# An Introduction to DMR

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# Digital Mobile Radio

- The specification was developed (and is owned, managed, and maintained) in Europe by the European Telecommunications Standards Institute ("ETSI"). It is not an American invention.
- DMR was intended for *commercial* (not amateur) use but has been adapted/adopted by public services (law enforcement, fire, rescue, other government and NGO entities…). And by hams.
- Amateurs, having the fear of being left out, petitioned the FCC to permit DMR to be used by amateurs on amateur bands, *up to a point*—i.e., with certain limitations. As we know, hams love to experiment with technology.

# DMR Resources

- *Amateur Radio Guide to Digital Mobile Radio*, by John Burningham, May 2019; available from http://www.dmr-marc.net (Motorola Amateur Radio Club)
- Rocky Mountain Ham Radio (aka “RM-HAM”) http://www.rmham.org. RM-HAM owns and operates a DMR-MARC network of repeaters that extends from Cheyenne into much of northern New Mexico. ARES R1D1 uses this network for the net the first Thursday of each month.
- Brandmeister network: http://brandmeister.network
- Etc. Google it.

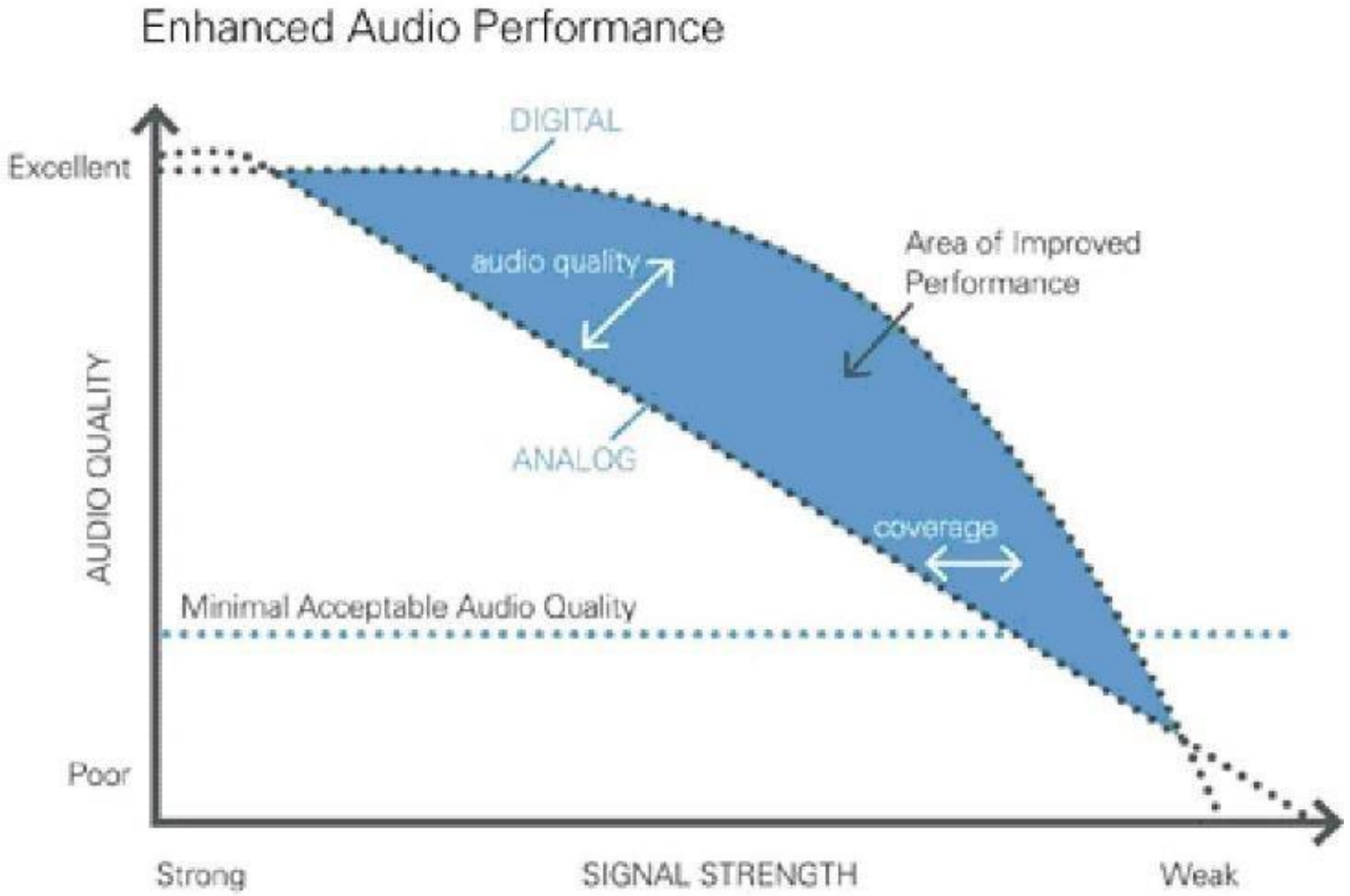
# DMR's Three-Tier Structure

- **Tier I: a single channel specification originally for the European unlicensed dPMR446 service. It is a single channel Frequency-Division Multiple Access (FDMA) 6.25 kHz bandwidth. The standard supports peer-to-peer (mode 1), repeater (mode 2) and linked repeater (mode 3) configurations.**
- **Tier II: a 2-slot Time-Division Multiple Access (TDMA) 12.5 kHz wide peer-to-peer and repeater mode specification, resulting in a spectrum efficiency of 6.25 kHz per channel. Each time slot can be either voice and/or data depending upon system needs. Amateur radio implementations use this tier. *Most amateur radio implementations of DMR are using voice on both time slots*.**
- **Tier III: adds to Tier II *trunking* operation involving multiple repeaters at a single or multiple site system. *Trunking is not legal on amateur bands*.**

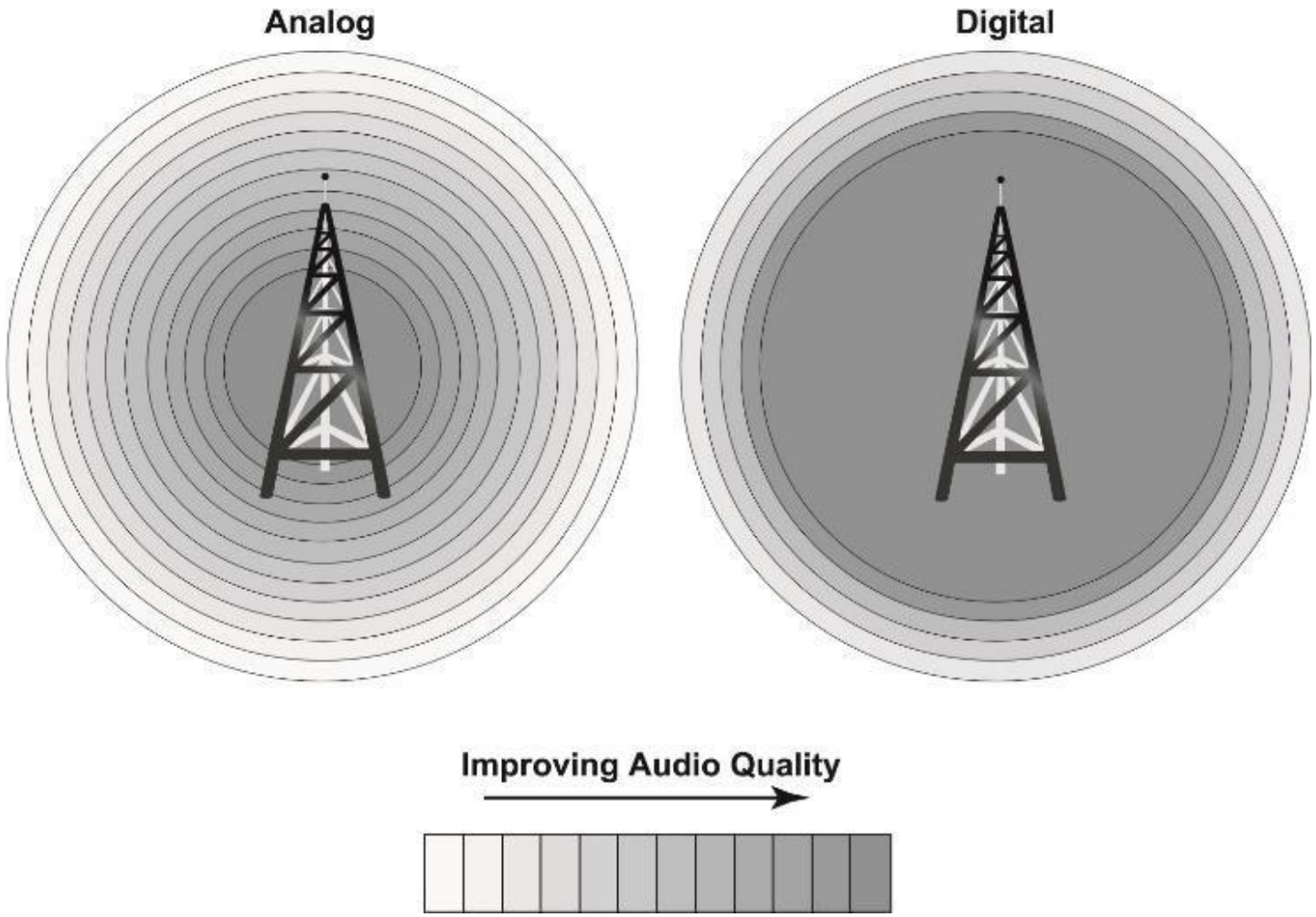
# Levels of Involvement in DMR

- **Radio User—the radio owner / control operator manipulates the radio hardware to communicate via simplex or repeater. Most amateur radio operators find themselves in this category.**
- **Repeater Operator—the repeater owner (or would-be owner) obtains, establishes, and maintains one or more repeaters because there are no previously existing repeaters and/or better coverage is desired. This can get expensive**
- **Network Operator—the network owner/manager obtains, sets up, and manages/maintains one or more bridges to build and maintain interconnections with other such networks. This can get very expensive.**
- **If you're not having fun, do something else. It's a hobby.**

# Why DMR? 1. Better Audio Quality



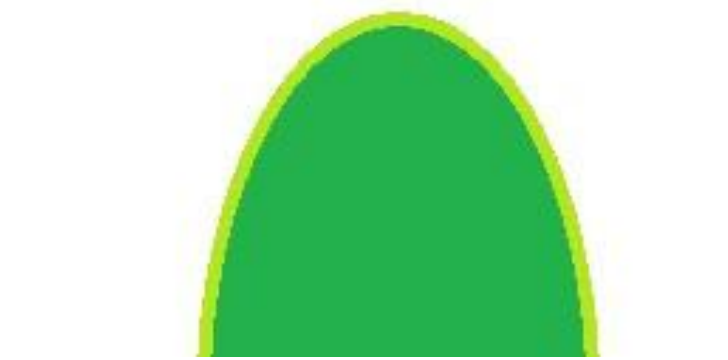
# Why DMR? 2. Broader Coverage



# What Puts the “Digital” in DMR?

- **Each transmission is a series of ones and zeros.**
- **The ones and zeros are generated from an analog source (e.g., voice, etc.) by a “vocoder” (think compact disk and digital video disk), equivalent to the DVSI AMBE+2 IC chip, *by agreement* among hardware manufacturers; this is *not part of the ETSI standard*. Most modern implementation of the vocoder function is done in software.**
- **AMBE+2 incorporates forward error correction, further improving audio quality.**
- **DMR is *not compatible* with other digital modes, i.e. D-Star (Kenwood, Icom) or Fusion (Yaesu).**

# Why DMR? 3. Narrower Bandwidth

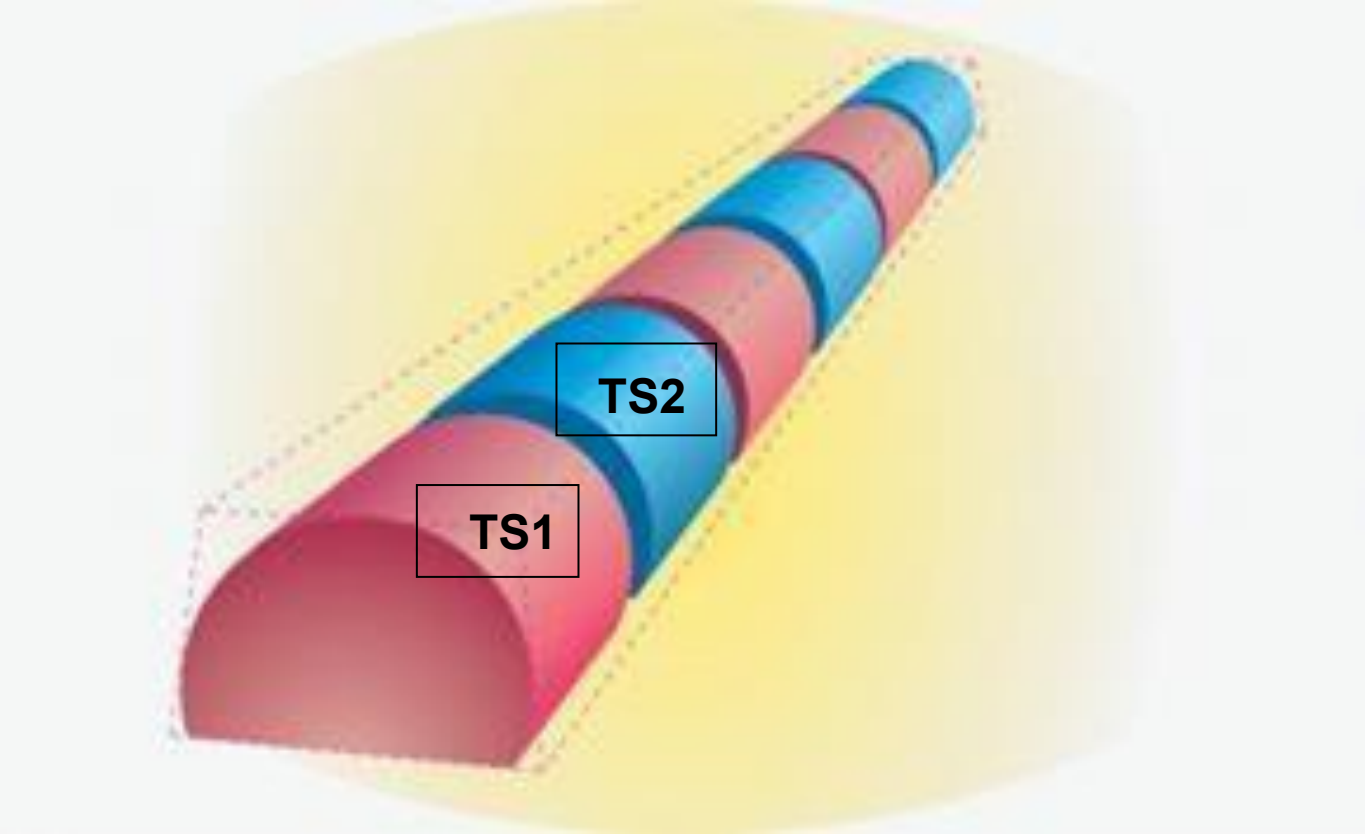




Wideband Analog FM
25 kHz Channel
Bandwidth
(25 kHz per Channel)

DMR
12.5 kHz Channel
Bandwidth
(6.25 kHz per Channel)

**How does DMR do this?**

# Two-Slot Time-Division Multiple Access (TDMA)




- DMR divides the bandwidth at the tuned frequency into two channels.
- Each channel gets alternating 30-millisecond intervals in which to transmit / receive.
- These two channels are called “Time Slots”.

# What Defines a DMR “Channel”?

- Frequency / Frequencies on which the desired repeater operates
- Color Code of the desired repeater (not a color, but a number from 0 to 15, inclusive)
- Time Slot (1 or 2)
- And one more thing…

# Talk Group

- **Who do you want to talk to? You need to know which Talk Group(s) a desired repeater can reach. And pick one.**
- **Determine who owns / manages the desired repeater (typically a club) and find their website.**
- **Talk Groups are typically (but not universally) organized by geographic area.**
- **In RMHAM's DMR-MARC network, think of a Talk Group as a cluster of linked repeaters.**
- **There are literally THOUSANDS of Talk Groups among the 40+ DMR networks.**