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National Public Safety Planning Advisory Committee

REGION 22 MINNESOTA

REGIONAL PLAN

FOR THE USE OF 800 MHz CHANNELS

1 THROUGH 230

WITHIN THE STATE OF MINNESOTA

GEN DOCKET 87-112

800 MHz NPSPAC Plan Amendment WT Docket No. 02-55

NPSPAC PR Docket No. 93-130

RECOMMENDED FOR USE BY THE

NATIONAL PUBLIC SAFETY PLANNING ADVISORY COMMITTEE (NPSPAC)

MINNESOTA REGION 22 REVIEW COMMITTEE

June 2009

PREFACE

Responding to direction by the United States Congress in 1983 the Federal Communications Commission (FCC) adopted Report and Order 87-359 on November 24, 1987 for General Docket 87-112 the Minnesota Regional Planning Committee was convened and a plan for the allocations and use to the NPSPAC channels was submitted to the FCC. This plan was approved for Region 22, NPSPAC PR Docket No. 93-130.

Since that time a number of changes have occurred that required the FCC to issue WT Docket No. 02-55 which required the Regional plans to be modified to show the post rebanding channel numbers and frequencies. WT Docket No. 02-55 allowed for two options to meet this required plan change: a quick plan submission with the channel number and frequency changes only or a full plan amendment. Due to the frequency planning and new channel assignments for the Allied Radio Matrix for Emergency Response "ARMER" System a full plan amendment was required.

This plan amendment submittal includes the following Region 22 Plan amendments:

- **800 MHz NPSPAC Plan Post rebanding Frequency and Channel Shift. These changes are reflected in Exhibit "G" Region 22 NPSPAC Channel Assignments.**

- **New statewide ARMER System channel assignments. These new channel assignments are reflected in Exhibit "G" Region 22 NPSPAC Channel Assignments.**

- **Modification of Section 8.1.1: Removing the 3 Public Safety Channels and the Additions of statewide mobile to mobile channels from Scene of Action use by ARMER system users.**

- **Modifying Section 16.1 to reflect the change from the Metro Area planning to statewide planning.**

- **Minor reformatting of the Region 22 Plan to clean it up and into an electronic document.**

The Region 22 modified plan and exhibits are viewable at:
http://www.srb.state.mn.us/ARMERDispArt.asp?aid=432

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EXECUTIVE SUMMARY

For those individuals who have been involved with the planning of Public Safety Land Mobile Radio systems and are familiar with frequency coordination guidelines for such systems, it will be immediately recognized that the technical requirements set forth for these particular 800 MHz channels, as they relate to the confinement of signal propagation, are considerably more stringent than what has been previously required for other commonly used Public Safety radio frequencies.

In most heavily populated areas of the country, and certainly within many areas within the State of Minnesota, public safety communications has for years been seriously compromised by frequency congestion and destructive interference from nearby adjacent and co-channel users. At first glance the 230 additional radio channels, recently made available by the FCC in the "NPSPAC" (National Public Safety Planning Advisory Committee) allocation and contained in this plan, may appear to be a lasting solution to such problems. It can only approach that however, if we plan, manage and continue to use these, and all other channels, in the most possible efficient manner.

Strict limitations are essential and will be placed on the geographical area over which a user's communication system, utilizing these NPSPAC channels, can propagate. Limitations will be placed on the transmitter output power (ERP), antenna heights and, where necessary, require the use of special antenna patterns to control unnecessary signal propagation. For all systems utilizing these channels, the geographical area covered by the base station's signal must be limited to only the legal jurisdiction of the applicant plus a very small distance beyond, typically three (3) air miles. Exceptions to this will be very rare and can only be made when extreme circumstances justify it and compatibility can be maintained with the frequency assignments for other nearby areas in the state outlined in this plan.

It is not realistic to expect that a user will never need to communicate beyond their jurisdictional boundaries, however if every system were capable of transmitting well beyond their jurisdictional boundaries chaos would soon return to Public Safety communications even in the 800 MHz band.

Being able to communicate with other Public Safety agencies during major disasters when joint response is being made has been a serious shortcoming in many present day systems. In this NPSPAC allocation of frequencies the FCC has mandated that five (5) specific channels be used for "common cannel" use throughout the nation thereby providing a communication link among all jurisdictions in areas using the NPSPAC channels. All 800 MHz systems utilizing NPSPAC channels will be required to include these "common channels" in their system so that this very essential objective will be achieved.

The radio channels contained in this allocation are primarily intended to be used in systems utilizing "trunking technology" and in fact is required by the FCC in any system utilizing five (5) or more channels. Although systems utilizing less then five (5) channels are not required to "trunk", adjacent jurisdictions, and even counties may find it rewarding and cost effective to combine their channels and utilize "trunking technology". This technique not only may prove cost effective but also would allow such users to realize the many other benefits of a "Trunked" radio system that otherwise may not be affordable.

In some of the less populated counties of the state where "trunking systems" are not needed, or contemplated, the use of the 800 MHz radio channels contained in this Plan with their seemingly stringent restrictions may be inappropriate. For those particular applications there are numerous other similar 800 MHz channels that have no "trunking" requirements, or stringent restrictions on antenna height, and coverage, that are attached to the NPSPAC channels. At the time of this writing such channels are for the most part very lightly used throughout the state of Minnesota and are available for both "conventional" and "trunking" system use by all Public Safety jurisdictions through the normal FCC application procedures.

In the more heavily populated areas of the state however these new radio channels, when properly planned and used, will bring greatly needed relief to Public Safety agencies who have been hampered in their attempts to utilize the modern technology that is rapidly emerging and so necessary for present day emergency communications systems.

1.0 SCOPE:

1.1 INTRODUCTION:

In December of 1983, the United States Congress directed the Federal Communications Commission (FCC) to establish a plan to ensure that the communications needs of the state and local public safety authorities would be met. By their regular means of initiation, the FCC began the process of developing such a plan. Through their efforts, and the efforts of the National Public Safety Planning Advisory Committee (NPSPAC) the plan was begun.

The National Public Safety Planning Committee provided an opportunity for the public safety community and other interested members of the public to participate in an overall spectrum management approach by recommending policy guidelines, clinical standards, and procedures to satisfy public safety needs for the foreseeable future. After consideration of NPSPAC's final report and comments filed in Docket No. 87-112, a Report and Order was released by the FCC in December 1987, which established a structure for the development of regional plans.

The National Plan provides guidelines for the development of regional plans. The particulars of this plan are found in FCC Docket 87-359, which contains the required steps and contents for regional plan development. It is on that document that this plan is developed.

1.2 PURPOSE:

Public Safety communications has, for many years, been inadequate throughout much of the United States. This is equally true for many of the United States. This is equally true for many areas of Minnesota where public safety radio users are constantly experiencing interference from other users in adjacent or nearby jurisdictions, who, because of necessity must share the same channel. Many public safety radio communications systems, because of their design and terrain characteristics, propagate signals much beyond their licensee's immediate service areas and interfere with other systems sharing the same channel. The metropolitan area of St. Paul/Minneapolis, where fifty-two (52) per-cent of the state's population is concentrated, borders the State of Wisconsin and must therefore also share and compete for channels used in several counties of Wisconsin.

Trunking technology will greatly improve on the utilization of the limited spectrum thus providing room for growth as the demands for public safety services increases. Trunking will provide greater compatibility of communications systems when emergency conditions require coordinated responses by other jurisdictions and

departments. Public Safety communications systems in different jurisdictions, and in many instances even within the same jurisdiction, are not always compatible with each other, thus placing serious limitations on their ability to communicate when joint responses are required. Although a nationwide Police channel is available that permits Law Enforcement personnel to communicate across jurisdictions, other Public Safety fleets do not have access to this or any other similar common channels.

This regional plan was developed with the objective of assuring all levels of Public Safety and Public Service agencies that radio communications in the near and distant future will not suffer from the problems of the past. The allocation of frequencies was done in as equitable a way as possible. A minimum of four (4) channels were allocated for use in each county in the state regardless of the total population. This allocation exceeds the "one channel per 25,000 population" formula that was first suggested for Regional Planning guidelines.

The National Plan, as developed by NPSPAC, was followed very closely for frequency allocation, reuse, turn back, regional interoperability, spectrum requirements and adjacent region operations. Strict guidelines have been established to insure proper design of communications systems so that unnecessary and harmful propagation into other areas does not occur. Antenna heights and ERP will be limited to only that necessary to provide a 40 dBu signal level throughout the applicant's service area. Intercommunications between un-like systems will always be possible on the common mutual aid channels. The use of remote receivers may be required to provide adequate "talk back" by both portable and mobile units where a single receive site would not be adequate. In some areas, especially those with irregular terrain and wide area jurisdictions, multiple transmitter sites will most likely be necessary. Every effort must be made to consolidate frequency allocations are to be expected to accommodate the needs of Public Safety communications for the foreseeable future. This plan should provide the flexibility to accommodate the growth and changes which are bound to occur in public safety and public service communications operations long into the future.

2.0 AUTHORITY:

2.1 REGIONAL PLANNING COMMITTEE:

See Exhibit A for a copy of the original Region 22 plan submission containing the regional planning committee information.

2.2 NOTIFICATION TO CONVENE:

See Exhibit A for a copy of the original Region 22 plan submission containing the notification to convene.

2.3 ORGANIZATIONAL MEETING:

See Exhibit A for a copy of the original Region 22 plan submission containing information on the organizational meetings.

2.4 ELECTED REGION 22 PLANNING COMMITTEE OFFICERS:

See Exhibit A for a copy of the original Region 22 plan submission containing information on the planning committee officers.

2.5 REGION PLAN APPROVAL:

See Exhibit A for a copy of the original Region 22 plan submission containing information on the approval of the original plan.

3.0 NATIONAL INTER-RELATIONSHIPS:

The Regional Plan is in conformity with the National Plan. If there is a conflict between the two plans, the National Plan will govern. It is expected that Regional Plans for other areas of the country may differ from this plan due to the broad differences in circumstance, geography, and population density. By officially sanctioning this plan the Federal Communications Commission agrees to it's conformity to the National Plan. Nothing in the Plan is to interfere with the proper functions and duties of the organizations appointed by the FCC for frequency coordination in the Private Land Mobile Radio Services, but rather it provides procedures that are the consensus of the Public Safety Radio Services and Special Emergency Radio Service user agencies in this Region. If there is a perceived conflict then the judgment of the FCC will prevail.

3.1 FEDERAL INTER-OPERABILITY:

Interoperability between the Federal, State and Local Governments during both daily and disaster operations will primarily take place on the five common channels identified in the National Plan. Additionally, through the use of S-160 or equivalent agreements, a licensee may permit Federal use of a non-Federal communications system. Such use, or other than the five identified common channels, is to be in full compliance with FCC requirements for government use of non-government frequencies (Title 47 CFR, sec 2.103). It is permissible for a non-Federal government licensee to increase channel requirements to account for 2 – 10 percent increase in mobile units, dependent on the amount of Federal Government Agencies involvement in it's area, provided that written documentation from Federal agencies supports at least that number of increased units.

4.0 REGIONAL REVIEW COMMITTEE:

Upon approval of the Original Plan by the Federal Communications Commission, NPSPAC PR No. 93-130, a Region Review Committee was established for Region 22 for the review of applications which do not fall within the stated guidelines provided for in this plan, to arbitrate disputes concerning this plan and/or it's application, monitor compliance by existing users of their channel loading and other requirements and to formulate any necessary modifications to the Regional Plan as circumstances may require.

The Review Committee was convened after the Plan was adopted and in order to maintain uniformity in it's proceedings, By-Laws and Operating Procedures were adopted by the Region 22 Review Committee.

Members of this committee must be regular full-time employees of organizations eligible for radio authorizations in these Public Safety Radio Services and to be selected as follows:

Chair:

Until the end of the first full calendar year following the date on which the Review Committee first convened, the Chairperson of the Region 22 Planning Committee. At the final meeting of this first full calendar year a chairperson should be elected from the membership of the Review Committee and thereafter at the end of each calendar year or as otherwise provided for by any adopted By-Laws and Operating Procedures.

Members will consist of:

1. **The APCO Frequency Coordinator for the Police and Local Government Radio Services within Minnesota.**
2. **A member appointed by the Minnesota State Fire Chief's Association.**
3. **A member appointed by the Minnesota State Police Chief's Association.**
4. **A member appointed by the Minnesota State Sheriff's Association.**
5. **A member appointed by the President of the Minnesota Chapter of APCO**
6. **A member appointed by the Minnesota Ambulance Association.**
7. **A member appointed by the Minnesota Chapter of the American Public Works Association.**
8. **A member of ASSHTO (American Association of State Highway and Transportation Officials) to represent Minnesota Highway Engineers responsible for highway maintenance radio systems.**
9. **A member appointed by the Association of Minnesota Emergency Managers.**
10. **A member appointed by the State of Minnesota's Commissioner of Public Safety.**
11. **A member appointed by the Governor of Minnesota.**

Terms of membership to this committee should be defined in the BY-LAWS AND OPERATING PROCEDURES of the Review Committee.

Although the membership described above should encompass all expected users of these frequencies in the near future, the Chairperson must insure that all licenses have a voice in the proceedings of the Review Committee. This may require additional members from either user groups not specifically identified herein.

Since this committee may not have a regular business schedule the local frequency coordinators for the Radio Services using these frequencies will be expected to notify the Review Committee Chairperson of matters requiring the attention of the Review Committee. It is recommended, however, that at least one meeting be conducted during each calendar year for the purpose of reviewing all license activity and to anticipate future problems in the Plan's implementation.

Due to the changes available in technology, travel time restrictions and the lack of ability to pull the Review Committee together for regular meetings, email notifications and reviews have been the

standard practice for the Region 22 Review Committee. See Exhibit B for a listing of the members on the notification list.

5.0 SPECTRUM UTILIZATION:

This portion of the Plan provides a basis for proper spectrum utilization. Its purpose is to guide the Local APCO Frequency Advisor and/or the Regional Review Committee in their task of evaluating the implementation of this plan within this Region.

5.1 REGION DEFINED:

Region 22 is the State of Minnesota. This region is the result of definition by the Federal Communications Commission as a result of recommendations made in the National Public Safety Planning Advisory Committee (NPSPAC) plan as submitted and approved and contained in Docket 87-112. For purposes of this plan the State of Minnesota shall be defined as all the lands and waters contained within the boundaries of the State of Minnesota.

5.2 REGION PROFILE:

The purpose of this section is to provide the basis for the assignment of frequencies, and their re-use. Since the frequency allocation formula used is based to a degree in population within a county, it is necessary to provide this information within this plan. Below is the data used in the determination of frequency allocations.

5.3 POPULATION:

The 1990 Census indicates a population of 4,375,099 for the State of Minnesota (Region 22). Population in each of the eighty-seven (87) counties within Region 22 is illustrated in EXHIBIT "D".

5.4 GEOGRAPHICAL DESCRIPTION:

There are 87 counties in the state with a total surface area of approximately 80,000 square miles.

Approximately 10% of the total surface area in the state is classified as water basins and wetlands.

The largest county is St. Louis, with a total area of 6.125 square miles. The smallest county in geographical area (154 square miles) is Ramsey, however, it is the second most populated in the State and contains more than 11% of the State's total population. Hennepin County, with 611 square miles and adjacent to Ramsey, contains 23% of the State's total population.

The seven (7) counties comprising the Minneapolis/St. Paul metropolitan area accounts for 52.3% of the State's total population, yet only 3.5% of the total land area. Conversely, many of the out-state counties have a relatively sparse population, however the state's four (4) smallest counties in geographical size are in the seven county Minneapolis/St. Paul metropolitan area and contain approximately 17% of the state's total population.

As defined by the U.S. Census Bureau the population of the State in the 1990 Census is classified as 69.9% being URBAN and 31.1% RURAL. This compares with the National Average of 75.2% being URBAN. For purpose of definition, URBAN is considered a population of 2500 or more residents.

All of these items were taken under consideration in the allocation plan.

6.0 USAGE GUIDELINES:

All systems operating within the Region having five or more channels will be required to be trunked. The FCC, in its Report and Order States, "Exceptions" will be permitted on the trunking requirement only when a substantial showing is made that alternative technology would be at least as efficient as trunking or that trunking would not meet operational requirements. Exceptions will not be granted routinely, however, and strong evidence showing why trunking is unacceptable must be presented in support of any request for exceptions.

Those systems having four or less channels may be conventional or trunked although as counties experience rapid growth in the future it may be prudent for both economic and operational considerations that counties pool their channels and implement a multi-county trunked system.

Systems of four or less channels operating in the conventional mode who do not meet FCC loading standards will be required to share the frequency on a non-exclusive basis.

Public Safety communications at the state level, as it impacts the Region, will be reviewed by the Committee. State-wide public safety agencies will submit their communications plans for impact approval if they utilize communications systems within the Region and those portions of such systems within the Region and those portions of such systems must be compatible with the Regional Plan.

The next level of communication coverage will be a county/multiple municipality area. Those systems that are designed to provide area communication coverage must demonstrate their need to require such wide area coverage. This would apply in a situation such as a city requesting coverage of an entire county. Communication coverage beyond the bounds of a jurisdictional area of concern cannot be permitted unless it can be substantiated that such radio coverage is critical to the protection of life and property. If the 800 MHz trunked radio technology is utilized, the system design must include as many county/multiple municipality government public safety and public service radio users as can be managed technically.

The county/multiple municipality agency (ies)), depending upon systems within an area, must provide intercommunications between area-wide systems. In a multi-agency environment, a lead agency or organization having primary response obligations in the geographic implementation the Common Channels in this band as mandated by the National Plan. Such implementation must be reviewed and approved by the local APCO Frequency Advisor, at his/her discretion, the Regional Review Committee.

Municipal terminology often differs. In order to provide a title for the next level of communications the term "municipal" is used to define the level below county-wide. "Municipal" communications for public safety and public services purposes must provide only the communications needed within its boundaries. However, if the total number of radios in service does not reach minimum loading criteria for a trunked system, that agency must consider utilizing the next higher system level if 800 MHz trunked radio is available in the area. As those higher level systems reach capacity, the smaller system communicators in public safety and public service must then consider uniting their communications efforts to formulate one large system or forfeit use of the limited 800 MHz spectrum.

Where smaller conventional 800 MHz needs are requested, those frequencies to be utilized must not interfere with the region's trunked systems. The 800 MHz trunked radio system is to be considered the higher technology at this time and in greater compliance with FCC guidelines. The amount of interference that can be tolerated depends on the service affected. Personal life and property protection shall receive the highest priority and disruptive interference with communications involved in these services in an area shall not be tolerated. Any co-channel interference within an authorized area of coverage will be examined on a case by case basis by the Regional Review Committee.

6.1 TECHNICAL DESIGN REQUIREMENTS FOR LICENSING:

6.2 DEFINITION OF "COVERAGE AREA"

"Coverage area" referred to in this Plan is that geographical area throughout which the applicant has primary jurisdiction, plus approximately three (3) miles, and throughout which the radio "base Station (s)" to be installed are intended to provide a minimum received signal strength of 40 dBu (decibels above 1 microvolt, equivalent to approximately 4.6 microvolts across 50 ohms at 850 MHz) to the associated mobile stations.

6.3 SYSTEM COVERAGE LIMITATIONS:

Every effort must be made to ensure the most possible re-use (shared) of spectrum by confining signal radiation of system to only the geographical area radiation of a system to only the geographical area throughout which the applicant has primary jurisdiction. It is recognized however that radio signals do not stop at jurisdictional borders nor do jurisdictional boundaries rarely center around a considerations however must be given in the systems design to achieve this valance of signal propagation to the utmost.

Overlap or extended coverage must be minimized, even where systems utilizing 800 MHz trunked radio systems are proposing to inter-mix systems for cooperative and/or mutual aid purposes.

Antenna heights are to be limited to provide only the necessary coverage for a system. When antenna locations are restricted to only the "high-ground", transmitter outputs and special antenna patterns must be employed to produce only the necessary coverage with the proper amount of ERP.

The following criteria must be met in the design of communication systems utilizing frequencies in this provided by the desired stations throughout the intended coverage area:

1. **BASE TO MOBILE:**
   - **(a) Signals from co-channels base stations must not exceed 5 dBu (approximately .08 microvolts across 50 ohms @ 853 MHz) at any point within other coverage areas.**
   - **(b) Signals from next-adjacent offset-channel base stations must not exceed 25 dBu (approximately .08 microvolts @ 853 MHz at any point within other coverage areas.**

2. **MOBILE AND CONTROL STATIONS:**

(a) Mobile and Control stations from co-channel systems shall provide a minimum of 35 dB protection to other co-channel base receivers.
(b) Mobile and Control stations shall provide a minimum of 15 dB protection to receivers operating on next – adjacent – offset channels.

The use of "satellite receivers" should be used to enhance the talk back of low powered transmitters.

The location and design of such systems however must anticipate the potential for interference from other systems operating within this plan's guidelines. The criteria listed above is intended to provide protection to only receivers located at the base or mobile relay station site.

Applicants choosing to operate a system with less than a 40 dBu signal contour within their coverage area should be cognizant that noticeable co-channel interference may be experienced from other co-channel users who have systems conforming to these radiated power limitations.

3. USE OF FREQUENCIES IN AIRCRAFT

(a) The degree to which these 800 MHz channel are to be "re-used" within the Region and their assignments in adjacent Regions require that their use in aircraft be restricted. Limitations are:

(1.) A maximum ERP of 1.0 watt above 500 ft AGL.
(2) No transmissions on the "local channels" above 2,000 ft AGL.
(3) No transmissions on "common channels" above 5,000 ft AGL
(4) Avoid using the input frequency to the mobile relay station and use the "talk-a-round" mode whenever possible.

6.4 DETERMINATION OF COVERAGE:

There are four variables used in determining the area of coverage of a proposed system. These variables are (1) the required strength of the received signal, (2) antenna height above average terrain (HATT), (3) the effective radiated power (ERP) of the system, and (4) the type of environment.

Received Signal Strength:
For purposes of this plan, received signal strength shall be the determining factor which defines the actual boundary of a system. The signal must not exceed 40 dBu.

Antenna Height:
Shall be the height of the antenna above the average terrain surrounding the tower site.

Effective Radiated Power (ERP):
The ERP is the transmitter output power times the net gain of the antenna system. The actual formula is:
ERP (watts) = watts x antilog (net gain/10)

Environment Type:
OKUMURA/HATA METHOD – The Okumura method uses four different classifications to describe the average terrain around a transmitter site or area. The classifications are:

1- URBAN;	**Which is build up city crowed with large buildings or closely inter-spread with houses and densely grown trees. This would include the downtown area of a major city.**
2 – SUBURBAN;	**Which is a city scattered with trees, houses and buildings. This would include the downtown area of a large city.**
3 – QUASI- OPEN;	**Is a area between suburban and open areas. This includes areas outside of city limits that have few buildings and houses.**
4 – OPEN;	**Is a area where there are no obstacles such as tall trees or buildings in the propagation path or a plot of and which is cleared of anything for 300 to 400 meters ahead. This would include farm land, open fields, etc.**

The Okumura/Hata method is the method resident in the computer packing program to develop this plan. A minimum system shall be permitted without special consideration when it is limited to an HAAT of 100 feet and the transmitter is centrally located within the jurisdiction or jurisdictions participating in a system. In all jurisdictions, regardless of size, a maximum boundary radius of 8 miles shall be allowed provided adequate measures have been taken to

assure that interference of existing co-channel and adjacent requirements shall be the responsibility of the applicant. The Federal Communications Commission provides, in part 90.309 (a) (4) of the Rules and Regulations, Some additional guidance for these calculations.

6.5 ANNEXATIONS AND OTHER EXPANSIONS:

It is well known that as cities grow, annexations occur. When an expansion of the present city limits of any city currently using an 800 megahertz system within the spectrum as herein specified occurs, it is understood that the existing system may have to be expanded and its range increased. This is a modification and may be permitted. The increased range of the system will have to be determined at the time of modification to assure non-interference with any other existing system. Where interference is likely, the use of alternate methods of expansion, such as satellite systems or multiple transmitter sites with reduced heights may be necessary. Should the annexation or expansion of a city effectively take in all or most of a county, the allocation for that county may be given to the city if required by said city and not in use or planned to be used by the county. Where more spectrum is not available from the initial allocations, the rules for expansion of initial allocations, as contained in this plan, shall apply.

6.6 COVERAGE AREA DESCRIPTON:

All applicants shall provide with their applications a map showing the jurisdictional boundaries to be covered by the system, with the calculated system coverage displayed graphically. This map must display the location of all systems, with the calculated system coverage displayed graphically. This map must display the location of all system
transmitter (s), including control stations. It is recommended that a U.S. Geological Survey (USGS) Quad topographical map be used for this purpose. If not available, a high quality locally produced map such as a highway map may be substituted. Regardless of the type of map used, the name of the applicant and the scale of the map shall be displayed on the map.

The field strength in dBu/KW versus distance and antenna height for the suburban environments relative to the suburban environment are:
Urban = Suburban – 9.7 dB
Quasi-open = Suburban + 9.2 dB
Open = Suburban + 18.4 dB

6.7 RE-ASSIGNMENT OF FREQUENCIES:

All agencies participating in the use of this new 800 MHz spectrum shall prepare and submit a plan for the abandonment of any currently licensed frequencies in the lower bands that are presently being used for the activity to be conducted on the new 800 channels. The regional planning committee would have the freedom to consider below-800 MHz public safety bands in further development of their regional plans, but the licensing of channels in these bands would continue to be conducted through existing frequency coordination procedure.

Lower band frequencies that are replaced by these 800 MHz channels can not be automatically retained or "handed down" to another agency in their respective jurisdiction. Such re-use of frequencies can only be accomplished through the regular procedure followed for a new application.

The time frame allowed for phasing out of lower band frequencies and into 800 MHz and will normally be one (1) year. Any agency requiring more than one year must provide documents stating the reasons for the delay and give the estimated time of completion. Such extensions are subject to approval by the FCC.

6.8 UNUSED SPECTRUM:

Since all of the frequency spectrum is not needed at this time, the excess channel pairs will be returned to a reserve pool. These channels may be used for conflict with adjacent Region allocations or may simply remain within this Region until needed. This does not imply that these frequencies are unavailable, only that before they can be utilized within the Region they must be coordinated via the regular APCO coordination process and within the guidelines set forth in this plan. Where, possible the cannels designated for a jurisdiction in this plan shall be used.

Additional assignments to be made from the "unused spectrum" pool, when proposed for areas within seventy-five (75) miles of a bordering state or region shall be first coordinated with that bordering state or region.

6.9 COORDINATION OF STATE-WIDE/COMMON CHANNELS:

As the use of the five national channels is not considered of day-to day function, coordination for the use of these channels is not considered to be necessary or advisable. The use of these channels will always be on a non-interference basis, with on-the-air coordination at the time of use when required. Any user found to be operating in any manner other than this shall be considered to be operating improperly and

subject to the existing Federal Communications Commission rules for willful interference with the communications of other users.

The block of thirty (30) additional channels allocated for "statewide" use were derived from the alternating blocks of thirty (30) channels used in the Illinois, Indiana, Michigan and Wisconsin Regions.

7.0 INITIAL SPECTRUM ALLOCATION:

7.1 FREQUENCY SORTING ALLOCATION:

The initial spectrum allocation for the Region was determined by a computerized frequency sorting process performed by APCO/CET. The purpose of the computer program which assigns frequencies to specific eligibles, if specified, or pool. Acceptable interference probabilities are determined for the Region. Frequency assignments are goals of spectrum efficiency and interference protection. The following narrative describes the factors and process used by the computer program.

7.2 GEOGRAPHIC AREA:

For the purpose of this frequency sort, a geographic area is defined as one or more circles of equal radius. To the degree practical, the circle (s) should include the entire area of the geo-political boundary, but not exceed the boundary by more than three (3) miles. Thus, the procedure is to gather maps of sufficient detail, determine the coordinates and radius of the circles which define each area, and tabulate the data.

7.3 DEFINE THE ENVIRONMENT:

The environment of each system is defined according to the Okumura/Hata method of classifications described elsewhere in this plan.

7.4 BLOCKED CHANNELS:

In the Region there are five mutual aid channels which must be blocked out to prevent the computer from making assignments on these channels. (Since the mutual aid channels are spaced at 0.5 MHz intervals, other region wide systems are spaced at 0.5 MHz and placed adjacent to the mutual aid channels. This procedure reduces the impact of blocked adjacent channels by virtue of the fact that the channel plan already has protection spacing on each side of the mutual aid channels.)

These Region-wide blocked channels are identified by FCC channel number, tabulated and they become input to the computer program.

7.5 TRANSMITTER COMBINING:

The computer program is designed to provide a minimum frequency separation between any two channels assigned to the same eligible at the same site. This separation is provided in order to enable more efficient combining of multiple transmitters to a single antenna. These separate blocks of frequencies also have a maximum size. That is, if the eligible has more frequencies than the maximum size of the combining block, then a second compatible block is created, and so on. Each of these parameters is adjustable in the program on a global basis. The default parameters chosen are 0.25 MHz minimum spacing and five channel blocks.

7.6 SPECIAL CONSIDERATIONS:

There are licensees in the 806-821/852-866 MHz spectrum who plan to expand existing systems to into the 806-809/851-854 MHz bands. Some of the existing radio units are unable to operate on 12.5 KHz separated carrier frequencies. The result is that these radios can only operate on "even" FCC numbered channels in the 806-809/851-854 MHz band. The computer program is able to take this into account when making assignments.

7.7 PROTECTION RATIOS:

There are two interference protection ratios built into the computer program. One is for the co-channel case; the other is for the adjacent channel case. The ratios provide 35 dB Desire/Undesired signal ratio for co-channel assignments, and 15 dB Desire/Undesired ratio for the adjacent channel case. These ratios provide an acceptable probability of interference for Public Safety Services.

7.8 ADJAACENT REGION COORDINATION:

The computer program requires a listing of channels to be blocked along the borderline with other regions which have pre-existing plans. If the adjacent region plan was developed using the APCO/CET packing program, this information exists in the data base.

All regions bordering Minnesota are being "packed" by the APCO/CET program and have received a copy of this plan.

Although channels 28, 66,104,142,180, and 220 have been assigned in certain Minnesota counties their proposed use within seventy-five (75) miles of the Wisconsin border must first be coordinated with the Wisconsin Region.

Channels assigned for Statewide use and their adjacent guard channels are to be shared and coordinated with the adjacent States and Regions.

7.9 FREQUENCY ALLOCATION PROCESS:

The method used for "packing" Region 22 was also the APCO/CET computerized method. The approximate geographical location for the center of each county, in latitude and longitude, were provided along with the environmental type of the county and the approximate radius to cover the county lines. Along with this information, a list of frequencies to block along the adjacent region's border was included. The actual assignment of frequencies is for a minimum of four (4) channel-pairs to be used in each county. To the extent possible the "one channel per 25,000 population formula" was followed for the greater seven county Minneapolis/St. Paul metropolitan area however, this was not entirely possible. In anticipation of expected rapid growth for certain "outer ring counties" in and adjacent to this metro area, the committee attempted to allocate more than the minimum of four channels however, this was not possible.

Twenty-seven (27) channels have been allocated for "statewide" assignments for use by the State of Minnesota. These channels shall provide the various state agencies with the channel capacity to insure the interoperability necessary when employing many different agencies and governmental service providers over large areas and requiring command and control over such wide spread operations.

Three (3) channels have been allocated for "statewide" assignments for use by <u>all</u> eligible applicants requiring wide area coverage such as drug enforcement or other application requirements not appropriate for the five National Mutual Aid channels.

7.10 FREQUENCY ALLOCATION MAP:

EXHIBIT "E" illustrates the geographical outlines of the State of Minnesota and its eighty-seven (87) counties.

EXHIBIT "F" displays the planned site locations within each county for the Statewide Shared Public Safety Radio System being built in Minnesota also referred to as the Allied Matrix for Emergency Response or "ARMER" System.

EXHIBIT "G" contains the channel assignments for the planned ARMER site and also assigns channels within each County for use by the Counties.

8.0 COMMUNICATIONS REQUIREMENTS:

8.1 "Common Channels" ("Mutual Aid") Implementation a very

essential requirement of this plan and benefit to be derived from its implementation is the needed enhancement of inter-agency communications, not only between agencies based in a common geographical area but also by transient vehicles from other jurisdictions who may be assisting or otherwise traveling outside their service area (s). Five (5) channels in this 800 MHz allocation have been mandated by the FCC for this "common channel" purpose, one of which is a nation-wide "calling channel" to be used only for the purpose of establishing initial contact when inter-agency communications is desired.

8.1.1 ADDITIONAL "COMMON CHANNELS"

In addition to the five Mutual Aid channels required by the FCC, the ARMER System has assigned 6 Scene of Action "SOA" channels for mobile to mobile use. These channels are 225 – 230. These channels are operated radio to radio in the digital (Project 25) mode. The use of these channels is outlined in the Statewide Radio Board Standard 3.15.0 available at:

http://www.srb.state.mn.us/ARMERDispArt.asp?aid=412

The implementation of the International Common Channels must follow the guidelines as set forth by the Federal Communications Commission by the approval of the National Plan. These five common channels are accessible by all levels of government and shall be used in accordance with the provisions of the National Plan.

As new 800 MHz "service areas" are developed, for example a "county", provisions must also be made to provide communications on at least two (2) of the national common channels (the "calling" plus a "TAC" channel) throughout the service area. Considering the number of jurisdictions served, their diversity in mission and quantity of mobile units, additional "TAC" channels may be required.

It is beyond the scope of this Plan to identify the source of funding for such equipment however a cooperative effort by all jurisdictions may be most acceptable. The "licensee" in most instances should be the county throughout which the system is intended to cover.

In those instances where only and individual agency, or only a small percentage of agencies in a "service area" applies for 800 MHz channels and others in the area continue to use lower frequency bands, the application must describe how "inter-communications with

other departments located in that service area, and with transients from other areas, will be accomplished. Interfacing the 800 MHz system with the existing "MINSEF" (155.475 MHz) system may be required to meet this objective.

In any area where 800 MHz common channel stations are installed, at least one agency must be required to monitor this channel at all times. The area of coverage provided by this channel must provide radio coverage throughout the area which the network serves. This may or may not require the use of satellite receivers within the area to meet this requirement.

Mutual Aid stations required by this Plan must be capable of functioning as a mobile relay station. Mobile units, including portable transceivers, must also have the capability of communication directly to other similar units without the mobile relay station in what is commonly referred to as "talk around".

The four International Tactical (ITAC) channels will be assigned State-wide, for use as needed by all eligible licensees. These channels are to be used in accordance with the National Plan and in compliance with the regulations as set forth by the Federal Communications Commission. These channels require no special licensing, for mobile and portable transceivers, only that the users have an authorization for Public Safety 800 MHz channels as specified in section 90.617 (a) of the FCC Rules and Regulations. Control stations must be licensed in the name of the department where installed.

8.2 AREAS OF OPERATION:

The common channels shall be available for use throughout the Region. No specific locations are specified within the Region.

8.3 OPERATION ON THE COMMON CHANNELS:

Normally, the five inter-operable channels are to be used only for activities requiring inter-communications between agencies not sharing any other compatible communications system. Inter-operable channels are not to be used by any agency for routine, daily operations. In major emergency situations, one or more ITAC channels may be assigned by the primary Public Safety Agency within that area of operation. The primary Public Safety Agency within each county, if not defined elsewhere in the plan should be the County Sheriff, State Patrol, or other Public Safety Department that has assumed the role of "incident commander" for the incident being attended, which may be any agency licensed to operate in this spectrum.

Participants in the inter-operable channels include Federal, State, and units of Local Government within the State of Minnesota. Police, Fire, and providers of Basic and Advanced Life support services will be the primary using agencies. If radio channels re available, other services provided for in the Public Safety Radio Services and the Special Emergency Radio Services may also participate to the extent required to insure the safety of the public.

It is recommended that a committee be established in the Region to formulate and enforce uniform procedures for the implementation, administration and use of these "common channels" on a state-wide basis. The committee must have a fair and proportionate representation by all the various user categories eligible for and using these channels. If acceptable by the State of Minnesota's Commissioner of Public Safety, this task may be performed by the existing "MINSEF" Committee that oversees the use of the 155.475 MHz Emergency channel throughout the state. In the absence of any such commitment by the "MINSEF" Committee" the Regional Review Committee must assume this responsibility.

8.4 OPERATING PROCEDURES: (MUTUAL AID CHANNELS)
On all Common Channels, plain English will be used at all times, and the use of unfamiliar terms, phrases, or codes will not be permitted.

8.4.1 INTERNATIONAL CALLING CHANNEL (ICALL)
The ICALL channel shall be used to establish contact with other users in a particular Region that can render assistance at an incident. This channel shall be utilized as an on-going working channel. Once contact has been established between agencies, an agreed upon ITAC or Mutual Aid channel shall be used for continued communications.

8.4.2 INTERNATIONAL TACTICAL CHANNELS (ITAC-1 – ITAC-2)
These frequencies are reserved for use by those agencies involved in inter-agency communication. Incidents requiring multi-agency participation will utilize these frequencies as directed by the control agency assuming responsibility for an incident or area of concern. These frequencies may be subdivided according to function in an incident or by geographical location in response to an incident. Unless otherwise provided for by the Region Review Committee, it is recommended that the following assignments for ITAC-1 through ITAC – 4 be used where diversity requires it.

ITAC-1……Law Enforcement
ITAC-2……Fire Services
ITAC-3……Emergency Medical Services
ITAC-4……Command and Control

8.5 CODED SQUELCH (MUTAL AID CHANNELS):

All equipment capable of operating on the five (5) common channels shall be equipped with the National Common Tone Squelch of 156.7 Hz. Mobile relays on these channels, if authorized, may use additional tone or digital squelch codes for the purpose of selecting individual mobile relay stations, provided the National Common Tone Squelch Code is used on the output. If such an arrangement is utilized, provision must also be made for certain centralized high level sites to be activated by the 156.7 tone to ensure emergency access by transient units.

8.6 NETWORK OPERATING METHODS:

Communications systems on ITAC-1 thru ITAC-4 will be implemented by agencies who volunteer on a distributed coordinated basis. Every primary geographic section of the Region is attended to be covered by at least one ITAC channel. In many areas the common channels will be utilized on a mobile to mobile talk-around basis. Mobile relays on ITAC-1 thru ITAC-4 will be on a limited coverage design to permit reuse of the channels several times within the Region and in the adjacent regions. Since Region 22 will probably not have a large number of stationary ITAC channels stations, the implementation of mobile relay or repeaters is strongly encouraged. This will fill an "on-scene" requirement for most multi-agency response situations.

Adjacent region coordination will be via existing mutual aid coordination procedures with the requesting region establishing the tactical frequency assignment.

9.0 TRUNKING REQUIREMENTS:

All systems operating in the Region having five or more channels will be required to be trunked. Those systems having four or less channels may be conventional however it is strongly recommended that any entity licensing three or more "repeaters" use trunking technology in their equipment.

The FCC in its Reports and Order states: "Exceptions will be permitted only when a substantial showing is made that alternative technology would be at least as efficient as trunking or that trunking would not meet operational requirements. Exceptions will not be granted routinely and strong showings as to why trunking is unacceptable must be presented in support of any request for exception."

Depending on systems loading and the need for multiple systems within an area, operator of wide area systems within an area, operators of wide area systems (including, but not limited to, designated "Monitoring Agencies") must provide for coordination between area-wide systems and "Monitoring Agencies". Single municipalities or agencies must restrict design and implementation of their systems to provide only the communications needed within its geopolitical boundaries. The use of trunked systems is encouraged, however if the total number of radios in service does not reach minimum loading criteria for a trunked system, that user must consider consolidating their communications systems to formulate one large trunked system.

10.0 CHANNEL LOADING REQUIREMENTS:

An agency/jurisdiction requesting its first single frequency to replace a frequency currently in use that will be turned back for re-assignment will not be required to meet loading requirements in order to obtain the new frequency. However, if the single frequency is not loaded to more than 50 units within three years after the license is granted, the agencies on a shared basis in the event that other frequencies meeting the criteria for assignment are exhausted. Shared use of a frequency is not interference free.

Agencies/jurisdictions requesting multiple frequencies or employing trunking technology shall comply with the loading standards as outlined below.

Systems that do not meet established loading standards can be required to share such frequencies on a non-exclusive basis. Those agencies requesting Data channels only can be required to share channels with adjacent agencies wherever feasible or limit coverage to their geographic area. Exceptions will be considered on a case-by-case basis by the Regional Review Committee.

Should a demand for frequencies exist after allocated frequencies become exhausted, any system having more than one channel assigned under this plan four or more years previously and not loaded to at least 70 percent loading standard. Frequencies lost in this manner will be re-allocated to other agencies to help satisfy the demand for additional frequencies.

10.1 MINIMUM LOADING TABLES FOR ALALONG MODULATION SYSTEMS

	UNITS PER CHANNEL (Conventional)	(Trunked)
(a) "EMERGENCY" USE (Police, Fire, Medical)	**70**	**100**
(b) "NON EMERGENCY" USE (All Other)	**100**	**130**

While these quantities are considered appropriate for most typical systems, it must be realized that the ratio of channels needed to the quantity of mobile/portable units is <u>not</u> necessarily linear as the quantity of mobile units increases in the large trunked systems. Justification for the number of requested channels in larger systems should not be solely based on the quantity of mobile and portable units expected to be used in the system. A mathematical calculation, similar to that used in the telephone industry for trunked circuit system design, that takes into consideration the "busiest hour", "message length", "number of units in service", "unit call rate" and "grade of service" may be required to further substantiate the desired channel assignments.

10.2 LOADING FOR DIGITAL SYSTEMS:

Standards for loading on channels utilizing "digital modulation" systems are yet to be formulated. As this technology develops and becomes common place in Public Safety communications the loading requirements set forth above for analog systems will most likely be in-appropriate for efficient spectrum utilization when using "digital" modulation. Existing users migrating to digital modulation and new applicants planning to use digital modulation technology in their equipment will be required to conform to new loading standards as they developed.

10.3 TRAFFIC LOADING STUDY:

At the discretion of the Regional Review Committee should a channel shortage exist, licensees with multiple channels assigned may be required to show justification for the number of channels being used.

For trunked systems a computer generated traffic loading analysis of the actual system would be required. A showing of air time usage, excluding telephone interconnect air time, during the peak busy hour greater than 70 percent per channel on three consecutive days will be required to satisfy loading criteria. Should the system be considered 100% loaded the loading study should illustrate the degree of

"blocking" (number of units placed in "queue" , and their waiting times) during peak hours of usage.

For conventional systems an accurate vehicle inventory list along with documents such as copies of Purchase Orders, vendor invoices, and packing slips accurately describing equipment regularly being used will be required.

10.4 SLOW GROWTH:

All system in the 806-809/851-854 MHz bands will be slow growth in accordance with Section 90.629 of the Commissioners Rules.

11.0 LONG RANGE COMMUNICATIONS:

During incidents of major proportions, where Public Safety requirements might include the need for long range communications in and out of a disaster area, alternate radio communications plans are to be addressed by Primary Public Safety agencies within this sub-region. These agencies should integrate the appropriate interface to the long distance radio communications providers. Such long distance radio communications might be amateur radio operations, satellite communications and/or long range emergency preparedness communications systems, any of or all of which should be incorporated as part of the communications plans of those lead agencies. They then could provide the means to communicate outside the area for themselves and the smaller agencies who might need assistance. Instances as addressed in the National Public Safety Planning Advisory Committee's Plan, such as earthquakes, hurricanes, floods, widespread forest fires, or nuclear reactor problems could be a cause for such long-range communications needs.

12.0 EXPANSION OF EXISTING SYSTEMS:

Existing systems that are to be expanded to include the frequency bands of 806-809/851-854 MHz will have the mobile radios "grandfathered", provided that they are modified in conformance with the Memorandum Opinion and Order, FCC Docket 87-112. Primarily this involves reducing the modulation to +/- 4 KHz. Existing base stations in the frequency bands 806-821/851-866-869 MHz.

13.0 ASSIGNMENT STATISTICS:

Maximum field strength for co-channel operation is 5.0 dBu.

Maximum field strength for adjacent channel operation is 25.0 dBu.

Iterations required for solution	**=**	**120**
Number of channels used for solution	**=**	**224**
Total number of channels assigned	**=**	**429**
Total number of un-assigned channels	**=**	**24**
Total number of reserved channels	**=**	**61**
Total number of co-channels assigned	**=**	**289**

Probability of interference with the nearest:

(a) Co-channel user is between 0% and 1%

(b) Adjacent channel user is between 0% and 1%

14.0 EXPANSION OF INITIAL ALLOCATION:

In the event that the allocation for any county becomes depleted, the Region Review Committee shall meet to make further allocations to said county. Should this occur, the applying agency or entity shall submit the proper license and coordination applications with all applicable fees, as in any other licensing request. Allocations will be made based on the initial frequency allocations plan as mentioned above, taking into consideration the channels which were returned to the reserve pool.

15.0 INFORMATION REQUIRED WHEN SUBMITTING APPLICATIONS:

In addition to the required FCC and Coordination forms, the following supplemental data must be provided for the coordinator's use to determine compliance with the Regional Plan.

1. **A statement that describes the purpose of the proposed radio equipment, for example is it a replacement for existing system, a new existing system?**
2. **A description of the applicant's legal jurisdiction such as "the City of_____" or the County of_____. A map, such as a county highway map or a U. S. Geological topographical map, should be used to draw an outline of the applicant's jurisdiction.**
3. **A proposed location of the base station (s) must be marked on the map.**
4. **An accurate, graphic illustration on the map of 40 dBu contour expected from each base station.**

5. **A statement describing the proposed loading of the channel (s) being requested. Quantities, <u>that can be verified,</u> of vehicles, mobile radios, portable transceivers, and control stations that will be using the system must be listed along with the projected dates by which they will be placed in service. Portable transceivers should be in two categories, (1) those used full time as the sole communicating device for the bearer and (2) those used only part time to supplement a vehicle installed radio unit or other part time usage.**
6. **To supplement the information listed on the FCC application form, provide a copy of the work sheet used to calculate the expected ERP of the base stations.**
7. **A list of any lower band frequencies that will be replaced by the proposed 800 MHz system.**
8. **The manner in which "interoperability" with other jurisdictions will be accomplished.**

16.0 PRIORITIZATION OF APPLICANTS:

At the present time there are no un-filled requests for spectrum usage in the 800 MHz Public Safety allocation within the Region an with the exception of the seven (7) county Minneapolis/St. Paul metropolitan area none is anticipated during the foreseeable future. To provide for such conditions should they occur however, a simple method of prioritization of requests will be used.

Until a more detailed prioritization formula is developed by the Region Review Committee the following will be used.

Public Safety Agencies……. 2 points
Public Service Agencies……1 point
Multi-agency System…….2 points
Multi-agency /Multi Jurisdiction System……3 points
Single Agency/Jurisdiction System……..1 point

16.1 Statewide Public Safety Radio System Planning:

At the present time a very significant planning effort is being undertaken to implement a shared state-wide trunked communications system for all Public Safety systems operating in Minnesota. The legislature has appropriated the funding to build the statewide backbone. The current plan has the backbone being used by Sate and regional agencies with provisions for the local governments to add to or operate on the system. The system is referred to as the Allied Matrix for Emergency Response or "ARMER" System. In addition to the funding a governance structure has been put into place

to oversee the standards form the ARMER system. Information on the ARMER System or the governance structure is available at:

http://www.srb.state.mn.us/

The build out of this system begin in 1998 making use of the NPSPAC channels. As of today there are nearly 28,000 subscriber radios from well over 100 different agencies cover 15 counties including all of the 7 Minneapolis/St Paul metro area counties.

17.0 APPEAL PROCRSS:

At any time, any applicant may appeal an allocation, rejection, or any limits placed on a particular application for any reason. The appeal process has two levels; the Region Review Committee, and the FCC. An applicant who decides to appeal a rejection should initiate that appeal immediately upon notification of rejection. In the event that an appeal reaches the FCC, their decision will be final and binding upon all parties.