Bob Cooper's

FEBRUARY 15 1995

# SatFACTS MONTHLY

Reporting on "The World" of satellite television in the Pacific Ocean Region

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The Auckland University 7.3m language arts TVRO System

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**THRESHOLD EXTENSION**
Real-world results using commercially available equipment

✓ Latest programmer news
✓ Latest satellite operations
✓ Latest SPACE Pacific news
✓ and Coop's Comment

Vol. 1 ◆ No. 6
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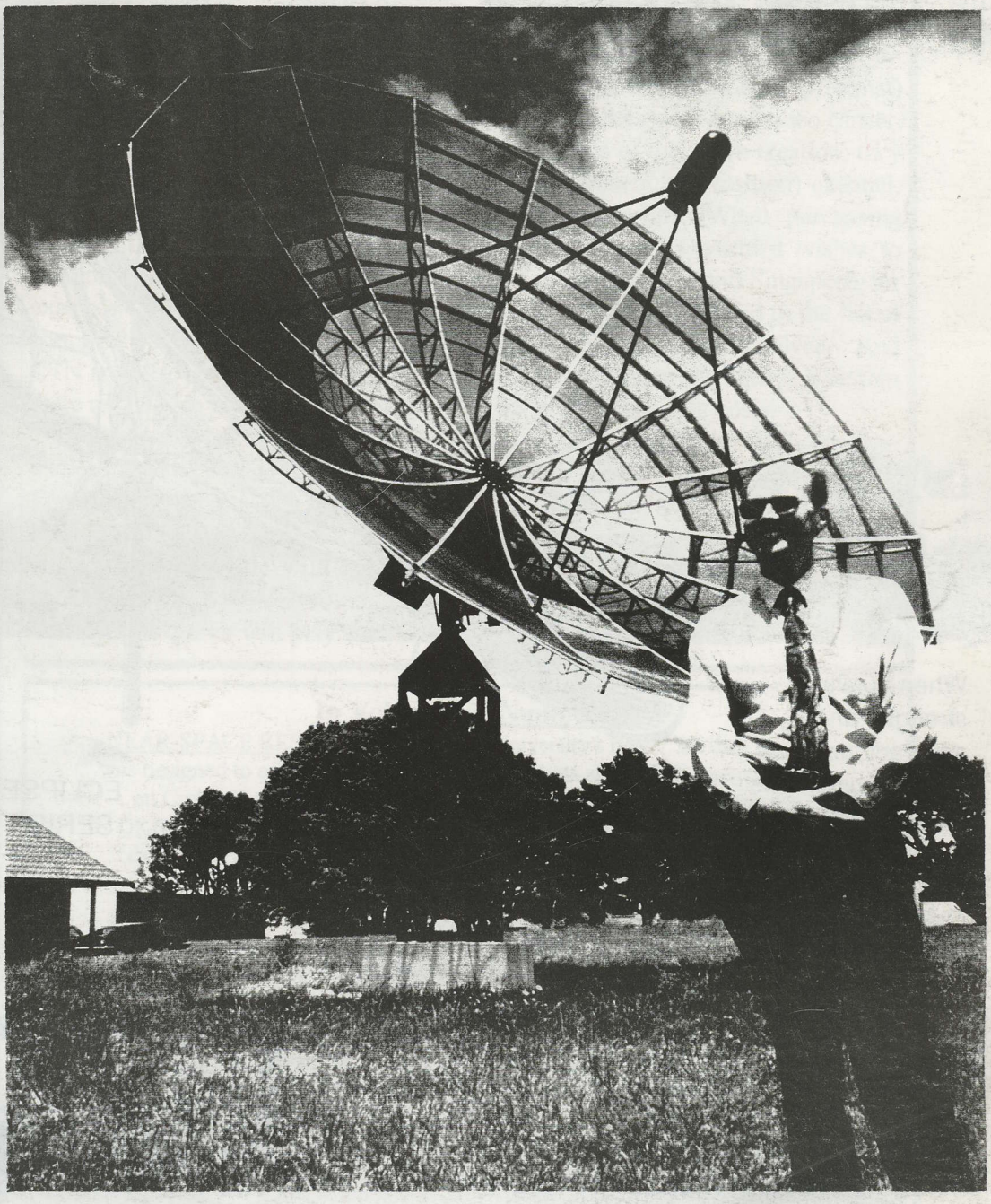

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# SatFACTS
## MONTHLY

SatFACTS Monthly is published 12 times each year (on or about 15th of each month) by Far North Cablevision, Ltd. This publication is dedicated to the premise that as we enter the 21st century, ancient 20th century notions concerning borders and boundaries no longer define a person's horizon. In the air, all around you, are microwave signals carrying messages of entertainment, information and education. These messages are available to anyone willing to install the appropriate receiving equipment and, where applicable, pay a monthly or annual fee to receive the content of the messages in the privacy of their own home. Welcome to the 21st century - a world without borders, a world without frontiers.

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## COOP'S COMMENT

Increasingly we are being faced with a new reason why some satellite delivered programming channels are not available in specified countries in despite of the fact the signals are strong and the reception relatively easy to achieve. That reason is "*copyright.*"

New Zealand has recently adopted a new comprehensive Copyright Act, the first major overhaul since 1962. The new act is a near-copy of an earlier act adopted in the UK (1988); near, but not exact. Further afield, the US has made major changes to its own copyright laws, and in fact more than 100 countries are doing so at this time. All of this legislative activity stems from the "GATT Treaty" accord reached late in 1993. To comply with the GATT Treaty, national laws regarding intellectual property rights (i.e., copyrights) must be brought to a new "international standard." World-wide this multitude of new laws try to recognise the ownership rights of those who create or put up money to create the news, entertainment and information programmes now circling the globe at the speed of light.

The Chinese Television Network (transponder 2 on PAS-2 in MCPC format) has two programming channels imbedded in their compressed digital video carrier. One of these, the *Zhong Tian* (information) channel is of their own creation; they own the copyrights. The other, the *Dadi* (entertainment and fashion) channel, contains programming they purchase from other creators. When purchasing material for *Dadi*, CTN must decide which portions of the world it wishes to "market" these programmes into. By paying for rights to China and Singapore, for example, CTN pays one fee. If New Zealand and Australia are added to the list of countries for which CTN buys rights, new (higher) charges are involved. And CTN is not going to pay for rights to New Zealand and Australia until it is certain there are enough viewers there to justify the additional copyright costs.

In this example (one of many) CTN can authorise you to receive *Zhong Tian* without hassle because they own the rights to that channel's material themselves. For *Dadi*, they buy the rights and before they can authorise a CDV receiver located inside of these countries to view *The Dadi* channel they must be convinced enough people will want *Dadi* to justify their buying rights for these countries.

Copyright 'quirks' will play an increasing role in your TVRO future.

## In Volume 1 ◆ Number 6



### Departments



**-ON THE COVER-**

University of Auckland's Brian Oliver and their 7.3m near-space research dish

HORIZON TO HORIZON IN NEAR SPACE:

# UNIVERSITY OF AUCKLAND 7.3m RESEARCH TOOL

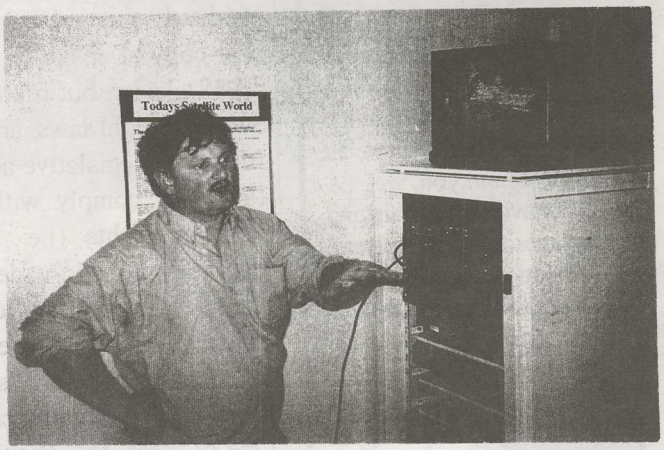

## THE PLAN

In the early 1980's a Franciscan Friar in the state of Nebraska saw real-time relevancy in a recently discovered quirk of satellite television communications. Lee Lubbers read with interest reports that Russian C band satellites looping over the north polar regions to provide full time television to Russia's far northern expanses could be received with modest sized dishes (3m and up) in many areas of the United States. At a time when cold war tensions were still running high, Lubbers believed he saw a "tool" here to achieve improved understanding between the "Russian block" and the "western block." Lubbers reasoned that if American political scientists, language students, and economists were routinely monitoring the Russian internal television programming, the information they would learn from these internal TV services would lead to a better grasp of the true nature of Russia. Lubbers saw satellite television, using the strangely orbited "Molniya system" as a crack in the wall that surrounded the USSR.

With the aid of college students at Creighton University he designed and built a quality Molniya "tracking system." Shortly, many other universities became interested in the project and by 1985, as the first signs of perestroika were appearing, several dozen US and Canadian universities were routinely monitoring the Russian Molniya TV service and carefully analysing every news report and documentary programme they encountered.

Lee Lubbers would next expand his concept and establish SCOLA, a North American network of colleges and universities tied together via their own satellite feed. Through SCOLA dozens of programmes from as many as 20 different countries each week are now routinely distributed using low cost C band technology. On the ground, the academics utilise the programming as a teaching and research tool.

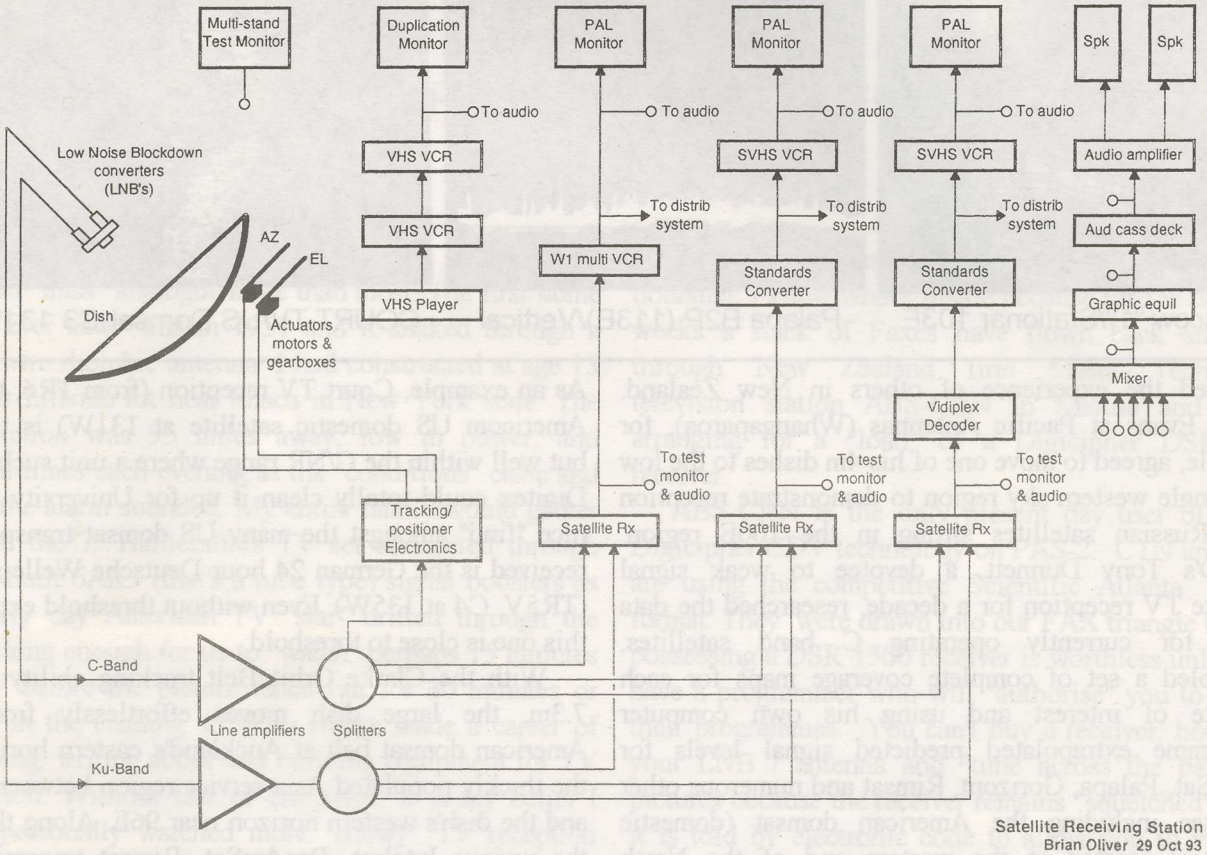
This same concept drove the University of Auckland to the 7.3m dish project. The system was defined on paper early in 1994, tenders were solicited in May and by mid September Auckland's TISCO had completed the mechanics of the installation. TISCO's choice, made with University approval, was the 7.3m Orbitron dual axis dish. Dual axis means the dish can be driven across the orbit belt (azimuth) from horizon to horizon, and with a separate motor drive also driven in elevation to track inclined orbit birds (Russian and Intelsat).



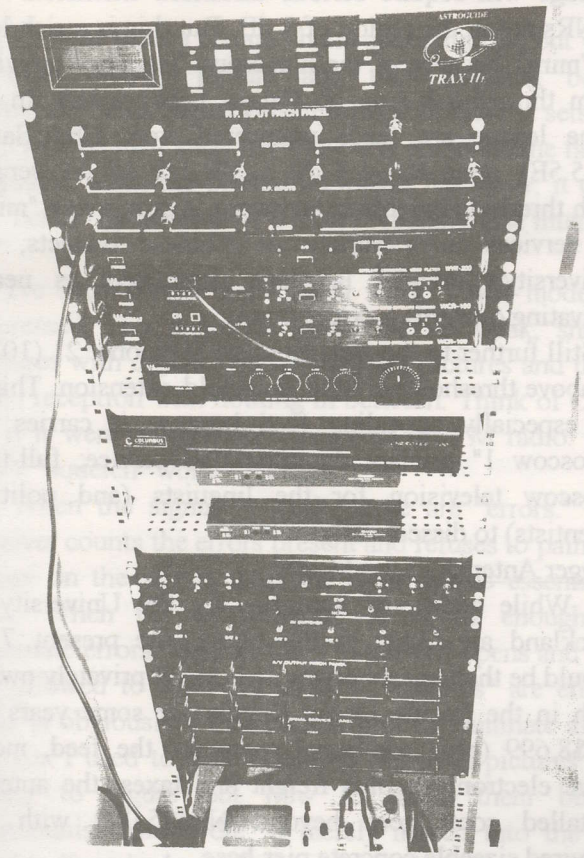

TISCO's Tony Dunnett with US domsat on screen

For electronics, the University opted for three receivers each equipped with variable bandwidth reduction. An ADL C + Ku band feed (the RP1-C & Ku) was selected because it allows independent selection of C or Ku band feed probes and for C band, right hand circular (RHC), left hand circular (LHC) or linear vertical and linear horizontal. With NTSC, PAL and SECAM format analogue signals anticipated, a number of standards converter units were included. The entire system design, overseen by the University's Brian Oliver, was skilfully assembled in a standard equipment rack with receiver and feed switching to allow either C or Ku band signals to be routed to any of the existing (or future expansion CDV) receivers. After reception, the signals are routed to a bank of PAL format industrial grade VCRs.

The initial University interest came from the language department with emphasis on Japanese, Chinese and Russian. To equip tomorrow's business and political leaders for a multi-lingual world, this department has for decades made use of films and recorded materials as a teaching aid. With access to real time or near real time foreign TV broadcasts, the language department has a new important tool to make language learning a much more immediate and relevant subject.




Brian Oliver's system plan for "near-space" monitoring system



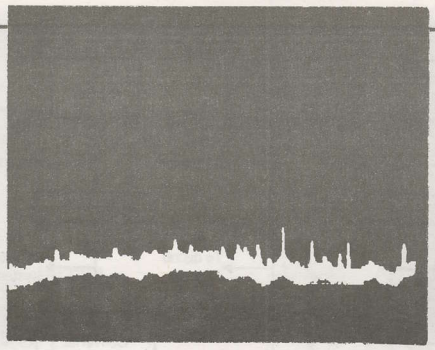
RECEIVING EQUIPMENT RACK for 7.3m "near space" system

With the aid of a "live" (constantly updated) programming schedule maintained in a computer programme, a master list of what is being transmitted by which source is reviewed weekly by an academic team. Decisions are made as to which programmes will be received and taped and where these tapes will be circulated within the University. Built into the system is a degree of "flexibility" to allow the dish taping to be directed to a single source in reaction to ever-changing international events. In this way a revolution in a Russian region, floods in China, or important economic changes in Germany or France can be "monitored" on a priority basis in addition to the routine scheduled taping. All of this makes the teaching of languages far more immediate and relevant to the students; real world language spotlighting real world events on a timely basis. As Lee Lubbers discovered more than a decade ago with American students, academic interest in languages takes on an entirely new, upbeat importance when the language conveys events as they happen rather than being relegated to events of the past.

System Design

The 7.3m dish, possibly only the first of several in years to come, had to be large enough to capture those very low level satellite signals beamed away from New Zealand towards boresights in the northern hemisphere. Here the University

Moscow "1"/Stationar 103E



Palapa B2P (113E)/Vertical

COURT TV/US Domsat C3 131W

reviewed the experience of others in New Zealand. Bryon Evans at Pacific Antennas (Whangaparoa), for example, agreed to move one of his 4m dishes to the low look angle western sky region to demonstrate reception from Russian satellites sitting in the 100E region. TISCO's Tony Dunnett, a devotee to weak signal satellite TV reception for a decade, researched the data bases for currently operating C band satellites, assembled a set of complete coverage maps for each satellite of interest and using his own computer programme extrapolated predicted signal levels for ChinaSat, Palapa, Gorizont, Rimsat and numerous other satellites including the American domsat (domestic satellites) located at the western end of the North American orbit belt.

The Orbitron 7.3m was chosen as a cost effective trade off between a more desirable 10m size dish and the need for maximum antenna gain. Dunnett's predictions suggested footprint levels from the north-pointing satellites as low as 12 dBw; well below the "threshold" for more commonly employed 3 to 5m antennas. Yes, a 10m (or even larger) would be "better" but there are both cost and mechanical considerations to weigh; the motorising of 10m antennas is seldom satisfactory for rapid movement of the dish from satellite to satellite (and costs escalate rapidly above the 7m plateau).

To "make up the difference" between the gain of a 7.3m and a 10m, the University's Brian Oliver (newly appointed Manager, Audio Visual Unit/ Satellite Receiving Station, Tamaki Campus) believed that rapid improvements in threshold extension technology could gain as much as a 3 dB C/NR improvement. The University is presently evaluating a number of threshold extension hardware devices.

Real World Performance

Winnersat receivers equipped with manually controlled bandwidth reduction showed the system is capable of quite dramatic "off boresight" reception. SatFACTS was on hand for demonstrations of reception ability using US domsats as a target. Photos shown here are without threshold extension, although the bandwidth was optimised for below threshold reception. As an example, Court TV reception (from TR6, the GE Americom US domestic satellite at 131W) is tattered but well within the C/NR range where a unit such as the Digitex could totally clean it up for University use. A nice "find" amongst the many US domsat transponders received is the German 24 hour Deutsche Welle service (TR5V, C4 at 135W). Even without threshold extension this one is close to threshold.

With the Clarke Orbit Belt tracking ability of the 7.3m, the large dish moves effortlessly from the American domsat belt at Auckland's eastern horizon to the thickly populated Asia service region between 120E and the dish's western horizon near 96E. Along the way the various Intelsat, PanAmSat, Rimsat transmissions pour through at well above threshold levels. At 113E now ageing Palapa B2P produces signals that on average will require serious threshold extension. The C/NRs are in the region of 3 dB. But this is a rich lode to "mine" because of the numerous "language" services from throughout Asia on Palapa transponders. In the same league are feeds uncovered from ChinaSat 5 (115.5E); none above 4 dB C/NR but all recoverable with threshold extension hardware. Again, a rich "mine" of services in a variety of Chinese dialects; the University's oriental language department is nearly salivating over this treasure trove.

Still further to the west Russian Statsionar 21 (103E) is above threshold without threshold extension. This is an especially appealing feed because it carries the "Moscow 1" primary domestic CIS service; full-time Moscow television for the linguists (and political scientists) to dissect daily.

Bigger Antenna - Less Money

While additional antennas for the University of Auckland are likely in the future, the present 7.3m should be the largest horizon to horizon privately owned dish in the Pacific Ocean Region for some years. At US$8,699 (plus additional costs for the feed, motor drive electronics), plus freight and taxes, the antenna installed soon goes beyond NZ$25,000 with the required sizeable concrete pier-base.

In the March issue of SatFACTS we will look at a unique 50 foot (!) dish built from concrete (!), and sitting on the ground near Colombo, Sri Lanka.

**Exploring The Edge Of Technology-**

# GI's DIGICIPHER DSR 1500 RECEIVER

*Part One of Two, by Coop*

A Mind Blowing Experience

I will "miss" analogue more than most. The first home TV I ever saw was in 1951 and it snaked through a huge wire rhombic antenna I had constructed at age 13 on our hillside lot near Ithaca in New York state. The TV station was 95 miles away, low in power, and several times each evening as the "conditions" came and went the alarm sounded. My entire family would gather around the 7" Hallicrafters TV set connected through home-built 6AK5 (that's a tube type) signal boosters as an early day American TV "star" drifted through the snow long enough for us to "watch" perhaps 15 minutes of TV before the picture faded out for 30 minutes or more. In the ensuing 43 years I have made a career of watching, writing about and building equipment for TV reception. Without fear of challenge, it is my belief I have personally watched more "snowy" TV reception than any other living human.

And it was all analogue; and I will miss it.

There has been a certain charm about starting out with a weak, snowy picture and then building better antennas, better signal preamplifiers, better TV sets to step by step melt away the snow and eliminate the fades. Actually, when the picture no longer has snow, it can't be "better" by technology tricks, I typically lose interest.

I've seen compressed digital work. I was modestly impressed. But annoyed. There are no weak, snowy pictures with digital. There is perfect pictures and there is no reception with nothing in between. Think of CDV as if it were a "squelch" circuit on an FM radio. The CDV "squelch" works like this:

When the signal is weak, there are "errors." The receiver counts the errors present and refuses to paint an image on the screen until the error rate is essentially zero. When the CDV signal is strong enough to eliminate errors, then the CDV "squelch" opens and you are allowed to view the image. "Sparklies" are errors. This is obviously a Communist plot to eliminate all of the fun I used to have watching degraded pictures and trying to figure out how to make them better. Communism didn't die; it merely moved into the TV world. Everybody will now have the same, "perfect quality" TV, or no TV. It's the kind of TV Karl Marx would have designed, all the same, or, none at all!

And so this box from San Diego appears on my doorstep. I know what's inside because for the last three weeks a stack of Faxes have flown back and forth through New Zealand firm Maser Technology, television station ABS-CBN in Manila and myself arranging for a "loan" of a Digicipher DSR 1500 receiver.

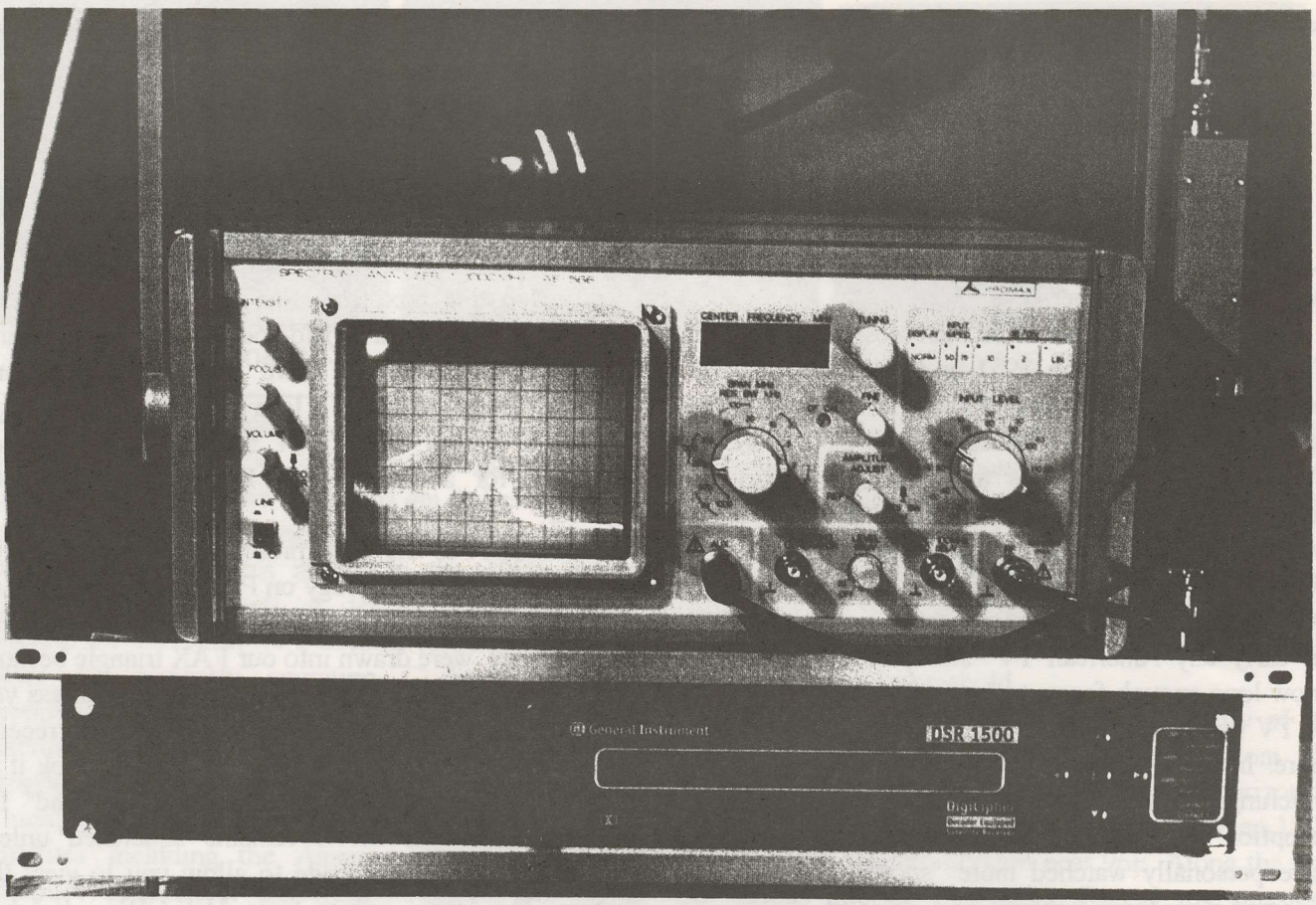
ABS-CBN is the only present day user of the GI Digicipher CDV technology on PAS-2. CTN and CMT are using the competitive Scientific Atlanta MPEG format. They were drawn into our FAX triangle because possessing a DSR 1500 receiver is worthless unless you have a programmer who will "authorise" you to receive their programmes. You can't buy a receiver, hook it to your LNB / antenna and "tune across the band" for pictures because the receiver remains "squelched" unless it is told by electronic code to allow you to view the picture. The "code" comes from ABS-CBN. If I had elected CTN or CMT for this test the receiver would have to be a Scientific Atlanta ("D9222") model because the receiver you use must also "match" the CDV format being transmitted.

The DSR 1500

This is a "commercial receiver/decoder." There are 50 carefully worded pages in the instruction manual and it would be to your advantage to have a few years of computer programming under your belt before you plug this device into the AC outlet (100 to 230 VAC, 47-63 hertz). A hearty breakfast is also recommended; the rack mounting unit weighs 6.6kg (19 lbs).

The 1500 is a triple threat receiver: Analogue FM ("in the clear") video, Videocipher II analogue encrypted video, and Digicipher (MPEG 1.5 range format) compressed digital video. It accepts input from your LNB in the standard (L band) 950-1450 MHz range which makes it C or Ku compatible. The receiver's internal IF is centred at 402.78 MHz (a number chosen perhaps after a lottery at GI); yes, that is a unique IF number. There are twin IF inputs (Port 0 and Port 1) so you can connect separate feeds from twin LNBs such as you might use in a commercial PAS-2 installation (one for horizontal, one for vertical).

The receiver has user definable software through a keyboard on the front panel. You must tell the receiver which transponder "band plan" you wish to tune by




General Instrument DSR 1500 Digicipher (at bottom); on Promax Analyser, ABS-CBN signal.

loading the memory with appropriate "IF" numbers. For example, the L band input for CNNI on PAS-2 is 1184 MHz. GI ships the receiver with 12 "band plans" in memory; satellites such as G-Star, K-2, Spacenet 3 .... alas, not PAS-2. Nor Intelsat. But not to worry, there is room in the memory for three user defined "band plans" and while you may be faster than we were in reprogramming PAS-2 (and Intelsat and Optus B1) into the "spare memory" positions, in an hour we had the task done.

The receiver uses a liquid crystal display (LCD) on the front panel and a strict, structured set of rules for programme memory loading. Some displays have sub-displays which we found initially tricky to enter, but essential to get the receiver "ready" for PAS-2.

Through the front panel programming, and the road map on the LCD, there is almost nothing within the receiver that is beyond change. Or erasure if you screw up.

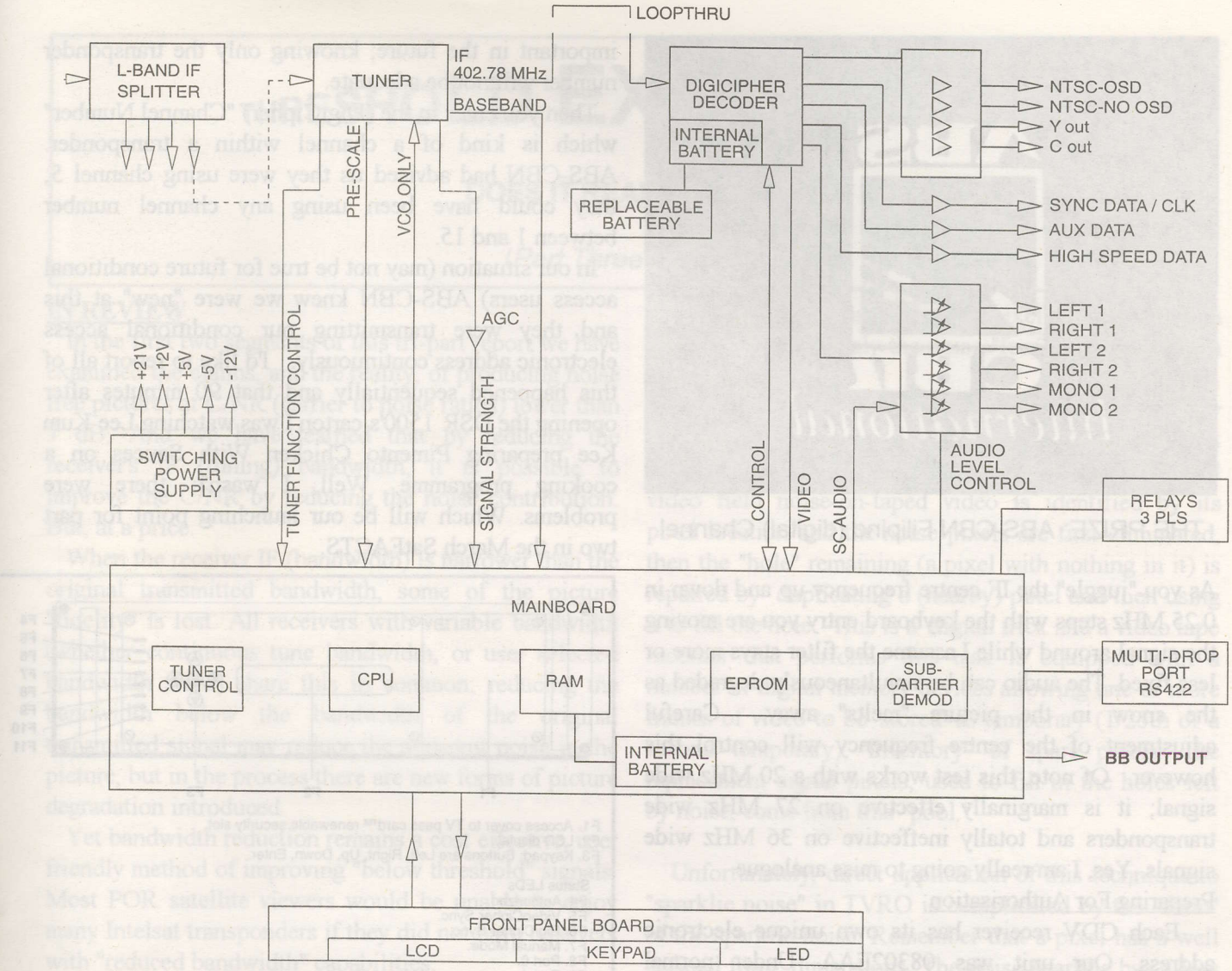
The Analogue Function

The presently available Digicipher (1) format receivers are unfortunately only designed to process NTSC signals in Digicipher format. In old fashioned analogue, the receiver doesn't really care whether the programme is NTSC, PAL or even SECAM. If you use it with a standards converter (or multi-format receiver), you won't care either.

After entering in the L band (IF) frequencies for Intelsat, we familiarised ourselves with the many reprogrammable receiver functions on Intelsat 180E. You'll see why we didn't jump right into the ABS-CBN feed shortly.

One of the interesting software routines is receiver bandwidth. With all of the interest in analogue Threshold Extension these days, we began with an "A" (Winnersat variable IF bandwidth), "B" (Cherokee Threshold Extension) and "C" (DSR 1500) comparison. First we looked at the video quality using the I180E CNNI signal since it is well above threshold on all three receivers. This is a "trust us" test as we report the picture quality of the DSR 1500 was an easy best of the group. The edges of lettering, the crispness of the colour, the stability of the often taxing text generated over video was simply "commercial quality" on the DSR 1500, and varying degrees of "amateur quality" on the "A" and "B" units. Well, for US$1,500 you'd expect this in a cable TV receiver.

Then we did a transponder by transponder comparison using each of the (many) video sources on I180E; all 3 receivers tuned to the same transponder at the same time. On the really weak (below threshold) services, such as the CNBC/NBC feed on 3,876 MHz (IF 1274) we found the DSR 1500 a poor second to either the




DSR 1500 block diagram over simplifies triple threat ability of this highly advanced instrument

Winnersat or Cherokee when we were in the 31 MHz (IF) bandwidth position. In the 1500's 27 MHz bandwidth, the DSR 1500 was still worse but the margin narrowed. Having said that, the quality of the video, while having more sparklies, was now actually better than the other two.

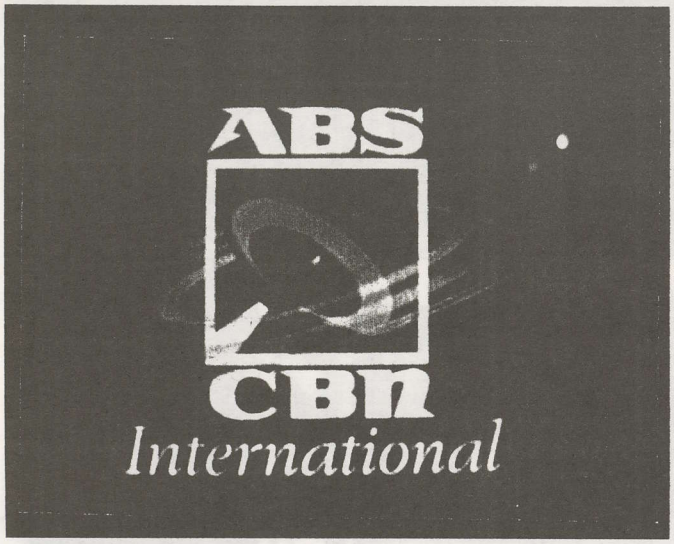
There is one more IF bandwidth position with the 1500 labelled "TI." That stands for terrestrial interference (filtering) which is something very few of us in the POR will ever experience. In North America, terrestrial microwave networks "share" the 3,700 - 4,200 MHz range for point to point TV and telephone relay. Often, these "terrestrial" signals cause significant interference to C band satellite reception. Modern US built receivers include a "TI" filter which allows the receiver to "notch" (selectively eliminate) the terrestrial signals. At the same time, a new, narrowed IF passband is created.

The "TI" filter option was there so we tried it. Hummm. The picture was instantly better; as good as the Winnersat and Cherokee. But there was something else to now try; varying the receiver's centre frequency point. The 1500 gives you 0.25 (quarter) MHz "steps" to reposition where the L band input is centred. With the receiver in the "TI" filter mode, we bumped the tuning up and down in quarter megahertz steps while watching the picture. Suddenly the image threshold improved dramatically. No question about it; in the TI filter position and by doing some really fine tuning, you could snap the IDB test card out of the noise as if you were using sophisticated threshold extension. Once you find this "combination" everything stays locked away in the receiver's memory for recall.

Curious how the TI filter is intended to function we found a brief reference in the manual:

*"Note: Use of the TI filter requires a good overall signal level. (The TI requires C/N of 12 dB or higher). Use of the filter with moderate to low signal will result in loss of video and audio."*

Wrong. The last thing the IDB test signal is is "*a good overall signal level.*" A 12 dB C/NR signal would be at least 4 dB above threshold; it starts out in the 31 MHz bandwidth closer to 4 dB C/NR, or 8 dB below the GI recommended minimum. There is a downside, however.




THE PRIZE: ABS-CBN Filipino (digital) Channel

As you "juggle" the IF centre frequency up and down in 0.25 MHz steps with the keyboard entry you are moving the signal around while I assume the filter stays more or less fixed. The audio can be simultaneously degraded as the snow in the picture "melts" away. Careful adjustment of the centre frequency will control this however. Of note, this test works with a 20 MHz wide signal; it is marginally effective on 27 MHz wide transponders and totally ineffective on 36 MHz wide signals. Yes, I am really going to miss analogue.

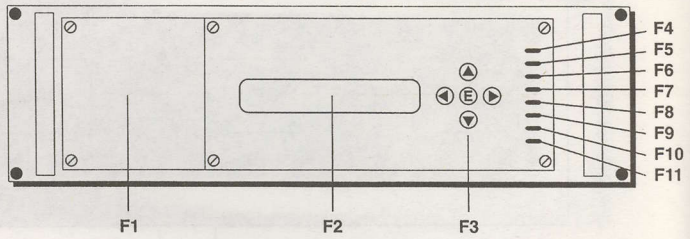
Preparing For Authorisation

Each CDV receiver has its own unique electronic address. Our unit was 08302EAA. Under normal circumstances, the receiver owner or an agent for same would arrange for "conditional access" to the programming. In the case of ABS-CBN this involves agreeing to pay them a fee (more about that next month) and arranging payment; and, giving them your "electronic address."

Then you tune your receiver to the transponder of the service (ABS-CBN is TR14 on PAS-2) having previously entered in the correct "band plan" to the receiver. Now, because each transponder is capable of containing perhaps 15 separate TV programmes, you must also tell the receiver (with the keyboard) which "programme channel" you are authorised to view. The actual ABS-CBN downlink frequency within TR14 is 4,087 MHz (IF of 1,063) and in our case we wanted to be "spot on" the centre of their signal so had entered that frequency into the receiver. Normally, the centre frequency for TR14 would be 4,100 but ABS-CBN (like most PAS-2 users) has room within the transponder to "offset" their operating frequency and leave room for future expansion of their services. Knowing the precise downlink frequency will be very important in the future; knowing only the transponder number will not be adequate.

Then you enter in the (DigiCipher) "Channel Number" which is kind of a channel within a transponder. ABS-CBN had advised us they were using channel 5; they could have been using any channel number between 1 and 15.

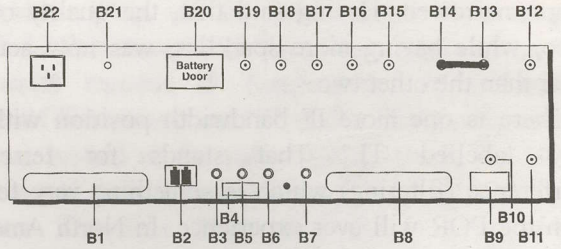
In our situation (may not be true for future conditional access users) ABS-CBN knew we were "new" at this and they were transmitting our conditional access electronic address continuously. I'd like to report all of this happened sequentially and that 90 minutes after opening the DSR 1500's carton I was watching Lee Kum Kee preparing Pimento Chicken With Sauces on a cooking programme. Well, I wasn't; there were problems. Which will be our launching point for part two in the March SatFACTS.




F1. Access cover to TV pass card™ renewable security slot.
F2. LCD display.
F3. Keypad: Buttons are Left, Right, Up, Down, Enter.

Status LEDs
F4. Authorized.
F5. VideoCipher Sync.
F6. DigiCipher Sync.
F7. Manual Mode.
F8. Port 0.
F9. Port 1.
F10. Contact 0 Energized.
F11. Contact 1 Energized.

ABOVE: DSR 1500 front panel controls
BELOW: Rear panel connections, data points




B1. Data and relay quick disconnect screw terminals
B2. Remote for PC network only.
B3. Video (Y out)
B4. Unit Address label
B5. Video (C out)
B6. Video (NTSC OSD)
B7. Video (NTSC NO OSD)
B8. Audio quick disconnect screw terminal.
B9. Unit Serial Number label.
B10. BB Output
B11. Tuner input port 1.
B12. Tuner input port 0.
B13. IF loop out.
B14. IF loop in.
B15. L Band splitter output 4.
B16. L Band splitter output 3.
B17. L Band splitter input.
B18. L Band splitter output 2.
B19. L Band splitter output 1.
B20. Battery access.
B21. Circuit breaker.
B22. Universal power input 100-250VAC (47Hz-63Hz)

DATA AND RELAY QUICK DISCONNECT SCREW TERMINALS (B1)

| Summary Alarm | | | Relay 0 | | | Relay 1 | | | Aux. Data | | | Sync. Data | | | HS Data | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |

Alarm
1. Relay 0 N/0
2. Relay 0 COM
3. N/C
Relay 0
4. Relay 0 N/0
5. Relay 0 COM
6. Relay Ø N/C
Relay 1
7. Relay 1 N/0
8. Relay 1 Comm
9. Relay 1 N/C
10. Aux
11. Aux
12. Aux Data GND
13. TX
14. TX
15. CLK
16. CLK
17. HS Data GND
18. HS Data +
19. HS Data -

AUDIO QUICK DISCONNECT SCREW TERMINAL (B7)

| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

1. LEFT 1 GND
2. LEFT 1-
3. LEFT 1+
4. MONO 1 GND
5. MONO 1-
6. MONO 1+
7. RIGHT 1 GND
8. RIGHT 1-
9. RIGHT 1+
10. LEFT 2 GND
11. LEFT 2-
12. LEFT 2+
13. MONO 2 GND
14. MONO 2-
15. MONO 2+
16. RIGHT 2 GND
17. RIGHT 2-
18. RIGHT 2+

# THRESHOLD EXTENSION

## DOES IT REALLY WORK?

*(Part Three of Three)*

**IN REVIEW**

In the first two segments of this tri-part report we have examined the claims, and the reality, of producing noise free pictures at C/NR (carrier to noise ratios) lower than 7 dB. And we have learned that by reducing the receiver's IF (tuning) bandwidth, it is possible to improve the C/NR by reducing the noise contribution. But, at a price.

When the receiver IF (bandwidth) is narrower than the original transmitted bandwidth, some of the picture "fidelity" is lost. All receivers with variable bandwidth (whether continuous tune bandwidth, or user selected bandwidth steps) share this in common; reducing the bandwidth below the bandwidth of the original transmitted signal may reduce the apparent noise in the picture, but in the process there are new forms of picture degradation introduced.

Yet bandwidth reduction remains a cost effective, user friendly method of improving "below threshold" signals. Most POR satellite viewers would be unable to enjoy many Intelsat transponders if they did not have receivers with "reduced bandwidth" capabilities.

To retain the original fidelity of the transmitted bandwidth and to not introduce new forms of picture degradation created by bandwidth reduction, the receiver's IF bandwidth must "mirror" the bandwidth of the transmitted signal.

As SF No. 4 (December 15) illustrated, "sparklie noise" (the term given to any noise in an analogue satellite TV picture) is completely random in occurrence. Each picture frame contains one complete image and by transmitting successive frames very rapidly (a new frame every 1/25th of a second with PAL; every 1/30th of a second with NTSC) television creates the illusion of motion. When a signal is "at or above threshold" each pixel (element in a frame of which there are hundreds of thousands) on the screen is painted there by a voltage which corresponds to the original voltage seen by the TV camera at the opposite end of the circuit. When a signal is below threshold, some of these pixels of signal voltage have been "lost" in the transmission - reception system and are replaced by the noise which always exists in a receiver system.

A pixel of signal voltage has a carefully structured form. Because hundreds of thousands of pixels must fit together to form a complete picture, each pixel has the same "dimensions" as every other pixel. Noise also has a form but unfortunately the noise "form" does not match the pixel form.

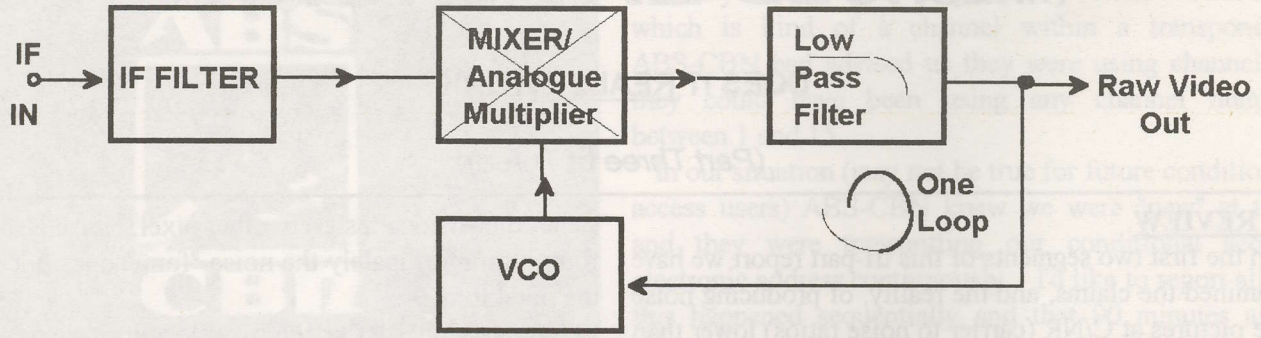
A frame with 10% of the pixel locations disrupted by noise is approximately equivalent to a C/NR of 6 dB when the receiver threshold is 7 dB. In the professional video field noise-on-taped video is identified by its pixel location and the noise pixels are first eliminated, then the "hole" remaining (a pixel with nothing in it) is repaired by duplicating a (nearby) pixel and then using it to fill the hole. This is a digital trick and a video tape recorder that performs this task is equipped with a number of digital memory devices allowing one or more frames of video to be 'stored' as temporary (1/25th of a second temporary) "inventory" of spare pixels. The replacement signal pixels, used to fill in the holes left by noise, come from this "pool."

Unfortunately, direct application of this technique to "sparklie noise" in TVRO is complicated by the "form" of the sparklie noise. Remember that a pixel has a well defined form; dimensions. The noise sparklie has a less well defined form (dimensions) but generally speaking a single sparklie is (on close examination) more like a 'tear drop' than the perfectly round pixel it has destroyed. The tear drop form of the sparklie includes a "tail" not unlike a comet's tail. It is the form or shape of the sparklie which allowed one European firm to create a device that is revolutionising the way we think of "threshold extension."

**The NTi System**

NTi is a German firm (*) using technology first considered in the UK (in 1987) by Multipoint, which was perhaps the first company to carefully analyse just what a sparklie (noise bit) really looks like. Unlike the noise one finds in video tape work, where a noise bit closely resembles a picture bit (in pixel shape and size), they found the sparklie noise was actually being enhanced (made larger and a tail was being added) with the common phase lock loop (PLL) demodulator found in virtually all TVRO (satellite video) receivers. The PLL approach to video demodulation originated with another English TVRO developer; Stephen Birkill. He,

**Conventional PLL Demodulator Block Diagram**




in 1978, found that enhanced performance with PLLs made pictures below the threshold appear less noisy and the majority of the satellite receiver world adopted his technique shortly thereafter.

As **Rudolf Ille**, Director of Engineering for NTi explains:

*"A PLL demodulator requires a presence of at least some signal to 'track'* (respond) *to the FM signal present. When a noisy segment appears in the transmission, the PLL very briefly loses 'tracking' (lock). This interruption is made of two parts:*

*The period of the initial noise bit (sparklie).*

*The 'tail effect' of the sparklie.*

*"If the tail could be eliminated, the PLL demodulator will recover faster. This does two things:*

*The PLL re-locks sooner.*

*The picture returns to normal (pixel) presentation sooner."*

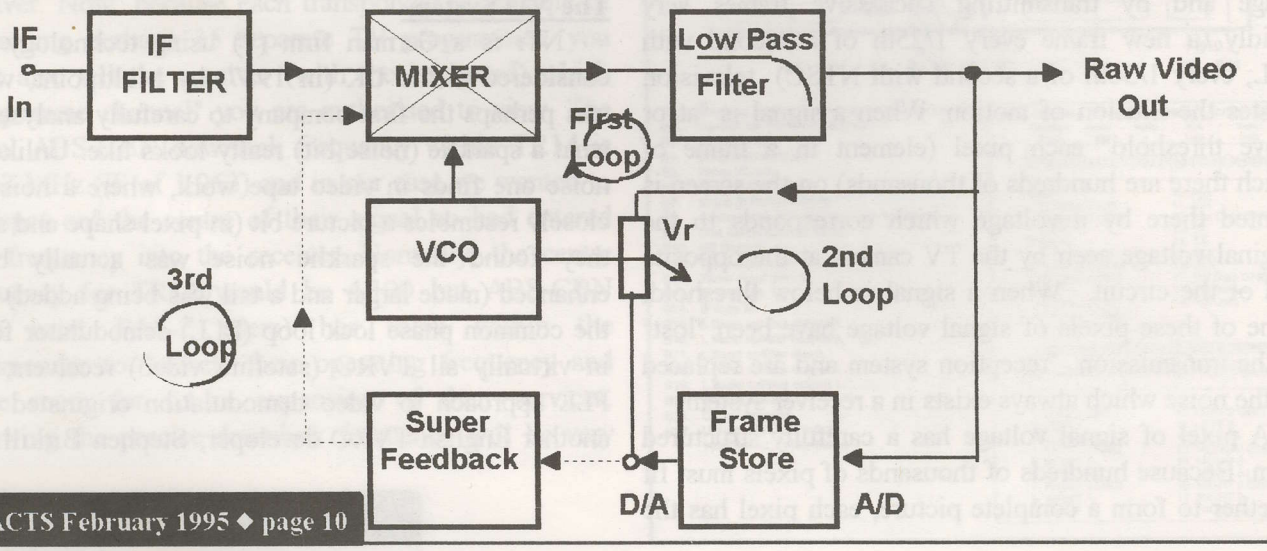
The Digitex attacks the time constant of the sparklie (noise) bit by allowing the receiver's PLL to recover more rapidly. Ille again:

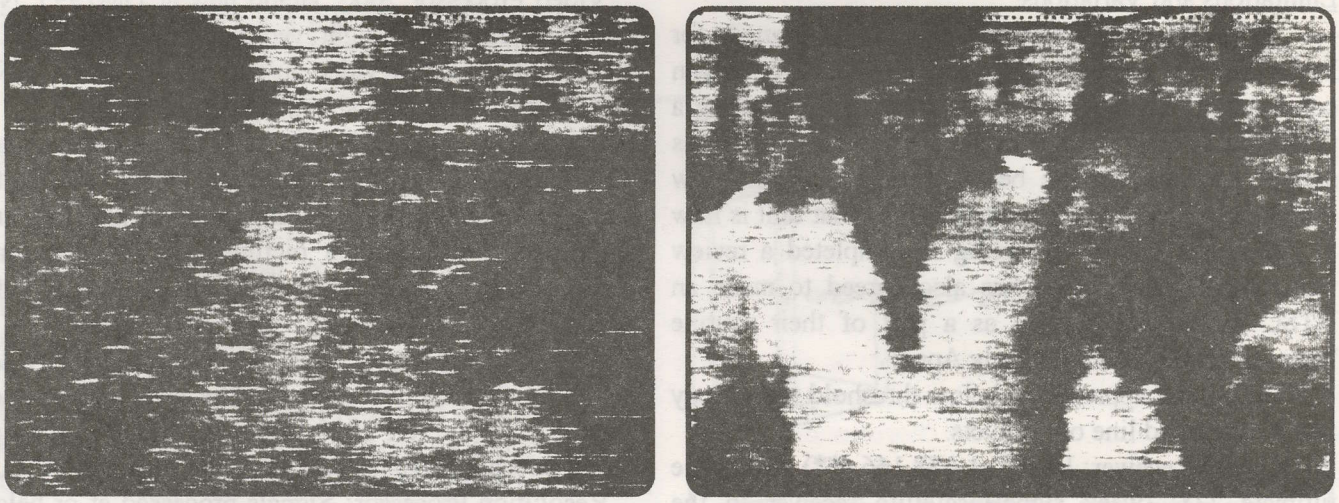
*"Sparklies no longer appear as bright 'dots' on the screen. Now the noise appears as a small, far less objectionable, grey line even with the receiver operating below threshold."*

A pair of block diagrams here show how the Digitex approach is at variance with conventional receivers. The "Super Feedback" network forces the signal to reappear in the video stream after it has been processed which effectively cancels the tail on the sparklie. The net effect is that rather than appearing as a sizeable bright dot, the sparklie appears as an almost harmless short grey line. At this point we have retained the original bandwidth (i.e., not lost any picture 'fidelity') and by changing the time element of the noise the bright-dot-sparklie has become a thin, grey line. And that works with signals with a C/NR down to approximately 4 dB. Note in the block diagrams that loop one is the standard PLL feedback circuit, loop two is the threshold extension circuit that changes the shape of the sparklies.

For signals between approximately 2 dB C/NR and 4 dB C/NR, there is loop three. Now the Digitex adopts a digital processing approach using an A/D (analogue to digital) converter to recover the frame in digital form.

**DIGITEX Threshold Extension Block Diagram**





"...buried in noise." A signal with C/NR near 2 dB (left) is partially reclaimed with aid of Digitex (right).

Here the signal is reprocessed a third time and after being reconverted in a D/A (digital to analogue) converter, re-entered to the mixer.

The combination of these elements overcomes problems inherent with all single-loop PLL systems: Colour smearing and tearing edges on below threshold signals as the "speed" of the phase-lock loop slows down from the feedback.

Where It Goes

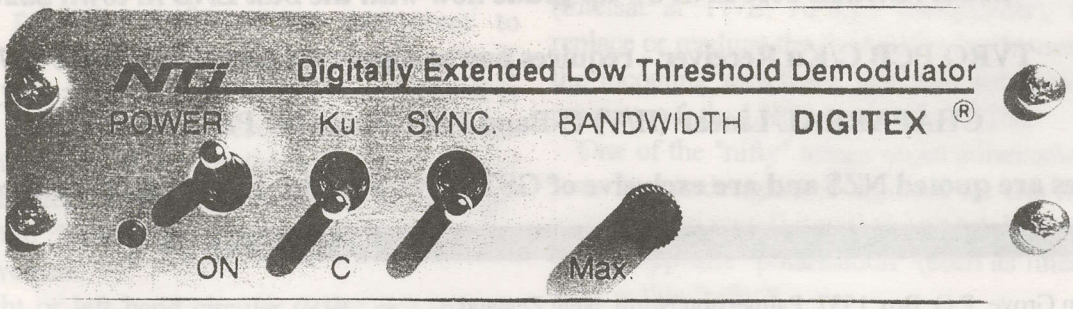
The Digitex is available with either a 140 MHz or 479.5 MHz IF input. The 140 MHz satisfies many of the Drake (ESR700e et al) receivers while the 479.5 MHz works with Echostar (LT730, SR8700) receivers.

Ille urges users to select the best basic receiver possible and favours the Echostar units because they have about the best (Sharp brand) tuner on the market. To add the Digitex requires that you get to the IF "line" in the receiver. Where there is an IF "loop" on the back deck, this is simply a matter of plugging the two together. In the case of the Echostar units, a coupling capacitor (10pF) is added to bring "out" the 479.5 MHz signal to a new chassis mount F fitting placed on the rear deck. Once you enter the Digitex from the receiver, all final signal processing takes place here and your video output (to monitor, modulator) comes from the Digitex. The audio must follow the standard receiver route.

Note: A 70 MHz input version is scheduled for late March and will function by converting the 70 MHz receiver supplied IF signal in an 'upconverter' to produce the desired 479.5 MHz input to the Digitex. Also scheduled for March is a below threshold audio processing system.

Technical writer and contributing editor Christian Mass of Europe's **TELE-satellit** magazine tested one of the units for SatFACTS and wrote:

*"The Digitex is a much better solution to below threshold signals than receivers with a built-in TED system. Where in TED receivers the colour information tends to tear and lose stability, the only artefact with the Digitex is a slight loss in brilliance. The hard to handle saturated colours have no adverse effects on the picture quality with the Digitex although in the most severe (<4 dB C/NR) conditions the on screen graphics such as titling may be slightly impaired by the unit."* The Digitex, possibly not yet widely available in the POR, is advertised in Germany at DM1698; approximately A$2,100 (**).




DIGITEX PROCESSOR: Note bandwidth control. On rear, in/out, powering and level adjust

Limitations and Variations

The original Digitex unit was designed for PAL/SECAM at 625 lines. SatFACTS began conversations with NTi and was successful in having a prototype NTSC version created. Our reasoning was simply that most of the below threshold signals now available to the POR are in fact NTSC. That unit is now in our hands and when testing is completed a review will be published. NTi has also agreed to make an NTSC compatible version as a part of their routine 'series 3' line (late March, early April).

NTi's unique approach to below threshold technology involves a broad line of products.

RX 2000 Receiver: Priced at A$8,166 (**), this is the ultimate 'DX' (weak signal) satellite receiver in the world today. It processes NTSC, SECAM or PAL and takes a totally unique approach to processing weak signals.

**1)** Signals are 'taken apart' and reduced to their original 'colour camera' component parts; r-y, b-y, and y. Each of the three picture elements is individually processed as digital data.

**2)** The picture-stability sync signals are recreated within the receiver to eliminate jitters.

**3)** The signal is returned, after processing, to analogue form.

Video Processor 2000: Brand new at DM2995, NTi describes this as a "light version" of the RX 2000. PAL/NTSC/SECAM video in/out, claims video S/NR gain of up to 11.7 dB using adaptive filtering.

Dorsy: This (A$1,609) unit goes after a receiver as a video input / output clean up device. Dorsy uses digital frame store to identify and eliminate sparklie bits and replace them with similar picture bits from the same frame. A real "ultimate" system would use the RX 2000 plus Dorsy as a package; PAL and SECAM only.

Synchron Processor: This device goes at the video output of the receiver and uses the sync regeneration circuits from the RX 2000 to remove picture jitters on below threshold signals. A$1,225, PAL and SECAM.

Resolution Processor: Signals processed at or below threshold may suffer some 'crispness loss.' Users with big-screen projection sets, in particular, see the artefacts of processing (no matter how well controlled) blown up in size. This unit resurrects the picture detail by redefining the vertical lines and edges (such as the edge of a human face). Price is A$848, PAL, SECAM and NTSC.

* / NTi, Dinkelbergstrasse 10, D-79540, Loerrach, Germany FAX 49-7621-18840 (Rudolf Ille).

** / The Satellite Shop, PO Box 3181, Nerang East 4211, Australia Phone/FAX 61-75-960-962.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# The SATELLITE novice

POLARISATION: Why Is PAS-2 Different?

Terrestrial television is transmitted with one of two "polarisations"; vertical or horizontal. With vertical polarisation the signal leaves the transmitting antenna straight up and down, like a straight tree stands "vertically" with respect to the earth. Take your index finger and place it between your eyes centred over and touching the bridge of your nose. Without changing the position of your index finger extend your arm straight out in front of you. Your straight up and down finger represents a vertically polarised wave. Now take the index finger and place it straight across your eye balls, again touching the bridge of your nose. Extend you arm, holding your finger in the same position. This represents horizontally polarised signals.

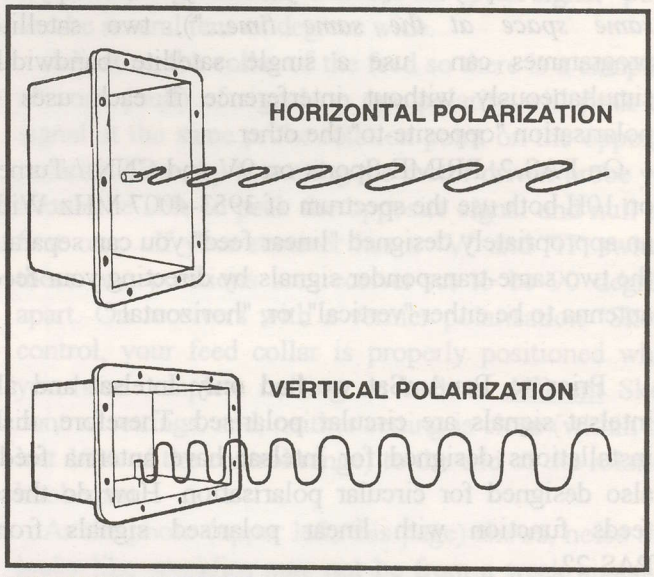
Satellites employ vertical and horizontal polarisation; the signals travel in a format identical to your vertical or horizontal finger. They also employ something called circular polarisation. Visualise a spring of wire continuously wound on itself, like the "Slinky Toy" of your youth. If you take your finger and trace the "windings" of the spring, the turns will "rotate" either in a clockwise direction or a counter clockwise direction; these are the only two choices. A spring wound such that the turns rotate clockwise to you is called "right hand rotation" while a spring wound counter-clockwise is called left hand rotation.

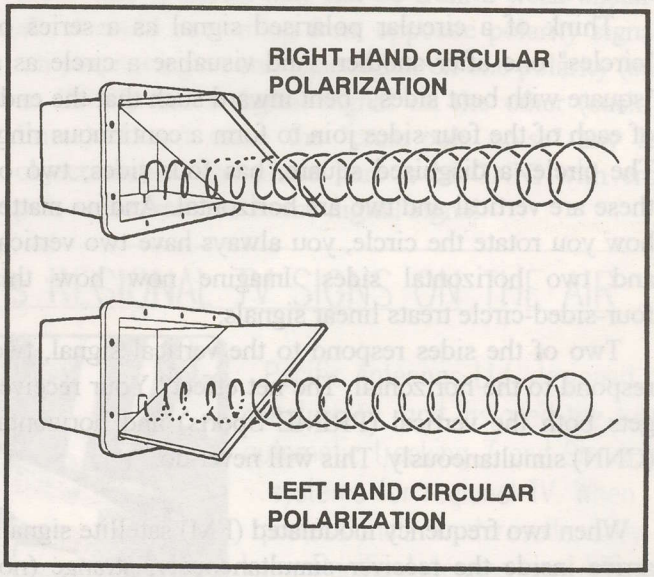
The type of polarisation is determined by the satellite's design. Intelsat birds commonly employ right or left hand "circular" (means the same as rotation) as do most Russian (C band) satellites. Most others employ "linear" (means vertical, horizontal or both) polarisation. They key point for you to focus upon is your receive "antenna" must have the same polarisation design as the incoming wavefront from the satellite if you are going to "catch" the maximum amount of signal for your receiver.

The parabolic "reflector" is transparent to polarisation; it does not care. However, the "real" antenna in your system is not the reflector; rather it is the "probe" or short bar (or piece of wire) seen inside of the feedhorn located at your dish focal point. One of the necessary steps in any dish installation is to "align" (position) the "probe" so it matches the incoming satellite wavefront.

With right or left hand circular (RHC or LHC) no real feed rotational positioning is required; the probe is designed to respond to a "Slinky Toy" waveform, which is a continuously "wound" circle. A circle is a circle is a circle; it's difficult to get this one wrong. However, a probe designed for right hand (RHC) will be totally "backwards" for a signal that is Left hand (LHC) so if you move your dish from a satellite with predominantly RHC (Intelsat 180E) to one with signals that are LHC (Intelsat at 177E; AFRTS transponder), unless you replace or readjust the feed probe for the new "twist" of the incoming wavefront, you will not even notice the presence of the LHC signal (of AFRTS).

One of the "nifty" things about polarisation is that if your feed is designed or adjusted for one format (such as linear horizontal) it will almost totally ignore signals on the opposite "polarisation" (such as linear vertical). Why is this "nifty?"



Because of the near total isolation between signals of opposite polarisations, the satellite operator is able to double up on his transmissions. Quite contrary to a basic law of physics (*"two objects may not occupy the same space at the same time..."*), two satellite programmes can use a single satellite bandwidth simultaneously without interference if each uses a polarisation "opposite-to" the other.

On PAS-2, PRIME Sports on 9V and CNN / Turner on 10H both use the spectrum of 3953-4007 MHz. With an appropriately designed "linear feed" you can separate the two same-transponder signals by directing your feed antenna to be either "vertical", or, "horizontal."

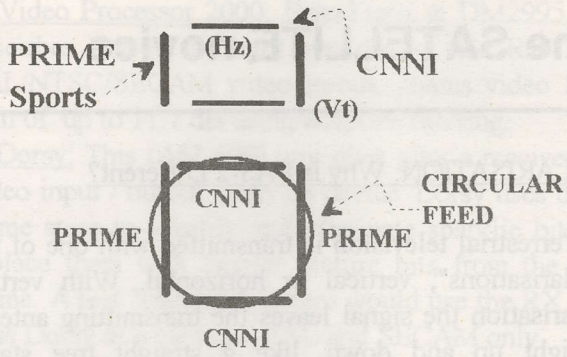
Prior to PanAmSat we had only Intelsat and all Intelsat signals are circular polarised. Therefore, dish installations designed for Intelsat have antenna feeds also designed for circular polarisation. How do these feeds function with linear polarised signals from PAS-2?

Think of a circular polarised signal as a series of "circles" one after another. And visualise a circle as a "square with bent sides;" bent inward such that the ends of each of the four sides join to form a continuous ring. The circle, a disguised square, has four sides; two of these are vertical and two are horizontal. And no matter how you rotate the circle, you always have two vertical and two horizontal sides. Imagine now how this four-sided-circle treats linear signals.

Two of the sides respond to the vertical signal, two respond to the horizontal. The net effect? Your receiver gets both the vertical (PRIME Sports) and horizontal (CNN) simultaneously. This will never do.

When two frequency modulated (FM) satellite signals arrive inside the receiver simultaneously, strange (not desirable) things happen. In the very best case, if one is stronger than the other, you will be able to "fine tune" the receiver to partially (but not completely) eliminate the "other" one. Unlike terrestrial TV where, when you have two signals on the same terrestrial channel at the same time you have 'beat bars' on the screen; with satellite and FM you get some signal from both, and lots of noise from both. The effect is a noisy picture that to the untrained eye looks like a weak signal; i.e., a below threshold signal.

Now it happens that while PRIME Sports and CNN both occupy the same 3953-4007 MHz "bandwidth" they do not do so "in balance." Prime is a MCPC signal 27 MHz wide; CNN is an analogue signal (27 MHz wide) plus a pair of MCPC "data streams." The receiver simply cannot cope with this mixture of analogue, CDV and "cross-pole" (signals from opposite polarities) and you see lots of sparklies and perhaps a drifting frame bar against the desired signal.



**PRIME and CNNI occupy same 3953-4007 bandwidth**

The solution is a linear polarised feed; one that allows you to remotely reposition the "probe antenna" at the feed to favour vertical, or horizontal. When you are peaked for PRIME Sports (vertical), the probe "discriminates" against the unwanted CNN analogue and CDV information by 30 dB. That's a bunch, considering that in most installations the PRIME Sports signal will have a signal level only 8 to 10 dB "above threshold" (the noise). In effect, with 30 dB of "polarity discrimination" the unwanted signal from the opposite polarity is 20 dB "below" your receiver's noise level. That's enough.

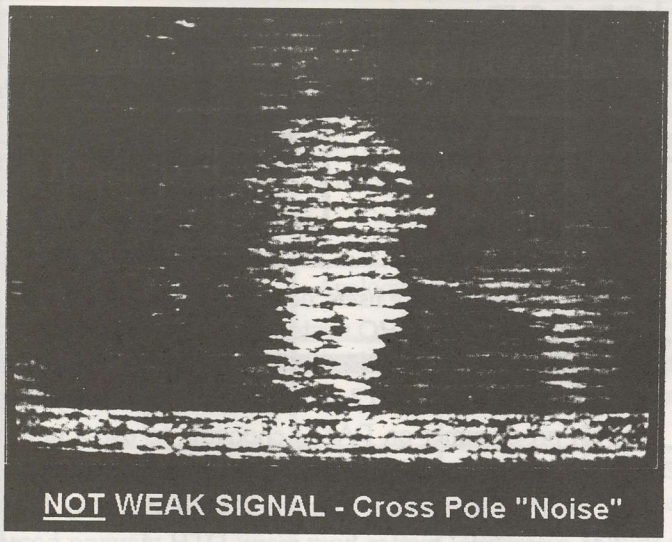
OK, so PAS-2 requires a linear feed and .... Intelsat requires a circular feed. Can you have both at the same time; a "feed" that can select between vertical, horizontal, and, circular? If a dish is to be used back and forth between Intelsat or Rimsat, and, PAS-2, running out of doors to mess with the feed is not an acceptable solution

There are such feeds out there. ADL, for example, has their model RP1 CP400-CKu which not only does all of these wondrous things, but it also functions on both C and Ku bands. Not an easy trick. Chaparral has their model Corotor II (Plus Wideband) which does essentially the same thing for C band.

If you are installing dishes for only PAS-2, you can get by perfectly with only the linear feeds. They are in two basic packages:

**1)** Equipped with a "Polarotor (**tm**)" or remote probe positioning device you control from a switch on the receiver;

**2)** Designed to receive vertical and horizontal simultaneously. These have a pair of flanges or ports on the feed housing and to each you bolt on an LNB. One of the ports receives the vertical channels, the other only the horizontal. After running two separate pieces of coaxial cable into the house or motel, you can then connect up one or more receivers to each line and have full-time simultaneous reception from both polarities.



NOT WEAK SIGNAL - Cross Pole "Noise"

A feed with a motor driven probe typically has a rotation "arc" of between 110 and 150 degrees; it does not cover a full circle. To switch from vertical to horizontal requires only a 90 degree swing. Even with a spectrum analyser, making the initial (at time of installation) feed adjustment to ensure peak performance on both polarisations is difficult. Unless you install for "null" rather than "peak" signal.

The feed's minimum signal (the "null") occurs when the position of the probe is 90 degrees off of the desired signal. This is a very sharp point, and as you initially rotate the collar of the feed while watching a signal, you will see there is a very small area where the signal goes completely away. This "null point" is only a few (physical) degrees wide whereas the "peak signal" point can be several tens of degrees wide.

Adjusting the collar of the feed so there is a complete absence (null) of signal on one polarity will peak the signal at the same probe rotation point on the opposite polarity. Now, by activating the motor driven probe you should be able to peak the opposite signal and null the first one. If your receiver has a "V" and "H" switch, these two positions are receiver-set to be 90 degrees apart. On receivers with a vernier polarisation "Skew" control, your feed collar is properly positioned when you have complete nulling on both at different Skew control settings, and, neither setting is close (within the last 10% of the control range) to the end of the rotation knob span.

As the photo (upper left, this page) shows, noise that looks like sparklies may not be from a weak signal at all; it could be coming from opposite polarity signals! Oh yes, having an analogue signal on one polarity (such as CNNI) and a digital signal on the other (such as Prime) doesn't make the "cross-pole noise" any less objectionable. The photo here is of CNNI with cross pole noise from the Prime digital signal!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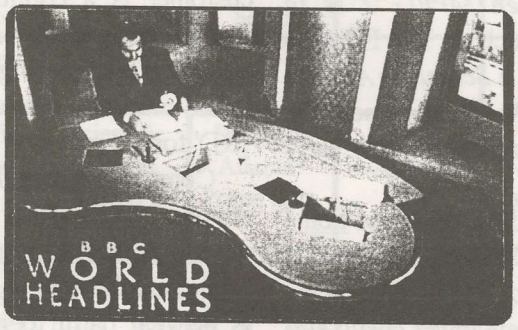


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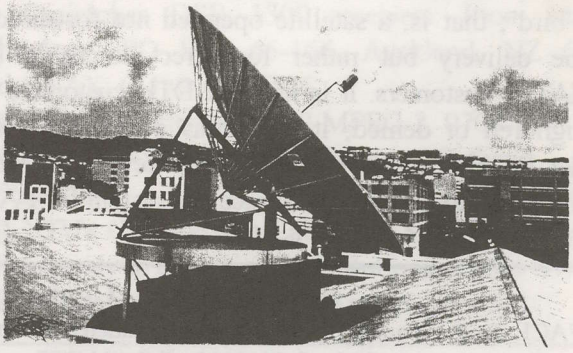

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# SPACE NOTES

**A technical and marketing advisory memo to the membership from your industry trade association group**

**SPACE Pacific**

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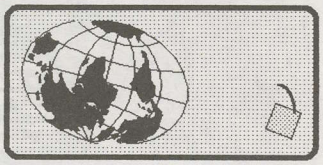

A trade association for users, designers, installers, sellers of private TVRO systems in the POR

ACCESSING PROGRAMMING

During the past 30 days a significant new trend has developed amongst programmers now offering or planning to offer services on PAS-2. The initial signs are not good for direct to home (DTH) viewers although for SMATV (motels et al) and cable TV what is happening could be beneficial.

When MPEG 2 was adopted as a "digital television standard" by the various national and international organisations that must pass on a new transmission system before it becomes a "standard," users were told that once MPEG 2 was adopted, and implemented, one world class receiver would be able to function any place on the globe subject only to conditional access restrictions (i.e., having paid a fee for reception where it applies). Now comes the disturbing revelation that this is not true.

A spokesman for General Instrument revealed to SPACE in mid-January *"Even when MPEG 2 is in operation, a GI MPEG 2 service* (such as The Filipino Channel) *will not be accessible with a Scientific Atlanta (S/A) receiver. And vice versa."* A spokesperson for PanAmSat verified this unpleasant news in early February.

Further, SPACE has learned that the delivery of home style MPEG 2 (as opposed to CATV level) receivers is further delayed with *"first quarter of 1996"* now being targeted for regular delivery of the new lower cost, DTH version receivers.

As a practical matter, PAS-2 is evolving into a "cable TV bird"; that is, a satellite operated not for direct to home delivery but rather for direct to cable (and SMATV) customers. It is not that DTH customers will be ignored or denied; it is that as a practical matter either by plan or happenstance very few DTH viewer will be able to afford a DTH receiver system for PAS-2. Here's why.

As the table on page 17 shows, we have virtually every known programmer on PAS-2 choosing to use a unique to their service encryption system. Each says they will offer their programming to anyone willing to pay for it, but as a practical matter how many DTH viewing homes will be willing (or able) to shell out US$1,500 for a Discovery receiver, another US$1,500 for ANBC / CNBC, a third US$1,500 for ESPN, plus US$1,000 for CNNI? Add The Chinese Television Network at US$1,500 or TFC at US$1,500 and you begin to see the insanity.

As these words are written, the only PAS-2 programmers to select the same format encryption (and therefore, in theory, the ability to receive more than one service with a single receiver) are Country Music Television, CTN and Prime Sports. All are S/A format and all three programmers are using encryption hardware provided by PanAmSat. If you or your customer is a country music toe tapping fan of US woman's university basketball who speaks Mandarin as a first or second language, you are in luck. That profile is the only one that allows you to get by with a single 'IRD' format receiver.

Commercial installations are not hurt by this. Yes, anyone would rather have a single receiver brand and model (one for each PAS-2 service received and processed through to cable connected viewers) but there is no real harm to motels (SMATV) or cable in this situation. They, after all, must purchase one receiver for full-time reception of each channel they carry so if they have five channels carried, they have five receivers anyhow. That they are five different brands or formats is nettlesome but not catastrophic.

All may not be lost. There is a high level effort underway to take a single PAS-2 transponder and combine the services of five (or more) programmers together for DTH delivery. If this plan works, and it is

**Contacting SPACE Pacific**

SPACE Pacific is a new trade association initiated in open group discussion during the Hastings Satellite Cable Seminar this past September. Until March 31, 1995, all SatFACTS readers are automatically enrolled as provisional members at no charge. A letter explaining full annual membership will be sent to you during March and you may elect to join as a full member at that time. In the interim, contact SPACE Pacific % of SatFACTS, PO Box 330, Mangonui, Far North, New Zealand.

| Programmer | PAS-2 Transponder | Present Format | Ultimate Format | IRD / Supplier | Approx. IRD Cost | Notes |
|---|---|---|---|---|---|---|
| ABS-CBN | 14/Hz IF 1058 | Digicipher 1 | Digicipher 2 | General Instrument | DSR 1500 US$1,500 | Digicipher 2 1996 |
| ANBC/ Super Channel | 13/Vt IF 1038 | Analogue | Philips Digital | Philips | Unknown | 1 |
| CBS-TV | 16/Hz IF 994 | Analogue | Unknown | | | 2 |
| Country Music TV | 7/Vt IF 1216 | Analogue | SA Digital | Scientific Atlanta | D9222 US$1,445. (*) | 3 *-includes shipping |
| CNNI | 10/Hz IF 1183 | Analogue | Leitch Encrypted Analogue | NZ: Sky Other: Turner Aust. | Unknown (A$1000 quoted) | 4 |
| Chinese Television Network | 2/Hz IF 1422 | Scientific Atlanta MPEG 2 | Scientific Atlanta MPEG 2 | Scientific Atlanta / CTN | D9222 US$1,445. (*) | 5 |
| Discovery | 4/Hz IF 1370 | Scientific Atlanta PAL Bmac | Unknown | Scientific Atlanta 9708-PAL | Unknown (US$1,500 quoted) | 6 |
| ENCORE | 9/Vt IF 1158 | Scientific Atlanta MPEG 2 | Scientific Atlanta MPEG 2 | Scientific Atlanta / Prime Spts | D9222 US$1,445. (*) | 7 *-includes shipping |
| ESPN | 5/Vt IF 1288 | Scientific Atlanta NTSC Bmac | Unknown | Scientific Atlanta 9708-NTSC | Unknown (US$1,500 quoted) | 8 |
| National Technology University | 3/VT IF 1383 | Comp. Labs. Inc. / 3.3Mbps | CLI (same) | CLI Spectrum Saver | (A$3,950 quoted) | 9 |
| NHK | 12/Hz IF 1116 | Analogue | Unknown | | | |
| Prime Sports | 9/Vt IF 1158 | Scientific Atlanta MPEG 2 | Scientific Atlanta MPEG 2 | Scientific Atlanta / Prime Spts. | D9222 US$1,445. (*) | 10 * - includes shipping |

**-IRD NOTES-**

**(1)** ANBC plans to provide two separate channels, ANBC-Financial, and, Superchannel Asia in May. At that time they will cease analogue feed.

**(2)** CBS is not now, not ever for use by anyone other than CBS network affiliates.

**(3)** CMT analogue feed continues to be available while S/A MPEG 2 is also being transmitted. Analogue may disappear at any time.

**(4)** CNNI has announced Leitch but may change this plan. Stay tuned!

**(5)** Only Zhong Tian (Timely News) channel is available; contact SPACE at (64)-9-406-0651.

**(6)** Discovery subscriptions available thru Sky NZ (64)9-579-9999, John Fellet.

**(7)** Encore is not available to anyone but Galaxy Australia.

**(8)** ESPN NZ/Sky; Australia see Optus.

**(9)** Details in March.

**(10)** Prime Sports same as Encore for now.

but a plan at this time, one programming consortium (marketing company) would offer DTH viewers a package service with <u>one</u> receiver that would decrypt any one or as many of the consortium programmers offerings as the DTH customer ordered. If (and that is a big **if** at the moment) this works, look for ESPN, HBO, Discovery and CNN to be a part of this entertainment package. We will keep you advised.

<u>Sources</u>

Anyone who wants to purchase an analogue satellite TV receiver can do so. Not so with the new breed of digital units.

Scientific Atlanta, for example, will not sell you a D9222 receiver until you have arranged for conditional access from the programmer. So you go to Country Music Television (one you will shortly be able to order through SPACE Pacific) and arrange for the service by paying the fee. You are given an "authorisation number" which you then take to Scientific Atlanta. They confirm the number and then will sell you a receiver. Complicated? For now, that's how it works. We'll explain this in March.

**1)** Digicipher DSR 1500 receivers: From Maser Technology, PO Box 65-166, Auckland, NZ (Ken Clark) FAX: (64) 9-479-6536.

**2)** Scientific Atlanta D9222 MPEG 2, 9708-PAL and 9708-NTSC; info from Selwyn Cathcart (64) 6-356-2749.

**3)** NTU's Compression Labs, Inc. Spectrum Saver is available only to educational institutions. At the U of A, Brian Oliver at (64) 9-373-7599 extension 6742.

---

Australian SatFACTS readers through AV-COMM will be able to register with SPACE in the March SF.

## PAS-2 Ku BAND CHANNELLING AND MECHANICS

| Transpon. Limits | 12,253-12,307 | 12,313-12,367 | 12,373-12,427 | 12,433-12,497 | 12,503-12,557 | 12,563-12,617 | 12,623-12,677 | 12,683-12,747 |
|---|---|---|---|---|---|---|---|---|
| Transpon. bandwidth | 54 MHz | 54 MHz | 54 MHz | 64 MHz | 54 MHz | 54 MHz | 54 MHz | 64 MHz |
| Nominal centre | 12,280 MHz | 12,340 MHz | 12,400 MHz | 12,465 MHz | 12,530 MHz | 12,590 MHz | 12,650 MHz | 12,715 MHz |
| Nominal IF centre | 980 MHz | 1,040 MHz | 1,100 MHz | 1,165 MHz | 1,230 MHz | 1,290 MHz | 1,350 MHz | 1,415 MHz |
| Vert. Ch. Number | 2K | 4K | 6K | 8K | 10K | 12K | 14K | 16K |
| Antenna Pattern/ Vertical | Australia/ New Zealand | NE Asia | Australia/ New Zealand | NE Asia | Australia/ New Zealand | NE Asia | Australia New Zealand | NE Asia |
| Hz. Ch. Number | 1K | 3K | 5K | 7K | 9K | 11K | 13K | 15K |
| Antenna Pattern/ Horizontal | China (1) | China (2) | China (1) | China (2) **or** Aus/NZ | China (1) | China (2) **or** Aus/NZ | China (1) | China (2) **or** Aus/NZ |

* / Receiver IF based upon LNB local oscillator operating at 11,300 MHz. For LO at 11,250 MHz, add 50 MHz to numbers shown. Footprints on Australia-New Zealand beams will be in 43 to 46 dBw region (higher in south-eastern Australia). **"OR"** beams mean switching is available but only one can be used at a time.

## PAS-2 C BAND CHANNELLING AND MECHANICS

| Transpon. Limits | 3,703 - 3,757 MHz | 3,763- 3,817 MHz | 3,823- 3,877 MHz | 3,883- 3,947 MHz | 3,953- 4,007 MHz | 4,013- 4,067 MHz | 4,073- 4,127 MHz | 4,133- 4,197 MHz |
|---|---|---|---|---|---|---|---|---|
| Transpon. bandwidth | 54 MHz | 54 MHz | 54 MHz | 64 MHz | 54 MHz | 54 MHz | 54 MHz | 64 MHz |
| Nominal Centre | 3,730 MHz | 3,790 MHz | 3,850 MHz | 3,915 MHz | 3,980 MHz | 4,040 MHz | 4,100 MHz | 4,165 MHz |
| Nominal IF Centre | 1,420 MHz | 1,360 MHz | 1,300 MHz | 1,235 MHz | 1,170 MHz | 1,110 MHz | 1,050 MHz | 985 MHz |
| Vert. Ch. Number | 1C | 3C | 5C | 7C | 9C | 11C | 13C | 15C |
| Vertical Ant. Pat. | Pacific Rim | Pacific Rim | Pacific Rim | Pac Rim, or Oceana | Pacific Rim | Pac Rim, or Oceana | Pacific Rim | Pac Rim or Oceana |
| Hz. Ch. Number | 2C | 4C | 6C | 8C | 10C | 12C | 14C | 16C |
| Hz Ant. Pattern | Pac Rim | Pac Rim | Pac Rim | Pac Rim | Pac Rim | Pac Rim | Pac Rim | Pac Rim |

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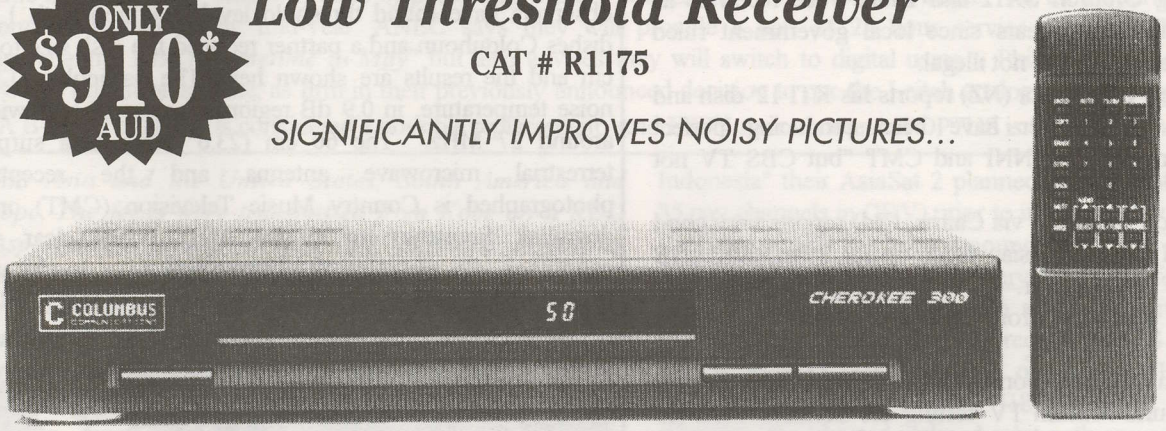


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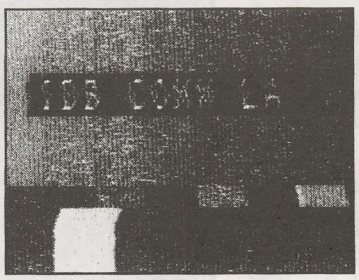
**FROM THIS**



**TO THIS**


## *Here's what "What Satellite" Magazine said:*

*This is because hidden inside this machine, with surprisingly little song and dance made about it, is a 3dB "low-threshold" tuner. This brings in the weaker signals with comparative ease, removing sparklies from pictures that other receivers would give up on.*

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# WITH THE OBSERVERS

Press Stop: China Central Television (CCTV) is using PAS-2 TR1V (digital: IF 1400) to deliver Mandarin programming to North America.

Ron Boyce (Alexandra Hills, Qld) reports RAJ-TV (130E) "Much better than CMT on PAS-2, almost noise free" on 1.8m dish with 20K LNB.

Roger Ovens of Willco Hardware, Port Vila, Vanuatu reports his firm has installed more than 100 TVRO antennas in Vanuatu using Orbitron SX12 and Drake 700e receivers as 'standard' in the three years since local government ruled ownership of a TVRO was not illegal.

Bruce Barnett of Wanaka (NZ) reports his KTI 12' dish and Echostar LT-730 receiver have been producing perfect reception from ANBC, CNNI and CMT "but CBS TV not quite as good."

Shane Wilson (Mareeba via Cairns, Qld) reports very good reception on I174, I177 Asian feeds on his 3.7m, 20K LNB and Cherokee 300 receiver. He is far enough north to have "colour lock" reception from Apstar 1 (138E) on some channels (IF 1130, 1170, 1272 and 1373). He also has reception from all 5 transponders from Rimsat 130E. Late in January he found Muslim TV 'testing' on Gorizont 140E (IF 1425) after 2000 UTC. CNNI is noise free for Shane on a 2.4m using a linear feedhorn.

SF understands that a new ethnic TV service is scheduled to appear on either G140E or R142.5E around the first of March; probably another Hindi or Tamil service. Who will be the first to log this one?

Tyrell Ruscoe (Wanganui, NZ) was first to report PAS-2 Ku operations (14 January). Country Music Television , in NTSC, and only as a test source (not for commercial delivery), is a temporary signal which a PAS-2 spokesperson told SF "*Will allow Ku reception tests to the toe-tapping rhythms of CMT.*" It certainly beats having a test card up there but the tests can terminate at any time. See sidebar to right.

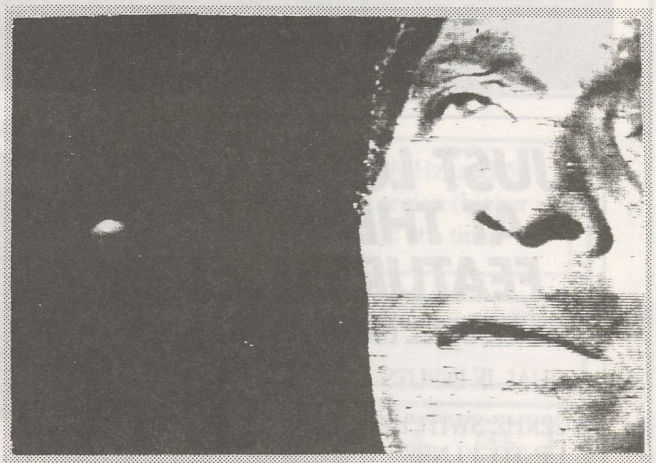
David Pemberton, Muswellbrook (NSW) reported he finds TVNZ, RFO and Worldnet improved on I180 since 511 change out, but NHK, VDP on 4,876 and 4,165 down on his 3.7m dish with 20K LNB.

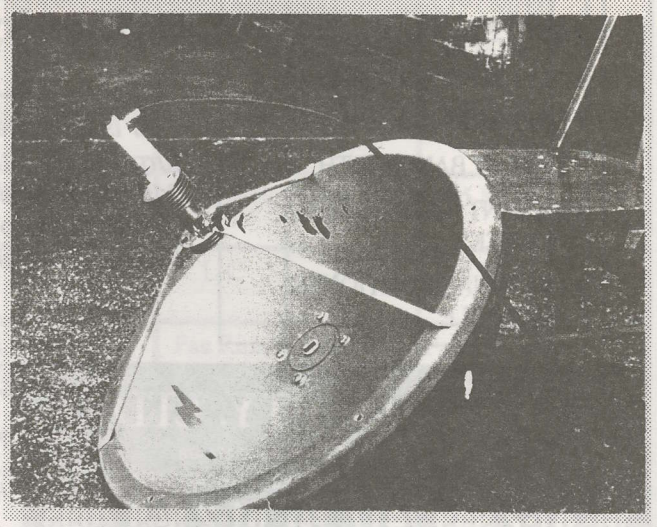
Tyrell Roscoe, Wanganui (NZ) and others reported the Japanese earth quake special news feeds on 3,930 MHz horizontal in NTSC but at levels weaker than other signals from PAS-2. Numerous TV stations pooled live coverage feeds for the USA newscasts using this transponder from the Kobe disaster, including KRON-TV (San Francisco) which serves a substantial Japanese-American audience.

Similarly many hours of NHK coverage went out immediately after the Kobe quake on PAS-2 4,034 (IF 1116) to news organisations world-wide. PanAmSat reports "(We) *were able to send out more than 25 hours of news feeds*

**BIG RECEPTION** - small dish

Robin Colquhoun (32 Valley Rd, Mt. Eden, Auckland; 9-630-7127) has used PanAmSat tests of their Ku band service to evaluate the real-world footprint (signal strength) of the PAS-2 Ku service into New Zealand. Although most observers have found threshold level reception with 1.2m dishes Colquhoun and a partner reduced the dish size to 60 cm and the results are shown here. The particulars: LNB noise temperature, in 0.9 dB region, receiver IF bandwidth around 27 MHz. The 60 cm (23.6") dish is a surplus terrestrial microwave antenna and the reception photographed is Country Music Television (CMT) on a downlink frequency of 12,406 MHz under clear sky conditions. By elevating the 60cm dish to a roofmount, Colquhoun found an additional improvement in video SNR.





WITH THE OBSERVERS: Reports from POR satellite dish operators relating to reception, equipment changes, programming trends as related to SatFACTS using our POR Observer reporting form (page 25, this issue). Photos of satellite TV reception, equipment, personnel invited. When snapping TV screen photos: Use ASA 100 film, set camera at 1/15th second (PAL/SECAM) or 1/30th (NTSC) with aperture of F3.5 to 4 with camera on tripod or stand. Material submitted becomes property of SatFACTS and none will be returned. Individual reports cannot be acknowledged.

## PanAmSat PAS-2 Status At Press Time

SKY Network, representing ESPN, CNNI and Discovery in New Zealand (and trying also to represent CMT) continues to 'stonewall' (ignore) requests for user agreements for any of these services. SKY claims its master contracts for these services have not come through although SKY has represented ESPN and CNNI for several years already. At least one SPACE member who located his own Scientific Atlanta PAL format B-MAC decoder is waiting for promised service authorisation on Discovery. CMT continues its free-to-air analogue service on a day to day basis on C band with several announced (and missed) 'termination dates'. CMT on Ku is strictly a test but should continue at least through early March. A number of Asian users of PAS-2 Ku band beams (see SF #5, p.6) are reported very interested in PAS-2's Northeast Asia beam with the chances that Australia-New Zealand will lose these transponders growing weekly. Prime Sports terminated analogue service in mid-January (TR9V) because of a need to provide three simultaneous video programmes to customer Australis / Galaxy. Presently in S/A MPEG is the missing Prime Sports feed plus two feeds for Encore, an American premium movie service. Prime says they are "*studying ways of providing a DTH and CATV service to the Pacific*" for their sports channel and promises a decision by mid-year. ANBC says they will provide a pair of 24 hour service feeds (ANBC Business, Superchannel NBC) "*sometime in May*" but also advises they will switch to digital using a Philips created CDV format. CNNI is not, at press time, as firm in their previously announced decision to use the Leitch analogue encryption system and S/A B-MAC in NTSC is considered a possible replacement. And ESPN Asia announced OPTUS is their agent in Australia.

*within Asia and the United States, South America and Europe. The feeds were transmitted from Kobe on a KDD transportable antenna leased by Starbird. Utilising cross-strapping technology, Starbird transmitted to PAS-2 over Ku-band frequencies and downlinked over a C-band transponder to PanAmSat's teleport in Sylmar, Ca. From there the signal was turned around to PanAmSat's teleport in Homestead, Fl. and retransmitted via the PAS-1 satellite to Latin America and Europe.*" Those taking the feeds included (US) ABC, BBC, CTN, KNBC (LA), KRON (SF), NBC, RTL and TV Globo. With cross-strapping techniques, a Ku-band signal uplinked to PAS-2 is internally connected to a C-band downlink transponder for retransmission.

China's loss of ApStar 2 during launch January 26 will have major negative effects on the Asian satellite scene for years to come. The controversial satellite had no announced pre-launch orbit spot although 87.5E, 91E and 112E had been variously suggested. During Long March 2E rocket launch a spectacular explosion rained debris on the countryside within 7km of the Xichang space centre in south-western Sichuan province killing six, injuring 33. APT, at whatever orbit location, was to have become the primary cable satellite delivery service to Asia for a score of programmers including Turner, HBO, ESPN and others. APT1, launched last July, is functional at 138E but lacks important coverage into many segments of India. The Long March rocket failure is worrisome to ApStar's chief competitor, AsiaSat, which is scheduling its own AsiaSat 2 satellite via Chinese launch in May. A failure of AsiaSat 2 would significantly set back the development of DTH and cable in the Pacific Ocean region. The Chinese launch corporation released a video of the launch early in February that claims the "explosion" first occurred within the satellite module, and then spread down stage two and stage one ending in the violent explosion. Hughes, which built APT2, said they were "*shocked at the suggestion the satellite exploded*" and denied it was capable of "*setting off a chain of reactions that ended with the launch vehicle explosion.*"

SF has been told that Murdoch's StarNet service distributed in Asia via AsiaSat I will appear in abbreviated form on a single transponder on Palapa B2P (113E) around 1 March. The plan is to run free to air programming during Indonesian daylight hours and an encrypted premium movie service in the night-time period. StarNet sees this as a way of "previewing to Indonesia" their AsiaSat 2 planned service (7 free to air plus 35 pay channels in CDV) prior to its availability in August. No B2P transponder has been announced.

United States Information Service (USIS) feed of AFRTS received from I703 on 7m dish at Wellington, NZ is being modified to accommodate the recent AFRTS change (from RHCP on 4135 MHz to LHCP on 4177.5 MHz). The USIS was having difficulty tracking I180's old 508 satellite at the extremes, the 'shorter' inclined orbit path can again be tracked since the change over to bird 511 at 180.

Peter Merrett (SCITEQ Pty Ltd), Wanneroo, Western Australia uses a 16' Orbitron and Echosphere SR5000 receiver to access 23 satellites (!) stretching from 40E Statsionar 12 to Intelsat 511 at 180E. The strongest signal received is from Statsionar 14 (96.5E) on 3680 MHz while other "perfect pictures" are seen from 130E (RAJ TV), 140E (Muslim TV on 3725), PAS-2's CMT, CNBC/ANBC, CNNI and 180E's CNNI. On Ku he also has perfect pictures from PAS-2's CMT test feed. A carrier below the normal band at 3610 from what appears to be 70E is a bit of a mystery. Statsionar 20 is there and known to have spotbeam service on 3825. Express 1 is also there with a 11,620 transmission of Ostankino. It's hard to get 3610 out of either however! Your 85.5E is a Raduga class (Statsionar 3) with Bombay's Auro TV, Peter. Of interest, he also finds Chinasat 5 (115.5E) at about the same level near Perth as the University of Auckland's 7.3m dish, on the same



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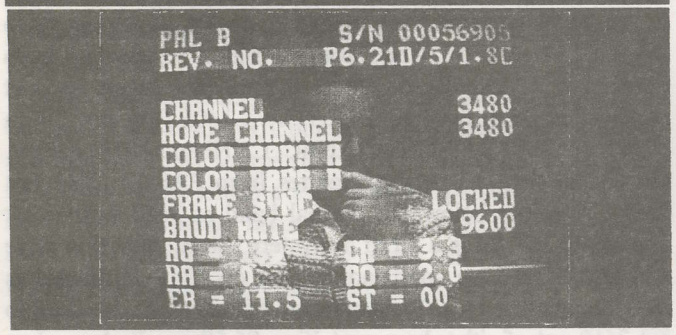
transponders. We also suggest Peter check: 40E at 3875 for Samanyolu TV, 53E for 11,525, 60E for 10,974 - 11,683.

National Technology University began transmissions into the Pacific from North America in mid-January using PAS-2 (TR3V, IF 1383). The compressed digital service uses a custom Compression Labs Inc. (CLI) 3.3 mbps data rate system. The 'programming' consists of university accredited courses and seminars for an array of engineering and technology disciplines.

The PAS-2 service level is predicted by NTU to be usable with 3.7m (or larger) dishes anywhere within the Pacific Rim footprint. The service is essentially 24 hours per day and users sign up for specific classes and course instructions. The project was launched in 1984 and in the most recent year included more than 22,000 hours of academic credit instruction and some 3,000 hours of advanced technology and


CLI SpectrumSaver as received in Auckland



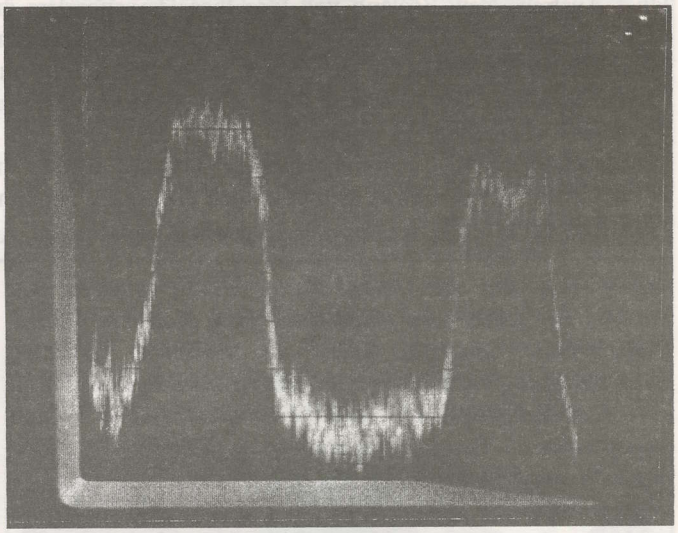

management programmes.

In New Zealand the University of Auckland and Waikato University are both participating in the initial test period; Waikato installed a 4m dish as soon as it was advised of the project. SF understands that while the present PAS-2 service is considered a 'test' that the response has been significant enough from Universities and private firms throughout AustralAsia that the continuation of the service is virtually certain.

Learning Network Pty Ltd (7 Martin St., South Melbourne, Victoria 3206; Tel 61-3-699-7144; FAX 61-3-699-4947) is the South Pacific region representative. The CLI receivers can be leased or purchased (A$3,950 quoted with LNB) and a 3.6m (KTI brand) glass fibre SMC antenna is also available (within Australia, quoted at A$2,500-3,000). NTU is at 700 Centre Avenue, Fort Collins, Co. 80526-1842; Tel 1-303-495-6400; FAX 1-303-484-0668.

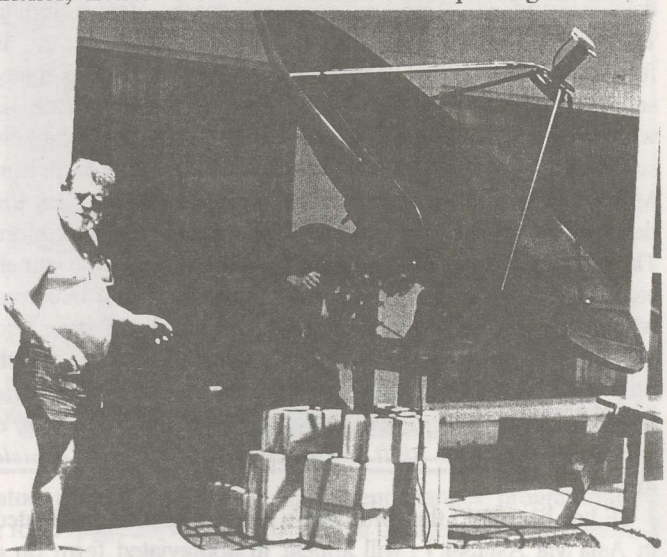
Pay TV via Optus B1 was begun January 26 using horizontal transponders 10H / 11H. The Digicipher 1 (NTSC format) service is initially available through MDS (2.3 GHz range terrestrial microwave) transmitters fed from the Optus service. Premier Sports Network (PSN) is the first operational channel; movie service channels are likely next. To that end, see PAS-2 update on page 21 here.

During their test phase of the Digicipher system several SF readers made C/NR (carrier to noise ratio) measurements throughout New Zealand of the TR10 and 11H signals. An Optus spokesman in Australia insisted to SF "*This is a highly sculptured beam and it will not reach New Zealand.*" Well,



wrong again, Optus. The spectrum analyser screen photo here shows both transponders, MCPC loaded, at a C/NR of 13.5 dB and above on a 3m dish. Even 1.2m dishes showed C/NRs of 7 dB or more. Unfortunately, for now, the PAY TV people in Australia have shown no interest in non-Australian viewers. The per month rate, reported in Australian press but not verified by SF, is A$61 after an A$350 hook-up charge for the MDS receive package.

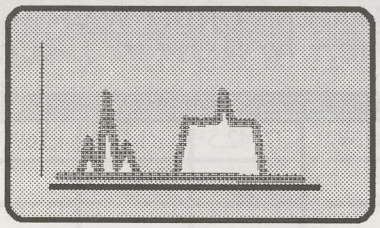
While SF had the loan of the GI Digicipher 1500 receiver, we took it to several locations to test it with the ABS-CBN digital feed. One of our stops was at Pacific Antennas where Bryon Evans trotted out a 2.4m screen mesh home style dish for a test. Using concrete blocks as a temporary dish base anchor, Evans went from dish antenna packing carton to



ABS-CBN digital pictures in 30 minutes time.

NOW - who says digital TV is going to be a nightmare to install! Kiwi ingenuity at work.

# SELECTED SPECTRUM ANALYSER DISPLAYS



**of current satellite activity as contributed by SatFACTS readers**

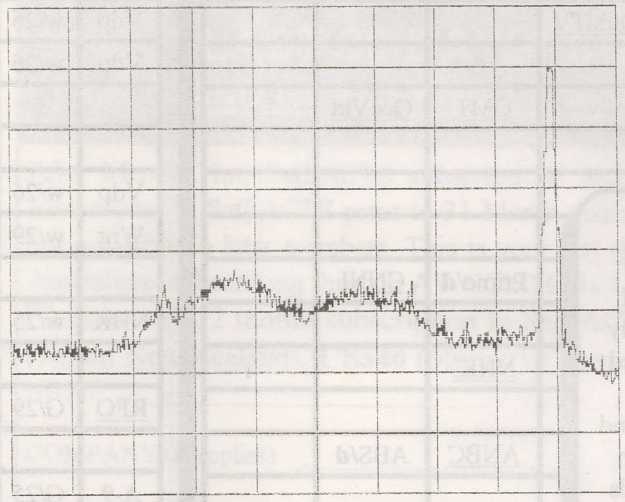
Full Satellite Views

Observer Steven McKelvie (28 Billhercock St., Napier, NZ Tel [64]-6-843-4206) uses a 3m Andrews dish equipped with a 20 degree LNB and an ADL multipolarisation feedhorn. He has supplied spectrum analyser printer plots for all satellites from 180E to 130E as seen at his location; four of these appear here.

At the top of his prints, -40 dBm is the reference and each vertical division is 5 dB. The analyser resolution bandwidth is 1 MHz or 300 kHz (see bottom each chart). From top count down 2 divisions; that's -50 dBm. Any signal -48 dBm or better is sparklie free on his installation. Lower RF channel numbers right, higher left. Note multiple data traffic carriers on 177E.

RIMSAT 130E

FREQ: 900.0M -- 1550.0MHz REF:- 40dBm 5dB/

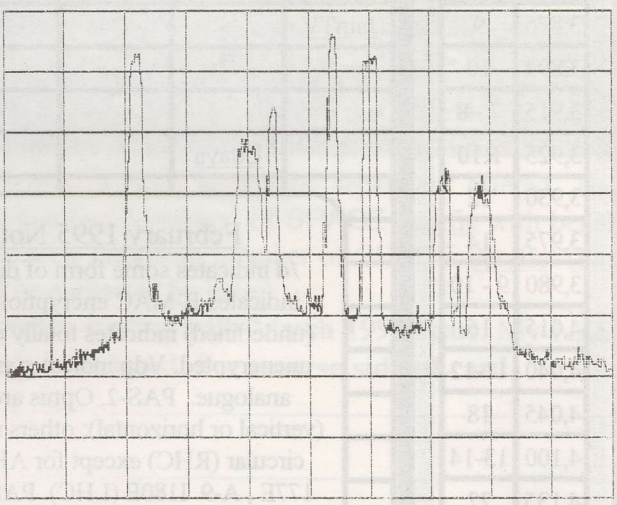


RBW:300kHz VBW:300kHz SWP: 10mS/@ ATT: 0dB

**ABOVE:** Rimsat 130E clearly showing RAJ-TV power-house (right). **BELOW**: Intelsat 177E; video (2) far left.

PANAMSAT 169E - VERTICAL

FREQ: 900.0M -- 1550.0MHz REF:- 40dBm 5dB/

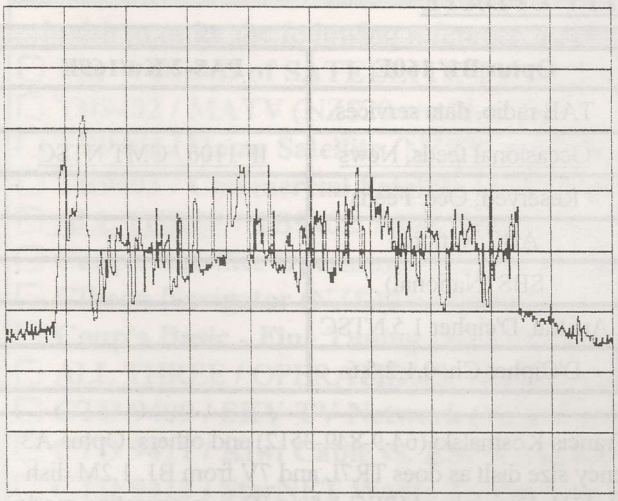


RBW:300kHz VBW:300kHz SWP: 10mS/@ ATT: 0dB

**ABOVE**: PAS-2 vertical (3rd from right ESPN, far left ANBC). **BELOW**: PAS-2 horizontal (CTN digital right).

INTELSAT 177E

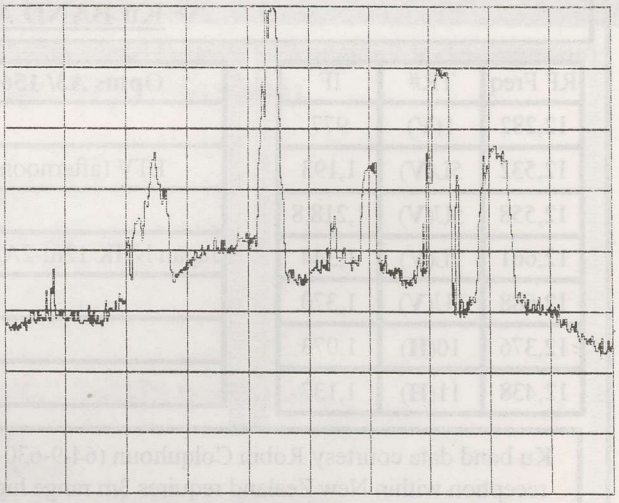
FREQ: 900.0M -- 1550.0MHz REF:- 40dBm 5dB/



RBW: 1MHz VBW:300kHz SWP: 10mS/@ ATT: 0dB

PANAMSAT 169E - HORIZONTAL

FREQ: 900.0M -- 1550.0MHz REF:- 40dBm 5dB/



RBW: 1MHz VBW:300kHz SWP: 10mS/@ ATT: 0dB

# SatFACTS PACIFIC OCEAN ORBIT WATCH: 15 FEBRUARY 1995

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| Freq. | TR# | G/102.7 | R/130.0 | G/139.9 | T/142.5 | G/145.0 | P169:Vt | P169:Hz | I174/177 | I/180 | Patrn |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3,675 | R6/-1 | DublTV | RAJ TV | | ATN | DublTV | | | | | |
| 3,720 | 1 | | | | | | | | | IDB | w/29 |
| 3,725 | 1+ | Muslim | SUN TV | DublTV | ATN | (tests) | | | | | |
| 3,730 | 1 - 2 | | | | | | CCTV/**d** | CTN/**d** | | | |
| 3,765 | 3 | | | | | | | | | Vdp | w/28 |
| 3,777 | R8 | | ABC-5 | | | | | | | | |
| 3,790 | 3 - 4 | | | | | | NTU/**d** | Discov/b | | | |
| 3,825 | R9 | | ATN | | Digital? | | | | | | |
| 3,840 | 6 | | | | | | | | | KDD | w/29 |
| 3,845 | 6A | | | | | | | | | CNNI | w/29 |
| 3,850 | 5 - 6 | | | | | | ESPN/b | (MCPC) | | | |
| 3,876 | 9 | JainTV | | | | DublTV | | | | Vdp | w/26 |
| 3,894 | 10 | | | | | | | | | Vdp | w/26 |
| 3,915 | 7 - 8 | | | | | | CMT | OccVid | | | |
| 3,925 | R10 | | Udaya | | | | | | | | |
| 3,930 | 12 | | | | | | | | | Vdp | w/26 |
| 3,975 | 14 | | | | | | | | | Wnt | w/29 |
| 3,980 | 9 - 10 | | | | | | Prime/**d** | CNNI | | | |
| 4,015 | 16 | | | | | | | | | NHK | w/25 |
| 4,040 | 11-12 | | | | | | NHK. | | | | |
| 4,045 | 18 | | | | | | | | | RFO | G/29 |
| 4,100 | 13-14 | | | | | | ANBC | ABS/**d** | | | |
| 4,135 | 22 | | | | | | | | | A-9 | G/25 |
| 4,165 | 15-16 | | | | | | | CBS/etal | | | |
| 4,166 | 23 | | | | | | | | NwsFds | NZ/**d** | G/22 |
| 4,177 | 23A | | | | | | | | (Afrts/b) | | |
| 4,188 | 24 | | | | | | | | NwsFds | TNZ | G/22 |

### February 1995 Notes

**/d** indicates some form of digital; /b indicates B-MAC encryption. CNNI (underlined) indicates totally or mostly unencrypted. Vdp indicates vidiplexed analogue. PAS-2, Optus are linear (vertical or horizontal); others right hand circular (RHC) except for AFRTS on 177E , A-9 I180E (LHC). PAS-2 feeds will continue to 'evolve' as full time CDV takes hold; see reports page 20.

## Ku BAND ACTIVITY UPDATE

| RF Freq | TR# | IF |
|---|---|---|
| 12,282 | 1(**V**) | 977 |
| 12,532 | 5L(**V**) | 1,193 |
| 12,558 | 5U(**V**) | 1,218.8 |
| 12,661 | 7L(**V**) | 1,344 |
| 12,688 | 7U(**V**) | 1,370 |
| 12,376 | 10(**H**) | 1,073 |
| 12,438 | 11(**H**) | 1,137 |

| **Optus A3/ 156E** | **Optus B1/ 160E** | **PAS-2 Ku/169E** |
|---|---|---|
| | TAB radio, data services | |
| ETV (afternoons) | Occasional feeds, News | IF 1106 / CMT NTSC |
| | Reserved; Occ. Feeds | |
| Japan NHK 12m-2AM NZT | ABC National | |
| | SBS (National) | |
| | Austral. D'cipher 1.5 NTSC | |
| | D'Cipher Ch. 0,1,2,5,6 | |

Ku band data courtesy Robin Colquhoun (64-9-630-7127), Francis Kosmalski (64-9-849-3512) and others. Optus A3 reception within New Zealand requires 3m range high efficiency size dish as does TR7L and 7V from B1. 1.2M dish and smaller will produce quality signals from B1 TR5 and 10H, 11H. Digicipher MPEG 1.5 on B1 is in operating mode.

## SatFACTS FEBRUARY 1995 POR OBSERVER REPORTING FORM
### (Please FAX [64-9-406-1083] or mail to arrive by 03 March)

TELL US what you are seeing, or using for equipment, that is new within the last 30 days. Observer reports (see "With The Observers" page 20) form an important part of the growing body of information we all share monthly.

• NEW programming sources seen since 1 February: (Please list receiver 'IF' or satellite transponder number if known) _____

_____

_____

• CHANGES in reception quality since 1 February: _____

_____

_____

• EQUIPMENT changes at my observing terminal since 1 February: _____

_____

_____

■ My Name _____ Address _____

Town / City _____ _____ Country _____ **(Please turn form over)**

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☐ **TB9404 / Home Satellite** (NZ$20 world-wide).
☐ **TB9405 / Commercial Satellite** (NZ$20 world-wide).
☐ ALL THREE / TB9402, 9404, 9405 (NZ$40 world-wide)
☐ **Coop's Satellite Operations** (NZ$30 world-wide).
☐ **Gibson Navigator** (NZ$30 world-wide).
☐ **Coop's Basic - Fine Tuning** (NZ$30 world-wide).
☐ ALL THREE / OPERATIONS, NAVIGATOR, BASIC (NZ$70 world-wide).
☐ **CTD 9409 / SKY TV Network** (NZ$30 world-wide)
☐ **CTD 9411 / Kiwi Cable vs. ESPN** (NZ$30 world-wide)
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Total amount of order: NZ$_____ **(Over, please)**

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Make/model receiver(s): _____
Make/model standards conversion: _____

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_____
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# -SatFACTS DATA SHOPPE-

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☐ **The WORLD of SATELLITE TV** (Asia Pacific edition) by Mark Long and Jeffrey Keating. The ideal "starter" manual for someone entering the field of satellite television. How the system works, what the parts do, how they all fit together. 226 high quality, well illustrated pages. Ease of comprehension plus excellent detail. Price: NZ$30 within NZ, NZ$35 elsewhere. Note: Limited copies remain in stock, these will surely sell out this month!

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