



**T**errestrial Trunked R**A**dio

# ***TETRA Release 2.0 Overview***

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## ***Agenda***

- **TETRA Release 1 offering**
- **Why TETRA 2?**
- **What is TETRA 2 data technology?**
- **How does TETRA 2 enhance TETRA?**
- **When will TETRA 2 standard be available?**
- **Summary and conclusion**



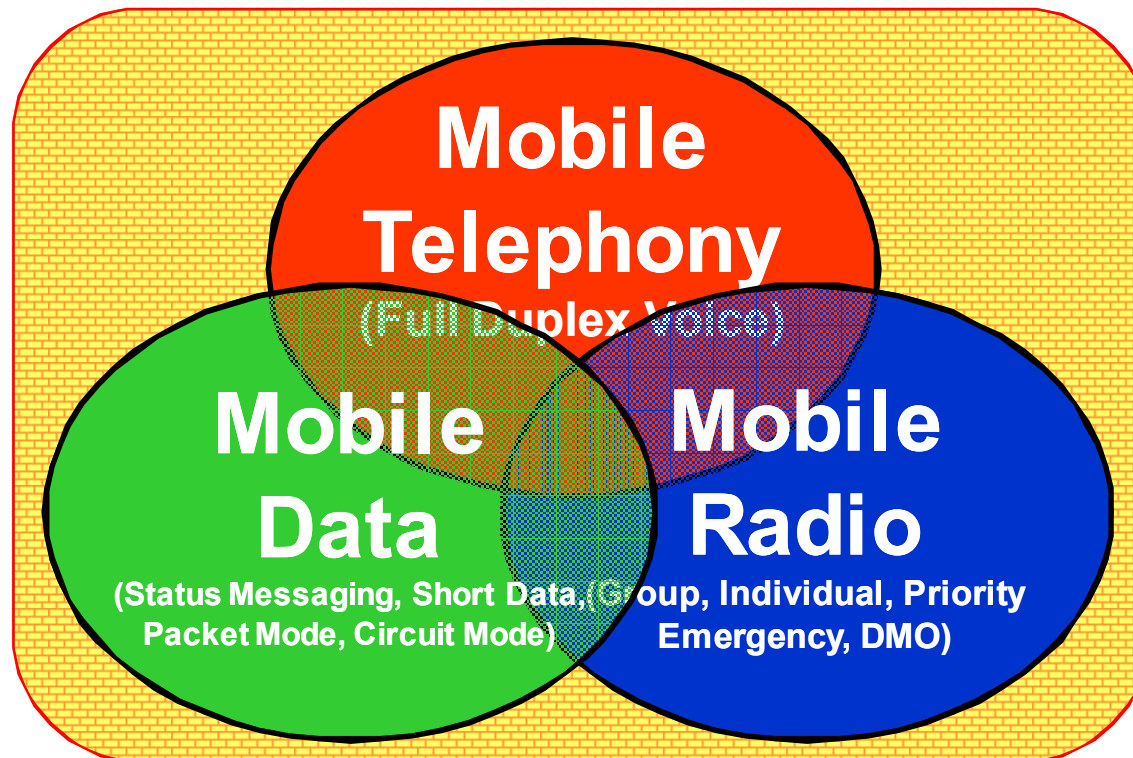


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## ***What does TETRA Release 1 offer?***



***All in a secure environment***



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## ***So why do we need TETRA Release 2?***

<b>Market need</b>	<b>Issues</b>	<b>TETRA User Requirements</b>
Mission critical multimedia data for multiple users	TETRA Release 1 can handle some multimedia (e.g. slow scan video), but with capacity implications	High Speed Packet Data (TEDS)
Roll-out of nation wide networks	Don't want to have to install extra sites when upgrading to TETRA 2  Continue to use TETRA 1 radios	TETRA R2 backwards compatible with R1.  Operate inside TETRA R1 frequency bands.
Air to ground & linear utilities	Small proportion of applications operate over much larger distances.	Enhance coverage
Deploy TETRA for special operations	Specialist users want full duplex telephony to own networks	NATO codec
Complement 3G in PMR/PAMR	Need to optimise for 3G-compatible services, provisioning, roaming etc.	High Speed Packet Data (TAPS or TEDS) AMR codec, SIM evolution Spectrum efficiency, Network capacity, system performance, QoS, terminal optimisation

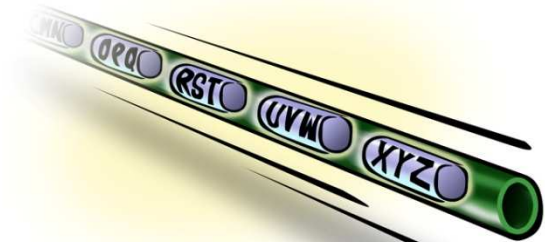


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## ***High Speed Packet Data***

- **Evolution of TETRA, which allows Packet Data at speeds more than 10 times that available in TETRA 1**
- **Two phased approach to meet conflicting market needs:**
  - TETRA Advanced Packet Service – TAPS  
To meet PAMR Operators' need for rapid deployment
  - TETRA Enhanced Data Service - TEDS  
To meet need for backward compatibility

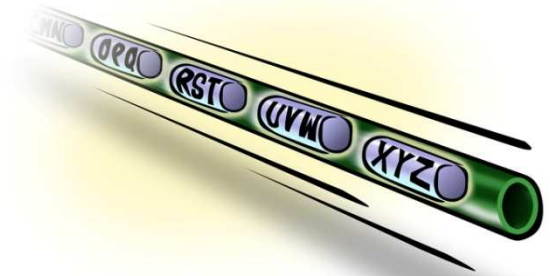






## ***TETRA Advanced Packet Service – TAPS***

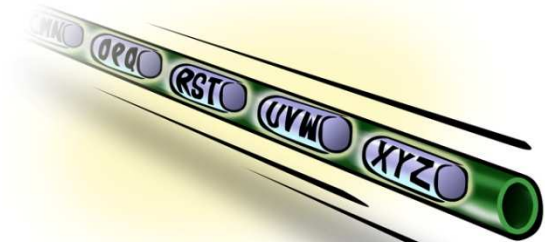
- **Data rates up to 384 kbit/s in 200 kHz channel raster**
- **Adaptation of GPRS and EDGE technology**
- **Overlay system**
  - Needs new Infrastructure and Terminals
- **Integration of TAPS standards in the GSM standards set has been requested**





## ***TETRA Enhanced Data Service - TEDS***

- **Backward compatible with TETRA Release 1**
  - Network integration capability
- **Flexible data rates and spectrum use**
  - 25, 50, 100 and 150 kHz channels
  - Can trade off data rate, spectrum and range
- **Integrated TETRA 1 and TEDS system**
  - i.e. can receive TETRA 1 calls on TEDS channels
- **Technology selected for TEDS use**
  - Multi-carrier QAM
  - Parameters being optimised





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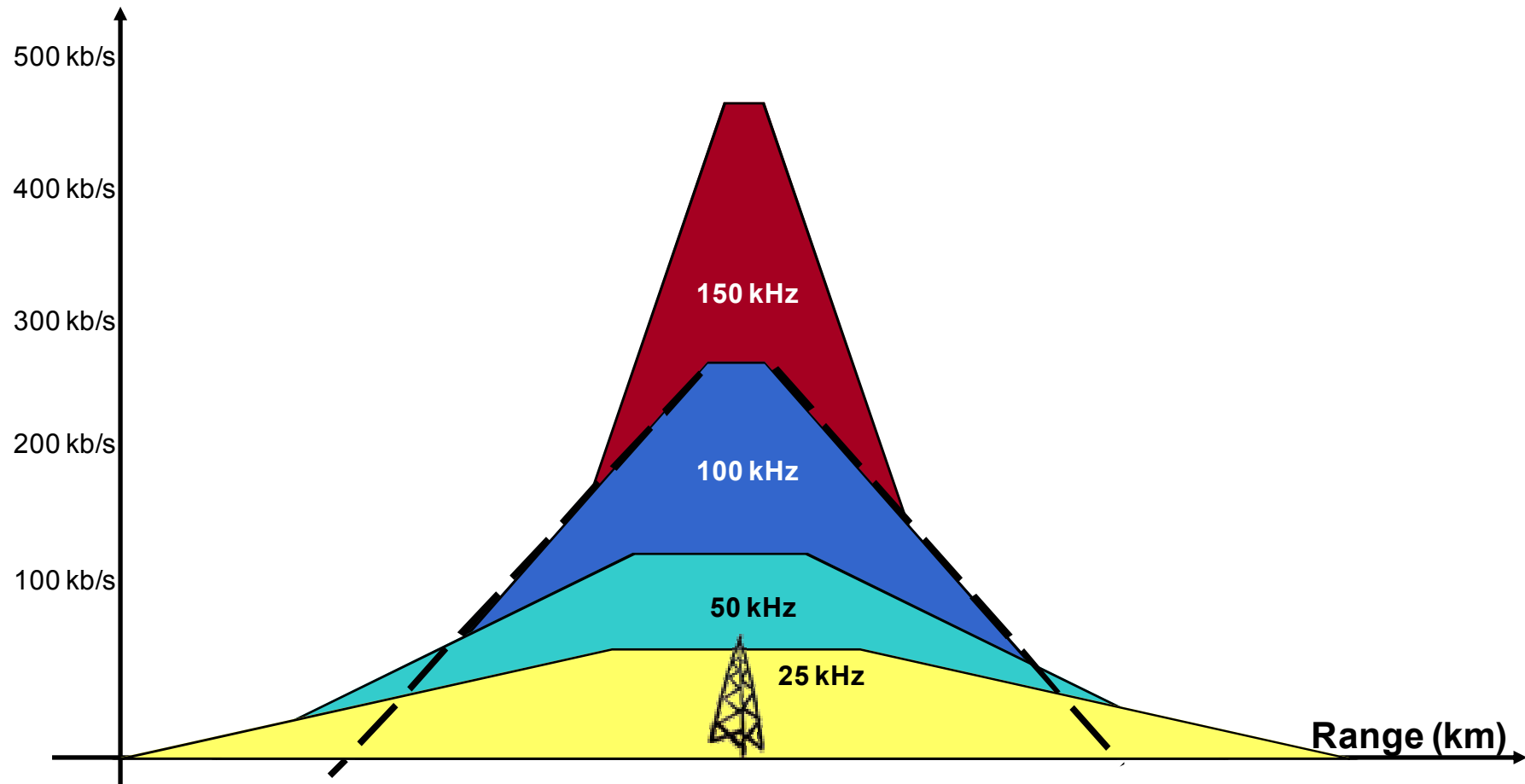


## ***High Speed Packet Data Deployment***

- **TEDS will be the solution for mission critical**
- **A range of channel bandwidths available in the standard**
  - Unlikely that all channel bandwidths to be offered at a single site
  - Consider how many users to share data channel, along with application requirements
- **The bandwidth and modulation scheme can both be varied to vary the throughput**

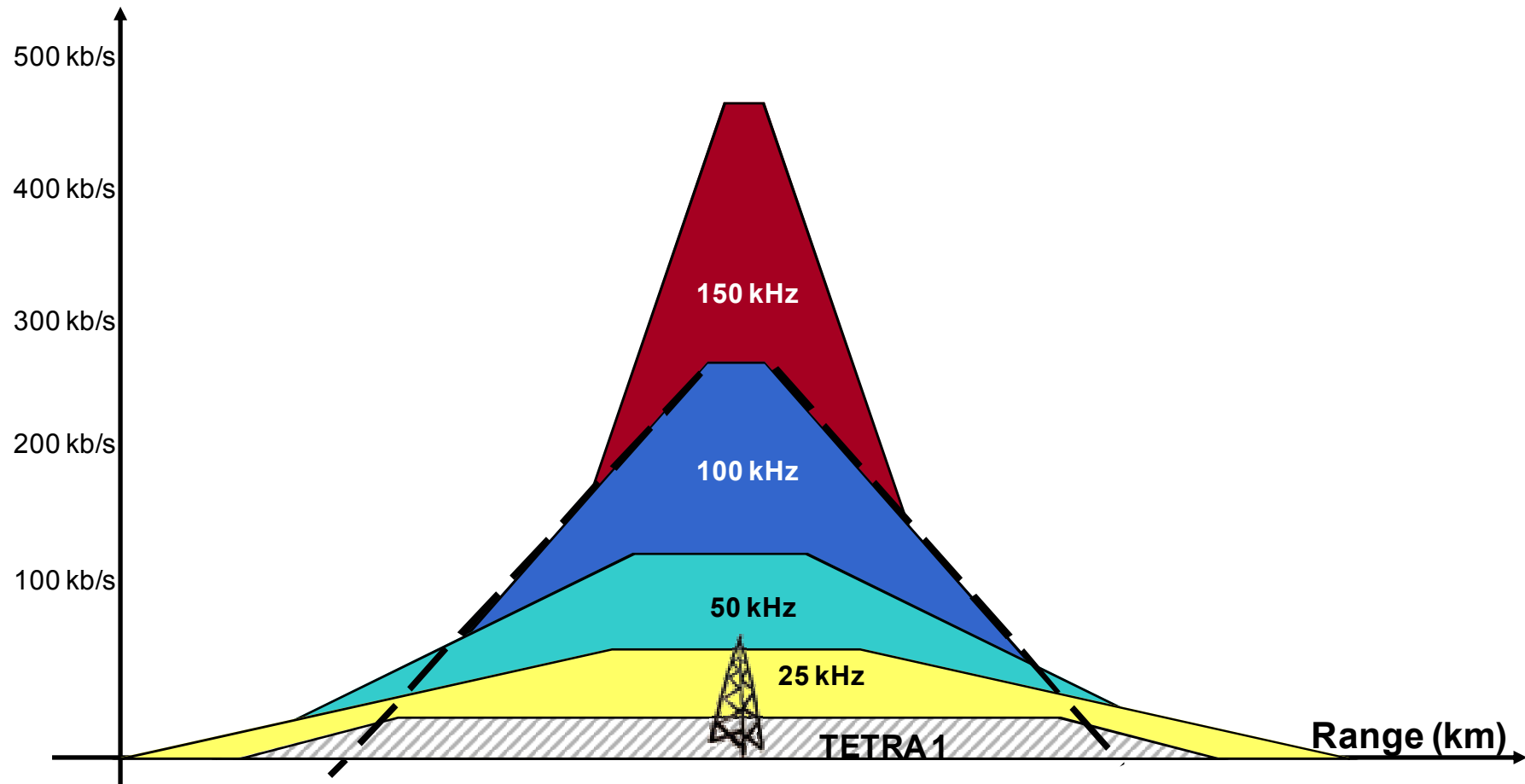


## *How do data, range, bandwidth vary?*



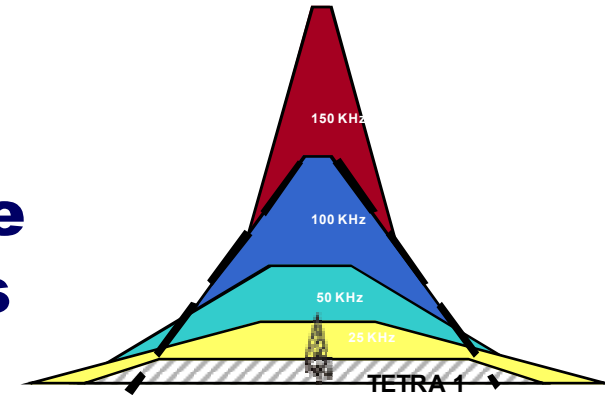


## How does this compare with TETRA 1?



## *The Key Points*

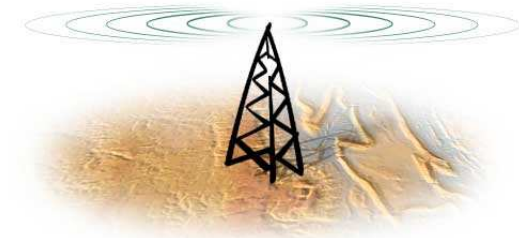
- **Modulation scheme can change dynamically with RF conditions**
- **As soon as the TETRA 1 curve starts to fall off, voice service is gone**
  - but data can still work with quite high MER numbers due to retransmissions.
  - For TETRA 1, the data coverage is therefore considerably better than voice coverage
  - For TETRA 2, the same trend is visible





## ***TEDS Coverage Planning***

- **Trade off between bandwidth, range, modulation**
- **How to perform a TEDS upgrade on a release 1 network designed for portable coverage**
- **Would TEDS be deployed to just mobiles initially?**
- **Can RF re-planning task be minimised when upgrading?**







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***What will TETRA 2 high speed data mean for data application users?***



## ***Does TETRA handle data?***

- **Database look up**
- **AVL**
- **Email**
- **File transfer**
- **Limited slow scan video**
- **But multimedia applications are more difficult....**





## Data Applications vs. TETRA bearers

	TETRA 1 single slot circuit data	TETRA 1 SDS	TETRA 1 Single slot PD	TETRA 1 multislot PD	TETRA 2 High Speed Data
Database search		★	★	★	★
AVL		★	★	★	★
Email			★	★	★
File transfer			★	★	★
Limited slow scan video				★	★
QoS managed video					★

Not suitable

Possible

Appropriate



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## ***Why enhance TETRA?***

**Reasons why you shouldn't just use  
a commercial service instead**



## ***Mission critical faces operational risks***

- **Interception/eavesdropping**
- **Poor coverage in remote areas**
- **Network congestion**
- **User stress – user overload (so many radios...)**
- **How do these risks impact data applications?**





## ***Different service - different risk profile***

<b><i>Risks</i></b>	<b><i>Interception</i></b>	<b><i>Poor coverage</i></b>	<b><i>Crisis induced congestion</i></b>	<b><i>User stress, Multiple MMI</i></b>
<b>Police</b>	High risk	High risk	High risk	High risk
<b>Ambulance</b>	High risk	High risk	High risk	Medium risk
<b>Fire</b>	Medium risk	High risk	High risk	Medium risk
<b>Mass transit</b>	Low risk	Low risk	High risk	High risk

High risk

Medium risk

Low risk



## ***Different application – different risk***

<b><i>Risks</i></b>	<b><i>Interception</i></b>	<b><i>Poor coverage</i></b>	<b><i>Crisis induced congestion</i></b>	<b><i>User stress, Multiple MMI</i></b>
Database	High risk	High risk	High risk	High risk
AVL	High risk	High risk	High risk	Low risk
Email	Medium risk	Medium risk	Medium risk	High risk
File transfer	High risk	Medium risk	Medium risk	High risk
Limited slow scan video	High risk	High risk	High risk	High risk
QoS managed video	High risk	High risk	High risk	High risk

High risk

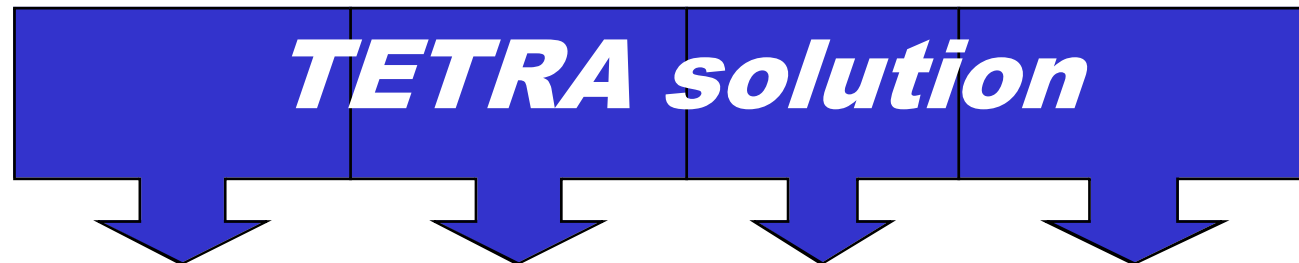
Medium risk

Low risk



## ***How does TETRA manage these risks?***

<b><i>Risks</i></b>	<b><i>Interception</i></b>	<b><i>Poor coverage</i></b>	<b><i>Crisis induced congestion</i></b>	<b><i>User stress, Multiple MMI</i></b>
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<b><i>Solutions</i></b>	<b><i>Air interface encryption</i></b>	<b><i>Minimum grade of service</i></b>	<b><i>Dedicated capacity, managed priorities</i></b>	<b><i>Integrated Voice and Data</i></b>
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## ***TETRA Data Solution Benefits***

- **Public data networks present operational risks for public safety**
  - TETRA data solutions are the only way to manage these risks safely
- **TETRA data solution can deliver on throughput and/or capacity**
  - TETRA PD and SDS is ideal for most applications today
  - TETRA 2 will add more capacity for multimedia applications





## ***What else will TETRA Release 2 offer?***

### **Other priority work items**

- **NATO Codec**
- **Air interface enhancements**
- **3G compatible speech coding**





## ***NATO low bit rate Codec***

- **US Department of Defence MELP (Mixed-Excitation Linear Predictive) Standard**
- **Plan**

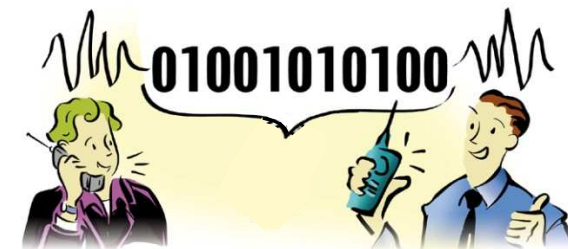
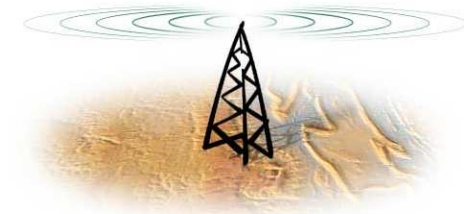
- **Feasibility Study**

- Coverage Enhancements?
- Quality Benefits ?

... compared to present and AMR Codecs

- Ability to Offer Enhanced or New Services

- **Possible Standardisation**





## ***Air interface enhancements*** ***- Extension of the range of TETRA***

### **To provide:**

- **increased coverage range**
- **low cost deployments for applications**

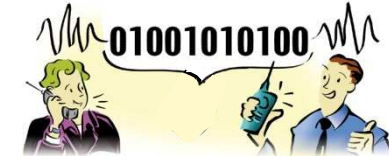
### **Solutions being considered:**

- **Faster ramp-up and using of guard bits for propagation**
- **Special class of MS for extended coverage range**
- **Changes of maximum path delay and adaptive power control**





## ***Speech coding***



- **Additional Speech Codecs for TETRA**
  - To enable intercommunication with other 3G networks without transcoding
  - To provide enhanced voice quality by using the latest low bit rate voice Codec technology
  
- **Adaptive Multi-Rate (AMR) Speech Codec**
  - 4.75 kb/s Mode
  - Specification of the AMR Speech Codec Completed
  - Quality Benefits for Telephone Interconnect & Duplex Calls
  - Coverage at least as good as present TETRA Codec



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## ***Standardisation Progress***

<b>Agreements So far</b>	
<b>Access Method</b>	<b>TDMA</b>
<b>Carrier bandwidths</b>	<b>25, 50, 100, 150 kHz</b>
<b>Modulation types and levels</b>	<b>4QAM, 16QAM, 64QAM plus D8PSK and DQPSK</b>
<b>channel coding</b>	<b>Parallel Concatenated Convolution Coding</b>

**Remaining standardisation due to complete Q2 2004**

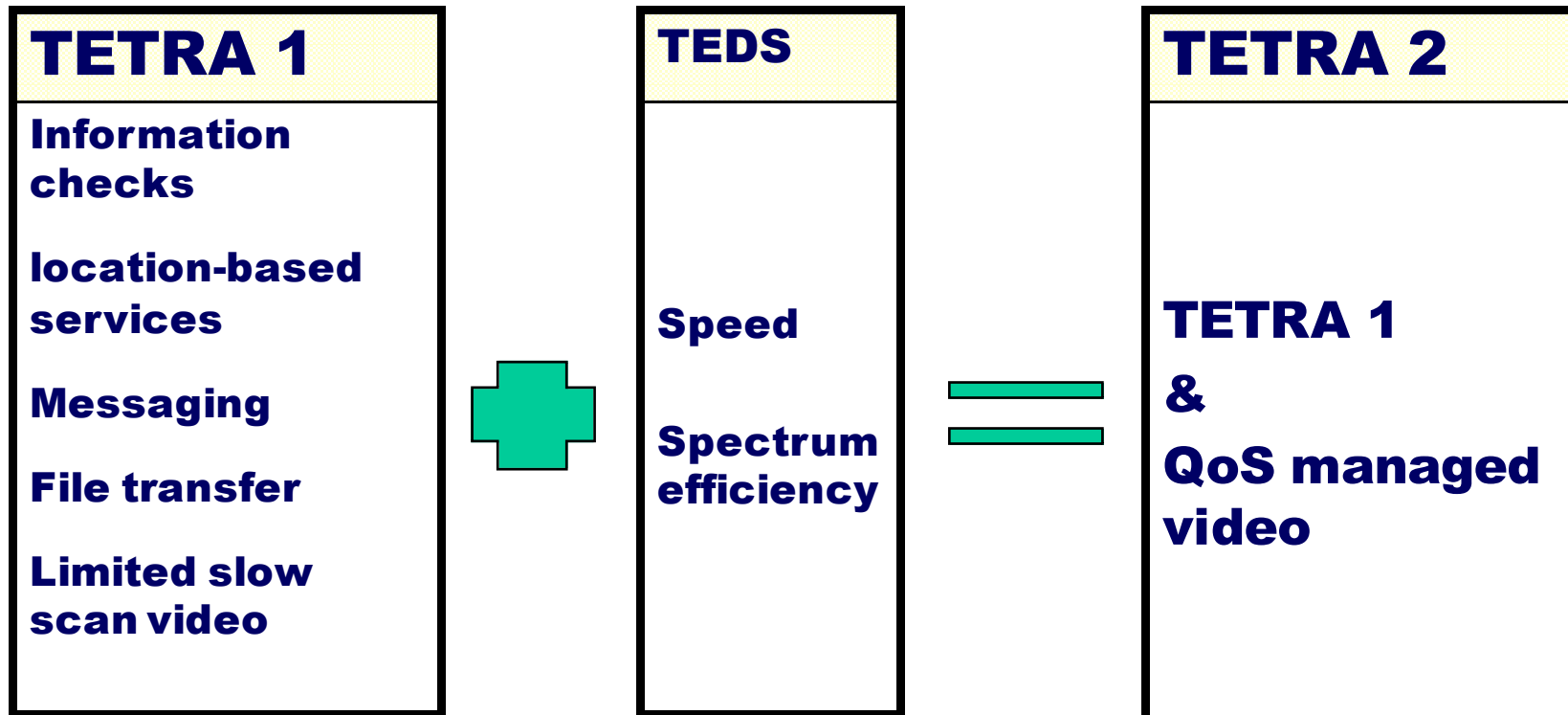


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## ***Mission Critical Data***





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***TETRA Data  
is the mission critical solution***

