Future Very Narrowband Radio Requirements

Implications for the Hydrologic Warning Community

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Very Narrowband Implications

Topics

- Narrowband Mandate and Status
- Future Very Narrowband Mandate
- Very Narrowband Standards
- Very Narrowband Equipment
- Testbed Status

Narrowband Mandate

Narrowband Mandate

- Most Part 90 licensees must migrate to 12.5 kHz channel bandwidth by January 1, 2013
- Culmination of a very long process
  - 1995: Original narrowbanding rules adopted
  - 1997: 12.5 kHz equipment available
  - 2004: 2013 deadline announced

Narrowband Mandate

Narrowband Status

- FCC appears concerned many licensees haven't yet migrated
- FCC January 26, 2011 Narrowband Workshop
  - Lots of interesting info
  - Many licensees haven't migrated yet
  - Many haven't updated licenses
  - Funding a concern for many

Narrowband Mandate

Narrowband Status

- What if my cousin doesn't migrate?
  - Waivers will be very difficult to obtain
  - FCC public answer:
    - Your system will not be incompliance
    - You won't be legally protected from interference
    - You may cause interference to lawful systems
    - Someone might complain
    - Enforcement is another division…
  - *Alleged* private answer
    - FCC will cancel wideband licenses

Narrowband Mandate

Narrowband Resources

- FCC January 26, 2011 Narrowband Workshop
  - <http://www.fcc.gov/pshs/summits/#narrowbanding_workshop>
  - <http://www.youtube.com/watch?v=rdV5DC5Kb70>
- FCC Narrowbanding Website
  - <http://www.fcc.gov/pshs/public-safety-spectrum/narrowbanding.html>
- Yahoo! LMR Narrowbanding Group
  - <http://tech.groups.yahoo.com/group/LMR_Narrowbanding/>

Very Narrowband Mandate

- Very narrowband, 6.25 kHz migration will occur, FCC says
  - No date set
  - FCC will follow usual rule-making processes
  - Note: narrowband deadline ~16 years after equipment availability
- Equipment certified after January 1, 2013 must support very narrowband (6.25 kHz) operation

Very Narrowband Standards

- Several *emerging* very narrowband standards
  - Many include data specification

- **dPMR (digital Private Mobile Radio)**
- **DMR (Digital Mobile Radio)**
- **TETRA**
- **P25 (Project 25)**

Very Narrowband Standards

- **dPMR (digital Private Mobile Radio)**
  - European 6.25 kHz digital standard
  - Includes both a voice mode and a data mode
  - Voice products are just starting to become available in Europe
- **DMR (Digital Mobile Radio)**
  - European digital standard
  - Multiplexes 12.5 kHz channel

Very Narrowband Standards

- **TETRA**
  - European standard
  - TDMA
- **P25 (Project 25)**
  - American solution for interoperable public safety radios
  - Phase 2 under development
  - Reported work on data-only mode apparently suspended

Very Narrowband Equipment

- Some very narrowband equipment starting to become available
  - Proprietary data radios
  - Standards-based voice equipment
    - Icom dPMR system

- Remember: Equipment certified by FCC after January 1, 2013 *must* support 6.25 kHz operation

Testbed Status

- 900 MHz spread spectrum radio
  - Digi (MaxStream) XTend
- VHF narrowband radio
  - Maxon SD-171E with ACC 513 modem

Testbed Status

900 MHz spread spectrum radio

- Digi International (MaxStream) XTend

Testbed Status

900 MHz spread spectrum radio

- Digi International (MaxStream) XTend
  - 900 MHz unlicensed operation
  - 1 watt transmit power
  - 9,600/115,200 bps
  - Claim line-of-sight (LOS) range of 14 - 40 mile
  - Includes mesh networking capability

Testbed Status

900 MHz spread spectrum radio

- Similar devices:
  - FreeWave FRG2-IOS
  - Laird (AeroComm) ConnexLink
- All use different, proprietary on-the-air formats
- Most ALERT / environmental monitoring vendors resell or experimenting with these radios

Testbed Status

900 MHz spread spectrum radio

- Attempted communications over:
  - Five-mile non-LOS urban path
  - Seven-mail not-quite-LOS urban path

Testbed Status

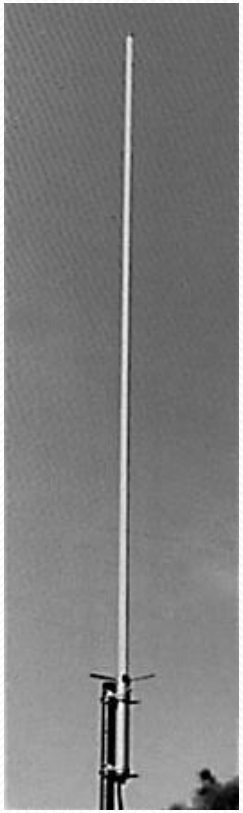
900 MHz spread spectrum radio

- 7 dbi mobile omni
- Laird MA7-7N
- 20”

Testbed Status

900 MHz spread spectrum radio

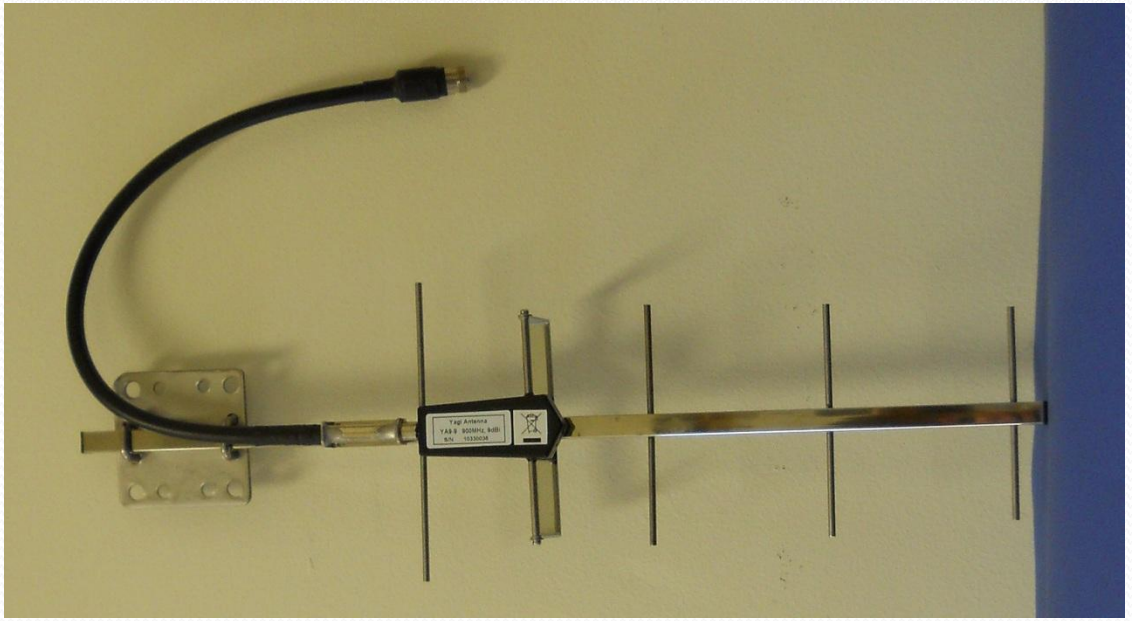
- 9.2 dbi omni
- Comet KP-20
- 96”



Testbed Status

900 MHz spread spectrum radio

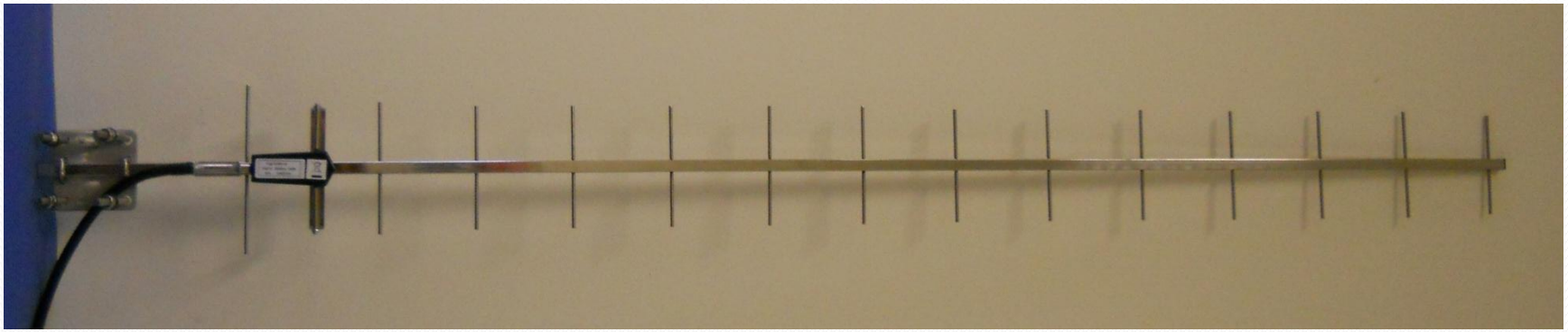
- 9 dbi 5-element yagi
- Laird YA9-9
- 20”



Testbed Status

900 MHz spread spectrum radio

- 13 dbi 15-element yagi
- Laird YA9-13
- 57”



Testbed Status

900 MHz spread spectrum radio

- Results
  - Communications never established over:
    - Five-mile non-LOS path
    - Seven-mile not-quite-LOS path
  - Communications established over shorter paths
- Substantial interference with consumer device
- Devices have potential in right circumstances
  - Not *the* solution for HWS

Testbed Status

VHF narrowband radio

- Maxon SD-171E radio and ACC-513E modem
  - Narrowband (not very narrowband) VHF radio
    - SD-171E/ACC-513E certified for narrowband operation
  - Inexpensive
    - Commercial off-the-shelf (COTS) product
      - Benefits from manufacturing economies of scale
    - SD-171E radio: $245
    - ACC-513E modem: $89

Testbed Status

VHF narrowband radio

- Maxon SD-171E radio and ACC-513E modem
  - Interoperates with Midland SD-171 and ACC-513
    - Maxon SD-171E appears to be a superior radio
    - Midland radio appears to be obsolete/discontinued

Testbed Status

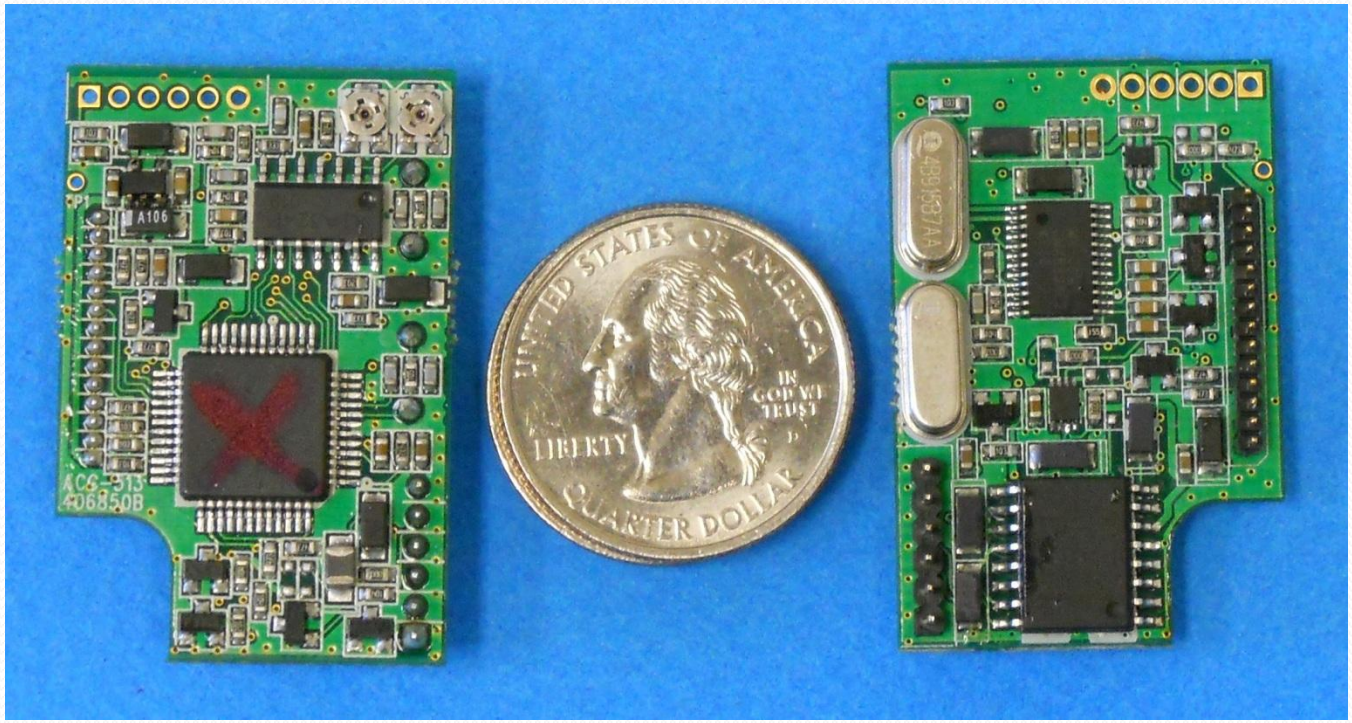
VHF narrowband radio

- Maxon SD-171E

Testbed Status

VHF narrowband radio

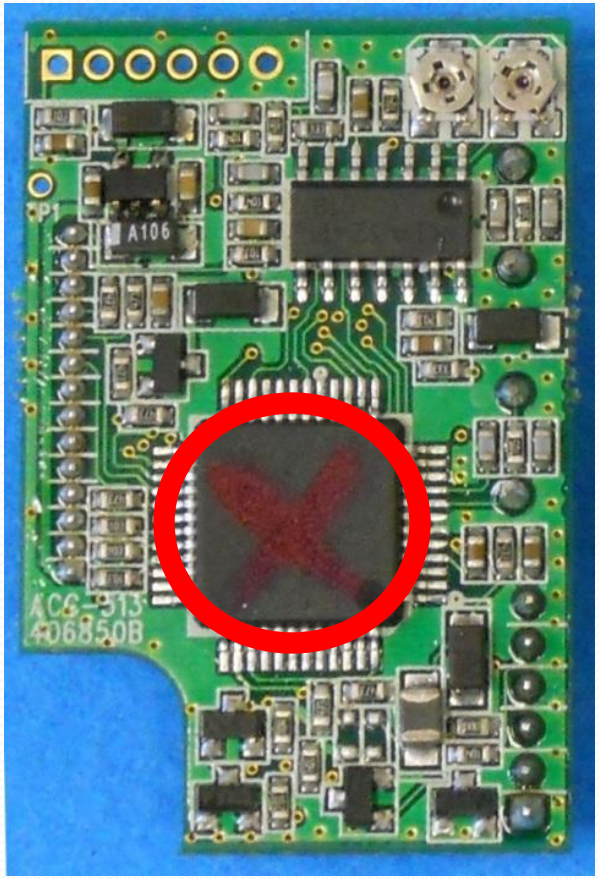
- ACC-513E modem



Testbed Status

VHF narrowband radio

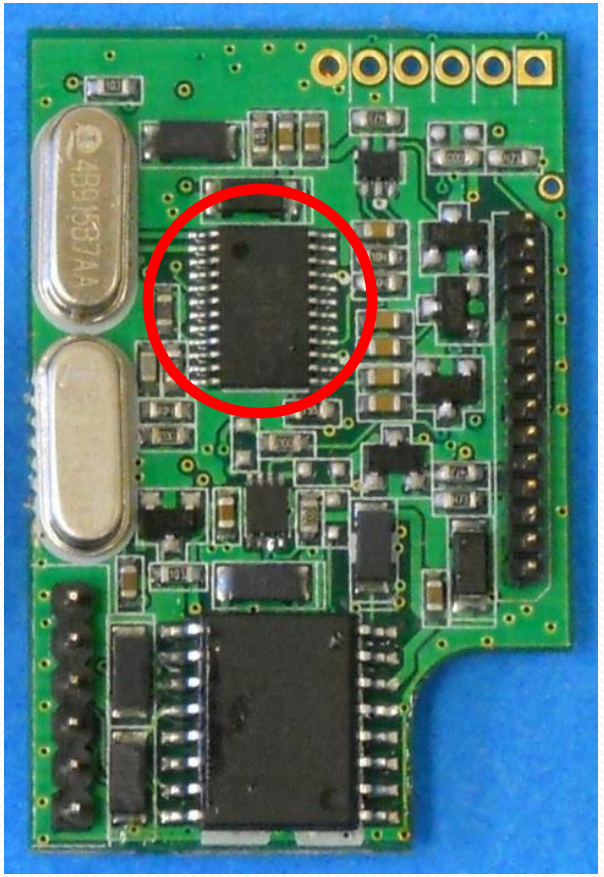
- ACC-513E modem
  - H8 8-bit microprocessor



Testbed Status

VHF narrowband radio

- ACC-513E modem
  - CML Microcircuits CMX589A GMSK modem



Testbed Status

VHF narrowband radio

- ACC-513E modem
  - 4,800 bps in narrowband operation
  - GMSK modulation
  - Link layer frame is based on part of MPT 1327 specification
    - Sort of documented in ACC-513E service manual
    - Is it an open protocol?

Testbed Status

VHF narrowband radio

- Future plans:
  - Test and evaluate Maxon SD-171E/ACC-513E
  - Demonstrate interoperability with Midland SD-171/ACC-513
    - Maybe

Very Narrowband Observations

- A very narrowband mandate is coming
  - Someday; probably not this decade
- Several emerging standards offer the prospect of interoperable very narrowband data equipment
  - Maybe; not today

Very Narrowband Observations

- HWS vendors and operators should make their needs known to data radio vendors
  - Standards-based, interoperable very narrow band data radios
    - dPMR data-only radio?
    - P25 Phase 2 data-only radio?
    - ???
- Speak with a collective voice

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Very Narrowband Implications