QEX 18
August 1983

The ARRL Experimenters' Exchange

AMSAT-OSCAR 10 Is Looking Good

While the final orbit of AMSAT-OSCAR 10 is not the one planned by AMSAT, it is nonetheless a useful one that should provide years of long-distance, long-duration communication. Operational since August 6, A-O-10 is coming through loud and clear. Stations with normal 2-m transceivers, no preamps and using simple antennas (3-element Yagis, for example) report 59 reception. DX is no problem either, with a recent pass bringing over 15 countries (the Americas and Europe) and four continents in a span of only a few hours.

AMSAT fired the kick motor (the first-ever firing of a kick motor in space by a non-governmental, non-commercial entity) for the first time on July 11 at 2230 UTC. Though intended as a 107-second burn, damaged helium pressure lines resulted in a burn of 190 seconds. AMSAT speculates that a collision between A-O-10 and the Ariane launcher about 53 seconds after separation on launch day caused the damage. A second firing on July 26 was unsuccessful because there was not enough pressure remaining in the helium lines to operate the valves and mix the propellant and oxidant. Therefore, A-O-10 is now in its final orbit with the following Keplerian elements (courtesy of Phil Karn, KA9Q, and subject to further refinement):

Reference epoch	: 83198.0000000000 (July 17, 00:00:00 UTC)
Inclination	: 25.8731 degrees
R.A.A.N.	: 250.0137 degrees
Eccentricity	: 0.6043432
Arg. of perigee	: 187.3701 degrees
Mean anomaly	: 333.5787 degrees
Mean motion	: 2.05847913 rev/day
Decay rate	: 0 rev/day squared
Semi major axis	: 26106.227 km
Anomalistic period	: 699.545591 min.
Apogee	: 35505.270 km
Perigee	: 3951.028 km

Note that this orbit differs from the intended one in two major aspects: perigee height and inclination angle. With the perigee so high, A-O-10 spends more time than AMSAT would like in the Van Allen Belt; over time, this will probably cause accelerated deterioration of the solar panels, though we have many years of operation before the effects cause any problems. The lower inclination angle (26 degrees instead of 57) simply means that stations in North America will have roughly 10.5 hours of access per day instead of over 16 hours, and intercontinental roundtables will be composed of stations in regions different from those roundtables on a satellite at 57 degrees. Though the DX is different, it's still there.

Several access patterns are emerging; for example, throughout the first few weeks of operation, the average North American station will be able to access only every other pass. One pass (the evening local) will be accessible for over ten hours, and the next will be hidden behind the earth. This is the pattern at W1AW -- the experiences of others over the first few months should prove very interesting. For information on finding AMSAT-OSCAR 10, see pages 47 through 49 in September QST; watch the Amateur Satellite Program News Column in QST for further developments; and tune into OSCAR 10 passband for scheduled W1AW bulletins (145.835 MHz cw, 145.864 MHz phone) and for the AMSAT nets.

Our hats are off to AMSAT for a fine job.

Incidentally, the graphic shown on the front page of QEX 17 for July 1983 should have been credited to AMSAT. -- Steve Place, WB1EYI.

ARRL Radio Amateur's Handbook

The 1984 Handbook has been sent to the printer. You will see it sometime in late October. Unless you've been a part of similar publishing projects, you have no idea how much time and energy goes into revising a book of this size. I had the opportunity to rewrite Chapter 14, Specialized Communications Systems. That 54-page chapter includes space communications, microwave, amateur television, coherent cw, spread spectrum, ACSB, and the digital modes of Baudot, AMTOR, ASCII and packet radio. Chuck Hutchinson, K8CH, did an extensive rewrite of Chapter 15, Interference. Gerry Hall, K1TD, worked many hours on indexing so that you'll have an easier time finding things in the 1984 Handbook. Does this give you any ideas for late-year holiday gifts?

Field Intensity Meter Antennas

The ARRL lab has an NM-105 FI meter with no antennas. Do you know anyone who might donate a set to a non-profit organization? -- W4RI

Correspondence

Modifications of Modifications to Real Time Satellite Tracking Programs for HP-41C/CV Programmable Calculator

In the July issue of QEX, Roy Welch, WØSL, pointed out an error in his two HP-41C/CV programs appearing in November QEX, 1982. The changes to the two programs, however, were not complete so we are using this space to reprint them correctly.

CHANGES TO PROGRAM "SATELLITE ORBITS I"

1. Delete program step 486 (RCL 24).
2. Delete program step 480 (STO 22) and replace it with the following two new steps:
   - -New program step 480 X⇄22.
   - -New program step 481 SIN.
3. Delete program step 454 (STO 24).

CHANGES TO PROGRAM "SATELLITE ORBITS II"

1. Delete program step 425 (RCL 24).
2. Delete program step 419 (STO 22) and replace it with the following two new steps:
   - -New program step 419 X⇄22.
   - -New progrm step 420 SIN.
3. Delete program step 393 (STO 24).

Thanks Roy. - Roy D. Welch, WØSL, 908 Dutch Mill, Manchester, MO 63011.

Reply to N1BEE on AMTOR

Like Mr. Bilow, N1BEE, I too have homebrewed my computerized RTTY. However, I must disagree with his contentions that AMTOR requires hardware changes, makes the monitoring of other stations' QSOs difficult and does not take advantage of its synchronous protocol. The following arguments result from successful experiences in homebrewing my AMTOR system.

Hardware

With the correct software, one needs but a single input bit from the Terminal Unit to copy all forms of AMTOR. The disabling of the TU "mark hold" circuit, if any, might be the only hardware change required. The "mark hold" tends to clobber the first few bits at the beginning of a "chirped" block.

Monitoring Other Stations

As an OO, the ability to monitor AMTOR QSOs is extremely important to me. The key is establishing sync with the ISS (Information Sending Station). I've done this by sampling the input bit every 10 ms until 21 bits pass a constant ratio check. If the next six characters (i.e., two mode A blocks) also pass the constant ratio check, the software can assume that we are synchronized. Except for an occassional "hit", I've printed countless maritime and amateur QSOs flawlessly after synchronizing with this method.

Synchronous vs. Asynchronous

Least plausible is the assertion that AMTOR takes no advantage of it's "synchronisity." Besides the obvious favorable improvement in data rate, the absence of start bits makes the protocol much more immune to noise. This is because the computer knows it is to expect data at predefined intervals, where asynchronously, practically any random noise that's properly timed could indicate a "spacing" condition and initiate the printing of at least one garbled character.

N1BEE's arguments are somewhat nostalgic in that they remind this reader of the old "a-m vs. ssb" battles of years past. The fact is that AMTOR, as presently defined, is easily implemented on virtually any processor. More importantly though, it is the most efficient and effective mode widely available for amateur RTTY use on the hf bands. - Howard Goldstein, N2WX, P. O. Box 905, Melbourne, FL 32902.

An Improvement for the ZX80 Microcomputer

Although not an owner of the ZX80 microcomputer, I read with interest the article regarding the use of it for RTTY in the July issue of QEX. I refer in particular to Fig. 1 which illustrates the method of connecting a UART port to the computer. The use of the 74LS138 octal decoder is a fairly common practice, its inputs being ideal for port decoding on a Z80 processor. However, there is one improvement I would consider an absolute must. Pin 6 of the 'LS138, an active high enable pin, is shown connected to +5 V. This will, of course, allow the device to operate. It should be connected to the M1 (Machine cycle one) pin of the Z80 processor bus. The reason for this has to do with the interrupt acknowledge cycle of the Z80. If placed in Interrupt Mode 2 (this allows powerful vectored interrupt operation), any interrupt causes the Z80 to issue a special "M1" cycle as an interrupt acknowledge cycle. This interrupt acknowledge cycle causes both IORQ and M1 on the Z80 to go active, **with the address bus in an indeterminate state!** This condition can then cause a possible false decoding of the port output. With the M1 signal connected to the active high (pin 6) input of the 'LS138, an active condition (low) on the M1 line will positively lock out the port decoder.

This little "feature" of the Z80 is an often-overlooked source of system trouble. If the programmer uses only interrupt mode 1 or Ø, then the schematic shown in QEX will be fine. However, Mode 2 interrupts can cause problems that would be virtually impossible for any non-professional to track down.

(continued on page 6)

BER Performance of TAPR TNC Modem

By Steve Goode,* K9NG

Any packet operator who simultaneously monitors the channel with their Terminal Node Controller (TNC) has probably heard packets that the TNC did not print. This raises the question, "What signal strength should it possess to print a packet?"

The 20-dB quieting sensitivity of a receiver is a known factor to most hams who operate on vhf and it would be helpful if some measure of performance was done on the TNC in relation to the 20-dB quieting (20 dBQ) of the receiver. The data presented in this article gives a relation between the TNC performance and the 20 dBQ of the fm receiver.

Bit Error Rate

Data transmission systems are normally measured on the basis of their Bit Error Rate (BER). The BER is defined as the probability of not receiving the transmitted bit properly at the receiver. This is expressed in percent or in direct decimal form. For example, a system may have a BER of:

$$1 \times 10^{-3}$$

or 0.1%. The chance of receiving the transmitted bit incorrectly is once in every 1000 bits. On the positive side, the chance of receiving the bit correctly is 100% - 0.1% or 99.9%. BER is measured by comparing the transmitted data bits with the received data bits and counting the number of errors. As is true for all digital systems, the BER for packet radios is dependent on the input signal to the receiver. The correct way of measuring performance, therefore, is a graph of BER versus input to the receiver.

Test Setup

The test setup used to measure the BER of the Tucson Amateur Packet Radio (TAPR) TNC modem is shown in Fig. 1. The modem was calibrated before the tests using a frequency counter and the internal calibration routine. The Bit Error Rate Tester (BERT) shown in the figure generates a pseudorandom data stream and is connected to the TNC modem by removing JP11 and connecting the data into the input of the modem. JP3 is removed and the modem output is connected to the BERT. BERT retimes the received data with an internal clock and the transmitted data is delayed to allow for transmission and reception delays. The transmitted and received data streams are then compared and a BER is displayed.

For these tests, the output of the TNC modem was connected through an "IDC Box" into the fm input of a HP8640B signal generator. The "IDC Box" contains the pre-emphasis and clipping circuits of a Motorola Motran Transmitter. The receiver used for these tests was a Motorola VHF Syntor. It had a 20 dBQ sensitivity of -121 dBm (0.2 uV).

Data

The question of transmitter and receiver levels must be answered before taking data. Since the TNC contains circuitry to correct pre-emphasis and de-emphasis differences, the transmitter and receiver audio should be kept out of clipping. A quick measurement of BER at one signal level showed best BER performance was obtained when both the "IDC Box" and the TNC were out of clipping. This agrees with the TAPR manual to keep the clipping LEDs off when receiving. BER data was then taken by varying the input signal to the receiver and measuring the BER for each level. The curve in Fig. 2 shows the BER performance of the modem at 1200 bps. The BER performance in Fig. 3 is at 300 bps.

Interpreting the Data

Now that the BER performance of the modem is known, what are the odds of receiving an unconnected packet or maintaining a packet QSO for 15 packets? We need to know the packet probability of reception. As said before, the Bit Probability of Reception (BPR) is 100% minus the BER. Since each bit is independent of any other, the probability of receiving two consecutive bits correctly is:

$$BPR \times BPR \text{ or } BPR^2 .$$

The probability of receiving three consecutive bits correctly is:

$$BPR \times BPR \times BPR \text{ or } BPR^3$$

(continued on next page)

*140 W. Wood #314, Palatine, IL 60067.

and so on. Thus, the probability of receiving N consecutive bits is:

$$BPR^{N}.$$

All flags, control bits and data bits must be obtained correctly before receiving a packet. For a maximum 128 length packet through a digipeater, this is 1240 bits. Therefore, the Packet Probability of Reception (PPR) is:

$$PPR = (1 - BER)^{N} = (1 - BER)^{1240} \quad (1)$$

The probability of receiving a packet for a given signal level and packet length can now be calculated. Let's take a signal at 20 dBQ, on the 1200 bps curve. It has a BER of:

$$1.6 \times 10^{-2}.$$

For a 1240 length packet, this gives a PPR of:

$$2 \times 10^{-9}$$

or 2 packets received in every billion sent. Not very good odds. We can convert from a given PPR to a BER by solving equation 1 for BER. The BER required for a PPR of 10% is:

$$1.8 \times 10^{-3}.$$

It corresponds to about -119 dBm, and to 23 dBQ in the Syntor. We can also calculate the level for a PPR of 98% to be:

$$1.6 \times 10^{-5}$$

or about -116 dBm. This corresponds to 25 dBQ in the Syntor. This shows that the fast quieting effect of fm takes the PPR from 10% to 98% for a change of only 3 dB in input signal strength.

"What are my odds of maintaining a packet QSO for 15 packets?" We must first know the odds of not retrying out for the current packet. [Ed. Note: "Retrying out" is assumed to mean "exceeding the maximum number of retries allowed in the protocol."] To maintain a packet QSO, one packet should be received correctly in every set retry count or it will retry out. Let's call this the Remain Connected Probability (RCP). This is the probability that the packet will be correctly received at least once for the set retry count (L). Since the probability of not receiving a packet is 100% - PPR, the RCP is:

$$RCP = 1 - (1 - PPR)^{L}.$$

Assuming the other station receives your acknowledgements, calculate the probability of maintaining a QSO for M number of packets. This is called the QSO probability for M packets (QPM) and is obtained by raising the RCP to M:

$$QPM = RCP^{M}.$$

If we assume a maximum retry of 10 at -119 dBm, the QP15 (QSO probability for 15 packets), would be:

$$BER = 2.2 \times 10^{-3}$$

$$PPR = (1 - BER)^{N} = (1 - 2.2 \times 10^{-3})^{1240} = 0.065 = 65\%$$

$$RCP = 1 - (1 - PPR)^{L}$$

$$RCP = 1 - (1 - 0.065)^{10} = 0.49 = 49\%$$

$$QP^{15} = RCP^{15}$$

$$QP15 = (0.49)^{15} = 2.2 \times 10^{-5}$$

or about 2 chances in every 100,000. Again, not very good odds. At -118 dBm, the BER is:

$$5.2 \times 10^{-4}$$

for a PPR of 52.5%, an RCP of 99.94% and a QP15 of 99%. So, in a change of one dB, we go from an extremely small chance of not retrying out to a high probability of sending 15 packets without error. With these formulas, we should be able to calculate the probability of staying connected for any number of packets, at any set retry count and any received signal level.

Since it is easy to send unconnected packets and the TNC can receive and transmit simultaneously, the calculations shown were checked by keying the HP8640B pulse input with the transmitter line from the TNC. This allowed the TNC to receive its own unconnected packets in the CONVERS monitor all mode. The generator level was set at -119 dBm. Only one data character was sent per packet so the packet length was 168 bits (8 Flag + 112 Address + 8 Control + 8 PID + 8 Data + 16 FCS + 8 Flags). This gives a PPR of:

$$PPR = (1 - 2.2 \times 10^{-3})^{168} = 0.69 = 69\%$$

One hundred packets were sent with 66 being received for a measured PPR of 66%.

Conclusions

We now know that at the 20 dB quieting level of an fm receiver, the TAPR TNC has an extremely small chance of receiving a packet. At 23 dBQ the packet probability of reception for a 128 byte packet is 10% and at the 25 dBQ level the PPR is 98%. Therefore, useful sensitivity of the TAPR TNC is about 23 dBQ. Above 25 dBQ a packet QSO has a high reliability. As a general rule of thumb, the TAPR TNC will require a stronger signal than a voice contact since 20 dBQ is normally defined as usable voice sensitivity. The TAPR board requires about 23 dBQ to print. The dBQ of a station being received is easily seen by measuring the voltage out of your receiver audio with no signal on channel. The audio level is then measured with the station not modulating, taking that ratio and expressing it in dB volts. For example, if the output of your receiver is one volt on noise and 0.05 volts with the unmodulated station:

$$dBQ = 20 \log_{10} \frac{(0.05)}{(1)} = 26$$

or 26 dBQ. By measuring the dBQ of the packet station you are trying to contact, you should get a good idea if you will be able to carry on a packet QSO. (continued on page 7)

VHF+ Technology

Conducted by Geoff Krauss,* WA2GFP

My last column asked for information about silver-bearing solder sources. One such solder is Ersin "Multicore" SN62 (2% silver), which K2LGJ informs me is available from Newark Electronics at a price around $30 for a 1-lb spool. WØGNV writes that this Ersin product and Kester 3% silver solder, both with flux core, are also available from Jensen Tools, Inc., 7815 S. 46th Street, Phoenix, AZ 85040. If a full lb spool is not required, KA8QKY mentions that small rolls of 2% silver solder, with separate flux, are normally sold in hardware stores. They are also available as kit 53013 from the manufacturer, Oatey Co., 4700 W. 160th Street, Cleveland, OH 44135. Everyone will now be able to use the proper silver-bearing solder for chip components at VHF+ frequencies.

New Low-Noise GaAs FETs

A pair of new low-noise GaAs FETs to consider for the 144-1296 MHz bands are the Mitsubishi MGF-1202, a single-gate device utilizing the MGF-1402 chip in a lower cost micro-X package, and the MGF-1100, a dual-gate device. Both are in the under-$10 class and available from Applied Invention, R.D. 2, Rte. 21, Hillsdale, NY 12529. Some preliminary measurements, at 432 MHz, indicate that the MGF-1100 should have an even lower noise figure than the 3SK97, another well known dual-gate GaAs FET in the under-$10 class, and does not appear to have the self-oscillation problems which often destroy a '97 device (my experience being the loss of five of six devices of that type!). Thus, we now have more candidate parts for use in the 902-MHz range when that band is authorized.

902-MHz Relay

Other potential 902-MHz parts recently tested by this writer include the Omron G4Y UHF relay. This relatively small (1 in. L X 0.83 in. W X 0.41 in. H) electro-mechanical unit is designed for microstrip mounting and is useful to beyond 900 MHz. The particular relay tested, model G4Y-152P-DC12, has a list price of about $5 and is available from Key Components, 365 Karlough Rd., Bohemia, NY 11716. While the 15-W maximum rf power rating of this relay is not comparable to that of a much larger coaxial unit, neither is the price nor the coil power (less than 1/2 W) required for switching. The relay has very impressive shock and vibration ratings, which, along with the power rating and size, point toward use in mobile VHF+ applications. The relay has its pair of dc coil terminals placed along the opposite edge of the same package surface from which the three rf contact pins protrude. At least one grounding pin is provided adjacent to each of the rf contact pins and each of these ground pins should be used, as should a continuation of the ground plane on the microstrip side of the board, with many relatively-thick ground jumpers between the ground planes on both sides and adjacent to the relay case. I tested a total of four units on 50-ohm microstrip at 220 and 910 MHz using 1/16 inch G-10 pc board and found the following average insertion loss, isolation, and VSWR:

Frequency	Insertion Loss	Isolation	VSWR
220 MHz	0.16 dB avg	>90 dB	1.29:1
910 MHz	0.27 dB avg	62 dB	1.65:1

A separate metallic plate (not tested) is available for increasing the isolation when this relay is mounted on a single-sided pc board. One final note, since my test microstrip boards were quickly "hand cut" and probably had unaccounted-for discontinuities and the like, I would expect that a properly laid-out microstrip transceiver would obtain even lower insertion loss and higher isolation from these relays.

With the addition of a stable LO, a pair of double-balanced mixers and a linear transmit amplifier, the above relay and FETs provide the basis for a 902-MHz ssb transverter. All we need now is authorization for use of this band. I have heard a rumor that someone has petitioned the FCC for the addition of this band to the authorized frequency table, and would appreciate receiving information from any reader concerning a 902-MHz Petition for Rulemaking (actual or contemplated). In the meantime, anyone desiring to try 902-MHz can still apply to the FCC for a license in the Experimental Service.

SWR Meters

There is one piece of test equipment just about every VHF+er owns: an output-power/SWR meter. Having recently built a 220-MHz 40-W ssb transverter, I was looking for a power/SWR meter that could be permanently installed between the transverter output and the input of a subsequent power amplifier. For tune-up purposes, I wanted to monitor the forward and reflected power (and therefore the SWR of the amplifier input), but was hesitant to purchase the best-known meter that does not simultaneously read forward and reverse power. After much testing, I acquired the Daiwa CN540 and CN550 meters, respectively covering 50-150 MHz and 144-250 MHz. Each of these power/SWR meters is a small (3 in. square X 3-3/4 in. deep) unit, having a single push-button located on the top of the case. The button selects between the higher-power 200-W forward power and 40-W reflected power indicating ranges, and the lower-power 20-W forward power and 4 W reflected power indicating ranges. Each unit is one of the "crossed-needle" type, with forward and reflected power magnitude being simultaneously indicated on the unit face, and with the point at which the needles cross indicating the SWR. Price range for the CN540 and CN550 is $80 and $90, respectively. The units are distributed by MCM Communications, 858 E. Congress Park Dr., Centerville, OH 45459.

*16 Riviera Drive, Latham, NY 12110

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Correspondence
(continued from page 2)

One other small item I would like to note is that logic signals tied active high should never be tied directly to +5 V, but rather through a series resistor of 1000-3300 ohms. This resistor acts as a current limiter to prevent noise or voltage spikes from damaging sensitive LSTTL inputs. - Steven E. Margison, WA9DRE, 704 Franklin St., Downers Grove, IL 60515.

Inductor Stack Revisited

An inquiry recently received questioned the wiring of the inductor stack shown in Fig. 2, p. 11 of the June 1983 issue of QEX. The jumper wiring of the inductor stack for the 88-mH and 22-mH connections is correct as shown. The internal connections of the two 22-mH windings on each inductor core were not shown because this detail was unnecessary for the external wiring of the filter. However, to anticipate questions and eliminate any possible confusion, it appears advisable that the internal wiring of the inductor stack be shown.

Shown below is a diagram taken from my article published in Radio Communication, April 1983. In Fig. 1(b), you will find the schematic diagram with polarity markings shows the winding connections of a single inductor in a typical stack. You can now verify that the jumper connections shown in Fig. 2 of my QEX article do in fact produce the expected 88- and 22-mH values as shown. - Ed Wetherhold, W3NQN, 102 Archwood Ave., Annapolis, MD 21401.

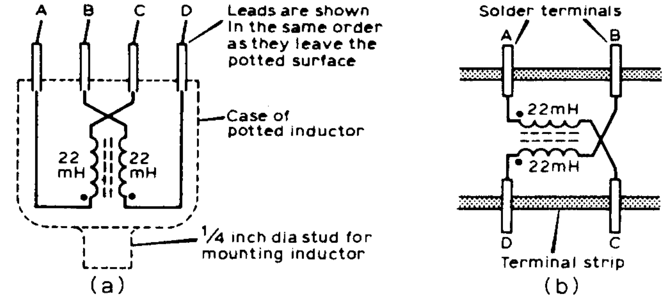

Fig 1. The internal wiring of the two coils found in the potted (a) and stack (b) inductors, and the external connections required for either the 22 or 88mH inductance values. For series-aiding connection (88mH), connect A to B to give 88mH between C and D, or connect C to D to give 88mH between A and B. For parallel-aiding connection (22mH) connect A to D and B to C to give 22mH between A and B or C and D

VHF+ Technology
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The CN540 and CN550 were tested against a Bird 43 wattmeter with the appropriate slugs and a lab-type rf calorimeter with the results shown in the Table.

Unfortunately, both units use UHF-type connectors. Even this manufacturer's type CN720B (a 1.8-150-MHz unit rated to 2 kW) utilizes the same SO-239s. The same manufacturer also makes the CN-630N (140-450 MHz, 20/200 W) with type-N connectors and an N-connector meter CN650 for 1.2-2.5 GHz! While I have not tested the latter three meters, it is extremely interesting to note the frequency range of the CN-650 (which has 2/20 W forward power ranges) and the recent advertisements for a certain foreign-made 1200-MHz mobile transceiver (and a repeater to work through on this band!). Note that neither the Daiwa meters nor the Bird model 43 presently offer a power metering capability for more than 1 kW in the 220-MHz range and above which may become necessary if the proposed 1500-W output limit goes into effect.

FM I-F Unit

The 1983 Spring Sprints, the June VHF QSO Party and the spring round of VHF+ conferences and conventions will be history. I do not want to prophesy as to what new VHF+ technology or operating advances have occurred at these events, but I will include anything of interest reported to or observed by me in my next column. I will particularly be interested in activity levels on 220 MHz (traditionally lower than either 144 or 432 MHz because of less variety of commercially available equipment), any impact on 1296 or 2304 MHz on account of recent articles in QST and other amateur magazines and especially on 10 and 24 GHz.

With respect to the latter bands, a number of VHF+ers have changed to a 10.7-MHz i-f for their FM equipment. It is cheaper to build a 10.7-MHz i-f receiver, relative to a 30- to 10.7-MHz or a 110- to 10.7-MHz superhet i-f receiver, if several must be built (one for each station in each section -- remember the rules). A solution is based on a small 10.7 fm i-f unit available from MTS Electronics, P. O. Box 1164, Round Rock, TX 78664. The MTS EK101 kit is priced at under $10. It has a measured sensitivity (12 dB SINAD) of 25 uV for 75-kHz-deviation signals and an audio output of 400 mV rms. Full usable sensitivity is achieved by adding a good preamplifier, which is necessary with a Gunnplexer ® or Mitsubishi FO-UP11KF receiver (the latter unit to be covered in greater detail in a future column) for the 10-GHz band.

24-GHz Gunnplexer?

The 24-GHz band is still a problem. M/A-COM had advertised and demonstrated a 24-GHz Gunnplexer ® at Dayton in 1981 which was "soon to be" available. I have heard nothing further about a 24-GHz Gunnplexer in the two years since. Does anyone have further info? I'm sure all VHF+ers would like to know the latest news about this 24-GHz equipment.

-- WA2GFP

BER Performance of TAPR TNC Modem
(continued from page 4)

This data also raises questions such as can the TAPR TNC sensitivity be improved? Would alternate modulation techniques provide even greater improvement and would it justify changing the modem standard? Experiments will have to be made to answer these questions. I am interested in hearing from anyone who does on-the-air tests or has done bench tests similar to these on the TAPR or other modems with fm receivers.

Suggested Reading Sources

[1] David Borden, K8MMO, and Paul Rinaldo, W4RI, "The Making of an Amateur Packet Radio Network," QST, October 1981, p. 28-30.

[2] Tucson Amateur Packet Radio, P. O. Box 22888, Tucson, AZ 85734

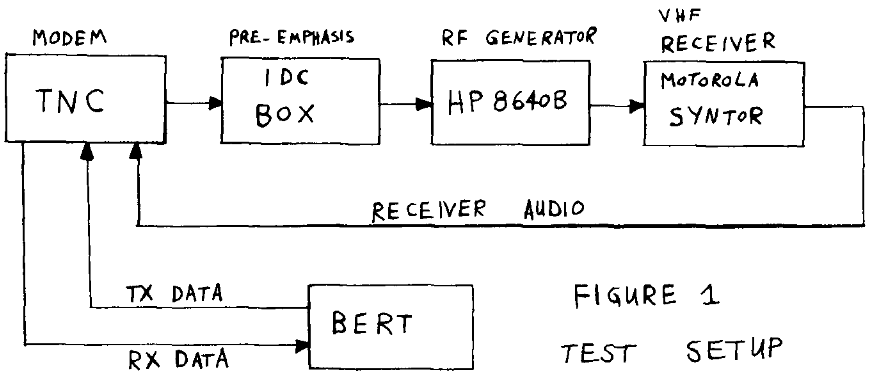

FIGURE 1
TEST SETUP

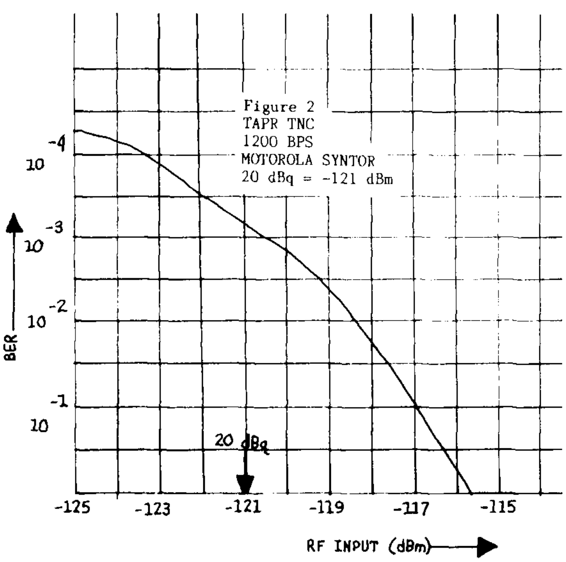

Figure 2
TAPR TNC
1200 BPS
MOTOROLA SYNTOR
20 dBq = -121 dBm

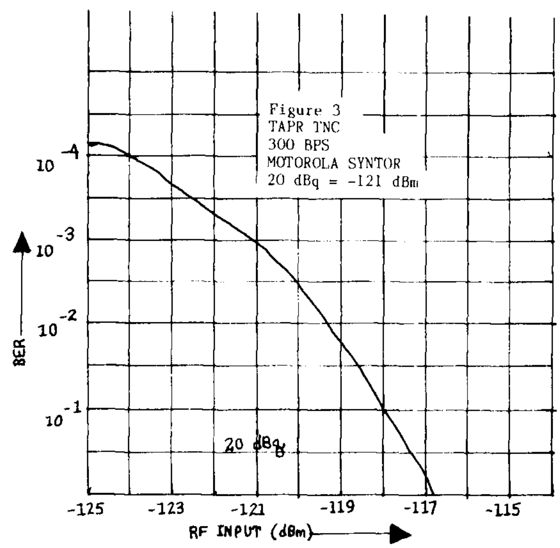

Figure 3
TAPR TNC
300 BPS
MOTOROLA SYNTOR
20 dBq = -121 dBm

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2) document advanced technical work in the Amateur Radio field, and

3) support efforts to advance the state of the Amateur Radio art.

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