

BARRICADED SUSPECT INCIDENT ANALYSIS



ENHANCING CRITICAL INCIDENT
RESPONSE WITH PUBLIC SAFETY LTE



ONE DAY THIS WEEK...

Officers arriving in response to a 9-1-1 call reporting fighting and loud screaming will try to make contact, but the subject will refuse to open the door and tell them to leave.

An officer will peek inside a window of a small business and see the proprietor bleeding from the nose as a man armed with a handgun paces back and forth.

The officers will back off, secure the scene and radio for SWAT and hostage negotiators to help control the situation.

The officers don't know it yet, but video information from well-placed sniper teams, overhead aircraft and remotely operated robots are guiding them toward tomorrow's lead story where a hostage was rescued and a troubled man detained.



AN INCIDENT INVOLVING A BARRICADED SUSPECT IS NOT SOMETHING PUBLIC SAFETY AGENCIES DEAL WITH EVERY ONCE IN A WHILE. THESE HIGH-RISK SITUATIONS CAN BE A WEEKLY OCCURRENCE.

When the actions of a violent or disturbed individual result in a crisis situation, law enforcement personnel are often forced to react to a high-risk situation where the subject may be barricaded, have taken hostages or threaten suicide. They won't know what's inside, if there are arms or explosives, or the nature of the circumstances they will have to respond to.

First responders arriving to the scene must be able to quickly assess the situation, contain the problem, secure the area, evaluate the threat to hostages or bystanders, call in specialized units as necessary and be ready to react at any time throughout the response that could last for hours.

Negotiator teams must engage the barricaded individual with the full advantage of real-time information and awareness so that the scene is considered from the proper perspective.

When all means available have been exhausted, Special Weapons and Tactics (SWAT) teams must be ready to support the transition from negotiations to a swift tactical resolution.

Incident commanders delivering decisive instruction to the response teams must have accurate, timely information from the very first minutes of the response to ensure the best promise of a peaceful resolution.

USING PUBLIC SAFETY LTE TO HELP PENETRATE A SUSPECT'S STRONGHOLD

With the introduction of high performing, broadband connections and advanced multimedia applications made possible by Public Safety LTE, agencies can deliver critical information to best support the operations and help deliver better outcomes.

For the tightly coordinated incident response to be successful, every responder needs access to the right information for the highest level of situational awareness matched to the specific role of that individual.

Every barricade incident will be unique, and the only certainty is that decisions made and resulting outcomes will be examined and dissected by city leaders and a ready press standing at the on-scene perimeter.



ANALYSIS OF BROADBAND UTILIZATION ALONG THE INCIDENT TIMELINE

The following analysis was conducted jointly by Motorola and active public safety professionals to determine how broadband multimedia services can support and provide the greatest advantage for a typical crisis response.

The study considers a barricaded suspect incident timeline and a typical response sequence based on the number of responders and the utility of broadband resources throughout the duration of the incident.

All of the traffic supporting this response is assumed to be served by a wide area, mobile broadband network. While a local area wireless network could be erected to carry some of the traffic, the challenges of deploying the necessary equipment at the scene and the limited range of coverage would add additional complexity to the response and limit the range of use cases.

PHASES OF THE INCIDENT RESPONSE

Expert guidance from the team organized the incident sequence below and dictated the supporting data represented throughout this analysis.

T = 0 MINUTES INCIDENT START	Page 5	T = 120 MINUTES DEPLOY THROW PHONE, RECON ROBOT	Page 10
T = 15 MINUTES SECURE PERIMETER	Page 6	T = 125 MINUTES NEGOTIATION	Page 11
T = 60 MINUTES SPECIAL RESPONSE ARRIVES	Page 7	T = 240 MINUTES ENTRY TEAM DEPLOYS	Page 12
T = 65 MINUTES SPECIAL RESPONSE DEPLOYS	Page 8	T = 245 MINUTES SUSPECT AND BUILDING SECURED	Page 12
T = 90 MINUTES DEPLOY LARGE ROBOT	Page 9	T = 250 MINUTES INCIDENT ENDS	Page 12

THE PRESENTATION OF OUR ANALYSIS

The following pages provide a high-level view of key actions taking place, the number of users at the scene, applications in use and the degree of broadband utilization throughout the incident. Each page is organized with the following information:



- 1 Phase of the incident response
- 2 Number of minutes that have transpired and key actions taking place during the response phase
- 3 Map of the incident scene and directional locations of key resources
- 4 Map legend with icons representing resources at the incident scene
- 5 The broadband capacity being occupied in the downlink – sent from the Public Safety LTE network to users
- 6 The broadband capacity being occupied in the uplink – sent from the users through the network
- 7 The time scale shown in minutes and the corresponding incident phases
- 8 The number of resources during the phases of incident response

INCIDENT START

- INCIDENT SCENE
- POLICE VEHICLE

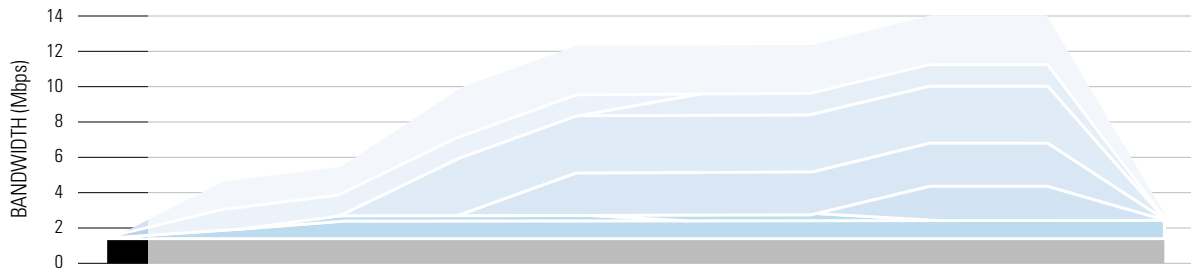


TIME = 0 MINUTES

INCIDENT SCENE ACTIVITY

- First police officers arrive on the scene and take measure of the situation.
- Officers determine that special units will be required to further proceed with the situation.
- Upon awareness of the incident, Public Safety LTE system resources and capacity have already been dynamically prioritized for the responding officers.
- Non-essential users on the system are automatically de-prioritized, and where necessary the network engages user pre-emption.
- Necessary safeguards ensure that critical system resources are focused on the emergency and will stay in effect throughout the entire response.

BROADBAND CAPACITY UTILIZATION - DOWNLINK



DOWNLINK APPLICATIONS

- SITUATIONAL UPDATES
- AIRCRAFT VIDEO
- THROW PHONE, RECON ROBOT
- SNIPER VIDEO
- LARGE ROBOT
- HELMET VIDEO
- NEGOTIATOR DATA
- COMMAND POST DATA
- COMPUTER AIDED DISPATCH
- AVERAGE BACKGROUND TRAFFIC

BROADBAND CAPACITY UTILIZATION - UPLINK



UPLINK APPLICATIONS

- SITUATIONAL UPDATES
- THROW PHONE, RECON ROBOT
- SNIPER VIDEO
- LARGE ROBOT
- HELMET VIDEO
- COMPUTER AIDED DISPATCH
- AVERAGE BACKGROUND TRAFFIC

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INCIDENT START	SECURE PERIMETER	SPECIAL RESPONSE ARRIVES	SPECIAL RESPONSE DEPLOYS	DEPLOY LARGE ROBOT	DEPLOY THROW PHONE	NEGOTIATE	ENTRY TEAM DEPLOYS	SUSPECT AND BUILDING SECURED	INCIDENT ENDS
INCIDENT RESPONSE TEAM									
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0	1	2	2	2	2	2	2	2	2
0	0	1	1	1	1	1	1	1	1
0	0	30	30	30	30	30	30	30	30
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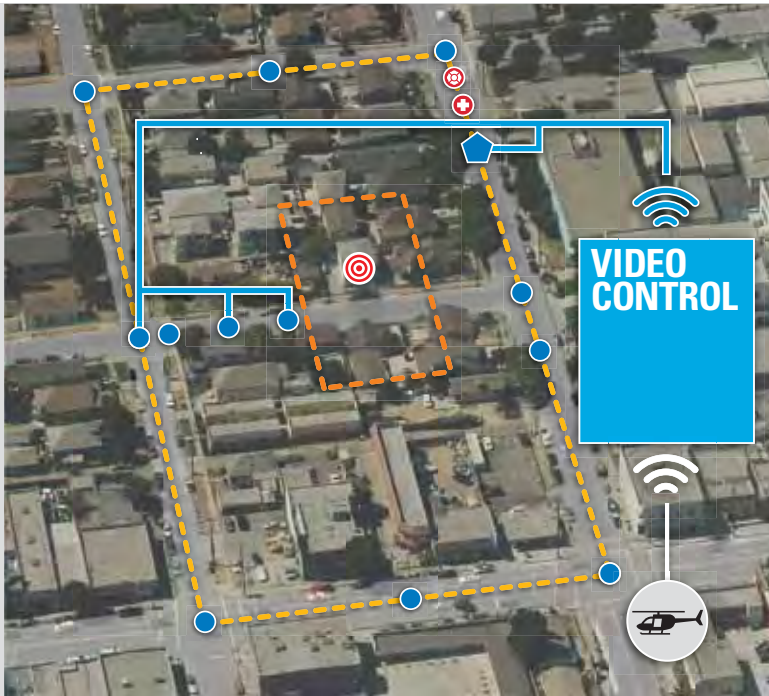
MINUTES

INDIVIDUAL RESOURCES

- POLICE
- FIRE, EMS
- COMMANDERS
- COMMAND VEHICLES
- SWAT
- FBI
- NEGOTIATORS

SECURE PERIMETER

-  INCIDENT SCENE
-  POLICE VEHICLE
-  POLICE COMMAND
-  FIRE
-  AMBULANCE
-  HELICOPTER
-  OUTER PERIMETER
-  INNER PERIMETER

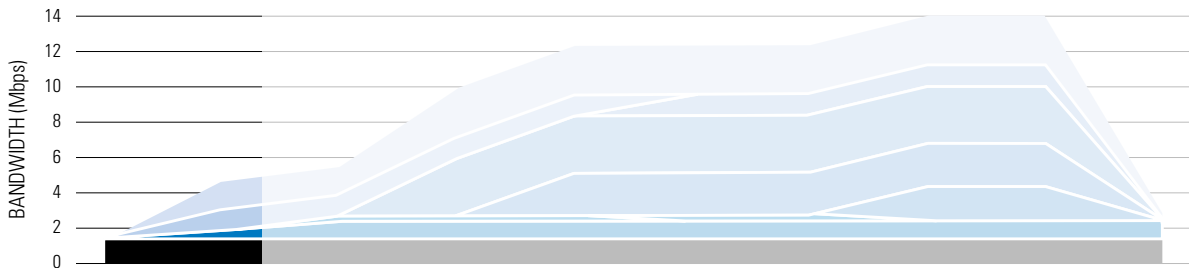


TIME = 15 MINUTES

INCIDENT SCENE ACTIVITY

- Police officers establish an inner and outer perimeter, and evacuate anyone in harm's way.
- A police command post is established.
- Fire and EMS arrive and are on standby.
- A helicopter arrives on scene and transmits a high-resolution video stream to video control at the network data center.
- The video stream from the helicopter is prioritized and multicast from the video control center at 1.2 Mbps to the on-scene responders.
- Situational updates begin from the command post. On average, 3 MB of data are multicast every 5 minutes to the response team.

BROADBAND CAPACITY UTILIZATION - DOWNLINK



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BROADBAND CAPACITY UTILIZATION - UPLINK



UPLINK APPLICATIONS

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0	7	7	7	7	7	7	7	7	7
0	1	2	2	2	2	2	2	2	2
0	0	1	1	1	1	1	1	1	1
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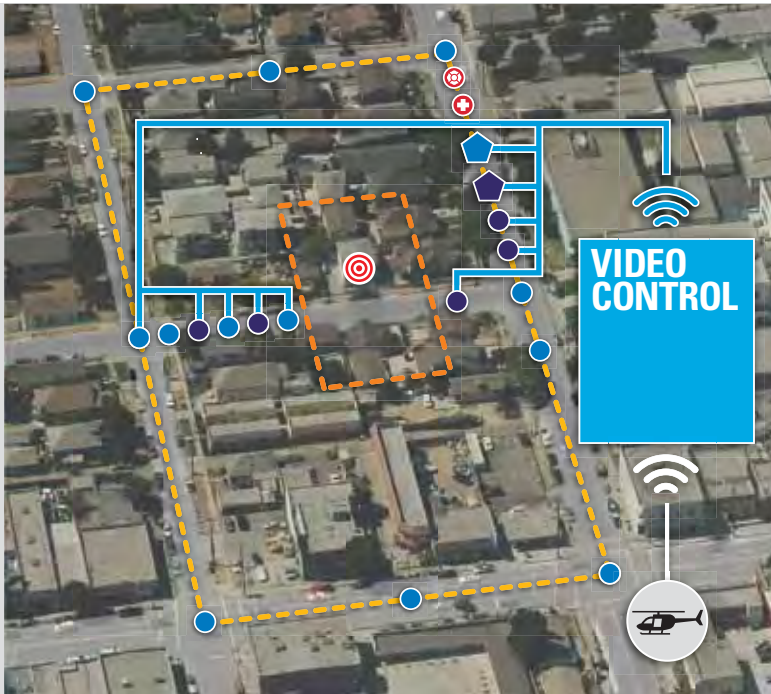
MINUTES

INDIVIDUAL RESOURCES

- POLICE
- FIRE, EMS
- COMMANDERS
- COMMAND VEHICLES
- SWAT
- FBI
- NEGOTIATORS

SPECIAL RESPONSE ARRIVES

- INCIDENT SCENE
- POLICE VEHICLE
- POLICE COMMAND
- SWAT VEHICLE
- SWAT COMMAND
- FIRE
- AMBULANCE
- HELICOPTER
- OUTER PERIMETER
- INNER PERIMETER

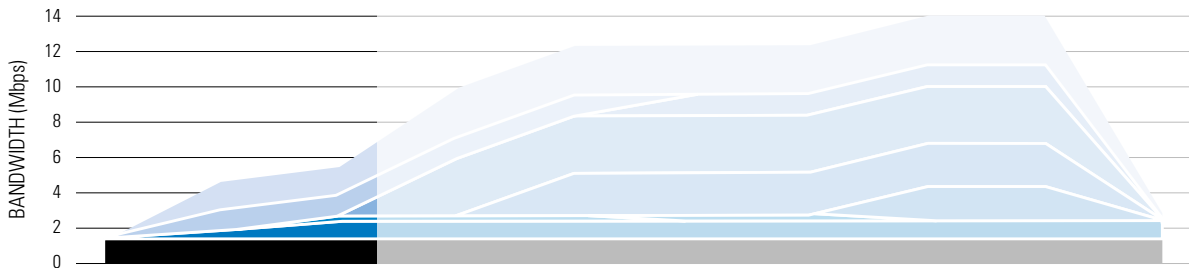


TIME = 60 MINUTES

INCIDENT SCENE ACTIVITY

- SWAT team arrives on scene.
- A SWAT command post is positioned nearby to host the SWAT command staff.
- The growing number of on-scene responders brings an increased number of video streams to choose from.
- By securely multicasting the video streams and data updates, the additional responders are able to also receive information without further taxing the system capacity.
- Real-time video intelligence optimizes LTE capacity by adjusting video content to available bandwidth and device screen size.

BROADBAND CAPACITY UTILIZATION - DOWNLINK



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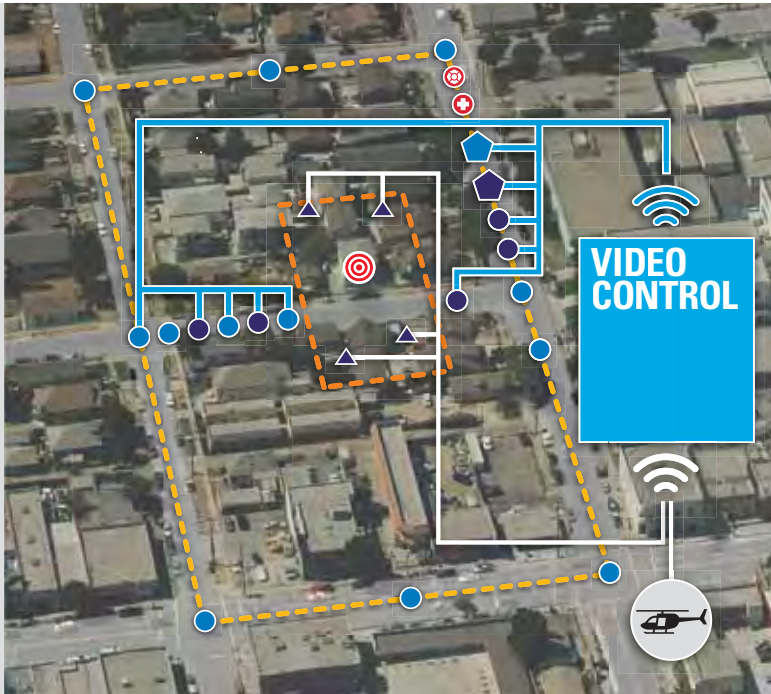
MINUTES

INDIVIDUAL RESOURCES

- POLICE
- FIRE, EMS
- COMMANDERS
- COMMAND VEHICLES
- SWAT
- FBI
- NEGOTIATORS

SPECIAL RESPONSE DEPLOYS

-  INCIDENT SCENE
-  POLICE VEHICLE
-  POLICE COMMAND
-  SWAT VEHICLE
-  SWAT SNIPER
-  SWAT COMMAND
-  FIRE
-  AMBULANCE
-  OUTER PERIMETER
-  INNER PERIMETER

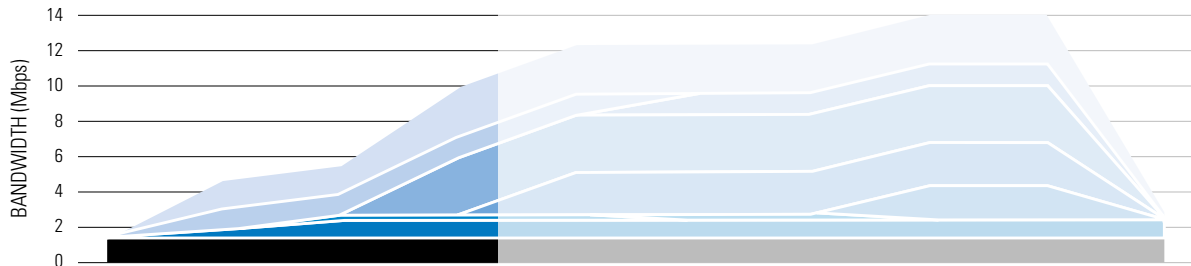


TIME = 65 MINUTES

INCIDENT SCENE ACTIVITY

- SWAT unit deploys sniper and spotter teams to observe, gather intelligence and provide a protective watch.
- Sniper teams are collectively transmitting to the video control center with two full-resolution video feeds focused on high-interest content and two low-resolution video feeds.
- Select video streams from helicopter and sniper teams are made available through secure multicast to the appropriate incident responders.

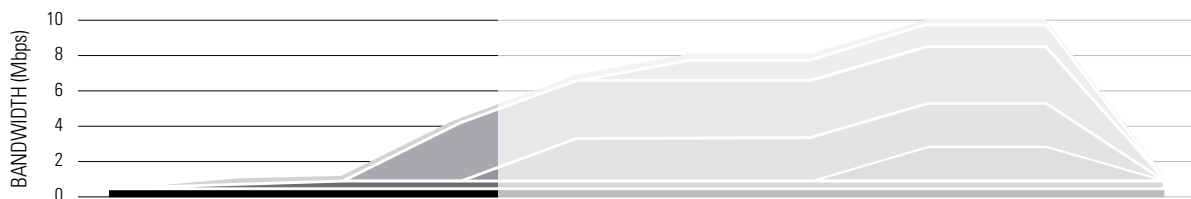
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-  AVERAGE BACKGROUND TRAFFIC

BROADBAND CAPACITY UTILIZATION - UPLINK



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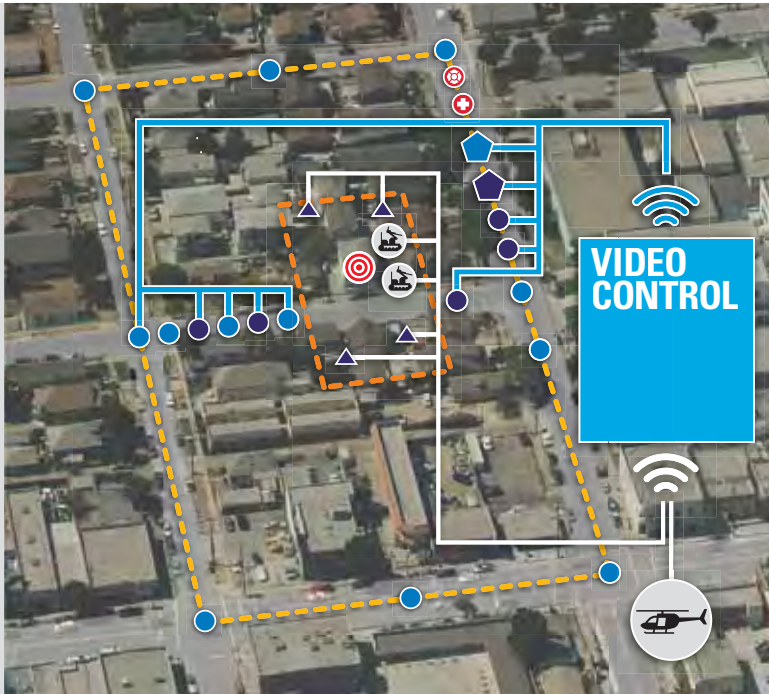
MINUTES

INDIVIDUAL RESOURCES

- POLICE
- FIRE, EMS
- COMMANDERS
- COMMAND VEHICLES
- SWAT
- FBI
- NEGOTIATORS

DEPLOY LARGE ROBOTS

-  INCIDENT SCENE
-  POLICE VEHICLE
-  POLICE COMMAND
-  SWAT VEHICLE
-  SWAT SNIPER
-  SWAT COMMAND
-  FIRE
-  AMBULANCE
-  HELICOPTER
-  LARGE ROBOT
-  OUTER PERIMETER
-  INNER PERIMETER

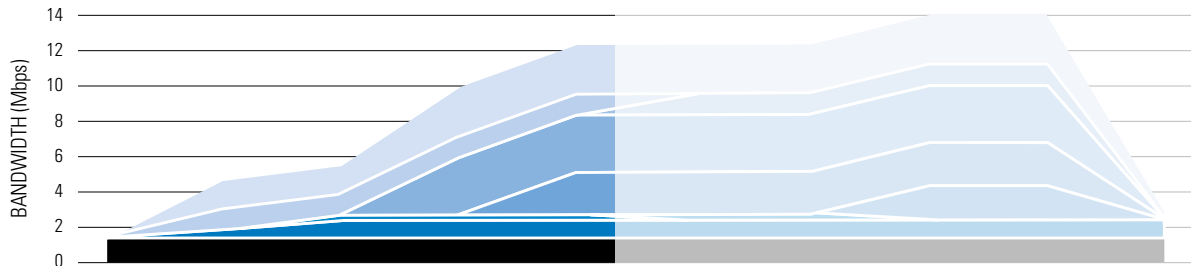


TIME = 90 MINUTES

INCIDENT SCENE ACTIVITY

- SWAT team deploys large, remotely operated robots, each equipped with a camera and claw to move obstacles and locate suspect.
- Video streams from the robots are transmitted to the command post through the video control center.
- Responders are able to receive secure multicast video streams from the helicopter, sniper teams and the robots.

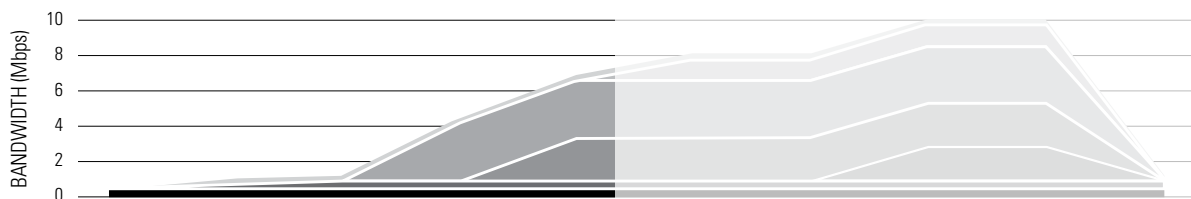
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-  NEGOTIATOR DATA
-  COMMAND POST DATA
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-  AVERAGE BACKGROUND TRAFFIC

BROADBAND CAPACITY UTILIZATION - UPLINK



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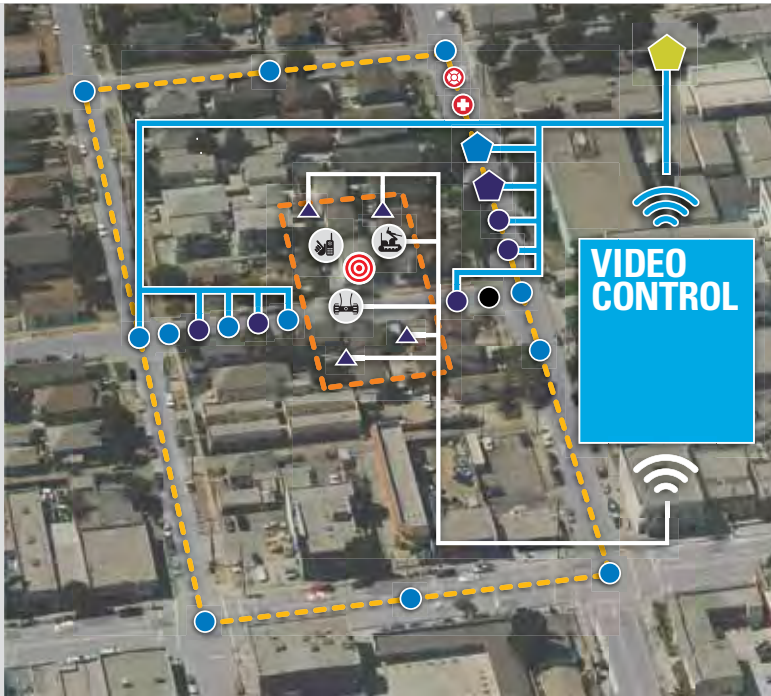
MINUTES

INDIVIDUAL RESOURCES

- POLICE
- FIRE, EMS
- COMMANDERS
- COMMAND VEHICLES
- SWAT
- FBI
- NEGOTIATORS

DEPLOY THROW PHONE, RECON ROBOT

- INCIDENT SCENE
- POLICE VEHICLE
- POLICE COMMAND
- SWAT VEHICLE
- SWAT SNIPER
- SWAT COMMAND
- COMMAND / CONTROL
- FBI VEHICLE
- FIRE
- AMBULANCE
- LARGE ROBOT
- RECON ROBOT
- THROW PHONE
- OUTER PERIMETER
- INNER PERIMETER

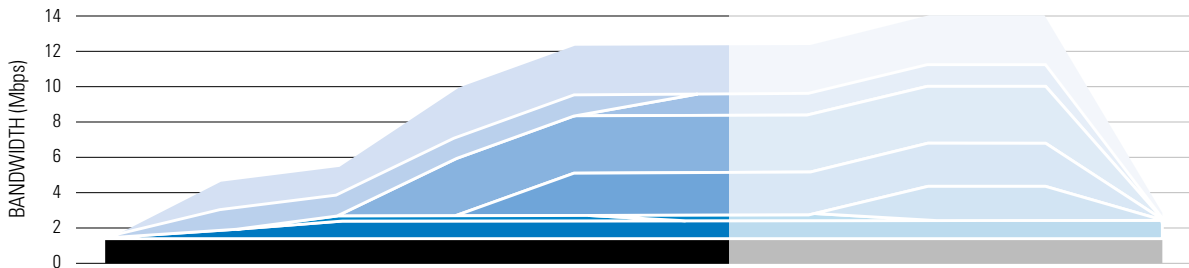


TIME = 120 MINUTES

INCIDENT SCENE ACTIVITY

- SWAT team deploys remotely operated reconnaissance robots. These camera-equipped “eyeballs” are thrown into windows to provide additional video streams for situational awareness.
- Having already disabled the telephones, the SWAT team tactically delivers a “throw-phone” to provide a direct, controlled line between the negotiators and suspect.
- A new mobile incident command and control vehicle arrives and establishes its position, hosts command staff and FBI negotiators, and receives all incident video feeds.
- Specially trained negotiation team and FBI arrive.
- Secure, voice Push-To-Talk (PTT) connects LTE devices to two-way radios.

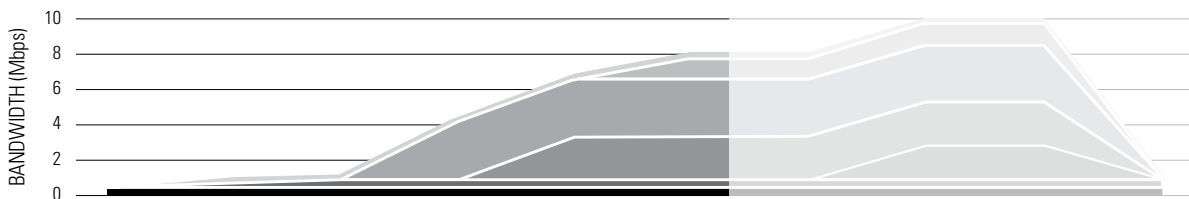
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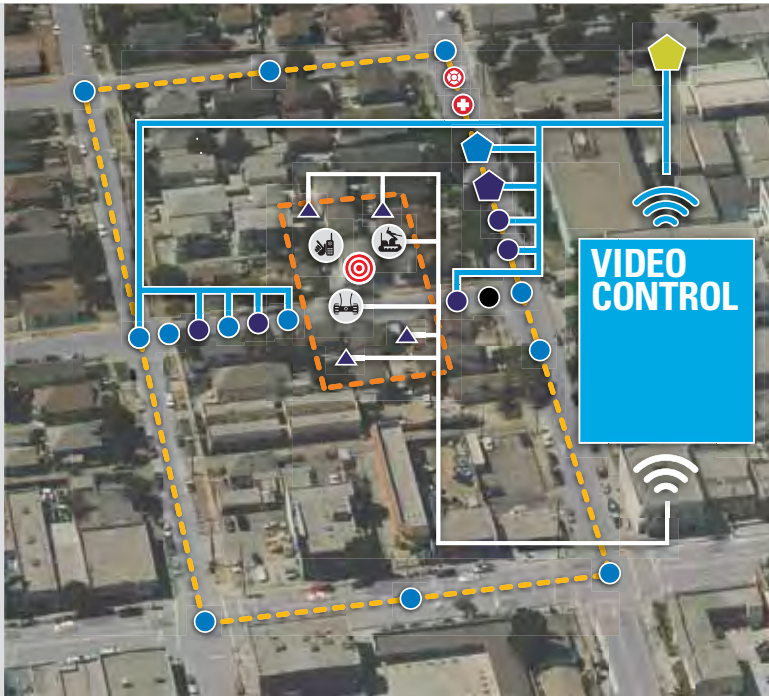
MINUTES

INDIVIDUAL RESOURCES

- POLICE
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- COMMANDERS
- COMMAND VEHICLES
- SWAT
- FBI
- NEGOTIATORS

NEGOTIATION

- INCIDENT SCENE
- POLICE VEHICLE
- POLICE COMMAND
- SWAT VEHICLE
- SWAT SNIPER
- SWAT COMMAND
- COMMAND / CONTROL
- FBI VEHICLE
- FIRE
- AMBULANCE
- LARGE ROBOT
- RECON ROBOT
- THROW PHONE
- OUTER PERIMETER
- INNER PERIMETER

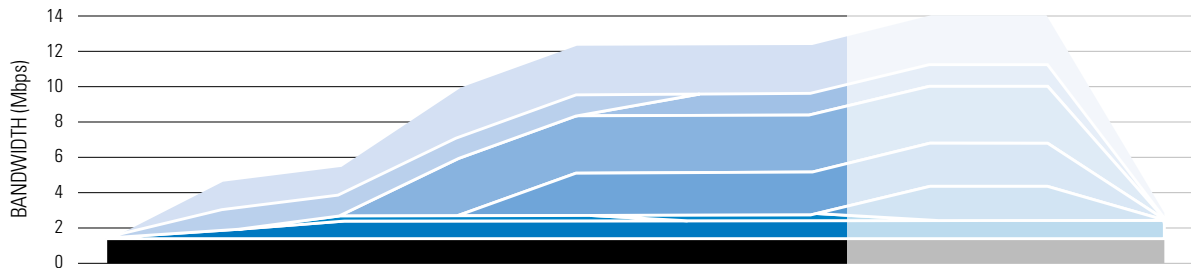


TIME = 125 MINUTES

INCIDENT SCENE ACTIVITY

- The time-consuming negotiation starts with the recognition that the prolonged process will wear down the suspect and increase the probability of a positive outcome.
- A primary negotiator communicates with the subject, following procedures aimed toward peaceful resolution.
- The support team utilizes incoming video feeds to offer advice, monitor progress and ensure that the primary negotiator sees and hears everything in the proper perspective.
- The intelligence team profiles the subject by gathering background information, compiling a criminal history and gathering other relevant information.

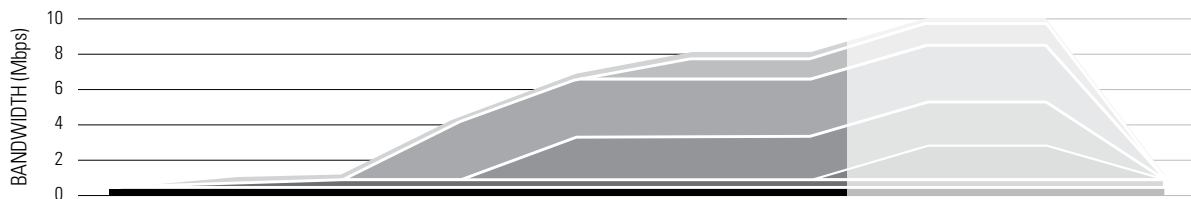
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BROADBAND CAPACITY UTILIZATION - UPLINK



UPLINK APPLICATIONS

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0	0	1	1	1	1	1	1	1	1
0	0	30	30	30	30	30	30	30	30
0	0	0	0	0	0	2	2	2	2
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MINUTES

INDIVIDUAL RESOURCES

- POLICE
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- SWAT
- FBI
- NEGOTIATORS

ENTRY TEAM DEPLOYS

- INCIDENT SCENE
- POLICE VEHICLE
- POLICE COMMAND
- SWAT VEHICLE
- SWAT SNIPER
- SWAT COMMAND
- COMMAND / CONTROL
- FBI VEHICLE
- FIRE
- AMBULANCE
- LARGE ROBOT
- RECON ROBOT
- THROW PHONE
- HELMET CAMERA
- OUTER PERIMETER
- INNER PERIMETER



TIME = 240 MINUTES

INCIDENT SCENE ACTIVITY

- Incident escalates and a point of concern demands immediate entry.
- SWAT team engages tactical operations.
- Ten SWAT officers make entry with five lower-resolution video feeds being transmitted from helmet video cameras.

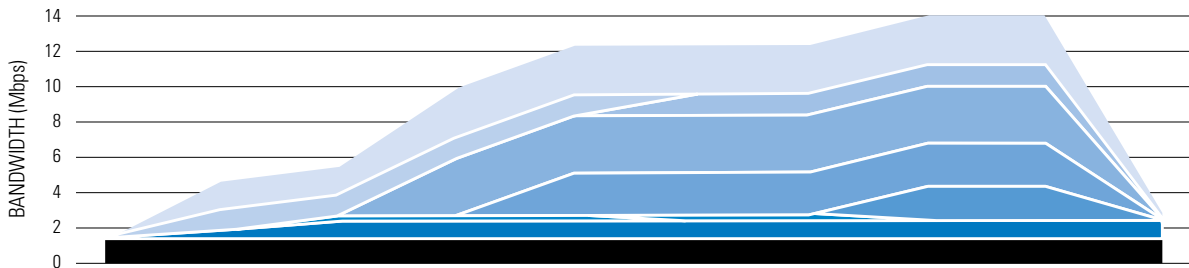
TIME = 245 MINUTES

SUSPECT AND BUILDING IS SECURED

TIME = 250 MINUTES

INCIDENT ENDS

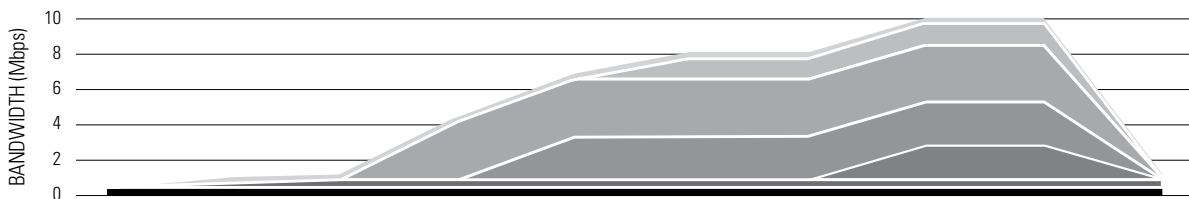
BROADBAND CAPACITY UTILIZATION - DOWNLINK



DOWNLINK APPLICATIONS

- SITUATIONAL UPDATES
- AIRCRAFT VIDEO
- THROW PHONE, RECON ROBOT
- SNIPER VIDEO
- LARGE ROBOT
- HELMET VIDEO
- NEGOTIATOR DATA
- COMMAND POST DATA
- COMPUTER AIDED DISPATCH
- AVERAGE BACKGROUND TRAFFIC

BROADBAND CAPACITY UTILIZATION - UPLINK



UPLINK APPLICATIONS

- SITUATIONAL UPDATES
- THROW PHONE, RECON ROBOT
- SNIPER VIDEO
- LARGE ROBOT
- HELMET VIDEO
- COMPUTER AIDED DISPATCH
- AVERAGE BACKGROUND TRAFFIC

0	15	60	65	90	120	125	240	245	250
INCIDENT START	SECURE PERIMETER	SPECIAL RESPONSE ARRIVES	SPECIAL RESPONSE DEPLOYS	DEPLOY LARGE ROBOT	DEPLOY THROW PHONE	NEGOTIATE	ENTRY TEAM DEPLOYS	SUSPECT AND BUILDING SECURED	INCIDENT ENDS
INCIDENT RESPONSE TEAM									
4	18	18	18	18	18	18	18	18	18
0	7	7	7	7	7	7	7	7	7
0	1	2	2	2	2	2	2	2	2
0	0	1	1	1	1	1	1	1	1
0	0	30	30	30	30	30	30	30	30
0	0	0	0	0	0	2	2	2	2
0	0	0	0	0	0	2	2	2	2

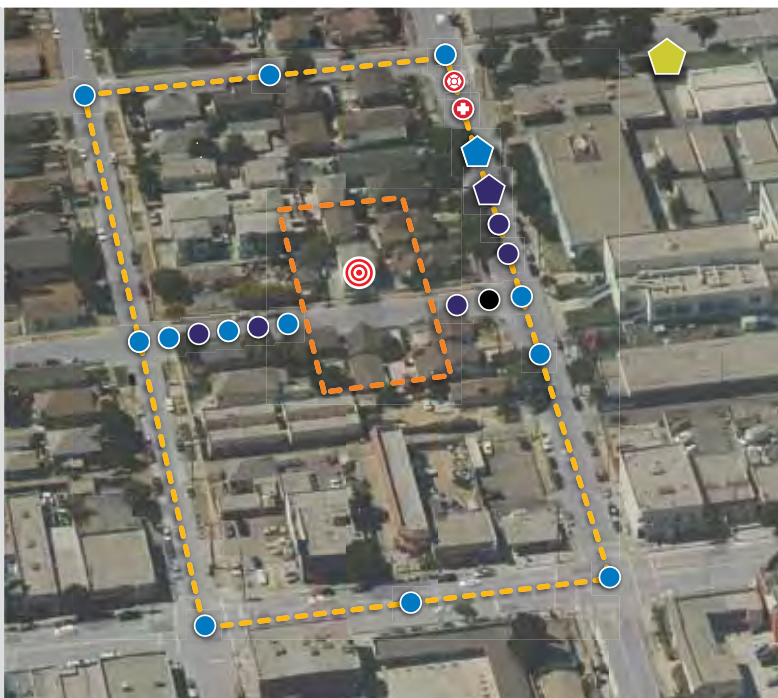
MINUTES

INDIVIDUAL RESOURCES

- POLICE
- FIRE, EMS
- COMMANDERS
- COMMAND VEHICLES
- SWAT
- FBI
- NEGOTIATORS

INCIDENT SUMMARY

- INCIDENT SCENE
- POLICE VEHICLE
- POLICE COMMAND
- SWAT VEHICLE
- SWAT SNIPER
- SWAT COMMAND
- COMMAND / CONTROL
- FBI VEHICLE
- FIRE
- AMBULANCE
- OUTER PERIMETER
- INNER PERIMETER



CUMULATIVE UTILIZATION

- Downlink Data Transmitted: 16,000 MB
- Uplink Data Transmitted: 10,000 MB

AVERAGE SECTOR CAPACITY

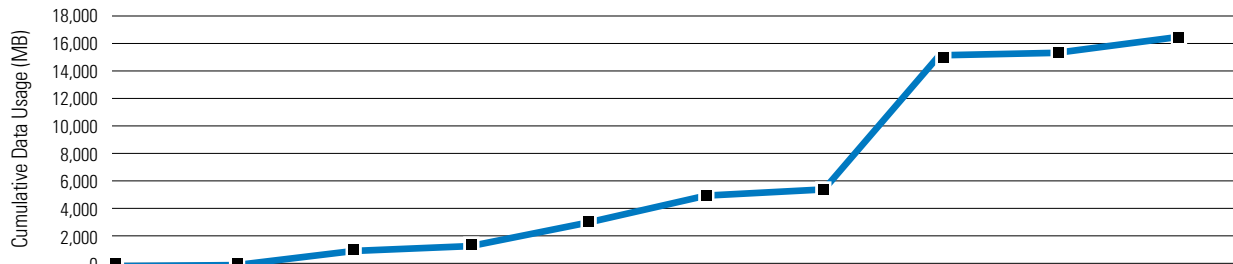
LTE 10+10 MHz Channel

- 16.7 Mbps Downlink
- 8.4 Mbps Uplink

LTE 5+5 MHz Channel

- 8.0 Mbps Downlink
- 3.5 Mbps Uplink

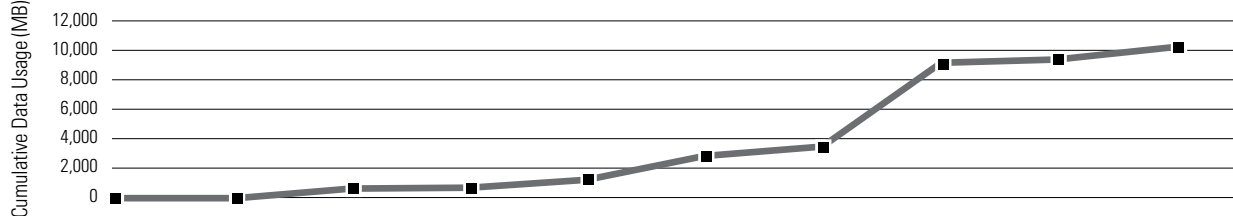
CUMULATIVE BROADBAND CAPACITY UTILIZATION - DOWNLINK



DOWNLINK APPLICATIONS

- SITUATIONAL UPDATES
- AIRCRAFT VIDEO
- THROW PHONE, RECON ROBOT
- SNIPER VIDEO
- LARGE ROBOT
- HELMET VIDEO
- NEGOTIATOR DATA
- COMMAND POST DATA
- COMPUTER AIDED DISPATCH
- AVERAGE BACKGROUND TRAFFIC

CUMULATIVE BROADBAND CAPACITY UTILIZATION - UPLINK



UPLINK APPLICATIONS

- SITUATIONAL UPDATES
- THROW PHONE, RECON ROBOT
- SNIPER VIDEO
- LARGE ROBOT
- HELMET VIDEO
- COMPUTER AIDED DISPATCH
- AVERAGE BACKGROUND TRAFFIC

0	15	60	65	90	120	125	240	245	250
INCIDENT START	SECURE PERIMETER	SPECIAL RESPONSE ARRIVES	SPECIAL RESPONSE DEPLOYS	DEPLOY LARGE ROBOT	DEPLOY THROW PHONE	NEGOTIATE	ENTRY TEAM DEPLOYS	SUSPECT AND BUILDING SECURED	INCIDENT ENDS

MINUTES

INCIDENT RESPONSE TEAM									
4	18	18	18	18	18	18	18	18	18
0	7	7	7	7	7	7	7	7	7
0	1	2	2	2	2	2	2	2	2
0	0	1	1	1	1	1	1	1	1
0	0	30	30	30	30	30	30	30	30
0	0	0	0	0	0	2	2	2	2
0	0	0	0	0	0	2	2	2	2

RESOURCE UTILIZATION

- 18 Police
- 7 Fire, EMS
- 2 Commanders
- 1 Command Vehicle
- 30 SWAT
- 2 FBI
- 2 Negotiators

MOTOROLA PUBLIC SAFETY LTE

TRANSFORMING PUBLIC SAFETY OPERATIONS WITH BROADBAND INNOVATIONS

Motorola is focusing extensive investment in resources and development to drive the critical innovations, built on a fully standards-compliant LTE architecture, needed to serve the unique requirements of public safety.



DYNAMIC PRIORITIZATION AND REAL-TIME MULTIMEDIA INTELLIGENCE

Dynamic prioritization and pre-emption safeguard capacity for critical resources. Real-time multimedia intelligence optimizes LTE capacity by adjusting rich-media content to available bandwidth and device screen size. Agencies control the publication of situational updates to incident participants for coordinated response.

AGENCY CONTROL OF SYSTEMS, APPLICATIONS AND DEVICES

Agency management of Public Safety LTE devices, real-time usage reports and account audits, and centralized management of mission critical performance across Public Safety LTE and commercial carrier networks.

RAPID DELIVERY OF PUBLIC SAFETY MULTIMEDIA DEVICES

A new breed of multimedia devices optimized for public safety applications, with accelerated delivery through open market components driven by the global LTE vendor ecosystem.

COMMERCIAL CARRIER INTEROPERABILITY, ENTERPRISE-WIDE INTEGRATION

Unify voice, data and video services while enabling enhanced nationwide roaming across LTE, public carrier, two-way radio, enterprise data networks and command and control applications.

BRINGING TOGETHER THE NEXT GENERATION OF PUBLIC SAFETY SOLUTIONS

Motorola's Public Safety LTE solutions are an integral component of Motorola's Next Generation Public Safety platform. The industry's most comprehensive approach for delivering advanced communications tools to the nation's public safety agencies, Motorola's Next Generation Public Safety platform will connect mission critical voice and data, broadband multimedia services, and advanced applications to the world's most trusted two-way radios, rugged in-vehicle workstations and a new arena of innovative public safety handheld data devices.

DESIGNING FOR REAL-WORLD SITUATIONS

LEARNING FROM USERS ON THE FRONT LINES

At its foundation, Motorola's design methodology depends on close collaboration with those who most intimately use our technology, and our development teams are committed to designing for the specific needs of first responders and the challenging circumstances they often face.

As public safety moves to embrace a new frontier of technology enablement through broadband connections, multimedia applications and intuitive data devices, we will continue to hold the tradition of designing from the user's vantage point first.

Real-world analysis, along with our vast collection of field research, deep experiential immersion and voice of the customer insights, establish the parameters of our Public Safety LTE solution.

The performance testing and validation criteria considered during the design and deployment of Public Safety LTE systems include real-world response scenarios like the one described in this analysis.



**MOTOROLA CREATES INNOVATIVE PUBLIC SAFETY SOLUTIONS TRUSTED
BY FIRST RESPONDERS FOR MORE THAN 75 YEARS.**

Motorola is leading the way to a new generation of public safety solutions that combine advanced new technological capabilities with the reliability of the industry's most trusted mission critical solutions to provide real-time sharing of crucial voice, data and video communications where they're needed most.

To learn more about Public Safety LTE and Motorola Next Generation Public Safety, visit **motorolasolutions.com/nextgen**.



MOTOROLA

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