



The GroundWire

Words From The Bayou

Is your station “At the Ready”?

Looking at the September 2013 issue of QST, the cover page asks the question: “Is your station *at the ready*”? This simple question started me thinking about my particular station(s) and how I would answer the question. Visions of late August 2005 come to mind and the anxiety surrounding one basic question: “Are they alright”? All of my family members fled New Orleans for the safety of northern Louisiana and were holding up in a small motel just outside of Monroe. But, my wife’s family decided to stay at my in-law’s brand spanking new home in Folsom, about 1 ¼ hours north of the city. Seven family members and three cats hunkered down riding out what would end up being one of the deadliest natural disasters in US History. Once landfall occurred early on Monday morning 29 August, communications to Folsom was knocked out. I sat at my desk here in the DFW area watching the weather radar full well knowing things were not “alright”. After living through enough hurricanes, you get to know which ones are mild, and which ones are wild. Katrina was way beyond wild, off the scales in most categories. From DFW, we called about every hour or so, getting telco intercept recordings stating all circuits are busy.

We finally received a phone call via landline from the Folsom bunch about 2200 hours on Tuesday evening 30 August. First thing my father-in-law said to me was “We’re alright, and tomorrow morning, were heading your way”.

That experience has taught me to never take electrical power, and clear flowing water for granted – ever again. In setting up my radio station(s), I placed a great emphasis on emergency power and operating for extended periods without the convenience of commercial mains power. I have two stations, a VHF/UHF mobile in the truck, and a HF station in the shack. For this article, I would like to talk to you about the HF station. Some of you in Groundwire land are aware that I enjoy building my gear when economical, feasible, and practical. The list of kits constructed is long. One common theme is that all of the components are powered by +12 VDC power.

The power system is simple, and dependable. The center of the system is a 26

ISSUE 2013-10



In This Issue

PAGE THREE

Duplexers and Repeaters

PAGE EIGHT

Financial Report

PAGE NINE

Minutes of Board Meeting

PAGE TEN

Minutes of General Meeting





amp/hour gel cell battery. It was purchased from a Ham-Com tailgate vendor several years ago for about \$40. The battery has two different sized Anderson Power Pole connectors attached to it. The larger one connects to a MFJ DC Power Distribution Panel (MFJ-1128) where each output position is individually fused and the panel has a single input fuse rated for 40 amps. The second battery connector is for the Solar Controller. The Solar Controller keeps the battery voltage peaked at 13.8 volts as long as the sun is shining. The Solar Controller has an input for the PV (Photovoltaic) panel that converts sunlight into DC electricity. A modest 40 Watt PV panel keeps the battery topped off and is more than adequate to keep the juice flowing indefinitely at my QTH. I've never experience a power outage using this system. We have a small, simple inverter that can connect directly to the gel cell battery for powering laptops, weather radios, small lighting systems, etc.

So in closing, take some time to review your station(s) be they simple handi-talkie, or full blown HF stations and ask yourself the question: "Is my station *at the ready*"? As the Boy Scout motto goes "Be Prepared". Do what you can do now to prepare that unexpected emergency.

73

Mike

K5MMH

We use them and talk about them, but rarely get involved with them. WA2YSJ presents an over-view on duplexers and repeaters and how they work.

Duplexers and Repeaters

Some Basic Information

REPRINTED WITH PERMISSION FROM CQ MAGAZINE JULY 1992

BY ROBERT A. LEHNING*, WA2YSJ

All across the country there are many amateur repeater stations operating on 2 meters, 220 and 440 MHz, and to some extent on 1.2 GHz. Several modes of operating such as FM, ATV, and packet (digital) have also become very popular. Many amateur radio operators use these repeaters but do not really understand the basics of duplexers or the role a duplexer plays in repeater operation.

Basic Repeaters

It is common knowledge that if you "hit" a repeater with low-level signal such as a mobile or handheld radio transmits, the repeater retransmits the information at a higher power level over a greater area. This is commonly referred to as the range of the repeater, the area within which you can activate the repeater with the transmitted signal. Antenna patterns can be adjusted so that a repeater range can cover a certain area or direction only, but a majority of repeater ranges are intended to be omnidirectional (see fig. 1).

The repeater does this receiving on one frequency and retransmitting on another frequency. This occurs simultaneously and is called **duplex** operation. The frequency separation between the TX

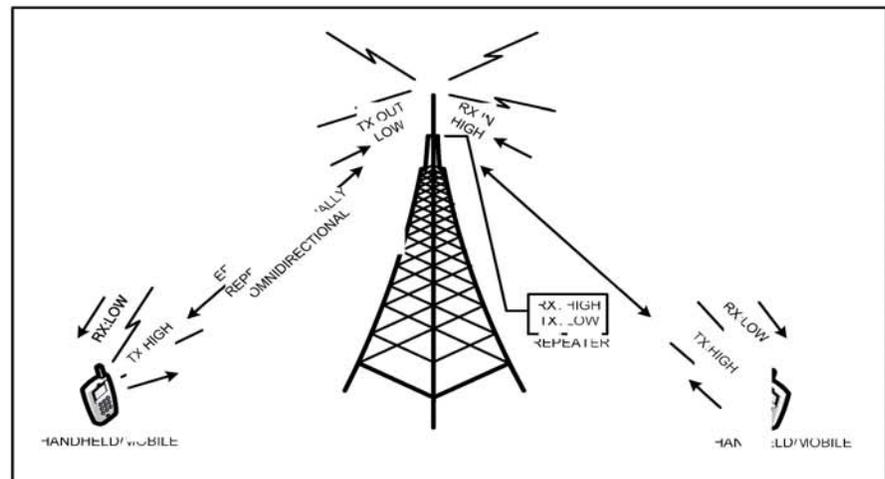


Fig. 1-Typical omnidirectional repeater installation

(transmit) and the RX (receive) is sometimes referred to as the **split** or **repeater pair** of frequencies. For example, on 2 meters the split is .6 MHz (600 kHz). The TX can be the low frequency and the RX the high, or vice versa. At 220 MHz the split is 1.6 MHz, and at 440 MHz it is 5.0 MHz. At 1.2 GHz the frequency separation can be 12 MHz or 20 MHz, depending on the area of the country where the repeater will be in operation. Therefore, it follows that if the repeater receives on a high frequency and transmits on a low frequency, the mobile or handheld radio will conversely transmit high and receive low. If you reverse the repeater, then the mobile or

handheld radios must also be reversed to match it.

Many repeaters both receive and transmit with a single antenna rather than operating with separate TX and RX antennas (see fig. 2). This is where the duplexer is employed.

The duplexer enables the repeater to transmit and receive simultaneously on a single antenna and feedline without interference to each function by providing the necessary "isolation" between the TX and the RX frequencies. This isolation is measured in decibels (dB). If separate TX and RX antennas were to be used, they would have to be physically spaced a certain

*1295 Wisconsin Rd. Derby, NY 14047

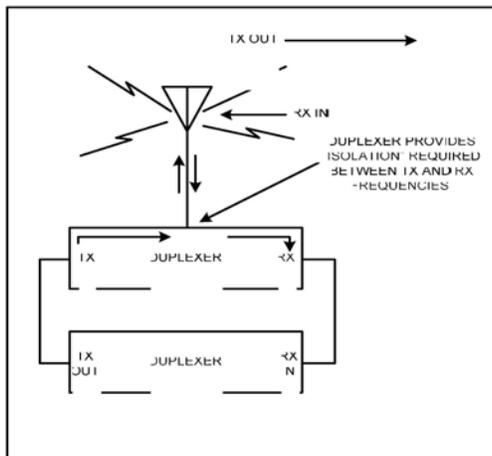


Fig. 2-A duplexer provides isolation between receive and transmit frequencies so that a single antenna and feedline can be used.

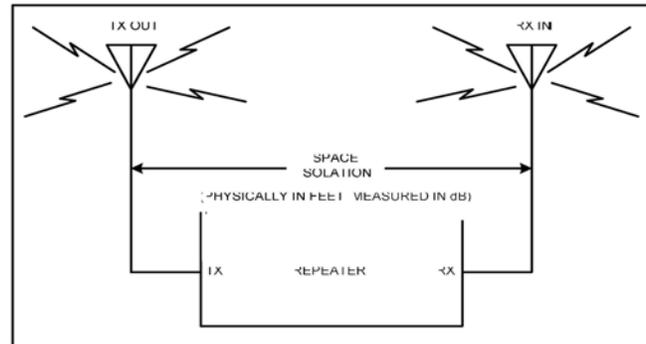


Fig. 3-Without the use of a duplexer, separate antennas for transmit and receive would be required. These antennas would have to be spaced far enough apart so as to provide suitable space isolation.

distance apart, either vertically or horizontally, to provide the necessary isolation (see figs. 3 and 4). This is usually referred to as **space isolation**.

For example, a 2 meter repeater using separate TX and RX antennas would require about 10 feet of vertical space isolation as compared to about 30 feet of horizontal space isolation to gain 30 dB of isolation between the transmit and the receive. Most repeaters require more isolation than this, so it is apparent that more space isolation would be required for the two-antenna approach. Two antennas take up valuable space on a tower, space that may not be available, and require two feedlines. A single antenna and feedline for a repeater is much more economical and saves tower space, particularly at a crowded antenna site. Antenna sites are generally located at the highest point of terrain in a given area and are usually shared by several radio services and users. Some duplexer designs can provide the repeater with protection from interference from other radios at the site and

protect other radios at the site from its own transmitter.

This filtering action of the cavities in the duplexer can also be used to control receiver desensitization (**desense**), which is one of the common problems that can be encountered on a repeater. Receiver desense can be defined as on-channel noise or a strong off-channel signal that degrades the receiver sensitivity. On-channel noise can be coming from the repeater or passing through the duplexer from some other source. An off-channel signal can be close in frequency and physically located somewhere else (another site), or it can be located in close physical proximity to the receiver, but not necessarily close in frequency. Either situation will restrict the receiver's capability to detect (pick up) a weak signal, such as a low-level signal from a mobile or handheld radio.

How Does A Duplexer Work?

There are several duplexer designs being used in repeaters today, but by far the most common is the **pass/reject** or "pseudo-bandpass" type of duplexer. For this reason

we will consider the pass/reject type of duplexer in this description of duplexer operation.

Imagine, if you will, a transmitted signal being received by a repeater antenna (see fig. 5). This signal travels down the feedline to the duplexer and looks at the cavities. The cavities tuned to the TX side of the repeater are set to block, or reject, this received signal. Therefore, the signal will pass through the cavities on the RX side of the duplexer which are tuned to accept, or pass, the RX frequency of the repeater. They will pass this frequency and tend to reject, or attenuate, most everything else.

At the same time the repeater transmitter is retransmitting the information on another frequency on the same feedline and antenna. This transmitted signal leaves the repeater transmitter and then travels along the interconnecting cable to the duplexer. This signal will look at the cavities and pass through the cavities tuned to pass the TX frequency of the repeater. The cavities on the RX side of the duplexer are set to block, or

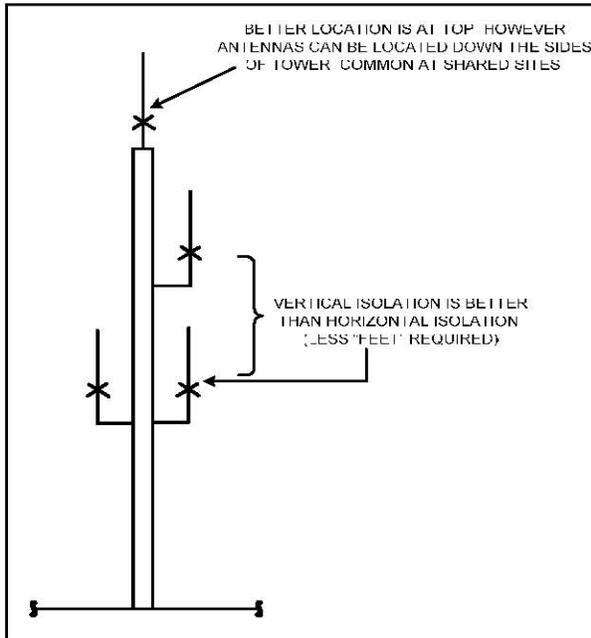


Fig 4-At shared or crowded sites some space isolation may be required between the antenna of one repeater and the antenna of another.

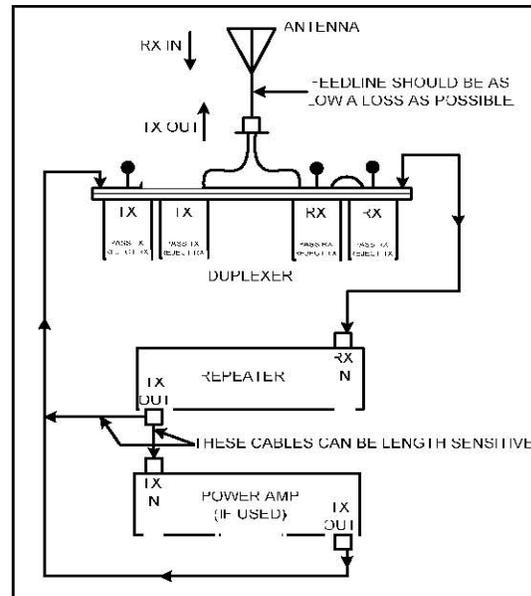


Fig 5-Flow diagram showing the use of a duplexer and repeater at a typical site.

reject, this transmitted signal. The signal passes through the TX cavities, travels up the feedline, and is radiated by the antenna. Thus, the duplexer "isolates" the TX from the RX and vice versa, enabling the repeater to receive and transmit simultaneously without interference to each function. Resonant cavities which are used in the pass/reject type of duplexer can be a valuable tool in controlling spurious emissions, desense, and other problems that a repeater can experience.

Quality duplexers are designed and built to perform within certain ranges of power, temperature, and frequency separation. The materials used in the manufacture of duplexers usually control the power rating and temperature range of the duplexer. The physical size of a duplexer is most often determined by the frequency at which the duplexer is to be used. Temperature stability

is a very important factor to be considered. The frequencies to which the TX and RX sides of the duplexer are tuned cannot change due to something moving when it heats up and expands or cools down and shrinks. Detuning of a duplexer in this manner, in the worse case, can render a repeater inoperative. Materials with a low coefficient of thermal expansion are therefore used in critical areas such as the cavity main tuning control.

The components used in the RF circuits of the duplexers—such as capacitors, coupling loops, connectors, and cable—also have to stand up to the amount of power going through the duplexer. This is another source of heat.

The reverse side of the temperature stability problem is seen when the duplexer and repeater are housed in an unheated shack during

the winter months. The duplexer must be stable in the cold also. Most manufacturers will usually provide the necessary data and specifications to enable the proper duplexer to be chosen for the particular application.

Some Common Sense

There seems to be a common misconception that a duplexer can be the cause or source of all the many problems that can plague a repeater. In reality there are things that can affect the operation of a repeater. Granted, there can be troubles with a duplexer, such as detuning during shipment or damage due to lightning or vandalism, but accidental detuning is perhaps the most common problem. There have been many instances of noise passing through a duplexer, making it appear that the duplexer is at fault. A majority of the time, however, problems usually can be

traced to some other source. A duplexer is not an active device and does not require much maintenance once it is installed and in operation.

There exists, the world over, a strong urge to “tweak” a duplexer after it is installed and the repeater is up and running. This “tweaking” can be the cause of some of the problems a repeater can experience. “Tweaking” can be equated with “detuning” if it is “tweaked” far enough. There usually will be some initial adjustment when the duplexer is first installed. However, once this is done and the repeater is operational, “tweaking” should be kept to a minimum or discouraged altogether.

Another area where problems can exist or be created is in the coaxial cable and connectors used to interconnect the antenna, duplexer, and repeater. It doesn’t pay to scrimp on cable and connectors. Quality cable, hardline or whatever, is expensive. But when you consider repeater “down time” due to connector or cable problems, it pays in the long run. Cheap connectors and cheap cable make for cheap performance and reliability. Since connector joints are a prime source for noise on a repeater, quality connectors properly assembled onto quality cable can minimize this possibility.

Keeping this in mind, the interconnecting “patch” cables are another important factor to be considered in the operation of a repeater. Specific cables for interconnecting the duplexer, the repeater, power amp, etc., should be made with quality connectors and cable that is of the specified impedance of the repeater system. Some of these cables may be length sensitive, such as the cable running from the repeater transmitter to the duplexer. You can’t just plug in a random length

of 75 ohm cable into a 50 ohm system and expect that system to work properly. The use of connector adaptors and splices in the cable are not considered “good practice” either. Double-shielded (double-braid) coaxial cable is a recommended choice when considering interconnecting cables and, in some cases, even the feedline.

Some thought is also required when routing cables at a repeater site. If cables are run close together—i.e., in a “bundle”—coupling may occur between cables. For example, the cable that connects the antenna to the duplexer is run parallel to, and in the same “bundle” with, the cable connecting the duplexer and the receiver in the repeater. When the transmitter is keyed, “desense” occurs in the receiver. This is caused by a strong RF field being generated by the transmitter coupling into the cable running to the receiver and overloading the receiver. This is a good argument favoring double-shielded cable.

Crowding at repeater sites is sometimes unavoidable and special care should be taken in the routing of the cables under such circumstances. Even the routing of feedlines or placement of the antenna on the tower can cause problems. At shared or crowded sites some “space isolation” may be required between the antenna of one repeater and the antenna of another (see fig. 5). In some adverse cases a little extra filtering may be required on a receiver or offending transmitter. Each case is usually unique, and sometimes they can drive a person crazy trying to analyze the problem and formulate a cure.

Once the repeater is up and operational, drawing up and sticking to a monthly or quarterly inspection schedule is a very good idea. Periodic inspection of the site can provide valuable

information on equipment status. Inspection of the cable, the tower and antenna, and the grounding system can usually detect potential problems. This can provide enough time to prevent a major problem with the repeater, causing it to provide poor or inadequate coverage, or even to be off the air for an extended period of time. Brief, intermittent periods of “down time” for inspection and repair are much more acceptable than days, weeks, or even months on end! Co-ordination and co-operation with other services at a site can also go a long way to help prevent or resolve any problems that may arise. As the old saying goes, “An ounce of prevention is worth a pound of cure.”

Lightning Protection

It cannot be stressed enough that a good grounding and lightning-protection system should be employed for just about any amateur installation, including a repeater.

Most repeater sites are located at higher elevations that are more prone to being struck by lightning. A tower or antenna, reaching into the sky, on top of a mountain, hill, or house, makes an excellent lightning rod. Lightning can damage or destroy just about anything at a repeater site, including towers, buildings, and equipment. A duplexer doesn’t have many parts, but it is just as susceptible to lightning damage as anything else at the site.

A good electrical ground is the basic requirement, and grounding the tower and equipment is the first place to start. Tower manufacturers can usually provide suggested grounding schemes for towers and equipment shelters. There may be local building and zoning codes that have to be followed. There are several manufacturers of lightning

protection equipment who can provide a wealth of information about lightning protection. Lightning protection cannot stop a lightning strike, but it can usually minimize the amount of damage that can result from one. Nature can be very unpredictable and sometimes any measure taken can be almost useless. It is best to provide some form of lightning protection even if the possibility of a lightning strike doesn't exist or is minimal. Some protection is better than none for any installation, if only for peace of mind.

In Closing

There are several manufacturers and quite a few varieties of duplexers and repeaters available on the market today for amateur use. Most offer excellent warranty and repair/retuning services for their products.

A good rule of thumb is to choose a duplexer that has specifications of power, frequency separation, and temperature range. Isolation requirements between the TX and RX frequencies are an important factor to weigh. Some duplexer designs provide more isolation than others. Some duplexer designs also suffer more insertion loss than others. Sufficient research and question asking can usually result in getting the right equipment for the job.

The same thinking should be applied to the antenna and feedline system to be used with the repeater. A good quality duplexer, connected to a good repeater and antenna, installed and maintained properly can provide many amateurs with reliable communications and enjoyment of their hobby over long periods of time with little or no aggravation and a minimum of down time.

Acknowledgements

I would like to thank Mr. Elliot Johnson of TXRX Systems, Inc. for his quiet insistence and helpful suggestions in attempting to present some basic, and I hope, pertinent information about a subject that doesn't seem to get much press. I would also like to thank Barbara George and Sydney Harrison for their able assistance on the CAD machine to produce some legible illustrations. 

Financial Report ... September, 2013



General Fund

Beginning Balance 9/1/2013			\$873.11
INCOME/EXPENSE			
Dues Income-2013	\$31.25		
ARRL Renewal Income-2013	\$2.00	\$37.00	
Transfer From Matl. Property			
Tranfer Petty Cash income			
TOTAL INCOME	\$33.25		
EXPENSES			
TOTAL EXPENSES		\$0.00	
TOTAL INCOME/EXPENSE	\$33.25	\$0.00	
Ending Balance 9/30/2013			\$906.36

Special Events Fund

Beginning Balance 9/1/2013			\$140.14
INCOME/EXPENSE			
Trans from General Fund			
TOTAL INCOME	\$0.00		
EXPENSES			

TOTAL EXPENSES		\$0.00	
TOTAL INCOME/EXPENSE	\$0.00	\$0.00	
Ending Balance 9/30/2013			\$140.14

Material Property Fund

Beginning Balance 9/1/2013			\$2,778.67
INCOME/EXPENSE			
Dues Income-2013	\$31.25		
Transfer from General Fund			
TOTAL INCOME	\$31.25		
EXPENSES			
Seabury & Smith Ck2029		\$320.00	
AT&T		\$42.12	
Transfer to General Fund			
TOTAL EXPENSES		\$362.12	
TOTAL INCOME/EXPENSE	\$31.25	\$362.12	
Ending Balance 9/30/2013			\$2,447.80
September Balance	\$64.50	\$362.12	\$3,494.30

2013 Board Members

President

Mike Harang (K5MMH)

Vice-President

Bill Ellis (N5TXN)

Treasurer

Jerry Keltner (KB6OJE)

Secretary

Pat Roberson (KB5YPP)

Directors

Paul Dryer (KD5IVP)

Rick Ellis (KJ5UY)

Lester Wong (K5ITO)

Committee Positions

Repeater Trustee

Johnny Roberson (KJ5LB)

Repeater Committee Chair

Mike Harang (K5MMH)

Newsletter Editor

Bill Ellis (N5TXN)

Web Master

Bruce Holt (KG1BAH)

MN²

Monday Night Net

Net Time 8:00PM

147.060(+) Primary

444.500(+) Alternate

Minutes of Board Meeting ... September 3, 2013



The meeting was called to order by Mike (K5MMH) at 6:31 PM.

Invocation was given by Paul (KD5IVP).

Executive Board members present:

Officers

Mike Harang (K5MMH)
Bill Ellis (N5TXN) - absent
Pat Roberson (KB5YPP)
Jerry Keltner (KB6OJE)

Directors

Lester Wong (K5ITO) - absent
Paul Dryer (KD5IVP)
Rick Ellis (KJ5UY)

Guests: Jimmy (KB5WIO) bids us farewell as he moves to South-East Texas. We will miss you, Jimmy. Bruce (KG1BAH), James (KF5RBN).

Minutes: Motion: Jerry (KB6OJE), 2nd : Rick (KJ5UY). Minutes approved as printed in Groundwire.

Treasure Report: Motion : Rick (KJ5UY), 2nd : Paul (KD5IVP). Treasure Report approved as printed in Groundwire.

COMMITTEE REPORTS

Repeater: The 2 meter output seems normal. No other update.

VE Session: None.

EOC: Larry (KY5S) will check out the site as work schedule allows.

Membership: One renewal for 2014 dues was received.

Net: This past Monday was a Holiday – no net. Previous week there were 5 who checked in on the 440.

Web: Groundwire updates are done. Friends Remembered page to be done soon.

Groundwire: Front page article on filters/duplexers/cans to be supplied by Johnny (KJ5LB).

OLD BUSINESS

1. None.

NEW BUSINESS

1. It's time to pay the club insurance. Jerry (KB6OJE) will take care of payment.
2. Jerry will also check on when and dollar amount of donation to be made to W.P.B.C.
3. Ben (K5NEB) will conduct a Tech. Training class Sep. 7, 14,21 at the G.P. Law Enforcement Center. The class is full! Ben could use some help with training and testing.

ADJOURN: Motion by Rick (KJ5UY) at 6:54 PM.

General Membership Meeting ... September 17, 2013



The meeting was called to order by Mike (K5MMH) at 6:35 PM.

Invocation was given by Paul (KD5IVP)

Executive Board members present:

Officers

Mike Harang (K5MMH)
Bill Ellis (N5TXN)
Pat Roberson (KB5YPP)
Jerry Keltner (KB6OJE)

Directors

Lester Wong (K5ITO) - absent
Paul Dryer (KD5IVP)
Rick Ellis (KJ5UY) absent

Guests: Steve Baird (KF5WYN)

Minutes: Motion by Johnny (KJ5LB) to approve as printed in the Groundwire. 2nd by Floyd (KC5QBC). Approved.

Treasure Report: Bills paid after Aug. report leaving Balance of \$3,481.00. Motion by Johnny (KJ5LB) to approve as printed in *Groundwire*, with update. 2nd by Ben (K5NEB). Approved.

COMMITTEE REPORTS

Repeater: 2 meter repeater is working, sounds good.

Backup repeater: Still searching for site to house unit. Disconnected at present. Still needs cans/filters.

VE Session: none

EOC: nothing to report

Membership: application given to Steve Baird (KF5WYN).

Net: net moved back to the 147.060 repeater. Six or seven checked in, thanks to Russ (KX5G) who was net control. The repeater sounded good.

Web: The "Friend Remembered" page has been modified by Bruce (KG1BAH). Rick (KJ5UY) to forward info on his father for addition to the site.

Groundwire: Front Page to be submitted by Mike (K5MMH) via Johnny (KJ5LB). Looking for program ideas for next few months.

OLD BUSINESS

Backup Repeater still needs site to house equipment, remote control, good notch filters/cans.

NEW BUSINESS

1. Ben (K5NEB) is conducting Tech training classes Sep. 7, 14, and 21 at the G.P. Law Enforcement Center. Class is full and he has the help he needs.
2. Club liability insurance payment has been sent by Jerry (KB6OJE).
3. Donation to W.P.B.C. of \$300.00 can be made in December. Motion by Johnny (KJ5LB), with second by Bill (N5TXN) to approve. Motion approved.
4. Gene (N5PKZ) announced the next 80 meter Fox Hunt will be Oct. 12 (second Saturday), after the Breakfast Gathering at Acapulco's.

ADJOURN: Motion by Johnny (KJ5LB) at 6:45 PM.

Program : Introduction on how to use **D-STAR (Digital Smart Technologies for Amateur Radio)** by Barry McCoy (K5BSM).