Simulcast Deployments for Small Cities

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Simulcast Forum XXII
Orlando, Florida
March 8, 2018

www.baycominc.com
Communications Service Merges with BAYCOM
Agenda

Suppliers

City of Tomah, Wisconsin

City of Wisconsin Rapids, Wisconsin
Suppliers

- Motorola GTR8000 Transceivers
- Motorola MLC8000 Analog Simulcast Timing and Voting
- Exalt 4.9 GHz Microwave (with licensing)
- RADWIN 4.9 GHz Microwave (with licensing)
- Spectracom SecureSync GPS Master Oscillators
- Bird TXRX Filtering and Duplexing
- Simple HP Switches (Managed or Unmanaged)
The Motorola MLC 8000
The Motorola GTR 8000

- Analog FM
- P25 Phase I Digital
- P25 Phase II Digital
- Backward Compatible to Quantar
- No Mix and Match Quantar and GTR8000 in Simulcast
Spectracom SecureSync

Programmable TTL Output
The Programmable TTL Output option module card provides four (4) programmable square wave outputs for the SecureSync platform.

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>4</td>
</tr>
<tr>
<td>Signal Type and Connector</td>
<td>TTL (BNC into 50 ohms)</td>
</tr>
<tr>
<td>Programmable Period</td>
<td>100 ns to 1,000,000,000 ns in 5 ns steps</td>
</tr>
<tr>
<td></td>
<td>100 µs to 60,000,000 µs in 1 µs steps</td>
</tr>
<tr>
<td>Pulse Width Range</td>
<td>20 ns - 900 ms in 20 ns steps</td>
</tr>
<tr>
<td>Rise Time to 90% of Level</td>
<td>&lt; 40 ns</td>
</tr>
<tr>
<td>Maximum Number of Cards</td>
<td>6</td>
</tr>
</tbody>
</table>

Ordering Information
1204-17: Programmable TTL output module
IP Microwave

• Separate LAN or VLAN for Radio-Only Traffic
  o ‘Dedicated’ bandwidth for radio-only traffic
  o All other traffic on separate LAN/VLAN with a maximum bandwidth

• RADWIN 2000i Microwave (4.9 GHz)
  o All indoor unit. BAYCOM prefers all indoor electronics for public safety
  o No hot standby option
  o Must be licensed – online licensing, no coordination necessary

• Exalt EX-4.9i Microwave (4.9 GHz)
  o All indoor unit
  o No hot standby option
  o No longer sold by Exalt
Non-Simulcast Audio Transport on IP Network

Dispatch Console Audio

IP Backhaul (Microwave)

Remote Console Priority Input

4 Wire Audio
City of Tomah, Wisconsin
City of Tomah, Wisconsin

- **Small Wisconsin City**
  - Population 9,328
  - Reasonably Flat Terrain
  - Dedicated Police Department Dispatched on its Own Channel
  - In Monroe County, Wisconsin

- **Indoor Coverage Problems**
  - Single Site at Police Department
  - Added Voting Site – But then had Downlink Problems indoors
  - Unbalanced Uplink/Downlink Depending on Location

- **Small System Simulcast Solution**
  - Expand to add a 3rd Site
  - Exalt 4.9 GHz MW Backhaul (first link)
  - RADWIN 4.9 GHz MW Backhaul (second link)
  - Tried DSL modems on leased lines but failed
  - Simulcast and Voted from All Three (3) Sites
  - Motorola GTR8000 and MLC8000 – No Routers
  - Spectracom SecureSync
City of Tomah PD Original System
City of Tomah Original Indoor Talk-Back from Portables

Grey: Excellent portable indoor coverage, light and heavy buildings
Dark Green: Excellent portable indoor coverage light buildings, good portable indoor coverage heavy buildings
Light Green: Good portable indoor coverage light buildings, acceptable portable indoor coverage heavy buildings
Yellow: Marginal portable indoor coverage light buildings, poor portable indoor coverage heavy buildings
Red: No portable indoor coverage
City of Tomah Final Indoor Talk-Back from Portables

- **Grey**: Excellent portable indoor coverage, light and heavy buildings
- **Dark Green**: Excellent portable indoor coverage, light buildings, good portable indoor coverage heavy buildings
- **Light Green**: Good portable indoor coverage, light buildings, acceptable portable indoor coverage heavy buildings
- **Yellow**: Marginal portable indoor coverage, light buildings, poor portable indoor coverage heavy buildings
- **Red**: No portable indoor coverage
City of Tomah Original Indoor Talk-Out to Portables

**Grey:** Excellent portable indoor coverage, light and heavy buildings

**Dark Green:** Excellent portable indoor coverage light buildings, good portable indoor coverage heavy buildings

**Light Green:** Good portable indoor coverage light buildings, acceptable portable indoor coverage heavy buildings

**Yellow:** Marginal portable indoor coverage light buildings, poor portable indoor coverage heavy buildings

**Red:** No portable indoor coverage
City of Tomah Final Indoor Talk-Out to Portables

- **Grey:** Excellent portable indoor coverage, light and heavy buildings
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- **Red:** No portable indoor coverage
City of Wisconsin Rapids
City of Wisconsin Rapids, Wisconsin

- **Small Wisconsin City**
  - Population 17,887
  - Reasonably Flat Terrain
  - Dedicated Police Department Dispatched on its Own Channel
  - In Wood County, Wisconsin

- **Indoor Coverage Problems**
  - Single Site at South Water Tower – not centrally located

- **Small System Simulcast Solution**
  - Expand to add a 2\textsuperscript{nd} Site
  - RADWIN 4.9 GHz MW Backhaul
  - Simulcast and voted from both sites
  - 3\textsuperscript{rd} Site may be added depending on indoor coverage need
  - Motorola GTR8000 and MLC8000 – No Routers
  - Spectracom SecureSync
City of Wisconsin Rapids – Coverage Before Simulcast

**Grey:** Excellent portable indoor coverage, light and heavy buildings

**Dark Green:** Excellent portable indoor coverage, light buildings, good portable indoor coverage heavy buildings

**Light Green:** Good portable indoor coverage light buildings, acceptable portable indoor coverage heavy buildings

**Yellow:** Marginal portable indoor coverage light buildings, poor portable indoor coverage heavy buildings

**Red:** No portable indoor coverage
City of Wisconsin Rapids – Two (2) Site Simulcast Coverage

Grey: Excellent portable indoor coverage, light and heavy buildings

Dark Green: Excellent portable indoor coverage light buildings, good portable indoor coverage heavy buildings

Light Green: Good portable indoor coverage light buildings, acceptable portable indoor coverage heavy buildings

Yellow: Marginal portable indoor coverage light buildings, poor portable indoor coverage heavy buildings

Red: No portable indoor coverage
City of Wisconsin Rapids – Three (3) Site Simulcast Coverage

Grey: Excellent portable indoor coverage, light and heavy buildings
Dark Green: Excellent portable indoor coverage light buildings, good portable indoor coverage heavy buildings
Light Green: Good portable indoor coverage light buildings, acceptable portable indoor coverage heavy buildings
Yellow: Marginal portable indoor coverage light buildings, poor portable indoor coverage heavy buildings
Red: No portable indoor coverage
Small City Simulcast Systems - Summary

• Provides **Indoor** Coverage Improvement
  - Downlink simulcast transmit coverage
  - Uplink voting receive
  - Typical site spacing 1-2 miles
  - No launch timing offsets required – close site spacing

• **Small Simulcast Systems are Cost Effective**
  - Motorola GTR8000 and MLC8000
  - Simple flat IP network with simple switching
  - 4.9 GHz point-to-point microwave
  - Affordable inside a city government budget

• **Lessons Learned**
  - 4.9 GHz microwave synchronization timing issues with different suppliers
  - Lock 4.9 GHz microwave radios onto a single frequency
  - LED obstruction light noise on water tower
  - Frequency Coordination – letters of concurrence when not needed
  - Additional sites may be added over multiple budget years