



MOTOTRBO Multi-Site Capacity Plus™ *Capability Guide*

Introduction

Avtec's Scout VoIP console system supports MOTOTRBO™ Multi-Site Capacity Plus, Motorola's mid-tier digital trunking radio system that links adjoining sites across an IP network.

Scout interfaces to the MOTOTRBO Multi-Site Capacity Plus system using a direct IP wireline connection that allows Scout to support native AMBE+2 encoded audio without requiring external vocoder dongles or control stations. Scout leverages the unique features of MOTOTRBO Multi-Site Capacity Plus to provide dispatchers with the best-in-class console features for which Scout is known.

Capabilities-at-a-Glance

In addition to all the standard features of Scout console, the following MOTOTRBO™ Multi-Site Capacity Plus features are available to the dispatcher:

Capability	Description
Interface Method	Scout uses a wireline console interface through a direct IP connection to Motorola™ repeaters. Scout console positions connect to Multi-Site Capacity Plus radio systems via VPGate and the Avtec Routing Controller (ARC).
20-Site Support	A Scout–MOTOTRBO™ Multi-Site Capacity Plus configuration supports multiple systems, and each system can include 20 sites, including Scout console gateways. NOTE In 20-site deployments, all peers must be at firmware R2.4a and NAI Protocol V7 or higher to function properly. You must also enable 20-site in the repeaters and all repeaters in a site must have the same Site ID.
Unit Call (Private Call)	Scout or a Multi-Site Capacity Plus subscriber unit can communicate with a specific Multi-Site Capacity Plus subscriber unit by selecting the individual unit ID when making contact.
Group Call (Local Group)	Group Calls allow the Scout console to affiliate with a group of subscriber radios for the purpose of establishing voice communication between the dispatcher and the group of local subscribers. All members of the group hear the conversation.



Capability	Description
Group Call (Wide Area Group)	<p>Wide Area Groups, as defined in the master repeater, allow the Scout console to affiliate with a group of subscriber radios for the purpose of establishing voice communication between the dispatcher and the group of subscribers across multiple sites.</p> <div style="border: 1px solid black; padding: 5px;"> <p>NOTE If operational requirements involve Wide Area Groups, we recommend that the dispatcher not simul-select or patch more than four Wide Area Groups to minimize the chance of failed calls.</p> </div>
Emergency Group Call (inbound)	<p>An Emergency Call is a call with a higher priority level than a regular call.</p> <p>When pressed, the emergency button on a subscriber unit signals Scout to perform two actions. First, the driver sends an emergency alarm to the Scout console, which can only be cleared by the dispatcher touching the Emergency Clear pad on the Scout Console User Interface. Second, the driver creates an emergency call to the Scout console.</p>
Site All Call	A Site All Call is sent to all subscribers in a particular MOTOTRBO™ site.
System All Call	A System All Call is sent to all subscribers in a MOTOTRBO™ system.
PTT ID with Alias (ANI)	PTT ID displays the subscriber unit ID on the associated endpoint pad and in the Activity History. PTT ID Alias changes the PTT ID from a numerical ID to an alphanumeric string. For example, PTT ID 2527 can be displayed as "Fire Engine 27."
Tones	<p>Scout has the capability to generate tones to various endpoints, including P25 radios. These tones include:</p> <ul style="list-style-type: none"> • Channel Marker • Keying Tones • Guard Tones • Function Tones <p>Scout can also send tone specifications as an alternative to WAV files for an endpoint. This is primarily used for P25 endpoints but can also be used for other conventional endpoints when WAV files cannot produce the desired audible tone.</p>
Console Over Subscriber Priority	Console Priority is the capability to assign priority order to console transmissions over subscriber unit transmissions. If a console and a subscriber unit both try to key the same talkgroup, the console wins. The radio infrastructure grants the console PTT over the subscriber. This is accomplished using Transmit Interrupt and/or Remote Voice Dekey.



Capability	Description
<p>Console Over Subscriber Priority (Transmit Interrupt Type)</p>	<p>Transmit Interrupt allows a user to interrupt an ongoing voice transmission and initiate its own voice transmission to the same call membership. It is typically used during a prolonged voice transmission when “late-breaking” or urgent information becomes available and it is necessary to disseminate the information to the group as quickly as possible.</p> <p>The Scout System Administrator can select the type of interruption the endpoint uses when a dispatcher interrupts an existing call:</p> <p>Impolite: The field unit is unaware that the call has been interrupted.</p> <p>Dynamic: The type of interruption is based on the type of the existing call. If the subscriber unit is transmitting an interruptible call, the unit displays Call Interrupted and sounds a negative indicator tone until releasing the PTT button. If the existing call is a normal (uninterruptible) call, Scout uses the Impolite Call Interrupt Type regardless of this setting, leaving the field unit unaware that the call has been interrupted.</p>
<p>Console Over Subscriber Priority (Remote Voice Dekey)</p>	<p>Remote Voice Dekey allows a dispatcher to take over a transmit channel by stopping an interruptible voice transmission if there are no available channels.</p> <p>When enabled on an endpoint, if there are no available channels when the dispatcher PTTs, VPGate attempts to interrupt the voice transmission of the last received call. The dispatcher is not required to be a member of the voice call that is being interrupted. Once the original voice transmission terminates via the Remote Voice Dekey feature, the call succeeds.</p>
<p>Encryption (Enhanced Privacy)</p>	<p>Enhanced privacy is encryption and decryption of dispatcher/endpoint voice signals when transmitted and received, making eavesdropping on conversations difficult. It is typically used in applications where tactical decisions are being discussed in a group such as a police or military action where the decision reached on the action to be taken has to remain confidential until the action occurs.</p> <p>Encryption settings and key lists for enhanced privacy are managed through the Avtec Encryption Key Manager. Avtec does not charge a separate licensing fee for the enhanced privacy capability.</p>
<p>Encryption (Transmit Encryption Mode)</p>	<p>The Scout System Administrator can set a permanent transmit encryption mode as Clear Only, Encrypted Only, or Dynamic.</p> <p>Selecting ENCRYPTED ONLY allows the endpoint to transmit in the secure mode at all times. Selecting CLEAR ONLY allows the endpoint to transmit unencrypted audio at all times. Selecting DYNAMIC allows the dispatcher to toggle between Clear and Encrypted.</p>



Capability	Description
Encryption (Auto Transmit Key)	If the Transmit Encryption Mode is set to ENCRYPTED ONLY or DYNAMIC, the Scout System Administrator can have Scout automatically set the transmit encryption key to the same key received during the last inbound transmission. This allows the dispatcher to respond to a transmission using the same key as the incoming audio without any operator intervention.
Dynamic Talkgroup	In addition to stationary talkgroup endpoints for daily communication, dispatchers may have the need to communicate with talkgroups in special situations. In these cases, dispatchers can use the Dynamic Talkgroup feature for Multi-Site Capacity Plus endpoints. This feature allows the dispatcher to dynamically change the talkgroup by selecting from a list of talkgroups.
Unit Alert (Call Alert)	A Unit Alert contacts either the dispatcher or a subscriber. If the person was away from the console or vehicle, the alert leaves an indication that someone tried to make contact. The alert could also be a message to the dispatcher or the subscriber such as "call me when you get time."
Unit Check (Radio Check)	A Unit Check is a signal to the field that verifies that the unit is in working order and in range of the radio signal.
Unit Monitor (Radio Monitor)	Unit Monitor allows the Scout console to activate a subscriber unit's monitor mode remotely to listen to any audio that originates from the subscriber unit location.
Unit Stun (Radio Disable or Selective Radio Inhibit)	Unit Stun allows the Scout console to send a network signal to a mobile radio to disable the unit.
Unit Revive (Radio Revive)	Unit Revive allows the Scout console to reverse the Unit Stun by sending a network signal to a stunned (disabled) mobile radio that enables the unit.
Activity History with Instant Recall Recorder (IRR)	Activity History and IRR are Scout tools that allow the dispatcher to monitor past history. Activity History lists the past conversations and IRR replays the audio of the past conversations for analysis or clarification. Instant Recall Recorder is an optional feature of Scout.
Restricted Access to System (RAS)	Scout supports Motorola's Restricted Access to System (RAS) feature in the Multi-Site Capacity Plus system which prevents unauthorized subscribers from using the repeaters in the system to transmit to the system's targeted users or user groups.
Repeater Authentication	To prevent unauthorized use of a repeater, a key matching the repeater's authentication key can be entered in VPGate's Avtec Routing Controller Peer-to-Peer Authentication Key field.
NOTE Software must be installed on computers running Windows 10, Windows Server 2016, or Windows Server 2019.	



Connections

A MOTOTRBO™ Multi-Site Capacity Plus system consists of one or more MOTOTRBO™ digital repeaters configured to intercommunicate. All the repeaters in a system are peers of one another. Each repeater transmits RF-received voice and data packets over the IP network to all other registered peers in the system.

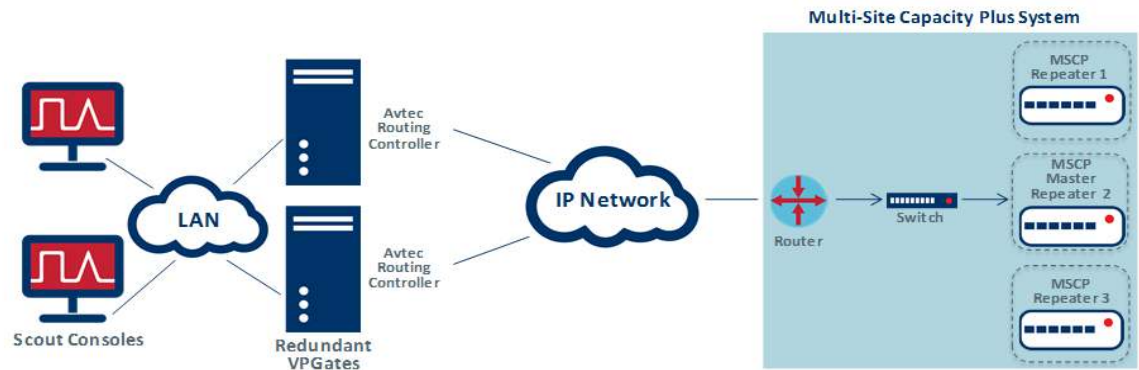
The Scout console system interfaces with Multi-Site Capacity Plus through the VPGate MOTOTRBO™ Multi-Site Capacity Plus driver. The driver provides options for settings unique to the Multi-Site Capacity Plus system such as:

- Timing of keepalive messages
- The type of connection for the endpoint
- Encryption settings

VPGate connects to Multi-Site Capacity Plus systems through the Avtec Routing Controller by registering the static IP address of the repeater acting as the Master peer. This Master peer obtains system information which includes both the IP addresses and ports of all the repeater peers and the site IP addresses of all the sites. Using the IP addresses and ports of the repeater peers, VPGate registers with interested repeaters in any site and exchanges keepalive messages with them through the repeater interface. After joining the system, repeater peers also get the updated system information, register with VPGate, and exchange keepalive messages to keep the firewall open.

Basic Configuration

In a basic setup, the Scout consoles connect to VPGate, which connects to an available Avtec Routing Controller either locally or over the same Local Area Network (LAN). The Avtec Routing Controller then connects to the MOTOTRBO™ Multi-Site Capacity Plus system. Multi-Site Capacity Plus connects to radio repeaters over IP.



The diagram shows a typical setup for the Scout console system along with VPGate and the Avtec Routing Controller that provides the connectivity to the MOTOTRBO™ Multi-Site Capacity Plus system.

NOTE

Avtec's VPGate and the Avtec Routing Controller must be on a different network subnet than the radio system.



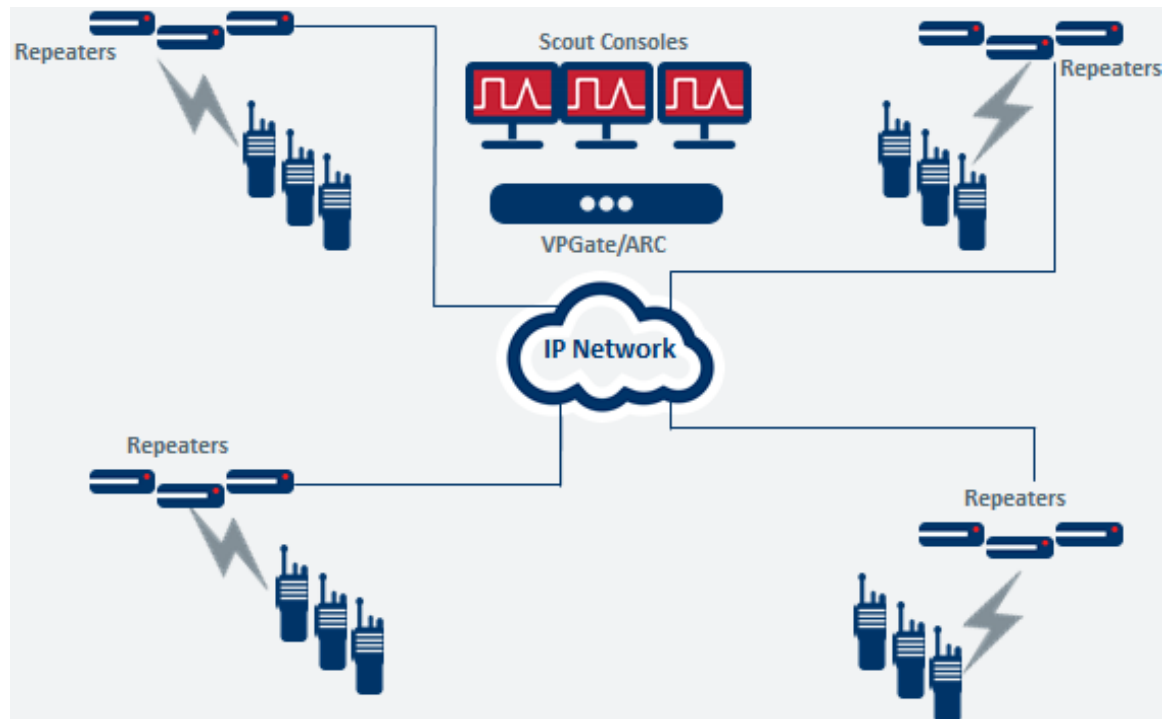
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The illustrations that follow show some typical applications for Scout with Multi-Site Capacity Plus. Refer to Motorola's *MOTOTRBO™ System Planner* document for detailed information about different Multi-Site Capacity Plus configurations.

Geographically Distributed Sites

The MOTOTRBO™ Multi-Site Capacity Plus solution supports a geographically distributed radio network, also called a *wide area system*, with multiple repeaters. With Scout consoles in a single communication center, an organization can coordinate activity in multiple remote locations.

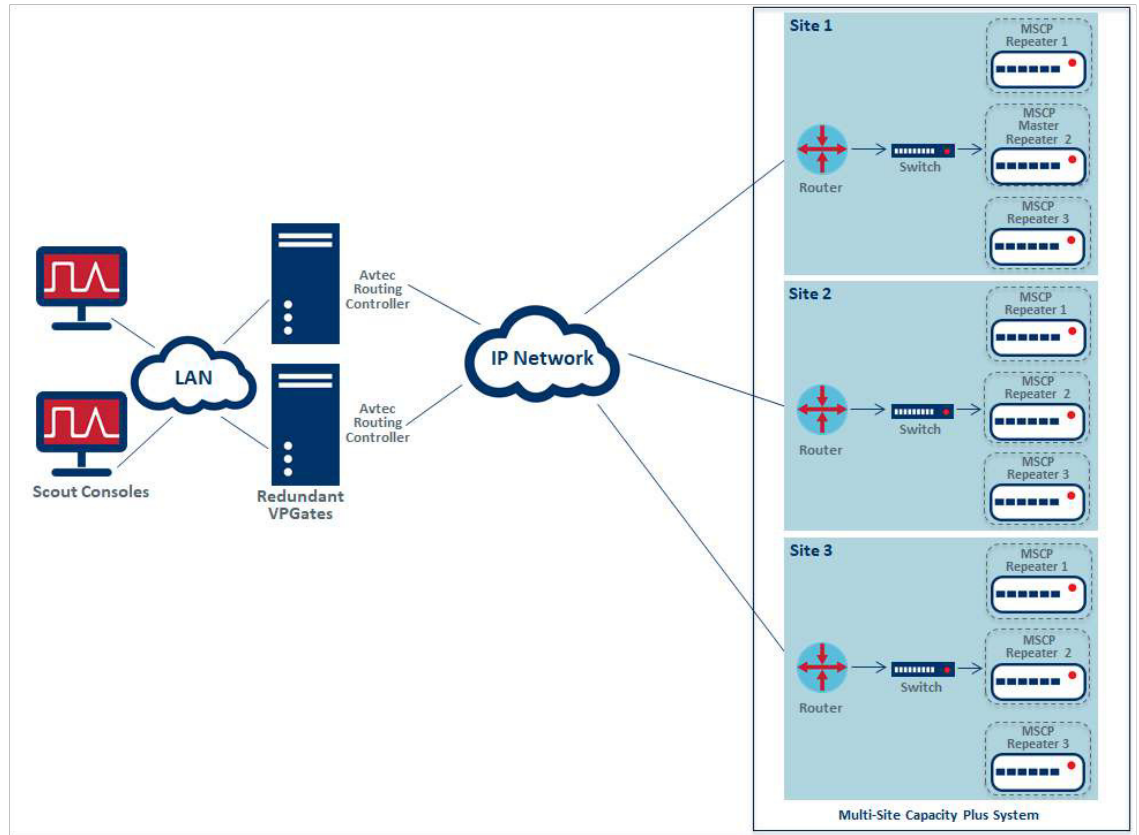


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MOTOTRBO™ Multi-Site Capacity Plus System

This multi-site layout illustrates the use of VPGate's Avtec Routing Controller to connect to multiple MOTOTRBO™ Multi-Site Capacity Plus sites. Note that Scout interfaces to this multi-site trunking system in the same way that it would with a single-site trunking system. Multi-Site Capacity Plus hides the details of the site configuration from Scout; Scout cannot tell if there is one MOTOTRBO™ site or multiple sites.

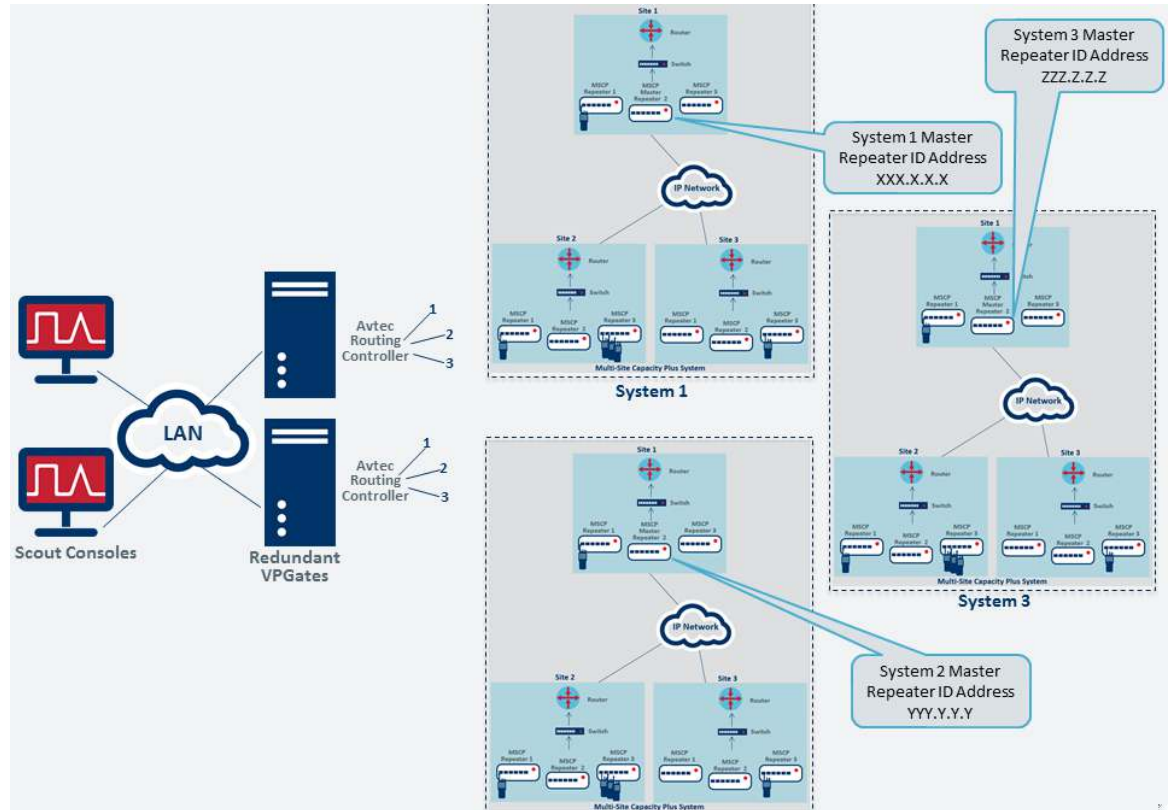


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*MOTOTRBO™
Multi-Site Capacity Plus
Configuration*

This multi-system layout illustrates the use of VPGate's Avtec Routing Controller to connect to multiple MOTOTRBO™ Multi-Site Capacity Plus systems. Note that Scout interfaces to these multiple trunking systems in the same way that it would with one single-site or multi-site trunking system. VPGate connects to each system by pointing to the IP Address of each system's Master Repeater. Regardless of which system an endpoint is connected to, the dispatcher communicates seamlessly with that endpoint.

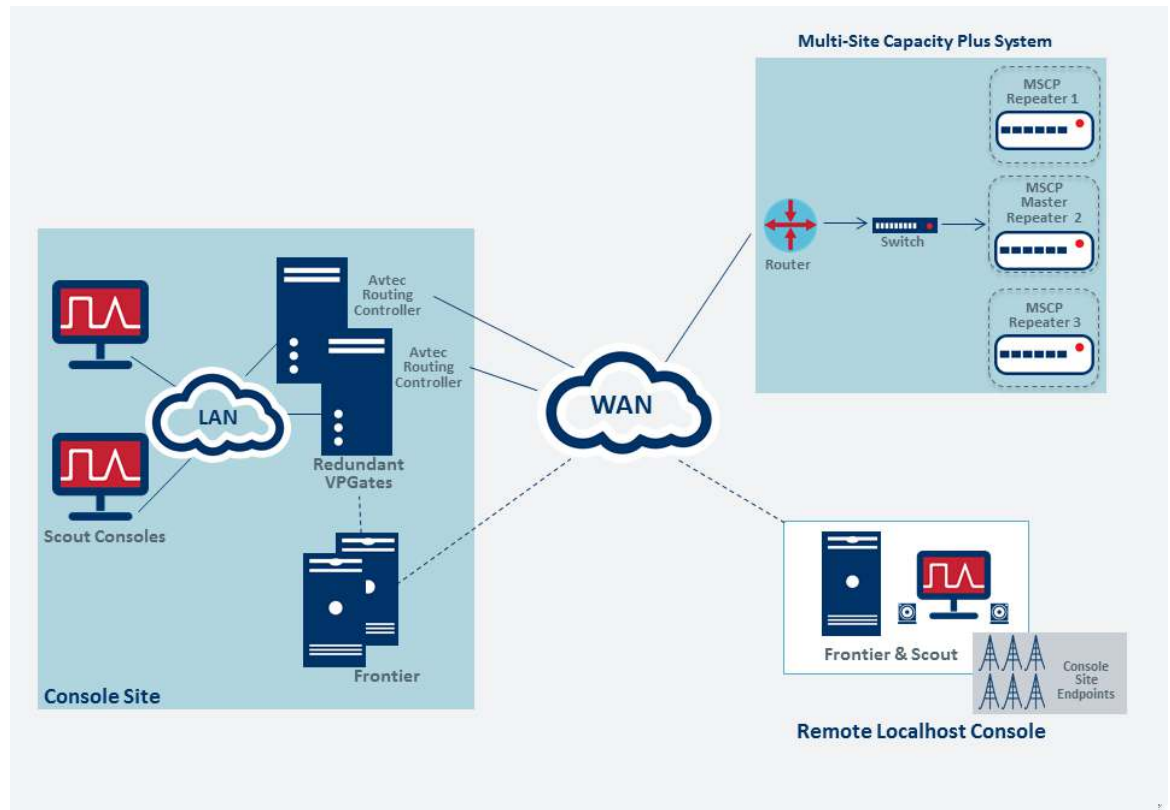


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Console Site and Remote Localhost Console

Scout supports localhost console deployments with Multi-Site Capacity Plus. While multiple VPGate/console sites are not currently supported on Multi-Site Capacity Plus, you can cover a remote area with a localhost console. The following illustration shows a remote localhost console where the Scout console and Frontier reside on the same computer and communicate with one another via the localhost ports instead of multicast. The localhost console registers its endpoints from the **Console Site's** VPGate.



NOTE
 Frontier is approved for use on MOTOTRBO™ Multi-Site Capacity Plus in these remote localhost console deployments with a single multicast domain only. Multi-site console system deployments are not currently approved on MOTOTRBO™ Multi-Site Capacity Plus.



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Scalability

The design for a Scout–MOTOTRBO™ Multi-Site Capacity Plus system is determined by the number of system connections, the number of endpoints required, and the number of consoles that require access to those endpoints. An endpoint is an IP talkpath between the console subsystem and the radio subsystem. When designing a Scout–Multi-Site Capacity Plus configuration, the number of systems, desired endpoints, and geographical locations for consoles determines the number and type of the licenses necessary. Review the information below to understand how the various components in a Scout–MOTOTRBO™ Multi-Site Capacity Plus system scale.

- A single Scout system supports up to 800 consoles and 4,000 endpoints.
- A single ARC supports 1,000 endpoints across 8 Multi-Site Capacity Plus systems.
- One VPGate bundled with MOTOTRBO™ Multi-Site Capacity Plus software license controls 40, 80, or 160 total endpoints, depending upon the license purchased. Of the total endpoints in the license, up to 30, 60, or 100 endpoints, respectively, are MOTOTRBO™ Multi-Site Capacity Plus endpoints.
- A total of 1,000 simultaneous voice calls are supported per ARC.

MOTOTRBO™ Multi-Site Capacity Plus trunked radio networks can scale from a single site with a few channels to a wide area system with several sites to several systems covering large geographic areas.

A Scout–MOTOTRBO™ Multi-Site Capacity Plus configuration supports multiple systems, and each system can include 20 sites, including Scout console gateways. Each site supports a maximum of 8 trunked repeaters and a maximum of 12 data revert repeaters; however, the total number of repeaters cannot exceed 12. For example, if you have 8 trunked repeaters, you can only have 4 data revert repeaters (all repeaters and peers in the system, with the exception of the data revert repeaters, require additional licensing that must be obtained from Motorola or an authorized vendor).

NOTE

In 20-site deployments, all peers must be at firmware R2.4a and NAI Protocol V7 or higher to function properly. You must also enable 20-site in the repeaters and all repeaters in a site must have the same Site ID.

Licensing

Implementing a Scout–MOTOTRBO™ Multi-Site Capacity Plus (MSCP) system requires software licensing for both the Scout console system and the MOTOTRBO™ MSCP systems. Motorola requires two licenses for all repeaters and all peers in the systems (obtain these licenses from Motorola or an authorized vendor). Avtec licenses are sold in capacity levels detailed below.

The MOTOTRBO™ MSCP driver is licensed as a supplemental VPGate driver and uses a variation of the base VPGate license with the option of including Frontier. The license size represents the number of active endpoints that VPGate and MOTOTRBO™ MSCP control. This VPGate license is available in four sizes: 24, 40, 80, or 160 total endpoints. The following table lists the license options and the maximum number of endpoints of each type the license allows. The model numbers ending in -FTR are Frontier-enabled versions.



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Avtec Model Number	Total Category A&B Endpoints	Maximum SIP Endpoints (Category B)	MOTOTRBO™ Connect Plus, MSCP, and Capacity Max Endpoints	Redundant
SFW-VPG-MTCP-L0NR SFW-VPG-MTCP-L0NR-SK	24	12	16	No
SFW-VPG-MTCP-L0NR-FTR SFW-VPG-MTCP-L0NR-FTR-SK	24	12	16	No
SFW-VPG-MTCP-L0 SFW-VPG-MTCP-L0-SK	24	12	16	Yes
SFW-VPG-MTCP-L0-FTR SFW-VPG-MTCP-L0-FTR-SK	24	12	16	Yes
SFW-VPG-MTCP-L1 SFW-VPG-MTCP-L1-SK	40	20	30	Yes
SFW-VPG-MTCP-L1-FTR SFW-VPG-MTCP-L1-FTR-SK	40	20	30	Yes
SFW-VPG-MTCP-L2 SFW-VPG-MTCP-L2-SK	80	40	60	Yes
SFW-VPG-MTCP-L2-FTR SFW-VPG-MTCP-L2-FTR-SK	80	40	60	Yes
SFW-VPG-MTCP-L3 SFW-VPG-MTCP-L3-SK	160	100	100	Yes
SFW-VPG-MTCP-L3-FTR SFW-VPG-MTCP-L3-FTR-SK	160	100	100	Yes

NOTE

For each MOTOTRBO™ Multi-Site Capacity Plus license used, a corresponding Category A license is also used. For example, if you configure 10 MOTOTRBO™ Multi-Site Capacity Plus endpoints in your system, 10 of your Category A endpoints are allocated.

Upgrading to Scout–MOTOTRBO™ Systems

See the following VPGate upgrade license options to field upgrade VPGate base licenses in a non-MOTOTRBO™ Scout system to support MOTOTRBO™ radio endpoints.



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VPG-UPG-L0-MTCP VPG-UPG-L0-MTCP-SK	Upgrade Level 0 VPGate base license to enable up to 16 MOTOTRBO™ Connect Plus, Capacity Max, or Multi-Site Capacity Plus talkgroups or private call endpoints.
VPG-UPG-L1-MTCP VPG-UPG-L1-MTCP-SK	Upgrade Level 1 VPGate base license to enable up to 30 MOTOTRBO™ Connect Plus, Capacity Max, or Multi-Site Capacity Plus talkgroups or private call endpoints.
VPG-UPG-L2-MTCP VPG-UPG-L2-MTCP-SK	Upgrade Level 2 VPGate base license to enable up to 60 MOTOTRBO™ Connect Plus, Capacity Max, or Multi-Site Capacity Plus talkgroups or private call endpoints.
VPG-UPG-L3-MTCP VPG-UPG-L3-MTCP-SK	Upgrade Level 3 VPGate base license to enable up to 100 MOTOTRBO™ Connect Plus, Capacity Max, or Multi-Site Capacity Plus talkgroups or private call endpoints.

Refer to the VPGate Cut Sheet or contact your Avtec sales representative for more information about licensing for Scout and MOTOTRBO™ Multi-Site Capacity Plus endpoints.

Network Requirements

The MOTOTRBO™ Multi-Site Capacity Plus network can be a local area network (LAN) or a wide area network (WAN) connection provided by an Internet Service Provider (ISP). Most customer networks are a combination of both types. Scout can connect to a Multi-Site Capacity Plus endpoint using a Local Group, Wide Area Group, Site All Call, System All Call, or Unit-to-Unit slot.

NOTES

- The network cannot use a Proxy server that directs all IP devices to a home or logon page before allowing them to access the WAN.
- Avtec's VPGate and the Avtec Routing Controller must be on a different network subnet than the radio system.

Jitter

Multi-Site Capacity Plus allows a jitter tolerance of 60 milliseconds (ms). If a delay of more than 60 ms occurs, audio quality begins to degrade. Scout allows for jitter ranging from 60 ms to 2.5 seconds.

NOTE

Packet loss and latency must be within the limits documented in the *MOTOTRBO™ System Planner* document from Motorola. The network cannot use a dial-up connection because of inadequate bandwidth. It also should not use satellite Internet access, such as a VSAT system, due to unacceptable delays during transmission and reception.

Bandwidth

Sufficient bandwidth must be available on the IP network. A fully populated repeater network can require more than 700 kbps.

Quality of Service

VPGate supports Differentiated Services (DiffServ) values for audio and control packets from the VPGate to the MOTOTRBO™ endpoint. This allows VPGate to assign a high priority to VoIP packets and prevent unwanted network delays.



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Addresses and Ports

A static IP Address and UDP Port for the master repeater must be made available to all peer devices on the Multi-Site Capacity Plus system.

When a peer device registers with the master repeater, the network supplies the return IP address and UDP port of the peer device to the master repeater. The IP address and UDP port are then made available to all other MOTOTRBO™ Multi-Site Capacity Plus devices on the system.

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