

WHAT'S NEW ON THE ELECTRONICS HORIZON?

Attention, Secret CB readers. If you really want to get your feet wet in state-of-the-art technology, the author of Secret CB will be introducing yet another periodical book dealing with home satellite TVRO (television receive only) earth stations. This book, to be published semi-annually, will bring you in touch with the current new developments and technical developments in the field of satellite reception. There will be articles on how to build your own earth station for a fraction of the cost of "turnkey" systems, and for those who want to get into the space-age fast - articles and descriptions of off-the-shelf components that can be "plugged together" to give you almost instant access to seven satellites now operating in geostationary orbit.

We will explore how to get four HBO channels off RCA's SATCOM I satellite - how to get pictures off the TIROS weather satellites, and interesting articles on what the "big boys" of the industry are doing - or trying to do.

You will be given proven experimental projects in antenna fabrication, circuit construction (from scratch), and have access to ALREADY AVAILABLE circuit boards, kits and components.

The first issue (scheduled for publication in May, 1980), will feature an introductory article on satellite technology and a glossary of terms that will be used in future publications. There will be listings of "turnkey systems" and components, etc. In general, it will be a gangbuster "get your feet wet" book on home satellite earth stations - one that you'll want to read - even if you don't shoot for the stars right away. You'll be informed about the systems that provide sports from Olympic games half-way around the world in terms that a neophyte or more technically oriented reader will find both educational and interesting. And, as an unquestionable feature - virtually every reader, regardless of his technical involvement in the satellite field will LEARN with each issue.

The following is an explanation of how a satellite system actually works, and concluding the feature, you'll find information on where to make dealer and/or consumer inquiries.

NEW HORIZONS (CONT'D)

HOW THE EARTH STATION WORKS

ORIGINATION & UP-LINK

The origination of satellite TV signals is usually in studios or various facilities at many different locations (locations will be found in the back of this presentation). These signals are transmitted via terrestrial means (cable or microwave) to up-link satellite terminals located at many different sites throughout the United States. The up-link terminal consists of a large aperture (10 meters or larger) parabolic antenna which transmits to the satellite in the 5.9 to 6.4 gigahertz (GHz) band, using wideband FM. For wideband video transmission, the up-link terminals transmit the signal in a 36 megahertz (MHz) bandwidth with sufficient power to fully saturate the satellite transponder.

SPACE SEGMENT (SATELLITE)

The space segment of the signal chain consists of a geostationary satellite located approximately 24,000 miles above the equator. This satellite orbits the earth at the same speed as the earth revolves, so in effect, the satellite does not move in relation to the earth's surface (figure 1).

There are presently two types of satellites in orbit which are used for TV relay. They are the Western Union (WESTAR) satellites, and the RCA (SATCOM) satellites. While both operate in the same 500 MHz frequency bands, the Western Union satellites have 12 transponders, each 40 MHz wide and separated by 40 MHz, while the RCA satellites have 24 transponders each 40 MHz wide, but separated by 20 MHz. RCA is able to accomplish this by utilizing frequency re-use, or cross-polarization. Basically, this consists of 12 transponders vertically polarized and 12 horizontally polarized with each adjacent transponder being in the opposite polarization; i.e., odd-numbered channels vertically polarized, and even channels horizontally polarized (figure 1).

The satellite receives the 6 GHz signal transmitted from the up-link terminal, translates it to 4 GHz and re-transmits it back to the ground in a beam shaped to cover the geographic area of interest which, in our case, is the United States.

DOWN-LINK OR RECEIVE TERMINAL

The down-link terminal is that portion of the signal chain which is of importance to the system user. It is this part of the chain which the user can control, design, and own, and it is this part of the chain with which he must become familiar.

NEW HORIZONS (CONT'D)

There are three primary parts of the receive terminal:

- *Antenna
- *Low Noise Amplifier
- *Receiver

We shall now examine each of these components individually.

THE ANTENNA

As the first element in the receive chain, the contribution of the antenna to the overall system noise temperature and gain are of primary importance. For the purpose of this article, we will consider antenna sizes of 3 meters (10 feet) to 5.6 meters (18 feet).

PRIME FOCUS PARABOLIC ANTENNA

The prime focus feed parabolic antenna uses a feed element located at the apex or focal point of the parabolic "dish" to extract the RF energy. There are two types of prime focus feeds.

- a. The button hook feed which uses a section of curved waveguide to receive the RF energy at the apex and then couple it back to the vertex of the dish and into the low noise amplifier.
- b. The feed located at the apex, mounted on struts or supporting members.

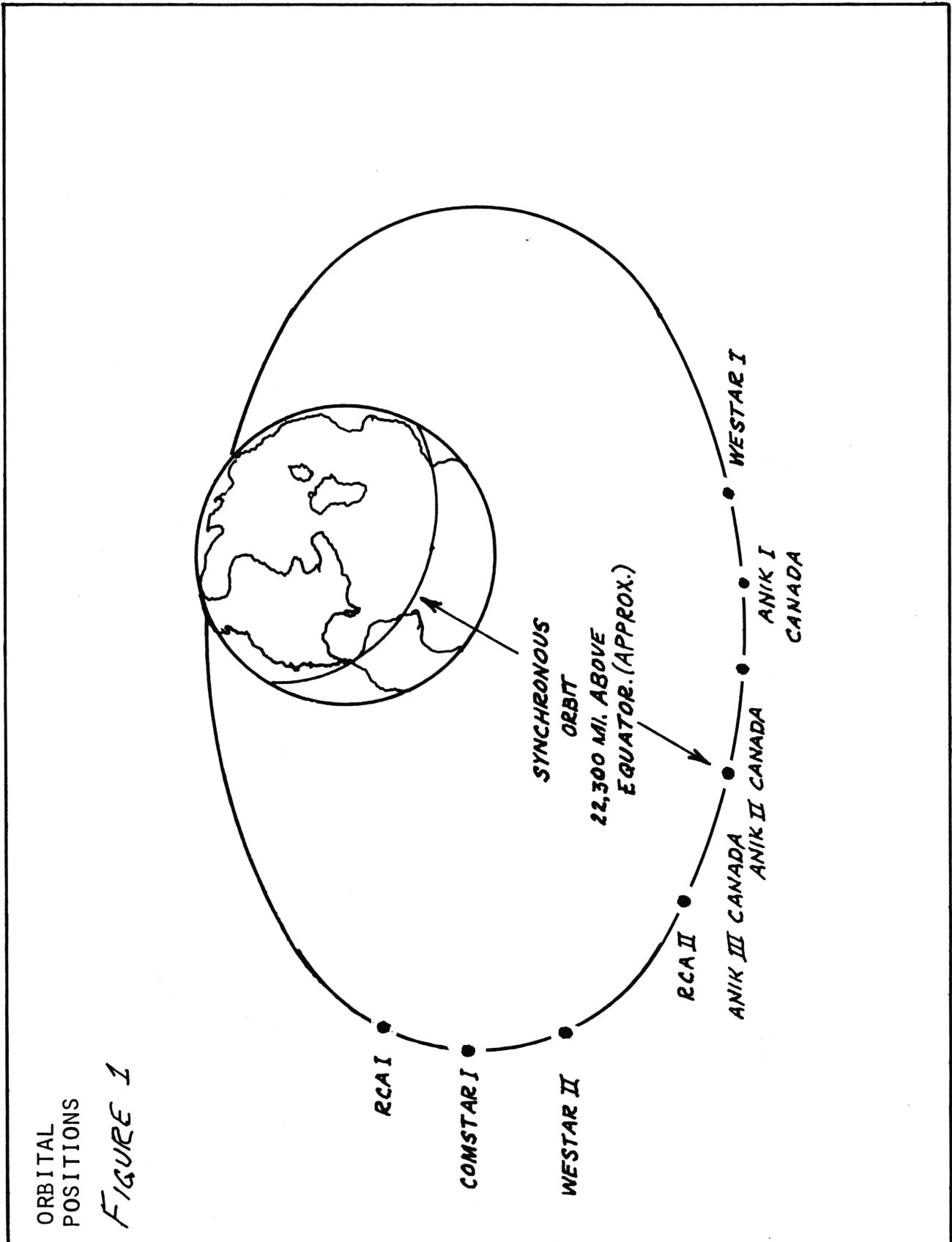
The prime focus feed exhibits excellent side lobe performance, but usually has lower gain due to losses in the waveguide runs to the low noise amplifier, Type (a) above. Type (b) above overcomes this loss by locating the low noise amplifier at the vertex, but this configuration offers some disadvantage when changing or aligning polarization.

LOW NOISE AMPLIFIER (LNA)

The LNA is perhaps the singular most important element in the receive terminal. As the first active component in the system, its design and characteristics can change overall system performance more than any other. These amplifiers' noise performance is specified in degrees kelvin.

There are two basic types of LNA used:

GEOSTATIONARY SATELLITES



NEW HORIZONS (CONT'D)

- a. The parametric amplifier makes use of the negative resistance characteristics or varactor diodes to achieve high gain and extremely low noise temperatures. These amplifiers are normally expensive and, for the low temperature units, quite bulky. They operate in the 45 to 120 degree kelvin area.
- b. The Gallium Arsenide Field Effect Transistor (GaAsFets) amplifier usually consists of a low noise GaAsFet input amplifier followed by a transistorized amplifier to achieve low noise temperatures of these units, while lowering the price. They operate in the 90 to 300 degree kelvin area.

In most applications, the earth station will employ the GaAsFet low noise amplifier.

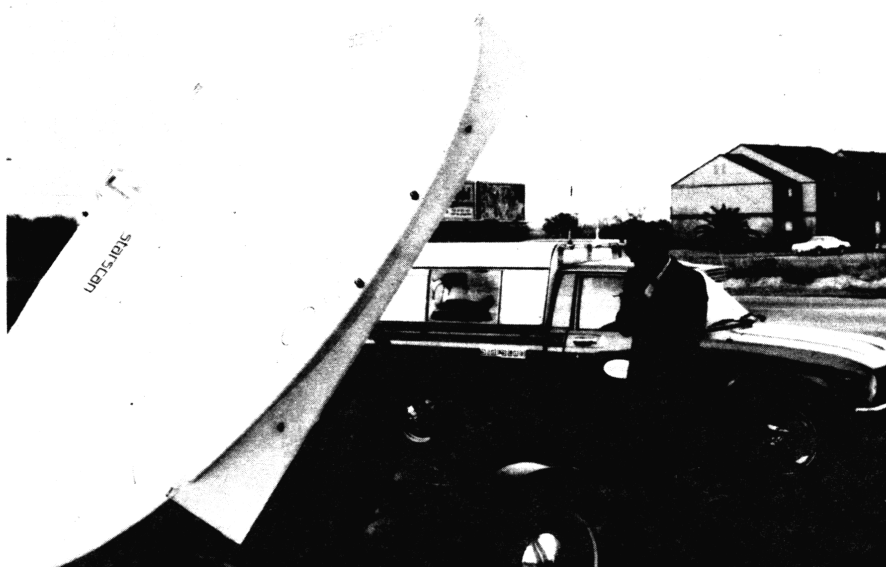
THE VIDEO RECEIVER

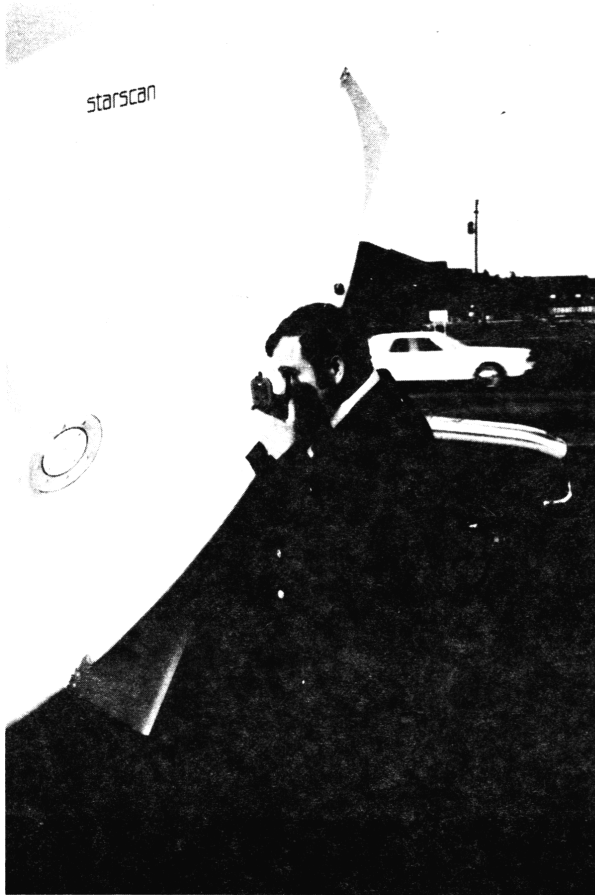
The video receiver in the system selects the desired satellite transponder, provides attenuation and isolation for unwanted signals, down-converts the signal, extracts audio and video information, processes it and provides inputs to the modulator.

With the recent availability of so many different signals from the satellites, there has been a change in philosophy in regard to receiving equipment. Some manufacturers are now offering a mix of low cost dedicated receivers and frequency agile receivers which results in a lower cost system for multiple channels.

AFTER THE RECEIVER

The receiver can be interfaced to an individual television receiver, a master antenna system (so as to serve many receiving sets), or as an integral part of a cable television system.





Author, Rod Johnson is shown here using a Brunton hand-held transit to locate the SATCOM I bird. Exact azimuth and elevation calculations are required in order to pick up the signals from any satellite. (We'll show you a couple of ways to calculate this in the first volume of Secrets of Satellite TV).

If this isn't enough to whet your appetite, in the first issue of Secrets of Satellite TV there will be a glossary of terms used in the field of satellite communications; a more technical introduction, and characteristic prices of boards, components, and complete turnkey systems that are available through the publisher.

Dealer inquiries are invited. For more dealer information, please address a letter on your letterhead to:

Selman Enterprises, Inc.
P. O. Box 8189
Corpus Christi, Texas 78412

Or call: 512/992-1303

Attention: Rod Johnson (author)
or: George F. Blancett (contributing author)

Until the first issue of Secrets of Satellite TV hits the press, here's hoping you will find the same interest and enthusiasm in satellite TVRO systems that I have.

George