

RUTGERS

Edward J. Bloustein School
of Planning and Public Policy

Narrowbanding

WT Docket No. 99-87
Mandatory VHF/UHF



Narrowbanding

Course Goal

Inform senior and executive management at transit agencies who need to be aware of the mandatory narrowbanding regulations and how it will affect their agency's radio communication system



Course Objectives

- Discuss how to determine if your current radio system is at risk
- Identify potential funding sources for project implementation
- Determine your regional interoperability, which may impact your transition
- Explore the benefits of narrowbanding for the transit industry
- Explain the impacts of non-compliance

What Is the FCC's Goal?

- Absence of clear land mobile radio spectrum available for public safety and business/industrial users for typical voice and data communications
- FCC wants to increase number of users that can be accommodated on land mobile spectrum
 - FCC proceeding to consider options begun in 1992
 - FCC Narrowbanding deadline set in December 2004

What Is the FCC's Goal?

Accomplish by making all users become more spectrum **efficient**

- All users must use no more than 12.5 kHz of channel bandwidth as of 1/1/2013
- Channels have operated with 25 kHz bandwidth for several decades
 - Reducing occupied bandwidth by half creates increased spectrum efficiency and additional opportunities for new users and capacity expansion of existing systems

Are You An Impacted Licensee?

- Do you operate on a private radio system?
 - Not cellular phones
- What frequency band do you operate in?
 - 35 MHz, 150 MHz, 450 MHz, 700 MHz, 800 MHz, 900 MHz
- Do you operate on your own system?
 - Do you share a system with other agencies?
 - Do you operate on a commercial private system?
- Is your system voice or data or both?

Impacted Bands

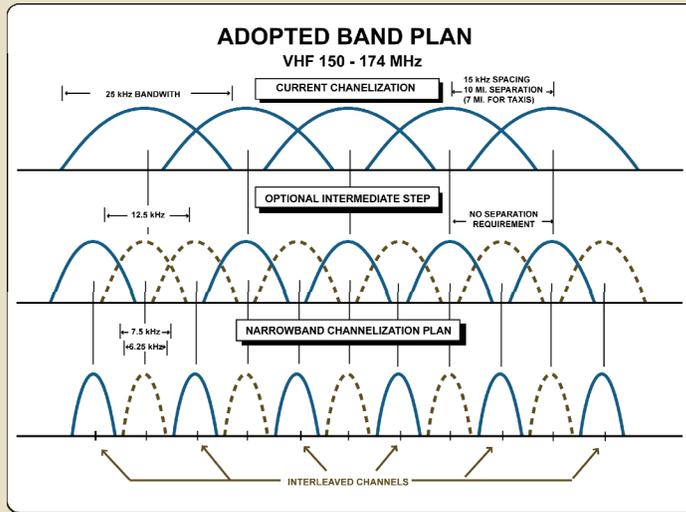
- VHF – 150-174 MHz
- UHF – 450-470 MHz
- UHF – 421-430 MHz
 - Detroit, Buffalo, and Cleveland
- UHF – 470-512 MHz in 11 cities where this spectrum is allocated for land mobile

Bands NOT Impacted

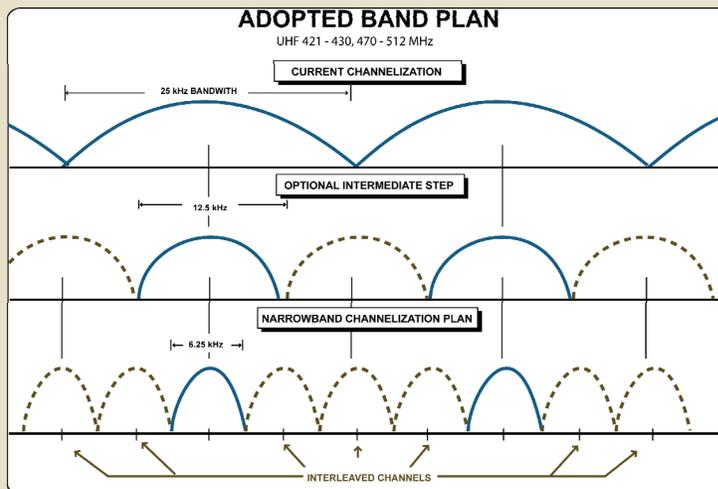
Not included in this proceeding

- 700 MHz – still need to narrowband, but under different rules
- 800 MHz
- 900 MHz
- Low band
- Part 22

Narrowbanding – 150-170 MHz VHF



Narrowbanding – 421-512 MHz UHF



What Does Narrowbanding Do?

- Allows new users to be placed on frequencies in between newly narrowbanded systems
 - **Brown dashes on prior slide**
- Reduces amount of adjacent channel overlap at VHF
- New equipment also brings potential new services for users through increased ability of new equipment to handle new applications

What Qualifies As Narrowband?

Spectrum efficiencies that meet FCC 2013 12.5 kHz efficiency rules for user equipment:

- Voice:
 - 1 voice path in one 12.5 kHz channel
 - 2 voice paths in one 25 kHz channel
- Data:
 - 4800 bits per second (BPS) per 6.25 kHz channel
 - 19200 BPS per 25 kHz channel
 - If operation is conventional, no channel exclusivity possible and operations secondary to other voice

Equivalent Efficiency

- FCC mandate is by spectrum efficiency
- Voice operations – one voice channel per 12.5 kHz of bandwidth
 - 12.5 kHz FDMA meets standard
 - Two-slot 25 kHz TDMA meets standard
- Data operations – minimum data rate of 4800 bits per second per 6.25 kHz of bandwidth for data systems using more than 12.5 KHz of bandwidth
 - 19200 BPS per 25 kHz channel
 - If operation is conventional, no channel exclusivity possible and operations secondary to other voice

What Qualifies As Very Narrowband?

- Technologies that meet FCC **6.25 kHz** efficiency rules for user equipment (equivalent efficiency):
 - 1 voice path in one 6.25 kHz channel
 - 2 voice paths in one 12.5 kHz channel
 - 4 voice paths in one 25 kHz channel
- While there is no FCC deadline for user migration to 6.25 kHz bandwidth efficiency, the FCC “recommends” users skip the intermediate 12.5 kHz efficiency step and go right to 6.25 kHz
- All equipment FCC type certified after 1/1/2011 must have 6.25 kHz efficiency **capability**

Are Your Radios Impacted?

- Each radio model is different, check with your technical folks, consultants, radio dealer, and/or manufacturer
- Radios (and repeaters) purchased since \approx 2000 are most likely dual mode and can operate either in wideband (25 kHz) or narrowband (12.5 kHz) analog mode
 - These radios only need to be **re-programmed** to operate in narrowband mode to meet FCC rules

Are Your Radios Impacted?

- Radios (and repeaters) purchased prior to 1997 must be replaced
 - Related radio accessories and infrastructure might have to be replaced, if there is an interface incompatibility
- Radios (and repeaters) purchased between 1997 and 2000 should be reviewed to determine if they are dual mode

Current Narrowbanding Deadlines

Issue	Relevant Date
New 25 kHz wideband applications	1/1/2011
Modification applications to expand contours of 25 kHz systems	1/1/2011
End of equipment certification of 12.5 kHz; only equipment without 6.25 kHz equivalent mode	1/1/2011
Paging only channels (152.0075 and 157.4500 MHz ONLY in PS, numerous in B/ILT)	Do not narrowband!
End of manufacturer building or importing 25 kHz only equipment	1/1/2013
Mandatory B/ILT 12.5 kHz conversion	1/1/2013
Mandatory PS 12.5 kHz conversion	1/1/2013
Mandatory 6.25 kHz conversion	Not until "technology matures"

PS – Paging System B/ILT – Business/Industrial

Should You Seek Assistance?

If your radio system is of significant size, you may need to employ consultants for your system review

- Do you need to issue an RFP?
- Vet your consultants carefully
 - Do they have real land mobile radio experience?
 - Do they have the ability to fully review your situation?
 - Radios, repeaters, consoles, system coverage, license issues, potential system enhancements, etc.

Begin Your Review

Review your FCC license

- Expiration; address; contact; operating frequency; operating location; number of units; emission designator
- If you operate on someone else's radio system, contact the licensee

Inventory Your Equipment

- Mobiles, portables, MDTs, repeaters, consoles, etc.
- Note serial number on equipment
- Consult manufacturers (and their websites) as to whether equipment is wideband only (and must be replaced), dual-mode analog, or narrowband

Common Manufacturer Websites

- Motorola
 - www.motorola.com/Business/US-EN/Business+Solutions/Product+Solutions/Public+Safety+Communications/Narrowbanding_US-EN
- Harris
 - www.pspc.harris.com
- Icom
 - www.icomamerica.com/en/landmobile
- Tait
 - www.taitworld.com/main/index.cfm/1,525,0,48,html

Common Manufacturer Websites

- Kenwood
 - www.kenwoodusa.com/Communications/Land_Mobile_Radio
- E. F. Johnson
 - www.efjohnsontechnologies.com/products
- Association of Public Safety Communication Officers (APCO) article on narrowband capable equipment
 - www.apcointl.com/frequency/documents/narrowbandingequipment.pdf

Determine Your Interoperability

- What agencies do you interoperate with?
 - Police, fire, transit, disaster teams, etc.
- How do you interoperate?
 - Shared talk groups
 - Mutual aid frequencies
- You must coordinate with your interoperability partners to ensure no loss of communications during the transition

Implementation Options

- Simple solution – radio by radio swap
- System redesign
 - VHF band
 - UHF band
 - 800/900 MHz
 - Purchased/leased spectrum
- Hybrid solution – combining private system with commercial carriers

Develop a Narrowbanding Plan

If your equipment is dual mode (i.e., narrowband capable)

- Develop a plan to reprogram radios and repeaters
- Don't forget to coordinate with interoperability partners
- If analog only, consider whether this presents an opportunity to "future proof" your system and add features by upgrading to 6.25 kHz capable equipment (more on this later)

If Your Equipment Must Be Replaced

Develop a narrowbanding plan

- Develop your business case
- Narrowbanding may be an opportunity to upgrade system functionality
- Consult system users to determine list of needed features
- Evaluate feature prices against available budget
- Develop multiple options:
 - Least cost solution to achieve 2013 compliance
 - System redesign for additional functionality

Future Proof Equipment Options

- 6.25 kHz spectrum efficiency equipment is readily available from a variety of manufacturers
- Ensures no need for mandatory second equipment change out
- Most 6.25 kHz efficiency equipment is backward compatible
 - Enables easy transition

FCC License Modifications

Currently operating wider than 12.5 kHz?

- File modification application for proper new emission designator
- Licensee must provide certification of narrowband operation by 1/1/2013
 - FCC to revise FCC forms to enable licensees ability to certify
- No new construction notification (schedule K) needed

Your License

Emission designator

- Licenses must be updated to include new emission designator(s)
- Reduction of bandwidth (only) does not require frequency coordination
 - Exception – “quiet zone” operation
 - Must obtain frequency coordination if other changes made
 - Analog to digital
 - ERP, antenna, or location changes
 - Temporary “offlining” procedure in place until ULS updated

Licensee Notifications To FCC

- Already operating 12.5 kHz or less bandwidth
 - Do nothing
- Licensees with dual emission designator
 - FCC says no need to file for removal; FCC will presume narrowband operation post 1/1/2013
 - FCC may audit

Impact of Emission Designator Modification

- Canadian coordination for border licensees
 - If no site or ERP modifications made, no re-coordination with Canada needed
 - HOWEVER, if you are adding an emission designator for new transmission technology (i.e., digital), you will need Canadian clearance again
- Safe Harbor Table (Section 90.205)
 - Safe Harbor Table limits ERP for higher elevations
 - Older licenses at higher elevations grandfathered
 - If no site or ERP modifications made, older licenses remain grandfathered

Will I Lose Coverage?

- All other things being equal (e.g., height, ERP), it depends
- 25 kHz analog to 12.5 kHz analog = 3 dB loss IF:
 - No consideration of the bandwidth of the receiver's IF;
 - Static sensitivity
 - Faded sensitivity
 - But going to 12.5 kHz digital may make up the difference
- You need to consult a competent engineer familiar with these issues

What If I Don't Do Anything?

- FCC December 2009 Public Notice
 - No secondary wide-band operation post 1/1/2013
 - “Operation in violation of the Commission’s rules may subject licensees to enforcement action, including admonishments, monetary forfeitures, and/or license revocation....”
- FCC will begin putting special conditions on all new, renewed, and modified licenses to remind licensees of deadline

“I’m Public Safety...”

What are they going to do to me?

- Brevard County, Florida Jail
- Non-renewal fines and reinstatements
 - Pre-ULS: Hudson County, NJ; Redondo Beach, CA; Upper Cumberland Regional Airport Board, PA – \$2,000 fine
 - Post-ULS: North Eastern Mass Law Enforcement Council; Malden R-1 School District; City of Billings Public Works – FCC refused to reinstate licenses
 - Post-ULS: Cooperative Light & Power – \$20,000 fine
 - Microwave licensee loses primary status – SW Central Dispatch; Warren County; Stanislaus County

Funding Available Through FTA (§ 5307)

Urbanized Areas Formula Program – eligible recipients are public bodies (3 tiers available)

1. Large Urbanized Areas (UZAs) have > 200,000 population
 - Funds apportioned directly to UZAs based on population, density, and other service factors
 - UZAs required to designate a recipient of funds, who is responsible for deciding how the funds are used
 - Funds may be used for capital and/or planning purposes
2. UZA with 50,000 to 200,000 population
 - Funds apportioned directly to State Governors
3. Small Transit Intensive Cities (STIC) have < 200,000 population, but experience abnormally high level of service



Funding Available Through FTA (§ 5311)

- Non-Urbanized Areas Formula Program – sub-recipients may be public bodies or private non-profit agencies
 - Funds apportioned to States based on non-urbanized land area and population
 - States decide which sub-recipients to fund; available to cities < 50,000 population
 - Funds may be used for capital, operating, state administration, and project administration expenses
- Tribal Transit – funding is a takedown from § 5311 (before apportionment to States)
 - Only federally recognized Indian tribes are eligible



Funding Available Through FTA

Discretionary funds

- Determined yearly – see www.grants.gov for more information
- Examples – §§ 5309, 5318
 - § 5309 – eligible capital assistance for new/replacement equipment and other activities
 - § 5318 – eligible capital projects (e.g., purchase of mobile radio units)



Funding Available Through DHS

- Department of Homeland Security (DHS) distributes grants to improve emergency management and preparedness capabilities
- Available funds (not inclusive):
 - DHS Office of Emergency Communications
 - FEMA
 - Public Safety Interoperable Communications
 - State Homeland Security Grant
 - Assistance to Firefighters Grants
 - Staffing for Adequate Fire and Emergency Response
 - Urban Areas Security Initiative
 - Assistance to Rural Law Enforcement to Combat Crime and Drugs
 - Community Oriented Policing Services
 - ARRA
 - Edward Byrne Memorial Justice Assistance Grant Program
 - Interoperable Emergency Communications Grant Program
 - Border Tactical Communications Program



Funding Available Through DHS

- Comply with SAFECOM guidance
 - Map to National Emergency Communications Plan (NECP)
 - Includes information on converting to narrowband equipment
- Ensure the following plans exist for your agency or region
 - Statewide Communications Interoperability Plan (SCIP)
 - Tactical Interoperable Communications Plan (TICP)

Narrowbanding Myths

Myth – You must go digital

- Truth – Analog narrowband equipment is acceptable and widely available from a variety of manufacturers
 - Since 1997, all newly certified equipment had to have 12.5 kHz mode (12.5/25 kHz dual mode was acceptable)
- Truth – No mandate to go to P25
 - Some federal grants do require going to P25

Narrowbanding Myths

Myth – You will double your channel capacity by going narrowband

- Truth – While narrowbanding “frees up” adjacent channel spectrum, you do not get a license for that adjacent spectrum
 - Maintain existing channel center
 - Is it possible to use non-standard frequency center, go 6.25 kHz on a 25 kHz channels, and get 3 for 1?

Narrowbanding Myths

Myth – You must buy new equipment

- Truth – Most new equipment bought during the past ten years is dual-mode (certification date is 1997) and may operate narrowband
 - Check with your manufacturer
- Truth – Compatible narrowband equipment can be gradually integrated into the existing system
- HOWEVER, for VHF PS licensees, make sure your guns and hoses radios can operate on the new VHF national interoperability channels – 151.1375 (VTAC 11) and 154.4525 MHz (VTAC 12)

Narrowbanding Myths

Myth – you must go 6.25 kHz by 2013 (or any other date) at VHF or UHF

- Truth – You must go 12.5 kHz by 2013, the FCC only **encourages** you to go 6.25 kHz at UHF and VHF in anticipation of some eventual conversion in the future
- 6.25 kHz equipment is readily available from a variety of manufacturers
 - No P25 standard for 6.25 kHz yet

Narrowbanding Myths

Myth – Paging on voice channels may remain wideband

- **Truth – Only paging on paging-only channels may remain wide-band**
- In public safety, ONLY 152.0075 and 157.4500 remain wide-band
 - Med channel 163.250 MHz MUST be narrowbanded
 - See Detroit Medical Center case, released March 7, 2007
- B/ILT – 4 paging-only VHF channels, 10 paging-only UHF channels

Narrowbanding Myths

- Myth – Reduction from 25 kHz to 12.5 kHz means existing licensees must change channel centers
 - Truth – License modification is to reduce deviation; channel centers for existing licensees remain the same
- Myth – VHF/UHF narrowbanding is the same as 700 MHz narrowbanding and 800 MHz rebanding
 - Truth – Different rules, different rationale, different goals, different timetables
 - Nextel is not funding narrowbanding!

What Happens Between Now and 2013?

- Influx of narrowband equipment on adjacent frequencies may increase interference to wideband systems on old “main” channels
 - Remember, systems that don’t have channel exclusivity (see Section 90.187) aren’t protected from interference
- 12.5 kHz narrowband at VHF eliminates some, but not all, adjacent overlap

What Happens Between 2011 and 2013?

- Manufacturers/providers continue to sell 25 kHz efficiency radios until Dec. 31, 2012 if type certified before January 1, 2011
 - Challenge – manufacturers need to determine inventory levels, if any, for all 25 kHz efficiency radios to be sold during 2011/2012
- By Jan. 1, 2013, licensees must:
 - Disable the 25 kHz mode on all dual mode radios
 - Replace all radios capable of only 25 kHz efficiency operation

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