Minnesota Land Mobile Radio Conventional Interoperability Plan

January 23, 2020

SECB

STATEWIDE EMERGENCY COMMUNICATIONS BOARD

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Abstract

The *Minnesota Land Mobile Radio Conventional Interoperability Plan* defines the State of Minnesota's intentions for public safety land mobile radio (LMR) interoperability between Minnesota's statewide 800 MHz trunked radio system and conventional public safety interoperability channels.

The plan aligns with the U.S. Department of Homeland Security's SAFECOM Interoperability Continuum and includes sections on Governance, Standard Operating Procedures, Technology, Training & Exercising, and Usage.

Minnesota's Statewide Emergency Communications Board (SECB) is tasked by statute with oversight of interoperability and the adoption of this plan. It is also responsible for standards to guide the operational and technical application of this plan.

The technical component of this plan calls for dismantling of the existing Motobridge VHF interoperability network as it is becoming obsolete. It calls for reconfiguration of existing VHF base stations connected to ARMER from single channel resources to multiple channel resources. The plan maintains existing 800 MHz conventional channel resources. The plan projects minimal financial consequences and explains that cost can be absorbed by the current budget.

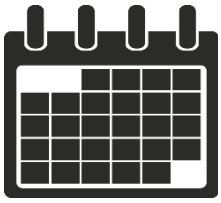
The plan encourages training, exercising, and usage of conventional interoperability resources. It urges public safety to put these resources into use so that dispatchers and responders alike are proficient in their application.

Scope

This document defines the State of Minnesota's plan and expectations to provide for land mobile radio interoperability between ARMER and conventional interoperability channels.

This plan does not limit the ability of a public safety entity with authority to operate on ARMER to implement its own interoperability tools or provide complimentary connectivity between ARMER and conventional interoperability channels.

Background



Until the early 2000s most Minnesota public safety land mobile radio communication was carried on the VHF radio band using conventional technology. Typically, each county maintained its own radio system and provided emergency call taking and radio dispatching for public safety entities within the county. Beginning in the early-2000s, a Motorola trunked-technology radio system known as ARMER (Allied Radio Matrix for Emergency Response) began deploying across the state. As of January 2020, ARMER is 99% built and eighty-six of eighty-seven counties have filed plans with the SECB expressing desire to be "full" ARMER participants. Nearly 100% of state public

safety and local law enforcement operations are on ARMER and roughly 90% of fire service and emergency medical services statewide are on ARMER.

Prior to ARMER, VHF radio users typically shared county-wide radio channel(s) for interoperability purposes and each public safety discipline (law enforcement, fire service, and emergency medical services) had a dedicated statewide simplex channel for discipline-specific interoperability (e.g. ”MINSEF” for law enforcement). Entities that were not using the VHF band relied on patches between their radio system and the applicable VHF interoperability channel.

ARMER was built in the 800 MHz radio spectrum and most end-user subscriber radios were incompatible with legacy VHF interoperability channels. Not knowing if or when counties across the state would migrate to ARMER, a plan was developed and supporting technology was implemented to provide statewide patching between ARMER and VHF interoperability channels. The plan was known as *Minnesota Public Safety Mobile Radio Cross Spectrum Interoperability System Operations Plan (September 27, 2012)*.

The 2012 plan called for 109 repeater sites be built and tied to a gateway technology tool known as Motobridge. Each site was to contain a mobile radio containing selectable VHF interoperability channels and a base station containing a single VHF interoperability channel. The Minnesota State Patrol dispatch and a few other local entities that opted to purchase Motobridge clients could then patch ARMER to either radio at any of the 109 VHF sites.

The 2012 *Minnesota Public Safety Mobile Radio Cross Spectrum Interoperability System Operations Plan* also called for the limited deployment of 800 MHz base station radios programmed with 800 MHz interoperability channels. These radios were connected to ARMER via Conventional Channel Gateway (CCGW) ports.

While the Motobridge interoperability network was built, ARMER adoption moved faster than expected and Motobridge use never gained momentum.

In 2018 Motorola announced that it would no longer sell Motobridge and the capabilities afforded by Motobridge were now standard in Motorola MCC-7500 consoles (currently used in 86% of Minnesota’s dispatch centers inclusive of the Minnesota State Patrol). Concurrent with Motorola’s announcement, the SECB Interoperability Committee created a workgroup to develop a new state plan for interoperability between ARMER and conventional public safety land mobile radio channels.

The workgroup concluded that the state should maintain its current statewide VHF coverage footprint and its current conventional 800 MHz coverage in population centers. The workgroup identified ongoing need for public safety radio interoperability between ARMER and non-ARMER radio users. They cited that the public safety of Minnesota’s neighboring states largely use VHF and 700/800 MHz radios and that federal public safety largely operates on VHF. The workgroup recognized value in using national interoperability channels (VTACs and 8TACs) without ignoring that traditional mutual aid channels such as VLAW-31 and VMED-28 are used daily in border areas.

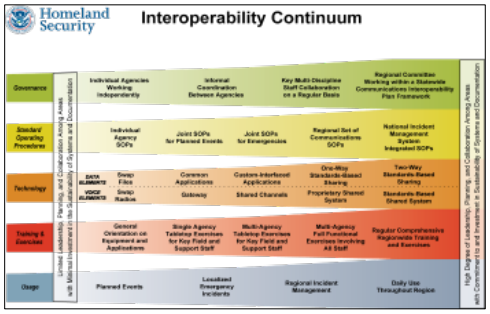
This plan is the product of the workgroup and has been approved by the Interoperability Committee of the SECB. The SECB adopted the plan on the date identified on the cover.

SAFECOM Interoperability Continuum

The US Department of Homeland Security's SAFECOM program recommends by way of its Interoperability Continuum that several parallel lanes be concurrently developed to best achieve interoperability.

Five unique lanes are identified:

1. Governance
2. Standard Operating Procedures
3. Technology
4. Training and Exercising
5. Usage



In order for the 2020 *Minnesota Land Mobile Radio Conventional Interoperability Plan* to be successful, the plan must address and its champions must develop each lane of the Interoperability Continuum.

See Appendix A for the Interoperability Continuum.

Governance

Authority

Under the authority established in Minnesota statute 403.36 subd. 1g, the Statewide Emergency Communications Board (SECB) serves as Minnesota's State Interoperability Executive Committee (SIEC). As such, statute directs, among other things, that it shall:

- Develop and maintain a statewide plan for local and private public safety communications interoperability that integrates with the Minnesota Emergency Operation Plan (MEOP), and
- Develop guidelines and standards for the efficient use of interoperability frequencies on all frequency spectrums assigned to public safety users.

Responsibility

The Minnesota Department of Transportation Office of Statewide Radio (MnDOT OSR), under the guidance of the SECB, is responsible for the technical aspects of this plan such as equipment deployment, maintenance, and licensing.

The Statewide Interoperability Coordinator (SWIC) and the Minnesota Department of Public Safety division of Emergency Communication Networks (DPS-ECN), under the guidance of the SECB, are responsible for operational aspects of this plan.

Standard Operating Guidelines

The SECB has adopted standards on a variety of different topics, including land mobile radio interoperability. Its Land Mobile Radio Committee and Interoperability Committee should endeavor to review and freshen existing standards and consider new standards to guide the implementation and execution of this plan. A workgroup inclusive of dispatchers, technical personnel, and a variety of public safety disciplines should be convened to consider these changes.

Console Programming

This plan recommends that standards or best practice guides encourage that each dispatch center with a technically-capable dispatch console add each of the state's conventional resources that have a coverage footprint inclusive of their jurisdiction. It further recommends that the technical resources of neighboring jurisdictions be installed and procedures be established between dispatch centers that provide assistance to one another.

Channel Management

This plan recommends that standards or best practice guides prescribe that idle VHF variable station base radios sit on the national VHF hailing channel of VCALL-10. As needed, the channel may be changed to another resource but at the conclusion of the event the channel shall be returned to VCALL-10. Due to Line A Canadian frequency coordination requirements, VCALL-10 may not be available at all sites and an alternative VHF channel will need to be identified.

Monitoring Plan

This plan recommends that standards and/or best practice guides recommend dispatch centers to monitor VCALL-10 (or an alternative hailing channel when not available) and 8CALL-90, when available as a dispatch console resource. The SWIC shall maintain a list off all fixed conventional interoperability resources and which dispatch centers that have agreed to monitor the available resources.

Subscriber Radio Programming

This plan recommends that standards or best practice guides prescribe that public safety subscriber radios be programmed with conventional interoperability channels identified in the appendices of this plan as they are technically capable and permitted.

Technology

Although only one lane of the Interoperability Continuum, the Technology lane requires the greatest detail in this plan. This section describes the types of interoperability channels that are available for this plan, the 2012 plan for connecting ARMER with these channels, and the technical plan for moving forward.

Conventional Interoperability Resources

The conventional interoperability channels available for this plan may be categorized into three types:

- Non-Federal National Interoperability Channels
- Public Safety Mutual Aid Channels
- State Interoperability Channels

Non-Federal National Interoperability Channels

Non-Federal National Interoperability Channels can be found in the VHF Low, VHF High, UHF, 700 MHz, and 800 MHz bands. They are commonly known by names such as V-TACs, U-TACs, 7-TACs, and 8-TACs. The frequency and other technical attributes assigned to each channel are consistent across the nation.

The FCC has afforded Public Safety "blanket authorization" for the mobile (including portable radio) use of these interoperability channels. Fixed and transportable transmitters require licensing.

Federal authorities and organizations including SAFECOM and the National Council of Statewide Interoperability Coordinators (NCSWIC) encourage that these channels be programmed in all public safety radios, nationally.

See Appendix B for a table of Non-Federal Interoperability Channels.

Public Safety Mutual Aid Channels

Public Safety Mutual Aid Channels can be found in the VHF High band. They are commonly known by names such as VFIRE-##, VMED-##, and VLAW-##. Prior to this naming scheme, these channels often had local monikers such as MINSEF (Minnesota Statewide Emergency Frequency) and WISPERN (Wisconsin Police Emergency Radio Network). The frequencies and technical attributes assigned to each channel name are recommended to be consistent across the nation.

These channels require licenses for public safety use in mobile and portable radios. Fixed and transportable transmitters also require licensing.

Public Safety Mutual Aid Channels are decided state by state and are discipline specific. For example, Minnesota opted to use VFIRE-23 (fire service), VMED-28 (emergency

medical service), and VLAW-31 (law enforcement). Other states may use other channels; as an example, VFIRE-21 is common to Iowa.

See Appendix C for a chart of Public Safety Mutual Aid Channels.

State Interoperability Channels

Minnesota-specific Interoperability Channels can be found in the VHF band. They are not part of any national channel plan but were adopted for use in Minnesota.

These channels require licenses for public safety use in mobile and portable radios. Fixed and transportable transmitters also require licensing.

See Appendix D for a chart of common State Interoperability Channels.

2012 Legacy Technical Plan

The 2012 *Minnesota Public Safety Mobile Radio Cross Spectrum Interoperability System Operations Plan* called for 109 tower sites hosting VHF radios to provide connectivity between conventional VHF interoperability channels and ARMER. Each site provides two types of connections, Motobridge and Conventional Channel Gateway (CCGW).

See Appendix E for a list of the 109 tower sites.

Eight urban sites about the state host 800 MHz radios providing connectivity between 800 MHz interoperability channels and ARMER.

The 2012 *Minnesota Public Safety Mobile Radio Cross Spectrum Interoperability System Operations Plan* was not inclusive of the Twin Cities metropolitan area as a separate network existed servicing that area.

Motobridge Resources

Each of the 109 tower sites contain a mobile radio that is connected to a Motobridge gateway. The channel may be remotely changed on these radios and a patch to ARMER may be created through Motobridge hardware or software hosted at the following locations:

- Minnesota State Patrol Regional Transportation Management Center (Roseville Dispatch)
- Minnesota State Patrol Southern Regional Communications Center (Rochester Dispatch)
- MnDOT Radio Operations Center
- Cass County Dispatch
- Mille Lacs County Dispatch
- Ottertail County Dispatch
- Saint Louis County Dispatch

VHF Conventional Channel Gateway Resources

Each of the 109 tower sites contain a base station radio that is connected to the ARMER network through a CCGW port. These radios are programmed to the law enforcement-specific Public Safety Mutual Aid Channel VLAW-31 and may be added as a resource in technically-capable dispatch consoles.

800 MHz Conventional Channel Gateway Resources

Eight urban-area tower sites each host two 800 MHz base stations programmed to 800 MHz National Interoperability Channels (8CALL-90 and a specific 8TAC). These radios are connected to ARMER via CCGWs and are available to technically-capable dispatch console.

2019 Technical Plan

This 2019 *Minnesota Land Mobile Radio Conventional Interoperability Plan* calls for the dismantling of the Motobridge network and rededication of the existing VHF base station radios at the 109 tower sites identified in the 2012 plan. The 2019 plan adds state-owned conventional VHF resources within the Twin Cities metropolitan area.

See Appendix F for a list of the 11 tower sites.

Decommission Motobridge

The VHF selectable-channel mobile radios and power supplies currently in use and connected to Motobridge gateways will be disconnected. The radios and power supplies should be distributed for use or retired per state property disposition guidelines. The VHF antennas and corresponding cabling at the tower sites will be temporarily left in place and made available to local entities for local VHF interoperability projects. The Motobridge gateways will be disconnected. They should be distributed for use as individual radio gateways or retired per state property disposition guidelines.

Repurpose VHF Base Stations (CCGW Connections)

The fixed-channel base stations currently at each of the 109 tower sites should be reprogrammed to hold multiple VHF interoperability channels and to provide remote control of the individual radios. Any technically-capable dispatch console with the resource programmed may access and utilize any of the channels in the base station. These radios are presently connected to the ARMER network via a CCGW port and will remain so. These radios are already connected to a VHF antenna.

MnDOT OSR must relicense each conventional interoperability site, as necessary.

See Appendix G for a list of channels recommended to be programmed into the VHF base stations.

Maintain 800 MHz Conventional Channel Gateway Resources

No technical changes are required of the eight base stations maintained by MnDOT OSR in various metropolitan areas of the state. They will remain programmed to various

800 MHz National Interoperability Channels and connected to ARMER via CCGWs. They will remain available to be programmed into any technically-capable dispatch console.

See Appendix H for a list of channels recommended to be programmed into the 800 MHz base stations.

Timeline

MnDOT OSR anticipates that a full switchover may be accomplished within twenty-four months of this plan's approval. Licensing updates must first be accomplished with the FCC and the technical site work will follow. The final step in making the tools identified in this plan accessible is for local dispatch centers to install the resources on their consoles.

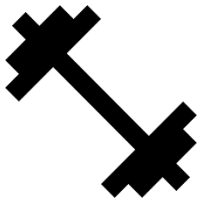
Financial Implications

MnDOT OSR budgets for routine inspection and maintenance of conventional interoperability resources. The cost to implement the 2019 *Minnesota Land Mobile Radio Conventional Interoperability Plan* should be insignificant and able to be absorbed into the ongoing maintenance budget.

The cost to update dispatch consoles with the VHF and 800 MHz interoperability resources will be the responsibility of the dispatch center.

Training and Exercising

Training and Exercising is a critical component of this plan.



Transitional Training

A transitional training plan should be developed for the approximate two-year transitional period from the technology prescribed in the 2012 *Minnesota Public Safety Mobile Radio Cross Spectrum Interoperability System Operations Plan* to the full implementation of this plan.

New Capabilities

A training plan should be developed to educate about the 2020 plan. Written guidance, online training modules, and in-person trainings should be utilized.

These resources should not remain the domain of technical staff. Every dispatcher should be trained in how to access and use these interoperability resources. Their strengths and their shortcomings should be taught. Every end user should be taught about these resources. Public safety partners not operating on ARMER should be told of Minnesota's capabilities. They should understand the benefits and limitations that come with patching.

The resources identified in this plan should be included in exercises. As training scenarios are developed—communications focused or not—consideration should be

given to how an ARMER user would communicate with a non-ARMER responder. As an example, if a neighboring state operates on VHF, their public safety should be asked to participate in a communications training to ensure that their radios are programmed consistent with our programming and the capabilities made known.

Usage

For this plan to be truly successful, it must be used. It should not remain in a conceptual format for it has no value unless it is applied in the real world.

Applicable channel resources made available by this plan should be installed in dispatch consoles. Dispatchers should be encouraged to use the resources and they should be empowered to recommend their use.

Communications Unit Leaders (COMLs) should, when beneficial, include conventional resources when developing communications plans.

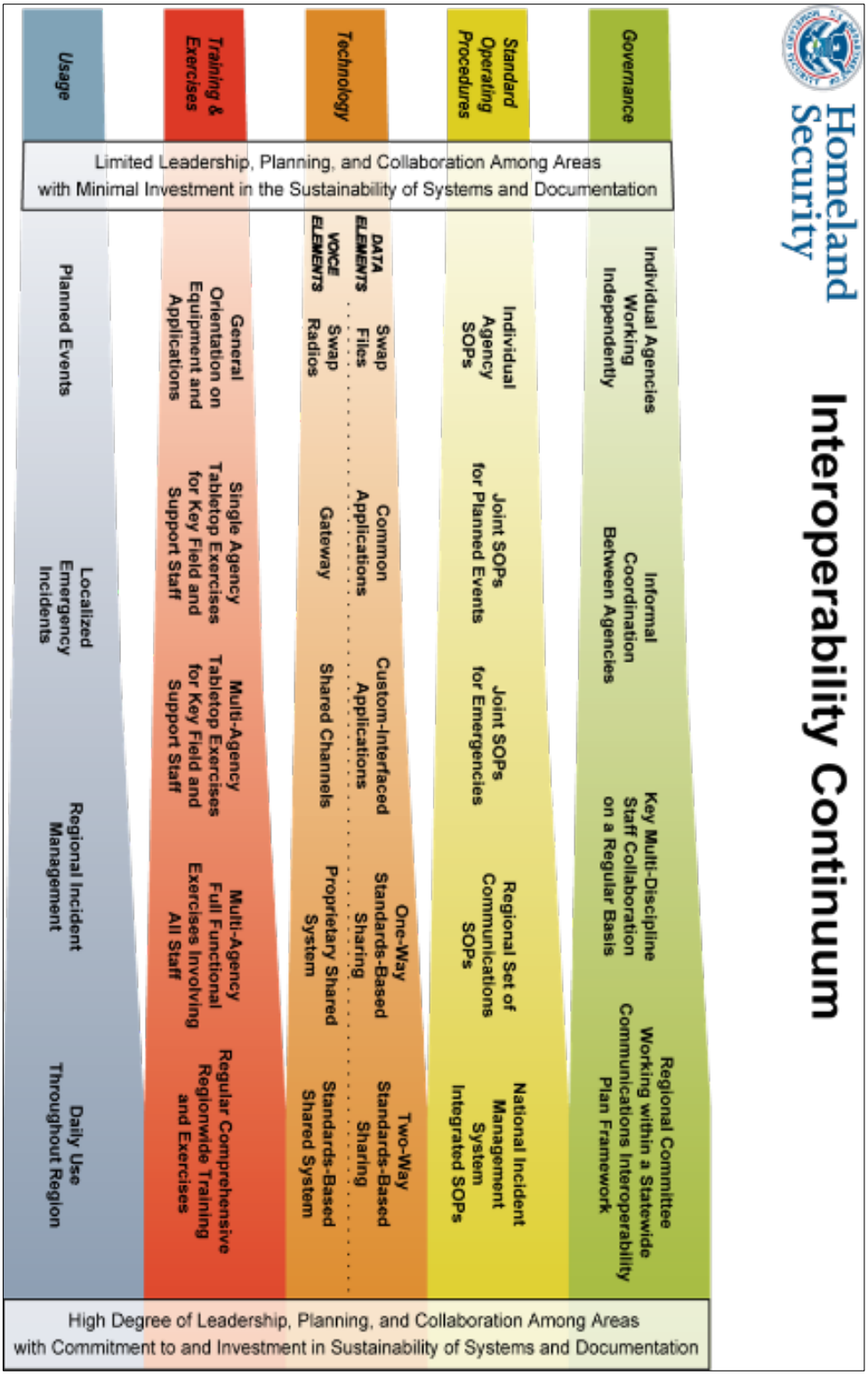
The interoperability resources identified in this plan should not be reserved for "the big one" or for some time in the future when there is time to figure them out. They should be used as often as possible so that they are understood, so that good and bad coverage areas become known, so that nuances can be identified and addressed, so that flaws can be found, and to ensure that the resource is good working when "the big one" really does happens.

Conclusion

The *Minnesota Land Mobile Radio Conventional Interoperability Plan* has the greatest potential to enhance public safety land mobile radio communications if each lane of the SAFECOM Interoperability Continuum is addressed. Not every lane needs to be fully developed and some lanes will, by their very nature, be more robust than others.

Minnesota's public safety communications governance processes are strong, as are processes for developing and refining standards. The technology component of this plan is straightforward and should not create any difficulties. Training and exercising are always challenging because they are time consuming and laborious. We must strive toward meeting the training and exercising challenge. When the first four lanes of the Interoperability Continuum are met and agencies embrace the resources, the fourth lane—usage—should easily fall in line.

APPENDIX A
SARECOM Interoperability Continuum



APPENDIX B
Non-Federal Interoperability Channels

Non-Federal National Interoperability Channels can be found in the VHF Low, VHF High, UHF, 700 MHz, and 800 MHz frequency bands. All are available in simplex or repeated modes.

The FCC affords Public Safety "blanket authorization" for *mobile (including portable radio)* use. Restricted to 3 watts or less when used north of Line A (approximately from Grand Forks to Lower Red Lake to Duluth).

VHF Low (25 – 50 MHz)

Name	Notes
LLAW-1 & 3	National Tactical Channels (law enforcement)
LFIRE-2 & 4	National Tactical Channels (fire service)

VHF High (148 – 174 MHz)

Name	Notes
VCALL-10	National Calling Channel
VTAC-11 – 14	National Tactical Channels
VTAC-33 – 38	These channels are derived from different frequency combinations of VTAC-11 – 14 to create repeated channel options.

UHF Band (450 – 470 MHz)

Name	Notes
UCALL-40	National Calling Channel
UTAC-41 – 43	National Tactical Channels

700 MHz Band (764 – 776 MHz & 794 – 806 MHz)

Name	Notes
7CALLs (50 & 70)	National Calling Channels
7TACs (51 – 57) (71 – 77)	National Tactical Channels (any discipline)
7MOBs (59 & 79)	National Tactical Channels (mobile repeaters)
7LAWs (61 – 62) (81 – 82)	National Tactical Channels (law enforcement)
7FIREs (63 – 64) (83 – 84)	National Tactical Channels (fire service)
7MEDs (65 – 66) (86 – 87)	National Tactical Channels (EMS)
7DATAs (69 & 89)	National Tactical Channel (data primary, voice secondary)
7AGs (58, 60, 67, 68, 78, 80, 85, & 88)	National Tactical Channels (air-to-ground communications)

800 MHz Band (806 – 824 MHz & 851 – 869 MHz)

Name	Notes
8CALL-90	National Calling Channel
8TAC-91 – 94	National Tactical Channels

APPENDIX C
Public Safety Mutual Aid Channels

Public Safety Mutual Aid Channels are limited to the VHF High frequency bands.

These channels are specific to each state and require licensing for use.

VHF High (148 – 174 MHz)

Name	Notes
VSAR-16	Dedicated to search and rescue operations
VFIRE-21 – 26	May be licensed for fire service use VFIRE-23 is common to Minnesota
VMED-28 – 29	May be licensed for EMS use VMED-28 is common to Minnesota
VLAW-31 – 32	May be licensed for law enforcement use VLAW-31 is common to Minnesota

APPENDIX D
State Interoperability Channels

State Interoperability Channels are Minnesota-specific channels.

These channels require licensing.

VHF High Band (148 – 174 MHz)

Name	Notes
VTAC-14-R	A repeated version of the Non-Federal Interoperability Channel VTAC-14, using a an input frequency licensed to the State of Minnesota
MNCOMM	Incident Management channel Formerly known as MIMS and Point-to-Point
DNRTAC1	Daily-use interoperability channel for DNR. Licensed by DNR.

700 MHz Band (764 – 776 MHz & 794 – 806 MHz)

Name	Notes
7SOA-1 – 2	Any use. Any user.

800 MHz Band (806 – 824 MHz & 851 – 869 MHz)

Name	Notes
8SOA-1 – 4	Any use. Any user.
FSOA-1 – 2	Dedicated for fire and EMS use.

APPENDIX E
VHF Interoperability Tower Sites

The following 109 sites are identified as the VHF interoperability tower sites:

Ada	Alden	Alma	Amherst	Arrowhead
Baxter	Bemidji	Benson	Bagley	Biscay
Blue Earth	Border	Brewster	Browns Valley	Buffalo
Caledonia	Canby	Cannon Falls	Cass Lake	Chandler
Crookston	Danube	Deer River	Dodge Center	Dorothy
Dresbach	Duluth	Eagle Lake	Effie	Elkton
Ely	Emily	Erhard	Freedhem	Freeport
Gaylord	Gheen Hill	Gleenwood	Grand Portage	Granite Falls
Greenbush	Gunflint East	Hardwick	Hawley	Hoffman
Janesville	Kabetogama	Kent	Kimball	La Salle
Lake Benton	Lake Bronson	Lawler	Leader	Litchfield
Little Fork	Long Prairie	Lonsdale	Madison	Mahnomen
Mankato MSU	Mantrap	Maple Hill	Margie	Mentor
Middle River	Morris New	Morton	Nashwauk	New London
Nickerson	Nicollet	Northcote	Northome	Oakland Woods
Onamia	Owatonna	Parkers Prairie	Pine City	Quadna
Red Wing	Roosevelt	Rushmore	Russel	Schroder
Schumacher	Sebeka	Shaw	Sherburne	Soudan
St Cloud	Thorhult	Tofte	Tracy	Viola
Virginia	Wales	Wanda	Warren	Waskish
Wheaton	Whyte	Wilson	Windom	Winter Silo
Wolf Lake	Woodland	Woods	Zimmerman	

APPENDIX F
Twin Cities Metro Conventional VHF Interoperability Resources

The following 11 sites are identified as VHF interoperability tower sites:

Cambridge	City Center	Empire
Ham Lake	Hennepin County Government Center	Medina
MnDOT Central Office	MnDOT Oakdale	North Branch
Norwood	Shakopee	

APPENDIX G
VHF Base Station Programming

The following channels should be programmed in each MTR2000 VHF base station, as allowed.

Primarily due to proximity to Canada, not every channel will allowed licensed by the FCC for use so some sites may deviate from this plan.

Name (D=simplex)	Notes
VCALL-10	Hailing. Stand by channel.
VTAC-11	Any use. Any user. Available to all public safety, nationwide.
VTAC-12	Any use. Any user. Available to all public safety, nationwide.
VTAC-14	Any use. Any user. Available to all public safety, nationwide.
VFIRE-23	Fire service use.
VMED-28	EMS use.
VLAW-31	Law enforcement use.
MNCOMM	Any use. Any user.
DNRTAC1	Interoperability with DNR Fire. Any user.

APPENDIX H
800 MHz Base Station Programming

The following 800 MHz National Interoperability Channels should remain available at the following sites.

Name	Notes
8CALL-90	City Center, Duluth, Enfield, Mankato, Moorhead, Red Wing, Saint Cloud, & Viola
8TAC-91	City Center, Duluth, & Moorhead
8TAC-92	Enfield & Red Wing
8TAC-93	Saint Cloud & Viola
8TAC-94	Mankato

Document Revision History

Version	Date	Changes
1		Original version. Approved by SECB.

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