

## 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<sup>®</sup> MoU Promotion Working Group with the full consensus and approval of the member companies. The dPMR<sup>®</sup> MoU hopes this document will provide clarification to the myriad of information currently available. The dPMR<sup>®</sup> MoU has checked the content for accuracy but reserves the right to amend and/or correct any part of this document without notice or obligation.

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### **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<sup>®</sup> 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. The FDMA systems’ channel spacing is 6.25 kHz. For a more detailed explanation of the technical difference of TDMA and FDMA, please see the “What is dPMR<sup>®</sup>?” tab on the dPMR<sup>®</sup> MoU website (<http://www.dpmr-mou.org/what-is-dpmr-30-minutes.htm>).

### **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:**

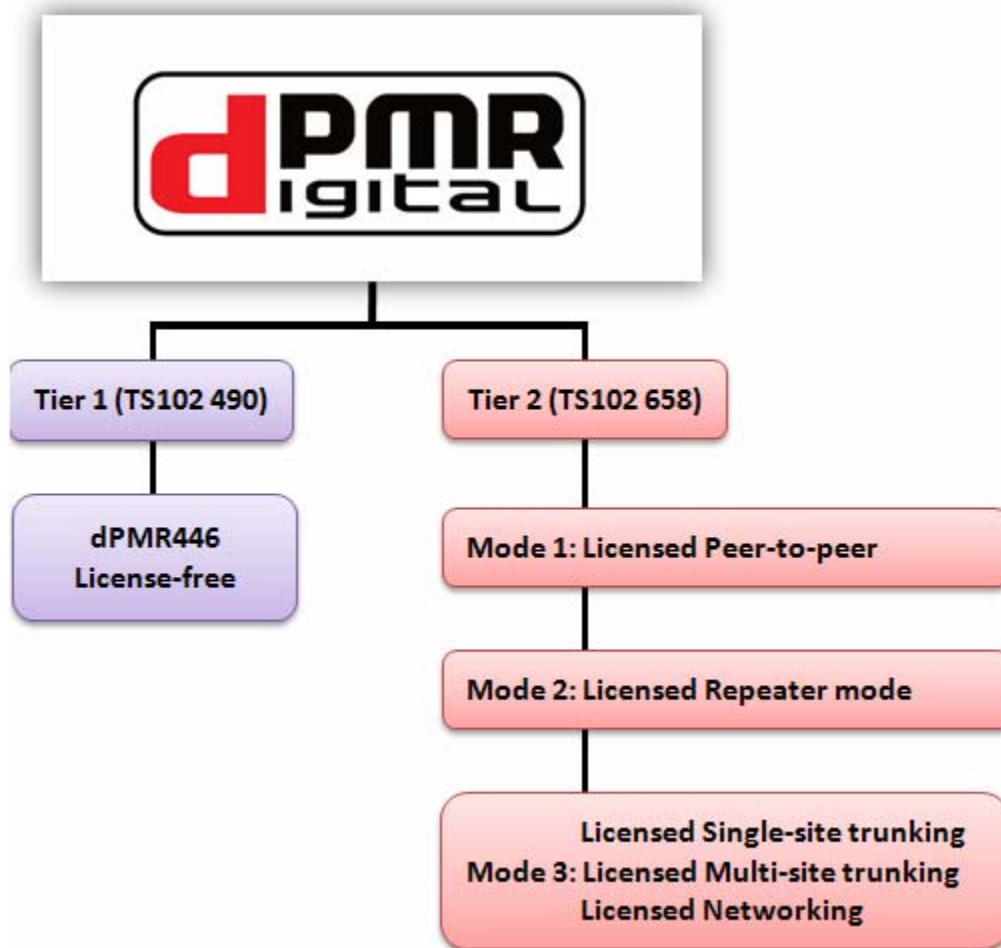
#### **Good old reliable FM:**

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<sup>®</sup>:

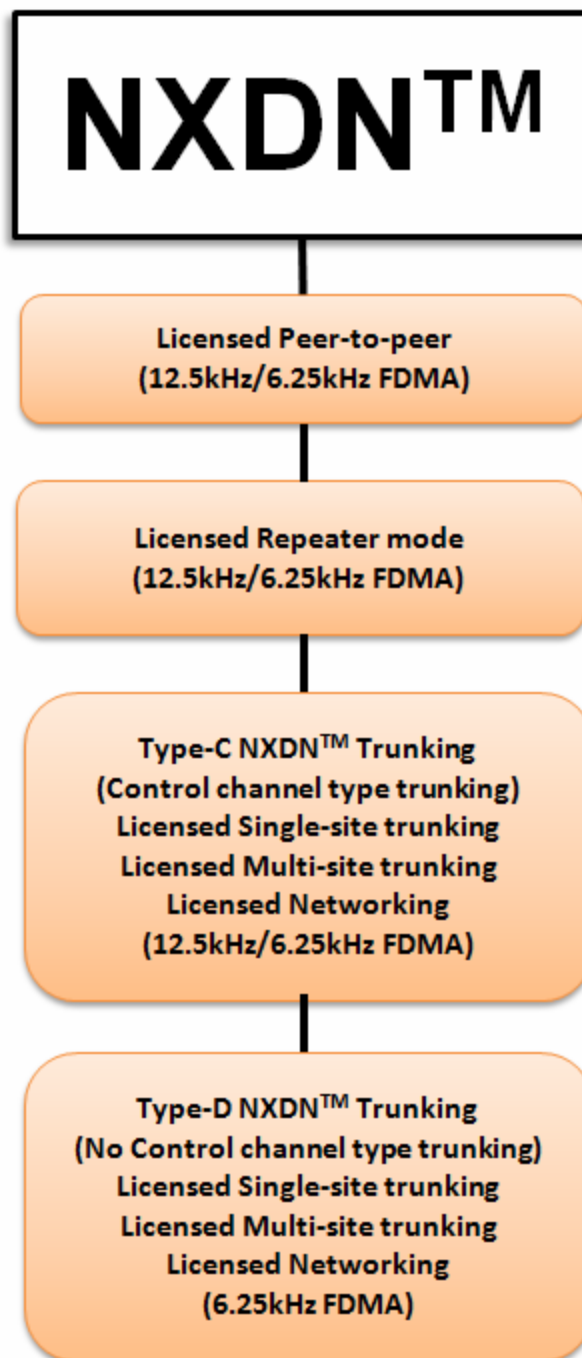
dPMR<sup>®</sup> is a digital 6.25 kHz FDMA based protocol described in the ETSI technical standards TS102 490 and TS102 658. Details of what dPMR<sup>®</sup> is and can do, can be found on the dPMR<sup>®</sup> MoU website, but the basic structure of the dPMR<sup>®</sup> suite is shown in the graphic below.



As the diagram shows, dPMR<sup>®</sup> is a full featured system capable of providing communications solutions ranging from license-free all the way up to nation-wide networks.

### NXDN<sup>™</sup>:

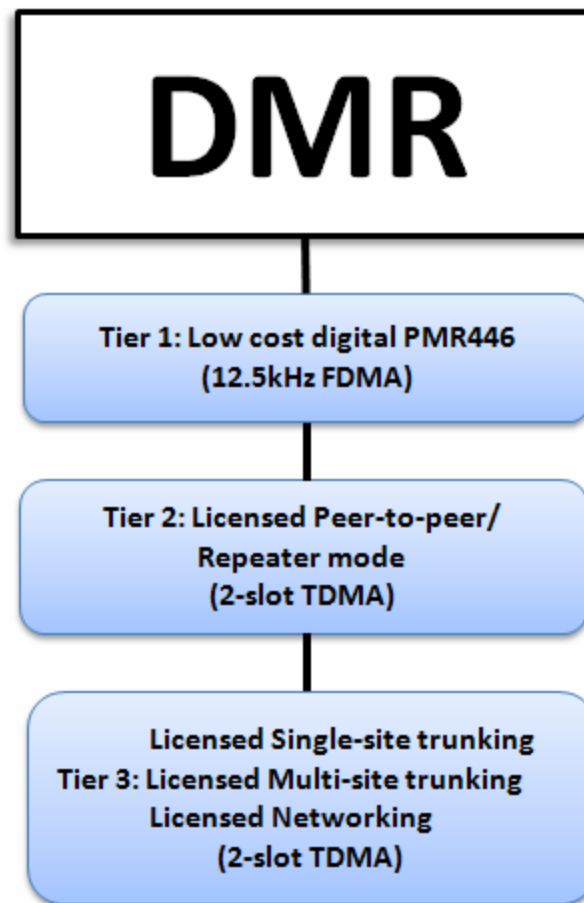
NXDN<sup>™</sup> is a digital 12.5 kHz or 6.25 kHz FDMA based protocol described in the NXDN<sup>™</sup> suite of standards. Details of what NXDN<sup>™</sup> is and can do, can be found on the NXDN<sup>™</sup> Forum website, (<http://www.nxdn-forum.com/>) but the basic structure of the NXDN<sup>™</sup>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



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 TS102 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 suite is shown in the graphic on the following page.



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

#### **Other Digital Systems:**

##### **APCO Project 25:**

APCO P25 is an evolving digital standard targeted mainly for the United States public safety market. The current Phase 1 part of the standard is a digital 12.5 kHz FDMA based protocol described in the TIA APCO P25 standards. A Phase 2 standard which is a 2-slot TDMA 12.5 kHz protocol is also recently 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:**

This is a digital 25 kHz 4-slot TDMA based protocol described in the ETSI EN300 392 suite of standards. Tetra is also targeted for the public safety market as well as high-end 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 is also developing a digital standard called Police Digital Trunking, which is a 12.5 kHz TDMA based standard.

As these indicate, there are also movements to adapt the base standards to country specific systems.

### 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 basically says there is room for both and it is still an even race. Below are some facts/statistics about this “race”.

**Fact 1:** At least 65% if not more of EVERY two-way manufacturer's business (including proponents of TDMA technology) is analogue FDMA based, and will continue to be so for the foreseeable future. FDMA has served the PMR/LMR industry as a reliable and proven radio technology for more than 70 years. Therefore, it is hard to believe that now the PMR/LMR world is going digital, FDMA is suddenly an “inferior” technology. It is still the most efficient method of achieving spectrum efficiency.

**Fact 2:** As of February 2011, the number of FCC licenses in the USA for narrowband digital technologies were:

- 79,900 FCC licenses for TDMA (DMR), and
- 79,300 FCC licenses for 6.25 kHz FDMA

As stated, this shows the market sees and accepts both technologies equally.

**Fact 3:** The number of 6.25 kHz radios in the market is estimated to be 350,000 to 400,000 units. Based on information in the public domain, the number of TDMA units in the market is probably about 600,000 to 700,000.

**Fact 4:** The number of countries where 6.25 kHz FDMA and TDMA digital systems are used worldwide is probably 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.

**Fact 5:** As of May 2011, the number of entities that support one or both of the technologies is as follows:

- DMR Association members : **26**
- dPMR® MoU members : **14**
- NXDN™ Forum members : **25**
- No. of dual members : **5**
- Net number of 12.5 kHz TDMA supporting entities : **21**
- Net number of 6.25 kHz FDMA supporting entities : **34**

**Fact 6:** As of May 2011 the supplier situation for the respective technologies is understood to be as follows:

- 12.5 kHz TDMA manufacturers with products\*: **5**
- 6.25 kHz FDMA manufacturers with products\*: **7**

\* Note “products” can be items that are not only radios, but silicon devices for example.

In regards to claims of multi vendor supply, it should be noted that to our knowledge, two of the five TDMA manufacturers are rebranding other manufacturer's products. It should also be noted that one TDMA manufacturer has supplied an estimated 90% of the DMR product to date. For 6.25 kHz FDMA, one manufacturer is rebranding another's product, and two companies have largely supplied the market to date.

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

**A5:** There have been comments in various media articles that dPMR<sup>®</sup> is a low cost "non-professional" orientated system. This should not to be confused with the original intention of dPMR<sup>®</sup> being 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, each system offers basically the same level of functions, trunking and networking capability. As with the "Which is better?" question, the answer is "the system that best suits the end user's needs".

**Q6: What about IPR, licenses or royalties?**

**A6:** dPMR<sup>®</sup> was also developed to avoid IPR and again reduce the total cost for both the manufacturer and ultimately the end user. A statement about dPMR<sup>®</sup> and IPR can be found on the website. No licenses are required for developing dPMR<sup>®</sup> either. Again, the dPMR<sup>®</sup> MoU can provide advice to prospective developers on this subject. However, it is public knowledge that a license is required to develop DMR, although the details require an NDA.

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