

PIKE AND KEY AMATEUR RADIO CLUB  
K 7 J E D R E T A Y

REGULAR BUSINESS MEETING FEB. 21, 1976

Friendship awards were handed out to Sue WB7DBZ, Bev WB7ACS and John WA7YIG, Congratulations to you all . . The minutes were read and approved... A membership certificate was given to Rick K7GGD, Congratulations to you Rick, We hope you will enjoy our club. There was no activity report as the chairman is attending school . A report was given by Pete K7WTG on the weekend trip to Vancouver B C. This trip will be the weekend of March 27 and 28th If you are interested please contact Pete K7WTG for more information . . There was a report by Clay on the article and pictures in the Tacoma News Tribune paper on C B. operation... A motion was made and seconded to send the news paper and Mr. Bob Diecsch of the F..C.C for telling it like it is" A report of activities for the Puget Sound council of Amateur Radio clubs was given by Lew WA7ELI. There was a report of the activities of the Banquet committee given by Karon Polacani. A report was given on the up and coming A R R L convention. The convention will be held at the Seattle Center Lots of help is still needed to get all the things started and along so if you would like to help get the show on the road please contact Steve K7KOT or Harry W7JWJ

The club voted on official club simplex two and six meter frequencys which are 146.58 for two and 52.76 for six meters.. This will be nice for operations away from the repeater and for local events which would not require the use of the repeaters...

BOARD MEETING FEB 21, 1975

No board meeting was held this time.

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NOTICE NOTICE NOTICE .. NOTICE...NOTICE...NOTICE...NOTICE.. NOTICE..

The April regular business meetin will be held at the Renton Library which is just off Hwy 405. Rember this is election Day so we hope you all will be there to support the club.

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THE TWO METER REPEATER

Many thanke to Pete K7IPQ and Al WA7TIB and Jerry WA7OYH FOR all the work and time spent on the package last week.. They missed some meals and being at home so you could enjoy the repeater.. its working fine now so enjoy it .. again thanks.....

# Measuring Receiver Performance By Means of the SINAD Method

By James I. Symons  
Vice President  
Helper Instruments Company

There seems to be a general lack of appreciation, even carrying through to some at the engineering levels, about the importance of receiver sensitivity degradation in total system performance. A lot of it is caused by the fact that receiver sensitivity is specified in microvolts across a given input resistance, while transmitter power is given in watts. Few technicians would let a 30-watt set out of the shop that only delivered 15 watts output. At the same time, many would not consider the sensitivity unduly low if it measured 0.5 microvolts in a set rated 0.35 microvolts. Bringing the transmitter back to specifications is likely to require replacement of an expensive power transistor, but bringing the receiver back to specifications will usually require nothing more than a little alignment correction. The typical land-mobile repairman will always measure transmitter power output before a radio leaves the shop—and shop managers insist on pretty good accuracy in their RF power meters. Receiver sensitivity measurement, however, is often merely estimated by ear.

Time and money are part of the reason for this neglect. Sensitivity measurements take time and commercial repair shops are facing increasing crises in hiring enough skilled technicians to keep up their business. Even the captive shops—those operated by a government entity or a large company to do their own communications maintenance—are seeing the pinch. But the number of radios

to maintain continues to increase faster than the number of technicians required to support them.

## SINAD Is Most Meaningful

It is pretty well acknowledged that the SINAD method is the most meaningful one for measuring FM receiver performance. It has the basic requirements of any good performance measurement: (1) it is repeatable; (2) it is quite insensitive to variations in technique by those making the measurement; and (3) the measurement relates directly to the actual, practical performance of the receiver. The SINAD measurement is becoming generally accepted by industry. EIA's specification RS-201 on land-mobile receivers gives SINAD as the preferred way of stating useful sensitivity. You seldom see the old 20-dB quieting methods in manufacturer's specifications any more, except as back-up to the universally stated "12-dB SINAD".

Let's review the procedure for making a 20-dB quieting measurement on a receiver. The receiver squelch is set "open", and an AC voltmeter is connected to the speaker terminals to read the level of "thermal" noise delivered by the receiver. The volume control is set to obtain a handy reference level on the AC voltmeter (usually 0 dB). A CW signal on the channel frequency is then introduced into the receiver and increased in level until the noise output at the loudspeaker drops to one tenth (20 dB) of its previous level.

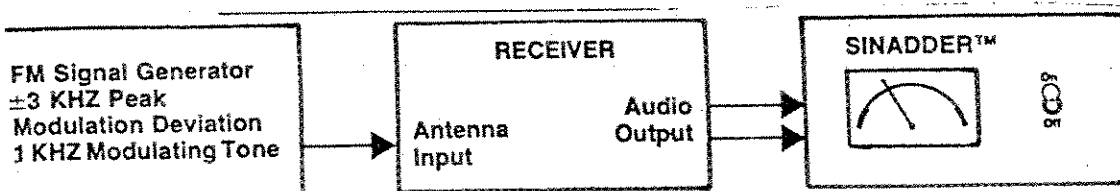
The trouble with this method is that it only measures the ability of the re-

ceiver to receive a CW signal. A receiver must receive voice-modulated signals if it is to be useful in land-mobile applications. In order to receive the modulated signal, the receiver must have an adequately flat bandwidth to receive all of the components of the modulated signal. Poor design, component aging or failure, or improper alignment can result in a peaked response that admits the CW signal nicely but will not permit effective reception of the modulated signals. A signal with a peaked response may seem exceptionally good when measured by the 20 dB quieting method. The SINAD method, on the other hand, provides an unambiguous measure of the ability of a receiver to receive a modulated signal. Unfortunately, this method has the reputation for being a pretty time-consuming procedure.

## How to Measure by SINAD Method

To measure sensitivity by the SINAD method, a signal generator is connected to the receiver antenna terminals and set exactly on the channel frequency. The generator signal is modulated by a 1000-Hz tone, and the peak modulation deviation is set at 3 kHz (for receiver used in systems with 5-kHz deviations). The receiver volume control is adjusted to deliver the receiver's rated audio output power, and the distortion meter is connected to the audio terminals. The distortion meter reference level control is set and the meter is then switched to read distortion. The frequency and null adjustments on the meter are adjusted to null out the 1000-Hz tone. The signal-generator attenuator is then adjusted to obtain a distortion meter reading of 25 percent (corresponding to 12 dB). The microvolts reading of the signal-generator attenuator is the "12-dB SINAD sensitivity" of the receiver.

The basis of this procedure is the following: The distortion meter is used as an audio voltmeter. When the reference level control is set, the voltmeter is reading all the components of the audio output of the receiver. This audio output



1. Set Signal Generator precisely on channel frequency.
2. Insert strong signal into receiver and set volume to comfortable level.
3. Decrease Signal Generator level until SINADDER™ reads 12 dB.
4. Signal Generator output level is the 12 dB SINAD sensitivity of the receiver.

consists of: (a) the 1000-Hz tone (corresponding to the wanted speech intelligence signal to be received in actual operation); (b) harmonics of the 1000-Hz tone (distortion); and (c) noise—the thermal noise you hear when a weak signal is being received. When the distortion meter is switched to the "distortion" position, a null circuit filters out the 1000-Hz tone, leaving the distortion products and the noise. The meter is usually calibrated in percent. When a distortion meter is used as above in a SINAD measurement, it is giving the answer to the following equation:

$$\text{Meter Reading (percent)} = \frac{(\text{Noise And Distortion}) \times 100}{(\text{Signal} + \text{Noise And Distortion})}$$

Distortion meters are usually calibrated in percent distortion, but SINAD measurements are customarily stated in decibels. A 25-percent reading corresponds to 12 dB, and a 10-percent reading corresponds to 20 dB. The 12-dB SINAD sensitivity is almost universally used. This 12-dB level is especially appropriate for land-mobile receivers because incoming signals become usefully understandable at about 12 dB SINAD. The procedure is shown in figure 1.

As you can see, SINAD measurement is quite time-consuming. Most shops that use SINAD measurement don't worry about adjusting the receiver to its rated audio output. This is a justifiable shortcut, because the audio distortion in any decent audio system will make a minor change in the measurement. Even with this time saving, however, there is still a lot of knob twiddling to do. One problem is that the total output of the receiver may vary somewhat at low signal levels, making it necessary to check or reset the reference level control several times during a measurement.

#### Knob Twiddling Removed

At Helper Instruments Company, we undertook them talk of removing the knob twiddling from SINAD measurements. We built a piece of equipment with a meter reading directly in SINAD. A very stable active notch filter preset at 1 kHz (by EIA definition, the SINAD test frequency) was internally provided to eliminate frequency and null controls. A tight AGC circuit permitted the instrument to operate over an input voltage range of from 30 millivolts rms to over 4 V rms while maintaining a constant reference level, thus eliminating the level set control and reference-distortion switch. This left an on-off switch as the only control on the panel. It would also have been eliminated had the present energy conservation awareness not been with us. The unit draws less than 5 watts and can be

At Helper Instruments Company, we undertook the ment, all you have to do is connect it to the receiver loudspeaker leads and feed a measured, 1-kHz modulated signal into the receiver front end.

The SINADDER, which is the name we gave the instrument, proved to be just as much of a time saver as we expected. Figure 2 shows the procedure for measuring 12-dB SINAD sensitivity using the instrument. Assuming a 3.2-ohm loudspeaker, the meter will read correctly from a receiver output level of a quarter of a milliwatt to over 5 watts. That's plenty of range when you consider that the task of removing the knob twiddling from SINAD measurement left on indefinitely. To measure SINAD with this instrument level would be hard to hear and the higher level would probably drive everybody out of the shop.

#### Found to Be Alignment Aid

Although the instrument was designed to measure SINAD sensitivity, we quickly found that it could be a

tremendous alignment aid. It is this use that is making it popular in a lot of service shops. Typical alignment procedures for FM receivers consist of DC metering at specified meter points. Usually a weak signal is injected, and the alignment adjustments are made to maximize the meter readings. Alignment "by the meter", as most technicians know, is not always the optimum alignment.

These "by the meter" procedures give the alignment for maximum gain of the various stages, but this is not necessarily the alignment for optimum signal-to-noise performance. It is often possible to improve on a "by the meter" alignment by touching up a few of the adjustments in the front end for optimum signal-to-noise. Although a few of the "old hands" can get good results doing this touchup by ear, the SINADDER makes the touchup procedure really practical—and fast! By retuning for optimum SINAD, it is almost always possible to squeeze a decibel or so extra sensitivity out of a receiver, and a 3 to 5 dB improvement is not at all unusual.

The automatic reference level control circuits in the SINADDER make the "alignment for best SINAD" procedure possible. After the receiver is roughly aligned by the usual methods, the signal generator is set to provide a 1-kHz modulated signal and the alignment adjustments are touched up to obtain minimum deflection on the SINADDER meter. As the procedure progresses, the signal generator is backed off to keep the SINAD reading at about 12 dB. This procedure avoids the peaked response that often occurs in the ordinary meter tuning methods. It results in a better bandpass alignment of overcoupled circuits and crystal filters than is obtained with the ordinary limiter meter procedures.

#### Aligning "Needle Nose" Job

One of the recurring problems in connection with receiver alignment concerns the occasional receiver that ends up with a "needle nose" bandpass. This can be caused by faulty receiver design, or by aging of bypass components, or a host of other reasons. Although it would be best to get truly to the bottom of the problem, the pressure of time often makes it necessary to get on to the next job, and it is usually possible to arrive at an alignment adjustment that results in normal performance. If the alignment on one of those "needle nose" jobs is touched up for optimum

MEETING FEB 28, 1976

... to the new Puget Sound counsel officers: ...  
K7... President.. Pete K7IPQ Vice President.. Jim K7VNI Secretary  
and Carl W7PRW Treasurer...

A letter was presented by the DX club which stated that the DX club  
going to pull out from the convention committee and would not support  
convention. The meeting was happy to have for the meeting Bob W2IGY the  
ARRL Northwest division director and Bob Diecsch from the local F.C.C.  
office.

Bob Diecsch gave a talk about the operation of Illegal stations in the  
low end of 10 meters. He asked the help of all amateur operators in tracking  
down these people. He asks that we supply the adresses and the times we  
hear these stations and any other information we can come up with. He  
does not garentee that the FCC will get all of the illegal operators but  
he did state that the FCC needs all the help they can get. If you do not  
want your name mentioned you do not have to give it in the report..  
This is a good chance to help help get rid of all illegal operations on  
the 10 meter band...

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NOTICE NOTICE NOTICE .

Congratulations to Les Jacobs WA7NXC... In this day when most of us are  
caught up with our own problems its nice to know that there are people  
like Les who will take the time to assist others...

FROM C B. NEWS MARCH 3rd 1976

Les Jacobs assists flood victums!!! , Local CBers assisted local athortia  
in the recient flooding in the Shonomish county area . They manned radio  
, providingpoint to point communications andassisted flood victums.

Congratulations to the Dead Beat..... Thats a Big 10-4!!!.....

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SIX AND SEVENTY FIVE METER NETS

Come-on, these nets are for the spreading of club information, and items  
interest! It was noted that the last few Tuesdays the only guy talking  
net control. In order to keep up the interest we have to start getting  
ARRL bulletens, read, imformation from the clubs officers, activities and  
the like.. Would the club like to start a Swar and Shop? We can you know,  
and there will be no problems as long as its Amateur equipment and prices  
are not discussed. Because the Six meter net is , forthe most part a  
"captive audience", Is it too excluscive? should we drop the six meter net  
and go to two meters?If so what frequency? Is the time and the day OK? If  
not which would be better? What about 75 meters? we have been having 10  
to 20 checkins each sunday and usally 1to2 visitors. do we need changed the

SINAD, normal performance can often be achieved. This procedure is aided if the modulation deviation on the signal generator is set at about 5 kHz instead of the 3 kHz that would be used for a SINAD measurement.

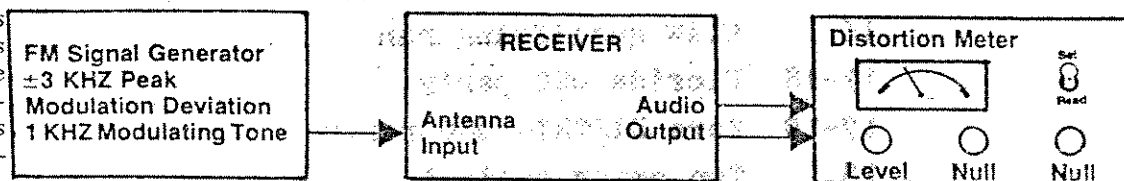
Modern receivers are making increasing use of quartz filters. Sometimes these have tuning adjustments associated with them. In general, they cannot be tuned by the usual adjustment for maximum limiter current. Some manufacturers specify a sweep procedure that requires a sweep generator and a scope. It takes quite a bit of time just to set up everything for the sweep alignment. It is possible to arrive at proper alignment of these crystal filters with the SINADDER. Set the signal generator for 5-kHz modulation deviation, reduce the signal generator output until the SINAD indication is about 12 dB, then adjust the tuning controls for minimum deflection on the SINADDER meter. The resulting alignment, we have found, is superior to the one obtained by the sweep method. This is because the sweep method arrives at the adjustment for a flat amplitude characteristic in the passband, whereas the SINADDER adjustment leads one to the most linear phase characteristic—and the linear phase characteristic is more important to the FM detector.

Frequently a technician is confronted with a receiver that needs

alignment, and the radio is a model with which he is unfamiliar, and he doesn't have the instruction manual on hand. Alignment then becomes a pretty tricky proposition. Using the conventional limiter metering approach, it's awfully easy to go astray because you are never sure whether you are twisting an adjustment that is located after the test point you are observing, or whether some intervening limiter is masking the effect of the tuning. The whole thing is a lot less tricky when you align the receiver for optimum SINAD. You know where the antenna input and the loudspeaker terminals are, so you can't make the metering mistake mentioned above. If you are trying to do one of these "blindfold" alignment jobs, you should proceed carefully and not make any radical changes in any of the adjustments. The main pitfall to

avoid is one of those oscillator circuits which tune with a "cliff" on one side, and won't start when peaked up to the maximum. Otherwise you can usually obtain a pretty good alignment without "the book".

One final note: If you have been thinking about using the SINAD method of sensitivity measurement for those AM receivers in your shop, you're right; it is just as meaningful as with FM. The 10-dB SINAD sensitivity of a decent receiver is surprisingly close to the 10-dB signal-plus-noise-to-noise specification you often see on AM receivers. You can also use the "alignment by SINAD" method to get the last bit of sensitivity out of the AM receiver. The "touchup" of the IF tuning probably won't gain you much, but the front-end touchup will usually show a worthwhile improvement.



1. Set Signal Generator precisely on channel frequency.
2. Insert strong signal into receiver, and adjust receiver volume to comfortable level.\*
3. Switch Distortion Meter to SET, and adjust level control for 100% scale reading.
4. Switch Distortion Meter to READ, and adjust Null controls for minimum scale reading.
5. Decrease signal generator output until Distortion Meter reads 25%.
6. Momentarily switch back to SET, and if necessary readjust level control to 100%.
7. Switch back to READ, and adjust signal generator output to obtain the 25% scale reading.
8. Signal Generator output calibration is the 12 dB SINAD sensitivity of the receiver.

Figure 1. SINAD measurement the old way.

INK FIELD DAY !!!!!

Kathy WA7WMD

First field day meeting of the year has been held, and was well attended. But...we need some help!!!! We need operators for all the stations. The following members are band chairman, pick the band you would like to operate and contact the chairman..... 20 meter phone...Clay WA7WM?, 40 meter phone...Jim WA7LNQ, 80 meter phone...Dick K7PKB, 10 meter phone...Tom WA7TBP, 15 meter phone...John K7PFR, 20 & 80 meter CW...Steve K7KOT, 15 & 40 meter CW...Hal W7DNU, 2 & 6 meter phone...Dave WA7TCM, Novice station...Arne WA7WKT. Les WA7NXC is taking care of the natural power station and Bob WA7NAN and crew is taking care of Oscar.

Future FIELD DAY meetings are scheduled for Mar. 13 (11:30 am on Marrowstone Island), April 24 (10 am), May 15 (10 am), May 29 (10 am), June 5 (10 am), and June 19 (after regular club meeting). All meetings will be held at regular meeting place unless otherwise noted above. Listen to all nets and watch the paper for any changes that might take place. Next month a

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OPERATING EVENTS

MARCH 13 The commonwealth contest  
 13-15 Virginia Stats QSO party  
 14-15 South Dakota QSO party  
 20-21 DX Competition (C W.)  
 22 WIAW Morning Qualifying run  
 27-28 BARTG Spring RTTY contest  
 27-28 Tennessee QSO party  
 APRIL 1 West Coast Qualifying run  
 3 Six meter contest  
 3-4 Open CD party (CWO)  
 3-4 SP DX contest  
 10-11 OPEN CD party (PHONE)  
 10-11 Novice QSO party  
 10-11 County Hunters SSB contest  
 16 WIAW qualifying run  
 17-18 Florida QSO party  
 17-19 Zero DISTRICT QSO party  
 18 Two meter contest  
 24-25 Bermuda contest (phone)  
 24-25 First Annual Triple Letter QSO party

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MIKE AND KEY ACTIVITIES

MARCH	13	Field day meeting	11:30	Marrowstone I.S.
	20	Regular business meeting	10:00	Club house
	26	Puget Sound counsel	2000	4th and Spokane St. Seattle
April	3	Activity meeting	10:00	Club house
	10	Regular Business meeting	10:00	Renton Library
		<u>ELECTION OF OFFICERS</u>		
	10	Mike and Key Banquet	18:30	Windjammer South
	24	Skaget Hamfest	10:00	Bryant Wa.
	24	Field Day meeting	10:00	Club house
	30	Puget Sound counsel	20:00	4th and Spokane St. Seattle
May	1	Activity meeting	10:00	Club house
	15	Regular Business meeting	10:00	Club house
	15	Field Day Meeting	12:00	Club house

Is the same OK? any other ideas? please let us know remember these are your nets and we would like to have good ones...

73,

Ken and Arnie

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SWAP AND SHOP

FOR SALE BY PETE K7WTC:

Heath SB101 w/cw filter, HP-23 supply w/Speaker, SB640 remote V P.O.  
HE S F R Meter... very clean... \$457.00

Heath HW-12A 80 meter Transceiver w/HP-13 supply GA-12A Mobile mike,  
long shaft Webster Bandsplitter with bumper mount nearly new \$ 180.00  
Call- Ident 24 hour clock with 10 min station call reminder \$15.00

For sale by Ken K7TRG

Marconi oscilloscope TP2200 30MHZ Dual trace  
Marconi Signal Generator TP 801D 10MHZ -470MHZ .1-1v  
Marconi Signal Generator TP 140A 10KHZ -72MHZ .2u -2v  
Marconi Signal Generator TP 1370 10Hz -10 MHz sine wave and square wave

Heath general purpose scope

HP Freq counter 524D 10MHZ no plugins

HP Freq counter 521 100 KHZ

HP Oscilloscope Mod 175 A 50 MHZ

Hughes Memo scope

Tektronix 531 scope 10MHZ

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ELECTIONS

Its again election time!!! Next meeting we will be nominating our new officers, the elections will be held the following meeting on the 10th of april at the Renton Library. Thru the excellent guidance and energy of your present club officers the Mike and Key Amateur Radio club has prospered. The club came in second, in its class forfield day last year, it has provided services to various fund raising groups around the area, it has brought happiness to quite a few kiddies at Christmas. Its members have, at the drop of a hat been available. .. to... help.. Do most anything. The club has a new club house, it has held a couple of auctions, it has held classes for amateur licencing, it has assisted other Amateurs with their equipments thru its tune-up clinics. We are also larger now to a membership of over 100 We have the best club in the State, and as far as I am concerned the USA. Now is the time for all club members to become involved... Elections the time when you can select the persons to represent you in the club, to run the club, to make it prosper. If nominated feel good that you may be



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W R 7 A C S      EXTRA

Last month we put the new MICOR receiver in operation on the two meter repeater, and last Saturday night was the debut of the new MICOR exciter and POWER AMPLIFIER. Power out of the cavity filter is about 20 watts, and the receiver has 20db quieting at 0.20uv. This is an improvement of 16db in receive sensitivity and 3db in transmit power over last month's performance. After a burn-in period of a week or two, we will bring up the transmitter output to full power, if we get no interference reports. One of the new items added, is the "anti-button-pushers" feature. Unless the input signal is present for 2.5 seconds, the transmit drop-out is inhibited. This is about the time required to give a call, and should discourage playing with the machine to see if its there. Repeated audio is crisper than before, and should be easier to copy. The next expansion planned is a satellite receiver at the KNO site, similar to the six meter machine, and is now under construction. It will be put in operation as soon as time and funds permit. Special thanks to Chuck WN7ZLV, Pete K7IPQ, Chris WA7RJW, Ken K7YRQ, Steve K7KOT, and all the others who helped make it all possible with contributions of time, energy, and cash.

Al- WA7TIB

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March Activity meeting

A big hand goes to Bill K7MWC and all the others who sent the time and effort to put on the demonstration of microprocessors. There were about 130 people interested in the program who were at the demonstration and the talks. It looks like the time is coming when every ham shack will have one of them in use. Again Thanks, Bill for your time and efforts for the demonstrations....

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ITEMS OF INTEREST

The March "HAM RADIO Magazine" has a good article on Crystal-controlled oscillators and a easy to build 5/8-wavelength vertical antenna for two meters. The April issue of 73 Magazine has a interesting article on a simple one I C tone burst oscillator and a easy to build two meter amplifier to go with your H.T. It can be built for less than \$10.00. going to Hawaiian Islands? take your H.T. there is a lot of activity there as noted in the issue.

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REMINDER    REMINDER    REMINDER    REMINDER    REMINDER

Lets get all those reservations in to Linda Gillert as soon as possible. We can have an idea how many will be coming to the banquet.



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ELECTIONS 1997

selected by the members to represent them in an office, but remember that with an office comes the responsibility of that office. You will be expected to give of your self to that office, or job!

LET'S GET OUT AND VOTE!!!

73.

Ken..

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SHORT BURSTS . SHORT BURSTS . SHORT BURSTS . SHORT BURSTS . SHORT BURSTS .

Ken K7PZX IS Sporting a new work truck aroun these days and is getting his radios installed so he can make coffee break arrangements with Clay what a deal. . See Jim W7GPW for all the good ways to keep people out of your car. He had some stuff sacted out of his rig while in Portland Do we have anything to sell? see Steve K7KOT he just sold a lot of radio gear and I'm sure he is in the market for some more... Saw Dick K7PKB covering the hills of Issaquah last week in his plane, A nice looking one to boot, someone said he is looking for antennas... with a big hook attached to the tail of his plane... John K7PPR WAS WHITE KNUCKLEING IT ALL THE WAY only like John WA7YIC will be moving away from the river later this spring and will be moving up to Redmond... down behind TBP hill... I guess its better than the river... Ozzie K7CAI will be coming to the club meeting and will be giving us a demonstration on CB radio from his stock soon... Ken WA7CBK has been in the basement of his house.. they won't let him up stairs till he gets one room finished down there... Nick WA7IVO has been on 29 from ZLJ land.. even have heard them on other frequencies also... James WA7WMB needs someone to get the door open at PSARC meetings... Arnie WA7WKT IS LOOKING FOR A HARD HAT TO MOUNT HIS ANTENNA SO HE CAN BE WHILE Rikin' around town.... Lew WA7ELI is an expert on ford timing chains... if you need help see him,.. If you want help to break them see Barb... Jar WA7UWX has been selected as the live target for the womens soccer team in REDmond .. I'll bet its just like a shooting gallery... Jimmy WA7LQ JOY HAS A NEW TRUCK, and a brand new antenna for two meters on it Les WA7IXC is using his Sand sparrer and atlas around 10 meters.... Let right left .. What is nete and Jan Up to? I heard that their talk show is dead, someone said "Its the water" Is that so? Well I guess thats it for now. Hope you have had a good laugh

74.  
