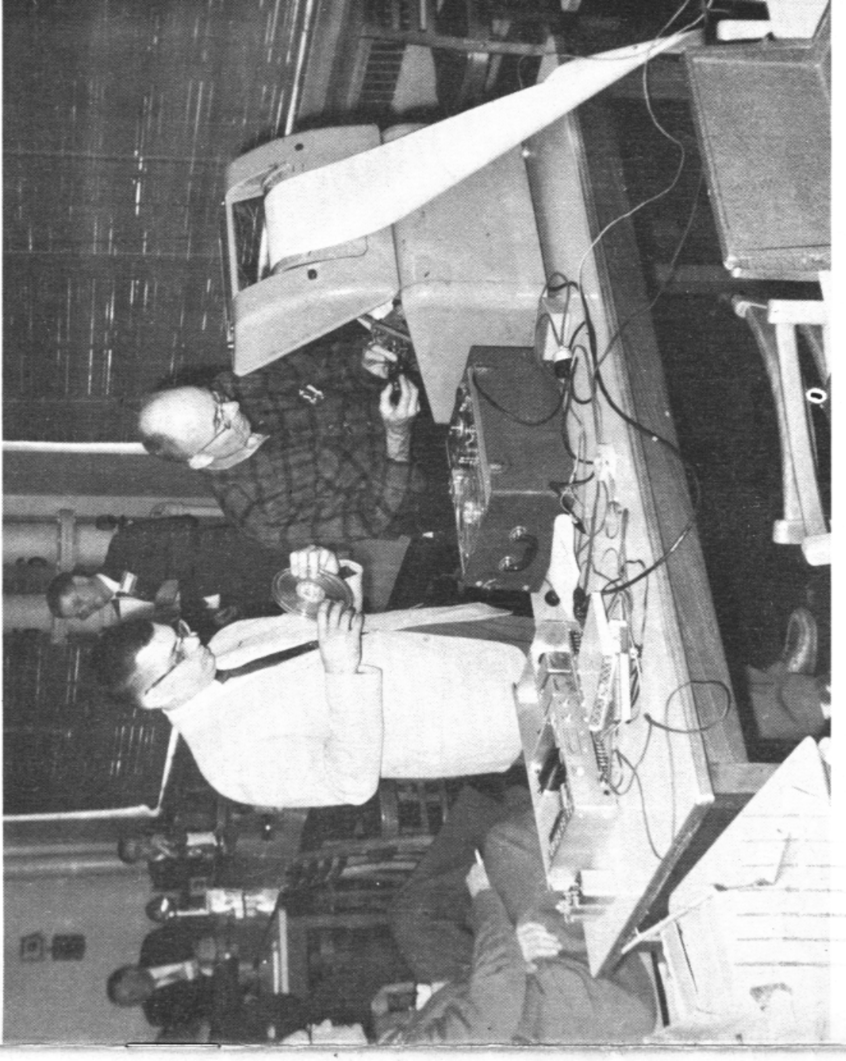
# RTTY



CHI - RTTY MEETING

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# NEWS OF AMATEUR RTTY

November, 1960
25 Cents
Vol. 8, No. 11

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## HORSE TRADES

This page of the Bulletin is for use of amateurs who have RTTY EQUIPMENT FOR SALE OR TRADE and those looking for equipment to buy or trade. It is a free service and may be the means of getting someone on the air.

**FOR SALE:** Model 26, need tape gear and sync motor for
**OR TRADE** model 14 TD . . . . . . . . . . . . . . . . . . W9FRU

**FOR SALE:** FSK keyer, Press Wireless 05FR (FS-12A)
Lee Roy Scott, 2703 Terrapin Road—Wheaton,
Silver Springs, Md.

**FOR SALE:** Polar Relays WE 255A 4.00 . . . . . . . . . . . W6DIE

**TRADE:** RTTYs 2 1955, 1 1956, 2 1958, 1 1959 Copy
for any RTTYs listed last month's RTTY . . W9GRW

**WANTED:** January 1959 RTTY . . . . . . . . . . . . . . . . W1QP

**FOR SALE:** Polar relays 255A @ 2.50, sockets @ 0.50,
Both for 2.75 — WE power supplies, 150V
output for FGC with mercury vapor tubes
9.50, FOB West Trenton, N. J. . . . . . . . . . W2TAM

**FOR SALE:** Swedish built FSK exciters, has xtal
and VFO with pre set frequencies.
With instruction manuals . . . . . . . . . . . . SM5KI

**FOR SALE:** Model 15s with metal tables, 90.00
one only, ASR Model 28 . . . . . . . . . . . RTTY, INC.

**FOR SALE:** Mu Electronic TUs (in stock), one model 15
with table 100.00 and one model 26 with
table 75.00. WE 255 polar relays and sockets.
Paper at 1.29 per roll 1.00 in case lots—
Radio Product Sales, Denver, Colorado

**FOR SALE:** WE 255A Polar Relays 2.95, 215A 1.95, sockets 0.60
Toroids (sealed in plastic, 25 to 500 mhys 0.98
and misc. RTTY items . . . . . . . . . . . . . W0IGU

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# RTTY SWEEPSTAKES CONTEST

## NOVEMBER 4, 5, 1960

The seventh Annual RTTY SS Contest will be held starting Six PM EST on the 4th November and running until Three AM 6th November, EST. This will provide thirty-three hours of operating for those who can stay at the GREEN KEYS that long. We have many new RTTYers this year, and hope they will join with the rest of us in the fun.

Stations will exchange messages consisting of message number, originating stations call, check or RST report of two or three numbers, ARRL Section of the originator, local time (0000-2400 preferred), date and band used. Score one point for a message received and acknowledged by RTTY. Score one point for each message sent and acknowledged by RTTY. For final score, multiply the total message points by the number of different ARRL (see page 6 QST) worked. Two stations may exchange messages again on a different band for added message points, but the section multiplier does not increase when the same section is worked on another band. Each foreign country counted by ARRL for DXCC credit is treated as a new section for multiplier credit. Logs should be mailed to RTTY, INC., 372 Warren Way, Arcadia, California.

In order to be scored, contest entries should be received by RTTY not later than November 15th, 1960. Certificates will be mailed to the top ten scorers in the contest. Best of luck and see you in the contest.

CONTEST PERIOD

| Time | Start | End |
|---|---|---|
| EST | 1800 - 4th | 0300 - 6th |
| CST | 1700 - 4th | 0200 - 6th |
| MST | 1600 - 4th | 0100 - 6th |
| PST | 1500 - 4th | 0000 - 6th |
| HST | 1300 - 4th | 2200 - 5th |
| GMT | 2300 - 4th | 0800 - 6th |

RTTY would appreciate any comments regarding this contest, and if you wish, include them with your contest entry.

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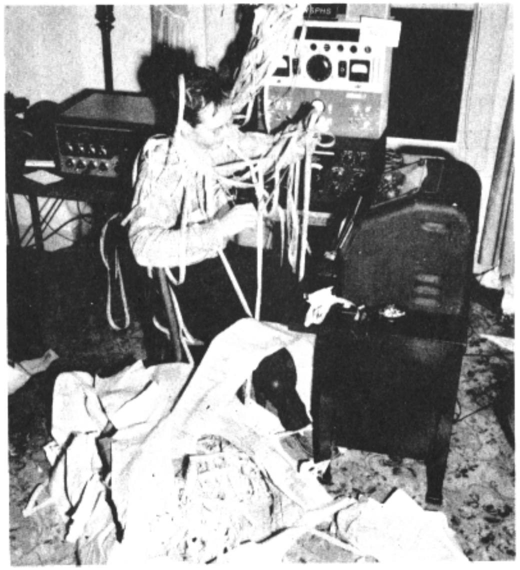


**AFTER THE CONTEST?**

# INTERFERENCE CHARACTERISTICS OF FSK SYSTEMS

### By DON WIGGINS, W4EHU

Amateur radioteletype operation differs in a number of respects from commercial and military operation. The commercial station can select a channel which is relatively free from interference. Thus, his most serious interference problem is from atmospherics and random noise. These problems and that of fading are usually solved by use of frequency diversity. The amateur, on the other hand must live with CW signals, fellow RTTYer's, foreign phones, and so on. However, the amateur has one advantage—he can tolerate much higher error rates before he considers a contact a failure where the commercials want reliabilities near 100%! Also, he has much more flexibility in tuning procedures to dodge QRM where commercial equipment is usually fixed tuned.

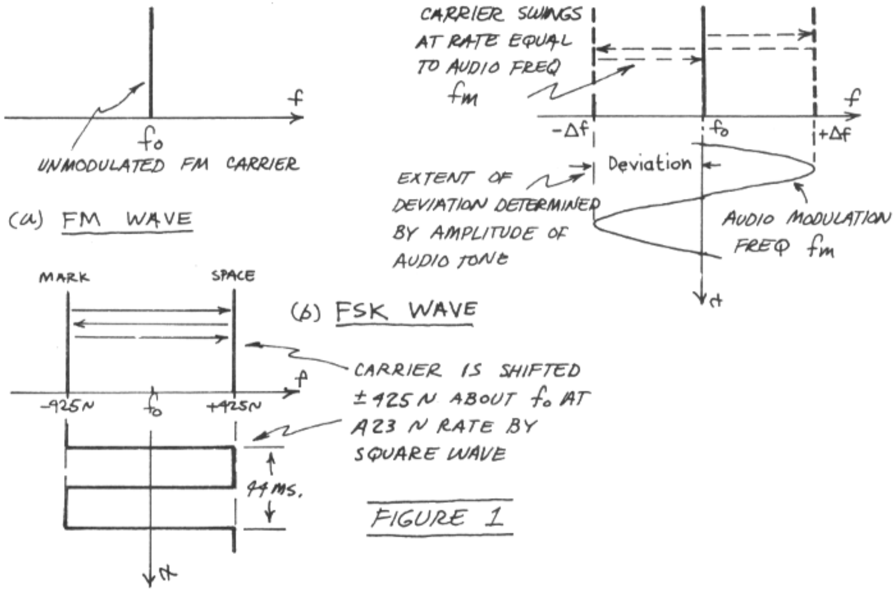
It follows that the design of a terminal unit for best all-around operation on the amateur bands may be somewhat different than conventional commercial designs. In order to point up some of these design considerations, I would like to review briefly the interference characteristics of FSK receiving systems. It is quite easy to throw together a circuit which will provide good copy under ideal receiving conditions. However, there are a number of points which need careful attention if good copy is to be obtained under adverse conditions. In fact, our intuition may give wrong answers in some instances!

First, I would like to make one point—that is that any TU utilizing a limiter ahead of the detector is an FM system. It matters little whether the TU is the so-called IF type or the audio tone type. This will be apparent from the discussion which follows. Thus, an FSK signal with 850 cps shift may be considered as a carrier which is frequency modulated by a square wave with a deviation of 425 cps and a deviation ratio of about 20.

FM PRINCIPLES.

To better understand our FSK system, let's review some FM principles. An FM signal can be thought of as a carrier whose frequency is being continuously varied by the modulating signal. A simple example is to consider a 1000 cps audio tone modulating an RF carrier. The tone causes the carrier frequency to vary between certain limits at the rate of 1000 times per second. The limit of the frequency swing depends on the amplitude of the audio tone. The stronger the audio tone, the farther the carrier frequency swings. See Figure 1. For there to be an advantage for FM, this frequency swing or deviation must be several times the modulating frequency. For example, we might let the 1000 cps tone deviate the carrier 5000 cps. In the FSK system, the fundamental pulse rate of about 23 cps swings the carrier 425 cps either side of center frequency.

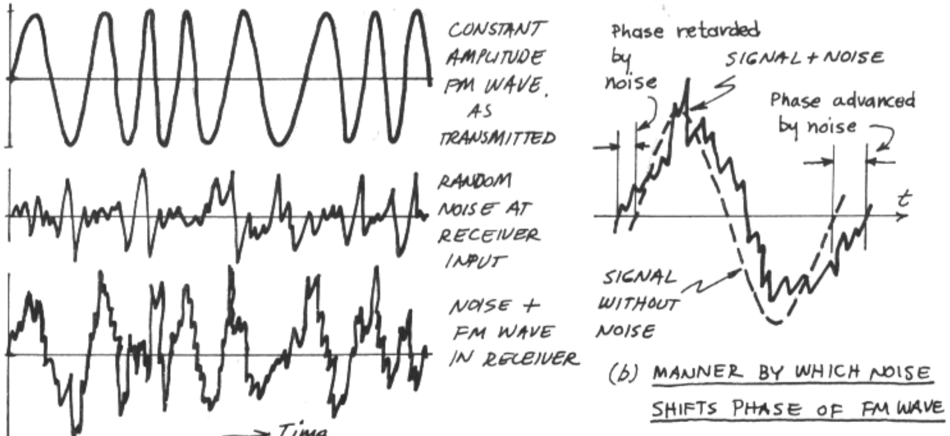
When the FM signal is transmitted its amplitude is constant. However, when received, it is mixed with noise and interference which causes the signal to be varying in amplitude. The signal is varying with frequency due to the modulation but the noise and interference will add spurious frequency variations also! In Figure 2, the manner in which noise causes the amplitude and frequency to vary is shown. It is easy to see how the amplitude changes but a little study and thought may be needed to see how the frequency is varied. If a sine wave is distorted in such a manner that the time at which its instantaneous amplitude goes to zero (the "zero crossing" time) comes earlier than normal, we can say the wave has speeded up, or increased in frequency. Similarly, if the zero crossing is delayed, then the frequency has been decreased. Thus, it should be apparent from the sketch how the noise causes this to happen. The amount of these shifts due to noise depends only on the amplitude of the noise and is independent of the deviation of the FM carrier due to the modulaion. Now if we have made the deviation from the modulation very large, the frequency changes due to noise will be small in comparison and little interference results. Fortunately, as we make our bandwidth wide to take care of the large signal



(a) FM WAVE

(b) FSK WAVE

FIGURE 1



(a) EFFECT OF NOISE ON FM WAVE

(b) MANNER BY WHICH NOISE SHIFTS PHASE OF FM WAVE

FIGURE 2

swing, the extra noise coming through is purely random and does not add together in such a way as to give high amplitudes. This situation is responsible for the noise reduction characteristics of wide-band FM.

Note that our detector must respond only to the frequency variations and *not* to the amplitude variations since these may be quite large. This is accomplished by using a limiter and discriminator as the detector. Basically, the limiter removes all amplitude variations producing a signal of constant amplitude and varying frequency. The discriminator then converts the varying frequency signal to a varying amplitude signal. Of course, this variation is the audio frequency modulation which we want.

## LIMITER-DISCRIMINATOR CHARACTERISTICS

Let's take a closer look at the limiter. The purpose of the limiter is to produce pure FM signals with no amplitude variation. It is *not* used for the purpose of maintaining a level during fading. An ideal limiter would produce a constant positive voltage any time the signal is greater than zero and a constant negative voltage whenever the signal is less than zero. See Fig. 3. Most practical limiters come very close to being ideal. The square waves at the limiter output contain harmonics of the input frequency components. However, the bandpass and lowpass characteristics of the discriminator and audio system effectively filter out these harmonics so we can think about a constant amplitude carrier whose frequency is varying. Notice that this wave is a reproduction of the original wave generated at the transmitter. The only difference is slight shifts in some of the zero-crossings caused by noise.

The discriminator is a device which produces a d-c output voltage whose amplitude is proportional to the frequency of the applied signal. If the frequency of the applied signal is varying, then the discriminator output will vary proportional to the instantaneous frequency. In Fig. 4, a typical discriminator characteristic is shown. A signal of frequency $f_1$ will produce an output of plus 10 volts; a signal of frequency $f_2$ will give plus 5 volts; at $f_3$, minus 10 volts and so on. If the signal frequency is varying sinusoidally between $f_1$ and $f_3$ at a 100 cps rate, then the output will vary sinusoidally between plus 10 and minus 10 volts, producing a 1 kc audio tone. Thus, we have recovered our original modulation. The effect which the noise had on the frequency variations will show up as a slight distortion of the output signal. For strong signals this distortion is unnoticeable. As the signal gets weaker, some distortion will begin to be more apparent. However, for wide-band FM, the frequency change due to noise will still be small. Finally though, a still weaker signal will find that the zero-crossings are due more often to noise than signal and the discriminator output becomes mostly random noise! This point occurs rather sharply and is known as the "threshold." For signals much below the threshold, we can consider that the system has failed. This action may be noted on FM broadcast when receiving a distant station. The audio is either quite clean or is quite noisy as the signal fades in and out.

So far we have talked about FM in the presence of random noise. Of perhaps greater interest is its behavior in the presence of an interfering signal. To give a complete answer for the general case is extremely complex, and theoretical work is still in progress. However, with a few simplifying assumptions we can get a fairly good picture of what happens and we can get some insight into equipment requirements. Since the discriminator output is proportional to the frequency at any instant, we want to see how the intereference changes the instantaneous frequency. To make life simple, let's assume we have a signal of constant frequency deviation from the discriminator center frequency. Since this represents a certain instantaneous carrier frequency, call it f-c. (Note that this is exactly the FSK case when a steady mark or space is being sent.) The discriminator ouput is a steady d-c voltage.

Consider that the signal f-c at the *limiter* input has an amplitude of 1 volt. Now let an interfering signal of frequency f-i and an amplitude of A volts appear at the limiter input. First, we will talk about the case when A is less than one (signal stronger than interference). The action in the limiter is as follows: The interfering sine wave adds to the signal in such a manner that the total signal zero-crossings come sooner for a few cycles and then farther apart for a few cycles and so on. The limiter converts this to a constant amplitude signal whose instantaneous frequency is now changing. The *rate* of change turns out to be the beat frequency or difference in frequency between f-c and f-i. The way in which the instantan-

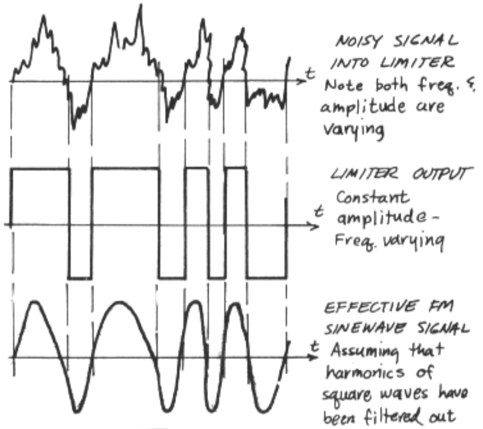


FIGURE 3

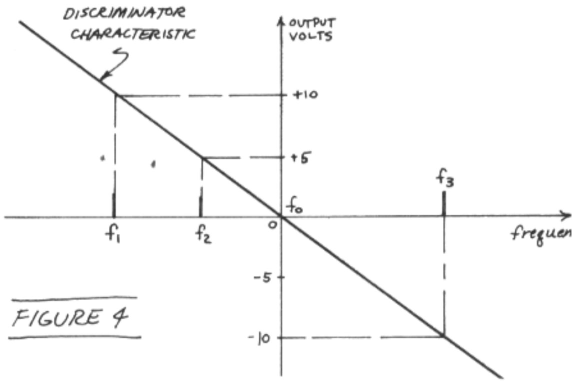
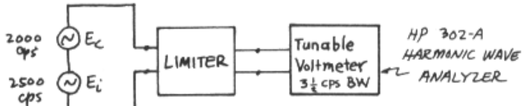


FIGURE 4



TEST SET-UP

| LIMITER INPUT | | | LIMITER OUTPUT | | | |
|---|---|---|---|---|---|---|
| $E_c$ Volts | $E_i$ Volts | S/N Ratio db | $E_c$ out Volts | $E_i$ out Volts | S/N Ratio db | Suppression effect |
| 100 | 89 | 1db | 76.5 | 52.6 | 3.2 db | 2.2 db |
| 100 | 70 | 3db | 87.4 | 39.5 | 6.8 db | 3.8db |
| 100 | 56 | 5db | 93 | 29 | 10 db | 5 db |
| 100 | 31.6 | 10db | 99 | 16.5 | 15.6 db | 5.6db |
| 100 | 17.8 | 15db | 100 | 9.3 | 20.6 db | 5.6 db |
| 100 | 10 | 20db | 100 | 5.2 | 25.6 db | 5.6db |
| 100 | 3.16 | 30db | 100 | 1.75 | 35.2db | 5.2db |

TABLE 1 - EFFECT of INTERFERENCE IN LIMITER

eous frequency varies is shown in Figure 5 along will illustrations of the conditions leading to this result.

For the example illustrated, notice that the instantaneous frequency is now a little higher than f-c for a time and then suddenly swings to much lower by a sharp negative-going frequency "spike." The extent of these changes from f-c are seen to depend on the value of A and are small for small interference and very great for A close to one. The important point about this picture is that the *areas* of this curve above and below f-c are exactly equal. Thus the *average* instantaneous frequency is f-c exactly! So, if the discriminator output is proportional to the instantaneous frequency and we filter this output to remove the beat frequency (the frequency or repetition rate of the spikes is the beat freqency) we recover f-c exactly and the interference has been completely suppressed! This is quite remarkable and is an example of the "capture" effect of an FM system.

The above situation occurs when the signal is greater than the interference. If the interfering signal becomes larger than the desired signal, then f-i becomes the average frequency and we suppress our desired signal! Note carefully that the point in the system at which this signal and interference amplitude is measured is at the *input* to the *limiter*. Narrow band filters following the limiter will not have the effect in reducing the interference that one might expect from intuitive considerations!

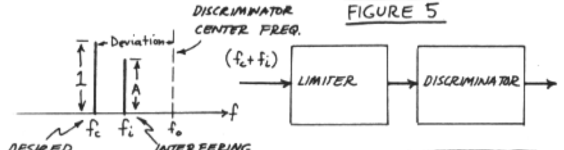
Let's go back for a moment to the idea that filtering or averaging after going through the discriminator will give f-c exactly for S/N greater than one. This will only be true if the discriminator is linear over a very wide band so that the entire instantaneous frequency swing is passed. Few FM receivers have such a bandwidth, but the capture effect may still be noticed up to the S/N ratio for which the swing is too large for the bandwidth. Also important in this respect is the frequency of the interfering carrier; the farther away it is from the desired signal, the worse its effect. We will relate these effects to the FSK situation and put in some typical numbers which may serve to illustrate these points a little better.

## FSK CHARACTERISTICS

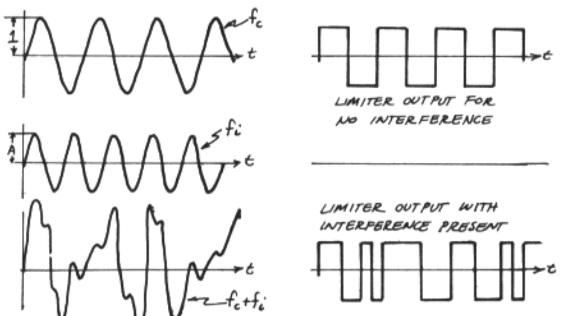
Figure 6 shows a block diagram of two general types of audio TU's in common use. Fig. 6 (a) in a linear type with a bandwidth of about 1200 cps and 6(b) is the non-linear type with two filters of about 250 cps bandwidth for each. Let our desired signal be an FSK carrier, f-c whose frequency shifts from 2125 cps to 2975 cps at a 23 cps rate as shown in Fig. 7. Let an interfering carrier be present at the limiter input at 2400 cps (f-i). Figure 7 shows the instantaneous frequency signal at the limiter output. The best note for mark will be 575 cps and 275 cps for space. Applying the relations from Fig. 5, we see that the peak swings on space for an interfering signal which is 0.8 as strong as the FSK signal, will be from 2246 down to 1025 cps and for mark, from 2720 up to 5275 cps. Since the linear discriminator will not accept this very wide band, some of the spikes will be lost, putting narrow "holes" in the signal output. Fortunately, these are very narrow and will be filtered out. The result is that the d-c level from the discriminator is a little less than it would be for no interference since the average frequency is a little greater than space and a little less than mark. Fortunately, we feed our FSK output through a clipper so very little distortion should result due to this small decrease in pulse height. This has been based on the interfering signal being between the mark and space signals and about 2 db weaker. If it is stronger, then the FSK will be lost. If the interference is outside the M-S frequencies, the instantaneous swing of frequency may cause the total signal to spend most of its time outside of the discriminator passband, and a very low d-c voltage will be present in the output. Even for interference which is weaker than the FSK signal, this action can cause loss of copy.

Applying these same conditions to the two-filter type discriminator it can be seen that even interference falling between M-S may cause a large drop in pulse amplitude in output since the instantaneous frequency swing may spend more time in the "notch" than in the pass band of the filters. Looking at this situation from a spectrum approach, the sharp filters attempt to pass the M-S frequency components in the FM signal and reject those lying outside. This is not a very efficient way to accomplish this aim since our limiting process causes a suppression of these components whenever the interference is almost as strong or stronger than the FSK signal. Table 1 is the results of laboratory measurements using a wave analyzer with about 3½ cycle bandwidth for measuring magnitude of the components of

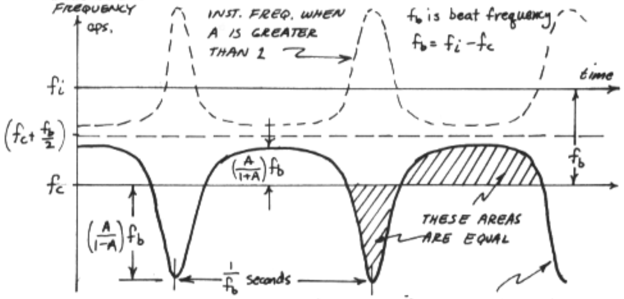
FIGURE 5



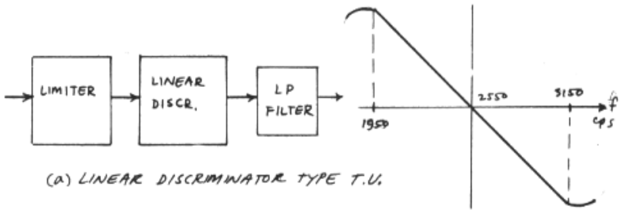
(a) Example of constant deviation signal plus interference



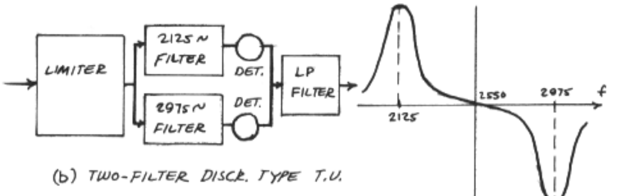
(b) Limiter action



(c) Plot of instantaneously frequency for A less than 1



(a) LINEAR DISCRIMINATOR TYPE T.U.



(b) TWO-FILTER DISCR. TYPE T.U.

FIGURE 6

two signals applied to a limiter. This illustrates this effect quite clearly. It seems much more desirable to attenuate the interfering signal ahead of the limiter before this suppression effect takes place. This will be considered more fully below.

## SUMMARY OF NOISE AND INTERFERENCE CHARACTERISTICS OF FSK

Let's review briefly the FSK situation with a view toward specifying design features of an optimum terminal unit.

Noise: An FSK signal in the presence of random noise will produce perfect copy as long as the power in the signal is greater than the total noise power contained in the pre-limiter bandwidth by a certain ratio. This ratio is determined by the bandwidth following detection and the bandwidth preceding detection. Practically speaking, if we can hear the FSK signal clearly in the noise, a good TU should give good copy.

Interference: The effect of an interfering signal, such as a phone carrier, CW signal, etc., will depend on the relative amplitude of the FSK signal and the interfering signal at the limiter input.

1. Interference stronger than FSK signal—Whenever the interference is larger in amplitude than the FSK signal, the limiter action causes suppression of the weaker signal. For a linear discriminator, the output will be the interference. If the two-filter discriminator had an ideal passband (completely rejecting frequencies outside the desired band) the signal components in the limiter output could be extracted, but the same filters ahead of the limiter could have rejected the interference completely! Because of non-ideal filters the possibility of getting a readable signal is small for this type discriminator.

2. FSK stronger than interference—If the interference falls between the M-S frequencies and the discriminator has a very wideband, linear characteristic then the interference is completely suppressed when a proper low pass filter is used. Even a narrow discriminator which is linear will almost suppress the interference. The pulse amplitude will be lower than normal but the keyer amplifier will handle reasonable variations in pulse height. For a non-linear discriminator, some of the signal needed for averaging which falls in the filter rejection region will be lost and the detected pulses will be lower than for the linear case.

For interference which falls outside the discriminator pass band, and is almost as strong as the FSK signals, copy may be poor due to the instantaneous frequency swing being out of the passband for a large percentage of the time.

Perhaps with this small insight into the manner in which noise and interference attack our efforts to get good copy, we can plot to minimize these effects.

## TERMINAL UNIT DESIGN CONSIDERATIONS

Looking at the noise characteristics first, let's see what can be done to improve our system. Fortunately, a design which helps the noise situation also helps with interference. The obvious thing to do is to limit or minimize the noise power at the limiter input. From a study of statistics of noise, one finds that the noise spectrum is essentially flat. That is, the total noise power is directly proportional to the noise bandwidth. Thus, the obvious answer is to make the bandwidth ahead of the limiter as narrow as possible without affecting the desired signal. Figure 8 is a typical receiving setup which we can use as an example. For a receiver with a 6 kc IF bandwidth, the spectrum at the limiter input is shown. While it is true that the exact noise spectrum depends on the BFO setting, the total noise power will be the same even if the spectrum is "folded." The signal power to noise power (S/N) ratio is $P_s/6P_n$ where $P_n$ is the noise power in watts per kc. For better receivers with narrower IF bandwidths, the S/N ratio will be proportionately higher.

With any receiver, an improvement is obtained by using a bandpass audio filter ahead of the limiter as shown in Figure 8(b). For our example, if the BP filter has a 1.4 kc BW, the S/N ratio is now $P_s/1.4P_n$, an improvement of about 4 to 1. Let's see if it is possible to reduce the noise bandwidth any further. An inspection of the spectrum of an FSK signal will reveal that most of the energy is concentrated around the mark and space frequencies, unlike the spectrum of an FM broadcast signal where the energy may be spread over the entire spectral width. This means we can obtain a further improvement by "throwing out" the small amount of signal energy in the center of the signal spectrum. This can be done with a double bandpass filter as shown in Fig. 8(c). The optimum filter widths taking the concentration of spectral

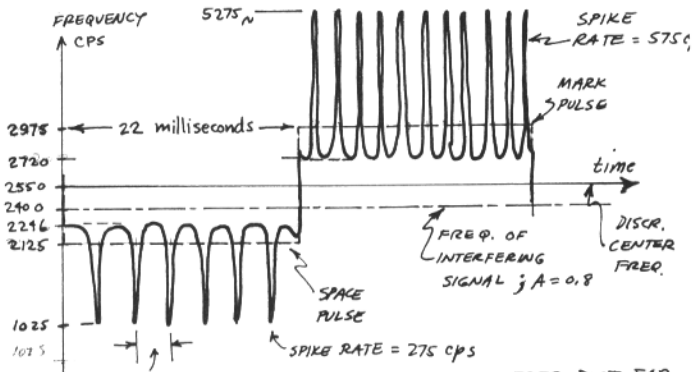
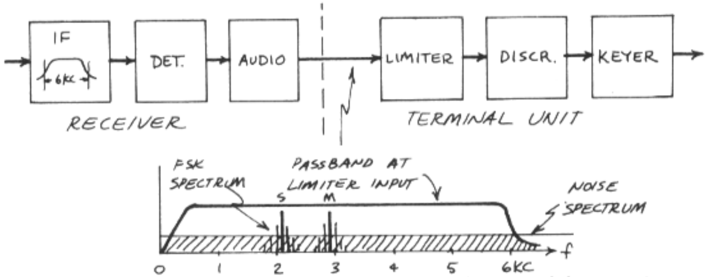
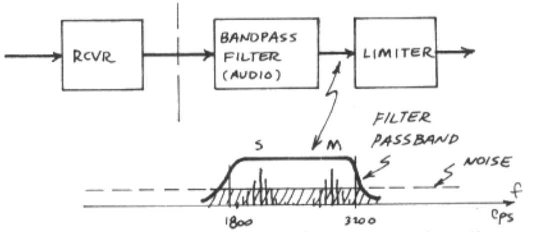


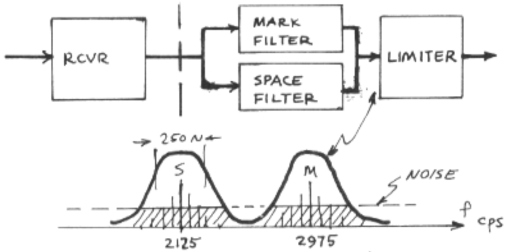
FIGURE 7 INSTANTANEOUS FREQ. PLOT FOR FSK WAVE PLUS INTERFERENCE



(a) Noise & signal bandwidth for typical receiving system



(b) Effect of audio bandpass filter ahead of limiter



(c) Effect of double narrow band filters

FIGURE 8

energy and allowance for equipment drifting into account would be about 250 cps each. The total bandwidth is now about 0.5 kc and the S/N ratio is now $P_s/0.5P_n$.

Neglecting the small amount of signal power lost, the improvement is about 12 to 1 for our example.

Now, let's consider the interference characteristics. Since we have seen that any interference signal of greater amplitude than the FSK signal will capture the system, our first concern should be to attenuate any such signals in the receiver output before they arrive at the limiter. Again, the double BP filter seems to be ideal for this purpose since it passes without attenuation only the FSK spectrum which we wish to use. Therefore, for interference outside of these regions, strong interfering signals may be attenuated sufficiently to allow our FSK signal to capture the system. In fact, for every db of attenuation in the filters, the system can tolerate a db stronger interfering signal before failure. Of course, if a stronger signal falls directly on our mark or space channel, the FM system will fail.

There seems to be little need to build sharp, flat-top filters for the discriminator since selectivity at this point does not help the basic interference problem as previously discussed. A linear discriminator is easier to build and offers the additional advantage of responding to narrow-shift operation. It would be necessary to switch a narrow band filter centered on 2550 cps in place of the double filter for narrow-shift operation.

## LOW PASS FILTERS

We have seen that an averaging operation following the discriminator is needed to accomplish the desired interference rejection characteristics. This is done with a low-pass filter. Most TU's have a rudimentary LP filter in the form of the by-pass capacitors across the detector load resistors. More positive and effective filtering can be done with L-C type filters. The optimum cutoff frequency is about 80 cps. This will remove the beat frequency due to interference (whenever it is above this value) and also smooth out sharp "holes" in the pulses due to impulse interference, etc. that would otherwise trigger the keyer. The value of the LP filter is most evident with weak signals and atmospheric noise.

## SINGLE-CHANNEL SYSTEMS

Once in a while a strong signal will come on top of the mark or space channel. As seen above, failure occurs. When using a double filter input, it is possible to switch out the offending channel and obtain copy from the good channel. Since this is an AM or make-break operation, the limiter must be by-passed. If not, noise will appear at the limiter during pulse-absent condition and errors will result. We must make certain that the detector output is above the keying level only during the pulse time. The system gain should be adjusted manually so that this condition exists. A good idea for this type of operation is an AGC circuit which obtains its signal after the sharp filter. This would tend to keep the pulse height constant and the manual adjustment would be less critical. Note that AGC should never be used ahead of the filters for FM work since out-of-channel interference can actuate the AGC causing a drop in system gain.

## PRACTICAL CIRCUITS

The desired TU characteristics outlined here can be obtained with many varieties of circuits. I am presently experimenting with various filter, limiter, discriminator and keyer circuits and will perhaps have some suggestions to pass along for easily built and adjusted units. I hope that there may be an idea or two here that someone can improve or implement and I would be glad to hear from some fellow "tinkerers."

## CONCLUSION

The interference characteristics of FM and FSK systems has been discussed here with no attempt to be rigorous. The aim has been to try to present a physical picture of what goes on. It has been necessary to discuss very simple cases since the general case of noise and time varying interference would be extremely difficult to even describe. However, design factors which improve the simple cases should be close to optimum for the general case. For those who wish to look up the technical background and mathematical verification of some of these results, there have been many papers in the technical journals by Arguimbau, Baghdady, Granlund, Crosby and many others.

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# DX - RTTY

**WILLIAM M. BRENNAN, G3CQE**

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This month your DX editor is out of touch with RTTY activity on a four weeks' vacation. Bill Brennan, G3CQE, has agreed to take over the writing of the column during my absence. This will be a refreshing change from my tired old cliches and give everyone a chance to see how RTTY-DX looks from the other side of the world. BCNU next month.

Bud—W6CG

Seems that Bud really IS allowed off the chain every decade or so! Anyway, while the Old DX Winkler takes a well earned rest and paddles in the Pacific, here's a worm's eye view of the DX situation.

DX . . . well we all know what that means—or do we? It really depends on how you look at it. To the VHF man on 1215 Mcs. it may be a station a few blocks away. To most of us on the HF bands DX begins where the home coastline ends. It's easy to forget that you are DX to someone wherever you are. The U.S.A. is of course DX to all the overseas gang. So, the kick that comes from putting across a good QSO is always a two way affair. Don't forget that the overseas stations are interested in what you fellas Stateside have been up to. It seems that RTTY-wise most of you are awful shy when it comes to revealing your activities! Why not turn in a report to Bud from time to time telling him (and through this column) everyone all the latest. How about it fellas—please?

As seen from Europe at any rate, the level of RTTY activity on all bands has reached a new high. Stateside signals have been blasting in over here on both fifteen and twenty meters. Not all have had a Kw and a rotary behind them either. One consistently good signal came from 35 watts and a dipole in Ohio!! Several newcomers to RTTY are doing well. In just over one week of operation W9UMJ snagged three continents. Some of the regular DXers like K6DSQ, W6TPJ, W7LPM, W0ALJ, W2RUI, W1BGW and many others have been right on the ball—all coming up for air with a bigger score. To the QSO starved overseas gang such activity is a real tonic.

If things stay this way, the RTTY frequencies may even be cleared of the DX fone QRM that has recently oozed down into them. Hats off to K6DSQ—the only man with enough confidence to put out a "CQ DX RTTY" tape! It pays off too—very few of the overseas boys have tape gear and pounding out CQs on the keyboard produces corns—in both places.

Good news for W.A.C. hunters!! Henry, ZS1FD is airborne with a Creed 7B machine, doing a first class job too . . . welcome aboard Henry. To Ed W8DU goes the distinction of providing the first solid QSO for Henry, closely followed by Jerry, W6TPJ. ZS1FD is open for business on 21090 Kcs. most days from 1800 GMT onwards. He reports that W7LPM fires the best signal into Capetown—that's not a bad citation for Dick's final QSL for W.A.C.! ZS6CR also has a printer via Henry and so Ossie will be in the fray by the time you read this.

In Europe, things have been moving fast too. G3LET has been doing well in all directions, G3GNR is prowling 15 and 20 looking for takers. So are G3FHL, G3LEQ, G3LFU, G3NES and G3NPF too. About a dozen others are cutting their RTTY teeth and there are more to follow. Incidentally Geoff, G3FHL is testing out some Phase Shift RTTY and you can expect to hear more about this. It is now a full time job keeping tabs on the new calls that appear daily on FSK here. Shank GM8FM has just about beaten the hash from his DC motor now and GM3ENJ is in there too. Doc G2UK has just returned from a trip to the USSR complete with pics!! Think he even looked into Box 88! Both Jan PA0FB and George, PA0YG are active and Jan lists several Stateside QSOs on 14090 Kcs. at around 0100 GMT. There's also promise of activity from OH, SM, OZ, EI, GI and GC.

From Eric, VK3KF comes welcome news . . . VK2AAB has a printer and VK2EL is hunting for a similar weapon. Eric himself is doing no mean job on the bands. He puts solid copy into the USA and Europe. Look for him on 15 at 0200 GMT Saturdays and 0800 GMT most weekdays on 20 meters. Bruce ZL1WB and Alec ZL3HJ continue their consistent operation on both bands. 14100 Kcs, between 0300 and 0800 GMT is a good bet. Bruce produced some nice printing in Europe at 0700 GMT. W6TPJ has been trying his luck with Bruce on 7 and 3.5Mcs. with promising results. In spite of losing his space filter, Bill ZK1BS has been really busy—printing on Mark only. Bill says he gets almost as good copy this way.

During a recent QSO, Danny Weil (of Yasme fame) said "I'm not carrying all this FSK gear aboard just to impress the natives." Well let's hope not! Apparently, he is not too familiar with the RTTY set up but will soon try his luck with RTTY callers. Seems it may be an idea to buzz Danny on CW and query the chances of exchanging a few Bauds with him. Wonder who will be the first to pull this QSO out of the hat? Whoever it is may shake lose a whole list of new countries for us all.

For the future . . . HZ1AB will be equipped for RTTY by the end of this year. Look out for another station in Korea—with W1GNS on the keys. A ZE station may soon be active and don't forget ET2US.

South of the Border, TG9AD and YV5AFA have both been active—but no details at this end. Nothing much has been heard of HL9KT or of VS6AZ—maybe the rainy season! Let's hope that the KR6 boys will pop up soon.

If anyone feels like trying some long haul RTTY on 3.5 and 7 Mcs. this winter, there are stations in Europe who will give it a whirl too. Apart from steel eardrums, all that's needed are times and frequencies. Weekdays between 0200 and 0500 GMT are a good bet. Any takers?

Seems that "The Great Unwashed" are beginning to wonder what all this RTTY stuff is. If we keep on throwing FSK at them they may take the trouble to find out. At the same time it will give newcomers a chance to have a yarn over the keyboard—as Bud would say, "Kill two birds with one keyboard."

Thanks a million to ZS1FD, W6TPJ, PA0FB, VK3KF and all who helped write this column by mailing or passing over the info.

Pleasant printing and good hunting gang.

Bill Brennan—G3CQE.

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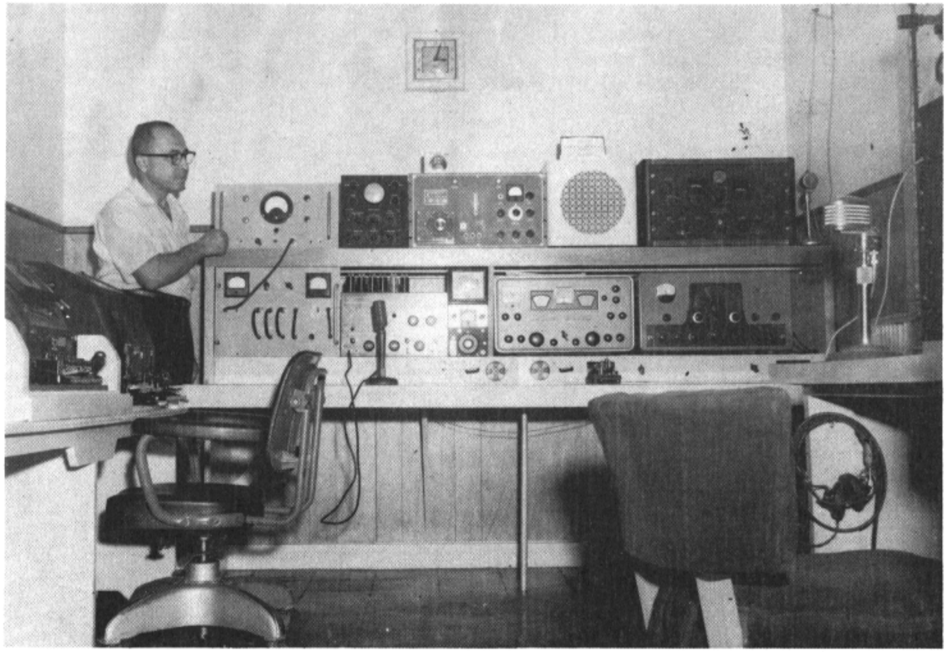

# TUNING UNIT FOR RTTY

### BOB HATCH, W0TBL

I have been on the air (RTTY) now since 20 Nov. 59 and had some very nice contacts. One of the best was with ( ) KL7USA, best DX. I am still looking for some contacts on ten meters, but have not had too much look. I still work W6DIE every now and then but it isn't too good, for Dick is having trouble with his TU.

Merrill, I thought that I might pass along some technical tips that might be helpful to other RTTY'ers, that I have found useful. First of all I am enclosing the schematic of the filter that I used with my Heathkit OM-3 scope to monitor the RTTY signal. It uses one of W6DIE's Torroids (cost .50) and a .002 capacitor. Total cost was $.75 to make and it took two minutes to build. Next, in looking through all the issues of RTTY that you sent, I could not find any mention of how to FSK the Elmac AF-67. After carefully reading all the articles on FSK for the Collins and HT 32 transmitters, I decided to use the diode keyer that was used in FSK'ing the HT 32 transmitter. The only problem was where to put it in the Elmac. It is a very compact transmitter. So after two nights of carefully looking at the transmitter I finally came up with the solution. The diode is mounted inside the Elmac next to the VFO tube and it was completely installed *without drilling one hole* in the Elmac and only one solder connection. If you are interested in this modification, I will be glad to take some pictures of the installation and send them out to you for publication in your magazine. I thought that possibly someone else might want to use the very versatile Elmac as a driver for a high powered amp. As I do. With my modification there is no worry about changing the transmitter and hurting the re-sale value.

Oh, by the way, I enjoyed the "RTTY Station in a House Trailer" in the June 1959 issue of RTTY. I also live in a house trailer and have quite a large amount of gear in a room (ex bedroom) about six by eight. If you are interested I will be glad to ship you some pix of the rig at W0TBL.

Before I close, I might pass along that I am in the process of converting a command transmitter to a FSK'd heterodyne exciter, and will let you know how I make out.

Keep up the good work with RTTY, we really like the mag. Hope to work you on ten or twenty one of these days . . .

VY '73 – BOB HATCH, W0TBL

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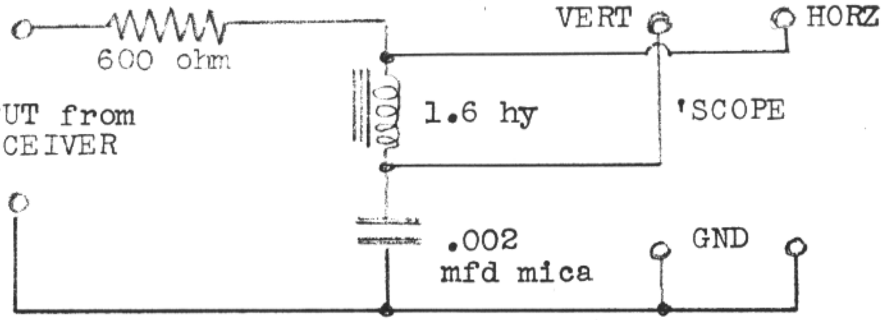

# DX-100 FSK KEYER

Also, might be interested in the latest of the diode shifters using power silicon rectifier ($1.30 locally) as variable voltage controlled capacitor circuit as shown is presently in use with a DX 100 VFO (Clapp).

The circuit shown is capable of 18 KC shift on 40M with heath VFO and +150V on the diode. Shift is proportional to $\sqrt{V}$ unfortunately.

A more linear model with provisions for shift reversal, narrow shift ident, and V.F.O. fine adjustment are in the works. By the way—use shielded wire to the pot, not necessary to keyboard and elsewhere and low impedance voltage source otherwise you have 60 cps FM modulation. Battery drain is small enough that they should last nearly shelf life.

Lamar E. Waddle, W0EPY

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