

Course number

MOTOTRBO Capacity Max System Design



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MOTOTRBO Capacity Max System Design

Course Objectives

After completing this course, you will be able to:

- Design a simple Capacity Max system.
- Calculate Capacity Max capacity and bandwidth using a case scenario and system design tool.
- Create an equipment list, licensing, frequency planning and IP network plan.

State the Objectives

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Course Prerequisites

General	<ul style="list-style-type: none">• An understanding of IP Network Addressing• Knowledge of RF Propagation Modeling Tools	
PCT1047	MOTOTRBO Capacity Max Technical Overview	OLT
PCT1046	MOTOTRBO Capacity Max Theory of Operations	OLT
PCT1032	Radio Management 2.0 Configuration Mode	OLT

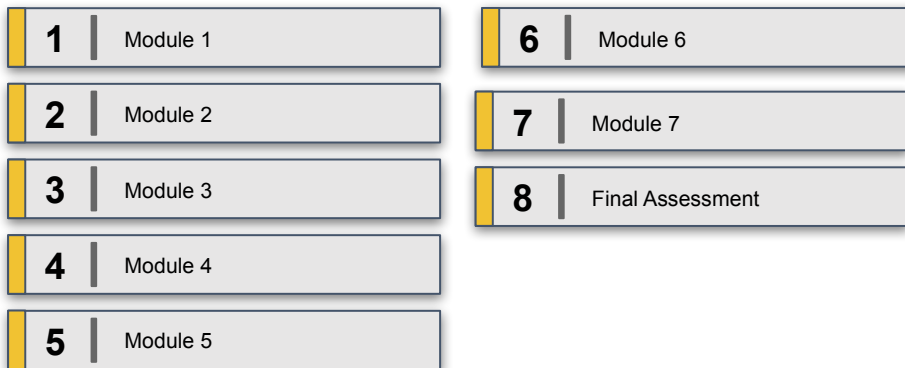
State the Objectives

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Course Map



Provide the modules for the course

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1 | MOTOTRBO Capacity Max System Design
Module 1: Capacity Max Review

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Section 1: Hardware and Software Requirements

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What is MOTOTRBO™ Capacity MAX?

- Next generation trunked radio solution.
- System control is centralized, traffic routing is optimized to minimize cost and maximize performance.



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MOTOTRBO Capacity MAX systems are a next generation trunked radio solution built to provide coverage, capacity, and control of your voice and data communications. The system control is centralized but the traffic routing is optimized to minimize cost and maximize performance.

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Benefits of MOTOTRBO™ Capacity MAX Systems

- Capacity MAX systems are:
 - Fully scalable for easy future growth.
 - DMR-TIER-III-compliant.
 - High performance, high availability, and high resiliency.
 - Easily transition from other MOTOTRBO systems, through a simple software upgrade.

Narration

The benefits of a MOTOTRBO Capacity MAX system features, a centralized control of everything you need to manage your system. All voice, data, and control traffic is encrypted within the IP network and all radios are securely authenticated. These benefits are what differentiate a Capacity MAX system from the other PCR system options or other manufacturers products.

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MOTOTRBO™ Capacity MAX Technical Summary

- Support for up to 250 sites and 3000 users per site.
- Dedicated control channel on every site and not required but supports optimal performance.
- Options for a redundant server which can be geographically separated and one redundant switch per site.

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A MOTOTRBO Capacity MAX system provides support for upto 250 sites with 3000 users per site.

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Hardware Components of a Capacity MAX System

- A CMSS (Capacity MAX System Server) with a licensed trunking controller.
- One RF site with at least one trunking repeater, with a Capacity MAX system license.
- Radio Management to program equipment.
- Switches and routers to connect equipment within the site or sites where the CMSS, repeaters, and Radio Management are located.
- Radios for end users.

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The following are mandatory hardware requirements that must be met in order to deploy a basic Capacity MAX system. Here are some supplemental requirements, additional RF sites can be added for wider area operations and additional trunking repeaters can be added at sites to support more users per site. Data Revert repeaters can be added to sites when higher location update rates are required or offload the data load from the trunking repeaters. Lastly, when more than one RF site is in the system, a Capacity MAX site license is required for each additional site beyond the first. The additional Data Revert repeaters will also require Capacity MAX system license.

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Software Components of a Capacity MAX System

- Radio Management application to program the equipment.
- Other software applications which may be needed depending on which Capacity MAX configuration is being deployed.
- The System advisor which can be optionally added to monitor call activity and equipment status.
- MNIS VRC Gateways and MNIS Data Gateways which can be added to support wire-line voice and data applications.
- A Battery Management application to manage the health of the radio's batteries in the system.

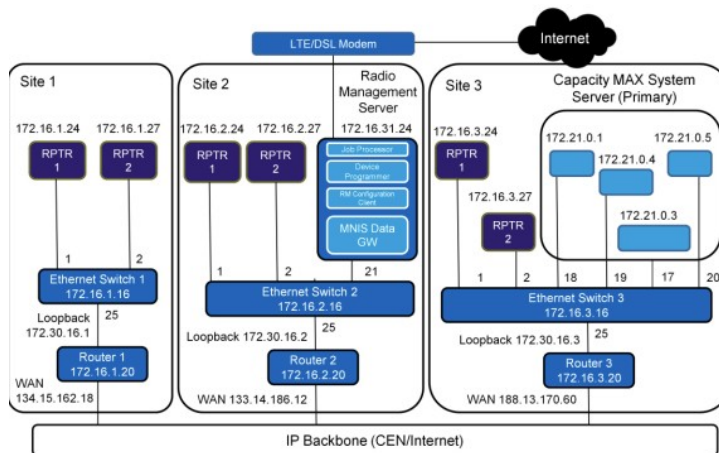
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The following are some software requirements that must be met in order to deploy a basic Capacity MAX system. A Capacity MAX system must have the following.

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Capacity MAX Three Site System Example (1/2)



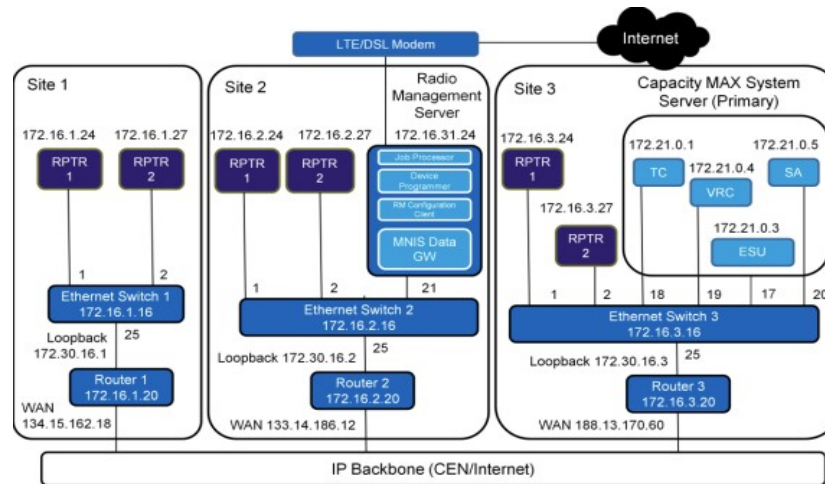
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This is an example of a three site system with a single CMSS and two repeaters on each site. Can you identify the missing pieces?

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Capacity MAX Three Site System Example (2/2)



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MOTOTRBO Capacity MAX 3 Site System Summary- Example Details

Notes

Repeater IP Address Format

Repeater IP Address = 172.16.(Site_Number).[21+(3*Device_ID)]

So if Site_ID = 1 and Device_ID = 1***

then repeater IP Address = 172.16.1.24

Key to Symbols



RF Hardware



Networking Hardware



Service/Application

Abbreviations

- RPTR = Repeater
- SA = System Advisor
- TC = Trunking Controller
- VRC = Voice and Radio Command
- ESU = Enhanced Software Update

** The Internet connection on the Radio Management Server is only required while any licenses are being activated.

*** The improved IP address efficiency feature is introduced in M2021.01 release. See next slides for details.

Site 1 (Repeaters)

Network Base IP = 172.16.1.0

Network Gateway = 172.16.1.20

Network Mask = 255.255.255.0

Site 2 (Repeaters)

Network Base IP = 172.16.2.0

Network Gateway = 172.16.2.20

Network Mask = 255.255.255.0

Site 3 (Repeaters)

Network Base IP = 172.16.3.0

Network Gateway = 172.16.3.20

Network Mask = 255.255.255.0

Radio Management PC**

Network IP = 172.16.31.24

Network Gateway = 172.16.31.20

Network Mask = 255.255.255.128

CMSS

Network IP = 172.21.0.0

Network Gateway = 172.21.0.20

Network Mask = 255.255.255.128

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Repeater Device ID and IP Addressing Prior to M2021.01

IP subnet mask	Device ID
255.255.255.224 (/27)	1, 2
255.255.255.192 (/26)	1–13
255.255.255.128 (/25)	1– 21
255.255.255.0 (/24)	1– 21

Table shows example of site with /27 IP subnet mask

Last Octet	Prior M2021.01 Plan
0	IETF Subnet Address
1	IA
2	CCM
3–6	RESERVED
7	RESERVED
8	RESERVED
9	RESERVED
10	RESERVED
11	RESERVED
12	RESERVED
13	RESERVED
14	RESERVED
15	RESERVED
16–19	Switches
20–23	Routers
24	Rptr 1 (Primary)
25	Rptr 1 (Redundant)
26	Rptr 1 (Payload)
27	Rptr 2 (Primary)
28	Rptr 2 (Redundant)
29	Rptr 2 (Payload)
30	
31 (/27)	IETF Broadcast Address

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Here are the following Device ID ranges that supported the Cap Max system release prior to the release of M2021.01.

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Repeater Device ID and IP Addressing Prior to M2021.01

IP subnet mask	Device ID
255.255.255.224 (/27)	1, 2 and 19 –21
255.255.255.192 (/26)	1–13 and 19–21
255.255.255.128 (/25)	1–21
255.255.255.0 (/24)	1–21

Table shows example of site with /27 IP subnet mask

Last Octet	Prior M2021.01 Plan	Starting M2021.01 New Plan
0	IETF Subnet Address	IETF Subnet Address
1	IA	IA
2	CCM	CC
3–6	RESERVED	RESERVED
7	RESERVED	Rptr 19 (Primary)
8	RESERVED	Rptr 19 (Redundant)
9	RESERVED	Rptr 19 (Payload)
10	RESERVED	Rptr 20 (Primary)
11	RESERVED	Rptr 20 (Redundant)
12	RESERVED	Rptr 20 (Payload)
13	RESERVED	Rptr 21 (Primary)
14	RESERVED	Rptr 21 (Redundant)
15	RESERVED	Rptr 21 (Payload)
16–19	Switches	Switches
20–23	Routers	Routers
24	Rptr 1 (Primary)	Rptr 1 (Primary)
25	Rptr 1 (Redundant)	Rptr 1 (Redundant)
26	Rptr 1 (Payload)	Rptr 1 (Payload)
27	Rptr 2 (Primary)	Rptr 2 (Primary)
28	Rptr 2 (Redundant)	Rptr 2 (Redundant)
29	Rptr 2 (Payload)	Rptr 2 (Payload)
30		
31 (/27)	IETF Broadcast Address	IETF Broadcast Address

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Here are the following Device ID ranges that are supported for Cap Max system release starting at M2021.01. A benefit of the M2021.01 release is three more repeaters can be deployed in a subnet mask /26 and /27.

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Section 2: Supported Call Types

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Call Types

- Multiple Group and Private Call Types
- Call Preemption
- Voice Interrupt
- Call Alert
- Site and Channel Extensibility
- Remote Monitor and Discreet Listening

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Call Types

- Emergency Alarm and Call
- Enhanced Channel Access
- Versatile All-Call
- Enhanced Roaming
- Radio Stun/Revive
- Dynamic Site Assignment

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Call Types

- Site Restriction
- Late Entry
- Telephony Calls
- Priority Call Queuing/Preemption

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Call Types

- Advanced Late Entry
- All Start and Critical Site Assignment
- Mass Registration
- Priority Monitor

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Call Types

- Radio Kill/Un-kill
- Registration and Access Control
- Dynamic Group Number Assignment
- Confirmed Group Data Call
- Status Call

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Call Types

- Inband Location
- Inband Caller Alias
- Dynamic Caller Alias

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Section 3: Capacity MAX Call Processing

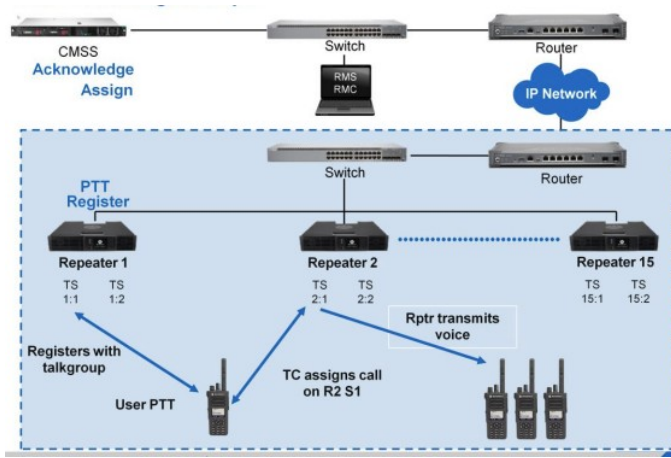
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Call Processing: Example



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Module 2: System Planning and Design

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High Level System Planning

- Correctly sizing the Capacity Max system is an important part of the planning process.
- The following items need to have the required quantities defined as a part of the planning process:
 - Radios
 - RF Sites
 - Trunked repeaters
 - Data revert repeaters
 - Voice gateway talk paths

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This module will describe the key elements of how to plan a Capacity Max System.

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High Level System Planning

These are the tools in the MOTOTRBO SDT to assist you in:

- Estimating the number of repeaters, trunked or data revert, needed at each Capacity Max site.
- Estimating the site link bandwidth need for each site in the system.
- Determining the number of MNIS VRC Gateways needed in the system.
- Estimating the number of talkpath licenses needed for each MNIS VRC Gateway.

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Motorola Solutions has create a group of software tools to assist in the planning for MOTOTRB systems called, MOTOTRBO System Design Tools (SDT).

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High Level System Planning



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In order to effectively use the MOTOTRBO System Design Tools (SDT), there are some basic planning considerations you must first understand. We will use the MOTOTRBO System Design Tools later in this module one we have reviewed the basic planning considerations for a Capacity Max System.

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Section 1: Planning Considerations

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Regulatory Licenses

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Module 3

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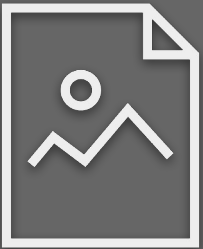
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Final Assessment

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Assessment

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