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Introduction to DMR

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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 for utilities.
5. Hear “Words of caution” migration considerations

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 (23)*
  - Category 2 – Application Developers, System Integrators, Peripheral Equipment Manufacturers, Test Houses (13)*
  - Category 3 – Users, Regulators and Operators (8)*
  - Partners – Others (2)*

*As of 04MAR13

DMR Association Activities

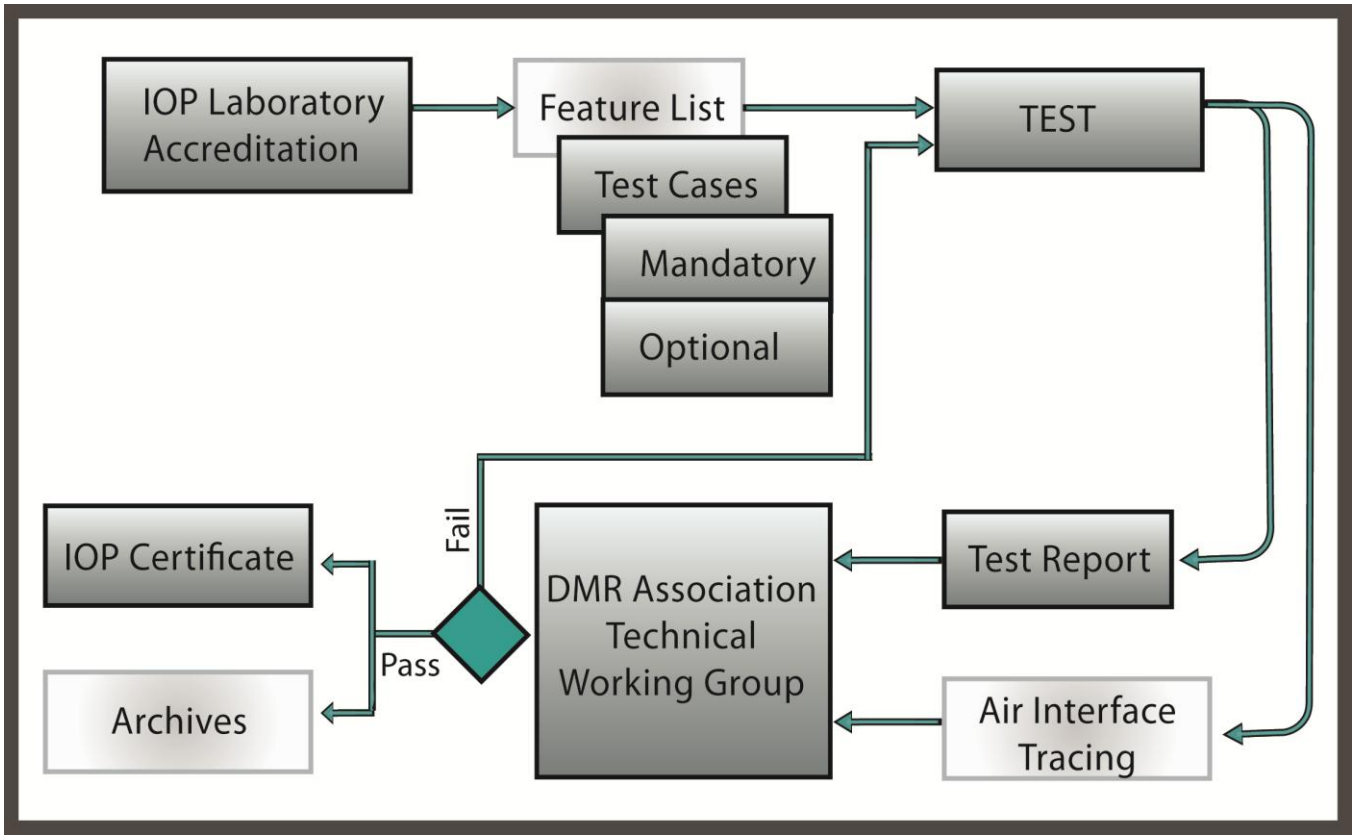
- Creating an interoperability testing and certification program
- Working with regulators to develop a favorable environment for DMR networks to flourish
- Increasing awareness about the DMR standard through education, promotion and discussion

DMR Association website

www.dmrassociation.org

DMR Interoperability

DMR IOP process



Source www.dmrassociation.org

MANUFACTURER	IOP CERTIFICATION	INFRASTRUCTURE	MOBILE TERMINALS
Hytera Respond & Achieve			
		AVAILABLE	AVAILABLE
	TIER 2 | TIER 3	Tier 2 | Tier 3	Tier 2 | Tier 3
MOTOROLA SOLUTIONS			
	TIER 2	AVAILABLE	AVAILABLE
		Tier 2	Tier 2
Selex ES A Finmeccanica Company			
		AVAILABLE	-
	TIER 2	Tier 2 | Tier 3	
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		AVAILABLE	AVAILABLE
	TIER 3	Tier 3	Tier 3
Vertex Standard			
	TIER 2	AVAILABLE	AVAILABLE
		Tier 2	Tier 2

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

- Global open standard
- Targets efficient migration to digital from existing conventional and analog trunked systems
- Achieves doubling of capacity in existing 12.5 kHz licensed channels
- 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 Conventional 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

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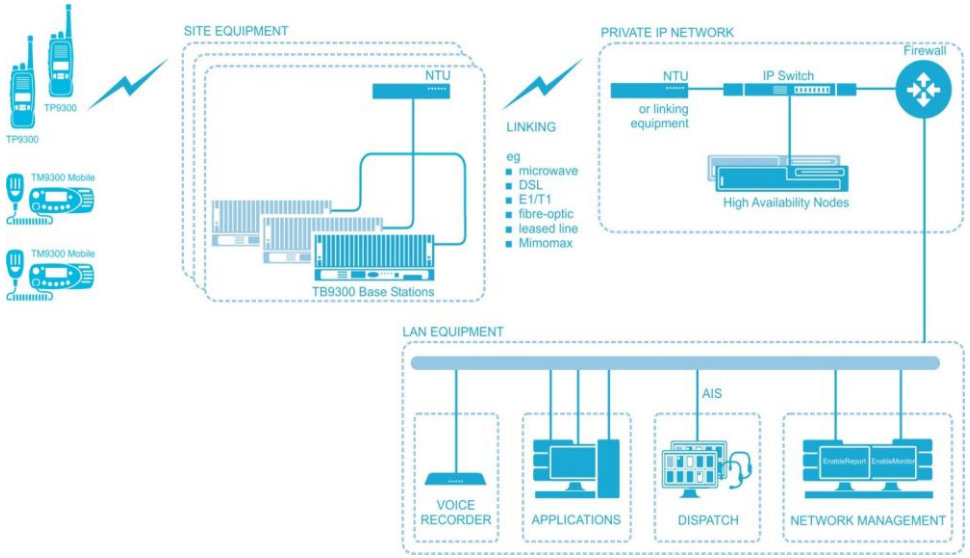
DMR Tier III Services (2 of 3)

- 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
- Encryption, but DMR TWG has agreed a common definition: ARC4 AES and DES.
- DMR TWG has also agreed to develop the Application Interface Specification (AIS) as it's console interface.

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

Public Safety & Defence
Police, Fire, Wildland Fire,
Government/Federal, Defence, Customs,
Border Patrol, Pub Safety System Integrators

TIA P25
Conventional and
Trunk

ETSI TETRA
Trunk

Utilities, Transport & PAMR
Bus, Taxi, Airports, Rail, Freight, Electric
Utilities, Oil & Gas, Utility & Transport
Integrators, PAMR operators

ETSI DMR Tier 3:
Trunk

Business & Industry
Councils/Local Government, Private Security,
Mining, Construction, Manufacturing, Retail,
Sports & Tourism, Schools, B & I
Dealers/Integrators

ETSI DMR
Tier 2: Conventional

Non Licenced
Family, Sport, Fun

ETSI DPMR
Unlicensed

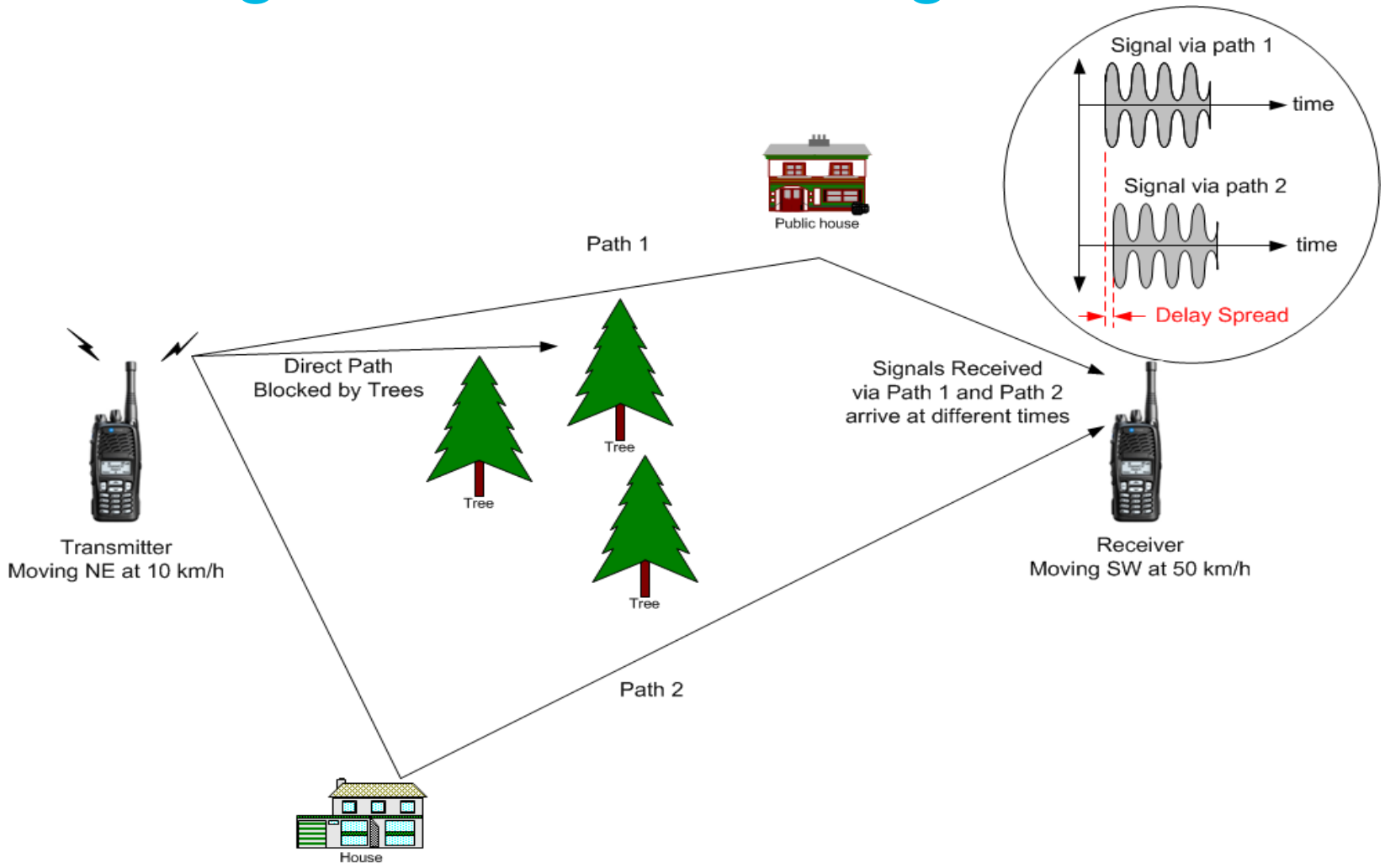
ETSI DMR
Tier 1: unlicensed

DMR Features and Benefits

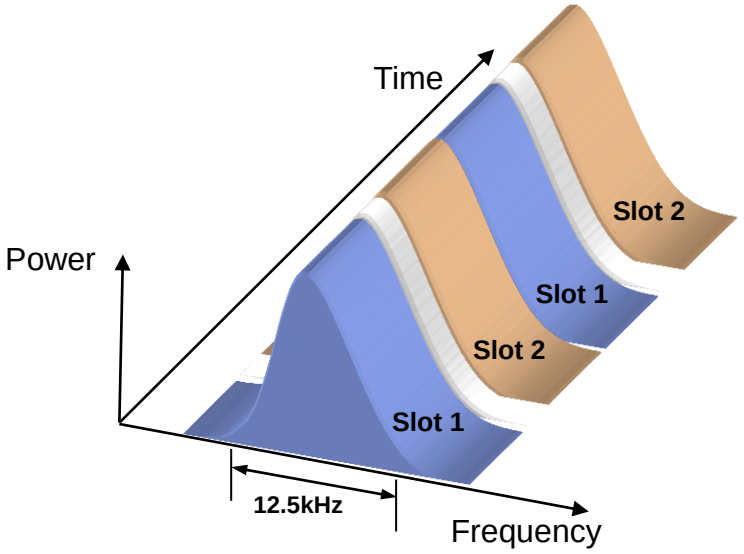
Coverage – DMR Theoretical Coverage

- 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: 3×10^8 m/s x 0.5mS = 150km
- In practice, this number is halved to account for Uplink and Downlink
- So, the theoretical range limit of the DMR TDMA system is 75km.

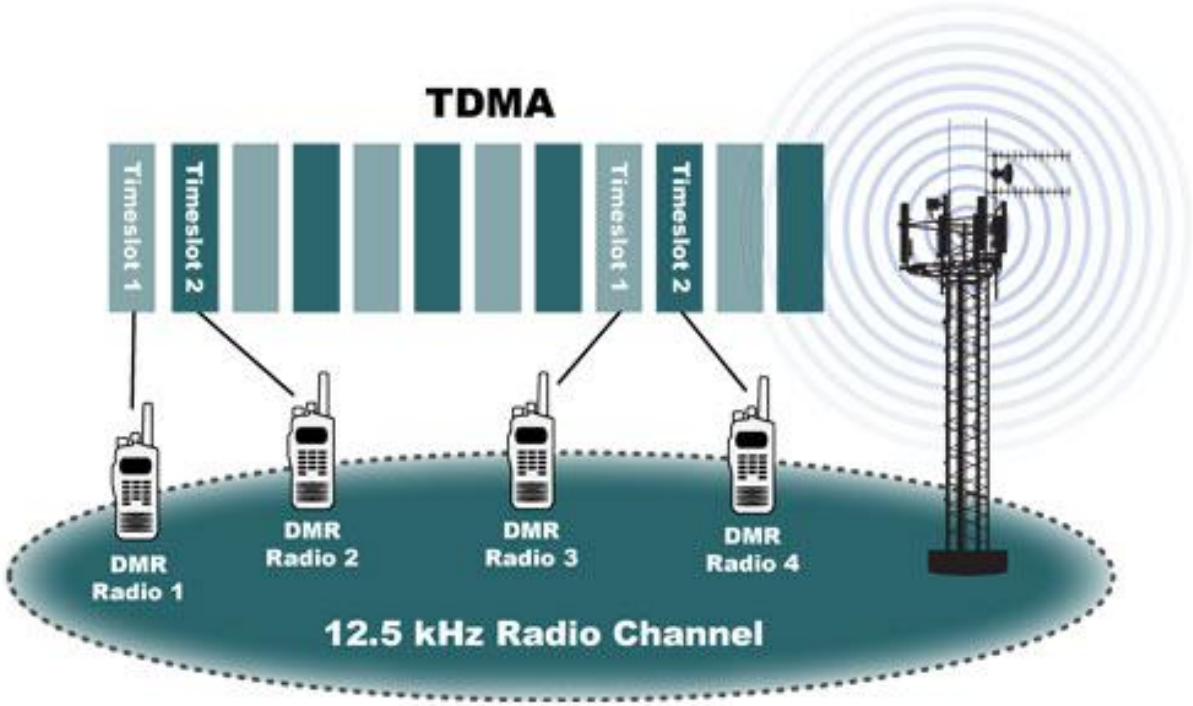
Coverage – Same as Analogue FM



Choice of Operation

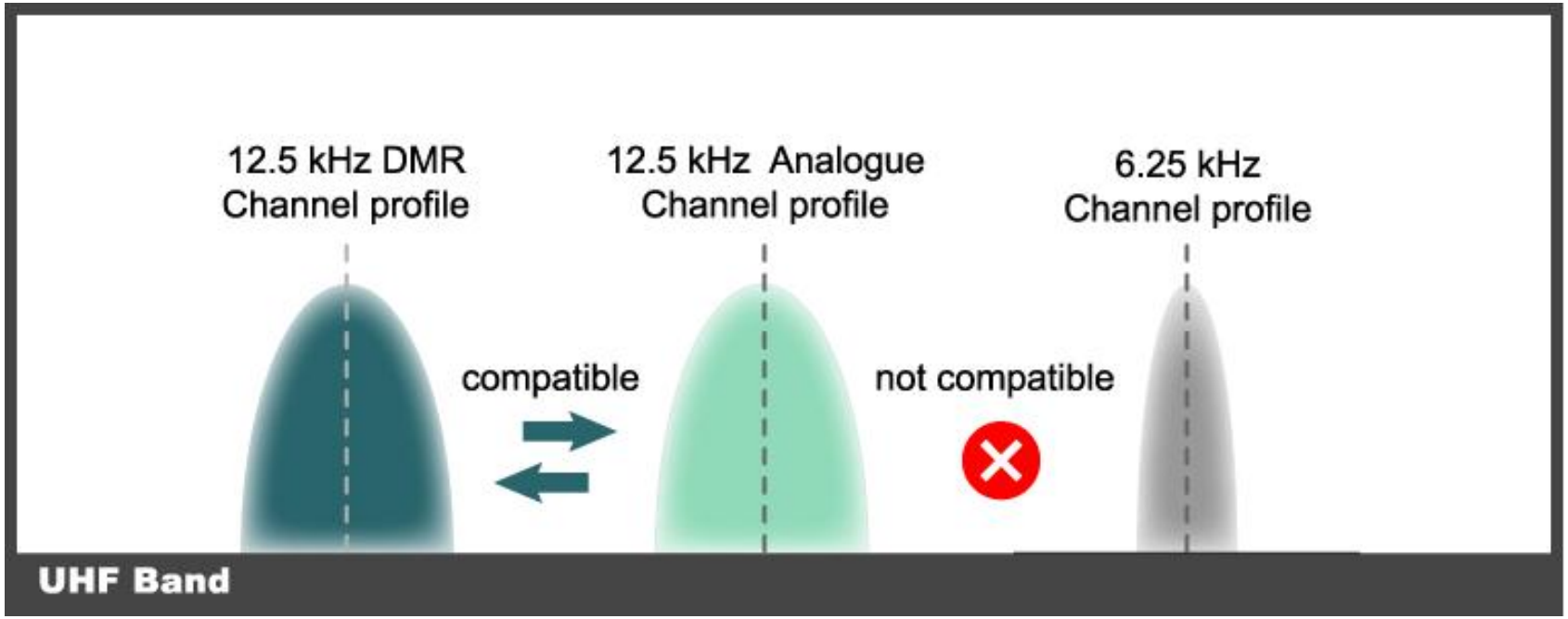


Predictable doubling of capacity in your existing 12.5 kHz licensed channels



Source www.dmrassociation.org

Backwards spectrum compatibility with legacy analogue systems



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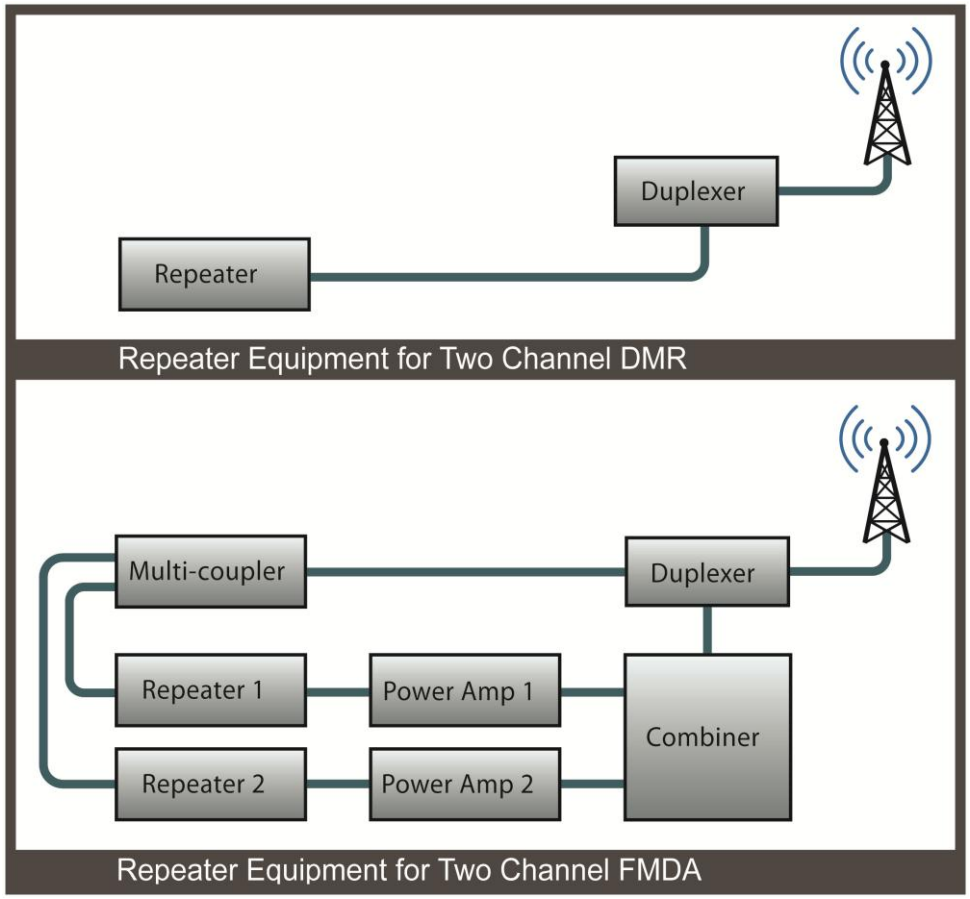
Efficient use of infrastructure equipment



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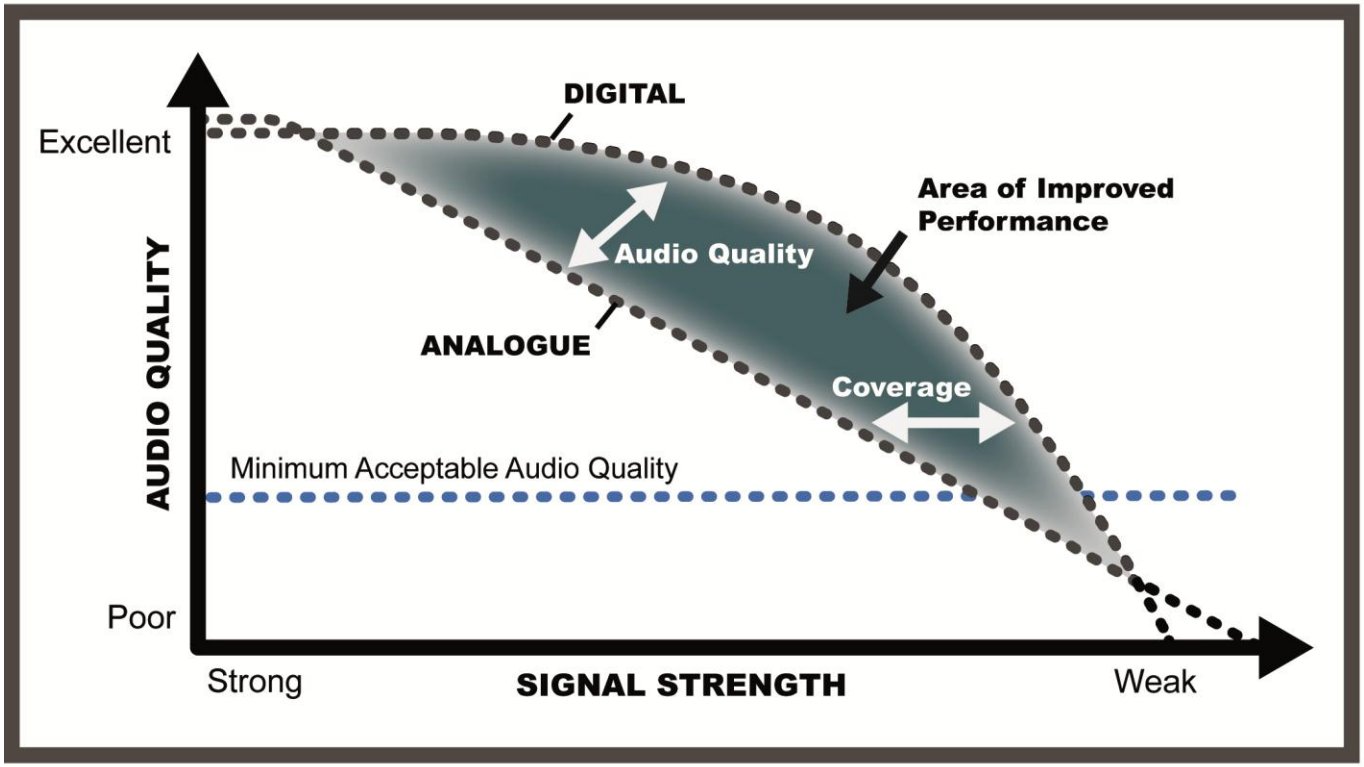
Improved audio quality to the edge of coverage



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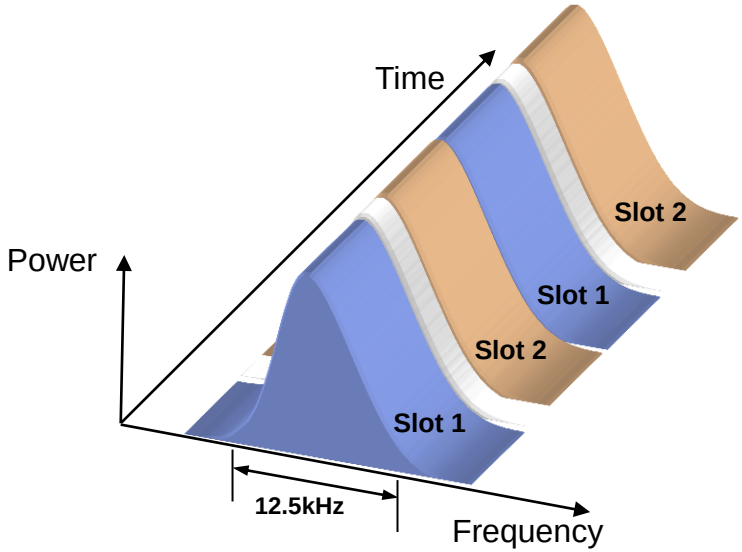
Other Benefits of DMR – (1 OF 2)

- Advanced Control features
- Voice and Data in parallel



Other Benefits of DMR – (2 of 2)

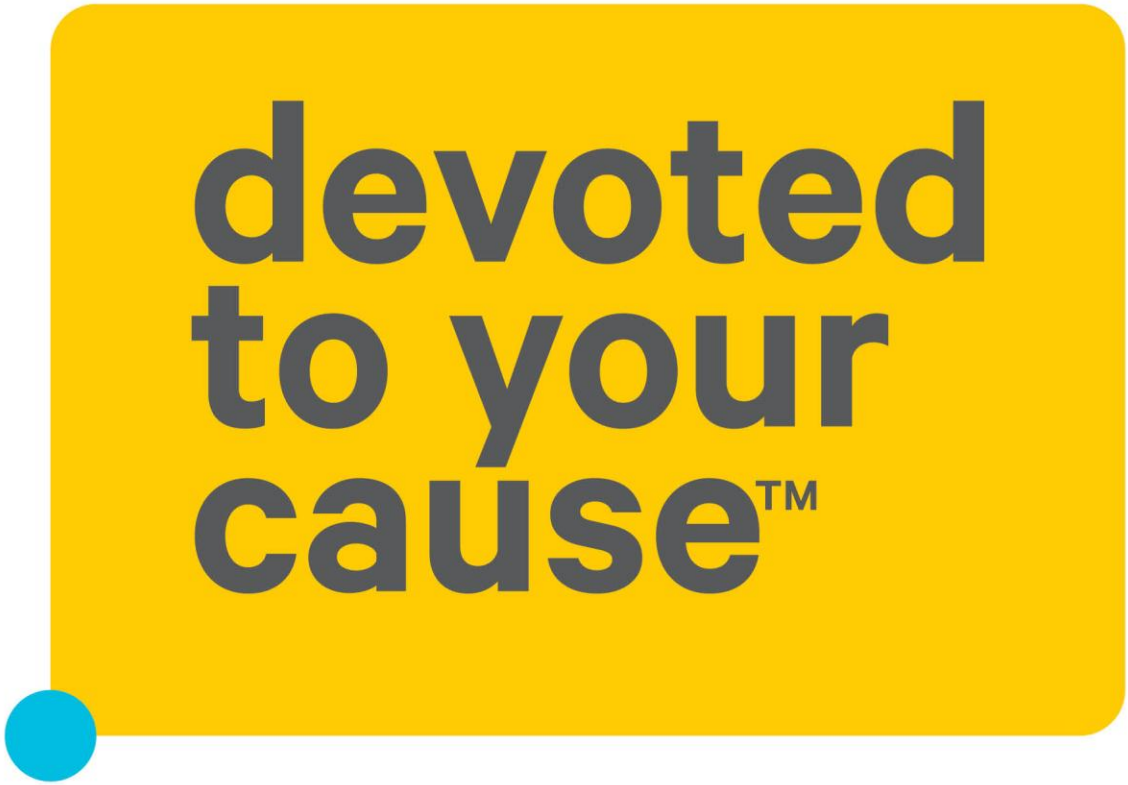
- Longer battery life
- Ease of use and creation of data applications

Key Benefits Summary for utilities:

- Confirm Predictable doubling of capacity within existing channels
- Backward spectrum compatibility with legacy analogue systems
- Efficient use of infrastructure equipment
- Longer battery life and greater power efficiency
- Ease of use an creation of data applications
- System flexibility through simultaneous use of TDMA channels
- Advanced control features
- Superior audio performance
- Security of supply through a fully open, well established, globally backed standard

“Words of Caution” - Migration Considerations

- Confirm stakeholders and interoperability requirements.
- Understand the differences between the available digital platforms.
- Know your migration plan details before you buy.
- Accept there will be audio quality differences.
- Don’t ignore your IT department in design decisions.
- Even if technology will allow reuse of existing infrastructure, 15+ years old antennas, lines, etc. should be evaluated for replacement.
- Check your mobiles and portables as they will likely have to be replaced.
- Don’t assume no user training is required.
- Be assured of continuity of supply.



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