

NARCC Technical Committee

Where we are...

Where should we go?

27 APR 2013



Overview

- Many members and non-members have expressed interest in new repeater technologies
- Our standards were basically designed for FM systems
- Advances in technology allow for more efficient use
- ARRL and FCC reports indicate that repeater bands are under-utilized
- But, members have expressed their concerns over potential interference to their repeater
- New users want NARCC to coordinate new uses between channels and in other sub bands



Overview (cont.)

- NARCC needs new policies and standards to address these issues
 - What standards are out of date?
 - What standards need modification?
 - What sorts of new standards can be made?
 - When is the right time to implement change?
 - Will my repeater lose coverage?

Current NARCC Standards

- Industry standard PL or DPL on FM repeater *inputs*
- 20 kHz channel pairs on 6 meters
- 20 kHz channel pairs below 146 on 2 meters
- 15 kHz channel pairs above 146 on 2 meters
 - *Special narrow receiver rules and 4.0 kHz deviation limit*
- 20 kHz channel pairs on 1.25 meters
- 25 kHz channel pairs on 70 cm
 - *Special power considerations to protect Pave-Paws Radar*
- 12.5 kHz channel pairs on 33 cm
- 25 kHz channel pairs on 23 cm

Standard to Consider--One

- Use industry standard PL or DPL on repeater outputs
 - Right now we only stipulate this require on inputs
 - *We need it on outputs, too*
 - Why--This allows users in fringes to avoid nuisance interference



Standard to Consider--Two

- Document 12.5 kHz channel “chunks” on UHF for use by narrow band technologies
 - Applicants for narrow band FM technologies need to demonstrate that their equipment is set for 2.5 kHz deviation. (AKA 11.25 kHz occupied bandwidth, 11K0F3E)
 - Applicants for digital technologies need to specify their occupied bandwidth—This will determine the channel needs



Standard to Consider—Two (cont.)

- Applicants for narrow band channels must demonstrate protection from existing users 6.25 kHz offset. (FYI—The commercial standard on VHF is around -120 dBm)
- Applicants for narrow band channels must accept interference from coordinated repeaters 6.25 kHz away
- Design in the 6.25 kHz splits to the plan, so as new technology comes along, it can be implemented on the correct frequencies
- Eventually specify occupied bandwidth for all other channel plans

Standard to Consider--Three

- Frequency stability/tolerance
 - The narrower the channel, the more important frequency tolerance needs to be to avoid interference
 - We need a real standard for all stations to meet going forward
- Modulation index ($B = \text{Dev}/\text{Max Audio}$)
 - 5 kHz Deviation: $B = 1.67$
 - 2.5 kHz Deviation: $B = 0.69$



Standard to Consider--Four

- Adjacent channel protection guidelines for narrow band systems similar to commercial guidelines
 - Coordinators need some metric to predict harmful interference between new narrow band users
 - We can look to the commercial standards for guidance

Standard to Consider—Five

- ERP limits based on height above average terrain (HAAT) on all new systems
 - This would essentially establish a service contour size and eliminate “super power, high altitude” applications
 - The higher the antenna, the lower the ERP



Standard to Consider--Six

- Formally adopt a co-channel and adjacent channel interference criteria to determine a service area based on Radio Soft software.
 - We have the tools, yet our Coordinators do not have NARCC adopted standards in place to predict coverage and interference between repeaters
 - We are asking our Coordinators to coordinate repeaters without any metrics

Standard to Consider--Seven

- Allow new repeater owners to use “guard receivers” on repeater inputs to protect existing repeaters, to increase frequency re-use
 - Guard receivers monitor an existing channel for use—If it is in use, the transmitter is blocked from transmitting



Standard to Consider--Eight

- Require all new repeater owners to certify that their equipment is frequency agile
 - Future agility will be necessary to implement band changes
 - If equipment is ready, we are much more future proof
 - Set a sunset on coordinating old legacy “rock bound” systems unless a statement is received that they will pay for their own re-tuning



Standard to Consider--Nine

- Require a new statement with all new repeater coordination's that states something like:
 - “by FCC rules, no amateur radio operator has an exclusive right to any amateur radio frequency. NARCC will not guarantee a specific channel, and repeaters owners must cooperate with NARCC if requested by the band Coordinator to facilitate and improve spectrum planning efficiency.”



Standard to Consider—Ten

- Re-affirm that only the repeater is protected from interference, not the user stations
 - It is impossible to protect all user stations in all areas with a *repeater* coordination

Standard to Consider--Eleven

The -XYZ dBm Question

- - 130 dBm is the general noise-floor limit of signal
- A typical radio has a 12 dB Sinad (generally readable) sensitivity of 0.18 uV / -122 dBm / about S-1, enough to “break squelch”
- A readable signal is about 1.77 uV / -102 dBm / S-4
- A strong signal is about 70 uV / -70 dBm / S-9
- Once the standard is set, our Coordinator's will have the tool they need to do their job?
- What is the ratio of desired to undesired signal going to be?

Other Issues to Consider

- What to do with 2 meters?
 - Our 15 kHz channels lend themselves to split as 7.5 kHz channels
 - Useful only to new narrow capabilities
 - 7.5 kHz is what the FCC mandated for high band narrow banding (Part 90)
 - Our 20 kHz channels lend themselves to split as 10 kHz channels
 - Again, only useful for new narrow capabilities
- Does it warrant complete re-farming with a future implementation date?
 - Re-farm 2 meters to 12.5/6.25 kHz requires most to move

“ARRL Band Plan”

144.00-144.50 EME (CW), General CW and weak signals, EME and weak-signal SSB, National calling frequency, General SSB operation, Propagation beacons, New OSCAR subband

144.50-144.60 *Linear translator inputs (breached 5x = 144.51 - .59)*

144.60-144.90 FM repeater inputs

144.90-145.20 Weak signal and FM simplex (145.01,03,05,07,09 are widely used for packet), *Linear translator outputs*

145.20-145.50 FM repeater outputs

145.50-146.0000 *Miscellaneous and experimental modes, OSCAR subband*

146.01-146.37 Repeater inputs

146.40-146.58 Simplex

146.52 National Simplex Calling Frequency

146.61-146.97 Repeater outputs

147.00-147.39 Repeater outputs

147.42-147.57 Simplex

147.60-147.99 Repeater inputs

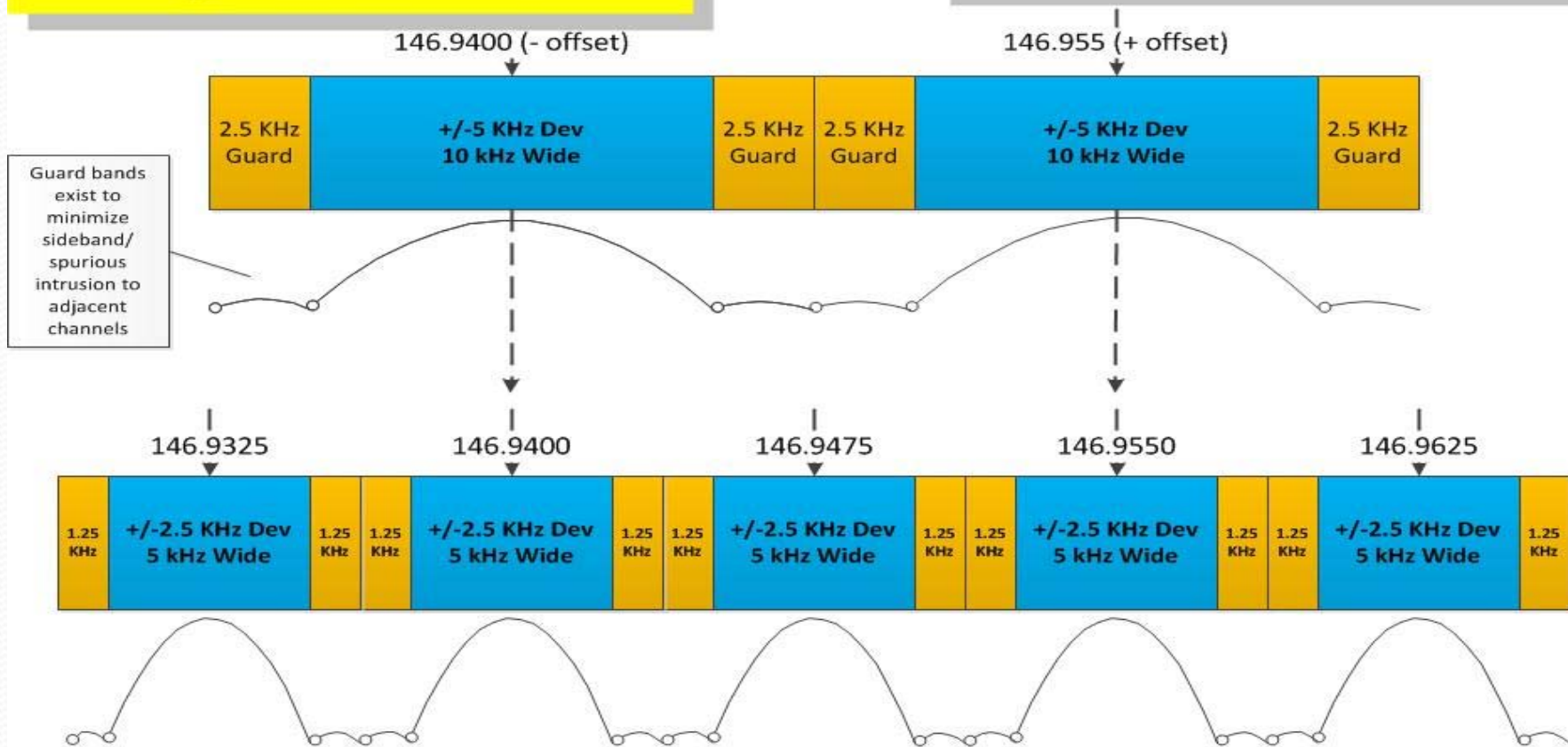
What 'Expansion' Looks Like

Re-farming 146-148 will be somewhat obvious. After existing adjacent channels are narrow-band compliant, new 7.5 KHz assignments may begin.

*** **HOWEVER**, since NorCal alternates In/Out every other 15 KHz channel, orientation changes or geographical separations must be considered.

Re-Alignment 146-148 MHz

Radios **MUST** be capable of standard/common 7.5 KHz frequency programming increments.



Expansion Considerations

- Prior survey indicates incapable user equipment
- Survey current repeater equipment for 'expansion' (i.e., true narrow-band)
- Determine availability of appropriate site equipment
- Determine availability of appropriate user equipment
- Determine a reasonable timeline for transition
- Determine a logistics process for transition
- Determine measurability of compliance



How To Affect Technical Change

- Participate in the technical committee
- Bring forward proposals you believe can gain community acceptance and action, within the appropriate spectrum of interest

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de Jim Aspinwall, K9GVF, Technical Committee Chairman