Additional Classified on Page 19

MAINLINE TT/L-2 FSK Demodulator for sale. One month old. Professionally wired. 850 and 170 cycle band pass and discriminator plug-in filters. Simpson meter. 60-75-100 WPM selection. Standard rack panel and Bud cabinet. $220.00. Ed Brackin, W8VAS, 3390 Higley Road, Rocky River, Ohio 44116.

MAINLINE TTL-2 ENTHUSIASTS. . .will assemble your kit form p.c. board. Quality workmanship, dozens completed to date. W1FCV, John Roache, 153 Chestnut St., Manchester, Conn. 06040.

HOT CARRIER DIODES; New HP 2800, 90¢. 12/$1.00pp. Integrated Circuits; New Fairchild Micrologic, epoxy TO-5 package. 900 buffer, 914 gate, 60¢ ea. 923 J-K flip flop, 90¢ ea. Guaranteed. Add 15¢ postage. H.A. L. DEVICES, Box 365RJ, Urbana, Ill. 61801.

TS-2B/TG Teletypewriter Signal Distortion test set used, good, $35.00 ea. Transmitter-Distributor, Teletype model 14, synchronous motor, used, good, $18.00 ea. 'Here-Is' answer back keyboard; for model 15 with attachments to set up identifications, complete, used, good $12.00 ea. Send us your requirements. Atlantic Surplus, 580 3rd Ave. Brooklyn, N.Y. 11215.

TIRED OF GARBLE? Don't give up. Treat yourself to a Mainline TT/L-2. Custom built by J & J Electronics, Canterbury, Conn. and enjoy RTTY with armchair copy.

TOROIDS 88mhy. center tapped - not potted 5/$1.50 postpaid USA. Foreign orders include extra postage. John Dilks III, Rte 1 Box 218, Mays Landing, N.J. 08330.

STELMA TDA-2 distortion analyzer $35. Motorized paper rewind reel $15. John Christy, 14945 Dickens St. Sherman Oaks, Cal. 91403.

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March 1970

RTTY JOURNAL

EXCLUSIVELY AMATEUR RADIOTELETYPE

Volume 18 No. 3 30 Cents

'A.B.' W0HVL 'Sara' WB0ZPF

Ten Meter Frequency Change!-

A recent directive by the FCC, starting March 2, permits RTTY operation on ten meters from 28000 to 28500 mhz. RTTY operation will probably settle around 28090 mhz. Let's have some action on this band especially on weekends.

Contents

DARC 'WAE' RTTY CONTEST-

The Deutscher Amateur Radio Club (DARC), the sponsor of the WAEDC for CW and SSB, has the honour to invite RTTY Amateurs all over the world to participate in the 2nd RTTY WAEDC 1970. This contest is always held on the last weekend of April.

1. Contest period: Apirl 25, 0000 GMT to April 26, 2400 GMT (cf. also 5 : rest period)
2. Contest call: CQ WAE de. . .
3. Bands: All bands 3.5 thru 28 MHz
4. Classifications: Single operator, single transmitter
   Multi operator, single transmitter
5. Rest period: Only 36 hours of operation out of the 48 hours are permitted for single operator stations. The 12 hours of non operation may be taken in one, but not more than 3 periods anytime during the contest. The periods need not be equal but must total a minimum of 12 hours and be clearly indicated in the log.
6. Exchange: a) QSO-Nr.
   b) RST
   c) Time in GMT
7. Points: Each two way RTTY contact with stations within one's own continent will count 1 point, with stations outside one's own continent 3 points. Contacts of non-European stations with European stations will count 5 points for non-Europenas but 3 points for Europeans.
   Each station may be worked once per band.

   Each QTC (cf. also 10 : QTC-Traffic) - given or received - will count 1 point.
8. Multiplier: The multiplier is determined by the number of countries worked on each band.
   The WAE country list and the latest ARRL country list will be used. In addition each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, ZS, UA 9, UA Ø.
9. Scoring: The final score is the total QTC points multiplied by the sum total countries from all band.
10. QTC-Traffic: Additional point credit can be realized by making use of the QTC traffic feature.
   A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to another station. The general idea being that after a number of stations has been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

a) A QTC contains time, call and QSO number of the station being reported. ie. :1300-DJ3KR-50. This means that at 1300 GMT you worked DJ3KR and received number 50.

b) A QSO can be reported only once and not back to the originating station.

c) Only a maximum of 5 QTCs to a station per band is permitted. You may work the same station several times to complete this quota. Only the original contact, however, has QSO point value.

d) Keep a uniform list of QTCs sent. QTC 3/5 indicates that this is the 3rd series of QTCs sent and that 5 QSOs are reported.

Logs must contain: bands, exchanges sent, call signs, exchanges received, QTCs sent and received, points, multipliers.

Use a separate log for each band.

Enclose a summary sheet showing the scoring, rest period, classification, your name and address in BLOCK LETTERS!

Send Logs to by June 10, 1970

Uli Stolz, DJ9XB
In der Ostert 3
D-597 Plettenberg W.-Germany

Audio Derived AVC-

AVC FOR THE HEATH HW 16, OR ANY RECEIVER THAT CAN STAND IMPROVEMENT IN THAT FUNCTION: This modification is extremely simple and can be added to any receiver in a matter of minutes. The modification is based on a "RAYTHEON RAYSISTOR". This is a completely self contained device, exactly the size of a miniature metal holder. It does not require any voltage other than the small amount of AC that occurs at the speaker output of a receiver. The RAYSISTOR has four pins coming out of the bottom. Pins 1 and 2 are connected to the internal "photo resistor". Both of these components are electrically isolated, and non polorized.

HOW IT WORKS: With no voltage going to the light source, the resistance of the photo resistor is 70 megohms, so with no audio voltage at the speaker output, the resistance at the first audio grid is infinite. As the audio voltage begins to increase, the photo resistor resistance will decrease. For the CK 1121, the ratings call for a maximum voltage on the light source of 5 volts, at this voltage the specification sheet says that the resistance of the photo resistor will be 150 ohms. The light source, dynamically, has a lag, and the intensity of the light will be an

Continued on page 5

Modifying the Model 28 Teletype

PART 2

IRVIN HOFF, W6FFC
12130 Foothill Lane
Los Altos, Calif. 94022

Hooking Up the Machine.

You most likely have already discovered how to hook up the machine, for use, but at any rate, here we go. There is a 120 VAC plug that goes to the normal wall plug in the building. The other cable has a telephone block type of connection consisting of a (1) green, (2) red and (3) yellow wire. These are connected on the rear terminal strip of the cabinet, which is called the "C" terminal strip. Thus the green wire goes to C-1, the red wire to C-2 and the yellow wire to C-3. The 120 VAC wires go to terminals 39 and 40 at the other end of the same terminal strip, with the third wire grounded to the cabinet itself.

Raising the lid and looking at the service panel to the rear of the printer, you see from left to right the line shunt relay, the mercury-wetted polar relay (type 314A, the 120 DC 300 ma. internal loop supply, and the motor-stop relay.

The 314A polar relay is of the pressure-filled, hermetically sealed mercury-wetted type and as such eliminates the objections most of us had to using the older 255A type polar relays. It is our suggestion that you use this relay as it will give excellent results and eliminates the inductive back-e.m.f. normally induced on the demodulator (TU) when the selector magnets go from space back to mark. Among other things, this allows several machines to be used on the same loop without adding distortion, or at least holds it to an insignificant amount.

The line shunt relay serves no important function in a ham station, but since it is already installed it is useful enough to retain. It shorts the "signal line" (incoming loop from the demodulator, etc.) out whenever the motor has been turned off manually by the switch to the bottom right of the keyboard, or when the motor has been turned off by the motor-stop relay. This serves one minor advantage and one fairly major advantage. The minor one: The printer stops printing whenever you turn the motor off, and does not print garble while "running down". The major one: If you remove the printer from the cabinet to do any work, it keeps the signal line shorted, thus if you have a second machine on the line, it continues to print normally, rather than "run open" when you disconnect the cable to this printer. One other advantage, if you have several machines on the same signal line loop, it shorts the line whenever the machine is not in use, thus again minimizing any distortion that could be added by the additional machine. These things are all rather superficial, but of some small interest, and justify in my mind, retaining the line shut relay.

The motor-stop relay is something else. It's an interesting device and is rigged so that if one types "upper-case blank H" it will close temporarily an electrical switch in the stunt box which operates the motor-stop relay, turning off the printer motor and again closing the line shunt relay. As soon as the signal line is interrupted (as when typing a character), the motor immediately comes back on. Actually, I have heard no valid reason so far for retaining this feature, so most everybody disables the motor shut-off relay. This is extremely easy to do and we'll tell you more about it in a few moments.

So, to hook up the 28DSR to the demodulator's loop supply, just connect the red and green wires to the demodulator. And of course, plug the 120 VAC cable into the wall socket and turn the motor on via the switch to the bottom right of the keyboard. If the printer runs "open" instead of going to mark (and the demodulator is in "standby"), then merely reverse the connections from the demodulator to the red and green wires. This is easier than worrying about plus-and-minus voltages. It either works or they are backwards.

If the motor doesn't even turn on at all under these circumstances, check the fuse on the rear service panel, check to see if the lights for illuminating the copy came on, etc. There is also a tiny red circuit breaker on the motor base, which is literally impossible to see unless you remove the entire base from the cabinet. You can feel it with your finger, it is directly under the motor housing. If the motor still does not turn on, probably one of the wires underneath the service panel is loose, or one of the terminals on the rear "C" terminal strip.

SEPARATING THE KEYBOARD

There are a few people for various reasons who will want to keep the keyboard separate from the rest of the machine. This is so they can drive certain F.S.K. systems directly, or some A.F.S.K. systems are set up to be driven directly from the keyboard. A few will want to be able to use the keyboard to drive a reperf while receiving an incoming signal directly from the demodulator. At any rate, here is how you can easily separate the keyboard and bring out its leads independently.

1. disconnect jumper between C-1 and C-15
2. disconnect jumper between C-10 and C-13
3. disconnect jumper between C-8 and C-9
4. now place jumper between C-1 and C-8
5. now place jumper between C-8 and C-13
6. You are finished. The keyboard (and break key) is now available at terminals C-9 and C-15. The line shunt relay still is in the circuit.

CHECKING FOR 60 MA.

Nearly all of the 28KSR mouse machines are wired as received for 60 ma. If you study the schematic included in the "basement" (bottom part of the cabinet) you may conclude the unit is actually wired for 30 ma. or "series configuration". Not so, in most cases. The selector magnets are indeed wired in series internally, but this does not in itself set the criteria for the current in the external signal line. Don't forget that in this unit we are using a polar relay, together with an internal loop supply that is isolated from the signal line by that polar relay. Thus the external signal line requirements have no bearing on how the selector magnets are connected for the internal loop supply.

You can easily check to see what configuration you have, but it requires you to remove the printer and keyboard base first. This is simple to do. First you remove the little piece that runs directly above the keyboard. There are thumb screws on the inside of the cabinet at either end of the keyboard to make removal of this piece easy.

Then on the keyboard base proper, there are four large bolts to remove, one at the extreme edge of each of the four corners. These bolts are about three inches long, or so, and go through the top of the keyboard chassis down to the cross pieces holding the unit to the deck of the cabinet. Remove these four bolts, unhook the cable to the right side of the printer unit, and lift the entire works out of the machine. The rear service panel of course still remains in the cabinet. Now at the left extreme end and at the right extreme end of the service panel you will notice similar long bolts holding the service panel to the deck of the cabinet. Remove these two bolts. Now pull out the on-off switch that goes from the front of the cabinet back to the service panel. This rod just "hooks" into the hole, so try to center it exactly in the hole by pushing down slightly, and then it will pull right out.

Now turn the service panel upside down. You will see numerous terminal strips underneath, all of which start numbering at the rear and come toward the front.

The terminal strip at the left end is the "A" strip, beside it is the "B" strip. (The "C;; strip is at the rear of the chassis itself). The "J" strip is on the bottom of the polar relay, the "D" strip is the second from the right, and the "E" strip is the final one on the right. Again notice carefully how they are numbered, as they will start from the front, and it's easy to count wrong if you don't look carefully for the numbers on the strips themselves.

For an external loop of 60 ma., the following should be jumpered: D4 to D5, D5 to D7, and D7 to D6. Over on the "J" strip, you would have JI-1 to JI-2. (The instruction book also mentions K1 to K2, don't waste your time looking for this connection, it is only in machines having a line test key, which none of these have.

While looking down there, if you do insist on by-passing the polar relay, and wish to get in on the selector magnets directly for 60 ma. here is how to do that. Most of you will wish to ignore this paragraph however:

1. Remove any jumpers between A-1 and A-2
2. Jumper A-1 to A-4 instead
3. There are two brown wires on A-3. Remove the left one (it goes to one of the selector magnets, the other brown wire goes to a 600 ohm resistor on the polar relay base) and hook it on A-2. You can verify you have the correct brown wire by hooking an ohmmeter between it and the brown wire on the left selector magnet on the printer, although this first requires you to place the connector back on the printer, which may be awkward to accomplish at this time. It also normally has a hole in the connector, while the "wrong one" normally has only a spade lug on the end.
4. Put a jumper between A-2 and B-5. This B-5 has a white wire on it which goes to C-4 on the rear terminal strip in the back of the cabinet.
5. You are finished with the power supply panel, so replace it in the cabinet, hook up the on-off switch, and replace the keyboard base, printer, etc. Reconnect the cables to the printer and keyboard.
6. On the rear terminal, remove the jumper between C-20 and C-21.
7. You are now completely finished. The selector magnets are now available at terminals C-4 and C-20.

ORDERING SOME MANUALS

We spoke the last time of how to order parts from Teletype Corp., and gave their address. Manuals come from a different department so do not mix an order for manuals with an order for parts. Address the letter to "Customer Service Department."

1149B 28KSR Page Printer
Parts. $4.00
216B 28KSR Page Printer
Description. $1.70
217B 28KSR Page Printer
Adjustments and Lubrication . . $4.20

There is another excellent manual:
NAVSHIPS 0967-173-7010
311B Bol.1 (Tech manual) $5.10

If you order the Navy manual, you would probably not need the 216B and the 217B, but you would want the 1149B if you ever plan to do very much to the 28KSR. It is not necessary to have this manual to "complete this course", but it might make things easier for you, and you may well wish to invest the $4.00 for it.

NEXT ARTICLE

The next time we'll get into things relative to keylevers, keypallets, perhaps show how to remove the stunt box, how to disable the motorstop relay, and possibly will have time to show how to add automatic non-overline (prevents printing over the same line a second time if an erroneous "carriage return" character is received during garble, etc.)

There is no need to change any other wires on the bottom of the service panel. By the way, that is called the "LESU" portion of the printer. The printer is called the "LP" and the keyboard is the "LAK". The cabinet is usually called the "LAAC".

So if you use the polar relay, and the connections we mentioned to check on terminal strips "J" and "D", you will then use a 60 ma. external loop to the red and green wires. The selector magnets will actually be hooked internally for series configuration of the internal loop. If you decide to bring them out directly, they will then be in parallel for 60 ma. operation.

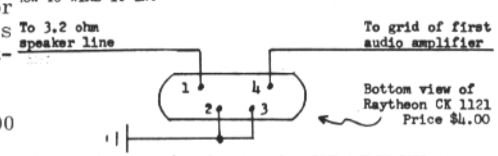
***

Audio AVC- -

Continued from page 2

averaging function related to the fluctuations of the audio level at the speaker. There is also a lag in the decay of the light source. Therefore the attack and release time of the audio AVC is dynamically controlled by the filament of the light source.

HOW TO WIRE IT IN:



It works perfectly in the HEATH HW 16, and in the Collins 75S3-B. The HEATH of course has no RF AVC at all, but in the Collins, the audio AVC works well in conjunction with the RF AVC. With the Collins AVC "off" the Raysistor AVC used alone, produces better copy under all conditions except extreme front end overloading. This latter condition does not happen very often, therefore I feel that the audio AVC is an improvement over the "stock" Collins AVC.

William Sherwood W6FBY
716 N. Rodeo Drive
Beverly Hills, 90120 CA.

Thanks to Keith Peterson, W8SDZ, and Truman Boerkoel K8JUG, for their experimentation with the Raysistor.

***

Modern RTTY Receiving Techniques

Reprinted from December 1964 RTTY- Part 1

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Los Altos, California 94022

1. General Background

Several very interesting articles which have outlined certain FSK receiving techniques that come under the definition of "two-tone limiterless" have appeared in recent months in amateur journals. Jim Haynes, WA9IBB, first pointed out work done in this field in his fine review series that began in November 1962. In June, 1963, Frank Gaude (then K6IBE but now residing in Huntsville, Alabama), introduced the TU-D converter utilizing the two-tone limiterless linear (AM) detection system.

Although generally unfamiliar to amateurs, commercial use of similar techniques had already been standard for many years. An even more advanced circuit has been patented by Page Communications Engineers, Inc., and used in their equipment since the late 1950's. Their work on this patent was supported in part by Signal Corps contact.

In September, 1963, Bob Weitbrecht, W6NRM, further explored the two-tone technique and adapted the dual-slideback system to his Mark III/IV converters.

Also in September, 1963, Gaude further discussed two-tone methods and proposed the TU-E converter with a block diagram. This converter was to utilize very narrow channel filters in an audio mixing system that would easily adapt to various shifts.

In January, 1964, Vic Poor, K3NIO, examined the deficiences and limitations of the dual-slideback systems as used by K6IBE, W6NRM and others. He introduced a variation of the patented DTC (Decision Threshold Computer) circuit which satisfactorily overcomes the basic disadvantages of other two-tone limiterless systems.

In the same month, the previous works of Gaude and Weitbrecht were reprinted.

In February, 1964, Gaude continued his comments on two-tone limiterless reception and discussed the completed TU-E, which was not published. Irv Hoff, K8DKC, provided interested parties with a schematic. This converter still used the dual-slideback dectors.

Since the DTC was protected by patent, Gaude was attempting to develop a new circuit which he hoped would have some commercial value.

A solid-state version of the TU-D was offered by Rene Belfi, DL3IR, in June, 1964, and another version, using tubes, by G.E. Blanchett, VE3BAD, in July, 1964.

In May, 1964, Poor contributed an outstanding paper on selection of filters for two-tone limiterless systems. In particular he pointed out the importance of a good post-detector, minimum band-width, low-pass filter.

Anyone wishing a full explanation of the two-tone limiterless (linear AM detection) and its merits is invited to read these and other articles.

2. Two-Tone Limiterless Defined

This system has been known since the thirties, and is only "new" to amateur RTTY enthusiasts.

A teleprinter needs on-off DC pulses for its operation. The "on" portion is called "mark" and the "off" portion is called "space".

FSK reception consists of two alternating frequencies being received; the one called "mark" and the other "space". As each of these contains on-off pulses, either one could be used alone to provide complete information for the printer.

The "two-tone" method, then, uses separate linear systems to individually receive and detect mark and space. These outputs are then combined in such a manner that the printer can operate normally from one or both channels, depending on conditions at the moment. This requires some form of automatic threshold correction, which is provided in all such systems.

Beard and Wheeldon, in a monumental work, set up criteria for meeting the optimum two-tone system. This included filter band-widths for the mark and space channels equal to the Baud rate in use; or 45 cps wide for 45 Baud. Poor pointed out this ideal band-width could not be met from a practical standpoint. He suggested that 54.6 cycles band-width (or wider) could actually be used.

3. Variable Threshold Correctors

It was mentioned in Section 2 that a printer needs on-off pulses to operate. These pulses all should be uniform length, except for the stop pulse which is usually longer. If the pulses vary from 22 milliseconds, they are said to be distorted. A normal printer can accept up to 45 per cent distortion.

In an FSK converter, at some point prior to the printer, there is normally a "slicer" that "decides" whether the incoming voltage should be considered mark or space. It then takes this incoming voltage, regardless of amplitude, and changes it to a specific output level to operate the printer. The voltage at which this slicer changes from negative to positive output is called the threshold, usually zero.

Various authors refer to the "decision point". This can be defined as a point on a waveform (relative to mark and space voltages) where the slicer output will change from mark to space if that waveform is applied to the input of the slicer.

Consequently, the voltage applied to the slicer should vary uniformly around its threshold in order to present correct pulses to the printer.

The job of the variable threshold corrector is merely to present this uniform (symmetrical) swing around the threshold. It must be able to do this whether receiving equal amplitudes from the mark and space channels or not. If properly designed, it will present symmetrical output from only one channel, or a greater output (still symmetrical) if the second channel is present to any extent.

A storage-system is provided for retaining the signal level of each channel to adjust the threshold level of the detector. A clamp device is included to provide the slicer with a symmetrical voltage swing.

It is the action of this storage-system that allows excellent copy on mark-only or space-only in this type of converter. However, it is this same storage-system that provides problems at times; particularly on keyboard-speed reception - a peculiarity of amateur frequencies.

4. Threshold Correctors for FM Systems

Such a device can well be utilized in FM converters using pre-detection limiting. Some military converters use a simple clamp circuit to provide a symmetrical output swing to the slicer. These are usually AC-coupled and do not work too effectively on slower keyboard-speed. Also, they do not have similar storage-systems to provide information in the event one tone completely fades for a short time.

In a well-designed FM unit, noise output at the discriminator will tend to balance, and peak variation will be less than peak signal voltage. If this noise variation is kept within reasonable limits, a variable threshold corrector can provide many of the benefits it does for the two-tone limiterless system.

To keep this variation to an acceptable minimum, however, a low-pass filter is necessary - the minimum variation coming from a minimum band-width filter. This filter tends to integrate the noise spikes for minimum output variation. With such a filter, action of the threshold corrector approaches that for two-tone limiterless reception.

Such a filter would theoretically be only 22.5 cycles wide, but the practical limit is about 27.3 cycles.

Observation of the noise variation at the output of a normal discriminator with a DC-coupled scope shows peaks often going to 70-80 per cent of normal signal level. After a minimum band-width low-pass filter, however, these same noise spikes rarely exceed 30-35 per cent peak signal voltage.

Variable threshold correctors have not been successfully used in the past on amateur converters primarily because they have not employed minimum band-width low-pass filters. Several of the better units have used simple, single-section RC filters, but such filters do not cut off sharply enough to be highly effective.

5. Use of Low-Pass Filters on Two-Tone Systems

The comments in Section 4 regarding the use of low-pass filters apply equally to two-tone limiterless converters. However, the channel filters on these units are normally more narrow and the improvement noted is not as significant. In the unlikely instance that minimum band-width channel filters are being used, no low-pass filter is needed. As the channel filters are narrowed, the post-detector low-pass filter is altered in its requirements. It is not likely that amateurs will use channel filters narrow enough to dispense with the low-pass filter, not even with the 70-cps Collins filters that a few currently use.

It is interesting to note that the dual-

COMPARISON OF SEVERAL 2125 FILTERS
WITH A COSINE CURVE

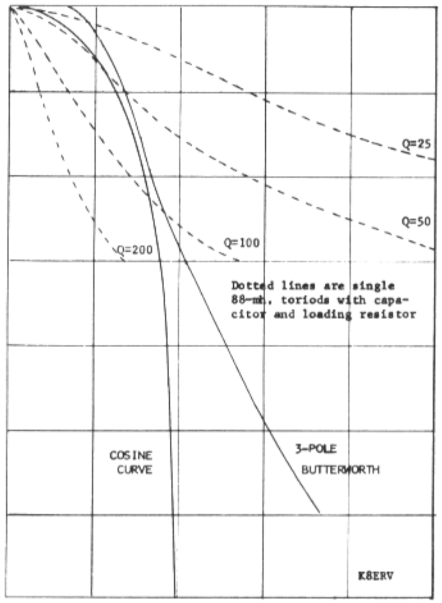


Fig. 1

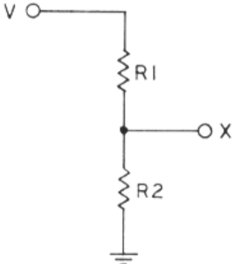


FIGURE 2

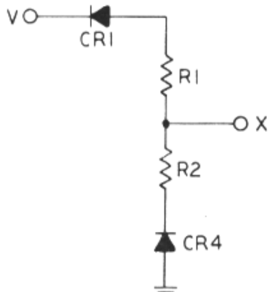


FIGURE 3

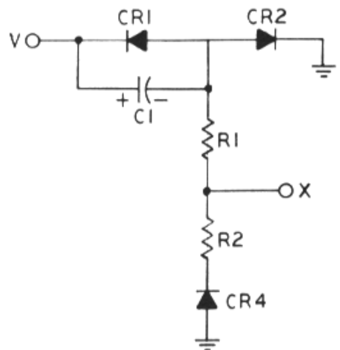


FIGURE 4

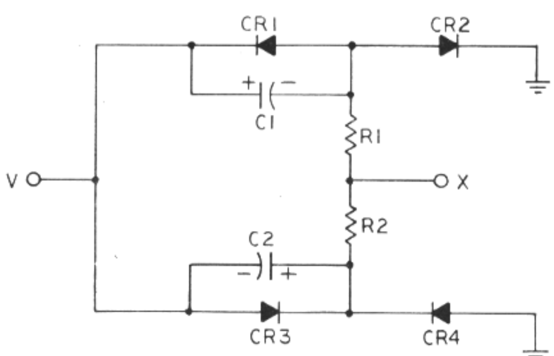


FIGURE 5

slideback system does not readily adapt to any type of low-pass filter ahead of the threshold corrector portion. Even if the impedance levels were drastically lowered to make this possible, at least two such independent low-pass filters would be required.

Although both Gaude's TU-D and Weitbrecht's Mark III/IV use low-pass filters, these filters not only are the simple RC type, but follow the threshold corrector system. As the noise spikes can adversely affect the threshold corrector, these systems cannot offer maximum performance in adverse conditions. Further, both of these units use quite broad channel filters, compounding the problem.

Most military converters use good LC low-pass filters. These often give better results than amateurs get with other converters. However, these low-pass filters usually are intended for faster speeds than 60 words per minute. An improvement of 2:1 to 10:1 could be realized on such units with a minimum band-width low-pass filter designed for 45 Baud when operated at that speed.

The addition of a good low-pass filter to any converter -- two-tone or FM -- will do more to improve the performance than any other single step taken.

6. Selection of Channel Filters

Channel filters for the two-tone system can be as narrow as 54.6 cycles. (Section 2) Under many conditions, though, the signal is such that it would take a wider filter than minimum to get best results. The width of the incoming signal can be modulated by multi-path conditions and other phenomena. Also, Hancock and Weiner have noticed up to 50 cycles shift in frequency of signals due to multi-path timing delay. They have observed modulation band-widths ranging from 20-150 cycles in the 3-30 meg. spectrum.

It is likely that use of minumum band-width channel filters would be restricted to certain types of conditions and that for general work their choice would not be suggested.

Filters of approximately 100-175 cycles would probably work quite well for most amateur conditions on two-tone units.

Use of very narrow channel filters requires some special means to allow for receiving the various shifts that amateurs claim to be 850; as well as for intentional narrow shift work. Many audio mixing schemes have been proposed, but most of them are non-linear - a variation in input having a different effect on the space channel from the mark channel.

With extremely narrow filters, any drift in the received signal must be immediately corrected. Heavy distortion can otherwise result. In the process of retuning, it is easy to go the wrong direction and momentarily lose the signal completely.

With narrow filters, a change on the scope pattern leaves the operator uncertain if the signal has drifted or has merely faded to some extent. Thus, one is seldom certain if the signal is actually tuned correctly.

When not tuned correctly, the effective signal-to-noise ratio can also be sharply reduced.

On FM units, a good band-pass input filter makes a very great improvement. The "capture effect" of the limiter is narrowed to those frequencies which include mark and space; rather to whatever band-width the selectivity of the receiver offers–usually 2.1 to 2.5 kc. This filter should be at least 1.0 kc. wide for 850 shift, and probably not over 1,150 cycles wide. This would include the 3rd order harmonic at 1,000 cycles and the 5th order at 1150 cycles.

Use of pre-limiter channel filters gives excellent results, as Wiggins has pointed out. These filters should probably be 4-5 times the Baud rate, or approximately 200 cycles or more for 45 Baud that amateurs use.

However, the extra cost of these filters would hardly be worth the small improvement shown over a good pre-limiter band-pass filter.

Use of fairly narrow post-limiter filters, such as is common in at least one commercial unit presented for amateur use, can give excellent noise balance from the discriminator. Much greater improvement could have been obtained by using these same filters ahead of the limiter with a modest cost discriminator following the limiter.

Use of 200-250 cps channel filters in an FM system either before or after the limiter restricts its ability to copy a wide range of shifts.

Many authors have mentioned that a limear discriminator for use with FM systems offers the greatest number of advantages. These linear discriminators are best made with very low "Q" circuits-typical values being 5-20 "Q". Various

RTTY theory & applications.

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

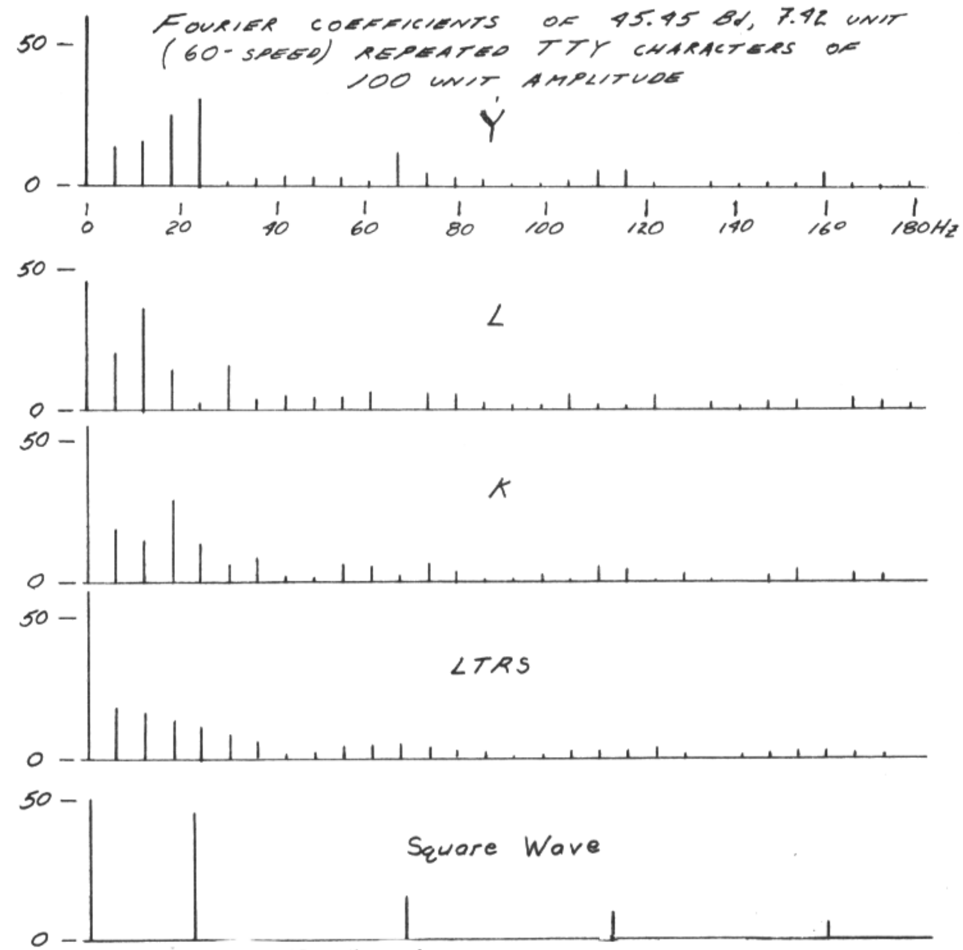
RTTY SIGNAL BANDWITH
Part 5 - TTY Character Fourier Components

In Part 3 of this series we discussed how to find the Fourier Series for a periodic function and proceeded to find the series for a square wave. The results were shown to be the equilvalentof a group of oscillators connected in series, the oscillators being set to the frequencies and amplitudes (voltages) given.

This month, we are going to present the results of analysis of several repeated TTY characters. The characters and their Fourier components (both frequency and rms amplitude) are given in the Table. The characters are assumed to be part of a continuous string of the same character being repeated over and over; the rate is 45.45 Baud for a Bell System 7.42-unit code (61.3 wpm).

For reasons of expedition, the "a " components were found; that is, the "zero time" point of the character to be analyzed was shifted so that all the "b " terms would vanish. (See Part 3, 1969 NOV, p. 8ff). Therefore, the resulting series is a cosine series. (Only those characters which are symmetrical can be expressed as a simple cosine series. By analyzing only symmetrical characters, it was possible to save considerable work.)

TERM	Frequency (Hz)	Y	L	K	Q	LTRS	M	BLANK
		Rms Voltage (V)						
0	dc	59.6	46.1	73.0	73.0	86.5	59.6	19.1
1	6.13	-14.0	-20.0	19.2	4.5	-18.5	-43.0	-25.5
2	12.27	15.9	36.8	15.5	32.7	-16.9	-12.7	21.0
3	18.40	-24.7	13.3	-28.6	-10.3	-14.3	9.3	-14.6
4	24.54	-30.9	2.0	12.9	-19.7	-11.2	10.5	7.6
5	30.67	1.2	15.9	6.1	8.9	-7.7	-0.6	-1.2
6	36.81	2.0	3.2	-8.4	6.3	-4.2	-7.3	-3.4
7	42.94	-2.9	-3.9	1.4	-1.7	-1.1	-3.3	5.6
8	49.08	2.9	3.9	-0.9	1.5	1.4	3.8	-5.6
9	55.21	-2.4	-4.1	6.1	-5.5	3.1	4.5	3.8
10	61.35	1.3	-7.2	-5.4	-2.7	4.0	-0.6	-1.2
11	67.48	12.1	-0.1	-2.2	8.0	4.1	-4.0	-1.3
12	73.62	4.2	-4.5	6.7	0.7	3.5	-1.7	3.0
13	79.75	-2.4	-4.8	-3.5	-4.9	2.4	2.5	-3.5
14	85.89	1.5	2.0	-0.5	0.3	1.1	2.8	2.7
15	92.02	-0.6	-0.8	-0.4	-0.4	-0.2	-0.6	-1.2
16	98.16	-0.3	-0.4	2.1	1.0	-1.3	-2.8	-0.5
17	104.29	1.6	4.7	0.6	3.6	-2.1	-1.0	1.9
18	110.43	-5.3	1.4	-4.5	-2.9	-2.4	1.9	-2.5
19	116.56	-5.7	1.0	3.8	-3.4	-2.3	2.0	2.2
20	122.70	1.0	4.1	0.3	2.8	-1.8	-0.6	-1.2
21	128.83	0.1	0.1	-1.9	1.2	-1.1	-2.1	-0.1
22	134.97	-0.6	-0.8	0.4	-0.4	-0.2	-0.7	1.3
23	141.10	1.0	1.4	0.0	0.4	0.6	1.6	-1.9
24	147.24	-1.2	-2.2	2.2	-2.5	1.3	1.5	1.8
25	153.37	1.4	-2.4	-2.9	-0.2	1.7	-0.6	-1.1
26	159.51	5.2	0.0	0.2	3.5	1.7	-1.7	0.1
27	165.64	1.0	-2.5	2.5	-0.5	1.5	-0.4	0.8
28	171.78	-1.0	-1.7	-1.9	-2.0	1.0	1.4	-1.4
29	177.91	0.8	1.1	0.1	0.4	0.4	1.2	1.5
30	184.05	-0.5	0.7	-0.3	-0.3	-0.2	-0.6	-1.1



The characters were assumed to be 100 units (volts) high. The reason for choosing a 100-unit amplitude is that the results can be changed easily in magnitude. If, for example, a 260-V wave were desired, the results could be obtained simply by multiplying all magnitudes by 2.6; if a current wave were desired, a multiplication by 0.6 would convert the results to a 60-mA full scale basis. Also, by using a 100-unit amplitude, the components are automatically in terms of percentage of the values of the original wave. (In the multiplication process, only the amplitudes are multiplied in order to account for different magnitudes of the original signal; the frequency components are dependent upon the time intervals within the wave.)

The results given in the Table can be easier to interpret if plotted as was done in the figure. The vertical axis is the relative amplitude, and the horizontal axis is the frequency. The presentation shown here is commonly referred to as a spectrum plot. The height of each vertical line represents the amplitude of a component, and the relative horizontal position indicates the frequency. Also, the spectrum plot of a 100-unit amplitude 45.45 Bd square wave is given.

There are several notable features of the results given in the figure. 1) The dc term dominates (for certain characters, not given, it will not, but it will be a ma-

Continued on page 15

RTTY-DX

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

Hello there. . .

If the balance of this year continues along at the same pace as the opening few weeks the RTTY-DXer will have quite a busy year to look forward to. Activity has been very high since the latter part of the old year and it seems that each week brings a new country on the bands, or at the very least, re-newed activity from countries not heard from for a long time.

The big event to report this month was, of course, the RTTY operation from Grand Cayman Island, B.W.I. by Charlie, W5QCH. Charlie had been planning a RTTY DXpedition to somewhere in the West Indies for almost two years. The question of "when and where" was more or less in the hands of his employers as Charlie is a Commercial aircraft pilot for a large corporation and as such he travels quite extensively, so it was just a matter of time as to when he would make a call at the islands. Finally, the big event was scheduled for the week-end of January 24-25. Due to the short notice, it was not possible to give advance publicity in last months column, however, many of the boys were informed and in no time at all the QST tapes were spreading the word far and wide. It certainly is to Charlies credit and efficiency that he got the whole operation to come off so smoothly in such short notice. He tells us that the permission to operate was extremely easy to obtain and his license permit was waiting at the Customs when he landed. (Note: The reciprocal licensing agreement between U.S. and Great Britain has now been extended to include all British possessions and territories.) The voltage and the hertz of the power facilities were compatible to U.S. standards and the equipment used were the Collins 'S' Line, the tiny Mite printer and the TT/L2 terminal unit. While it was originally hoped that some activity could be made on 20 meters on January 24th, this was not possible due to the late arrival. The first CQ, with the call Z F 1 C H went out at 1322z on January 25th, on 15 Meters and was immediately answered by SM5QV. The contact was not completed at that time due to QRM on both ends, so the first solid contact was with W4YG a few minutes later. Charlie was on the band for the next several hours until he received work making it necessary for him to close down and fly to Jamaica. The last hour or so was spent on 20 Meters and the last contact was with G6JF at 2052z, after which he packed up the gear and took off. Charlie contacted 48 stations in 11 countries in something less than eight hours of operation. He plans to return again sometime in the future so those that missed him will have another opportunity. We held off describing the antenna (system?) until last, because it was really something to behold. Charlie strung up a 15 Meter dipole in the hotel room and that was it! He never got a chance to change it after the first CQ. When he went on 20 Meters toward the end he removed the feed-line from the dipole, shorted the center together, and end fed the wire with a small antenna tuner he brought along. So you see, it really doesn't take much, a ZF1 call has the power gain of a rhombic.

Since Charlie moved recently the call book address is not correct. For QSL's send with SASE to --

C.H. Latham, W5QCH
327 Whitecap Dr.
Seabrook, Texas 77586

When M1B, San Marino, shows on CW or SSB you can be sure of some pile-ups on the frequency. Recently Arthur, ON4BX, heard and worked him on 20 Meters. The San Marino station was having some operational difficulties which are perhaps resolved by now so this is a rare country to watch for on RTTY. This is not a 'first' from here however, I1CAC/M1, I1AMP/M1, and I1SGS/M1, made a DXpedition to San Marino back in 1966 with good results. M1B has since been printed by ON4CK, DK3CU, and VK2FZ.

Activity from Scotland is so infrequent that when a station from there shows up it does cause a flurry of excitement. GM3EGW has been on for the past few weeks with a fairly good signal here in the States. Those of you that contact him can QSL to-- Fraser Shepherd, 28 Garvock Hill; Dunfirmline, Fife, Scotland.

Sam, 9V1PG, has been getting thru to Europe lately and many of the boys have him in the log by this time. Larry, KG6NAA, also reports continued activity from Gin, JA1ACB. This station is on 15 Meters quite often but has been having problems with hash from the series governed motor on the model 15. He would appreciate any information on eliminating this problem. Off hand, I know there have been some cures for motor hash in past issues of the Journal, and Don, WOITU, has a real cure-all he has devised that may appear in a future issue. Gin is apparently an old hand at DXing having been the first JA on SSB and the 3rd Asian to WAZ. His QTH is - Gin S. Naniwada, JA1ACB - 3-4-8 Izumi, Hoya - Tokyo, Japan.

Larry has received traveling orders and will be leaving Guam in the near future. He may be located in the state of Maine but as of this writing this is not definite. For you fellows that have not contacted him yet check 15 Meters on week-ends from 2230z onwards and as Larry points out, the week-end on Guam is Friday and Saturday here in the States. We were fortunate to contact him at this time and he has been putting in an S-9 signal to the East Coast U.S.

A recent QSO with Giovanni, I1KG, brings to light two contacts he made in the Congo during the last Volta Contest. 9Q5EP and 9Q5BY were the stations and these made all Continents available during that Contest. Real rare prefixes too, we might add.

As for possible stations to look for in the future. Uli, DK3CU, tells us that UT5KCU will shortly be QRV from the Ukraine. We are certainly glad to see Uli back on the bands again after a bad time in the hospital over the holiday.

In a recent QSO on SSB in which RTTY was discussed, the station that Bud, W2LFL, was in contact with was tail-ended by ZS2PX in Port Elizabeth, who informed Bud that he was licensed for RTTY and hoped to be active in the mode shortly. Bud also says that ZD9BN, on Gough Island does have a full RTTY set-up which is on the European Standard of 50 baud and 425 hz shift and used in Commercial service at this time. We of course hope that he will venture down into the ham bands with it one day and create a mild riot.

Currently QRV are a couple of good calls for the prefix hunters. Tony, I1JX, is using his new commemorative call of I R O J X and will be using it for the rest of this year. This special prefix is allowed to be used by all stations in the City of Rome and it marks the first Century of Rome as the capitol city of Italy. The QSL is a replica of a famous painting and very well done.

HG5SPZ was recently printed on 20 Meters putting out an excellent signal. The 'HG' prefix is in the block assigned to Hungary but normally used only on VHF.

LX1SK and LX2BQ bring renewed activity from Luxenbourg. The former station is possibly a new one, but the latter is Willy, and we are happy to see him back on RTTY after a long absence.

Via Bud, W2LFL, we have news of a new QSL Bureau for the Republic of Ireland. The former bureau has apparently closed down which no doubt accounts for many of the boys not getting EI cards and vice versa. Forward your cards to the following QTH and be assured that they will reach their destination.

EI QSL Bureau
Box 73
Athlone, Ireland

As of this writing we have news that the FCC here in the States has finally taken favorable action on moving the RTTY sub-band to a more compatible part of the 10 Meter band. Commencing the beginning of March, U.S. amateurs will be permitted to use F-1 from 28.0 to 28.5 mhz. We'll see you fellows around 28090 real soon. This should create a lot more activity on Ten particularly during Contests and also make for cooler running finals on that band.

73 de John

***

RTTY Contest Calendar

B.A.R.T.G. SPRING RTTY CONTEST
0200 GMT Saturday, March 21st until 0200 GMT Monday, March 23rd, 1970.
Complete Rules In Last Months Issue.

DARC WAE RTTY Contest - last week end of April 1970
Rules in this issue.

***

HITS & MISSES

From The Editor and his Mail

Back from SAROC hamvention in Las Vegas. They call this a "fun" hamvention and that seems like an understatement after attending.

Unfortunately we did not meet as many teletypers as at other conventions, maybe we missed some as there was so much to do, Leon W7DKB an old veteran of SAROC met us soon after arrival and not only had reservations for shows but a car for going places. For about 96 hours, days and nights were forgotten but we did manage to visit the exhibits and partake of the parties of Ham Radio, Galaxy and Swan that literally 'flowed" with hospitality.

***

The release of over 150 model 28 machines pleased a lot of fellows, disappointed a lot, but whetted the appetite to see if more machines in other sections of the country might be available for amateurs. Apparently the Bell system is retiring and replacing many 28 machines with newer models. Frankly we know nothing of where, how, or if any of these machines may be turned over to amateurs. We do know that among our readers are a number of Bell system employees and possibly friends of Bell executives that might investigate and find out the possibilities. It is very possible that even if individual sales were out that some organization similar to the NACARTS group could handle the distribution. If you are in the 'know' anyplace ask about it. It is a shame to have them pounded up for scrap.

***

One suggestion that has been offered by a number of readers is to print an index of each issue on the front cover or elsewhere in each issue. We agree this is a fine suggestion, only trouble has been that we often are in doubt as to the exact contents ourself until about midnite of the day we take the copy to the printers. We hope to try it with this issue however and see if it can be done.

We must admit the expiration dates on some of the mailing stencils are confusing to some (and us). Briefly the abbreviated month and the figure are the last month of that year of the subscription. (Example - Dec 890 would expire with the Dec 70 issue). Where our trouble appears is the numbers are not always in rotation and one figure may be on another line above or below the others. Also some of the centers of the zero are lost and appears as a round blot. During the past year we have attempted to rubber stamp the last issue of each subscription so this should help. All stencils should now have a 0 or a 1 showing someplace.

***

BACK ISSUES —

The ONLY back issues available are:

July through December 1966. No issues of 1967. All issues of 1968 except January and November. All issues of 1969. (July-August is one issue.) Copies are 30¢ each. RTTY JOURNAL binders are $2.50 each in the USA and $3.00 in Canada.

Our last copies of the TT/L-2 reprints are exhausted. Since this article has been reprinted in the May and June 1969 issues of QST we have no plans for more reprints.

RTTY JOURNAL

P.O. Box 837 Royal Oak, Mich. 48068

"Dusty" Dunn — W8CQ

Editor & Publisher

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THEORY- -

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jor term). 2) The first few components (lowest frequency) are by far the strongest. This is a natural consequence of the basic structure of the 7.42-unit code; if the code were composed of an even integral number of bits, then the pattern could be markedly different and much simpler. 3) The components generally become smaller as the frequency increases (i.e., as the order of the term increases), but there is no frequency beyond which the components go to zero. This means that the bandwidth required by this signal is, theoretically, at least, infinite. 4) The components of the characters vary in a seemingly erratic manner (other than the general decrease with increasing frequency just noted.) However, if the components for a character are compared with those for the square wave, it can be seen that the amplitudes of the individual components peak in the general vicinity of frequencies present in the square wave. (This can be explained by means of sinx/x curves, but it becomes a bit gross.) The "LTRS" character shows this "grouping" or "peaking" nicely.

Although the Fourier Series for a TTY character can be found readily, the number of terms in the series makes analysis by means of Fourier Series very complex. The square wave having the same Baud rate contains only about 1/4 as many terms. Also, there is a close relationship between the square wave and the TTY character Fourier Series at the higher frequencies. Usually, the higher frequency components are the ones that are affected by bandwidth limitations. Therefore, the square wave is considered to be a convenient and accurate substitute for a TTY character when testing for the effects of finite bandwidth; however, it should be remembered that there is a big discrepancy between the square wave and a TTY character at the low frequency end.

Next month we will apply a square wave to a modulator in order to see how the bandwidth at "baseband" compares with the bandwidth of the signal from a modulator.

--73 ES CUL, RG

***

LEGAL Identification-

by Irvin M. Hoff W6FFC

A recent article in this magazine (January 1970 "RTTY JOURNAL", page 13) by Jerry Hall K1PLP drew considerable interest. This article went into detail on proper identification by RTTY operators. One statement raised quite a few eyebrows and to save you the time of looking up the article once more, here it is:

No identification is required on the teleprinter, and if such identification is given, it does not alleviate the requirement for Morse identification.

This stirred a lot of interest, because most RTTY enthusiasts (including myself) thought this was some sort of error on Jerry's part, or if correct, some oversight on the FCC's part when writing the current regulations.

After reading Jerry's article, we had some correspondence back and forth and he assured me the current regulations indeed were as he stated, and sent various excerpts from "QST" and the FFC regulations to back up his thinking. These new regulations have been in effect since 15 Jan. 1968. Finding this hard to believe, and that no teleprinter identification was required "at all" to be legal, I wrote the FCC for clarification. Apparently they had been all through this many times before, as they sent a mimeographed sheet which went into detail regarding the Board's thinking when they adopted the current regulations. Here is the text of the letter we received:

Dear Mr. Hoff:

This is in response to your 9 Jan 1970 letter wherein you ask whether the Commission intended to remove the dual identification requirement for amateur stations transmitting teleprinter signals when the identification rule section 97.87 was amended in Docket 17377, effective 15 Jan 1968.

The omission of any identification requirement by means of the printer code was intentional. The Commission's basic need to identify stations without having to use special equipment is met by the requirement for identification by international Morse code. Therefore, the operator may now transmit his printer identification at his own convenience.

Sincerely yours,

James E. Barr (signed)

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inductors can be used, including the 88-mh. toroids, if properly loaded. (Their normal, unloaded "Q" is around 200 at these audio frequencies.) An excellent circuit is obtained through use of TV horizontal oscillator coils.

Any of the filters discussed in this paper can be easily obtained from the Electrocom Corporation in South Bend (contact Burt Jaffe, K9BRL). This company specializes in amateur RTTY equipment.

7. Linear Phase Filters

Maximally linear phase filters (Thomson variation of the Bessel filter) are very likely the optimum type for use with keyed pulses. Van Brunt has worked out data on the construction of such filters using 88 mh. toroids readily available to amateurs at low cost.

However, the little improvement such filters provide (when compared with standard 3-pole Butterworth design of less sections at lower cost) makes their use debatable when other factors such as price, etc., are considered.

8. Filters Using One 88-MH. Toroid

Most amateur converters publicized in the past have used only one 88-mh. toroid with a capacitor for each channel filter. This can be a satisfactory method, but not unless the very high "Q" of the toroid is handled correctly. Tom Lamb, K8ERV, has plotted the curves of several single-tuned filters against an ideal curve suggested by Dr. Nyquist.

Fig. 1 shows these curves. Filters having a circuit "Q" of higher than perhaps 25 or so would not meet acceptable standards. Since this represents a rather broad filter with quite broad skirt selectivity, their correct use would result in a rather linear curve which would be excellent for FM systems with limiting. To achieve this low "Q", the filters may be placed in the plate circuit of certain tubes as was done in the TU-D, or resistors as in the Mark III/IV units. In any event, to offer proper bandwidth using a fixed inductance, each filter is swamped with a different load.

To properly design even simple filters without merely copying a previous circuit, elaborate testing equipment is needed, including a good AC VTVM, audio generator and audio frequency counter.

9. The ATC Circuit

The dual-slideback system also offers problems with voltage matching and requires use of center-tapped transformers or inductors. We shall now show another less-complicated system which does the same job and avoids most of the disadvantages. This we have called the "ATC" or Automatic Threshold Corrector.

It was derived from a Press Wireless patent that seems to have gone somewhat unnoticed by many who infer they have since developed similar circuits independently. The "Assessor" circuit of H. B. Law is essentially identical, although the Press Wireless patent was issued in 1948 as a result of work done prior to 1944 by Bob Sprague. The same circuit forms the basic system used by Elmer Thomas in the DTC patent.

The Press Wireless circuit was only AC-coupled and would not work well on keyboard-speed typing. In 1961, Dick Hilferty, W2HEY, Chief Engineer for Press Wireless, added two extra diodes to remedy the situation by providing a DC path in addition to the AC storage-system.

As far as is known, this particular circuit was never applied to limiterless operation until Harold Carlson, former Chief of the Radio Division of Associated Press, sent the circuit to Tom Howard of Altronics-Howard for possible use in 1963. A form of this circuit is in use in the current Altronics-Howard Model "L" converter, and follows the simple RC low-pass filter.

10. Theory of the ATC Circuit

Refer to Fig. 2--if voltage is placed at point V, some current will flow through R and R to ground. If the resistors are equal, the voltage at point X will be 1/2 the original voltage.

Refer to Fig. 3--if positive voltage is applied to point V, there will be no current flow, as D_1 (and D_4) will not conduct. Point X now "dangles in space" and has no voltage. If negative voltage is used, then current flows as in Fig. 2, as both D and D_4 conduct. The voltage at point X is negative and 1/2 the original value.

In Fig. 4, if negative voltage is used, the situation is similar to Fig. 3. If positive voltage is used, C_1 is charged by drawing electrons through D_2. With positive voltage again there is no current flow through R_1 and R_2 (as in Fig. 2).

If the positive voltage falls quickly to less than 1/2 the original input level, C_1 then has a discharge path to ground and current will flow. Since C_1 has negative voltage on the right side, this current flow will be as in Fig. 3, and the voltage at point X will be negative.

C_1 can discharge at any time the input voltage falls to less than 1/2 the original positive input, or goes negative.

If the input voltage alternates from positive to negative, there is no output voltage at X with positive input; on negative input, C_1 not only discharges but D_1 conducts. Consequently, the output at X is the combination of these two voltages, in this case equalling the original input voltage.

Thus with on-off negative input, there is 1/2 on-off negative output. With on-off positive input, there is still 1/2 on-off negative output for a short time, depending on the time constant of the circuit.

With alternating negative and positive input, there is negative output voltage equal to the sum of plus and minus voltages when the input goes negative, and no output voltage when the input goes positive.

11. How the ATC Works

The incoming RTTY signal alternates from mark to space to provide information for the printer. Mark is then an on-off keyed pulse, as is space. Assume a mark-only condition where mark is negative voltage. (The detector circuit can be arranged in any manner that will correctly operate the particular slicer used.) This then would be an on-off negative voltage.

Refer to the complete ATC circuit in Fig. 5 -- if negative voltage is used at the input; it goes through D_1 (is blocked from ground by D_2). R_1, R_2 and D_4 to ground as in Fig. 3. At the same time, it is blocked by D_3 and charges C_2.

If the negative input voltage is steady, the output voltage at point X is negative and 1/2 the input voltage. If the negative input voltage is an on-off signal, the output becomes positive (1/2 what the input voltage had been) during the "off" portion, and negative (1/2 the input voltage) during the "on" portion.

Thus with on-off negative input, the output is $\pm$ 1/2 the input voltage, and point X is symmetrical around zero with only negative input.

The opposite situation quickly can be shown for on-off positive input voltages -- there the output again will swing, $\pm$ 1/2 the input voltage -- during positive "on" voltage, the output will be + 1/2 (through D_3, etc.) and during the "off" portion, the output will be -- 1/2 (what the input voltage had been) from the discharge of C_1.

If mark and space equally appear at the input (as occurs with no fading and correctly tuned), the output is the sum of the voltage through the diode plus the voltage from the capacitor; so that full (rather than 1/2) voltage then appears at point X.

If one tone fades completely, the output voltage remains a minimum of plus and minus 1/2 the input voltage remaining. With both tones present to some extend, the output is equal to the sum of 1/2 of each of their voltages. It is this feature which assures excellent copy on selective fading where one input tone might fade completely for awhile. It is also this feature that allows intentional copy of mark-only or space-only.

12. Advantages of the ATC Circuit

The ATC circuit is a simple system using only a few parts. It can be readily used after a minimum band-width low-pass filter, a feature few other circuits offer. This allows noise to have a mimimum effect on the mark-space decision, particularly when one tone is momentarily absent.

Due to the simplicity of the circuit, minimum bias is introduced, as the output voltage is symmetrical. The length of time this is true, of course, depends upon the time constants selected.

Normal detectors without threshold correction need both tones at the input (except where the slicer has been manually readjusted to simulate the action of the missing tone); for minimum distortion these tones must be equal in amplitude. If one tone fades momentarily into the noise, there is no information from that channel, and an error must be printed. This frequently allows the printer to become unsynchronized, and a disproportionate number of errors result. Consequently, even a normal converter with limiter could greatly benefit from the use of such a system as the ATC. Correct tuning is no longer a basic requirement for presenting a symmetrical output voltage to the slicer, and signals that have badly drifted continue to print properly with little or no distortion.

13. Disadvantages of the ATC Circuit

All such methods using storage-systems (with the exception of the unique DTC circuit) will go to 1/2 mark voltage at their output on steady mark input. Since the capacitor involved will discharge if mark falls quickly to 1/2 voltage (6 db.) or less, the system can be considered as unbalanced to "mid-mark" anytime a steady mark signal is being received.

A similar situation exists for a steady space signal, but this condition is of no importance as steady space is not received. It is, however, important to realize that if this condition did exist, the system would unbalance to "mid-space".

Fades considerably in excess of this 6 db. figure occur quite frequently. This is why operators with limiterless two-tone converters print so many errors on slow-speed typing and during steady mark. Even a normal converter without such a variable threshold corrector will not print errors unless the signal fades near (or into) the noise level, rather than merely to this 6 db. point.

On static bursts and impulse noises, the limiterless two-tone will again print a disproportionate number of errors on slow typists (and steady mark signals) due to this unbalance.

Only during machine-speed is the normal two-tone system in a somewhat balanced condition. This is easily illustrated by considering that with continuous "letters" keys, the threshold goes to nearly "mid-mark"; while with continuous "blank" keys, it goes to nearly "mid-space". The threshold can then wander between these two extremes (even at machine-speed) but with normal text, it will average about zero. With machine-speed, this sytem will be more nearly immune to errors during noise bursts than a normal FM system not using threshold correction. In the case of the limiterless two-tone, the system must remain linear, which is not likely to occur with instantaneous noise bursts. A good limiter system with threshold corector would probably have a noticeable advantage under these conditions. This threshold corrector should follow a minimum band-width low-pass filter to be effective. (Section 5)

The second and last installment, describing the DTC circuit will be published next month.

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IDENTIFICATION- -

Continued from page 15

To review, then, the comprete requirement in language we should all understand, no identification on the teleprinter itself is legally required at any time for any reason, but it is assumed that you will need to identify at normal intervals for the operator's own convenience in knowing who he is copying, and to whom he has turned it for the next transmission, etc.

That's the whole section. A final "interpretation" would be that you can identify on teleprinter however and whenever and if ever you wish, but you must identify at the beginning and end of each transmission via Morse code with your own station identification only. There is no mention of minimum length transmissions such as on fast-break, so it's possible this comes under the "beginning and each of an exchange of transmissions or at least every 10 minutes". This is additional relaxation over the older rules.

On 2M, etc, you can identify by voice and meet the legal requirement.

Insofar as all official monitoring is therefore done by Morse requirements, I might suggest those people who do not have an automatic means of sending C.W. investigate getting such a device or by using the T.D. in a manner that will produce suitable-sounding C.W. -- several articles have appeared in various magazines regarding this system. K1PLP and K5ANS/5 among others have worked up suitable methods using the T.D. Above all, I suggest those diddling various RTTY keys manually with one or two fingers, such as the "break key" or the "letters" and "blank" keys in the hopes this diddling will vaguely resemble acceptable C.W. cease this type of operation and use an authentic C.W. key across the FSK line, or in series with it, or better yet, via narrow shift means such as incorporated into the TT/L and TT/L-2 and the Mainline AK-1 A.F.S.K. unit. In this regard, the FCC has stated unofficially (previously) that speeds not in excess of 15 WPM, and if using FSK shift for C.W. such as narrow shift identification that it be at least 100 cycle shift.

This should clear things up for those (like myself) who had not kept up accurately on current regulations. The rules quoted are currently in effect and were official as of 15 Jan 1968.

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Dayton Hamvention

April 24-25

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