

RGAINC
Presents ...

**Wireless Solutions for
Closed Loop Systems
and
Other ITS Traffic Applications**

Presentation Outline

- The Basic Wireless Installation
- Radio Features for Traffic Applications
- The Wireless Site Survey
- Wireless Applications for Traffic

Why Consider Wireless Communications

- Proven Technology
- Easy and Timely Installation
- Low Cost
- Reliable
- Secure
- Reusable

Types of Wireless Systems for Closed Loop Applications

- Licensed- Fixed Frequency
- Unlicensed- Frequency Hopping Spread Spectrum
- Unlicensed- Direct Sequence Spread Spectrum

Application Considerations

- Will it work with my equipment
- Radio Path
- Height of Structure for Antenna
- Radio Frequency Interference
- Proximity to other Radio Systems

Application Considerations...

Controller/Equipment Interface

- Serial RS-232 or 485
- Ethernet
- Contact Closure
- Baud Rate
- Data Bandwidth
- Proprietary FSK (Frequency Shift Keying)
 - 2-wire
 - 4-wire

Application Considerations...

Radio Path

- Line of Sight
- Distance Between Radios
- Obstructions
- Use of Repeaters

Radio Path...

Transmit Range

- Performance is always based on several factors:

- 1) Frequency Selection

- 2) Antenna Height (17 miles is the horizon!)

- 3) Antenna Type & Gain- OMNI or YAGI

- 4) System Losses

- 5) Local RF Interference

- 6) Transmission Data Rates

Data Security

- Most use an encrypted, proprietary FHSS communications protocol
- WiFi uses the 802.11 DSSS communications protocol, which can be encrypted, but which can also be breached with 802.11 compatible wireless equipment

Radio Selection Criteria

- **Frequency Selection**
- **Transmit Output Power**
- **Receiver Sensitivity**
- **Bandwidth Requirements**
- **Transmit Range**
- **Power Requirements**
- **Data Security**
- **Standard Interface Requirements**
- **Standard Traffic Radio Configurations**

Radio Selection...

Frequency Selection (900MHz vs. 2.4GHz)

	900MHz	2.4GHz WiFi
Range	Long	Short (FSL)
Data Rate	Low	Higher
Radio Path	Flexible	LOS req'd
Weather Fade	Minimal	Increased

Radio Selection...

Bandwidth Requirements

(The 900 MHz Advantage)

- **900 MHz**
 - lower free space loss
 - LOS not always required
 - smaller channels
- **Smaller channels**
 - better receiver sensitivity!
 - better noise immunity!
 - more co-located systems!
- **** Use 900 MHz whenever possible!!**

Radio Selection...

Transmit Output Power

- **Make sure that the radio you select is FCC approved to transmit 1 full Watt of output power.**
- **This is especially true for 2.4GHz!**
- **Most Direct Sequence WiFi = $\frac{1}{4}$ Watt Output power!**

Radio Selection...

Available Interface Configurations

- Serial interface (RS-232, 422, 485)
- 2 or 4 Wire FSK port
- Ethernet interface
- Fiber optics
- interface cables to controller
- Radio drivers for traffic controllers



Rack Mount Radio

Radio Selection...

Radio Configurations

- Data
- Contact Closure



Shelf



Rack



Pole Mount

PLUS 170 and 2070 Pluggable radios!!

Antenna Selection...

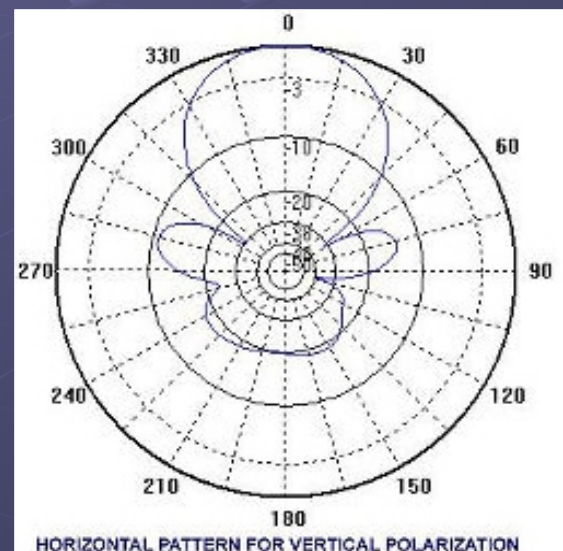
Radiation Patterns

OMNI



Omni-directional Radiation Pattern

YAGI



Yagi Radiation Pattern

Basic Equipment List

- Radio Transceiver/Modem
- Data cable to Controller
- RF jumper cable from Radio to Surge
- Lightning/surge suppression device
- Antenna cable
- Antenna
- Antenna mounting hardware

Typical Wireless Installation

You Must Order a YAGI OR OMNI Antenna

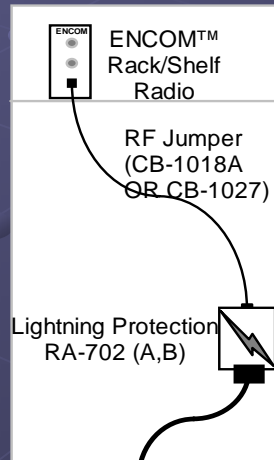
Omni Directional Antenna
(AN-159, AN-160, AN-144,
AN-145)

Yagi Directional Antenna
(AN-140, AN-143)

RF Cable

Part Number	Cable Length (feet)
CB-1025	25
CB-1035	35
CB-1045	45
CB-1055	55
CUSTOM	>55

Traffic Controller Cabinet



Equipment Required at Each Site

ENCOM™ Shelf/ Rack Mount Radio
5000 Series and 4000 Series

RF Jumper

Lightning Protection (900MHz (A) or 2.4
GHz (B))

RF Cable (specify length)

Antenna (Omni or Yagi)

The Site Survey

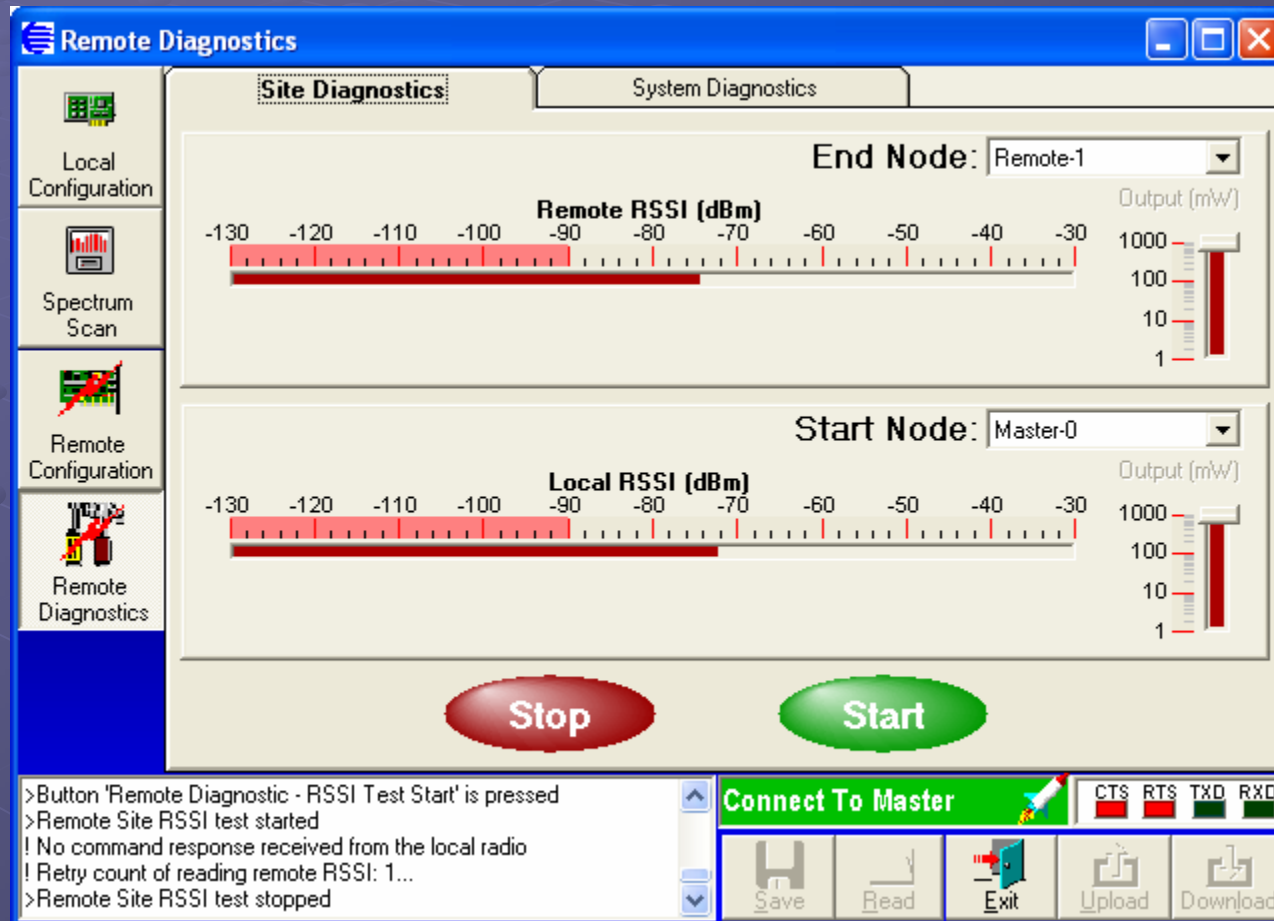
Three parameters must be taken into account when performing a site survey:

- 1) Radio Path Analysis
- 2) Data Communication Analysis
- 3) Spectral Analysis

ENCOM Site Survey Kit



Receive Signal Strength Indication Level Test



Data Transfer Test

The screenshot displays the 'Remote Diagnostics' software interface. The window title is 'Remote Diagnostics'. It features a sidebar on the left with icons for 'Local Configuration', 'Spectrum Scan', 'Remote Configuration', and 'Remote Diagnostics'. The main area is divided into 'Site Diagnostics' and 'System Diagnostics' tabs. Under 'System Diagnostics', there is a 'Set Up' section with options to 'INCLUDE or EXCLUDE Specific Units for the test (Separated by commas ',')'. The 'EXCLUDE' radio button is selected. Below this, there are options for 'Short Message', 'Medium Message', and 'Long Message', with 'Long Message' selected. A 'Poll Cycles Transmitted' field shows '153' and a 'RESET' button. A text area displays a test log with the following content:

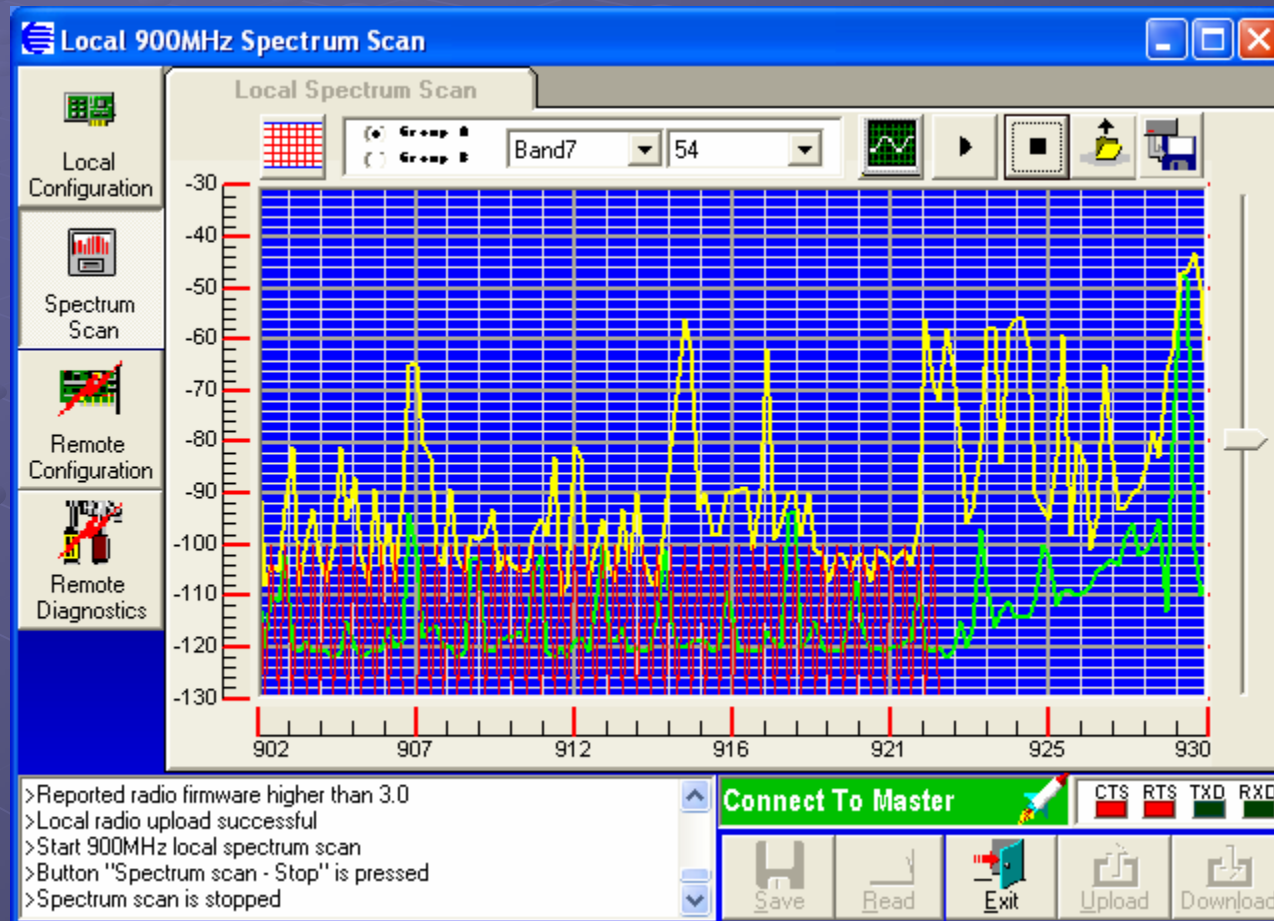
```
0123456789: ;<=>?@ABCDEFGHIJKLMNOPQR
STUVWXYZ[\]^_`abcdefghijklmnopqrstu
vwxyz{|}~
Radio 1?
0123456789: ;<=>?@ABCDEFGHIJKLMNOPQR
STUVWXYZ[\]^_`abcdefghijklmnopqrstu
vwxyz{|}~□
```

At the bottom of the main area are three large buttons: 'Stop' (red), 'Start' (green), and 'Update' (yellow). The bottom status bar contains a log window with the following text:

```
>Remote Site RSSI test stopped
>Button 'Remote Diagnostic - System Poll Test Start' is pressed
>System Poll Test started
! No command response received from the local radio
>Button 'Remote Diagnostic - System Poll Test Stop' is pressed
```

To the right of the log is a 'Connect To Master' button with a rocket icon and a status indicator for CTS, RTS, TXD, and RXD. Below this are buttons for 'Save', 'Read', 'Exit', 'Upload', and 'Download'.

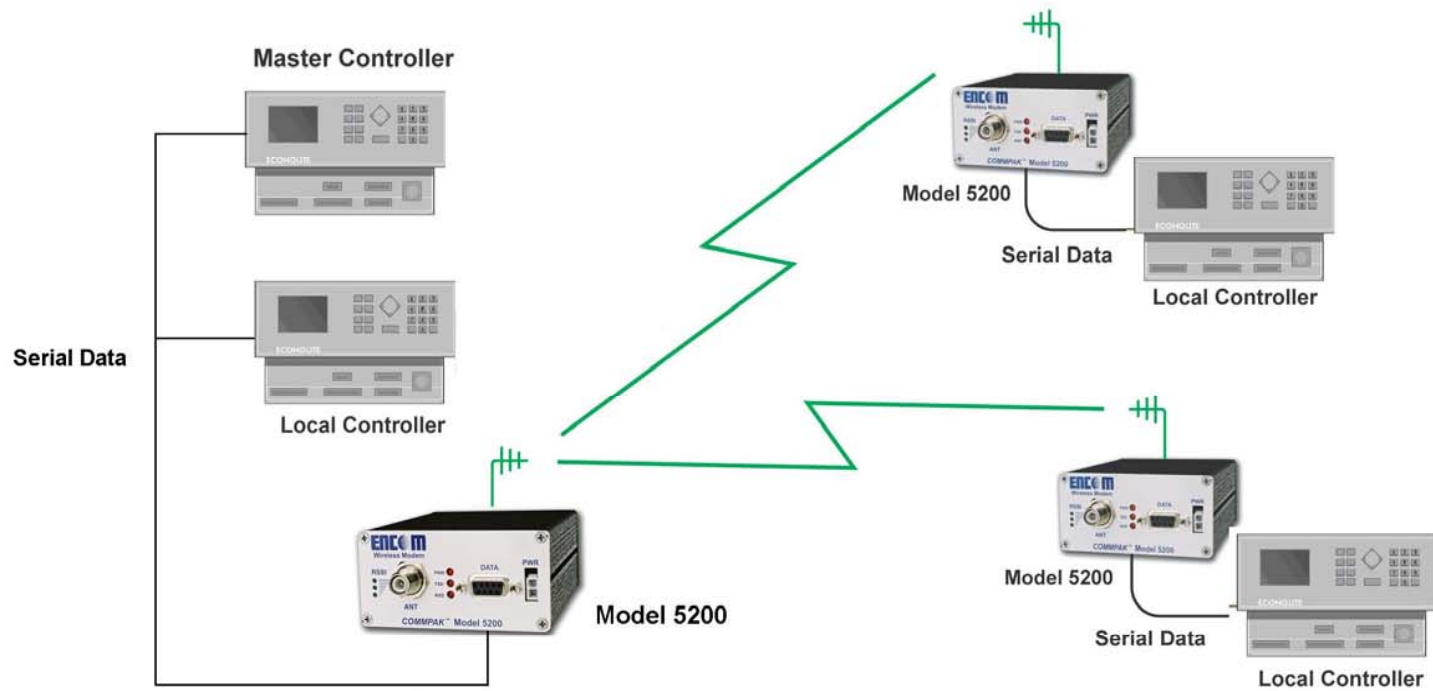
Radio Frequency Spectrum Analyzer



Wireless Applications for Econolite

- Closed Loop Controller Interconnect
- Central Control (ICONS)
- Last Mile Link (Jump Off Copper)
- Econolite Loop Detection Applications
- Autoscope Camera Applications

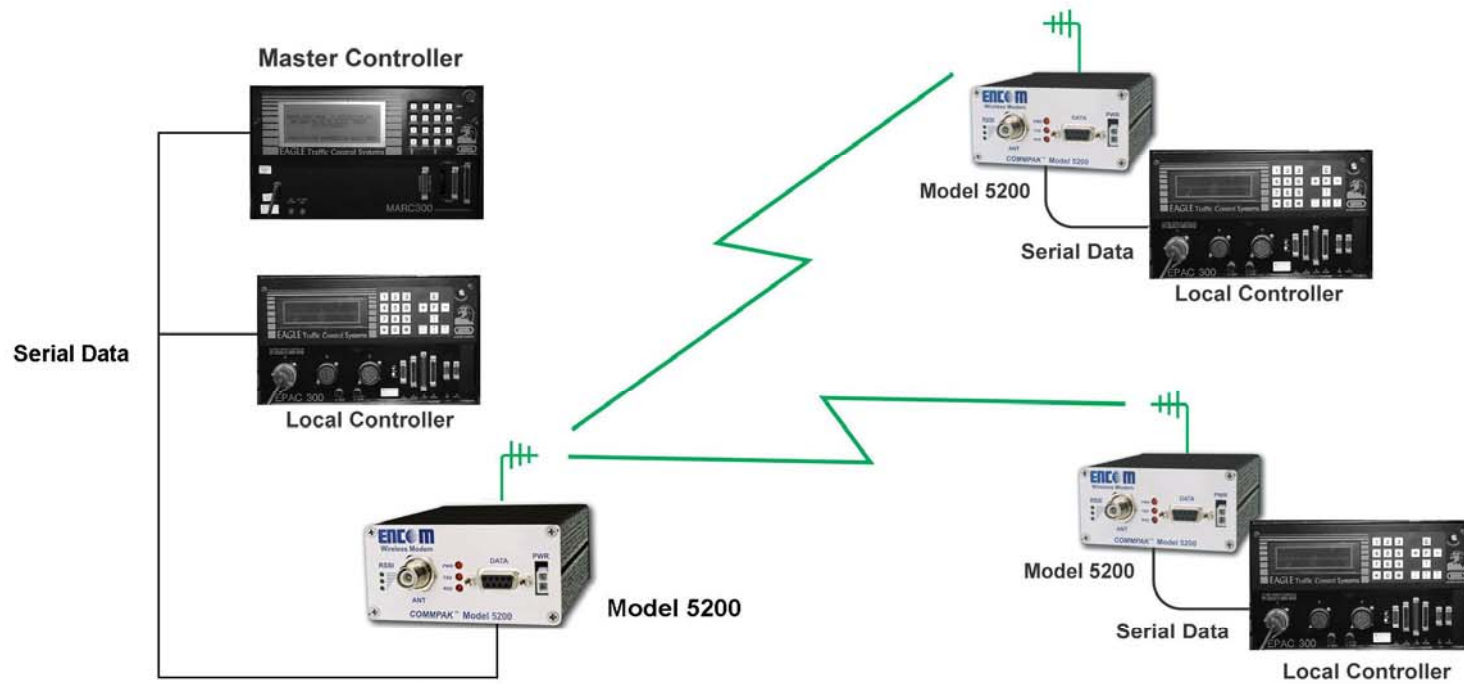
RS-232 Interconnect



Wireless Applications for Eagle/Siemens

- Closed Loop Controller Interconnect (MARC 300, M50 and 2070 systems)
- Central Control (Eagle ACTRA)
- Last Mile Link (Jump Off Copper)
- Bridge Broken Copper
- NEMA Loop Detector Applications
- ITERIS Edge2 Camera Applications

RS-232 Interconnect



Other Wireless Traffic Applications

- Variable Message Signs

- Fixed
- Portable

- Vehicle Detection

- Loops
- Video
- Radar

- Ramp Metering



Traffic Applications continued...

● Sign Control

- Weigh scale station
- Speed advisory
- Advance warning
- School zone flasher

● Pre-emption Applications

- Emergency vehicle
- Railroad
- Funeral home

● Fog Detection and Weather Stations



Other Traffic Applications Continued...

Autoscope Camera Applications



The Wireless Advantage

- Low Cost
- Fast installation
- Guaranteed performance
- Adaptable for all applications
- Overcomes Limitations of direct connection
 - Railroads
 - Rivers/Bridges
 - Roads/Freeways
 - Secure - impervious to digging!
- Complimentary Technology

Questions



Thank You for *Your* Attention!