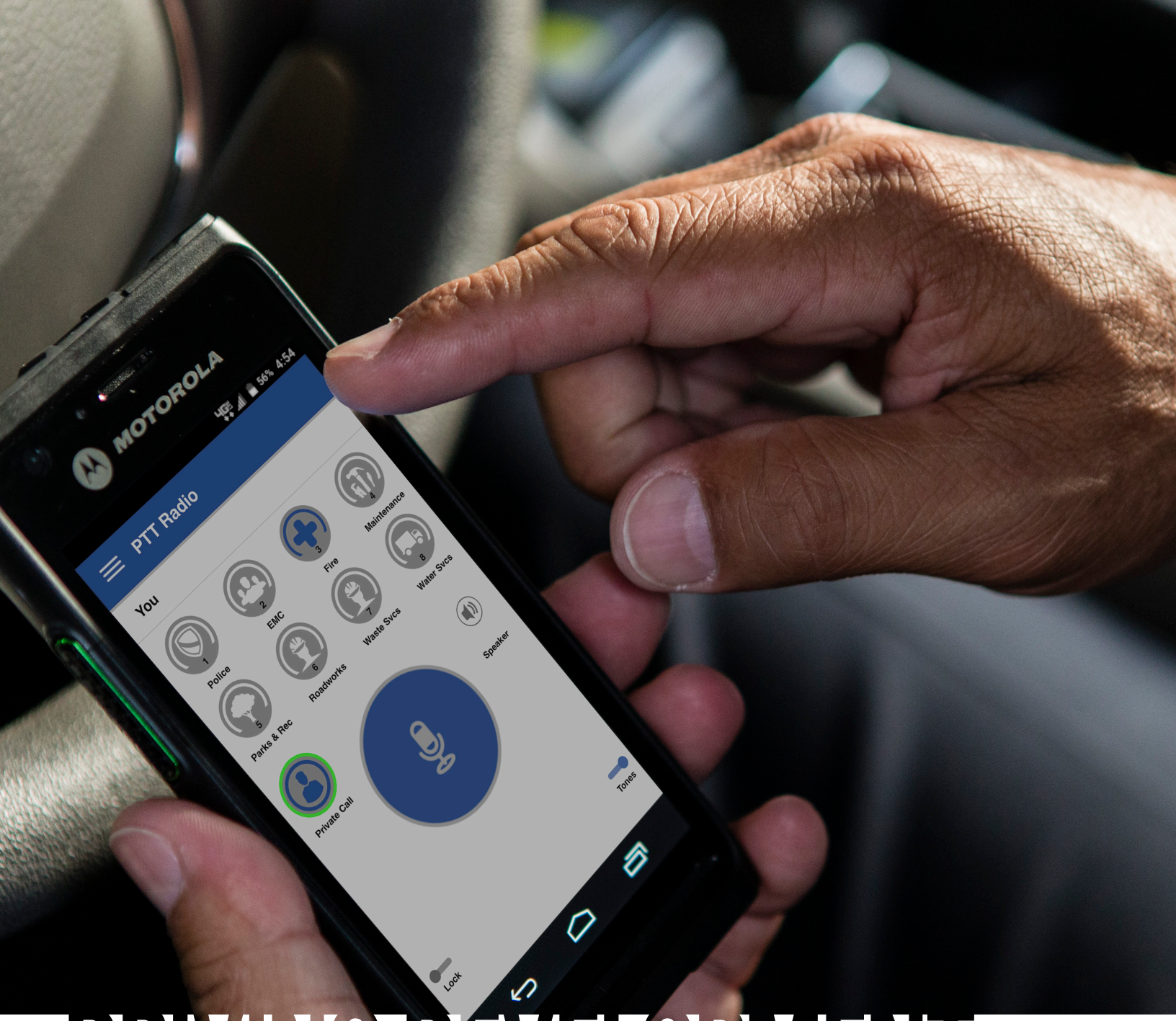


DRIVING DEVELOPMENT OF THE MISSION CRITICAL PTT STANDARD

OUR COMMITMENT TO OPEN, STANDARDS-BASED BROADBAND PUSH-TO-TALK COMMUNICATION

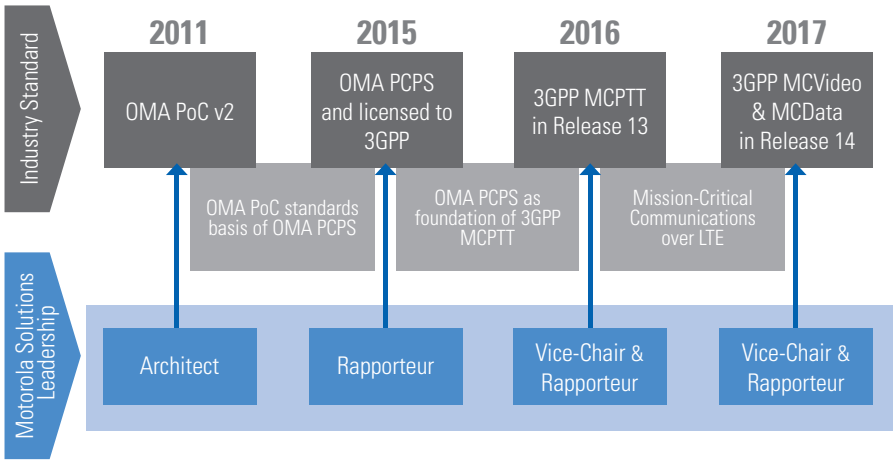
WHITE PAPER | MCPTT FROM MOTOROLA SOLUTIONS

MOTOROLA SOLUTIONS

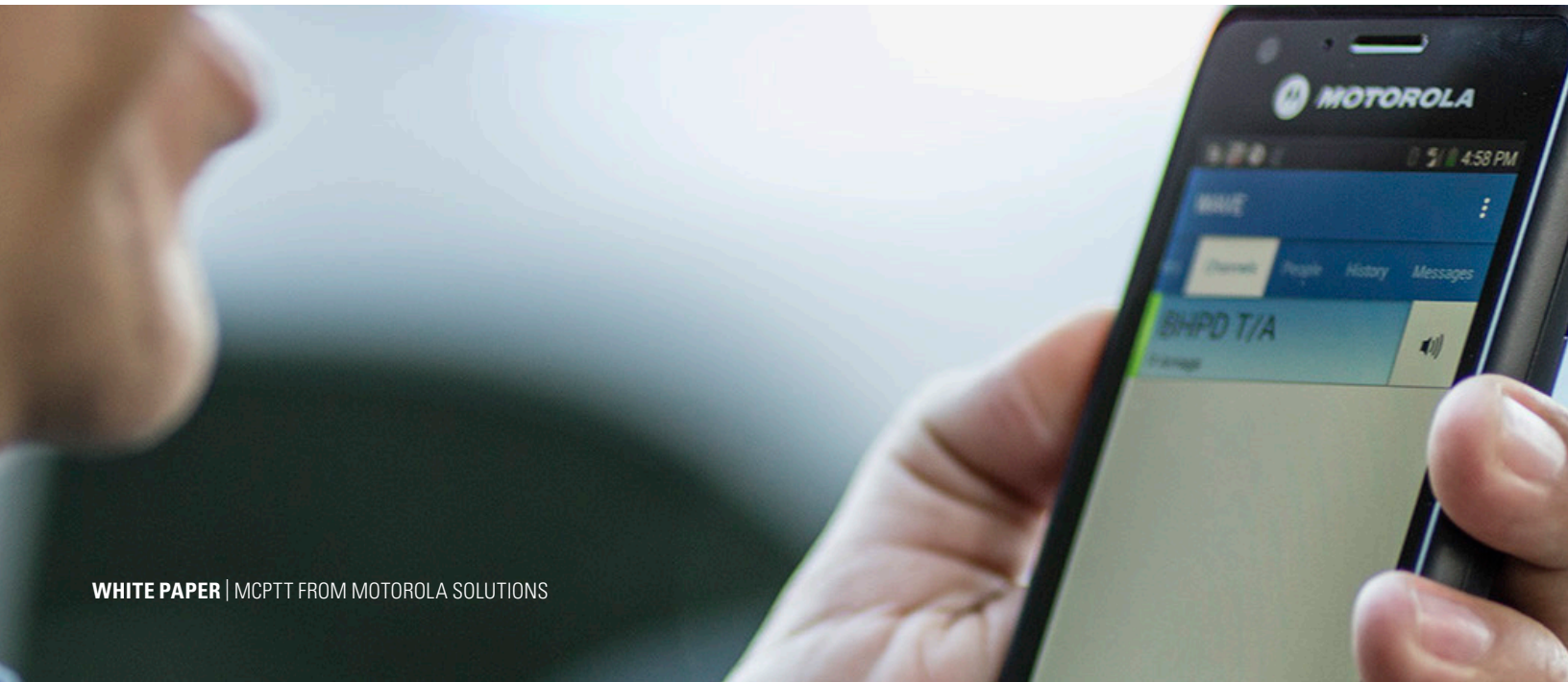
WHERE WE HAVE BEEN, WHERE WE ARE AND WHERE WE ARE GOING

Motorola Solutions is a longtime proponent of open, standards-based communication platforms, as evidenced by our active role in helping to define the Open Mobile Alliance (OMA) Push-to-Talk over Cellular and Push-to-Communicate for Public Safety specifications, in addition to our contributions to European Telecommunications Standards Institute (ETSI) and 3rd Generation Partnership Project (3GPP). This longstanding commitment to standards-based push-to-talk provides the foundation for the Kodiak Mission Critical PTT (MCPTT) platform, our cornerstone solution designed to align with the MCPTT reference architecture, information flows and interfaces.

LEADING THE WAY IN BROADBAND PTT STANDARDS AND COMPLIANCE



The Kodiak MCPTT platform has already demonstrated compliance with key areas of the 3GPP MCPTT Standard, such as registration and authorization, identity management, private and group calling, location reporting, and ambient listening. A mature product, the Kodiak MCPTT platform also provides a stable foundation for compliance with future mission-critical communication capabilities including MCData and MCVideo.



DEVELOPING BROADBAND PUSH-TO-TALK STANDARDS SINCE 2003

Motorola Solutions has a long history of providing leadership within the organizations that define public safety standards, such as ETSI, 3GPP, and TIA (Telecommunications Industry Association). Our journey to leadership in industry standards for broadband push-to-talk communications actually began in 2003 as an active participant in the OMA standardization activities.

For over a decade, Motorola Solutions led the development of the OMA Push-to-Talk over Cellular (PoC) industry specifications, including, v2.0 and v2.1. Not only were we a significant contributor to OMA PoC v2.0, but we also developed our broadband PTT platform, Kodiak, in compliance with that specification. In use by leading wireless carriers such as AT&T, Bell Canada, KPN, Proximus, Sprint, Telefónica and Verizon, the Kodiak platform has the largest installed base of OMA PoC v2.0-compliant systems globally.

Motorola Solutions also played a key role in the development of the OMA Push-to-Communicate for Public Safety (PCPS) v1.0 specification that included critical communication functions such as multicast PoC, ad-hoc or pre-defined PoC group communications, prioritization and pre-emption, and dispatcher functions.

We served as Rapporteur for all stages of the specification development, submitting over 50% of the agreed technical contributions, including the PoC Control Plane technical specification, XDM (PoC specific) technical specification, and the entire set of XML Schemas.

In March 2015, OMA reached an agreement with 3GPP to allow the PCPS specification to be used as the base for development of the 3GPP MCPTT Standard.

THE JOURNEY TO MCPTT

RELEASE 12 (2015)	RELEASE 13 (2016)	RELEASE 14 - 16 (2017 - 2019)
Device-to-Device Communications (D2D) Proximity Services (ProSe) Group Communications System Enabler (GCSE)	**Mission-Critical PTT** ProSe Extensions MBMS Enhancements Isolated E-UTRAN Operation for Public Safety (IOPS) **OMA PCPS (licensed to 3GPP) and contributions from other critical communication industry groups**	Mission-Critical Data Misison-Critical Video Mission-Critical PTT/Data/Video Enhancements and Additions

With the creation of the 3GPP Working Group for Mission Critical Applications (SA WG6), Motorola Solutions has continued its support for industry standards by becoming a major contributor to the definition of the MCPTT Standard. In addition to serving as the Vice-Chair of the SA WG6 working group, our contributions to the development of the MCPTT Standard include serving as Work Item Rapporteurs for the following technical specifications:

- Functional Architecture and Information Flows to Support MCPTT Stage 2 (TS 23.379)
- MCPTT Identity Management Protocol (and TS 24.482)
- Mission Critical Services Identity Management Protocol (and TS 24.482)
- Mission Critical Data Media Plane Control (TS 22.582)

KODIAK MCPTT PLATFORM: BUILT ON EXPERIENCE

Motorola Solutions' commitment to the OMA PoC and PCPS specifications and its active role in defining the 3GPP MCPTT Standard provide the foundation for our Kodiak Mission Critical PTT platform. The cornerstone of our broadband PTT portfolio, the Kodiak MCPTT platform, builds on that foundation to deliver the enhanced communications and connectivity Public Safety needs to increase collaboration, improve situational awareness, and simplify operations.

Able to scale to millions of subscribers while meeting MCPTT call setup KPIs (Key Performance Indicators), the Kodiak platform delivers the scalability required for private or nationwide MCPTT deployments. Used globally by major wireless carriers, the distributed, geo-redundant architecture of the Kodiak platform has consistently demonstrated the 99.999% uptime required of a carrier-scale, carrier-grade broadband PTT solution.

The Kodiak MCPTT platform is based on our years of experience delivering carrier-grade scalability and reliability in push-to-talk communications. A proven solution backed by over a decade of experience delivering highly reliable carrier-integrated PTT communication, our Kodiak platform provides Public Safety with the fast, secure, reliable push-to-talk service for which we are known.

The Kodiak MCPTT platform addresses the unique communications needs of Public Safety with an extensive set of 3GPP MCPTT Standard-compliant features, including:

QoS, PRIORITY AND PREEMPTION (QPP)- supports dynamic, policy-based prioritization using the Rx interface to ensure critical communication gets through during times of network congestion; ensuring that subscriber network prioritization and guaranteed levels of performance remain in sync with changing call types and QoS profiles.

EMERGENCY CALLING & ALERT- allows users in times of distress to press and hold a dedicated emergency button to initiate an emergency call with the highest priority and preemption.

AMBIENT LISTENING- makes it possible for dispatchers or supervisors to check on the well-being of users by remotely opening the device's microphone.

DISCREET LISTENING- enhances training with the ability for supervisors to monitor all PTT communications between a targeted user and other PTT callers.

LOCATION-BASED TEMPORARY GROUPS- enables responses that are more efficient by allowing dispatchers and location-enabled supervisors to select talkgroup members from a map to form temporary groups for PTT communication.

USER ENABLE/DISABLE- protects critical communication by allowing a supervisor to remotely enable or disable the PTT function on specific devices that have been lost or stolen.

USER CHECK- enhances user safety by enabling supervisors to monitor the health of a user's device, including battery level, signal strength, and location.

KODIAK ECOSYSTEM

In addition to Standard-compliant features, the Kodiak MCPTT platform also offers an unparalleled range of options for interoperability with Professional Mobile Radio (PMR) networks. As part of the Motorola Solutions family, the Kodiak MCPTT platform provides wireline interoperability to our DIMETRA TETRA networks. Users on an interoperable talkgroup between a DIMETRA network and Kodiak MCPTT platform have access to clear and encrypted group communications (1:1 and emergency calling are planned for a future release) and talker ID.

For interoperability with other PMR systems, the Kodiak platform supports the use of Radio over IP (RoIP) technology.

The Kodiak MCPTT platform also supports an array of ruggedized devices and accessories, including the LEX L11 Mission Critical LTE Device. From the rugged, easy to operate design to the always loud and clear audio to the advanced end-to-end secure mobile platform, the LEX L11 is the device first responders can count on to perform when it is needed most.

3GPP MCPTT COMPLIANCE: REACHING A MAJOR DESTINATION

Standards create service stability and consistency by defining how features/functions will work. Adherence to the Standard ensures that the Kodiak platform follows the MCPTT benchmark for how critical communications features work, in addition to establishing a solid foundation for development and implementation of new capabilities.

Having direct, extensive experience in defining the 3GPP MCPTT Standard paved the way to quick compliance with significant elements of the Standard. The table below provides a list of the 3GPP technical specifications for which the Kodiak MCPTT platform has demonstrated its support.

TECHNICAL SPECIFICATION	TITLE
TS 22.280	Mission-Critical Services Common Requirements
TS 23.280	Common Functional Architecture to Support Critical Services; Stage 2
TS 24.481	Mission-Critical Services (MCS) Group Management; Protocol Specification
TS 24.482	Mission-Critical Services (MCS) Identity Management; Protocol Specification
TS 24.483	Mission-Critical Services (MCS) Management Object
TS 24.484	Mission-Critical Services (MCS) Configuration Management; Protocol Specification
TS 24.980	Minimum requirements for support of Mission-Critical Push-To-Talk (MCPTT) service over the Gm reference point
TS 22.179	Mission-Critical Push-to-Talk (MCPTT) over LTE; Stage 1
TS 23.379	Functional Architecture and Information flows to support Mission-Critical Push-To-Talk (MCPTT); Stage 2
TS 24.379	Mission-Critical Push-To-Talk (MCPTT) call control; Protocol Specification
TS 24.380	Mission-Critical Push-To-Talk (MCPTT) media plane control; Protocol Specification
TR 26.179	Mission-Critical Push-To-Talk (MCPTT); Codecs and media handling
TS 22.282	Mission--Critical Data over LTE; Stage 1

WHERE ARE WE GOING WITH MCPTT

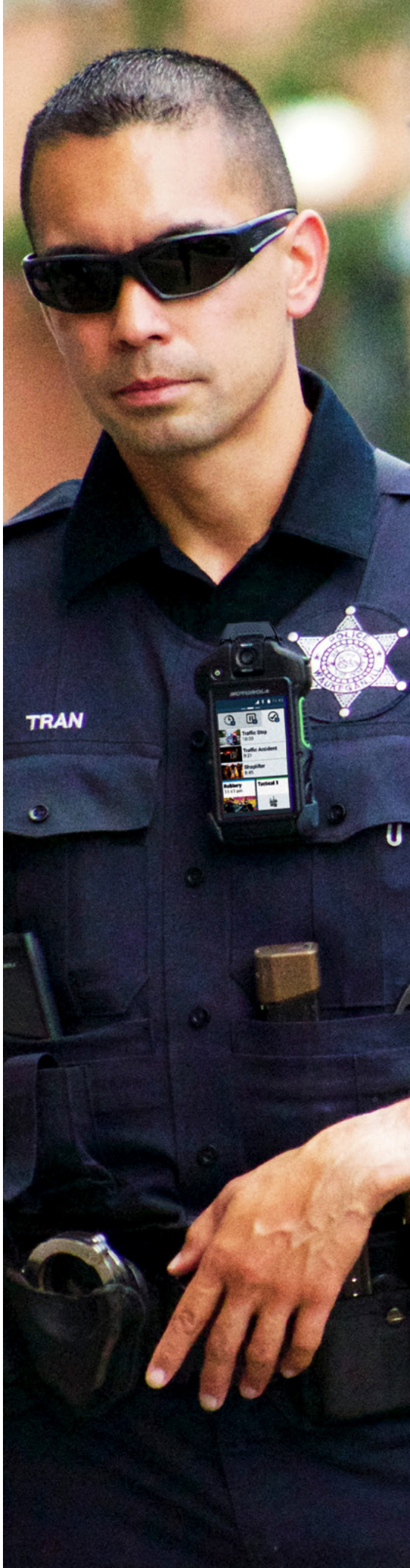
LTE Release 14 introduces two new mission-critical applications, MCVideo and MCData, to the MCPTT Standard.

MCVideo makes it possible for individuals as well as groups to efficiently share real-time video communications. MCData makes it possible for groups and individuals to share high-definition images, three-dimensional building schematics and other high-bandwidth data, as well as supporting the transport of data from sensors in the field.

To support the introduction of the MCVideo and MCData mission-critical applications, as well as other enhancements to the Standard, the Kodiak MCPTT platform roadmap includes compliance with the technical specifications identified in the table below.

TECHNICAL SPECIFICATION	TITLE
TS 22.281	Mission-Critical Video (MCVideo) over LTE; Stage 1
TS 23.281	Functional Architecture and Information Flows to Support Mission-Critical Video (MCVideo); Stage 2
TS 24.281	Mission-Critical Video (MCVideo) Signaling Control; Protocol Specification
TS 24.581	Mission-Critical Video (MCVideo) Media Plane Control; Protocol Specification
TS 22.282	Mission-Critical Data (MCData) over LTE; Stage 1
TS 23.282	Functional Architecture and Information Flows to Support Mission-Critical Data (MCData); Stage 2
TS 24.282	Mission-Critical Data (MCData) Signaling Control; Protocol Specification
TS 24.582	Mission-Critical Data (MCData) Media Plane Control; Protocol Specification
TS 29.468	Group Communication System Enablers for LTE (GCSE_LTE); MB2 Reference Point

Beyond MCVideo and MCData, the MCPTT Standard will continue its journey toward full mission-critical communications, and our Kodiak MCPTT platform will remain at the forefront in Standards compliance.



THERE IS MORE TO CRITICAL COMMUNICATIONS THAN JUST BUILDING TO A STANDARD

Our Kodiak MCPTT platform is a proven, standards-compliant solution deployed in leading wireless networks globally. While the Kodiak platform is unmatched in its adherence to the MCPTT Standard, we realize that providing the right solution for critical communications takes more than just building to a standard. What is also required is our demonstrated ability to work inside the network, integrating with the network, the back office, and operations systems to deliver the service interoperability, scalability, and reliability necessary for mission-critical communications.

For more information, please visit:
www.motorolasolutions.com/broadbandptt

MOTOROLA SOLUTIONS

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