
WIRES-X Operations Plan

Connecting the Hibbing
Repeater to WIRES-X

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WIRES-X Operations Plan For the NØAGX Node

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Introduction

The Hibbing repeater operating on a Minnesota Repeater Council coordinated frequency of 147.120 MHz, has recently been upgraded as of July 2016, to incorporate VOIP technology utilizing the Yaesu Fusion family of two meter amateur radios. This family of radios provides for both conventional analog and the CF4 proprietary digital communications instituted by Yaesu. WIRES-X allows remote access to the repeater over the internet. This technology is also available through other means notably Echo Link. The installation incentive program offered by Yaesu has resulted in several repeater sites located within northern Minnesota to also upgrade. Fusion repeaters are located in Two Harbors, Knife River, Duluth, Grand Rapids, Gilbert, and Hibbing. As this technology becomes more widely accepted and local amateur radio operators embrace the features available to them, a plan is needed to fully appreciate the capabilities of this newer technology.

Purpose

This plan although specific to the node operated under the NØAGX call sign, is expected to promulgate guidelines for the operation and linking of the other WIRES-X nodes as well. These guidelines will institute a common approach and operating technique to allow for effective communications utilizing WIRES-X. Communications procedures for both the operator and control operator will be developed in coordination with the other users in the area in order for local users and remote users to utilize the repeater simultaneously where possible. Due to the nature of digital signal processing, conventional analog communications and digital can be disruptive to one another; therefore, restrictions in use designed to segregate analog from digital users will be imposed for the benefit of all parties where considered necessary. See the section titled [Mode: Digital or Analog](#). Operational procedures developed within this plan will be subject to FCC rules and regulations. In no case will the procedures developed herein supersede FCC regulation.

Mode: Digital or Analog

The ability of the DR-1X Fusion Repeater to support both analog and digital when coupled with a WIRES-X node is a paradox as the WIRES-X node can only be in one mode. **The repeater will operate in AUTO/AUTO to support the dual mode capability.** Until such time as the predominance of users have the capability to operate digital, **the node will operate as an analog node.** The user may contact the Node Operator and request he change the mode to digital.

Tone Signaling

As amateur radio equipment has advanced in step with emerging technology, the use of tone signaling has been inevitable. Historically, the Hibbing repeater has not been toned in deference to the older radio built without the benefit of tone boards. Although the Hibbing repeater is currently not toned, instituting this plan will entail the adoption of a tone. There are tone schemes such as DSQ available to the newer radios that are outside the reach of many of the older generation radios. Therefore, a tone

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squelch or CTCSS will be adopted. This will effectively blank out the digital users on the repeater allowing the analog users to yet monitor the repeater output frequency in peace while the repeater filters the input of spurious signals. The tone for the repeater will be set to 115.4 Hz on both receive and transmit signals.

Communications Topology

A brief introduction of the structure of the node will serve to acquaint the reader with the various options available in structuring a WIRES-X node. The arrangement implemented will differ with each node as the connections are equipment dependant. An internet connection compatible with VOIP is the first requirement.

Local Node Configuration

The DR-1X Fusion repeater is capable of connecting directly to the internet through the HRI200 interface to provide WIRES-X capability. Due to the cost and unavailability of an internet connection the node was designed using a radio link to the repeater to afford the greatest area coverage. Initially the node used a simplex radio link, but it was determined that the widest area coverage for the perspective users would require a repeater to be linked to the node. The components necessary to implement a WIRES-X connection are collectively referred to as the “local node” and are depicted in Figure 1 Local Node Configuration.

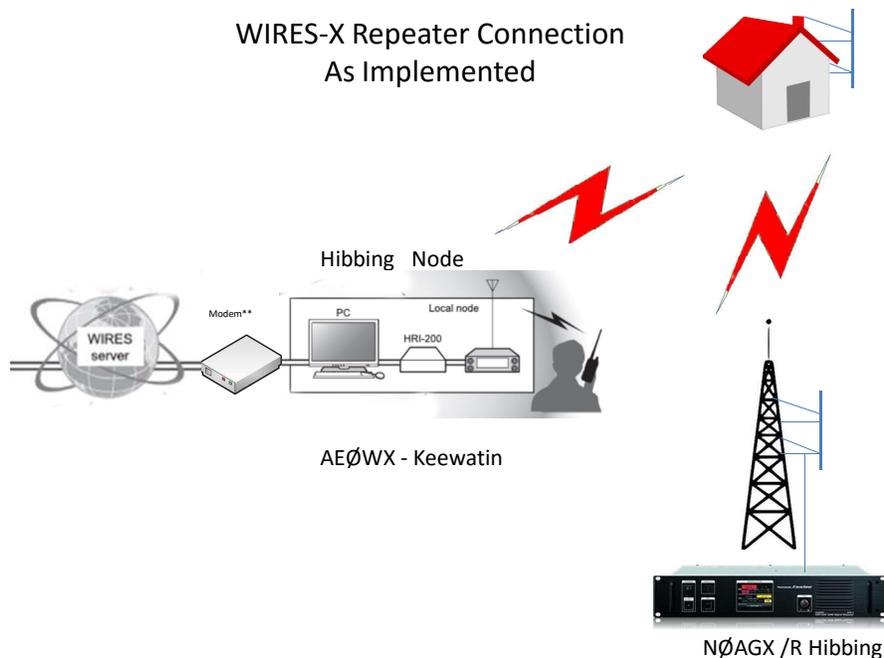


Figure 1 Local Node Configuration

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Repeater Link

Figure 2 WIRES-X Connection depicts the configuration which is being utilized with the NØAGX node. The user instructs the node by DTMF codes which remote node to connect to. Linkage through repeaters is problematic in that the repeaters ID is broadcast indiscriminately thereby potentially causing interference. Another potential issue when using repeaters in the path is the ping-pong effect by which the hang-time is greater than zero causing a bouncing return between the two repeaters. This is avoided by setting both repeaters' squelch tail or hang time to zero. The Hibbing repeater is currently configured for zero hang time.

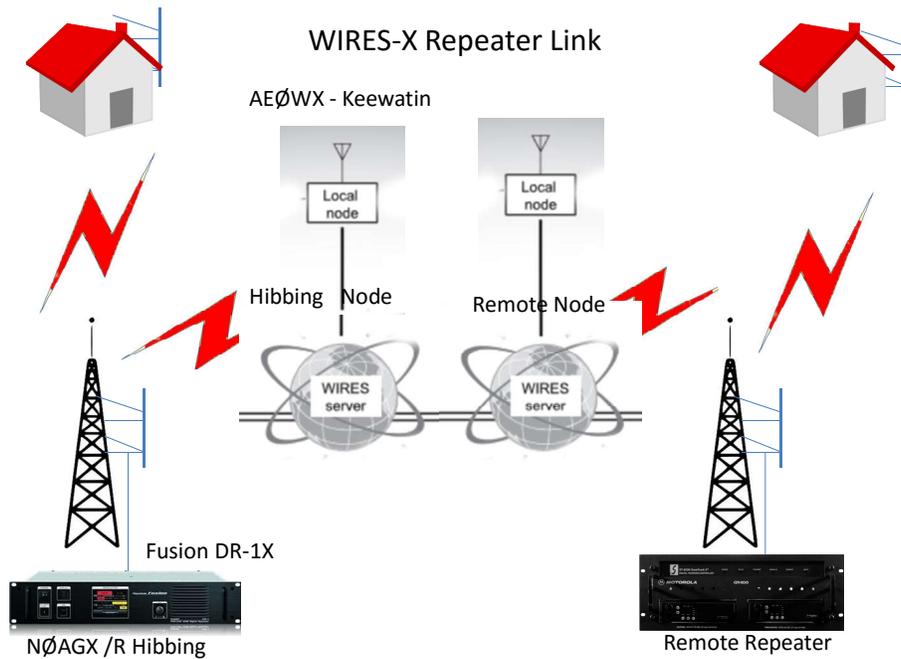


Figure 2 WIRES-X Connection

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Simplex Link

Figure 3 WIRES-X Simplex Link is another connection scenario. The remote user is also able to initiate the connection.

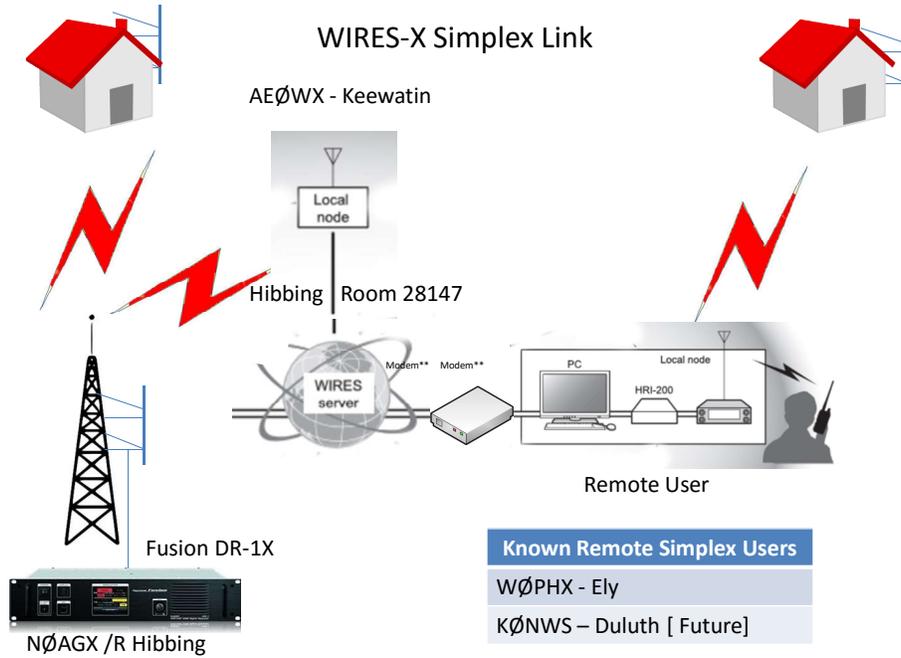


Figure 3 WIRES-X Simplex Link

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Connection Protocol

A procedure for the user to make connection to nodes has been established and published as seen in Figure 4 Connection Protocol. The reason behind Item 4 of the referenced figure is to provide access by multiple users – a chat room as it were. It is suggested that the node be configured to allow unlimited connection time to avoid unwanted disconnects while remote nodes are monitoring.

WIRES-X Analog Connection Protocol

1. Confirm frequency not in use. Status may be determined by #66666
2. ID and announce “Attempting to connect WIRES-X to [node name]”
3. Transmit DTMF Node ID[†] prefixed by # using 1 sec tones
4. Connection to rooms (21XXX) rather than nodes is encouraged .
Connection should be among analog users only. Do not mix modes.
5. Node will announce connection status
6. Listen and ID with location announcing your intent
7. When in QSO wait for signal to drop before starting to transmit -
limit key down time to <3min. Utilize a turnover technique.
8. ID prior to disconnecting
9. Disconnect from node using * or #99999* (more reliable)
10. Local Node will confirm disconnect by three beeps
11. ID and announce “WIRES-X terminated. Frequency returned to normal use.”

[†] Active DTMF Node IDs (subject to greater than 20 minute lag) are available from :
https://www.yaesu.com/jp/en/wires-x/id/active_node.php

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Figure 4 Connection Protocol

Control Operator Presence

The FCC requires an amateur radio station be under the control of an operator.

§97.109 Station control.

- (a) Each amateur station must have at least one control point.
- (b) When a station is being locally controlled, the control operator must be at the control point.
Any station may be locally controlled.
- (c) When a station is being remotely controlled, the control operator must be at the control point.
Any station may be remotely controlled.

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Control operator duties can be exercised locally by the operator at the station or remotely through the use of remote control software available through Yaesu. This allows the operator to be able to control the station through the use of a PC over the internet.

NØAGX Node Operations Schedule

In order to promote the use of the WIRES-X node, a schedule of operation is maintained solely at the Control Operators availability pursuant to the above [section](#). Determining if the node is active can be accomplished as outlined in item1 of Figure 4 Connection Protocol. The current operating schedule is posted on the [NØAGX web site](#) and is included as Figure 5 Node Schedule as an example:

NØAGX WIRES-X Node Schedule

- Node is being monitored
- If active, the system and node will ID every 10 minutes
- Analog mode on +147.120 MHz no tone* (NØAGX Hibbing Repeater)
- Hours of Operation:
5:00 PM – 11:00 PM Mon – Sun
- Limit key down time to less than 3 minutes
- Inform NØAGX or AEØWX, control operator, of any issues

* Tone may be applied at a later date .

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Figure 5 Node Schedule

Sharing the WIRES-X Connection

Sharing the node can be implemented on various levels.

Tier 1

The [communications topology](#) utilized by the node as depicted in Figure 2 WIRES-X Connection and Figure 3 WIRES-X Simplex Link avails itself to sharing by other nodes or users. This level of sharing will be referred to as Tier 1. The node is currently operating under Tier 1 sharing. No intervention is needed to use the node. This level of sharing is exemplified by the WØPHX linkage in which the node operator (WØPHX) connects his node to the Hibbing node. See Figure 3 WIRES-X Simplex Link.

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Tier 2

Tier 2 sharing is dependent on the proximity of the node to those desiring to share the connection and will require a modification of the link be made by the node's control operator. This modification will require linking the node locally to another repeater system other than the NØAGX repeater and hence breaking the Hibbing repeater radio link to the node. This linkage will only be made with the prior approval of the repeater trustee unless otherwise permitted under [emergency conditions](#). Area repeaters which may consider Tier 2 sharing at the time of this document being drafted are Gilbert and Grand Rapids. The connection is depicted in Figure 6 Tier 2 Sharing.

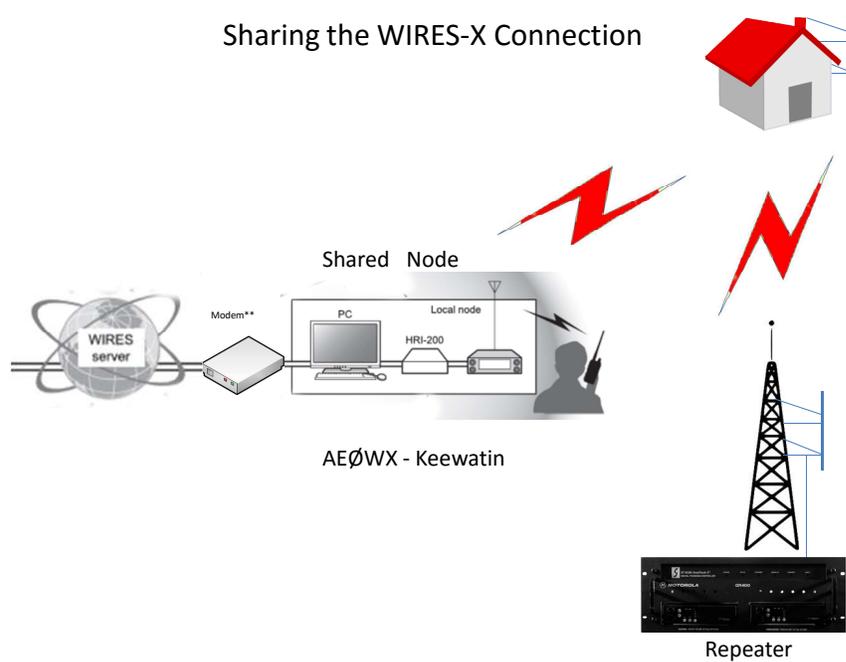


Figure 6 Tier 2 Sharing

Tier 3

Linking repeater systems connected to the node through use of an amateur radio transceiver configured for cross band repeat will be referred to as Tier 3 sharing. At this point Tier 3 has not been implemented.

Emergency Communications

Emergency communications or EMCOM will take priority over other communications. If an emergency net is called such as in the case of severe weather, the net control operator (NCS) will announce the presence of the net every 10 minutes and request that transfer of normal traffic and messages be deferred until the net is closed or the message is relayed by the NCS. By definition an emergency is in

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the public service; therefore, the mode of communications will be typically analog unless the NCS deems digital is more reliable. The mode of operation will be determined on a case by case basis with the default being the analog mode.

SKYWARN

During times of emergency, monitoring several repeater frequencies has been utilized in order to reliably receive transmissions from the National Weather Service (NWS). This operating practice is not expected to change until NWS either improves its radio transmission or implements use of WIRES-X. Until this occurs, receiver desense is of a real concern. Both radios located at the node must have their transmitter power turned down to the lowest possible level and the receiver's attenuated.

The Hibbing repeater is not designated as the repeater to be used for severe weather warnings. The LSAC system retains this designation due to its wider area coverage; however, utilization of the WIRES-X capability could provide a more secure connection to NWS SKYWARN. Connection to NWS SKYWARN under [Tier 2 sharing](#) may be a workable solution for the Itasca County Skywarn Net. Node sharing under Tier 2 may also be an alternative for the LSAC system being aware of the zero hang time requirement. The missing link in implementing Tier 1 Sharing which would allow linking with NWS under the current topology is the absence of a node in the Duluth area.

Instituting EMCOM via WIRES-X

Depending on the geographic area covered by the emergency, the node may be properly configured to provide the necessary service. Under Tier 1. If other than Tier 1 is required or the node is not in operation, intervention on the part of the control operator will be required. Contact information for the current NØAGX node operator is:

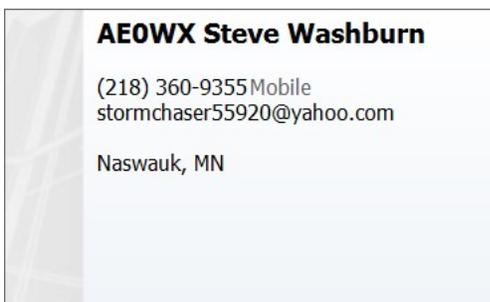


Figure 7 Node Control Operator

Steve can normally be contacted by radio on the Grand Rapids or Virginia repeater if he isn't monitoring the Hibbing repeater. Alternatively, Don can be contacted :

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Figure 8 NØAGX Repeater Control Operator