System Release 7.17
ASTRO® 25
INTEGRATED VOICE AND DATA

Console Site Bandwidth Management

NOVEMBER 2016

MN003248A01-A

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Document History

Version	Description	Date
MN003248A01-A	Original release of the *Console Site Bandwidth Management* manual	November 2016

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About Console Site Bandwidth Management

This manual provides an introduction to bandwidth management, which is necessary in the dispatch console subsystem to ensure efficient transport for the services in your system, for example, voice calls, and data service.

Included are detailed descriptions and procedures for operation, optimization, and troubleshooting. This manual is intended for field service managers and field service technicians.

What Is Covered in This Manual

This book contains the following chapters:

- Console Site Bandwidth Management Introduction on page 21, provides a high-level description of bandwidth management and the function it serves on your system.
- Console Site Bandwidth Management Theory of Operations on page 23, explains how bandwidth management works in the context of your system.
- Console Site Bandwidth Management Optimization on page 31, details the tasks that you perform to manage bandwidth on your system.
- Console Site Bandwidth Management Operation on page 37, details the tasks that you perform once bandwidth management is operational on your system.
- Console Site Bandwidth Management Troubleshooting on page 41, provides the fault management and troubleshooting information relating to bandwidth management.

Helpful Background Information

Motorola Solutions offers various courses designed to assist in learning about the system. For information, go to http://www.motorolasolutions.com/training to view the current course offerings and technology paths.

Related Information

See the following documents for associated information about the radio system.

Related Information	Purpose
Standards and Guidelines for Communication Sites (6881089E50)	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. Also known as R56 manual. This manual may be purchased on CD 9880384V83, by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System Overview and Documentation	Provides an overview of the ASTRO® 25 new system features, documentation set, technical illustrations, and system-level disaster recovery that support the ASTRO® 25 radio communication system.

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Chapter 1

Console Site Bandwidth Management Introduction

Bandwidth management involves setting call counts at the console site to ensure that bandwidth is not exceeded.

This chapter provides a high-level description of bandwidth management and the function it serves on your system.

For specific bandwidth needs, contact the Motorola Solutions Support Center (SSC).

1.1 Bandwidth Management Importance

The amount of bandwidth required for efficient transport services such as voice calls, data service, and network management is established during system planning and is influenced by the microwave system, IP network, or local telecommunications company providing the bandwidth. The process of providing adequate bandwidth is called provisioning.

After the system installation, adding any of the following factors impacts the amount of bandwidth required for your system:

- Adding RF sites
- Adding console sites
- Adding conventional resources, talkgroups, or subscribers.

These factors can lead to traffic congestion and degradation of services, especially voice services. The voice call traffic may begin to experience more busies.

If traffic has increased and degraded voice services, add more bandwidth.

If overall traffic remains the same, but the trunked call count has increased while the conventional call count has decreased, bandwidth management is required.

NOTICE: Trunked and conventional operations use different amounts of bandwidth. To change the assigned amount of bandwidth, contact the Motorola Solution Support Center (SSC).

1.2 Bandwidth Management Description

Bandwidth management is implemented for voice traffic only and is based on call counts – the anticipated number of trunked and conventional calls.

When the number of trunked calls reaches the Trunking Call Count limit, the Zone Controller busies incoming trunked calls to prevent using more bandwidth than provisioned.

When the number of conventional calls reaches the Conventional Call Count limit, the console operator affiliated to the conventional channel at the console site receives a notice that audio cannot be forwarded for subsequent calls.

If a console has colocated conventional channels, they must be factored into the initial system plan for required bandwidth since this bandwidth is not managed by using the Conventional Call Count parameter. For trunked or conventional channels that are colocated at the Master Site, typically always sufficient bandwidth is available.

Bandwidth Management in an ASTRO® 25 system manages voice traffic going to and from a dispatch console site.

Only the dispatch console sites have bandwidth managed by the system. It is useful when trunked and ASTRO® 25 Conventional system calls cannot be regrouped into digital calls. The Zone Controller allows separate management of trunked and conventional call bandwidth to allow for tuning the system to your traffic.

Bandwidth management for voice traffic is based on the parameters for the trunked call count and conventional call count configured for a console site in the Provisioning Manager.

When the number of calls reaches the call count limit for trunked calls, the Zone Controller busies any calls not already in process. However, if the console site does not have available bandwidth, conventional calls proceed without a console site.

NOTICE: The specific voice traffic (to and from consoles at the dispatch console site) is the only bandwidth that can be managed.

Chapter 2

Console Site Bandwidth Management Theory of Operations

This chapter provides information about how bandwidth management works in the context of an ASTRO® 25 system. To manage the bandwidth properly, know the rules according to which the system uses the bandwidth, and the factors that can influence the environment.

2.1 Bandwidth Management Operations Overview

Bandwidth is the amount of data transmitted per unit of time over a site link, with the capacity on the site link dedicated to the voice and data transmission.

Bandwidth is measured in DS0s:

- 1 DS0 equals 64 kilobits per second (kbps).
- 24 DS0s make up a T1 line; all 24 DS0s can be used in the T1.
- 32 DS0s make up an E1 line; 30 DS0s are used for the E1, 1 DS0 for framing, and 1 DS0 for signaling.

NOTICE: For Ethernet site link considerations for the dispatch console sites, see the *Flexible Site and InterZone Links* manual.

When the overall bandwidth calculated is greater than a single T1 line, multiple full or fractional T1 lines can be used as long as all physical links to the site use the same number of DS0s. All legacy conventional channels at the console site require separate bandwidth.

The Zone Controller manages bandwidth for voice traffic to and from consoles at the dispatch console sites by using the call count limits set up in the Provisioning Manager.

For trunked ASTRO® 25 system repeater sites, simulcast sites, and conventional channel sites, the Zone Controller manages the RF channels, but not the bandwidth. The system must be commissioned with enough bandwidth for the RF channels.

2.1.1 Hybrid T1/E1 and Ethernet Links Bandwidth Management

The Hybrid T1/E1 and Ethernet Links feature connects redundant zone cores to redundant remote sites. Before you use this solution, verify whether it is available for your architecture type and meets the bandwidth needs of your site types.

The Hybrid T1/E1 and Ethernet Links feature is a flexible scheme for connecting redundant zone cores and redundant remote sites in ASTRO® 25 systems. The legacy solution is to create redundant remote connections by using links of one type, that is, either T1/E1 link or Ethernet links. The Hybrid T1/E1 and Ethernet Links feature allows for creating connections that use both types of links. The feature is available in the M2 system configuration, M3 system configuration with Dynamic System Resilience (DSR), and M3 system configuration without DSR. You can use the Hybrid T1/E1 and Ethernet Links feature to connect redundant zone cores to the following site types:

- ASTRO® 25 Repeater Site (ISR)
- IP Simulcast Prime Site

- NM/Dispatch Console Site with MCC 7500 Dispatch Console or MCC 7100 IP Dispatch Consoles only
- Conventional Only Site (Centralized Conventional Architecture)

The site types that you can connect by using the hybrid T1/E1 and Ethernet links have different bandwidth requirements. For ASTRO® 25 Repeater Sites and Conventional Only Sites, the bandwidth requirement is a single T1 or E1 line. IP Simulcast Prime Sites and NM/Dispatch Console Sites can require more bandwidth than a single T1 or E1 line can provide.

The Hybrid T1/E1 and Ethernet Links feature is available only for sites that require bandwidth not greater than two T1/E1 lines. For sites that need bandwidth greater than a single T1 or E1 line, bundle up to two T1 or E1 lines using the Multilink Frame Relay (MFR) technology. The two bundled T1 or E1 physical lines create one logical link with increased bandwidth. For sites that require bandwidth greater than two T1 or E1 lines, the Hybrid T1/E1 and Ethernet Links feature cannot be used.

The hybrid T1/E1 and Ethernet links must be equivalent in terms of payload bandwidth capacity. If you create a redundant remote connection by using both types of links, the Ethernet link cannot be expected to carry more system payload bandwidth than the T1/E1 link. Both types of connection carry traffic at the same time and both types of connection must have equivalent quality and availability so that traffic quality does not suffer.

Transport devices that support hybrid links are S6000 routers at zone cores and GGM 8000 gateways at remote sites. Hybrid links are not supported on interzone links.

2.2 Bandwidth Utilization Operations Overview

Bandwidth use differs for trunked audio and analog conventional audio. Compared to trunked audio, analog conventional audio requires about three times as much bandwidth. Bandwidth use for trunked audio is approximately 7400 bits per second. For conventional analog audio, bandwidth use is about three times as much, over 23 000 bits per second.

When you allocate DS0s for voice channels, more bandwidth is required to support conventional analog calls than to support the same number of trunked calls. Call count is equivalent to RF voice channels in the following table and the subsequent discussion.

NOTICE:
For bandwidth management consideration, call counts for ASTRO® 25 Conventional system calls (using an Advanced Multi Band Excitation (AMBE) vocoder) are the same as for Analog Conventional calls (using a G.728 vocoder). This concept is true even though the type of vocoder used is different and even though the vocoder used to process ASTRO® 25 Conventional system calls is the same vocoder (AMBE) as the one used to process trunked audio calls.

Bandwidth use for trunked (digital) audio whether it is used in a Frequency Division Multiple Access (FDMA)-only or a Time Division Multiple Access (TDMA) system is the same for a console site.

Bandwidth use for ASTRO® 25 Conventional system channels is the same as for trunking channels.

Table 1: Relationships between Conventional Channels, DS0s, and Trunking Channels

See an example of the relationship between conventional channels, trunking channels, and the number of DS0s used. It is important to understand this relationship to make informed decisions about

bandwidth. The purpose of this table is only to provide an example of that relationship, and it is not meant to provide the specific information for configuring bandwidth.

Conventional Voice Channels	DS0s Required	Trunking Channels Supported with Same DS0s	Trunking Channels Supported with 1 Additional DS0	Trunking Channels Supported with 2 Additional DS0s
7	7	8	17	25
8	7	3	13	23
9	7	0	9	18
10	8	5	15	24
11	8	2	12	20
12	9	7	16	25
13	9	4	13	22
14	9	1	9	19

The relationship between the number of conventional and trunked voice channels are important. The number of trunked channels decreases when conventional channels are added without adding DS0s.

For example, the bandwidth can stay the same – 7 DS0s – but the number of voice channels available differs greatly, depending on whether the bandwidth is used for conventional or trunked channels:

- 15 voice channels total when there are seven conventional channels and eight trunking channels.
- Nine voice channels total when there are nine conventional channels. No bandwidth is available for trunking channels.

NOTICE: For more information about how trunked and analog conventional call counts map to physical DS0s, contact the Motorola Solution Support Center (SSC).

2.2.1
ASTRO 25 Conventional Voice Interzone Bandwidth Utilization

Bandwidth planning must account for the interzone conventional traffic to carry the conventional voice and signaling payload between the zones of a multizone system. The WAN link bandwidth must account for additional voice, control, supplemental signaling, and Aux I/O traffic introduced by the feature. Additionally, bandwidth use is different for digital conventional calls and analog conventional calls. Analog calls require more bandwidth. The additional traffic requires updates to the bandwidth allocation on the interzone WAN links.

Impact on Call Model

A zone controller handles a definite number of new calls per second. If you add interzone conventional calls to a system and do not change the existing call models, the zone controllers exceed the defined number of calls per second. Call models specify sustained call rates for a mix of trunked and conventional resources. The call rates vary depending on whether the system contains only trunked resources, only conventional resources, or a mix of trunked and conventional resources.

2.3
Bandwidth Management at Console Sites

The Zone Controller does not manage the RF channel resource. The size, in bits per second, of an RF site link is a function of the number of RF channels at the site.

The Zone Controller manages the bandwidth of the dispatch console site links.

The Zone Controller is configured with a maximum call count for any given site, based on the site link bandwidth. The Zone Controller busies any voice calls to and from a dispatch console site that is above the configured call count.

2.4

Capacity and Management at Various Site Types

This section provides information about the valid ranges for the number of channels at the various site types and about how to manage bandwidth for these various site types.

Number of Channels Supported at Various Site Types

ASTRO® 25 system repeater sites

This site type supports up to 28 trunking channels (27 voice, 1 control), 0-8 analog conventional channels, 4 digital conventional, or a combination of both.

Simulcast prime sites

This site type supports up to 30 trunking channels (29 voice, 1 control), 0-8 analog or 4 digital conventional channels at a prime site (up to 128 analog or 64 digital total, including conventional channels at remote sites).

Simulcast remote sites

This site type supports up to 30 trunking channels (29 voice, 1 control), 0-8 analog or 4 digital conventional channels.

NOTICE: In the case of circuit simulcast, trunked channels, use separate dedicated bandwidth for audio.

Dispatch console sites

The total combination of trunked call counts, conventional call counts, and all other traffic at a dispatch console site is limited by the number of calls that can fit on three T1s:

- 0–493 trunked calls;
- 0–212 conventional calls (including up to 40 local Conventional Analog channels).

NOTICE: The maximum call count numbers do not apply to dispatch console sites colocated at the master site. These colocated dispatch console sites are configured with an “infinite” call count, which is implemented as 500 conventional and 500 trunking call counts.

Standalone conventional channel sites

This site type supports 1–40 analog conventional channels (using 1-10 conventional channels).

Standalone digital conventional channel sites

This site type supports 1–20 ASTRO® 25 Conventional system channels (1-10 digital conventional channels).

ISSI.1 Network Gateways

This site type supports up to 28 trunking channels (27 voice channels).

Bandwidth Management at Various Site Types

Table 2: Bandwidth Management at Various Site Types

This table compares bandwidth at different types of RF sites, based on the amount of IP-based trunked and conventional channels at the site. The traffic profile for the dispatch console site call count is

approximately the same as the traffic profile of an RF channel. Therefore, the concepts of an “RF channel” and “call count” are used interchangeably.

Site Type	Provisioned or Managed?	Where?	How?
Remote console site including: • Dispatch console only, with no network management applications • Remote console site with analog conventional channels • Remote console site without analog conventional channels	Managed by the Zone Controller	Provisioning Manager / Console Site parameters	Trunking Call Count parameter Conventional Call Count parameter
Dispatch console site colocated at the master site	NA Colocated	Provisioning Manager / Console Site parameters Configured with an “infinite” call count because the console site is colocated at the master site.	Trunking Call Count = 500 Conventional Call Count = 500
Non-IP-based console sites, including: • Analog conventional site • Conventional channel site • ASTRO® 25 system repeater site with colocated analog channels • ASTRO® 25 system repeater site without analog channels • Simulcast prime site with colocated analog channels • Simulcast remote site with analog channels • Simulcast prime site without analog channels • HPD site • Network Management site only • Auxiliary Input/Output - comparator display • CTI (3rd Party) - comparator display • ISSI.1 Network Gateway	Provisioned	Has a dedicated number of channels.	Call count = number of resources

2.5 Bandwidth as Physical Channel Resources

At sites not using the MCC 7500 Dispatch Consoles and MCC 7100 IP Dispatch Consoles, the amount of bandwidth required is directly limited by the amount of physical resources at the site.

If the resources are all busy, the Zone Controller cannot assign a channel when it receives a new call request. The Zone Controller busies the new call request, and the call waits until a channel frees up.

For sites such as the ASTRO® 25 system repeater site, a High Performance Data (HPD) site, or a simulcast site, the Zone Controller knows what the resources are. Each site has a dedicated number of channels. After these channels are busy, no more resources are available.

2.6 Bandwidth as Call Counts

Dispatch console site links use the Zone Controller for bandwidth management. The Zone Controller is configured with a maximum call count for any given site, based on the site link bandwidth. If the trunked resources are all busy, the Zone Controller cannot assign a channel when it receives a new call request. When the Conventional Call Count limit is reached, the console operator affiliated to the conventional channel at the console site receives notice that audio cannot be forwarded for subsequent calls.

The call count parameters represent the maximum number of calls allowed on the site for trunked calls and for conventional calls. These numbers artificially create the idea of a limitation, similar to the limitation of all physical resources being busy. Call counts allow the Zone Controller to manage the bandwidth at a dispatch console site, even though no actual physical resource is associated with the call count.

The amount of bandwidth installed is the basis for the call count values. Call counts are used only for a dispatch console site. They represent the maximum number of simultaneous calls, both trunked and conventional, allowed to be active at the console site at a given time.

The significance of the call count parameter is that it is the maximum number of calls allowed on a dispatch console site link. If the physical bandwidth does not support the call count values, audio quality deteriorates.

IMPORTANT: Call count values are critical. Nothing else prevents you from adding more calls. Raising the call count too high has a serious impact, including poor audio quality, calls queued up too long, and the loss of packets. Call count must be based on what the installed bandwidth can support.

You can change the distribution of Call Count values. For example, if the system experiences an increase in busied trunked calls, you can increase the Trunked Call Count value and lower the Conventional Call Count value.

Another example is adding a Site Gateway (conventional channel interface) to a dispatch console site. The most practical option to the bandwidth issue is to add a T1 line. Then, after configuring it, you can modify the Call Count values in the Provisioning Manager.

A less favorable option is to decrease the Call Count values since it may not support the call throughput needed at the console site.

If both the Trunked Call Count and the Conventional Call Count are too low, add bandwidth before increasing the Call Count, to avoid an adverse impact on the calls. Call Count must be based on what the installed bandwidth can support.

NOTICE:
For bandwidth management consideration, call counts for ASTRO® 25 Conventional system calls (using an Advanced Multi Band Excitation (AMBE) vocoder) are the same as for analog conventional calls (using a G.728 vocoder). This system is true even though the type of vocoder used is different, and even though the vocoder used to process ASTRO® 25 Conventional system calls is the same vocoder (AMBE) as the one used to process trunked audio calls.

Bandwidth use for trunked (digital) audio (whether it is used in a Frequency Division Multiple Access (FDMA)-only or a Time Division Multiple Access (TDMA) system) is the same.

Bandwidth use for ASTRO® 25 Conventional system channels is the same as for trunked channels.

Use of the AMBE vocoder supporting TDMA operation provides high-fidelity audio with fewer voice bits. However, the smaller audio payload packet size does not translate into greater wireline efficiency because TDMA requires greater time synchronization data. Therefore, to determine the appropriate bandwidth provisioning and management at a console site, no differentiation is needed between a call employing IMBE vocoding (FDMA-only) or a call employing AMBE vocoding (TDMA).

2.7 Zone Controller and Bandwidth Utilization

The Zone Controller (ZC) manages bandwidth at the dispatch console sites by using the Call Count limits set up in the Provisioning Manager.

For trunked, ASTRO® 25 system repeater sites, simulcast sites, and conventional channel sites, the ZC manages the RF channels, but not the bandwidth. The system must be already commissioned with enough bandwidth for the RF channels.

NOTICE: Bandwidth management for console sites is performed through call counts.

trunked Call Counts

The trunked call count for a dispatch console site is the measure of the managed trunked audio traffic at the site. The counts indicate the maximum number of simultaneous trunked calls desired/expected at the site. More than one console may be affiliated to the resource. For example, ten consoles at the same dispatch console site affiliated to the same active resource (TG) only counts for one call count.

Conventional Call Counts

The conventional call count for a dispatch console site is the measure of the managed conventional audio traffic at the site. The counts indicate the maximum number of simultaneous conventional calls desired/expected at the site. More than one console may be affiliated to the resource. For example, ten consoles affiliated to the same active resource (conventional channel) at the same dispatch console site only count for one call count. Both analog and ASTRO® 25 Conventional system are part of the same Conventional Call Count.

For the Site Gateway (conventional channel interface), the bandwidth must be pre-provisioned for each channel connected to the Site Gateway (conventional channel interface). The ZC then assigns channels to calls. This approach is the same as the one used for a trunked RF channel.

Bandwidth management for console sites for voice traffic is based on the parameters for the trunked call count and the conventional call count configured for a console site in the Provisioning Manager. When the number of calls reaches the call count limit for trunked calls, the ZC busies any calls not in progress. However, conventional calls do proceed. The ZC manages the call counts for an allocated bandwidth, separately for both trunked and conventional calls.

2.8
Impact of Audio Patch on the ISSI.1 Network Gateway

The ISSI.1 Network Gateway does not support regrouping of talkgroups via Console Patch or Multiselect (MSEL). Configure each talkgroup configured in the ISSI.1 Network Gateway as non-regroupable in the console.

The implication of Patch/MSEL to the call count calculation is that a separate simulation activation occurs for each talkgroup configured in the ISSI.1 Network Gateway. Consider it in the call count calculation for the ISSI.1 Network Gateway.

2.9
Impact of Emergency Calls on Bandwidth

Emergency call activity, initiated at the subscriber or console level, may require the reallocation of limited bandwidth to an emergency call and away from non-emergency calls. If the bandwidth of a console site is fully consumed at the time when an emergency call is initiated, the Zone Controller preempts active calls from obtaining the bandwidth needed for the emergency call.

Dispatch console sites are subject to preemption. The Zone Controller does not preempt bandwidth for a conventional emergency call.

2.10
Impact of the Audio Patch on Bandwidth

Audio patch service provides the ability to route audio from one talkgroup and conventional channel to other talkgroups and conventional channels. The talkgroups and conventional channels must be assigned to the same patch to benefit from the audio routing services.

The audio patch causes simultaneous activity on member talkgroups and conventional channels. If, for example, a single talkgroup or a conventional channel is active, all other talkgroups and conventional channels in the same patch become active and remain active as long as at least one patch member is active.

The implication of the audio patch service to the call count calculation is its impact on Offered Erlang for the site due to the simultaneous activation of talkgroups and conventional channels. The Offered Erlang calculation should account for the fact that talkgroups and conventional channels in the same patch are activated simultaneously.

Consider talkgroup regrouping to minimize the audio patch impact on bandwidth. Regrouping is available only for trunked. Regrouping consolidates multiple talkgroups in the patch into a single supergroup. To calculate the trunked call count, regrouped talkgroups can be accounted for by considering the associated supergroup. As far as the trunked call count is concerned, a supergroup is the same as a regular talkgroup.

Chapter 3

Console Site Bandwidth Management Optimization

This chapter provides information about how to gather information about the bandwidth management in you system, and how to optimize it by applying settings properly.

3.1 Console Site Bandwidth Optimization

For the dispatch console sites, you configure the conventional and trunking call counts. The Zone Controller uses these parameters to manage the bandwidth used for console calls. Historical and Dynamic Reports are designed to help you determine whether these call counts are configured properly.

By looking at these reports, you can understand the bursts in call activity and determine:

- How often they exceed the call counts.
- How long they last.
- How much the call counts have to be increased to accommodate them.

After you determine the cause of the bursts, decide whether to increase the call counts or accept the occurrences.

If the average call activity is higher than the configured call counts, the consequences can be high call counts for trunked busies and/or for conventional denies in the Console Site Historical Reports. The statistics for the Average Console Site Trunking Bandwidth Utilization, Average Console Site Analog Conventional Bandwidth Utilization, and Average Console Site Conventional Talkgroup Bandwidth Utilization report parameters can be close to the corresponding Call Count values.

Dynamic Reports show these report parameters for bandwidth use also close to the corresponding Call Count values. In such a situation, you can consider increasing the call count value for the appropriate trunked or conventional resource. Before you increase the call count value, verify that you provisioned enough bandwidth at the site to accommodate the increase in the call count.

The busy duration is an indication of how long the bandwidth was unavailable. For real-time snapshots of the bandwidth use, monitor the dynamic reports.

3.2 Historical and Dynamic Reports

Bandwidth use is dependent upon the unique operation and changes periodically during the life of the system. Bandwidth use can be monitored periodically to determine if sufficient bandwidth is available. Historical and Dynamic Reports are available to monitor bandwidth use at the console site.

3.2.1 Console Site Detail Historical Report

The Historical Report, **Console Site Detail**, is designed to gather data on how the system uses the available bandwidth, as tracked by call counts.

Historical Reports can be run for various time periods in the past. The parameters in this site level report include:

Time
Date and time when the statistics for the report were collected.

Group Calls
The total number of group calls involving this console site.

Busy Group Calls
The total number of group call busies involving this console site.

Private Calls
The total number of private calls involving this console site.

Busy Private Calls
The total number of busy private calls involving this console site.

Emergency Calls
The total number of emergency calls involving this console site.

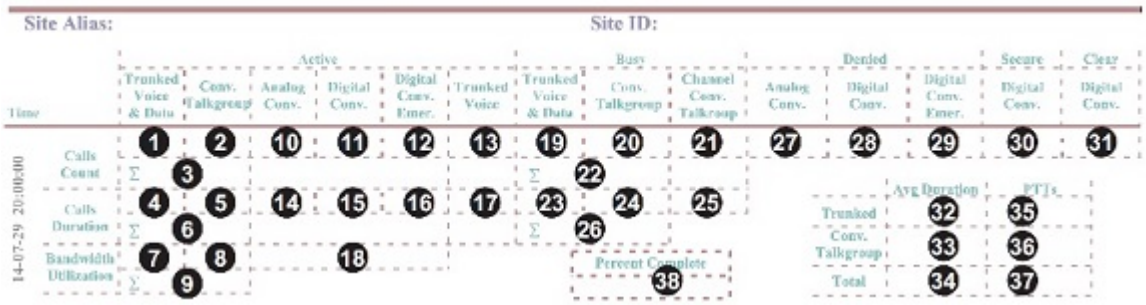
Busy Emergency Calls
The total number of busy emergency calls involving this console site.

Percent Complete
The amount of all the channels at the site being used versus the availability of all the channels. The formula used to make this calculation is: (Control Channel Duration + Total Active Duration) / (Interval Length * Number of Channels - Blocked Duration).

3.2.2
Console Site Summary Historical Report

The Historical Report, **Console Site Summary**, is designed to gather data on how the system uses the available bandwidth, as tracked by the total call counts.

Figure 1: Console Site Summary Historical Report



The parameters in this site level report include:

1 – Active Trunked Voice & Data Calls Count
The number of active trunked voices and data calls involving this console site.

2 – Active Conventional Talkgroup Calls Count
The total number of active conventional talkgroup calls involving this console site.

3 – Active Trunked Voice & Data and Conventional Talkgroup Calls Count
The total number of active calls involving this console site. This count includes trunked voice and data calls and conventional talkgroup calls.

4 – Active Trunked Voice & Data Calls Duration
The total duration of all active trunked voice and data calls involving this console site.

5 – Active Conventional Talkgroup Calls Duration
The total duration of all active conventional talkgroup calls involving this console site.

6 – Active Trunked Voice & Data and Conventional Talkgroup Calls Duration
The total duration of all active trunked voice and data and conventional talkgroup calls involving this console site.

7 – Trunked Voice & Data Bandwidth Utilization
The percentage of bandwidth to a console site consumed by trunked voice and data calls in the time interval.

8 – Conventional Talkgroup Bandwidth Utilization
The percentage of bandwidth to a console site consumed by conventional talkgroup calls in the time interval.

9 – Trunked Voice & Data and Conventional Talkgroup Bandwidth Utilization
The percentage of bandwidth to a console site consumed by trunked voice and data and conventional talkgroup calls in the time interval.

10 – Active Analog Conventional Calls Count
The total number of analog conventional calls involving this console site during the time span of the report.

11 – Active Digital Conventional Calls Count
The total number of all (secure and clear) non-emergency digital conventional calls involving this console site during the time span of the report.

12 – Active Digital Conventional Emergency Calls Count
The total number of all emergency digital conventional calls involving this console site during the time span of the report.

13 – Active Trunked Voice Calls Count
The total number of active trunked voice calls involving this console site.

14 – Active Analog Conventional Calls Duration
The total duration of all analog conventional calls involving this console site.

15 – Active Digital Conventional Calls Duration
The total duration of all non-emergency digital conventional calls involving this console site.

16 – Active Digital Conventional Emergency Calls Duration
The total duration of all emergency digital conventional calls involving this console site.

17 – Active Trunked Voice Calls Duration
The total duration of all active trunked voice calls involving this console site.

18 – Conventional Bandwidth Utilization
The amount of configured conventional call count used on the console site link. This parameter aggregates analog and digital conventional calls.

19 – Busy Trunked Voice & Data Calls Count
The number of busied trunked voice and data calls involving this console site.

20 – Busy Conventional Talkgroup Calls Count
The total number of busied conventional talkgroup calls involving this console site.

21 – Busy Channel Conventional Talkgroup Calls Count
The total number of conventional talkgroup calls involving this console site that were busied due to another console originating a conventional talkgroup call on the same conventional talkgroup channel.

22 – Busy Trunked Voice & Data and Conventional Talkgroup Calls Count
The total number of busied calls involving this console site. This count includes trunked voice and data calls and conventional talkgroup calls

23 – Busy Trunked Voice & Data Calls Duration
The total call duration for all busied trunked voice and data calls involving this console site.

24 – Busy Conventional Talkgroup Calls Duration
The total call duration for all busied conventional talkgroup calls involving this console site.

25 – Busy Channel Conventional Talkgroup Calls Duration
The total call duration for all conventional talkgroup calls involving this console site that were busied due to another console originating a conventional talkgroup call on the same conventional talkgroup channel.

26 – Busy Trunked Voice & Data and Conventional Talkgroup Calls Duration
The total call duration for all busied trunked voice and data and conventional talkgroup calls involving this console site.

27 – Denied Analog Conventional Calls Count
The total number of rejected analog conventional calls involving this console during the time span of this report.

28 – Denied Digital Conventional Calls Count
The total number of rejected non-emergency digital conventional calls involving this console site during the time span of this report.

29 – Denied Digital Conventional Emergency Calls Count
The total number of rejected emergency digital conventional calls involving this console site during the time span of this report.

30 – Secure Digital Conventional Calls Count
The total number of all secure digital conventional calls involving this console site during the time span of the report.

31 – Clear Digital Conventional Calls Count
The total number of all clear digital conventional calls involving this console site during the time span of the report.

32 – Average Trunked Calls Duration
The average call duration for all trunked call types involving this console site.

33 – Average Conventional Talkgroup Calls Duration
The average call duration for all conventional talkgroup call types involving this console site.

34 – Average Trunked and Conventional Talkgroup Calls Duration
The average call duration for all trunked and conventional talkgroup call types involving this console site.

35 – Trunked PTTs
The number of console user Push-to-Talks on a trunked talkgroup.

36 – Conventional Talkgroup PTTs
The number of console user Push-to-Talks on a conventional talkgroup.

37 – Trunked and Conventional Talkgroup PTTs
The number of console user Push-to-Talks on a talkgroup. This count includes trunked and conventional talkgroup PTTs.

38 – Percent Complete
The percent of data collected for the interval. One hundred percent indicates all data has been collected.

3.2.3
Console Site Busy Service Dynamic Reports

The **Console Site Busy Service** Dynamic Report is designed to track the types of busy calls at this site.

The parameters in this site level report include:

Busy Group Calls
The count of all non-emergency group call busies involving this console site.

Busy Private Calls
The count of all private call busies involving this console site.

Busy Emergency Calls
The count of all private call busies involving this console site.

Busy Conventional Talkgroup Calls
The count of all non-emergency conventional talkgroup call busies involving this console site.

Channel Busy Conventional Talkgroup Calls
The count of all non-emergency conventional talkgroup call busies involving this console site that were busied due to a conventional talkgroup call originated by another console on the same conventional talkgroup channel.

3.2.4
Console Site Call Type PTT Count Dynamic Reports

The **Console Site Call Type Push-to-Talk Count** Dynamic Report is designed to track the total number of calls made at this site.

The parameters in this site level report include:

Group Call
The count of all group calls that involved this site.

Private Call
The count of all private calls that involved this site.

Emergency Call
The count of all emergency calls that involved this site.

Analog Conventional Call
The count of analog conventional calls that involved this console site.

Digital Conventional Call
The count of digital conventional calls that involved this console site.

Digital Conventional Emergency Call
The count of digital conventional emergency calls that involved this console site.

Secure Digital Conventional Call
The count of secure digital conventional calls that involved this console site.

Clear Digital Conventional Call
The count of clear digital conventional calls that involved this console site.

PTT
The count of all Push-to-Talks (PTTs) on a talkgroup at this console site.

Grant Count
The count of all grants at this console site.

Total Active Calls
The count of all group, private, phone, and emergency calls that involved this site.

Conventional Talkgroup Call
The count of conventional talkgroup calls that involved this console site.

Conventional Talkgroup Emergency Call
The count of conventional talkgroup emergency calls that involved this console site.

Secure Conventional Talkgroup Call
The count of secure conventional talkgroup calls that involved this console site.

Clear Conventional Talkgroup Call
The count of clear conventional talkgroup calls that involved this console site.

3.2.5
Console Site Denied Service Dynamic Reports

The **Console Site Denied Service** Dynamic Report is designed to track the total number of conventional calls denied participation at this console site. The parameters in this site level report include:

Denied Analog Conventional Call Count
The count of analog conventional calls denied participation by this console site.

Denied Digital Conventional Call Count
The count of digital conventional calls denied participation by this console site.

Denied Digital Conventional Emergency Call Count
The count of digital conventional emergency calls denied participation by this console site.

Denied Conventional Talkgroup Call Count
The count of conventional talkgroup calls denied participation by this console site.

3.2.6
Console Site Link Bandwidth Usage Dynamic Reports

The **Console Site Link Bandwidth Usage** Dynamic Report is designed to track the trunked call count used at this console site. The parameters in this site level report include:

Trunking BW Utilization
The percentage of bandwidth to a console site consumed by the trunked calls in the time interval.

Conventional BW Utilization
The amount of configured conventional call count actually used on the console site link. This parameter aggregates analog and digital conventional calls.

Trunking and Conventional Talkgroup BW Utilization
The percentage of bandwidth to a console site consumed by the trunked and conventional talkgroup calls in the time interval.

Chapter 4

Console Site Bandwidth Management Operation

After you gather information about the bandwidth management in you system, perform the tasks necessary to manage bandwidth on your system.

4.1 Bandwidth Management Basic Information

Read the following information for the basic rules that you must follow when you manage bandwidth in your system.

To efficiently manage bandwidth in your system, meet the following requirements:

- Ensure you have the necessary physical transport bandwidth required to operate the system installed.
- Perform calculations to determine the appropriate amount of bandwidth and the corresponding T1/E1 lines required for the number of talkgroups, conventional channels (analog and/or digital), audio patches at the console, Auxiliary Input/Output (Aux I/O), and private calls at each site.

Bandwidth is specific to each dispatch console site.

Over time, systems change and evolve to meet different needs. When problems arise that point to bandwidth issues (such as an increase in the number of busied calls), you have two options:

- Adjust the call count values. If you need more trunked and less conventional, adjust the call counts accordingly. Adjusting call counts must be performed within the limits of the existing physical bandwidth.

  NOTICE: If there are more busied calls than can be accommodated by changing the call counts, contact Motorola Solution Support Center (SSC).

- Determine the need for additional physical bandwidth.

4.1.1 Adjusting the Call Count Parameters

Perform this procedure to manage the existing bandwidth for voice traffic to/from the console at a dispatch console site.

Prerequisites: To minimize the negative impact on the system, and before increasing or decreasing any call counts, use the Historical and Dynamic Reports to document the current bandwidth utilization and busied calls at a console site.

CAUTION: Changing Call Count parameters without understanding the impact negatively affects the system.

Procedure:

1. Use one of the several Dynamic Reports (listed below) to view the status of bandwidth utilization:
   - Console Site Busy Service
   - Console Site Call Type PTT Count

- Console Site Denied Service
- Console Site Link Bandwidth Utilization

2 Use one of the Historical Reports to view the status of bandwidth use over a specified period:
- Console Site Detail
- Console Site Summary

3 Identify the following issues:
- Where bandwidth use or where the number of busied or denied calls was greatest.
- How long the problems lasted.
- How often the number of calls exceeded the call counts.

4 Determine how much to increase the Trunking or Conventional Call Count.

5 Change the call count. See Changing the Call Count Parameters on page 39.

6 Return to Step 1 and determine the impact of the changes, and to potentially readjust the call counts again until the number of busied or denied calls is at an acceptable level.

7 If adjusting call counts does not provide the expected results, call Motorola Solution Support Center (SSC) for information on purchasing bandwidth.

When one or more T1 lines are added, a Motorola representative must reprogram the information at the master site.

4.1.2
Determining Bandwidth Needs

If you have tried managing the bandwidth by changing the trunked and conventional call count parameters, and you cannot obtain acceptable results, increase the physical transport bandwidth. Consult the Motorola Solution Support Center (SSC) to determine bandwidth needs and the impact that adding this bandwidth has on the system.

When and where to use: Adding bandwidth requires Motorola to reconfigure the network transport equipment at the Master Site. The addition of a physical T1/E1 line for additional bandwidth involves reprogramming at the Master Site, and must be coordinated through the Motorola Solution Support Center (SSC).

Procedure:

1 Consult Motorola to determine the bandwidth needs and the corresponding impact on the system.

2 Determine other bandwidth needs in ASTRO® 25 systems, including Network Management functions, running the ZoneWatch software, data traffic, and requirements for Auxiliary Input/ Output and other non-voice traffic.

3 Determine bandwidth needs for other equipment that is not a part of an ASTRO® 25 system.

4.2
Estimating the Call Counts

Trunked and conventional call counts are the number of simultaneous calls made and received at a dispatch console site by the console or the Archiving Interface Server (AIS).

The Zone Controller uses the call count values to manage the bandwidth at a dispatch console site. The call counts are configured in the Provisioning Manager.

The bandwidth allocated at a dispatch console site for voice usage depends directly on the call counts configured for the site.

Dispatch console sites colocated at the Master Site have fixed call counts for both trunked and conventional. The system chooses a large call count for a console site colocated at the Master Site, assuming an infinite bandwidth. Determining the call count is unnecessary.

Process:

1. Determine the number of unique trunked affiliations at the site by determining the number of unique talkgroups affiliated at the site.

   Trunked audio is received or sent only on talkgroups affiliated at the site.
2. Determine the number of unique Unit-to-Unit (private calls) to/from dispatch consoles.
3. Determine the number of conventional affiliations at the site by determining the number of unique conventional channels affiliated at the site.

   Conventional audio is sent or received only on channels affiliated at the site.
4. Evaluate the impact of the audio patch on the site bandwidth.
5. Determine the impact of the audio patch on Offered Erlang.

   The Erlang is a measure of voice traffic. One Erlang is the equivalent of one call (including call attempts and holding time) on one channel for 1 hour.
6. Determine the Offered Erlang for the Dispatch Console site for trunked conventional.
7. Determine the Grade of Service (GoS), as a percentage, for the dispatch console sites for trunked and conventional calls.

   IMPORTANT: The GoS for the dispatch console sites must be as good as, or better than, the RF sites in the system. The GoS is often zero (0), indicating that no calls are blocked or delayed. The bandwidth can always handle the required voice traffic.
8. Calculate conventional and trunked call counts, based on the Offered Erlang and the GoS using Erlang B method.
9. On a talkgroup and conventional channel, evaluate the impact of simultaneous radio and console transmissions on the call count and adjust accordingly.

4.3 Changing the Call Count Parameters

Prerequisites: Before you change the call count at a Dispatch Console, perform a careful research and planning. Changing call count parameters without understanding the impact negatively affects the system.

When and where to use: For the information about why and when to change the call count parameters, see .

Procedure:

1. From the main menu of Provisioning Manager, select **Consoles**.
2. In the object menu, go to the **Site** section and select **Console Site**.
3. In the list view, double-click the required console site record.
4. In the **Configuration** section of the configuration page, update the required call count parameters.

   For more information about setting the call count parameters, see the *Provisioning Manager* manual.
5. Click **Update**.

4.4

Group Data over Voice

This feature permits the console to send text messages to a Talkgroup, Supergroup, Announcement group, Agency group, and Patch group. For details, see the *MCC 7500 Dispatch Console with Voice Processor Module* manual.

Chapter 5

Console Site Bandwidth Management Troubleshooting

Use this chapter to troubleshoot any problems related to bandwidth management in you system.

5.1 Bandwidth Improvement with Historical/Dynamic Reports

Historical Reports provide the historical perspective of bandwidth use over a period (for example, every 15 minutes, hourly, daily, weekly, or monthly). The Dynamic Reports are useful because they give a real-time snapshot of bandwidth use.

Before deciding how to change the mix of values for each of the two call count parameters, Trunking Call Count and Conventional Call Count, it is critical to know the bandwidth use at the console site. The Zone Controller uses the two parameters to manage the number of calls allowed at that console site.

Both the Historical Reports and the Dynamic Reports are designed to help determine the answers for the following questions:

- Whether the bandwidth at a console site is properly configured
- Whether the bandwidth must be adjusted using the call count parameters
- Whether more bandwidth must be added at the console site

For example, if call counts are configured too low for the average call activity:

- Historical Reports show many busied trunked calls and/or conventional denies for the selected console site
- Historical Reports show the appropriate average Bandwidth Utilization statistic as close to the configured call count value
- Dynamic Reports systematically show the Bandwidth Utilization close to the configured call count value
- Determine the best mix to increase the appropriate Trunking or Conventional Call Count value

For more information, see Adjusting the Call Count Parameters on page 37.

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