Additional Classified on Page 15

TOROIDS, 88 & 44mhy. center-tapped, unused, 5/$1.50 postpaid. 11/16'' oiled reperf tape $3/box. RTTY page printer paper $5.50/case. Polar relays $3. Sockets $1.00. Sync motors $10. Gears for most machines $5.50/set. Eico 720 CW transmitter $40. Johnson 6N2 and matching VFO $95. Model 15 complete $75. WANTED: Collins PTO #70E15 for 51J3/R388. Stamp for list Van W2BLT 302R Passaic, Stirling, N.J. 07980.

NO GLARE WINDOWS for Model 15 & 19 Printers. Cadinum plated & Gold iridite finish. $12.50 P.P. Check or M.O. Bud WA6UEF, 17114 Sunderland Dr., Granada Hills, Calif. 91344.

SELL; TMC FRR-502 Receiver with four tuning units, 2-32 MHz, excellent $110. CE100V clean, excellent, $285. R388 Good condition $275. Geo. Tate, 7 Artillery Rd., Taylors, S. Car. 29687.

FOR SALE 3 HEADED TD(MXD) with 3 supply & 3 powered takeup reels. Series Motor $40.00 or sync motor $45.00. W9DGV 2210-30ST. Rock Island Ill. 61201.

MODEL 19. EXCELLENT condition. $225. Deliver within 100 miles. North Radio 152 RTTY Converter to 850 cycles $35. Model 15, 2 tables, $15. each. 2 Covers $15. ea. John Murray, 40 33, 61st St. Flushing, N.Y. 11377

PRECISION FREQUENCY L-C FILTERS in clear epoxy for permanent protection. Use for frequency reference or channel filters. Specify octal plug or solder terminals, and frequencies. $3 or 3/$7.50 postpaid. Gerald Hall, K1PLP, 15 Endleigh Ave., Pinehurst Mass. 01866.

MODEL 19 FOR SALE or TRADE. Excellent condition. With 60 wpm gears, communications type, and all accessories. $150.00. Wanted: 2 meter FM gear. Richard Zach, WB2AEB, Pike Place, RFD-4, Mahopac, New York 10541.

''SAROC'' Fourth Annual fun convention scheduled January 8-12, 1969, in Hotel Sahara's new space convention center, Las Vegas, Nevada. Advanced registration closes January 1, 1969. Ladies program in Don the Beachcomber. Technical seminars, FM, MARS, RTTY, QCWA, WCARS-7255. Registration $12.00 per person entitles ''SAROC'' participant to special room rate $10.00 plus room tax per night single or double, occupancy, admittance to cocktail parties, technical seminars, exhibit area, Hotel Sahara's late show, Sunday breakfast equal to any banquet dinner, ask any ''SAROC'' veteran. Brochure planned November mailing for details QSP QSL card with ZIP Southern Nevada ARC, Box 73, Boulder City, Nevada 89005

Additional Classified on Page 15

Return Requested
RTTY JOURNAL
P O Box 837
Royal Oak, Mich. 48068

First Class Mail --

ROYAL OAK MICH. NOV 19 '68
U.S. POSTAGE 30

RTTY JOURNAL

DECEMBER 1968

EXCLUSIVELY AMATEUR RADIOTELETYPE

Vol. 16 No. 11

30 Cents

WB6QFE **ON4BX** **WA6WGL**

Arthur Blave, ON4BX, operator of one of the best known RTTY stations from overseas, has just completed a trip around the states on a project for his country investigating and learning methods and uses of Educational TV. John, W3KV met Arthur at the airport in New York and was with him for several days at the beginning and again at the end of his trip. K8QLO and the writer had the pleasure of entertaining Arthur for a day while he was in Michigan. On the west coast he met a number of hams among them WB6QFE, WA6WGL and W6DDQ that we know of. In most stops Arthur was able to complete a schedule with a home station and these contacts with his family were deeply appreciated. Arthur met many other RTTY fans on his trip but we have no accurate list. Arthur told us how much he appreciated seeing John at the airport on arriving in a strange country and once again Amateur Radio has acted as an ambassador of international understanding.

FILTERS for RTTY

Part 2. Channel Filter Responses Using the 88mhy Toroids

Jerry Hall, K1PLP
15 Endleigh Ave.
Pinehurst, Mass. 01866

Part 1 of this series appeared in the November issue. That article contained construction and tuning hints for simple L-C filters using the well-known 88 millihenry toroidal inductor, which sees almost universal use in demodulator channel filters. But yet how well do we really understand this toroid? Resonated with a capacitor at an audio frequency, perhaps loaded with a fixed resistance to lower its Q and placed in an audio discriminator circuit, can we accurately predict the filter impedance and subsequent voltage response at various frequencies, both at and off resonance? Can we calculate the filter bandwidth accurately?

If the equations below disturb you, please read on. This article is not going to be a mathematical treatise on L-C filters! The equations are listed only to show that definite mathematical relationships do exist between the various values and responses of a simple L-C filter. There are several useful equations for the more industrious individuals who may wish to perform calculations regarding various responses, most of these having been learned as basic electronics and perhaps even forgotten by now. These equations apply to Figure 1, where R is the resistive loss of the toroid, or the sum of the toroid loss plus any external loading resistor placed in series with the toroid in the position shown for R.

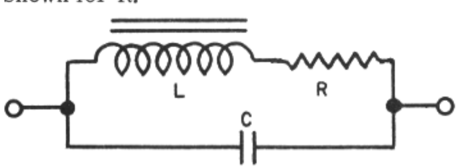


FIGURE 1. SIMPLE L-C CIRCUIT.

Equation 4 is good only at filter resonance, and is an approximation based on the assumption that the inductive reactance is much greater than the resistive loss of the coil. (This is true for the 88 MHY toroid at audio frequencies used for RTTY work, even with normal resistance values purposely added externally for loading.)

1) $X_L = 2\pi fL = \omega L$

2) $X_C = \frac{1}{2\pi fC} = \frac{1}{\omega C}$

3) $Q = \frac{X_L}{R}$

4) $Z = Q_L X_L = \frac{X_L^2}{R} = \frac{L}{CR}$

5) $|Z| = \sqrt{\frac{R^2 + \omega^2 L^2}{(1 - \omega^2 LC)^2 + \omega^2 C^2 R^2}}$

Although the relationships of equation 4 may be used to calculate voltage responses at resonance, they are of no value for calculating filter bandwidths. Equation 5 is the general formula, assuming perfect filter isolation from remaining circuitry, and must be used to calculate the filter impedance off resonance. This equation will be found only in the more advanced technical reference books. Once the impedances at various frequencies are determined by formula, one may then calculate the voltage responses and thereby determine the filter bandwidth at a given number of decibels down from peak response. However, all of these calculations become very long and involved, and are even more complex if filter loading due to imperfect isolation is taken into account.

Rather than performing laborious calculations to determine these responses, a limited number of amateurs with access to sophisticated test equipment, such as digital frequency counters or very accurately calibrated audio signal generators, rely on empirically or experimentally derived external circuit component values to obtain the desired responses. But the majority of amateurs, lacking such equipment, find it necessary to consult published information to obtain the desired bandwidth responses.

It is worthy to note that Irv Hoff, W6FFC (formerly K8DKC), has contributed a wealth of filter data for the RTTY amateur to use. See QST issues for May, August, and September 1966. These papers opened the eyes of the RTTY group to the fact that for optimum response in audio discriminators, it is necessary to use more than merely a balance pot and two toroids resonated with appropriate capacity. For symmetrical bandwidth and amplitude responses between mark and space for narrow frequency bandwidth filters, or for a linear discriminator response, it is necessary to select with care each individual value of loading resistance and isolation resistance.

Previous published data has been confined to specific circuit values for selected bandwidths at specific audio frequencies. Such information does not really illustrate how the various responses of a simple L-C filter are affected by changes in circuit values. Nor do mathematical formulas, because the calculations are so complex.

For anyone performing response measurements on simple L-C circuits, it soon becomes apparent that we are concerned with several variable factors. Listing the six principle variables, they are the values for L, C, isolation resistance, intentional loading resistance, amplitude response, and bandwidth response. There are of course other factors involved, such as filter loading due to imperfect isolation, but in a given circuit these are more-or-less constant. The first four of the above variables may be arbitrarily selected, and interact to affect the last two. By making a careful selection of the values for the first four, we can control the amplitude and bandwidth responses.

The frequency of resonance of a channel filter is usually determined by the builder's preference. Using 88 MHY toroids, the capacitance required can be calculated or determined experimentally without highly sophisticated test equipment. (See the nomogram in Part 1 of this series of articles for painless determination of the proper capacitor value. A copy of that nomogram alone is available from the author for a SASE.) For each of the two channel filters, then, we have reduced the number of variable factors to four. It only remains necessary to juggle values of isolation resistance and loading resistance to obtain the desired bandwidth response at the desired amplitude response. Unfortunately, this is not a simple task because a change in either resistance affects both responses, and may also affect the amplitude response of the opposite channel filter, depending on the drive circuitry used. Thus, one can see that even

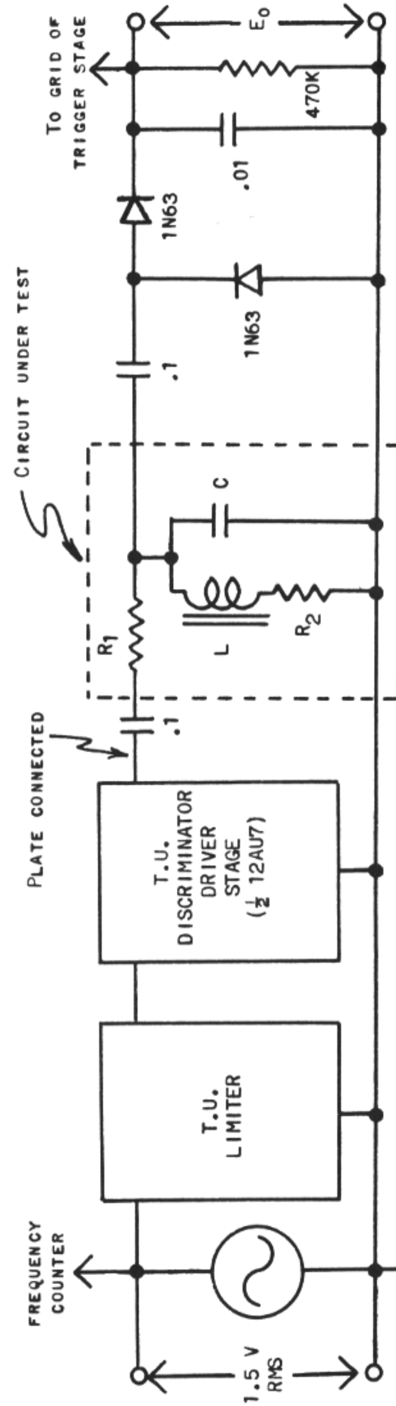


FIGURE 2. CIRCUITRY USED FOR RESPONSE MEASUREMENTS.

with sophisticated test equipment, the empirical design of a demodulator discriminator circuit to precise responses is rather laborious.

I have accumulated extensive data from many response measurements made with 88 mhy toroids in channel filters at 1275 and 2125 Hertz. Figure 2 shows the test circuitry used to make these measurements. This circuitry is presented to enable the reader to evaluate in terms of his own circuitry the data given later in this article. Actual demodulator circuitry was used in order to eliminate the effects of additional unknown variables, such as loading by the discriminator detectors, etc. Note that the diode detectors are capacitively coupled to the filter output, in contrast to the technique used in the TT/L-1 and 2 units where an amplifier stage effectively isolates the filter from the detectors. The bandwidth response of the circuit of figure 2 will therefore be broader than for similar values of resistance in the TT/L units.

The input audio level to the limiter was sufficient for hard limiting. All measurements were based on the DC voltage response indicated as Eo, taken with a VTVM. Bandwidth measurements at the 3 db points were based on frequency differences versus ratios of DC voltages at the output. The circuit under test is shown in the dashed line rectangle. The inductor was an arbitrarily selected 88 mhy toroid, with C to resonate at the desired frequency. R1 represents the isolation resistance used, and R2 the loading resistance. Although parallel loading of the toroid could have been used, the series loading technique was arbitrarily chosen. Responses were measured for several combinations of values of R1 and R2. From a hypothetical viewpoint, I desired to display the accumulated data in graphic form. After some head-scratching, satisfactory graphs showing the inter-relationship of isolation resistance, loading resistance, amplitude response, and bandwidth response, were devised. This information is interesting to view. Figure 3 shows the measured responses for a 1275 Hertz filter.

At first glance, this graph may appear a bit formidable. One comment received was, "It looks like a tennis net blowing in a strong wind." But the graph is not difficult to interpret, and vividly portrays how changes in resistor values will affect the responses of a simple L-C filter. Each curved line drawn in the graph represents one value of fixed resistance associated with the channel filter. The lines running primarily in the horizontal direction represent various test values for R1, the isolation resistance, while the lines running primarily in the vertical direction represent values for R2, the loading resistance in series with the toroid. At the intersection of a pair of lines, the DC voltage response of the test circuit at resonance for the particular resistance values may be read from the scale at the left. For the same point, the 3 db bandwidth may be read from the scale at the bottom of the graph.

It may be seen that in the 50 to 100 Hertz bandwidth range, the bandwidth response is controlled primarily by the series loading resistor, R2. The isolation resistance, R1, has a great effect on the voltage response but not so great an effect on the bandwidth response in this range. At wider bandwidths, a change in either resistance has an appreciable effect on both responses.

The shift in direction of the curves in the upper left portion of the graph warrants an explanation. Because the measurements were taken "inside" the demodulator, with the grid of the succeeding trigger stage connected, the high DC output voltages caused the trigger stage to draw grid current. This, in turn, is reflected as additional parallel loading of the channel filter, broadening the response. The higher the DC voltage, the lower the equivalent parallel resistance became, and thus the broader the response. This type of an effect would be very difficult to calculate by mathematical means.

There is no point in reproducing the similar graph obtained for the 2125 Hertz filter. The only real difference is that the lines for identical value resistances appear to be shifted upward and to the right. In other words, a broader bandwidth with higher amplitude voltage response would be noted in the 2125 Hertz filter for identical resistor values. Say that one used this identical demodulator circuit and wanted a 10 or 12 volt response at a bandwidth response of 100 Hertz. For 1275 Hertz, it may be seen from the graph that a value of 100K ohms for R1 and 30 ohms for R2 gives this result. If the same values of resistors were used in the 2125 Hertz filter, the amplitude response would be 20 volts with a bandwidth of 162 Hertz. To duplicate the desired response at 2125 Hertz, it would be necessary to use a value

in the range of 390K ohms for R1 and a 10 ohm resistor for R2. The different values are required because of the impedance differences of the basic filter elements.

Most of us probably have found that a pair of simple L-C filters with only a balance pot will work in a demodulator discriminator. However, almost anyone who has made comparisons between copy received under various conditions with such simple filters versus with optimized filters will have high praise for the results of the tailored responses. The next article of this series will present more detailed information on demodulator channel filter circuitry.

▼▼

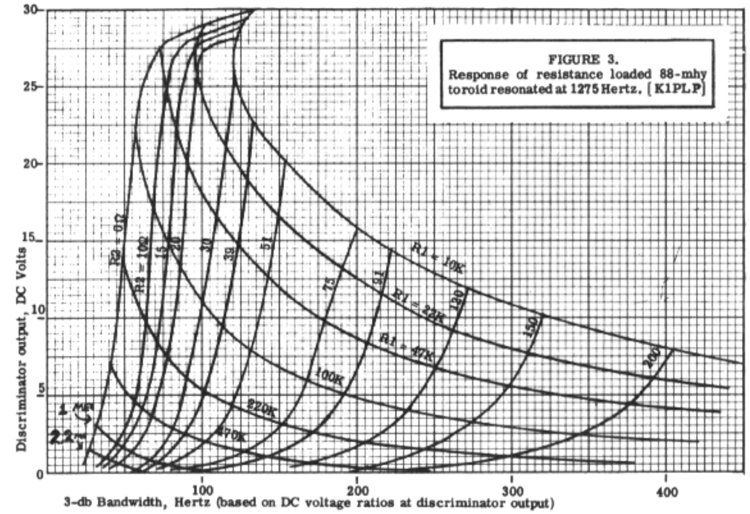


FIGURE 3.
Response of resistance loaded 88-mhy toroid resonated at 1275 Hertz. [K1PLP]

Experimentors I C Power Supply--

Reprinted from CARTG Bulletin.

John Hewson
406 Soudan Ave.
Toronto 7, Ontario, Canada

Whilst experimenting with some intergrated circuits recently, the writer came up against the perennial problem of a suitable power source. During the earlier experiments, a 'battery eliminator' unit was used, but this was not satisfactory for many reasons. In the main, these were; high 'off-load' voltage, decreasing output with increasing load, high percentage ripple, the inability to vary the output voltage as well as no overload/short-circuit protection. Talking about overloads, once the writer inadvertently reversed the supply polarity to a breadboard containing twelve Motorola MC 800 series intergrated circuits, causing a sustained current of about 3.6 amps for about two minutes - with no apparent damage to them.

The requirements were, therefore, for a power supply of modest cost, with a high order of voltage stability, low ripple content, ability to vary the output voltage with overload/short-circuit protection auto-rest incorporated.

The unit to be described fills the bill a treat. The current is limited by the capability of the power source, the ratings of either the protective diode or the bridge diodes as Tr1, the series regulating transistor. Another factor affecting the current handling ability of Tr 1 is the cooling effect of any heat sink.

Briefly, the circuit functions as follows; Tr 1 is a germanium power transistor operating in the series regulator configuration, the base current being controlled by Tr 2 collector. Zener bias is provided via R3, the zener voltage is applied to the base of Tr 2.

A standing current is set up through R4, by Tr 2, a common emitter resistor with Tr 3. The base of Tr 3 is the tap of a voltage divider, VR 1, which is between ground (earth) and the stabilized output.

Any increase in current through Tr 3 base (increasing output voltage) will result in an increase in Tr 3 emitter current, any such increase reduces the current through Tr 2 proportionately, and, subsequently Tr 1 base current. A decrease in Tr 1 base current will result in decreased emitter-collector current, thereby reducing the output voltage. This action ceases when the standing current through Tr 2 assumes it's normal level.

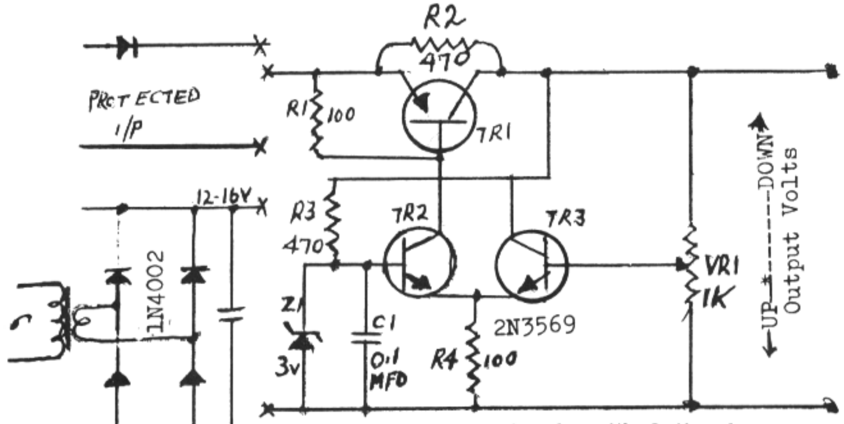
A decrease in output voltage will result in decreased current flow through Tr 3, proportionately increasing the current through Tr 2, until standing current equilibrium is achieved. The increasing Tr 2 current increases the emitter-collecter current, upping the output.

power source. Any noise on Tr 2 base is reflected in the output.

Ripple, measured on a 1 amp load, was 0.03%!

In the prototype, Tr 1 was a Silitron SDT 3080, a 15 amp transistor that was spare, and grossly overated for the job. A more economical Motorola plastic equivalent is given at the end of the article.**

Z1 was a 3 volt zener, 1.5W for which four or five silicon diodes in series may be substituted. Zener voltage dictates lowest regulated voltage. T2 & T3 are 2n3569, all resistors are 5%, 0.5 watt,



Stabilized Voltage Supply with Optional Imputs.

Should the output be overloaded to the extent that the output voltage is lower than zener voltage or a short-circuit occur, the standing current through Tr 2 would be reduced, it in turn reduces the Tr 1 base current, causing Tr 1 emitter-collector to be reduced. This action is accumulative & results in Tr 1 being cut-off. The only current flowing is through R R2 which is negligible.

When the overload or short circuit is removed, zener bias now via R2 and R3. The bias current turns Tr 2 on, its rising current turns Tr 1 on, the output voltage increases until standing current level is achieved.

When the load is removed, the regulating action cannot hold the output to the required level due to the effect of heat on a germanium transistor, as well as the base charge effect.

R 1 provides a discharge path for the base charge, maintaining the output near the desired value.

C1 presents a low impedance path to noise generated by the zener or from the

10% being satisfactory, all values are in ohms. The voltage divider potentiometer should be one tenth watt rating.

The protective diode in the DC power source circuit should be adequately rated for the proposed load.

In the prototype AC version a Hammond 166-J-12 transformer was used, the secondry centre tap being taped up. Four 2N4002 diodes formed the bridge the capacitor was a Mallory valued at 3800 MFD, 50 VDC wkg, although less expensive equivalents were used in subsequent versions.

Prototype construction was in a Hammond utility case, using the chassis as a heat sink, other components being mounted on vector board with the exception of the transformer & 3800 MFD capacitor. Later versions used double sided P.C. boards, one side being the interconnecting foil, whilst the other served as a heat sink for Tr 1. The maximum current required was only 1 amp.

Frills can be added, two indicator lamps, one across the DC input to the

stabilizer unit, the second across the output. A manual start/reset push button, normally open, could be inserted between R2 & Tr 1 collector. A voltmeter could be fitted, although it would be cheaper to put a switch in place of the potentiometer, choosing voltage divider resistors to give fixed voltages.

Two or more circuits could share a Zener Diode, providing its rating was increased.

Shortly articles will be published that employ this circuit as a basic building block, so, go to it AND don't be afraid to try out the short circuit test-it works! Any queries can be addressed to the writer at 406 Soudan Ave., Toronto 7.

**Motorola Transistor for TR 1 for -2 Amp O/P is 2N4-912.

Extended Tube Life in TT/L-2

Have you ever wondered why some of the tubes in the TT/L-2 seemed to get weak prematurely?

In vacuum tubes there is a phenomenon that occurs in some circuits known as "Cathode Stripping". This occurs when a positive voltage is applied to the grid of a tube before the cathode has reached operating temperature. This occurs each time you turn the unit on because the B+ is applied immediately due to the solid state rectifiers used in the power supply. The grid strips some of the coating off the cathode, thus lowering the emmision capabilities of the tube and shortening the life of the cathode.

The cure for this problem is to clamp the grid to the cathode with a silicon diode (where possible - consistent with the circuit design).

In the Mainline TT/L-2, the only stages requiring this clamping are V-5A, V6A, V-6B, V-7B, V8, V12A, V13B and V14B.

The clamping is easily and effectively accomplished by hooking a 1N2070A silicon diode from the grid to the cathode. The anode (arrow) of the diode goes to the grid. The cathode (bar) of the diode goes to the cathode of the tube. Only eight diodes are required for the TT/L-2. This is a small price to pay for the vastly increased life and adjustment stability of the cathode follower, slicer, loop keyer, auto receive, anti-space and motor control circuits.

APOLOGIES

EXPLANATIONS --

HAPPY HOLIDAYS --

On the left side of our typewriter is a pile of letters, that we intend-hope and promise to answer when we get a chance. Many of them are for thank you notes on some contribution, others questions of - do you know where? - or how? - (which we usually don't) some just notes to friends that we would like to answer. Unfortunately the pile seems to grow instead of diminish, we will try to answer the most pressing ones but many will have to wait until after the Holiday rush. And speaking of "rush" the following hints will make it easier for us.-

If renewing - mention renewal and the name AND call. Our files are according to calls in each area.

Please do not ask us to "bill" you for something, if a classified ad, you make your own word count - we never question it. If a little extra money is enclosed or a little short on subscriptions we extend or shorten the time to compensate.

We try to keep a current list of back issues available in each issue. No others are on hand.

Check the expiration date on your subscription, we try to hand stamp the last copy on your subscription but with the December issue we will not be able to do this.

Foreign subscribers should send their name and address separately when sending a postal money order as the information on the money order is very brief and often mis-spelled.

It's not that we want to be tough, but help on the above things will let us get at that pile of letters faster.

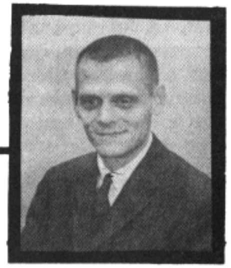
This issue ends our second year of publishing the Journal.

At this time last year we thanked everyone, authors, and subscribers for the marvelous co-operation and help. We have missed a lot of third strikes but you have kept us in there swinging and we appreciate your confidence. All we can say is a sincere "THANK YOU".

Health and Wealth,
Happy Holidays,
Dusty

RTTY theory & applications.

RON 'RG' GUENTZLER, W8BBB
Route 1 Box 30
ADA OHIO, 45810



RTTY FOR THE BEGINNER
RECEIVING AN RTTY SIGNAL

A few months ago we described how an RTTY signal is transmitted. This was done before describing how to receive a signal because it was felt that it is easier to understand how to receive something if one knows what that "something" is. We will review the transmitting process and then describe the receiving process.

There are two methods used to transmit an RTTY signal. Both involve frequency shifting a signal. One method employs frequency shifting the carrier from a CW transmitter. The other method involves frequency shifting an audio tone which is applied to the microphone input of a voice transmitter (FM or DSB AM). The former method is called FSK and the latter method is called AFSK. Which method is used is dependent upon legal restrictions and/or technical problems. Generally, FSK is used on 10 meters and below, and AFSK is used on 6 meters and above.

FSK is obtained by connecting the keyboard contacts to the oscillator circuit in a CW transmitter. The connection is made thru a simple circuit consisting of a diode, an RFC, and a few resistors and capacitors. This shifting circuit is placed physically close to the oscillator in the transmitter. When the keyboard contacts are closed (Mark), the output from the transmitter is a particular desired frequency (for example, 3.600 MHz). When the contacts open (Space), the frequency of the oscillator is shifted downward by some desired amount; when "wide-shift" is being used, the frequency is shifted downward by 850 Hz during a Space. (If 3.600000 MHz were used for Mark, the space frequency would be 3.599150 MHz.)

It should be emphasized that something is always being transmitted; i.e., regardless of whether a mark or space is being sent, the transmitter is "on the air" and RF is being fed into the antenna. The only difference between Mark and Space is that the output or transmitted frequency is slightly different.

AFSK is obtained by building (or buying) an audio oscillator that contains a shifting circuit similar to the one that was used in the FSK transmitter oscillator circuit. When a Mark is to be sent, the output from the audio oscillator is a given frequency (typically 2125 Hz). When a space is to be sent, the output from the audio oscillator is shifted upward in frequency. Usually, a shift of 850 Hz is used; therefore, if the Mark frequency is 2125 Hz, the Space frequency is 2975 Hz. The audio oscillator and its shifting circuit are called, collectively, an "AFSK Keyer" and this keyer is housed in a box that is physically separate from the transmitter. (That is, with FSK the shifting circuit is built into the transmitter, while with AFSK the shifter and its oscillator are located external to the transmitter.) The output from the AFSK keyer is connected to the audio input of an FM or DSB AM transmitter.

THE BASIC RECEIVING PROCESS

Whether the signal to be received is FSK or AFSK, there are certain similarities in the receiving process. In the case of AFSK there are essentially two steps and with FSK there is an additional step. We will describe the AFSK situation first.

The two steps to receiving an AFSK signal are: 1) Tune the receiver so that the AFSK tones are heard in the loudspeaker, and 2) Apply the tones coming from the receiver to a "terminal unit" (TU), or a "receiving converter", or a "decoder", whichever you prefer to call it, and connect the output of the TU to the selector magnets in the printer.

The receiver tuning process for AFSK is quite simple. Because the signal being transmitted was generated by applying audio-frequency tones to the microphone input of an FM or DSB AM transmitter, the receiver is tuned in exactly the same manner as it would be for a voice signal.

The TU and the process within it will be described briefly in order to present the basic processes taking place within it. A more detailed description will be given next month.

As mentioned above, the audio output from the receiver is fed into the TU. This audio signal is composed of two tones one at 2125 Hz representing a Mark and one at 2975 Hz representing a Space. Only one tone is present at any one time. Inside the TU is a pair of tuned circuits; one circuit is tuned to the Mark audio frequency and the other to the Space audio frequency. When a Mark tone is received there is an output from the Mark tuned circuit and none (or very little) from the Space tuned circuit. When a Space tone is received, there is an output from the Space tuned circuit and none from the Mark tuned circuit. The output from these tuned circuits is an audio frequency voltage (AC). These AC voltages are rectified (converted to DC) by a circuit similar to that used in a power supply. There is one rectifier circuit connected to each tuned circuit. The diodes in one of the rectifier circuits are reversed from the way those in the other circuit are connected. Therefore, for example, when a Mark tone is received a positive DC voltage results whereas when a Space tone is received a negative voltage is produced. This DC voltage is too weak to directly operate selector magnets and is amplified. The amplification can be accomplished by means of a polar relay, a vacuum tube, or a transistor. The amplified voltage is applied to the selector magnets.

To summarize the AM or FM AFSK receiving process: The tones are received on an "ordinary-type" AM or FM voice receiver as would a voice signal. The tones coming from the receiver are fed into a terminal unit (TU). The TU separates the two tones, converts them to DC, and then turns on and off a DC loop connected to the selector magnets. The DC loop is turned on when a Mark tone is received and off when a Space tone is received.

RECEIVING FSK

The FSK receiving process involves three steps: 1) Tuning in the FSK signal, 2) Converting the FSK signal into an AFSK signal, and 3) Converting the AFSK signal into a DC loop signal by means of a TU.

The last step will be considered first because we have already discussed it. The TU used for FSK can be the same one used for AFSK so long as the tones applied to it are AFSK tones of the proper frequencies.

How do you get AFSK tones from a receiver tuned to an FSK signal? The answer is the same as the answer to the question: How do you get a tone from a receiver when receiving a hand-keyed CW signal? The answer is: Use the BFO in the receiver. When receiving a hand-keyed CW signal you are trying to listen to a single carrier or RF signal that is simply going on and off. By means of the BFO you (or, rather, the receiver) converts that single carrier frequency to an audio frequency. The pitch (or frequency) coming from the receiver is dependent upon the difference between the transmitted frequency and the frequency of the BF oscillator within the receiver. If the carrier frequency of the received signal varies, the pitch of the tone from the receiver varies. If you tune in an FSK RTTY signal, the tone coming from the receiver will change as the transmitted signal changes frequency. Therefore, the first two steps involved in receiving an FSK signal are more-or-less accomplished simultaneously.

Now come some problems that occur with FSK that do not occur with AFSK. In order to describe and understand these FSK problems, let's look at AFSK again. When a person is transmitting voice or AFSK on an FM or DSB AM transmitter, the audio frequencies he sends are determined by him. When you tune your receiver to hear his signal, you tune for maximum signal or least noise but in the tuning process you do not change the frequencies being heard. You merely optimize what you are hearing. In the TU the tuned circuits are tuned so that one gives maximum response to Mark tone and the other to Space tone. In order to greatly simplify what could become a messy tuning problem, certain standards have been set up for AFSK RTTY and one of them is that when using "850-shift" the Mark tone is always 2125 Hz and the Space tone is always 2975 Hz. Therefore, once you have built your TU you should not have to retune it everytime you receive an AFSK signal because "everyone" uses 2125 Hz for Mark and 2975 Hz for Space.

When you tune a CW signal, you tune for a combination of things including maximum signal and least noise. When tuning you also change the pitch of the signal. This pitch is not particularly important because your head contains a rather broadly-tuned circuit that will accept almost any pitch. When you tune an SSB signal you have a slightly tougher situation than with CW because you have to tune to get the voice frequency components in approximately their proper range in order to understand what the person is saying, but there is still some room for error and your head will compensate for it. However, the tuning is more critical than it is with CW.

Now back to FSK. When you tune in an FSK signal, your tuning determines the pitch of the received tones. If his transmitter or your receiver drifts, the pitch of the received signal changes as it does with CW or SSB. However, because the TU contains rather sharply-tuned circuits, the audio tones presented to the TU must match rather closely the frequencies to which the circuits are tuned. Therefore, when you receive an FSK signal you must tune for the proper pitch of tones and a slight drift in frequency at the transmitter or receiver may alter the frequency of the received tones enough to cause errors in the printed copy or prohibit copy.

For example, if either end drifts by 100 Hz, the tones will change by 100 Hz, and this may be enough to prohibit copy. A change of 100 Hz at a frequency of 3.600 MHz is a change of one part in 36 thousand or approximately 0.003%. At ten meters a change of 100 Hz is approximately 0.0003%. This represents a pretty tight frequency tolerance.

Again, a problem with FSK reception is that the person receiving determines by his tuning what audio tones will appear from the receiver. This means that the tuning process is more difficult than with AFSK. Also, any drift in frequency at either end will directly result in an error in the tone output frequency from the receiver. With AFSK a tuning error is either totally unnoticed, or, at worst, may result in a change in noise level from the receiver.

Another problem with FSK, although not as serious, is that by improper tuning you may end up with an "upside-down" signal. This is analogous to what happens when an SSB signal is tuned on the "wrong" side (trying to receive with the mode switch in "LSB" when it should be in "USB"). You might tune in the signal so that one tone is exactly 2125 Hz and the other is 2975 Hz but get nothing but "garbage" from the printer. The problem is that space is 2125 Hz and Mark 2975 Hz! (Incidentally, this could also be the fault of the transmitting station.) A simple remedy for this situation is to incorporate within the TU a "reversing" switch that permits the interchange of Mark and Space signals.

SUMMARY

We have briefly reviewed the two methods of transmitting RTTY signals. It was pointed out that when AFSK is received a voice type receiver is used and the tones being transmitted are heard in the loudspeaker. Tuning the receiver optimizes reception of the tones but does not change their pitch or frequency. The tones are fed from the receiver into a terminal unit (TU). The TU separates the tones by means of two filters or tuned circuits, converts the outputs of these filters into DC, and applys the DC to a loop keyer which operates the selector magnets in the printer. The loop keyer may be a polar relay, a vacuum tube, or a transistor.

When FSK is to be received, the receiver must receive the signal (obviously) and convert the FSK signal to audio tones or AFSK. (The conversion to AFSK is the same process used to receive CW or SSB.) Once the AFSK signal has been generated within the receiver a TU is connected to the output of the receiver as it was for a pure AFSK situation. The prime difficulty with receiving FSK is that the frequency of the tones appearing at the receiver output is dependent upon the tuning of the receiver, and precise tuning is required compared with the rather sloppy tuning required with AFSK. Also, any drift of the receiver or transmitter when using FSK will result in a shift of the frequency of the tones coming from the receiver, and even a relatively minor drift (when compared with AFSK or DSB AM voice) will result in loss of copy.

Next month we will describe TUs in more detail.

YY

RTTY JOURNAL Binders- $2.50 —pp.

We just wondered. . .Is RTTY to be allowed at all in the CW section allotted to Extra Class licenses??????

RTTY-DX

JOHN POSSEHL - W3KV
Box 73 Blue Bell, Pa., 19422

Hello there. . . . .

It is always a pleasure to start off this column by announcing the most recent applicants for the W A C Award. This month the applause goes to--

Nr. 113	Stan Spaeth	WB6QFF
Nr. 114	Leon Speight	VE5LG
Nr. 115	Herb Hoover Jr.	W6ZH

Stan is very active from the west coast, and those of you thinking about a new crank-up tower should read Stan's very excellent construction article on the subject that appears in the November issue of QST. Len accomplished the feat with low power from up there in Saskatoon. Herb needs no introduction of course. His contribution to amateur radio as past president of the ARRL and IARU has done much to boost the prestige of the amateur all over the world. Congratulations fellows. For the W A C Award, this makes an increase of twenty from the same period last year and a good indication of the increasing activity on RTTY-DX.

At the end of October the Sint Maartin Dxpedition showed up on twenty meters and put out a terrific signal for a few days. Bert, VE3EUU, and Jose, PJ2MI, handled the keyboard alternately and it is hoped that many of you were able to contact this rare prefix. The call used was FG7TI/FS7. This time Jean, FG7XT was able to be on the receiving end to make a contact, for as you know, Jean was giving out the contacts from FS7 a few years ago.

The ghost of "Murphy" still haunts the contest. The power transformer at KH6GLU got tired after 26 contacts and Fred, HK3SO, says that some slightly inebriated person knocked down the power line pole causing a black-out for most of the second day. Other failures in the rig kept Freds power to a big twelve watts so he is sorry not to have been able to give out more numbers from Colombia. But just wait till next year! In addition Fred says that we should be hearing a new station, Hk3HC, from Bogota real soon if he has not been on already. Hernando, HK7XI, has been doing some experimenting with facsimile which is possibly why he has not been very active lately.

We received some very interesting information recently from Ed, KH6GLU. Ed says that 9Q5EP, in the Republic of the Congo, should be on RTTY by December or January. This will certainly be a welcome addition from the African continent as EL2N is about the only station on from there at the moment. Incidentally, you can usually find Orbra on fifteen meters on Tuesdays around 12-1300z and he will give you a report after he completes his schedules.

Ed continues by saying that VKØVK is very strong in Hawaii at about 0800z. This station is no doubt Vic, VK6VK, who was quite active from Australia before going on a mission to Antarctica.

In February, 1969, Ed is going on a Dxpedition to Wallis Island, FW8, and we presume that the operation will coincide with the ARRL Dx Contest. However, Ed is very much interested in doing some RTTY operating while there and this certainly would be a rare country for the gang. He will take with him a complete solid state TU and AFSK unit but since he will be flying he is looking for a light-weight printer to take along and the RTTY operation will depend upon its availability. In addition to the light weight the power available on the island is 220 volts 50 hz. Anyone that can assist in this matter should get in touch with Ed, KH6GLU, whose full QTH appeared in the October column.

It seems that wonders never cease on RTTY. All the tools for doing this column are right at the operating desk and of course we always have the rig hot and ready to go. While idly twisting the receiver dial and wondering what to write about next we heard and printed Charlie, W5QCH, in QSO with Jean, FG7XT/FM7. Well, I won't intrude upon your imagina-

D X HONOR ROLL

	Call	Wkd/Conf.	States	QCA
1.	FG7XT	89/76	WAS	50
2.	ON4BX	78/72	W-44-S	50
3.	I1KG	78/72	W-45-S	50
4.	W3KV	75/72	W-40-S	50
5.	ON4CK	67/60		50
6.	W8CQ	62/60		50
7.	K8YEK	64/58	WAS	50
8.	W4AIS	62/53		
9.	WA6WGL	51/49		25
10.	W6CG	51/46		25
11.	W5QCH	48/46		
12.	W1GKJ	52/45	W-48-S	25
13.	WA8BOT	50/41	W-49-S	25
14.	I1ROL	50/41		
15.	VE3AYL	48/40		25
16.	K8QLO	44/39		
17.	K8JTT	41/38		
18.	W3ISE	47/35		
19.	K4VDM	36/33		
20.	UA1KBW	36/33		
21.	PY2CQ	43/32		
22.	VE4BJ	33/31		25
23.	K6EV	33/29		
24.	W4EGY	37/28		

	Call	Wkd/Conf.		Call	Wkd/Conf.
25.	XE1YJ	33/28	36.	W3AVQ	22/19
26.	W2LFL	44/27	37.	VP9BY	26/18
27.	W8CAT	31/27	38.	G3LDI	26/18
28.	DL5PQ	35/24	39.	K9QNV	24/17
29.	VK2EG	33/24	40.	PJ2CR	27/15
30.	YV5CIP	30/24	41.	OA4BR	22/15
31.	W8GPB	45/23	42.	W6TX	20/15
32.	VE5LG	29/21	43.	VK3NR	32/13
33.	VE4FG	23/21	44.	HK3SO	18/13
34.	WØHAH	32/19	45.	W6ZH	15/12
35.	WB6QFE	26/19			

Next Honor Roll in March issue.

RTTY W A C AWARDS

1.	VE7KX	40.	W5SH	78.	I1KG
2.	W6CG	41.	W6LVQ	79.	K8YEK
3.	K6OWQ	41A	LU1AA	80.	ON4HW
4.	W6AEE	42.	W8CAT	81.	W6DNJ
5.	W7PLM	43.	W6MTJ	82.	ON4BX
6.	W2RUI	44.	W7VKO	83.	WA8BOT
7.	W2JAV	45.	W6NRM	84.	W4EGY
8.	W6TPJ	46.	W4AIS	85.	W8ZYW
9.	G3CQE	47.	W7UKH	86.	W7ATV
10.	W6LIP	48.	I1AHN	87.	K8JTT
11.	W7ESN	49.	K8MYF	88.	WB6ADY
12.	W8JIN	50.	ZL1WB	89.	F8KI
13.	K3GIF	51.	W4GJY	90.	KL7BAJ
14.	W5BGP	52.	KP4AXM	91.	3C3GK
15.	WONFA	53.	VE3BIJ	92.	K6EV
16.	W8UUS	54.	W2MXN	93.	ON4CK
17.	TG7AD	55.	SM6CSC	94.	W2UGM
18.	Kr6MF	56.	W3KV	95.	WA8FYF
19.	K4JXG	57.	KR6BQ	96.	K7VDD
20.	W7FEN	58.	W7JWI	97.	VK2EG
21.	W6FYM	59.	W1GKJ	98.	K8QLO
22.	W1BGW	60.	DL1IN	99.	F3PI
23.	ZS6UR	61.	W3ISE	100.	3C3AYL
24.	VK3KF	62.	SM5KV	101.	WA6VVR
25.	VE4BJ	63.	KH6AX	102.	W5QCH
26.	WØPHM/	64.	WA6WGL	103.	XE1YJ
27.	I1RIF	65.	FG7XT	104.	W6TX
28.	DL6EQ	66.	W6LDF	105.	3C3RTT
29.	WOFQW	67.	K5OLU	106.	W3ABT
30.	W6UGA	68.	W8CQ	107.	WA2YVK
31.	W9HJV	69.	KW6DS	108.	W3AVQ
32.	W5CME	70.	K8MZS	109.	OA4BR
33.	K8DKC	71.	G2HIO	110.	W8GPB
34.	W3DJZ	72.	PY2CQ	111.	W2LFL
35.	WB2CVN	73.	PY2SO	112.	DL5PQ
36.	W6JOX	74.	K7MNZ	113.	WB6QFE
37.	VK4RQ	75.	I1ROL	114.	VE5LG
38.	DL1VR	76.	I1ORS	115.	W6ZH
39.	DL3IR	77.	OZ8US		

tion as to what went on here during the next few minutes, but after Charlie finished we were able to contact Jean for his number three from there and of course, a new one for us. Jean gets to Martinique from time to time on business on no fixed schedule so it is impossible to give out advanced notice. He was using an antenna right out of the hotel window but had excellent signals here. His business associates there in the room with him were amazed to watch him in contact with the states (and so was I).

An interesting letter from Roger, G3LDI, gives us something to think about for a future operation and perhaps a new country. Roger says that there is a place outside the limits of England called Sealand that has been declared a principality by the English courts. The owner and permanent resident has declared the place autonomous, made himself a Prince, and has his own flag and stamps. Roger is in contact with the chap with the hopes of obtaining permission to go there and do some operating and will keep us posted on events as they progress. We certainly wish Roger the best of luck in this endeavor.

Bud, W2LFL, has been operating exclusively on narrow shift for a while and says that it is amazing how many of the DX stations have this capability. Recently on two way 170 hz shift he worked YV1IK, VE5DR, PAØGKO, KP4JM, VE7BHH,

FG7XT, I1AHN, G3RHP, G8LT, G6JF, PY2CQ, KH6AX, UQ2AB, VE5LG, SM5QV, and DL8VX. So you see, it is quite prevalent and just a matter of getting on it and sticking to it.

Here are a few stations recently printed on twenty meters that may be of interest to those after WAS. K1BWB, New Hampshire; W1EIZ, Rhode Island; WØAVI, WØPKH, Iowa; K4OAN, Kentucky; and John, K4VDM is back on to represent Tennessee.

In a QSO with PJ2CR, Ike says that there may possibly be more activity from Curacao soon,. PJ3CD has a machine but no TU yet. PJ2CE is in the same category and PJ2CD is expecting to get a machine very soon. Ike also says that after the first of the year the prefix of the various islands in the Netherlands Antilles will change. For example, Sint Maartin will become PJ7. PJ8 and PJ9 are reserved for tourists with reciprocal licenses, and PJ1 for special occasions.

If you thought that conditions were bad at the end of October and early November, they were. A severe solar flare-up on October 29th had east-west communications just about zero for about ten days. North-South was still possible but very much attenuated.

As an item of information, on page 93 of the November issue of QST there is some interesting news of some special RTTY tests on 28,890 khz between W and VK. The tests are in AFSK using standard tone frequencies (2125-2975). Intensive activity will occur on Sundays from 2200 to 0400z.

This issue brings us to the end of another year of RTTY-DX. It certainly has been fun for me and I sincerely appreciate the support given me by you fellows all over the world both by letter and QSO. Without your help these ramblings would not be possible as all I do is put your information in some kind of order for Dusty to publish. Keep the information coming. No matter how insignificant you may think it is, a little here and a little there soon fills up a page.

Until we meet again, Good Luck and Happy Holidays.

--73 de John

BROAD MINDED

USE NARROW SHIFT

10 Meter AFSK RTY Experiment Allowed

Cliff Buttschardt, W6HDO, has received special permission from the FCC for operation of an experimental AFSK station on 28890 Kc/s for test purposes. Auto start equipment will be used. The purpose is to experimentally conduct long distance communications with Australian stations. A further purpose is to pass technical information regarding OSCAR topics as the next satellite will probably be of their design. The special permit extends from October 1, 1968 until May 1, 1969.

Although only W6HDO will be permitted to transmit on this frequency using AFSK, any one with receiving equipment is requested to send any reports of reception or other test information to W6HDO. The FCC requests a report on the experiment and any outside reports will be welcomed by W6HDO to aid him in filing his report.

Check Your Renewal Date

Check your address stencil for expiration date of your subscription. The month and last numeral are the month and year of your expiration.

On your address stencil the month and year of the expiration of your present subscription are coded by an abbreviated month and figure. The figure being the last digit of the year. Dec. 8 - means the last issue on your subscription is December 1968.

BACK ISSUES —

Only back issues available are July through December 1966, December 1967 and February to date 1968. Copies are 30¢ each.

RTTY JOURNAL

P.O. Box 837 – Royal Oak, Michigan 48068

"Dusty" Dunn — W8CQ

Editor & Publisher

SUBSCRIPTION - 1 Year (11 Issues)

U.S.- Possessions - Canada-Mexico

First Class -$3.00

Air Mail -$3.50

South-Central America - $5.00

All Foreign Countries-

First Class -$3.50

Air Mail -$5.50

HITS & MISSES

From The Editor and his Mail

About the time you read this the first allocation of new frequencies will be in effect. The first changes will not directly effect any of the commonly used RTTY frequencies but will tend to crowd more of the cw stations into the area. Next year a further loss of frequencies will cause more QRM. Although there is nothing to stop two extra class stations from working in their exclusive area, the general use of RTTY is so small that except for a schedule very few stations would be available in this area. At present the status-quo will probably prevail. Time and experience only can lead to any changes that may be necessary. 40 meters will be the most difficult to settle on, especially when the first 50 kHz are reserved next year. In the mean time - patience - the CW boys have troubles too.

We have to admit disappointment in the results of the SWL section of the "RTTY Trophy Week End" contest. Knowing how many fellows just print and read the mail we hoped that a contest would give them something to achieve and check their abilities. So far, we understand there has been only one reply and that was for information on sending in a log. Probably we goofed in not being more detailed in explaining this, it is as simple as sending in your log, however many SWl's probably do not keep a log and we regret not being more explicit.. Anyway if somebody does send in a log they have a good chance of a trophy. As for the rest of the contest - it was bigger and better than a jamming station on forty meters. Remember all logs must be in Toronto by November 30th.

With the addition of an 800 hz filter sent us by W3KV, narrow shift is more impressive than ever over the wider shift. Unfortunately a great many stations do not have the stability in equipment to use narrow shift and should not be blamed for staying on wide shift. In most cases it is just a matter of a switch to change from one to the other, in a few cases narrow shift cannot be copied by some using wide shift only but any narrow shift station can always use either shift so let us promote narrow, but switch when necessary to accomodate the other fellow. I would rather "Switch than Fight".

From Alan, VE7BHH, mentions that there will be some model 15 printers available for Western Canadian amateurs. Contact J.W. Thorndyke, 428 West Hastings, Vancouver. These are surplus machines from the Canadian Pacific Telecommunications Co. and a declaration must be signed that it is for amateur or experimental use. The price is about $50.

The Canadian Amateur Radio Teletype net has been reactivated and new members are welcome. Meets at 3630KHz 1900 EST. Monday, Tuesday and Thursday.

A RTTY net in Australia has also been formed. Schedules and frequencies will be arranged for mutual convenience with overseas operators. Two meter operation will also take place for local contacts. Contact Peter Brown VK4PJ for any information.

After seven years the FCC is still "considering the application" of the ARRL for RTTY permission in the lower CW band. Apparently somebody has to be against it to get a ruling. So far we have heard of no one objecting - or even caring except us few RTTY fans.

Ten Meters, we're talking about.

Still no word from the results of the BARTG contest but we have written again. Probably as soon as the logs are checked the results will be announced. Apparently the contest has been cancelled in the future.

CLASSIFIED ADS

Rates - $1.00 30 words - Additional words 2¢ ea. Closing date 1st of month.

Additional Classified on Next Page