MOTOROLA SOLUTIONS

CHANGE ORDER
[#008]

Change Order No. 08

Date: 03/04/19

Project Name: MERA Next Generation Radio System

Customer Name: Marin County

Customer Project Mgr: Ernest Klock

The purpose of this Change Order is to:

Capture the following changes:

1. Addition of MPLS hardware, design and implementation services - including the provisioning of non-LMR traffic, and 15 year life cycle services

Contract # 31701399 **Contract Date:** 03/07/17

In accordance with the terms and conditions of the contract identified above between Marin County and Motorola Solutions, Inc., the following changes are approved:

Contract Price Adjustments

Original Contract Value:	$ 34,337,451.06
Previous Change Order amounts for Change Order numbers 0-7 through 9-10	$ 7,653,457.77
This Change Order:	$ 1,781,092.86
Existing Contract Credit:	$ 0.00
Net Contract Impact of this Change Order:	$ 1,781,092.86
New Contract Value:	$ 43,772,001.69

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Completion Date Adjustments

Original Completion Date:	3/27/2019
Current Completion Date prior to this Change Order:	12/27/2022
New Completion Date:	12/27/2022

Changes in Equipment: *(additions, deletions or modifications)* Include attachments if needed
Please refer to the attached equipment list

Changes in Services: *(additions, deletions or modifications)* Include attachments if needed
Please refer to the attached Scope of Work (SOW) document

Schedule Changes: *(describe change or N/A)*
The project schedule will be finalized upon CDR approvals and is contingent upon CEQA and site construction timelines

Pricing Changes: *(describe change or N/A)*
Please refer to the attached pricing summary sheet Please note that taxes are estimated at 9% but the final number will be determined based on where the equipment will be shipped

Customer Responsibilities: *(describe change or N/A)*
Please refer to the attached Scope of Work (SOW) document

Payment Schedule for this Change Order: *(describe new payment terms applicable to <u>this</u> change order)*
The Payment milestone plan for this Change Order is the following: 1. 20% of the Change Order Price upon signing this Change Order 2. 45% of the Change Order Price upon shipment of equipment 3. 25% of the Change Order Price upon completion of installation (site by site) 4. 10% of the Change Order Price upon final system acceptance

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If Subscribers are purchased, 100% of the Subscriber Contract Price will be invoiced upon shipment (as shipped).

Motorola may make partial shipments of Equipment and will request payment upon shipment of such Equipment. In addition, Motorola will invoice for installations completed on a site-by-site basis or when professional services are completed, when applicable. The value of the Equipment shipped/services performed will be determined by the value of the shipped/services performed as a percentage of the total milestone value. Unless otherwise specified, contract discounts are based upon all items proposed and overall System package. For invoicing purposes only, discounts will be applied proportionately to the FNE and Subscriber Equipment values to total Contract Price. Overdue invoices will bear simple interest at the maximum allowable rate.

For Lifecycle Support Plan and Subscription Based Services:
Motorola will invoice Customer annually in advance of each year of the plan. The annual warranty and post-warranty services costs quoted in this Change Order (Appendix D of the attachment) is in addition to the original contract's annual costs of tech support and infrastructure replacement, SUA II, and Nokia's Maintenance and Upgrade Program for the MPR 9500 system.

Unless amended above, all other terms and conditions of the Contract shall remain in full force. If there are any inconsistencies between the provisions of this Change Order and the provisions of the Contract, the provisions of this Change Order will prevail.

IN WITNESS WHEREOF the parties have executed this Change Order as of the last date signed below.

Motorola Solutions, Inc.		**Customer**	
By:		By:	
Printed Name:	KENT MARTIN	Printed Name:	
Title:	Regional Services Manager	Title:	
Date:	March 4, 2019	Date:	

Reviewed by: Kourosh Mostashari — Date: March 4, 2019

Motorola Solutions Project Manager

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CHANGE ORDER #8 ATTACHMENT

MARCH 4, 2019

CHANGE ORDER #8 ATTACHMENT

The following changes have been captured in Change Order #8:

1. Addition of MPLS hardware, design and implementation services - including the provisioning of non-LMR traffic, and 15 year life cycle services

Summary of services included for this item is the following:

- Establish the system architecture and logically identify which networks/sites need to communicate within the system
- Define and build the bandwidth requirements document (TNDT report) for each site
- Define the QoS values for ASTRO and other applications
- Determine demarcation points at each site for non-ASTRO traffic
- Review and validate all the requirements identified in Appendix A
- Define and build the WAN Transport IP Plan for ASTRO application based on the logical design
- Gather, validate and input TNCT parameter for config generation, validtion and configuration file generation
- Build and deploy MPLS Configuration files. This includes the Network Management Subsystem
- Ensure all MPLS equipment is installed and connected as specified in the rack drawings
- Ensure physical connectivity has been tested and validated before validating service/logical connectivity
- Each service logical path will be tested using the Y.1564 testing method to validate the design specifications
- Provide As-Built Documentation for provided equipment; this will include a network drawing and final IP plan
- Provide all router configuration files and audit of each device

All MPLS equipment come with a one-year standard repair warranty.

Summary of the 15-year post-warranty services are the following:

- **RTS Gold** – Remote Technical Support, Gold. The NOKIA Technical Support (TS) Service provides the customer remote access to NOKIA engineers in support of product-related questions, troubleshooting assistance, diagnostic procedures, Patch Releases and Maintenance Releases, as may be made available, to restore service and/or functionality and resolve problems for Maintained Products. Customer access is provided via phone or email to the Welcome Center or, if available, via web-based Online Customer Support 24 hours a day, 365 days a year, to open a ticket or 'Assistance Request' ("AR").

- **RES-AES-NBD** – Repair & Exchange Services, Advanced Exchange Service, Next Business Day The NOKIA Repair & Exchange Services (RES) provides repair or exchange of defective, customer-owned hardware (Parts). Upon receipt and acceptance

of a 'Part Request' from the Customer, NOKIA will provide a functioning part from the list of RES Entitled Parts (based on existing customer configuration). The functioning part is delivered within the next business day (NBD) in advance of the Defective Return from the Customer except for RES Entitled Parts that require customer configuration before dispatch, require SW installation before dispatch or exceed 60 lbs. (27 kg). Upon receiving the replacement Part, Customer will ship or return the reported defective Part to Seller within five (5) Calendar Days.

- **SSP** – Software Subscription Plan for nodal equipment. **SRS** – Software Release Service for NFM-P network management systems. The NOKIA SSP or SRS makes available all Feature Releases of software for network/node elements and management systems for specific network elements or families of network elements, and other network-related applications available for download from a NOKIA web site. Professional Services to provide Installation or application of such software upgrades, is not included in SSP or SRS.

Please note that the warranty and post-warranty pricing for this item in the Change Order captures one MPLS network refresh only. The MPLS network refresh as quoted replaces the original 7705-SAR hardware with the same functionality, but with the exception of the T1 cards. It is assumed that the T1 functionality will be replaced with ethernet in the future by the time of refresh. Also, the 7705 OS is not included in the refresh price since OS upgrades would already have been covered by the Software Subscription Service (SSP) for the 7705's.

In collaboration with MERA, Motorola has identified the non-LMR traffic (such as IP cameras) that will be provisioned on the MPLS network as per Appendix A.

The detailed MPLS equipment list has been provided in Appendix B.

APPENDIX A – NON-LMR TRAFFIC

MPLS NETWORK/Non LMR CONNECTIONS

Services	PORT #	EOF	CIVIC CENTER 2ND DECK	BIG ROCK	DOLLAR	MILL VALLEY	MT TAM	OTA	SAN PEDRO	TIBURON	WOLFBACK	BARNABE	COYOTE	MUIR WT	REYES	STEWART	TOMALES	SONOMA	SKYVIEW
GATEWAY 1		VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1
CGW 1			VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1	VLAN BHS 1
GATEWAY 2		VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2	VLAN BHS 2		
CGW 2			VLAN BHS 2																
RECTIFIERS(Mngmt)		CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1	CEN 1
INVERTERS(Mngmt)				CEN 1	CEN 1		CEN 1		CEN 1	CEN 1		CEN 1			CEN 1	CEN 1		CEN 1	
COUNTY USE(FD Camera)		VLAN MC 1	VLAN MC 1	**VLAN MC 1**	VLAN MC 1	VLAN MC 1	VLAN MC 1	VLAN MC 1	VLAN MC 1	VLAN MC 1	VLAN MC 1	**VLAN MC 1(WoodAcre**	VLAN MC 1	VLAN MC 1	**VLAN MC 1**	VLAN MC 1	VLAN MC 1	VLAN MC 1	VLAN MC 1
COUNTY USE(Security Camera)		VLAN MC 2	**VLAN MC 2**	**VLAN MC 2**	VLAN MC 2	VLAN MC 2	**VLAN MC 2**	VLAN MC 2	VLAN MC 2	VLAN MC 2	VLAN MC 2	VLAN MC 2	VLAN MC 2	VLAN MC 2	VLAN MC 2	VLAN MC 2	VLAN MC 2		
CEN- Uwave -UEM-Mngmt		VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3	VLAN MC 3
Web-Wifi-		VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4	VLAN MC 4
VOIP-IP Phone		VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5	VLAN MC 5
Future		VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6	VLAN MC 6
SMARTX		T1-1	T1-1																
SMARTX		T1-2	T1-2																
SMARTX		T1-3	T1-3																
SMARTX		T1-4	T1-4																
SMARTX		T1-5	T1-5																
Woodacre telephone/CAD		T1-6	T1-6 ?									T1-6(to Woodacre)							
FBI ckt(v.24)			RS232(12 port)	RS232(12 port)															
CHP Ckt							4W(6 port)					4W(6 port)							

RNI NETWORK IP BACKHAUL	Primary Use
CNI IP BACKHAUL	Secondary Use
COUNTY USE IP BACKHAUL	Secondary Use
SMARTX T1 BACKHAUL	Primary Use
NON IP BACKHAUL	Primary Use

Notes:
1. Custom Tones: Review Gold Elite Admin
2. Test Radio on Mt. TAM will be Connected to CGW
3. Intercom System Connected to CGW
4. Refer Conventional Interface Drawing

APPENDIX B – EQUIPMENT LIST

MPLS Equipment List

Item	Part Number	Description	BIG ROCK	FOW CENTER	CONDIT PEAK	DOLLAR HILL	FOF	MIRA VALLEY MT 2	MT BARHAM	MT TAMALPAIS	MT TEDDY	MUIR BEACH	OTS BROADCASTING	PT REYES	SAN PEDRO	SKYVIEW MT	SONOMA MT	STINSHIP PT	TOMALES	WAVERLY RIDGE
3.00		2705 SAR-8																		
3.01	3HE05791AA	SAR-8 SHELF V2	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.02	3HE05792AA	Fan Module (SAR-8 Shelf V2) Ext Temp -48VDC	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.03	3HE02774AB	CONTROL SWITCH MODULE V2 (CSMV2)	2	2	2	2	4	2	2	4	2	2	2	2	2	2	2	2	2	2
3.04	3HE07784AA	SAR-8/-8 EASE 8.0 BASIC OS LIC/NSE	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.05	3HE02782AA	Packet Microwave Card (-48/+24 VDC)	2	2	2	2	2	2	2	6	2	2	2	2	2	2	2	2	2	2
3.06	3HE02776AB	8 PORT GE/FE ETHERNET CARD V2		1																
3.06	3HE02775AB	16 PORT T1/E1 ASAP CARD V2 (-48/+24 VDC)		1			1		1											
3.09	3HE02351AB	12P SERIAL DATA CARD V2 -48/+24VDC	1	1																
3.10	3HE03176AA	6 port F&M Interface Card							1	1										
3.07	3HE03394AA	32 PORT T1/E1 RJ45 PANEL		1			1		1											
3.08	3HE03397AA	E1/T1 CABLE FOR DISTRIBUTION PANEL 1M		1			1		1											
3.10	3HE04507AB	RS232 Cable - 2M	2	2																
3.11	3HE04511AA	6 PORT RS232 DISTRIBUTION PANEL	2	2																
3.09	3HE03401AA	SYNCHRONIZATION Y-CABLE	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.20	3HC09062CB	SFP - GIGE BASE T RJ45 R6/6 DDM -40/85C	8	10	8	8	8	6	8	24	8	8	8	8	8	8	8	8	8	8
3.11	3HE00027CA	SFP - GIGE SX - LC ROHS 6/6 DDM -40/85C	4	4	4	4	4	4	4	12	4	4	4	4	4	4	4	4	4	4
3.50		2705 SAR-8																		
3.51	3HE05791AA	SAR-8 SHELF V2																		
3.52	3HE05792AA	Fan Module (SAR-8 Shelf V2) Ext Temp -48VDC																		
3.53	3HE02774AB	CONTROL SWITCH MODULE V2 (CSMV2)																		
3.54	3HE02782AA	Packet Microwave Card (-48/+24 VDC)																		
3.55	3HE02776AB	8 PORT GE/FE ETHERNET CARD V2																		
3.55	3HE02775AB	16 PORT T1/E1 ASAP CARD V2 (-48/+24 VDC)																		
3.56	3HE02351AB	12P SERIAL DATA CARD V2 -48/+24VDC																		
3.57	3HE03176AA	6 port F&M Interface Card																		
3.56	3HE00063CB	SFP - GIGE BASE-T RJ45 R6/6 DDM -40/85C																		
3.57	3HE00027CA	SFP - GIGE SX - LC ROHS 6/6 DDM -40/85C																		
4.00		NFM-P																		
4.01	3HE11799DA	NSP 1R: NFM-P STANDARD BASE																		
4.02	3HE11801DA	NSP 1R: NFM-P STANDARD LP	23	33	18	18	31	18	28	51	18	18	18	18	18	18	18	18	18	18
4.03	3HE11803DA	NSP 1R: NFM-P HIGH AVAILABILITY LP	23	33	18	18	31	18	28	51	18	18	18	18	18	18	18	18	18	18
4.50		Software OS Upgrades																		
4.51	3HE02785QA	2705 SAR RELEASE 8.0 BASIC OS UPGRADE (2 OS level upgrades)	2	2	2	2	4	2	2	4	2	2	2	2	2	2	2	2	2	2
4.52	3HE10161AA	NFM SRS 2 years [2 NFM sw upgrades]																		

Attachment 2
Agenda Item H
MERA NGPOC - June 26, 2019

MPLS Equipment List

Item	Part Number	Description	BIG BOCK	CIVIC CENTER	COYOTE PEAK	DOUBLE HILL	EGP	MIRA VALLEY WT 2	MT ELDRIDGE	MT EMMALPIN	MT TRIMBOR	MUIR BEACH	OTS BROADCASTING	PT REYES	SAN PEDRO	SKYVIEW WT	SONOMA MT	STEWART PT	TOMALES	WOLFBACK RIDGE
3.00		7705 SCALE 1																		
3.01	3HE06791AA	SAR-8 SHELF V2	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.02	3HE06792AA	Fan Module (SAR-8 Shelf V2) Ext Temp -48VDC	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.03	3HE02774AB	CONTROL SWITCH MODULE V2 (CSMV2)	2	2	2	2	4	2	2	4	2	2	2	2	2	2	2	2	2	2
3.04	3HE02784AA	SAR RELEASE 8.0 BASIC OS LICENSE	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.05	3HE02782AA	Packet Microwave Card (-48/+24 VDC)	2	2	2	2	2	2	2	4	2	2	2	2	2	2	2	2	2	2
3.06	3HE02776AB	8 PORT GE/FE ETHERNET CARD V2		1																
3.06	3HE02775AB	16 PORT T1/E1 ASAP CARD V2 (-48/+24 VDC)		1			1		1											
3.09	3HE03391AB	12P SERIAL DATA CARD V2 -48/+24VDC	1	1																
3.10	3HE03126AA	6 port E&M Interface Card							1	1										
3.07	3HE03394AA	32 PORT T1/E1 RJ45 PANEL		1			1		1											
3.08	3HE06197AA	T1/E1 CABLE FOR DISTRIBUTION PANEL 1M		1			1		1											
3.10	3HE04507AB	RS232 Cable - 2M	2	2																
3.11	3HE04511AA	6 PORT RS232 DISTRIBUTION PANEL	2	2																
3.09	3HE03401AA	SYNCHRONIZATION Y-CABLE	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
3.10	3HE00062CB	SFP - GIGE BASE-T RJ45 86/6 SDIM -40/85C	8	10	8	8	8	8	8	24	8	8	8	8	8	8	8	8	8	8
3.11	3HE00027CA	SFP - GIGE SX - LC ROHS 6/6 DDM -40/85C	4	4	4	4	4	4	4	12	4	4	4	4	4	4	4	4	4	4
3.50		7705 Spares																		
3.51	3HE06791AA	SAR-8 SHELF V2																		
3.52	3HE06792AA	Fan Module (SAR-8 Shelf V2) Ext Temp -48VDC																		
3.53	3HE02774AB	CONTROL SWITCH MODULE V2 (CSMV2)																		
3.54	3HE02782AA	Packet Microwave Card (-48/+24 VDC)																		
3.55	3HE02776AB	8 PORT GE/FE ETHERNET CARD V2																		
3.55	3HE02775AB	16 PORT T1/E1 ASAP CARD V2 (-48/+24 VDC)																		
3.56	3HE03391AB	12P SERIAL DATA CARD V2 -48/+24VDC																		
3.57	3HE03126AA	6 port E&M Interface Card																		
3.56	3HE00062CB	SFP - GIGE BASE-T RJ45 86/6 DDM -40/85C																		
3.57	3HE00027CA	SFP - GIGE SX - LC ROHS 6/6 DDM -40/85C																		
4.00		NFM-P																		
4.01	3HE11799BA	NSP 1R- NFM-P STANDARD BASE																		
4.02	3HE11801DA	NSP 1R- NFM-P STANDARD LP	23	33	18	18	31	18	28	51	18	18	18	18	18	18	18	18	18	18
4.03	3HE11803DA	NSP 1R- NFM-P HIGH AVAILABILITY LP	23	33	18	18	31	18	28	51	18	18	18	18	18	18	18	18	18	18
4.50		Software / OS Upgrades																		
4.51	3HE02785XX	7705 SAR RELEASE X.0 BASIC OS UPGRADE (2 OS level upgrades)	2	2	2	2	4	2	2	4	2	2	2	2	2	2	2	2	2	2
4.52	3HE10161AA	NFM SRS 3 years (2 NFM sw upgrades)																		

APPENDIX C – PRICING SUMMARY

	Price
MPLS Equipment, Implementation Services, and Training after discount	$640,562.86
MPLS 15 Year Life Cycle Services (including one network refresh in year 6) after discount	$1,104,930
Total	$1,745,492.86
Estimated Equipment Taxes at 9%	$ 35,600.00
Final Price	$1,781,092.86

15 Year Life Cycle Services Annual Cost Breakdown															
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	**Total**
$ 33,669.75	$ 42,835.45	$ 42,835.45	$ 42,835.45	$ 42,835.45	$ 412,562.62	$ 50,923.64	$ 50,923.64	$ 50,923.64	$ 50,923.64	$ 56,732.26	$ 56,732.26	$ 56,732.26	$ 56,732.26	$ 56,732.26	$ 1,104,930.00

Milestone Plan for MPLS Equipment, Implementation Services, and Training Total (including taxes)	$ 676,162.86
Payment Milestone	**Payment Amount**
20% of the Change Order Price upon signing of the Change Order	$ 135,232.57
45% of the Change Order Price upon shipment of equipment	$ 304,273.29
25% of the Change Order Price upon completion of installation (site by site)	$ 169,040.72
10% of the Change Order Price upon final system acceptance	$ 67,616.29
Total	$ 676,162.86

Marin Emergency Radio Authority [MERA]

MERA NEXT GEN MICROWAVE DESIGN

Existing system, Current layer 2 Next Gen design, and MPLS option

Ethan Simpson 1/10/2019

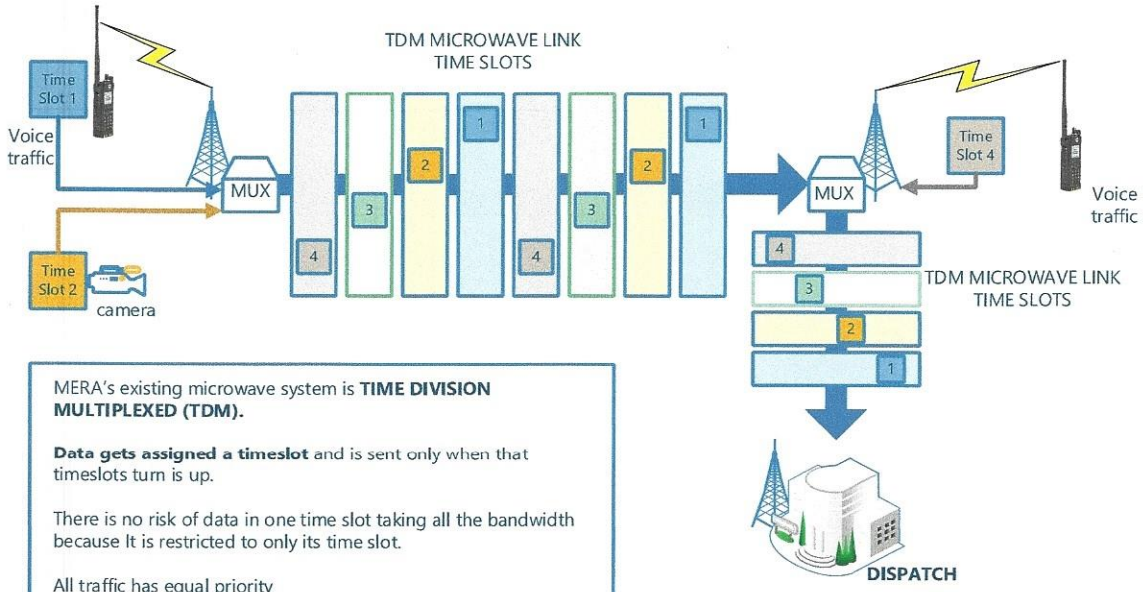
Marin Emergency Radio Authority [MERA]

Purpose - Should MERA stay with Layer 2 or move to MPLS solution? To aid in the decision, the following should be considered:

- How the existing system handles voice and data
- How Layer 2 and MPLS differ
- Current Contract – Motorola Design
- Pros/Cons/Approximate Cost of Options

Marin Emergency Radio Authority [MERA]

EXISTING SYSTEM DATA FLOW



MERA's existing microwave system is **TIME DIVISION MULTIPLEXED (TDM).**

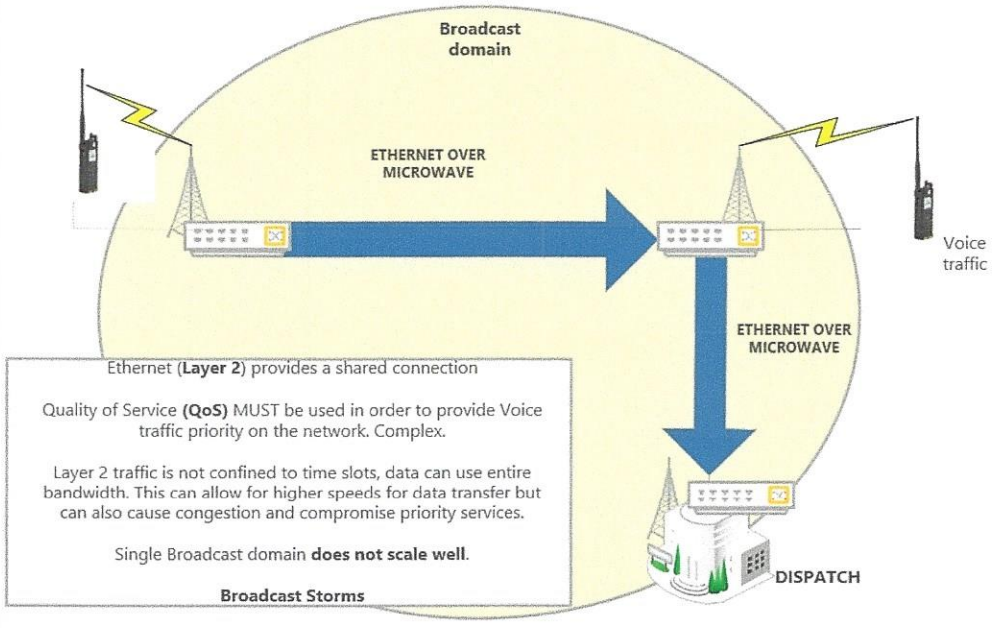
Data gets assigned a timeslot and is sent only when that timeslots turn is up.

There is no risk of data in one time slot taking all the bandwidth because It is restricted to only its time slot.

All traffic has equal priority

Marin Emergency Radio Authority [MERA]

Layer 2 design. Current Next Gen design per contract.



Ethernet (**Layer 2**) provides a shared connection

Quality of Service **(QoS)** MUST be used in order to provide Voice traffic priority on the network. Complex.

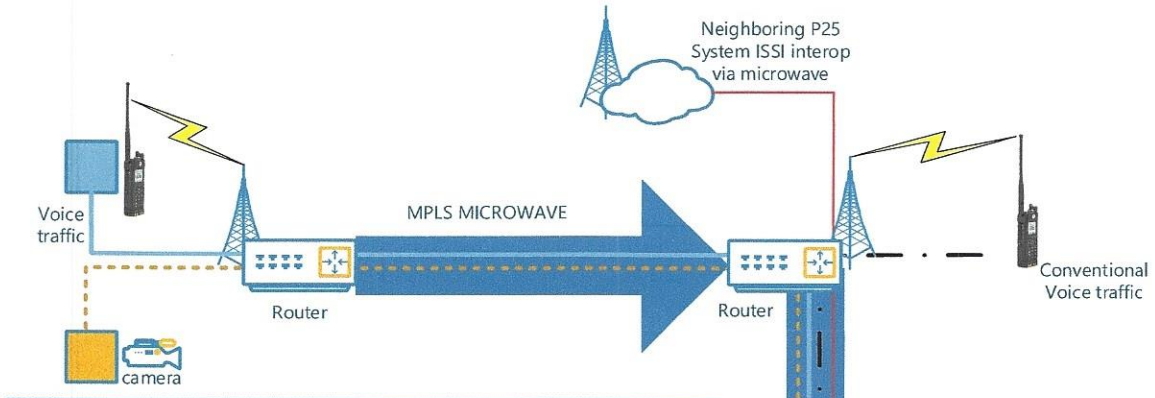
Layer 2 traffic is not confined to time slots, data can use entire bandwidth. This can allow for higher speeds for data transfer but can also cause congestion and compromise priority services.

Single Broadcast domain **does not scale well**.

Broadcast Storms

Marin Emergency Radio Authority [MERA]

MPLS OPTION



Support multiple services on the microwave and still provide Priority to MERA voice traffic.

Multi Protocol Label Switching (MPLS) limits risk of broadcast storm by allowing for Layer 3 connections to sites. Each site has its own Network.

Better Network performance such as faster recovery times.

Offers higher level of security when providing service to multiple users.

Better use of QoS

Allows MERA to utilize extra bandwidth for security, troubleshooting, Monitoring and expansion.

More future proof.

Marin Emergency Radio Authority [MERA]

PROPOSED LAYER 2 DESIGN

This design focuses on simplicity and more importantly lower financial investment at the cost of:

- Reduced functionality when compared with existing system,
- Higher risk of service degradation due to broadcast storms.
- Lower bandwidth utilization,
- Reduced expandability,
- Lower configurability,
- Any future needs of MERA outside of Motorola voice traffic would require and upgrade to the microwave.

MPLS OPTION

- MPLS offers higher performing networks but at an added cost.
- MPLS allows MERA to accommodate existing services on the microwave that are not be supported by Motorola in the Layer 2 design.
- MPLS allows MERA to add additional services in the future on the microwave.
- MPLS provides better bandwidth utilization of the valuable microwave links that will be established for Next Gen.

Attachment 1 - MPLS Comparison Matrix

	OPTION 0	OPTION 1	OPTION 2	OPTION 3	OPTION 4
Description	Take no action. Configuration in the original contract. Maintains Layer 2 architecture. Non-LMR services are not permitted on network.	Motorola implements MPLS now as part of current design of Next Gen System.	Motorola implements MPLS at a future date after the Next Gen system is accepted and in operation.	Third party vendor (IPKeys) implements MPLS at a future date after the Next Gen system is accepted and in operation.	Motorola implements MPLS now as part of current design of Next Gen System, paid for by reduction in Layer 2 SUAII services.
Data Transfer	Layer 2 - used predominantly in single-use networks.	MPLS - commonly used in high performance networks.	MPLS - commonly used in high performance networks.	MPLS - commonly used in high performance networks.	MPLS - commonly used in high performance networks.
Traffic	Conventional voice channels, interoperability voice channels, 700 MHz trunked voice channels, and basic system management data.	Conventional voice channels, interoperability voice channels, 700 MHz trunked voice channels, and system management data, plus data traffic from other applications (cameras, site security, radio system diagnostics, etc.)	Conventional voice channels, interoperability voice channels, 700 MHz trunked voice channels, and system management data, plus data traffic from other applications (cameras, site security, radio system diagnostics, etc.)	Conventional voice channels, interoperability voice channels, 700 MHz trunked voice channels, and system management data, plus data traffic from other applications (cameras, site security, radio system diagnostics, etc.)	Conventional voice channels, interoperability voice channels, 700 MHz trunked voice channels, and system management data, plus data traffic from other applications (cameras, site security, radio system diagnostics, etc.)
Pros	- According to Motorola, it can robustly and reliably support single-use traffic at no additional cost to current project.	- MPLS is specifically designed to carry many kinds of traffic simultaneously. - More reliable network. - More flexible and more future oriented. - Motorola alone is responsible for correcting all implementation issues. - Various diagnostic and security tools for the P25 radio system can be added.	- MPLS is specifically designed to carry many kinds of traffic simultaneously. - More reliable network. - More flexible and more future oriented. - Motorola alone is responsible for correcting all implementation issues. - Various diagnostic and security tools for the P25 radio system can be added.	- MPLS is specifically designed to carry many kinds of traffic simultaneously. - More reliable network. - More flexible and more future oriented. - IPKeys has experience in designing and configuring these systems. (Motorola has contracted with them for this type of work in other locations.) - Various diagnostic and security tools for the radio system can be added.	- MPLS is specifically designed to carry many kinds of traffic simultaneously. - More reliable network. - More flexible and more future oriented. - Motorola alone is responsible for correcting all implementation issues. - Various diagnostic and security tools for the P25 radio system can be added.
Cons	- Low-level protocols may not have the logic built in that would be required to compensate for a broadcast storm or other sudden network event. - May not support future upgrades to the P25 radio system. - Uses only a fraction of the available bandwidth of the Next Gen microwave network. - Existing troubleshooting services will be removed. - Current non-MERA users (CHP, FBI) will be required to find another path. - Provides less functionality than today's microwave system. - Not industry best practice.	- Significant additional cost to project. - Requires additional hardware. - Adds some complexity to the network. - Hardware refresh is only for hardware that is not compatible with updated Motorola software. - Reduces contingency funds in current project.	- Significant additional cost to project. - Requires additional hardware. - Adds some complexity to the network. - $400-500K more expensive than Option 1 because Motorola will have to remobilize resources. - Risk of outages when modifying the system after going live. - Additional installation and commissioning labor required when modifying a live system. - Hardware refresh is only for hardware that is not compatible with updated Motorola software.	- Significant additional cost to project. - Requires additional hardware. - Adds some complexity to the network. - Introduces an additional vendor to the project, possibly leading to scope and blame issues. - Risk of outages when modifying the system after going live. - Additional installation and commissioning labor required when modifying a live system.	- Additional cost to project. - Requires additional hardware. - Adds some complexity to the network. - Hardware refresh is only for hardware that is not compatible with updated Motorola software. - Reduces contingency funds in current project. - Reduces Layer 2 network hardware refresh from two instances to one. - SUA II services reduced from existing contract.
Cost - No SUA, no Hardware Refresh	$0	$640,562.86	$1,076,162.86	$326,132	~$89,000
Add'l Cost - 5-Yr SUA, Yr-6 Hdwr Refresh	$0	N/A	N/A	$623,559	N/A
Add'l Cost - 15-Yr SUA, Yr-6 Hdwr Rfsh	$0	$1,140,530	$1,204,930	N/A	N/A

Marin Emergency Radio Authority [MERA]

Summary

- **The existing MERA system transmits voice traffic and other data (non-LMR circuits – Cameras, FBI, CHP circuits) separately through TDM timeslots.**
- **MERA Next Gen Layer 2 Design has "one big pipe" to transmit data and cannot separate data streams.**
    - **To ensure MERA's priority voice traffic is secure, non-LMR traffic will not be added to Layer 2 "pipe" under the current Next Gen System design.**
    - **Motorola Contract does not include provisioning of non-LMR traffic, so only the voice traffic will be included.**
- **MPLS is a solution should MERA decide to continue to accommodate existing non-LMR traffic and/or build a system to accommodate future non-LMR traffic.**