



METROPOLITAN EMERGENCY SERVICES BOARD RADIO TECHNICAL OPERATIONS COMMITTEE AGENDA

May 22, 2019, 1:00 p.m.

1. **Call to Order** – Committee Chair, Captain Scott Haas
2. **Approval of Agenda** – Haas
3. **Approval of Minutes of April 24, 2019 Meeting** – Haas
4. **Action Items**
 - A. Edina Police Department ME TAC Waiver Request – Tony Martin
 - B. Metro Standard Updates – Tracey Fredrick
 - i. 1.8.0 Moves, Additions, Changes
 - ii. 1.8.1 Bi-Directional Amplifiers
 - iii. 3.28.1 METEM
 - iv. 3.30.0 METCOM
 - v. 3.33.2 STR Portable Tower
 - vi. 3.42.0 RVRHAIL OPS
 - vii. 6.2.0 User Fees
 - viii. 7.2.0 Response to Non-Compliance
 - ix. 7.3.0 Appeals Process
5. **Moves, Additions & Changes to the System**
6. **Committee Reports**
 - A. Metro Mobility System Usage Update – Chad LeVasseur/Clay Stenbeck
 - B. System Managers/Metro Owners Group Update – Ron Jansen
 - C. SECB Committees
 - i. Steering – Jill Rohret
 - ii. LMR (OTC) – John Gundersen/Nate Timm
 - iii. WBBA (IDC) – Rod Olson/Jake Thompson
 - iv. IOC & Workgroups – Thompson/Timm; Jansen; Timm/Dan Anderson
 - v. IPAWS – Haas
 - vi. Finance/Grants Workgroup – Rohret/Fredrick
7. **Other Business**
 - A. Update on Subscriber Training - Fredrick
 - B. WBBA Applications Workgroup Discussion – Marcus Bruning
 - C. Retirement Farewell for John Gundersen
8. **Adjourn**

Reminder: Next meeting scheduled for June 26, 2019

**Metropolitan Emergency Services Board
Radio Technical Operations Committee
Meeting Notes
April 24, 2019**

Members Present:

Jeff Bjorklund, Metro Airports
Kyle Breffle, Sherburne County-**absent**
Jon Eckel, Chisago County
Scott Gerber, MN Fire Chiefs-**absent**
John Gundersen, Hennepin County
Scott Haas, Scott County
Ron Jansen, Dakota County
Chad LeVasseur, Metropolitan Transit

Wendy Lynch, Hennepin EMS-**absent**
Mike Mihelich, Ramsey County
Rod Olson, City of Minneapolis
Bob Shogren, Isanti County
Chuck Steier, U of M Police
Jake Thompson, Anoka County
Nate Timm, Washington County
Tim Walsh, Carver County-**absent**

Guests Present:

Nick Schatz, Scott County (alternate); Marcus Bruning, ECN; Butch Gillum, City of Bloomington; Randal Larson, Ramsey County; Rikard Nordlander, DOC; Jeff Lessard, U of M; Jill Rohret, Tracey Fredrick, Martha Ziese, MESB

1. Call to Order:

Scott Haas called the meeting to order at 1:00 p.m.

2. Approval of Agenda

M/S/C – John Gundersen moved to approve the agenda for April 24, 2019. Jeff Bjorklund seconded. Motion carried.

3. Approval of March 27, 2019 Minutes

Ron Jansen asked phrasing changed in Section 5 from “talking over one another” to “splitting the patch”.

M/S/C – Jansen moved to approve amended minutes from March 27, 2019. Gundersen seconded. Motion carried.

4. Action Items

A. COMU Position Approvals

Tracey Fredrick asked for INTD certification approval for Alyssa Super and COML certification approval for Shane Sheets.

M/S/C — Bob Shogren motioned to approve the INTD approval for Alyssa Super and COML approval for Shane Sheets. Jake Thompson seconded. Motion carried.

B. City of Bloomington Participation Plan Change Request

Butch Gillum said fourteen years ago the City of Bloomington acquired 29 talk groups. The City of Bloomington is requesting an increase of six more talk groups for a total of thirty-five.

M/S/ C — Motion by Gundersen to approve City of Bloomington Participation Change Request. Jansen seconded. Motion carried.

C. U of M Participation Plan Change Request

Jeff Lessard said the U of M is requesting approval to add a CAM server to allow dispatchers to modify radio aliases directly from the console.

Jansen asked if MnDOT had approved of the change, and Lessard said yes.

M/S/ C — Motion by Jansen to approve U of M Participation Change Request. Nate Timm seconded. Motion carried.

D. Metro Standard Updates

i. 6.3.0 Site Lease and Utilities

Fredrick said a few corrections were made since this request came before the RTOC last month. A statute reference was updated and the Board approval date was corrected.

M/S/C - Motion made by Jansen to approve modifications to 6.3.0. Timm seconded. Motion carried.

ii. 3.8.0 LE & IR Nationwide Channels for Interoperability

iii. Appendix 3 Master Fleetmap Matrix Example

Fredrick said that upon review, the necessity to renew 3.8.0 and Appendix 3 was discussed. Jansen said MOG would have no objection to sunsetting these two standards.

M/S/C Motion made by Timm to sunset Metro Standards 3.8.0 and appendix 3. Jansen seconded. Motion carried.

Upon MESB approval, both standards will be sunset.

5. Moves, Additions & Changes to the System Move, Additions & Changes to the System:

Mike Mihelich said Ramsey County South Maplewood site going offline for fourteen weeks. Traffic will route to Washington County while this site is offline.

Jansen said Dakota County has some sites going offline for microwave work.

Timm said there was a planning meeting on April 23 about the King Stack site move to Houlton. It is on time and is going to be completed by June.

6. Committee Reports:

A. Metro Mobility System Usage Update

Chad LeVasseur said radios are being programmed for testing with Private Call.

B. System Managers/Metro Owners Group

Jansen said Motorola maps and updates will be sent out shortly. Continuing work on decommissioning Motobridge. The Genesis upgrade is ready. Last hop connectivity was discussed.

C. Reports from SECB Committees:

Steering:

Jill Rohret said the by-laws continue to be discussed. There was an update for the St. Cloud IV&D Draft Standard.

OTC (LMR):

Gundersen said the OTC, now called the Land Mobile Radio Committee, met on April 9. The Sanford Health System amendments were approved. There was discussion on vendor

participation plan, but no new action was taken. Discussion that radio manufacturers already have IDs assigned to them for testing. Push to Talk over cellular was also discussed.

Interoperable Data Committee:

Rod Olson said there was a conference call April 16. The Minnesota Public Safety Conference was discussed. On May 1, a kick-off for the Standards and Applications workgroup for this committee will be held after the Public Safety Communications Conference. There will be the First Responder Network Authority meeting in Chaska to discuss FirstNet and TSCR on May 22 and 23. There is room for a representative to attend the Chicago TSCR July 6-9; if anyone is interested, they should contact Melinda Miller at ECN.

IOC & Subcommittees:

STR and COMU subcommittees are now workgroups. Gundersen said there will be a change in funding the end of May for the SATCOW trailer lease.

IPAWS:

Haas stated there is no report. This committee will be meeting during the Communications Conference.

Finance/Grants Workgroup:

Rohret said STR maintenance funds were discussed. ECN would like each region to voluntarily pass a resolution saying they will use these for maintenance for the STR.

Other Business

Fredrick said the subscriber maintenance training dates will be forthcoming.

Adjourn Meeting

M/S/C – Gunderson moved to adjourn. Thompson seconded. Motion carried.

Meeting adjourned at 1:36 p.m.



EDINA

POLICE DEPARTMENT

April 30th, 2019

Metropolitan Emergency Services Board
Radio Technical Operations Committee
2099 University Ave
St. Paul, MN 55104

Re: METACE's, LTAC's and LTACE's for 4 Edina SWAT Team Members

Radio TOC Chair Scott Haas,

The Edina Police & Fire Departments are seeking a waiver to Metro Region Radio Standard 3.14.0 "Use of Metro ARMER ME TACs" and State Standard 3.19.0 "Use of ARMER Statewide Law Enforcement Interoperability Talkgroups". The Edina Fire Department has four fulltime Paramedic/Fire Fighters that are members of the Edina SWAT team and the Southwest Metro SWAT consortium (Edina, Eden Prairie, Hopkins, Minnetonka and St. Louis Park Police Departments). These Paramedic/Fire Fighter's continuously train with and are considered SWAT members of the team. All Edina Paramedic/Fire Fighters are assigned their own specific radios and are not used by others.

The Edina Police & Fire Departments are requesting permission to program the above four mentioned portable radios with ME TACE, LTAC and LTACE talkgroups. All agencies mentioned above utilize the requested law enforcement specific talkgroups for communication during incidents.

Approving this requested waiver would significantly reduce the risk of all members allowing them to be on the same talkgroup and reduce a safety risk for lost or missed communications.

Thank you in advance for your consideration on this item.

Sincerely,

Tony Martin
PSAP Manager
Edina Police/Fire Communications

**METRO REGION
800 MHz Trunked Regional Public Safety Radio System
Standards, Protocols, Procedures**

Document Section:	1. Management of System	Radio TOC Recommended
Sub-Section:	METRO 1.8.0	
Procedure Title:	Moves, Additions and Changes	Date: 5/24/01
Date Established:	4/4/01	
Replaces Document Dated:	5/24/01	MESB Approval
Date Revised:	2/25/09 4/11/19	Date: 06/01/01

1. Purpose or Objective

To establish the procedure for approval of moves, additions and changes (MACs) to the regional public safety radio system.

2. Technical Background:

- Capabilities
- Constraints

3. Operational Context:

Since changes to the regional public safety radio system may affect more than one participant, changes and upgrades will need to be reviewed by the Metro Radio TOC for possible performance or cost impact to some or all users of the system.

Some hardware/software ~~changes-MACs~~ may require that ~~the~~ changes be implemented region-wide. This could require all system and sub-systems to be upgraded at the same time in order to implement the change. With the different system owners involved, an agreement may not be reached on the need for the change or there may not be the ability of all the owners to arrange for funding of the change at the same time.

Some MACs may cause an incremental increase in required system resources beyond what is available in the system. For these MACs there could be a significant cost in obtaining the resources required.

The following is a listing of some, but not all, of the possible MACs that may occur with the system:

Non Participant initiated

- Requests to operate on system, including approval of fleetmap

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- Requests to add sub-system and join system, including approval of fleetmap
- Request for ancillary use of excess capacity on the metro area backbone

Participant initiated

- Request for ancillary use of excess capacity on the metro area backbone
- Request for system software upgrades for feature additions
- Requests to change subsystem, additional channels, site relocation
- Requests for more radio or talkgroup ID blocks (see ARMER Standard 1.8.0)
- Request for additional logger ports
- Requests for new user categories which were not anticipated or included in the original Radio TOC-approved plan
- Requests for additional consoles
- Requests which change previously approved connections to the ARMER system, i.e. port connections, microwave connections, logging connections
- Requests for moves, additions or changes to add bi-directional amplifier systems and/or distributive antenna systems.

Infrastructure equipment changes and changes initiated by upgrades (see ARMER Standard 1.8.0)

Regulatory change initiated

- FCC
- State legislation

It is difficult to conceive of or list all of the possible changes that may occur to the system. As System Managers become aware that changes or upgrades are required or may be required to the system, they must submit requests or make notification of the changes or upgrades to the Metropolitan Emergency Services Board (MESB), via the Radio Services Coordinator.

4. Recommended Protocol/ Standard:

Request for moves, additions or changes (MACs) or ancillary use of excess capacity to the regional portion of the ARMER system shall be submitted in writing to the MESB. The request shall include full description of the MAC, along with any costs associated with the MAC.

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5. Recommended Procedure:

Routine requests shall be submitted to the appropriate system or sub-system administrator. If the resources are available at the system or sub-system level the request will be handled internally between system owners. If additional resources are required from the system, a request shall be forwarded to the MESB and/or the Statewide System Administrator.

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The MESB will forward the request to the Radio Technical Operations Committee (TOC) for review and recommendation.

A complete review will be made by the Radio TOC to determine:

- Technical and operational impact to current system performance, which system or subsystem impacted.
- Conformance with the MESB and ARMER standards.
- Cost impact to the MESB and current participants.
- ~~Are there other alternatives?~~ If other alternatives exist.
- Impact on future system capacity and plans.

The Radio TOC will return its findings to MESB along with recommendations.

The MESB may approve, modify or deny the request. If approved, the MESB will determine how the MAC is to be paid for and any cost allocations to system participants as outlined in section 6 of the system standards manual.

Requests for MACs that have been approved by the MESB that have an impact on system capacity or performance of the regional backbone infrastructure or have cost implications to MnDOT shall be forwarded to MnDOT for approval. (This is to be done as outlined in the cooperative agreement between the MESB and MnDOT.)

If the MAC is approved, a contractor agreement may be required by the MESB, and if so it will be negotiated and implemented with the affected parties.

6. Management

The appropriate System Manager will be responsible for the routine day-to-day moves, changes or additions within their appropriate system or subsystem.

The MESB is responsible for approval of MACs that impact the regional portion of the ARMER system.

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METRO REGION
800 MHz Trunked Regional Public Safety Radio System
Standards, Protocols, Procedures

Document Section:	1. Management of System	Radio TOC Recommended
Sub-Section:	METRO 1.8.1	
Procedure Title:	Bi-Directional Amplifier Systems	Date: 10/28/09
Date Established:	10/28/2009	
Replaces Document Dated:		MESB Approval
Date Revised:	<u>4/11/2019</u>	Date: 12/2/09

1. Purpose or Objective

To establish the procedure for approval of installations of bi-directional amplifier systems (BDAs) to the regional public safety radio system.

2. Technical Background:

- **Capabilities**
- **Constraints**

3. Operational Context:

Since changes to the regional public safety radio system may affect more than one participant, changes and upgrades will need to be reviewed by the Metro Radio TOC for possible performance or cost impact to some or all users of the system.

4. Recommended Protocol/ Standard:

Request for the installation of BDAs which do not connect directly to the ARMER system must be reviewed by the appropriate sub-system administrators to insure no interference with the ARMER system is caused.

5. Recommended Procedure:

BDA requests which require direct physical connection to the ARMER system must be reviewed by the Radio Technical Operations Committee and approved by the Metropolitan Emergency Services Board (see Metro Standard 1.8.0).

Requests for BDAs which are being installed to improve ARMER coverage in buildings shall be submitted to the appropriate sub-system administrator for review. The sub-system administrator will review the request to ensure the BDA will not cause interference with the ARMER system. If

the BDA request is determined to have no negative effect on the ARMER system, the sub-system administrator may approve the installation of the BDA. If a determination is made that the proposed BDA design poses a risk to proper operation of any ARMER subsystem system, the sub-system administrator can recommend a design change or request review by the Radio TOC. The sub-system administrator shall maintain a record of the installation and will notify first responders that a BDA exists in the building.

6. Management

The appropriate system manager or sub-system administrator will be responsible for the approval and tracking of BDAs which are installed to improve ARMER system coverage, but do not physically connect into the ARMER system.

**METRO REGION
800 MHz Trunked Regional Public Safety Radio System
Standards, Protocols, Procedures**

Document/ Section:	3. Interoperability Guidelines	Radio TOC Recommendation
Sub-Section:	METRO 3.28.1	Date: 10/26/2011
Procedure Title:	Use of Metro Emergency Management Talkgroup METEM	
Date Established:	10/6/2011	MESB Approval - Signature:
Replaces Document Dated:	10/6/2011	Date: 11/9/2011
Date Revised:	4/11/19	

1. Purpose and Objective:

To establish operational policy for use of the **Metro Emergency Management Talkgroup METEM**. This talkgroup is a shared resource that allows interoperability between Emergency Managers their respective Emergency Operations Centers (EOC) and other key partners for the purpose of emergency management coordination.

The intention of the resource is to allow Emergency Managers to communicate with one another and to connect EOCs as well as emergency management field operations until another talkgroup is assigned if deemed necessary. The talkgroup may be use for direct communication on an ongoing daily basis depending on the operation. The talkgroup may also be used for large scale coordination during a disaster to coordinate regional resources, agencies, EOCs, etc. The talkgroup may be used to facilitate coordination between many different partners.

2. Technical Background:

- **Capabilities** – N/A
- **Constraints** – N/A

3. Operational Context:

Emergency Managers and their partners may need to coordinate operations, resources, etc. across the metro Homeland Security region, which includes the Counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne and Washington. Emergency Managers and their partners in the region may need speak directly utilizing METEM for ongoing daily business (event dependent), as well as operations and planning during an incident.

4. Recommended Procedure:

Talkgroup requirements:

- Highly Recommended for Metro Emergency Management personnel at the state, county and local levels as well as those partners that routinely work with emergency management.
- Optional for Public Safety Agencies
- ~~May not be used by: _____~~

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If an Emergency Manager, or emergency management partner needs to talk to another Emergency Manager or partner, the following information should be given

- Their agency
- Identify what Emergency Manager/Partner your calling by agency, or name

It is up to each agency Emergency Manager/Partner to monitor the METEM talkgroup.

5. Recommended Procedure:

N/A

6. Management:

The Metro Region Homeland Security Emergency Management Council and the Metropolitan Emergency Services Board will be responsible for monitoring communication on the talkgroup.

**METRO REGION
800 MHz Trunked Regional Public Safety Radio System
Standards, Protocols, Procedures**

Document Section:	3 - Interoperability Guidelines	Radio TOC Recommendation
Sub-Section:	METRO 3.30.0	Date: 05/23/07
Procedure Title:	800 MHz METCOM Talkgroup	MESB Approval - Signature:
Date Established:	5/2/07	Date: 06/13/07
Replaces Document Dated:		
Date Revised:	3/18/19	

1. Purpose or Objective

To establish guidelines and procedures for the use of the 800 MHz **METCOM** talkgroup.

2. Technical Background:

▪ **Capabilities**

The **METCOM** talkgroup is a metro region-wide talkgroup intended to facilitate communications between dispatch centers.

▪ **Constraints**

This Standard strives for consistency among all metro region agency dispatch centers and also serves to minimize usage conflicts when multiple incidents may be occurring simultaneously within the metro region area.

3. Operational Context:

The **METCOM** talkgroup is to be used for day-to-day interagency urgent or emergency mutual aid situations. It is also a means for hailing another dispatch center, to re-direct non-emergency communications to an alternative talkgroup of their choice.

4. Recommended Protocol/ Standard:

Emergency Communications shall be defined, for these purposes, as those communications necessary to reduce the time factor when intervening in a life-threatening situation, or a large-scale property damage situation.

Emergency communications shall have priority over all other types of communications. Those emergency communications shall include, but not necessarily be limited to:

- Any situation where human life may be in danger of great bodily harm or death.
- Situations where property damage occurs, or very possibly could occur, on a large scale and immediate action is necessary to restore order or prevent further damage or harm.
- Any emergent situation when a dispatcher must provide essential information to multiple agencies at once.

Non-emergency communications shall be defined as any communications where the probability of a life-threatening or large-scale property damage situation does not exist but no other reasonable means of communication between users is available.

Non-emergency communications include, but are not limited to:

- Loss of telephone systems and the need to relay call information on a temporary basis.
- A need to direct short announcements to more than one agency to expedite essential communications.
- Use during emergent need only; no daily monitoring.

TG Requirements	For Whom?
Mandatory	All Region Dispatch Centers
Highly Recommended	EOCs, Incident Command Centers
Optional	None
Not Allowed	Mobile and Portable Radios <u>(waiver only)</u>

Cross Patch Standard	YES / NO	To Talkgroup(s)
Soft Patch	No	NA
Hard Patch	No	NA

No personnel in any dispatch center shall soft patch the 800 MHz METCOM talkgroup to an 800 MHz trunked talkgroup, RF control station or conventional resource (See Metro Standard 3.24.0). PSAPs with a waiver must not use for daily monitoring.

5. Recommended Procedure:

Any user transmitting information to another shall:

- Identify by department name and department(s) being called.
- Identify talk group being used "METCOM".
- Identify the type of incident or emergency,
- Example: "Minneapolis to Golden Valley and State Patrol on METCOM, pursuit".

6. Management

The dispatch center managers for agencies on the regional 800 MHz radio system shall ~~insure~~ ensure that there is a procedure for use of the METCOM talkgroup in the dispatch center for which they are responsible.

Dispatch center operators shall receive initial and continuing training on the use of this procedure.

The system managers and administrators will be responsible to see that this policy is implemented as defined in the system standards manual. Identified issues and concerns will be brought to the monthly ~~Interoperability Subcommittee~~ Radio TOC meetings for resolution.

METRO REGION
800 MHz Trunked Regional Public Safety Radio System
Standards, Protocols, Procedures

Document Section:	3 – Interoperability Standards	Radio TOC Recommendation:
Sub-Section:	METRO 3.33.2	Date : 2/29/12
Procedure Title:	STR – Transportable Tower/Repeater	
Date Established:	2/6/12	MESB Approval – Signature
Replaces Document Dated:	2/6/12	
Date Revised:	2/29/12 4/11/19	Date : 3/14/2012

1. Purpose or Objective

To establish policies and procedures for the deployment and use of the Metro Region Strategic Technology Reserve (STR) component:

Transportable Tower and Repeaters

2. Technical Background

▪ **Capabilities**

As part of the Public Safety Interoperable Communication grant program a transportable tower and repeater system will be established in Metro Region. The transportable tower and repeater system basic capabilities are described as follows:

Resource	Description
Transportable Tower	Trailer based, 50' crank up aluminum tower, assembled with 800 MHz, VHF and amateur radio antennas and transmission cables.
Repeaters	Repeater-Transportable 800 MHz and VHF repeater capable of cross-band operation in analog and digital P25 modes. The repeater is equipped to support at least two 2 -800 MHz frequency pairs and at least one of two VHF frequency pairs for repeater operation. The repeater is enclosed in a case that can be transported in the back of an SUV, weights approximately 70 lbs. The repeater is battery operated and can be connected to a 12 volt vehicle battery or 120 VAC power source.

Frequencies identified for use in the transportable repeater are specified in Appendix A [of this standard](#).

STR transportable repeater frequencies will be identified in the state of Minnesota Interoperability Frequency Plan and should be available in public safety mobile and portable radios throughout the state of Minnesota. They may also be programmed into public safety mobile and portable radios for neighboring state agencies operating along the Minnesota border.

Through the allocation of this STR resource the Metro Region should have the ability to respond to any catastrophic loss of the existing public safety communication resources, to provide additional communication resources under certain circumstances and to provide local responders with a transportable communication resource should they respond to a major event or natural disaster in another state.

▪ **Constraints**

The Interoperability Frequency Plan and the National Interoperable Frequency Operational Guide (NIFOG) provide a comprehensive list of all available interoperability frequencies. In the VHF spectrum, most interoperability frequencies are specifically simplex and not paired for repeater use. There are very few permanent repeaters in place on interoperability frequencies outside the Minneapolis/St. Paul metropolitan area. Based upon the limited nature of this resource, care must be exercised in the overall coordination of communications, the deployment of equipment to achieve the maximum effectiveness and in defining expectations.

3. Operational Context

The Metro Region STR transportable tower and repeater system will be housed at the City of Bloomington, 9920 Logan Ave South. The primary contact for emergent deployment of the equipment will be directed to Butch Gillum, secondary contact Chief Ulie Seal, followed by the Metropolitan Emergency Services Board's (MESB) Regional Radio Services Coordinator and/or Metro Region COML's or through the Minnesota State Duty Officer. For planned events and exercises, the primary contact will be the MESB's Regional Radio Services Coordinator. The maintenance and support of the Metro Region STR transportable tower and repeater system will be conducted by Metro Region COML and COMT personnel.

Commented [TF1]: Names could be outdated soon

The Metro Region STR transportable tower and repeater system may be deployed individually or used in conjunction with other STR resources. The Metro Region STR transportable tower and repeater system has been designed to provide a limited resource (capacity and coverage) that can be implemented very quickly to address public safety communication needs over a very limited geographic region (3-7 mile radius). Actual area coverage may vary depending upon tower placement which should be at the highest point overlooking the area of operations. Where additional communication paths are needed, consideration should be given to requesting the STR Satellite enabled ARMER base radio site.

4. Standardized Policy

Any of the ~~ten nine~~ counties in the Metro Region can request the use of the Metro Region STR transportable tower and repeater system. The primary use will be to respond to any loss of basic public safety communications. This standard defines the steps necessary to make sure the Metro Region STR transportable tower and repeater system is available for deployment by addressing the requirements to maintain, operate and deploy the STR transportable tower and repeater system.

To the greatest extent possible, the Metro Region STR transportable tower and repeater system should be available to support operations in other regions of the state and to provide

communication resources for public safety personnel responding to an event or disaster in another state.

5. **Standardized Procedure**

Maintenance and Storage

The Metro Region STR transportable tower and repeater system will be housed at the City of Bloomington, 9920 Logan Ave South.

The Metro Region STR transportable tower and repeater system will be fully exercised once every six months in a structured exercise to assure all equipment and features are in good working order. This testing will be conducted by the Metro Region Communications Response Taskforce (CRTF). In addition to the semi-annual exercise of the equipment, the repeater battery should be maintained with a “maintenance charge” and tested under load at least once annually.

Commented [TF2]: Question to group – does this happen? Do we need to change standard language?

The Metro Region STR transportable tower and repeater system will be tested by a qualified technician at least once every year, and after each deployment. The tests will include, frequency error, power output and controller tests to insure the equipment is kept ready for deployment.

Resource Activation

Any time the Metro Region transportable tower and repeater system is deployed, at least one person involved in the deployment must have participated in deployment familiarization training within the last year. It may be possible for a qualified person to conduct deployment familiarization training immediately before deployment, but such training must be documented.

A pre-deployment check list must be maintained with the equipment that includes a thorough list of the equipment, verification of deployment familiarization training, and verification of set up procedure. This check list must be followed and must remain with the equipment.

Written step-by-step set up procedures, including safety notices, should be reviewed periodically and must be maintained with the equipment at all times. These procedures must be followed and a copy must remain with the equipment.

Commented [TF3]: Do we want better definition of how many times this should be reviewed?

Deployment of the Metro Region STR transportable tower and repeater system within the region may be for any purpose authorized by the MESB or its Radio Technical Operations Committee (Radio TOC).

Deployment outside the region to support public safety response to an event or natural disaster must be coordinated through the Minnesota State Duty Officer.

The requesting agency shall be responsible for the transporting of Metro Region STR transportable tower and repeater system to and from the incident scene.

The agency requesting the Metro Region STR transportable tower and repeater system assumes full risk of loss for any equipment loaned to it which are lost, stolen, damaged, consumed, and inoperable or destroyed until the equipment is returned to the Metro Region primary contact.

Commented [TF4]: Who is this? Radio Services Coordinator?

The requesting agency shall reimburse the MESB for the repair or replacement cost of any equipment which are lost, stolen, damaged, consumed, and inoperable or destroyed.

Operational Training

Deployment familiarization training will be conducted twice per year.

Commented [TF5]: Note that this is only done once per year now. Checking with Butch to see if it truly is exercised 2x.

All Metro Region trained Communication Leaders and Communications Technicians should participate in deployment familiarization training for the equipment at least once per year.

The Metro Region STR transportable tower and repeater system will be available for local disaster exercises, local events (fairs or celebrations) or other activities where operational personnel will become familiar with the deployment procedures and operational characteristics of the equipment.

6. Management

The MESB will maintain responsibility for assuring compliance with this standard. The Metro Region Radio TOC or a subcommittee thereof shall review this standard and make adjustments as necessary. In that process, the subcommittee shall seek comment and suggestion from the STR transportable tower and repeater system points of contact and may inspect equipment to determine needs.

**ARMER Public Safety Communications System
Standards, Protocols, Procedures**

Document Section:	3-Interoperability Standards	Appendix A
Sub-Section:	State 3.33.2	
Procedure Title:	STR-Transportable Tower/Repeater	
Date Established:	10/01/2010	
Replaces Document Dated:		
Date Revised:		

The following frequencies identified for use in the Transportable Tower/Repeater shall be maintained in all repeaters maintained as part of Minnesota’s Strategic Technology Reserve:

VHF

Name	Transmit	Receiver	CTCSS/NAC
F1-VTAC14/VTAC14R	159.4725 MHz	154.6875 MHz	156.7 Hz E/D
F2-LE2 Federal LE Interop *	167.2500 Mhz	162.2625 MHz	167.9 Hz E/D
F3-IR2 Medical Evac Control	170.4125 MHz	165.9625 MHz	\$68F

* Subject to coordination with federal LE partners

800 MHz

Name	Transmit	Receiver	CTCSS/NAC
F1-8CALL90	851.01250 MHz	806.01250 MHz	156.7 Hz
F2-8TAC91	851.51250 MHz	806.51250 MHz	156.7 Hz
F3-8TAC92	852.01250 MHz	807.01250 MHz	156.7 Hz
F4-8TAC93	852.51250 MHz	807.51250 MHz	156.7 Hz
F5-*TAC94	853.01250 MHz	808.01250 MHz	156.7 Hz

METRO REGION
800 MHz Trunked Regional Public Safety Radio System
Standards, Protocols, Procedures

Document/ Section:	3. Interoperability Guidelines	Radio TOC Recommendation
Sub-Section:	METRO 3.42.0	Date: 11/30/11
Procedure Title:	Use of Metro Water Patrol Talkgroups – ME RVR HAIL & ME RVR OPS	
Date Established:	11/30/11	MESB Approval - Signature:
Replaces Document Dated:	11/30/11 1/25/12	Date: 1/18/2012
Date Revised:	1/25/2012 4/11/19	

1. Purpose and Objective:

To establish operational policies for the use of the Metro Water Patrol Talkgroups, ME RVR HAIL and ME RVR OPS. These talkgroups are shared resources which allow interoperability between Metro Area Water Patrol Units and other key partners for the purpose of coordinating non-emergency responses on waterways within the Metro Region.

The intention of these resources are to allow Water Patrol, Fire Rescue, Coast Guard, and Conservation officers units in the Metro Region to have a common talkgroup to communicate with one another to facilitate a coordinated response to incidents on the waterways of the Metro Region. These talkgroups would be used until another regional talkgroup is assigned, if deemed necessary. The talkgroups may be used for direct communication on an ongoing daily basis depending on the operation and may be used to facilitate coordination between many different partners.

2. Technical Background:

- Capabilities – ~~N/A~~ None
- Constraints – ~~N/A~~ None

3. Operational Context:

Water Patrol Units and their partners routinely need to coordinate operations, resources, etc. across the Metro Region which includes the Counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, and Washington. Water Patrol Units and their partners in the region may need to speak directly utilizing these talkgroups for ongoing daily business as well as operations and planning during an incident. The basis of creating these talkgroups stems from the nature of the region's waterways. With few exceptions, the rivers are the borders between jurisdictions and frequently have multiple agencies from different disciplines overlapping. At some locations, as many as seven agencies could be called upon for assistance.

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4. Recommended Procedure:
Talkgroup requirements:

- Highly Recommended for Metro Water Patrol Units and personnel at the state, county and local levels as well as those partners that routinely work with Metro Water Patrol Units such as Fire, EMS, Law Enforcement, and Coast Guard Units.
 - Optional for Public Safety Agencies
- ~~May not be used by: _____~~

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If a Water Patrol Unit or their partner needs to talk to another Water Patrol Unit or partner, ME RVR HAIL talkgroup should be used to contact that unit and a request should be made to switch to ME RVR OPS and the following information should be given:

- Their agency
- Identify what Water Patrol/Partner is being called by agency, or name.

It is up to each agency Water Patrol Unit/Partner to monitor the ME RVR HAIL talkgroup.

5. Recommended Procedure:

~~N/A None~~

6. Management:

The Metro Region Water Patrol Units and the Metropolitan Emergency Services Board will be responsible for monitoring communication on the talkgroup.

Commented [TF1]: Who?

Commented [TF2]: Add chart for talkgroups

METRO REGION 800 MHz Trunked Regional Public Safety Radio System Standards, Protocols, Procedures

Document Section:	6 – Financial Policies & Procedures	Radio TOC Approval – Signature:
Sub-Section:	METRO 6.2.0	
Procedure Title:	User Fees for Administration	
Date Established:	8/27/01	
Replaces Document Dated:	8/27/01 1/27/05	MESB Approval - Signature:
Date Revised:	1/27/05 3/18/19	9/07/01

1. Purpose or Objective

The purpose of this standard is to outline a procedure for determining costs of operation, administration, and maintenance of the shared region-wide 800 MHz digital trunked public safety radio ~~first phase backbone~~ system and for billing each agency its prorated share. The standard is governed by Minnesota Statutes ~~403.31~~ **473.902**, which grants the Metropolitan Emergency Services Board (MESB) the power to assess user fees, and by the various cooperative agreements between the Board and the governmental entities who are full participants in the region-wide system.

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2. Technical Background:

▪ ~~Capabilities~~ - None
 — N/A

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▪ ~~Constraints~~ - None
 ▪ N/A

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3. Operational Context:

Minnesota statutes provide for the MESB to assess each fully participating entity a user fee to cover the ongoing costs of administering, operating and maintaining the system. The MESB’s Policy as adopted by resolution on June 1, 2001 states: “**Whereas**, all management and administrative costs of operating the Metropolitan Emergency Services Board previously borne by the Metropolitan Council will transfer to the MESB by July 1, 2002, and **whereas**, Minnesota Statutes 473.894 provides that the MESB shall determine how capital, operating and administrative costs of the first phase system will be spread across users of the system, **therefore**, the Board determines that fees shall begin being charged to users effective July 1, 2002 to cover operating and administrative costs not eligible to be paid by 9-1-1 surcharge revenues.- Fees to be set by the Board shall be based on the number of subscriber radios deployed by respective users and on the projected need of the MESB for funds. It shall be the policy of the Board to phase the user fees in as radios are deployed, and to use funds in the unrestricted operating account to make up any shortfall during the ramp-up period prior to full deployment.”

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4. Recommended Protocol/ Standard:

The standard is governed by the cooperative agreement among the parties. The agreements require the Metropolitan Emergency Services Board to provide an estimated charge rate by August 1st of the year prior to the budget year. The agreement provides for quarterly billing. Current MESB policy is to bill each entity on the basis of the number of subscriber radio sets projected to be in use when the system is fully deployed. For purposes of budgeting, each entity must, upon request of the MESB, supply the MESB with information concerning the entity's projected use of subscriber radios.

To the extent possible, system maintenance costs, which are an eligible use of the Board's 9-1-1 revenues, shall be paid by the Board without being charged back as a part of the user fees. If and when 9-1-1 moneys are not available to the Board, system maintenance may become a cost to be allocated to users.

Each "Active Radio" on the system, regardless of ownership or intended use, will be assessed a user fee for the administrative costs of the Board. A radio is considered to be an "Active Radio" when all of the following conditions are present: (1) The unit has to be a two-way radio connecting with the system over the air via the control channel; (2) The unit has to be assigned a unique system user ID; and (3) Installation/deployment and commencement of use has occurred. Radios that are "cache radios," intended primarily for use in emergencies, but not used on a regular basis, shall be considered "active" only during each calendar month of use for purposes of assessing the fee. At other times such units shall be considered "inactive" and need not be reported as an active radio.

Radios purchased by Authorized Users but not yet deployed and/or installed, or radios that are no longer in service, are not considered "Active Radios" because they are not being used.

Initial functional tests on radios intended for future deployment conducted by a radio technician as part of inventorying, programming and bench testing does not constitute "commencement of use."

Any exception to this policy for specific radios or users will require a formal Waiver by the Board in accordance with ~~Interim~~ Standard 1.5.3b.

5. Recommended Procedure:

Each year, during the MESB's annual budgeting process, MESB staff shall prepare an estimate of the projected administrative costs to be covered by user fees for the upcoming calendar year. This procedure shall be accomplished by the regular June meeting of the Board. Administrative costs include salaries and benefits for MESB staff, rental of office space, the cost of office supplies, postage, travel, subscriptions, fees and dues; and services such as legal, financial, web site development and maintenance, general liability insurance, and intergovernmental relations.

Each entity shall be informed of the fee projected to be charged for the following calendar year no later than August 1st of the year preceding the budget year.

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Billings shall be prepared and submitted quarterly beginning with the third quarter of 2002.

6. Management

The Executive Director of the Board is responsible for managing this procedure.

METRO REGION 800 MHz Trunked Regional Public Safety Radio System Standards, Protocols, Procedures

Document Section:	7 - Compliance & Conflict Resolution	Radio TOC Recommendation
Sub-Section:	METRO 7.2.0	Date: 5/24/01
Procedure Title:	Response to Non-Compliance	MESB Approval - Signature: Date: 06/01/01
Date Established:	3/31/01	
Replaces Document Dated:	5/24/01 1/28/09	
Date Revised:	1/28/09 4/11/19	

1. Purpose or Objective

The objective of this procedure is to describe the consequences of non-compliance. These consequences will be spelled out for varying degrees and duration of non-compliance.

2. Technical Background:

- **Capabilities** ~~N/A~~ None
- **Constraints** ~~N/A~~ None

3. Operational Context:

Metropolitan Emergency Services Board (MESB) is charged with setting standards and determining protocols and procedures for the smoothest possible operations between and among the users of the metropolitan region of the ARMER system.

The ability to communicate between full participants and non-participants in the regional system is possible due to the interoperational hardware and software being developed. –The improper use of this hardware can have minor to grave consequences. –These standards, policies, and procedures have been set forth to describe how and under what conditions the regional public safety radio system will be used. This is essential in order to maximize service to the citizens of the metropolitan area and minimize potential negative consequences. Responsible management of this resource, therefore, requires that standards, protocols, and procedures be enforced and that consequences to non-compliance be developed and implemented.

REVIEW BODY

Radio Technical Operations Committee
(Radio TOC)

Metropolitan Emergency Services Board
(MESB)

ROLE

Peer review, fact finding, recommend action
Endorse/ sign-off on action

Approval or disapproval of recommended action

Radio TOC \longrightarrow MESB

4. Recommended Protocol/ Standard:

Consequences of failure to comply with these standards, protocols and procedures fall into two categories of non-compliance:

a. Moderate to high potential for serious adverse effect affect on participants and/or non-participants of the Backbone System.

- **First violation** Written order to immediately stop the non-compliant practice. Either the MESB Executive Director, owner agency of affected Systems/Sub-System may send this letter, with a copy to the Chair of the Radio TOC in both cases. The governing body of the violating agency shall be notified of the violation.
- **Failure to correct problem and respond within 30 days or 2nd offense-violation within 180 days** Suspension of user privileges on the Backbone System to the extent of time determined by the Radio TOC -with prior notification to the MESB.
- **Failure to respond within 60 days or 3rd offense-violation within 180 days** Revocation of user privileges on the Backbone System. This action must be recommended by the Radio TOC and requires the approval of the MESB.

b. Low potential for adverse effect affect on participants and/or non-participants of the Backbone System:

- **First violation** Written warning calling attention to the non-compliant practice. The violator is asked to stop the non-compliant practice(s) or apply for a formal waiver or variance within 30 days. (See *Metro Standard 1.5.3 Variances and Waivers.*) The MESB Executive Director or owner agency may send the warning with a copy to the Radio TOC in both cases. The governing body of the violating agency shall be notified of the violation.
- **Failure to respond within 30 days or 2nd offense-violation within 180 days** Written order to immediately stop the non-compliant practice or be subject to suspension or revocation of user privileges. The MESB Executive Director or the owner agency may send this letter with a copy to the Chair of the Radio TOC.
- **Failure to respond within 60 days or 3rd offense-violation within 180 days** Suspension or revocation of user privileges on the **Backbone** system. The specific penalty must be recommended by the Radio TOC and requires the approval of the MESB.

c. The Radio TOC will be the first review body for discovery or report of non-compliance.

5. Recommended Procedure:

Non-compliance may come to the attention of various personnel as a result of routine monitoring, an audit, a report or complaint from radio users to name a few of the possible alternatives. Regardless of how the issue arises, as soon as there is awareness of non-compliance:

- The individual discovering non-compliance is obliged to immediately report it to their respective system manager or administrator. If local management fails to resolve the situation within a reasonable time the manager will notify the Chair of the Radio TOC and the MESB Executive Director.
- If the matter is determined to be urgent by either system management or by the Executive Director it will be placed on the next Radio TOC agenda.
- Should immediate action be required the non-compliant agency will be notified of:
 - The required action. This will include a request to explain the reason for non-compliance.
 - The date the matter will come before the Radio TOC.
 - Their rights to request a variance or waiver and, ultimately, to appeal (See *Metro Standard 7.3.0 The Appeals Process*).
- The Radio TOC will hear the issue and recommend corrective action or consequences.
- These will be communicated to the violator within 10 days.
- System Managers will follow up to ensure that all next steps and/or corrective action has been completed within the time frame established.
- MESB staff will review results, follow up with System Managers on next steps and study trends/-impact and take action if appropriate.

6. Management

The Executive Director and staff of the Metropolitan Emergency Services Board, acting on behalf of the Board, will manage this process. Any action taken by staff shall be reported to the MESB and shall be subject to review and/or appeal.

METRO REGION
800 MHz Trunked Regional Public Safety Radio System
Standards, Protocols, Procedures

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Document Section:	7 - Compliance & Conflict Resolution	Radio TOC Recommendation
Sub-Section:	METRO 7.3.0	Date: 5/24/01
Procedure Title:	The Appeals Process	MESB Approval - Signature:
Date Established:	4/2/01	Date: 06/01/01
Replaces Document Dated:	5/24/01	
Date Revised:	1/28/09	

1. Purpose or Objective

The objective of this procedure is to describe the process by which a decision of the owner agency, Radio TOC, MESB Executive Director or the MESB may be appealed.

2. Technical Background:

- Capabilities N/A
- Constraints N/A

3. Operational Context:

Metropolitan Emergency Services Board (MESB) is charged with setting standards and determining protocols and procedures for the smoothest possible operations between and among the users of the metropolitan region of the ARMER system.

The ability to communicate between full participants and non-participants in the regional system is possible due to the interoperational hardware and software being developed. The improper use of this hardware can have minor to grave consequences. These standards, policies and procedures have been set forth to describe how and under what conditions the regional public safety radio system will be used. This is essential in order to maximize service to the citizens of the metropolitan area and minimize potential negative consequences. Responsible management of this resource, therefore, requires that:

- Standards, protocols and procedures be enforced
- Consequences to non-compliance be developed and implemented
- An appeal process be provided

4. Recommended Protocol/ Standard:

All users of the Backbone System, whether full Project 25 participants or conventional users connecting by means of interoperational infrastructure and protocols, have the right to appeal a procedure, a decision, or a sanction set forth by the Radio TOC and the MESB.

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5. Recommended Procedure:

Step 1. APPEAL

- In the event of a dispute regarding the outcome of non-compliance procedure 7.2, an aggrieved party may file a written appeal to reverse recommendations or sanctions within 30 days of issuance of directives or sanctions.
- Within ten days of receiving a request for appeal, the MESB shall provide written notice of the request to all involved parties and set a date for an appeal hearing by the full MESB within 45 days.

DECISION - The MESB, after a hearing on the matter, shall make a decision regarding the dispute within 60 days and transmit an order to all parties involved. Unless a request for mediation by an aggrieved party is received within 30 days the action called for shall be implemented in accordance with the order. Copies of the order will be mailed to all affected parties and the MESB Executive Director.

Step 2: MEDIATION

If a dispute between an aggrieved party and the MESB is not satisfied by Step 1 (above), an aggrieved party may file a written request for mediation with the MESB Executive Director. This may be filed at any time prior to a deadline for action or within 30 days of a final action.

- Within ten days of receiving a request for mediation, the MESB shall provide written notice of the request for mediation to all parties involved and provide a list of neutral parties experienced in the regional trunked 800 MHz system and public safety and public service issues. Within 30 days thereafter, the affected parties shall select a mediator from the list of neutrals or someone else mutually acceptable to all parties and submit to mediation for a period of 30 days.
- Any cost incurred throughout this process will be shared equally by all involved parties.

DECISION – The mediator will attempt to negotiate a decision agreeable to the affected parties within 60 days and transmit an order to the parties and the Radio TOC. Once agreement is negotiated and fully executed it will supercede all other directives on the matter at hand and becomes binding on all parties. Copies of the agreement will be mailed to affected all parties and the MESB Executive Director.

If no agreement is reached the MESB’s previous sanctions, directives or findings will remain in effect. The aggrieved parties may need to seek other remedies as provided by law.

The Executive Director of the MESB will maintain a master schedule and calendar for each event to ensure timely response.

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6. Management

The Executive Director and staff of the Metropolitan Emergency Services Board, acting on behalf of the Board, will manage this process.

**Metro Mobility Usage
(Hours:Mins:Secs)
2019**

Month	City Center	Anoka (Lino Lakes)	Dakota	Norwood	Hastings	North Branch	Hennepin West	Overall
January	343:33:37	208:53:30	74:10:28	71:45:16	150:07:30			848:30:21
February	382:09:11	250:50:04	74:30:44	87:10:01	79:07:58			873:47:58
March	335:52:03	228:50:02	73:03:09	83:31:53	142:58:44			864:15:51
April	302:01:37	218:59:44	85:40:51	81:58:15	133:00:24		354:36:38	1176:17:29
May								0:00:00
June								0:00:00
July								0:00:00
August								0:00:00
September								0:00:00
October								0:00:00
November								0:00:00
December								0:00:00

*note missing data for Jan-Mar
Motorola reporting error, new
report not yet given

Difference
since Jan.

12 656:57:50 385:58:45 298:06:15 222:53:22 265:34:15 0:26:46 152:56:51 1982:54:04

Target 150:00:00 75:00:00 75:00:00 75:00:00 75:00:00 0:00:00 75:00:00 525:00:00

1.1.1.1 APX CPS Programming And Template Building

APX7001V

Course Synopsis and Objectives:	<p>The APX CPS Programming and Template Building course provides communications management personnel and technicians with the knowledge and training necessary to build templates and program APX portable/mobile subscriber radio's in the most efficient way possible. The content, parameters and exercises demonstrated in this class apply to the APX portable and APX mobile.</p> <p>After completing this course, the student will be able to:</p> <ul style="list-style-type: none"> - Build APX portable/mobile templates using the APX Customer Programming Software (CPS) Program the specific parameters related to various radio system configurations: Conventional, Single Site Trunking, Simulcast, SmartZone, ASTRO 25 and ASTRO 25 X2 - Demonstrate detailed knowledge of APX CPS navigation, tools, options and features that make efficient programming of the radio possible - Demonstrate a complete understanding of APX CPS efficiency tools, such as Cloning, Drag and Drop, Codeplug Comparison, Radio Flashing, Advance System Key Administration and others.
Delivery Method:	<p>ILT – Instructor-led Training Can also be taught as VILT – Virtual Instructor-led Training</p>
Duration:	<p>2 days in the field 4 days total when combined with Radio Management (RDS2017) VILT – 2.5 hours per day for 5 days</p>
Participants:	<p>Radio Technicians, System Managers and anyone responsible for programming APX subscriber radios</p>
Class Size:	<p>Up to 12</p>
Prerequisite:	<p>Knowledge of the basic features and options of two-way radios, and the basic concepts of conventional and trunking systems</p>
Curriculum:	<ul style="list-style-type: none"> - Introduction to APX portable Radio - Introduction to APX CPS - APX CPS Install, Setup and Configuration - Navigating APX CPS - APX CPS Data Transfer including POP25/OTAP - Understanding and Interpreting Radio Information - Detailed Review of Codeplug Contents - APX Conventional Codeplug Build - APX Type II Trunking Codeplug Build - APX ASTRO 25 Trunking Codeplug Build - Building Scan List - Additional/Advanced CPS Functionality

1.1.1.1 APX Technical Subscriber Academy

APX010

Course Synopsis and Objectives:	<p>This course focuses on the knowledge required for a 2-way Radio Technician working in a communication environment or using the family of APX radios in the field. The course is specifically designed to provide significant amounts of hands-on, scenario based labs around configuration and troubleshooting. Key Loading and Management, Encryption, Over-The-Air Programming and Mobile Radio Installation are some of the topics that will be covered in detail for both mobile and portable radios.</p> <p>After completing this course, the student will be able to:</p> <ul style="list-style-type: none"> ▪ Distinguish between the features and specifications of APX portable and APX mobile radios. ▪ Verify the correct operations of the APX portable and the APX mobile radio. ▪ Maintain and troubleshoot an APX portable and APX mobile radio. ▪ Disassemble and reassemble the radio using the documented procedures. ▪ Verify the housing integrity of an APX portable radio. ▪ Flash upgrade an APX portable and APX mobile radio.
Delivery Method:	ILT–Instructor-led Training (Classroom)
Duration:	5 days
Participants:	Radio technicians
Class Size:	Up to 12
Prerequisite:	<p>Completion of the following courses</p> <p>:</p> <ul style="list-style-type: none"> ▪ APX CPS Programming and Template Building Overview (APX7001-V) or equivalent experience. <p>Completion of the following courses or equivalent experience in Radio Communications:</p> <ul style="list-style-type: none"> ▪ Communication Systems Concepts (NST021) ▪ Radio Systems Overview (RCS002-E or Test out RCS002-T) ▪ Theory of Radio Operations (RCS003-E or TEST out RCS003-T)
Curriculum:	<ul style="list-style-type: none"> ▪ APX Radio Introduction ▪ APX Radio Performance Checks ▪ APX Radio Alignment ▪ APX Radio Theory of Operation ▪ Radio Disassembly/Reassembly ▪ Vacuum Testing For Submergibility ▪ Mobile Radio Installation and Configuration ▪ Advanced Customer Programming Software ▪ Radio Troubleshooting