SYSTEM PURCHASE AGREEMENT

BETWEEN

City of Aurora
(Buyer)

and

L3HARRIS TECHNOLOGIES, INC.
COMMUNICATION SYSTEMS SEGMENT
(Seller)

DATE: _____, 2023

SYSTEM PURCHASE AGREEMENT

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SYSTEM PURCHASE AGREEMENT

THIS SYSTEM PURCHASE AGREEMENT ("Agreement") is made and entered into this ___ day of____, 2023 ("Effective Date"), by and between **City of Aurora, an Illinois home rule municipal corporation, having a place of business at City of Aurora, 44 East Downer Place, Aurora, Illinois 60505**, (hereinafter referred to as "Buyer") and **L3Harris Technologies, Inc.**, a Delaware corporation, acting through its Communication Systems Segment (hereinafter referred to as "Seller") together the ("Parties").

WITNESSETH:

WHEREAS Seller, whose address is 221 Jefferson Ridge Parkway, Lynchburg, VA 24501, delivered a proposal (collectively, the "Seller's Proposal") to provide the radio communication System and services.

WHEREAS Buyer has selected Seller's Proposal and now desires to contract with Seller to provide Buyer with the radio communications System and services set forth in the Statement of Work attached to this Agreement as an exhibit.

WHEREAS Buyer and Seller desire to enter into this Agreement to set forth in writing their respective rights, duties and obligations hereunder.

NOW, THEREFORE, for and in consideration of the mutual promises contained herein and other good and valuable consideration, the sufficiency and receipt of which are hereby acknowledged, it is mutually agreed between the Buyer and Seller as follows:

SECTION 1. DEFINITIONS:

As used herein, the terms set forth below shall have meanings set forth below.

A. "Acceptance" shall mean Acceptance of the System as set forth in the Testing and Acceptance section of this Agreement.

B. "Acceptance Date" shall mean the date the System is accepted or deemed accepted as set forth in the Testing and Acceptance section of this Agreement.

C. "Acceptance Tests" shall mean the testing procedures attached to the Statement of Work and mutually agreed upon by Buyer and Seller to be performed to determine whether the System has met the Acceptance criteria either set forth in the Statement of Work attached to this Agreement as an exhibit or as mutually agreed upon in writing by Buyer and Seller.

D. "Certificate of Insurance" shall mean the certificate to be provided by Seller evidencing the insurance coverage of Seller.

E. "Change Order" shall mean a written modification to the Total Agreement Price, Project Schedule or other Agreement terms which is signed by both Parties.

F. "Detailed Design Documents" shall mean those documents deliverable by Seller to Buyer at the conclusion of the Detailed Design Review described in the subsection Detailed Design Review under the Project Management Planning section of this agreement.

G. "Detailed Design Review" or "DDR" shall have the meaning given in the subsection Detailed Design Review under the Project Management Planning section of this agreement.

H. "Documentation Deliverables" shall mean the standard commercial quality manuals to be furnished by the Seller to the Buyer pursuant to the terms set forth in the Statement of Work attached to this Agreement as an exhibit and this Agreement.

I. "Effective Date of the Agreement" shall be the date on which the Agreement is signed by the last of the parties to sign the Agreement. The "Effective Date" shall be the date inserted on the first page of the Agreement.

J. "Expiration Date" shall mean the date on which the Term of this Agreement shall end which shall be the end of the Warranty Period (as defined in the Warranty Section) except that some other sections of this Agreement may have a later end date for that section of the Agreement as specifically provided in those sections of this Agreement.

K. "Hardware" shall mean, collectively, the Terminal Hardware and Infrastructure Hardware, as defined below.

L. "Infrastructure Hardware" shall mean the equipment, goods, and materials to be supplied by Seller for the System infrastructure, as further described in the Statement of Work attached to this Agreement as an exhibit.

M. "Project Kick-Off Meeting" shall have the meeting given in the Project Management and Planning section of this Agreement.

N. "Project Manager" shall mean each respective Party's duly authorized representative designated to manage each Party's obligations.

O. "Project Schedule" shall mean the schedule attached to the Statement of Work or otherwise mutually agreed upon by Seller and Buyer in writing for the delivery of the Hardware and Software and the performance of the Services described in the Statement of Work attached to this Agreement as an exhibit.

P. "Project Sites" shall mean those sites where any construction work is performed or any Infrastructure Hardware is installed under the terms of this Agreement. The term "Project Sites" will include all of the Tower Sites (as defined below).

Q. "Responsibility Matrix" shall mean the table included in the Statement of Work attached to this Agreement as an exhibit, which depicts the roles and responsibilities of Seller and Buyer set forth this Agreement.

R. "Services" or "Work" shall mean the services and work to be provided by Seller to Buyer included in the Statement of Work attached to this Agreement as an exhibit.

S. "Software" shall mean the proprietary computer software of Seller as owned exclusively by Seller or Seller's suppliers, as appropriate, and as further defined in and licensed to Buyer pursuant to the terms of the Software License Agreement.

T. "Software License Agreement" shall mean the System Software License Agreement set forth in an exhibit attached to this Agreement.

U. "Statement of Work" shall mean the description of the work to be performed by Seller to deliver the Hardware, install the System and provide the Services, all as described in an exhibit attached to this Agreement.

V. "System" shall mean the radio communications System comprised of the Hardware and Software to be furnished by Seller to Buyer pursuant to the terms set forth in the Statement of Work attached to this Agreement as an exhibit.

W. "Terminal Hardware" shall mean mobile units, portable units, control stations and related accessories to be provided by Seller as listed in the Statement of Work attached to this Agreement as an exhibit.

X. "Total Agreement Price" shall mean the price of the Hardware, the Software license and the Services to be furnished by Seller to Buyer pursuant to the terms set forth in the Statement of Work attached to this Agreement as an exhibit and this Agreement.

Y. "Tower Sites" shall mean those sites where Infrastructure Hardware will be installed on existing or new towers as included in the Contractor's Statement of Work and to be finalized in the Detailed Design Documents or subsequent Change Orders.

SECTION 2. SCOPE OF WORK:

A. Seller shall furnish, deliver and install the Hardware and Software for the System and provide the Documentation Deliverables and Services in accordance with the terms of the Statement of Work, attached to this Agreement as an exhibit, the Project Schedule and this Agreement.

B. The Detailed Design Documents, as described in the Project Management and Planning section of this Agreement and as amended from time to time in writing by the Parties, shall be incorporated into this Agreement after the Detailed Design Documents are approved by the Buyer and thereafter shall supersede any contrary provisions in the Statement of Work attached to this Agreement as an exhibit.

C. Seller shall commence, carry on and complete its obligations under this Agreement with all deliberate speed in accordance with the dates set forth in the Project Schedule and in a sound, economical and efficient manner, in accordance with this Agreement and all applicable laws. In providing services under this Agreement, Seller agrees to cooperate with the various departments, agencies, employees and officers of Buyer.

D. Seller agrees to secure at Seller's own expense all personnel necessary to carry out Seller's obligations under this Agreement. Such personnel shall not be deemed to be employees of Buyer nor shall they or any of them have or be deemed to have any direct contractual relationship with Buyer. Seller expressly understands and agrees that the Seller is and shall in all respects be considered an independent contractor.

SECTION 3. PROJECT MANAGEMENT AND PLANNING:

A. **Project Managers.** Seller shall designate a Project Manager who will lead the Seller' team for the System installation project and other Services and Work described in this Agreement (the "Project") and will serve as the Buyer's primary point-of-contact for Seller's project team and the official liaison between Seller's project team and Buyer. Buyer shall designate a Project Manager to function as the single point-of-contact and official liaison between Seller's Project Manager and the Buyer.

B. **Project Completion Dates.** The Project completion dates are described in the schedule included in the Statement of Work, entitled "Project Schedule." The Project Schedule may only be modified by mutual written approval of the Parties or as otherwise provided in this Agreement.

C. **Project Kick-off Meeting.** Promptly after the Effective Date of the Agreement, the Seller's Project Manager shall schedule a Project Kick-Off Meeting, the timing and location of which will be mutually agreed upon by Seller and Buyer. The objectives of this meeting include introduction of all project participants, review of the roles of the project participants, review of the overall project scope and objectives, review of the resource and scheduling requirements and review of current site status.

D. **Site Visits.** All existing towers, shelters and associated equipment provided by or mandated by Buyer shall be satisfactory in all manners to accommodate the System proposed by the Seller. Following the Effective Date of the Agreement, the Buyer shall provide Seller with access to all Project Sites upon reasonable notice to allow Seller to thoroughly examine each Site and to perform the Detailed Design Review, to prepare a schedule of preparatory work required for each site and a timeline for completion of the preparatory work at each site.

E. **Construction Management Services, Site Preparatory Work.** Seller shall perform the civil construction services set forth in the Statement of Work and the Responsibility Matrix including, but not limited to, the site improvement civil construction to be performed at the identified sites. Buyer shall identify and disclose to Seller any and all problems or conditions at all Project Sites of which Buyer is aware that may affect the Work to be performed by Seller under this Agreement.

F. **Detailed Design Review.** The Detailed Design Review ("DDR") phase will commence after the Effective Date of the Agreement, and conclude at a mutually acceptable time to maintain adherence to the Project Schedule. During the DDR, Seller's Project Manager will meet with Buyer's project team on one or multiple occasions to review the System design, technical data, and site specific information to confirm and to refine the System and Tower Sites. At the conclusion of the DDR, Seller will provide Buyer with the following documents (the "Detailed Design Documents") for review and approval by Buyer:

- Final Siting Plans
- Project Schedule
- Engineered Site plans (sufficient for the Buyer to obtain required zoning approvals) and construction drawings for each site.
- Shelter Floor Plan Drawings
- Rack Elevation Drawings
- System Block and Level Diagrams
- Power and HVAC Loads
- Antenna Network Diagrams
- Site Frequency Plans (including spectrum analysis and intermodulation studies of existing and proposed frequencies at each site).
- TX Combiner Plan by Site
- Network Backhaul Plans

- Any other documents as mutually agreed upon by the parties

Buyer shall have fourteen (14) days to conduct its review of the above documents. Approval of Detailed Design Documents by the Buyer shall not be unreasonably withheld, conditioned or delayed.

G. **Project Schedule.** The Project Schedule for the Work is included in the Statement of Work, as an attachment entitled "Project Schedule." Updates to the start dates and durations will be made as the information evolves and will be mutually agreed upon by both parties or updated as otherwise provided herein.

H. **System Implementation Communications.** Seller and Buyer shall jointly establish a plan that defines regular meetings, reporting structure, and other communications activities, including working sessions that may be needed throughout the term of this Agreement to plan sub-tasks, including at a minimum: (a) one or more DDR meetings to communicate the final engineering design; (b) formal monthly reports to Buyer's Project Manager concerning work in progress and accomplishments; (c) periodic status meetings at which the parties' Project Managers and other project participants will provide updates; (d) conference calls with Seller's and Buyer's project teams to discuss tasks, assign responsibility, and establish schedules; and (e) workshops or working sessions that may be needed throughout the Project to plan subtasks.

I. **Buyer Approvals**. Buyer will review and respond with reasonable promptness to all submittals or other items requiring its approval under this Agreement. For all such submittals or other items Buyer will provide the Seller with either; (i) written notification of Buyer's approval, or (ii) a written notification of conditional approval subject to Seller providing prompt correction of any noted deficiency, or (iii) in the case of a submittal that does not meet the requirements of the Agreement, a written notification of Buyer's disapproval. Buyer's disapproval notification will be provided with reasonable detail to sufficiently advise Seller of the basis on which the submittal was determined to be unacceptable. Buyer agrees that, except as otherwise provided, failure to provide approval, conditional approval or non-approval of a submittal for which its approval is required within fifteen (15) days of receipt of the submittal from the Seller shall constitute approval of the submittal. The parties agree that this section, Project Management and Planning, does not relate to the Testing and Acceptance procedures in the Testing and Acceptance section of this Agreement.

SECTION 4. OBLIGATIONS FOR SYSTEM IMPLEMENTATION:

The following subsections apply to the Work to be performed under the Agreement.

A. **Project Management and Implementation Plan.** Buyer and Seller each agree to perform their respective tasks and obligations pertaining to permits and licenses, Project Site surveys, general Project Site-related responsibilities, general Hardware-related responsibilities, and Project Site-specific responsibilities as set forth in the Statement of Work. The Buyer's obligations set forth in the Statement of Work shall be performed by Buyer in a timely and proper fashion in accordance with the Project Schedule, or as otherwise agreed upon by Buyer and Seller, to allow Seller to timely perform its obligations under the Agreement.

B. **Access.** Buyer shall provide access, at no cost to Seller, to all owned, leased, or licensed Project Sites at reasonable times, and with an escort (if required) at no charge, upon reasonable prior notification from Seller. Buyer shall ensure sufficient room, within reason, for construction vehicles used by Seller. Buyer shall issue temporary identification cards to Seller's personnel and its authorized subcontractors, if required, for access to any of the Project Sites.

C. **Changes in Sites.** Any sites where Seller will operate and perform System installation under the terms of this Contract must be approved by Buyer, which approval shall not be unreasonably withheld, delayed or conditioned. Should Buyer direct an addition to, removal from, or modification of the list of sites as detailed in this Agreement that affects Seller's cost or schedule or System performance, including, but not limited to coverage, the parties agree that such change shall entitle Seller to a Change Order and each Party shall attempt, in good faith to fully negotiate and execute such Change Order prior to commencement of the Work at the changed site.

D. **Preparatory Work on Sites.** Notwithstanding anything to the contrary contained in this Agreement, the parties agree that some Project Sites may require tower replacement or modifications, as well as related permitting and licensing for Work and/or obtaining physical real estate space. As stated in the Responsibility Matrix, Buyer shall be responsible for securing all necessary site zoning, site access, or other permits (including but not limited to easements, impact studies, planning commission approval, variances, etc.) necessary for the Work, whether required by federal, state, or local authorities, with Seller assisting by providing information and any required civil engineering drawings. Buyer shall also have the responsibility to secure by lease, purchase, easement or otherwise all rights and access to selected sites or additional real estate as may be required. Buyer also shall be responsible for paying all utility charges to the appropriate utility for providing utility services to the System installation areas. The Parties agree to mitigate the need for tower replacement or modification to the extent practical. If any unanticipated tower replacements or modifications become necessary, Seller is entitled to an extension of time for any impacted activities and/or an equitable adjustment to the Contract Price to maintain the Project Schedule.

E. **Frequency Federal Communications Commission (FCC) Licensing.** The Buyer will be responsible for obtaining all FCC frequency licenses for the System, with Seller providing technical assistance and information as set forth in the Statement of Work. Seller has no responsibility or obligation to secure licensed frequencies. In the event Buyer fails to obtain FCC licenses, and such failure has a material impact on the cost of Work performed by Seller under the Agreement and/or the Project Schedule, the parties agree that Seller shall be entitled to an equitable adjustment to the Project Schedule, the Total Agreement Price, or both and that a Change Order shall be agreed to by the parties.

F. **Federal Aviation Administration (FAA) Approvals.** Buyer will be responsible for obtaining all FAA approvals for newly-constructed or modified towers.

G. **Contractor Licenses**. Seller will be responsible for obtaining all contractor licenses required for the performance of its duties and obligations.

SECTION 5. DELIVERY, TITLE AND RISK OF LOSS:

A. **Infrastructure Hardware**. Seller shall ship the Infrastructure Hardware to Buyer at Buyer's expense on or before the dates set forth in the Project Schedule. Partial deliveries shall be permitted. Upon delivery to the Buyer, title to each portion of the Hardware and all risk of loss or damage shall pass to Buyer. Infrastructure Hardware may be shipped directly to Buyer or to a mutually agreed upon staging or storage location. Buyer shall keep the Hardware fully insured for the total amount of all monies then due, or yet to become due, to Seller with respect to this Agreement.

B. **Terminal Hardware**. Seller shall ship the Terminal Hardware to Buyer at Buyer's expense on or before the dates set forth in the Project Schedule. Partial deliveries shall be permitted. Upon delivery to the Buyer, title to each portion of the Hardware and all risk of loss or damage shall pass to Buyer.

C. If Buyer fails to take delivery of any of the Hardware, Seller may place such Hardware in storage at the place of manufacture or elsewhere. In such event: (1) Seller shall notify Buyer, in writing, of the placement of any Hardware in storage; (2) Seller's delivery obligations shall be deemed fulfilled and title and all risk of loss or damage shall thereupon pass to Buyer; (3) any amounts otherwise payable to Seller upon delivery shall be payable upon presentation of Seller's invoices, in accordance with the Illinois Local Government Prompt Payment Act, therefore; and (4) promptly upon submission of Seller's invoices therefore Buyer shall reimburse, in accordance with the Illinois Local Government Prompt Payment Act, Seller for all expenses incurred by Seller such as preparation for and placement into storage, handling, storage, demurrage, inspection, preservation and insurance.

SECTION 6. PRICE:

The Total Agreement Price to be paid by Buyer to Seller is set forth in the Pricing Summary as an attachment to the Statement of Work.

SECTION 7. TAXES:

In addition to any price specified herein, Buyer shall pay the gross amount of any present or future sales, use, excise, value-added, or other similar tax applicable to the price, sale or any Hardware or Services furnished hereunder or to their use by Seller or Buyer, or Buyer shall otherwise furnish Seller with tax exemption certificates acceptable to all applicable taxing authorities.

SECTION 8. CHANGES AND ADDITIONS:

A. **Hardware Changes**. In the event of any change in the Hardware as a result of the imposition after the Effective Date of this Agreement of any requirements by any federal, state, or local government, Seller shall be entitled to an equitable adjustment, by Change Order, in the Total Agreement Price, the Project Schedule, or both. Any such adjustment in the Total Agreement Price or Project Schedule shall be mutually satisfactory to Buyer and Seller. Price increases and/or extensions of time shall not be binding upon either Party unless and until evidenced by a Change Order signed by the parties hereto.

B. **Buyer Requested Changes.** Buyer may request changes in or additions to the Work or in the time or place of performance of the Work under this Agreement. If any such change causes an increase or decrease in the cost of, or the time required for, performance of any part of the Work under this Agreement, Seller shall be entitled to an equitable adjustment, by Change Order, in the Total Agreement Price, the Project Schedule, or both. Any such adjustment in the Total Agreement Price or Project Schedule shall be mutually satisfactory to Buyer and Seller. Price increases and/or extensions of time shall not be binding upon either Party unless and until evidenced by a Change Order signed by the parties hereto.

C. **Buyer Delays In Performance.** To the extent that Buyer fails to timely perform its obligations under the Responsibility Matrix or otherwise under this Agreement, and such failure has a material impact on the cost of Work performed by Seller under the Agreement and/or the Project Schedule, the Parties agree that Seller shall be entitled to an equitable adjustment to the Project Schedule, the Total Agreement Price, or both. Any such adjustment in the Total Agreement Price or Project Schedule shall be mutually satisfactory to Buyer and Seller. Price increases and/or extensions of time shall not be binding upon either Party unless and until evidenced by a Change Order signed by the parties hereto.

D. **Concealed Conditions.** If, following Buyer's Acceptance of the Detailed Design Documents, Seller encounters a concealed condition, of which it had no reason to be aware, at one or more Project Sites, then the Parties agree to work together to determine the best course of action and agree to negotiate in good faith a Change Order and an equitable adjustment to the Project Schedule and/or Total Agreement Price. Any such adjustment in the Total Agreement Price or Project Schedule shall be mutually satisfactory to Buyer and Seller. Price increases and/or extensions of time shall not be binding upon either Party unless and until evidenced by a Change Order signed by the parties hereto.

E. **Product Discontinuance**. Subject to its obligation to fulfill its obligations set forth in the Agreement, Seller reserves the right to change or to discontinue any product covered by the Agreement provided that Seller agrees to make available to the Buyer a functionally equivalent replacement product equal to or better than the product discontinued.

F. **Frequency Support and Frequency Changes.** Seller shall reasonably support Buyer in submitting the Buyer's frequency licensing applications to the regional authorities and the FCC for this project. In the event that, after all commercially reasonable efforts and due diligence have been expended, the Buyer cannot obtain all of the necessary United States and Canada government approvals for the frequency plan as described in this Statement of Work and this Agreement, it shall be treated as an excusable delay event pursuant to the Excusable Delays section of this agreement for which an extension to the Project Schedule shall be granted, and Seller will diligently and expeditiously prepare and provide to Buyer a System re-design for its review and approval including all price and Project Schedule changes. Notwithstanding anything to the contrary contained in the Agreement, the Parties agree if a System re-design has a material impact on the cost of Work performed by Seller under the Agreement and/or the schedule, the Parties agree that that Seller may be entitled to an equitable adjustment to the Total Agreement Price and/or the Project Schedule for Seller's services on any such System re-design. Any such adjustment in the Total Agreement Price or Project Schedule shall be mutually satisfactory to Buyer and Seller. Price increases and/or extensions of time shall not be binding upon either Party unless and until evidenced by a Change Order signed by the parties hereto. In the event that Buyer and Seller cannot mutually agree on the System re-design, either party may then terminate the Agreement on thirty (30) days written notice to the other Party.

SECTION 9. PAYMENTS:

A. The Total Agreement Price for the Hardware, the Software license and the Services shall be paid by the Buyer to Seller as follows:

A.1. Infrastructure Hardware:

1. Twenty percent (20%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due at the time of the signing of the Agreement by the Buyer and Seller.
2. Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due at the time of the first System design review meeting.
3. Twenty percent (20%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due at the time of Infrastructure Hardware factory staging as described in the project schedule.
4. Thirty percent (30%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due at the time of

Infrastructure Hardware shipment and delivery to Buyer. Partial payments of the total Infrastructure Hardware amount due under this subparagraph shall be allowed and shall be calculated using the value of the Infrastructure Hardware shipped and delivered as a percentage of the total value of the Infrastructure Hardware to be shipped and delivered under the terms of this Agreement. The Buyer shall have the right to inspect and confirm that the Infrastructure Hardware included in Seller's invoice has been delivered to Buyer.

5. Fifteen percent (15%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon substantial completion of the Hardware installation (exclusive of the mutually agreed upon value of any punchlist items).

6. Five percent (5%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) plus any remaining unpaid portion of the Total Agreement Price for all Hardware, Software and Services to be provided under the terms of this Agreement (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon final Acceptance of the System.

A.2. Terminal Hardware:

1. One Hundred Percent (100%) of the purchase price of Terminal Hardware shall be invoiced upon shipment of unit on a per unit basis.

B. Invoices and Electronic Funds Transfer

Unless otherwise agreed by the parties, Seller shall electronically submit invoices using Seller's standard invoice template. Buyer shall pay all invoices via Electronic Funds Transfer ("EFT") directly to Seller's banking institution using Seller's banking information and EFT instructions below.

L3Harris Technologies, Inc.
Bank of America, New York, NY 10038
Account No.: 4451124230
Routing/ABA (ACH ONLY): 111000012
Routing/ABA (Wire ONLY): 026009593

C. Payment Dates

The Seller shall provide an invoice to the Buyer for services rendered and the Buyer shall approve and thereafter pay any undisputed portions thereof in accordance with the Illinois Local Government Prompt Payment Act (50 ILCS 505/1 et. seq). Approved, but unpaid invoiced amounts shall accrue interest in the manner and to the extent authorized by the Act."

SECTION 10. SUBCONTRACTING:

Upon prior written permission from the Buyer, Seller may subcontract any portion of Work to be performed by Seller hereunder provided that Seller shall be responsible for the performance and Work of any such subcontractors.

SECTION 11. EXCUSABLE DELAYS:

A. Seller shall not be liable for delays in Project delivery, Project cost increases, or failure to perform due directly or indirectly to Acts of God, acts (including failure to act) of any governmental authority (de

jure or de facto), wars (declared or undeclared), riots, revolutions, strikes or other labor disputes, fires, floods, sabotage, nuclear incidents, earthquakes, storms, epidemics; Seller's inability to timely obtain necessary materials, items, components or services at quoted prices from suppliers who are affected by the foregoing circumstances; other causes beyond Seller's reasonable control; or Buyer delays in performance of its obligations hereunder in a timely manner (individually "Excusable Delay"). The foregoing shall apply even though any of such causes exists at the time of signature of the Agreement or occurs after delays in Seller's performance of its obligations due to other causes.

B. In the event of any Excusable Delay, Seller shall as soon as practical notify Buyer and diligently after such notice, specify the revised delivery, pricing, and performance dates. In the event of such delay, the time of delivery, pricing, or performance dates shall be extended for a reasonable time period to compensate for the impact to Seller by reason of the delay.

SECTION 12. SELLER'S INSURANCE:

A. In order to protect itself and Buyer, its officers, boards, commissions, agencies, employees and representatives under the indemnity and other provisions of this Agreement, Seller shall obtain and at all times during the term of this Agreement keep in full force and effect comprehensive general liability and auto liability insurance policies issued by a company or companies authorized to do business in the State of and licensed by the Insurance Department, with liability coverage provided for therein in the amounts of at least $1,000,000.00 CSL (Combined Single Limits). Coverage afforded shall apply as primary. Within ten (10) days after execution of this Agreement, Seller shall furnish Buyer with a Certificate of Insurance listing Buyer as an additional insured. Seller shall maintain coverage for the duration of this Agreement and for two years following the completion of this Agreement. Seller shall furnish Buyer, annually on the policy renewal date, a Certificate of Insurance as evidence of coverage. It is further agreed that Seller shall furnish the Buyer with a 30-day notice of cancellation or renewal. Seller shall furnish evidence of adequate Worker's Compensation Insurance.

B. In case of any sublet of Work under this Agreement, Seller shall furnish evidence that each and every subcontractor has in force and effect insurance policies providing coverage substantially equal to that required of Seller.

C. The parties do hereby expressly agree that Buyer, acting at its sole option and through its Risk Manager, may waive any and all requirements contained in this section Seller's Insurance, such waiver to be in writing only. Such waiver may include or be limited to a reduction in the amount of coverage required above. The extent of waiver shall be determined solely by Buyer's Risk Manager taking into account the nature of the Work and other factors relevant to Buyer's exposure, if any, under this Agreement.

SECTION 13. TESTING AND ACCEPTANCE:

A. Seller shall notify Buyer that the System is ready for Acceptance Tests at least ten (10) days before commencement of the Acceptance Tests. Buyer and Seller shall jointly commence the Acceptance Tests on the date specified in Seller's notice (or other mutually agreeable date) and a representative of Seller and a representative of Buyer shall sign off on the form provided as part of the test procedure whether each item of the test was passed or failed. If the System does not fulfill the requirements of the Acceptance Tests, Seller shall correct the defects at no additional cost to Buyer as soon as practicable. Upon correction of the defects the Acceptance Tests for the applicable part of the System shall be repeated in accordance with the procedures set forth in this Section. Successful completion of the Acceptance Test is the sole criterion for technical System Acceptance and the initiation of the Warranty Period. Final System Acceptance shall occur when the Hardware and Software for the

System, Documentation Deliverables and Services have been furnished, delivered, installed and the Acceptance Tests have been passed.

B. Notwithstanding the Acceptance testing of the System set forth in subsection A above, if Buyer commences use of any portion of the System for its intended purpose, other than for the express purpose of training or testing as mutually agreed upon by Seller and Buyer in writing, prior to System Acceptance, the applicable portion of the System shall be deemed accepted by Buyer. The final payment for the applicable portion of the System shall be due and payable upon such Acceptance. The Warranty Period for the applicable portion of the System put into use together with the associated installation Services shall be deemed to have commenced concurrently with the use of the applicable portion of the System for its intended purpose. The use of the applicable portion of the System for its intended purpose shall be deemed to have occurred when Buyer commences to use and rely primarily on the applicable portion of the System for its communications.

C. As used in the Agreement, the term "Acceptance Date" shall mean and "Acceptance" of the System shall be deemed to occur upon the earlier of: (1) the date on which the System is deemed accepted pursuant to subsection (A) above, or (2) the date on which the System is deemed accepted pursuant to subsection (B) above.

D. Buyer and Seller agree that in the process of completing the Acceptance Tests, most if not all of the Acceptance Tests can be successfully completed with only a minor number of punchlist items remaining to be completed. In such event, Buyer and Seller shall mutually (and reasonably) agree upon the punchlist items to be completed, the value of those items and that "Conditional Acceptance" of the System has occurred. For the purpose of initiating the Warranty Period, satisfying the Project Schedule requirements and the release of any retained funds (other than the value of the punchlist items) conditional Acceptance shall constitute "Acceptance" of the specific portion or phase of the System. Conditional Acceptance shall not, however, release Seller from its obligations to complete the remaining punchlist items by the dates set forth on the punchlist schedule.

E. Terminal Hardware shall be deemed accepted upon Buyer's receipt of delivery at a Buyer-controlled facility, together with a bill of sale or other reasonably requested evidence of title.

SECTION 14. SOFTWARE LICENSE.

Subject to the terms and conditions of the Software License Agreement attached hereto as an exhibit to this Agreement, Buyer is granted a license to use the Software only in conjunction with the System purchased under this Agreement. "Software" means the "Licensed Programs" as defined in the Software License Agreement.

SECTION 15. COVERAGE:

Seller's representations concerning the distance at which usable radio signals will be transmitted and received by Hardware supplied hereunder are set forth in the Statement of Work. Coverage for the System shall be measured as provided in the Testing and Acceptance section of this Agreement.

SECTION 16. WARRANTIES:

A. Hardware and Services

Seller warrants for the following periods of time from the Acceptance Date (hereinafter referred to as the "Warranty Period"), that the Hardware and installation Services furnished

by Seller under this Agreement shall be free from defects in material and workmanship and shall conform to the Agreement specifications. Any Services provided during the Warranty Period are set forth in the Statement of Work. Any and all claims for breach of this warranty are conclusively deemed waived unless made within the Warranty Period.

1. for mobile and portable radios, twenty-four (24) months.
2. for all other Hardware, one (1) year.

B. For purposes of this Warranty the batteries supplied by Seller shall be deemed defective if: (1) the battery capacity is less than 80% of rated capacity, or (2) the battery develops leakage. Replacement batteries shall be warranted only for the remaining unexpired portion of the Warranty Period. This warranty becomes void if: (1) the battery has been subjected to any kind of misuse, detrimental exposure, or has been involved in an accident, or (2) the battery is used in equipment or service other than the Hardware for which it is specified.

C. During the Warranty Period if any component of the Hardware or portion of the installation Services fails to meet the foregoing warranties, Seller's sole obligation and Buyer's exclusive remedy under this warranty shall be the correction by Seller of the failure. Seller shall, at Seller's sole option, (1) repair any defective component of the Hardware, or (2) furnish necessary repaired, refurbished, or replacement parts, or (3) correct the faulty installation. Seller will be responsible for all shipping charges incurred in returning defective parts to Seller's facility and the shipping charges to return repaired, refurbished, or replacement parts to Buyer. Any such repair or replacement of the defective component or the redoing of any installation shall not extend the Warranty Period. All warranty work must be at the Seller's place of business, for mobile or portable equipment, or at the Buyer's location for fixed location equipment. Where such failure cannot be corrected by Seller's commercially reasonable efforts, Seller will refund to Buyer the fees paid for the parts or Hardware less depreciation.

D. Any additional purchases of equipment, including radios, and installation services which may be purchased by Buyer and delivered or performed by Seller after System Acceptance, shall be warranted on the same terms, limitations, and exclusions as are set forth herein, except that the warranty on the equipment and installation services shall be for a period of two (2) years for additional Terminal Hardware items from the date of delivery of that item of equipment, one (1) year for additional Infrastructure Hardware items from the date of delivery of that item of equipment, and one (1) year from the date of completion of that installation service.

E. Seller's obligations shall not apply to: (1) Hardware or components thereof which are normally consumed in operation, or, or (2) defects which are the result of improper storage, use, or installation performed by other than Seller, maintenance performed by other than Seller, or repair performed by other than Seller, or (3) Hardware which has been subjected to any other kind of misuse or detrimental exposure or has been involved in an accident, or (4) Hardware or installations altered or repaired by any party other than Seller without Seller's prior written consent.

F. **Coverage Warranty.** Notwithstanding the other provisions of this Section Warranties, Seller's only Warranty as to radio coverage is that the System, prior to Acceptance, shall have successfully passed the coverage tests in the Acceptance Test Plan.

G. **Software**

The warranty for the Software is set forth in the Software License Agreement.

H. THE WARRANTIES AND REMEDIES SET FORTH IN THIS SECTION AND IN THE SOFTWARE LICENSE AGREEMENT CONSTITUTE THE ONLY WARRANTIES WITH RESPECT TO THE HARDWARE, SOFTWARE AND SERVICES AND THE BUYER'S

EXCLUSIVE REMEDIES IN THE EVENT SUCH WARRANTIES ARE BREACHED. THEY ARE IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL, EXPRESS, IMPLIED, OR STATUTORY INCLUDING, WITHOUT LIMITATION, THE WARRANTY OF MERCHANTABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

SECTION 17. INTERFERENCE:

Radio System coverage and performance are subject to degradation or disruption due to anomalous propagation and interference by natural phenomena or other radio Systems ("Outside Interference"). Seller cannot be responsible for Outside Interference over which the Seller has no reasonable control. In the event of a case of degradation or disruption due to Outside Interference by natural phenomena or an outside party, Seller will provide engineering support to Buyer at Buyer's expense to support Buyer's efforts in investigating and resolving the Outside Interference.

SECTION 18. INDEMNIFICATION:

A. Seller shall be responsible for and agrees to indemnify, hold harmless and defend the Buyer and its boards, commissions, agencies, officers and employees from and against all liability, losses, damages, costs or expenses which the Buyer and its boards, commissions, agencies and employees may sustain, incur or be required to pay by reason of third party claims, demands and causes of action for damages resulting from personal injuries, loss of life or damage to tangible property to the extent resulting from the willful misconduct or negligent acts or omissions of Seller, Seller's officers, agents, employees, or subcontractors. Buyer agrees to notify Seller in writing as soon as practical of any third party claim, demand or cause of action for which Buyer will request indemnification from Seller. Buyer will provide Seller with the necessary information and assistance to defend or settle such claim, demand or cause of action. The obligations of Seller under this paragraph shall survive the expiration or termination of this Agreement.

SECTION 19. PATENTS:

A. Seller warrants that the System furnished hereunder shall be delivered free of any rightful claim of any third party for infringement of any United States patent or copyright. If Buyer notifies Seller of the receipt of any claim that the System infringes a United States patent or copyright and gives Seller information, assistance and exclusive authority to settle and defend such claim, Seller at its own expense shall defend, or may settle, any suit or proceeding against Buyer so far as based on a claimed infringement which breaches this warranty. If, in any such suit arising from such claim, the continued use of the System for the purpose intended is enjoined by any court of competent jurisdiction, Seller shall, at its expense and option, either: (1) procure for Buyer the right to continue using the System, or (2) modify the System so that it becomes non-infringing, or (3) replace the System or portions thereof so that it becomes non-infringing, or (4) remove the System and refund the purchase price (less reasonable depreciation for use). The foregoing states the entire liability of Seller for patent or copyright infringement by the System and is subject to any limitation of total liability set forth in this Agreement.

B. The preceding subsection (A) shall not apply to: (1) any portion of the System which is manufactured to Buyer's design, or (2) the use of the System in conjunction with any other apparatus or material not supplied by Seller to the extent that such conjoined use causes the alleged infringement. As to any portion of the System or use described in the preceding sentence, Seller assumes no liability whatsoever for patent infringement.

C. THE PATENT AND COPYRIGHT WARRANTY AND INDEMNITY OBLIGATIONS RECITED ABOVE ARE IN LIEU OF ALL OTHER PATENT AND COPYRIGHT WARRANTIES AND INDEMNITIES WHATSOEVER, WHETHER ORAL, WRITTEN, EXPRESS, IMPLIED OR STATUTORY.

SECTION 20. LIMITATION OF LIABILITY:

A. Except for Seller's liability to third parties for its willful misconduct or negligent acts or omissions as more particularly described in the Indemnification Section of this Agreement, the total liability of Seller, including its subcontractors or suppliers, for all claims of any kind for any loss or damage, whether in contract, warranty, tort (including negligence or infringement), strict liability or otherwise, arising out of, connected with, or resulting from the performance or non-performance of this Agreement or from the manufacture, sale, delivery, installation, technical direction of installation, resale, repair, replacement, licensing or use of any Hardware, Software or the furnishing of any Service, shall not exceed the amount paid by Buyer allocable to the particular item of Hardware, Software or Service which gives rise to the claim. Except as to title, any such liability shall terminate upon the expiration of the Warranty Period.

B. Except in cases of recklessness, or willful misconduct, WHETHER AS A RESULT OF BREACH OF AGREEMENT, WARRANTY, TORT (INCLUDING NEGLIGENCE OR INFRINGEMENT), STRICT LIABILITY OR OTHERWISE, SHALL SELLER, OR ITS SUBCONTRACTORS OR SUPPLIERS, BE LIABLE FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, INDIRECT OR EXEMPLARY DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR REVENUES, LOSS OF USE OF THE HARDWARE OR ANY OTHER EQUIPMENT, COST OF CAPITAL, COST OF SUBSTITUTE GOODS, FACILITIES, SERVICES OR DOWNTIME COSTS.

C. Any action for any claim of any kind for any loss or damages arising out of, connected with, or resulting from the performance, non-performance or breach of the Agreement, or from the manufacture, sale, delivery, installation, technical direction of installation, resale, repair, replacement, licensing or use of any Hardware, Software or the furnishing of any Services, shall be commenced within one (1) year after the cause of action accrued or it shall be deemed waived or barred.

D. The provisions of this Section, LIMITATION OF LIABILITY, shall apply notwithstanding any other provisions of this Agreement or any other agreement.

E. The provisions of this Section, LIMITATION OF LIABILITY, shall survive the expiration or termination of this Agreement.

SECTION 21. REMEDIES:

A. In the event of a material breach of this Agreement by Seller which shall continue for one hundred twenty (120) or more days after written notice of such breach (including a reasonably detailed statement of the nature of such breach) shall have been given to Seller by Buyer, Buyer shall be entitled to avail itself cumulatively of any and all remedies available at law or in equity and either: (1) suspend performance of its payment obligations under the Agreement for as long as the breach continues uncorrected; or (2) terminate this Agreement by written notice to Seller if the breach remains uncorrected. The following shall constitute material breaches of this Agreement:

1. violation by Seller of any State, Federal or local law, or failure by Seller to comply with any applicable States and Federal service standards, as expressed by applicable statutes, rules and regulations.

2. failure by Seller to carry applicable licenses or certifications as required by law.
3. failure of Seller to comply with reporting requirements contained herein.
4. inability of Seller to perform the Work provided for herein.

B. In the event of: (1) any failure by Buyer for thirty (30) or more days to make any payment when due, or (2) any other material breach of this Agreement by Buyer which shall continue for one hundred twenty (120) or more days after written notice of such breach (including a reasonably detailed statement of the nature of such breach) shall have been given to Buyer by Seller, Seller shall be entitled to avail itself cumulatively of any and all remedies available at law or in equity and either: 1) suspend performance of its obligations under this Agreement for as long as the breach remains uncorrected; or (2) terminate this Agreement by written notice to Buyer if the breach remains uncorrected.

C. In the event of a termination under this Agreement as provided herein, all Services performed and finished and unfinished Hardware and Documentation Deliverables produced or made by Seller for Buyer, up to and including the date of termination, shall become the property of Buyer and Seller shall be entitled to receive full price accrued up to the point of termination, for any such Services performed and finished and unfinished Hardware and Documentation Deliverables. Notwithstanding the above, Seller shall not be relieved of liability to Buyer for damages sustained by Buyer by virtue of any breach of this Agreement by Seller described in subsection A above and, after providing Seller with written notice of breach as set forth in subsection A, Buyer may withhold any payments to Seller for the purpose of set-off of any damages, as agreed upon or finally adjudicated, against such payment.

SECTION 22. CONFIDENTIALITY:

A. During the term of this Agreement, it is anticipated that one party (hereafter the "Disclosing Party") may disclose to the other party (hereafter the "Receiving Party") information which the Disclosing Party considers proprietary and confidential. Accordingly, with respect to any specification, drawings, sketches, models, samples, tools, technical information, confidential business information or data, in written or other tangible form which: (1) has been designated in writing by the Disclosing Party as confidential or proprietary, or (2) is of the type that the Receiving Party customarily treats as confidential or proprietary, and which is furnished by the Disclosing Party to the Receiving party in contemplation of or under this Agreement (hereinafter "Information"), the Receiving Party shall treat such Information, for a period of five (5) years after the Effective Date of this Agreement, as confidential information with the same degree of care as the Receiving Party affords to confidential information of its own of a similar nature and shall not reproduce any such Information, in whole or in part, except as specifically authorized in writing by the Disclosing Party.

B. The provisions of the preceding subsection shall not apply to any Information which:
1. is or shall become publicly available without breach of this Section Confidentiality, on the part of the Receiving Party;
2. is already known by the Receiving Party prior to receipt from the Disclosing Party;
3. is independently developed by the Receiving Party;
4. is rightfully obtained by the Receiving Party from third parties without restriction; or
5. is required to be disclosed by appropriate governmental or judicial order provided that Receiving Party gives Disclosing Party prior written notice of such order and assists Disclosing Party in taking reasonable actions to restrict such order.

C. The provisions of this Section, Confidentiality, shall survive the expiration or termination of this Agreement.

D. The confidentiality obligations of this Section, Confidentiality, shall not apply to Software, the confidentiality and other rights and obligations with respect to which are set forth in the Software License Agreement.

E. Except as required to fulfill its obligations under this Agreement, Seller will have no obligation to provide Buyer with access to its Confidential Information and/or proprietary information. Under no circumstances will Seller be required to provide any data related to cost and pricing.

F. Notwithstanding the foregoing, as a public body, the Buyer's records are governed by the Illinois Freedom of Information Act (5 ILCS 140/1), which provides that any public records in its possession are subject to inspection by the public. Therefore, unless a statutory exemption applies, records relating to this contract are considered public records under FOIA and therefore not confidential. To the extent Seller may be performing a governmental function on behalf of the Buyer, records in Seller's possession that relate to this contract, unless exempt under FOIA, may also be considered public records subject to inspection by the public. Therefore, Seller agrees to cooperate with the Buyer in the event a FOIA request for such records is received, and agrees to provide the Buyer with the requested records within two (2) business days.

SECTION 23. COMPLIANCE:

Seller agrees to comply with all federal, state and local laws, ordinances, codes, rules and regulations in effect as of the Effective Date of this Agreement that may in any way affect the Work by Seller hereunder. Any Hardware or Software furnished by Seller under this Agreement shall comply in all material respects with federal, state and local laws and regulations applicable to the manufacture, packing, sale and shipment of such Hardware or Software as of the Effective Date of this Agreement and shall comply with any amendments thereto which may have come into effect prior to the time such Hardware or Software are delivered provided that the price and, if necessary, delivery of such Hardware or Software shall be equitably adjusted to compensate Seller for the effect of compliance with any such amendments.

SECTION 24. NOTICES:

Notices and other communications between the parties shall be transmitted in writing by certified mail or nationally recognized overnight courier service to the parties at the addresses set forth below and shall be deemed effective upon receipt by the receiving party. Either party may change its address by giving notice in writing thereof to the other party.

IF TO BUYER:
_____
_____
_____
Attn: _____

IF TO SELLER:
L3Harris Technologies, Inc.
221 Jefferson Ridge Parkway
Lynchburg, Virginia 24501
Attn: [Program Manager]

WITH A COPY TO:
City of Aurora _____
44 E Downer Place_____
Aurora, Illinois_____
Attn: Law Department

WITH A COPY TO:
L3Harris Technologies, Inc.
221 Jefferson Ridge Parkway
Lynchburg, Virginia 24501
Attn: Tim Nalepka, Contracts Manager

BUYER INVOICE CONTACT:

_____
_____
_____
Attn: _____

SELLER INVOICE CONTACT:
L3Harris Technologies, Inc.
221 Jefferson Ridge Parkway
Lynchburg, Virginia 24501
Attn: April Gallagher
434-455-9272 /
april.gallagher@l3harris.com

SECTION 25. ORDER OF PRECEDENCE:

The Statement of Work and the following Exhibits are expressly incorporated herein by reference and, together with this Agreement, constitute the Agreement Documents. In the event of a conflict among or between the Agreement Documents, the documents shall control in the order of precedence set forth below:

1. Amendments to this Agreement
2. This Agreement (not including the Exhibits and documents listed below)
3. Detailed Design Documents
4. **Exhibit A** - Statement of Work, with Attachments
5. **Exhibit B** - Software License Agreement

SECTION 26. TERM:

The term of this Agreement shall commence upon the Effective Date of this Agreement and shall run through the Expiration Date. The term of the Software license is set forth in the Software License Agreement.

SECTION 27. ENTIRE AGREEMENT:

The entire agreement of the parties is contained herein and this Agreement supersedes any and all oral agreements and negotiations between the parties relating to the subject matter hereof.

SECTION 28. AMENDMENT:

The parties expressly agree that this Agreement shall not be amended in any fashion except in a writing(s) executed by authorized representatives of both parties.

SECTION 29. SEVERABILITY:

The invalidity, in whole or in part, of any Section or part of any Section of this Agreement shall not affect the validity of the remainder of such Section or the Agreement.

SECTION 30. WAIVER:

No term of this Agreement may be waived except in a writing signed by the party waiving enforcement. No term of this Agreement shall be deemed to be waived by reason of any failure to previously enforce such term. In no event shall the making of any payment required by this Agreement constitute or be construed as a waiver by Buyer of any breach of the covenants of this Agreement or a waiver of any default of Seller and the making of any such payment by Buyer while any such default or breach shall exist shall in no way impair or prejudice the right of Buyer with respect to recovery of damages or other remedy as a result of such breach or default.

SECTION 31. HEADINGS:

Section headings are inserted for convenience only and shall not be used in any way to construe the meaning of terms used in this Agreement.

SECTION 32. GOVERNING LAW:

This Agreement shall be governed by the laws of the State of Illinois, without reference to its conflict of laws provisions. The provisions of the United Nations Convention on the International Sale of Goods shall not apply to this Agreement. The exclusive for a for any litigation arising out of this Agreement shall be the United States District Court for the Northern District of Illinois (Eastern Division) or the Circuit Court of the Sixteenth Judicial Circuit, Kane County Illinois."

SECTION 33. ASSIGNMENT; SUCCESSORS AND ASSIGNS:

This Agreement shall not be assigned nor any interest or obligation in this Agreement transferred by either Party without the written consent of the other Party, which shall not be unreasonably withheld or delayed. Notwithstanding the above, Seller may assign this Agreement, without consent, (a) in whole or in part, to an affiliate, subsidiary, or authorized reseller or (b) in the event of a change of controlling ownership interest (either directly or indirectly) in Seller or in the event of merger, recapitalization, consolidation, other business combination or sale of all or substantially all of the assets of Seller. In addition, Seller may also assign or transfer, without consent, claims for money due or to become due Seller from Buyer under this Agreement to a bank, trust company or other financial institution if and only if the instrument of assignment contains a provision substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to Seller shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the Work called for in this Agreement. Seller shall promptly provide to Buyer notice of any such permitted assignment or transfer without consent.

[*Signature Page Follows*]

IN WITNESS WHEREOF, Buyer and Seller have executed this Agreement.

BUYER
CITY OF AURORA

By: _____

Name: _____

Title: _____

Date: _____

SELLER
L3HARRIS TECHNOLOGIES, INC.
ACTING THROUGH ITS
COMMUNICATION SYSTEMS SEGMENT

By: _____

Name: Tim Nalepka

Title: Contracts Manager

Date: December 12, 2023

LIST OF EXHIBITS

Exhibit A - STATEMENT OF WORK (with Attachments)
Exhibit B - SOFTWARE LICENSE AGREEMENT

EXHIBIT A

STATEMENT OF WORK

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SYSTEM DESCRIPTION

TABLE OF CONTENTS

SYSTEM DESCRIPTION

L3Harris is pleased to offer the City of Aurora an upgrade of the existing SR10A.4 OpenSky Network Switching Center (NSC) to a SR10A.7 P25 trunked simulcast LMR solution. For a period of time, these two separate LMR networks will interoperate via the VIDA® (Voice, Interoperability & Data Access) NSC (Network Switching Center). Additionally, Aurora's existing Symphony Consoles will be upgraded and migrated to the SR10A.7 P25 system.

It is L3Harris' goal to partner with the City of Aurora to deliver unified emergency communication services to users via a highly reliable, redundant network with excellent coverage and superior performance. The network solution utilizes L3Harris' latest technologies, which include: P25 Trunked Simulcast operation, IP-based network switching, centralized network management, and integrated interoperability solutions.

VIDA provides the ability to combine these technologies into one highly integrated, highly available system, offering City of Aurora a single unified architecture for linking the various technologies present in the system today with the technologies of tomorrow.

AURORA SOLUTION

- Seamless transitioning from OpenSky to P25
- Continuous operation of both OpenSky and P25 on the same VIDA core
- P25 Trunked Simulcast 700MHz LMR system with guaranteed coverages throughout the City's service area
- High availability, redundant network controller
- IP-centric solution that is future-ready
- Logging recorders
- Converged Broadband voice infrastructure capable of both Wi-Fi and LTE operation on 20 portables and 20 mobiles
- BeOn® clients

L3Harris makes communications projects simpler with our customer's goals at the forefront. Our VIDA solution is scalable and can easily accommodate more sites, users, sub-systems, and additional interoperability interfaces with other entities. IP-centric solutions are meant to ease installation and transition burdens and provide a flexible path to future technologies that avoid costly "forklift type" upgrades.

The L3Harris Advantage

The L3Harris design provides the City of Aurora a focused solution that outlines the following benefits:

- **Reliability, Outstanding Value** – The new P25 Phase 2 trunked, 700MHz simulcast system is designed to minimize single points of failure. Included in the base offering are geographically-redundant Network Switching Center (NSC) cores to provide redundancy and survivability – not simply two servers in the same room. L3Harris recommends the primary core to be located at Aurora Police Headquarters and the secondary core to reside at Fire Station 8. However, the City of Aurora can locate the NSCs anywhere within the system as long as adequate space and backhaul service is available. Our non-proprietary, commercial-off-the-shelf (COTS) equipment provides ease of upgrade and mitigates system obsolescence. System redundancy is provided through the utilization of two distributed control points, dual routers, and redundant switches,

which will maintain real-time connectivity and status with the high availability (HA) network switching cores. At the RF sites, dual integrated site access router/switches are configured to enhance system availability.

- **Guaranteed Coverage** – The new P25 system's coverage solution shall provide increased portable on-street and in-building coverage throughout the service area.
- **Interoperability** – The new P25 system will allow interoperable communications with the existing OpenSky network along with neighboring jurisdictions, agencies, and schools with the included Pathway+ interoperability gateways. Interoperable communications with the City of Naperville is possible with the included inter sub-system interface (ISSI) once Naperville's system is ISSI-ready.
- **Next Generation Consoles** – L3Harris understands the critical role that dispatchers play during life safety events, and it requires a platform that is intuitive and minimizes the time it takes for each task. The existing proven Symphony dispatch console shall be migrated to the new P25 core, eliminating training for the end user, and providing a cost savings for Aurora. Consoles will run Symphony software on the Symphony hardware platform.
- **BeOn®** – The BeOn® app brings full Push-to-Talk (PTT) services to any smart phone, tablet, XL radio, or PC operating on broadband networks such as Wi-Fi or LTE. BeOn® can be used to enhance coverage in critical buildings eliminating the need for BDAs (bi-directional amplifier) or vehicular repeaters and to expand the City of Aurora's coverage to anywhere with broadband connectivity.

Figure 1. The L3Harris VIDA Architecture

Proposed System Offering

L3Harris is pleased to provide the City of Aurora with a P25 Phase 2 Trunked Simulcast solution. The simulcast system is comprised of a six (6) RF sites, each with seven (7) Phase 2 channels. For purposes of redundancy, the system also has two (2) Distributed Control Points (DCP), for simulcast control, as well as two geographically redundant VIDA NSCs.

L3Harris understands that the existing OpenSky infrastructure will remain in place for an extended period of time.

A detailed "Ansible" system audit was not performed due to the limitations of legacy system, however, L3Harris has utilized "as-built" documentation and a high-level system audit to determine existing system platform and hardware compatibility.

The system block diagram is shown in Figure 2.

Proposed System Components

The following equipment and services are included.

- Two high-availability, geographically redundant, VIDA Premier Network Switching Center Cores (NSC) using the latest virtual machine (VM) technology.
- Two System Management Terminals (SMTs) with password permitted access to VIDA Core services. Terminals are password protected so multiple users can access.
- Six P25 Trunked Simulcast RF sites, with seven, Phase 2 channels, utilizing 700MHz Two47 repeaters.
- A fleet of radios XL-200M mobiles and XL-200P portables operating on 7/800 MHz. A subset of each will also be LTE capable[1].
- One BeOn® virtual server with Enterprise Package for client licenses. BeOn® provides the ability to use smartphones or properly equipped XL radios over Wi-Fi or LTE networks to enhance coverage in hard-to-reach places like schools and hospitals. BeOn® can expand the coverage outside of its normal footprint with no additional capital investment and/or be used as a backup network.
- Eighteen (18) Pathway+ interoperability gateways, providing 36 talkpaths of DFSI or four-wire E&M connections.
- Upgrades to twenty-one (21) existing Symphony consoles
  - Network equipment
  - Upgraded Solid State Drive (SSD)
  - Upgrade to Windows 10
  - Update to Symphony application

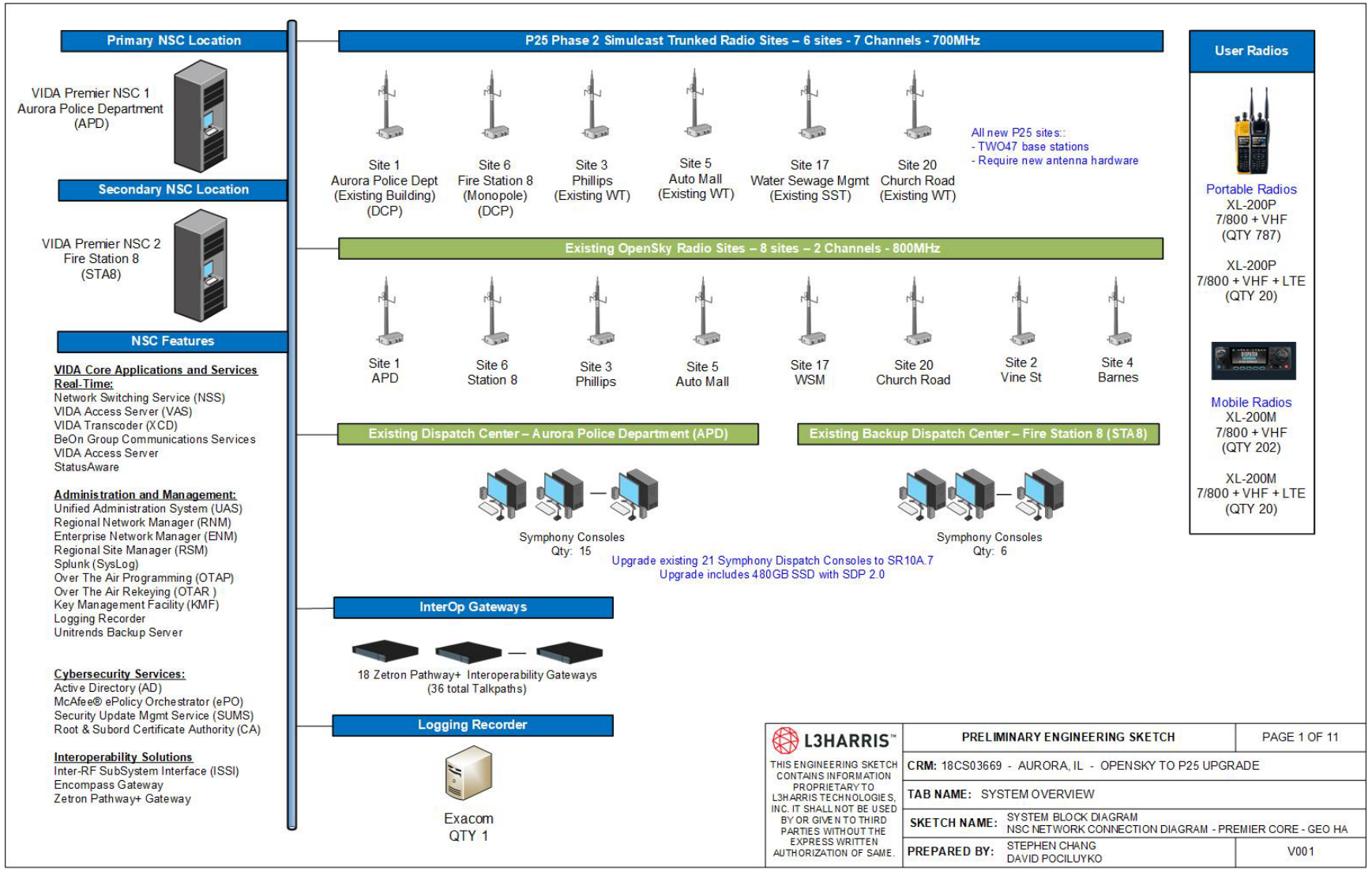
[1] *LTE is inherent in the design of the XL radio. It requires the radio to be equipped with the LTE modem and a data service from a cellular carrier. An LTE equipped radio is priced in the options section. L3Harris can set up the cellular service if the City decides to add LTE; broadband services are provided exclusively by L3Harris Mission Critical Services, LLC ("L3H MCS"), and will require a separate purchase order with L3H MCS. Please see your sales representative for more details.*

- One new Exacom logging recorder
- New MPLS based microwave backhaul system at six (6) locations. Each microwave station shall be collocated at the six (6) P25 RF site locations.
- L3Harris professional services are provided and include system engineering, project management, factory staging, installation, one-year standard warranty on infrastructure, and five-year warranty on subscriber radios.
- L3Harris shall provide new battery back-up DC plants only at the P25 radio sites.
- L3Harris shall conduct a grounding assessment as part of the site survey. The findings and recommended grounding upgrades shall be provided to the City of Aurora, so that the City may implement the upgrades to meet the current L3Harris grounding standard.
- New Mobile and Portable Radios. The details are in the Subscriber Radio section of this document.

The following will not be included.

- New uninterrupted power supplies (UPS). L3Harris assumes that the existing UPSs shall be sufficient for the P25 radio system's NSC and AC powered equipment.
- IP interconnect devices to the existing 4.9 GHz microwave system. L3Harris assumes Aurora will provide and maintain this connection.
- Bi-directional amplifiers (BDA).

Figure 2. System Block Diagram



System Design Overview

The system includes six (6) P25 radio site locations and two dispatch locations, located at Aurora Police Headquarters and at Fire Station 8. Figure 3 summarizes the functional components and equipment layout as shown in the City of Aurora system block diagram.

Figure 3. Functional Components and Layout

LOCATION	DESCRIPTION & VIDA EQUIPMENT	
AURORA POLICE HEADQUARTERS, 911 CENTER Primary VIDA Core/NSC, Interop site, RF Site with Distributed control point & Dispatch Center	Geographically separated Network Switching Servers; network management and control applications; network security application; BeOn® PTT over broadband Server. Firewall for VPN management and BeOn® access. Equipment: – VIDA Application Server 1 – Network Switching Server Application 1 (VM) – Unified Administration System 1 (VM) – Regional Network Manager 1 – Regional Site Manager 1 (VM) – Enterprise Network Manager (ENM 1) – Active Directory 1 (VM)	– Exacom IP Logging Recorder – Interoperability Gateways – BeOn® server (VM) – Inter-subsystem-Interface (ISSI) – Internet Firewall – One System Management Terminal – Redundant Router and Switch
FIRE STATION 8 DISPATCH CENTER Secondary VIDA Core/NSC, Interop site	Geographically separated Network Switching Server; network management and control applications; Firewall for VPN management. Equipment: – VIDA Application Server 2 – Network Switching Server Application 2 (VM) – Unified Administration System 2 (VM) – Regional Network Manager 2 – Regional Site Manager 2 (VM)	– Enterprise Network Manager (ENM 2) – Active Directory 2 (VM) – Interoperability Gateways – Internet Firewall – One System Management Terminal – Redundant Routers and Switches
AURORA POLICE HEADQUARTERS RF Site	– Seven 700MHz Two47 Stations – One 700MHz Transmit Antenna – One 700MHz Receive Antenna – One 7-Channel Transmit Combiner – One Distributed Control Point – One Receive Multi-coupler	– One Tower Top Amplifier – Redundant Router and Switch – DC Power Plant – MPLS Microwave Backhaul – Interoperability Gateways
AUTO MALL RF Site	– Seven 700MHz Two47 Stations – One 700MHz Transmit Antenna – One 700MHz Receive Antenna – One 7-Channel Transmit Combiner – One Receive Multi-coupler	– One Tower Top Amplifier – Redundant Router and Switch – DC Power Plant – MPLS Microwave Backhaul
CHURCH ROAD RF Site	– Seven 700MHz Two47 Stations – One 700MHz Transmit Antenna – One 700MHz Receive Antenna – One 7-Channel Transmit Combiner – One Receive Multi-coupler	– One Tower Top Amplifier – Redundant Router and Switch – DC Power Plant – MPLS Microwave Backhaul

LOCATION	DESCRIPTION & VIDA EQUIPMENT	
FIRE STATION 8 RF Site	– Seven 700MHz Two47 Stations – One 700MHz Transmit Antenna – One 700MHz Receive Antenna – One 7-Channel Transmit Combiner – One Distributed Control Point	– One Receive Multi-coupler – One Tower Top Amplifier – Redundant Router and Switch – DC Power Plant – MPLS Microwave Backhaul
PHILLIPS PARK RF Site	– Seven 700MHz Two47 Stations – One 700MHz Transmit Antenna – One 700MHz Receive Antenna – One 7-Channel Transmit Combiner – One Receive Multi-coupler	– One Tower Top Amplifier – Redundant Router and Switch – DC Power Plant – MPLS Microwave Backhaul
WATER SEWER MAINTENANCE RF Site	– Seven 700MHz Two47 Stations – One 700MHz Transmit Antenna – One 700MHz Receive Antenna – One 7-Channel Transmit Combiner – One Receive Multi-coupler	– One Tower Top Amplifier – Redundant Router and Switch – DC Power Plant – MPLS Microwave Backhaul

SYSTEM TRANSITION

L3Harris has developed a transition plan for migrating users to the P25 system that allows for flexibility without any loss of existing functionality on the existing OpenSky system. L3Harris understands that the City of Aurora would like to keep the Aurora OpenSky sites operational for the foreseeable future. This plan accommodates that request with minimal interruption to public safety operations. L3Harris plans to avoid a single “cutover” moment in which all users are migrated from OpenSky to P25 at once. Rather OpenSky users can communicate with P25 users, until the decommissioning of the OpenSky radio sites.

The legacy OpenSky system and P25 system can both be on-air without interfering with each other as they shall operate on different bands, 800MHz and 700MHz, respectively.

The migration plan is contingent on Aurora fulfilling the following requirements:

> Space is available to install and power up the microwave system (antenna systems, and site equipment).

> Space is available to install and power up the L3Harris radio system (antenna systems, pre-racked RF site equipment, DC power plant, and pre-racked NSC cabinets) in parallel with the existing OpenSky radio system equipment.

> The existing 4.9 GHz microwave link shall remain in place, so that the OpenSky only sites can connect to the VIDA core.

L3Harris assumes that the City of Aurora will make available microwave frequencies for the radio system.

> The microwave vendor shall be responsible for microwave radio licensing.

> The microwave system must be operational prior to L3Harris commissioning the SR10A.7 P25 system.

Upgrade Plan

The following steps outline the high-level upgrade plan for Aurora:

1. Perform site surveys (core and LMR) and implement contractual improvements based on survey findings.
2. Install new microwave system.
3. Build out the new P25 core and RF sites, which will be running version SR10A.7.
   - Install L3Harris VIDA Core equipment, both primary and secondary.
   - Install L3Harris radio site equipment.
     - Install radio equipment and DC power plant.
     - Install transmit and receive antennas for P25 system.
   - Install and configure interoperability systems (Pathway+ gateways & ISSI).
     - Test interoperability connections (Pathway+ gateways & ISSI to Naperville).
4. Test the P25 system.
   - Functional testing of radio system.
   - Coverage testing and coverage characterization.
5. Copy the database/sites from the OpenSky core to the SR10A.7 P25 core.
6. Bridge existing microwave to new microwave.
7. Migrate the existing Symphony Consoles from the OpenSky core to the SR10A.7 P25 core.
   - Consoles shall remain on SR10A.4.
   - Migrate consoles by disconnected from the old microwave and then connecting to the new microwave.
   - Test console on new SR10A.7 P25 core.
8. Transition a single OpenSky site from the OpenSky core to the SR10A.7 P25 core.
   - Migrate OpenSky site by disconnected from the old microwave and then connecting to the new microwave.
   - Test the OpenSky site on the SR10A.7 P25 core to ensure OpenSky functions properly.
   - Test communications on shared talkgroups between OpenSky and P25.
   - Test console patches between OpenSky sites and P25 sites.
9. Continue to transition remaining OpenSky sites, one-by-one, until all OpenSky sites are on the SR10A.7 P25 core.
10. The SR10A.7 P25 Core now supports OpenSky LMR sites and P25 LMR sites.
11. Transition users from OpenSky to P25, as desired.
12. OpenSky sites to be decommission and removed by Aurora when user migration is complete.

Coverage Solution

COVERAGE MODEL

L3Harris' internal toolset for propagation modeling is known as RAPTR (Radio Analysis and Propagation Tool Repository). RAPTR propagation modeling is compatible with Telecommunications Industry Association (TIA) Telecommunications Systems Bulletin TSB-88 "Wireless Communications Systems - Performance in Noise and Interference Limited Situations – Recommended Methods for Technology-Independent Modeling, Simulation, and Verification." RAPTR uses the Okumura-Hata-Davidson (OHD) model as described in TSB-88. Factors relating to environment and terrain combine to derive the total path loss value. RAPTR employs the Epstein-Peterson diffraction model in conjunction with the OHD model in a proprietary method to greatly enhance the path loss calculation. The diffraction calculations coupled with the environment database further increase the accuracy of the path loss calculation.

RAPTR uses a tile method for analyzing the propagation, a much more accurate method than the older radial method. Radial methods begin to lose resolution as the distance from the site increases; the distance increases between evaluation locations from radial to radial. The tile method uniformly predicts the coverage for a system by dividing the project area (i.e., County jurisdictional boundary area) into small areas called tiles. The size of the tiles used by RAPTR is three arc-seconds, approximately 300 feet per side. RAPTR models the propagation from a site to each tile in the project area. With the tile method, the interaction of signals from different sites can be more accurately determined. This increases the accuracy of evaluating coverage for simulcast systems, voting systems, multisite networks, interference, and handoff (roaming).

The RAPTR path loss calculation methods are the result of evaluating over 189,000 different propagation paths as part of an extensive data collection effort performed over a period of years. These paths encompassed a variety of terrain and environment features, ranging from over water paths, to flat terrain, to mountainous areas. It also included varying environmental conditions, ranging from highly urbanized areas to rural, open and forested areas. As a result, the propagation model has been refined to perform in all the conditions present in a land-mobile radio system. The model is accurate from flat terrain to highly rugged mountainous terrain, and from urban to rural areas.

TERRAIN DATABASE

The accuracy of any coverage prediction is to a large degree dependent upon the terrain data available for the project. RAPTR makes use of three arc-second database derived from the United States Geological Survey (USGS) Digital Elevation Model (DEM) data that provides high resolution and accuracy, both spatially and in elevation. More recent USGS 30-meter data can supplement the database providing higher degrees of resolution and accuracy. The 30-meter data incorporates into the main RAPTR terrain database using methods described in TSB-88. L3Harris uses thirty-meter data when available from the USGS for analyzing the coverage design and predictions.

The terrain data can be displayed within RAPTR to give system designers the ability to locate sites based on elevation. The terrain can be displayed in either an aerial view, as a colored contour map or combined as shown in Figure 4 and Figure 5.

Figure 4. City of Aurora Terrain Data

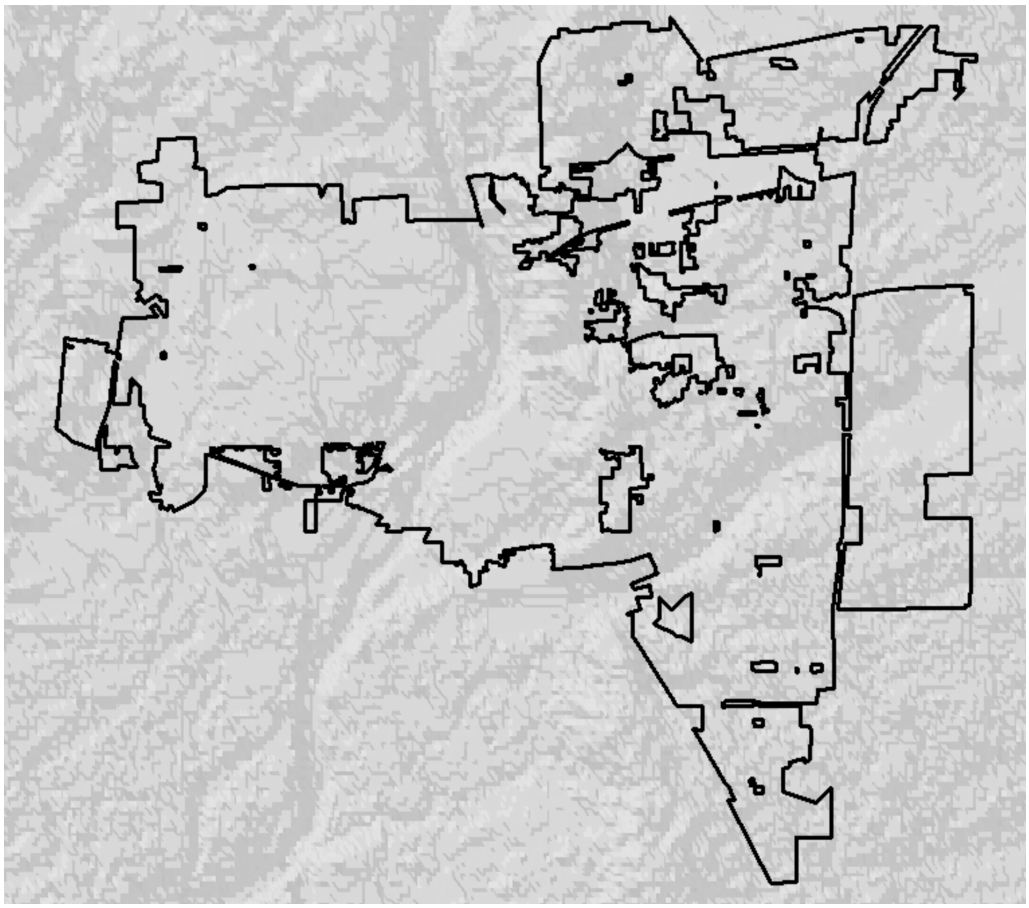
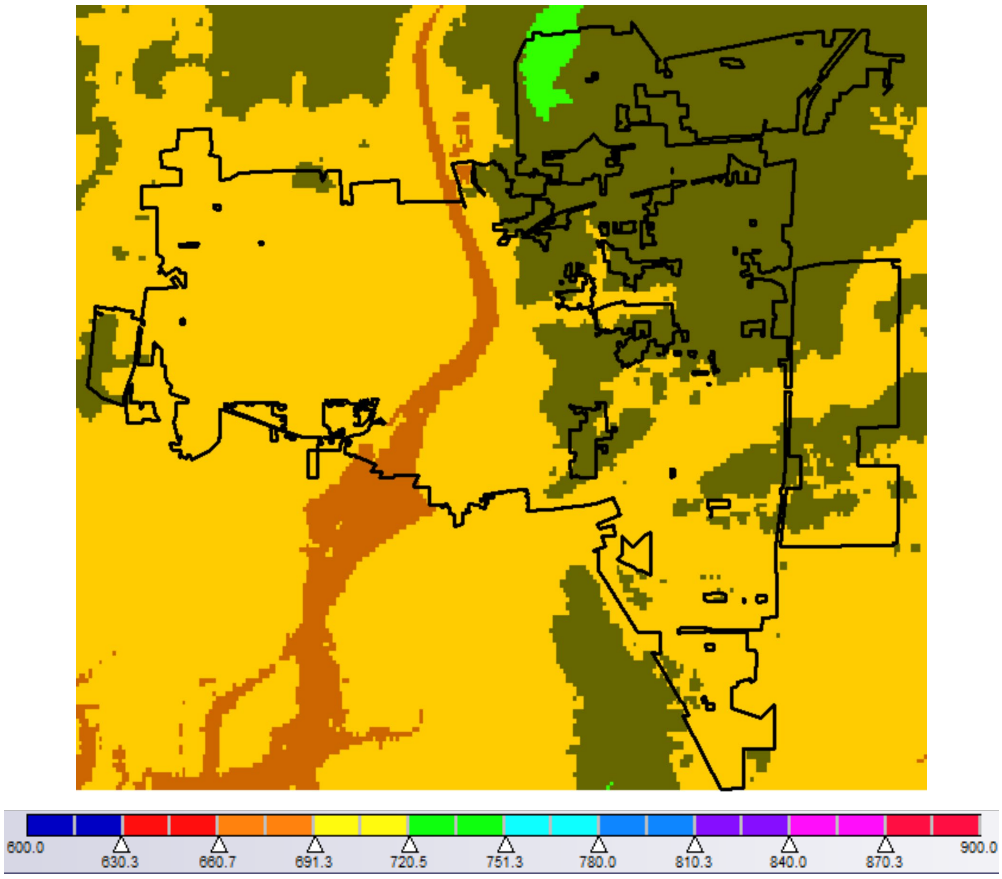


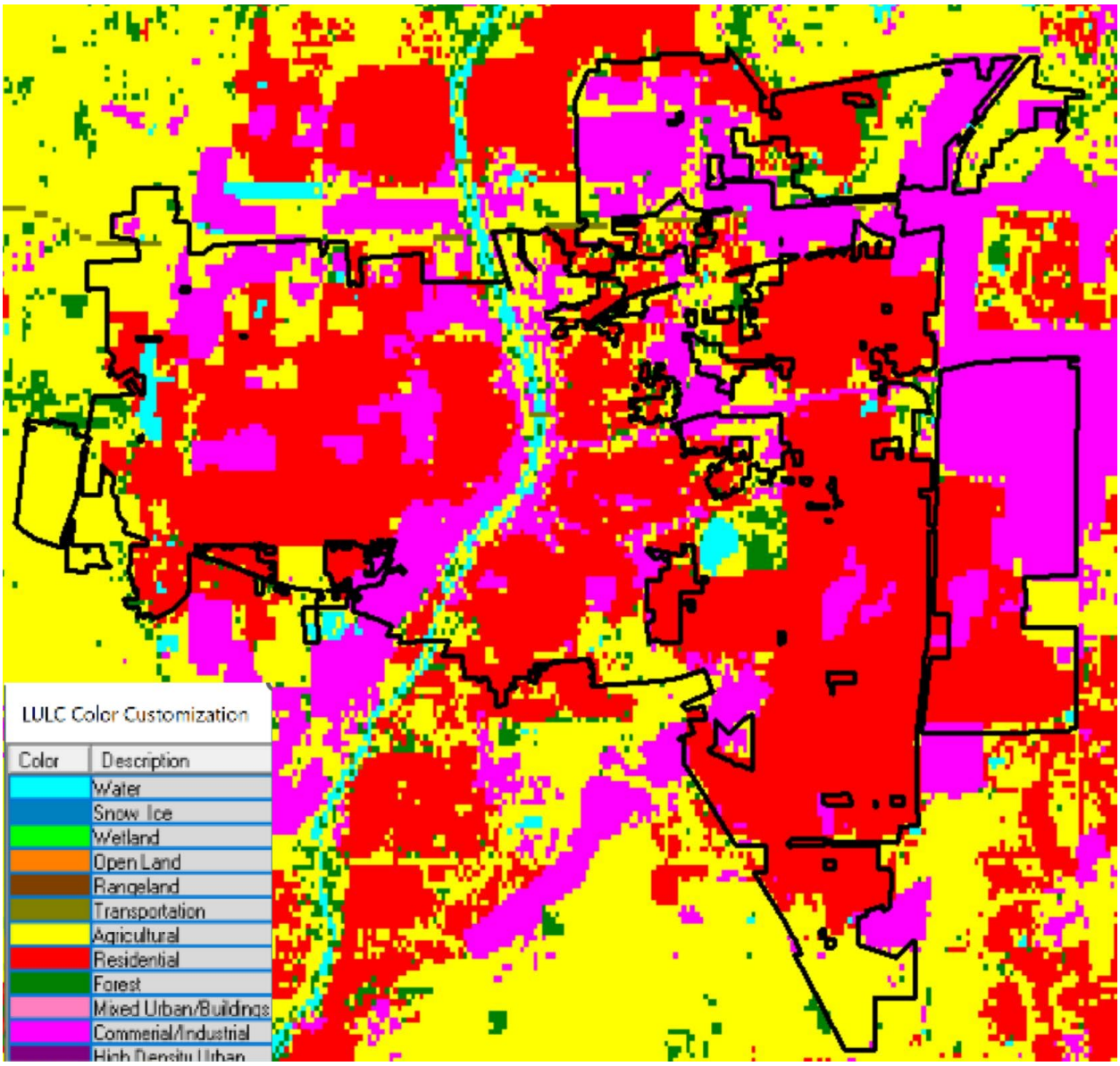
Figure 5. City of Aurora Terrain Data with Elevation



ENVIRONMENT DATABASE

Using an environment database further enhances the coverage prediction accuracy. This database describes the ground structures contained in an area such as urban, residential, forest, water, etc. It increases the coverage design accuracy by allowing the propagation model to account for the type of local clutter present. RAPTR's main database derives from the USGS Land Use Land Clutter (LULC) data set. The City of Aurora's environment database information is shown in Figure 6.

Figure 6. City of Aurora Environment Database



RAPTR employs sophisticated analysis techniques when evaluating coverage. Instead of only considering what the environment type is at the location, or tile, being evaluated, it also considers the environment surrounding the location. This further increases the accuracy of coverage predictions by detecting transitions in the environment – for instance, when transitioning from agricultural to forest, or urban to suburban. In addition, a designer can select from a category of environment. For example, the designer can select from the forest environment class categories of pine, hardwood, mixed, etc.

Also, RAPTR can perform an analysis of the environment and classify it based on density. This increases the accuracy of coverage predictions by being able to account for dense forests and sparse forests. All these factors combine to allow RAPTR to incorporate a very detailed model of the environment into coverage designs.

COVERAGE GUARANTEES

The L3Harris coverage design is based on bounded area reliability and is path-balanced for portable radios, meaning portable radio coverage is equal in the talk out and talk back directions. The design is established to achieve DAQ 3.4 voice quality, or better, throughout the predicted covered areas, as described below in Figure 7.

Figure 7. Delivered Audio Quality Classifications as defined by TSB-88

DELIVERED AUDIO QUALITY	SUBJECTIVE PERFORMANCE DESCRIPTION
DAQ 5.0	Speech easily understood.
DAQ 4.5	Speech easily understood. Infrequent noise/distortion.
DAQ 4.0	Speech easily understood. Occasional noise/distortion.
DAQ 3.4	Speech understandable with repetition only rarely required. Some noise/distortion.
DAQ 3.0	Speech understandable with slight effort. Occasional repetition required due to noise/distortion.
DAQ 2.0	Understandable with considerable effort. Frequent repetition due to noise/distortion.
DAQ 1.0	Unusable: speech present but unreadable.

It is important to note that usable coverage extends beyond DAQ 3.4. In areas that do not have DAQ 3.4 coverage, but have DAQ 3.0 coverage, users will still be able to make portable calls, with occasional repetition, as this is still usable coverage.

The following targets are offered for the system for the City of Aurora. Guarantees are valid for L3Harris terminals, but similar coverage from other vendors equipment can be expected.

Figure 8. System Coverage Guarantees

BOUNDED AREA DEFINITION	DESCRIPTION	REQ'D PERFORMANCE CRITERIA	% VALIDATED CPC SERVICE AREA RELIABILITY ACCEPTANCE CRITERIA
City of Aurora	Mobile	DAQ 3.4	95%
City of Aurora	Portable Outdoor	DAQ 3.4	95%
City of Aurora	Portable Indoor 20 dB	DAQ 3.4	95%

The system configuration associated with these guarantees is presented in Figure 10. Please refer to the **Coverage Acceptance Test Plan (CATP)** provided for additional details on coverage guarantees and testing.

COVERAGE ASSUMPTIONS

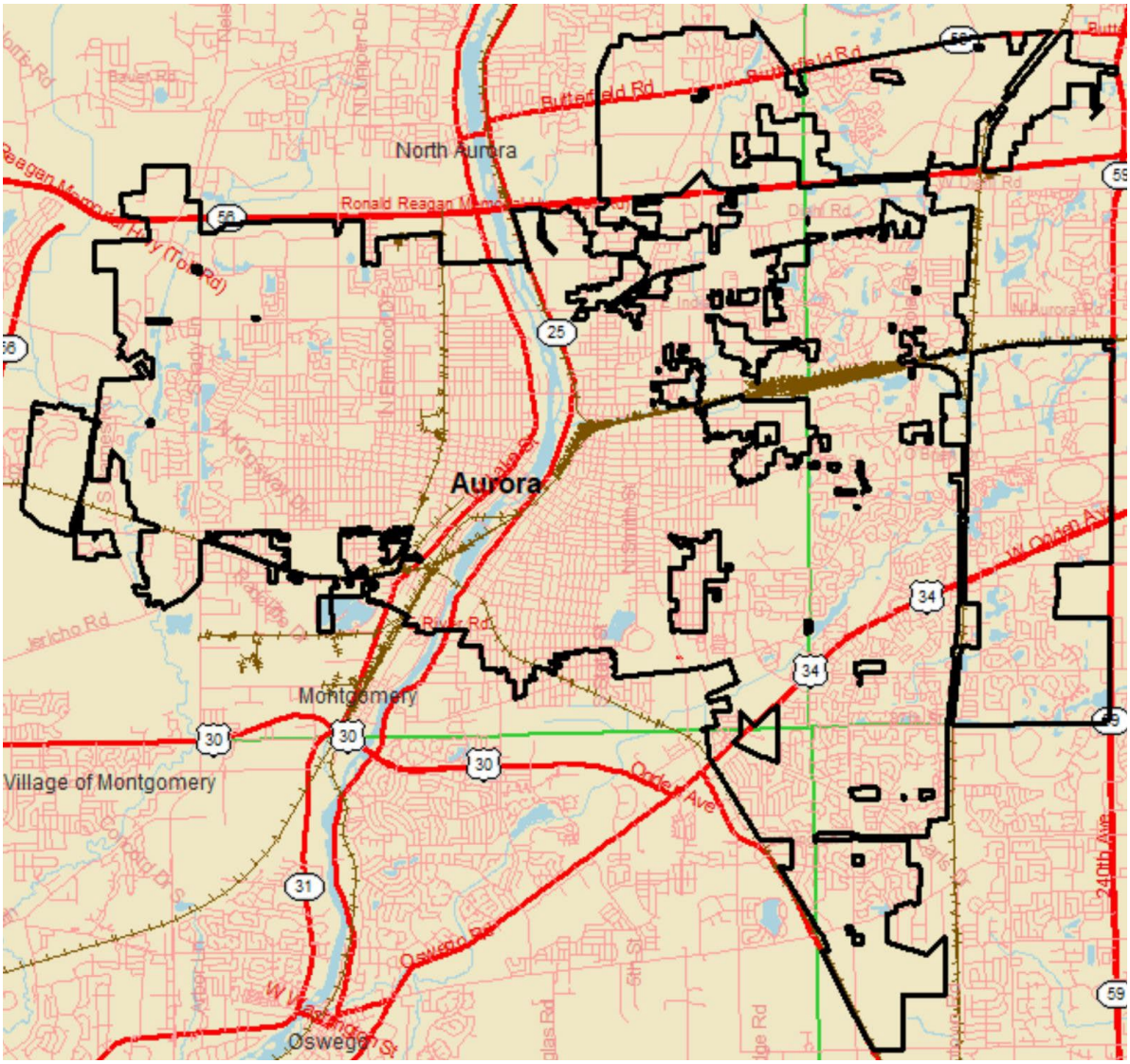
- A typical 3.5 ft portable height and 5.0 ft mobile height is used for the P25 design.
- Designed to a voice quality level of DAQ 3.4.
- Minimum 250 kHz spacing between transmit frequencies.

BOUNDED AREA

L3Harris used the Aurora City border for the boundary. This boundary will also be used for Coverage Acceptance Testing. Please refer to the **Coverage Acceptance Test Plan (CATP)** provided for additional details.

Figure 9 shows the Aurora City boundary in black.

Figure 9. Service Area Boundaries



SITE SELECTION

Aurora has an existing Open Sky system today. The existing sites were surveyed, and coverage analysis was performed on those that were suitable to be converted over to P25 sites. The coverage requirements were met with 6 P25 sites. Critical areas of concern were provided by the customer and taken into consideration when selecting which sites will convert to P25.

RF SITE CONFIGURATION

The site parameters of the system can be found in Figure 10.

Figure 10. System Design Parameters

SITE	LATITUDE	LONGITUDE	MAX ERP (dBm)	TX ANT CL (FT)	RX ANT CL (FT)	TX AND RX ANTENNA MODEL
Aurora PD HQ - Tower	41.78333	-88.2872	53	218	218	SC46A-HF1LDF(D00-PIP)
City Water Tower Phillips Park	41.73778	-88.2861	54.8	185	185	SR4BC-HF4P4LDF(D00-PIP)
City Water Tower	41.80194	-88.3694	57.1	235	235	SR4CG-SF4P6LDF(D00-PIP)
Aurora Fire Station 8	41.755	-88.2244	52.4	229	229	SR4A9-HF4P2LNF(D00)
Water Sewer Maintenance	41.74696	-88.3305	57	150	150	SR4CG-SF4P6LDF(D00-PIP)
2680 Church Road	41.80818	-88.2879	51.3	180	180	SR4A8-HF4P4LNF(D00)

The 6 sites will form a single simulcast cell to provide coverage to the City.

COVERAGE ACCEPTANCE TESTING

L3Harris has included a Coverage Acceptance Test Plan (CATP) that will verify the coverage predictions provided to the City. The tests listed below will be used to demonstrate the RF coverage throughout the City and County of Aurora.

For detailed information on the coverage tests and coverage guarantee, refer to the **Coverage Acceptance Test Plan (CATP)** provided.

- Talk Out Bit Error Rate (BER)
- Talk Out Signal Strength
- Voice Quality (For Information Only)

COVERAGE MAPS

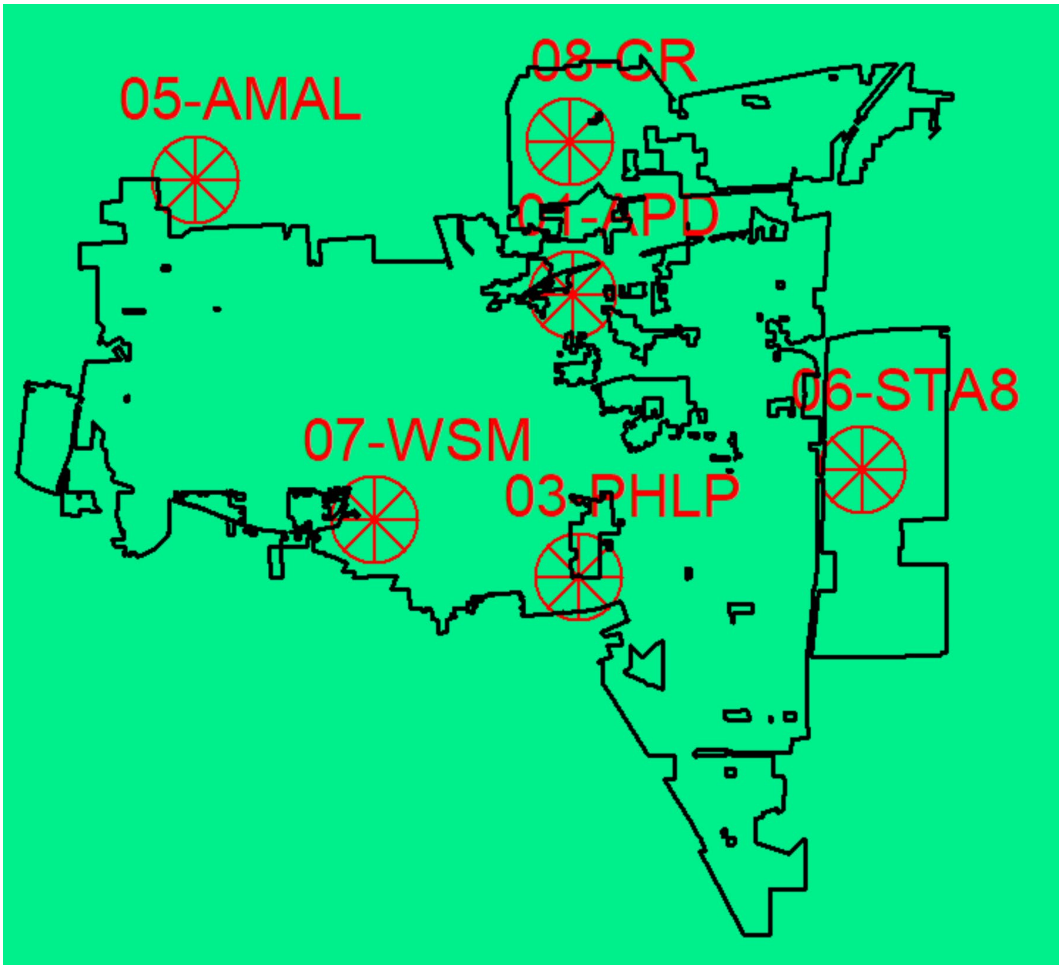
L3Harris has included a full complement of coverage maps. A sampling of those coverage maps is included here.

All maps represent P25 Phase 2 Trunking DAQ 3.4 or better communications to a receiver terminal at the indicated level (e.g. mobile, portable outdoors, portable indoor). The following colors are used to represent coverage:

- Green represents areas predicted to reliably have DAQ 3.4 or better communications
- White represents areas not predicted to have reliable DAQ 3.4 communications due to inadequate signal level
- Pink represents areas not predicted to have reliable DAQ 3.4 communications due to the presence of time domain interference

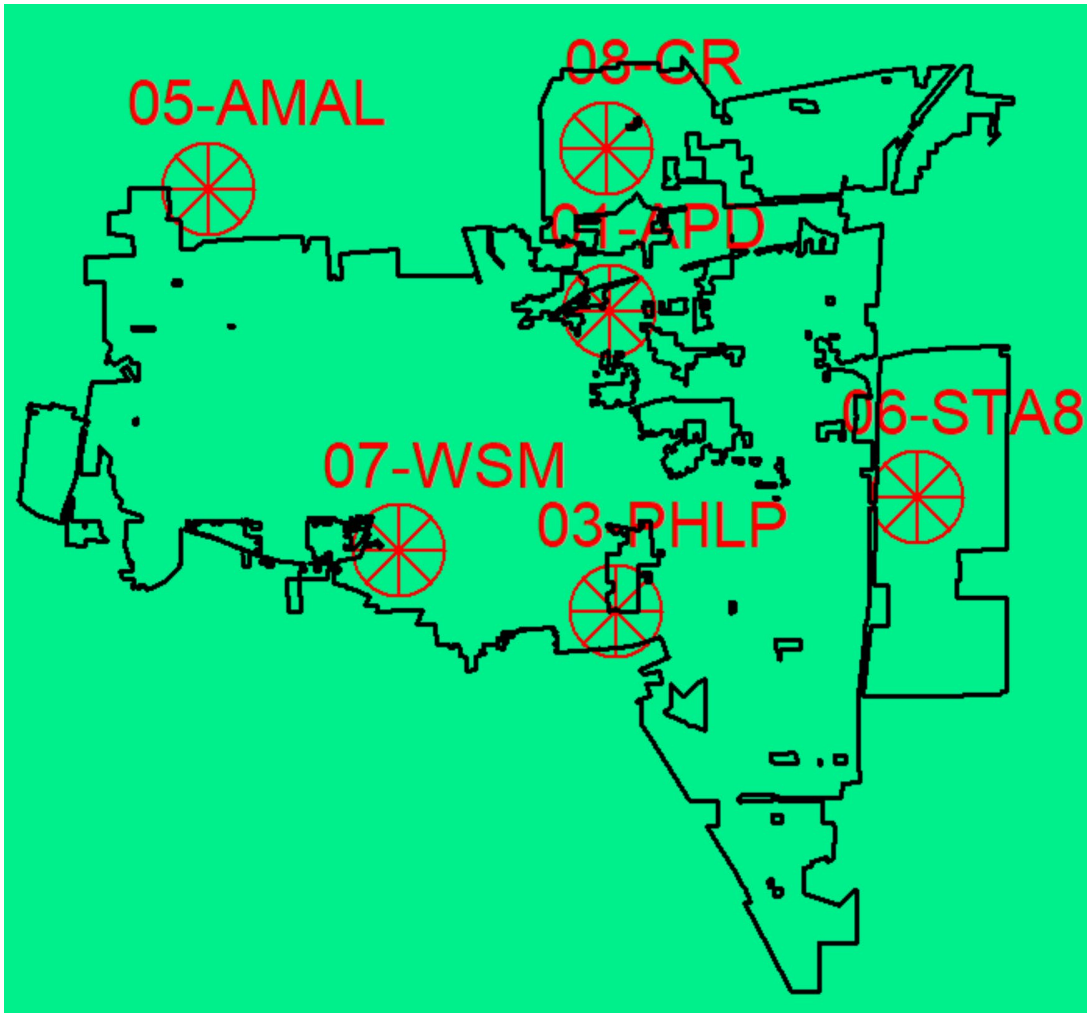
The City of Aurora's mobile talk-out coverage is shown in Figure 11.

Figure 11. City of Aurora Mobile Talk-Out Coverage



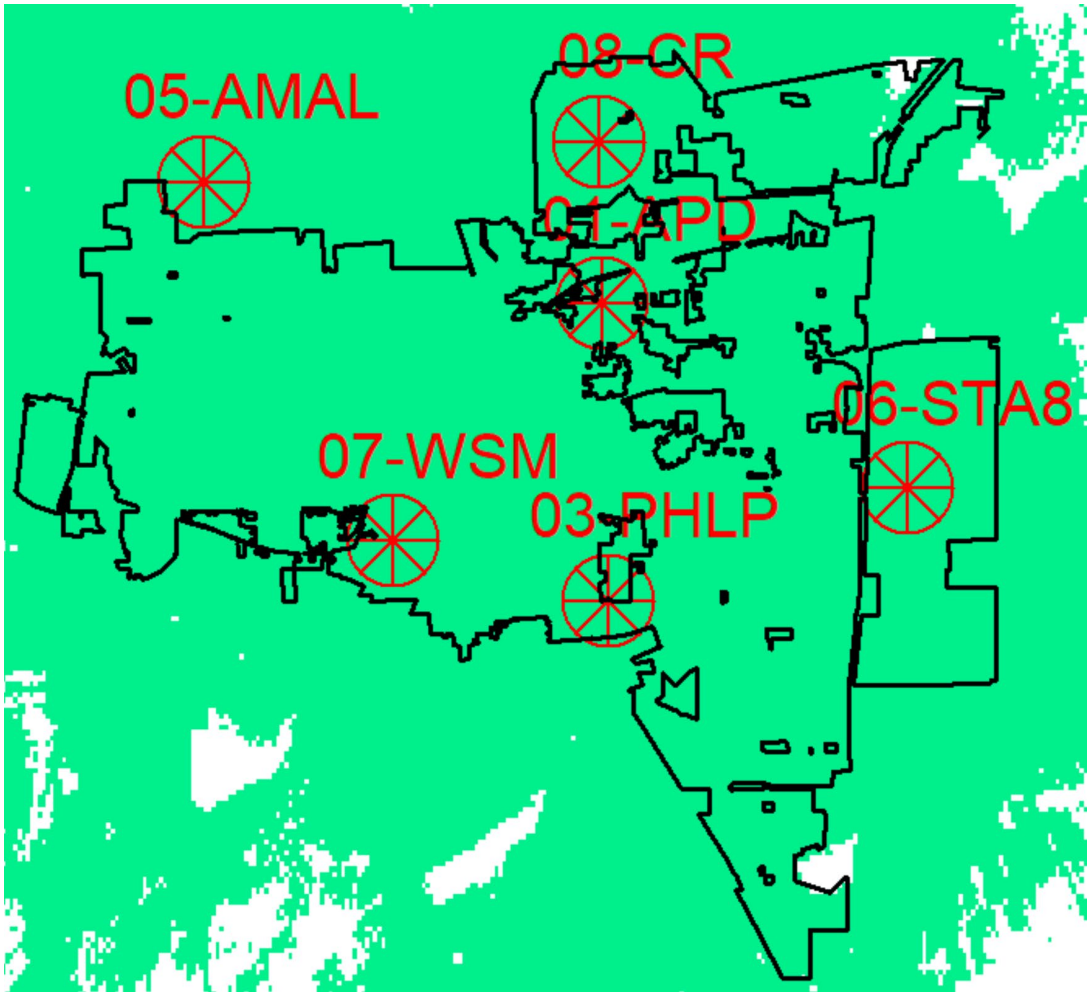
The City of Aurora's portable outdoor talk-out coverage is shown in Figure 12.

Figure 12. City of Aurora Portable Outdoor Talk-Out Coverage



The City of Aurora's portable indoor 20 dB talk-out coverage is shown in Figure 13.

Figure 13. City of Aurora Portable Indoor 20 dB Talk-Out Coverage



FREQUENCY PLANNING

7/800 MHz Frequency Plan

L3Harris has designed a 7-channel, 6-site simulcast cell. L3Harris has industry leading expertise in frequency planning and management. In 2022, our Spectrum Engineering Group has reviewed allocated frequencies for the geographic region of the City of Aurora and the surrounding service area and has found 6 frequency pairs that meet the requirements of the system.

Frequency availability and acquisition is a dynamic and complex environment and subject to change. We will establish usable and licensable frequencies post-contract award and support the City of Aurora in the acquisition of those frequencies.

With a minimum spacing between the frequencies of at least 250 KHz, L3Harris is confident that the combiner system will be adequate for system operations without the use of additional filtering

components. The complete set of frequencies along with the intermodulation analysis will be presented at the Detailed Design Review.

Frequency Planning Assistance

L3Harris shall provide engineering analysis and technical documentation required and defined by the Regional Planning Committee to complete one set of FCC license applications for the system.

Additional engineering analysis that may be required to address unusual or atypical licensing requirements will be addressed through the program change order process. L3Harris will complete and submit the FCC license applications on behalf of the City and will be responsible for all FCC Application and Coordination Fees. L3Harris requires the City of Aurora to approve all documents/applications prior to submission to the Regional Planning Committee, FCC Certified Coordinator, or FCC, as applicable.

FCC AND RPC RULES AND REGULATIONS

L3Harris' tower selection process has ensured that our design complies with FCC regulations. Further, our design complies with FCC regulations and meets RPC requirements with regards to the ERP.

INTERMODULATION INTERFERENCE ANALYSIS

Our intermodulation interference analysis at this stage consists only of the frequencies we propose to place at each site. During the detailed design phase L3Harris would conduct expanded intermodulation interference analysis which would consider all identifiable co-located tenants at the site.

L3Harris will base its intermodulation analysis on the L3Harris system frequencies and those identifiable in the FCC database for each site or that the City of Aurora provides L3Harris in advance of L3Harris' intermodulation analysis.

L3Harris cannot be responsible for omissions or inaccuracies to the FCC data or for which frequency assignments cannot be specifically defined such as with market-based allocations.

Further, L3Harris cannot be responsible for interference to equipment installed near L3Harris' equipment that is inadequately designed or installed, making it susceptible to interference from equipment that is operating properly. L3Harris will make a best-faith effort to identify any such equipment and recommend engineering solutions that might be applied to that equipment.

L3Harris cannot be responsible for interference, either self-induced or external to the system, caused by any of the following:

- Self-induced/external adjacent interference.
- Self-induced or created with other transmitters IM distortions.
- Self-induced interference due to elevated noise floor.

The following mitigation steps are taken in the design to minimize intermodulation products and self-interference:

- Filters as needed for transmit antenna feed line
- Vertical or horizontal separation between transmit and receive antennas
- Use of low passive intermodulation (PIM) antenna system products where available such as use of DIN connectors after the transmit combiner

Traffic Analysis

L3Harris calculated the traffic capacity requirements with the Aurora provided traffic data. Traffic data was provided as total-hours for each site, per month, for the entire year of 2016, second quarter of 2019, and second quarter of 2022.

L3Harris calculated the average hourly Erlang traffic; this value was then used with an Erlang-C table to determine the number of channels needed.

SIMULCAST TRAFFIC CHANNEL COUNT CALCULATION

The steps taken to determine the number of channels is as follows:

- Determine the average hourly Erlang traffic for the city of Aurora.
  - The monthly traffic data per site was divided by the number of days in a month, and then divided again by twenty-four (24). This result provided the average hourly Erlang traffic, per month, per site.
  - The average hourly Erlang traffic for all Aurora sites were then added together to provide the city's total average hourly Erlang traffic. This was done to calculate the total capacity for a single-cell simulcast system.
  - Of the monthly aggregated Erlang values, the month with the maximum value of traffic (2.17 Erlangs) was used to complete the calculations.
- Determine busy hour traffic plus future growth.
  - The value of 2.17 Erlangs was doubled (4.33 Erlangs) to represent "busy hour" traffic, which is an assumption used in cellular industry.
  - An additional 24% was added (5.36 Erlangs) to include future growth. 25% was not used as there is less than 1% difference, but would require an additional P25 channel.
- Utilize the Erlang-C lookup table to determine the number of talk-paths required for 1% GOS.
  - 5.36 Erlangs = 12 talk paths
  - 12 talk paths = six (6) Phase-2 traffic channels

PHASE-2 CHANNEL COUNT

Based on this analysis, the recommended number channels for the 6-site simulcast cell is shown in Figure 14.

Figure 14. Number of Channels Needed

TOTAL CHANNELS (CCH + TCH)	CONTROL CHANNELS (CCH)	PHASE 2 TRAFFIC CHANNELS (TCH)
7	1	6

MAXIMUM NUMBER OF ACTIVE USERS

L3Harris also performed a subscriber load analysis to determine the maximum number of active-users the 7-channel system could support. The analysis consists of the following inputs:

- Six Phase-2 talk channels that correlates to 12 talk-paths.
- 1% GOS (Grade of Service) or better.
  - Grade of Service refers to the probability that a user will be queued when trying to make a call. The standard for Public Safety is to operate at 1% or less GOS.

PUBLIC SAFETY USER TRAFFIC PROFILE

L3Harris used empirical data gathered from Public Service and Public Safety customers across the Country to create a Traffic Profile.

L3Harris has made the following traffic profile assumptions in our calculation.

- 6.5 Group Call PTTs per hour per user
- 3.2 seconds transmission time average per Group Call PTT
- 0.2 Individual Call PTTs per hour per user
- 4.2 seconds transmission time average per Individual Call PTT
- 0.76 seconds of call overhead, Phase-2 call
- 25% of the system traffic is generated by dispatch

MAXIMUM NUMBER OF ACTIVE-USERS

Figure 15 shows the calculated maximum number of active users.

Figure 15. Maximum supportable subscriber units

PROFILE	MAXIMUM ACTIVE USERS
Public Safety	727

An active-user does not equate to a subscriber unit, as some active-users will have both a portable unit and mobile unit. Units that are powered off do not count as active users.

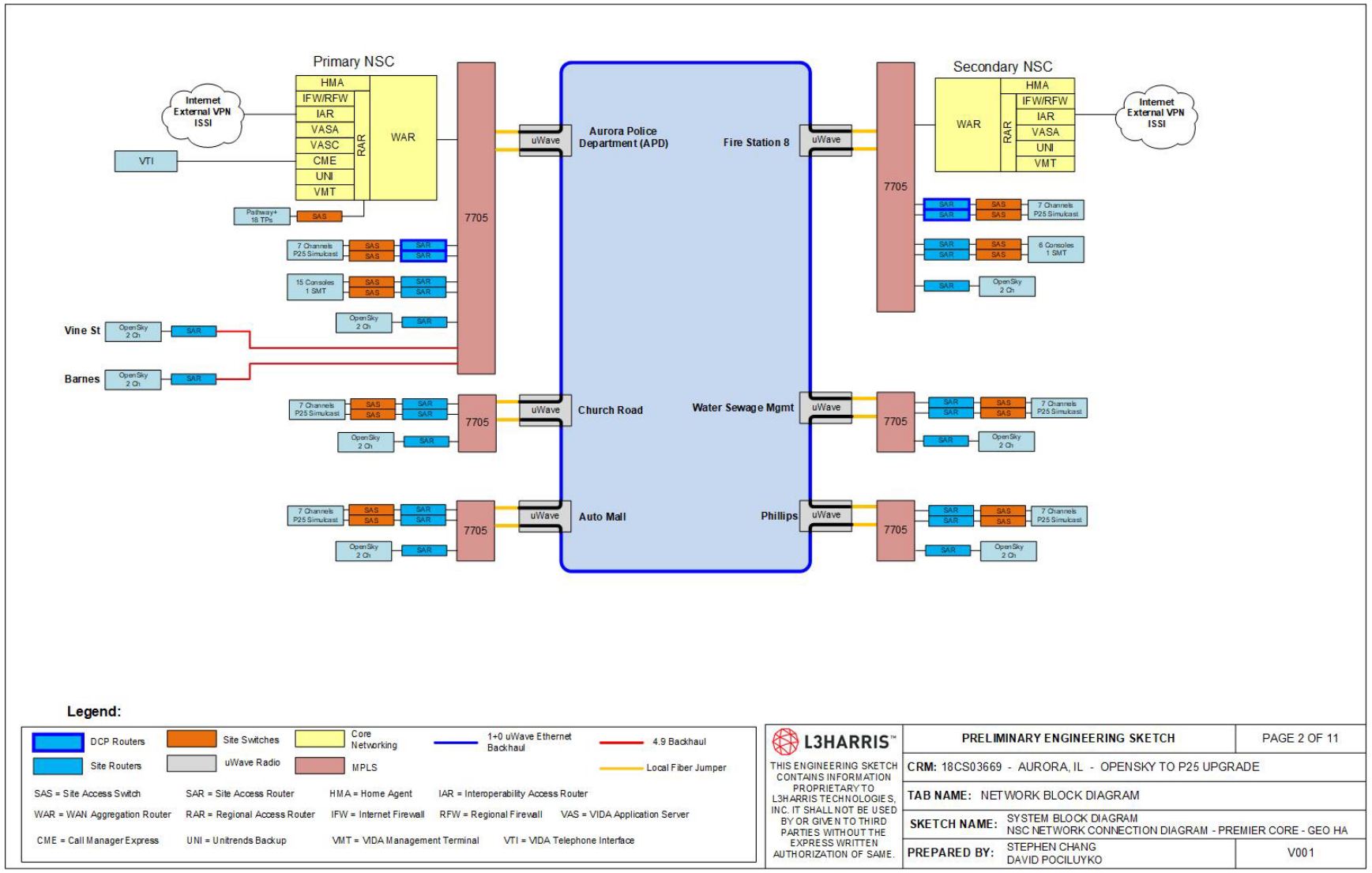
Knowing the system's maximum user capacity helps to know the system's capability during surges of traffic. Surges may occur during shift changes, where users from both the ending and starting shift overlap operations, or when the is a wide scale mutual aid event or incident.

VIDA Network WAN Design

To assure the quality of voice through the VIDA network, L3Harris will design wide area network (WAN) links to strictly adhere to the requirements provided in the following sections. Conformance with these design requirements is a necessary condition for L3Harris to meet the overall performance needs of the VIDA system. All requirements are necessary to provide an assured level of service for voice quality.

Figure 16 provides an overview of Network connectivity for the City of Aurora.

Figure 16. Network Diagram



SYSTEM BANDWIDTH REQUIREMENTS

The City of Aurora system migration requires the bandwidth requirements specified in Figure 17. Note that the bandwidth of at least 100 Mbps is recommended should the City of Aurora install live video cameras at the towers or anywhere else within the system.

Figure 17. Bandwidth Requirements (7705 MPLS Requirements)

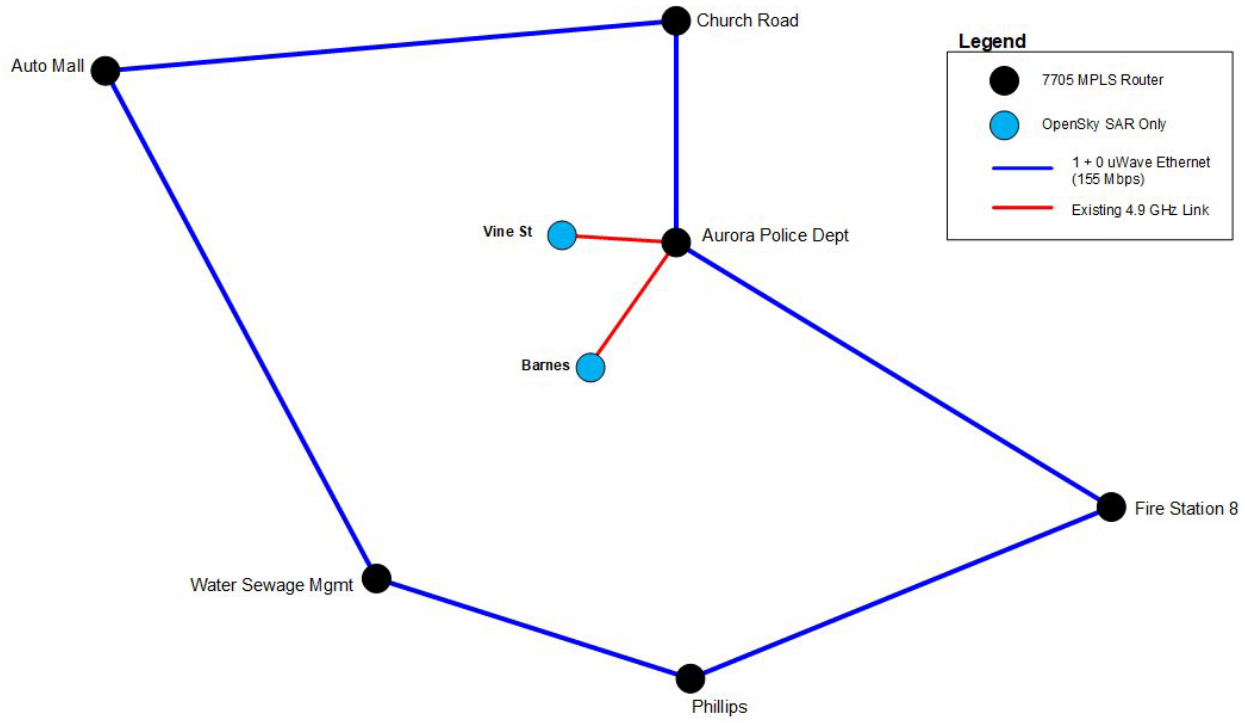
SYSTEM NAME	TYPE	RAW SIMULCAST AND SITE RING AGGREGATED TRAFFIC (Kbps)	CORE TO CORE BANDWIDTH (Kbps)	MINIMUM RECOMMENDED RING REQUIREMENT (Kbps)
P25 Aurora Simulcast Cell	Simulcast	3,626	770	7,252
Multisite	OpenSky	928	928	1,856
Primary Dispatch	Dispatch	7,710	7,710	15,420
Secondary Dispatch	Dispatch	3,084	3,084	6,168
ISSI	Interoperability	788	788	1,576
CSSI	Interoperability	394	394	788
Pathway+	Interoperability	1,584	1,584	3,168
Logging Recorder	NSC	1,756	1,756	3,512
AGGREGATION TOTAL		**19,870**	**17,014**	**39,740**

BACKHAUL NETWORK DESIGN

L3Harris shall provide the City of Aurora with a new microwave backhaul network to accommodate the new P25 radio system infrastructure. The new backhaul design consist of a 6-hop Aviat microwave system with 178 Mbps of bandwidth, over a MPLS (multi-protocol label switching) ring topology. The new microwave radio platform is Aviat's Eclipse IRU600v4 indoor-mounted radios in 11GHz FCC licensed band. The IRU600v4 platform allows the deployment of smaller antennas, which will reduce tower-loading and avoid large expenditures in costly tower construction and retrofits. Each site is also provided with a Nokia 7705 MPLS router that provides routing of the microwave transport links within the ring topology. The MPLS routers will also accommodate any fiber links between sites that the City of Aurora has determined to be added as part of the backhaul WAN (wide area network).

The MPLS structure interconnects all microwave links, RF sites and dispatch centers to the high available (HA) geographically split core. The VIDA core is configured with a primary and secondary core for redundancy. At the site level, WAN connections are provided via the MPLS routers that connect to neighboring sites within the microwave ring topology. The sites within the ring will have diverse paths to the core and shall provide WAN redundancy if a link should fail using MPLS routing algorithms to determine the new route. Each MPLS router has a specific view of the MPLS network. If a link goes down, each MPLS router is immediately notified and updated with the change in topology. Figure 18 shows the microwave topology based on the Aviat Preliminary Path Loss and Fade Margin Calculations.

Figure 18. Microwave Network Topology



PATH DESIGN

The new microwave network topology has been developed based on P25 Site selection and the preliminary desktop analysis using terrain database and clutter database. The preliminary path designs have been based on meeting an annual two-way path availability of 99.999% at 10-6 BER using the 11 GHz FCC bands, in compliance to the FCC minimum spectral efficiency rules applicable for the frequency band. All backhaul paths are designed to meet a minimum 178 Mbps air-link capacity.

The paths have been designed as an unprotected REPEATER (1+0) ring. Each path uses one 40 MHz channel at 11 GHz. Figure 19 lists the Eclipse IRU600v4 radios configurations and air-link capacities.

Figure 19. Link Summary of the City of Aurora Microwave Network

PATH #	SITE NAME 1	SITE NAME 2	PATH LENGTH (MI)	FCC FREQUENCY BAND (GHz)	RADIO TX POWER	RADIO CONFIGURATION	AIRLINK CAPACITY (Mbps)
1	05-AMAL	17-WSW	4.28	11	Standard	NP	178
2	17-WSW	03-PHLP	2.39	11	Standard	NP	178
3	03-PHLP	06-STA8	3.40	11	Standard	NP	178
4	06-STA8	01-APD	3.79	11	Standard	NP	178
5	01-APD	20-CHRD	1.67	11	Standard	NP	178
6	20-CHRD	05-AMAL	4.25	11	Standard	NP	178

EXISTING 4.9 GHZ MICROWAVE

The existing 4.9 GHz microwave links shall remain in place, so that the OpenSky only sites can connect to the Aurora core. L3Harris assumes Aurora will provide and maintain the 4.9 GHz microwave system.

L3Harris will use the existing 4.9 GHz microwave link to facilitate the ISSI connection between Aurora and Naperville. L3Harris' microwave system will not include a connection between the two cores.

Equipment Descriptions

VIDA NETWORK ARCHITECTURE

The latest L3Harris' Voice, Interoperability, Data, and Access (VIDA) network solutions are revolutionizing the way critical communications users view their network. These solutions do not limit users to a single radio access technology with the inevitable tradeoffs in coverage, cost, and features. Instead, the VIDA network architecture supports selected technologies on one common network that meets the diverse needs of all user groups operating on the system.

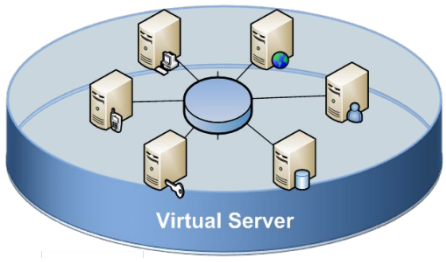
The new VIDA services platform is a fully integrated solution providing unified interoperable communications for voice, data, and applications across many technologies ranging from Land Mobile Radio (LMR) narrowband to LTE broadband data networks.

Virtualization of Core Components

The latest VIDA SR10A solution incorporates the use of virtual machines (VM) in the server core. Figure 20 illustrates how virtual machines are arranged to support multiple applications at the same time.

The virtualized servers automatically allocate the appropriate processing, memory, and networking resources for each application. The virtualized servers within the VIDA core perform all the mission critical services required, while reducing hardware, increasing efficiency, and making the most out of the resources for the network.

Figure 20. Virtualization



Virtualization has many benefits that serve to reduce total cost of ownership in terms of physical space required for the deployment and the cooling associated with having multiple servers. For a typical deployment, L3Harris' fully virtualized core will produce 25% of the heat and occupy 25% of the space as compared to traditional server architectures.

Virtual servers provide the flexibility and control to manage resources more effectively, reduce costly down time, and provide that extra level of system resilience with key services to keep mission critical users operational. Additionally, a virtual server environment has many IT-centric benefits that fully support operations expected in an IT environment, including server redundancy, services monitoring, backup/restore capability and installation/upgrade processes.

PREMIER NETWORK SWITCHING CENTER (NSC) ELEMENTS

VIDA Applications Server (VAS)

The Premier NSC is made up of one main hardware component: the VIDA Application Server (VAS). The VAS provides the single point of access for the call switching, as well as management and administrative tasks for a VIDA Network. Powerful virtual machine (VM) technology consolidates several call routing and management applications on a single server (as opposed to running on separate servers). This provides L3Harris customers with a simplified (hardware configuration) solution and achieves cost savings through reduced maintenance activities, valuable equipment room space conservation, and reduced power consumption.

The VAS is a server workstation equipped with fully redundant geographically separated hardware to ensure a robust network for the City of Aurora operations. It hosts a voice controller application performing routing functions for digital trunked voice messages through an IP backbone. By tracking the radio site location of subscriber unit radios and their voice group affiliation, the VAS ensures delivery of voice messages only to those radio sites essential to reach the destined radios. In addition to call routing based on user radio (to site) registration, it is possible to set up the system to force certain talkgroup calls to those locations required for scanning.

Virtual Machine (VM) Technology

VM technology allows many applications running under separate operating systems to co-exist on a single server. The VM software allocates processor power, Random Access Memory (RAM), and Network Interface resources to each application. It isolates each application and ensures that no application impacts the operation of the others. VM technology also allows the addition of software capabilities on the server. For example, a customer adding encryption to the radio system can easily install the KMF VM software package on the VAS (instead of the conventional installation of a separate server to support that application).

Applications that Run on the VAS

Figure 21 shows a sample of the applications and services that are configured to run on the City of Aurora's VIDA Premier NSC.

Figure 21. VAS Applications and Services

Network Switching Service (NSS)

The Network Switching Service (NSS) is a fully integrated voice and data controller. The NSS routes calls to and from each voice group or mobile data user on a real-time basis. In addition, it regulates voice and data traffic on the network. Each voice user belongs to a voice group of peers (talkgroup). A network administrator assigns the members of a voice group and sets the voice group parameters, including priority, hang time, preferred site, and response time. This governs the functional behavior of user devices operating on the network. The NSS maintains a database of these voice group files. The NSS routes the IP voice traffic of one member to all others of a given voice group.

The NSS is a voice controller application performing routing functions for digital trunked voice messages through an IP backbone. By tracking the radio site location of subscriber unit radios and their voice group affiliation, the NSS ensures delivery of voice messages only to those radio sites essential to reach the destined radios. In addition to call routing based on user radio registration, it is possible to set up the system to force certain talkgroup calls to those locations required for scanning, regardless of user radio affiliations.

Unified System Administration (UAS)

The Unified Administration System (UAS) is an integrated real-time administration tool based on client-server architecture allowing multiple authenticated users at any Network Switching Center or remote location. By using the UAS, the administrator can securely modify a user or a group of user's priority, privileges, and encryption properties.

Regional Network Manager (RNM)

The Regional Network Manager (RNM) provides users with powerful tools that facilitate effective management of a VIDA network. Managed network objects continuously monitor their performance grade of service. Through active polling of the objects and receipt of autonomous trap information, the RNM keeps the network operators up to date with the latest status of the network. Aided with tools such as the Network Viewer, Object List, Event Browser, History Browser, and Real-time Viewer, an RNM user can carry out the task of network management much more efficiently.

Enterprise Network Manager (ENM)

The Enterprise Network Manager (ENM) is an all-in-one network management monitoring platform suited for the entire enterprise, including servers, operating systems, network appliances and database applications.

It informs and alerts regarding the state of the network, applications and hardware through a single web browser interface.

Regional Site Manager (RSM)

The Regional Site Manager (RSM) routes administrative information (users and groups) between the UAS and each site. As part of the Site Management Services (SMS), the RSM also routes activity data from the Sites to the RNM.

Active Directory (AD)

Active Directory (AD) is the primary method of controlling access to the VIDA network. This centralized service performs authentication and authorization of users and devices to restrict unauthorized network access.

AD authentication is extended to UNIX servers with the integration of Quest Authentication Services for Linux operating systems, and to devices that do not support the protocols (i.e. Cisco) through RADIUS.

Active Directory allows the City of Aurora administrators to create multi-level role-based accounts. These differentiated roles are not only keyed to a user but to the machine they are accessing. This permits an administrator to not only control access to infrastructure devices, but to generate and push security policies and establish trusted websites and certifications. Active Directory Group Policies allow not only differentiation by user role, but also the tandem application of joint machine and user profiles.

Key Management Facility (KMF)

The KMF is a network-based application that manages large fleets of crypto nets. The KMF provides complete management of voice encryption keys for all network devices, including subscriber devices. This application generates keys and distributes them via Over-The-Air Rekeying (OTAR) messages to compatible field devices and over network-to-network devices, such as logging recorders and dispatch consoles.

A secure HTML web browser on the UAS provides the user interface to the KMF. From the UAS, crypto officers provide keying information to any of their agency radios anywhere across the network. The UAS has a partitioned database with multiple levels of access so multiple agencies can share a single KMF. This partitioned database also allows agencies to restrict OTAR or other sensitive information to limited personnel. The KMF is tightly coupled into the UAS, seamlessly binding key sets to users and talkgroups.

NETWORK MANAGEMENT AND EVENT MONITORING

The L3Harris NMS offering consists of a suite of network management software programs that complement each other. The combination of these offer a high level of system management as well as standard and customized reporting capabilities.

Following is a list of the management applications and services included:

- NMS Solution for the L3Harris LMR system
  - Enterprise Network Manager (ENM)
  - Regional Network Manager (RNM)
  - Activity Warehouse (AW)

The L3Harris applications physically reside in the VIDA Administration Server, which is offered in a geographically separated redundant configuration.

All management applications are available for human interface at the Network Management Terminal (NMT), which is a dedicated PC, equipped with a 21.5” monitor. The NMT can be installed anywhere in the VIDA network.

ENTERPRISE NETWORK MANAGER (ENM)

The ENM is a fault monitoring solution L3Harris offers that manages all VIDA network devices and monitors site equipment. It has the capability to serve the entire enterprise. The ENM utilizes the Centerity Monitor Standard software application developed by Centerity Systems. The ENM monitors all communication components by use of the SNMP protocol and has a listen address where devices can send traps.

Events are reported up the hierarchy to the ENM and are displayed on the Centerity Monitor Dashboard as seen in Figure 22.

The following components are monitored in real time by the ENM:

- Cisco routers and switches
- MPLS routers
- Network Core VIDA Application Servers (VAS)
- Storage Area Networks (SAN)
- Two47 base stations
- Distributed control point architecture
- Dispatch consoles
- Site alarm equipment from Network Sentry alarm devices

Figure 22. Centerity Monitor Dashboard

Centerity Monitor Dashboard provides a single-point summary of the Enterprise

Additionally, the ENM supports emails and text messaging with various levels of fault configurations to alert the network operators with the latest status information.

The ENM uses Active Directory (AD) server to manage resources and access capabilities. The user management system on the AD server enables the administrators to create different logical groups with ranging access permissions. Accessing ENM requires domain user authentication in AD. Typically,

L3Harris assigns the following users' groups in AD providing multi-layer protection to the network monitoring systems.

- **Administrators:** Full access.
- **Maintenance Users:** Read-Write access to configuration but no access to user profiles.
- **Users:** Read only access, with no access to configuration or user profiles.

Reporting and Trend Analysis

The ENM has built in reporting capabilities that can be utilized to provide insightful analysis into the entire environment. Centerity has native reporting functionality built into the platform. Some of the most popular reports are, History, Trends and Summary reports. These reports provide a quantitative basis for planning as well as historic reference. When combined with the Artificial Intelligence and Machine Learning capabilities, reporting empowers the end user to utilize trend information from multiple key performance indicators and correlate the results in an intuitive manner. The ENM can also make the collected information available to other third-party tools and can export data into an industry standard format for external manipulation.

Trend Analysis is supported through historical data collection. The term of retention determines the available dataset and can be configured by the customer to conform to their requirements. Individual key performance indicators as well as host data can be reported on, and trending information can be derived from the database.

REGIONAL NETWORK MANAGER (RNM)

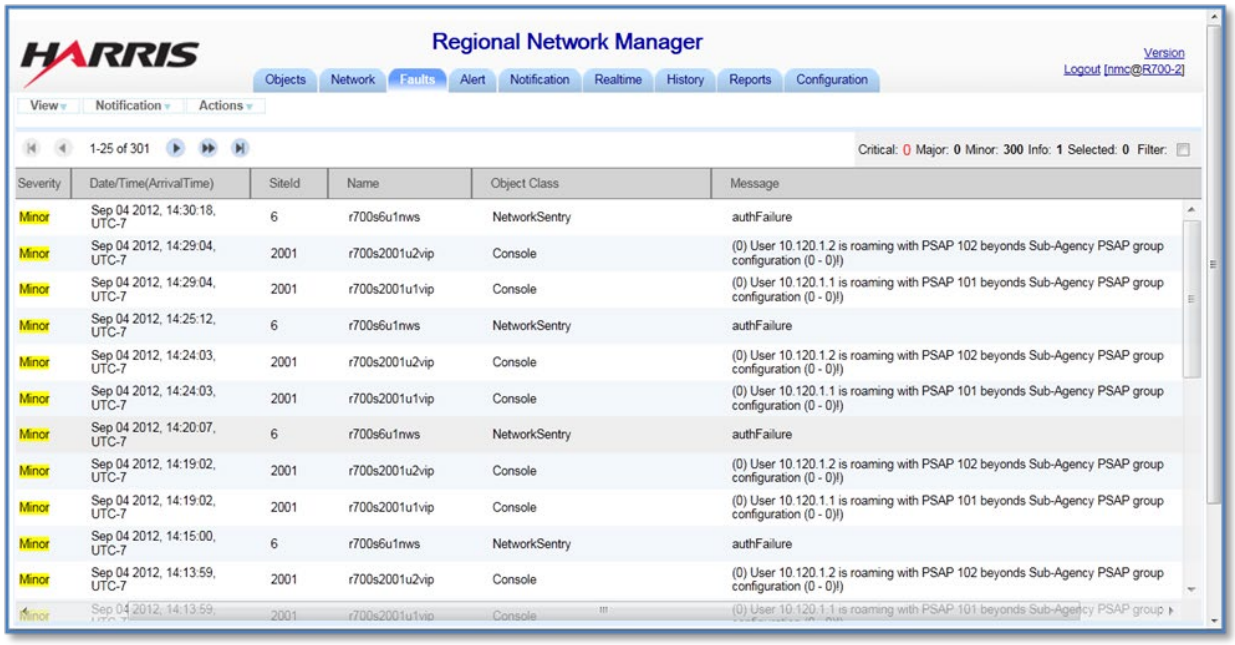
The RNM is a powerful network manager that monitors and consolidates faults from various sites and presents them to the user through elegant graphical user interface. It provides performance, event and fault monitoring, and reporting for the radio network through a collection of applications and administrative programs. RNM also interfaces with MoM (Manager of Managers) to consolidate and report all the regional level alarm information to the ENM. It uses Simple Network Management Protocol (SNMP) for managing alarms.

The radio system manager can monitor the overall health of the Network Switching Server (NSS), view real-time diagnostics, monitor call activity, set system/network configuration parameters, and generate reports. Managed network objects continuously monitor their performance grade of service. Through active polling of the objects and receipt of autonomous trap information, the RNM keeps the network operators up to date with the latest status of the network.

Aided with tools such as the Network Viewer, Object List, Fault Browser, Notification Manager, History Browser, and Real-Time Viewer, an RNM user can carry out the task of network management much more efficiently.

Figure 23. Fault Browser Screen

This screen reports faults in scrollable, time-sorted order.



ACTIVITY WAREHOUSE (AW)

Activity Warehouse is a reporting application that monitors and reports airtime usage, site affiliations and various other aspects of the network. Reports are based on IP call activity related to RF sites, consoles, gateways, and other devices on the VIDA network. Activity Warehouse performs data searches on call logging data created and stored by VIDA network components. Parameters stored within this data are reported by Activity Warehouse in textual, table, and graphical formats.

Activity Warehouse is configured with a set of predefined report types that are accessible from the NMT. Some report types may include Input filters that may be customized by the user for specific search limits. User-definable filters include dates, times, systems, and Agency IDs. Some input fields allow direct entry while others are populated with a dropdown box providing specific limits or choices.

ENM, RNM, AND AW REPORTS LIST

The ENM, RNM, and AW support the creation of query-based reports and system reports that includes but not limited to the following reports:

- Alarms
- Active Alarms
- Alarms by Time Segment (Day, Week, Month, Year)
- Alarm by Component with Granularity of Individual Alarm
- Alarms by Time Segment/Component
- Busies
- Busies per Talk Group per Specified Time
- Busies per Site per Specified Time
- Busies per System per Specified Time
- Individual Call Data
- UID
- Talk Group
- Type of Call
- Time of Channel Access
- Duration of Transmission
- Channel Assigned
- Site(s) Involved in Call
- General Call Data
- Number of Calls per Talk Group per Specified Time
- Number of Calls per Site per Specified Time
- Number of Calls per System per Specified Time
- Number of Type (Talk Group, UID, Data) of Call per Specified Time
- Call Duration per Talk Group per Specified Time
- Call Duration per Site per Specified Time
- Call Duration per System per Specified Time
- Special Call and/or Functions Data
- Number of Special Calls (Emergency Call, Data, Status Messaging, OTAR, OTAP) per Call Type per Specified Time Call Duration per Call Type per Specified Time
- Utilization report of each NSS and radio site in the system
- Call blocking and queue size report at each radio site in the system.
- Alarm resolution details (via the Fault Browser program)
- Detailed listings of all initiated alarms or object status changes
- Downtime by location for the entire system, subsystem, and each managed object in the system
- Downtime by specific equipment item for the entire system, subsystem, and each managed object in the system
- Host groups Status Report
- Service View Status Report
- Performance Summary Report
- Events Status Report

P25 Simulcast System Architecture

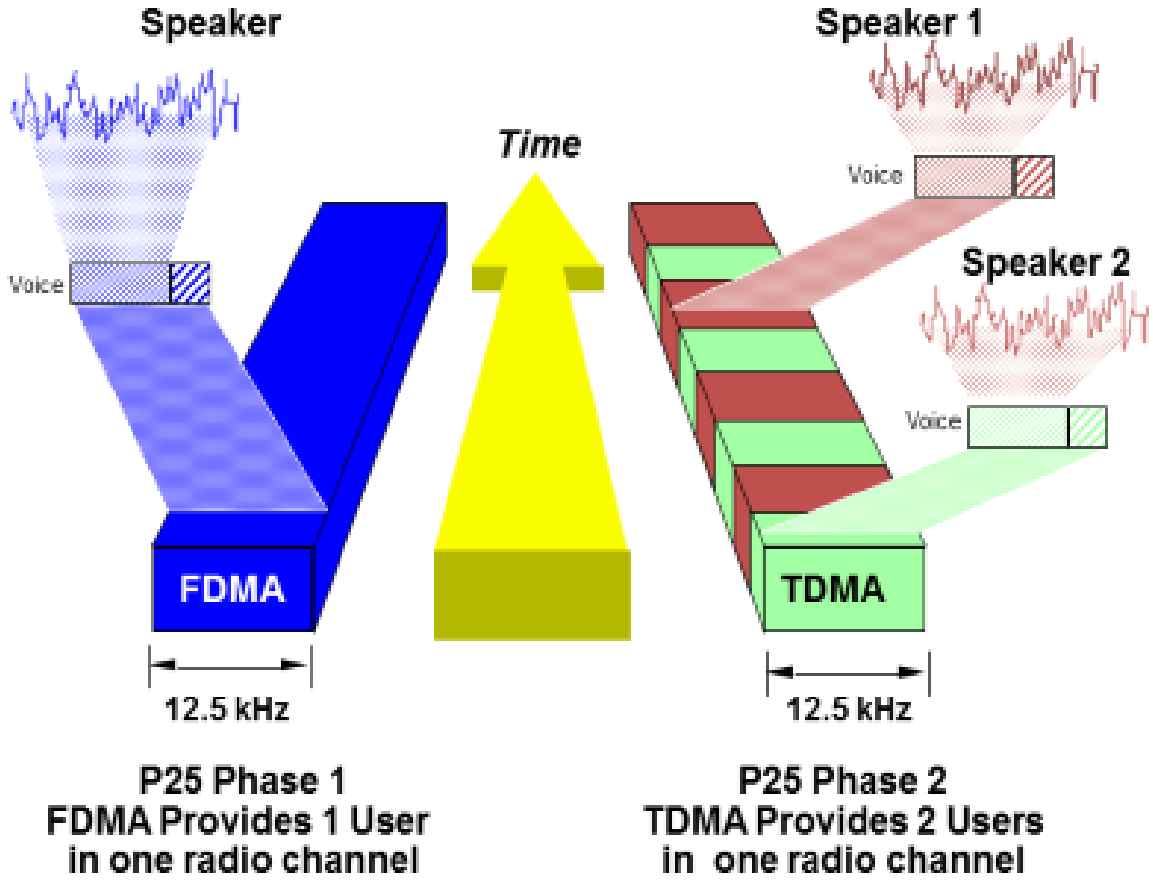
P25 SYSTEM OVERVIEW

L3Harris' P25 was the first completely Internet Protocol (IP)-based mobile radio communications system developed for users requiring the secure digital voice and data capabilities of Project 25. P25 is part of a portfolio of solutions that L3Harris offers for wide-area communication systems – each of which can meet the communications requirements of federal, public safety, public service and first responders. P25 meets the requirements of the P25 Phase 1 and Phase 2 standards, plus provides value-added voice and data features.

To allow more users per channel, the P25 standards committee defined "P25 Phase 2 TDMA operation." P25 Phase 2 compliant radios can operate using the two-slot Time Division Multiple Access (TDMA) modulation format. In this case, TDMA technology allows two voice calls simultaneously on each frequency/channel. The channel is still 12.5 kHz, but it now supports two active calls simultaneously, thereby providing operation with 6.25 kHz equivalence.

In P25 Phase 2, each base station supports two timeslots (two calls) per 12.5 kHz channel bandwidth (Figure 24). This TDMA modulation scheme enables radios to use the equivalent of a 6.25 kHz voice channel. So P25 Phase 2 is called "6.25 kHz channel equivalent" by the FCC. P25 Phase 2 supports twice as many calls per channel as P25 Phase 1 mode. By using the RF spectrum more efficiently, P25 Phase 2 effectively increases the available voice talk paths by a factor of four, compared to a legacy analog RF channel.

Figure 24. Comparison of FDMA and TDMA Radio Channels



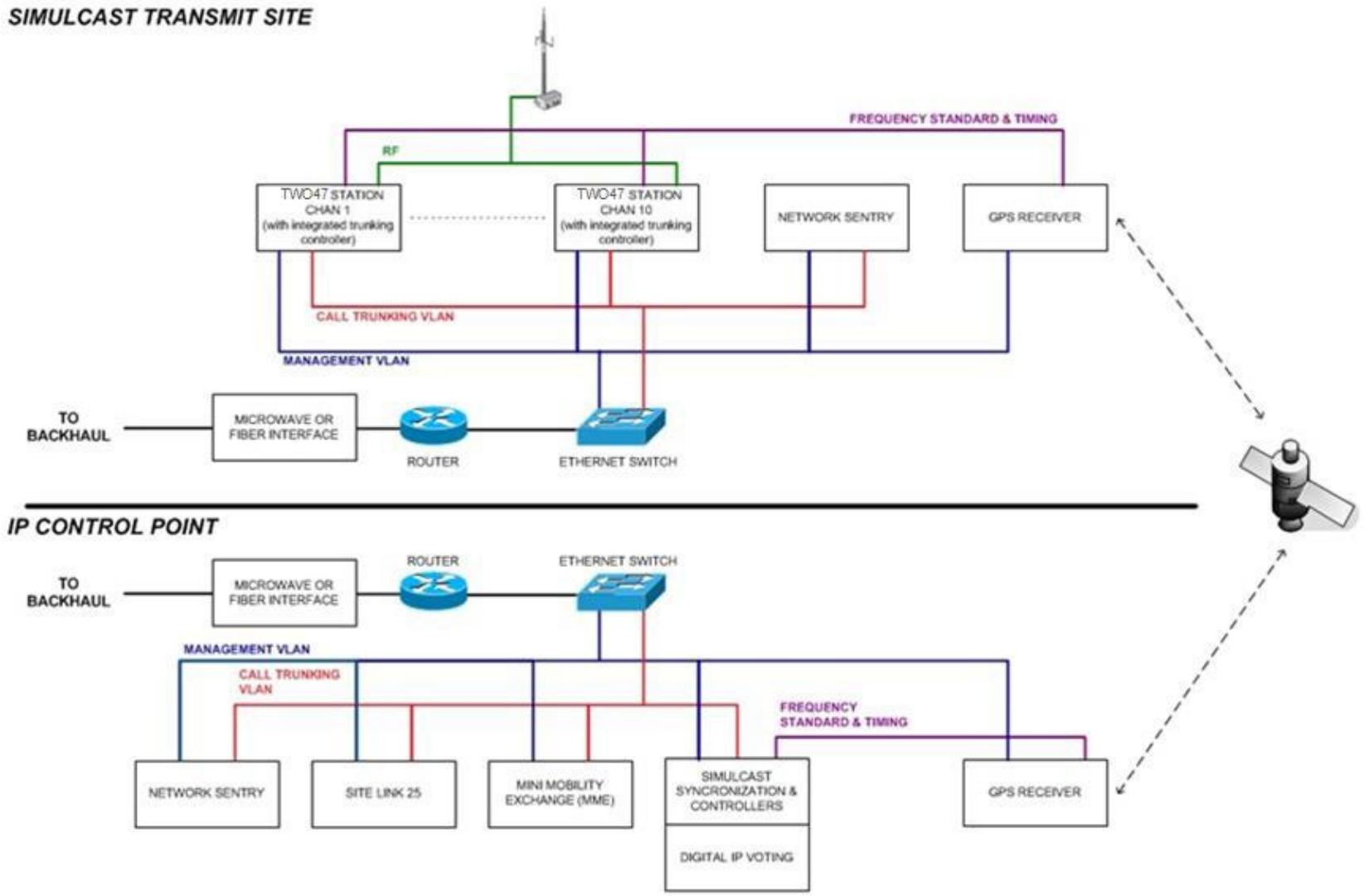
As the number of LMR users increase, so does the need to support greater capacity and improve system efficiency. L3Harris P25 Phase 2 technology offers a solution to support the challenges and demands of the technologically maturing LMR industry. The following features and benefits are supported within L3Harris P25^{IP} Phase 2 systems:

- Meets FCC Narrowband initiative
- Increases voice channel capacity – two voice-paths per working channel
- Maintains voice quality by using digital technology
- Improves interoperability through standards-based protocols and interfaces
- Protects Phase 2 system capacity while providing backwards compatibility

P25 PHASE 2 TRUNKED SIMULCAST

In the P25 Phase 2 trunked simulcast system, the simulcast sites include both a transmitter and receiver for each of the seven trunked channels, as well as the common equipment required for simulcast operation. The Distributed Control Point(s) connect to each of the simulcast RF sites through the new microwave system. Figure 25 shows a high-level block diagram for the P25 Simulcast Control Point and transmit site architecture.

Figure 25. Control Point and Transmit Site Architecture



Linear Simulcast Systems operating in P25 Phase 2 use the H-DQPSK Phase 2 Linear Modulation trunked digital protocol. Combining P25 with trunked Simulcast adds benefits like extended coverage areas, trunking, and greater usage of RF bandwidth.

Outbound (Transmitter) Signaling

Timing (or delay) for the outbound transmissions is adjusted by each transmit site to make the timing reference signals from the Control Point and transmit site match. Control of the exact time the common outbound signal is transmitted from each transmit site in a simulcast system is critical to areas where overlapping coverage zones exist between the simulcast transmit sites. Proper timing results in effective simulcast communications. Using the precise timing signals produced by Global Positioning Satellite (GPS) receivers to synchronize P25 trunked Simulcast systems provides an efficient and cost-effective solution for obtaining the above conditions.

GPS receivers at all sites produce a 1 pps clock signal, used for system timing. At the Control Point, the GPS timing signals are used to generate the outbound data and a timing reference that is embedded in the outbound transmit data packets that are sent to all transmit sites.

The timing reference generated from the local GPS receivers at all transmit sites are compared with the recovered timing signals from the Control Point by the base station to set the proper transmit time.

In addition to the 1 pps timing reference signal, the GPS receivers at the Control Point produce a 10 MHz clock for the control point traffic controller shelves and the network backbone equipment. At the transmit site the GPS receivers produce a 10 MHz clock for the station reference that is used for both precise RF carrier generation and precise control of the transmit data rate.

System Stability

In a typical simulcast system, transients produced by weather disturbances such as lightning and other sources of noise can affect data synchronization. These transients may disrupt a microwave path or cause the microwave system to switch over to hot standby. Data synchronization must be maintained to achieve overall system communication integrity in the overlap zone.

Two methods are employed to assure long-term synchronization and stability:

- Frequency synchronization from the Global Positioning System.
- A unique high-speed data auto re-synchronization system.

The RF carrier frequency of each channel is precisely maintained within 0.1 Hz of the desired frequency to minimize distortion due to heterodyning frequencies. To achieve this level of performance, the reference oscillator at each transmitter is locked onto the 10 MHz reference signal derived from the 1.5 GHz signal from the GPS receiver. The accuracy of the 10 MHz oscillator, when locked to the GPS, is held within $\pm 1 \times 10^{-12}$.

P25 TRUNKED DATA

The P25 Digital Trunking Radio System solution provides an entirely IP radio backbone architecture concept called VIDA. The same VIDA architecture that supports the Digital Trunking Radio System for voice also supports data communications. The VIDA network includes the capability to provide P25 Trunked Data. The VIDA architecture supports many features for mobile data system enhancements to

meet the City of Aurora's mobile data requirements. A summary of our P25 data offering is provided below:

- P25 Compliant
- GPS location reporting for Mapping Applications
- Over-The-Air-Rekeying (OTAR)
- Over the air radio programming/provisioning (OTAP)

The key to voice and data integration is that data calls are trunked in the same manner as voice calls, thus bringing to data the trunking advantages of adaptive load balancing, a single radio for voice and data, fault tolerance, and future growth opportunities.

The VIDA architecture provides the City of Aurora the capability to communicate with other public safety, private and commercial Wide Area Networks (WAN) without changing the network infrastructure. Because the backbone of a VIDA network is IP, there are many options to implement applications and systems as required to meet performance, coverage, and budget requirements without additional networking equipment.

P25 Mobile IP Subsystem (PMIPS)

The P25 Mobile IP Subsystem (PMIPS) is an integral part of data routing at each RF site. PMIPS provides a communication interface for data between mobile client radios as part of the P25 trunked radio system and computer systems connected to the VIDA network.

P25 Simulcast Site Equipment

A transmit site contains the base station equipment which provides over-the-air communications for mobile and portable users in the system. Each transmit site includes a receiver and transmitter for each frequency (channel) used by the system.

Sites within a simulcast cell or zone operate on the same set of RF frequencies. What makes simulcast unique is the ability for each site to transmit the same message, on the same frequency, with exact (precision) timing; thereby minimizing interference generally caused by two or more transmitters operating on the same frequency in close proximity. Outbound voice and data intended for subscribers simultaneously transmit from each transmit site in the simulcast cell. Simulcast systems must consider delay spread restrictions that are not addressed in the analog system.

The L3Harris simulcast system does not require manual alignment to maintain the specified system-level performance. The simulcast equipment, including transmitters, timing elements, and other system components, support long-term stability and maintainability and operate without the need for frequent manual optimization and system/subsystem alignment.

The L3Harris IP simulcast solution uses an all-digital (non-mechanical) setup and alignment verification procedure. This means there are no mechanical controls or switches to adjust during system alignment verification. Coupled with the all-IP-based network design, system test and alignment may be performed from anywhere that an IP network connection is available and the transmit sites can be received by the test receiver. Required test equipment includes a test receiver, an oscilloscope, and a GPS receiver with a 1 pps output (such as a GPS receiver at one of the sites), and a laptop PC. Unlike non-IP-based simulcast systems, this means full remote alignment is possible from a location other than one of the system's sites, providing the test equipment mentioned above is available along with a 1 pps signal from a GPS receiver.

Two47 Base Station

The L3Harris Two47 Base Station is a visionary platform that increases power and thermal efficiency, reduces equipment footprint, and builds on L3Harris' proven ability to implement world-class stations with leading-edge technology.

The Two47 Base Station extends the L3Harris P25 trunked repeater functionality into a robust, industry leading, single rack unit design. Incorporating advanced digital signaling capabilities, improved power and thermal efficiencies, and extended remote network management features, the Two47 Base Station delivers high-specification performance with lower total cost of ownership than other commercial offerings.

TWO47 BASE STATION FEATURES

- **Project 25 Phase 1 (FDMA) and Phase 2 (TDMA)** – the Two47 Base Station supports P25-compliant control channel and working channel operation, maximizing the number of subscriber radios that can be supported on 12.5 kHz channels.
- **Linear Modulation** – the Two47 Base Station supports P25-compliant linear simulcast modulation, optimizing coverage and capacity for the networks using a limited number of channels. L3Harris' industry leading Distributed Control Point (DCP) technology is included in the Two47 Base Station, allowing customers to configure up to four sites as control points within a single simulcast cluster.
- **Analog FM Simplex and Duplex** – the Two47 Base Station supports Analog FM Simplex and Duplex operation for legacy and mutual aid, narrow-band (12.5kHz) communications.
- **Optional High Velocity Data (HVD)** – the Two47 Base Station supports use of the Project 25 FDMA Autonomous Data Channels, allowing frequent data calls such as subscriber radio location updates to be moved to dedicated data channels. For networks that have access to 25 kHz bandwidth channels, the Two47 Base Station also supports HVD-TDMA, which provides additional capacity, as well as the ability to dynamically manage the allocation between data and voice channels. Only a software update on the station is necessary to convert a P25 Phase 1 or Phase 2 channel to HVD or HVD-TDMA mode.

COMPACT AND ROBUST

The Two47 Base Station builds on the L3Harris legacy of operation in rugged environments, with the new design eliminating potential failure modes with interconnection between multiple modules.

The new single, integrated package meets MIL-STD-810G requirements:

- Ambient temperature range of -22 °F to +140 °F
- Operation at altitudes of 15,000 feet above sea level.

The customer specifications for smaller shelters or roof-top footprints, and tough environments gives more flexibility to pick site locations, even those formerly discarded for old generation base stations.

The Two47 Base Station integrated package also includes an enhanced suite of alarms network management capabilities that supports remote maintenance and servicing, adding to the reduction in the overall total cost of ownership.

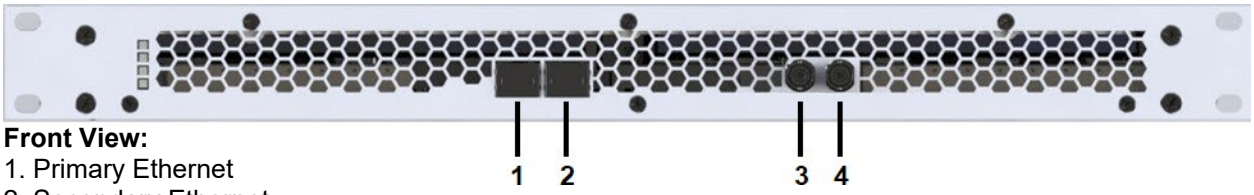
DISTRIBUTED ARCHITECTURE

Distributed architecture results in high-fault tolerance, minimizing the effects of hardware failure, Also, allows all trunking channels to operate as either a control channel, voice and data working channel, or as a dedicated data channel, which results in a greater level of reliability than that of other systems.

- Single rack unit design.
- Fault tolerant network connections.
- Two (2) simulcast control points for the simulcast cell.
- Ethernet connection to the VVS (Network Sentry) site monitoring and alarm equipment.
- Remote maintenance and services.
- Digital-signal processing provides economical routing and backhaul.

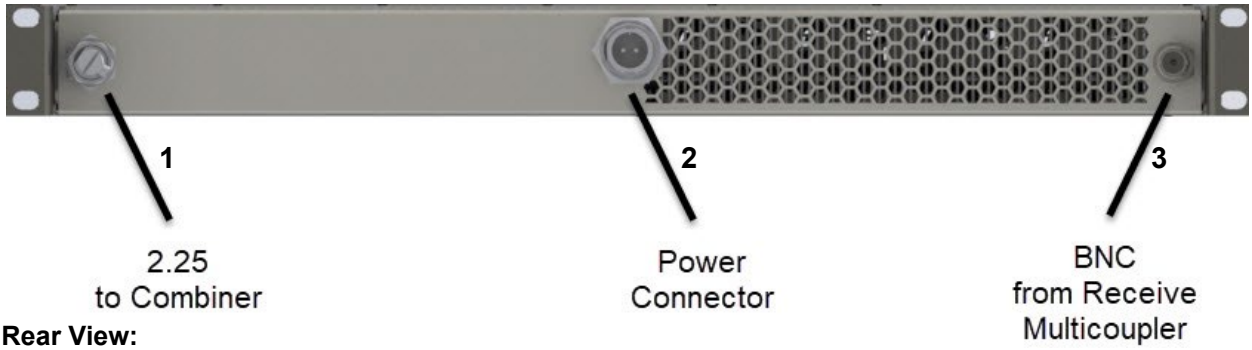
Figure 26. Two47 Base Station Transceiver Module (1RU)

Figure 27. Front View of Two47 Base Station Transceiver



Front View:
1. Primary Ethernet
2. Secondary Ethernet
3. IEEE 1588 Characterization Port
4. IEEE 1588 Characterization Port

Figure 28. Rear View of Two47 Base Station Transceiver



Rear View:
1. Transmit Antenna Port
2. Power Connector
3. Receive Antenna Port

SOFTWARE RE-DEFINED SITES

The Two47 Base Station builds on L3Harris' experience implementing and supporting world-class networks. The sites incorporate Network Function Virtualization (NFV), which decouples network features from legacy embedded computing appliances. Instead, with the Two47 Base Station, site features such as provisioning, network management, and data proxies are provided as virtual machines, allowing flexible network design, including future private or public cloud deployments.

Highlights of the Two47 Base Station site architecture include:

- Feature flexibility – the Two47 Base Station allows any channel to be a control channel, voice and data working channel, or dedicated data channel.
- NFV technologies at the Two47 Base Station site allow for flexible deployments and improved redundancy.
- Two47 Base Station high density site design allowing up to eight channels, antenna equipment, and network infrastructure in a single rack to reduce equipment footprint at the shelter.
- Improved power and thermal efficiency over legacy designs, lowering the requirements for backup power capacity and air conditioning at remote sites.
- Extreme reliability with no single point of failure in the site design. This includes redundant timing and network infrastructure.
- Simplicity in the Two47 Base Station sites to reduce installation and maintenance activities. Improved network management capabilities alert system administrators to trending degradation in service before failure occurs.

COMPACT SITE LAYOUT

With an eco-friendly design to reduce power consumption and equipment footprint, the Two47 Base Station supports up to ten channels in a single 86-inch rack, including:

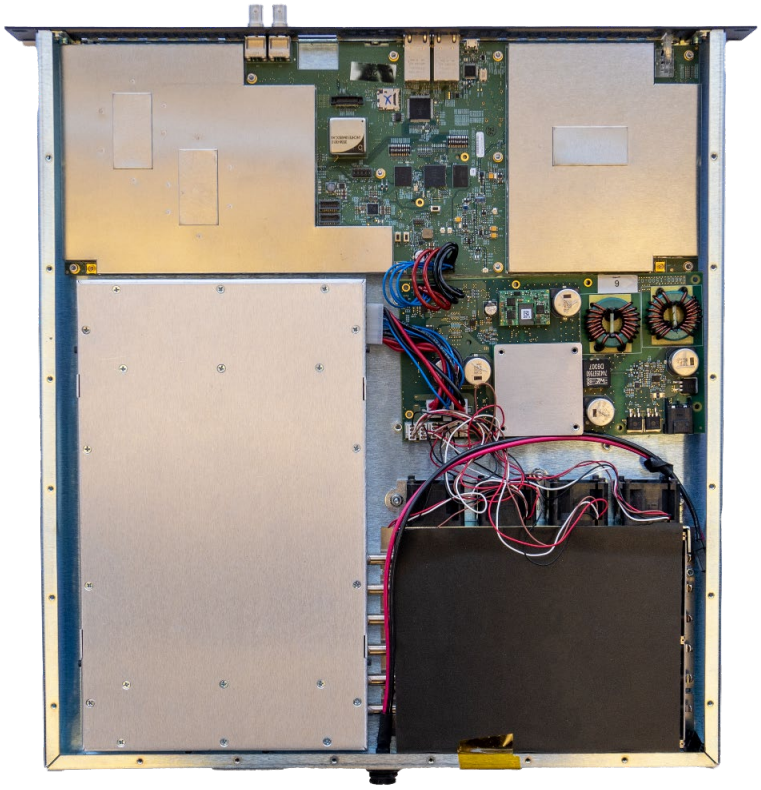
- Base transceivers
- VIDA Virtual Site controller
- AC Power supplies
- Cisco networking equipment
- Transmit combining and receive multicoupler equipment
- IEEE1588 master clock timing equipment

TRANSCEIVER SPECIFICATIONS

- Includes TX, RX, Linearizer, High Power PA, and Modem processing in a single channel in a 1 RU package with 86.0 H x 20.5 W x 19.3 D inch overall dimensions.
- Transceiver offered in configurations that support the major LMR bands: VHF, UHF, 700/800 MHz, with single bands to cover 146-174 MHz, 380-430 MHz, and 450-512 MHz.
- Software defined radio that supports P25 Phase 1 (FDMA) and P25 Phase 2 (TDMA) trunking operation.

Available in single site, multi-site, and Distributed Control Point simulcast configurations.

Figure 29. Top View of Transceiver



SIMPLIFIED MAINTENANCE PROCEDURES

The distributed architecture of the Two47 Base Station sites results in high-fault tolerance, minimizing the effects of hardware failure. For example, each Two47 Base Station has built-in Traffic Controller functionality that controls its call-processing functions. Redundant Ethernet switch functionality in the repeater chassis connects each Traffic Controller to two Local Area Networks (LANs) for network management and call processing which results in a greater level of reliability than that of other systems.

- Remote programming of the Two47 Base Station allows the system administrator to perform software upgrades, firmware upgrades, or individual parameter changes without traveling to the site and manually connecting to the stations.
- Network integration into site monitoring and alarm equipment. Remote diagnostics monitor real time system performance, tracking performance degradation before failure occurs.
- Integrated packaging and automated channel provisioning allow the fastest possible channel replacement, eliminating the need to test and swap modules at remote sites.

Distributed Simulcast Control Point Technology

L3Harris brings its patented, advanced Distributed Simulcast Control Point Technology (DCP) to the City of Aurora to provide maximum system uptime. DCP represents a new approach on how to architect simulcast cells. The advantages of L3Harris' design approach include:

- Traditional simulcast control point hardware is eliminated, including separate voting systems.
- Control functionality redundancy with geographically distributed control technology increases simulcast resiliency over only single or hot standby prime site redundancy.
- Scalability and flexibility provide the most cost-effective solution on a per-cell basis.
- Supports Layer 3 transport for better backhaul utilization than competitive Layer 2 transport solutions.
- Features automatic and manual transitions from one simulcast control point to another.
- Network and VIDA Core components are transparent to transition.
- Supports P25 Phase 1 and Phase 2 operation.

L3Harris has configured two (2) RF sites in the system to act as distributed control points.

SITE NETWORKING EQUIPMENT

Commercial-off-the-Shelf (COTS) routers and Ethernet switches perform the following functions:

- Move information across a network from source to destination
- Recognize all the different network layer protocols used on the network
- Provide more than one path to a destination network
- Switch voice packets and arbitrate cross-site voice access

Unlike other systems that use proprietary operating systems on non-standard networking equipment, L3Harris P25 systems deploys routers and switches that utilize their native operating systems. This ensures the full benefits of COTS networking equipment.

**L3Harris uses COTS equipment for site switch and routing.
These devices utilize non-proprietary operating systems.**

Ethernet Switch

The site Ethernet switch provides a LAN interface for site equipment and a LAN port for the site router. L3Harris shall provide Cisco C9200L switches for cores and RF sites and the Cisco C1000FE at the dispatch locations.

Figure 30. Cisco C9200L Switch

RF Site Router

The redundant site routers provide an interface handling all the IP network voice, data, and management traffic between the network switch and the RF site. It provides the following:

- **Media Conversion** – This converts the Ethernet to the selected transport medium.
- **Quality of Service (QoS)** – This applies a prioritization marking to each packet to ensure real-time services (e.g., voice) receive its required bandwidth.

VIDA Virtual Site – Remote Terminal Unit

The VIDA Virtual Site is a powerful, compact computer that hosts Site Management Services as part of L3Harris' total Site Management System. It provides a full array of digital communications capabilities for fast, accurate, and efficient relay of critical information.

The VIDA Virtual Site monitors the site call processing local area network (LAN) for call activity and fault messages. The VIDA Virtual Site ensures that data such as user, group, and channel configurations is reliably transferred to configured site devices. The fault monitoring services take input from the site call processing of LAN, RF Power, Digital Input/ Output (I/O), Channel Test services and current alarms. It uses this information to identify potential problems and their severity, status, and reason for the most recent failure. This increases operator awareness, improves response time for maintaining vital communication links, and decreases repair time and system downtime.

The VIDA Virtual Site can be custom configured with an array of analog or digital Input or digital Outputs adapters which can be used to gather site alarms or control relay logic devices. These I/Os can also be configured by the user to indicate faults in devices such as tower beacons, doors, temperature alarms, etc. that require remote controlling and monitoring. This information allows users to make quick, informed decisions to meet their needs and to adapt as those needs change.

Site Mobile Data

The P25 Mobile IP Subsystem (PMIPS) architecture includes the Site Mobile Data functionality, which is the heart of the P25^{IP} data system and is responsible for running the Foreign Agent services. Site Mobile Data performs mobile IP registrations on behalf of all radios, stores radio destined IP packets during call setup and retries, provides Logical ID (LID) to IP address mapping, interfaces to the control channel for call setup, and delivers IP packets to an assigned working channel. Call handling is an important Site Mobile Data feature because of the disparity in speeds achievable by the computer network and the radio network. Specific call handling tasks include:

- Placing channel requests
- Monitoring channel assignments
- Routing data traffic to the assigned channel
- Retrying when a busy assignment is granted
- Standing by when a queued assignment is granted
- Limiting the duration of radio destined data calls
- Logging statistics on call events such as the number of packets delivered

The P25 Mobile IP Subsystem (PMIPS) provides a communication interface for data between mobile client radios and a host computer network. PMIPS allows Host Applications such as OTAR KMF, ProFile™ Manager, and third-party applications to communicate via IP open standards over the P25 System.

PMIPS uses a Home Agent and Foreign Agent design (as defined by the IP Mobility standard documented in RFC 3344) to route data messages to radios as they roam between sites.

The PMIPS core components consist of the Site Mobile Data functionality, one or more IP routers serving as Home Agents, and radios which are feature encrypted for data operation. An SMD is required at each RF site. The Site Mobile Data functionality is provided by a virtual machine hosted by the VIDA Virtual Site computer.

Over-the-Air Rekeying (OTAR) via PMIPS

The L3Harris P25 Key Management System for OTAR provides a secure framework for encryption key generation and distribution within the network of P25 devices using the PMIPS architecture. Key management becomes more complex as the number of encrypted units increases. L3Harris offers a key management solution to meet the requirements for a large network of radios, dispatch consoles, and Crypto Nets, which will be managed effectively by network-based key management servers using encrypted over-the-air transport of keys to fielded radios and network devices. The L3Harris P25 Key Management System provides mechanisms for key generation, storage, transport, and key loading. Key generation is accomplished either automatically by the KMF, or by manually entering in a known key. Keys are stored in the KMF database.

Radio network key transport is performed securely using encrypted Over-the-Air Rekeying (OTAR) formats. Loading keys into the target devices is accomplished either through a direct cable connection to a PC or through encrypted OTAR messages transmitted across the network (IP) connection.

Over-the-Air Programming (OTAP) via PMIPS

ProFile is a L3Harris' Over-the-Air Programming (OTAP) solution for reading and writing P25^{IP} radio personalities over the air using the PMIPS architecture. Profile offers tremendous improvement in efficiency and flexibility by providing the capability to read and write radio personalities over the air. Over-the-air programming is accomplished with the ProFile Manager, a Windows-based application, which was developed to make wireless programming simple and easy to perform. ProFile Manager sends and receives information to or from radios via P25^{IP} packet data. The radio operator can interrupt the programming process, if necessary, by depressing the PTT button or declaring an emergency. Once a radio personality update is successfully completed, the radio automatically resets itself, switches to the new personality, and returns to normal operation. If reprogramming is unsuccessful, the radio continues to operate using the existing programming settings. ProFile Manager informs the operator of the status, whether successful reprogramming or unsuccessful.

ProFile Manager communicates with radios through the P25^{IP} Mobile IP Subsystem (PMIPS) using the Internet Protocol (IP). The ProFile Manager works with the Radio Personality Manager (RPM) to download the personality files. The RPM creates, modifies, and stores personality information while the ProFile Manager delivers the personality over the trunked or conventional network to the desired radios. RPM and ProFile Manager work together to make network and subscriber maintenance easier and more controllable.

The ProFile Manager is loaded on a personal computer (PC) and can be connected anywhere on the radio network. Its basic tasks are to:

- Access personality files and reduce them to packet-size blocks.
- Place a sequence of data calls to send the entire personality file to the target radio.
- Keep track of the sequencing and the re-sending of blocks after failed attempts.

Display a status to the operator during and upon completion of the sending process.

Multi-level Voice Interoperability

Interoperability, a core feature of the system, enables radio users to fulfill critical missions by being able to interoperate with neighboring systems. The system includes several interoperability solutions for bridging communications with legacy and neighboring systems.

The L3Harris VIDA architecture will port the existing solutions that address interoperability at network, system, and local levels, to the new VIDA core. This includes legacy 2 wire and 4 wire audio from remote base stations and network level interoperability via existing ISSI connections.

The P25 trunked system for the City of Aurora is based on the L3Harris VIDA architecture and includes the levels of interoperability shown in Figure 31.

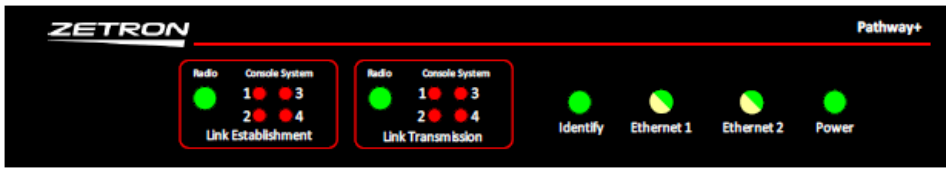
Figure 31. Multiple Levels of Interoperability

INTEROPERABILITY FUNCTION	ACHIEVED BY	DESCRIPTION
Legacy OpenSky to new P25	VIDA SR10A.7	The VIDA core allows the OpenSky LMR system to communicate with the P25 system with shared talkgroups and talkgroup patches.
Radio Interoperability	I/O Gateway	The I/O gateway connect to 4-wire E&M resources that converts the audio to IP for inclusion into the Dispatch Consoles.
Interoperability with cellular data, Wi-Fi, or other data connectivity	BeOn® Server	The BeOn® server provides interoperability between the P25 radio system and cellular or Wi-Fi systems.
ISSI to other P25 systems	P25 Inter-RF Subsystem interface (ISSI)	ISSI enables network connectivity between any L3Harris network and other vendor P25 systems. This will allow authorized radios to roam across networks while maintaining access to dispatchers and radios on their home system.

PATHWAY+ ANALOG RADIO GATEWAY

The Pathway+ Analog Radio Station Gateway uses the Zetron Pathways+ Digital Fixed Station Interface (DFSI) Gateway to provide voice connections for interoperability between VIDA networks and repeaters, base stations, and control station radios on legacy radio systems.

Figure 32. Front View of the Zetron Pathway+ Gateway



Pathway+ acts as a communication bridge that operates over IP networks while replacing proprietary and legacy network connections. It allows for two-way communications between base stations and DFSI-connected consoles, regardless of the manufacturer or age of the equipment. This makes Pathway+ a powerful tool for agencies that are not ready to invest in fully upgrading their voice communication systems.

The audio from the legacy system is transported to the VIDA network using the L3Harris Encompass Gateway, which maps the DFSI talkpaths to VIDA P25 Talkgroups.

The Zetron Pathway+ Gateway supports:

- Up to two connected base stations or repeaters.
- Up to four radio connections (2 gateways) in a 1RU rack mounted configuration. Multiple gateways can be installed at any suitable location.
- The following base station control features:
  - Conventional Control Channel Selection
  - Conventional Control Repeat Mode (Enable/Disable)
  - Conventional Control Squelch Mode (Monitor Mode On/Off)

L3Harris has included Pathway+ Gateways with 36-talkpaths, matching the count of the existing Unified Audio Cards (UAC). These gateways permit system-level audio connectivity with legacy trunked and conventional analog radio systems, regardless of manufacturer or frequency band.

The Pathway+ Gateways accept analog audio and converts it to digital voice packets for use within the VIDA network. Any source that is capable of providing analog audio can connect to an Interoperability Gateway.

Typical sources of audio accepted via an Interoperability Gateways include:

- Mutual aid repeaters
- Conventional base stations of any frequency band
- Trunked systems (analog or digital) including L3Harris (EDACS/ProVoice), Motorola (SmartNet, SmartZone, ASTRO), and other manufacturer systems (of any frequency band)
- Analog systems or P25 conventional systems
- Digital Mobile Radio (DMR) systems or base stations
- TETRA, iDen, or SMR systems or base stations

The Pathway+ gateways will be an upgrade for the City's existing Universal Audio Card (UAC) gateways currently in place.

Encompass Gateway

The Encompass Gateway for Digital Fixed Station Interface (DFSI) provides the capability for a VIDA Network to interface to any device that supports the DFSI P25 TIA-102 BAHA Fixed Station Interface. The application provides configuration, call control, and audio processing into and out of the VIDA Network for connected stations. The application also provides some Conventional Control capability.

The Encompass Gateway for DFSI bridges VIDA with DFSI stations or gateways, providing connectivity between conventional stations and Dispatch, BeOn®, and P25 radios.

The Encompass Gateway provides the following conventional controls, which are supported by the Symphony Dispatch Console:

- Channel Selection
- Repeat Mode (Enable/Disable)
- Squelch Mode (Monitor Mode On/Off)

The Encompass Gateway application runs on the VIDA Application Server (VAS) as a Virtual Machine (VM). The Regional Network Manager (RNM) monitors, reports and logs the link status of the DFSI to the VNIC. Call records are recorded in Activity Warehouse. Realtime call activity is displayed by the RNM.

P25 ISSI CONNECTIVITY

The City of Aurora has expressed a need to continue to communicate with the City of Naperville. L3Harris has included an ISSI gateways connections and licenses for as well as the services to connect the City of Aurora side of the ISSI link.

ISSI Connectivity to Naperville

L3Harris will use the existing 4.9 GHz microwave link to facilitate the ISSI connection between Aurora and Naperville. L3Harris' new microwave system will not include a connection between the two cores.

ISSI Gateway

The Inter-RF Subsystem Interface (ISSI) is part of the P25 standards to facilitate the connection of two or more P25 networks. Regardless of frequency or manufacturer, two or more different P25 LMR networks that support the ISSI can communicate with one another. If radios from separate agencies function in the same frequency band, users from one system can roam onto the other system and achieve interoperability and extend operability of their home network.

The ISSI provides the features and capabilities necessary for communicating and interfacing with surrounding agencies. The ISSI server is virtualized on the NSC hardware. Therefore, one ISSI server is highly scalable and expandable with mere software upgrades to a maximum capacity of:

- Twenty (20) external system interconnections on the VAS (additional servers support more external system connections)
  - System interconnect licenses available on a per-system basis. L3Harris has included interconnect licenses for connections to one external system in the baseline solution.
  - Hundreds of concurrent talkpaths between systems.

- Every talkgroup and channel on the L3Harris VIDA P25 system can map to the ISSI connections with no additional license charge!
- Talkpaths are trunked resources that are available to all talk groups allowed by the City of Aurora to connect to the home systems from foreign systems via ISSI connectivity.
- Talkpaths licensed on a per-talkpath basis, not on a per group basis, meaning no additional license fees to expand access.

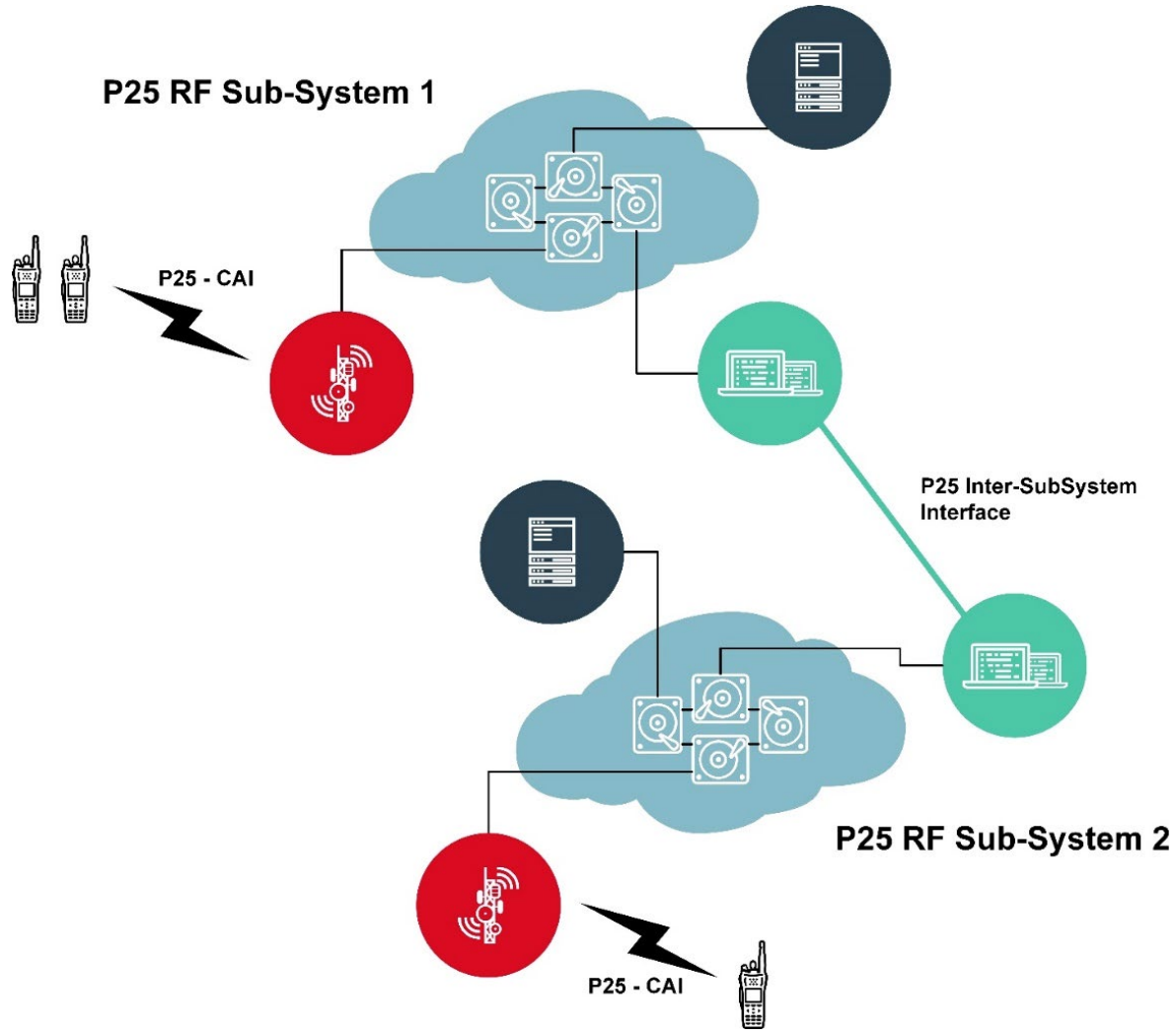
L3Harris has included one system interfaces with 20-talkpaths in the baseline solution, meaning 20 active ISSI conversations can occur concurrently. The City of Aurora can add connections to additional systems with software licenses (ISSI system licenses and appropriate talkpath licenses) and an additional router, as desired.

Figure 33. Features Supported by the L3Harris ISSI

ISSI FEATURES	
Group Calls (unconfirmed, encrypted)	Group Tracking
Emergency Calls	Highly Secure Operation
Fixed Group Mapping	Fault and Performance Traps
Automatic (forced) Group Registration	Real Time and Historical Call Activity
Send Caller ID in Group Calls	Support Site Adjacency
Foreign User Registration Support	ISSI Supplementary Data - Group Emergency Cancellation
Granting Requested Resources	Group Calls (confirmed)
Home User Roaming	Support Multiple Audio Streams for Preemption and Other Cases
Roaming Management	Console Subsystem Interface (CSSI) Voice Services
Unit Tracking	Capability Polling
Group Affiliation	CSSI Mobility Management Functions
Inter-RF Subsystem Interface (ISSI) Supplementary Data - Emergency Alarm	Support for P25 Phase 2
ISSI Supplementary Data - Emergency Alarm Cancel	–

L3Harris is constantly working to improve its ISSI offering in accordance with P25 standards. As the P25 standards bodies ratify new ISSI standards, L3Harris typically implements the new features within 18-months of ratification.

Figure 34. Inter-Subsystem Network



The ISSI application provides for the following features:

- Unconfirmed group calls
- Confirmed group calls
- Emergency group calls and cancellation
- Emergency alarm
- Console pre-empt calls
- Emergency alarm and clear
- Phase 1 and Phase 2 audio
- Support for the CSSI
- Conveyance of RF site adjacency information for automatic roaming
- Group and unit registration
- Supports up to 200 concurrent group calls
- Call arbitration
- Fault reporting to the regional network manager
- Dynamic database information from the Unified Administration Server (UAS)
- VIDA device manager support
- RFSS service capability polling
- High availability Service

LOGGING RECORDER

L3Harris shall provide an Exacom logging recorder solution to address the recording requirements for the project and the Exacom solution is a great value. This approach shall provide a recording system that is easy for users to navigate, that is secure as it is aligned with L3Harris cyber security policies and will remain up to date in terms of patching via the L3Harris SUMS process and server. This combination provides a recording solution that is not just secure and compatible with L3Harris now but will remain secure and compatible in the future as well. The Exacom recorder solution is fully backed and support by L3Harris and Exacom support teams.

Aurora shall be responsible for retaining the old logging recorder for archival purposes to meet departmental policies and applicable regulations. L3Harris assumes that the data contained on existing logging recorder will not be transferred to the new logging recorder. L3Harris assumes that the data contained on existing logging recorder will not be made available or be accessible via the new logging recorder.

Overview

Exacom, L3Harris' preferred logging recorder vendor, is pleased to provide this solution for the City of Aurora project recording system as we understand the requirements as discussed with L3Harris and outlined in our quote. This design provides a solution approach that is fault tolerant and features redundant servers with hot swappable power supplies and Raid 5 hard disk storage. It is important to note that the recording system will feature the latest Exacom HindSight 4 recording software. The combination of their latest software, along with the Dell hardware will support the current requirements as well as accommodate future optional upgrades that will support additional functionality and technology such as Quality Assurance and screen capture options for example. Exacom systems have been deployed in many mission critical public safety, government and military projects with L3Harris. One example of a large, multi-location recording system provided with L3Harris would be the City of Chicago's Office of Emergency Management and Communications. The OEMC was founded in 1995 and is responsible to coordinate the City's delivery of police, fire, emergency medical resources to 911 calls.

With more than 30-years of experience, Exacom is a leading provider of multimedia (analog, RoIP, VoIP, text /SMS, and screen capture) logging/recording solutions across public safety, government, DoD, energy, utilities, transportation, and security applications. Their distributed recording capabilities enable some of the most flexible and all-encompassing recording solutions in the industry. Exacom's unique architecture also allows for a single recording platform to be securely shared between different organizations in a way that makes each organization feel like they have their own recorder. With thousands of recorders installed across the world, their solutions are proven to exceed the demanding needs of today's complex and rapidly advancing mission-critical environments.

This solution addresses typical customer needs for the latest technology related to multimedia recording, specifically for P25. The Exacom solution will meet the current requirements as well as accommodate future upgrades to support new features and technology such as Quality Assurance and screen capture.

Like L3Harris, Exacom is customer-focused and demonstrates this with the investments they have made in supporting those customers. With a base of regional employees throughout the United States and Canada, they provide regional support to L3Harris and their customers. They also provide an industry leading lifecycle management program that supports users for the long term through software assurance, hardware warranty, software patches, and planned hardware and software refreshes. As a

part of this program, and because of Exacom's partnership with L3Harris, Exacom keeps customers problem-free with proactive support as L3Harris upgrades and updates the radio system.

Exacom recording systems have been deployed in many mission critical public safety, government, and military projects with L3Harris during their partnership of more than 18-years. Both companies share a dedication to technology innovation, reliability, and creating the best possible experience for the customer.

The City of Aurora Recorders Configuration

Exacom has provided a solution based on redundant, 84-channel recording servers (Dell T-640), to be installed in the City of Aurora designated Communications Centers. The system is configured with the following channels to meet the specified requirements:

- 12 IP channels for L3Harris P25 audio and data for both encrypted and non-encrypted talk paths as well as Interop channels, all via the L3Harris VIDA core.

The servers will simultaneously record all L3Harris P25 vocoded and encrypted communications. Once these recordings have been captured by the recorders, the recordings will be stored in the core location recording servers as well as the NAS device for backup purposes.

Client Access

The HindSight 4 client software provides the ability to search, playback and save P25 and phone calls. This includes the ability to search by all available P25 associated data and any phone related data. The HindSight 4 software will assist with incident recreation through the playback of radio calls for replay of the incident. It is important to note that recording access will be administered and governed by the local system administrator and users will have permissions and access provided by the system administrator. The client access will be provided to all users as determined by the City of Aurora Administrative contact. Two (2) client licenses are provided per recording server so that two users can access recordings from each system. Additional concurrent client access can be provided by the City of Aurora administrative contact; however, the limit of two concurrent users per server will remain until additional licenses are purchased.

BEON® – LMR OVER BROADBAND SOLUTION

L3Harris developed the BeOn® group communications suite to extend P25 Land Mobile Radio (LMR) Push-to-Talk (PTT) communication services to users on commercial cellular and private LTE broadband networks. With the BeOn solution, voice communication services can be delivered to subscribers as Voice-over-IP data packets using wireless broadband IP data services. Using the BeOn solution, subscribers on a cellular or Public Safety LTE broadband network can communicate amongst themselves or with interconnected LMR users.

The BeOn solution goes beyond LMR functionality by providing integrated voice, messaging, and location functionality. BeOn subscribers can use the coverage and bandwidth capabilities of a commercial or private broadband data network for communications between team members. BeOn subscribers can interoperate with users on existing LMR systems, exchange text messages with other BeOn subscribers, dispatchers using the BeOn PC Windows client, and pass real-time location and presence information between connected BeOn team members. Transmitted voice and text messages can then be communicated in real-time and also be available locally on the subscriber handset for later recall. When

these communications are combined with integrated mapping and presence (subscriber status) information, BeOn users have the ability to determine the most efficient actions to take.

Because BeOn operates over both commercial cellular and LTE networks, utilizing these networks provides an additional level of interoperability with LMR narrowband communications. This extends the network coverage of a regional, statewide, or nationwide LMR network to the available coverage of global commercial cellular networks. BeOn subscribers operating on broadband networks have a cost-effective approach to extend the reach of their LMR communication systems.

The BeOn® User Experience

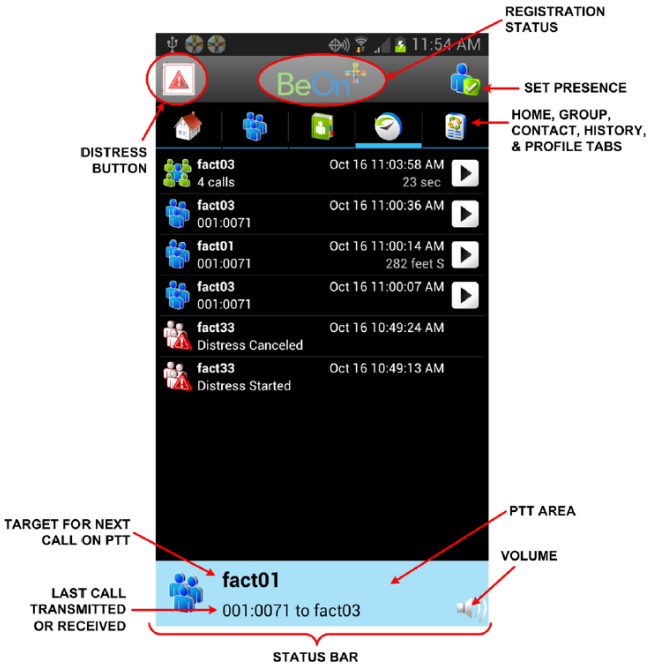
The BeOn subscriber application fully leverages the capabilities of the Apple iOS, Android OS and Windows operating systems and uses discrete buttons on the supported hardware platforms. The BeOn subscriber application provides intuitive and distinguishable icons for core functionality, with features driven through use of the Android touch screen. For ease of access, the Push-to-Talk function is mapped to a specific hardware button on each device.

BEON SOLUTION

The BeOn solution extends LMR features to cellular and broadband-based devices, and adds text, location and presence information and functionality. It has been configured (Capable/Enabled) for the XL family of portable radios.

The BeOn Home screen shows the currently selected talk group, scan operation, connection status and the user identification of incoming calls. Using the tabbed interface, the user can select the Groups screen to change talk groups, the Contacts screen to communicate individually with other BeOn users, the Events screen to replay missed conversations, and the Scan screen to select and manage scan lists. Other icons on the display provide access to Presence/Status updates and the Location services.

Figure 35. BeOn Subscriber Application



PTT Features

The BeOn PTT feature set comprises a collection of communications features focused on one-to-many (group) communications between mobile[1] users. Individual PTT communications (one-to-one) are also supported. A summary of the currently supported PTT feature set between BeOn devices is provided in Figure 36.

Figure 36. Push-to-Talk Features Between BeOn Devices

FEATURE	DESCRIPTION
Group Call	The ability for a user to simultaneously communicate with multiple users who are all part of the same talk group on the BeOn® network.
Individual Call	The ability for a user to establish a private 1.1 call with another user on the BeOn® network.
User Registration	Every user device is registered and authenticated on the BeOn® network.
Caller ID	Devices display the number and alias of the talking user while the transmission is ongoing.
Distress Calls	Distress calls notify a talk group that a field user needs assistance. Distress calls scan at a higher priority than normal calls.
Caller Location	Ability to include the device based geographical location (latitude and longitude) of a talker in each transmission. (Also includes relative location so the call participant knows where the call initiator is relative to his/her own location)
Location Privacy	A user may optionally disable the location feature from the handset.
User Presence	Allows a user to determine whether another user is logged onto the system and active or in silent mode.
Group Presence	Allows a user to determine which other users are currently members of a particular talk group
Call Logging and Callback	The device retains a log of each received transmission. By selecting the call record of a particular transmission, the user can “call back” the talk group or individual that was the source of the transmission.
Late Call Entry	Ability to join and participate in an ongoing talk group call due to the receiver being busy or out of coverage at the beginning of the transmission.
Group Scanning	Allows a user to monitor activity on groups other than its selected group and scan over to it when activity is detected.
Supervisor Override	Allows a Supervisory user to take the floor from the current talking party.
Console Override	Allows a Console to take the floor from the current talking party.
Instant Recall	Enables users to re-play recordings of recent transmissions directly from the call-log window of the device.
SmartGPS	The end user can configure the application to periodically report location to the server. The reports are sent on a time interval and distance removed basis.

[1] *L3Harris carrier’s network or other third-party network nor can L3Harris guarantee the quality of the data service provided. Given the dependency on commercial cellular and third-party networks, the operation of the BeOn® solution, including location information, is not intended for mission critical communications but rather for administrative and other communications.*

Enhanced System Redundancy and Resiliency

CORE RESILIENCY

The VIDA solution provides full-service location high availability failover. In the event that the primary core fails, the secondary core takes over in failover. VIDA provides robust performance without compromise; therefore, failover does not mean failure. VIDA networks meet mission critical reliability, availability, and maintainability requirements, utilizing centralized services and geographically split redundant servers. When operating at distinctly and judiciously separate geographic locations (yet fully network interconnected), the system shall provide automatic failover capability. If any part of a network core ceases to perform within specifications because a server, network, or physical location issue, the high availability service on the VIDA core ensures that communications continue with minimal impact to users through an expeditious failover of call routing.

SYSTEM RELIABILITY - FAILURE TOLERANCE

A fault-tolerant system approach maximizes radio system uptime by minimizing single points of failure for critical components. The City of Aurora needs a system that can reliably serve their residents and L3Harris has designed the system to meet those needs.

The network is equipped with location-diverse, high-availability cores to minimize downtime. Should a primary core fail, the system will automatically divert all traffic to the secondary core. The secondary core synchronizes all traffic with the primary core to maintain configuration integrity. The primary and backup VIDA Core servers exchange heartbeat messages approximately every five seconds. When the backup core fails to receive these heartbeats, it automatically takes over functionality from the primary. This could be the result of equipment failure, power and backup power failure, or connectivity failure. This switchover occurs within a few seconds and is typically not noticed by radio users and dispatchers.

Call processing applications within the Premiere VIDA core have redundant components at the secondary, so when switchover occurs, full service is restored. Dispatch consoles are programmed to continuously verify VNIC application by exchanging heartbeat messages every minute. No data or records are lost. The failure is reported as an alarm to the network management system, and corrective maintenance is coordinated by L3Harris or the City of Aurora, depending on warranty and post-warranty service agreements.

During catastrophic failures VIDA networks are designed to support a variety of user-configured operation modes to provide a managed fallback rather than an uncontrolled crash. L3Harris' P25^{IP} system uses distributed processing architecture to provide fault tolerance. This design philosophy concentrates on minimizing single failure points or common cause failures.

NETWORK REDUNDANCY

To meet the City's need for redundant links between the NSC cores and the Symphony Consoles, L3Harris shall include dual routers and switches at Dispatch and to further harden the overall system reliability.

VIDA NETWORK RELIABILITY MATRIX

Figure 38 shows possible failure modes of the new P25 system, the effects of those failures, and backup plans to mitigate the effect of the failure.

Figure 37. VIDA Premier NSC Cores

SYSTEM COMPONENT	FAILURE TYPE	EFFECT	BACKUP PLAN	RECOVERY PLAN
VIDA Administration Server (VAS)[1]	Failure of one power supply and/or one network interface controller	The VAS continues to operate normally due to redundancy	NONE REQUIRED	Replace failed modules
VAS	Complete failure of unit	VIDA system continues to operate normally and network management functionality switches to backup VIDA Core.	NONE REQUIRED In the event of a primary VAS failure, the backup VIDA Core automatically takes over.	Repair or replace failed VIDA Core. The backup VIDA Core will continue to monitor system performance and alarms on the network.
SMT Admin Client	Complete failure of unit.	System continues to operate normally.	Operators use one of the other SMTs.	Repair or replace failed unit.
Wide Area Router (WAR/RAR)	Complete failure of unit	System continues to operate normally and route network traffic.	NONE REQUIRED HA architecture provides a redundant WAR/RAR. In the event of failure, the backup VIDA Core automatically takes over.	Repair or replace failed unit.
MPLS Router	Failure of one power supply and/or one router card and/or one network interface controller	Router continues to operate normally.	NONE REQUIRED MPLS router is internally fully redundant.	Repair or replace failed modules.

[1] *VIDA Administration Server (VAS) includes the following applications Network Switch (NSS), Regional Network Manager (RNM), Regional Site Manager (RSM), and Active Directory Service (AD).*

Figure 38. P25 Conventional Failure Scenarios

SYSTEM COMPONENT	FAILURE TYPE	EFFECT	BACKUP PLAN	RECOVERY PLAN
Two47 Base Station	Complete failure of a repeater	One channel of capacity lost. User re-affiliates on their designated backup channel.	NONE REQUIRED System continues to operate normally with fewer channels.	Repair or replace failed component part or unit. System automatically returns to normal operation when failure corrected.
Site Access Router (SAR)	Complete failure of one unit	System continues to operate normally. Both site access switches are connected to primary and redundant routers.	NONE REQUIRED	Repair or replace failed unit.
Site Access Switch (SAS)	Complete failure of one unit	System continues to operate normally. Both site access switches are connected to primary and redundant routers.	NONE REQUIRED	Repair or replace failed unit.
Symphony Dispatch Console	Complete failure of unit	Loss of one dispatch position	All other Symphony positions remain fully operational. Dispatcher can move to another position or use back up control station radio.	Repair or replace failed component part or unit

Subscriber Radio Overview

With a proven track record of land mobile radios and battle-tested military tactical radios, L3Harris offers the City of Aurora a wide variety of P25 subscriber products to meet every user's needs.

All radios are software-definable and configurable to match Aurora's mission and needs. In addition, every L3Harris P25 radio model has successfully passed the Compliance Assessment Program (CAP) established by the Department of Homeland Security to ensure radio compatibility among P25 vendors.

L3Harris is proud to offer the XL family of converged radios for all public safety mobile and portable operations, and for public works/utilities users and supervisory portable roles. Please refer to Figure 40 for specific radio models per general use type, and consult the pricing pages for quantities, features and options included.

Figure 39. Radio Models per General Use Type

RADIO MODEL	XL-200P	XL-200M
GENERAL USE TYPE	PORTABLES	MOBILES
Law Enforcement – User	✓	✓
Law Enforcement – Supervisor (Partial Keypad)	✓	✓
Fire – User (Partial Keypad)	✓	✓
Fire – Supervisor (Partial Keypad)	✓	✓
EMS – User (Partial Keypad)	✓	✓
EMS – Supervisor (Partial Keypad)	✓	✓
Public Works / Utilities - User	✓	✓

XL PORTABLE RADIOS

XL Series portable radios provide the advanced connectivity that first responders require while addressing evolving voice and data communications. XL portable radios support P25 Trunking, P25 Conventional, analog conventional, and BeOn® operation over a Wi-Fi® or LTE network.

Figure 40. XL Series of Portables

Built on a rigid metal I-beam frame, this family of radios is engineered for top performance in severe environments. As if meeting the tough MIL-SPEC standards IP68 and MIL-STD 504.1 were not enough, these portables are also ruggedized to meet MIL STD 504.1 for contamination by fluids and MIL-STD 511.4 for flammability. The intuitive and easy-to-use XLP radios also feature an A-B-C-D switch that's easy to operate while wearing gloves, plus front and top LCD displays—all packaged in a slim, ergonomically contoured shape. Plus, their 10-hour battery lasts all shift long.

In addition to being compliant with the TIA-603-D and TIA-102.CAAB-D recommendations, L3Harris subscriber radios are capable of secure authentication by the radio system.

Combining a 1.5/4.0-watt max amplifier and dual speakers with advanced noise cancellation, the XLP radios deliver clear, loud audio in a wide range of challenging environments. In addition, Bluetooth integration with leading firefighting Self-Contained Breathing Apparatus (SCBA) improves in-mask audio and quality of communications on the fireground.

XL-200P Portable Radio

XL-200P portable radios provide the advanced connectivity that first responders require while addressing evolving voice and data communications. They meet MIL-STD-810G for durability and are certified to more stringent MIL-STD parameters for contamination by fluids and explosive atmospheres. XL portable radios support P25 Trunking, P25 Conventional, analog conventional, and BeOn® operation over a Wi-Fi® or LTE network.

The XL-200P is a P25 converged, multiband Land Mobile Radio with optional broadband LTE. Designed for anyone who needs to communicate with multiple agencies or across multiple bands, the XL-200P delivers mission-critical connectivity.

KEY BENEFITS

- Multiband, LTE-capable, P25 radios
- Built-in Wi-Fi®, Bluetooth® and GPS
- Advanced data sharing
- Secure voice and data encryption
- Crystal clear audio with advanced noise cancellation
- Built to operate in harsh conditions
- Long battery life
- Intuitive and easy to use
- Ergonomic, glove-friendly design

Figure 41. XL-200P Portable Radio Controls

XL-200P PORTABLE RADIO SPECIFICATIONS

Please refer to the XL-200P product datasheet provided with the Equipment Specifications of the **Attachments** section.

XL-200P PORTABLE RADIO FEATURE MATRIX

Figure 42. XL-200P Portable Feature Matrix

FEATURE DESCRIPTION	XL-200P FEATURE AVAILABILITY	
GENERAL FEATURES		
Frequencies (MHz)	VHF	136-174*
	UHF	378-522*
	700	768-776 798-806*
	800	806-816 851-861*
**XL-200P provide VHF, UHF, and 700/800 MHz frequencies in one radio. The portable also provides 763-776, 793-806, 806-825, and 851-870 MHz frequencies for International use.*		
Display	Top multi-color backlit, sunlight-readable display; Front color LCD	
Radio Name on Front Display	Standard	
Volume On/Off Control Knob	Standard	
16-Position Group/Channel Select Switch	Standard	
Programmable Function Keys (Side)	3	
Programmable 2-position Top Switch	Standard	
Programmable Top Switch	Standard, 4-position (A, B, C, D)	
Emergency/Home Button (Top)	Standard	
Programmable Option Key (Front)	Standard, 3 labeled soft keys	
Keypad	Full or Partial	
Keypad Lock/Unlock	Standard	
Keypad Ramp/Wrap	Standard, 4 cursor control keys	
Programmable Menu	Standard	
Low Battery Alert Tone & Display Icon	Standard	
Programmable Bandwidth – Narrowband or Wideband per channel or system	Standard	
Intrinsically Safe or HAZLOC Certification	Optional – UL approved for use in the U.S. in Class I, Division 1, Groups A, B, C, and D hazardous locations. Also, UL approved for use in the U.S. and Canada in Class I, Division 2, Groups A, B, C, and D hazardous locations.	
Immersion	1m for 30 min (Standard); 2m for 4 hrs (Optional)	

FEATURE DESCRIPTION	XL-200P FEATURE AVAILABILITY
GPS	Standard
Noise Suppression	Standard, 3 mics
Bluetooth® Wireless Technology	Standard
Motorola KVL-3000+/4000 Keyfill	Optional
P25 TRUNKING FEATURES	
Group Calls	Standard
Announcement (Agency/Fleet) Group Calls	Standard
Individual Calls/Private Calls	1,024
Mute Audio until “Wake-up” Page	Standard
Telephone Interconnect Calls	Standard
All Calls/Broadcast Calls	Standard
Calling Unit ID Display	Standard
Talkgroup ID Display	Standard
Data Tx/Rx Indication on Display	Standard
Caller ID (Assign Alias)	Standard
Color Tagging of Talkgroups	Standard
Auto Login	Standard
Registration/Authentication	Standard
VIDA ID	Optional
Multiple SSIDs	Standard
Console Patch/Simulselect Support	Standard
Remote Radio Enable/Disable	Standard
Radio Unit Monitor	Standard
Carrier Control Timer	Standard
Link Layer Authentication	Optional
Home Group	Standard
Multi-Group Feature[1]	Standard
Group Scan	Standard
Priority Group Scan	Standard
Programmable CC Scan Delay	Standard
P25 Trunked/Conventional Scan	Standard
Dynamic Regroup	Standard
Status Message	Optional

FEATURE DESCRIPTION	XL-200P FEATURE AVAILABILITY
Radio TextLink	Optional
ProFile™ (OTAP)	Optional
ProScan™ and Priority System Scan (Roaming)	Standard
Wide Area System Scan (Roaming)	Standard
P25 Conventional Fallback/MS Failsoft	Optional
Audible Failsoft Indication	Standard
DES-OFB Encryption	Optional
Single-key DES	Standard – no charge
Single-key AES[2]	Standard – no charge
AES Encryption (256-bit)	Optional
AES Key Capacity to 128 Keys	Standard
Key Store/Encryption per System	Standard
Encryption Lite[3]	Standard – no charge
FIPS-140-2 and FIPS-197 for AES Encryption	Optional
Mixed Key Encryption	Optional
Audio Tone on KVL Key Load	Standard
Keyset Names from KVL	Standard
RED Store and Forward from KVL	Standard
Project 25 Over-the-Air Rekeying (SCEP OTAR)	Optional
Project 25 Over-the-Air Rekeying (SNDCP OTAR)	Optional
P25 Common Air Interface(CAI)	Standard
Project 25 Data	Optional
P25 Personality Lock (PL)	Standard
P25 Phase 2 Upgradeable	Optional
Inter-RF Subsystem Interface (ISSI)	Standard
ISSI WACN Auto-Roaming	Standard
Virtual Sites	Standard
3000 Aliases	Optional
Site Alias/Site Lock	Standard
Voice and Data on Control (VDOC)	Standard
Enhanced Vocoder (AMBE+2™)	Standard
RF Safe Mode (100 mW)	Optional
GPS Position Update	Standard
PPP/SLIP	Standard

FEATURE DESCRIPTION	XL-200P FEATURE AVAILABILITY
Tier 2 Triggers	Standard
In-Band GPS	Optional
GPS Adapter	Standard (Internal Module)
Stealth Mode	Standard
Voice Playback	Standard (Last 5 Calls)
Voice Annunciation	Standard
eData	Optional
HVD TDMA	Optional
HVD FDMA	Standard
Bluetooth® Integration with SCBA	Standard
P25 Linear Simulcast	Standard
[1]Motorola's form of Announcement group. *[2]Single-key AES is free of charge but must be ordered.* *[3]Allows communication with commonly available ARC4 encrypted radios using a 40-bit key.*	
P25 CONVENTIONAL FEATURES	
No. of Conventional Channels	12,500 (1,250 per mission file)
Standard No. of Systems/Groups	1,024
Up to 1,024 System/Group Combinations	Standard
250 Zones	Optional
Zones in Single-Band Radio	Standard
Mixed Zone Scan	Standard
Noise Cancelling Algorithm with Echo Cancellation	Standard
Programmable Bandwidth – 12.5 kHz NB or 25/30 kHz WB per channel or system	Standard
Low Power Transmit	Standard
Emergency Calls	Standard
Group Calls	Standard
Individual Calls/Private Calls	Standard
Mute Audio until "Wake-up" Page	Standard
All Calls/Broadcast Calls	Standard
Calling Unit ID Display	Standard
Talkgroup ID Display	Standard
Color Tagging of Talkgroups	Standard
3000 Aliases	Optional

FEATURE DESCRIPTION	XL-200P FEATURE AVAILABILITY
Caller ID (Assign Alias)	Standard
Unit Registration	Standard
Data Registration	Standard
Remote Radio Enable/Disable	Standard
Carrier Control Timer	Standard
Home Group/Channel	Standard
Channel Scan	Standard
Priority Channel Scan	Standard
Status Message	Optional
ProFile™ (OTAP)	Optional
DES-OFB Encryption	Optional
Single-key DES	Standard – no charge
Single-key AES**	Standard – no charge
AES Encryption (256-bit)	Optional
AES Key Capacity to 128 Keys	Standard
Key Store/Encryption per System	Standard
FIPS-140-2 and FIPS-197 for AES Encryption	Standard w/AES Encryption
Audio Tone on KVL Key Load	Standard
Radio Check	Standard
Project 25 Over-the-Air Rekeying (OTAR)	Optional
Project 25 Data (Radio to Fixed Network Equipment)	Optional
P25 Personality Lock (PL)	Standard
Enhanced Vocoder (AMBE+2™)	Standard
Vote Scanning	Optional
Stealth Mode	Standard
GPS Adapter	Standard (Internal Module)
PPP/SLIP	Standard
Voice Playback	Standard (Last 5 Calls)
Voice Annunciation	Standard
Bluetooth Integration with SCBA	Standard
P25 Linear Simulcast	Standard
***Optional single-key AES is free of charge but must be ordered.*	
ANALOG CONVENTIONAL FEATURES* **	
No. of Conventional Channels	12,500 (1,250 per mission file)

FEATURE DESCRIPTION	XL-200P FEATURE AVAILABILITY
250 Zones	Optional
Zones in Single-Band Radio	Standard
Mixed Zone Scan	Standard
Noise Cancelling Algorithm with Echo Cancellation	Standard
Programmable Bandwidth – Narrowband or Wideband per channel or system	Standard
Caller ID (Assign Alias)	Standard
Direct Frequency Entry	Standard
Low Power Transmit	Standard
Channel Guard (CTCSS)	Standard
Digital Channel Guard	Standard
Scan	Standard
Dual Priority Scan	Standard
Channel Busy Lock-Out	Standard
5-Tone Signaling Encode	Standard
Type 99 Encode/Decode	Standard
Emergency G-STAR™ Encode	N/A
G-STAR (ANI) Encode	Future
DTMF Encode	Standard
MDC-1200	Standard
DES-CFB/12 kbps CVSD Mode	Optional
Stealth Mode	Standard
Voice Annunciation	Standard
Voice Playback	Standard (Last 5 Calls)
****All portables include Analog Conventional operation.*	

XL MOBILE RADIOS

XL-200M Mobile Radios

The multiband XL-200M delivers crystal-clear audio with advanced noise cancellation technology, intuitive ease of use, rugged performance that meets MIL-STD-810G compliance and more ways to connect.

The multiband XL-200M power interoperable critical communications with other agencies operating across the VHF, UHF, 700/800 and 900 MHz bands. They both feature an intuitive interface and high-visibility color display, allowing users to stay more focused on the job, less on the radio. A modular design also offers flexible mounting configurations for a variety of vehicles. They connect in more places and comes standard with Wi-Fi®, Bluetooth® and GPS. The XL-200M transforms your vehicle into an on-the-go communications hub with the addition of LTE and broadband connectivity providing hot spot capabilities that allow you to stay connected through an LMR or LTE network.

Figure 43. XL Mobile Radio

KEY BENEFITS

- P25, open standards-based with proven interoperability
- AT&T and Verizon Certified and FirstNet Ready™
- Operates in the VHF, UHF, 700/800 and 900 MHz bands
- Loud, clear audio with up to 5 speaker outputs and digital microphone supporting active noise cancellation
- Connect in more places with built-in Wi-Fi®, Bluetooth® and GPS
- Field upgradable LTE and broadband hotspot capabilities
- LTE connectivity transforms the vehicle into an on-the-go communications hub
- Multiple encryption options for secure communications
- Ruggedized to meet MIL-STD-810G standards for tough conditions

Figure 44. XL Mobile Radio Control Head Controls

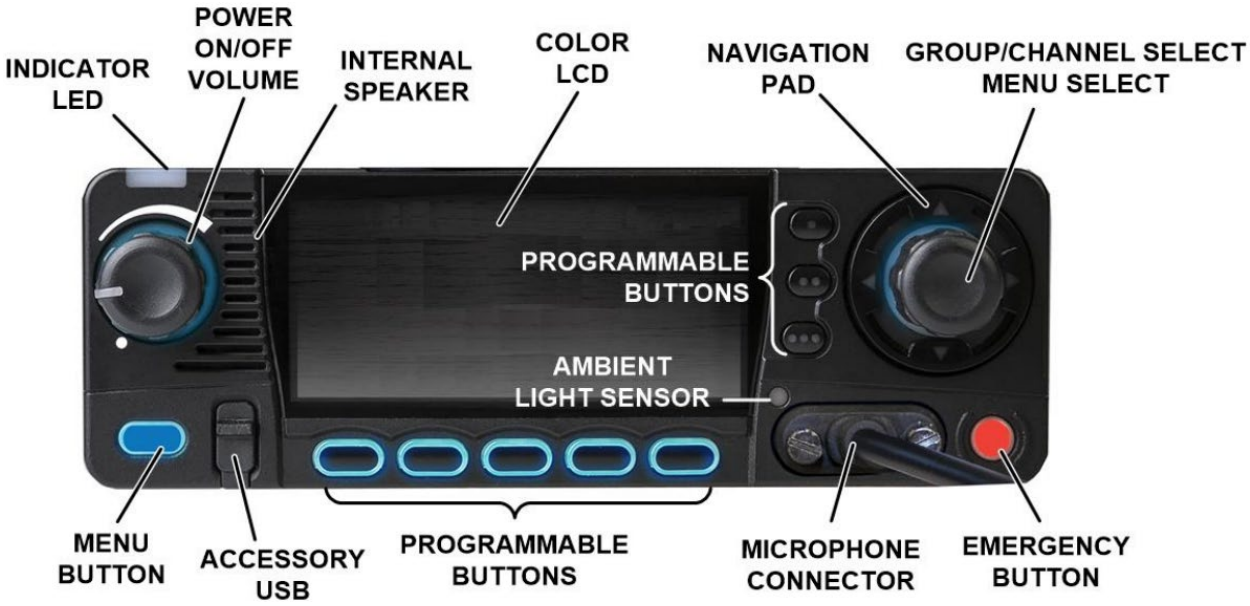


Figure 45. Noise Cancelling Standard XL Microphone

200M MOBILE RADIO SPECIFICATIONS

Please refer to the XL-200M product datasheet provided with the Equipment Specifications of the **Attachments** section.

XL-200M MOBILE RADIOS - FEATURE MATRICES

Figure 46. XL-200M Mobile Feature Matrix

FEATURE DESCRIPTION	XL MOBILE FEATURE AVAILABILITY	
GENERAL FEATURES		
Frequencies (MHz)	VHF	136-174*
	UHF	378-522
	700	763-870
	800 900	896-944
**XL-200M provides VHF, UHF, 700/800 MHz, and 900 MHz in one radio. XL-200M also provides 763-776, 793-806, 806-825, and 851-870 MHz frequencies for International use.*		

FEATURE DESCRIPTION	XL MOBILE FEATURE AVAILABILITY
Display	3.3-in. color LCD display, 18-bit color, 480 x 220 pixels, Visual Channel/7-Zone backlit indicator colors
Radio Name on Front Display	Standard
Remote Mount	Standard
Front Mount	Standard
Hand Held Controller (HHC)	Future
Ramp Controls	N/A
Control Units	Scan
Adjustable Backlighting	Standard
External Alarm	Standard
Keypad Control of External Speaker	Standard
Public Address	Future
Programmable Menu	Standard
Programmable Bandwidth – Narrowband or Wideband per channel or system	Standard
External Speaker	Optional
Motorcycle Kit	Future
Control Station	Optional
Multiple Control Head Support	3+ Control Heads
WiFi® Programming over Control Head	Standard
Dual Control	N/A
GPS	Standard
GPS Data over USB Interface**	Standard
Noise Suppression (Dual Microphone)	Standard
Bluetooth® Wireless Technology	Standard
Motorola KVL-3000+/4000 Keyfill	Future
***This standard feature requires the third-party application "GPS over USB Tool for XL Radios" (media kit number 14004-0276-xx) to process the GPS information originating from the XL mobile.*	
P25 TRUNKING FEATURES	
Standard No. of Systems/Groups	1,024+
Up to 1,024 System/Group Combinations	Standard
250 Zones	Optional
Zones in Single-Band Radio	Standard
Mixed Zone Scan	Standard

FEATURE DESCRIPTION	XL MOBILE FEATURE AVAILABILITY
Direct System/Zone Entry	Standard
User Presets for System/Group or Zone/Channel Assignment	Standard
Programmable Bandwidth – Narrowband or Wideband per channel or system	Standard
Low Power Transmit	Standard
VIDA® Provisioning	Optional
Emergency Calls	Standard
Emergency Check-in Timer	Standard
Emergency Alarm Cancel	Standard
Emergency Clear on Encrypted System	Standard
Group Calls	Standard
Announcement (Agency/Fleet) Group Calls	Standard
Individual Calls/Private Calls	Standard
Telephone Interconnect Calls	Standard
All Calls/Broadcast Calls	Standard
Calling Unit ID Display	Standard
Talkgroup ID Display	Standard
Data Tx/Rx Indication on Display	Standard
Caller ID (Assign Alias)	Standard
Auto Login	Standard
Registration/Authentication	Standard
VIDA ID	Optional
Console Patch/Simulselect Support	Standard
Remote Radio Enable/Disable	Standard
Radio Unit Monitor	Standard
Carrier Control Timer	Standard
Link Layer Authentication (LLA)	Optional
Home Group	Standard
Multi-Group Feature*	Standard
Group Scan	Standard
Priority Group Scan	Standard
Programmable CC Scan Delay	Standard
P25 Trunked/Conventional Scan	Standard
Dynamic Regroup	Standard

FEATURE DESCRIPTION	XL MOBILE FEATURE AVAILABILITY
Status Message	Optional
Radio TextLink	Optional
ProFile™ (OTAP)	Optional
ProScan™ and Priority System Scan (Roaming)	Standard
Wide Area System Scan (Roaming)	Standard
P25 Conventional Fallback/MS Failsoft	Optional
Knox Box Tones	Standard
DES Encryption (Includes Phase 2 Support)	Optional
Single-key DES	Standard
Single-key AES**	Optional
AES Encryption (256-bit)	Optional
Key Store/Encryption per System	Standard
Encryption Lite***	Standard
FIPS-140-2 and FIPS-197 for AES Encryption	Optional
Mixed Key Encryption	Optional
Project 25 Over-the-Air Rekeying (SCEP OTAR)	Optional
Project 25 Over-the-Air Rekeying (SNDCP OTAR)	Optional
P25 Common Air Interface (CAI)	Standard
Project 25 Data	Optional
P25 Personality Lock (PL)	Standard
P25 Phase 2 Upgradeable	Optional
Inter-RF Subsystem Interface (ISSI)	Standard
ISSI WACN Auto-Roaming	Standard
Virtual Sites	Standard
3000 Aliases	Optional
Site Alias/Site Lock	Standard
Voice and Data on Control (VDOC)	Standard
Enhanced Vocoder (AMBE+2™)	Standard
GPS Position Update	Standard
Tier 2 Triggers	Standard
In-Band GPS	Optional
Control and Status Services	Optional
Stealth Mode	Standard
Voice Playback (with Remote Mount Control Head only)	Future

FEATURE DESCRIPTION	XL MOBILE FEATURE AVAILABILITY
Voice Annunciation	Future
Voice Recorder Support/Logging Recorder Mode	Standard
eData	Optional
HVD TDMA	Optional
HVD FDMA	Standard
P25 Linear Simulcast	Standard
[1]Motorola's form of Announcement group. *[2]Optional single-key AES is free of charge but must be ordered.* *[3]Allows communication with commonly available ARC4 encrypted radios using a 40-bit key.*	
P25 CONVENTIONAL FEATURES	
No. of Conventional Channels	12,500 (1,250 per mission file)
Standard No. of Systems/Groups	1,024
Up to 1,024 System/Group Combinations	Standard
250 Zones	Optional
Zones in Single-Band Radio	Standard
Mixed Zone Scan	Standard
Programmable Bandwidth – Narrowband or Wideband per channel or system	Standard
Low Power Transmit	Standard
Emergency Calls	Standard
Emergency Check-in Timer	Standard
Group Calls	Standard
Individual Calls/Private Calls	Standard
All Calls/Broadcast Calls	Standard
Calling Unit ID Display	Standard
Talkgroup ID Display	Standard
Caller ID (Assign Alias)	Standard
3000 Aliases	Optional
Unit Registration	Standard
Data Registration	Standard
Remote Radio Enable/Disable	Standard
Carrier Control Timer	Standard
Home Group/Channel	Standard
Channel Scan	Standard

FEATURE DESCRIPTION	XL MOBILE FEATURE AVAILABILITY
Priority Channel Scan	Standard
Status Message	Optional
ProFile™ (OTAP)	Optional
DES-OFB Encryption	Optional
Single-key DES	Standard
Single-key AES**	Optional
AES Encryption (256-bit)	Optional
Key Store/Encryption per System	Standard
FIPS-140-2 and FIPS-197 for AES Encryption	Standard w/AES Encryption
Radio Check	Standard
Project 25 Over-the-Air Rekeying (OTAR)	Optional
Project 25 Data (Radios to Fixed Network Equipment)	Optional
P25 Personality Lock (PL)	Standard
Enhanced Vocoder (AMBE+2™)	Standard
Vote Scanning	Optional
Control and Status Services	Optional
Stealth Mode	Standard
Voice Playback (with Remote Mount Control Head only)	Future
Voice Annunciation	Future
P25 Linear Simulcast	Standard
***Optional single-key AES is free of charge but must be ordered.*	
ANALOG CONVENTIONAL FEATURES* **	
No. of Conventional Channels	12,500 (1,250 per mission file)
250 Zones	Optional
Zones in Single-Band Radio	Standard
Mixed Zone Scan	Standard
Programmable Bandwidth – Narrowband or Wideband per channel or system	Standard
Caller ID (Assign Alias)	Standard
Direct Frequency Entry	Standard
Low Power Transmit	Standard
Channel Guard (CTCSS)	Standard
Digital Channel Guard	Standard

FEATURE DESCRIPTION	XL MOBILE FEATURE AVAILABILITY
Scan	Standard
Dual Priority Scan	Standard
Channel Busy Lock-Out	Standard
5-Tone Signaling Encode	Future
Type 99 Encode/Decode	Standard
Emergency G-STAR™ Encode	Future
Emergency Check-in Timer	Standard
G-STAR (ANI) Encode	Future
DTMF Encode	Standard
MDC-1200	Standard – Encode, Decode, Emerg
DES-CFB/12 kbps CVSD Mode	Optional
Control and Status Services	Optional
Stealth Mode	Standard
Voice Annunciation	Future
Voice Playback (with Remote Mount Control Head only)	Feature
****All XL-200M mobiles include Analog Conventional.*	

XL-200M CONFIGURATIONS

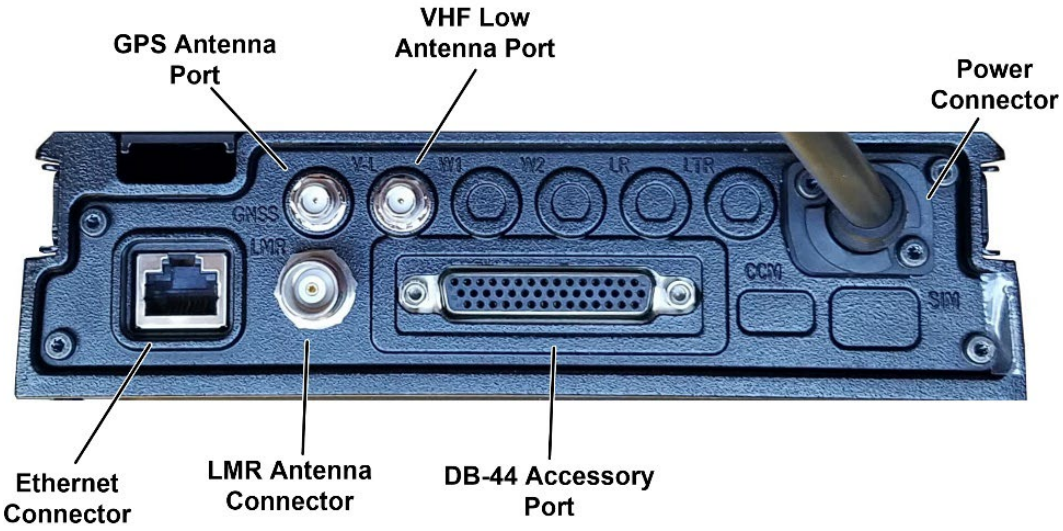
The XL-200M mobile radio consist of the Vehicular Communications Hub (VCH) and a Control Head (CH). Those components can be configured multiple way depending on needs.

Vehicular Communications Hub (VCH)

The XL Vehicular Communications Hub (VCH) is the main radio unit in a vehicular (mobile) radio system. A major feature of the VCH design is the use of IP networks for tethering multiple radio CHs.

Figure 47. Vehicle Communications Hub (VCH)

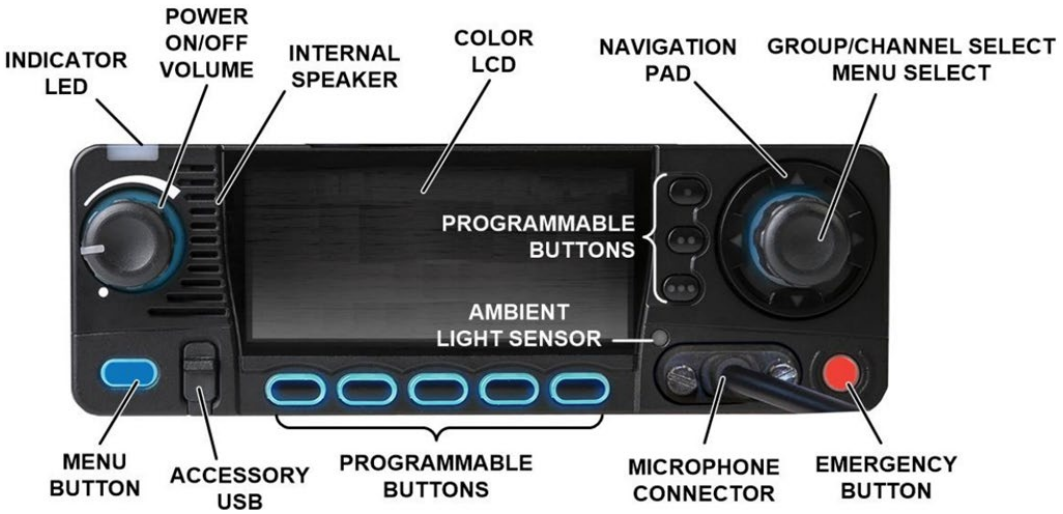
Figure 48. VCH Rear View



XL Control Head (XL-CH)

The XL Mobile Desktop Cabinet supports the addition of an XL-CH in a CH-Only, Front-Mount, or Remote-Mount configuration.

Figure 49. XL-CH Control Head Front



Cybersecurity - The L3Harris Advantage

L3Harris is a world leader in cybersecurity, with proven expertise in designing, implementing, and maintaining large state-of-the-art secure networks that meet the exacting demands of our government, transportation, and utility customers.

The City of Aurora system will be secured using a defense-in-depth strategy. This strategy provides resilient radio system operations while minimizing failures and intrusions. It mitigates the risk of any single defense being compromised or circumvented. There are a number of complementary components that comprise a complete layered defense strategy, as shown in Figure 51. These ensure City of Aurora radio system users will have the confidence and trust that the system maintains the confidentiality of their information, the integrity of their data, and the availability of their communications.

Figure 50. Layered Defense Strategy

Layered defense cybersecurity practices provide resilient LMR operations while minimizing failure and intrusions.

CYBERSECURITY SOLUTION

The cybersecurity approach for City of Aurora addresses specified requirements. The VIDA architecture will include the following elements:

Baseline VIDA Security

- Access Control
- Centralized User Management
- Malicious Code Protection
- Host Intrusion Detection
- Security Flaw Correction
- Boundary Protection
- Multi-Factor Authentication
- Network Intrusion Detection
- Network Isolation
- Secure Configuration Setting
- Centralized Log Management
- Centralized Time Reference
- Disaster Recovery
- Protection of Information in Transit

Optional VIDA Security Features

The City of Aurora system can be enhanced with the following elements:

- Protection of Information at Rest
- Session Auditing
- Network Key Management Facility (KMF)
- P25 Link Layer Authentication
- VIDA Secure Sentry

L3Harris cybersecurity products consist of hardware, software and/or service elements. Some of the products require ongoing maintenance services in order to provide their full benefit.

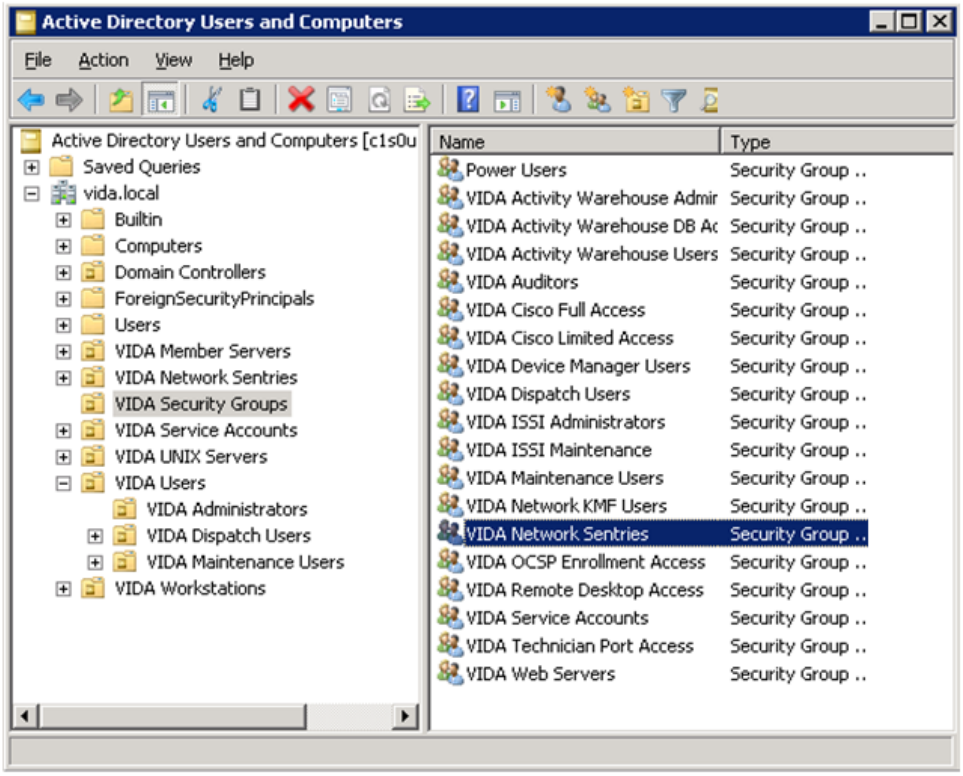
BASELINE VIDA SECURITY FEATURES

Access Control, Identification and Authorization

Windows Active Directory (AD) controls access to the City of Aurora radio network. This centralized service performs user and device authentication and authorization across the network, eliminating the need to manage individual user accounts on every device on the system. AD authentication is extended to UNIX servers with the integration of One Identity Authentication Services Unix agents, and to networking devices (i.e. Cisco) through the remote authentication dial-in user service (RADIUS). Active Directory is hosted on redundant virtual servers on the VIDA Application Server (VAS) in the VIDA NSC to ensure service availability.

Active Directory security groups allow administrators to create role-based accounts to enforce the concept of “least privilege”. This ensures users are provided only the access necessary to complete their assigned tasks. Examples of security groups and roles pre-configured in the City of Aurora system Active Directory are shown below:

Figure 51. Active Directory Users and Computers



Malicious Code Protection and Host Intrusion Detection

City of Aurora servers and workstations will be protected by Trellix (formerly McAfee) Endpoint Security. Trellix Endpoint Security is an integrated security platform, combining antivirus, reputation, and heuristics with cutting-edge machine learning containment and intrusion detection system (HIDS) functions in a single platform agent. It is centrally managed using Trellix's ePolicy Orchestrator® (ePO). ePO provides end-to-end visibility and automations that reduce incident response times and strengthen protection. The ePO server is a virtual machine running on the VIDA Application Server in the primary NSC. It is managed by accessing the secure ePO management web page from any System Management Terminal on the City of Aurora radio network.

Security Flaw Correction

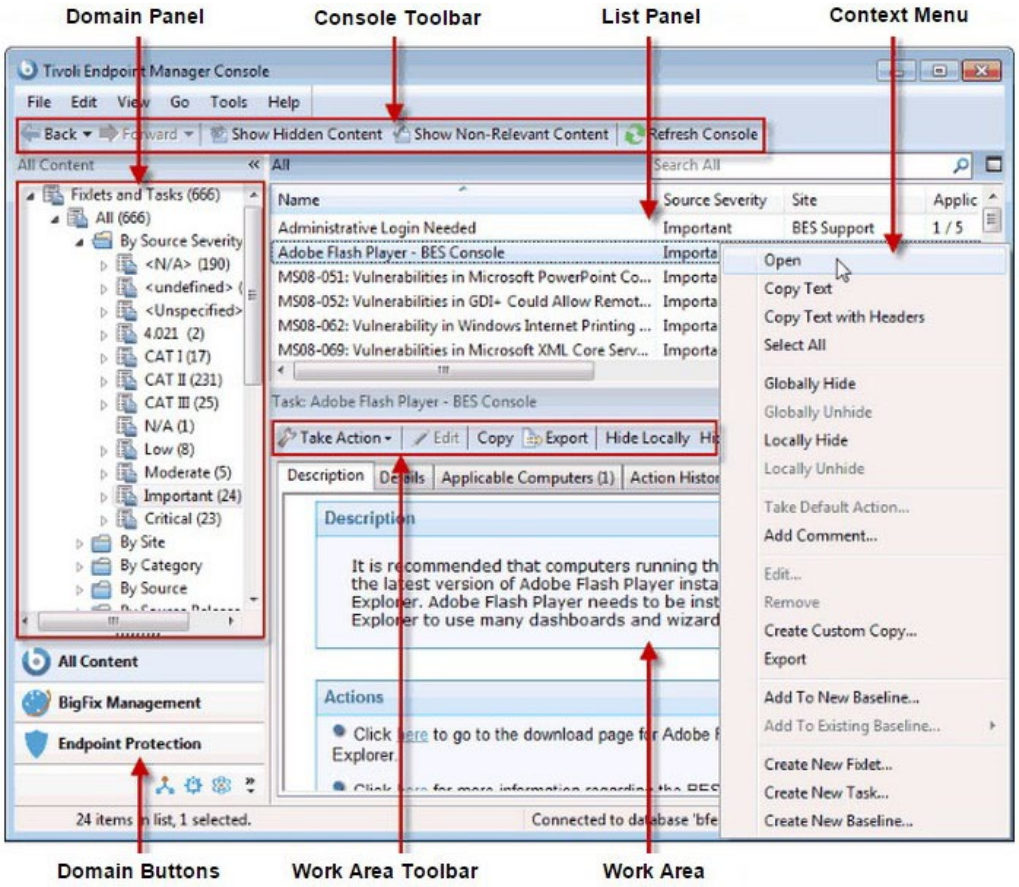
Ongoing protection of the system is necessary, as new and different threats may emerge. Since many malware attacks and exploits target known software defects, it is essential to deploy security patch updates to the network in a timely fashion. The SUMS Automation Server in the City of Aurora Network Switching Center (NSC) makes this task easier to manage by automating update distribution. The SUMS Automation Server is one of the virtual machines running on the VIDA Application Server in the primary VIDA NSC.

Security patch updates are pre-validated and regularly provided through an optional subscription service from L3Harris called the Security Update Management Service (SUMS). For more details on this optional service, see the following section. Note: a one-year subscription to SUMS is included.

City of Aurora radio system administrators start the automated distribution by loading the SUMS release media in the SUMS Automation Server using the SUMS Endpoint Manager Console. SUMS Agents loaded on each supported device then pull the patches from the SUMS Automation Server. The automated process can be paused, stopped or reversed as required.

Figure 52. SUMS Endpoint Manager Console

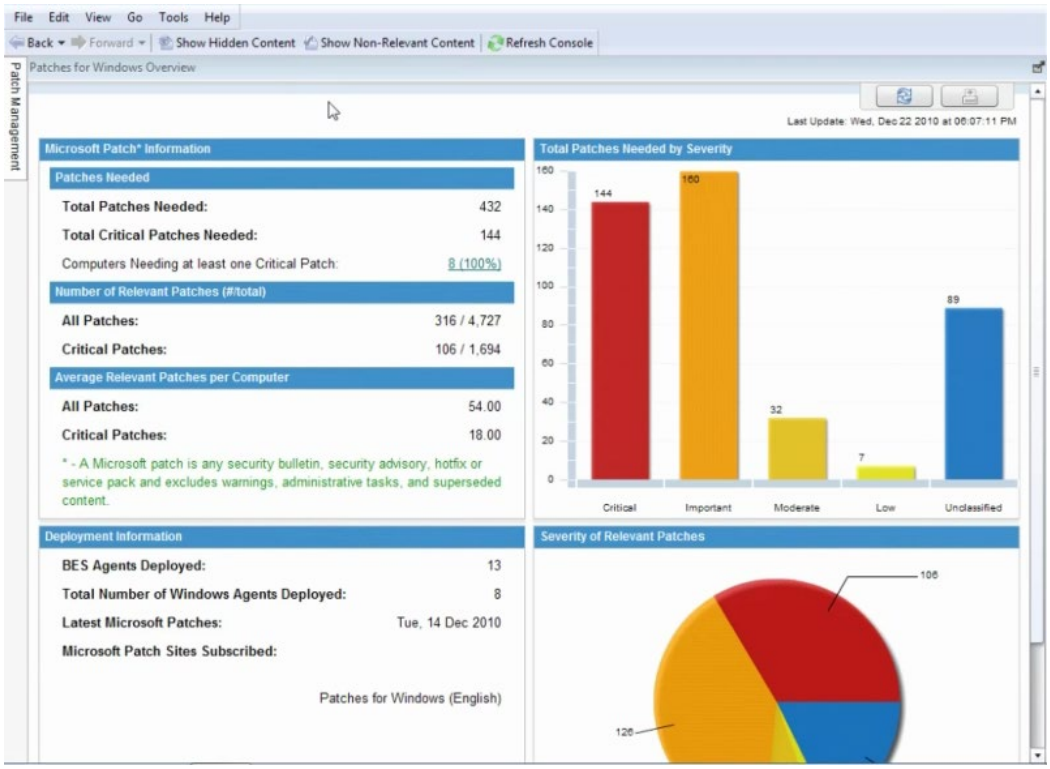
The SUMS Endpoint Manager Console allows centralized management of City of Aurora system patch distribution



Once all patches are successfully applied, the system administrator can minimize impact to radio system users by scheduling the reboot of host endpoints directly from the SUMS Endpoint Manager Console, at times convenient to the users. System administrators can monitor and control the patch distribution process via the secure web-based SUMS Dashboard. The SUMS Dashboard is accessible by any authenticated administrator from any System Management Terminal on the City of Aurora radio system network.

Figure 53. SUMS Dashboard

The SUMS Dashboard provides City of Aurora system administrators patch reporting



Security Update Management Service (SUMS)

The Security Update Management Service (SUMS) is an optional L3Harris subscription service that provides regularly scheduled, pre-validated security patch updates.

A ONE-YEAR SUBSCRIPTION TO SUMS IS INCLUDED.

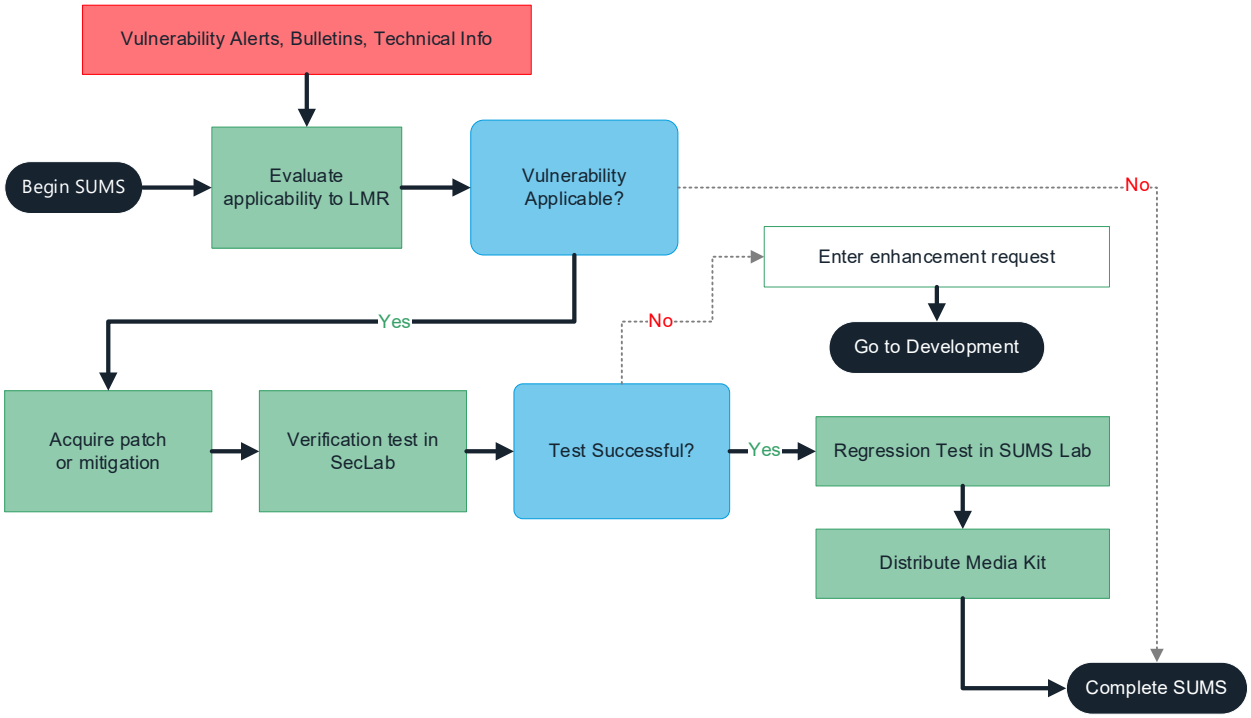
SUMS solves the problem of testing patches and deploying reliable updates. L3Harris monitors security alerts, bulletins, advisories and directives from credible external organizations. These include information assurance vulnerability alerts (IAVAs), operating system patches and anti-virus updates from OEMs, industry, and US Government sources.

Once obtained, L3Harris verifies the patches to ensure they have not been altered, and thoroughly evaluates these patches in our dedicated SUMS laboratory for quality assurance and to ensure they do not adversely affect radio system usability.

Once the radio system is installed and accepted, L3Harris cybersecurity services continue throughout its life cycle. This process helps prevent exploitation of vulnerabilities.

Figure 54. Software Update Management Service Process

L3Harris' SUMS process tests patches before deployment to critical communications systems.



L3Harris distributes those patches that are applicable and usable in a release every 60 days throughout the lifecycle of the system, as long as a SUMS subscription is maintained. City of Aurora radio system administrators will have access to the releases via Harris' Tech-Link website and mailed media. Releases include the distribution media, the release notes documenting the contents of the release, and the detailed installation instructions.

Should any evaluation between regular updates reveal high priority vulnerability (such as a significant virus or denial of service attack), supplemental updates will be released between regular cycles. Just like standard releases, emergency releases are available via Tech-Link downloads and mailed media. Additionally, emergency releases are integrated into the next available standard release.

Boundary Protection

The City of Aurora system includes Cisco Firepower firewalls running Firepower Threat Defense software to control access and maintain the integrity and security of the network and connected devices. Specifically, Cisco Firepower Regional Firewalls (RFWs) secure the internal enclave boundaries encompassing the Primary and Secondary VIDA Cores. They restrict unauthorized network access, detect, prevent, and respond to network attacks, enforce policies, and integrate high-performance security features such as state awareness and application filtering. Firepower firewalls are centrally managed by the Cisco Secure Firewall Management Center (FMC). To secure RF sites and dispatch centers, the routers at these locations incorporate Zone-Based Firewall (ZBFW) support to provide a comprehensive end-point firewall.

Remote Access

To secure communications external to the City of Aurora network, specifically supporting ISSI, BeOn and remote access, a Firepower Internet Firewall (IFW) will monitor and control communications at the external boundary of the system. City of Aurora authorized employees and contractors will access internal radio system network resources using the Cisco AnyConnect Secure Mobility Client. Connecting via AnyConnect requires authentication with valid radio system Active Directory credentials. Authentication will be enhanced with addition of the multi-factor authentication solution described in a later section. Once connected, all traffic is secured with SSL or IPsec IKEv2 encryption and inspected by the firewall and network intrusion detection system.

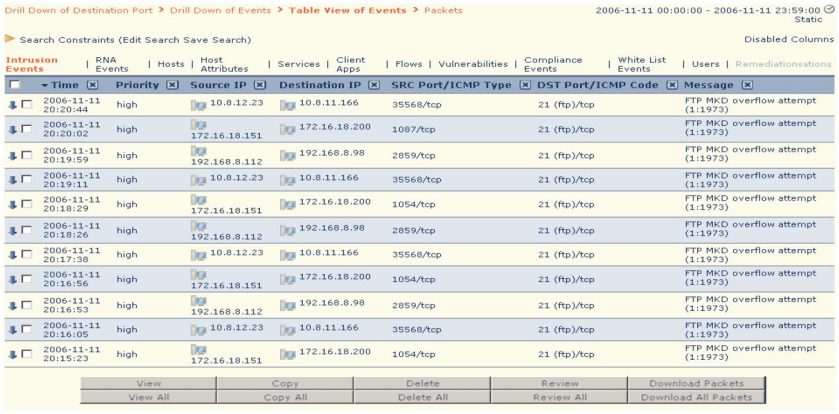
The firewalls and firewall policies are configured in accordance with the general industry practices. For example:

- All communications, with the exception of specifically enabled communications between devices on the unprotected LAN and protected networks, is blocked. Blocking is based on source and destination IP address pairs, services, and ports. Blocking occur on both inbound and outbound packets, which is helpful in limiting high-risk communications;
- Information flow for traffic monitoring, analysis, and intrusion detection is logged;
- Logs are forwarded to a centralized logging server; and,
- The base rule set is deny all, permit none.

Communications Monitoring and Protection

The Cisco Firepower firewalls also provide network intrusion detection system (NIDS) services to inspect general network traffic, monitoring all network traffic in the VIDA NSCs, including local network traffic not being routed outside of the NSC. When the Firepower Threat Defense software detects a pattern of communications associated with a network intrusion, it generates an intrusion event. The event is sent to the Cisco Secure Firewall Management Center (FMC) in the primary NSC, which logs it in a database, displays an alert on the FMC dashboard and issues an alert to City of Aurora personnel. The City of Aurora incident response personnel can review intrusion events to determine whether they threaten the network, and either address or mark the event as reviewed.

Figure 55. Firewall Management Center Dashboard



Network Isolation

The radio system network incorporates Virtual Local Area Networks (VLANs), which enable traffic separation and shaping of the network. In addition, they allow network implementation and optimization to proceed in a highly managed and controlled manner. Access Control Lists ACLs) between VLANs isolate and partition trunked system traffic transport from other support network traffic. This ensures that a security breach in the support network equipment does not impact the dedicated capacity for call processing.

VLANs include:

- Traffic VLAN, which handles all voice, data, and call signaling
- Management VLAN, which supports administration and management servers
- Backbone management VLAN, which supports management of routers and switches and does not appear on any switch ports
- Security VLAN for firewall, Network Intrusion Detection & Prevention (IDS/IPS), management traffic, and centralized logging
- Remote management communications VLAN
- Loghost local VLAN, which provides communication between two Network Switching Servers (NSSs) in a high availability configuration
- Technician VLAN, which enables maintenance of the network
- Peripheral VLAN used to support customer-supplied equipment
- Bit bucket VLAN, which is the destination for nonradio system packets that enter the radio network

All switch ports are configured with 802.1X authentication or MAC address filtering, through the implementation of Cisco Port Security with dynamically learned sticky MAC addresses.

Audit and Accountability

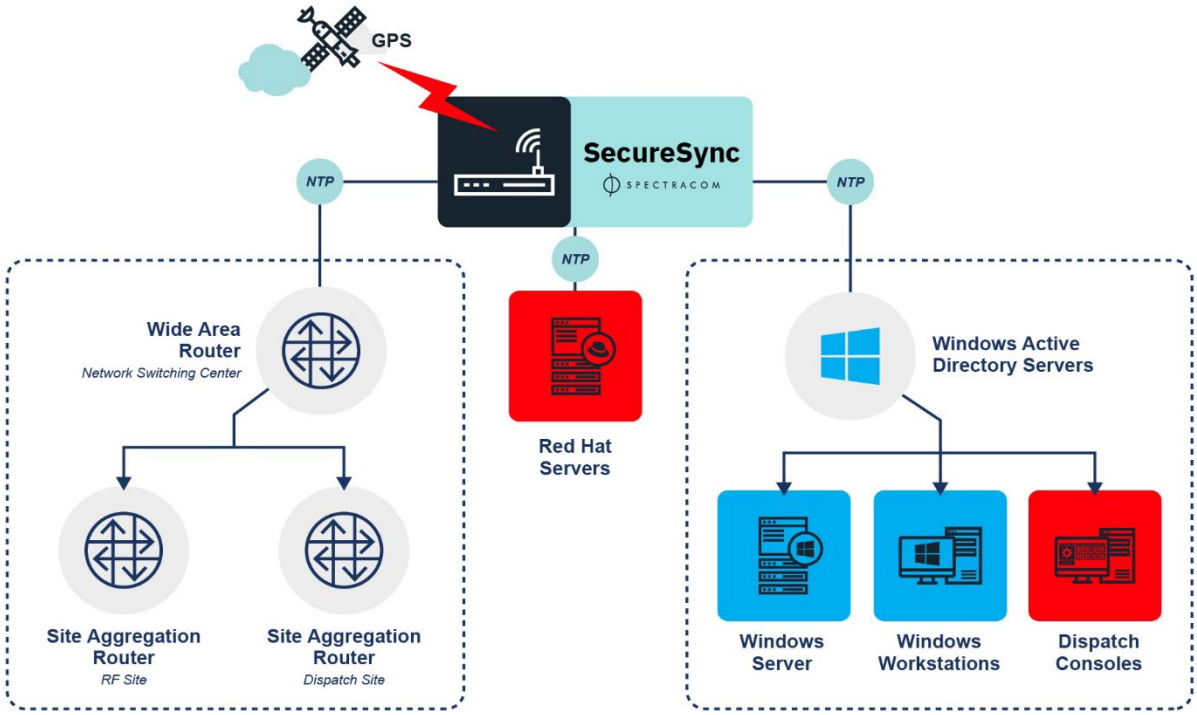
Auditing of critical processes, directories and actions is enabled throughout the system. A centralized log manager facilitates the collection and review of system log data from all enterprise components. This device integrates the collection, normalization, and indexing of log information. Creating a centralized database of system event logs from all network devices greatly simplifies the analysis of network security issues. This results in a faster response by network personnel.

Industry-standard Splunk Enterprise shall provide centralized log management. It collects logs sent by the Spunk Universal Forwarder installed on UNIX and Windows devices, and logs sent by Cisco firewalls, routers and switches by their native Syslog utility. It automates the collection, indexing and alerting of critical machine data, providing an analytics-driven solution, allowing your administrators to monitor threats in real time and respond quickly to incidents, so that damage can be avoided or limited.

Centralized Time Reference

A centralized time reference capability is critical to accurately synchronize system, log and event recordings, facilitating data analysis and evaluation. Stratum-1 GPS-based Spectracom SecureSync® time reference systems are installed in each NSC. The time reference in the active HA NSC serves as the time reference for the entire system. The NSC Wide Area Router (WAR) synchronizes directly from the SecureSync as its primary clock source. Windows Active Directory servers and Linux servers also obtain time directly from the SecureSync. All other Windows based devices obtain time from Active Directory. The Site Aggregation Routers (SAR) at the RF and dispatch sites synchronize time with the WAR. The Spectracom SecureSync in the inactive NSC is a secondary clock source. There is no reduction in capability even if one is completely lost.

Figure 56. Spectracom SecureSync®



Security Configuration Settings

Servers, workstations, and network routers will be hardened with applicable security controls defined in the U.S. Department of Defense Information Systems Agency Security Technical Implementation Guides (STIGs). The system efficiently achieves consistent and compliant configurations by utilizing Microsoft® Active Directory Group Policy Objects (GPO), SUMS and custom lockdown scripts for Linux machines, standalone Windows® platforms and internetwork equipment. Security controls include:

- Removing unnecessary services and programs
- Disabling unneeded communication ports and removable media drives
- Utilizing secured remote administration tools
- Enabling auditing of critical processes, directories and actions
- Enforcing minimum authentication standards

Multi-Factor Authentication

Multi-factor authentication will protect remote access via VPN through the Internet Firewall. Using multi-factor authentication minimizes risks associated with compromised credentials and identity impersonation. One Identity™ Defender® soft tokens are integrated with Active Directory, taking advantage of the user directory already in place, User token assignment is simply an additional attribute to a user's properties within Active Directory.

Transmission Confidentiality

To prevent the unauthorized disclosure of sensitive data during transmission, the advanced security operating system running on the Cisco Integrated Service Routers will be leveraged to provide link encryption. Link encryption enables complete encryption of information traversing the network through public, shared, or insecure physical media, mitigating the risk of providing information about network infrastructure, user behavior, or confidential information to unauthorized sources.

All system and network management activity use secure protocols for client-to-server communications.

Recovery and Data Protection

Security best-practice recommends backups of critical data be performed using the "backup-in-depth" approach, with layers of backups (e.g., local, facility, disaster) that are time-sequenced in such a way that rapid recent local backups are available for immediate use and secure backups are available to recover from a massive security incident. A mixture of backup/restore approaches and storage methods should be used to ensure that backups are rigorously produced, securely stored, and appropriately accessible for restoration.

There are a number of backup strategies incorporated in the City of Aurora radio system design that protect system data from partial or catastrophic malfunction at any of the system site or node.

DEVICE DATA

The Voice, Interoperability, Data, and Access (VIDA) Device Manager is a Windows®-based application that facilitates the loading of code updates and personalities to many devices throughout the VIDA network. It maintains information in databases, facilitating the gathering of historical activities, validation checking, and the secure storage of data. As personalities are saved, the Repository automatically creates historical versions so that they can be easily tracked and compared.

The Repository maintains a history of activities performed upon devices, personalities, and code instances. History viewers facilitate browsing activities per device, personality, code instance, or all events within a specific time period. Supported devices include:

Figure 57. VIDA Supported Devices

VIDA SUPPORTED DEVICES	
CNM	NWS VVS
Console (Symphony IP and VIP)	RNM
CSM	RSM
eData Gateway	RSM Pro

VIDA SUPPORTED DEVICES	
Encompass Gateway	Site Management Interface (SMI)
ISSI Gateway	SiteLink SP
MASTR V Baseband	SiteLink TC
MASTR V Baseband Module	SitePro P25
MASTR V Traffic Controller P25	SitePro P25 Conventional
MASTR V Traffic Controller P25 Conventional	Subscriber Units (Terminals)
MASTR® III DSP Module	Transcoder
MME	Unified Audio Card (UAC)
Network KMF	VNIC

VIDA Device Manager and its associated database repository resides on a virtual system running on the VIDA Application Server. This data, in turn, is archived by the enterprise backup solution.

VIRTUAL SYSTEM STATE

The VIDA Application Server uses snapshot imaging to capture state, data, and hardware configurations of a running virtual machines. Snapshots, taken manually, provide a fast and easy way to revert the virtual machine to a previous state. Having an easy way to revert a virtual machine can be very useful the system administrators need to recreate a specific state or condition to troubleshoot a problem. This is particularly useful when upgrading software or diagnosing a problem.

REPLICATION

vSphere Replication provides a storage-agnostic and workload-agnostic solution that efficiently, periodically, and asynchronously replicates over the IP-based network, typically to a remote site for disaster recovery. This solution is used with networks configured for Location HA.

CENTRALIZED ENTERPRISE BACKUP

Unitrends Recovery-Series Disk-to-Disk Backup Appliances shall provide centralized backup and secure encrypted storage of enterprise data. Installed in each VIDA NSC, Unitrends Backup Appliances back up system data, and copy data to drives suitable for removing data to be stored securely off-site. Each appliance supports up to 6 TB raw backup data.

Figure 58. Unitrends Disk Backup Appliances

Unitrends is an affordable, easy-to-use data protection solution.

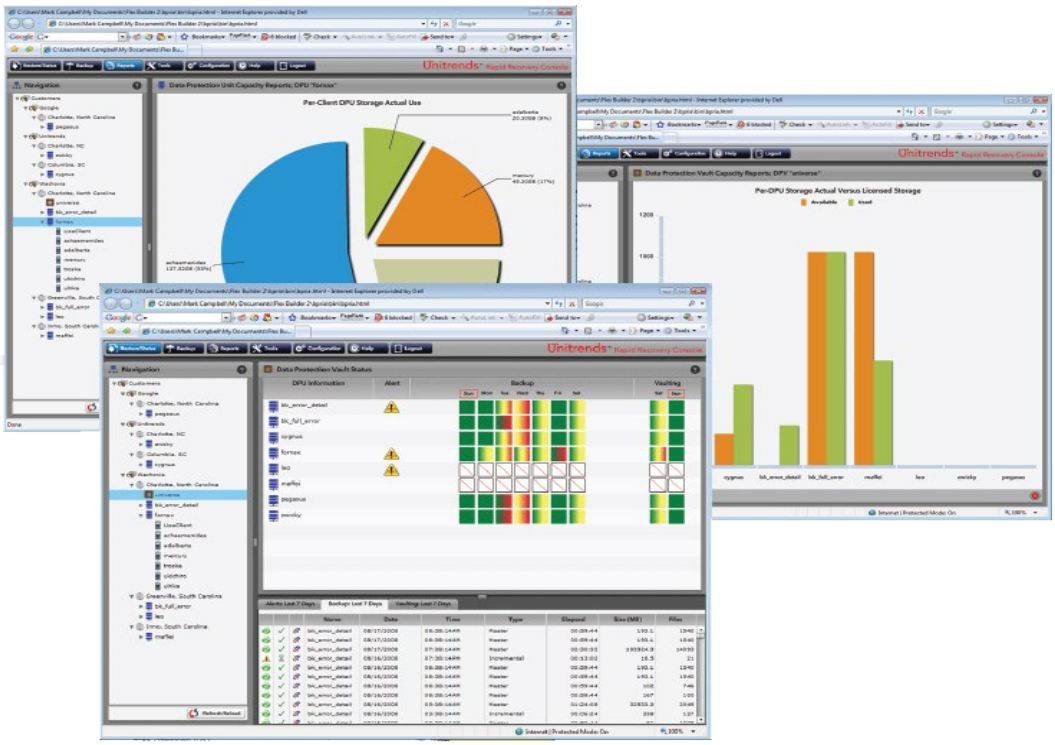
Critical data on the VIDA Application Server is backed up to the local Backup Appliance using VMware's Storage APIs for Data Protection (VADP). VADP enables Unitrends to do centralized, efficient, off-host backup of vSphere virtual machines stored on the storage system. Using VADP, vSphere virtual machines are backed up to the Unitrends appliance without requiring backup agents or requiring backup processing to be done inside each guest virtual machine on the VAS. VADP leverages the snapshot capabilities of VMware vSphere to enable backup across the network without requiring downtime for virtual machines. As a result, backups can be performed non-disruptively at any time of the day without requiring extended backup windows and downtime to applications. The data backed up on the VAS includes the Unified Administration Server database, Active Directory backups, system configuration parameters from Device Manager, radio system utilization history from the Regional Network Manager and Regional Site Manager, the KMF database, Cisco and VMware's ESXi hypervisor configurations.

The Unitrends "de-duplicates" the data for storage efficiency (ensures that only one copy of duplicate data is stored). Standards-based AES 256-bit encryption is performed automatically, protecting data from unauthorized access and theft, and the data is stored on a redundant array of independent disks, for availability, reliability and speedy access. Once stored on the DPU, the data is available for rapid system restoration. Data can also be copied from the local DPU to a second set of blank drives, which can be removed and sent to a secure off-site storage facility.

Unitrends backup and recovery operations are centrally monitored and managed from the secure, web-based Rapid Recovery Console. In the event of loss of equipment data, network operators can use the Rapid Recovery Console to restore the data and configuration to get the network device operating again. The Rapid Recovery Console is accessible by any authenticated administrator from any System Management Terminal on the City of Aurora radio network.

Figure 59. Unitrends Rapid Recovery Console

The Unitrends Rapid Recovery Console is the single interface to manage backups throughout the City of Aurora radio network



FIPS-Validated Cryptography

The FIPS-140 certification status of the L3Harris products included, and is noted in the table below.

Figure 60. FIPS-140 Certified L3Harris Products

PRODUCT	CERT
BeOn - IOS	911
BeOn - Android	911
BeOn - Windows	911
VIP Console	911
DFSI (Encompass)	911
Transcoder	911
KMF	911
UAC	1592
XG	1949
LAP	2398
XLP	2503
Symphony V1.0	2605
NWS 4020	2605
10A4-10A7 VIDA VMs	2936
10A4-10A7 VIDA VMs	3063
Symphony V2.0	3196
OnLogic SMT	3196
Secure Key Exchange (IKI)	3196
Key Admin	3196
Key Loader	3196
NWS 4020 R10A (VM on VIDA Virtual Site)	3196
VIDA Virtual Site	3196
BeOn - XLP	3389
RPM2	NA

OPTIONAL VIDA SECURITY FEATURES

Protection of Information at Rest

To maintain the confidentiality and integrity protection of information at rest, the virtual SAN solution, StorMagic, can implement optional AES-256 encryption. A virtual appliance from HyTrust called Key

Control acts as the key manager for the StorMagic volumes. Per CJIS 5.10.1.2.2, it is assumed sensitive data at rest (i.e. stored digitally) is not stored *outside* the boundary of the physically secure location

Session Auditing

L3Harris offers an optional advanced host-based session recording, auditing, and reporting solution to record all user actions on System Management Terminals and VIDA Management Terminals. These sessions are sent to a virtual server in the NSC where authorized users can select a user session and capture or view that session.

Network-Based Key Management Facility

VIDA P25 is capable of providing End-to-End encryption across the whole network. The KMF is an optional network server-based application used to manage large fleets of crypto nets. This application is a P25IP network product that works in conjunction with the network to provide complete key management of all network devices, including subscriber devices. The KMF consists of a network server that generates key sets and sends Over-the-Air Rekeying (OTAR) messages to encryption devices. Multiple KMFs can exist on the same P25IP network; this allows different agencies sharing a single integrated network to control their own assets.

A secure HTML web browser on the P25IP Unified Administration System (UAS) provides the user interface to the KMF. From the UAS, crypto officers can provide keying information to agency radios located anywhere on the network. The UAS has a partitioned database with multiple levels of access so multiple agencies can share a single KMF. The partitioned database also allows agencies to restrict OTAR or other sensitive information to limited personnel. The KMF is tightly coupled into the UAS, seamlessly binding key sets to users and talkgroups.

Because of the scope and capacity of the Network KMF server, a single KMF can support the OTAR needs of 10,000+ users across a nationwide network.

P25 Link Layer Authentication

Link Layer Authentication (LLA) is the method defined in the P25 standards to prevent unauthorized radios on the radio network. It is based on a “challenge and response” authentication method to verify the identity or legitimacy of a radio and to validate the radio network. The P25IP system uses unit authentication to verify whether a radio is a valid unit authorized to operate on this system. The P25IP system also uses mutual authentication to enable an authorized radio to validate the radio network. This prevents the radio from being captured by a rogue RF site.

When a radio requests access to the system, the radio network sends a challenge message to it. The radio returns a response that requires knowledge of the authentication key. The radio can also authenticate the radio network by making authentication mutual: it sends a challenge message to the radio network. In return, the radio network sends a response that requires knowledge of the same authentication key.

P25 LLA was developed by the P25 standards committees to vastly increase the security of P25 networks from unauthorized radios.

- When a P25 user radio registers on a site, it checks the LLA system-wide and per-user radio unit policy. If enabled for LLA, the system attempts to authenticate the user radio. The site receives authentication messages from the radio. After translating the messages, the site sends them to

the NSC. If the authentication succeeds, only then is the radio allowed to register. If not, the radio is not allowed to register.

- An outsider may succeed in programming an invalid radio with system information and stealing valid radio IDs and groups. However, he or she will not be able to register on the system because the rogue radio will be unable to answer the challenge with a valid authentication key.

Also, a P25 radio can challenge the system for mutual authentication. This feature was added by the P25 standards committees at the request of the federal government. It prevents radios from logging into a fake P25 system (system spoofing) by having the radio challenge the system prior to registering.

Authentication is performed as part of a full registration procedure. However, it can also be demanded of a radio (from the network management system) that is idle and monitoring the control channel.

VIDA Secure Sentry

VIDA Secure Sentry is an optional service that provides an additional level of protection against growing cybersecurity attacks targeted against VIDA® systems. This service provides quarterly remediation, vulnerability and firmware updates to harden the IP network against known and emerging threats. This quarterly service enhances the ongoing safety and availability of critical communications through the deployment of certified technical guidelines, policies and available updates for third-party software.

VIDA Secure Sentry provides quarterly releases of publicly available, government-adopted Security Technical Implementation Guides (STIGs) updates and industry and manufacturer specific updates for security vulnerabilities and other software and firmware anomalies. STIGs are a collection of recommended settings and configurations that support the risk management process of the National Institute of Standards and Technology (NIST) for improving security on communications systems.

L3Harris tests updates on the VIDA system in our dedicated security laboratory, ensuring compatibility with applications prior to making VIDA Secure Sentry releases. Our cybersecurity engineers also identify the highest priority CVEs which need to be addressed with interim patches. When critical vulnerabilities are identified, an Information Security Notice is issued to communicate vital information to all customers. Documentation is provided for installation, recommended configuration changes, and identified issues and remediation for each update releases

A VIDA Secure Sentry subscription is provided as part of an L3Harris Infrastructure Managed Services plan on an annual basis or through discounted multi-year plans.

IMPLEMENTATION PLAN

A proven methodology

L3Harris excels in the multifaceted implementation of mission critical radio communications systems to fulfill the specific needs of our customers and support their vital public safety operations as shown in the successful implementation of more than 150 P25 systems to date.

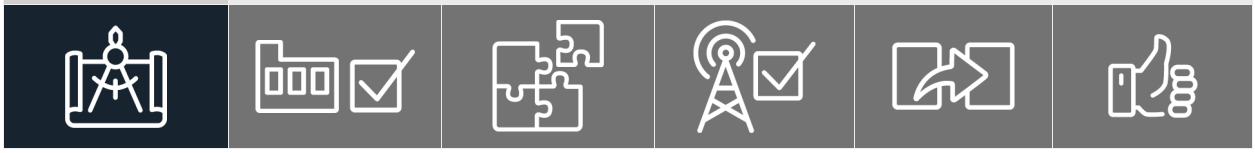
L3Harris uses a life cycle approach to implement projects with excellence. The life cycle methodology standardizes a control point where each phase of the project is reviewed, then approved (or not) before continuing with the next phase. With this methodology, L3Harris ensures that the project is reaching the expected performance, it controls cost, improves schedule, and promotes projects being executed in the most efficient way.

Upon contract signing, the L3Harris proposal and implementation teams will go through a 'contract hand-off' process. The proposal team coordinates with the assigned L3Harris implementation project manager and systems engineer to review the contractual obligations, key milestones, and other important issues. The process concludes with a hand-off of all necessary documentation to the L3Harris implementation team.

This document details the scope of work required for the project, through the following implementation phases:

- Design
- Production
- Installation/Optimization
- Acceptance Testing
- Cutover
- Final Acceptance
- Responsibility Matrices

1	2	3	4	5	6
DESIGN	PRODUCTION	INSTALLATION/ OPTIMIZATION	ACCEPTANCE TESTING	CUTOVER	FINAL ACCEPTANCE



Design

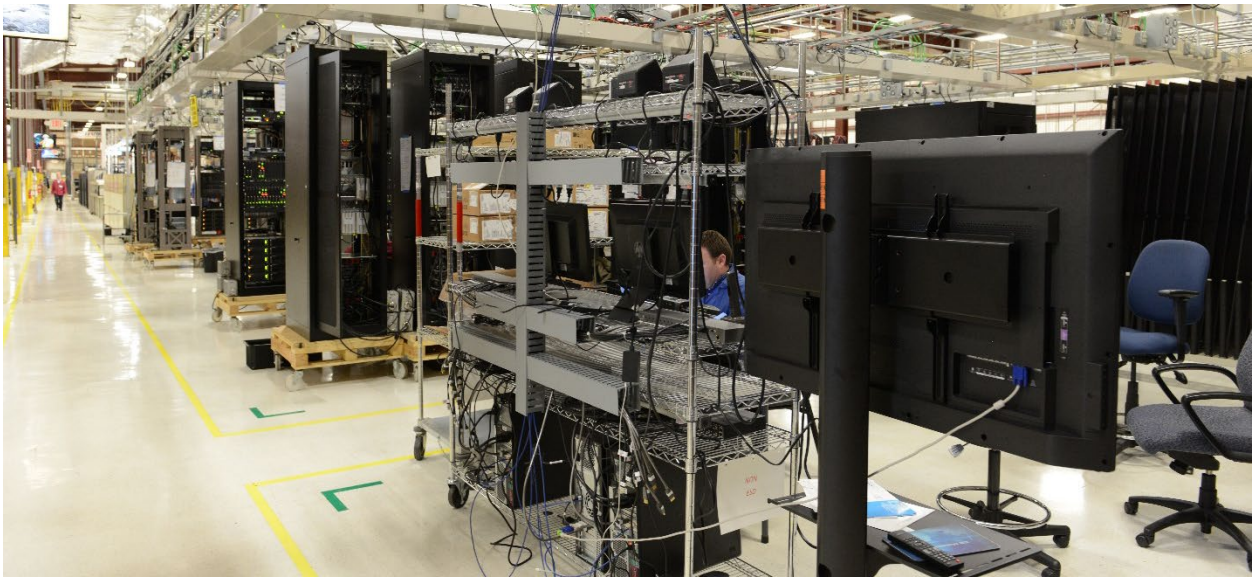
KICK-OFF MEETING

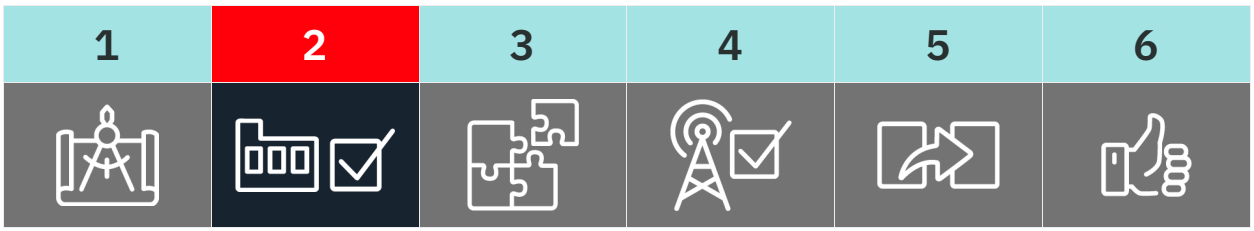
The project manager initiates project implementation with a project kick-off meeting and preliminary design review. The L3Harris Team, and the City of Aurora, will mutually agree on the timing of these meetings. The objectives of the meeting include:

- Introduction of all project participants
- Review the roles of the project participants
- Review the overall project scope, objectives, and deliverables
- Review the current site status
- Review customer owned site documentation
- Review the current frequency plan
- Review the preliminary project schedule
- Schedule site surveys with the City of Aurora
- Schedule vehicle survey if required

DETAILED DESIGN REVIEW (DDR)

The L3Harris Team uses the information obtained during the kick-off meeting, preliminary design review, and site surveys, along with regulatory and engineering documentation, to deliver the final system design at the DDR. The design drawings and documentation are presented during the DDR with the City of Aurora.





Production

SYSTEM INTEGRATION AND TEST - *FACTORY STAGING*

Immediately following approval of the DDR, the L3Harris Team procures material and schedules system integration and test using its' material requirements planning (MRP) system. Our Eagle Focus Factory assembles the RF equipment, integrates it with the key supplier components, and then tests each rack of equipment.

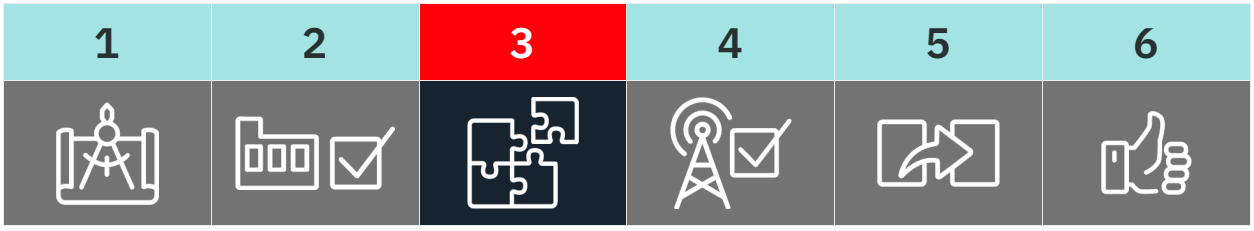
After assembly and test, each RF site rack will be configured. This entails loading customer-specific parameters and personalities into each piece of equipment, as applicable. Also, the VIDA core will be imaged and validated. The staging technicians make all network connections for each site's equipment. Ethernet and/or fiber cable connections are made to simulate backhaul networks and ensure the equipment connects to the network switches. The staging team programs radios to operate on a test user database. Next, system levels are verified and tested to confirm that system is ready for the factory acceptance test (FAT). Once the staging team completes a dry run FAT, the system is transitioned to the systems engineer for additional testing and verification. During the following week, customer representative may visit the Eagle Focus Factory for a facility tour, introduction to the staged system, and to formally witness the FAT.

Running the FAT demonstrates the radio system functionality. The FAT uses the functional acceptance test plan (ATP) tests appropriate in a factory staging environment. The FATP defines each test, with instructions on how to set up and run the test, and compares the actual results to the expected results. The test team, consisting of the L3Harris systems engineer and the City of Aurora representatives, scores and initials each test.

SHIPPING, WAREHOUSING, AND INVENTORY

After a successful factory acceptance test (FAT), all system equipment is packaged using established procedures depending on the mode of transportation. The Team engages appropriate freight carrier services to deliver the system to the address designated in the sales order.

Subscriber equipment may ship with the system or separately as determined by the L3Harris Team.



Installation/Optimization

SITE DEVELOPMENT

After DDR approval, the L3Harris Team places orders for site development materials and services. We coordinate shipments with the suppliers based on the project schedule to ensure parts and materials are available as needed at each site. Typically, the site development work occurs in parallel to radio system equipment manufacturing and staging. We then perform site development in accordance with L3Harris' best practices and industry standards.

Figure 1. Site Development Overview

Balancing cost with long-term sustainability.

SITE NAME	TOWER	SHELTER	GENERATOR	UPS/DC BATTERY PLANT
Police HQ	Existing	Existing	Existing	New
Fire Station 8	Existing	Existing	Existing	New
AutoMall	Existing Water Tank	Existing	Existing	New
Church Rd	Existing	Existing	Existing	New
Phillips Park	Existing Water Tank	Existing	Existing	New
Water Sewer Maint	Existing	Existing	Existing	New

SHELTERS & TOWERS

EXISTING TOWERS

For those sites that have existing towers, we perform a structural analysis to verify that the towers have the capability to support the loads of the existing antennas and cables, as well as the loads for any new antennas and cables. The Team reviews each tower configuration, recommends the best location to mount the new antennas, and presents this data at the DDR.

EXISTING SHELTERS

Sites that have existing shelters will be physically inspected and floor space calculations performed to verify that there is adequate space to install new equipment racks. We will also review the existing electrical power, HVAC, and standby power systems, and discuss needed upgrades at the DDR.

GROUNDING

Our grounding system design goal for new ground systems is a measurable 5 ohms resistance or less between any connected point on the ground bus and earth ground. This goal assumes that soil conditions local to the RF site are typical, conducive to good grounding systems and the RF site geography can receive a standard grounding system. Where these conditions do not exist, or a 5 ohms resistance cannot be reasonably obtained, then the target ground system resistance should be at least 400% better than the resistance of the site's AC ground rod located at the AC meter.

At existing sites, it is generally not practical or even possible to perform an accurate three-point fall of protection test. After contract award, L3Harris will perform a ground system inspection to determine the suitability of existing ground systems. L3Harris will identify and make recommendations for any ground system improvements or deficiencies identified during the ground system inspection. L3Harris can provide a quotation to perform any recommended ground system improvements or the City of Aurora may elect to handle the issues directly.

For each new external grounding system installed or existing ground system inspected, the installed system requires a design that meets the L3Harris Site Grounding and Lightning Protection AE/LZT 123 4618/1 guidelines.

SITE DETAILS

The following sections summarize (by site) the site facilities, and defines the specific site development, and equipment installations, that L3Harris has proposed and will perform.

AURORA POLICE HEADQUARTERS (HQ)

The Aurora Police HQ site is an existing City-owned site and no civils work is anticipated. Towers, generators, compound, and shelters are assumed to be adequate to accommodate the new P25 system equipment while existing OpenSky system remains in use until cutover.

FIRE STATION 8

The Aurora Fire Station 8 site is an existing City-owned site and no civils work is anticipated. Towers, generators, compound, and shelters are assumed to be adequate to accommodate the new P25 system equipment while existing OpenSky system remains in use until cutover.

AUTO MALL

The Auto Mall site is an existing City-owned site and no civils work is anticipated. Towers, generators, compound, and shelters are assumed to be adequate to accommodate the new P25 system equipment while existing OpenSky system remains in use until cutover.

CHURCH ROAD

The Church Road site is an existing City-owned site. Towers, generators, and compound are assumed to be adequate to accommodate the new P25 system equipment while existing OpenSky system remains in use until cutover. The Church Road shelter will require a new entry port to accommodate additional antenna cables.

PHILLIPS PARK

The Phillips Park site is an existing City-owned site and no civils work is anticipated. Towers, generators, compound, and shelters are assumed to be adequate to accommodate the new P25 system equipment while existing OpenSky system remains in use until cutover.

WATER SEWER MAINTENANCE

The Water Sewer Maintenance site is an existing-City owned site and no civils work is anticipated. Towers, generators, compound, and shelters are assumed to be adequate to accommodate the new P25 system equipment while existing OpenSky system remains in use until cutover.

INFRASTRUCTURE INSTALLATION

The L3Harris Team develops the installation plan during the detailed design phases of the project and presents it to the City of Aurora for review and approval. The installation plan includes floor plan drawings, equipment rack-up drawings, antenna location details, and installation procedures based on site surveys the team or designated subcontractors conduct. The installation plan helps drive the activities of the project team, minimizing installation conflicts, and ensures that system implementation proceeds efficiently. The project team takes great care to ensure there is minimal disruption in service when installing the new P25 system in existing equipment locations.

Site equipment installations follow industry standards, including L3Harris Grounding and Lightning Protection. We review the installation work after it is complete to ensure we followed these standards.

ANTENNA SYSTEMS

A key aspect of the infrastructure equipment work is installation of the new P25 antenna systems. Installation of new antenna systems may occur on a newly constructed tower, existing towers in use by the customer as part of their legacy radio system, or on existing towers that are not part of the legacy radio system.

For towers that are part of the customer's legacy system, new antenna system installations must consider the location of the existing customer antennas, and the timing of their removal. Antenna system installation on existing towers that are not part of the customer's current system are not impacted by the presence of legacy system antennas. However, if using towers ownded by an outside organization, the City of Aurora must coordinate the proposed location of the antenna systems on the tower with the tower owner and obtain a site lease.

Our experienced tower crews place antennas on side arm mounts and support the RF cables with transmission line hangers secured to the tower cable ladder. The cables have ground kits that will be installed at the top, at the bottom as the cable leaves the tower, and at the end of the ice bridge before the cable entry port. Where applicable, grounding kits will be installed in the middle every 75 ft., so that there is no more than a 75-foot gap between grounds.

The tower crew runs coaxial cables down the tower cable ladder, and onto the ice bridge terminating just inside the cable entry port.

After installation, we sweep the receive and transmit transmission lines separately, and one sweep from the transmission line to the transmit antenna(s) as a system to confirm that the line and antenna(s) were

properly connected, with an Anritsu Site Master, or equivalent cable-testing device, on the appropriate frequency band(s) to ensure proper performance.

We then record the baseline test data and provide it to the City of Aurora. A copy will remain on-site for future reference.

INFRASTRUCTURE EQUIPMENT

Upon completion of the antenna work, installation crews install the base-stations, and associated equipment. The P25 system equipment typically mounts in 86-inch standard aluminum EIA 19-inch open-frame racks or EIA 19-inch enclosed cabinets. The RF connections extend to the coaxial cables using appropriately sized jumper cables.

L3Harris assumes that the City of Aurora-provided shelters will accommodate the height of these racks and allow them to position the desired 36 inches of free aisle space (in front and in the rear). Racks and cabinets are anchored to the floor using at least four anchor points.

Once the infrastructure racks are secured, we ground and connect them to power, and technicians verify proper levels and settings, preparing the site for the acceptance test.

L3Harris will work with the City of Aurora personnel and/or their representatives to prepare for their participation in acceptance testing. After the test is complete, the installation team records the alignment and test data and provides copies to the City of Aurora. Copies of the individual site alignment and test data will be available at the sites.

OPTIMIZATION

Upon installation of infrastructure equipment, the system engineer(s) works with the on-site technicians to optimize the equipment in preparation for acceptance testing. For each simulcast cell, we verify launch timing, verify timing drive test, making iterative adjustments, repeat timing drive test, if needed, and verify configuration, test voter, test network latency, verify network switches, and dispatch console operation.

L3Harris will conduct a preliminary acceptance test to determine that the systems are fully optimized and ready for the acceptance test with the City of Aurora.

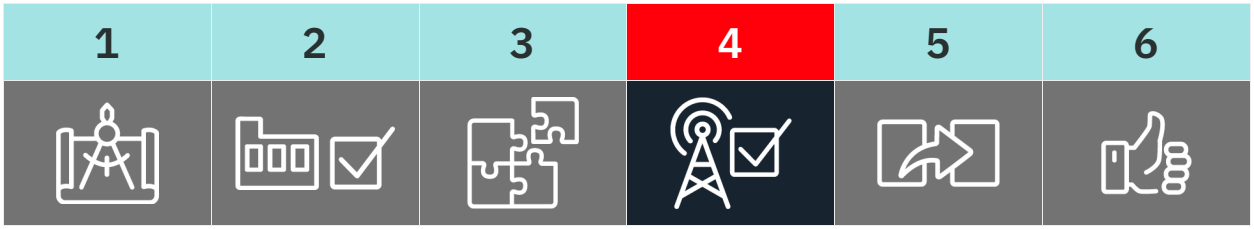
USER EQUIPMENT

Prior to system cutover the team can begin programming and installation of the user equipment. This project includes the following equipment:

- 807 Portables
- 222 Mobiles, to be front mount installed in Police sedan style vehicles (to be programmed/deployed after cutover)

Mobile radio installations will be performed in accordance with the guidelines outlined in each radio models installation manual.

Should the user equipment model numbers or mobile radio unit vehicle types change from the items listed above a change order will be required.

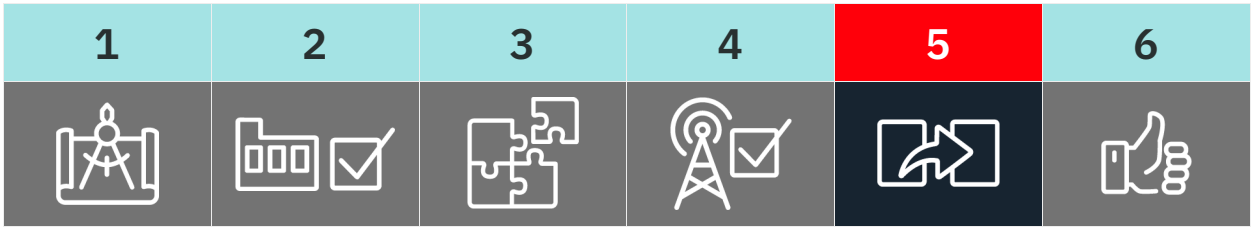


Acceptance Testing

We will perform systems acceptance testing per the agreed upon acceptance test plan (ATP). The L3Harris Team notifies the City of Aurora when installation and optimization are complete, and the system is ready for acceptance testing.

The system engineer provides documentation defining each of the test areas. The ATP procedures contain a short description, test methodology, and a record form for logging results and acceptance signatures for each test. A punch list is used to document any issues found, so the team can quickly resolve them. Follow-up documents will show the correction of open items. Upon satisfactory completion of each testing phase, the project manager will present the system acceptance documentation to the City of Aurora's project manager(s). With the City of Aurora's approval, the City of Aurora proceed with cutover.

L3Harris will submit initial system acceptance documentation for the City of Aurora to sign, marking the successful conclusion of acceptance testing, and readiness for system cutover.



Cutover Approach

L3Harris and the City of Aurora will work together to prepare the cutover plan prior to user integration.

L3Harris is certain that the City of Aurora and L3Harris share the same overarching goals in the process – that there are no missed calls, and that each agency maintains adequate departmental communications during the cutover process.

Other than the bulleted items below, the cutover plan may also include topics such as the timing of the cutover, systematic fleet-by-fleet or agency-by-agency users' cutover, initial trial window or live system test window for the first batch of migrated users, milestones during cutover process, and finally, a fallback plan in case of any uncertainty. The entire cutover plan may be broken into multiple phases to ensure the smooth transition to new system.

The cutover plan will address:

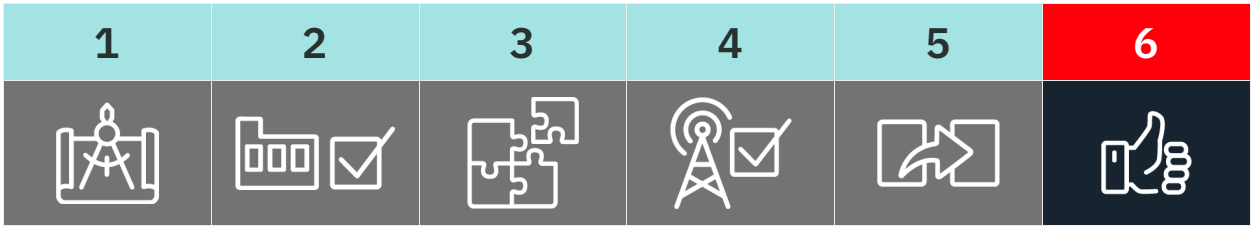
- **Timing and Use of New and Existing RF Frequencies –** Because no existing frequencies are planned for use on the new system, this aspect of cutover should be fairly straightforward. All new frequencies must be clearly defined and licensed prior to cutover
- **System User Migration –** Current plan is to initially migrate all users over on portable radios only. Existing mobile raidos will be reprogrammed as possible after cutover to accommodate P25 operation.
- **User Unit Personalities –** L3Harris will assist the City of Aurora's project manager to develop a series of user profiles for the radio system users. These profiles will determine the user defined parameters for each agency and radio. Project worksheets will be filled out and approved, then forwarded to the City of Aurora for creation of individual personality files.
- **Dispatch Support During Cutover –** There may be a period when dispatchers may need to coordinate users on both systems. If so, an interim solution will be created where the new dispatcher positions can talk to field units on both the existing system and the new system during the transition phase.
- **Dispatch Center Cutover –** Operation of the upgraded consoles will be verified before cutover is to begin. L3Harris will work closely with the City of Aurora's project manager to coordinate the dispatch center cutover with the City of Aurora cutover.
- **Dispatcher and Radio User Training –** Radio users will need to be trained on the new subscriber radios' operation. Our training team will help the City of Aurora develop quick-reference materials and produce seminar-oriented train-the-trainer materials to facilitate this.

Because the new system would have already undergone extensive testing, the probability that the new system would need to be taken down for repairs during cutover will be very low. However, provisions and plans for reverting to the old legacy system will be established in the event it becomes necessary.

These plans will be worked out with the City of Aurora and put into action only with proper consent of the City of Aurora's project director.

Reaching a final cutover plan is typically the result of several customer reviews that include the City of Aurora's representatives, and department heads.

After completion of cutover planning, the L3Harris Team and the City of Aurora agree on a day and time for cutover to begin. The L3Harris Team will be present with the City of Aurora to provide any last-minute answers to users as they go live on the new system.



Final Acceptance

L3Harris will submit initial system acceptance documentation for the City of Aurora to sign, marking the successful conclusion of cutover.

DECOMMISSIONING

Decommissioning will occur after system functional testing and cutover is complete. Some equipment (i.e. backup UPS equipment and/or microwave antennas) may need to be removed sooner if tower loading is too high and there is not sufficient shelter space. Decomissioned equipment will be delivered to a single customer owned location within the city for disposition by the City of Aurora.

FINAL ACCEPTANCE

Upon the successful completion of acceptance tests, cutover, and submission of the final drawing package, the project manager submits the final system acceptance letter for the City of Aurora to sign. With the final acceptance, the project manager arranges a meeting with the field service team to review maintenance support during the warranty period. The L3Harris Team provides the contact information and procedures used to obtain service during the warranty period.

Responsibility Matrices

The following responsibility matrices provides the project activities for which the L3Harris Team is responsible, and those activities that are the City of Aurora's responsibility.

Figure 2. Customer Design Review Responsibility Matrix

TASKS	L3HARRIS	AURORA
PREPARE FOR DETAILED DESIGN REVIEW		
Provide location in appropriate conference room or training facility		X
Assemble project team and complete handoff from proposal team	X	
Assemble customer team for kick-off meeting		X
FCC licensed frequencies that meet contour limits and fulfill the frequency plan in accordance with the project schedule		X
Provide a team and propose a schedule for site surveys	X	
Arrange access to sites and confirm site survey schedule		X

TASKS	L3HARRIS	AURORA
Provide site-knowledgeable personnel (customer and site owner reps, as appropriate) to accompany the project team on site surveys		X
Conduct site survey(s) and provide recommendations	X	
Provide site plans and applicable electrical and layout plans		X
Provide current tower and foundation drawings, along with a current mapping of installed antennas and cabling sufficient to complete a structural analysis as determined by the structural analysis firm		X
Perform structural analysis on existing towers, and provide results at DDR	X	
If tower(s) fails load analysis, strengthen or replace tower (L3Harris can provide quotes to strengthen (if possible) or replace the tower)		X
Conduct grounding inspection and provide recommendations	X	
Complete any required grounding remediation prior to equipment installation		X
Prepare one set of FCC license applications for the City of Aurora's submission	X	
Submit FCC license applications and pay requisite fees		X
Arrange for site lease for any non-customer-owned sites (if required)		X
Provide complete list of vehicle types and quantities per Vehicle Audit Form		X
Provide number of installation bay's (include vehicle capacity) available for vehicle installations		X
Provide acceptance of proposed vehicle installation schedule		X
Provide a change order for increased cost if vehicles are not provided according to the vehicle programming or installation schedule		X
DETAILED DESIGN REVIEW DELIVERABLES		
System block diagrams	X	
List of deliverable equipment for each site	X	
Network connection plan and backhaul requirements	X	
Tower antenna placement drawings	X	
Antenna system drawings	X	
Coverage prediction maps	X	
Frequency plans	X	
Combiner plans	X	
Site plot drawings	X	
Shelter floor plan drawings	X	
Rack elevation drawings	X	

TASKS	L3HARRIS	AURORA
AC power and BTU requirements	X	
Tower antenna placement plan	X	
Preliminary cutover plan	X	
ATP	X	
Project schedule	X	
DETAILED DESIGN REVIEW		
Present design	X	
Approve the design following DDR meeting (within 5 business days)		X

Figure 3. System Integration and Test - Staging Responsibility Matrix

TASKS	L3HARRIS	AURORA
Insert equipment delivery dates into the material planning system	X	
Place orders with the L3Harris Eagle Focus Factory and key suppliers	X	
Manufacture all infrastructure equipment	X	
Assemble equipment in factory staging area on a per site basis	X	
Provide appropriate personnel to approve the FAT test		X
Run FAT	X	
Provide approval for FAT test and authorize the system to ship (within 5 business days)		X

Figure 4. Shipping & Inventory Responsibility Matrix

TASKS	L3HARRIS	AURORA
Provide temporary storage near the City of Aurora's location		X
Package equipment and ship to storage area	X	
Inventory equipment	X	
Validate L3Harris equipment inventory		X
Sort equipment in preparation for site delivery and installation	X	

Figure 5. General Responsibility Matrix

TASKS	L3HARRIS	AURORA
Coordinate with federal, state, and local government agencies, as required		X
Provide access to all buildings and sites, including temporary ID badges for L3Harris project team		X
Provide parking permits for L3Harris project team for any restricted parking areas		X
Provide adequate road access for delivery vehicles		X
Arrange for temporary parking to off-load equipment at all buildings and sites		X
Clean up site and remove all installation debris	X	
Remove any hazardous material found on site		X
Ensure that no utility transformers additions or upgrades will be required to provide the adequate AC power needed for each site		X
Comply with FCC OET65 Signage requirements (https://www.fcc.gov/general/oet-bulletins-line)		X

Figure 6. Existing Customer-Owned Sites Responsibility Matrix

TASKS	L3HARRIS	AURORA
CUSTOMER-OWNED SITE TASKS		
Obtain any necessary zoning approval for site changes		X
Perform physical path surveys for each microwave path (microwave path studies are not final until a physical survey is made)	X	
Provide existing site plans		X
Conduct grounding inspection and provide recommendations	X	
Conduct site survey(s) and provide recommendations	X	
EXISTING TOWER		
Identify specific tower attachment points to mount new antennas per the system design	X	
Confirm availability of tower attachment points for L3Harris antennas		X
Provide space on existing tower to mount new system antennas at L3Harris specified locations		X
Ensure adequate space is available on cable ice bridge, and tower cable ladders, to support new cable runs		X

TASKS	L3HARRIS	AURORA
Install new antenna(s) using appropriate side arms and mounting hardware	X	
Install antenna coax, connectors and jumpers, using cable clamps to properly secure cable to tower, and add grounding kits at the top, bottom, and on ice bridge	X	
Install antenna lightning protection devices on each transmission line LMR run after it enters shelter via cable entry port; ground device to main ground bus bar	X	
Install new microwave dish(es) on pipe mounts with anti-sway kits	X	
Install new microwave waveguide or coaxial feed lines, secure to cable ladder(s), and add grounding kits at the top, bottom, and on ice bridge	X	
Tag and identify each new antenna line	X	
Sweep test each new antenna line in accordance with L3Harris' Transmission Line Analysis (Antenna Sweep) procedure	X	
EXISTING SHELTER		
Provide floor space in existing RF shelter for new equipment racks used in the new design		X
Provide adequate shelter/equipment room utility AC electrical power, single-point ground system HVAC, and backup generator power		X
L3Harris will provide new cable entry port with (4) new ports at Church Road	X	
Upgrade existing interior ground system (if required)		X
Install new DC power plant and wire to racks	X	
Provide backup power (UPS) for VIDA core		X
Provide backup power (UPS) for consoles		X
Provide demarcation blocks for connection to existing legacy radios to be used in interoperability system		X

Figure 7. System Infrastructure Installation Responsibility Matrix

TASKS	L3HARRIS	AURORA
Deliver equipment to each site	X	
Install equipment, connect to existing ground system and apply power	X	
Connect all RF cables	X	
Interface to network, verify network connectivity	X	
Set all P25 system levels and parameters	X	
Connect all P25 system alarms	X	

Figure 8. System Optimization Responsibility Matrix

TASKS	L3HARRIS	AURORA
Prepare all installed sites for site inspections	X	
Verify microwave/backhaul system is functional and meets reliability specifications	X	
Provide frequencies to use for optimization and testing		X
Verify P25 levels and parameters are set	X	
Verify P25 alarm and system monitoring system are operational	X	
Verify system database is installed and operating correctly	X	
Verify proper dispatch operation	X	
Verify proper P25 functional operation	X	
Verify proper network switching operation	X	
Coordinate testing of the desired interoperability channels		X

Figure 9. Acceptance Testing Responsibility Matrix

TASKS	L3HARRIS	AURORA
Provide appropriate team members to participate in acceptance tests		X
Inspect each site (RF, dispatch, VIDA core), noting discrepancies on a punch list	X	
Submit site inspection results	X	
Approve site inspection results (within 3 days)		X
Perform functional ATP on radio system, network monitoring, and user radios	X	

TASKS	L3HARRIS	AURORA
Submit functional ATP results	X	
Sign approval of functional ATP results (within 5 business days)		X
Provide team members to participate in coverage tests		X
Provide test vehicles and drivers for coverage testing & characterization		X
Provide new test radios for automatic coverage tests as defined in the CATP		X
Perform automated coverage test of P25 system per system contract	X	
Provide new test radios for voice quality characterization as defined in the CATP		X
Perform voice quality characterization of P25 system per system contract	X	
Submit coverage ATP results	X	
Sign approval of coverage ATP results		X
Submit letter of system acceptance	X	
Sign letter of system acceptance		X
Approve cutover plan		X
Notify users of system cutover date		X
Proceed with system cutover according to cutover plan	X	

Figure 10. User Equipment Matrix

TASKS	L3HARRIS	AURORA
Provide detailed inventory of vehicle types requiring mobile radio installations		X
Program and distribute L3Harris portable units with accessories	X	
Provide a central facility for mobile vehicle installation that has a minimum of 4 garage bays for mobile installations, workbench space for portable radio programming, and storage for radios.		X
Provide a continuous supply of vehicles to meet the project schedule timeline or		X
Provide cost and schedule relief for crew demobilization and remobilization for non-continuous supply of vehicles or for installations requested outside of the schedule		X

TASKS	L3HARRIS	AURORA
Program and install L3Harris mobile units	X	
Provide pre and post installation vehicle assessments, presenting installation documentation for customer acceptance for each vehicle	X	
Provide a representative to review installation documentation and provide acceptance for each vehicle		X
Program and install L3Harris Control Stations	X	
Provide a change order should user equipment models, quantities or vehicle types change.		X

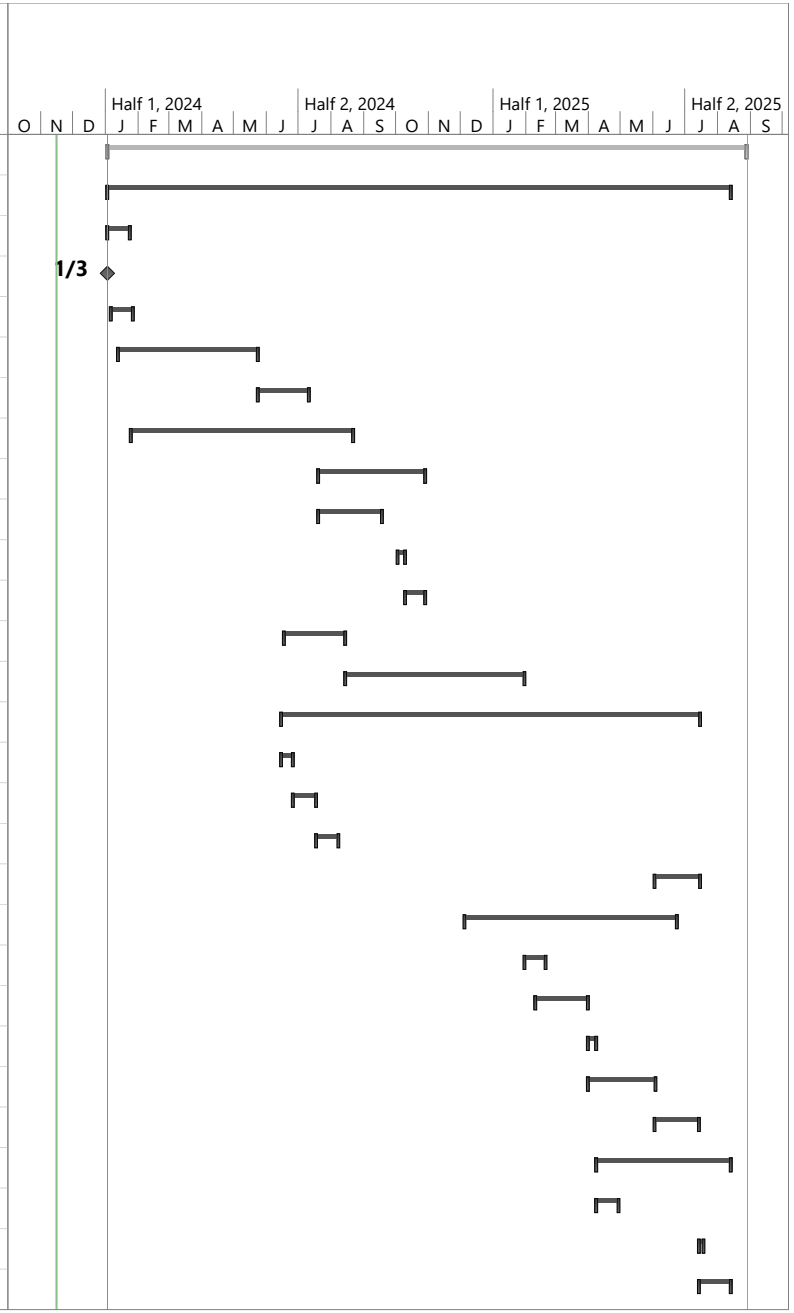
Figure 11. Cutover Responsibility Matrix

TASKS	L3HARRIS	AURORA
Identify system administrators		X
Provide administrator training	X	
Attend system administrator training		X
Provide workshops for talkgroup planning	X	
Attend workshop for talkgroup planning		X
Provide training on system database creation	X	
Develop user training plan and schedule with L3Harris (collaborative effort)		X
Develop dispatcher training plan and schedule with L3Harris (collaborative effort)		X
Develop user programming profiles with L3Harris (collaborative effort)		X
Develop console programming profiles with L3Harris (collaborative effort)		X
Develop and enter system database		X
Define which interoperability channels are desired during cutover		X
Provide radio user training	X	
Attend radio user training		X
Provide dispatcher training	X	
Attend dispatcher training		X

Figure 12. Final Acceptance Responsibility Matrix

TASKS	L3HARRIS	AURORA
Submit final drawing package	X	
Submit letter of final system acceptance	X	
Provide warranty and contact information	X	
Meet with L3Harris to review warranty contact procedures		X
Meet with L3Harris to outline system support and services requirements		X
Accept final drawing package (within 5 business days)		X
Sign letter of final system acceptance (within 5 business days)		X

Name	Duration	Start	Finish
Schedule	**414.25 days**	**Wed 1/3/24**	**Thu 8/28/25**
Aurora IL	**403.25 days**	**Wed 1/3/24**	**Wed 8/13/25**
L3H Internal Startup	**14 days**	**Wed 1/3/24**	**Tue 1/23/24**
Contract Start	**0 days**	**Wed 1/3/24**	**Wed 1/3/24**
Customer Kickoff	**14 days**	**Fri 1/5/24**	**Fri 1/26/24**
Detailed Design	**93 days**	**Fri 1/12/24**	**Thu 5/23/24**
Post Detailed Design Review	**32 days**	**Thu 5/23/24**	**Wed 7/10/24**
Procurement	**148 days**	**Wed 1/24/24**	**Wed 8/21/24**
Production	**70 days**	**Fri 7/19/24**	**Mon 10/28/24**
LMR Assembly and Staging	**41 days**	**Fri 7/19/24**	**Tue 9/17/24**
CFAT with Customer	**5 days**	**Wed 10/2/24**	**Wed 10/9/24**
Shipping	**13 days**	**Wed 10/9/24**	**Mon 10/28/24**
Civils	**41 days**	**Mon 6/17/24**	**Wed 8/14/24**
Installation and Optimization	**109.25 days**	**Wed 8/14/24**	**Thu 1/30/25**
Subscriber Programming and Installation	**266.25 days**	**Fri 6/14/24**	**Tue 7/15/25**
Fleet Mapping	**7 days**	**Fri 6/14/24**	**Tue 6/25/24**
Personality Development	**15 days**	**Tue 6/25/24**	**Wed 7/17/24**
Portable radio Programming	**15 days**	**Wed 7/17/24**	**Wed 8/7/24**
Mobile Radio Deployment	**30 days**	**Mon 6/2/25**	**Tue 7/15/25**
System Acceptance	**133.25 days**	**Thu 12/5/24**	**Mon 6/23/25**
Field Acceptance Testing	**14 days**	**Thu 1/30/25**	**Wed 2/19/25**
Coverage Testing	**35.25 days**	**Mon 2/10/25**	**Mon 3/31/25**
System Acceptance	**6 days**	**Mon 3/31/25**	**Tue 4/8/25**
Cutover Planning and Execution	**45 days**	**Mon 3/31/25**	**Tue 6/3/25**
Decommissioning	**29 days**	**Mon 6/2/25**	**Mon 7/14/25**
Final Acceptance	**89 days**	**Tue 4/8/25**	**Wed 8/13/25**
Program Documentation	**15 days**	**Tue 4/8/25**	**Tue 4/29/25**
Warranty Hand off Meeting with Customer	**4.5 days**	**Mon 7/14/25**	**Fri 7/18/25**
Final Invoicing	**22 days**	**Mon 7/14/25**	**Wed 8/13/25**



PRICING SUMMARY

Aurora, IL

L3Harris is pleased to provide Aurora, IL with the following firm fixed price proposal. Pricing is valid for 90 days from submittal date of December 12, 2023. Upon expiration of the pricing validity, L3Harris reserves the right to provide an updated pricing proposal.

BASE OFFERING	PRICE (USD $)
Year 1 Pricing - Infrastructure Equipment and Implementation Services	$3,500,000.00
Year 2 Pricing - Infrastructure Equipment, Implementation Services, Managed Services Year 2, Installation/Programming Services and 807 XL-200P Portable Radios + Accessories (Antennas, Batteries, Cases, Chargers, and Speaker Mics)	$6,045,460.88
Year 3 Pricing - Managed Services	$794,317.39
Year 4 Pricing - Managed Services	$794,317.39
Year 5 Pricing - Managed Services	$794,317.39
Year 6 Pricing - Managed Services	$794,317.39
Year 7 Pricing - Managed Services	$794,317.39
Year 8 Pricing - Managed Services	$794,317.39
Year 9 Pricing - Managed Services	$794,317.39
Year 10 Pricing - Managed Services	$794,317.39
BASE OFFERING SUBTOTAL	**$15,900,000.00**
PROJECT TOTAL	**$15,900,000.00**
OPTIONS - NOT INCLUDED IN BASE PRICING	
222 XL-200M Mobile Radios + Accessories, Installation Services, and Maintenance Services	$1,512,783.00
Aurora System Growth Contengency Fund - Begins Year 3	$80,000.00
OPTIONS SUBTOTAL	**$1,592,783.00**

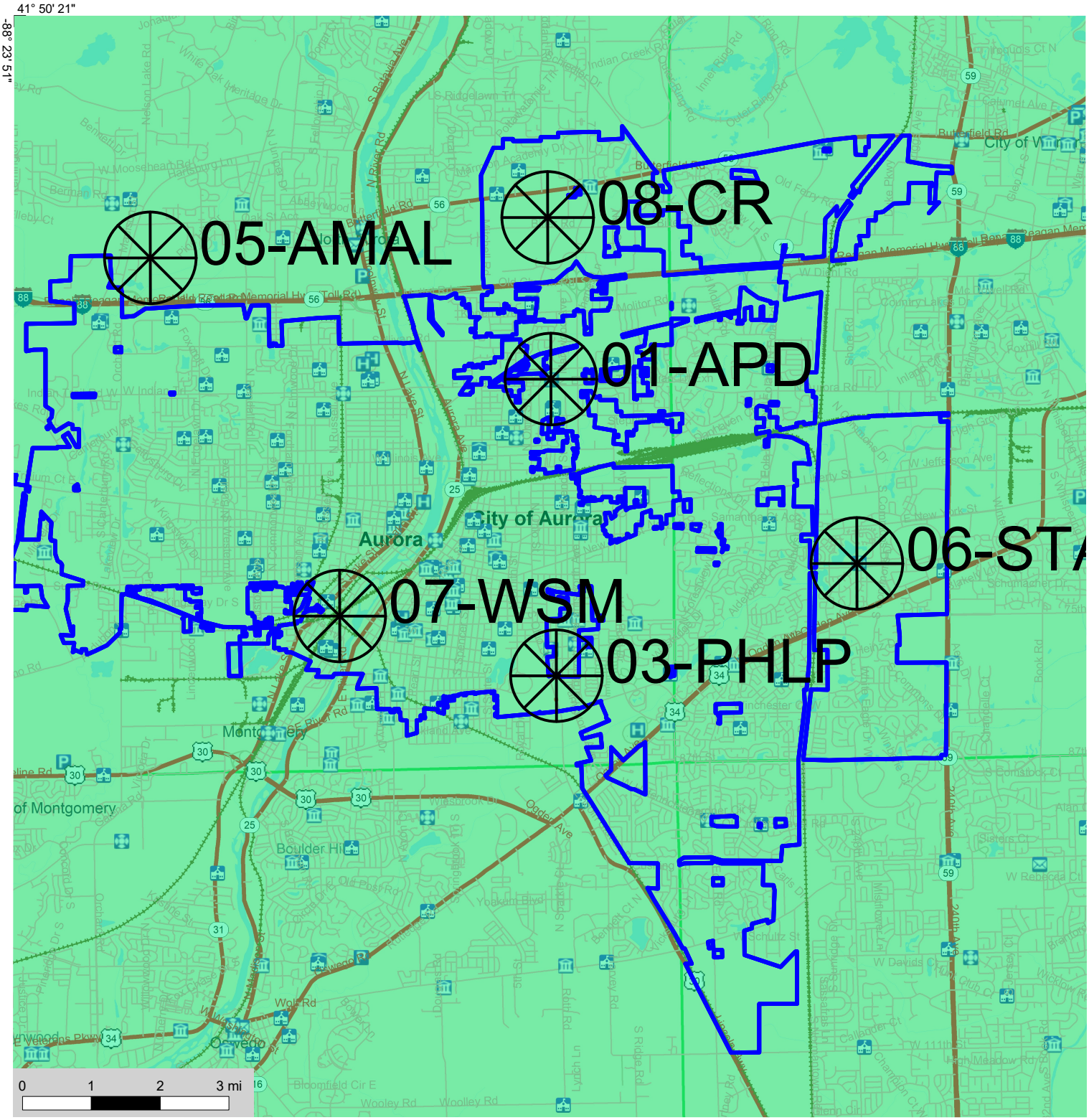
**State and Local taxes not included*

**Aurora System Growth Contengency Fund to be applied to the After Market Services Agreement*

Milestone Payments	%	Value
Contract Execution	25%	$1,500,000
Detailed Design Review	25%	$1,500,000
Factory ATP	8%	$500,000
Infra Equipment Shipment	22%	$1,316,480
Installation	15%	$897,600
Final System Acceptance	5%	$269,920
Infrastructure & Services	100%	$5,984,000
Total Infrastructure & Services Milestone Payments	**100%**	**$5,984,000**

RF Solutions

RAPTR Version 33.2.489
Monday, March 06, 2023 10:44:57
Project: AURORA P25
MBP: 1234
Figure: Aurora 800 P25 Phase 2 Mobile Talk-Out
Engineer: Bjelovuk
Map type - 1:92,460
Note: Map depicts coverage across the defined service area. Statistical variability does not allow for guarantee of coverage in specific locations, but does represent graphically area % coverage.



RF Solutions

RAPTR Version 33.2.489
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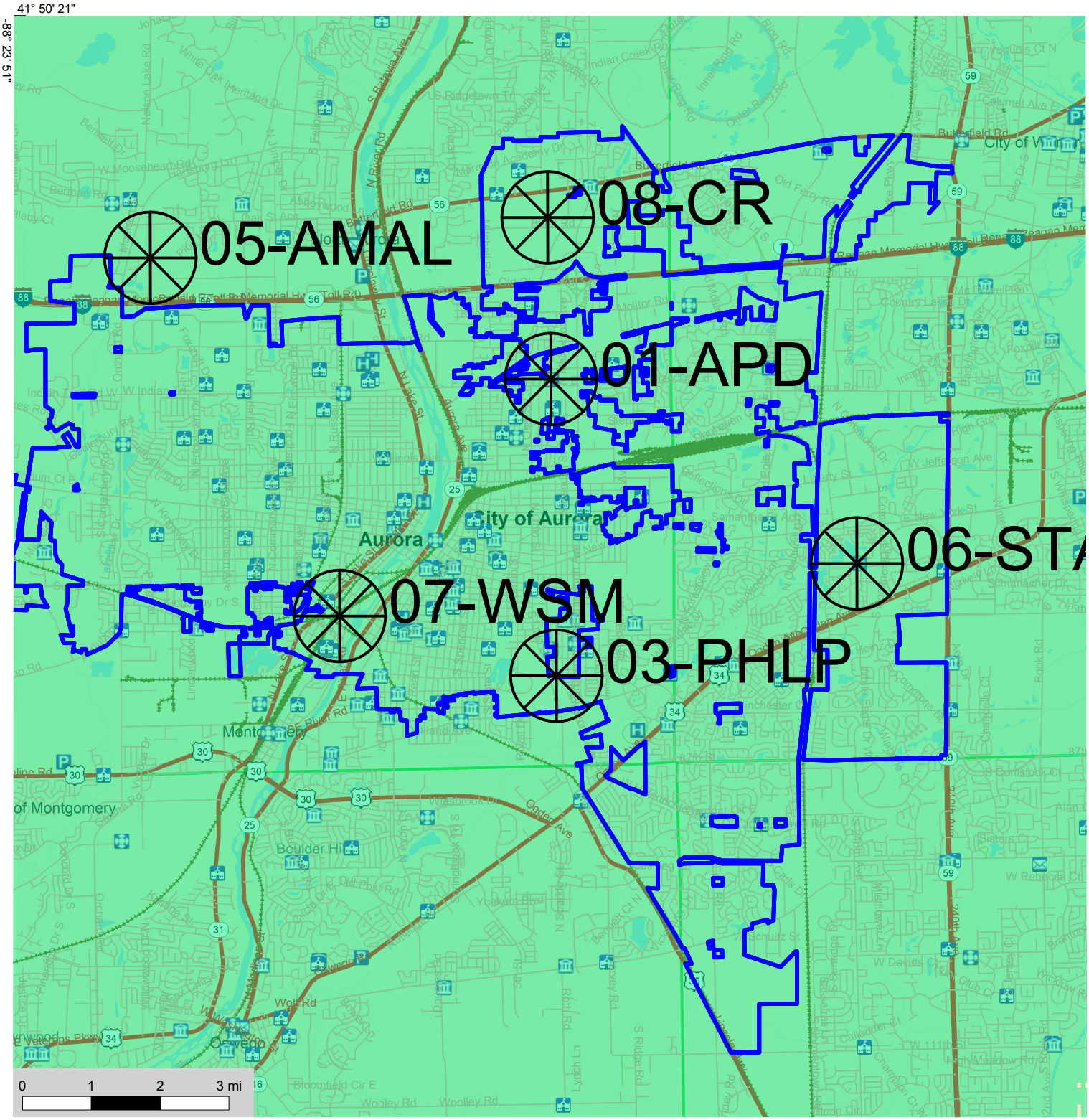
Project: AURORA P25
MBP: 1234
Figure: Aurora 800 P25 Phase 2 PortableTalk-Out
Engineer: Bjelovuk
Map type - 1:92,460
Note: Map depicts coverage across the defined service area. Statistical variability does not allow for guarantee of coverage in specific locations, but does represent graphically area % coverage.



RF Solutions

RAPTR Version 33.2.489
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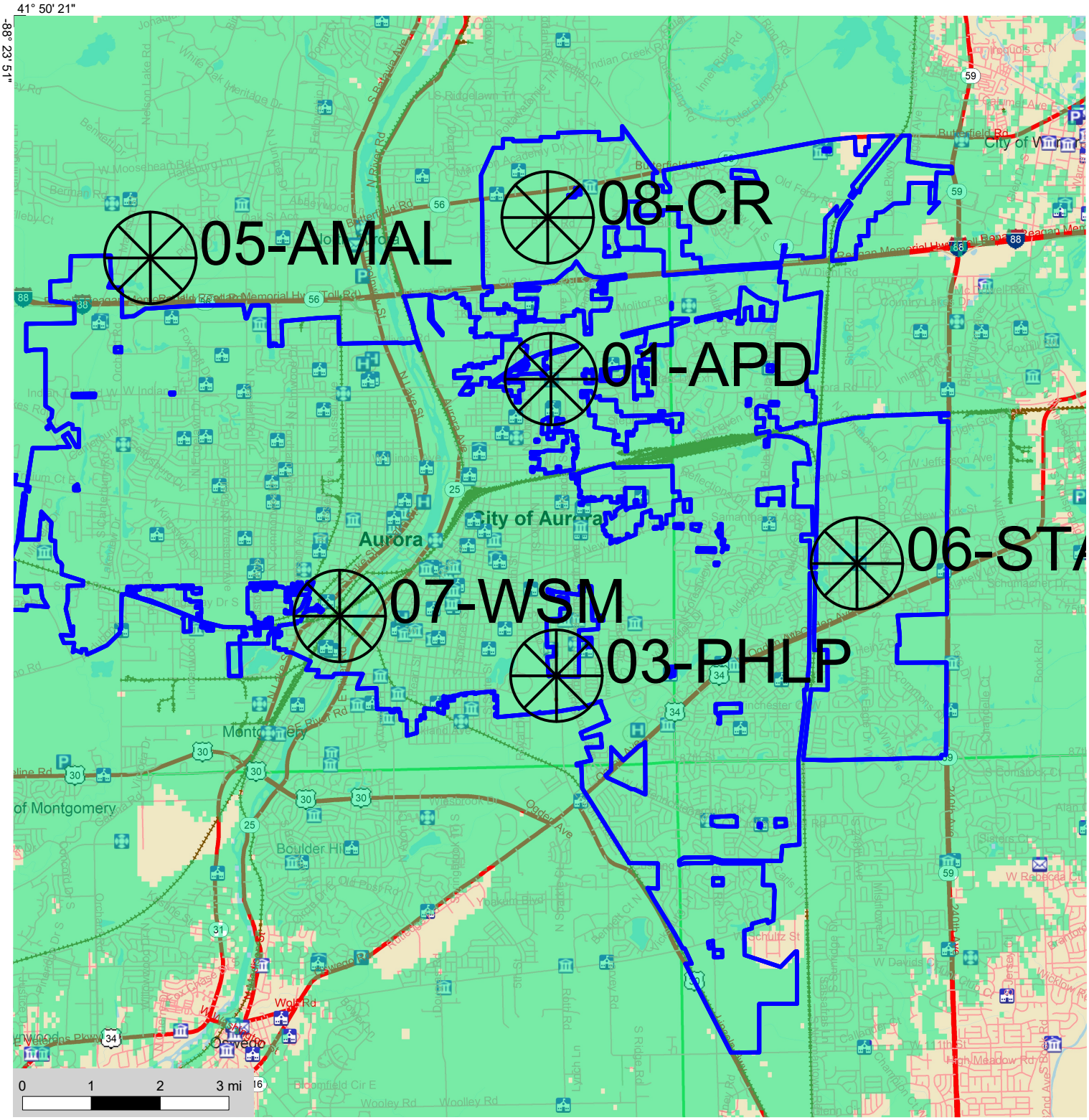
Project: AURORA P25
MBP: 1234
Figure: Aurora 800 P25 Phase 2 PortableTalk-Out 20dB
Engineer: Bjelovuk
Map type - 1:92,460
Note: Map depicts coverage across the defined service area. Statistical variability does not allow for guarantee of coverage in specific locations, but does represent graphically area % coverage.



L3HARRIS

TEST PLAN FOR SYSTEM ACCEPTANCE

Customer:
City of Aurora, Illinois

Prepared by:
Peter C. Abraham

Table of Contents

TEST PLAN

INTRODUCTION

L3Harris designed this System Test Plan to validate the installation and functionality of our P25 Phase 2 Trunking system at the SR10A.7 release. It defines the plan for conducting tests and analyzing test results, to confirm that the system satisfies design objectives.

The Test Team shall perform these tests in the order they appear in the plan and test procedures, or as required by the L3Harris systems engineer. The team will record test results in the appropriate test procedure referenced by this document. The prescribed test procedures have been developed and rigorously vetted by L3Harris engineering to provide extensive functional verification of the system features under test.

ROLES AND RESPONSIBILITIES

A Test Team consisting of at least one L3Harris system engineer and one City of Aurora, IL representative to act as a witness to the testing is required to execute the test plan. It may be necessary for a secondary team, consisting of an additional L3Harris employee and a City of Aurora, IL witness, to be present at another location to test certain features, such as multisite calls or for the secondary team to initiate site alarms so that the primary team can observe them from a system management terminal (SMT).

An L3Harris employee will execute the test steps outlined in the test procedure using the required equipment and with optional assistance from Aurora representatives. Additional personnel may attend as desired, or as required, to provide access or escort others to certain locations, such as RF shelters or other restricted access areas. City of Aurora, IL shall provide access for the entire team to its facilities, including, the Network Switching Center (NSC) locations, RF site shelters, and dispatch locations. For secure facilities, appropriate access permissions must be granted prior to the testing events.

ACCEPTANCE TESTING CLARIFICATION

Final acceptance testing can occur in two separate phases. The first phase of testing begins with functional testing performed in the L3Harris staging facility immediately after initial factory configuration is complete. During this first phase, Aurora representatives may be on-site to witness the testing. The second phase occurs after final installation at customer facilities.

Staging tests, as detailed in the identified test procedures, verify equipment functionality that we can reasonably perform in a factory environment. We will perform all identified functional testing in the field after final install and commissioning of the system.

Factory staging tests will be virtually conducted via a remote video conferencing session. The virtual testing allows for a greater number of participants than typically allowed for during an on-site visit.

Once acceptance testing begins, we will lock system configurations, hardware platforms, and software versions, except to correct software defects affecting system performance. Prior to conducting the factory tests, we perform a system audit to verify installation of the appropriate software system release version on each platform.

ELECTRICAL SPECIFICATIONS

If requested, L3Harris will provide raw test data and site alignment measurements from the factory Automated Manufacturing Test Station (AMTS) for the L3Harris provided transceiver equipment.

BASELINE CONFIGURATION

L3Harris systems include a baseline configuration with a predefined test agency and group structure to support the defined test procedures. L3Harris system engineering will determine the hardware and software revisions during program planning and check the system conforms to that baseline prior to the start of testing.

A complete set of as-built system schematics will be available during testing and includes:

- System block diagrams
- Network schematics
- Connection diagrams
- Wiring and cabling schematics
- Rack up drawings
- Alarm punch down drawings
- Grounding and power schematics

TESTING PREREQUISITES

Following installation and commissioning of the applicable hardware and software, L3Harris will verify the system readiness for test. If the testing includes RF sites, L3Harris will complete site alignment and optimization by setting site configurations, aligning stations, and optimizing system timing parameters. As part of the standard installation practices, we measure equipment settings and record levels. L3Harris will provide these site measurements as part of the final documentation package. These parameters include:

- Transmit frequency and deviation
- Output and reflected power
- Receiver sensitivity
- Receiver multicoupler gain (if applicable)
- Receiver preamplifier gain (if applicable)
- Time domain reflectometry of transmission line
- Combiner loss (if applicable)
- Audio line out
- Audio line in

Prior to conducting installation testing, L3Harris performs a system audit to verify installation of the appropriate system release version of software on each platform.

Finally, prior to conducting the testing procedures detailed in this document, L3Harris and City of Aurora, IL representatives will agree upon the dates and times of the test.

SYSTEMS AND SITES TO BE TESTED

L3Harris will test the P25 Phase 2 Trunking system installed at each of City of Aurora, IL's locations. Functional testing is expected to take up to two to three days per site but may be completed sooner.

Final system acceptance testing will take place at each of the RF site locations. A site will be chosen to initiate the testing, and all test procedures appropriate to the site will be executed and recorded. Once a site has completed the test cycle, the team will move on to the next site. This approach will be repeated until all sites have been tested.

Equipment is located at various locations across the facilities and is identified as the following:

SYSTEM/SITE LOCATION	SYSTEM/EQUIPMENT DESCRIPTION
Aurora Police Headquarters and 911 Center	NSC (primary core) Dispatch Center Interoperability Site Radio Site
Fire Station 8 and Dispatch Center	NSC (secondary core) Dispatch Center Interoperability Site
Auto Mall	Radio Site
Church Road	Radio Site
Phillips Park	Radio Site
Water Sewer Maintenance	Radio Site

PASS/FAIL CRITERIA

Criteria for Pass / Fail is determined by execution of the test procedures in the Acceptance Test Plan. If a feature test is successfully executed, that feature is deemed to be compliant and results in a PASS. If a failure occurs, the failed test may be repeated to address missed steps or configuration requirements overlooked during execution.

If a certain piece of equipment is deemed to be malfunctioning and duplicate spare equipment is available to replace it, the test may be executed using the spare equipment. If the feature test is successfully executed on the spare equipment, the feature will be deemed compliant and result in a PASS. At such time as the original piece of equipment is repaired or replaced and is able to function as designed, the original equipment will be returned to service and tested to ensure functionality.

If a feature is found to be non-compliant, L3Harris will address the non-compliance and retest. Until a successful retest, the feature is deemed to be non-compliant and results in a FAIL.

If it is necessary to defer a test for any reason, it may be marked as Not Yet Evaluated (NYE). The test may be executed, with appropriate witnessing, at any time afterward to change the result to a PASS.

TROUBLE REPORTING

Any issues found during testing will first be recorded on the comment page at the end of the feature set, and then they will be reported directly to the L3Harris program manager to be logged in the project issues log for corrective action.

Failures must be appropriately addressed. For hardware failures occurring during test events, failed hardware will be removed from the system being tested and turned over to L3Harris' quality organization for repair or replacement.

Test Procedures

FEATURES TO BE TESTED

The following list of acceptance procedures will be used to validate system performance:

- Network Switching Center
- Subscriber Units

TOOLS / TEST EQUIPMENT

Unless otherwise specified, L3Harris will supply all special tools necessary to test the product.

Equipment list TBD during program planning.

EQUIPMENT MODEL NUMBER	DESCRIPTION	SERIAL NUMBER
TBD	TBD	TBD

RADIO MODEL NUMBER	DESCRIPTION	SERIAL NUMBER
TBD	TBD	TBD

Safety

L3Harris will take reasonable safety precautions to ensure personnel against harm while operating within and traversing the installations.

General safety guidelines for portable radios:

- Do not hold onto the antenna when the radio is powered on.
- To ensure you do not exceed FCC RF exposure compliance requirements, always keep the antenna at least 0.43 inches (1.1 cm) away from the body and 0.98 inches (2.5 cm) from the face when transmitting.
- Do not use the portable radio with a damaged or missing antenna. A minor burn may result if skin comes into contact with a damaged antenna. Replace a damaged antenna immediately. Operating a portable radio with the antenna missing could cause personal injury, damage the radio, and may violate FCC regulations.

- Use only manufacturer-approved antennas. Use of unauthorized antennas, modifications, or attachments could cause damage to the radio unit and may violate FCC regulations.
- RF energy from portable radios may affect some electronic equipment. Most modern electronic equipment in cars, hospitals, homes, etc., is shielded from RF energy. However, in areas in which you are instructed to turn off two-way radio equipment, always observe the rules. If in doubt, turn it off!

L3Harris engineering will identify environmental detriments prior to testing, if deemed applicable. L3Harris will make adjustments to the extent required to address any such deficiencies deemed to present a danger to either system performance or personnel safety; examples include excessive temperature variations, contaminants, hazardous materials, or obstructions to LMR equipment.

TEST PROCEDURES

SYSTEM FEATURE SET

P25 TDMA Phase 2 Functionality (Single-site / Simulcast Single Site)

Purpose: Demonstrate P25 TDMA Phase 2 implementation provides the additional traffic channel capacity and features of P25 TDMA Phase 2 while allowing backwards compatibility with FDMA Phase 1 radios and talkgroups.

Expected Results: Verify that a P25 FDMA call will work on a TDMA system.

Setup: In the following tests, Radios 1 and 2 will be set up as FDMA only. Radios 3 and 4 will be set up as TDMA and FDMA capable, depending upon TG.

FDMA refers to Phase 1 and TDMA refers to Phase 2.

Log into RNM, Realtime Tab, start RSM Site Activity or VNIC site calls to monitor system channel assignment and call type during active calls.

DESCRIPTION	RADIO LID	TG DESCRIPTION	TG ID	SYSTEM
Radio 1	9980001	TG 64051 P25	64051	Phase 1
Radio 2	9980002	TG 64051 P25	64051	Phase 1
Radio 3	9980003	TG 64051 P25	64051	Phase 2
Radio 4	9980004	TG 64051 P25	64051	Phase 2

TDMA SITE CALL

Purpose: Demonstrates that a TDMA call will work on a TDMA system.

Expected Results: Verify that a P25 TDMA call will work on a TDMA system.

Setup: Turn off Radios 1 and 2.

Execution:

1. PTT Radio 3 and talk. The transmit (TX) indicators should turn on at Radio 3.
   - > Verify that the call is assigned as an TDMA by viewing the real time viewer site activity on the RNM.
   - > Verify Radio 4 can hear Radio 3.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

TRANSMISSION TRUNKING

Purpose: Test will demonstrate that the system is working as a transmission trunking system.

Expected Results: Verify the control channel will assign a working channel to the radio and that the radio and site will work as a trunking set by dropping radio transmission upon PTT release.

Setup: Radios 1, 2, and 3 should be the only radios on the system.

Use RNM real time viewers to monitor system channel assignment.

DESCRIPTION	RADIO LID	TG DESCRIPTION	TG ID	SITE
Radio 1	9980001	TG 64001 P25	64001	1
Radio 2	9980002	TG 64001 P25	64001	1
Radio 3	9980003	TG 64001 P25	64001	1

Execution:

1. Log into RNM, Realtime Tab, start RSM Site Activity, to monitor system channel assignment. Observe all channels on Site 1.
2. PTT Radio 1 and talk.
   - > The transmit (TX) indicators should turn on at Radio 1.
   - > Verify the number of the channel assigned.
   - > Un-PTT Radio 1.
3. PTT Radio 2 and talk.
   - > The transmit (TX) indicators should turn on at Radio 2.
   - > Verify the next channel is assigned.
   - > Un-PTT Radio 2.
4. PTT Radio 3 and talk.
   - > The transmit (TX) indicators should turn on at Radio 3.
   - > Verify the next channel is assigned.
   - > Un-PTT Radio 3.
   - > Verify the channel immediately drops, or as configured by station hang timers.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

P25 Simulcast Bypass Operation

Program the Two47 modules (both Control Points and Transmit Sites) to the Final Configuration. Refer to the installation manual for the guide to setting TX Traffic Controllers / CP Traffic Controllers personality parameters.

Verify the BYPASS plan has been reviewed and approved by customer representative. This procedure makes assumptions on bypass sites before implementation and test of the System. After WMS/Panther signal strength data collection, final decision will be made on the actual bypass “ON” and “OFF” sites.

Prepare a minimum of two terminal radios programmed to operate on the active BYPASS site and the main simulcast system.

SITE OFF - FINAL CONFIGURATION

Purpose: Confirm sites configured to be in the “OFF” condition during BYPASS are in the expected BYPASS mode.

Expected Results: The “OFF” site traffic controllers have no control channel.

Setup: Sites intended to be “OFF” in event of BYPASS must have all channels set to disabled (unchecked in Device Manager, TC personality).

Execution:

1. At one of the sites designated as an “off” site, create a condition to force BYPASS by disconnecting the router to MPLS connection. All other sites will have the HPAs disabled locally.
   - > Verify transmit site is in BYPASS mode.
   - > The Traffic Controller module display indicates “TC” instead of “TR”. Note: TC= Working Traffic Channel, standalone mode, TR=Working Channel, simulcast mode, and Control Channel, simulcast mode is indicated by the transmit LED indicator.
2. Observe the repeater (station) Traffic Controller modules.
   - > Verify there is no active control channel.
   - > Verify no stations are keyed or producing RF power.
3. Restore the site to normal by returning the site to simulcast mode by reconnecting the router to MPLS connection.
   - > Verify transmit site is in normal simulcast mode. The Traffic Controller modules will indicate “TR(n)”, where n is the channel number.
4. Repeat Steps 1-3 for the remaining “OFF” bypass sites in the simulcast system under test.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

SITE ON (TRUNKING) - FINAL CONFIGURATION

Purpose: Confirm sites configured to be in the “ON” condition during BYPASS are in the expected BYPASS mode.

Expected Results: The “ON” site traffic controllers have a control channel.

Setup: Site is configured to be ON during BYPASS.

Execution:

1. Create a condition to force BYPASS by disconnecting the router to MPLS connection.
   - > Verify transmit site is in BYPASS mode. BYPS LED on Baseband module and the Traffic Controller module display indicates either “TC” or “CC” instead of “TR.
   - > Observe the stations/repeater Traffic Controller modules. Verify there is an active control channel on one of the Traffic Controller modules. The remaining repeater/stations Traffic Controller modules will indicate “TC”.
   - > Verify the station appearing as control channel is keyed, producing RF power and modulated with control channel data.
   - > Verify a terminal radio set to the system programmed for the site in BYPASS with the correct site ID recognizes the site’s control channel data.
2. Key the terminal radio on a group call.
   - > Verify a working channel assignment is made within the channel group allowed in the personality.
   - > Verify the call is heard on a second terminal radio set to the active BYPASS system.
3. Restore the site to simulcast mode by reconnecting the router to MPLS connection.
   - > Verify transmit site is in normal simulcast mode. Traffic Controller modules indicate “TR(n).
4. Repeat Steps 1-3 for remaining “ON” bypass sites in the simulcast system under test.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

CONTROL POINT TRUNKING RESET CONTROL

Purpose: A properly set up Simulcast BYPASS system will disable CP Traffic Controller modules associated with active channels at a TX site operating in BYPASS. This keeps the remaining sites operating in Simulcast mode from being assigned to channels expected to be active at the site in BYPASS. Sites programmed to be OFF in BYPASS will not require any Traffic Controller modules to be held OFF.

Expected Results: This test will verify that the Control Point Traffic Controller modules will be held OFF corresponding to the active channels at a site, due to the TX site being in BYPASS.

Setup: N/A

Execution:

1. Force a TX site that will become active into BYPASS by disconnecting the router to MPLS connection.
   - > Verify TX site is in BYPASS mode.
   - > Verify transmit site is in BYPASS mode. Traffic Controller module display indicates either “TC” or “CC” instead of “TR”.
   - > Verify the CP Traffic Controller modules on the channels intended to be OFF are held OFF.
2. Observe the RNM screen for the simulcast system.
   - > Verify the channels intended to be OFF at the Control Point are reported as OFF (RED).
3. Restore the site to simulcast mode by reconnecting the router to MPLS connection.
   - > Verify the TX site Traffic Controller modules revert to normal Simulcast.
   - > Verify the CP Traffic Controller modules associated with the site in BYPASS are returned to normal.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

BYPASS – SITE MINIMUM CHANNELS

Purpose: Confirm a site enters bypass when active channels fall below site minimum channels setting.

Expected Results: The site enters bypass mode.

Setup: Sites are configured with cluster minimum channels set to 6 and site minimum channels to 7. Bypass Plan: TR Site 1 Ch 3,4,5; TR Site 2 Ch 6,7,8; TR Site 3 Ch 9,10,11 TR Sites 4 and 5 dark.

Note: Settings and bypass plan can be customer final settings; execution will have to adjust to accommodate those settings.

Execution:

1. At TR Site 1 disable Channels 8 - 11 using the TX disable switch on the PA (only Channels 1-7 are still functioning).
   - > Verify system and site still functioning in simulcast; the disabled Channels 8-11 are in alarm state at the control point site.
   - > At TR Site 1 the Traffic Controller modules displays still indicates “TR” not “TC” or “CC”. Note: TC= Working Traffic Channel, standalone mode, TR=Working Channel, simulcast mode, and Control Channel, simulcast mode is indicated by the transmit LED indicator.
2. At the same site, disable Channel 7 using the TX disable switch on the PA.
   - > Verify system is still functioning in simulcast. Control Point ch 3,4, and 5 in alarm state.
   - > Verify TR Site 1 is in bypass. The Traffic Controller module display indicates “TC” instead of “TR”. All channels status indicates alarm. Note: TC= Working Traffic Channel, standalone mode, TR=Working Channel, simulcast mode, and Control Channel, simulcast mode is indicated by the transmit LED indicator always on.
3. At the same site restore all channels back to service (enable the PA using the TX disable switch on the PA).
   - > Verify transmit Site 1 is in normal simulcast mode. The Traffic Controller modules will indicate “TR(n)”, where n is the channel number.
   - > Verify all channels are in service at the control point.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

BYPASS – CLUSTER MINIMUM CHANNELS – TR SITE FAILURES

Purpose: Confirm all sites enter bypass when available channels fall below the cluster minimum channels setting. Depending upon the system size, bypass plan, and which channels have been failed a subset of sites may subsequently come out of bypass and operate as a cluster before any channels are restored to service.

Expected Results: All site in the system enter bypass mode.

Setup: Sites are configured with cluster minimum channels set to 6 and site minimum channels set to 7 (these settings are normally lower; they are set high to simplify testing).

Execution:

1. At TR Site 1 disable Channels 9, 10 and 11 using the TX disable switch on the PA (8 channels are still functioning).
   - > Verify system and site still functioning in simulcast.
   - > The Traffic Controller module displays still indicates “TR” not “TC” or “CC”. Note: TC= Working Traffic Channel, standalone mode, TR=Working Channel, simulcast mode, and Control Channel, simulcast mode is indicated by the transmit LED indicator.
2. At TR Site 3 disable Channels 6, 7 and 8 using the TX disable switch on the PA (5 channels are still functioning).
   - > Verify All sites have entered bypass (the TCs display “TC” and “CC”, not “TR” and every channel status indicates failed at every site.
3. Enable the PAs at the sites using the TX disable switches.
   - > Verify the system recovers to simulcast mode with all transmit sites in normal simulcast mode. The Traffic Controller modules will indicate “TR(n)”, where n is the channel number.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

SITE ON (TRUNKING) - ENHANCED BYPASS FINAL CONFIGURATION

Purpose: Confirm sites configured to be in the “ON” condition during BYPASS are in the expected BYPASS mode and can connect to VNIC.

Expected Results: The “ON” site traffic controllers have a control channel and calls between terminal radios and dispatch can be made.

Setup: N/A

Execution:

1. Create a condition to force BYPASS that does not disrupt network connectivity by logging into both GPS receivers and configuring their notifications to set the major alarm threshold to minimum satellites 12 and duration below threshold 5 seconds. This will cause the GPS receivers to set a major alarm after 5 seconds.
2. Configure Notifications from Spectracom GPS Receivers
   > Navigate to: Management > Notifications

3. In the **Events** window pane, click the **GPS** tab.
4. Set the Major Alarm Threshold as follows:
   > Minimum Satellites: **12**
   > Duration Below Threshold: **5**
5. Click: Submit

6. Verify transmit site is in BYPASS mode. The Traffic Controller module display indicates either “TC” or “CC” instead of “TR”.
   - > Observe the stations/repeater Traffic Controller modules. Verify there is an active control channel on one of the Traffic Controller modules. The remaining repeater/stations Traffic Controller modules will indicate “TC”.
   - > Verify the station appearing as control channel is keyed, producing RF power and modulated with control channel data.
   - > Verify a terminal radio set to the system programmed for the site in BYPASS with the correct site ID recognizes the site’s control channel data.
7. Key the terminal radio on a group call.
   - > Verify a working channel assignment is made within the channel group allowed in the personality.
8. Restore the site to simulcast mode by restoring the GPS major alarm notification threshold to minimum satellites = 1 and duration = 345600 for both GPS receivers.
   - > Verify transmit site is in normal simulcast mode. Traffic Controller modules indicate “TR(n).

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Control Point Movement

DCP FORCED CONTROL POINT MOVEMENT

Purpose: This test will demonstrate the DCP system can move the control point in response to user command.

Expected Results: This test will verify that the Control Point can be moved from the active site to an alternate Control Point Site. After the control point is switched to the alternate Control Point the system should operate normally.

Setup: The DCP system is operating with an active control point and at least two sites are enabled to be the control point.

Execution:

1. Log into the RNM.
2. In Network view identify the site which is the active control point.
3. Right click on the control point site icon and select “Change Control Point to Best Site Available”.
4. Verify system is still functioning (i.e. voice calls can be made – between radios and a radio and console and optionally data calls can be made (e.g. radios can be ‘pinged’).
5. Verify that the RNM indicates a different site as control point and the previous control point is now a TX site. (Note – a CP only site displays “zzzz” when it is not the active control point.)
6. On the RNM right click on the previous control point site and select “Change to be the Control Point”.
7. Verify system is still functioning (i.e. calls can be made – between radios and a radio and console and optionally data calls can be made (e.g. radios can be ‘pinged’).
8. Verify that the RNM indicates the control point has moved to the site selected in Step 6 and the previous control point is now a TX site. (Note – a CP only site displays “zzzz” when it is not the active control point.)

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

DCP CONTROL POINT MOVEMENT IN RESPONSE TO FAULTS AT THE ACTIVE CONTROL POINT

Purpose: This test will demonstrate that the Control Point will move in response to failures at the active Control Point.

Expected Results: This test will verify that the DCP system will move the active Control Point to an alternate control point site when the active control point experiences failures. After the Control Point moves the old control point should drop into bypass and the rest of the system should operate normally as a Simulcast cluster.

Setup: The DCP system is operating with an active control point and is properly configured with at least two sites enabled to be the control point.

Execution:

1. Verify system is functioning (i.e. calls can be made – between radios and a radio and console and optionally data calls can be made (e.g. radios can be 'pinged').
2. At the control point site disconnect the 1pps cable from GPS B.
3. Verify the system is still functioning (i.e. calls can be made – between radios and a radio and console and optionally data calls can be made (e.g. radios can be 'pinged') and control point has not moved. The traffic controllers at the control point display 'CC xx' and 'TC xx' when idle; at a satellite site the traffic controllers display "TR xx' where xx is the channel number.
4. At the control point site disconnect the 1pps cable from GPS A.
5. Verify that the control point moved to next ranked site and the old control point is now in bypass. The traffic controllers at the control point display 'CC xx' and 'TC xx' when idle: Any channels that are configured to be active at the old control point site when it is in bypass will have all their status LED red. In bypass all the traffic controllers display 'CC xx' and 'TC xx' when idle and the status LED will be red.
6. Verify the RNM indicates the new control point and shows the old control point site is now in bypass.
7. Verify the simulcast system is still functioning (i.e. calls can be made – between radios and a radio and console and optionally data calls can be made (e.g. radios can be 'pinged').
8. If the old control point has channels active in bypass, verify radios switched to this bypass site acquire the control channel and can communicate.
9. Restore the connections to the GPS receivers at the site in bypass (the old control point site).
10. Verify that the site exits bypass and joins the simulcast cluster.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

P25 and OpenSky Trunked Call Interoperability

MULTISITE OPENSKY TO SIMULCAST P25 GROUP CALL

Purpose: This test will demonstrate that the system will allow a common group call to function in an OpenSky multisite and P25 simulcast environment.

Expected Results: The test will demonstrate that all radios assigned to a common group will hear a call regardless of the site they are affiliated with.

Setup: Radios must be affiliated with sites with VNIC connectivity (wide area communications).

DESCRIPTION	RADIO LID	SITE AFF	TG DESCRIPTION	TG ID
Radio 1	9980001	P25 Site	TG 64001 P25	64001
Radio 2	9980002	P25 Site	TG 64001 P25	64001
Radio 3	9980003	OpenSky Site	TG 64001 P25	64001

Execution:

1. PTT Radio 1 and talk.
2. The transmit (TX) indicators should turn on at Radio 1.
3. Radios 2 and 3 should hear the call.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

MULTISITE OPENSKY TO SIMULCAST P25 ANNOUNCEMENT GROUP CALL

Purpose: This test will demonstrate that the system will allow an announcement group call to function in an OpenSky multisite and P25 simulcast environment.

Expected Results: The test will demonstrate that all radios assigned to a common group will hear a call, although some of the radios are at distant sites, and all radios assigned to an uncommon group will not hear the call.

Setup: Groups 64001 and 64002 are in announcement group 64007 per test group structure. Ensure scan is turned OFF.

DESCRIPTION	RADIO LID	TG DESCRIPTION	TG ID	SITE
Radio 1	9980001	TG 64007 P25	64007	P25 Site
Radio 2	9980002	TG 64001 P25	64001	P25 Site
Radio 3	9980003	TG 64002 P25	64002	OpenSky Site
Radio 4	9980004	TG 64008 P25	64008	P25 Site

Execution:

1. PTT Radio 1 and talk.
2. The transmit (TX) indicators should turn on at Radio 1.
   - > Audio should be heard on Radios 2 and 3.
   - > ANNOUNCE should be displayed on Radios 2 and 3.
   - > Radio 4 should not receive announcement call.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

MULTISITE OPENSKY TO SIMULCAST P25 EMERGENCY GROUP CALL

Purpose: Demonstrate the capability of the system to process an emergency group call.

Expected Results: This test will verify that when a radio initiates an emergency group call, all other radios in the common OpenSky-P25 talk group indicate an emergency and the emergency can be cleared by a supervisor radio or console.

Setup: Program three radios with the same emergency home group. Set the supervisor (Radio 1) & Radio 2 to the home group. Set Radio 3 to a different group (not home group). A console will be used to clear the emergency.

DESCRIPTION	RADIO LID	TG DESCRIPTION	TG ID	SITE
Radio 1	9980001	TG 64001 P25	64001	P25 Site
Radio 2	9980002	TG 64001 P25	64001	OpenSky Site
Radio 3	9980003	TG 64003 P25	64003	P25 Site

Execution:

1. Press the Emergency call button on Radio 1 and talk within the pre-defined Emergency Auto-key time, and/or PTT Radio 1 during or just after that time.
   - > Verify that Radio 1 indicates the “TX EMER” declaration and that it reverts to the home group.
   - > Verify Radio 2 (on Site 2) indicates a “RX EMER” and hear audio on the emergency home group.
   - > Verify Radio 3 does not display the emergency.
2. Clear the emergency with a supervisor radio or console.
   - > Verify the emergency clears in the radios.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

System Test Notes / Issues

System Functional Test Acceptance

This Functional Test Acceptance Procedure has been fully and successfully completed with all action items resolved.

City of Aurora, IL Representative	L3Harris Technologies Representative
Signature	Signature
Printed Name and Title	Printed Name and Title
Date	Date

NETWORK SWITCHING CENTER FEATURE SET

VIDA Unified Administration System (UAS)

ACTIVE DIRECTORY CONTROL OF UAS USER ACCOUNTS (SR10A.4 OR LATER)

Purpose: Transition from managing UAS-user accounts in the UAS application to AD instead. New systems will be shipped w/ AD control instead of UAS application user control. Existing systems may choose to switch to AD control or continue to use the existing accounts in UAS.

Expected Results: Demonstrate for SR10A.4 or later UAS Login; the UAS uses Active Directory-configured user login with AD username and password.

Setup: All users configured in Active Directory prior to UAS Login. UAS Users are added to AD 'Active Directory Users and Computers' > within vida.local area > VIDA Users > VIDA Administrators > "each User defined here". For "User X", within "Properties" > "Member of" Tab; User X needs appropriate "VIDA UAS access group".

Execution:

1. Login into UAS with AD user login. Use AD username and password.
   With SR10A.4 or later, UAS web login interface will pass username and password to Active Directory for authentication.
   > Verify user has logged into the UAS.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

CREATE A RESTRICTED USER ACCOUNT IN THE UAS

Purpose: Show that a user can be created in the UAS that has restricted access.

Expected Results: New user will only have access to the agencies tab and 998 agency.

Setup: User will need system level access to a UAS to define a new administration class that has limited access privileges and create a new user with that class.

Execution:

1. Log into AD and create a new test user with UAS login rights.
2. Attempt to login with new account. (should receive message that user has now scope)
3. Login to the UAS with an AD account that has admin rights.
4. Grant the new test user rights to only agency 998
5. Log out and log back in as the test user.
   Verify the new user only has access to the 'Agencies' tab and agency 998.
6. Return to AD and delete test user to remove from system.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

PROVISION AGENCY WITH TALKGROUPS AND SUBSCRIBER UNITS IN THE UAS

Purpose: Demonstrate the capability to add talkgroups and users to the agency accounts in the UAS.

Expected Results: Test will show that a user can add a new TG and users to the system.

Setup: System/region/agency level access to the UAS or a UAS client.

Execution:

1. Log into the UAS with one of the default accounts.
2. Select Agency 998, select 'R/W Talkgroup', to create a talkgroup.
3. Click 'Add' and then on the 'Talkgroup Detail' screen input the talkgroup ID from the table below. For any setting not listed, use the auto setting. Click OK and download.
   > Verify the talkgroup has been added to the list of talkgroups.

TG ID	NAME	DESCRIPTION	SPNI	PROPERTY ID	PRIORITY ID	COVERAGE	VALID COVERAGE
64454	64454ANA	Half Rate Low Priority	1	3	5	P25Sites_PSAPs	P25Sites_PSAPs

4. Using telnet, log into a traffic controller at a control point for simulcast or site for multisite and issue the command 'show gdb'.
   > Verify that Group 64454 exists in the traffic controller user data base.
5. Once the group has been verified, delete it from the UAS.
6. In the UAS, select Voice End (VEU) User tab and add a VEU.
7. Select the Subscriber Unit tab, and add a Subscriber Unit for the Voice End User.
8. Using Telnet, log into a traffic controller at a control point for simulcast or site for multisite and issue the command 'show udb'.
   > Verify the added user exists in the traffic controller user data base.
9. Once the user has been verified, delete it from the UAS.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

DYNAMIC REGROUP FROM THE UAS

Purpose: Demonstrate ability to dynamically regroup subscriber units from the UAS.

Expected Results: Test will combine selected talkgroups into a single interop group.

Setup: Radios must have "Allow P25T Unsolicited Dynamic Regroup" checked in the radio personality under general options. Ensure radio IDs and talkgroup IDs are uploaded to the site.

DESCRIPTION	TG DESCRIPTION	TG ID	SITE
Radio A	TG 64001 P25	64001	1
Radio B	TG 64002 P25	64002	1
Radio C	TG 64003 P25	64003	1

Execution:

1. At the UAS, select 'Regroup' tab and 'Regroup Profile'.
2. Click 'Add' to add profile detail; name Group 'Regroup1', and Description 'Regroup1 Test'.
   - > Define regroup profile; select Agency 998 and 'TG64003'.
   - > Select 'OK' and save changes to the UAS.
3. Click 'End User Group' and click 'Add'. Name Group 'Regroup1' and Description 'Regroup1 test'.
   - > Select Agency 998 from 'Select a Scope' drop down box.
   - > Add 'Radio A' and 'Radio B' to the 'Selected' windows.
   - > Select 'OK' to close 'End User Group Detail'.
   - > Click 'Save' button to download the new regroup.
4. Click 'Define Regroup' and click 'Add' to name the regroup 'Regroup1' and description 'Regroup1 test'.
   - > Change 'Profile Name' to 'Regroup1' and change 'End User Group Id' to 'Regroup1'.
   - > Click 'OK' and save to click 'Save' the changes to the UAS.
5. Click 'Manage Regroup' check the box for 'Regroup1' and select the button for 'Regroup'.
   - > Click 'Save' to start regroup.
   - > Verify that Radio A and Radio B are forced to 'Talkgroup 64003'.
6. At 'Radio A' and 'Radio B', attempt to change talkgroups away from 'Talkgroup 64003'
   - > Verify that both radios are forced to remain on 'Talkgroup 64003'.
7. PTT 'Radio A' on 'Talkgroup 64003'.
   - > Verify that 'Radio C' hears audio on 'Talkgroup 64003' and can respond.
8. Clear the dynamic regroup from the UAS client.
   - > Verify 'Radio A' and 'Radio B' are no longer forced to 'Talkgroup 64003' (i.e., they can select other predefined talkgroups).

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

UNIT DEREGISTRATION

Purpose: Demonstrate that a radio will automatically deregister when the radio is turned off.

Expected Results: Test will show that the radio is off and will not create traffic load demand.

Setup: Radio A is the only radio on 'TG A' for this test. All other radios should be on different talkgroups. UAS>System Properties>Protocol Timer>Radio Re-Registration Timer for P25 trunked sites must be lowered to a minimum value to test this feature. It is typically setup for 360 minutes. Set the timer for two minutes and note the "calculated" value of "VNIC Remove Demand Timer". The VNIC Remove Demand Timer value is the "wait time" to see the radio be "deregistered" by the system after losing connectivity. Restart the VNIC following the change. Be sure to set the timer back to 360 minutes following the test.

Execution:

1. Browse to https://s0u1rnm.vida.local/nmc and log in with an Active Directory account. Choose 'System Map' and select 'Launch Application' button. Open 'Realtime' tab and click 'Mobiles.'
   > Verify Radio A LID is shown registered on the site.
2. PTT console and verify it communicates on the system to Radio A.
   > Return call from Radio A to the console.
3. Turn off Radio A and wait for expiration of the radio timeout period.
4. Refresh RNM mobiles screen periodically and verify Radio A is deregistered after VNIC *Remove Demand Timer* has passed.
5. PTT console, after the expiration of the timeout.
   > Verify no channel is assigned to site, since no demand exists at the sites.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

UAS SITE ADJACENCY CONFIGURATION (FIELD TEST)

Purpose: Demonstrate the capability to configure site adjacencies in the UAS.

Expected Results: Site adjacencies will be successfully configured and modified.

Setup: UAS is installed and functioning on system network.

Execution:

1. In the UAS go to System > System Properties > Site adjacency.
2. Select a site on the left-hand side to configure for adjacency information.
3. Use the left-hand side to add adjacencies for the site.
   > Confirm the adjacent sites are removed from the non-adjacent site list and display correctly on the right side.
4. Use the right-hand side to remove a site adjacency.
   > Confirm the removed adjacency disappears on the right side and is displayed as a non-adjacent site on the left side.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

UNIT ENABLE/DISABLE FROM THE UAS

Purpose: Demonstrate the ability to disable a lost/stolen radio from the UAS.

Expected Results: Test will disable and re-enable a designated radio.

Setup: Ensure radios can communicate together on same trunk group. Verify all sites are connected to the NSC and are online.

Note: If a radio is encrypted, unit disable will automatically delete the encryption key from the radio, as it is disabled. To restore unit functionality for an encrypted radio, the radio must have the encryption key re-installed.

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A
Radio C	TG A

Execution:

1. PTT on Radio C and verify call is heard on other Radios.
2. From the UAS:
   - Click Radio C Enable/Disable.
   - Under the Unit Enable/Disable tab, enter the ID of Radio C to be modified.
   - Select the disable button and check the status.
   - Attempt to PTT Radio C and verify that it will not communicate with the other radios.
   - PTT Radio A and verify that Radio C cannot receive the call.
3. Enable the ID of Radio C.
   - Verify that the Enable/Disable screen indicates that the current state of the radio is enabled.
   - Confirm that the radios can communicate by placing call.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

UAS SITE ACCESS CONTROL FOR INVALID USER ID

Purpose: Demonstrate access control for subscriber units with invalid radio IDs and high availability of the Regional System Manager (RSM).

Expected Results: Radio will be denied access to the system with an invalid subscriber ID. Once the radio is added to the system in the UAS database, the primary RSM will download the database that includes it to the sites and allow the radio access. When the primary RSM is turned off and the radio is deleted from the UAS database, the secondary RSM will download the database that deletes the radio from the system. Once the radio is deleted from the system, the radio will again be denied access.

Required Materials: Three radios, a programming cable, and computer with RPM2 installed.

Setup: Use the table below to set up the new radio in the UAS.

VOICE END USER	INPUT	SUBSCRIBER UNIT	INPUT
User ID	010:998:9150	Description	Radio9150
Name	Rad9150	Electronic Serial No.	0109989150
Description	Radio9150	RSI	0000000109989150
Personality	Pers1	Protocol Mask	P25
User Privilege	998_10_default	Status	Enabled Unit
Message Trunked Icall	TRUE	Sub Type	Harris XL-200P
Enable P25 AES OTAR	TRUE	Assigned End User	010:998:9150
Manually Keyed	FALSE	Algorithm Support	AES
Preferred Vocoder	P25 Half Rate		
Transc Allowed Flag	TRUE		

Execution:

1. Log into a site traffic controller, issue a “show udb 9989150.”
   > Verify radio is not present in the traffic controller database.
2. Program Radio A with an ID 9989150.
3. Attempt to PTT Radio 9150.
   > Verify access to the site is denied and audio is not heard.
4. Use the supplied table to enter Radio 0109989150 into the UAS database.
   > Select Agency/”agency name”/Voice End User. Click ‘Add Entry’ and then on the ‘End User’ Detail screen input the user ID, password (“p25user”), name, description, etc. of the user.
   > Select agency/”agency name”/subscriber unit and enter appropriate user ID, IP address, and ESN for the user.
5. Log into a site traffic controller, issue a “show udb 0109989150.”
   > Verify the radio is now present in the traffic controller database.
6. Key Radio A (9150).
   > Verify access to the site is permitted and audio is heard on radio.
7. Delete 0109989150 from the UAS database.

8. Key Radio A (9150)
   > Verify access to the site is not permitted and audio is not heard.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

Network Management

REAL-TIME SITE MONITORING (RNM)

Purpose: Demonstrate the capability to monitor real-time call activity from the RNM.

Expected Results: This test will show active call traffic on specific talkgroups and caller IDs.

Setup: Administrator access to the RNM.

Radio A and Radio B operating on a site and NSC under test, both programmed with Group A.

Execution:

1. On a client computer, open the Windows Internet Explorer and browse to https://s0u1rnm.vida.local/nmc and log into the RNM.
   - > Choose the 'System Map' and select the 'Launch Application' button.
   - > Open the 'Real-time' tab and click 'Site Activity'.
   - > Select the site and expand.
2. Check the box next to the channels and select it to add the channels to the target list. Select the 'OK' button to launch the application.
3. Place a group call from Radio A to Radio B on the site.
   - > Verify the event viewer displays the talkgroup ID and caller ID.
   - > Verify the state changes from free to talk.
   - > Verify the trunk group alias displays the group number.
4. Place an emergency call from Radio A to Radio B on the site.
   - > Verify the event viewer displays the emergency indication.
   - > Verify the event viewer displays the talkgroup ID and caller ID.
5. Place an individual call from Radio A to Radio B on the site.
   - > Verify the event viewer displays an individual call on the channel.
6. For P25 Phase 2: Verify the P25 Phase 2 RF traffic channels are sub-divided into two bearers (2-slot TDMA) when all Radios on the TG are Phase 2 capable.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

REGIONAL NETWORK MANGER (RNM) MONITOR SYSTEM STATUS

Purpose: Demonstrate the capability to monitor system status from the RNM.

Expected Results: This test will show system level equipment icons.

Setup: Administrator access to the RNM.

Execution:

1. On a client computer, open the Windows Internet Explorer and browse to https://s0u1rnm.vida.local/nmc and log into the RNM.
2. Choose the system map and select the 'Launch Application' button. Select the 'Network' tab and expand the tree in the left-hand panel until you can see a site in the right-hand panel.
   > Verify the infrastructure is presented.
   > Select an object and right click to select properties to view information related to the object.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

RF SYSTEM ALARMS INDICATIONS ARE REPORTED (RNM)

Purpose: Demonstrate the capability to monitor system faults and alarms at the RNM.

Expected Results: Site equipment will send alarms to the RNM.

Setup: Need access to the site under test and the regional RNM. The alarm will need to be generated by equipment being physically powered-down or reset. Note the time of the alarm condition for later tests. On the 'RNM Domain' screen, verify all map icons are either green or blue. On the fault browser screen, delete any prior alarms.

Execution:

1. On a client computer, open the Windows Internet Explorer and browse to https://s0u1rnm.vida.local/nmc and log in with an Active Directory account.
   - > Choose the system map and select the 'Launch Application' button.
   - > Select the 'Network' tab and expand the tree in the left-hand panel until a site is in the right-hand panel.
2. Generate an alarm on a device (see chart) by powering down or otherwise disabling the device.
   - > Verify that the RNM Network Viewer indicates a site alarm for the affected device.
   - > Review alarm details by doing a right mouse click on an 'Alarm Object'. Select the desired menu option.
   - > Verify alarm is listed in the 'Fault Browser'.
3. Turn the device back ON.
   - > Verify that the device alarm clears and displays green.
4. Repeat Steps 2 - 3 for all equipment listed in the below chart.
5. Substitute https://s0u2rnm.vida.local/nmc and repeat test Steps 1 - 4 for the second RNM.
6. Record the results below for each site.

Note: This form can be modified to reflect actual as-built alarms

SITE #		SITE NAME	
ALARM #	NAME	RESULTS (PASS/FAIL)	REMARKS
1	Traffic Controller		Press the reset button on the TC and watch for the alarm
2	Router		Remove cable from Gi0/0 (interface to SAS)
3	Switch		Remove a cable from a PLAN port
4	PA		Disable one of the site PAs

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

NETWORK SENTRY SITE ALARM INDICATIONS ARE REPORTED (RNM)

FIELD TEST ONLY

Purpose: Demonstrate the capability to monitor site faults and alarms at the RNM.

Expected Results: Site level equipment will indicate faults and alarms at the RNM. During factory testing the alarm will be simulated by changing the active state polarity. During field acceptance testing the jumper alarm contacts will be opened or closed to simulate an alarm. An actual alarm could be monitored if the contacts have been connected.

Setup: This test verifies that the site and shelter alarms are connected to the new system and alarm names are programmed to show the alarm types and locations. Site specific digital alarm inputs connected to the alarm management system (Network Sentry) alarm unit.

Execution:

1. On a client computer, open the Windows Internet Explorer and browse to https://s0u1rnm.vida.local/nmc and log in with the Active Directory account.
2. Choose the system map and select the 'Launch Application' button.
3. Select the 'Network' tab and expand the tree in the left-hand panel until you can see a site in the right-hand panel.
4. Select a physical site to test alarm inputs.
5. Create a condition that will either simulate an alarm (jumper alarm contacts) or the actual event to trigger each alarm
   > Verify that the alarm is detected and displayed in the RNM Network Viewer and is listed in the 'Fault Browser.'
6. Clear the alarm condition.
   > Observe that the alarm indication has cleared in both the 'Network Viewer' and the 'Fault Browser.'
7. Repeat for each alarm and for each site in the system.
8. Record the results below for each site.

Note: This form can be modified to reflect actual as-built alarms.

SITE #		SITE NAME	
ALARM #	NAME	RESULTS (PASS/FAIL)	REMARKS
1			
2			
3			
4			

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

ENTERPRISE NETWORK MANAGEMENT DISPLAY VERIFICATION (ENM)

Purpose: Demonstrate ENM monitoring capabilities.

Expected Results: Monitor various components of the LMR system.

Setup: The ENM product must be configured in Active Directory, in the “VIDA ENM Administrators” group. The user must log into the ENM with an administrator account.

Execution:

1. Open Internet Explorer and browse to https://s0u0enm.vida.local.
2. On the left side of the screen select the “Maps” heading and the “Maps Dashboard” sub-heading. From here, you can select the type of map you would like to view.
3. Verify that geographical maps display system and NSC information as configured.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

ENTERPRISE NETWORK MANAGER ALARM AND ALERT TEST (ENM)

Purpose: Demonstrate the capability to monitor system faults and alarms at the ENM.

Expected Results: ENM will detect in system status by displaying the appropriate alarm.

Setup: Need access to the system under test and the ENM. The alarm will need to be generated by equipment being powered-down or reset. The ENM product must be configured in Active Directory in the "VIDA ENM Administrators" group. The user must log into ENM with an administrator account.

Execution:

1. On a client computer, open Windows Internet Explorer and browse to https://s0u0enm.vida.local. Log in with the Active Directory account.
2. On the left side of the screen select "Maps" heading and "Maps Dashboard" sub-heading. Then select "System" map. At the "System" map, select the icon for the NSC that you will be working on.
3. Generate an alarm on a device (see chart below) by powering down or otherwise disabling the device.
4. The machine will take a few minutes to shut down.
   > Verify after a few minutes that the host will be highlighted red, and the icon in the "Status" column will turn red.
5. Turn the device back on.
   > Verify after a few minutes the icon in the "Status" column will turn green. (It may take some time for the red highlight to clear).
6. Repeat Steps 1 - 5 for all equipment listed in the below chart.

Note: This form can be modified to reflect actual as-built alarms.

ALARM #	NAME	DESCRIPTION	RESULTS (PASS/FAIL)	REMARKS
		NSC1		
1	NSS	Network Switching Service		
2	ISSI	Inter Sub-System Interface		
3	ADSA	Active Directory Server (A, B, C)		
4	RCA/SCA	Root Certificate Authority/ Subordinate Certificate Authority		
5	VCC (vCenter)	VCenter Computer		
7	UAS	Unified Administration System		
8	RSM/PRO	Regional Site Manager		
9	LAP (BeOn)	LMR Access Point		
10	RNM	Regional Network Manager		
11	VPS	VIDA Presence Server		
12	TXT	TextLink Server		
13	EDTA	eData Server		

ALARM #	NAME	DESCRIPTION	RESULTS (PASS/FAIL)	REMARKS
14	KMF	Key Management Facility		
15	EPO	ePolicy Orchestrator		
16	SUMS	Security Update Management Service		
17	BAK	Backup Server (Unitrends)		
18	DFC	Defense Center Server		
19	NIDS	Network Intrusion Detection		
20	SMT	System Management Terminal		
21	Console- Dispatch (CON)	Console		
22	VMT	Virtual Management Terminal		
23	XCD	Transcoder		
		NSC2		
1	NSS	Network Switching Service		
2	ISSI	Inter Sub-System Interface		
3	ADSA	Active Directory Server (A, B, C)		
4	SCA	Subordinate Certificate Authority		
5	PRO	Regional Site Manager		
6	LAP (BeOn)	LMR Access Point		
7	RNM	Regional Network Manager		
8	VPS	VIDA Presence Server		
9	EDTA	eData Server		
10	BAK	Backup Server (Unitrends)		
11	DFC	Defense Center Server		
12	NIDS	Network Intrusion Detection		
13	VMT	Virtual Management Terminal		
14	XCD	Transcoder		

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Cybersecurity Testing

ACTIVE DIRECTORY

Purpose: The purpose of this test is to view the GPO structure on an Active Directory server.

Expected Results: The GPO structure is valid.

Setup: None

Execution:

1. Remote desktop into an active directory server on the system.
2. Open Active Directory ‘Users and Computers’
   - > Validate that the computer accounts are in the appropriate containers. No computers should appear in the “Computers” container.
   - > Verify VIDA administrator group and VIDA Dispatch group exist.
   - > Verify VIDA administrators template exists for creation of new accounts.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

SUMS

Purpose: Demonstrate the SUMS server is communicating with the remote client.

Expected Results: Test will verify the SUMS server is communicating with the remote clients and that the remote clients are updated.

Setup: N/A

Execution:

1. Remote Desktop into the SUMS server.
2. Launch the 'IBM Endpoint Manager Console' and log into the console with the SUMS administrative user.
3. Expand 'Sites' 'Custom Sites' 'VIDA' and select 'Subscribed Computers'
   - > Verify that each computer is listed, in the "Subscribed Computers" window
   - > Check to make sure that each computer has reported to the SUMS server within the last 30 minutes by checking the 'Last Report Time' column.
   - > To check to make sure all the subscriber computers are updated by selecting the 'Baseline' in the left-hand window.
   - > Make sure the 'Baseline' window is empty or all computers in the window are gray.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

EPOLICY ORCHESTRATOR

Purpose: This test verifies that ePolicy Orchestrator is communicating with its end devices and it will report actions taken by McAfee Antivirus on a remote computer.

Expected Results: ePolicy Orchestrator is accessible and displays valid reporting.

Setup: N/A

Execution:

1. Use Internet Explorer on a client PC to navigate to the McAfee E-Policy Orchestrator server located at “https:/s0u1epo.vida.local:8443”.
2. Log in using proper credentials
   > Use local account user “xAdministrator”.
3. Go to ‘System Tree.’
4. Expand VIDA groups.
   > Verify all servers and computers are present within EPO and are communicating.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

UNITRENDS SYSTEM BACKUP

Purpose: This test verifies the Unitrends server has a schedule for performing backups of network computers and that it can display the backup status of those computers.

Expected Results: The test will verify the backup configuration.

Setup: N/A

Execution:

1. Use Internet Explorer on a client PC to navigate to the Unitrends backup servers:
   > s0u1bak.vida.local located at "**https://10.128.0.145**".
   > s0u2bak.vida.local located at "**https://10.128.0.177**".
2. Log in using root.
3. On the left panel click protect.
4. On the left look at file level and VMware backups.
   > Verify that devices are visible and configured for backups.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

INTRUSION DETECTION

Purpose: This test verifies that the Cisco FMC is communicating with its IDS sensors at remote sites across the network.

Expected Results: Cisco FMC is communicating with its IDS sensors.

Setup: N/A

Execution:

1. Use Internet Explorer on a client PC to navigate to the Cisco FMC server at "https://s0u1fmc.vida.local".
2. Log in using proper credentials.
3. Go to the Cisco FireSIGHT dashboard.
4. Click 'Operations.' Go to 'Sensors.'
   > Verify all sensors are visible.

   NOTE: There is only one Cisco FireSIGHT Server with two sensors (one at each NSC) reporting to it.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Over the Air Rekeying (OTAR)

GENERATING A SYSTEM UKEK

Purpose: Test is setup to verify the KMFs ability to create a UKEK.

Expected Results: KMF will create a UKEK.

Setup: Test requires a computer that is on the IP network and has 'Harris Key Manager' installed and running.

Execution:

1. Log into the KMF with the administrator level Active Directory account.
2. Open the 'Network KMF Management'
3. Select UKEK tab
4. Change 'Save As' text field to '\\fileshare\fileshare\kmf_files\ProvisionFile.ukek'
5. Generate UKEK file by selecting the 'Export UKEK' button
6. Select 'SLN Bindings' tab
7. Change 'Save As' text field to '\\fileshare\fileshare\kmf_files\SlnBindingsReport/xml'
8. Generate bindings by selecting 'Generate SLN Bindings Report'. This file will be used in a later test.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

UKEK A RADIO

Purpose: Test is setup to verify the KMFs ability to load UKEKs into a radio.

Expected Results: Radio should accept the UKEK file developed by the KMF.

Setup: Test requires a computer that is on the IP network and has 'Harris Key Manager' installed and running. Three radios programmed with a talkgroup using an AES encryption key. All radios should be feature-encrypted and enabled for OTAR operation. Two radios should have keys and one radio should not have keys. In test "Unit Enable/Disable from the UAS" the keys were removed from Radio 5.

Execution:

1. On a computer with 'Harris Key Manager' installed, save the file at '\\fileshare\fileshare\kmf_files\ProvisionFile.ukek' to the local computer.
2. Start 'Harris Key Manager' and connect the radio to the local computer.
3. Select 'Tools' -> 'Key Load Wizard' to open key load wizard
4. Select 'Next' -> Load a UKEK file into one or more devices" and open the UKEK file in Step 1 and select 'Next'
5. Once the UKEKs are loaded select 'Next'
6. Power on the radio and choose connection method USB or Serial.
7. Select 'Load' to load UKEK into the radio.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

WARM STARTING A RADIO FROM THE UAS KEY MANAGEMENT APPLICATION

Purpose: This will test the system's ability to push encryption keys to a radio and the radio to hear other radios on the encrypted talkgroup.

Expected Results: Radio will accept keys from the system and be able to communicate with other encrypted radios on an encrypted talkgroup.

Setup: Test requires three radios with a talkgroup using an AES encryption key. Radios and the talkgroup need to be in a test CryptoNet in the UAS Key Management application. Radios should be both feature-encrypted and enabled for OTAR operation. Two radios should have working encryption, and Radio E should have the UKEK load but no keys.

DESCRIPTION	TG DESCRIPTION
Radio A	Encrypted TG A
Radio B	Encrypted TG A
Radio C	Encrypted TG A

Execution:

1. PTT all three radios
   > Radios A and B should communicate normally
   > Radios A and B should hear calls from Radio C, but Radio C should not be able to hear calls from the encrypted radios
2. From the UAS, warm start Radio C.
   > The UAS will report "Warm Starting".
3. After the operation is complete, refresh the UAS screen.
   > Verify the UAS reports "Warm Started Success" for Radio C.
4. Again, PTT Radio A on the encrypted TG A and talk.
   > Radio A's transmit (TX) indicator should turn on and be amber.
   > Verify that Radio B and C now decrypt the call's audio.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

REKEYING AND CHANGING OVER A CRYPTO NET FROM THE UAS

Purpose: Test will show that the system can change encryption keys to a new set of keys.

Expected Results: After this test is complete, the radio will be able to communicate with the new set of keys sent by the system

Setup: Test requires three radios programmed with a talkgroup using an AES encryption key. Radios and talkgroup need to be in a test crypto net in the UAS Key Management application. All radios should be feature-encrypted and enabled for OTAR. Radios should have been warm started previously. If a console and/or gateway (GWB) are present in the system, then these devices should be included in this test also. They need to be in the same test crypto net as the radios and be programmed with the test talkgroup. They should have been warm started previously.

DESCRIPTION	TG DESCRIPTION
Radio A	Encrypted TG A
Radio B	Encrypted TG A
Radio C	Encrypted TG A

Execution:

1. Put Radios A, B, and C on the encrypted talkgroup.
   > Verify that all 3 Radios can transmit and receive on the encrypted talkgroup.
2. Leave Radios A and B powered on and power off Radio C.
3. From the UAS, rekey the crypto net. The UAS will report “Rekeying” for the crypto net.
4. Select report icon for the crypto net.
   > Radios A and B should be shown as “Rekeyed.”
   > Any consoles and/or GWB’s should also be shown as “Rekeyed.”
   > Radio C should be shown as “Rekey Failed.”
5. From UAS, change over the crypto net. It should report “Changing Over” for the crypto net.
6. After the operation is complete, refresh the UAS screen. It should report “Changing Over Complete” for the crypto net
7. Turn on Radio C. PTT Radio A on the encrypted TG A and talk. The transmit (TX) indicator should turn on and be amber at Radio A.
   > Verify that Radio B but not Radio C decrypt the call’s audio.
   > Verify that any consoles and/or gateway bases decrypt the call’s audio also.
8. PTT Radio C on the encrypted TG A and talk.
   > The transmit (TX) indicator should turn on and be amber at Radio C.
   > Verify that Radios A and B decrypt the call’s audio.
   > Verify that any consoles and/or GWB’s decrypt the call’s audio.
9. From UAS, do an end user level rekey on Radio C for that crypto net.
   > The UAS will report “Rekeying” for Radio C.
10. After the operation is complete, refresh the UAS screen. It should now show “Rekeyed” for Radio E.
    > Select the report icon for the crypto net. Radios A, B, and C will be shown as “Rekeyed.”
    > From the UAS, do an end user change over on Radio C for the test crypto net. The UAS will report “Changing Over” for Radio C.

11. Again, PTT Radio A on the encrypted TG A and talk.
    - > Verify that Radio A's transmit (TX) indicator turns amber.
    - > Verify that Radio B and C decrypt the call's audio.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

ZEROIZING A RADIO FROM THE UAS KEY MANAGEMENT APPLICATION

Purpose: Test will verify system's ability to delete keys from a radio that was encrypted.

Expected Results: A radio that has keys and can communicate with other encrypted radios and will have the keys removed so the radio cannot communicate with other encrypted radios.

Setup: Three radios programmed with a talkgroup using an AES encryption key. Radios and the talkgroup need to be in a test crypto net in the UAS Key Management application. All radios should be feature-encrypted and enabled for OTAR. The radios should have been warm started previously.

DESCRIPTION	TG DESCRIPTION
Radio A	Encrypted TG A
Radio B	Encrypted TG A
Radio C	Encrypted TG A

Execution:

1. Put Radios A, B, and C on the encrypted talkgroup.
   > Verify that all 3 radios can transmit and receive on the encrypted talkgroup.
2. From the UAS, zeroize Radio C.
   > The UAS will report "Zeroizing" for Radio C with the date and time updating to reflect the date and time the operation was initiated.
   > After the operation is complete, refresh the UAS screen. Verify the UAS reports "Zeroized" for Radio C.
3. PTT Radio A on the encrypted TG A and talk.
   > The transmit (TX) indicator should turn on and be amber at Radio A.
   > Verify that Radio B decrypts the call's audio.
   > Radio C should hear garbled audio or muted audio.
   > Verify the receive indicator is amber on both radios and the ID of Radio A should be seen at both Radios B and C.
   > Verify Radio C shows "No Key 0" when it is PTT'ed on the encrypted talkgroup.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

REKEY A RADIO FROM THE RADIO

Purpose: Test system's ability to send keys to a radio, when radio requests keys.

Expected Results: Take a radio that has no keys and can't communicate with other encrypted radios and add keys to the radio, so it can communicate with the system.

Setup: Three radios programmed with a talkgroup using an AES encryption key. Radios and the talkgroups need to be in a test crypto net in UAS Key Management application. All radios should be feature-encrypted and enabled for OTAR. One of the radios should be the radio that was zeroized in the previous test.

DESCRIPTION	TG DESCRIPTION
Radio A	Encrypted TG A
Radio B	Encrypted TG A
Radio C	Encrypted TG A

Execution:

1. Key Radio A on an encrypted talkgroup.
   > Radio A should display 'No key' Radio B, and Radio C should not hear the call.
2. From the menu on Radio A select 'Rekey' to request new key for Radio A.
   > Once the radio receives the encryption keys, key Radio A and verify Radios B and C hear the call.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

UKEK AND SYMPHONY

Purpose: Test is setup to test the KMF's ability to make UKEK files for Symphony.

Expected Results: Symphony should accept UKEK file developed by the KMF.

Setup: Test requires three radios programmed with a talkgroup using an AES encryption key. All radios should be feature-encrypted and enabled for OTAR operation.

Execution:

1. With an encrypted radio, make a call on an encrypted talkgroup,
   > Radio with encryption should hear the call.
   > Symphony Console will not hear the call, since it does not have keys.
2. To load UKEK Keys to the Symphony Console, close the Symphony Console application, and start the Manual Key Load application to load UKEK Keys.
3. In 'Manual Key Load' application, do a "Zeroize", to remove any potential unwanted keys.
4. In 'Manual Key Load' application, do a "Load UKEK". Enter the UKEK filename, the password (if a password is associated with the file), and the RSI.
   > [RSI for Symphony (User ID), is defined in UAS > Subscriber Unit (for Symphony); or defined in KMF > in NKMC (Network KMF Mgmt. Console) > End Users Tab > at Console User ID.]
5. Restart Symphony Console application. UKEK keys are now available.
   > Verify Symphony 'System History' shows "KMF Key Load Completed".
   > Verify on console group / unit modules, the "encryption" key is enabled, no longer grayed out.
6. With an encrypted radio, make a group call on an encrypted talkgroup.
   > The radio with encryption will play the call,
   > The console will now hear the TG A audio.
7. On the Symphony talkgroup, ensure the encryption key is set for locked. Initiate call on Symphony talkgroup, and the call should be heard on the encrypted radios.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Over the Air Programming (OTAP) (SR10A.3 or later)

P25 OVER-THE-AIR DATA TEST (SR10A.3 OR LATER)

Purpose: Confirm remote radio terminals can be accessed from a Profile Manager host over the VIDA network and personalities can be read/programmed using Over-the-Air-Programming (OTAP).

Expected Results: The radio can be pinged, and radio personality can be read/programmed using the Profile Manager host.

Setup: Test requires a radio on the system and a host computer that is logged on to the system. Verify Profile Manager and RPM2 are both installed and running on the host computer.

- ProFile Manager > Tools > ProFile Transport Configuration... >
- Data Environment > select “LandLine Data”
- LandLine Data > enter “First LID”, “Last LID”, “First IP Address”, and select “Add”
- Select “OK”

Execution:

1. Log the radio into the site to be tested.
   - Using ProFile Manager, verify that a host can ping the radio.
2. Using ProFile Manager, over the air, read the radio personality. Radio > Read. Save the personality.
3. Using RPM2, change the name of one of the talkgroups. Save the updated personality file with a different file name.
4. Using ProFile Manager, write the change to the radio. Radio > Write.
   - Verify that the name of the talkgroup has changed on the radio.
5. With ProFile Manager, reprogram the radio with the initial personality.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Activity Warehouse

SITE ACTIVITY USING THE ACTIVITY WAREHOUSE

Purpose: Demonstrate the capability to create various agency level system usage reports.

Expected Results: Test will create an agency level user report.

Setup: Ensure radio traffic has occurred across the network recently. If necessary or desired, place some calls with a known radio ID on multisite talkgroups prior to running the test for reference during the test.

Execution:

1. Open a web browser and browse to 'https://s0u1pro.vida.local/reports' and log in with active directory credentials.
2. Select 'Activity Reports' → Call Activity
3. Enter the time period for the report (Example: 2-hour window before this test).
4. Enter additional report information required.
5. Click on "View Report"
   > Check to make sure that there is call activity.

   NOTE: These reports can be up to two hours behind.

TEST RESULTS				
Tester:				
Date:				
Result:	☐	Pass	☐	Fail

Transcoder Test

TRANSCODER TEST

Purpose: Test will demonstrate the transcoder ability to transcode calls made with different vocoders.

Expected Results: This test will verify that the transcoder is needed to transcode a call, and each transcoder will transcode calls.

Setup: Radio A Personality: Systems > P25 Trunked > Select the “System Name” > “TDMA Capable” needs to be unchecked (for FDMA / Phase 1).

Radio B Personality: Systems > P25 Trunked > Select the “System Name” > “TDMA Capable” needs to be Checked (for TDMA / Phase 2).

UAS > Agencies > Voice End User >

- Radio A > P25 Full Rate
- Radio B > P25 Half Rate

DESCRIPTION	TYPE	TG DESCRIPTION	SITE
Radio A	Phase 1 Radio	Half rate TG	1
Radio B	Phase 2 Radio	Half rate TG	2
Console		Half rate TG	

Execution:

1. Shutdown s0u1xcda.vida.local, s0u2xcda.vida.local and s0u1xcdb.vida.local.

TRANSCODER	STATE
s0u1xcda.vida.local	Off
s0u2xcda.vida.local	Off

2. From the console place a call on Talkgroup, a P25 TDMA Phase 2 call.
   - Verify call is not heard on P25 FDMA Radio A on Talkgroup, this call failed, since there is no working transcoder.
   - Verify call is heard on P25 TDMA Radio B on Talkgroup.
3. From FDMA Radio A place a call on Talkgroup.
   - Verify call is not heard on TDMA Radio B on Talkgroup, since there is no working transcoder.
4. Restart s0u1xcda.vida.local.

TRANSCODER	STATE
s0u1xcda.vida.local	On
s0u2xcda.vida.local	Off

5. From the console place a call on Talkgroup, a P25 TDMA call.
   - Verify call is heard on P25 FDMA Radio A, call is using s0u1xcda.vida.local.
   - Verify call is heard on P25 TDMA Radio B.
6. From FDMA Radio A place a call on Talkgroup.
   - Verify call is heard on TDMA Radio B on Talkgroup, call is using s0u1xcda.vida.local.
7. Restart s0u2xcda.vida.local wait for 15 minutes for services to start

8. Shutdown s0u1xcda.vida.local.

TRANSCODER	STATE
s0u1xcda.vida.local	Off
s0u2xcda.vida.local	On

9. From the console place a call on Talkgroup, a P25 TDMA call.
   > Verify call is heard on P25 FDMA Radio A, call is using s0u2xcda.vida.local.
   > Verify call is heard on P25 TDMA Radio B.
10. From FDMA Radio A place a call on Talkgroup.
   > Verify call is heard on TDMA Radio B on Talkgroup, call is using s0u2xcda.vida.local.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

BeOn Features

Purpose: Demonstrate the BeOn features.

Expected Results: Following tests will demonstrate that BeOn works as designed.

Setup: Tests will show that the BeOn system allows a smartphone to communicate with the radio system.

TRANSMIT GRANT TONE

Purpose: Demonstrate the grant tone on BeOn.

Expected Results: When the smartphone PTTs on the BeOn app, it will play a grant tone.

Setup: Grant tone (Ready to Talk tone) enabled in smartphone radio personality.

DESCRIPTION	TG DESCRIPTION
BeOn Phone 1	TG A
BeOn Phone 2	TG A
BeOn Phone 3	TG A

Execution:

1. Press PTT button on smartphone with valid group selected.
   > Verify grant tone is heard at smartphone when working channel access is granted.
   Note: If the call is queued, the grant tone will be delayed until the call is assigned a working channel.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

GROUP CALL

Purpose: Confirms BeOn can make group calls.

Expected Results: Selected talkgroup call audio is heard.

Setup: Set Smartphones 1, 2, and 3 to (Group A) per test group structure. Make sure Scan is turned OFF.

DESCRIPTION	TG DESCRIPTION
BeOn Phone 1	TG A
BeOn Phone 2	TG A
BeOn Phone 3	TG A

Execution:

1. PTT on BeOn Phone 1 and talk.
   - > The transmit (TX) indicators should turn on at BeOn Phone 1.
   - > Audio should be heard in BeOn Phone 2 and BeOn Phone 3.
   - > The ID of BeOn Phone 1 should be seen at BeOn Phone 2 and BeOn Phone 3.
2. Set BeOn Phone 3 to TG B. PTT on BeOn Phone 1 and talk.
   - > The transmit (TX) indicators should turn on at BeOn Phone 1.
   - > Audio should be heard in BeOn Phone 2 only.
   - > The ID of BeOn Phone 1 should be seen at BeOn Phone 2 only.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

INDIVIDUAL (PRIVATE) CALL

Purpose: Confirms individual calls can be initiated using BeOn enabled smartphones.

Expected Results: Individual calls are confirmed.

Setup:

DESCRIPTION	TG DESCRIPTION
BeOn Phone 1	TG A
BeOn Phone 2	TG A
BeOn Phone 3	TG A

Execution:

1. Using the BeOn Phone 1, select the pre-stored ID of BeOn Phone 2 or enter the BeOn Phone 2 ID directly from the keypad, and PTT Smartphone 1.
   > Verify that BeOn Phone 2 receives the call and displays the ID of Smartphone 1.
   > Verify that BeOn Phone 3 remains idle.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

GROUP SCAN

Purpose: Confirms the scan function which allows a smartphone to hear audio on selected talkgroups other than the current talkgroup.

Expected Results: Selected talkgroup call audio is heard.

Setup: BeOn Phone 1 set up with Talkgroup A P25 and B P25 in the scan list, Talkgroup A P25 selected, and group scan initially disabled.

DESCRIPTION	TG DESCRIPTION
BeOn Phone 1	TG B
BeOn Phone 2	TG A

Execution:

1. Place a call from BeOn Phone 2 on Talkgroup A P25.
   > Verify the call is not received by BeOn Phone 1.
2. Enable group scan on BeOn Phone 1.
3. Place another call from BeOn Phone 2 on Talkgroup A P25.
   > Verify that the call is now received, and audio is heard on BeOn Phone 1.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

EMERGENCY GROUP CALL

Purpose: Confirms an emergency can be declared, recognized, and cleared by a smartphone.

Expected Results: The emergency is declared, recognized, and cleared.

Setup:

DESCRIPTION	TG DESCRIPTION
BeOn Phone 1	TG A
BeOn Phone 2	TG B
BeOn Phone 3	Talkgroup C

Execution:

1. Press the emergency call button on BeOn Phone 3 and then PTT BeOn Phone 3.
   - > Verify that BeOn Phone 3 indicates the “TX EMER” declaration and that it reverts to the home group.
   - > Verify that BeOn Phone 1 and BeOn Phone 2 indicate a “RX EMER” and hear audio on the emergency home group.
2. Clear the emergency with supervisor phone or console.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Trunked Logging Recorder

GROUP CALL

Purpose: Confirms group call audio is captured, recorded, and accessible on the logging recorder

Expected Results: Calls are captured, recorded, and accessible.

Setup:

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A

Execution:

1. PTT Radio A and talk.
   > Audio should be heard on Radio B. Note the start time of the call and the approximate duration.
2. Retrieve the call from the logging recorder.
   > Verify the caller, callee, start time, and duration.
   > The caller should be the LID for Radio A and the callee should be the GID for TG A. Verification should include the user ID (LID), group ID (GID), and its alias as defined by the UAS.
   > Verify that the call is identified as a group call.
3. Playback the audio.
   > Confirm that the playback audio is all recorded and intelligible.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

EMERGENCY GROUP CALL

Purpose: Confirms emergency group call audio is captured, recorded, and accessible on the logging recorder

Expected Results: Emergency calls are captured, recorded, and accessible.

Setup:

RADIO DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A
Radio C	TG A

Execution:

1. Press the emergency call button on Radio B. Talk during the hot mic transmit time.
2. Clear the emergency with the Radio A.
3. Retrieve the call from the logging recorder.
   - > Verify the caller.
   - > Verify the callee.
   - > Verify the start time.
   - > Verify the duration.
   - > The caller should be the LID for Radio B, and the callee should be the GID for the home group.
   - > Verification should include the user ID (LID), group ID (GID), and its alias as defined by the UAS.
   - > Verify that the call is identified as an emergency.
   - > Playback the audio and confirm that it is all recorded and intelligible.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

BeOn Server High Availability (Field Test Only)

BEON SERVER HIGH AVAILABILITY

Purpose: Demonstrate BeOn LAP servers operate as high availability.

Expected Results: Verify BeOn LAP servers provide high availability BeOn operational status.

Setup: Two BeOn LAP servers are up and operational. Test can include BeOn Windows client, BeOn iOS client, BeOn Android client if available for testing.

> Use RNM > “Network” tab > BeOn Sites > LAP1 and LAP2 to view Server Active Status.

DESCRIPTION	TG DESCRIPTION
BeOn Windows Client	TG A
BeOn iOS Client	TG A
BeOn Android Client	TG A
Radio A	TG A

Execution:

1. All BeOn clients and BeOn-capable radios are on same Talkgroup.
   > Verify all BeOn clients and radios can transmit and receive on Talkgroup.
2. On RNM > “Network” tab > BeOn Sites > LAP1 and LAP2 > “Properties”:
   > Verify both LAP1 and LAP2 are “Online” and “Reachable” and “Up”.
3. Shutdown LAP1 server.
4. Monitor at RNM, the status of LAP1 server, to indicate when LAP1 server is down. RNM > “Network” tab > BeOn Sites > LAP1 > “Properties”.
   > Verify “Monitor” is “Offline”.
   > Verify “Connectivity” is “Unreachable”.
   > Verify “Operation” is “Down”.
5. Ensure at RNM, status of LAP2 server remains “Online”, “Reachable”, and “Up”.
   > Verify “Monitor” is “Online”.
   > Verify “Connectivity” is “Reachable”.
   > Verify “Operation” is “Up”.
6. PTT Radio A on Talkgroup and talk. Transmit (TX) indicator should turn on at Radio A.
   > Verify BeOn Windows client, BeOn iOS client, BeOn Android client and BeOn-capable Radio B all receive the call audio.
7. Restart LAP1 server.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

High Availability NSS Switchover

HIGH AVAILABILITY WIDE AREA ROUTER FAILURE

Purpose: Demonstrate capabilities of the system to work after a WAR failure.

Expected Results: System components that are set-up with high availability will continue to work after a WAR failure.

Setup: These tests are setup to be run twice, once on each router. After completing Step 4 restart the WAR router if not already running. Wait 20 minutes and rerun the tests for the second router. These tests will simulate a WAR failure by disconnecting it from the Wide Area Network (WAN), so the WAR to WAN connection will need to be known.

DESCRIPTION	TG DESCRIPTION	SITE
Radio A	TG A	1
Radio B	TG A	1
Radio C	TG A	1
Radio D	TG A	2

Execution:

1. Use Radio A to initiate a call
   > Verify that the call is heard on the Radio B. Keep the call active during fail-over.
2. Use Radio C to initiate a call
   > Verify that the call is heard on Radio D. Keep the call active during fail-over.
3. Log in to s0u1nss and s0u2nss; change your user to the Root User and enter the password.
4. Type ‘HArunning’ into both NSSs, one will report that it is the ‘Stand By’ and one will report that it is the ‘Primary’. Note the name of the primary NSS and the primary WAR.

DESCRIPTION	TEST RUN 1	TEST RUN 2
Primary NSS Name		
Primary RNM Name		
Primary RNM Name		
Primary RSM Name		
Time of Server Reboot		

5. Log into the WAR that is associated with the ‘Primary’ NSS. “Reload” the WAR router.
   > The call from Radio C to Radio D will be dropped.
   > The call from Radio A to Radio B will continue and the console will lose connectivity to the VNIC.
   > Verify that after a short delay, the backup server NSS2 automatically takes over as the primary server.
6. Wait 20 minutes for the two NSS servers to synchronize and replicate their databases.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

VIDA Inter-Operability Gateway Test

LOCAL INTEROPERABILITY

Purpose: The purpose of this test is to verify correct functionality of the Interoperability Gateway.

Expected Results: Verify that the Interoperability Gateway connects via four-wire audio connections in the Zetron Pathway+ units to interoperability radio units (mobile or desktop). The gateway also connects to a router and the Network Switching Center (NSC) to provide call functionality across the network.

Setup: N/A

Execution:

1. Select 'Inter-op Group 1' on the radio.
2. Initiate a call from the radio to Group 1
   > Verify that audio is heard on inter-op Group 1 radio.
3. Initiate a call from the inter-op Group 1 radio to Group 1
   > Verify that audio is heard on the radio.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

NSC Test Notes / Issues

NSC Test Acceptance

This Functional Test Acceptance Procedure has been fully and successfully completed with all action items resolved.

City of Aurora, IL Representative	L3Harris Technologies Representative
Signature	Signature
Printed Name and Title	Printed Name and Title
Date	Date

SYMPHONY CONSOLE FEATURE SET

FEATURE SET TESTING ASSUMPTIONS

Console feature tests will use the customer's existing Symphony consoles.

Failed console equipment will be replaced by the customer and the call test will be repeated.

Perishable equipment failures or used equipment failures will not count toward a failed feature test.

TRANSMITTING WITH A MICROPHONE

Purpose: Demonstrate Symphony operator can initiate communication with a radio using Symphony select functions and foot pedal.

Expected Results: Confirms Symphony communication with radio

Setup: Radio set to same TG as console

Execution:

1. Press INSTANT TX function (right mouse button) on module with test group.
   - > Verify call is heard on radio.
   - > Verify a ripple effect on 'TX' indicator is displayed.
   - > Verify a channel access tone is heard.
   - > Release the Instant TX key.
2. Click the 'Select' button on the module to make the TG the selected talkgroup.
   - > Verify module for TG is highlighted, indicating it is selected talkgroup.
3. Make a call on TG by pressing PTT foot pedal.
   - > Verify a channel access tone is heard.
   - > Verify halo around the 'TX' indicator is displayed.
   - > Verify call is heard on radio.
   - > Verify audio is heard at radio on talkgroup.
   - > Release foot pedal to end call.
4. Make a call on TG by pressing headset button.
   - > Verify a channel access tone is heard.
   - > Verify halo around 'TX' indicator is displayed.
   - > Verify call is heard on radio.
   - > Verify audio is heard at radio on talkgroup.
   - > Release headset button to end call.
5. Make a call on TG by selecting it with a mouse.
   - > Verify a channel access tone is heard.
   - > Verify halo around 'TX' indicator is displayed.
   - > Verify call is heard on radio.
   - > Verify audio is heard at radio on talkgroup.
   - > Release mouse button to end call.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

RECEIVING CALLS (UNIT ID DISPLAY, TALKGROUP ID DISPLAY, ALIASING)

Purpose: Confirm Symphony operator can receive communications from a radio, using both TG A and individual calling.

Expected Results: Communications are initiated and received on appropriate speaker (select or unselect) and radio's ID is displayed.

Setup: Symphony has talkgroups A, B, and C configured with TG B selected.

Talkgroup Call

Execution:

1. Key radio and verify
   - > That call is heard at unselect speaker.
   - > Calling radio ID is displayed on module for TG.
   - > A green light ID displayed indicating an incoming call on module TG A.
2. Switch radios talkgroup to TG B and key radio.
   - > Verify call is heard at select speaker.
   - > Verify calling radio ID is displayed on TG B module.
   - > Verify a green light ID displayed indicating an incoming call on module for TG B.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Individual Call (Unit – Unit)

Execution:

1. Right click on ‘Harris’ box on top left-hand side of screen.
2. Select ‘Open Directory’ this will open a pop-up window for ‘Directory’.
3. Select ‘Users’ tab.
4. Select ‘Radio A’ under “ALIAS’ column.
5. Press ‘Radio A’ button right side to screen to place an individual call to ‘Radio A’.
   - > Verify ripple effect on ‘TX’ indicator is displayed.
   - > Verify a ringing tone will be heard at console and radio.
   - > Verify radio displays ‘INDV’ and consoles ‘ID”.
6. Respond to console by PTTing radio.
   - > Verify call is heard on Symphony and calling radio’s ID and call indicator are displayed.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

EMERGENCY CALL AND EMERGENCY ALARM

Purpose: Confirms Symphony indicates an emergency declared by a radio and can reset and clear emergency.

Expected Results: Symphony indicates and can clear emergency.

Setup: Test requires a test radio capable of generating and clearing an emergency (i.e. supervisor radio).

DESCRIPTION	TG DESCRIPTION
Radio A	TG A

Execution:

1. Using test radio, declare an emergency on TG A.
   - > Verify TG A module turns red,
   - > Verify ID/name of test radio is displayed
   - > Verify emergency alert tone is heard on Symphony.
2. Select triangle with a '!' to access emergency menu.
   - > Verify acknowledge 'Ack' button is red and check box is red.
3. Using radio, transmit on talkgroup
   - > Verify call is received by Symphony.
4. With Symphony, transmit on group with emergency.
   - > Verify test radio receives call and is still in emergency mode.
5. Acknowledge emergency by selecting 'Ack' button
   - > Verify button changes from 'Ack' to clear.
   - > Verify radio and Symphony are still in emergency mode.
6. Clear the emergency by selecting 'Clear X' button
   - > Verify Symphony clears emergency.
   - > Verify radio clears emergency.
7. Transmit on radio.
   - > Verify emergency is cleared and normal group calls have resumed.
8. Select TG A group selected on Symphony, declare an emergency on test group by pressing 'Emer Declare'.
   - > Verify Symphony and radio have same indications as Steps 2 to 4.
9. Acknowledge by hitting 'Ack' in Step 5.
10. Clear emergency with Symphony.

TEST RESULTS			
Tester:			
Date:			
Result:	☐ Pass	☐ Fail	

SYSTEM WIDE CALL

Purpose: Confirm Symphony can initiate system wide calls.

Expected Results: Symphony can initiate system wide all call.

Setup: Program console modules with 'TG64000 P25' talkgroup

DESCRIPTION	TG DESCRIPTION
Radio A	TDMA Group A
Radio B	TDMA Group B
Radio C	FDMA Group A
Radio D	FDMA Group B

Execution:

1. Press INSTANT TX on 'TG64000' module.
   - > Verify channel access tone is heard,
   - > Verify ripple effect on 'TX' indicator is displayed
   - > Verify call is heard at all radios
   - > Release Instant TX key.
2. Press INSTANT TX on TDMA Group A module.
   - > Verify channel access tone is heard,
   - > Verify ripple effect is displayed
   - > Verify call is heard at Radio A.
   - > Verify Radios B, C, and D do not hear audio.
   - > Release Instant TX key.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

ALERT TONES

Purpose: Confirm Symphony can initiate alert tones which can be heard at radio.

Expected Results: Tones can be initiated and heard.

Setup: Symphony programmed with TG A.

DESCRIPTION	TG DESCRIPTION
Radio A	TG A

Execution:

1. Make TG A P25 selected talkgroup.
2. Select tones tab on talkgroup module.
3. Select one of three ALERT TONE keys by selecting drop-down list next to orange button.
4. Radio A will receive tone.
5. Test all three alert tones to ensure all alert tones can be heard on radio.
   > Verify ALERT TONE is received by Radio A and is also heard on Symphony.
6. When ALERT TONE key is released.
   > Verify tone on Radio A drops.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

CONSOLE PRE-EMPT

Purpose: Confirm Symphony can pre-empt an ongoing call between radios.

Expected Results: Call started by the radio will be interrupted by the console.

Setup: Symphony programmed with TG: TG64001 P25

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A

Execution:

1. Key Radio A on TG A and hold call up. Verify that audio is heard at Radio B and Symphony.
2. Key Symphony on TG A and hold, while continuing to hold call up on Radio A
   - > Verify console pre-empts.
   - > Verify transmit indicator is displayed along with pre-empted caller LID and CALL indicator.
   - > Verify second radio begins to hear Symphony audio and not first radio call.
   - > Verify pre-empted radio audio is still heard on pre-empting console.
3. Un-key first radio.
   - > Verify pre-empted caller LID and CALL indicators are removed, and pre-empted radio audio is no longer heard on pre-empting Symphony.
4. Un-key Symphony.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

SIMULSELECT

Purpose: Confirms operation of Symphony simulselect feature, which allows multiple talkgroups to be selected for communication simultaneously.

Expected Results: Symphony can select multiple talkgroups and communication is allowed.

Setup: Symphony programmed with TGs A, B, C, and D.

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG B
Radio C	TG C
Radio D	TG D

Execution:

1. Create simulselect group on 4 test group modules.
2. Place a call from Symphony on simulselect group.
   > Verify call is heard at all four radios.
3. Place a call from each radio.
   > Verify only Symphony hears calls.
   > Verify only radios on the same talkgroup hear each other.
4. Deactivate simulselect group.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

PATCH

Purpose: Confirms Symphony patch feature creates shared communication between multiple selected talkgroups.

Expected Results: Patched talkgroups can communicate.

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG B
Radio C	TG C
Radio D	TG D

Execution:

1. Create patch on PATCH 1 with all four groups above.
2. Place a call from newly created patch.
   > Verify call is heard on all radios.
3. Place a call from each radio.
   > Verify call is heard on Symphony and each radio.
4. Deactivate patch.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

CALL HISTORY

Purpose: Confirms a history of calls processed at the Symphony.

Expected Results: History is accessible and valid.

Setup: Test compares programmed module call activity to history scroll lists. Utility page, dispatch menu will be selected. Select either “Select History” or “Unselect History”.

Execution:

1. Press ‘scroll up’ and ‘scroll down’ buttons to scroll through Unselect Call History list.
   > Compare these calls with known activity.
2. Press ‘scroll up’ and ‘scroll down’ buttons to scroll through Selected Call History list.
   > Compare these calls with known activity.
3. Press ‘Esc’ button to exit history scroll mode.
4. To monitor call history on a single group, use ‘module history’ button on ‘module modify’ menu.
5. Use ‘scroll up’ and ‘scroll down’ buttons to scroll through calls for picked module.
   > Compare these calls with known activity.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

GROUP EMERGENCY AND UNIT ALERT WITH SYMPHONY

Purpose: Confirm Symphony receives a group emergency and an emergency unit alert declared by a radio. Confirm console can acknowledge and clear emergency alarm (unit alert) and acknowledge and clear group emergency.

Expected Results: Symphony Console can indicate emergency alarm (unit alert) and group emergency. Symphony can also clear unit alert & cancel group emergency.

Setup: Radios A & B have “Emergency Alarm” enabled in personalities.

DESCRIPTION	TG DESCRIPTION	TG ID
Radio A	TDMA TG A	64152
Radio B	TDMA TG B	64152

Execution:

1. Select TDMA TG A on the console. On Radio A, declare an emergency on TG B. PTT Radio A to talk to the dispatcher.
   - > Verify Radio B on site 2 receives emergency and hears emergency group call.
2. On Symphony’s TG B Module:
   - > Verify TG B Module has a striped red background.
   - > Verify TG Smart Button flashes an “emergency icon”, which alternates with TG icon.
   - > Verify Declarer ID is shown in Red on TG Module.
   - > Verify emergency alarm tone and radio emergency group call audio is heard on Symphony.
3. On Symphony’s Sidebar Panel, go to the Emergency Panel:
   - > Verify emergency listed shows TG B, in a mini module, with a red background.
   - > Verify declarer ID is listed, with an “ACK” button and a number ‘1’, for number of group emergencies declared, [listed below TG Mini Module].
   - > Verify below declarer ID, single unit icon and declarer ID is listed, with an “ACK” button.
4. To clear group emergency alarm tone on Symphony emergency sidebar panel, select top “ACK” button next to declarer ID.
   - > Verify group emergency alarm tone is silenced on the console.
   - > Verify group emergency is still displayed on talkgroup module and emergency sidebar panel.
   - > Verify unit alert “ACK” is still displayed below group emergency.
5. On Symphony, select and transmit on TG B.
   - > Verify Radio A and B both receive emergency call.
6. Clear group emergency on Radio A.
   - > Verify console TG module no longer indicates a group emergency.
   - > Verify the group emergency is no longer seen on Radio A and Radio B.
7. PTT on Radio A, to do a group call:
   - > Verify an emergency group call goes to the Symphony on TG B module, and to Radio B.
   - > Verify emergency is also seen in emergency sidebar panel.
   - > (This occurs, since emergency unit alert is still active on TG B.)

8. On Symphony emergency sidebar panel, clear unit alert tone by selecting second “ACK” button next to unit icon and declarer ID. Also, clear group emergency alarm tone on TG B, by selecting first “ACK” button next to declarer ID.
   > Verify all emergency tones have been silenced.
9. On emergency sidebar panel, clear group emergency by selecting first “Clear” button next to declarer ID. Also, clear unit alert by selecting second “Clear” button next to Unit Icon and declarer ID.
   > Verify emergency on TG B has been cleared from Symphony, Radio A, and Radio B.
10. PTT on Radio A on TG B, to do a group call.
    > Verify a group call without an emergency is seen and heard at Symphony and Radio B.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Symphony Console Test Notes / Issues

Symphony Console Test Acceptance

This Functional Test Acceptance Procedure has been fully and successfully completed with all action items resolved.

City of Aurora, IL Representative	L3Harris Technologies Representative
Signature	Signature
Printed Name and Title	Printed Name and Title
Date	Date

SUBSCRIBER UNIT FEATURE SET

TRANSMIT GRANT TONE

Purpose: Demonstrate the system channel grant tone is heard on the radio.

Expected Results: This test will show that the radio will play a grant tone when the radio is assigned a working channel.

Setup: One radio with valid ID and a valid group on selected system. Grant tone (ready-to- talk tone) enabled in radio personality as applicable for specific radio type being tested.

Execution:

1. Press PTT button on radio with valid group selected.
2. Verify grant tone is heard at radio when working channel access is granted.

   Note: If the call is queued, the grant tone will be delayed until the call is assigned a working channel.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

OUT OF RANGE TONE ON PTT

Purpose: Test demonstrates the radios out of range tone.

Expected Results: When the radio losses connectivity with the control channel the radio plays a tone to make the user aware that it has lost connectivity to the control channel.

Setup: One radio with a valid ID and a valid group on selected system. System scanning should be disabled in the radio personality as necessary for specific radio type being tested.

Execution:

1. With valid group selected, and radio initially logged into and monitoring the control channel on the selected system, reduce the signal strength reaching the radio by some means (ex. unscrewing and removing the portable radio antenna, or moving further from the site).
   > Verify that the radio indicates loss of control channel on the display when the received signal strength is sufficiently reduced (i.e. out of range of system).
   > Press PTT button on radio and verify that an out of range tone is heard at the radio.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

GROUP SCAN

Purpose: Verify when scan is enabled, calls from groups in the radio's scan list are received.

Expected Results: In this test the radio will play calls from multiple talkgroups while scan is enabled.

Setup: All radios for this test need to have scan ability.

Radio A set up with TG A and TG B P25 in the scan list, TG A P25 selected, and group scan initially disabled.

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A

Execution:

1. Place a call from Radio B on TG A.
   > Verify the call is received and audio is heard on Radio A.
2. On Radio B, change to TG B. Place a call from Radio B on talk TG B.
   > Verify the call is not received by Radio A.
3. Enable group scan on Radio A.
4. Place another call from Radio B on TG B.
   > Verify that the call is now received, and audio is heard on Radio A.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

PRIORITY SCAN

Purpose: Demonstrate groups assigned a higher priority in the scan list override groups of a lower priority.

Expected Results: Radio will play calls with a higher level of priority.

Setup: Set Radio A to priority scan TG A P25, and scan (at lower priority – 3 bars) TG B P25. Set Radio A to TG C. Have scan enabled on Radio A.

DESCRIPTION	TG DESCRIPTION
Radio A (SCAN)	TG A
Radio B	TG B
Radio C	TG C

Execution:

1. Have Radio A selected to TG C P25. Place a call from Radio B on TG B P25.
   > Verify Radio A scans to TG B P25 and hears audio from Radio B. Continue transmitting from Radio B.
2. Place a call from Radio C on TG A P25. [Radio B is still transmitting on TG B P25.]
   > Verify Radio A priority scans to TG A P25 and hears audio from Radio C.
3. Unkey all radios and turn off scan.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

TRANSMIT BUSY LOCKOUT

Purpose: Demonstrate a radio cannot key on a group, on which a group call is already active.

Expected Results: A radio will not be allowed to transmit on a talkgroup while a different radio is transmitting on the same talkgroup.

Setup: Talkgroup used for test must be set up as transmission trunked. This feature does not apply to message trunked calls.

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A

Execution:

1. Place a call from Radio A on selected TG by pressing and holding the PTT button.
   > Verify the call is received and audio is heard on Radio B.
2. While the call is in progress, press the PTT button on Radio B.
   > Verify that Radio B does not transmit over (step on) the call in progress. (A double bump busy sound will be heard).

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

CONTINUOUS CONTROL CHANNEL UPDATE

Purpose: This test will demonstrate that a radio will join a call that is already in progress.

Expected Results: This test will verify that a radio will join a call that is already in progress.

Setup:

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A

Execution:

1. Set both radios to the test group.
2. Turn Radio B OFF.
3. Key Radio A and hold. Turn ON the Radio B (and set it to the test group if necessary).
   > Verify that the second radio joins the call in progress and hears audio from the call in progress.
4. Unkey Radio A.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

CONVERT TO CALLEE

Purpose: Demonstrate when radios are simultaneously keyed, only one radio is given talk privilege.

Expected Results: When two radios on the same TG are keyed simultaneously, only one radio will receive access to the working channel. The other radio will play the audio from the first.

Setup: Test of single site simultaneous call arbitration. Radio A and Radio B are registered on the same site and talkgroup.

DESCRIPTION	TG DESCRIPTION	SITE
Radio A	TG A	1
Radio B	TG A	1

Execution:

1. Set two radios to the same site and group.
2. Key both radios at the same time.
   - > Verify that one radio ends up transmitting and the other ends up receiving.
   - > Verify that the call audio is routed and received by one of the units although the PTT is pressed.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

GROUP TEST CALL

Purpose: A group test call will show that the site will allow a radio to communicate using a group call.

Expected Results: Test will demonstrate that all radios assigned to a common group will hear a call and all radios assigned to an uncommon group will not hear the call.

Setup: Make sure scan is turned OFF on the radios.

DESCRIPTION	TG DESCRIPTION
Radio A	TG A
Radio B	TG A
Radio C	TG A

Execution:

1. PTT Radio A and talk.
   - > The transmit (TX) indicators should turn on at Radio A.
   - > Audio should be heard in Radios B and C.
   - > The ID of Radio A should be seen on Radios 2 and 3.
2. Set Radio C to a different talk group. PTT on Radio A and talk.
   - > The transmit (TX) indicators should turn on at Radio A.
   - > Audio should be heard in Radio B only.
   - > The ID of Radio A should be seen at Radio B only.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

SINGLE SITE CALL QUEUE DECLARATION ALERT

Purpose: This test will demonstrate the system queuing.

Expected Results: This test will verify that the system will assign users in a queue when the system has no available channels and assign users a working channel when the system has an available channel.

Setup: This test requires four radios and two working channels. Disable channels (if necessary) until there are two working channels at the site. This test is to be run with no other users on the system.

DESCRIPTION	TG DESCRIPTION
Radio A	FDMA TGA
Radio B	FDMA TG B
Radio C	FDMA TG C
Radio D	FDMA TG C

Execution:

1. Busy up all talk paths on the system with Radio A, and 2 by pressing and holding the PTT button.
2. With all talk paths busied, momentarily press, and release the PTT button on test Radio C.
   > Verify that a call queued tone is heard at the radio.
3. Unkey (release PTT button) Radio B.
   > Verify that Radio C is assigned to the free talk path.
4. The grant tone is heard at the radio, without having to rekey the radio (re-pressing the PTT button).
5. Press the PTT button on Radio C within the auto key time applicable to the radio type (approx. 2 seconds) to keep the assigned channel.
   > Verify that audio from Radio C is heard at Radio D.
6. Unkey all radios.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

RECENT USER PRIORITY

Purpose: Demonstrate system's ability to prioritize recent users in queueing situations.

Expected Results: When radios of the same priority level enter the queue, one that has been recently active will exit the queue first.

Setup: This test requires four radios and two working channels.

Disable channels (if necessary) until there are two working channels at the site. Set the radio according to the table below. This test is to be run with no other users on the system and at intervals as set in the recent caller interval (a time of greater than 10 seconds is recommended for the test, which is configurable in the traffic controller module). *This will only work if performed quickly.*

DESCRIPTION	TG DESCRIPTION
Radio A	FDMA TG A
Radio B	FDMA TG B
Radio C	FDMA TG C
Radio D	FDMA TG D

Execution:

1. PTT and release Radio A (establish a recent user entry).
2. PTT Radios C and D and hold on transmit to busy both working channels.
3. PTT and release Radio B (queue a call less recent than Radio A).
4. PTT and release Radio A (queue the recent user).
5. Unkey Radio D.
   > Verify that Radio A un-queues and transmits.
6. Unkey all radios.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

CALL PRIORITY FOR GROUP IDS

Purpose: Demonstrate the system's ability to allow a user with a higher priority to be assigned a channel before a user with a lower priority, despite who enters the queue first.

Expected Results: This test will verify that a user who has a higher priority will be assigned a channel before users with a lower priority regardless of who entered the queue first. In this test Radio D should get the first available channel, because it has a higher priority, and Radio C will be assigned a channel next because it has a lower priority.

Setup: This test requires two working channels on the site. Disable channels (if necessary) until there are two working channels on the site. Setup the radio according to the table below. This test is to be run with no other users on the system.

DESCRIPTION	TG DESCRIPTION
Radio A	TG 64001 P25
Radio B	TG 64002 P25
Radio C	TG 64003 P25
Radio D	TG 64004 P25

Execution:

1. PTT Radios A and B and hold on transmit to busy both working channels.
2. PTT and release Radio C (medium priority entry into the queue).
3. PTT and release Radio D (high priority entry into the queue).
4. Un-key Radio D.
   > Verify that Radio C un-queues and keys.
5. Un-key Radio B.
   > Verify that Radio A un-queues and keys.
6. Un-key all radios.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

TDMA RUTHLESS PREEMPT, FOR EMERGENCY DECLARATION

Purpose: When all active channels/timeslots at a site are busy, an emergency declaration can preempt calls of a lower priority.

Expected Results: Site will attempt to drop a lower priority local TDMA call when the emergency declaration is TDMA.

Setup:

Site 1: UAS: P25 site capability: “Mixed Site”

Site 1: One control channel and one working channel only

Site personality: Emergency declaration: Handling when all channels are busy: “Drop Calls of Lower Priority”

Log into RNM real time Viewers: RSM site activity or VNIC site calls to observe Phase 1 and Phase 2 calls.

DESCRIPTION	TG DESCRIPTION	SITE
TDMA Ph2 Radio A	TDMA Low priority TG	1
TDMA Ph2 Radio B	TDMA TG	1
TDMA Ph2 Radio C	TDMA high priority TG	1
TDMA Ph2 Radio D	TDMA high priority TG	1

Execution:

1. PTT Radio A, and PTT Radio B.
   > Verify on RNM real time viewers that two TDMA calls are active on the traffic (working) channel.
2. While the two calls are active in Step 1, declare an emergency on Radio C, and PTT Radio C to perform an emergency group call.
   > Verify on the RNM, that the active call on Radio A is preempted, and the group emergency is now on the available channel, where the Radio A call had been preempted from.
   > Verify Radio A no longer has an active call, checking to see that the transmit indicator is off, while still PTTing Radio A.
   > Verify Radio D has received the emergency call and can hear the audio.
3. Release PTT on Radios A and B. Release PTT on Radio C and clear the group emergency on Radio C.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

P25 RADIO CHECK (SR10A.3 OR LATER)

Purpose: To verify the radio is connected to the VIDA system and is available for communications.

Expected Results: Symphony dispatcher can send a message to a radio, and the dispatcher can see the time the text message was sent to the radio.

Setup:

Radio A registered on Site 1.

Radio B not registered on Site 1.

Symphony Console has radio check license.

DESCRIPTION	TG DESCRIPTION	SITE
TDMA Ph2 Radio A	TG A	1
TDMA Ph1 Radio B	TG A	1

Execution:

1. Dispatcher presses “Radio Check” button for Radio 1, on Symphony.
   > Verify text to the left of the “Radio Check” button indicates the time the message was sent.
2. Dispatcher presses “Radio Check” button for Radio 2, on the Symphony.
   > Verify the text to the left of the “Radio Check” button indicates that the text message failed to reach Radio 2.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Unencrypted / Encrypted Calls

Radios need to have encryption keys loaded prior to doing the tests in this section.

ENCRYPTED GROUP CALL TEST

Purpose: Encrypted call test will demonstrate that radios that have the encryption keys will hear encrypted calls and radios that do not have encryption keys will not hear encrypted calls.

Expected Results: Radios 1 and 2 will hear encrypted calls, and Radio E will not hear encrypted calls because it does not have encrypted keys. All the radios will hear unencrypted calls.

Setup: Radios 1 and 2 should have encryption keys and be set to encryption mode. Radio E should not have encryption keys and be set to encryption mode.

DESCRIPTION	TG DESCRIPTION
Radio A	Encrypted TG A
Radio B	Encrypted TG A
Radio C	Encrypted TG A

Execution:

1. PTT Radio A and talk.
   > Audio should be heard on Radio B.
   > No audio should be heard on Radio C.
2. PTT Radio E and talk.
   > Audio should be heard on Radio A and B.
   > Radio C should display that it does not have a key.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

ENCRYPTED INDIVIDUAL (PRIVATE) CALL

Purpose: The individual call test will verify that the site will allow two radios to communicate on a private call.

Expected Results: Test will demonstrate that two radios can communicate on an individual call and other radios will not hear the private conversation.

Setup: Set Radios 1, 2, and 3 to (TG64001) per test group structure. All radios should not be in encrypted mode but have encryption keys.

DESCRIPTION	TG DESCRIPTION	TG ID
Radio A	TG 64001 P25	64001
Radio B	TG 64001 P25	64001
Radio C	TG 64001 P25	64001

Execution:

1. On Radio A, select the Individual Call Function, and select pre-stored Radio B ID, or enter Radio B's ID, and PTT Radio A.
2. Verify that Radio B receives the call and displays the ID of Radio A. Verify that Radio C remains idle.
3. Release the PTT on Radio A and immediately PTT on Radio B.
4. Verify that Radio A receives the call and displays the ID of Radio B. Verify Radio C remains idle.
5. On Radio A, select the Individual Call Function, and select pre-stored Radio C ID, or enter Radio C's ID, and PTT Radio A.
6. Verify that Radio C receives the call and displays the ID of Radio A. Verify that Radio B remains idle.
7. Release the PTT on Radio A but do not immediately PTT Radio C. Verify that Radio C gives a Call Back Alert (WHC- "Who Has Called") indication. Then make the return call from Radio C back to Radio A.
8. Verify that Radio A receives the call and displays the ID of Radio C. Verify Radio B remains idle.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

TDMA DES

Purpose: Confirms the operation of DES encryption for TDMA voice calls.

Expected Results: Encrypted talkgroups can communicate.

Setup: Console 1 programmed with a DES encrypted TDMA trunk group and two radios programmed with the same DES trunk group and key, one radio with the group but no key and one radio with the DES group with a different key.

Execution:

1. Place a call from one of the radios with the correct key on the DES group.
   - > Confirm that the call is heard on the other radio and the console.
   - > Confirm the call is not heard on the two radios that do not have the correct key.
2. Place a call on the DES group from the console.
   - > Confirm that the call is heard on the two radios with the correct key.
   - > Confirm the call is not heard on the two radios that do not have the correct key.

TEST RESULTS		
Tester:		
Date:		
Result:	☐ Pass	☐ Fail

Subscriber Unit Test Notes / Issues

Subscriber Unit Test Acceptance

This Functional Test Acceptance Procedure has been fully and successfully completed with all action items resolved.

City of Aurora, IL Representative	L3Harris Technologies Representative
Signature	Signature
Printed Name and Title	Printed Name and Title
Date	Date

APPENDIX A – ACRONYMS AND DEFINITIONS

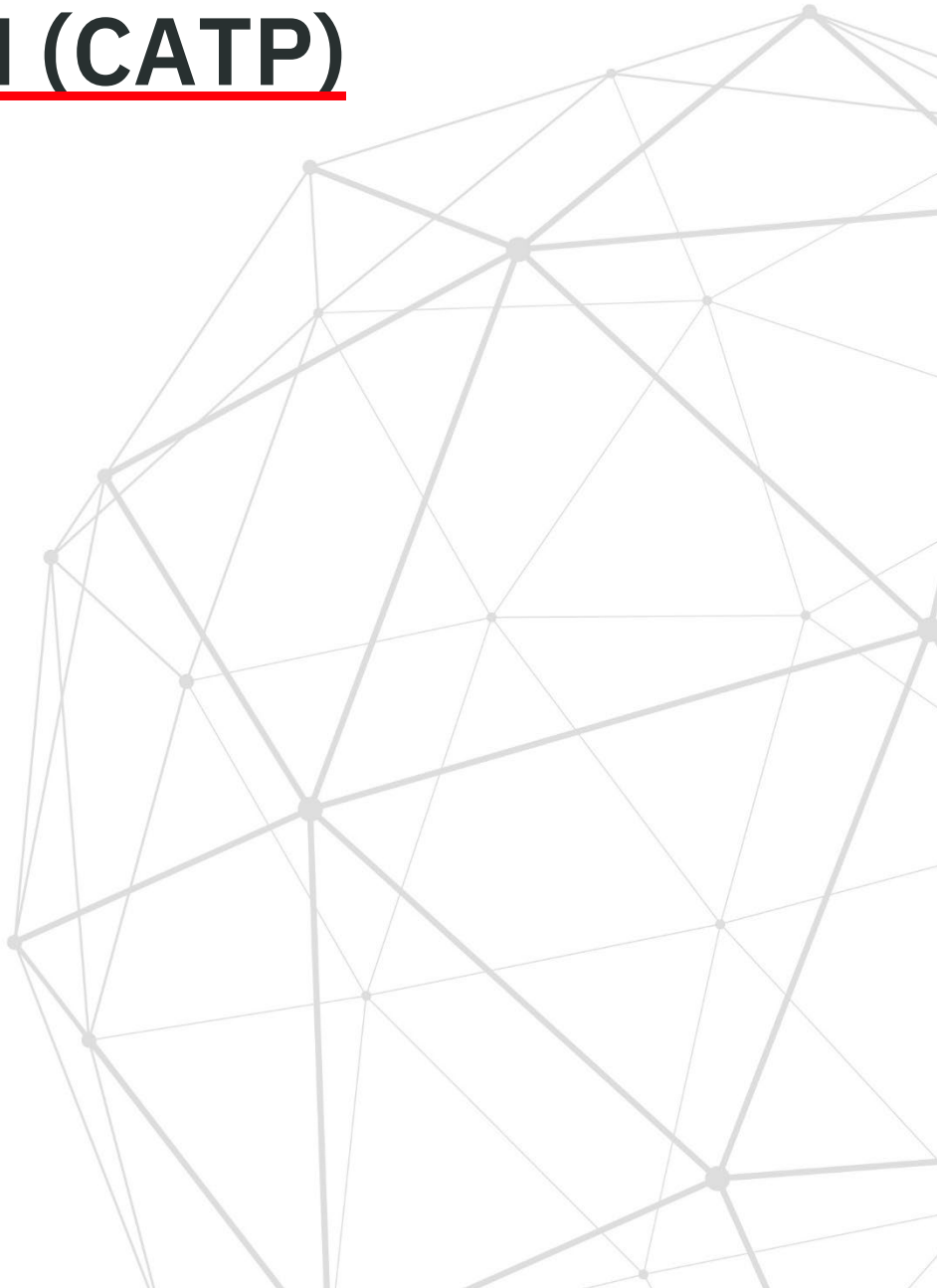
ACRONYM	DEFINITION
AD	Active Directory
AES	Advanced Encryption Standard
ATP	Acceptance Test Procedure
CAI	Common Air Interface (usually in reference to P25)
CME	Cisco Mobility Exchange (Telco Interconnect)
CNM	Central Network Manager, an L3Harris product
Confirmed Call	A confirmed call is a special type of call where the call is queued until all sites have resources available, or until the confirmed call timer expires (configurable, typically one or two seconds)
COTS	Commercial-off-the-Shelf
CPC	Channel Performance Criterion
DAQ	Delivered Audio Quality
DES	Digital Encryption Standard
LMR	Enterprise Land Mobile Radio
ESN	Electronic Serial Number (64 bits)
FDMA	Frequency Division Multiple Access
GID	Group ID (16 bit). This corresponds to a talkgroup. The group ID is unique within a VNIC and can be reused on other VNICs within the same WACN. Some of the older P25 documents refer to the GID as a talkgroup ID (TGID)
HA	High Availability
Individual Call	An individual call is a private call between one user and another. It can be between two radios, or between one radio and a dispatch console
KEK	Key Encryption Key
KID	16-bit encryption key ID
KMF	Key Management Facility
KMM	Key Management Message
LAN	Local Area Network
MASTR V	An L3Harris base station product
MES	Mobile End System, a subscriber radio
MME	Miniature mobility exchange, which consists of L3Harris software running on a SitePro card at the base site. The MME runs the SNDCP layer of the data protocol and is the equivalent of the P25 RFG (RF Gateway)

ACRONYM	DEFINITION
N(S)	A 3-bit sequence number for the packet data unit
NSC	Network Switching Center
NSS	Network Switching Server
NWS	Network Sentry
OTAP	Over-the-air-programming
OTAR	Over-the-air-rekeying
P25	Project 25, a suite of standards for digital radio communications, developed by the Association of Public Safety Communications Officials (APCO) under the TIA TR-8 engineering committee, and published as the TIA-102 set of documents
Priority Talkgroup	The priority talkgroup selected on the subscriber device. Usually this is the talkgroup that the radio will transmit on when the user presses PTT
ProFile	An L3Harris product used for configuring radios over the P25 radio channel
ProScan	An L3Harris software algorithm used for radio roaming
PTT	Push-to-Talk
RAR	Regional Access Router
RF	Radio Frequency
RNM	Regional Network Manager
RSM	Regional Site Manager, a server that runs the RSM, Activity Warehouse and Device Manager applications
RSSI	Received Signal Strength Indicator
RVM	Regional VIDA Manager, a server that runs the UAS and RNM applications
SAN	Storage area network
SMT	System management terminal.
SU	Subscriber unit. In the P25 world, an SU is a mobile or portable radio
SUT	System Under Test
SUMS	Security Update Management Service (an L3Harris product)
SUMSplus	Version of SUMS
TAC	Technical Assistance Center, an L3Harris service
TDMA	Time Division Multiple Access
TEK	Traffic Encryption Key
TGID	Talkgroup ID (16 bit, equivalent to GID). The P25 documents usually use GID but some of the older documents use TGID
Traffic Controller	Software entity that resides in a base station at the site and generates the P25 control channel
Two47	An L3Harris base station product
Tx	Transmit

ACRONYM	DEFINITION
UAS	Unified Administration System
UKEK	User Key Encryption Key
UPS	Uninterrupted Power Supply
VAS	VIDA Application Server
VIDA	Voice, Interoperability, Data, Access (an L3Harris system product)
VLAN	Virtual Local Area Network
VM	Virtual Machine
VNIC	Voice Network Interface Controller, the L3Harris voice switch
VPN	Virtual Private Network
VTI	VIDA Telephone Interconnect
WACN	Wide area communication network (20 bit network ID, part of SUID). This is a customer network that can include many VNICs
WAR	Wide Area Router
Zeroize	A P25 control channel command which causes the mobile radio to erase its encryption keys (but then requires manual loading to restore encryption keys)

L3HARRIS

COVERAGE ACCEPTANCE TEST PLAN (CATP)



Customer:
City of Aurora, Illinois

Prepared by:
M. Bjelovuk

TABLE OF CONTENTS

About This Test

These procedures provide an accurate, statistically valid, repeatable, objective, and cost-effective method to verify all of L3Harris' coverage commitments to City of Aurora's are met.

This Coverage Acceptance Test Plan ("ATP"), where applicable, conforms with the requirements set forth in the latest revision of Telecommunications Industry Association ("TIA") Telecommunications Systems Bulletin TSB-88 titled "Wireless Communications Systems - Performance in Noise and Interference-Limited Situations - Recommended Methods for Technology-Independent Modeling, Simulation, and Verification". TSB-88 defines Channel Performance Criterion ("CPC") as the specified minimum design performance level in a faded channel and provides a set of Delivered Audio Quality (DAQ) CPCs that define subjective voice quality performance applicable to both analog and digital voice systems.

L3Harris designs a balanced system such that uplink performance is comparable to downlink performance. Because of this design approach, the principal of reciprocity (as defined by TSB-88) ties the inbound predictions to the outbound test results in a mathematically predictable manner. In accordance with TSB-88, we will infer talk-in performance from the outbound test data.

SITE PERFORMANCE VALIDATION

As part of our standard installation practices, we measure and record electrical measurements and timing parameters of equipment. L3Harris will provide these measurements to City of Aurora as part of the final documentation package. These parameters may include:

- Base station output and reflected power
- Base station receiver sensitivity
- Receiver subsystem alignment parameters
- Time domain reflectometry of transmission line
- Combiner loss (if applicable)

Prior to conducting the testing procedures detailed in this document, we review each site to verify that the radio system is operating properly. The reviews verify the antenna configuration, the power into the antenna, the antenna installation, and the system channel used for test. We will provide all test equipment necessary to perform the reviews.

Definitions

SUBSCRIBER UNIT USAGE

All tests requiring subscriber (terminal) units in this document will use XL-185 or XL-200 Mobile and Portable radios. L3Harris will bench test and align all subscriber (terminal) radios prior to their use during coverage testing.

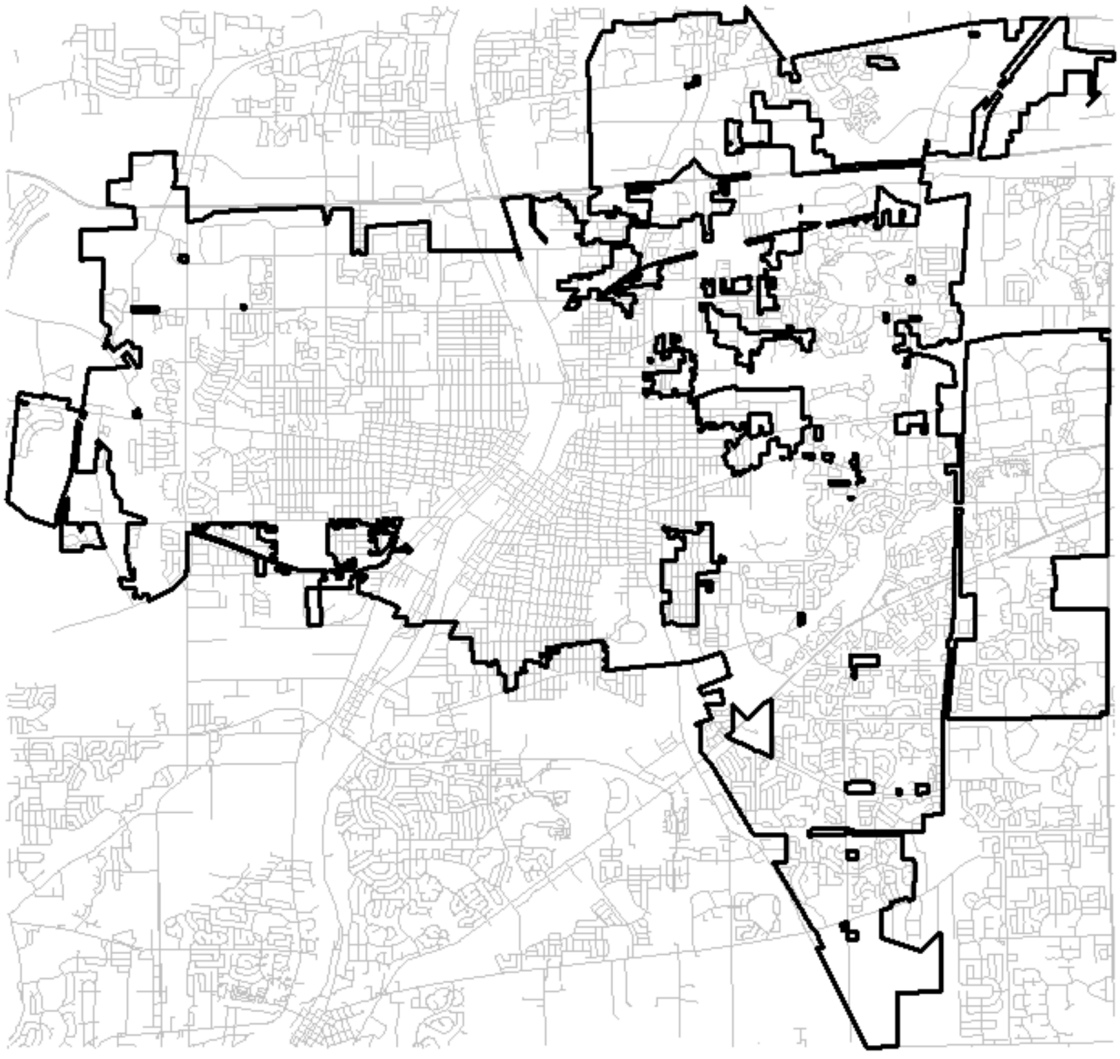
Test Vehicle Configuration

The non-stationary test equipment will mount inside one or more SUVs or vans, with external antennas mounted on the roof. The roof of the test vehicle(s) must not contain any other objects, including lightbars, roof racks, or other obstructions. All non-test radios must be off during testing. We may divide test equipment into multiple test vehicles. L3Harris will determine the number of test vehicles required and which tests, if any, can be run concurrently.

SERVICE AREA

TSB-88 defines a service area as a boundary of the geographic area of concern for a user, and states that Validated CPC Service Area Reliability is the percentage of test locations in the bounded service area that meet or exceed the specified CPC. We are using a Bounded Area design for City of Aurora as defined in TSB-88 wherein coverage predictions are made out to the boundary of the defined service area and coverage verification occurs throughout the service area out to the boundary through the performance of a Validated CPC Service Area Reliability test. The service area is shown in Figure 1.

Figure 1. City of Aurora



SERVICE AREA GRID STRUCTURE

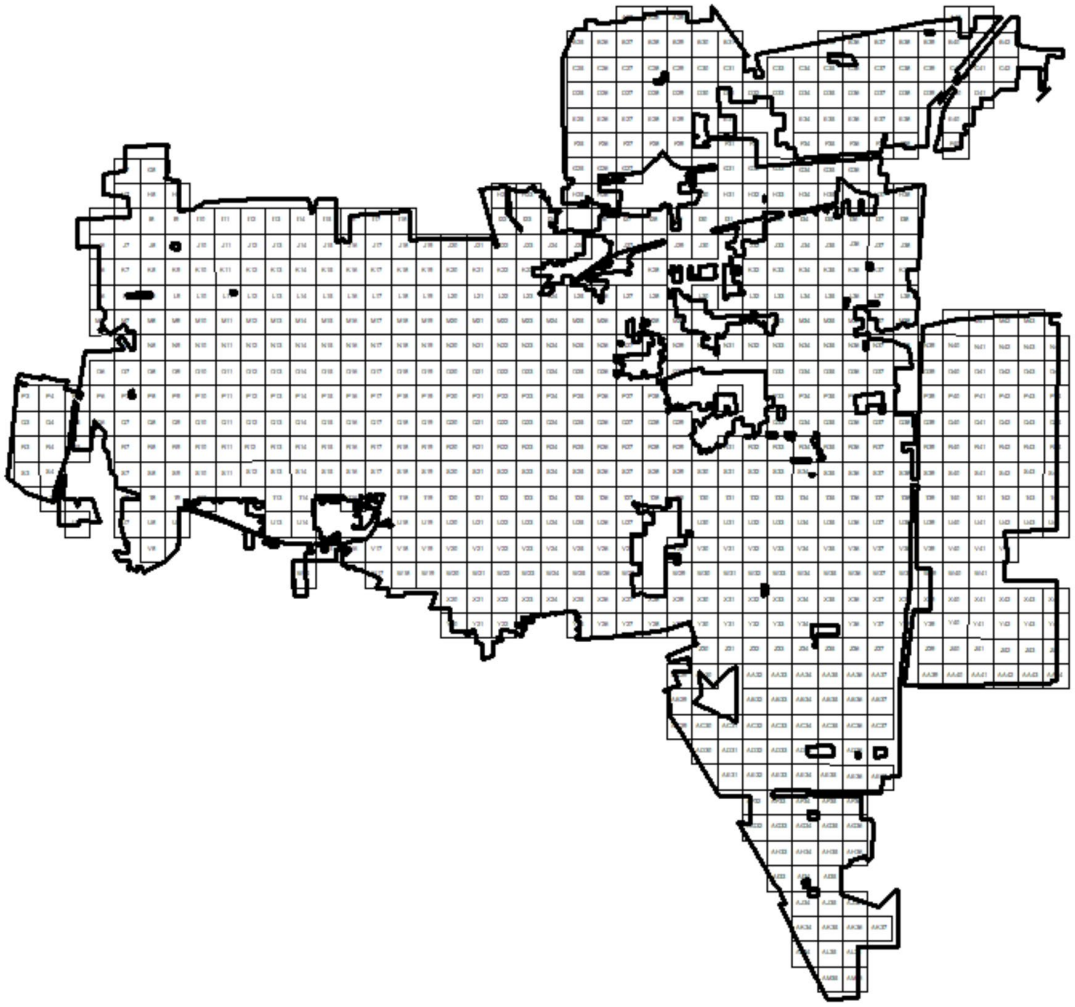
TSB-88 recommends coverage verification measurements at a statistically significant number of random test locations, uniformly distributed throughout the service area. We divide the service area by a test grid pattern using TSB-88 Estimate of Proportions analysis to determine the number and size of the test tiles. This analysis provides both statistically significant measurement results and a high confidence that the results are a true indication of the installed radio system coverage.

Figure 2 provides our recommended tile sizes to obtain a uniform distribution of tiles throughout the service area(s).

Figure 2. Service Area, Tile Size, and Tile Count

SERVICE AREA DEFINITION	TILE SIZE (MILES)	APPROXIMATE TILE COUNT
City of Aurora	0.25 × 0.25	730

Figure 3. Service Area Tile Structure



The grid pattern overlays onto street maps and the drive test team will navigate through all accessible tiles (i.e. those having roads traversable by the test vehicle) within the defined service area boundaries. Based on the US Census Bureau TIGER roads database, we estimate 730 tiles are accessible within the service area. To include as many test tiles as possible, we assume the following roads may be accessible:

- Primary roads
- Secondary roads
- Local roads (streets)
- Ramps
- Service drives

The final determination on accessibility will be made by the drive test team based on the conditions they encounter. The following are examples of tiles that will be deemed inaccessible:

- Tiles that require special permission from property owners to (not counting cases where the Customer has obtained or provided permission)
- Tiles that are hazardous to navigate or may result in the test vehicle becoming stuck or damaged
- Tiles that require clearing of brush, debris, or other obstacles before the vehicle can enter
- Tiles that do not have road access

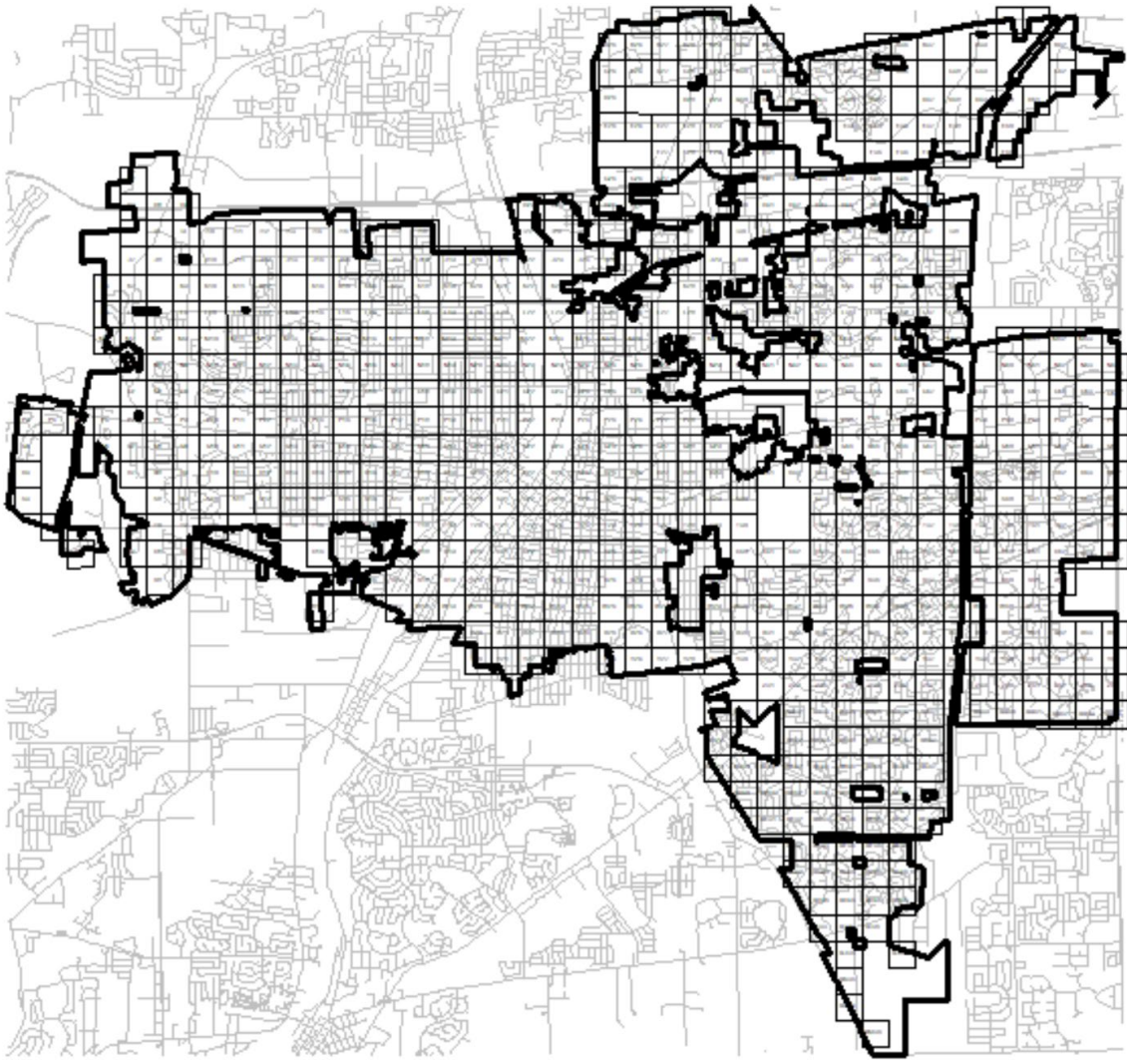
The test team should not pass-through tunnels, underpasses, underground garages, or other man-made obstructive areas where radio coverage is not planned or expected while testing. If they do pass through any of these areas while testing, we disable the TYPHON test unit to prevent collection of data in these areas.

Measurements will be made in all accessible tiles within the defined service area boundaries. We do not use test measurements outside of each service area boundary. Any areas or accessible tiles within the service area boundary that City of Aurora decides not to test will score as a PASS in the reliability calculations.

We will discard inaccessible tiles (i.e. those having no roads) from the reliability calculations with the acceptance criteria adjusted by treating the inaccessible tiles as exclusion zones.

The accessible tile structure is shown in Figure 4.

Figure 4. Service Area Accessible Tile Structure



DELIVERED AUDIO QUALITY

TSB-88 defines Channel Performance Criterion (CPC) as the specified minimum design performance level in a faded channel and provides a set of Delivered Audio Quality (DAQ) CPCs that define subjective voice quality performance applicable to both analog and digital voice systems. The DAQ definitions are in Figure 5.

Figure 5. Delivered Audio Quality Scale Definitions

DELIVERED AUDIO QUALITY	SUBJECTIVE PERFORMANCE DESCRIPTION
DAQ 5.0	Speech easily understood.
DAQ 4.5	Speech easily understood. Infrequent Noise/Distortion.
DAQ 4.0	Speech easily understood. Occasional Noise/Distortion.
DAQ 3.4	Speech understandable with repetition only rarely required. Some Noise/Distortion.
DAQ 3.0	Speech understandable with slight effort. Occasional repetition required due to Noise/Distortion.
DAQ 2.0	Understandable with considerable effort. Frequent repetition due to Noise/Distortion.
DAQ 1.0	Unusable, speech present but unreadable.

STAKEHOLDER RESPONSIBILITIES

City of Aurora to provide:

- Any non-automobile test vehicles required for the testing (e.g. boats for water-based coverage testing)
- A driver / operator for any customer-provided test vehicles
- Customer representative(s) to participate in tests as necessary
- Access to the test areas as may be required in each test procedure

L3Harris to provide:

- SUV/van for roads-based drive testing
- A driver for L3Harris-provided vehicles
- Drive test measurement equipment
- Representatives to operate this equipment and execute the test procedures
- Representative(s) to participate in tests as necessary
- Final test results

Coverage Guarantees

L3Harris offers these guarantees based on the system design. Deviation from the details of the design including, but not limited to, site count, tower location, antenna make and model, antenna location on the tower, changes to the antenna sub-systems, etc. will require a re-analysis of the coverage and may require a change to the coverage guarantee. The details of the design are shown in Figure 11 at the end of this document.

These coverage guarantees only apply once installation and testing of all sites in the system has been completed.

Figure 6. Service Area Coverage Guarantees

SERVICE AREA DEFINITION AS SHOWN IN FIGURE 2	DESCRIPTION	REQUIRED PERFORMANCE CRITERIA	% VALIDATED CPC SERVICE AREA RELIABILITY ACCEPTANCE CRITERIA
City of Aurora	Portable Outdoor	DAQ 3.4	95%
City of Aurora	Portable Indoor 20 dB	DAQ 3.4	95%

Radio system coverage and performance are subject to degradation due to undefined anomalous propagation and interference beyond control of L3Harris. L3Harris cannot be responsible for degradation or disruption of Service caused by operation of other radio systems or by natural phenomena or other interference over which L3Harris has no reasonable control. In the event of a case of degradation due to interference by an outside source, with outside source encompassing everything other than L3Harris supplied equipment, L3Harris will provide engineering support to City of Aurora at City of Aurora's expense to support efforts in resolving the interference issue with the outside party.

The project schedule may have to be adjusted to account for both the time spent reviewing and determining the source of the interference and the time spent working on potential mitigation efforts. Not all interference may be able to be mitigated and coverage guarantees may have to be adjusted based on the presence of external interference that is unable to be mitigated.

If a failure of the tests defined in this document occurs, L3Harris reserves the right to determine if failed test points/test tiles are due to undefined anomalous propagation and interference. If these are external sources of interference and are beyond the control of L3Harris, any such points/tiles will be excluded from subsequent data analysis, and the Percent Validated CPC Service Area Reliability re-calculated.

In locations where multiple coverage guarantees apply, performance need only be demonstrated at the most stringent level. For example, a test point that is demonstrated to have passing portable outdoor coverage is also considered to have passing mobile coverage.

Talk-Out Signal Strength Bounded Area Test

This test verifies RF coverage by measuring talk-out (base to mobile) signal strength throughout City of Aurora's defined bounded service area. We then calculate the percentage of measurements that equal or exceed a -110 dBm signal level at a mobile or portable radio required to support the specified CPC of DAQ 3.4

SETUP

We will use our TYPHON wireless testing system to measure coverage performance. TYPHON uses calibrated measurement receivers to produce repeatable measurement results in conformance with industry standards. We maximize the accuracy of test measurements through periodic calibration of the TYPHON system and its integral automated hardware and software. This minimizes the likelihood of procedural errors. TYPHON can configure with up to four industrial grade measurement receivers to provide received signal strength indicator (RSSI) data for single or multiple sites, a GPS receiver to provide accurate position information for each measured data point, a computer with an internal clock that coordinates and records the test data, and a roof mounted antenna. TYPHON contains multiple receivers to facilitate gathering data simultaneously from several multi-sites or simulcast sites at common measurement locations.

DATA MEASUREMENTS

The TYPHON equipment mounts inside the test vehicle (a large van or SUV is recommended) with an external antenna mounted on the outside, centrally located on the vehicle's roof, without other equipment installed on the roof.

Each radio system base station site transmits either on the control channel or an unmodulated carrier on one selected working channel, and the equipment makes measurements of this signal at equal distance intervals throughout the entire drive route. The TYPHON equipment operates in the "40 λ Wave Distance Average" analysis mode. With the test vehicle in motion[1] along the drive route, a local mean signal measurement is made every 40-wavelengths[2]. By averaging a minimum of 200 data points within each 40-wavelength measurement window, the measured mean value is within ±1 dB of the actual value with 99% confidence.

DATA ANALYSIS AND ACCEPTANCE

As defined by Section 5 of TSB-88.3, latest revision, we post-process all mean measurement data records collected from the drive test within the defined service area boundary, with data records recorded every 0.1-mile (typically) used in the final analysis.

For each service area, we adjust the minimum acceptable signal level at a portable radio to the mobile measurement reference point using the loss factors shown in Figure 7. We compare the mean

[1] Vehicle velocity must not exceed 60 miles per hour to ensure an adequate number of points over the measurement window.
[2] 40 wavelengths for UHF, 800 MHz and 900 MHz. 20 wavelengths for VHF 150 MHz.

measurement points in the service area, and this adjusted minimum level, denoting the adjusted signal threshold.

The installed radio system meets the coverage requirements if, for each bounded service area in Figure 7, the ratio of the number of PASS points to the total number of points in the service area equals or exceeds the minimum percent Validated CPC Service Area Reliability acceptance criteria that is shown.

Figure 7. Coverage Service Area, Adjusted Signal Level

SERVICE AREA DEFINITION AS SHOWN IN FIGURE 2	DESCRIPTION	MINIMUM REQUIRE SIGNAL LEVEL (dBm)	BODY LOSS (dB)	BUILDING LOSS (dB)	ADJUSTED SIGNAL THRESHOLD (dBm) [1]
City of Aurora	Portable Outdoor	-110dBm	7 dB	0 dB	-103 dBm
City of Aurora	Portable Indoor	-110dBm	7 dB	20 dB	-83 dBm

Points that equal or exceed the adjusted signal threshold value record as PASS, and those below record as FAIL.

RESULTS PRESENTATION

We plot the data records on a map showing the test tiles, the areas tested, and the test results. Different colors show ranges of measured mean signal levels. An included test report summarizes the test results.

[1] *Adjusted Signal Threshold accounts for portable body loss and antenna gain and will be finalized prior to acceptance testing based on actual equipment configuration.*

Talk-Out Bit Error Rate (BER) Bounded Area Test

This test verifies RF coverage by measuring talk-out (base to mobile) BER throughout the bounded service areas defined in Figure 5, and by calculating the percentage of measurements that are equal or better than a BER of 2.4% required to support the specified CPC of DAQ 3.4.

SETUP

We use our TYPHON wireless testing system to measure BER. TYPHON consists of L3Harris terminal radios, a GPS receiver to provide accurate position information for each measured data point, a computer with an internal clock that coordinates and records the test data, roof mounted antennas, and variable attenuators for use when testing portable coverage.

The TYPHON equipment mounts inside the test vehicle (SUV/van) and has an external antenna(s) mounted on the outside, centrally located on the vehicle's roof, without other equipment installed on the roof.

When testing portable coverage, a variable attenuator installs in the test vehicle between the radio and the external antenna to simulate portable operations on the hip for both outdoor and indoor operation. For portable outdoor coverage verification, the variable attenuator is set to the appropriate level to account for portable body losses. For portable indoor coverage verification, the variable attenuator is set to account for the portable body losses plus the loss of the building category under evaluation. Variable attenuator values, where applicable, are shown in Figure 8.

Figure 8. Coverage Service Area, Body/Building Loss, and Attenuator Values

SERVICE AREA DEFINITION AS SHOWN IN FIGURE 2	DESCRIPTION	BODY LOSS (dB)	BUILDING LOSS (dB)	ATTENUATOR VALUE (dB) [1]
City of Aurora	Portable Outdoor	7 dB	0 dB	7 dB
City of Aurora	Portable Indoor	7 dB	20 dB	27 dB

DATA MEASUREMENTS

Each radio system base station site continuously transmits a P25 test pattern data sequence on a working channel (in a simulcast system, the same working channel is used for each simulcast site). The TYPHON equipment inside the test vehicle collects measurements of this signal every 3 seconds as it is driven along the defined test drive route. The software in the TYPHON laptop computer automatically records the BER as reported by the terminal radio for each 3-second measurement data record along the test drive route.

[1] *Attenuator value accounts for portable body loss and antenna gain and will be finalized prior to acceptance testing based on actual equipment configuration.*

DATA ANALYSIS AND ACCEPTANCE

As defined by Section 5 of TSB-88.3, latest revision, we post-process all mean measurement data records collected from the drive test within the defined service area boundary, with data records recorded every 0.1-mile (typically) used in the final analysis. Measurements that have a BER equal to or less than 2.4 % record as PASS; the remainder record as FAIL.

The installed radio system meets the coverage requirements if, for each bounded service area in Figure 6, the ratio of the number of PASS points to the total number of points in the service area equals or exceeds the minimum validated CPC service area reliability acceptance criteria.

RESULTS PRESENTATION

We plot the data records on a map showing the test tiles, the areas tested, and the test results. Different colors show ranges of measured BER. An included test report summarizes the test results.

Voice Quality Characterization Test

This test characterizes coverage by evaluating the voice quality of digital voice test calls to/from a radio at test locations throughout City of Aurora's defined bounded service area. At each test location, the radio user places a test call to the dispatcher (an inbound call), and the dispatcher places a test call to the radio user (an outbound call). Evaluators grade the inbound and outbound test call at each location using the DAQ definitions in Figure 5. Scores that equal or exceed the specified CPC of DAQ 3.4 are acceptable, and those lower than DAQ 3.4 are not acceptable.

TEST EQUIPMENT AND PREPARATION

The terminal radio mounts inside the test vehicle (standard passenger vehicle) with an external antenna mounted on the outside and centrally located on the vehicle's roof, with no other equipment installed on the roof.

When testing portable coverage, a variable attenuator installs in the test vehicle between the radio and the external antenna to simulate portable operations on the hip for both outdoor and indoor operation. For portable outdoor testing, the value of the attenuator is set equal to a 7 dB loss representative of the portable radio at the hip level and equipped with a shoulder mounted speaker/microphone. For portable indoor testing, the value of the attenuator is set equal to 7 dB body loss plus City of Aurora's defined building loss level(s).

TEST PLANNING

Testing will occur in all accessible tiles. We will conduct the voice quality test at a randomly selected location within each tile, typically as close to the center of the tile as possible. To the extent possible, test locations in adjacent tiles should not cluster closer to one another than 100λ[1]. All test calls will be made with the vehicle at street level outside any enclosure such as buildings, tunnels, underpasses, underground garages, or other man-made obstructive areas where radio coverage is not planned or expected.

GRADING OF TEST LOCATIONS

The voice quality test requires two representatives from each entity (L3Harris and City of Aurora). One representative from L3Harris and one from City of Aurora will be the field team, which travels the drive route, performs the inbound calls, and grades the outbound calls. The second representatives from L3Harris and City of Aurora are the base team, which remains at the dispatch location, grades the inbound calls, and performs the outbound calls.

To reduce the time necessary for this coverage test, a single base team can support multiple field teams, and we can use multiple field and Base teams.

Some test tiles have more than one applicable level of attenuation (e.g., portable in 20 dB and portable outdoor). To reduce the time necessary for this coverage test, testing in a tile will start at the most attenuated level applicable to that tile and proceed through the different applicable levels of attenuation, from highest attenuation to least attenuation, until a passing result is obtained. The tile will

[1] *Approximately 125-ft at 800 MHz, 245-ft at UHF and 650-ft at VHF.*

be marked as a pass for the level at which it passes, and as a pass for any lower-attenuated levels (e.g., if the tile passes at portable in 20 dB, it is also marked as a pass for portable outdoor).

The voice test calls within each tile consist of a short message representative of typical public safety call duration and include the identification of the location under test. The suggested inbound test message is "TESTING TILE NUMBER XXX", followed by a short sentence or two from a newspaper or periodical such as "USA Today". To ensure the message is understood, the dispatcher repeats the inbound test message. The dispatcher makes a similar outbound test call. The suggested outbound test message is "CONFIRMING TILE XXX", followed by a different short sentence or two from a newspaper or periodical such as "USA Today". The field team repeats the dispatcher's test message. Within each tile, if the message is not understood on the first attempt, the user can repeat the test one time. Dependent on the size of the test tile and the vehicle speed, the test vehicle can be driven through the test tile a second time and the voice quality test call repeated.

Each of the four representatives grades the test call using the DAQ definitions in Figure 5 and records the test score for each test location using the template in Figure 10. Call quality is determined separately for the inbound and outbound calls at each location. For each call direction, a test location is deemed acceptable if it meets or exceeds City of Aurora's requirement for DAQ 3.4 voice quality from both graders. If both graders agree that the voice quality does not meet the defined DAQ 3.4 criteria, then that test location is deemed unacceptable for the direction under evaluation. If a score differs between testers at a location that results in an unacceptable score from only one tester, that location will need to be tested again to determine the cause of the discrepancy. If the discrepancy cannot be rectified, then that tile will be set aside for discussion and evaluation.

TEST ANALYSIS

We analyze the data logged by the four representatives on the grading template to determine whether each individual test tile meets the DAQ 3.4 definition.

Figure 9. Coverage Service Area, Body/Building Loss, and Attenuator Values

SERVICE AREA DEFINITION AS SHOWN IN FIGURE 2	DESCRIPTION	BODY LOSS (dB) [1]	BUILDING LOSS (dB)	ATTENUATOR VALUE (dB)
City of Aurora	Portable Outdoor	7 dB	0 dB	7 dB
City of Aurora	Portable Indoor	7 dB	20 dB	27 dB

RESULTS PRESENTATION

A test report is provided that includes:

- The number of test tiles
- The location tested within each tile
- A copy of the Figure 10 inbound or outbound grading template used by each grader

[1] *Attenuator portable loss accounts for portable body loss and antenna gain and will be finalized prior to acceptance testing based on actual equipment configuration.*

Figure 10. Test Grading Template

Voice Quality Testing

Customer:	Date:
Service Area:	Time sheet started:
Direction:	Correlation Reference:
Evaluators:	
Test type/attenuation:	

TEST TILE	L3HARRIS SCORE	CUSTOMER SCORE	DAQ SCORE (P/F)	REMARKS

System Parameters

Figure 11. System Design Parameters

	Site Name	2680 Church Road	Aurora Fire Station 8 - Tower	Aurora PD HQ - Tower
	Site ID	08-CR	06-STA8	01-APD
	Latitude	41° 48' 29.441" N	41° 45' 18.000" N	41° 46' 59.999" N
	Longitude	88° 17' 16.339" W	88° 13' 27.998" W	88° 17' 13.999" W
	Datum	NAD27	NAD27	NAD27
	Site Elevation	768 ft	692 ft	725 ft
	Base Station	MASTR V	MASTR V	MASTR V
	Frequency Range	764 - 806 MHz	764 - 806 MHz	764 - 806 MHz
Site Transmit	Station Output Power	52.5 W	57.5 W	56.2 W
	Combiner Model	CP01261 (6 ch.)	CP01261 (6 ch.)	CP01261 (6 ch.)
	Tx to Tx Spacing	250	250	250
	Combiner Loss	3.0 dB	3.0 dB	3.0 dB
	Filter/Duplexer Model			
	Filter/Duplexer Loss	0.0 dB	0.0 dB	0.0 dB
	Coax Type	1-5/8" Foam	1-5/8" Foam	1-5/8" Foam
	Coax Length	180 ft	229 ft	218 ft
	Coax Loss	1.3 dB	1.6 dB	1.5 dB
	Antenna Model	SR4CG-SF4P6LDF(D00-PIP)	SR4A9-HF4P2LNF(D00)	SC46A-HF1LDF(D00-PIP)
	Antenna Height (C.L)	130 ft	179 ft	168 ft
	Antenna Azimuth	95°	358°	0°
	Antenna Mechanical Tilt	0°	0°	0°
	Antenna Gain (Hzn)	15.9 dBd	9.4 dBd	10.0 dBd
	Maximum ERP (Hzn)	759.1 W	173.8 W	199.5 W
	HAAT	177.0 ft	173.0 ft	186.0 ft
Site Receive	Total System Gain	7.2 dB	7.3 dB	7.3 dB
	Multicoupler Model	CP00918 (8 ch.)	CP00918 (8 ch.)	CP00918 (8 ch.)
	Coax Type	1-5/8" Foam	1-5/8" Foam	1-5/8" Foam
	Coax Length	180 ft	229 ft	218 ft
	Tower Top Amp Model	CP00732	CP00732	CP00732
	TTA Pad	4.6 dB	0.0 dB	0.0 dB
	Distribution Pad	2.9 dB	7.1 dB	7.2 dB
	Duplexer Loss	0.0 dB	0.0 dB	0.0 dB
	Antenna Model	SR4CG-SF4P6LDF(D00-PIP)	SR4A9-HF4P2LNF(D00)	SC46A-HF1LDF(D00-PIP)
	Antenna Height (C.L)	130 ft	179 ft	168 ft
	Antenna Azimuth	95°	358°	0°
	Antenna Mechanical Tilt	0°	0°	0°
	Antenna Gain (Hzn)	15.9 dBd	9.4 dBd	10.0 dBd
	HAAT	177.0 ft	173.0 ft	186.0 ft

Figure 11 System Parameters (Continued)

	Site Name	City Water Tower	City Water Tower Phillips Park	Water Sewer Maintenance
	Site ID	05-AMAL	03-PHLP	07-WSM
	Latitude	41° 48' 06.998" N	41° 44' 16.001" N	41° 44' 49.049" N
	Longitude	88° 22' 09.998" W	88° 17' 10.000" W	88° 19' 49.969" W
	Datum	NAD27	NAD27	NAD27
	Site Elevation	686 ft	719 ft	633 ft
	Base Station	MASTR V	MASTR V	MASTR V
	Frequency Range	764 - 806 MHz	764 - 806 MHz	764 - 806 MHz
Site Transmit	Station Output Power	58.9 W	67.6 W	63.1 W
	Combiner Model	CP01261 (6 ch.)	CP01261 (6 ch.)	CP01261 (6 ch.)
	Tx to Tx Spacing	250	250	250
	Combiner Loss	3.0 dB	3.0 dB	3.0 dB
	Filter/Duplexer Model			
	Filter/Duplexer Loss	0.0 dB	0.0 dB	0.0 dB
	Coax Type	1-5/8" Foam	1-5/8" Foam	1-5/8" Foam
	Coax Length	235 ft	185 ft	150 ft
	Coax Loss	1.7 dB	1.3 dB	1.1 dB
	Antenna Model	SR4CG-SF4P6LDF(D00-PIP)	SR4BE-HF4P3LDF(D00-PIP)	SR4CG-SF4P6LDF(D00-PIP)
	Antenna Height (C.L)	185 ft	135 ft	100 ft
	Antenna Azimuth	132°	133°	307°
	Antenna Mechanical Tilt	0°	0°	0°
	Antenna Gain (Hzn)	15.9 dBd	14.2 dBd	15.9 dBd
	Maximum ERP (Hzn)	776.7 W	525.3 W	759.1 W
	HAAT	154.0 ft	168.0 ft	41.0 ft
Site Receive	Total System Gain	7.3 dB	7.3 dB	7.2 dB
	Multicoupler Model	CP00918 (8 ch.)	CP00918 (8 ch.)	CP00918 (8 ch.)
	Coax Type	1-5/8" Foam	1-5/8" Foam	1-5/8" Foam
	Coax Length	235 ft	185 ft	150 ft
	Tower Top Amp Model	CP00732	CP00732	CP00732
	TTA Pad	0.0 dB	0.0 dB	5.0 dB
	Distribution Pad	7.1 dB	7.5 dB	2.7 dB
	Duplexer Loss	0.0 dB	0.0 dB	0.0 dB
	Antenna Model	SR4CG-SF4P6LDF(D00-PIP)	SR4BE-HF4P3LDF(D00-PIP)	SR4CG-SF4P6LDF(D00-PIP)
	Antenna Height (C.L)	185 ft	135 ft	100 ft
	Antenna Azimuth	132°	133°	307°
	Antenna Mechanical Tilt	0°	0°	0°
	Antenna Gain (Hzn)	15.9 dBd	14.2 dBd	15.9 dBd
	HAAT	154.0 ft	168.0 ft	41.0 ft

TRAINING

Overview

The comprehensive training program developed by L3Harris provides City personnel with the knowledge and skills needed to operate, manage and potentially self-maintain the new P25 radio system.

Developing the knowledge and skills of the City of Aurora's personnel who will operate and manage the new radio system are critical elements to successfully migrate to a P25 radio system. To perform these tasks, high-quality, performance-based training is necessary to build and enhance personnel competence. In addition, training enables the City to optimally use the features and capabilities of P25 to meet and exceed its communication requirements.

To provide high-quality, performance-based training, L3Harris develops and maintains our training courses using a systematic approach. This methodology identifies the training necessary for each job position and focuses on the performance of tasks. Courses are designed and developed with explicit learning objectives and appropriate content. We evaluate the training effectiveness and use the results to maintain and improve the training programs.

The systematic approach to training methodology also ensures that we deliver training in the most effective learning environment, such as a classroom or laboratory, and use a proper mixture of discussion, lecture, and hands-on training to provide for optimal learning. In addition, we create easy to follow student materials that support the training and provide appropriate supplemental technical documentation.

After every training event, detailed evaluations will be distributed to the attendees, and the results will be recorded and shared, upon request, with City radio system project administrators.

Our technical training staff, comprised of training professionals with extensive experience in both telecommunications and adult learning, deliver the training. Instructor certification ensures that each trainer possesses the instructional skills and technical competencies to deliver high-quality training to our customers. We regularly evaluate our instructors and they participate in a continuing instructor development program to maintain and improve their technical and instructional knowledge and skills. Further, we assign our instructors to conduct customer training based on their areas of expertise. The Training Plan for the encompasses the following categories:

- Radio User Training and Radio User Train-the-Trainer
- Dispatcher Training
- System Administration and Management Training

These categories define the training program for City personnel in distinct job classifications. Each category includes a description of the training, the course length, and timing of course delivery in relation to project implementation. L3Harris understands that the City must review and approve all training curriculum prior to delivery of any training.

Radio User Training

The importance of radio users understanding basic system operation and the operation of their portable and/or mobile radios cannot be overstated. L3Harris will provide Radio User Training directly to the end users and also deliver individual Radio User Train-the-Trainer sessions for both first responders and non-first responder groups. The end-user training sessions will be approximately 30 mins in duration and include hands-on practice with the user's radios. As part of the Train-the-Trainer sessions, we provide model training and support materials for designated City trainers to use during the implementation phase. Support documentation will include a customized, laminated user guide for all radio users. One Train-the-Trainer session will be conducted for all potential trainers and will include:

- An overview of the City P25 radio system including the talkgroup structure
- A description of system operation including failure modes
- A discussion of radio/system coverage expectations
- A discussion and demonstration of the differences between analog and digital voice
- A demonstration of basic radio operations including proper radio use
- Hands-on practice with the radios
- A discussion of basic radio care including battery maintenance

L3Harris will provide customized presentation materials for the instructors as well as electronic copies of the training materials to allow for additional customization, if desired, City trainers will also be provided with a flash drive that contains three short training videos on conventional versus trunked operation, analog versus digital voice, and the radio noise cancellation feature.

Our proposal includes the price to conduct on site train-the-trainer and radio user sessions over one-day. Day and/or evening sessions are permissible in order to reach the largest number of users. Each radio user training session may include up to twenty (20) participants per session. This training will be conducted approximately two-to-four weeks prior to cutover to allow time for the trainers to practice using the equipment as well as to hold training sessions for their trainees. These training sessions will occur at a facility provided by the City and use L3Harris radios purchased as part of the system.

ONLINE REFRESHER TRAINING

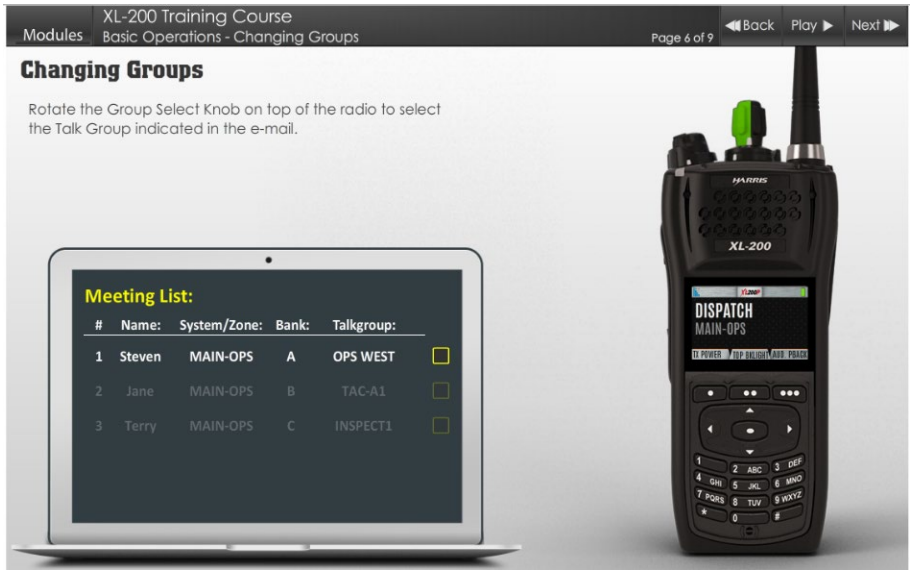
The importance of refresher training for radio users is paramount to smooth and effective operations. L3Harris Technical University consists of web-based training courses that effectively deliver ongoing training and reinforce knowledge transfer that took place during instructor-led training. Performance will improve, and the number of trouble reports reduced by enhancing the knowledge and skills of City personnel on radio operation. Additionally, it can be used to train new personnel due to turnover. A web-based training solution has numerous benefits that include the following:

- Training is accessible whenever needed (24 hours a day, seven days a week) from any location that has access to the Internet.
- Courses are self-paced, highly interactive, and developed utilizing animation and other multimedia tools to help keep students engaged, which increases retention.

- It is cost-effective, especially when considering student or instructor travel and living expenses associated with attending traditional classroom instruction.
- Training delivery is consistent and structured to ensure learning objectives are met.

L3Harris Technical University will host and provide one year of unlimited access to standard radio operational courses for all City radio users. Each student will require a unique e-mail address, self-register, and create a unique username and password. Students will be able to access transcript information showing course progress and completion status, and print a completion certificate once all course activities are completed.

Figure 1. The XL Series is L3Harris' Latest Family of Full-Featured Radios



Dispatcher Training

Dispatch personnel are at the core of effective and efficient implementation of a radio system. While the time required for training is minimal, the payback is immense. Dispatcher training consists of Console Configuration training which will be combined with a Console Operator Train-the-Trainer session. This course will be 2-days in duration and will be followed by console operational training for dispatchers. The console operator training will be two to four hours in duration. Additionally, City dispatchers will have unlimited access to web-based refresher training for a period of one year.

CONSOLE CONFIGURATION AND OPERATOR TRAIN-THE-TRAINER

This two-day course provides City dispatch supervisor(s) with the knowledge and skills to configure the Symphony Dispatch Console to meet operational needs. The training includes a detailed operational Train-the-Trainer session that introduces the various features and capabilities of the console. The dispatch supervisor(s) will work within the configuration utility to explore the various settings including how these settings impact the operation of the console. With an understanding of the configuration utility settings, the supervisors will have the requisite knowledge to define the parameters that best

satisfy operational needs. These settings will be saved and used as a template to set up additional consoles. Additionally, we will define the operating characteristics of the console, and will use the configuration editor to create setups to address the various functions required. This includes performing the following tasks:

- Adding, renaming, and deleting workspace tabs
- Designing communications modules (i.e., entities, colors, sizes, etc.)
- Adding, deleting, and moving communication modules
- Changing the sidebar panel layout
- Creating, switching, deleting, and password protecting console setups
- Setting encryption indicators and controls (if applicable)

This training will be conducted after the Symphony Dispatch Consoles are installed and made operational but prior to console operational training and cutover. Each dispatch supervisor will receive a copy of the training presentation and any applicable technical documentation. L3Harris will conduct this course one time for up to eight participants at a designated City dispatch facility.

CONSOLE OPERATIONAL TRAINING

Instructor-led, hands-on training sessions on the operation of the Symphony Dispatch Console are two-to-four hours in length, depending upon the complexity of the setup. This training will be conducted using operational consoles in conjunction with the previously described Console Configuration Training. L3Harris recommends limiting each training session to no more than two dispatchers per console to maximize the hands-on training. The training includes an overview of the new P25 radio system, operation of the backup radio, and the following tasks performed using the Symphony Dispatch Console, as applicable:

- Select communication modules
- Transmit and receive group and individual calls
- Transmit, receive, and clear emergency calls
- Review call history and play back audio
- Modify communication modules
- Create, modify, and transmit on patches and simulselects
- Control conventional channels
- Use the paging function
- Change console setups
- Use special and enhanced console features

L3Harris will conduct a total of two console operator training sessions on one day. The training sessions will be conducted just prior to cutover to allow participants to promptly begin using the skills learned. Each participant will receive a hardcopy of the Symphony Dispatch Console Operation Quick Reference Guide.

OPTIONAL: ONLINE REFRESHER TRAINING

The importance of refresher training is just as important for dispatchers as it is for radio users. All City dispatchers will receive one year of unlimited access to the web-based Symphony Dispatch Console Operation course. The training would be delivered through L3Harris Technical University, our online training program that was previously described in the User Equipment Training section of our proposal. L3Harris recommends dispatchers complete the online training prior to the instructor-led training to optimize learning console operation. Unit pricing for this optional training is provided.

Figure 2. The Symphony Dispatch Console

Designed with input from dispatchers to reduce work flow.

System Manager Training

System managers have the overall responsibility for defining and maintaining the system's configurable parameters. The importance of this role has increased significantly as communication systems have become larger and more complex. Their responsibilities include the following:

- Defining the fleet map and associated properties
- Planning radio feature usage and personalities
- Developing operating procedures
- Maintaining unit and group databases
- Generating reports
- Controlling radios (e.g., enabling and disabling units)
- Monitoring system performance

The recommended training program for P25 system managers uses a blended learning approach comprised of virtual and traditional classroom training and web-based training.

Virtual classroom training is live, instructor-led training over the Internet. It is ideal for transferring knowledge and provides a cost savings by eliminating travel and living expenses for the instructor or students. Additionally, we limit each virtual classroom session to only four hours per day allowing participants to perform their normal job duties during the remainder of the day.

Traditional classroom training is used to conduct system planning workshops, train on special system features, and perform hands-on instruction. This training is conducted on-site and at the L3Harris Technical Training Center in Lynchburg, Virginia.

Web-based training is self-paced training hosted by L3Harris Technical University. It provides prerequisite training for both the virtual and traditional classroom training and refresher training on assorted subjects to assist system managers in performing their day-to-day duties.

Figure 3 lists the training courses that comprise the System Manager Training Program and indicates the length of training and the delivery method (i.e., virtual or traditional classroom).

Figure 3. The System Manager Training Program

Provides participants with the knowledge and skills needed to meet their responsibilities.

COURSE/WORKSHOP NAME	VIRTUAL CLASSROOM TRAINING	ON-SITE TRAINING	LYNCHBURG TRAINING
P25 Fleet Mapping Workshop	–	3 days	–
P25 System Overview Course	Five (5) four-hour sessions	–	–
Unified Administration System Course	Three (3) four-hour sessions	–	–
Regional Network Manager Course	Two (2) four-hour sessions	–	–
P25 System Implementation Workshop	–	–	4½ days

The P25 Fleet Mapping Workshop will be conducted at a facility provided by the City and should be attended by system manager, technician, and key representatives from the user community. Each student will receive a hardcopy of the training presentations, associated hands-on exercises, and applicable technical documentation for each course.

Our proposal includes tuition for one person to participate in the open-enrollment virtual classroom training and the P25 System Implementation Workshop that is hosted at the L3Harris Technical Training Center. The training schedule is published annually in the Technical Training Catalog. The City is responsible for student travel and living expenses.

In addition to the above virtual and traditional classroom training, the radio system manager will receive unlimited access to the following web-based training courses for one year beginning the week the system manager attends the P25 System Overview virtual classroom course. Activation of this training license can be delayed at the customer's request.

- P25 Fleet Mapping Overview
- XL-200P Radio Operation
- Symphony Console Operation
- Radio Programming Overview
- Advanced Access Control (AAC)
- Unified Administration System (UAS) Overview
- UAS "How to..." Training Modules
- Regional Network Manager (RNM) Overview
- Enterprise Network Manager (ENM)
- Over-The-Air Programming (OTAP)

- Radio Personality Manager 2 (RPM 2)
- Active Directory
- Activity Warehouse
- Over-The-Air Rekeying (OTAR) Fundamentals
- OTAR “How to…” Training Modules
- Inter-RF Subsystem Interface (ISSI) Fundamentals

Additional self-paced courses will be added to the web-based training program, as developed, at no additional cost to the City. Access can be renewed annually.

The following is a description of each virtual and traditional classroom training course.

P25 FLEET MAPPING WORKSHOP

This workshop will assist the City in defining the system fleet map and planning radio personalities. The workshop begins with an abbreviated overview of the P25 system that focuses on system design and operation so that participants can make informed decisions about the fleet map. The workshop explores advantages of different talk group structures and configuration parameters (e.g., property classes, priority levels, etc.) associated with talk groups and radio users. We will include discussion of other configuration options such as announcement groups and the workshop will also ensure sufficient definition of interoperability talk groups. The workshops should be conducted as early as possible during system installation.

P25 SYSTEM OVERVIEW COURSE

This virtual classroom course provides system managers with an understanding of terminology, equipment, components, and operational processes associated with the P25 system. Topics include RF communication basics, VIDA network and site equipment, call processing, wide-area coverage solutions, interoperability, and much more. This course provides the system manager with prerequisite knowledge for system management application training on the Unified Administration System and Regional Network Manager. This course will be made available as soon as the contract is awarded.

UNIFIED ADMINISTRATION SYSTEM COURSE

This virtual classroom course provides system managers with the knowledge to create and maintain system databases using the Unified Administration System (UAS). Course topics include logging into the UAS, establishing user accounts, navigating through the user interface, creating, and changing parameter values, and adding/deleting radio users and talk groups. The system manager should complete this course as.

The P25 System Overview virtual classroom course is a required prerequisite. Completion of the following web-based training courses is highly recommended prior to participating in this course: P25 Fleet Mapping Overview, Unified Administration System (UAS) Overview, and Active Directory.

REGIONAL NETWORK MANAGER COURSE

This virtual course provides system managers with the knowledge to monitor and manage the P25 system using the Regional Network Manager (RNM). Course topics include system access, monitoring the status of system equipment, identification and acknowledgement of system faults, historical views

of system performance, and exploring real-time viewers. System managers should complete this course shortly before cutover.

The P25 System Overview virtual classroom course is a required prerequisite. Completion of the following web-based training courses is highly recommended prior to participating in this course: Regional Network Manager (RNM) Overview and Active Directory.

P25 SYSTEM IMPLEMENTATION WORKSHOP

This hands-on workshop conducted at our Lynchburg, VA Technical Training Center allows the system manager to implement the knowledge acquired during prerequisite virtual classroom and web-based training. The workshop includes students completing structured hands-on exercises on the Unified Administration System (UAS), Regional Network Manager (RNM), and radio programming.

Participants then divide into teams to plan, implement, and operate the Training Center's P25 radio system based on communication requirements provided by the instructor. Activities include defining a fleet map, planning radio personalities, establishing UAS databases, configuring dispatch consoles, programming radios, and operating the system.

Since this workshop is primarily hands-on and builds upon previously acquired knowledge, it is important for students to meet the prerequisites for optimal learning and to gain the most benefit from this course. The P25 System Overview, Unified Administration System and Regional Network Manager virtual classroom courses are required prerequisites. Additionally, completion of the following web-based training courses is highly recommended prior to participating in this course:

- Radio Programming Overview
- Radio Personality Manager 2 (RPM2)
- Advanced Access Control (AAC)
- Symphony Dispatch Console Operation

Zetron Pathway+ Interop Gateway Training

TRAIN-THE-TRAINER

Zetron will conduct one-day of technical training at the customer site on the operation and configuration of the Zetron Pathway+ interop gateway. Zetron provides Pathway+ interop gateway training based on a train-the-trainer approach. In this approach, we provide model training and support materials for designated City trainers to use during the implementation phase. This class will support up to 10 designated trainers.

Summary

The comprehensive training program developed for the City of Aurora involves personnel from various departments and at many levels. We envision a program that facilitates the smooth transition to a P25 radio system and builds the foundation for long-term excellence. Wide participation and in-depth instruction reflect our commitment to delivering an outstanding training program.

Should the City desire additional training in the future due to turnover in personnel, upgrades to the system, or other factors, information on additional training can be found on our website at https://www.l3harris.com/resources/pspc-technical-training-catalog. The catalog includes the annual training schedule, student tuition, and on-site training prices.

EXHIBIT B

SOFTWARE LICENSE AGREEMENT

This License Agreement ("License Agreement") is made upon the Effective Date of the Primary Agreement (the "Effective Date") between L3Harris Technologies, Inc., a Delaware Corporation, acting through its Communication Systems Segment, ("LICENSOR" or "L3Harris") with offices at 221 Jefferson Ridge Parkway, Lynchburg, VA 24501 and City of Aurora, an Illinois home rule municipal corporation, having a place of business at City of Aurora, 44 East Downer Place, Aurora, Illinois 60505 ("LICENSEE"). LICENSOR is the owner of certain wireless communications software programs and LICENSEE desires to obtain a license from LICENSOR to use such wireless communications programs.

1.0 Definitions.

1.1 "Designated Systems": Means the L3Harris System(s), products, and Designated Terminals purchased by Buyer and identified in the Primary Agreement for which the Licensed Programs and documentation are intended to be used.

1.2 "Designated Terminals": Means the LICENSOR's Terminals purchased by LICENSEE.

1.3 "Licensed Programs": The term Licensed Programs shall mean the wireless communications computer programs in software or firmware supplied under this License Agreement by LICENSOR in binary object code format to the LICENSEE (stand alone or in conjunction with the purchase of a LICENSOR wireless communications System.) Licensed Programs shall also include all other material related to the Licensed Programs supplied by LICENSOR to LICENSEE hereunder, and which may be in machine readable or printed form, including but not limited to user documentation and/or manuals.

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14.0 Notices.

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15.0 Survival.

Sections 2, 3, 5, 6, 8, 9, 11, and 13 of this License Agreement shall survive termination of this agreement.

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