IP Simulcast in Rural Areas

Steve Dubberstein
General Manager and Engineer, Communications Service Wisconsin LLC

Simulcast Forum XVIII
Las Vegas, Nevada
March 27, 2014
P25 Rural Simulcast Issues

• P25 Site Spacing in Rural Areas
  o Typical rural site spacing 7 to 15 miles
  o P25 15 uSec simulcast tolerance
  o Terrain can make for significant challenges
  o Site spacing beyond 5 miles can be difficult

• P25 Simulcast Modulation Methods for Narrowband
  o C4FM
  o LSM (Linear Simulcast Modulation)
    ▪ Sharper shaping of symbols
    ▪ Allows for increased simulcast site spacing
  o 800 MHz can use 25 KHz P25 simulcast – greater site spacing

• P25 Subscriber Unit Compatibility
  o Demodulation of P25 simulcast signal across manufacturers
  o Demodulation of P25 simulcast signal by legacy units
  o Consistent programming across manufacturers and platforms

• Fire Pass-Alert and Other Audio Issues
  o P25 vocoder performance
Trempealeau County, Wisconsin

**7 Site System**

**4 Channels**

Voted/Simulcast

**7 Sites**
- Strum
- Osseo
- Whitehall
- Arcadia
- Blair
- Ettrick
- Galesville
Narrowband Analog Simulcast

Simulcast Time Delay 60 usec

After Offset Delay Optimization

- Time Delay Offset -10 usec to +10 usec
- Radiosoft ComStudy 2.2
- Reference Simulcast Forum XII
  “Simulcast Optimization Techniques”
**P25 Simulcast**

**Simulcast Time Delay 15 usec**

After Offset Delay Optimization

- *Time Delay Offset* -10 usec to +10 usec
- *Radiosoft ComStudy 2.2*
- *Reference Simulcast Forum XII*
  
  "Simulcast Optimization Techniques"

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<thead>
<tr>
<th>Transmitter Information - VHF High</th>
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<td>Sites Select Display Calculate Search ReDraw</td>
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<tr>
<td>VHF HI Interference Time Delay Selected</td>
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<th>Parameters</th>
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<th>Delay [μs]</th>
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LTE as a Digital Migration Option

• LTE – Long Term Evolution
  • Commercial 4G technology
  • LTE Coverage
    o Minimum channel 1.25 MHz – greater noise bandwidth
    o 700 MHz public safety spectrum
    o 4X or more sites for equivalent VHF coverage
  • LTE Push-to-talk
    o LTE is a 4G digital broadband specification
    o Push-to-talk specification under development
    o Demand for push-to-talk is low
• The LTE One-to-Many Issue
  o LTE is spread spectrum – each user is an individual channel
  o One-to-many requires each user be set up individually
  o System must set up all users within a maximum time frame
Rural Analog to Digital Migration Strategy

• P25 Simulcast Not Always Practical in Rural Counties
  o Extra sites may be required to meet timing requirements at VHF & UHF
  o P25 is becoming a dated technology
  o Narrowband FM analog with MDC signaling offers most P25 features
    ▪ Unit ID
    ▪ Man-down
    ▪ Note no encryption with FM analog narrowband
  o Consultants becoming aware of rural P25 simulcast limitations

• Not Everything is Migrating to Digital
  o FM Broadcast

• The Rural Solution: Analog Simulcast until LTE is Available
  o Operate analog simulcast until LTE push-to-talk is available
  o LTE system will be federally funded?
  o Need LTE rural coverage installed – 4X number of VHF analog sites
    ▪ Becomes practical as 4G LTE commercial systems roll out
  o Need push-to-talk LTE subscriber units – likely an integrated unit
  o 2025 or later in rural USA?