

W7FLY BEARONS Repeater User's Guide
Rev. 0

Introduction

This user's guide is intended to familiarize individuals with the W7FLY repeaters' basic theory and operational characteristics. It also defines the user-available functions and their use.

Configuration

The W7FLY repeaters consist of two separate, complete repeaters that are controlled by a single control unit. The controller is an S-Com 7K. One of the repeaters operates in the 440 MHz band, the other operates on 6 meters (50 MHz). The 440 MHz repeater utilizes an input frequency of 448.925 MHz with a PL access tone of 100 Hz. The output frequency for this repeater is 443.925 MHz. The 6 meter repeater's input frequency is 51.25 MHz and requires a PL access tone of 100 Hz. The output frequency is 52.95 MHz. The two repeaters are housed in a utility room atop the main factory building at the Boeing Everett plant. The antennas for each repeater are mounted on the roof of the main factory building. The repeaters are maintained by BEARONS and the Boeing Everett Radio Shop. The S-Com 7K controller is designed to control one repeater along with additional control for a link receiver, link transmitter, and a third remote receiver. In our application, the link receiver and link transmitter inputs/outputs have been configured via software to completely mimic the operation of the normal repeater input/output pair and thus control the second repeater. The third receiver input/output is not used. The controller also has provisions for auto-patch - however, in our application this feature is not used.

Characteristics – Identifier

The repeater controller programming for ID is identical for both the 440 MHz and 50 MHz machines. The normal ID cycle is 10 minutes and utilizes both voice and CW messages during a "typical" 10 minute cycle. A normal ID cycle is initiated when the repeater has been inactive for at least 10 minutes. Upon the first signal received at the repeater input following this minimum period of inactivity, the repeater will ID with the voice message, "W7FLY repeater". If there is continued repeater activity beyond the point when the initial ID message was triggered, then additional CW ID messages will occur at a time interval between 9 minutes, 30 seconds and 10 minutes. The controller "looks ahead" to see when the next ID is supposed to occur – if there is a signal present on the input at the same time the ID timer reaches 10 minutes, the repeater will send what is known as an "impolite" ID – it is the CW message, "W7FLY". That message will be sent along with the audio signal present at the repeater input (i.e. – mixed audio) at that time. If the input carrier drops after the 9 minute, 30 second interval but before 10 minutes have elapsed, then a "polite" ID message will be sent when the carrier drop occurs. The "polite" ID message is sent in CW, "W7FLY_R". CW is sent at 20 WPM at a frequency of 1000 Hz.

Characteristics – Anti-Kerchunker

The 440 MHz repeater has an “anti-kerchunk” feature enabled. Assuming that the repeater has been inactive for at least 30 seconds, the anti-kerchunk timer will inhibit repeater activation by any carrier signal received that has a duration of less than 0.7 seconds. Once the repeater has been activated, however, the anti-kerchunk timer is disabled until such time that a 30 second continuous period of repeater inactivity has elapsed – after that, the anti-kerchunk timer will re-enable automatically. The anti-kerchunk feature is only active on the 440 MHz repeater.

Characteristics – Courtesy Tones

Courtesy tones are programmed for each repeater pair. Upon carrier drop at the repeater input there is a delay of 1.0 seconds and then a 60mS, 880 Hz tone is heard on the repeater output, followed by an additional 0.5 seconds of delay before the repeater transmitter unkeys. Note: courtesy tones may not always be heard when ID messages (either CW or voice) are being sent.

Characteristics – Transmitter Timeout

Both repeaters are programmed for a maximum continuous allowable transmission time of 5 minutes. Upon a carrier being sensed at the repeater input, a one-shot timer is activated. The timer begins counting towards the 5 minute limit. If the carrier drops prior to the expiration of the one-shot timer, the timer is automatically reset and ready to be triggered again upon receipt of the next carrier. On the 440 MHz repeater, if the one-shot timer expires while there is still a carrier present at the repeater input, the CW message “TO” is sent followed immediately by the repeater transmitter being disabled. The transmitter will not re-enable until either of the following occurs: 1) the offending carrier drops, or 2) another user remotely re-enables the transmitter. When the transmitter re-enables, the CW message “TO” is sent again, notifying the user that the transmitter is re-enabled and that at least some portion of the prior transmission was lost. If the transmitter is reset remotely, the CW message “TO” will not be sent when the transmitter re-enables, it will simply start transmitting again assuming that the offending signal is still present. For a user to remotely re-enable the transmitter, their signal must be able to override the offending signal at the repeater’s input. The transmitter reset enable command is DTMF digit 5 sent for a minimum of 3 seconds.

On the 6 meter repeater, transmitter timeout implementation is a bit different. If the one-shot timer expires while there is still a carrier present at the repeater input, a series of 10, 60mS, 880 Hz tones spaced at 320mS intervals will be sent, followed immediately by the repeater transmitter being disabled. The transmitter will not re-enable until the offending carrier drops. When the transmitter re-enables, a 60mS,

880 Hz tone is sent, notifying the user that the transmitter is re-enabled and that at least some portion of the prior transmission was lost. There is no remote transmitter re-enable capability for the 6 meter repeater.

Characteristics – Scheduled Voice Announcements

For both repeaters, there is one scheduled voice announcement. This announcement occurs at the top of every hour, 24 hours a day, 365 days a year. The scheduled voice announcement is, "Welcome to the W7FLY BEARONS repeater". The 440 MHz repeater plays this message first, followed by the 6 meter machine. In the event that a QSO is taking place at the same time the voice announcement is scheduled to occur, the announcement is sent as mixed audio along with the normal receive audio and both signals will be heard simultaneously on the repeater output.

Characteristics – Link Operation

The 440 MHz repeater and the 6 meter repeater have the ability to be linked. The S-Com controller is programmed to activate the link when a user sends DTMF digit 2 for a minimum of 3 seconds. The link can be activated from either the 440 MHz repeater or the 6 meter repeater. There is a link inhibit which disables the ability to activate the link under the following conditions: 1) A user attempts to activate the link on the 6 meter repeater when there is current activity on the 440 MHz repeater, or 2) A user attempts to activate the link on the 440 MHz repeater when there is current activity on the 6 meter repeater.

When the link is commanded "on", there will be a voice announcement on the 440 MHz repeater output that says, "6 meter link on". Immediately following that voice announcement, a second voice announcement will occur on the 6 meter repeater output that says, "440 link on". Once those voice announcements have occurred, the link will be ready for use.

When the link is active, both repeaters will still be functioning in half-duplex mode. For example, a signal received at the 440 MHz machine's input will be repeated only on the 6 meter machine's output. Conversely, a signal received at the 6 meter machine's input will be repeated only on the 440 MHz machine's output. To users who are simply listening to one repeater or the other (but not both simultaneously) at that time, they will only be able to hear one side of a conversation. In this mode of operation, there will be times when it appears that the repeaters aren't being used when, in fact, the link is actually up and running.

The normal ID cycle will still be in effect for both repeaters when the link is active. When the link is active, however, the frequency of the CW ID messages sent will be 500 Hz instead of 1000 Hz. Also, the courtesy tones will be 440 Hz in frequency instead of the normal 880 Hz. The anti-kerchunk feature is disabled when the link is operating. The transmitter timeout function remains the same, a maximum of 5

minutes continuous transmit time is allowed before a transmitter is disabled. The timeout warnings remain in effect for both transmitters and the implementation is the same as when the repeaters are functioning as standalone.

To deactivate the link, a user sends DTMF digit 6 for a minimum of 3 seconds. Once the DTMF digit is sent, a voice announcement on the 440 MHz repeater output will say, "6 meter link off". Immediately following that announcement, a second voice announcement will be heard on the 6 meter repeater output frequency that says, "440 link off". After those voice announcements have occurred, both repeaters will be restored to standalone operation. There is no inhibit for link deactivation – therefore, the link can be deactivated at any time by any user on either repeater, regardless of the current link activity state.

A "failsafe" timer is implemented when the link is up and running. If there is no 440 MHz receiver activity for a continuous period of 10 minutes, 30 seconds, then the link is automatically deactivated and the repeaters are returned to standalone operation. As with manual link deactivation, the voice announcements will be heard when the link deactivates due to a "failsafe" timeout event. The "failsafe" timer is used as a protection device should a user bring up the link and then either forget to deactivate it when finished or is unable to deactivate it.

Characteristics – Real Time Clock

The controller is able to send a voice announcement to give the current time of day in 12 hour (AM/PM) format upon a user request. Users can activate the time of day announcement by sending DTMF digit 1 for a minimum of 3 seconds. When activated, the voice announcement will say, "The time is XX:YY AM/PM". The time of day voice announcement is a female voice. All other voice announcements that occur on the repeaters are in a male voice. Note that the time of day announcement, regardless of whether commanded on the 440 MHz repeater or the 6 meter repeater and irrespective of the link being active or not, will only be heard on the 440 MHz repeater output. The real time clock is accurate to within 1 minute per month and can be remotely set/adjusted. In the event of a power failure, the real time clock is kept alive by an internal battery and will continue to keep time during a power outage event.

Characteristics – DTMF Decoder

The S-Com 7K controller has a built-in DTMF decoder. All of the various repeater receiver inputs must share this single decoder. As such, the 440 MHz machine receives priority, followed by the 6 meter machine. Once the decoder has been "captured" by a receiver, there is a maximum time limit allowance of 5 seconds between DTMF digit entries. That is, once you send a DTMF digit, you have 5 seconds time allowance to enter another digit before the decoder clears its buffer and resets. When a user sends a DTMF digit, only the first 0.5 seconds of the tone

will be heard at the repeater output – the remainder of the tone is muted. The muting eliminates the annoyance of hearing repeated DTMF tones and adds a measure of system security. If a series of DTMF digits are sent, you may or may not hear the first 0.5 seconds of each digit depending on how fast the digits are being entered. Since the user functions on these repeaters only require the input of a single DTMF tone under normal circumstances, the multiple tone entry muting noted above was included as information-only.

Characteristics – Long Tone DTMF Digit 0

The controller has been programmed to be compliant with the ARRL “long tone zero” or LiTZ protocol. Please refer to the current edition of the ARRL repeater guide for details on this program. The implementation on our system is as follows: to activate the LiTZ protocol, a user sends DTMF digit 0 for a minimum of 3 seconds. After DTMF digit 0 is sent, a voice announcement will be heard on the 440 MHz repeater output that says, “Emergency help please – emergency help please”, followed immediately by a CW message, “SOS SOS”. When this announcement concludes, the user should then state the nature of their emergency and/or type of help needed. Other users should then respond to the call for help as needed. The long tone zero function should only be used on the 440 MHz repeater. Although the DTMF decoder in the repeater controller will process a DTMF input from the 6 meter repeater, the voice announcement will only be heard on the 440 MHz repeater output.

Available User Functions

Request Time Of Day – Transmit DTMF digit 1 for a minimum of 3 seconds

Activate 440/6 link – Transmit DTMF digit 2 for a minimum of 3 seconds

Reset Transmitter Timeout – Transmit DTMF digit 5 for a minimum of 3 seconds

Deactivate 440/6 link – Transmit DTMF digit 6 for a minimum of 3 seconds

Emergency Assistance Request – Transmit DTMF digit 0 for a minimum of 3 seconds