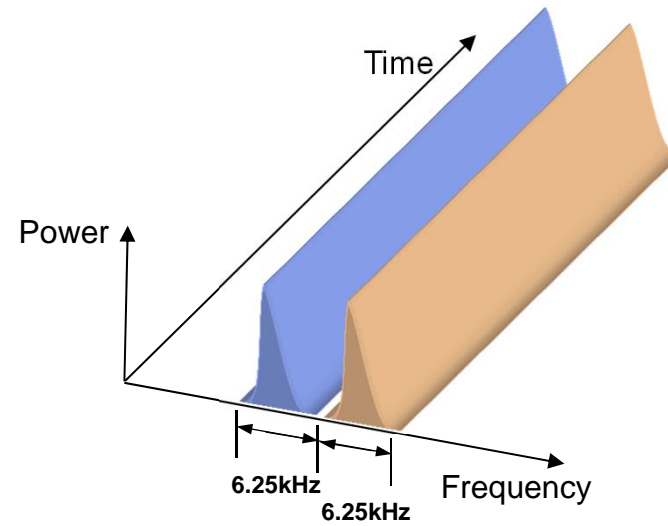
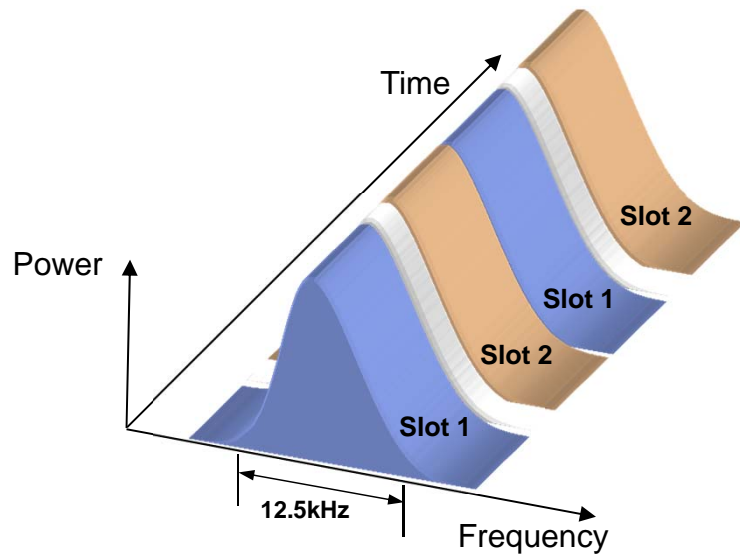


Predictable doubling of capacity in your existing 12.5 kHz licensed channels

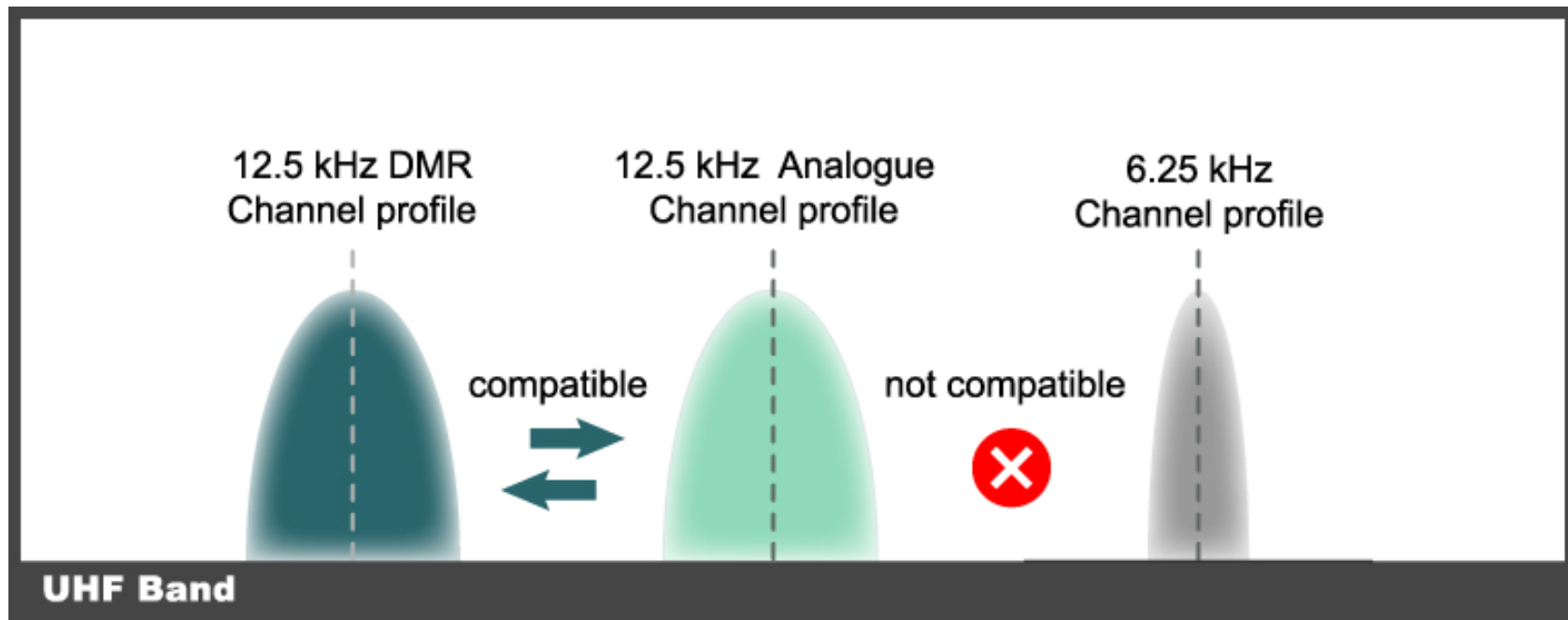


Source www.dmrassociation.org

Choice of Operation

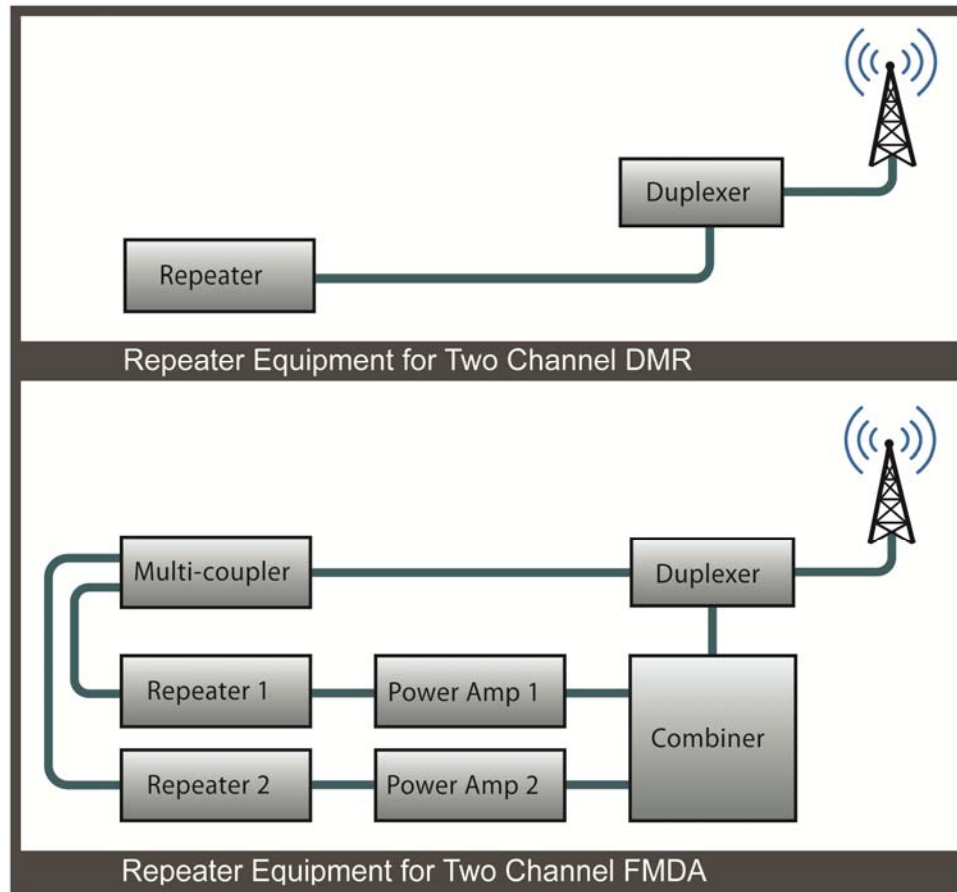


Backwards spectrum compatibility with legacy analogue systems



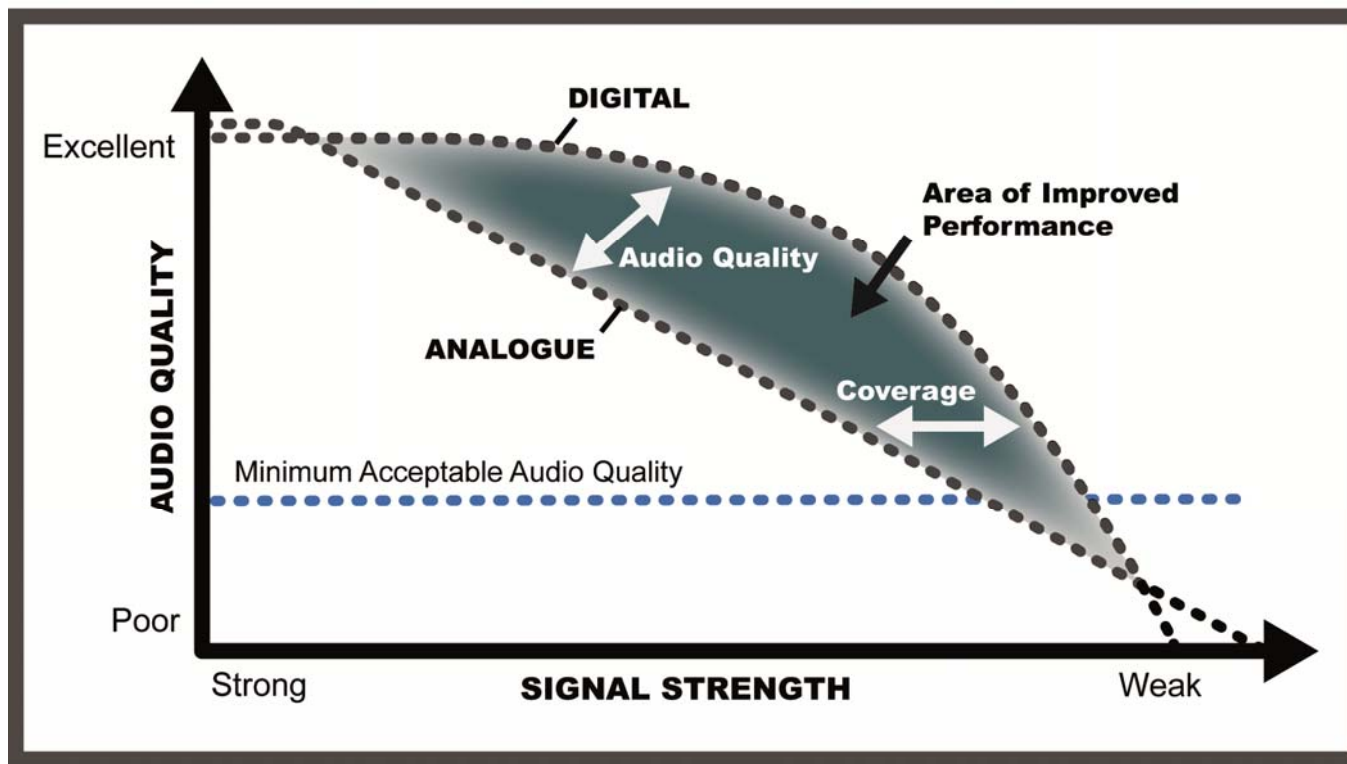
Source www.dmrassociation.org

Efficient use of infrastructure equipment



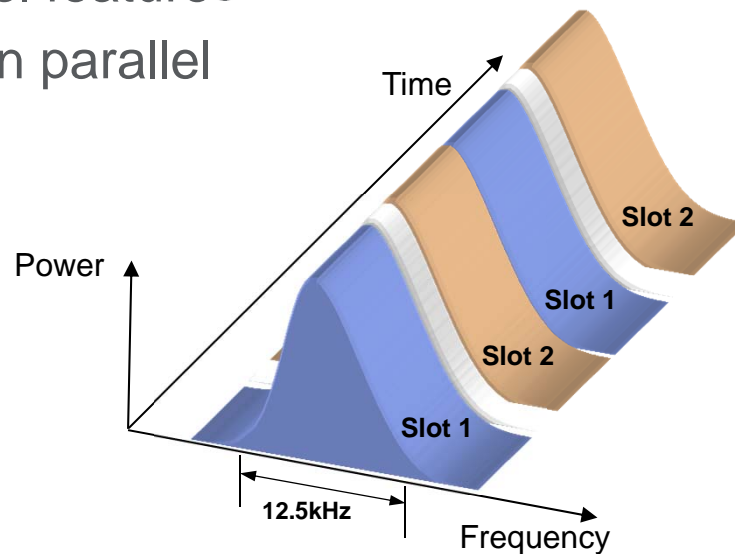
Source www.dmrassociation.org

Improved audio quality to the edge of coverage



Other Benefits of DMR

- Longer battery life
- Ease of use and creation of data applications
- Advanced Control features
- Voice and Data in parallel





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DMP

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