C-Bridge™

Rayfield COMMUNICATIONS

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MOTOROLA
PROFESSIONAL RADIO
APPLICATION provider
MAKING SOLUTIONS WORK FOR YOU

Company Background

- Rayfield Communications was started in 1978 as a 2-way radio dealership
- Appointed as a Motorola Dealer in 1999
- Software and hardware communications product development since 1989
- One of the first companies to join the **MOTOTRBO**™ Application Developer's Program
- Located in Springfield, MO in the beautiful Missouri Ozarks

What is the c-Bridge™?

The **c-Bridge**™ is an 'infrastructure solution'. It is a *Bridging Controller* and *Call Router*, a *Server* and a *Gateway*, all rolled into one piece of equipment. It is a '*Swiss Army Knife*', a piece of equipment and associated software that allows **MOTOTRBO**™ conventional and IP Site Connect repeater systems to be expanded beyond their 'core' functionality.

The c-Bridge™

IP Site Connect System Expansion

- **MOTOTRBO™ IP Site Connect Systems are limited to a maximum of 15 repeaters in one 'system'.**

- A **c-Bridge™** acting as a Bridging Controller can 'break' that 15-repeater limit
  - One **c-Bridge™** can control and network up to 50 repeaters
  - You can build VERY Large Systems
    - There's virtually No Limit to the Number of Repeaters that can exist in a **MOTOTRBO™** system
      - » For example there are literally hundreds of repeaters in the world-wide amateur radio DMR network, all connected using multiple **c-Bridge™** Bridging Controllers

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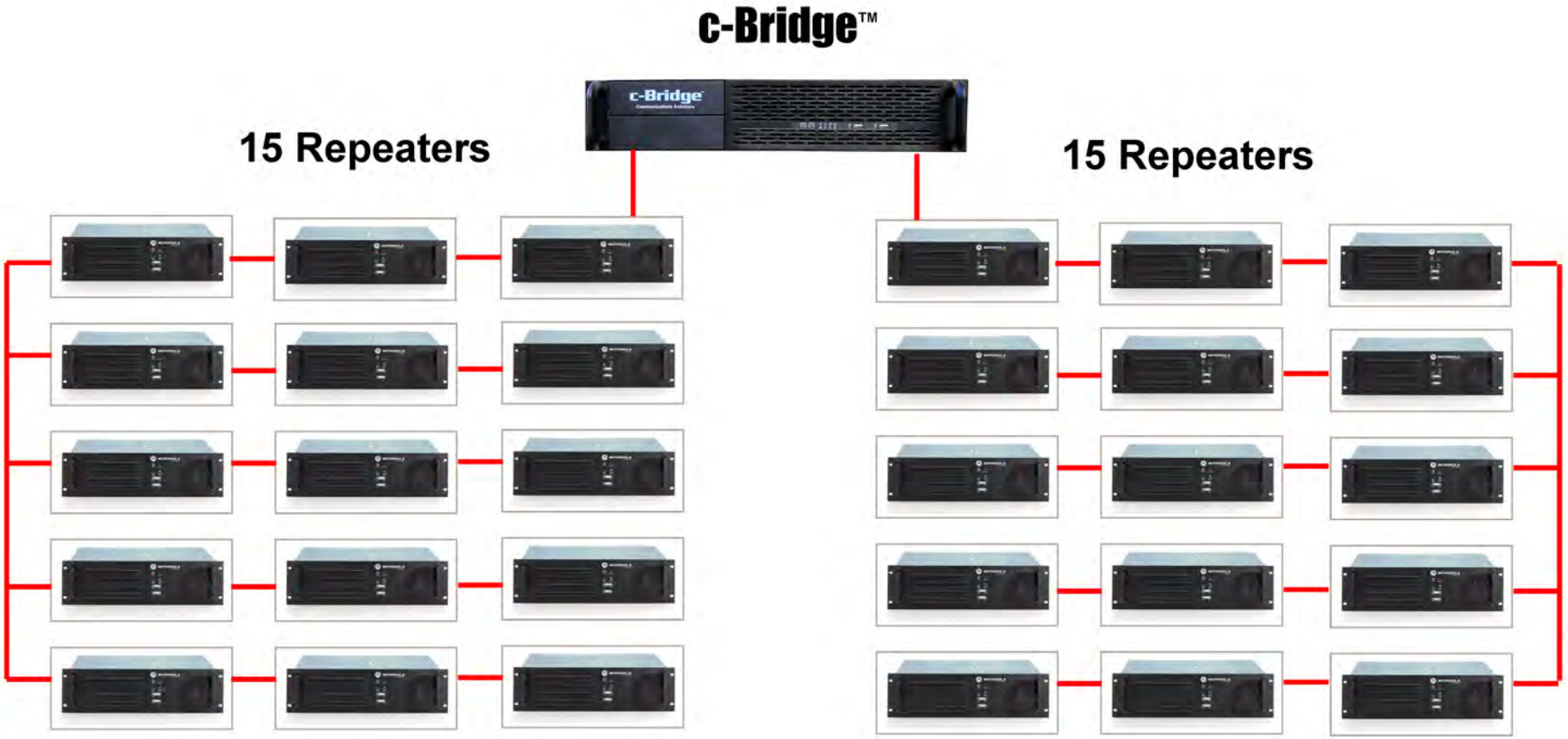
System Example – 30-Repeater System



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Flexible Call Routing - without a c-Bridge™

- **MOTOTRBO™ IP Site Connect provides for basic bridging capability between Slots and Talkgroup IDs**
  - Slot 1 can be bridged to Slot 1
  - Slot 2 can be bridged to Slot 2
  - Slot 1 can be bridged to Slot 1 AND Slot 2 can be bridged to Slot 2
  - No Slots bridged (local only)
  - There is no way to bridge between Slot 1 and Slot 2, not even for All Call or Emergency Calls
  - The Talkgroup ID that someone transmits on is the same Talkgroup ID that must be received – There is no provision for 'Translation' of Talkgroup IDs

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Emergency Call without a c-Bridge™

Emergency Call Transmitted Site 1 Slot 1

Site 1 – Master

Main School Site

Emergency Call Transmitted Site 2 Slot 1

Site 2 - Peer

2nd School Site

Emergency Call Received Site 3 Slot 1

Site 3 - Peer

3rd School Site

Emergency Call Transmitted Site 3 Slot 1

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Flexible Call Routing - with a c-Bridge™

- **When a c-Bridge™ is used in a MOTOTRBO™ IP Site Connect System, a tremendous amount of flexibility can be realized with regards to bridging Slots and Talkgroup IDs**
  - Slot 1 can be bridged to Slot 2
    - on any Repeater, based on Talkgroups or manually controlled from a PC Dispatch Application
  - All Call and Emergency Calls can now be true 'system wide' Calls
    - All Call and Emergency Calls can be heard on all repeaters and on both Slots, if desired
  - Any Talkgroup, on any repeater, on either Slot, can be bridged to any other Talkgroup, on any other repeater, on either Slot

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Emergency Call with a c-Bridge™

c-Bridge™

Emergency Call Transmitted Site 1 Slot 1 *AND* Slot 2

Site 1 – Master

Main School Site

Emergency Call Transmitted Site 2 Slot 1 *AND* Slot 2

Site 2 - Peer

2nd School Site

Emergency Call Received Site 3 Slot 1

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3rd School Site

Emergency Call Transmitted Site 3 Slot 1

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Translating Talkgroup IDs with a c-Bridge™

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Group Call Received
Site 1
Slot 1
TG-1

Site 1 – Master

Main School Site

Group Call Transmitted
Site 2
Slot 1 *AND* Slot 2
TG-201

Site 2 - Peer

2nd School Site

Group Call Transmitted
Site 3
Slot 2
TG-5001

Site 3 - Peer

3rd School Site

Group Call Transmitted
Site 1
Slot 1
TG-1

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Call Capabilities - Group Calls

Group Call Received Site 2 Slot 2

Group Call Transmitted Site 1 Slot 1

- **The c-Bridge™ can handle voice and data calls**
  - Group Calls, All Calls and Private Calls
  - GPS, Call Alert, Emergency Alert, Radio Query, Radio Enable/Disable, etc.

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Call Capabilities - All Calls

All Call Transmitted Site 3 Slot 1

All Call Received Site 1 Slot 1

- **The c-Bridge™ can handle voice and data calls**
  - Group Calls, All Calls and Private Calls
  - GPS, Call Alert, Emergency Alert, Radio Query, Radio Enable/Disable, etc.

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Call Capabilities - Private Calls

Private Call Transmitted Site 3 Slot 1

Private Call Received Site 1 Slot 1

- **The c-Bridge™ can handle voice and data calls**
  - Group Calls, All Calls and Private Calls
  - GPS, Call Alert, Emergency Alert, Radio Query, Radio Enable/Disable, etc.

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Call Capabilities - Data Calls

Data Call Transmitted Site 3 Slot 1

Data Call Received Site 1 Slot 1

- **The c-Bridge™ can handle voice and data calls**
  - Group Calls, All Calls and Private Calls
  - GPS, Call Alert, Emergency Alert, Radio Query, Radio Enable/Disable, etc.

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Server/Gateway Interoperability

- **Analog Interface Ports can be added to a c-Bridge™, making it an interoperability Gateway (up to 4 Analog Ports per Gateway)**
  - With a Server/Gateway or a combination of a Server and multiple Gateways, interoperability with **non-MOTOTRBO™** radio systems can be achieved by using control stations, base stations or 4-wire E&M interfaces to access the **non-MOTOTRBO™** systems. This includes analog am, analog fm, and P25 systems
  - Interfacing to analog console systems can also be done through the Analog Interface Ports on a **c-Bridge™** Gateway
  - Interoperability can be enabled/disabled by Talkgroup IDs or a PC Client Dispatch Application

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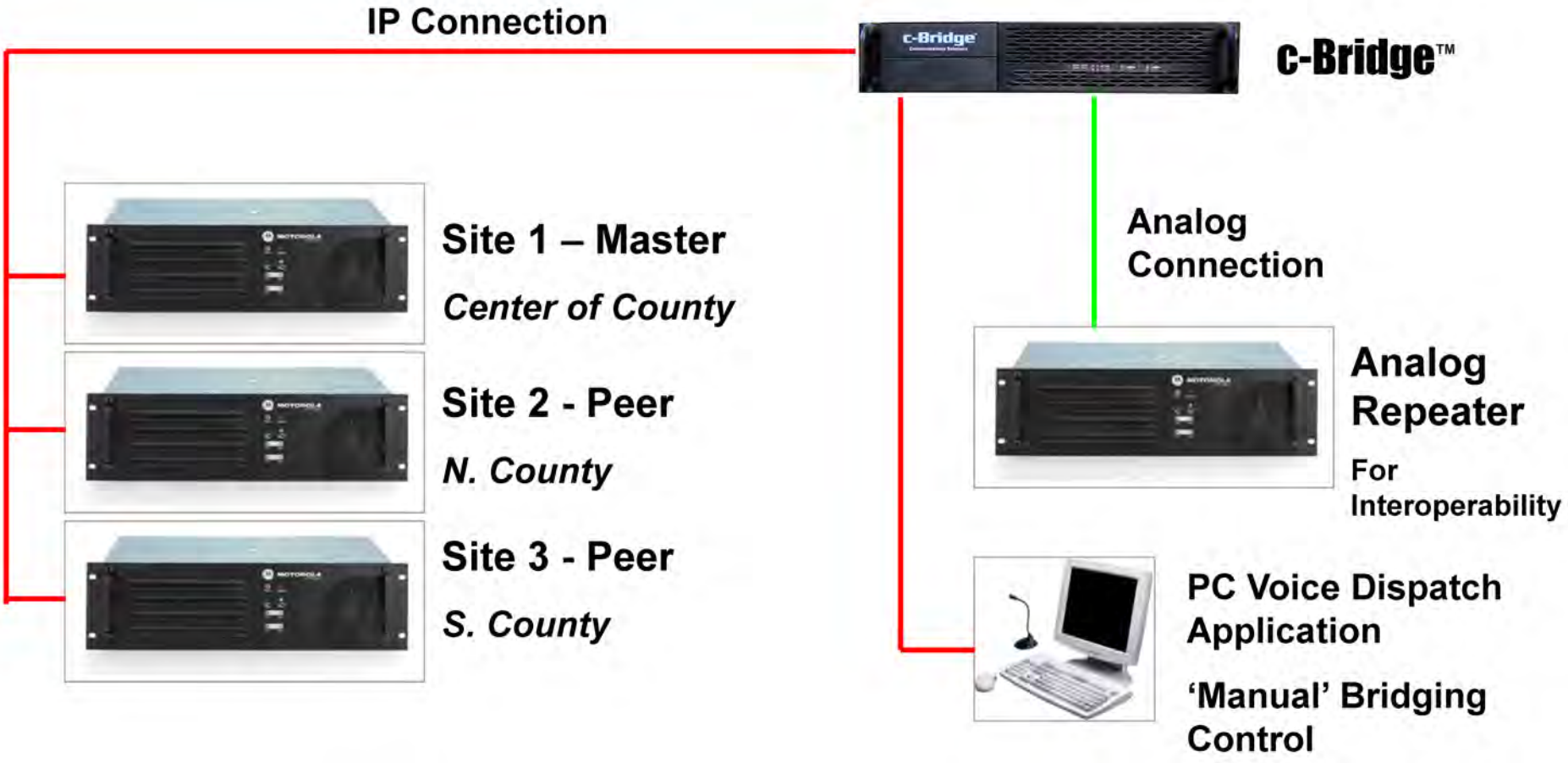
System Example – Analog Interoperability



NOTE - The **c-Bridge™** Servers and Gateways pass Voice traffic ***ONLY*** when configured for Interoperability with non-**MOTOTRBO™** systems. NO data capabilities exist when bridging to non-**MOTOTRBO™** radio systems or consoles

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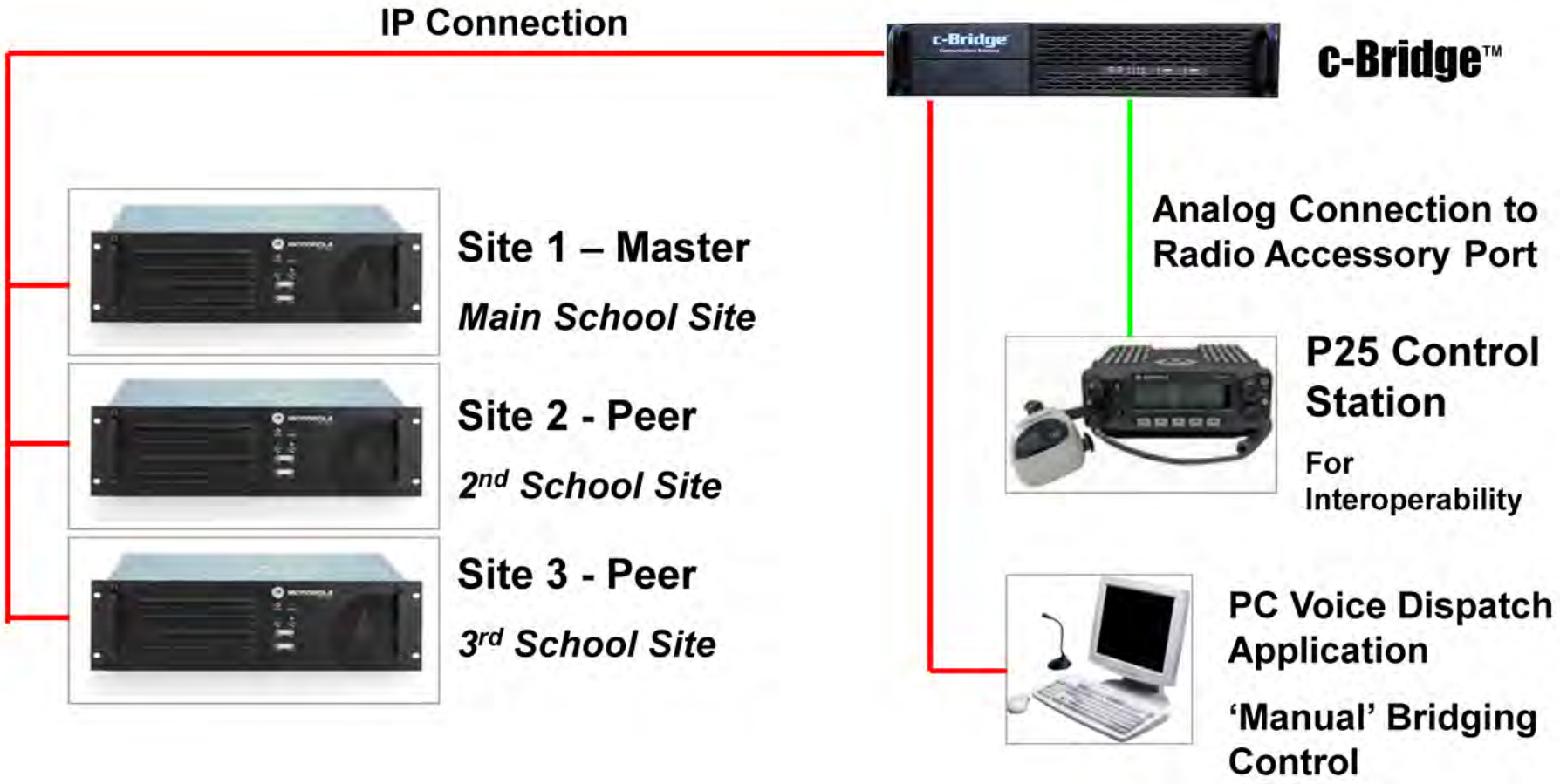
System Example – P25 Interoperability



NOTE - The **c-Bridge™** Servers and Gateways pass Voice traffic ***ONLY*** when configured for Interoperability with non-**MOTOTRBO™** systems. NO data capabilities exist when bridging to non-**MOTOTRBO™** radio systems or consoles

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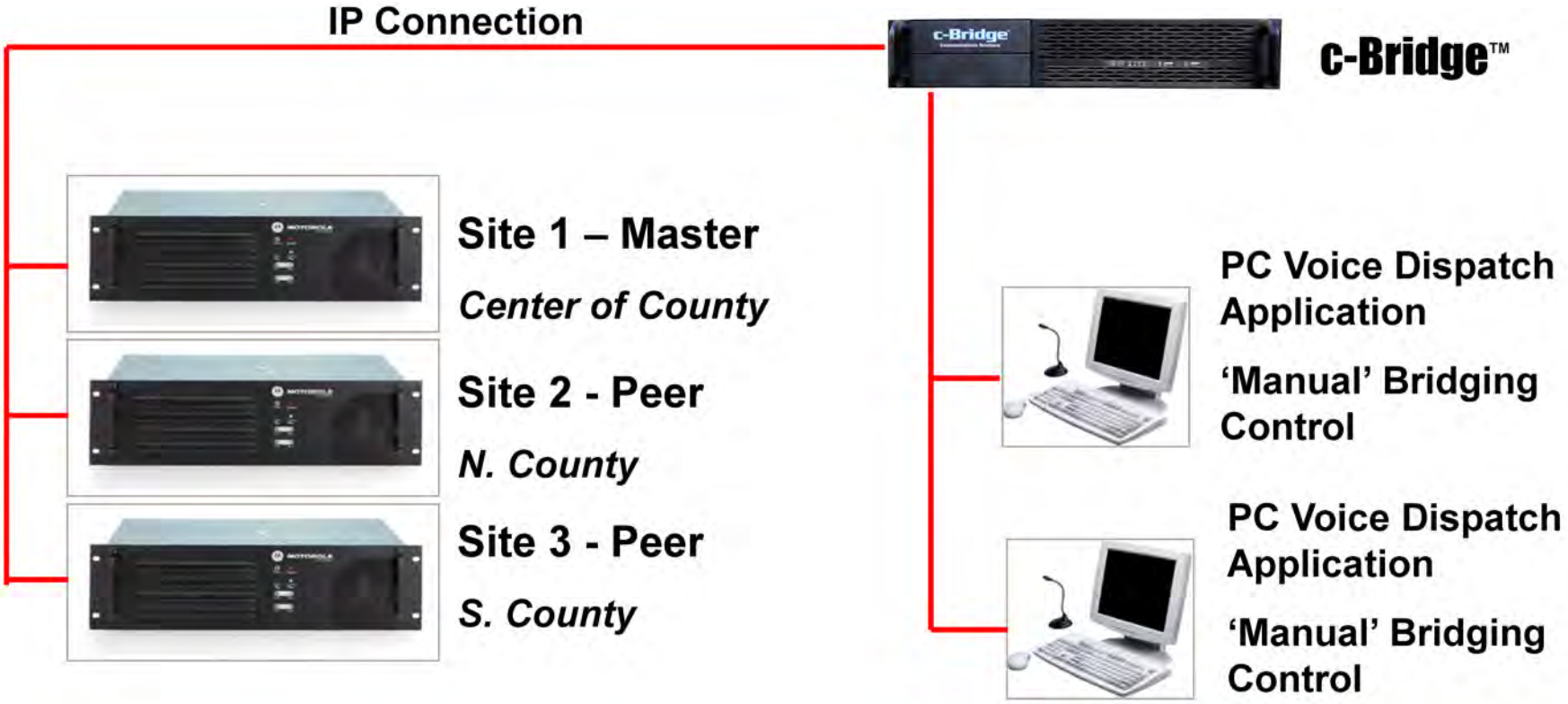
The c-Bridge™ PC Voice Dispatch



The c-Bridge™ can be used as an "IP Gateway", allowing for IP-based Remote Voice Dispatch, where control stations or tone-control systems are not needed

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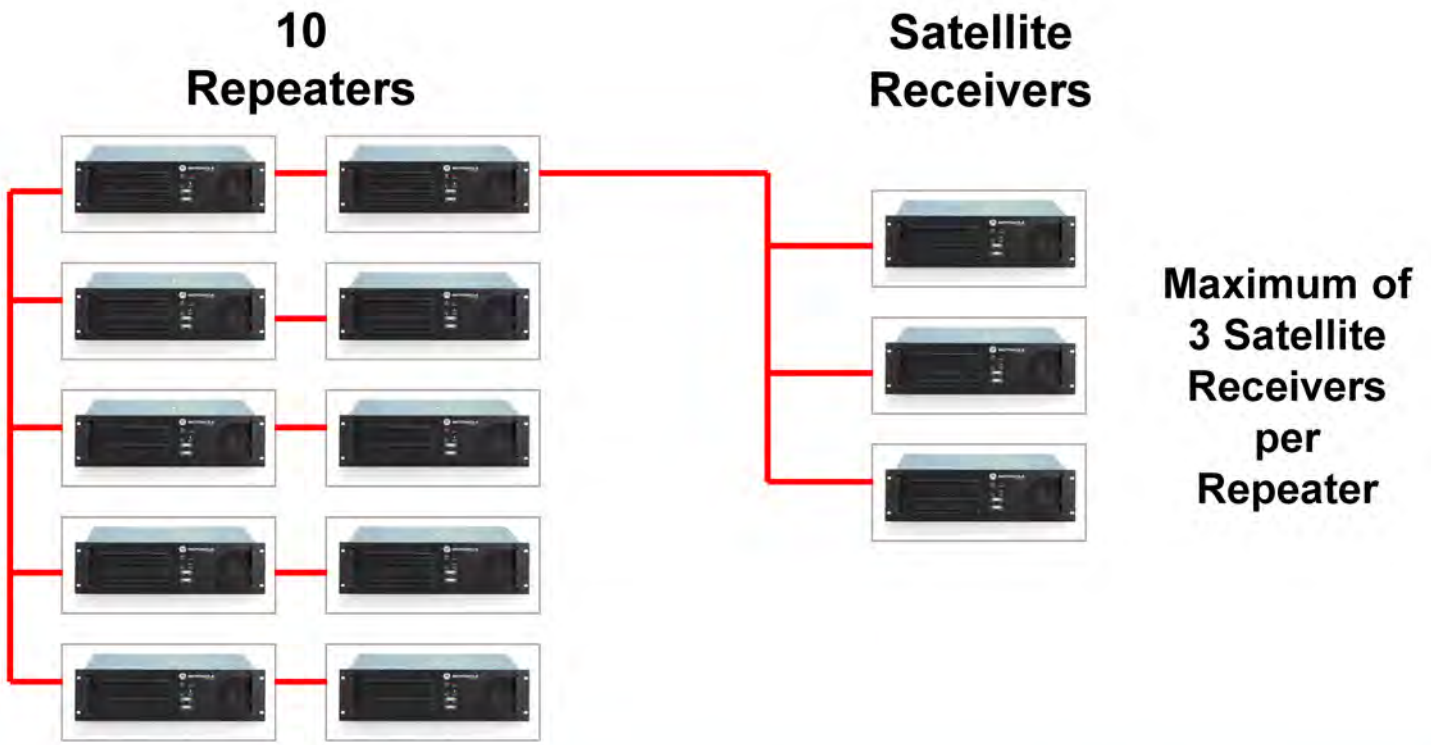
Receiver Voting System without a c-Bridge™



MOTOTRBO™ IP Site Connect Systems can be somewhat limited when using Voting and Satellite Receivers. For example, with 10 Repeaters, a maximum of only 3 Satellite Receivers Per Repeater may be used

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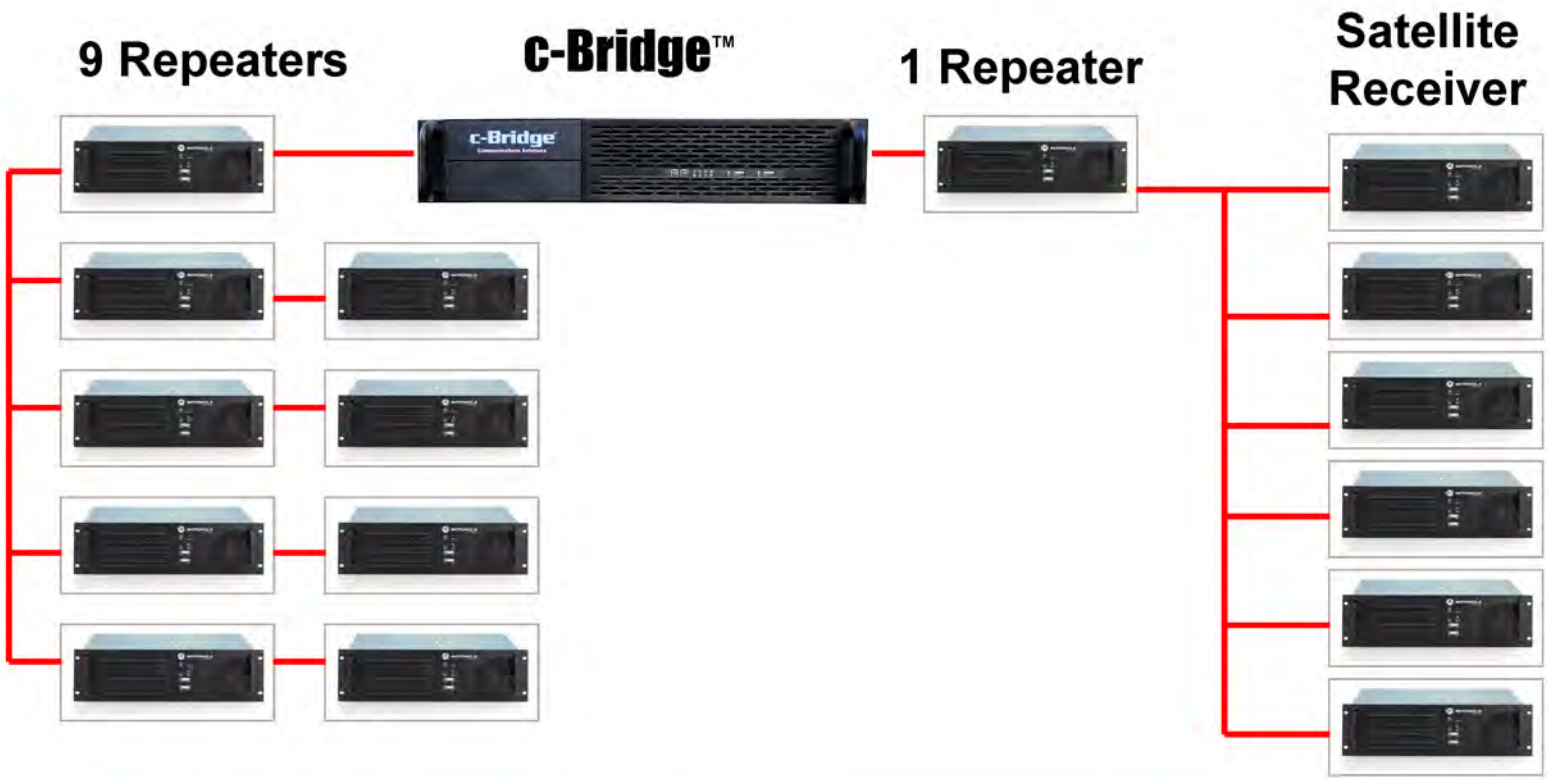
Receiver Voting System with a c-Bridge™



A c-Bridge™ can be used to expand this limit to 6 Satellite Receivers per Repeater
We could even have up to 50 Repeaters Configured in this way, with up to 6 Satellite Receivers per Repeater

The C-Bridge™

Reduce Site Bandwidth Needs





10 Repeaters/Sites

IP Site Connect operates as a Peer-to-Peer system. Each repeater communicates directly with other repeaters. They do NOT communicate through the Master Repeater.

Each Site must have enough upload bandwidth available to communicate with all 9 other sites.

So with 10 Repeaters in a network, at least 540 kbps *upload* bandwidth is needed at each site. More is needed if RDAC is used.





C-Bridge™ Bridging Controllers can be used to reduce the network bandwidth needed in IP Site Connect Systems where bandwidth is limited at some sites.

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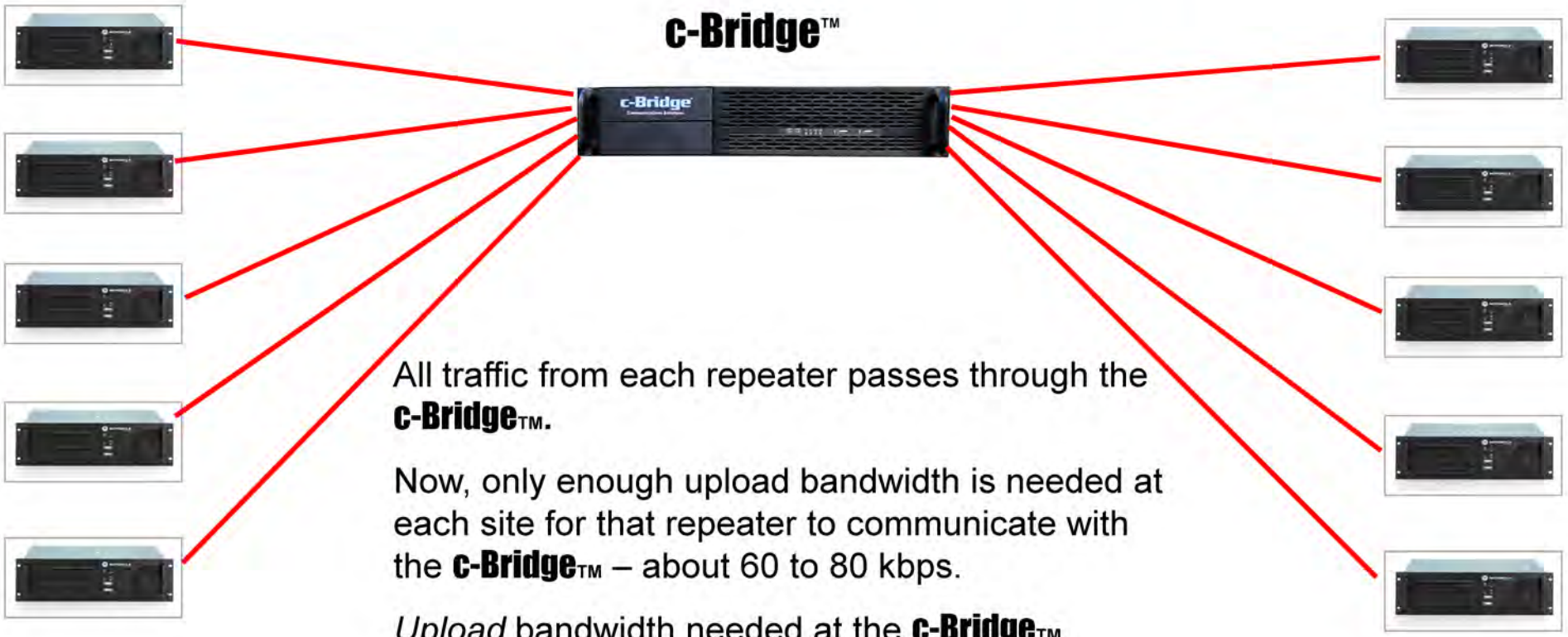
Reduce Site Bandwidth Needs



All traffic from each repeater passes through the **c-Bridge™.**

Now, only enough upload bandwidth is needed at each site for that repeater to communicate with the **c-Bridge™** – about 60 to 80 kbps.

Upload bandwidth needed at the **c-Bridge™** location will be 800 kbps to 1 Mbps.

C-Bridge™ Bridging Controllers can be used to reduce the network bandwidth needed in IP Site Connect Systems where bandwidth is limited at some sites.

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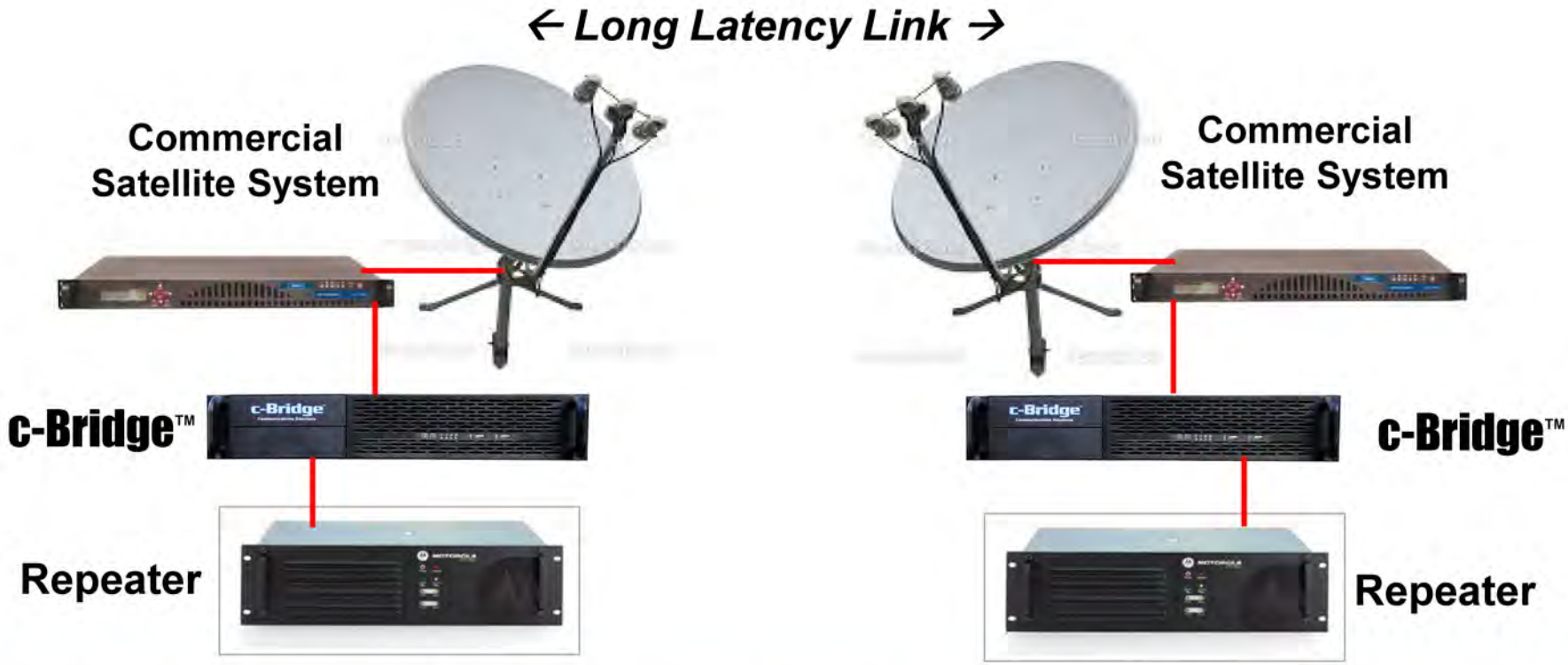
IP Transport with Long Latencies and High Jitter Rates



c-Bridge™ Bridging Controllers can be used to allow the use of IP networks with long latencies and/or high jitter rates, such as satellite links that are often unsuitable for IP Site Connect systems

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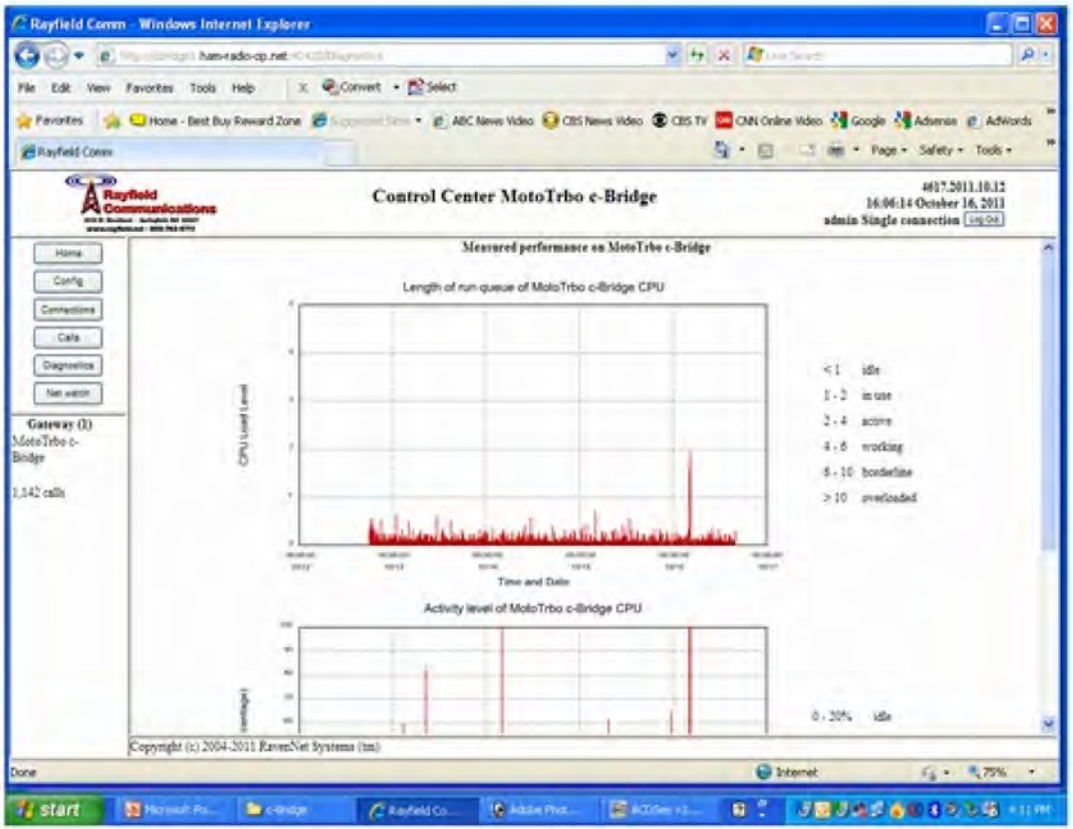
IP Network Diagnostics and System Monitoring



The c-Bridge™ Includes Built-In Real-Time Diagnostics for Troubleshooting IP Network Problems and Monitoring System Operation, which can prove to be invaluable when IP Network issues come up

The c-Bridge™ Summary

1. IP Site Connect System Expansion (Virtually Unlimited Sites)
2. Flexible Call Routing (True System-Wide All Call/Emergency Call)
3. Handles Voice and Data Calls
4. Interoperability (analog radio, digital radio, analog consoles)
5. IP-Based Voice Dispatch with Bridging/Interoperability Control
6. Expand Receiver Voting Systems (up to 6 Receivers per Repeater/Up to 50 Repeaters per System)
7. Reduce Network Bandwidth Needs at Sites
8. Network Repeaters through Satellites (Problematic Networks)
9. IP Network Diagnostics and System Monitoring

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Summary – Typical Users

- **Schools**
  - More than 15 Repeaters in System
  - Interoperability with Public Safety
  - IP-Based Voice Dispatch
- **Mining Operations**
  - System-Wide All Call and Emergency Calls
- **Small and Rural Public Safety**
  - Interoperability with other agencies
  - Interface with Legacy Analog Consoles
- **Enterprise**
  - More than 15 Repeaters in System
  - Large Number of Voting Satellite Receivers
  - IP-Based Voice Dispatch
- **All MOTOTRBO™ IP Site Connect Users**
  - IP Network Diagnostics and Monitoring

The c-Bridge™ Summary

- The **c-Bridge**™ offers an extremely flexible and cost-effective 'system' that can be used to enhance **MOTOTRBO**™ conventional and IP Site Connect systems

- By allowing **MOTOTRBO**™ systems to be designed with *capabilities that simply don't exist with other DMR systems*

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The c-Bridge™ Summary

If you'd like to be kept up-to-date on new features as we add them to the **c-Bridge**™ as well as learn about examples of how the **c-Bridge**™ is being used in 'real world' systems, send us an email and we'll be sure and keep you updated.

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www.rayfield.net

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Basic Overview – How to Set Up a c-Bridge™

1. Enter IP Network Information (IP Address, etc)
2. Enter MOTOTRBO™ Repeater Information
3. Create Bridge Groups

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IP Network Information and Configuration

1. The **c-Bridge™** uses the Linux operating, and specifically the **CentOS** distribution
2. The IP Network information must be entered into the **CentOS** operating system at the 'command line' before any further configuration can be done
3. A monitor and keyboard are connected to the **c-Bridge™** and are used to enter the IP Network Information
4. Once the IP Network Information is set in the **c-Bridge™**, then another computer must be used to configure the **c-Bridge™**
5. The **c-Bridge™** has its own web server, so a web browser is all that is needed to access the **c-Bridge™** configuration screens
6. Configuration and changes can easily be made from a computer on the same LAN to which the **c-Bridge™** is connected, or from any other network through which the **c-Bridge™** can be accessed (including the Internet)

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Basic Architecture and Configuration

c-Bridge™

=

IPSC Managers


Peer Repeater with NO RF


Peer Repeater with NO RF


Peer Repeater with NO RF


Peer Repeater with NO RF


Peer Repeater with NO RF

A **c-Bridge**™ emulates a group of Peer Repeaters with No RF.

One **c-Bridge**™ can emulate up to 50 Repeaters.

Within the **c-Bridge**™ Configuration, each Peer Repeater Emulation is referred to as an "IPSC Manager"

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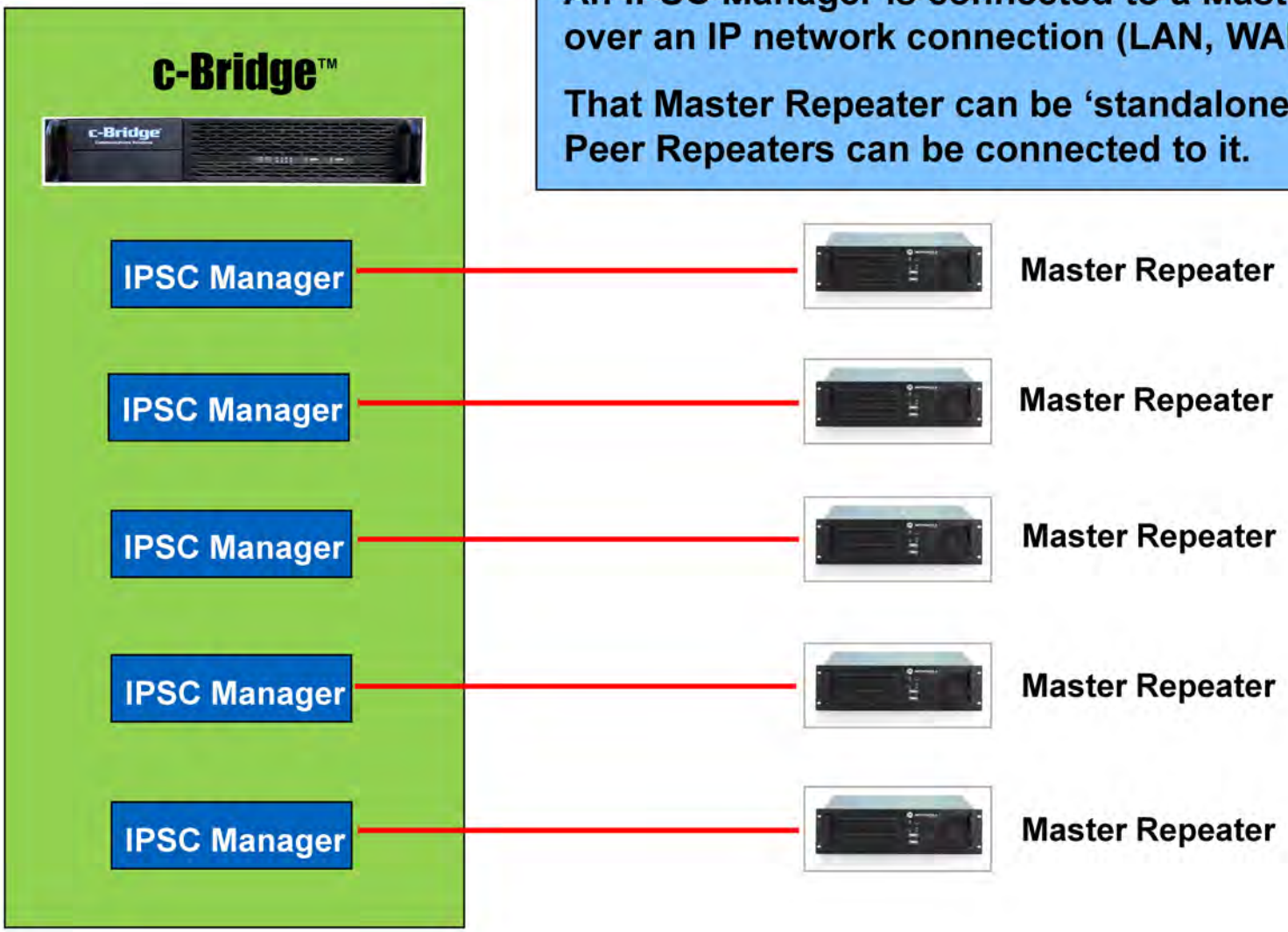
Basic Architecture and Configuration

An IPSC Manager is connected to a Master Repeater over an IP network connection (LAN, WAN, Internet)

That Master Repeater can be 'standalone' or other Peer Repeaters can be connected to it.



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Basic Architecture and Configuration

c-Bridge™

Since an IPSC Manager emulates a repeater, then programming an IPSC Manager is very similar to programming a repeater. There just aren't any 'frequencies', since there is no RF.

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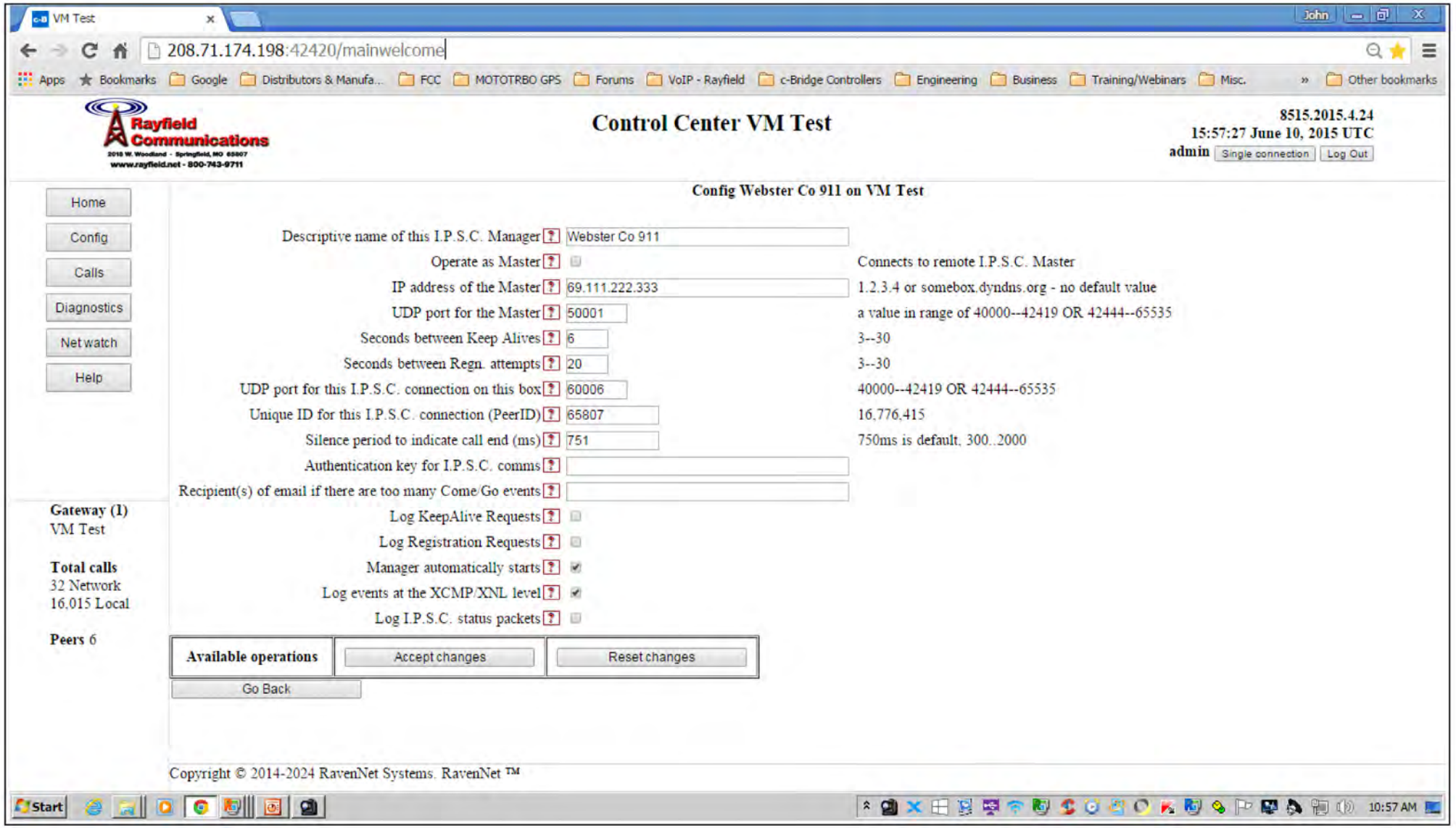
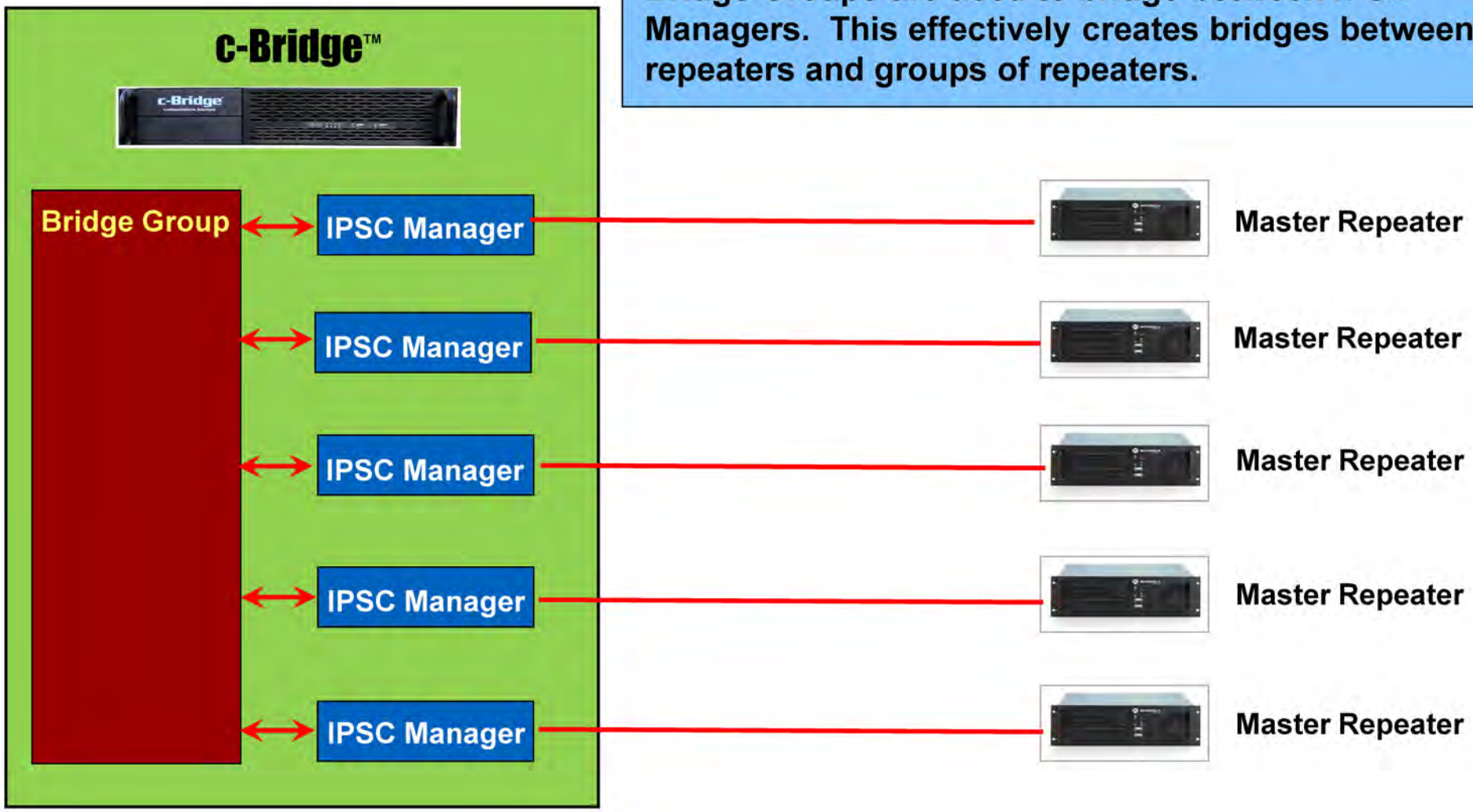
Basic Architecture and Configuration



The c-Bridge™

Basic Architecture and Configuration

Bridge Groups are used to bridge between IPSC Managers. This effectively creates bridges between repeaters and groups of repeaters.



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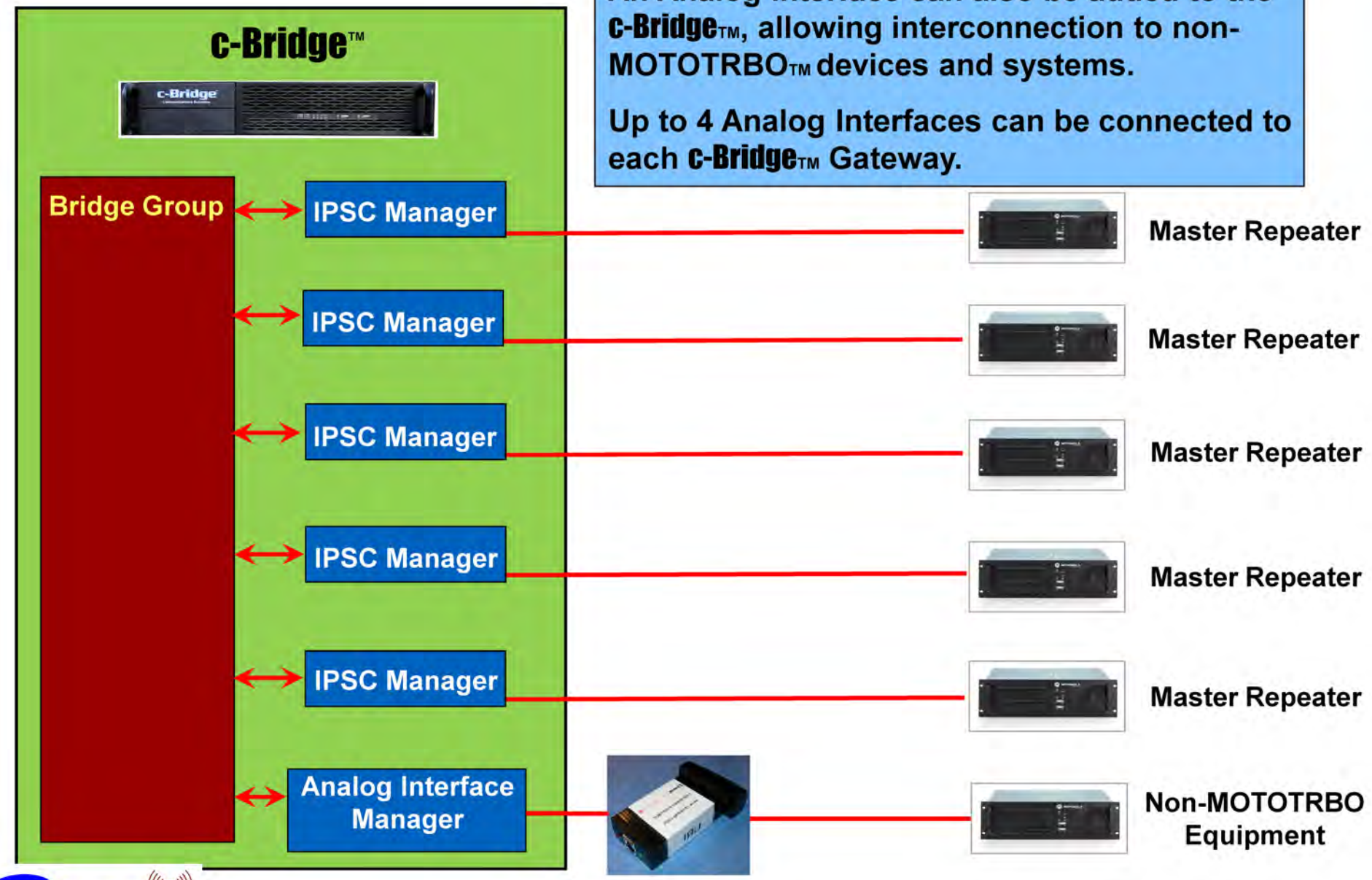
Basic Architecture and Configuration

An Analog Interface can also be added to the c-Bridge™, allowing interconnection to non-MOTOTRBO™ devices and systems.

Up to 4 Analog Interfaces can be connected to each c-Bridge™ Gateway.



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Configuration – Bridge Groups

Repeater	*Slot 1*	*Slot 2*
Repeater 1	Link ID 1	Link ID 2
Repeater 2	Link ID 3	Link ID 4
Repeater 3	Link ID 5	Link ID 6
Repeater 4	Link ID 7	Link ID 8
Repeater 5	Link ID 9	Link ID 10

Each Repeater and its Slots are assigned Link IDs

Configuration – Bridge Groups

Bridge Group Name	Talkgroup ID	Repeater Link ID
Bridge Group Main	101	1
Bridge Group Main	220	3
Bridge Group Main	101	4
Bridge Group Main	1002	6
Bridge Group Main	1003	8

In order to 'bridge' between a Talkgroup ID on one Repeater and Slot and another Talkgroup ID on another Repeater and Slot, the desired Talkgroup IDs and Repeater Slots are entered into a Bridge Group. The assigned Link IDs are used to represent which Repeater and Slot is desired

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Configuration – Bridge Groups

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All of the Repeater Slots and Talkgroup IDs that have been assigned the same Bridge Group Name are effectively bridged together. When one of these Repeaters receives a transmission using the associated Talkgroup ID, that transmission will be retransmitted on these other Repeaters and Slots using the programmed Talkgroup IDs.

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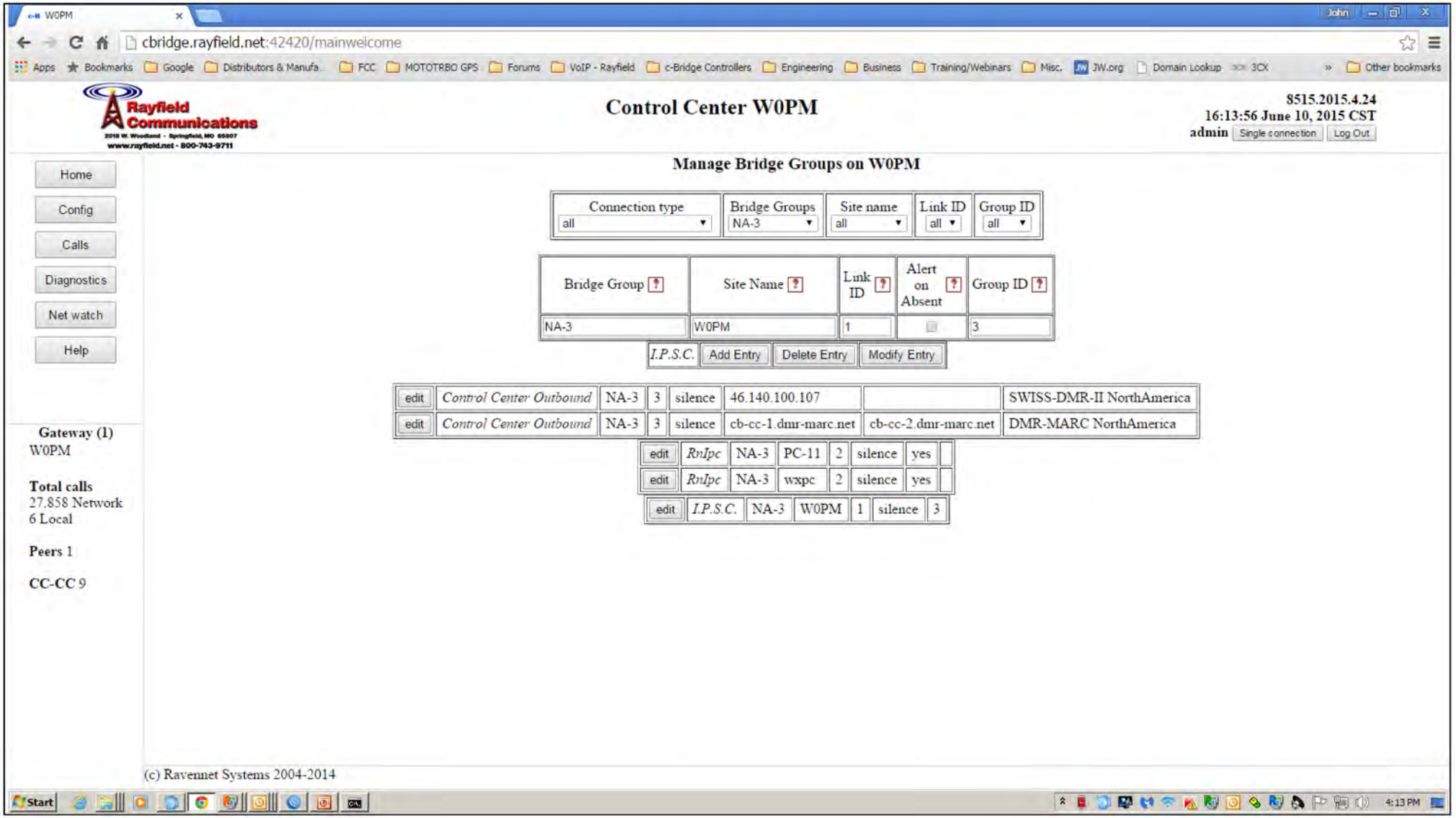
Configuration – Bridge Groups



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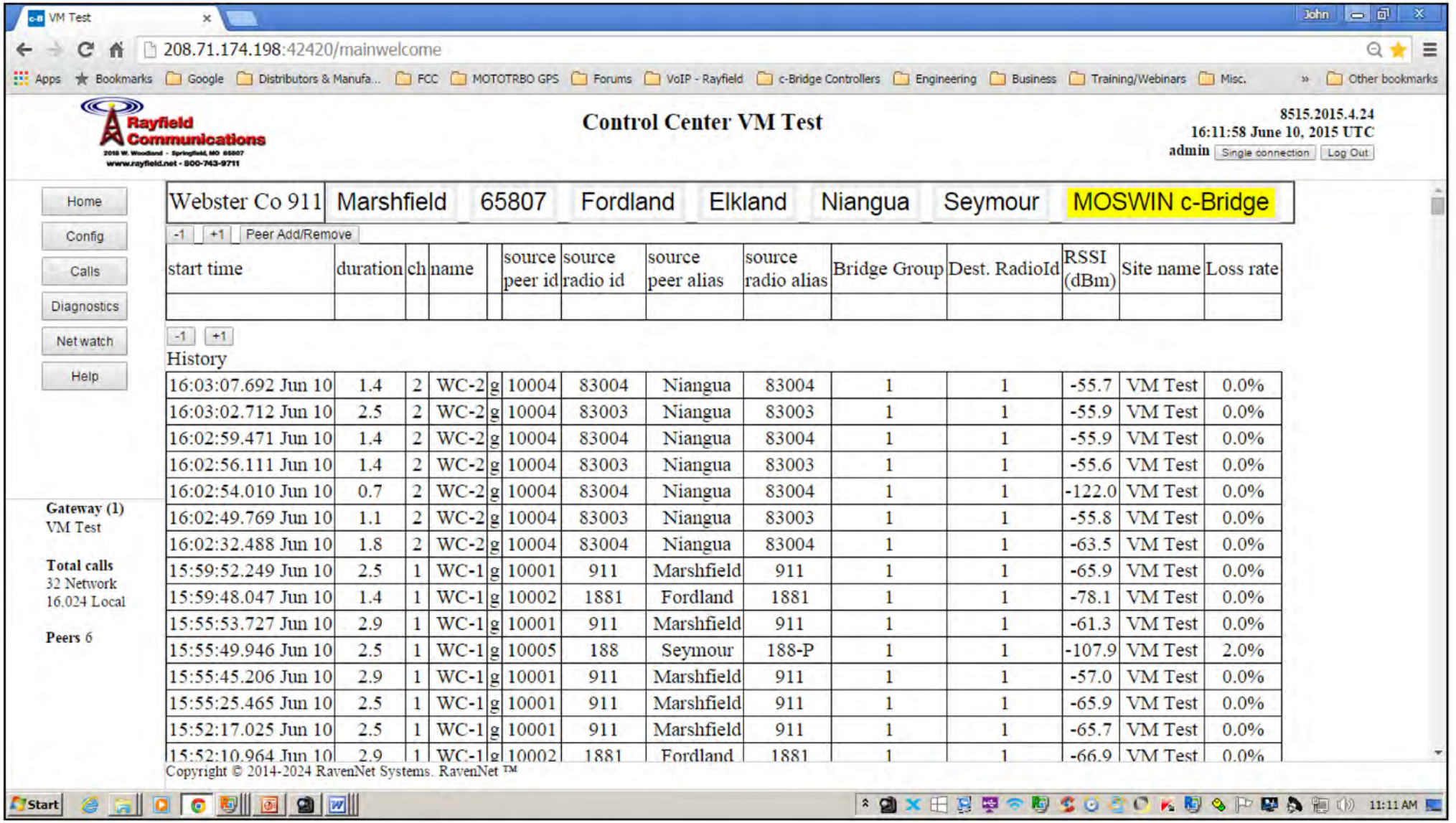
Configuration – System Monitoring



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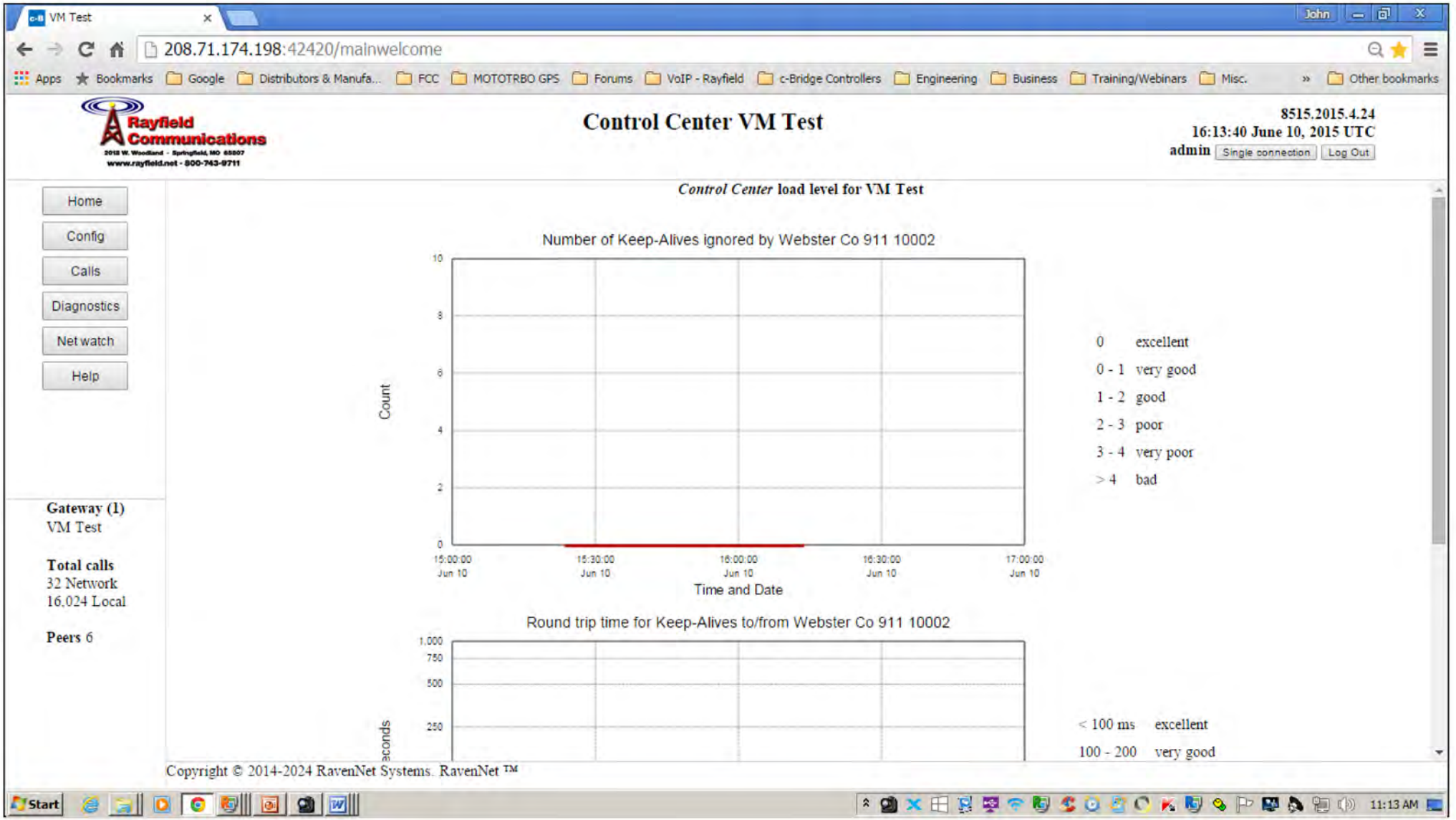
Configuration – Network Diagnostics



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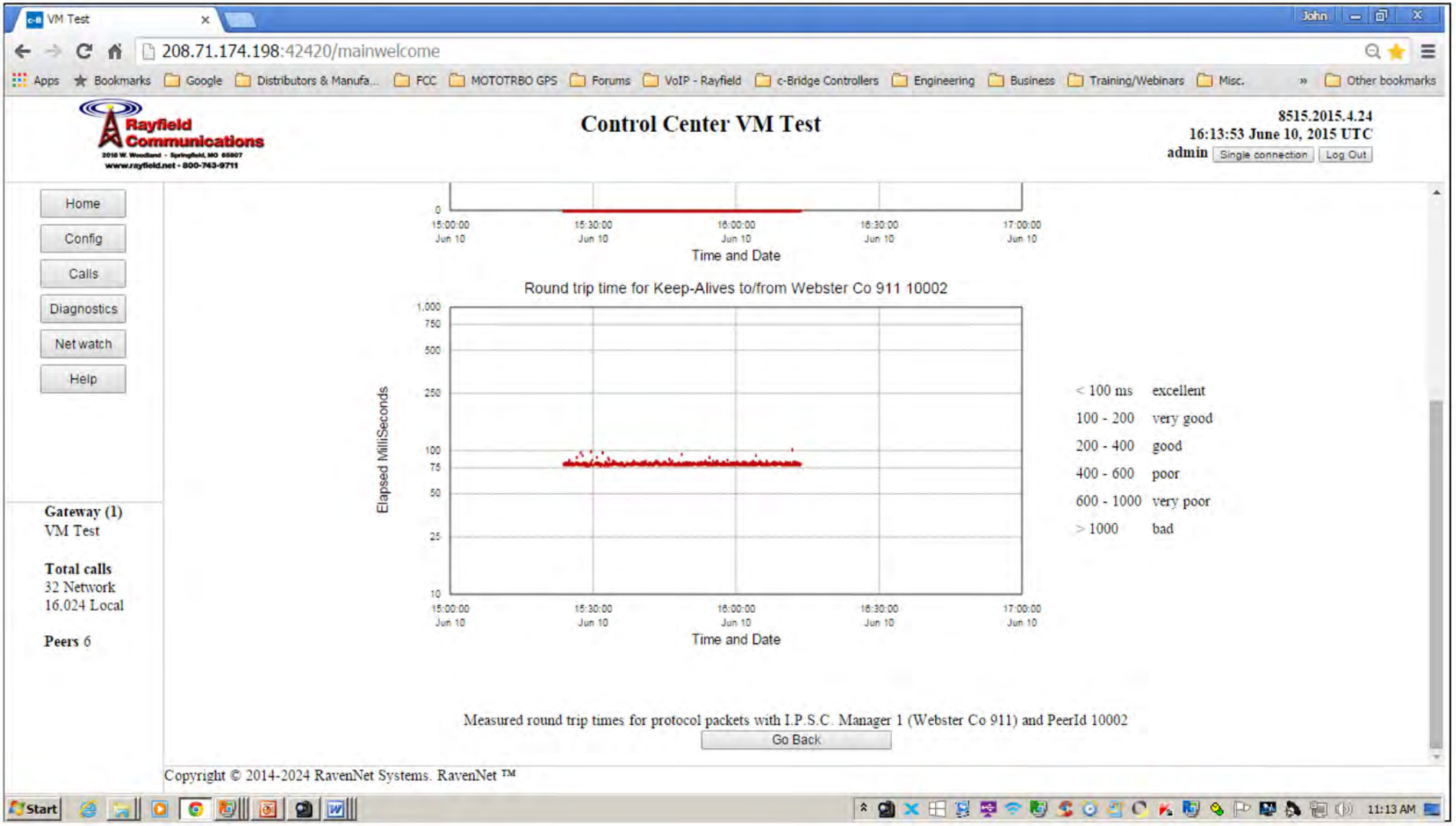

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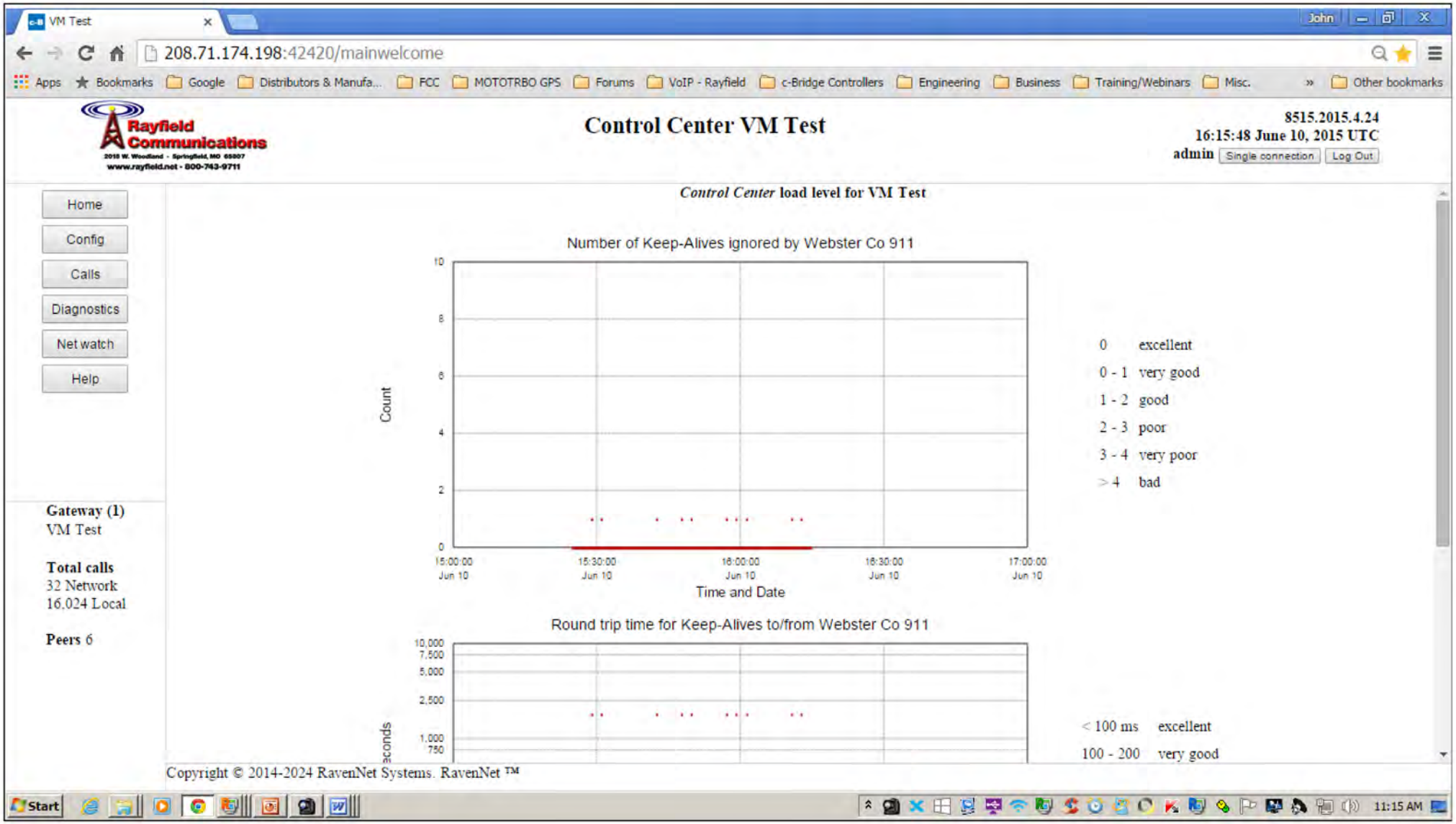

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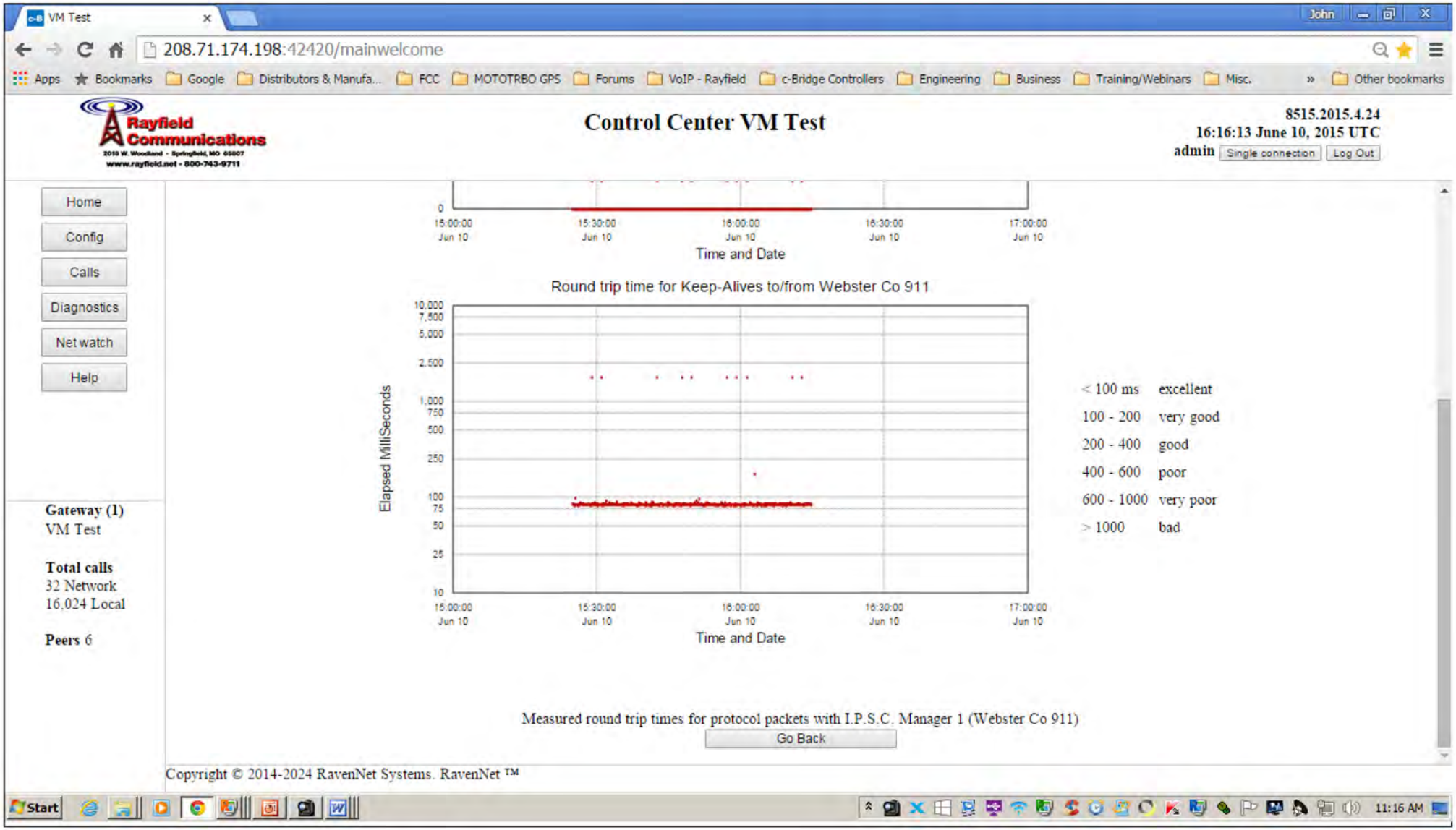

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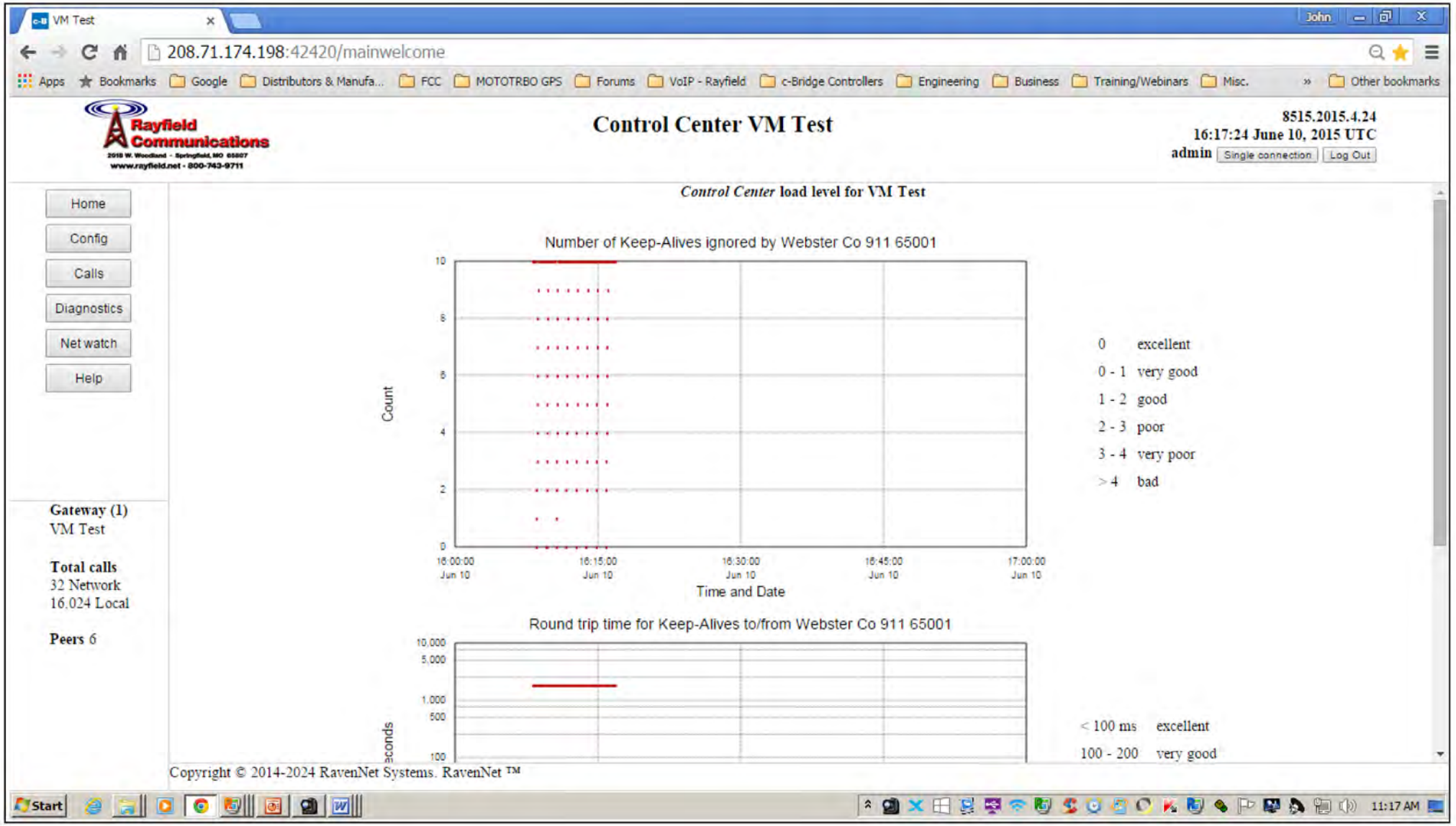
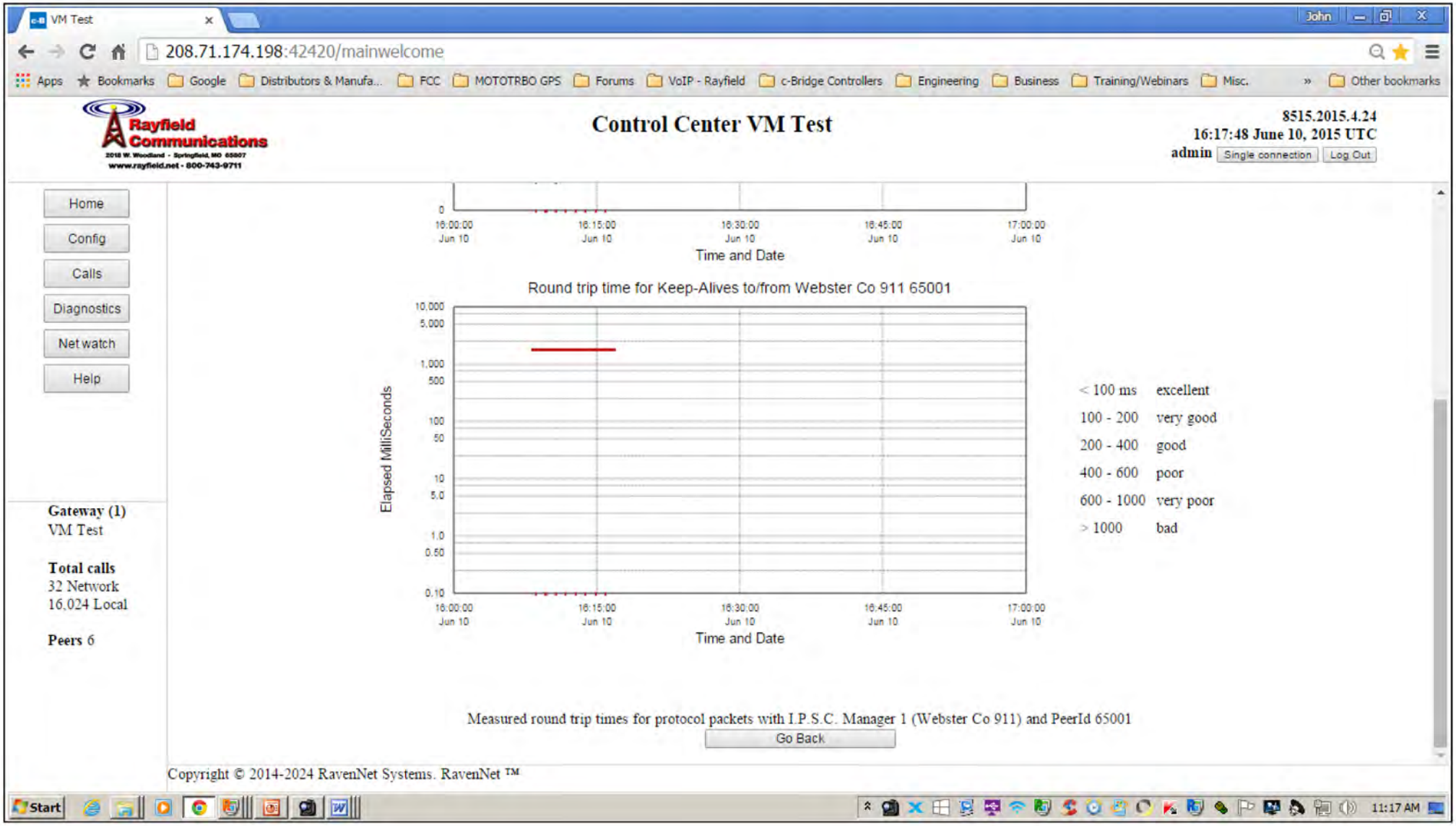


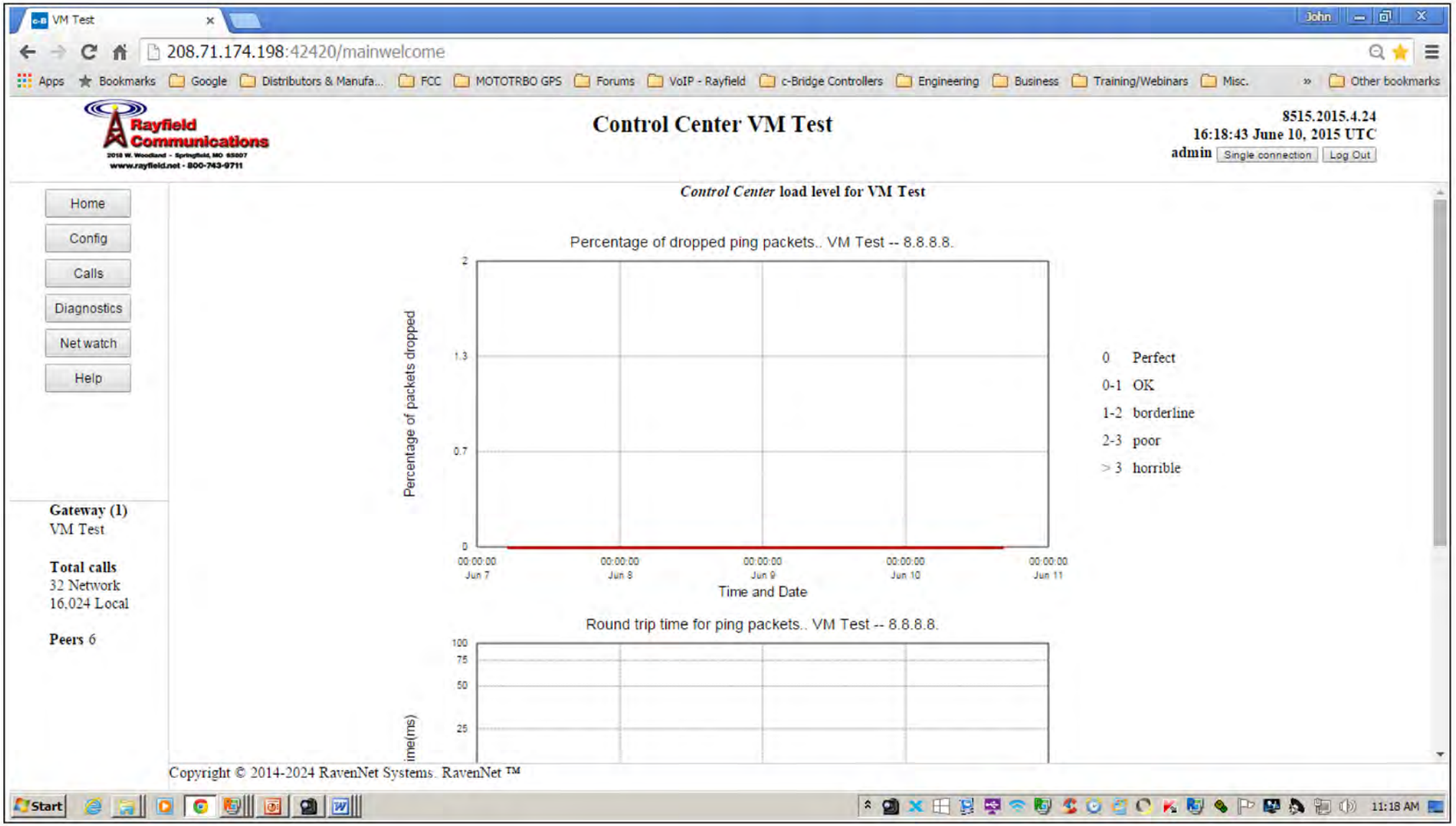
The c-Bridge™

Configuration – Network Diagnostics



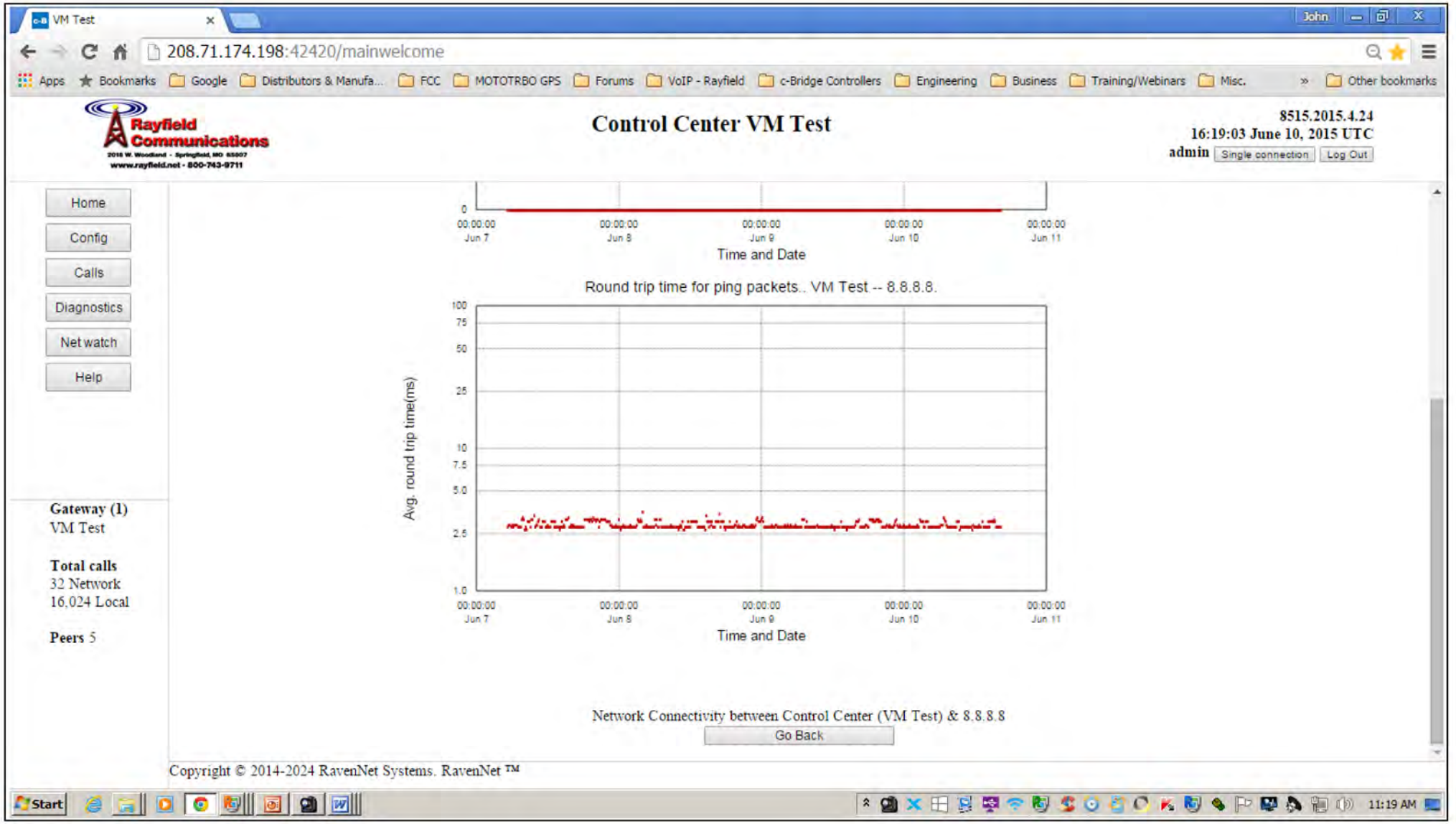
The c-Bridge™

Configuration – Network Diagnostics



The c-Bridge™

Configuration – Network Diagnostics



The c-Bridge™ Summary

We'll be developing new training videos that will go into more detail of setting up a **c-Bridge™**. These videos will be available on through our website and on **YouTube™**.

If you'd like to be kept up-to-date on these new videos and on new features as we add them to the **c-Bridge™**, send us an email and we'll be sure and keep you updated.

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Rayfield COMMUNICATIONS

Thank you…

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