Hytera DMR Introduction

The leading provider of professional wireless communication equipments and solutions
Introduction to DMR standard
Reasons for DMR

• Analog technology has reached its peak and can not breakthrough the technological limitations including
  – battery life,
  – audio quality (near the edge),
  – communication safety,
  – Spectrum efficiency,
  – integrated data applications.

• Many countries from America, Europe, Asia etc. released corresponding regulations that limit the professional communication equipment working on channel bandwidth \( \geq 25\text{kHz} \). DMR meets Narrow banding Mandate – WORLDWIDE!!

• Predictable doubling of capacity in existing 12.5 kHz licensed channels

• Backwards spectrum compatibility with 12.5 KHz analog systems
Reasons for DMR

• Efficient and simple use of infrastructure equipment saving money, power and work

• Ease of use and creation of data applications

• System flexibility through simultaneous voice and data calls, two way calls, double data rates enabled by two slot TDMA

• Advanced control features

• Benefit of an open standard

• For more information, visit: www.dmrassociation.org
What is DMR?

- DMR (Digital Mobile Radio) is a digital radio standard specified for professional mobile radio (PMR) users covering unlicensed and licensed conventional and trunked modes of operation.

- The standard was developed by the European Telecommunications Standards Institute (ETSI), and first ratified in 2005.

- The worldwide market leading open standard for digital two way radio for business and professional users.

- The Tier II and Tier III standard is designed to operate within the existing 12.5kHz channel spacing used in licensed land mobile frequency bands globally and to meet future regulatory requirements for 6.25kHz channel equivalence. The primary goal is to specify affordable digital systems with low complexity. DMR provides voice, data and other supplementary services. Today, products designed to its specifications are sold in all regions of the world.

- A two slot TDMA technology operating in 12.5 kHz channels with 4 level FSK (frequency shift key) modulation and advanced FEC (forward error correction) techniques.

- Defined for PMR frequency bands from 66-960 MHZ
What is DMR?

• The DMR protocol covers unlicensed (Tier I), licensed conventional (Tier II) and licensed trunked (Tier III) modes of operation, although in practice commercial application is today focused on the Tier II and III licensed categories.

• Tier I: DMR equipment having an integral antenna and working in direct mode (communication without infrastructure) under a general authorization with no individual rights operation.

• Tier II: DMR systems operating under individual licenses working in direct mode or using a Base Station (BS) for repeating.

• Tier III: DMR trunking systems under individual licenses operating with a controller function that automatically regulates the communications.

• NOTE 1: Tier II and Tier III products encompass both simulcast and non-simulcast systems.
Why DMR?

- Improved Digital Audio Quality and Range

- Clearer voice over a greater range
- Expanded range
- Static and noise rejection
Why DMR?

Double voice capacity (2 slot)

**TDMA Advantage: Double Voice Capacity**

- Time slot 1
- Time slot 2
- Time slot 1
- Time slot 2
- Time slot 1
- Time slot 2

Voice Call 1

Voice Call 2

**TDMA Advantage: Unique Future Functionality**

- Time slot 1
- Time slot 2
- Time slot 1
- Time slot 2
- Time slot 1
- Time slot 2

Voice Call 1

**Functionality available in future software releases:**
- 2nd slot functionality in repeater and radio-to-radio operation
- Priority call control
- Remote control of transmitting radio functionality
Why DMR? Lower equipment cost

- Compared with FDMA solution, 2 slot TDMA solution allows 2 simultaneous calls through 1 repeater, which helps reduce equipment cost.
Why DMR? Longer battery life

- 80% of battery is used for transmission;
- Two-slot TDMA, however, offers a good way forward. Since an individual call uses only one of the two timeslots, it requires only half of the transmitter’s capacity.
- 40% Battery Life Improvement with TDMA
- Advanced Battery Save
Why DMR?  

Enhanced privacy

• On analog channels, the audio signal is easily monitored.

• Digital offers inherent protection against casual eavesdropping by scanners.

• On a digital channel, the audio signal cannot be heard if the signaling or ID doesn’t match. (16776415 ID)
<table>
<thead>
<tr>
<th>Public Safety</th>
<th>Mission Critical or Community Link</th>
<th>APCO P25, TETRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities Security Public Service</td>
<td>Professional Tier Products</td>
<td>DMR</td>
</tr>
<tr>
<td>Education Construction</td>
<td>Commercial Tier Products</td>
<td></td>
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<tr>
<td>Retail Services</td>
<td>Business Radio Tier</td>
<td>DPMR</td>
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</table>
The transition from analog to digital
Expected number of unit to be sold

DMR Growth

Market capacity (10,000 units)

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
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<tbody>
<tr>
<td>Level</td>
<td>2</td>
<td>18</td>
<td>23</td>
<td>42</td>
</tr>
</tbody>
</table>
The transition from analog to digital

With the global boom of digitalization, the above markets will be the main markets which are interested in DMR.

Source: IMS 2007 report
The transition from analog to digital
Driven by narrow banding mandate

- FCC: Mandate by FCC that non frequency efficient (≥12.5kHz) equipment will not be approved after 2011 due to congestion. And all public safety equipments have to be migrated by the end of 2012.

- GB: non frequency efficient (> 12.5kHz) equipment will not be approved after 2010. Analog radio will not be approved after 2011. And all radios will likely be migrated to digital by 2016.
The transition from analog to digital

- DMR MoU created to drive worldwide growth of digital mobile radio market
- Leading manufacturers and suppliers join forces to develop and promote affordable, interoperable and innovative digital radio solutions

MOU PURPOSE
- Ensure multi-vendor interoperability
- Drive market awareness
The DMR Association

- The DMR Association is an evolution of the DMR-MOU set up at the time of the standardization of DMR by ETSI in 2005

- The original MOU group undertook background work such as deciding the choice of vocoder but then ceased activity

- Market evolution (DMR market entrants, competitive landscape) has meant the makers of DMR products and the two way radio user community need an active trade body
The DMR Association

Objectives:

• **Promotion of the standard to:**
  – **Users:** for informed choices about DMR products
  -- **Regulators:** for fair allocation of spectrum
  – **Standards bodies:** for recognition of the standard choice and to enable market growth through a greater supply of equipment and services
  -- Define and run an interoperability process for DMR
  -- Create a forum for discussion on the standard
HYTERA’s Active role in DMR

- One of DMR MoU key members.
- One of the leading companies which own the key DMR technology.
- Hytera will offer the most complete initial DMR portfolios among major providers, including complete digital solutions of DMR conventional, simulcast and DMR Tier III trunking systems.
- Hytera products are developed on the ETSI DMR standard and do not limit the end user to one brand.
Hytera DMR system solution

DMR simulcast

GPS visualization dispatch

DMR conventional solution
Hytera DMR Portable Radios

PD782/PD702

- **Global Frequency Bands:**
  - 400-470 Mhz, 450-520Mhz, 330-400Mhz, 136-174Mhz

- **Dimensions:**
  - 4.69 x 2.2 x 1.3 inches (PD782)
  - 4.69 x 2.2 x 1.28 inches (PD702)

- **Weight:** 11.45 oz (PD782)/ 10.75 oz(PD702)

- **256 channels (PD782) / 32 channels (PD702)**

- **RF output power 4W/1W**

- **2000mAh Li-ion Battery**

- **1.8 inch TFD Thin Film Diode Color display and full keypad (PD782)**

- **Louder Audio Output: 1.5W**

- **IP57**

- **Compatible with analog mode**

- **FM explosion-proof with special battery**

- **GPS (Optional)**

- **Optional board support**
Hytera DMR Portable Radios

① Compact size design
② Dual-color injection molding
③ Integrated GPS antenna
④ Unique knob design on the top
⑤ High resolution 1.8” TFD color LCD
⑥ Comfortable operation with big buttons even with glove on
⑦ Covert speaker with quality audio and smart look
⑧ Clear status indication with tri-color LED
⑨ Compliant with MIL-STD-810 C/D/E/F and IP57 standards
Antenna description

- Hytera antenna innovation:
  - GPS directivity improvement
  - Eyes-off, hands-on operation
  - Maximize the distance between volume knob and channel switch knob, and more convenient for operation with gloves.
Hytera DMR Mobile Radio

MD782

- **Global Frequency Bands:**
  - 400-470 MHz, 450-520MHz, 330-400MHz, 136-174MHz

- **Dimensions (W*H*L):** 6.9 x 2.4 x 7.9 inches

- **Weight:** 3.75 lbs

- **256 channels**

- **Output power:** 45W (High power model) / 25W (Low power model)

- **2.0 TFT (Thin Film Transistor Color LCD display with intuitive navigator buttons)**

- **Louder Audio Output:** 6W

- **IP54**

- **Compatible with analog mode**

- **GPS (Optional)**
Hytera DMR Mobile Radio

① Dual-color Injection Molding  
② 2.0" High-Resolution Color LCD  
③ Six Programmable Keys  
④ Innovative Ring-shaped LED to show clear status  
⑤ Large and easy to use knob ( channel switch knob and volume knob in one )  
⑥ Rugged accessory port  
⑦ Effective heat-sink capability  
⑧ Compliant with MIL-STD-810 C/D/E/F and IP54 standards
Hytera DMR Repeater
RD982

- **Global Frequency Bands:**
  - 400-470 MHz, 450-520 MHz, 330-400 MHz, 136-174 MHz

- **Dimensions:**
  - 19 x 3.5 x 14.4 inches
  - 19 x 3.4 x 14.4 in

- **Weight:** 18.7 lbs

- **32 channels**

- **Continuous 5 – 50W, 100% full duty cycle**

- **2.0”’, 262K TFT LCD, 220 × 176 pixel**

- **Audio Output:** 1W

- **Auto detection between analog and digital modes**

- **MTBF ≥ 100,000 hours**
Hytera DMR Repeater

① Standard 19”, 2RU rack-mount design, compatible with desktop housing as well
② 2.0” TFT LCD and menu navigation knob to facilitate service and maintenance
③ Color LEDs for clear status indication
④ Advanced heat sink design with thermal-controlled cooling fan
⑤ Internal installation for mobile duplexer
⑥ More comfortable handling with ergonomic design
⑦ Programmable buttons for customized application
Hytera DMR Covert Radio

- **Global Frequency Bands:**
  - 330-400Mhz, 400-470 Mhz, 450-520Mhz, 136-174Mhz
- 16 channels
- User selectable and automatic digital/analogue operation
- FM explosion-proof with special battery
- Smart ID
- Small (4.5 x 2.1 x 0.75 inches)
- Lightweight
- Programmable top button
- Vibration
- GPS(Optional)
- Bluetooth(Optional)
- Encryption
- IP57mm
Hytera DMR Covert Radio

- **Global Frequency Bands:**
  - 330-400Mhz, 400-470 Mhz, 450-520Mhz, 136-174Mhz
- 16 channels
- User selectable and automatic digital/analogue operation
- Smart ID
- Small (4.5 x 2.1 x 0.73 inches)
- Lightweight
- Vibration
- FM explosion-proof with special battery
- GPS (Optional)
- Bluetooth (Optional)
- Encryption
- IP67
Hytera DMR Covert Radio

1. Flexibility
2. Stealth
Hytera DMR Product Features and Advantages
Co-exist with analog systems

-- 12.5kHz channel spacing in digital mode and 12.5/20/25kHz channel spacing selectable in analog mode.
-- Mixed mode scanning (scans both analog channel and digital channel);
Hytera Innovation: DGNA(2)

Dynamic Group Numbering Assignment: Current

Group 1

Group 2

Group 3

Security Group
Hytera Innovation : DGNA (Conference)

HYT CONFERENCE FEATURE (Dynamic Group Numbering Assignment)
Hytera Patented
Hytera Innovation: DMO mode true two slot

Voice Call 1

Time Slot 1

Time Slot 2

Voice Call 2 or Data

Time Slot 1

Time Slot 2
Hytera innovation: Pseudo trunking

- Voice Call 1
  - Used Slot
  - Un-Used Slot
  - Used Slot

- Voice Call 2 or Data
  - Used Slot
  - Un-Used Slot
Hytera innovation: Pseudo trunking with repeater

*Through the Repeater*

- Voice Call 1
- Voice Call 2 or Data

Used Slot

Un-Used Slot

Un-Used Slot

Used Slot

Ease of migration from Analog to digital system

Hytera DMR Smooth Migration: Multi-channel system

1. Add Digital Site, Remove some analog repeaters

2. Start migration of talk groups

3. Move more channels to digital

4. Complete talk group migration

5. Remove analog system & complete digital channel adds
Ease of migration from Analog to digital system
Multi-Site Infrastructure Overlay with Slow Subscriber Migration
Increased Robustness

- Hytera DMR terminals have gone through 76 items of environmental test and ALT (accelerated life test) to ensure the reliability.

- Certificate and third party test
  - Military standards: MIL-STD-810C/D/E/F
  - CE/FCC/GB
# Hytera DMR advanced digital voice features

<table>
<thead>
<tr>
<th>features</th>
<th>benefits</th>
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</thead>
<tbody>
<tr>
<td>All call</td>
<td>Ensure Entire radio fleet is instantly provided with critical information</td>
</tr>
<tr>
<td>Group call</td>
<td>Helps ensure critical work group are fully informed</td>
</tr>
<tr>
<td>Private call</td>
<td>Allows call to be directed at individuals</td>
</tr>
<tr>
<td>Channel Scan</td>
<td>Supporting mix mode scanning (analogue &amp; digital channel). Helps ensure all relevant calls are heard</td>
</tr>
<tr>
<td>PTT ID &amp; Aliasing</td>
<td>Allows the receiving party to instantly identify the caller and respond accordingly</td>
</tr>
<tr>
<td>Talk around</td>
<td>Enable the radio to communicate directly with one another</td>
</tr>
<tr>
<td>Emergency</td>
<td>An emergency call can be confirmed to maximize the employee’s safety and accelerate incident response</td>
</tr>
</tbody>
</table>
Hytera DMR INTEGRATED DATA FUNCTIONS

- Text messaging
  --- Editable text messaging (one to one, one to group and one to all)
  --- Free entry up to 256 characters
  --- Preprogrammed quick text entered via CPS (Customer Programming Software)
- 3rd party API (application interface)
Hytera DMR integrated solution

Hytera DMR offers communication and dispatching solutions to different sectors including public security, transportation, energy, education and business.

1. Effective dispatching for security situations.
2. GPS application (portable + mobile + control center)
3. GPS and emergency alarm ensure personal safety of people working alone

1. DGNA (Conference) function is essential.
2. Group calls established according to contact list
3. Status messages and user message is helpful for job.

1. High image quality and bright LCD; easy to read in dark environment.
2. Explosion-proof radios ensure users' safety

1. Flexible and fast dispatching ensuring the transport schedule.
2. Staff of station can keep in touch with staff on high speed train.
3. LCD is easy to read; help staff to get information quickly.
Benefits of HYT DMR Radio

FEATURES:

• Unique Industrial Design
• Big Color Display
• Small and Light Weight
• Shorter and central located Antenna
• Long Battery Life (2000MAH Battery)
• Improved Audio Quality
• Cost Effective and Value for Money
Benefits of HYT DMR Radio

- Bigger Keypad
- True two time slot in DMO
- Pseudo Trunking in DMO
- Pseudo trunking in repeater mode
- Repeater auto detect for analog and digital mode
- Repeater Scan mode
- Open DMR platform
Benefits of HYT DMR Radios

- Covert Radio is available for public Security Customer
- HYT CONFERENCE (DGNA)
- Tier III DMR Trunking in the development plan
- Complete offering for DMR solution
- Software based five tone
- 12.5/20/25 channel spacing for analog mode
- Simple migration plan
• DMR Roadmap Summary

**Phase I**
- Analog (CSQ, CTCSS, CDCSS)
- DMR Tier II Voice and Data
- DMR Tier II Repeater
- Single Site repeater
- Mixed Mode Scan
- Portable UHF1
- Mobile UHF1
- Repeater UHF1

**Phase II**
- Analog (HDC, 2-Tone, 5-Tone)
- Pseudo-trunk 2-slot operation
- DMR Supplementary Services
- Rptr Analog/Digital Auto Detection (Scan)
- GPS Capable Radios
- 3rd party radio API
- PD702
  - Portable
  - Mobile
  - Repeater VHF/350MHz
  - Covert Portable

**Phase III**
- Single Site Trunk Tier III voice and data calls.
- Repeater Multi-Site
- Encryption
- DGNA
- True 2-Slot
- Simulcast
  - Trunking System
  - UHF2
  - Portable 800M
  - Mobile 800M
  - Repeater 800M
  - Blue Tooth Accessories

April-2010
Q3 2010
Early 2011
Common Features   R1

- Portable and Mobile UHF1 (403 – 470 MHz)
- IP 57
- Repeater Single Site operation UHF1
- Analog Voice Communication
- Digital Voice and Data communication (DMR Tier II compliant)
- 256 Channel
- USB Interface for programming
- Mixed Mode channel scan (Scans both Analog and Digital Channels)
- Language Support (English, Chinese)
- Public Addressing (Mobile)
- Noise Suppression (Mobile)
• Analog Communication Features  R1

• CSQ
• CTCSS
• CDCSS
• 12.5/20/25 kHz
• Emergency Call
• Radio Monitor
• Digital Communication Features R1
  • Private Call (confirmed and unconfirmed)
  • Group Call
  • All System Call
  • Emergency Call
  • PTT ID
  • Later Entry
  • Channel Access Criteria - Channel free, Color Code free and Always allow
  • Text Messaging - Free Entry and Pre-Programmed with CPS (Customer Programming Software)
  • Support Multiple Color Code
  • Repeater Access Support (Able to make calls via repeater)
Second DMR Release (July-September 2010)

Common Features  R2

- Portable and Mobile VHF/350MHz (350 – 400 MHz)
- Covert Radio in U1 and VHF
- DMR U2 (450-520MHz band)
- Repeater VHF/UHF2
- Battery Pack Repeater
- Portable Non Display (PD702)
- Repeater Analog/Digital auto detect.
Common Features  R2

• Factory Mutual - Intrinsically Safe Portable (with optional battery)
• Remote IO Sensing (Mobile)
• Lone Worker
• GPS
• Channel Change Voice notification
• Real Time Clock / Personal Alarm
• Microphone Automatic Gain Control
• 3rd party API. (The API documents will be available around Q2 2010)
SECOND DMR RELEASE (Q3-2010)

• Analog Communication Features
  • HDC1200
  • 2 Tone
  • 5 Tone (*MotoTurbo needs optional board to support this function*)
  • Scrambling

• Digital Communication Features
  • Pseudo-Trunk Direct Mode 2-slot operation
  • Pseudo-Trunk Repeater Mode 2-slot operation
  • Supplementary services
    – Remote Monitor
    – Call Alert
    – Radio Check
    – Radio Kill/Wake-Up
    – Emergency Alarm
  • GPS Data over Text Messaging System (ARS)
  • Enhanced Battery Saver
  • Scrambling
Third DMR Release (Q1-2011)

- Trunking Operation (DMR Tier III protocol)
- Portable and Mobile VHF
- Radio Cloning
- Option Board for encryption and other application
- Man Down
- VOX
- Voice Recording
- Repeater Multi Site
- Repeater Auto Roaming
• **Analog Communication Features**  R3
  • MPT1327
  • Phone Interconnect (DTMF)

• **Digital Communication Features**
  • Direct Mode True 2-slot operation
  • Trunking Voice and Data Calls
  • Conference (DGNA)
  • Voice/Data Encryption
Others

- HYT DMR Solutions:
  1. HYT DMR simulcast system for wide area coverage
  2. Simulcast system will support normal radio to roam from site by site
  3. HYT will release own encryption and accept third party encryption board
  4. HYT Text Message protocol will be free to any SI partners
  5. HYT will release DMR Tier III Compatible Trunked DMR Terminals and system
The AMBE++

- All DMR transmitters use the same vocoder (voice coder) yet the radios don’t all sound the same
- The vocoder tries to filter sounds, which are not the human voice, from the transmission
Coverage Comparison

The Advantage of DMR?

DMR digital (encrypted or not)

<table>
<thead>
<tr>
<th>Coverage</th>
<th>dBm</th>
<th>uV</th>
</tr>
</thead>
<tbody>
<tr>
<td>30dB</td>
<td>-99dBm</td>
<td>2.5uV</td>
</tr>
<tr>
<td>20dB</td>
<td>-114dBm</td>
<td>0.45uV</td>
</tr>
<tr>
<td>12dB</td>
<td>-121dBm</td>
<td>0.19uV</td>
</tr>
<tr>
<td>7dB</td>
<td>-124dBm</td>
<td>0.14uV</td>
</tr>
</tbody>
</table>

Here!
HYT DMR Radio
Any Questions?
Email us!
Help4U@falcondirect.com
or call 205.854.2611
Thank you!

Falcon Direct