

**\* MRC FC 2011-04-A**

**MINNESOTA**

**REPEATER**

**COUNCIL**



# **FREQUENCY COORDINATION POLICIES**

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**MINNESOTA REPEATER COUNCIL,  
FREQUENCY COORDINATION  
POLICY REVIEW COMMITTEE**

\* This policy statement supersedes all previous versions

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### 3 GENERAL

#### 3.1 GENERAL

This policy manual defines the Minnesota Repeater Council's frequency coordination policy and will be used as the definitive statement on how frequency coordination shall work in Minnesota under conditions in which the Minnesota Repeater Council has authority.

#### 3.2 CONVENTIONS USED IN THIS MANUAL

This manual contains additions that may be useful to the reader or implementer. These are as such:



THIS BOX WILL CONTAIN A WARNING WHICH SHOULD BE READ AND UNDERSTOOD.



THIS BOX WILL CONTAIN AN ANSWER TO A QUESTION YOU MAY HAVE.

Other highlighting, such as **bold**, *italics*, or **different typefaces**, may be used to indicate important statements. The entirety of this manual, including these notations is considered policy and in force.

#### 3.3 USE OF SHALL, SHOULD, AND MAY

Within this manual, the word **shall** is used to indicate a mandatory requirement. The word **should** is used to indicate a non-mandatory but preferred method of accomplishment. The word **may** is used to indicate an acceptable method of accomplishment.

#### 3.4 UPDATES TO THIS MANUAL

Updates or changes to this manual will be made with the addition of the in-effect date of the update shown behind the section containing the change. For example:

- A. This statement was not updated.
- B. This statement was updated. (2009-04-27)

#### 3.5 READABILITY

This manual is designed and should continue to be presented in plain language with the goal of being readable by any reasonable person. Technical terms not in common use shall be defined. Complex language should not be used when a simpler statement can be used.

### 3.6 OBJECTIVE

The objective of these policies is to make efficient use of the limited Amateur Radio frequency spectrum for repeaters, link stations, and control stations while providing for an acceptable amount of interference between coordinated stations in and adjacent to the state of Minnesota.

These policies intend upon and expect the participation and cooperation of everyone involved in the process. Amateur Radio is a community fostered on mutual cooperation for a greater good.

The MRC Repeater Frequency Coordinator coordinates repeater and link frequencies on the basis of making maximum frequency utilization of the various Amateur Radio bands.

The MRC does not recognize the difference between various forms and uses of repeaters as long as they meet the criteria of a repeater that should be coordinated by the MRC. This policy encourages truthful and actual reporting of a repeater's performance for purposes of maximizing the coordination of repeaters.

### 3.7 DEFINITIONS

**REPEATER**, within this document

Any radio device or system (such as a traditional repeater, link station, or control station) that is commonly accepted as needing coordination.

**REPEATER SYSTEM**, technical definition

A fixed location automated radio system that takes in communications of any type and retransmits it on another frequency of which the capabilities of the system *extend the coverage of a vehicle mounted mobile radio*.

**REPEATER COORDINATION**

A combination of a frequency or frequency pair and a designated physical coverage area, nominally determined by modeling.

**OPEN REPEATER**

A repeater that allows public access.

**CLOSED REPEATER**

A repeater that does not allow public access.

**SHARED NON-PROTECTED REPEATER**

Two or more repeaters operating the same frequency without consideration for physical distance or performance.

**REPEATER TRUSTEE**

The responsible party or person for a repeater. Every repeater must have a trustee.

**3 GENERAL**

**ACTIVE REPEATER**

A repeater that is on the air and functioning to provided specifications and within guidelines enumerated in the section OPERATING A REPEATER, excluding the first year of operation.

**INACTIVE REPEATER**

A repeater that does not meet the requirements of an ACTIVE REPEATER.

**INTERFERENCE**

Interference is defined as signals that cause distortion or RF signal blocking of an incoming or repeated signal. Hearing other on-channel or co-channel users as a nuisance is not interference. Abnormal short term propagation is also not considered interference.

**FREQUENCY COORDINATOR**

The Repeater Frequency Coordinator, appointed by the Minnesota Repeater Council (MRC), is the recognized Repeater Frequency Coordinator in the State of Minnesota. This coordinator may appoint district or sub-band assistant coordinators as approved by the MRC board, but the MRC appointed Repeater Frequency Coordinator will be responsible for the final approval on all matters of repeater frequency coordination in the state of Minnesota. The Frequency Coordinator shall not interfere with the internal operating policies of groups or clubs.



This policy manual is not meant to be exhaustive in nature and cannot cover every possibility and challenge faced by a repeater coordination body. Therefore it is the policy that the Frequency Coordinator and, when deemed necessary, the Board are considered the final decision making entities when confronted by situations not directly addressed in this manual. The Frequency Coordinator and the Board shall act in a responsible, well reasoned, and impartial manner when confronting these decision making processes.

## 4.1 COORDINATING A NEW REPEATER

This section defines the methods, requirements, and qualification for coordinating a new repeater. Repeater coordination requests are one of two different methods: **Fixed Frequency Request** and **Assigned Band Pool Request**. The Fixed Frequency Request allows a potential repeater owner to request a specific frequency for the proposed repeater. An Assigned Band Pool Request allows a potential repeater owner to request any valid pair on a specific band (2m, 440, etc). All coordination requests will be subjected to the MRC Frequency Coordination Process detailed in this section.

## 4.2 ALL REQUESTS

For each repeater an MRC approved application must be filled out completely with accurate information by the repeater's expected trustee or owner and filed with the MRC in writing. The application shall specify the following site information: site location by MRC region, complete address, Latitude/Longitude and the method used to locate lat/lon (gps, map, etc), elevation, Antenna Height above Ground, Antenna Height above Average Terrain. The application shall also contain: Transmitter power output in watts, Antenna system losses in db, Antenna gain in db, and effective radiated power in watts. Any access control mechanism (CTCSS, DPL, etc) shall be noted. System mode (AM/FM/Digital with specific mode) shall be noted. The antenna radiation pattern (omni, beam, etc) with pattern data shall be provided. Trustee and owner information, including contact information and any/all callsigns, shall be provided. Any reasonable additional information, as requested by the Frequency Coordinator shall be provided. The information supplied in the application shall be accurate and truthful. Failure to represent a repeater's application truthfully and completely will result in denial of coordination or decoordination if found to be falsified.

### **The Repeater Frequency Coordinator shall not honor requests for repeaters that:**

- **Are contrary to the MRC recommended plans of spacing, power, or location.**
- **Practice or use substandard equipment, engineering techniques, or assembly.**
- **Are not reasonably receive and transmit balanced, that is, can be operated in the same region in which they can be heard.**
- **Fail to use Good Amateur Radio operating practices.**
- **Are not submitted in written and mailed format.**

## 4.3 FIXED FREQUENCY REQUEST

The fixed frequency request is a one-time request for coordination of a specific frequency at a specific location with the specific operating parameters supplied in the application. Using the MRC Frequency Coordination Process, the Frequency Coordinator will evaluate and either approve or deny the application based upon any factors used in the Process. If the application is denied the application may be resubmitted.

**4 COORDINATION****4.4 ASSIGNED BAND POOL REQUESTS**

The assigned band pool request is a standing request for a frequency in a specified band, such as two meters, 440 UHF, etc. Applicants will complete the entire application form indicating the band they wish to be coordinated in, where the proposed station will be, and the operating parameters of the station. The Frequency Coordinator will attempt a “best fit” for the proposed station within the band and if a frequency pair is found, an offer of a coordinated frequency will be made. If the owner accepts the offer, the frequency is coordinated. If the owner rejects the offer, the application is denied. The components of the “best fit” are determined by the Frequency Coordination Process and include an attempt to fit a station of stated performance into the local geometry of repeaters on any frequency within the requested band. A lower performance metric may also be offered if, for instance, the coverage as stated cannot be allocated but a lower value of coverage can. This offer may be declined with the application remaining in effect. Requests in the assigned band pool category are *standing*, which means once a request is made and is not able to be accommodated it is placed in a queue until it can be allocated. The Frequency Coordinator maintains the queue and changing positions in the queue is strictly prohibited. Because the Frequency Coordinator will coordinate within any band any waiting queue members, these requests take priority over fixed frequency requests.

**4.5 MRC FREQUENCY COORDINATION PROCESS****1. The Frequency Coordinator accepts an application for coordination.**

The Frequency Coordinator receives, by mail, the application for frequency coordination. The Coordinator will then contact, by any common means, the applicant to inform them that the Coordinator is in possession of their application. The Coordinator has 90 days from receipt of the application to return a denial, a coordinated frequency, or a position in a band pool queue.

**2. The Frequency Coordinator reviews the application for technical accuracy and engineering practices.**

The application will be scrutinized to determine if the application was made truthfully and completely, including locating latitude/longitude coordinates, identifying reasonable data, and any other verification the Frequency Coordinator sees fit to determine if the application is representative of the actual expected operation of the proposed repeater. Guidelines for engineering and operating practices, as stated elsewhere in this manual, will be evaluated for accuracy and compliance. If the application fails to meet any or all of these standards, the coordination is denied.

**3. The Frequency Coordinator will determine if the station can be “fit” into the local repeater geometry using the metrics defined for each band later in this manual.****FOR FIXED FREQUENCY REQUESTS**

The Coordinator will model the proposed repeater using the accepted RF modeling software (noted elsewhere in this manual) and accepted parameters of measurement. He will also model or recall previous modeling results for the surrounding same frequency repeaters. It is expected that the Frequency Coordinator will be aware of and completely model any and all repeaters that might interfere under normal operating conditions. If the modeled results show any coordinated repeater overlapping the proposed repeater within minimum accepted RF levels, the coordination is denied.



**FOR ASSIGNED BAND POOL REQUESTS**

The Coordinator will model the proposed repeater using the accepted RF modeling software (noted elsewhere in this manual) and accepted parameters of measurement. He will also model or recall previous modeling results for the surrounding repeaters in the same band by channel. It is expected that the Frequency Coordinator will be aware of and completely model any and all repeaters that share the same band within the range under which any two or more repeaters might interfere under normal operating conditions. If the modeled results show any channel in which the proposed repeater does not overlap any coordinated repeaters within minimum accepted RF levels, the channel is offered for coordination. If a reduced performance model is shown on any channel in which the reduced-performance repeater does not overlap any existing repeaters within minimum accepted RF levels, the channel is offered for coordination under the conditions of specified reduced performance.

**4. If a channel is available, the Frequency Coordinator makes an offer of coordination.**

The coordinator issues an Offer for Coordination to the applicant by mail. The applicant has up to 30 days to accept or reject the offer. If the applicant accepts the offer of coordination, the frequency becomes provisionally coordinated. The applicant will receive a Notice of Provisional Coordination from the Frequency Coordinator.

**FOR FIXED FREQUENCY REQUESTS**

If an offer is made and rejected, the application is denied.

**FOR ASSIGNED BAND POOL REQUESTS**

If an offer is made using the application specific data and rejected, the application is denied.

If an offer is made with reduced coverage and rejected, the application is queued for the applied-for band. The applicant may remove their application from the queue at any time by informing the Frequency Coordinator of their intention by mail.

**5. If a channel is not available, the Frequency Coordinator will inform the applicant by mail.****FOR FIXED FREQUENCY REQUESTS**

If no channel is available, the application is denied.

**FOR ASSIGNED BAND POOL REQUESTS**

If no channel is available, the application is placed in queue for the applied-for band. The applicant may remove their application from the queue at any time by informing the Frequency Coordinator of their intention by mail.



**“I have had my application denied, what do I do now?”**

**The Frequency Coordinator will tell you why your application was denied. If operating parameters allow you to change your repeater such that it will result in an offer of coordination, then you may reapply after making changes.**

**4 COORDINATION**

**“I want to apply for a Shared Non-Protected Repeater. How do I do this?”**

**Shared Non-Protected repeaters do not require the same application as non SNP repeaters. A SNP Notification Form will need to be filed with the Frequency Coordinator. Please see the Shared Non-Protected section for the band you wish to operate in for more information.**



**“I and the trustee of potentially interfering repeater are OK with being closer than the specifications for coordination allow. Can we still be coordinated?”**

**You can, as long as your agreement is in writing and signed by all parties and presented to the Frequency Coordinator. The stipulations will become a requirement of both (or more) repeater’s coordinations. If an interference complaint occurs, the most recent coordination will be found in violation of the stipulations of their coordination.**



**“What if I want to coordinate near a state border?”**

**The Frequency Coordinator will work with the bordering state’s Coordination body in determining if the coordination is acceptable. The Frequency Coordinator may coordinate without the permission of the neighboring state if the modeling is within acceptable parameters for coordination.**

#### 4.6 ACCEPTED MODELING SYSTEM AND PROCEDURES

The accepted modeling technology is the most recent version of Radio Mobile or its direct successor using the parameters supplied in this manual for the specified band. This is a requirement of modeling for the purpose of coordination, but may be changed within this document by standard procedures if the MRC decides that another system or software is more appropriate to the task. The MRC Frequency Coordinator or their designee will be responsible for documenting and publishing the specific configuration of the modeling software and mapping data used for coordination purposes. This documentation should be published on the MRC website and made available to MRC members upon request.

## 5.1 BUILDING A NEW REPEATER

Congratulations on your coordinated repeater pair. From the date that you received your written Notice of Provisional Coordination from the Frequency Coordinator you have six months to get your repeater, as specified in the application with any conditions imposed by the Frequency Coordinator, on the air. If you cannot make your repeater operational in that time you may apply for a six month extension. You must apply in writing to the Frequency Coordinator. All extensions are granted at the discretion of the Frequency Coordinator.

## 5.2 FAILURE TO BE OPERATIONAL AFTER 6/12 MONTHS

If you cannot get your repeater “on the air” within the six (or twelve if extended) months that your provisional coordination is in effect, your provisional coordination will expire and you will no longer be coordinated. You will be required to reapply for coordination if you wish to attempt to build your repeater again.



**An expired provisional coordination will result in the channel assigned returning to the band pool. This channel may be assigned to another applicant in the queue for the applied band. A reapplication will be considered a new application and will follow the MRC Frequency Coordination Process. The reapplication may only be submitted 90 days after the expiration of your original Provisional Coordination.**

## 6 OPERATING A REPEATER

### 6.1 OPERATING AN ACTIVE COORDINATED REPEATER

Once coordinated a repeater must meet these standing requirements in order to retain the assigned coordination. A channel coordination may be revoked at any time following the procedures in this manual.



**COORDINATED FREQUENCIES ARE ASSIGNED BY THE AUTHORITY OF THE MINNESOTA REPEATER COUNCIL AND ARE NOT CONSIDERED PROPERTY OF THE REPEATER THAT OPERATES ON THAT ASSIGNED FREQUENCY.**

### 6.2 REQUIREMENTS OF AN ACTIVE COORDINATED REPEATER

Failing to meet any of these requirements may result in classification as an inactive repeater and may be de-coordinated and lose its assigned channel(s).

- A coordination must be renewed annually. Renewal must be requested in writing by the repeater trustee. Returning the Annual Update Request supplied by the Minnesota Repeater Council is accepted as renewal.
- If a coordination stipulates any conditions of coordination, such as channel bandwidth, access controls (CTCSS, DPL, etc), or mode (FM, Digital, Etc) those conditions must be met at all times.
- The state of the repeater, its coverage, and its equipment must be kept current.
- The repeater must remain on the air for at least 305 days of the year.
- The repeater must provide coverage similar to and no more than the modeled coverage results using the repeater's specification.
- The repeater must not interfere with other repeaters.



**“I am making changes to my repeater, what do I do?”**

**Any changes may be made to a repeater that do not effect either the operating frequency or the stipulated coverage. If the changes you propose to make change the location or coverage of the repeater, a re-coordination is required.**



**“I need to shut down my repeater for more than 60 days, what do I do?”**

**You must inform the Frequency Coordinator of your request to temporarily shut down. The acceptance of the temporary shutdown is at the discretion of the Frequency Coordinator.**

### 6.3 MRC RE-COORDINATION PROCESS

Under conditions that require a re-coordination the following steps shall be taken:

1. **The trustee will submit an application identical to a new coordination request.**  
The application must be completed in full with all relevant data. The same requirements exist as a new coordination.
2. **The Frequency Coordinator reviews the application for technical accuracy and engineering practices.**  
The application will be scrutinized to determine if the application was made truthfully and completely, including locating lat/lon coordinates, identifying reasonable data, and any other verification the Frequency Coordinator sees fit to determine if the application is representative of the actual expected operation of the proposed repeater. Guidelines for engineering and operating practices, as stated elsewhere in this manual, will be evaluated for accuracy and compliance. If the application fails to meet any or all of these standards, the coordination is denied.
3. **The Frequency Coordinator will determine if the updated station can be “fit” into the local repeater geometry using the metrics defined for each band later in this manual.**  
The Coordinator will model the proposed repeater using the accepted RF modeling software (noted elsewhere in this manual) and accepted parameters of measurement. He will also model or recall previous modeling results for the surrounding same frequency repeaters. It is expected that the Frequency Coordinator will be aware of and completely model any and all repeaters that might interfere under normal operating conditions. If the modeled results show any coordinated repeater overlapping the proposed repeater within minimum accepted RF levels, the re-coordination is denied.
4. **If the channel is available, the Frequency Coordinator updates the coordination.**  
The coordinator issues an Update of Coordination to the applicant by mail. The applicant must comply with the requirements of BUILDING A NEW REPEATER when making the changes stipulated in the Update of Coordination. Failure to comply in the required time frame will result in failure to meet the requirements of an Active Coordinated Repeater. When a repeater is moved or significant changes are made the coordination date shall be reset to the current date.
5. **If the channel is not available, the Frequency Coordinator will inform the applicant by mail.**  
The application for re-coordination is denied.



**“My re-coordination application has been denied. Now what?”**

**You may continue operating under your original coordination, relinquish your coordination and cease operating, or in the case of club repeaters, transfer your coordination to another organization\*.**

**\* see the TRANSFER OF COORDINATION section for details**

## 6 OPERATING A REPEATER

### 6.4 RELINQUISHING A COORDINATION

A repeater trustee may relinquish his coordination at any time by stating the intent to do so in writing to the Frequency Coordinator. The coordination will be cancelled upon receipt by the Frequency Coordinator. A relinquished coordination returns the frequency pair to the pool of available channels.

When a coordination is relinquished all associated links are also relinquished at the same time even if they are not specifically surrendered.

### 6.5 TRANSFER OF COORDINATION

A Coordination may only be transferred from an Individual (singly licensed person) to a Club (FCC/ARRL recognized ham radio organization with a club callsign).

## 7.1 REPEATER DECOORDINATION

Under the following conditions a coordination may be revoked and no longer considered valid. This is considered decoordination and is permanent. Any revoked coordination channel returns to the pool of available channels. When a system is deordinated all associated links are also relinquished at the same time.

The following result in immediate decoordination with notification by mail from the Frequency Coordinator:

- If a repeater is ordered shut down by the FCC or any other government body with the authority to order a cessation of operation.
- A provisional coordination does not become operational within the specified time frame.
- The submitted application or renewal data has found to have been falsified.
- The coordination is not renewed annually. A confirmation of information will be sent and if no response is had in 60 days the repeater will be deordinated.
- The repeater is found to be the primary cause of interference with another repeater and the trustee refuses to participate in the Interference Resolution Process.

The following result in a vote to be completed at the next MRC meeting to decoordinate following an appropriate motion to do so. Violation of the following requires a 30 day written notice by the Frequency Coordinator in order to be addressed by the MRC:

- A repeater is shown to be non-functional by research on the part of the Frequency Coordinator or his assignees.
- The trustee, through action or inaction, violates good operating practices, engineering principles, or common sense.



**“I have received a letter that tells me I may be deordinated. What do I do?”**

**The letter will state the reason you may be deordinated. It is important for you to work with the Frequency Coordinator in order to address the concerns in the letter. You have 30 days to address those concerns. An additional 30 days may be granted by the Frequency Coordinator if requested in writing.**

## 8 INTERFERENCE

### 8.1 REPEATER INTERFERENCE

The process below outlines the steps that should be taken to resolve interference problems between repeaters.

### 8.2 DOCUMENT AND CONTACT

Repeater owners receiving harmful interference from another repeater system or its users should document times, conditions, call signs and describe the type of interference. Band conditions should be observed in all cases. Abnormal band conditions are not considered a reason for complaining about interference. The trustee of the repeater receiving the interference should contact the trustee of the interfering repeater, with a letter, outlining the problems and include his documentation. It is expected that both trustees represent their repeaters in a manner befitting the “spirit” of Amateur Radio and mutual cooperation. Most interference problems should be solved by the trustees working together to address the interference issues.



#### **“Who’s fault is it?”**

**If the interference is coming from an uncoordinated repeater, that repeater is at fault.**

**If the interference is coming from the more recently coordinated repeater, that repeater is at fault.**

**If the interference is coming from a repeater modified without notification to the Frequency Coordinator, that repeater is at fault.**

**If the interference is coming from outside the jurisdiction of the MRC (another state or country) then the Frequency Coordinator will work with the responsible agency to address the interference.**

### 8.3 INVOLVING THE MINNESOTA REPEATER COUNCIL

If all arbitration attempts fail and the interference problem cannot be solved with the trustee of the interfering repeater, the trustee of the station being interfered with should contact the Repeater Frequency Coordinator by letter, outlining the problem and providing other documentation available. Attempts to contact the other trustee should also be explained in detail. The Frequency Coordinator will need a completely documented history of both repeaters, their coordinated status, dates, times and other pertinent information from both repeater trustees. The MRC Repeater Frequency Coordinator cannot handle the job alone and will need cooperation from all individuals involved.



## 8.4 NON-COOPERATION

If the Repeater Frequency Coordinator cannot resolve the problem, using the guidelines explained above, and the operator bearing responsibility for the interference will not cooperate, will not take reasonable steps to solve the problem, or refuses to cooperate with the Repeater Frequency Coordinator in any reasonable way, the MRC Repeater Frequency Coordinator will then turn over the documentation to a review board which will be named by the MRC Chairman. This review board shall have 21 days to uphold the suggested action of the Frequency Coordinator, or recommend further investigation and/or arbitration with the responsible repeater owner.

If the review board upholds the decision of the Repeater Frequency Coordinator, the Repeater Frequency Coordinator shall within 10 days, by certified mail, inform the responsible repeater owner that his frequency has been de-coordinated. Upon receipt of confirmation of delivery of the de-coordination letter, the Repeater Frequency Coordinator will then write the FCC Field Office under whose jurisdiction the interfering repeater is located, requesting this repeater be ordered off the air. The Repeater Frequency Coordinator will be responsible for including with the request, an outline of all procedures taken and documentation that proper procedures were followed. Copies of all correspondence will also be included. At this point, final action rests with the involved FCC Engineer-in-charge with the District.

## 8.5 MALICIOUS INTERFERENCE

A coordinated station desiring FCC intervention or enforcement to eliminate malicious interference shall first submit their complaint and request in writing to the MRC Chairman. The MRC will have 90 days to resolve the complaint. If, at the end of the 90 day period, the complainant still desires FCC action, the MRC shall submit the complaint to the FCC along with the MRC's findings and recommendations. All cases of apparent malicious interference will be forwarded to the respective FCC Field Office that have jurisdiction over the area in which the source of interference is located.

## 9 OPERATING PRACTICES

### 9.1 GOOD OPERATING PRACTICES

Repeater station owners and users are expected to maintain good engineering and operating practices and use common Amateur Radio courtesy on repeater stations, as outlined in the FCC rules. Good Amateur Radio practices promotes harmony and prevent unwanted interference to other operating repeater systems. Some guidelines are:

- 1) Repeater trustees should encourage repeater users to only use the necessary amount of power to operate into the repeater system. This prevents unwanted keyups of other systems on the same frequency, and at the same time on nearby adjacent channel repeaters.
- 2) Repeater trustees should encourage and help their repeater users to keep their equipment operating on the frequency intended and with audio deviation not to exceed 5 Khz. Repeater stations on frequencies coordinated 15 Khz from the 30Khz spaced 2 meter repeaters must advise their users to limit their transmitter deviation to no more than 4.0 Khz maximum. 15 Khz split frequency system operators are encouraged to incorporate automatic devices to tell users that they are exceeding the maximum allowed deviation.
- 3) Repeater owners shall maintain their system in such a way that it maintains proper operating frequencies and have audio limiting capabilities on the repeater transmitter to prevent over deviation.
- 4) Repeater station ERP shall balance with the input receive capabilities. Excessive ERP will encourage operators to use more power to access the system, thereby creating an atmosphere of potential interference to other repeater stations.
- 5) Repeaters owners are encouraged to use state-of-the-art equipment on their repeaters, with sufficient filtering on the input and outputs to prevent adjacent channel interference both on receive and transmit.

### 9.2 ERP COMPLIANCE

Although the FCC has eliminated specific power limitations on repeater transmitter Effective Radiated Power (ERP) according to Height Above Average Terrain (HAAT), they have left the decisions on power limitations up to the individual frequency coordinator. MRC adheres to the policy which is designed to give the Repeater Frequency Coordinator maximum flexibility in making use of the already crowded VHF and UHF spectrum. The Repeater Frequency Coordinator has the ultimate decision as to power limitations of repeaters when coordinating.

The Repeater Frequency Coordinator will recommend maximum output power (ERP) based on the coordinated repeater's HAAT, antenna system and separation from co-channel and adjacent channel repeaters. For a rule-of-thumb, MRC recommends the "old" FCC repeater maximum power rules:

*For frequencies from 29.5 Mhz to 420 Mhz*

- 1) Antenna HAAT 100 ft and below - 800W ERP
- 2) HAAT 105 to 525 feet - 400W ERP
- 3) HAAT 525 to 1050 feet - 200W ERP
- 4) HAAT above 1050 ft - 100W ERP

For frequencies above 420 Mhz, where permissible by FCC rules, the following power limitations will apply:

- 1) Antenna HAAT or 105 ft and below - 800W ERP
- 2) HAAT 105 to 525 ft - 800W ERP
- 3) HAAT 525 to 1050 ft - 800W ERP
- 4) HAAT above 1050 ft - 400W ERP

### 9.3 CLOSED REPEATERS

The appropriateness of a closed repeater is in some circumstances recognized. However, requests for closed repeaters on the 2 meter band, especially those proposing wide-area coverage will be discouraged. Rationale: 2 meter frequency pairs are a limited and valuable resource and should be made available to the majority of Amateur Radio operators. It should be noted that the upper VHF and the UHF bands offers privacy to closed repeaters that is not possible on 2 meters, greatly aiding in the problem of unwanted use of private repeaters.

NOTE: It should be recognized that just because a repeater system uses CTCSS or other means to protect its input frequency it is not to be considered a closed system.

**10 BAND PLANS**

## 10.1 OPERATING AND BAND PLANS

## 10.2 DIGITAL COMMUNICATIONS

The MRC recognizes organized Statewide Digital Communications organizations, recognizes the frequencies currently used for digital communications (such as packet radio), and permits the RECOGNIZED Digital Groups the task of ASSIGNING and DELEGATING frequencies for digital systems and operations on these SIMPLEX frequencies. (It should be noted that a Packet Digipeater or node station is considered a simplex operating system.)

Digital systems utilizing FM repeater input AND/OR output pairs are classified as FM repeaters, operating Digital, and therefore must be coordinated by the MRC Repeater Frequency Coordinator as for any other FM repeater. All rules of repeater frequency coordination including the accepted standards of frequency and bandwidth, mileage spacing between repeaters on the same frequency and operation with lack of interference to users on adjacent frequencies must be followed. Cross-band repeaters operating in a digital mode on FM repeater or auxiliary link frequencies are also considered repeaters and must be frequency coordinated.

Digital systems that operate SIMPLEX in the auxiliary and control frequency ranges of 446.025 to 446.200 Mhz that are normally coordinated by the MRC repeater frequency coordinator are expected to ask for frequency coordination BEFORE THESE DIGITAL OPERATIONS ARE STARTED to eliminate interference between these digital operations and any existing FM voice type auxiliary link operations that might be currently operating on these frequencies. If digital operations wish to use auxiliary link frequencies that are currently being used for FM voice type auxiliary links, arrangements to reimburse the existing users for the costs of relocating must be made.

## 10.3 DIGITAL SIMPLEX

The Amateur Radio frequencies currently recognized by the MRC for SIMPLEX digital operation in the 2 meter band include 145.010, 145.030, 145.050, 145.070, 145.090, 145.610, 145.630, 145.670 and 145.690 Mhz. Even though some of these frequencies are spaced 600 Khz apart, a full-duplex FM digital repeater cannot be operated on them per current FCC part 97 rules.

The simplex frequencies of 144.910, 144.930, 144.950, 144.970 and 144.990 Mhz are also recognized as being used for digital operations, but these frequencies are shared with the activities generated by the SAREX space missions. Operators using these frequencies for digital operations must be cognizant of SAREX operation and cease operations when interference will be caused to these operations.

The MRC Repeater Frequency coordinator will coordinate full-duplex digital repeaters only on the 20 Khz spaced repeater pairs in the 44/145 sub-band of 2 meters. All full-duplex digital repeaters coordinated on this band must operate with a baud rate of 9600 baud or greater to make maximum use of the repeater pair.

MRC recommends that digital operations (packet radio) do not operate on the nationally recognized SIMPLEX frequencies for FM voice operations on 2 meters.

## 10.4 FM SIMPLEX

The MRC also recognizes and will preserve allocated FM voice Simplex frequencies which fall within the FM repeater portion of the Amateur Radio bands. The use of these simplex voice frequencies for Digipeaters IS NOT RECOMMENDED, although simplex digital point-to-point operation is permitted as is CW, RTTY or other point-to-point simplex operations per the FCC rules.

Only 52.525 Mhz is currently recognized in the 50 to 54 Mhz band for FM voice simplex.

The current 2 meter voice simplex frequencies are:

146.400\*, 146.415, 146.430\*, 146.445, 146.460\*, 146.475, 146.490, 146.505, 146.520, 146.535, 146.550, 146.565, 146.580, 147.420, 147.435, 147.450, 147.465, 147.480, 147.495, 147.510, 147.525, 147.540, 147.555, 147.570 and 147.585 Mhz.

NOTE: In some cases these FM simplex frequencies are used as FM voice repeater inputs to pair up with 147.000, 147.030, and 147.060 Mhz. FM simplex users should expect to be repeated if they use these frequencies for simplex operation when in an area in Minnesota or surrounding states or provinces where these frequencies are used as repeater inputs.

Only 223.500 Mhz is currently recognized in the 222-224 Mhz band for FM voice simplex. But FM voice simplex can be done on any of the 20 Khz spaced frequencies in the 223.400 to 223.740 Mhz range. These 20 Khz spaced channels are shared by both voice and digital modes.

Only 446.000 Mhz is currently recognized in the 420-450 Mhz band for FM voice simplex. This is because of the extremely short range expected with low power FM SIMPLEX operations in this frequency range.

## 10.5 REPEATERS IN 29.50 – 29.70 Mhz

### MODELING SPECIFICATIONS

MINIMUM RECEIVE db	-100 dBm
MINIMUM RECEIVE v	.3 uV
RECEIVER ANTENNA GAIN	¼ wave
RECEIVER ANTENNA HEIGHT	8 feet

All assignments in this band shall be in accordance with the Nationally accepted 10 meter band plan agreed upon by the MRC. Currently there are only 4 repeater pairs allocated with 100 Khz spacing between input and output frequencies. 29.600 Mhz is recognized as the National Simplex channel on 10 meters.

## 10.6 REPEATERS IN 51.00 – 53.99 Mhz

### MODELING SPECIFICATIONS

MINIMUM RECEIVE db	-100 dBm
MINIMUM RECEIVE v	.3 uV
RECEIVER ANTENNA GAIN	¼ wave
RECEIVER ANTENNA HEIGHT	8 feet

**10 BAND PLANS**

All assignments in this band shall be in accordance with the Nationally accepted 6 meter band plan agreed upon by the MRC. 52.525 Mhz is recognized as the National Simplex calling frequency on 6 meters.

**10.7 REPEATERS IN 144.00 – 147.99 Mhz****MODELING SPECIFICATIONS**

MINIMUM RECEIVE db	-100 dBm
MINIMUM RECEIVE v	.3 uV
RECEIVER ANTENNA GAIN	¼ wave
RECEIVER ANTENNA HEIGHT	8 feet

Unless otherwise described in this policy, all assignments in this band shall be in accordance with the Nationally accepted 2 meter band plan agreed upon by the MRC. 146.520 Mhz is recognized as the National Simplex calling frequency.

In Minnesota, the frequencies between 144.500 and 145.500 Mhz used for repeaters are coordinated on 20 KHz steps starting with 144.510 Mhz. Repeater inputs are low, with the outputs located 600 KHz above the inputs. Narrowband digital signals will be placed on 6.25 KHz offsets from the normal spacing.

In Minnesota, the frequencies between 146.000 and 147.990 Mhz, used for repeaters, are coordinated on 15 KHz steps starting with 146.010 Mhz. Between 146.010 and 146.985 Mhz repeater inputs are low, with the outputs located 600 KHz above the input. Between 147.000 and 147.990 Mhz repeater inputs are high, with the outputs located 600 KHz below the input.

144.630 Mhz input and 145.230 Mhz output will be coordinated in the State of Minnesota for use by repeater stations on a shared basis (Shared Non-Protected). No geographical separation from other repeater stations in Minnesota using the same frequency will be done. All stations using this pair must use CTCSS, digital CTCSS or DTMF access. The tone to be used for protecting the repeater input must be given to the Repeater Frequency Coordinator. In the event a noncontinuous code, e. g. DTMF tone(s), is used to initiate access, the system must provide:

1. Automatic return to controlled access if no signal is present on the input frequency for 60 seconds (maximum).
2. Automatic means to prevent unintended activation by users by other systems using DTMF for autopatch activation and use. Anti-PL would be one possible method.

Frequencies 144.900 to 145.100 Mhz & 145.61 to 145.69 Mhz are recognized as being used for single channel digital communications including digipeaters or “digital repeaters”, e.g. packet radio, using 20 KHz spaced channels. The 20 KHz steps shall be based on 145.010 Mhz (channel center).

## 10.8 REPEATERS IN 222.50 – 225.00 Mhz

**MODELING SPECIFICATIONS**

MINIMUM RECEIVE db	-100 dBm
MINIMUM RECEIVE v	.3 uV
RECEIVER ANTENNA GAIN	¼ wave
RECEIVER ANTENNA HEIGHT	8 feet

Unless otherwise described in this policy, frequencies between 222.50 and 225.00 will be assigned in accordance with the Nationally accepted 220 Mhz band plan agreed upon by the MRC. 223.500 Mhz is recognized as the National Simplex calling frequency.

The frequencies between 222.500 and 223.380 Mhz are used as repeater inputs with the repeater outputs located 1.6 Mhz above them at 223.880 to 224.980 Mhz. These frequencies pairs are spaced 20 Khz apart starting with 222.260 Mhz.

The repeater pair of 222.640/224.240 Mhz is coordinated as a Shared Non-Protected repeater pair for repeaters in this band in Minnesota. This pair must be frequency coordinated and will be assigned on a shared basis without respect to geographical separation from other repeater stations in Minnesota using the same frequency pair.

All stations using this pair must use CTCSS, digital CTCSS or DTMF access. The tone to be used to protect the input of the repeater must be given to the Repeater Frequency Coordinator. In the event a noncontinuous code, e. g. DTMF tone(s), is used to initiate access, the system must provide:

1. Automatic return to controlled access if no signal is present on the input frequency for 60 seconds (maximum).
2. Automatic means to prevent unintended activation by users by other systems using DTMF for autopatch activation and use. Anti-PL would be one possible method.

## 10.9 REPEATERS IN 420.00 – 450.00 Mhz

**MODELING SPECIFICATIONS**

MINIMUM RECEIVE db	-100 dBm
MINIMUM RECEIVE v	.3 uV
RECEIVER ANTENNA GAIN	¼ wave
RECEIVER ANTENNA HEIGHT	8 feet

## 10 BAND PLANS

Frequencies between 420.00 and 421.00 Mhz maybe used for auxiliary links and control links where allowed for in the State of Minnesota. 25 KHz spacing will be used starting at 420.025 Mhz. The use of CTCSS and directional antennas is recommended. Coordination must be done to eliminate any possible interfere between auxiliary and control links and a Fast Scan ATV repeater output on 421.250 Mhz.

NOTE: Line "A", which outlines an area located along the Canada border of the US, runs through Duluth, MN. By FCC rules Amateur Radio operation between 420 Mhz and 430 Mhz is not allowed north of line "A".

Frequencies between 433.000 and 435.000 Mhz are also reserved for auxiliary and repeater links. 25 KHz spacing will be used starting at 433.025 Mhz. The use of CTCSS and directional antennas is recommended. Frequencies from 445.000 to 446.975 Mhz are reserved for control links, auxiliary links and various types of simplex operation. 12.5 KHz channel spacing will be used starting at 445.00 Mhz. The use of CTCSS and directional antennas is recommended for all control and auxiliary links.

The frequency 446.00 Mhz is to be used for simplex communications only.

Frequencies between 442.000 and 444.975 Mhz are reserved for repeater outputs with inputs located 5 Mhz above the output. 12.5 KHz spacing will be used starting at 442.000 Mhz. Narrowband digital signals will be placed on 6.25 KHz offsets from the normal spacing.

Frequencies between 447.000 and 449.975 Mhz are reserved for repeater inputs with outputs located 5 Mhz below the input.

One Amateur radio Fast Scan TV repeater can be frequency coordinated on the 440 Mhz band with an input on 439.25 Mhz and an output on 421.25 Mhz. Due to the wide band nature of ATV signals, (ATV channels are normally 6 Mhz wide) FM voice repeaters that share this frequency range must be carefully coordinated to eliminate possible interference to ATV activities.

Due to possible interference to a coordinated ATV repeater presently operating in the Twin Cities metro area on the 440 Mhz band the repeater system output frequencies between 444.000 and 444.975 Mhz will all be assigned before the frequency pairs between 442.000 and 444.00 will be assigned. This guideline will be used on all frequency assignments in the 440 Mhz band within 30 miles of the Twin Cities metro area.

The following are coordinated for Shared Non-Protected repeaters in Minnesota: 449.725/444.725, 449.325/444.325, 448.700/443.700, 448.000,443.000, 447.700.442.700 Mhz. Repeaters operating on these pairs must be frequency coordinated and operate on a shared basis without respect to geographical separation from other repeater stations in Minnesota using the same frequency pairs. A separation distance of 120 miles between repeater stations must be maintained along our state's borders as the adjacent states do not necessarily have similar assignments.

All repeater stations using these frequency pairs must use CTCSS, digital CTCSS or DTMF access. The choice of tone used must be given to the Repeater Frequency Coordinator. In the event a noncontinuous code, e. g. DTMF tone(s), is used to initiate access, the system must pro-vide:

1. Automatic return to controlled access if no signal is present on the input frequency for 60 seconds (maximum).
2. Automatic means to prevent unintended activation by users by other systems using DTMF for autopatch activation and use. Anti-PL would be one possible method.



## 10.10 REPEATERS IN 902.00 – 927.9875 Mhz

**MODELING SPECIFICATIONS**

MINIMUM RECEIVE db	-100 dBm
MINIMUM RECEIVE v	.3 uV
RECEIVER ANTENNA GAIN	¼ wave
RECEIVER ANTENNA HEIGHT	8 feet

Frequency in MHz	Use
902.000 – 902.300	Weak signal modes ( CW, SSB, EME, Beacons)
*902.3125 – 902.4875	Narrowband FM/DV repeater inputs (25 Khz channel spacing)
902.500	National FM simplex (15Khz wide channel)
902.8500 - 902.9750	Narrowband FM/DV repeater inputs (25 Khz channel spacing)
*902.9875	Narrowband SNP/portable repeater input
903.000 - 903.400	Weak Signal Modes (CW, SSB, EME, Beacons)
903.425 to 906.975	Digital Communications
904.00 -909.750	Intelligent Transportation Services (Part 90 Higher Priority)
*907.000 – 908.900	FM Repeater inputs (50 Khz channel spacing)
*909.000 – 915.000	ATV repeater input
*915.025- 916.000	FM Auxiliary/Control links (25Khz channel spacing)
916.025 - 918.975	Digital Communications
919.000 - 928.000	Intelligent Transportation Services (Part 90 Higher Priority)
*919.000 - 920.900	FM repeater outputs (50 Khz channel spacing)
*921.000 - 927.000	ATV repeater output
*927.3125 – 927.4875	Narrowband FM/DV repeater outputs (25 KHz channel spacing)
927.600	Alternate FM Simplex (15 Khz wide channel)
927.700	Alternate FM Simplex (15 Khz wide channel)
927.800	Alternate FM Simplex (15 Khz wide channel)
*927.8500 - 927.9750	Narrowband FM/DV repeater outputs (25 Khz channel spacing)
*927.9875	Narrowband SNP/Portable repeater output

\*Coordinated by Minnesota Repeater Council (MRC) Frequency Coordinator

**NOTES:**

- 1) The above Minnesota band plan is based on various accepted band plans and does not always follow the band plan in the ARRL repeater directory.
- 2) Repeater frequencies with an offset of 25 Mhz, are coordinated on 25 Khz channel steps. The repeater frequencies, with a 12 Mhz offset, are coordinated on 50 Khz steps.
- 3) Normal digital operations, on this band, ARE NOT frequency coordinated by any party in the state of Minnesota. Speed of digital operations must be adjusted so that transmitted signal is not wider than a phone type signal of the same type. Maximum recommended baud rate is 56K baud. Digital Voice Repeaters on designated repeater pairs are frequency coordinated.
- 4) Simplex auxiliary/control links have coordinated frequencies at 915 Mhz to 916 Mhz. Duplex auxiliary/control links should be operated/coordinated on repeater frequencies.

- 5) Intelligent Transportation System (formerly called Automatic Vehicle Locating), which is a Part 90 licensed service, has a higher priority in this spectrum and is operating on some of these 902 to 928 Mhz frequencies. Amateur Radio cannot cause ‘Harmful interference’ to these licensed uses on these frequencies.
- 6) Cordless phones, which are un-licensed and share this spectrum, are typically spaced every 30, 60 or 100 Khz between 927.500 and 927.800 Mhz. Some common frequencies are 927.5000, 927.5100, 927.5650, 927.5700, 927.6000, 927.6250, 927.6300, 927.6600, 927.6850, 927.6875, 927.6900, 927.7200, 927.7450, 927.7500, 927.7800, 927.8050, 927.8100, 927.8400, 927.8650 and 927.8700. You might try and avoid these frequencies for your repeater.
- 7) Wireless Internet services (un-licensed 802.11 channels) also share this spectrum and have up to 20 Mhz wide channels centered on 907.000, 912.000, 917.000 and 922.000 Mhz. Motorola ‘Canopy’ (un-licensed) systems use 3 non-overlapping channels that are 8 Mhz wide and can be set with a center frequency of 906, 907, 911, 915, 919, 923 or 924 Mhz. If such a system is used in your area it is suggested that you advise the system operator to use 907 Mhz (instead of 906 Mhz) to lessen the interference to narrowband amateur radio repeater inputs on 902 mhz frequencies.

**The 12 Mhz offset repeater pairs are coordinated on 50 Khz steps:**

907.000/919.000, 907.050/919.050, 907.100/919.100, 907.150/919.150, 907.150/919.150  
 ...and every 50 Khz step thereafter through ..  
 908.650/920.650, 908.700/920.700, 908.750/920.750, 908.800/920.800, 908.850/920.850

**Narrowband repeater pairs (25 Mhz offset) are coordinated on 25 Khz steps:**

902.3250/927.3250, 902.3500/927.3500, 902.3750/927.3750  
 ...and every 25 Khz step thereafter through ..  
 902.9800/927.9800, 902.9825/927.9825, 902.9850/927,9850 and 902.9875/927.9875

**Recommended FM simplex 902-928 Mhz band frequencies (100 Khz matrix):**

902.500. 927.600, 927.700 and 927.800 Mhz

## 11 CHANGES

### 11.1 CHANGES TO THIS POLICY

All changes to this policy must be approved by the Minnesota Repeater Council.

If any group does not agree with this policy or the interpretation of the Frequency Coordinator, they may submit, in writing, a request that the MRC Chairman convene a Board of Appeals to review the decision. The board or appeals will consist of the MRC Chairman, Metro area Owner or Operator, MRC User Liaison, Non-metro owner or Operator, and the Frequency Coordinator.

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