



# Analog Communications Planner

## A wireless planning guide for communications users

from



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## If you listen.....

to all the talk in the media, by manufacturers, sales representatives, and all the technical people in the know, you may conclude that all communications will soon be digital and if you don't make your move right now, you can be losing out on the greatest thing since sliced bread!

However, there is a contrarian opinion, not greatly publicized, but an opinion based on currently available statistical data. There are actually some people who claim that the cost savings of analog outweighs the perceived benefits of digital communications. Our job is not to debate the issues of analog versus digital, but to give you the facts you need to intelligently decide which is best for you.

Let's start by reviewing some of that statistical data. Mission Critical magazine, a highly respected magazine serving the communications industry and the major users of private wireless services recently conducted a reader survey to determine who is using what at the current time. The results may be surprising to many of the self proclaimed experts in the private wireless industry. Here are the results of the survey"

- 73% Use Analog Conventional Systems
- 38% Use Digital Trunked Systems
- 32% Use Digital Conventional Systems
- 30% Use Analog Trunked Systems
- 12% Use Commercial PTT (iDEN, Verizon, etc) Systems
- 9% Use Satellite Systems

Source - Mission Critical Communications -June, 2010

Mission Critical magazine is primarily focused on users involved in public safety, but in general, commercial users could be expected to reflect the same patterns. What we learn from these statistics is a trend from conventional (single channel, single user) systems to trunked systems where two or more users combine their frequencies for more efficiency. Putting it another way – any radio purchased today should be capable of trunking (multi-channel operation with automatic frequency selection) regardless of whether that radio is analog or digital.

As you will note, some agencies use commercial networks for wide area, even nationwide PTT (Push to talk service). While very popular just a few years ago, the demand for carrier provided service is declining since the demands of public safety communications are quite different from commercial networks. An even smaller number use Satellites for wide area PTT service. Satellite communications can be very useful, but in general, the high cost of non-existent coverage in buildings limits use for public safety users.

The bottom line is that the whole issue of analog versus digital communications is considerably more complex than some would have you believe. We hope that the material contained herein will be helpful making the right decision for YOU!

## Digital Differences

Before we discuss analog technology in detail, we think it would be beneficial to address the different types of digital systems currently available. As mentioned previously, we will not discuss carrier network or satellite networks since our focus is on the privately owned systems primarily used by mission critical public safety users. In addition to analog systems, there are four major forms of digital technology. They are DMR, NXDN, and P25 and TETRA. At this time (July 2013), this technology is being considered by larger utility users, but for now, the following would be the main choices for public safety and commercial users in the USA.

### DMR

Initially offered by Motorola, followed by Hytera, Harris, Tait, and Vertex. DMR (Digital Mobile Radio) is fundamentally a European technology standard. In essence, DMR is based on 12.5 kHz narrow band operating standards with the ability to split the allotted bandwidth into two separate “channels”. This allows two simultaneous communications paths – One for data and one for voice, two voice paths, or two data channels. The Motorola version of DMR is known as MotoTRBO. Hytera is the largest of the DMR competitors for Motorola. We have a complete information guide available at [www.info4u.us/DMR.pdf](http://www.info4u.us/DMR.pdf). Typical user pricing for mobiles is in the eight hundred dollar range, portables in the seven hundred dollar range, and repeaters in the twenty five hundred dollar range. Neither Motorola or Hytera suggests DMR as a mission critical communications technology, although it is sometimes chosen as it is significantly less expensive than the government approved P25 technology. We will deal with this in more detail shortly.

### NXDN

Many of the innovations in communications are developed by and for amateur communication users, alternately known as Hams. A technology developed by ICOM for amateur use is the building block for the technology known today as NXDN. The amateur digital format known as D-Star quickly became a defacto world standard with many of the features and functions that are now a part of NXDN technology. The primary providers of NXDN are ICOM (IDAS) and Kenwood (NexEdge). ICOM had approximately a one year head start over Kenwood, primarily as a result of experience with D-Star. NXDN is not suggested by either manufacturer for mission critical applications although the American Association of Railroads has accepted NXDN as the standard for railroad use. NXDN is the only technology currently available capable of operating at 6.25 kHz single channel Very Narrow Band (VNB) channel spacing. The prices are comparable to DMR. However, DMR is by far the more popular since it essentially gives the user two channels for the price of one.

### APCO-25 (P25)

APCO-25 or P25 is the oldest basic digital technology used in the USA but is an evolving technology which means that for future use, it is most likely the safest choice. It is the only technology endorsed by the Department of Homeland Security (DHS), FEMA, and SAFECOM and is required for use by all federal agencies and any governmental agency contemplating the use of federal funds for communications purchases. Prices will generally be at least twice as much as DMR or NXDN (in some cases, three or four times more). There are two basic types of P25 - Phase One, for non-trunking single channel operation and Phase Two which uses the same two for one technology as DMR.

## What are to Top 5 reasons for choosing digital radios?

**Number 5 - Technical benefits** – Digital radios consume less current than analog radios. This means portable batteries operate longer between charges. This leads to longer intervals between charges and that means longer battery operating life before replacement. Most digital radios use memory free, high capacity Lithium-Ion batteries that are smaller and lighter than the old Nickel-Cadmium or even Nickel Metal-Hydride batteries. Lower current consumption means less vehicle battery drain and longer operating life when fixed stations are operating on battery backup in an emergency situation.

**Number 4 - Advanced features** – There are some really beneficial options that can easily be incorporated in a digital communications system. The reason is that digital communications systems convert everything to data (including voice). This means it is fairly easy to add 2-way text messaging and GPS either for finding directions, fleet dispatch, or vehicle tracking. The most popular at this time is text messaging.

**Number 3 - Privacy** – The difference in 2-way radio and cellular communications is that cellular communications are designed for one-to-one communications whereas 2-way radio is designed for one-to-many communications. This is great for group coordination, dispatch, and other activities where a large group of people need to communicate with each other. The shortcoming of the one-to-many communications is the lack of privacy. Analog systems can easily be monitored by the public – not so with digital. Of equal importance, digital radio systems allow user groups, or even individuals, to communicate with each other in PRIVATE while still being available to monitor group activity. This is a huge benefit!

**Number 2 - Elimination of Noise** – Static, hiss, and fringe area communications are words that do not apply to digital communications. With an analog system, as the signal level degrades with distance, noise intensifies until the noise is actually greater in the fringe areas than the actual communication signal. You may be able to hear a transmission, but it is unintelligible because of noise – Not so with digital. If you've got a signal – it's crystal clear since there is no noise. A digital system sounds like it is talking farther than analog. Actually it doesn't. It just gives you maximum communications capability that sounds great!

**Number 1 - More Efficiency** – In the case of DMR and P25 Phase Two, you get two operating channels with a single repeater. This is a HUGE benefit. A DMR digital repeater now costs no more than an analog repeater, yet it can handle two separate conversations at the same time, in complete privacy, even TRUNK the two channels with the Hytera repeater! For smaller counties and/or municipalities, this two for one capability allows a single repeater to serve all the needs of law enforcement as well as fire and rescue users without interference. Phase One P25 and NXDN radios do not have this capability which is a major reason for the popularity of DMR, and more recently for P25 Phase Two technology.

As a final comment, it should be noted that interoperability to communicate with other users and compliance with mandatory government regulations are important, but the real reasons for going digital from the individual user viewpoint are as shown above. In general, the needs of law enforcement users are best served by using a large scale wide area system such as MISWIN.

The needs of fire and rescue users are very often best served with analog technology.. We've been using (and are still using) analog radios for close to a century. That should be reason enough to at least consider looking at our analog offerings. The price is right, and analog may be just the right choice for YOU!

## A Reintroduction to Analog Radio

There are two compelling reasons to consider analog radios over digital. They are LESS EXPENSIVE, compatible with other systems, and generally smaller and lighter. Features and functions for analog radios are available that provide similar capabilities to their digital counterparts. The chart below will give you an overview of analog and digital radios.

Criteria	Analog	Digital
Narrow band 12.5 kHz capable	Yes	Yes
Encryption for private communications	Yes (Some models)	Yes
User ID (Name displays on screen of other units)	Yes (Display models)	Yes (Display models)
Extended battery life	Yes	Yes
High output audio	Yes (Some models)	Yes (Some models)
GPS Option	Available	Available
Limited texting capability	Yes (Some models)	Yes (Some models)
Trunking, single and multiple site	Available	Available
2-Tone Paging	Yes	No
Audible and vibrate alert	Yes (Some models)	Yes (Some models)
Message record and playback	Yes (Some models)	Yes (Some models)
Intrinsically safe	Yes (Some models)	Yes (Some models)
Compatible with call boxes & wireless alarms	Yes	No
FCC licensing modification	Not required	Required

Well now, suddenly, analog doesn't look so bad does it? It should be noted that all digital radios, whether DMR, NXDN, or P25 are backwards compatible with analog radios operating at 12.5 kHz channel spacing. All digital radios have CTCSS and DCS tone squelch capability in the analog mode. This means that an analog radio CAN talk to a digital radio (as long as both are operating in the analog mode).

Digital radios can talk to each other only if both radios use the same digital operating system. (i.e. a DMR radio cannot talk to a P25 radio unless both radios switch to the analog mode). In addition, the standard protocol is for fire departments to switch to the analog mode when conducting on-scene communications. The reason being that analog has a higher level of immunity to background noise than digital!

Don't get us wrong. We encourage those we serve to seriously consider digital radio (in particular if they will be using federal funds to pay for their radios). Still, there are situations where budget, local interoperability and other factors can favor analog. Our job is to provide you with the facts and let YOU make the ultimate decision.

## The FCC and you!

One of the major influences toward the move to digital was an FCC requirement for all VHF or UHF radios sold in the USA after January 1, 2011 to be capable of operating with two 6.25 kHz slots (channels) within a 12.5 kHz channel width. FM Analog radios were not, and are not designed for this Very Narrow Band (VNB) standard.

Many users were moving to digital as they were prompted by the manufacturers to make the conversion to digital to avoid future problems and additional expense as the industry moved to VNB technology. This was good advice until June 30, 2010 when the rules were inexplicitly changed to eliminate this requirement. Suddenly the analog/digital playing field was leveled! More detailed information follows:



Score a knockout for another FCC mandatory compliance date! For those who keep up with such things, you know that the FCC yielded to pressure to cancel their original date of 2018 for mandatory 6.25 kHz Very Narrow Band (VNB) channel spacing.

There was also a requirement for all VHF and UHF 2-way radio equipment manufactured in the USA (you've got to be wondering who that would be) or any 2-way radio imported into the USA would have to be capable of operating at 6.25 kHz channel spacing. This was later changed to 6.25 kHz equivalence for 12.5 kHz Narrow Band Channel spacing (i.e. two 6.25 kHz channels per 12.5 kHz "channel").

Then, the FCC dropped the requirement for manufacturers to produce 6.25 kHz capable or equivalent equipment starting in 2011 and moved the date up to January 1, 2013. The bottom line is that 6.25 kHz has taken a SERIOUS hit! There are no established coordination policies for 6.25 kHz frequencies. The message from the FCC is very clear. The manufacturers who invested heavily in developing 6.25 kHz compliant technology as well as users trying to advance greater utilization of existing spectrum have just been rewarded with a *Thanks but no thanks* message for trying to meet yet another unfunded mandate.

In essence, the decisions by the FCC all but eliminated NXDN from the public safety marketplace. NXDN is still a viable alternate for many commercial users, but it is becoming increasingly rare as a choice for public safety users. Taking the place of NXDN for major utilities is the TETRA digital system (a subject for another day). Through it all, analog is still alive and well!

## Analog Radio Choices

Not too long ago, the big names in analog radios were Motorola, Kenwood, ICOM, and Vertex. In 2012, a major change swept through the marketplace with companies like CSI, HYT, Maxon, Ritron, TEKK, TecNet, and Vero taking major market share with affordable and reliable analog radios, many priced under two hundred dollars. Along with the lower prices came a host of innovative features that left the big name competitors far behind. The mid 2013, they still haven't caught up, and it doesn't appear that they will.

There will always be a market for high tier mission critical analog radios. Motorola is expected to continue to lead the field in terms of sales volume, but Kenwood generally provides greater value at less cost (at least as we see things). The one to watch in high quality analog communications is Tait Communications. Tait is leading the way in offering products that are based on total cost of ownership coupled with reasonable prices along with beneficial features. We think you'll be seeing more of Tait!

If you would like more information of affordable choices in communications, give us a call at 205.202.1269 or visit [www.samaritanservices.biz](http://www.samaritanservices.biz)