FAQ about Narrowband Technologies

This is an information paper regarding the latest information about the respective narrowband two-way radio technologies in the market at present. It is intended to present a neutral and balanced view of the respective technologies, and also correct misrepresentations and misunderstandings seen in various media publications of presentation materials in circulation in the public domain.

This document has been prepared by the dPMR™ Association Marketing Group with the full consensus and approval of the member companies. The dPMR™ Association hopes this document will provide clarification to the myriad of information currently available.
The dPMR™ Association has checked the content for accuracy but reserves the right to amend and/or correct any part of this document without notice or obligation.

Q1: What does "narrowband" really mean?

A1: This should probably be clarified before anything else. To keep things simple, narrowband in its current form would refer to the use of 12.5 kHz channels for two-way PMR/LMR radio communication. However, as 6.25 kHz technologies exist, these would be considered "ultra-narrowband" or "very narrowband".

Q2: 6.25 kHz "equivalent" versus real 6.25 kHz capability.

A2: Historically, professional two-way radio has dealt with the problem of congested spectrum/channels by narrowing the channel spacing. I.e. 50 kHz → 25 kHz → 12.5 kHz → 6.25 kHz. The DMR system is often quoted as being 6.25 kHz "equivalent", and dPMR™ or NXDN™ are true 6.25 kHz. Basically what this means is that the 2-slot TDMA architecture of DMR provides the equivalent of two 6.25 kHz voice or data paths in a 12.5 kHz channel and the FDMA systems' channel spacing is 6.25 kHz.

Q3: Just what kind of narrowband technologies/systems are there?

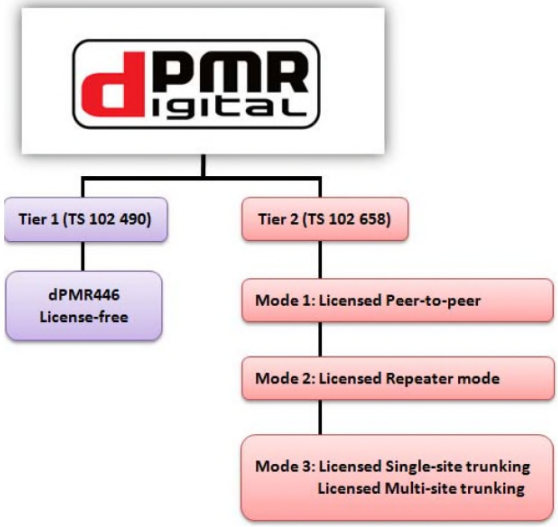
A3: Notice we have not used "digital" with narrowband. This is because analogue FM is considered narrowband technology based on the explanation in A1 above, and thus the first type of narrowband technology available. Diagrams are provided for the systems relevant to the discussion in this document with references to other systems as required.

Analogue Narrowband:

Good old reliable FM:
As mentioned above, analogue FM 12.5 kHz products have been available for many years now, and fit the description of the current narrowband channel spacing standard of 12.5 kHz.

Digital Narrowband:

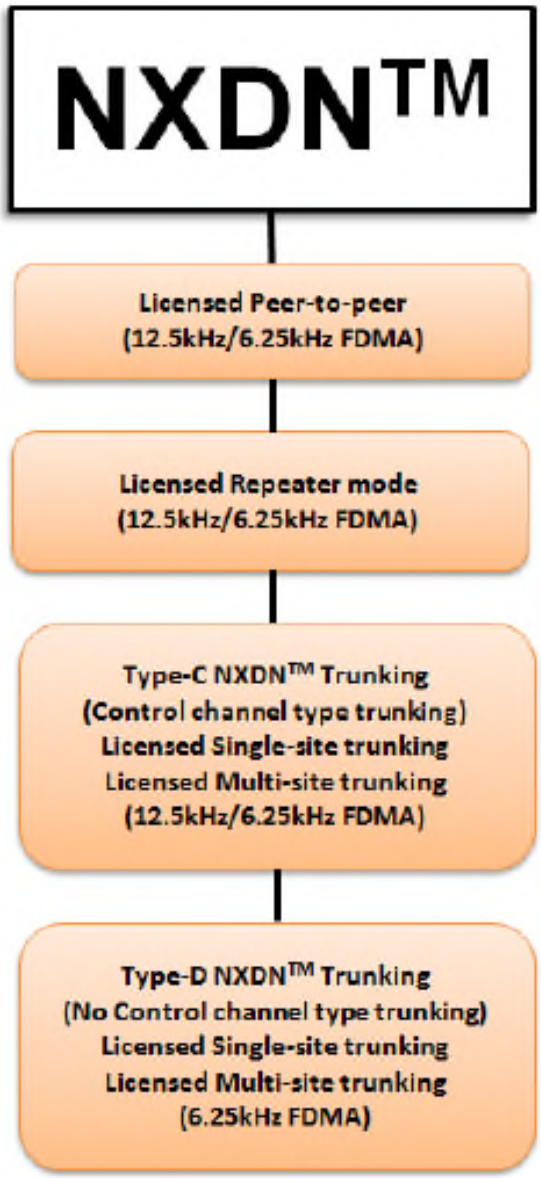
dPMR™:
dPMR™ is a digital 6.25 kHz FDMA based protocol described in the ETSI technical standards TS 102 490 and TS 102 658. Details of what dPMR™ is and can do, can be found on the dPMR™ Association website, but the basic structure of the dPMR™ standards suite is shown in the graphic below:



As the diagram shows, dPMR™ is a full featured system capable of providing communications solutions ranging from license-free PMR446 all the way up to Mode 3 multi-site trunking networks.

NXDN™:

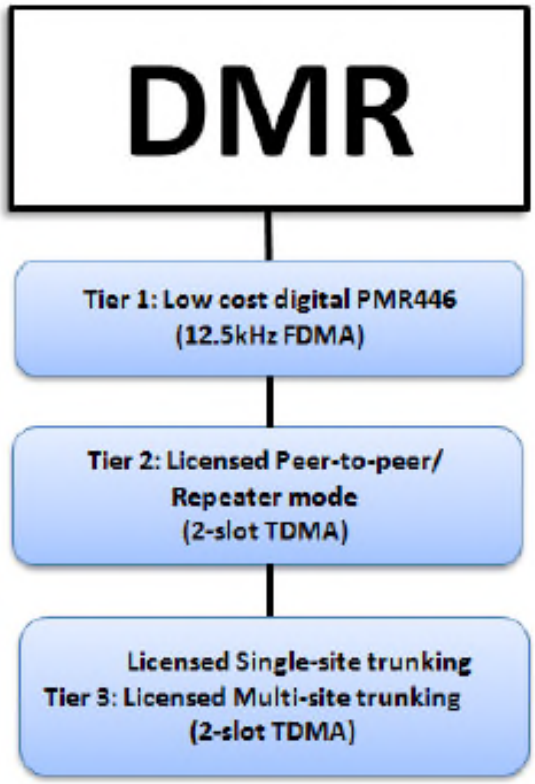
NXDN™ is an open digital 12.5 kHz or 6.25 kHz FDMA based protocol described in the NXDN™ suite of standards. Details of what NXDN™ is and can do, can be found on the NXDN™ Forum website, (http://www.nxdn-forum.com/) but the basic structure of the NXDN™ standards suite is shown in the graphic below:



As the diagram shows, NXDN™ is a full featured system capable of providing flexible trunking solutions for small to medium sized networks.

DMR™:

DMR is a digital 12.5 kHz 2-slot TDMA based protocol described in the ETSI technical standard TS 102 361. Details of what DMR is and can do, can be found on the DMR Association website (http://dmrassociation.org/), but the basic structure of the DMR standards suite is shown in the graphic below:



As the diagram shows, DMR is a full featured system capable of providing communications solutions ranging from license-free all the way up to multi-site trunking networks.

Other Digital Systems:

APCO Project 25:

APCO P25 is a digital standard targeted mainly for the United States public safety sector. P25 Phase 1 part of the standard is a digital 12.5 kHz FDMA based protocol described in the TIA APCO P25 standards. A P25 Phase 2 standard which is a 2-slot TDMA 12.5 kHz protocol has also been completed.

Tetrapol:

This is a 12.5 kHz FDMA digital standard that is also targeted for the public safety market as well as high-end commercial markets.

Tetra:

Tetra is a digital 25 kHz 4-slot TDMA based protocol described in the ETSI EN 300 392 suite of standards. Tetra is also targeted for the public safety market as well as large, infrastructure based systems in commercial markets.

Japanese and Chinese standards:

ARIB standards T-98 and T-102 are NXDN™ based 6.25 kHz FDMA standards that are available in the Japanese domestic market. China has also developing a digital standard called Police Digital Trunking (PDT), which is a 12.5 kHz TDMA based standard. They are also looking at creating a separate Business and Industry digital standard, and discussions on proposed candidate protocols has begun.

As the content above indicates, there are also movements to adapt base standards as country specific standards.

Q4: Which is better, 6.25 kHz FDMA or 12.5 kHz TDMA?

A4: This is the million dollar question. The answer is that both technologies have been accepted in the market based on the features and advantages provided respectfully. This suggests there is room for both. Below are some facts and statistics of interest.

Fact 1: At high percentage of every two-way manufacturer's business (including supporters of TDMA technology) is analogue FDMA based, and will continue so some time while the market migrates to digital at its own pace. FDMA has served the PMR/LMR industry as a reliable and proven radio technology for more than 70 years. Therefore, even with the migration to digital, FDMA remains the most efficient method of achieving spectrum efficiency.

Fact 2: Both 6.25 kHz FDMA and 6.25 kHz equivalent TDMA have millions of devices in use worldwide, both are accepted as technologies with the selection of either made on the basis of suitability for a given application.

Fact 4: The number of countries where 6.25 kHz FDMA and TDMA digital systems are used worldwide is virtually the same. The majority of countries worldwide now have regulations and/or band plans in place that allow the use of 6.25 kHz in one way or another to maximise spectrum efficiency.

Q5: "Professional" versus "Simple, low cost"

A5: There have been comments in media articles placed by equipment manufacturers that dPMR™ is a low cost "non-professional" orientated technology.
This should not to be confused with the original intention of dPMR™ which was conceived as a "low cost, low complexity" protocol. This means that the technology can be achieved by largely using existing FM hardware engineering architecture.
Also, as explained with the diagrams in previous pages, both FDMA and TDMA based protocols offer basically the same level of functions, trunking and networking capability. As with the "Which is better?" question, the correct answer is "the system that best suits your needs".

Alinco, Icom, Lisheng and JVCKENWOOD to name but three all manufacture dPMR FDMA equipment for professional applications.

Q6: What about IPR?

A6: dPMR™ was also developed to avoid IPR and again reduce the total cost for both the manufacturer and ultimately the end user. dPMR™ is an open standard and no IPR has been determined to be essential to the dPMR™ standards and thus no licenses* are required for developing dPMR™.
* No licenses required for the CAI, but a vocoder license may be required depending on implementation and the right to mark products as compliant to dPMR standards will be subject to successfully completing interoperability testing.

Q7: What kind of products are available for dPMR™?

A7: At this time, the following products and services are available from a number of dPMR™ Association member companies. Further details can be found in a Product Showcase page on the dPMR Association website.

- Tier 1 dPMR446 license-free radios
- Tier 2 dPMR™ Mode 1, 2 and 3 radios, infrastructure and controllers
- Tier 1 baseband IC chips (for radio development)

- Tier 2 Mode 1 and 2 baseband IC chips (for radio development)
- Tier 2 Mode 1, 2 and 3 protocol stacks (for radio development)
- Test and Measuring equipment supporting dPMR™ (for radio development and maintenance)
  Various applications tailored for dPMR™ products

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