COVER STORY: 2304 MHz QUADRIFILAR ANTENNA FOR AMSAT-OSCAR 7

(preprinted from QST)

OSCAR 7 Project Manager Jan King, W3GEY, a NASA engineer, (seated R) and Randy Bricker review radiation characteristics of the 2304 MHz OSCAR 7 beacon antenna, while W2DU and W2WGH (standing, L-R) look on. The antenna is shown mounted on an OSCAR 7 test model at the RCA Space Center, attached to an ITOS weather satellite in the piggy-back launch configuration. In spite of its small size (0.7 oz.), this quadrifilar-design antenna now flying on OSCAR 7 boasts a tremendous performance for spacecraft use. The original design was developed by RCA Engineers Bricker, H. Rickert, and Walt Maxwell, W2DU, for use on the USAF's newest and highly successful spacecraft, the Block 5-D Meteorological Satellite, built by the RCA Astro-Electronics Division of Princeton, N.J. The antenna is circularly polarized, radiates hemispherically without requiring a ground plane, has a gain of 5 dBi on axis, down smoothly to 0.0 dBi 90 degrees off axis over entire 360 degrees around edge of hemisphere, with good polarization circularity at hemisphere edges. It is fed with an infinite balun, and has elements phased at 90 degrees with no phasing line. With a W2DU modification to operate at the 2304 MHz beacon frequency of OSCAR 7, this antenna was fabricated under the direction of Bricker and W2DU specifically for the OSCAR 7 amateur spacecraft, and presented to AMSAT by RCA, which designed and built the TIROS-ESSA-ITOS weather satellite series.

W2DU also served as consulting engineer for all antenna systems on AMSAT-OSCAR 7, and is well known to QST readers as the author of the current series, "Another Look at Reflections." RCA Technician Walt Ozmon, W2WGH, performed many of the impedance and radiation pattern measurements during the final testing of the antenna.

Scaled up for other frequencies, the quadrifilar would have similar performance characteristics. At 146 MHz, the quadrifilar would form a cylinder approximately 13 inches in diameter and 20 inches high, while at 432 MHz, diameter and height would be 4.4 inches and 6.8 inches, and at 29 MHz 5.5 feet and 8.4 feet, respectively. The circular polarization will reduce polarization fading caused by Faraday rotation of the electric field vector, especially on the 10 m downlink. A construction article is under way by W2DU.

PUBLICITY PHOTOS WANTED

Black and white photographs of users at their stations are wanted by the AMSAT information and Publicity Department. If you have any such photos and would like to see them displayed in public, please send them to AMSAT in care of the Director of Information and Publicity.

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Washington, D.C. 20044

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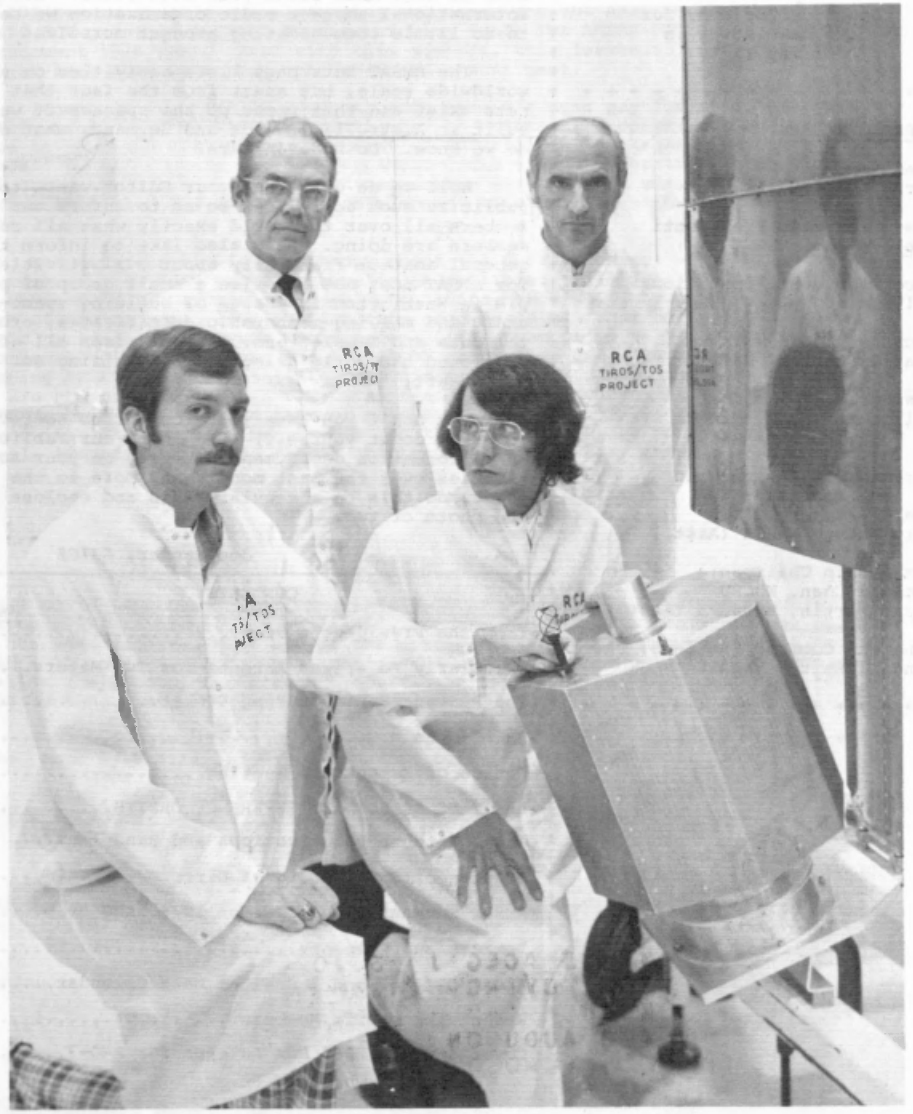
AMSAT™ NEWSLETTER

Affiliated with

Issued quarterly by the Radio Amateur Satellite Corporation

Volume VII Number 1 March 1975 50¢



AMSAT NEWSLETTER, published by the Radio Amateur Satellite Corporation (AMSAT), with offices at 700 Seventh St. S.W., Apt. 226, Washington, D. C. 20024 U.S.A.

Telephone: (202) 488-8649

Subscription Price: $3.00 per year, inseparable from $5.00 membership dues.

Deadline for copy for next Newsletter is 1 May 1975

AMSAT OFFICERS

AMSAT

EDITORIAL

How much do you know about the activities of other AMSAT-affiliate organizations? How much do they know about your activities? For an international amateur radio organization we seem to do little communicating amongst ourselves.

The AMSAT Nets page lists activities on a worldwide scale, but apart from the fact that nets exist and that parts of the spacecraft were built in Australia, Canada and Germany, what else do we know. Do we even care?

Well we do care, and your Editor wants to publicize such activities so as to inform our members all over the world exactly what all our members are doing. We'd also like to inform the general amateur fraternity about our activities, for AMSAT does not comprise a small group of people in Washington in charge of building spacecraft and mailing membership certificates, orbital data and Newsletters. It comprises all of us around the world using and publicizing our spacecraft.

Why don't you have your local club secretary (or even do it yourself) send in to our Publicity and Information department a report on your activities over the last month, and more to the point, do this on a regular basis and enclose the odd photo or two.

Joe Kasser, G3ZCZ

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FROM THE PRESIDENT'S DESK

by Perry Klein, K3JTE

As announced in the last issue of the *AMSAT Newsletter*, the Board of Directors has approved an increase in the annual membership dues to $10 U.S. per year ($20 U.S. for member societies), effective July 1.

The AMSAT annual dues were originally set at $5 per year when AMSAT was first organized in 1969, and have remained the same now for over six years. Over the same period, AMSAT's expenses have increased from about $300 in 1969 to over $49,000 in 1974! At the end of 1969 AMSAT had around 250 members. Today we have over 2,000, with the result that expenses are now in excess of $24 per member per annum.

Even at $10 per member, dues will cover less than half of AMSAT's $47,000 budgeted operating expenses for 1975. The rest of AMSAT's funds come from grants, donations, and proceeds from miscellaneous items such as first day covers, orbit books, slide sets, etc. For this year the ARRL has again agreed to contribute $6,000 toward AMSAT's administrative expenses, and the ARRL Foundation is considering a $20,500 grant from Eitel-Hoover matching funds for AMSAT-OSCAR 6 and 7 operations management this year. Even with this support, this leaves $21,000 that must be sought from dues and other sources to make ends meet.

It should be clear by now that each member's dues pay for more than just the *AMSAT Newsletter*; we have two satellites to maintain in operation, and we still have to continue with the development of future OSCAR packages. All this requires funds! In addition to $20,500 for AMSAT-OSCAR 6 and 7 operations management, $12,300 are expected to go toward membership services and administrative expenses during 1975, and $14,400 to the development of satellite hardware for future satellites.

For those particularly unhappy about the dues increase, we would encourage you to renew for as many years in advance as possible. This must be done before July 1 to take advantage of the old dues rate. Life Membership, available for a contribution of $50 or more, is a particularly good bargain. From our point of view, it would be ideal if everyone would become Life Members, as this would greatly simplify the bookkeeping and reduce the burden of processing renewals here. We are still sending AMSAT-OSCAR 6 satellite communicator's pins to each new Life Member, and we are now offering both AMSAT-OSCAR 6 and the new AMSAT-OSCAR 7 satellite pins to Life Members contributing $100 or more until July 1st, 1975. For members outside the United States, Life Membership has the added advantage of requiring only a single transfer of funds, rather than converting currency annually. Consider it.

FOR THE RECORD

FIRST NORTH AMERICAN RECEPTION OF AMSAT-OSCAR 7 should be credited to VE2BYG and not to K7BBO as previously published, because since the launch story was published it has been reported that AOS of the spacecraft at VE2BYG was at 1843:10 and AOS was 1845 ± 15 secs at VE3QB, both stations being linked on the Spacecraft Command Station (Telephone) Conference Circuit. Sorry, Dave, but that beats out your 1846:37 time. Anyone claim an earlier time?

KH6IHP is claiming a first for a phone patch through an amateur radio satellite, made by KH6IHP and WØNQQ on orbit 8810 of A-O-6 (19 Sept. 1974).

KH6IHP, W6OAL and WØNQQ are believed to have taken part in a first international three-way mobile contact via an amateur radio spacecraft on Orbit 8860 of AO6 (23 Sept. 1974).

W4ART and G3ZCZ are claiming a land first mobile-in-motion contact through an amateur spacecraft. The claim is in respect to their contact as G3ZCZ/M/W3 with W3HUC on AMSAT-OSCAR 6 orbit 10260 on 13 January 1975. Does anybody dispute their claim?

A HOME-BREW CIRCULARLY-POLARIZED ANTENNA FOR TWO-METER OSCAR WORK

by Ron Dunbar, WB9NLF

Below is a drawing of a simple, easy to construct, 146 MHz OSCAR antenna. I have found that elevation control is not necessary if the antenna is permanently mounted at a fixed elevation angle of 45°, which gives excellent coverage down to 10° above the horizon, where I then switch to the normal 2 meter array. It only takes about 2½ minutes for the satellite to get up to 10° elevation on any equator crossing from 35° to 105° at this location, so not much will be lost if this is the only station antenna available.

Because of the circularity of this antenna's pattern, those annoying polarization fades observed on the linear antenna previously in use are completely eliminated. The antenna in the below drawing provides approximately 9 dB gain, right-hand circular polarization.

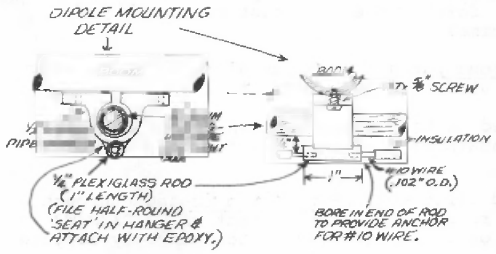
One of the rules I observed in the materials list used for this construction was to restrict that list to items which are commonly available. A somewhat better match than the calculated 1.15:1 SWR probably could have been obtained by using an oddball size conductor in the dipole, but the #10 wire specified is obtainable in any hardware or electrical store, so it was used instead. (I left the plastic insulation on, except where it joined the feedline, and at the end of the ½" tubing.) I used the technique of keeping the end of the aluminum tubing covered with heavy oil both while I cleaned the oxide off with steel wool and while tinning it with ordinary solder. If you have not tried this trick, you will find that it works amazingly well . . . much better than all the special 'aluminum solders' I have tried in the past.

The method of mounting the 1/8" aluminum elements was borrowed from John Fox, (WØLER) and not only contributes to a simple 2-3 hour construction, but also eliminates the corrosion-generated noise which is created by poor element-to-boom contact inherent in all "through-the-boom" construction techniques (unless the elements are soldered to the boom).

I used a 1" aluminum for the boom (with a relatively thin wall), resulting in a compact 3 pound antenna. Mine is mounted on a rectangular aluminum plate (¼" thick), which is in turn mounted to the vertical mast. It is not necessary to orient the elements vertically and horizontally; mine is mounted like an 'X' to minimize interaction with the vertical mast and the 435 MHz helix mounted directly beneath it.

The pattern is clean and broad, which reduces the antenna aiming chores, while providing more than enough gain to bring OSCAR 7 passband signals up to 50 dB out of the noise at this location.

This antenna should bring me up to very near 100% perfect print on the 145.975 teletype telemetry when used in conjunction with the Active Filter AINT Terminal Unit. I hope to have an article out on the T.U. in the very near future to encourage more OSCAR users to try their hand at telemetry reception.



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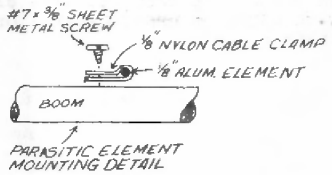
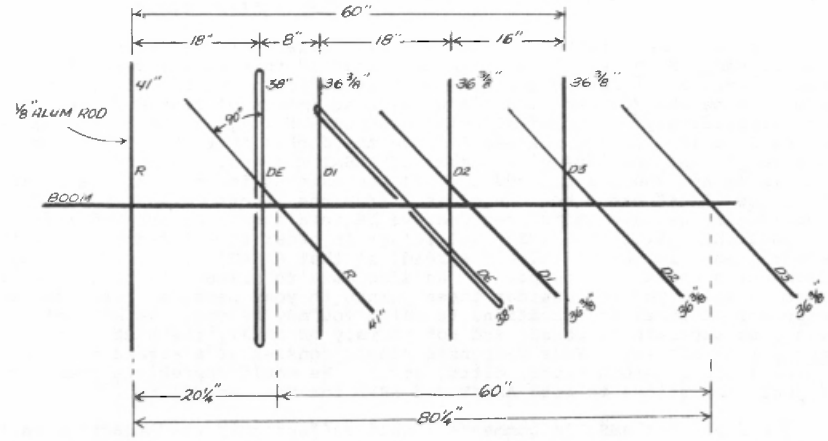
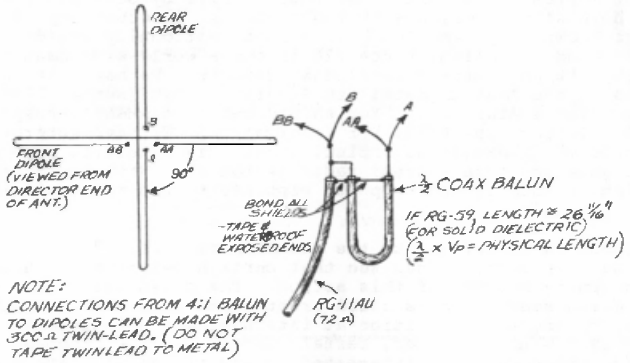
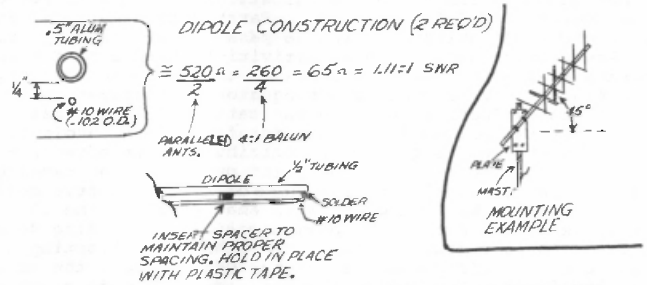


USE MINIMUM 8' BOOM TO PROVIDE REAR EXTENSION FOR MOUNTING.







146 MHZ OSCAR ANTENNA
(RIGHT-HAND CIRCULAR)
WB9NLF/WØMJS 1/75

THE AMATEUR RESTRUCTURING DOCKET

by Tom Clark, WA3LND/WØIUF
Ray Soifer, K2QBW

Last December the FCC published Docket 20282 entitled Restructuring of the Amateur Radio Service. To all who have studied this docket carefully, it is clear that if even a portion is adopted, amateur radio in the U.S.A. will never be the same. Since the FCC realized the widespread impact of restructuring, they took the extraordinary action of allowing a 6-month filing period, with the deadline set as June 16. In the six weeks since the docket "hit the street," the authors have sought the opinions of a number of AMSAT members, not only in the U.S.A. but also in Japan, where a no-code license has existed for several years, and the U.K. where the "G8's" are a no-code class. From the inputs of a number of concerned individuals, we have formulated what we believe should be AMSAT's response. We are publishing it in the *AMSAT Newsletter* in order to solicit comments from other members, both in the U.S.A. and abroad, so that AMSAT's final filing may truly represent a consensus viewpoint. We also want to present it to the membership in order to allow you to consider these points in your personal responses and in the responses of other organizations to which you may belong. We strongly urge you to file your separate responses and not to rely on AMSAT, the ARRL, etc. to present your points of view. Your responses should consist of a signed original and 14 copies (Xerox, carbon paper, ditto, etc.). We would appreciate your sending copies of your submissions to both AMSAT and ARRL for the record, too.

We feel that AMSAT's comments should reflect only the impact of restructuring on amateur space communications, and as such we have avoided any comments on such questions as the 250 watt Novice power limit, the loss of RTTY by General class licensees, etc. If you have strong feelings on these points, we would hope that you would make them in your own response. We have also intentionally avoided any discussion of the 220 MHz band situation, since 220 is not a world-wide amateur band, and hence cannot support any amateur satellite activity. We have also assumed that the FCC's actions on the Amateur-satellite Service Docket (Number 19852) will not materially affect the status quo. You should refer to AMSAT's response in the June 1974 *AMSAT Newsletter*, pp. 8-12, for information. We have interpreted "amateur space communications" liberally as including not only satellite communications, but also moon-bounce and even amateur radio astronomy. With these provisos, here are the salient points of our proposed response to the restructuring docket:

(1) AMSAT has no objection, in principle, to the establishment of a "no-code" Communicator class license. In fact, we can see that certain benefits may accrue to the amateur radio fraternity because of this action. The potential influx of new people into the dwindling amateur ranks could breathe new life into our hobby and give us a much stronger bargaining position at international allocations conferences, such as the 1979 WARC. However, certain details of the proposal will cause serious problems for those amateurs interested in any aspect of amateur space communications.

(2) Within the amateur radio community there are several activities which rely heavily on space. These include the Amateur-satellite Service, as exemplified by AMSAT, the small but exciting effort in communications by means of reflection from the moon (hereafter called E-M-E for Earth-Moon-Earth communications) and even a limited number of amateurs experimenting in the passive "listen-only" discipline of radio astronomy. Amateurs engaged in these activities share a bond with other experimentally-minded amateurs working in areas of tropospheric scatter, ionospheric scatter, meteor scatter, auroral and trans-equatorial propagation, etc., all of which may be categorized as "weak-signal" communications. In general, amateurs experimenting with these techniques are at the forefront of technological development and have, in the past, made significant contributions to advancing the state-of-the-art in communications technology. We point out a few outstanding examples of this as precedent. The original demonstrations of trans-Atlantic communications in the HF bands in the 1920's were made by radio amateurs. In the 1930's, amateurs began pushing the state-of-the-art in VHF communications, including demonstrations of the capabilities of FM as a viable modulation technique. Starting in 1939, and throughout the War, a U.S. radio amateur singlehandedly brought the science of radio astronomy to the forefront. During the War, amateurs made a number of invaluable contributions to the development of radar and field communications equipment. In the late 1940's, it was radio amateurs who demonstrated that SSB was a very efficient mode for point-to-point HF communications. The 1950's brought the discovery of meteor scatter communications by radio amateurs. In the 1960's, and 1970's amateurs have been expanding into space and have now successfully completed

seven artificial satellites, four of which were for the purpose of relaying communications and two of which still continue to operate. Amateur ingenuity has also demonstrated that communications with relatively modest equipment can be made via the E-M-E mode and stations with such capability now exist in all corners of the world, from Africa to Alaska, from Sweden to New Zealand. The provisions of spectrum space for such experimental activities should be mandatory, and we fear that if Docket 20282 is adopted without change, such activities will be severely compromised.

(3) At present, the activities mentioned in (2) are conducted primarily in the following frequency bands: 29.4-29.6 MHz; 144-146 MHz; 431-438 MHz; 1290-1300 MHz; and 2300-2310 MHz. Some additional activity takes place in the bands 50.0-50.2 MHz, 220.0-220.1 MHz, and in all the amateur bands above 2300 MHz. Most of these frequencies are not heavily used by amateurs not participating in weak-signal communications. In fact, the population is quite sparse when compared to bands such as 28.5-29.0 MHz. Much of the protection that currently exists for these weak-signal activities comes from self-policing within the amateur ranks. The majority of present U.S. amateurs respect the importance of these activities and permit them to be carried out without any undue interference.

(4) With the advent of artificial satellites, E-M-E communications, and even the other weak-signal communications modes, the VHF (and higher) bands can no longer be regarded as "local" or "line-of-sight." Through the AMSAT-OSCAR 6 (AO-6) and AMSAT-OSCAR 7 (AO-7) satellites we have observed that incidental communications, not directed towards the satellite, have been retransmitted to an "audience" that is far wider than that intended by the original transmitting stations. That this "audience" includes areas outside the U.S.A. demonstrates that the Commission's actions on this docket can have international ramifications. In most foreign countries, as well as within the U.S.A. and the neighboring countries of Canada and Mexico, amateurs have worked hard on voluntary band-planning, particularly in those portions of the amateur bands which are allocated for amateur use on a world-wide basis. Figure 1 shows the band-plan adopted by the International Amateur Radio Union (IARU) Region 1 (Europe) for the 144-146 MHz band. The allocation of the 144-144.5 MHz segment for weak-signal activities and the allocation of 145.845-146.00 MHz segment to space activities should be noted. These voluntary allocations in Europe are compatible with voluntary band-planning in the U.S. and the rest of the world. To adopt changes which would abrogate these international amateur agreements would show bad faith on the part of U.S. amateurs and cause harmful interference to weak-signal activities in other countries. Figures 2 and 3 present the European band-plans for the 430-440 MHz and 1296-1298 MHz band segments which could also be affected by adverse action on Docket 20282.

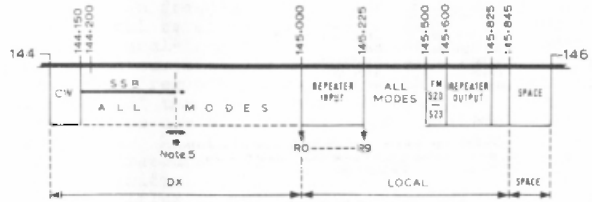


Figure 1. 144-146 MHz European Band-Plan.

144 - 146MHz

144.000 - 144.010	EME
144.100	RANDOM MS
144.150	CENTRE FREQUENCY REGIONAL BEACONS
144.200	SSB CALLING
144.600	RTTY (DX)
145.000 - 145.225	REPEATER INPUT - RO to R9
145.300	RTTY (LOCAL)
145.500	MOBILE CALLING
145.500 (S20), 145.525 (S21)	FM SIMPLEX
145.550 (S22), 145.575 (S23)	FM SIMPLEX
145.600 - 145.825	REPEATER OUTPUT

FOOTNOTES

1. Established simplex frequencies on repeater output channels may be retained.
2. The segment 145.250 - 145.500MHz may be allocated, if desired to FM channels.
3. No regional planning for low power beacons (erp of 5W or less).
4. Area coverage by regional beacons (erp of 50W or greater).
5. The upper limit of ssb is flexible.