



**January 2010**

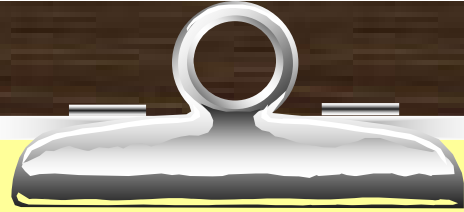
# **Narrowband Basics**

**For the Public Safety  
Community**



# Objectives

- Understand the why, what, and when for narrowbanding.
- Review some radio communication basics.
- Understand the differences between wideband and narrowband.
- Develop an awareness of potential problems.



## What does Narrowbanding mean?

- If you use the analogy of three radio channels being like a three lane expressway, it would be like adding three more traffic lanes in between the existing lanes without adding any width to the highway. In other words, the old highway had three lanes in 30', and the new one has six lanes in the same 30' width.
- In simple terms, splitting one frequency into two.



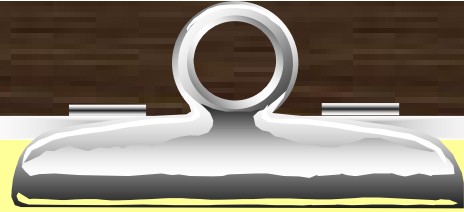
# Why the Switch to Narrowband?

- Increase the number of available frequencies for general use.
  - Many federal State and local agencies, including local public safety agencies use radio frequencies between 150MHz and 174MHz.
  - Where there was one frequency now there are two.
  - Increasing the number of usable frequencies reduces frequency congestion.



# What Has Changed?

- The National Telecommunications & Information Administration (NTIA) “refarmed” frequencies used by government agencies.
- As a part of refarming, each 25kHz wideband channel was divided into two 12.5kHz narrowband channels.
- There are now twice the number of available frequencies.



# When Did the Change Occur?

- In 1995, Congress mandated that all federal agencies transition to narrowband frequencies by January 1, 2005.
  - In 2013, the FCC will require all agencies utilizing public/private radio frequencies to be narrowband.
  - When technology permits, each 12.5kHz frequency will again be divided in half, resulting in an even narrower frequency of 6.25kHz.



# Deadlines

To phase in the migration deadline of January 1, 2013, the FCC has established interim deadlines. The first important deadline is January 1, 2011, after which:

- The FCC will not grant applications for new voice operations or applications to expand the authorized existing stations that use 25 kHz channels. Only narrowband authorizations will be granted.  
(Only narrowband frequencies)
- The FCC will prohibit manufacture or importation of new equipment that operates on 25 kHz channels. This will reduce the availability of new equipment for new radio systems and will affect how agencies maintain and upgrade older systems.

# A Channel is Defined By Its.....

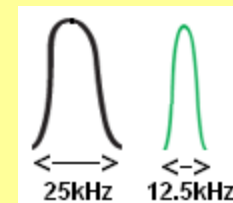
- Frequency

- Every channel on a radio has a specific frequency.
- FM frequencies are shaped like a “bell”.
  - The “bell” seen on a spectrum analyzer and indicates the signal strength as a function of frequency.



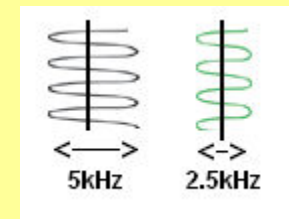
- Bandwidth

- The width of a frequency’s bell.
  - Wideband – uses a range 25kHz wide.
  - Narrowband – uses a range 12.5kHz wide.  
*(half the wideband bandwidth)*



- Deviation

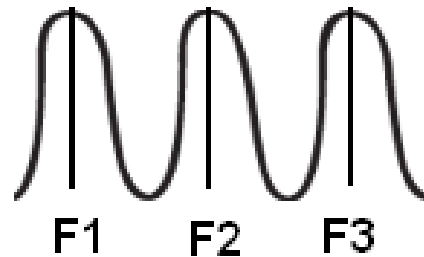
- The amount of modulation (voice) carried on a frequency within its assigned bandwidth.
  - Wideband deviation is 3-5kHz.
  - Narrowband deviation is 1.5-2.5kHz.  
*(half the wideband deviation)*



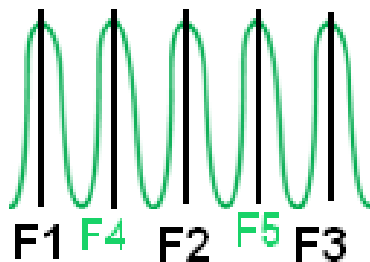
# Wideband vs. Narrowband

## Frequency Separation

Wideband  
Frequencies  
(25kHz apart)

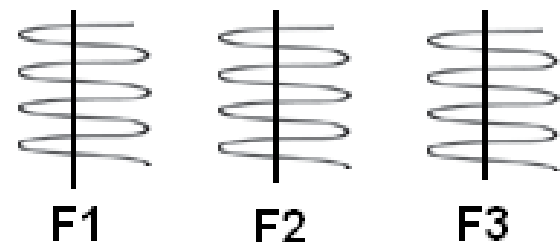


Narrowband  
Frequencies  
(12.5kHz apart)

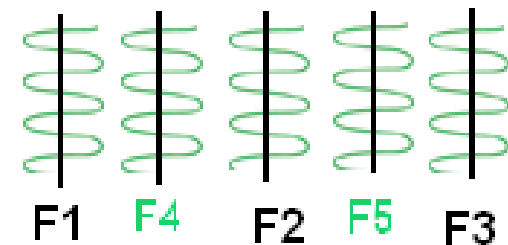


## Frequency Deviation

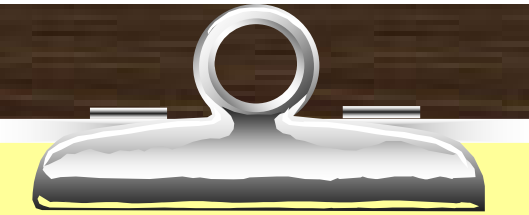
Wideband  
Deviation  
5kHz



Narrowband  
Deviation  
2.5kHz



*Note: Signals do not touch their neighbors.*



# Interference

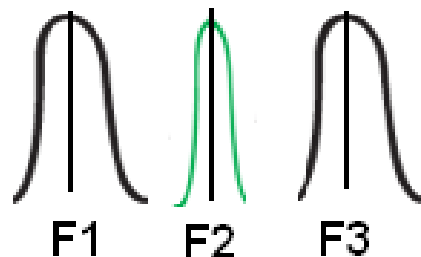
- Interference occurs when both wideband and narrowband are used to communicate on the same channel.
  - This is the cause of many of our current communication problems.
  - Channels are programmed for either wide or narrowband.
  - Channels must be programmed consistently for all radios in use.
  - Not all agencies are narrowband capable.
    - Includes ancillary equipment, such as repeaters, handhelds, and mobiles.
  - Units broadcasting wideband need to be reprogrammed to narrowband and given a warning, or if the radio is wideband only, they need to be sent home or issued a fine after the compliance date.

# Possible Interference Problems

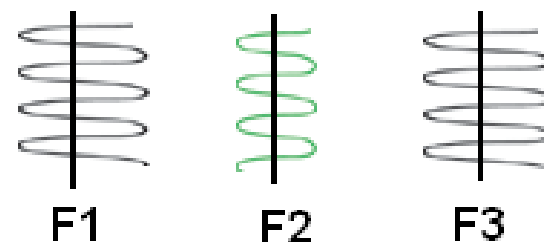
- **Narrowband Communication on a Wideband Channel**
  - Received audio may be very soft and quiet.
  - Caution, wideband radios must turn up volume to hear. However, once a second wideband radio transmits, the original wideband radio's received audio will become very loud.
  - Audio may not be picked up (processed) by wideband receiver.

## Narrowband on a Wideband Channel Interference

### Frequency Separation



### Frequency Deviation



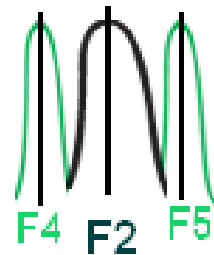
*Note: The narrowband signal is "narrower" resulting in larger gaps between the signals.*

# Possible Interference Problems

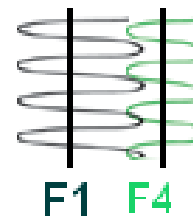
- Wideband Communication on a Narrowband Channel
  - Received audio may be loud, distorted, or inaudible.
  - Communications may work at a distance but no audio may be received when close to receiver.
  - Usually the cause of mixed band communication problems.
  - Caution, if you turn down the volume, narrowband communications may not be heard.

## Wideband on a Narrowband Channel Interference

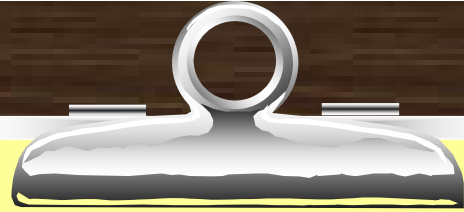
### Frequency Separation



### Frequency Deviation

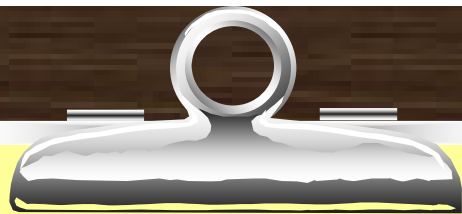


*Note: The wideband signal overlaps the narrowband signal.*



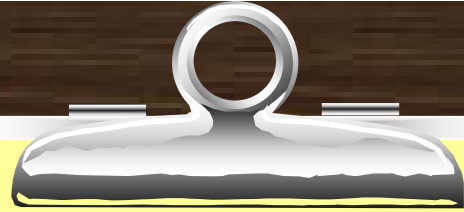
# Why New Radio Equipment?

- Narrowbanding halved a frequency's bandwidth and deviation.
  - Many older wideband radios could not operate on frequencies set to narrowband. They could only be set to frequencies on wideband.
  - An older wideband radio's frequency would interfere with both new narrowband frequencies on either side of the old frequency.



# Planning for the Move to Narrowband

**Assess current equipment and start planning.** To prepare for the migration, public safety agencies should start assessing their radio systems and planning for replacements or upgrades. They should inventory their current equipment to ascertain what can be converted to narrowband and what will need to be replaced before January 1, 2013. Most new equipment has the capability for both wide and narrowband because any VHF/UHF radio equipment accepted by the FCC after February 14, 1997, had to have both capability. The narrowband equipment is available in both conventional analog FM and digital formats (such as Project 25), so narrowband conventional FM systems will be compliant. Local governments should develop contingency plans to accommodate system changes for both public safety and nonpublic safety systems.



## Planning for the Move to Narrowband

- **Obtain new or modified licenses.** To move to narrowband operations, agencies must apply for new frequencies or modify existing licenses. An agency that is licensed for a wide channel is not guaranteed two channels. Licensees will have to justify to the FCC why they need additional channels. Consideration of applications for new narrowband licenses will follow the same process as a new license application. As agencies migrate to narrowband operation, however, the pool of available frequencies will increase.



# Avoiding Problems

1. Do not operate in a mixed band environment. Only use narrowband.
2. Issue narrowband capable equipment to those with wideband only equipment. Report the deficiency back to authorities if you discover an issue.
3. Establish reliable communications before entering the field.



# Programming Help

- The <http://radios.nifc.gov/> site has up-to-date tips, news, and troubleshooting information.
- Check this site to find the following information:
  - How to verify if radio is narrowband or wideband.
  - How to program your radio for narrowband or wideband operation.
- [www.Lincolncountyema.net](http://www.Lincolncountyema.net)